APPENDIX J
BAT SURVEYS

Natural Forces

DILLON CONSULTING

NATURAL FORCES DEVELOPMENTS LP

Bat Surveys

Westchester Wind Project - Appendix J

February 2022 – 21-1329

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1.0 Introduction

The proponent understands that one of the key environmental concerns associated with wind projects is the potential for effects to bats (i.e., mortality). As such Dillon consulted with the Nova Scotia Department of Natural Resources and Renewables (NSDRR) regarding the level of effort for the acoustic survey program. The 2021 bat acoustic program methodology was developed in consultation with NSDRR. Dillon's qualified professionals have been involved in several resource development projects in Atlantic Canada and have assisted many Proponents through the provincial environmental assessment processes.

1.1 Bats in Nova Scotia

Little Brown Myotis (Myotis lucifugus), Northern Myotis (M. septentrionalis), and Tri-Colored bat (Pipistrellus subflavus) are known bat species that reside in Nova Scotia. All three are small-bodied bats typical of the plain-nosed bats and all three are listed provincially and federally as Endangered. The listing is the result of drastic bat population declines that have occurred due to a fungal infection (white nose syndrome) that appears to severely affect cave-dwelling hibernating bats. It is believed that mortalities affecting up to 90% of populations result from interference with hibernation and starvation during the winter period. The syndrome was first observed in 2006 in New York and has been since confirmed in Ontario, Quebec, New Brunswick and Nova Scotia (EC 2014). One other bat species, Big Brown Bat (Eptesicus fuscus), is also known to reside in Nova Scotia; however, few sightings have been recorded. The Hoary Bat (Lasiurus cinereus), Eastern Red Bat (Lasiurus borealis), and Silver-haired Bat (Lasionycteris noctivagans) are migratory bat species that are less common in Nova Scotia, but are known to live in the province for a portion of the year (Moseley, 2007).

Little Brown Myotis are distributed throughout much of Canada, with the exception of northern Canada. They are also found in southern Alaska, across the United States from coast to coast, and the higher elevation forested regions of Mexico. There is also a population of this species in Iceland; however, they are presumed to have been accidently transported there on ships by humans. Mating occurs in the fall and they have liter sizes ranging from one to two pups, but most commonly one (Havens, A. 2006). Northern Myotis are distributed across southern Canada and as far north as Newfoundland. They also inhabit much of the United States, extending through to Florida. Mating occurs during the autumn months and they are known to only have one offspring (Ollendorff, J. 2002). Tri-Colored Bat inhabit the southern edge of Canada, eastern United States, eastern edge of Mexico, extending as far south as northern Honduras. Mating occurs between August and October, and they are known to have one set of twins in each litter (Hamlin, M. 2004). Big Brown Bat are known to reside as far north as southern Canada, as far south as northern South America, and the West Indies (Mulheisen, M. and K. Berry 2000).

Resident bats live in three different roosting sites: day roosts, night roosts, and hibernacula. Day and night roosts are used during the spring, summer and fall months whereas hibernacula sites are used during the winter months. Common hibernacula sites are typically caves and old mining shafts; whereas day and night roosts commonly include tree hollows, spaces between tree bark, rock crevices, buildings, and tree foliage.

The Hoary Bat (migratory) has been spotted as far north as Southampton Island in Nunavut as well as Iceland, and as far east as Bermuda and the Orkney Islands off Scotland, during the summer months. They commonly spend the winter months in California, southeastern United States, Mexico, and Guatemala. Hoary bats are thought to mate around the time of autumn migration, and their litter size can range from one to four, but are most commonly two (Anderson, S. 2002). Eastern Red Bat (migratory) are widely distributed between southern Canada, Central America, Chile, and Argentina. Like the Hoary bat, mating takes place during autumn migration and their litter size can range from one to four, but are most commonly two (Myers, P. and J. Hatchett 2000). The Silver-haired Bat (migratory) is known to inhabit the lower south-central part of Alaska, the west coast of Canada, and the entire lower third of Canada; as well as most of the United States except for the south eastern and south western coasts, and as far south as the Victoria province of Mexico. Like the Hoary Bat, they have also been documented as far east as Bermuda. Their litter size ranges from one to two, but are most commonly litters of two (Bentley, J. 2017).

The migratory bats that have been spotted in Nova Scotia are known as solitary tree bats, and prefer to roost in a large variety of forested habitats with minimal human activity. They have; however, also been known to roost in mildly populated areas as well (Moseley, 2007).

1.2 Scope of Work

For the purpose of this assessment, the spatial boundaries (i.e., the Study Area) have been identified as the area encompassing the access roads (including a 250m buffer), each proposed wind turbine generator and substation location (plus a 250 m radius surrounding each turbine).

Surveys were designed to capture the breeding season and extend through the fall migration period (June 1 until October 15, 2021; inclusive). This approach allowed for collection of data which could capture bat activity levels during the vulnerable periods (i.e., breeding and migration) while considering seasonal and temporal variations.

2.0 Methods

2.1 Desktop Survey

Prior to programing and setting up the monitoring stations, a desktop survey was completed using the following resources:

- The proponent requested a search of the ACCDC for a list of rare flora within 100 km of the project area. The ACCDC Report is included in **Appendix L** of the main EA Registration Document; and
- Available mapping was consulted to develop a list of terrestrial habitat types with the potential to be impacted by Project activities and was used to inform the selection of monitoring stations.

2.2 Field Survey

Acoustic bat data was collected from five acoustic survey stations surveys in 2021 across the Project Site between June 1 and October 15 (the survey period). Five acoustic survey stations within the LAA for bats were selected to capture the various terrain and habitat types within the LAA (Figure J-1).

Five acoustic survey stations were mobilized to purposefully build redundancy into the monitoring program in the event of meter malfunction between data checks while collecting data within the dominant habitat features observed within the LAA. Each survey station consisted of either a Wildlife Acoustics SM3BAT, SM4BAT or miniBAT ultrasonic bat detector; each collected data in full-spectrum.

Each acoustic monitoring station was equipped with an omni-directional microphone. Bat detectors were programmed as follows:

- Trigger Frequency Minimum: 16 kHz;
- Trigger Frequency Maximum: 192 kHz;
- Trigger Level: Automatic (12dB);
- Trigger Wind Setting (recording continues until no trigger is detected): 3 seconds, or when the maximum file duration (i.e., 15 seconds) was reached;
- Sample Night: from dusk to 5 hours after dusk; and
- Gain Level: Automatic (12dB).

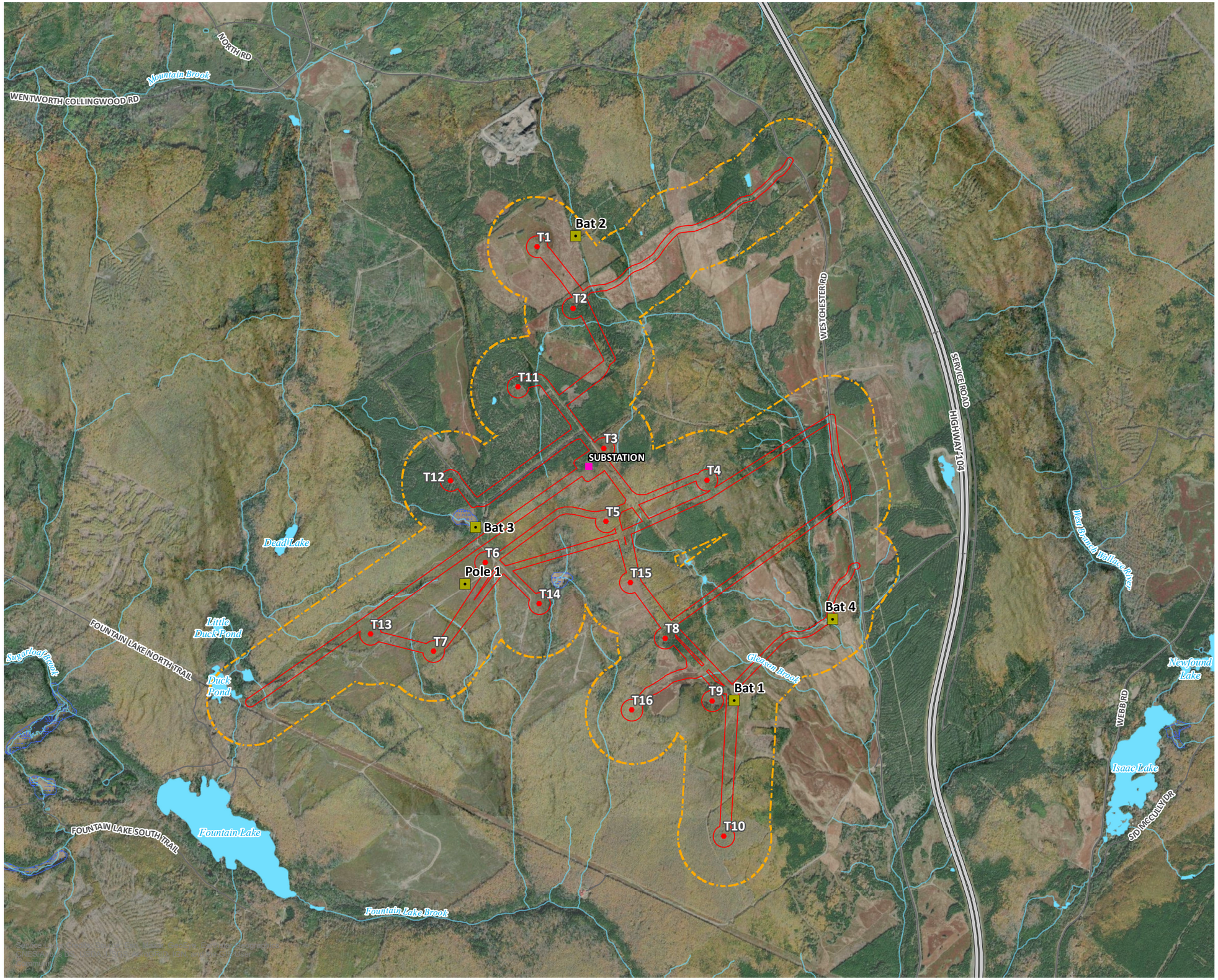
The initial acoustic bat meters were mobilized on May 27, 2021 and programmed to record bat calls from June 1 through to October 15 (inclusive) in accordance with the aforementioned parameters. The periods of monitoring for each station within the survey dates are summarized in Table J-1.

Five of the acoustic monitoring stations were installed at ground level (<2 m above ground level (agl) and captured bat activity data within the LAA and located near potential wind turbine generator (WTG) locations and unique habitat types. Following the installation of a pole on June 16, 2021, an elevated monitoring station approximately 25 m agl was set up as a mechanism to capture activity data within

the elevation range of the blade sweep area of a WTG. Table J-1 includes representative photos for each acoustic monitoring station, as well as a spatial description for each monitoring station relative to the LAA and the locations are shown on Figure J-1.

Table J-1: Summary Table of Bat Monitoring Stations and Their Location in the Study Area

Acoustic Station ID	Description
Bat 1	Elevation: 1.8 m Equipment: Wildlife Acoustics SM3BAT/SM miniBAT Habitat: Located at the edge of a blueberry field on the southern edge of the PDA. Dates Deployed: June 1-5 and July 14 to October 15, 2021 (meter malfunctioned between June 7 and July 13, 2021).
Bat 2	Elevation: 1.5 m Equipment: Wildlife Acoustics SM4BAT Habitat: Located at the edge of a blueberry field on the northern side of the PDA. Dates Deployed: August 11–October 15, 2021
Bat 3	Elevation: 1.8 m Equipment: Wildlife Acoustics SM3BAT Habitat: Located at the edge of a wetland on the western side of the PDA. Dates Deployed: June 1-15 (afterwards, meter was moved to Pole 1 location).
Bat 4	Elevation: 1.8 m Equipment: Wildlife Acoustics SM3BAT Habitat: Located in a small immature tree stand on the edge of a blueberry field and near Gleason Brook, on the south-western portion of the PDA. Dates Deployed: June 7 – 25, June 29 – Sept 29, Oct 5 – 15 (meter malfunctioned June 26 – 29 and Sept 30 – Oct 4).
Pole 1	Elevation: 1.8 m Equipment: Wildlife Acoustics SM3BAT/ SM miniBAT Habitat: Located in an open, recently clear cut area, on the western side of the PDA. Dates Deployed: June 16 – 25, June 30 – Sept 16, and Sept 18 – Oct 15 (meter malfunctioned June 26 – 29 and Sept 17).
Pole 1	Elevation: 25 m Equipment: Wildlife Acoustics SM3BAT/ SM miniBAT Habitat: Located in an open, recently clear cut area, on the western side of the PDA. Dates Deployed: June 16 – 25, June 30 – Sept 16, and Sept 18 – Oct 15 (meter malfunctioned June 26 – 29 and Sept 17).



Natural Forces

WESTCHESTER WIND PROJECT

ACOUSTIC BAT SURVEY LOCATIONS

FIGURE J-1

- Proposed Turbine Location
- Substation
- Highway
- Local Road
- Watercourse
- Project Development Area
- Local Assestment Area
- Waterbody
- Wetland

Bat Observation

- Bat Survey Location

0 0.25 0.5 1 km

N W E S

SCALE 1:24,000

MAP DRAWING INFORMATION:
DATA PROVIDED BY DILLON CONSULTING, GEONB, NATURAL FORCES

MAP CREATED BY: MEC
MAP CHECKED BY: KB
MAP PROJECTION: NAD 1983 UTM ZONE 20N

DILLON CONSULTING

PROJECT: 21-1329
STATUS: DRAFT
DATE: 2022-02-09

FILE LOCATION: K:\2021\211329\Product\Client\EA_WC\WC_Terrestrial_Bat.mxd

2.3 Analysis

Bat acoustic data was analyzed using the automated software Kaleidoscope Pro (Wildlife Acoustics) with the following settings:

- Minimum number of pulses = 2;
- Division Ratio = 8;
- Time Expansion Factor = 1;
- Duration = 2 – 500 ms; and,
- Frequency Range = 16 – 120 kHz.

Using the automated species identification feature provided by Kaleidoscope Pro, each acoustic file was first identified to species and species groups (where possible), or identified as either NOID (i.e., pulses recorded but unable to identify species) or NOISE (i.e., no pulse recorded). Species/species groups were identified based on maximum frequency, minimum frequency, call duration and shape (Jones & Siemers 2010).

When bats are far from the detectors or at an angle that reduces detectability, calls can become fragmented where the higher frequency components of the calls are not recorded. This confounds the ability to reliably differentiate several species with overlapping call parameters. For example, several Myotis species can be differentiated based on the maximum frequency of their calls, but not the minimum frequency (Agranat 2012). Although call shape can also aid in differentiating Myotis species, shape varies considerably with habitat structure as bats modify their calls for better long-distance detection in more open habitat and to reduce interference from echoes generated in more cluttered habitat (i.e., within woodlands) (Jones & Siemers 2010). As such, based on the auto ID generated by Kaleidoscope Pro, each of the acoustic files (including NOISE and NOID) were manually reviewed and subsequently classified as follows (van Zyll de Jong 1985):

- LANO/LABO – Silver-haired Bat (abbreviated LANO) and Eastern Red Bat (abbreviated LABO). Both of these species are migratory and were assessed together as a group based on similarities of their calls. Silver-haired Bats produce calls with a constant frequency (CF) tail around 22 – 25 kHz. Although Eastern Red bats produce calls with a minimum frequency between 30 – 35 KHz, they also produce calls with lower minimum frequencies within the range of Silver-haired bats; therefore, these species were grouped together. Although Big Brown Bat (abbreviated EPFU) also produce calls with a CF similar to Silver-haired bat and are generally reported as EPFU/LANO, given the few sightings reported to date in Nova Scotia, all potential EPFU/LANO calls were assumed LANO; hence the species grouping of LANO/LABO. Both Silver-haired and Eastern Red Bat are considered migratory species.
- LACI – Hoary Bat (abbreviated LACI) is a migratory bat with calls that are reliably differentiated from all other species. Hoary Bat calls have lower frequency (ranging from 25 to 18 kHz) and are noticeably longer in duration compared to other bat species known to occur within the project assessment area.

- MYOTID SSP – (abbreviated MYOTID) is a species group that includes resident (i.e., non-migratory) bat species in Nova Scotia including Little Brown Myotis, Northern Myotis, and the Tri-Colored Bat. Unlike the migratory species outlined above, the Myotid species group of bats produce shorter duration calls with a minimum frequency between 40 – 45 kHz, and maximum frequencies ranging between 120 kHz and 80 kHz. Occasionally, Myotis calls can have a minimum call frequency of 35 kHz.

Ecologically, these classifications make sense as Hoary Bats are typically confined to more open habitat, the LANO/LABO group typically forage in the open and along woodland edges, and the MYOTID SSP are the most agile and therefore may be found in more cluttered environments, near water bodies, and along woodland edges (van Zyll de Jong 1985).

3.0 Results

A total of 105 bat passes were recorded during the June 1 through October 15 survey period (inclusive). Table J-2, below, provides a summary of the number of species/species group bat passes per acoustic monitoring station by month.

Table J-2: Number of Bat Passes by Species/Species Group per Monitoring Station

Station	Species Group	Bat Passes per Month					Bat Passes
		June	July	August	September	1-15 October	
BAT 1	LACI	3	0	0	0	3	6
	LANO/LABO	3	0	0	8	0	11
	MYOTID	0	0	22	45	0	67
	total	6	0	22	53	3	84
BAT 2	LACI	0	0	0	0	3	3
	LANO/LABO	0	0	0	0	0	0
	MYOTID	0	0	0	0	0	0
	total	0	0	0	0	3	3
BAT 3	LACI	0	0	0	0	0	0
	LANO/LABO	0	0	0	0	0	0
	MYOTID	0	0	0	0	0	0
	total	0	0	0	0	0	0
POLE 1-Ground	LACI	0	0	0	0	0	0
	LANO/LABO	0	0	0	1	0	1
	MYOTID	0	3	1	2	0	6
	total	0	3	1	3	0	7
POLE 1-Elvevated	LACI	0	0	0	0	0	0
	LANO/LABO	0	0	0	0	0	0
	MYOTID	0	0	0	0	0	0
	total	0	0	0	0	0	0
BAT 4	LACI	0	2	2	0	0	4
	LANO/LABO	0	0	1	1	0	2
	MYOTID	0	2	3	0	0	5
	total	0	4	6	1	0	11
	TOTAL	6	7	29	57	6	105

The deployment periods varied through the survey program for reasons such as meter malfunctions, meter relocation and the addition of a survey location during the fall migratory period, as outlined

above in Table J-2. The analysis considers the total number of detector nights that each monitoring station was active for during the survey, which is summarized in Table J-3.

Table J-3 Number of Detector Nights per Survey Station and Month

Station	Number of Detector Nights (2021)					
	June	July	August	September	October	Total
Bat 1	5	18	31	24	9	87
Bat 2	0	0	21	29	15	65
Bat 3	15	0	0	0	0	15
Bat 4	20	31	31	29	11	122
Pole 1 - Ground	11	31	31	29	15	114
Pole 1 - Elevated	11	31	31	29	15	114
Total	62	111	145	140	65	523

3.1 2021 Breeding Period (June 1 to July 31)

Of the 105 bat passes recorded during the June 1 to October 15 monitoring period, 12% (or 13 bat passes) occurred during the breeding period. Figure J-2 below summarizes the number of bat passes per species/species group (including migratory and non-migratory species) by month. Similarly, Figure J-3 summarizes the number of bat passes (illustrated as All Bats and Migratory Bats) per detector night through the breeding period, as well as the average number of bat passes during the breeding period (illustrated as Average_All Bats and Average_Migratory Bats). Fewer detector nights were completed for the breeding period as a result of meter malfunctions a in between battery checks and later mobilization dates for Stations that were iniated after June 1st. The average 'All Bats' and 'Migratory Bats' passes per detector night during the breeding period was calculated at 0.08 and 0.06. bat passes, respectively.

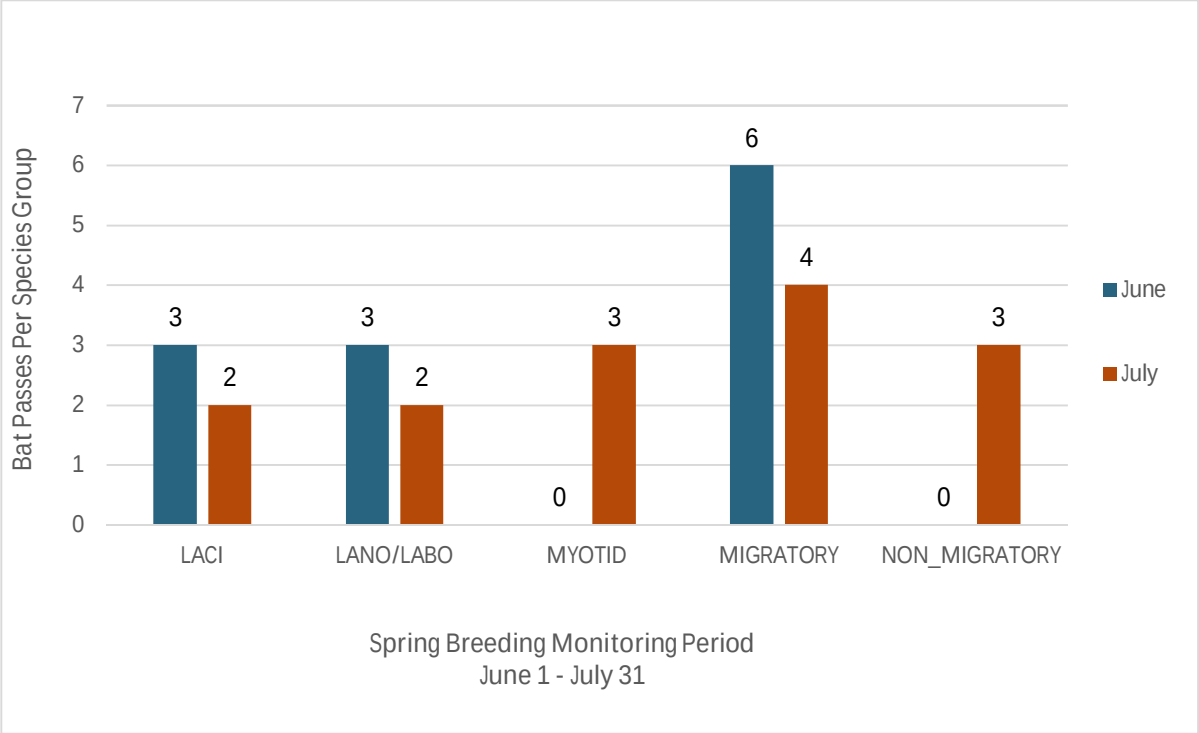


Figure J-2: Total Number of Bat Passes per Species/Species Group by Month – Spring Breeding

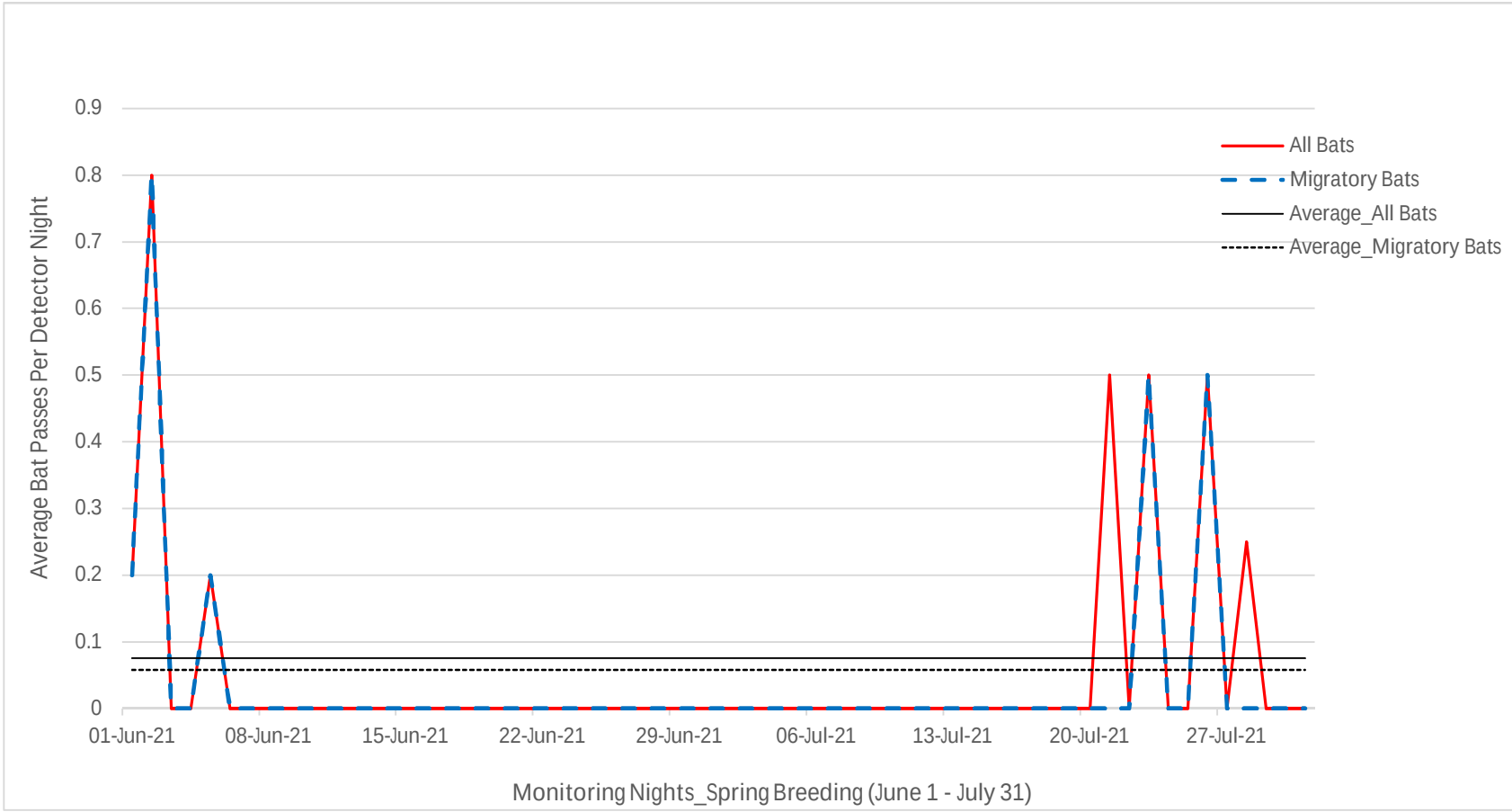


Figure J-3: Average Number of Bat Passes per Detector Night – Spring Breeding

3.2 2021 Fall Migration (August 1 to Oct 15)

Of the 105 bat passes recorded during the June 1 to October 15 monitoring period, 88% (or 92 bat passes) occurred during the fall migration period. Figure J-4 below summarizes the number of bat passes per species/species group (including by migratory and non-migratory species) by month. Similarly, Figure J-5 summarizes the number of bat passes (illustrated as All Bats and Migratory Bats) per detector night through the breeding period, as well as the average number of bat passes during the fall migration period (illustrated as Average_All Bats and Average_Migratory Bats). The average 'All Bats' and 'Migratory Bats' passes per detector night during the fall migration was calculated at 0.26 and 0.05 bat passes, respectively.

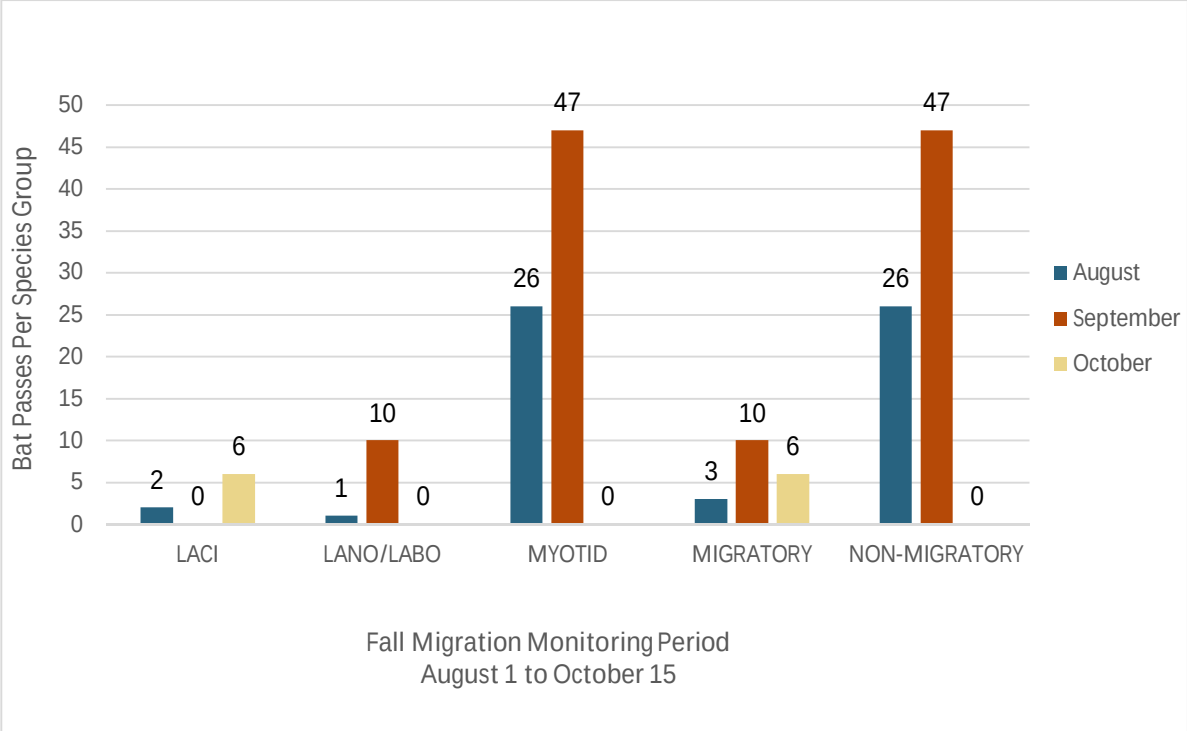


Figure J-4: Total Number of Bat Passes per Species/Species Group by Month – Fall Migration

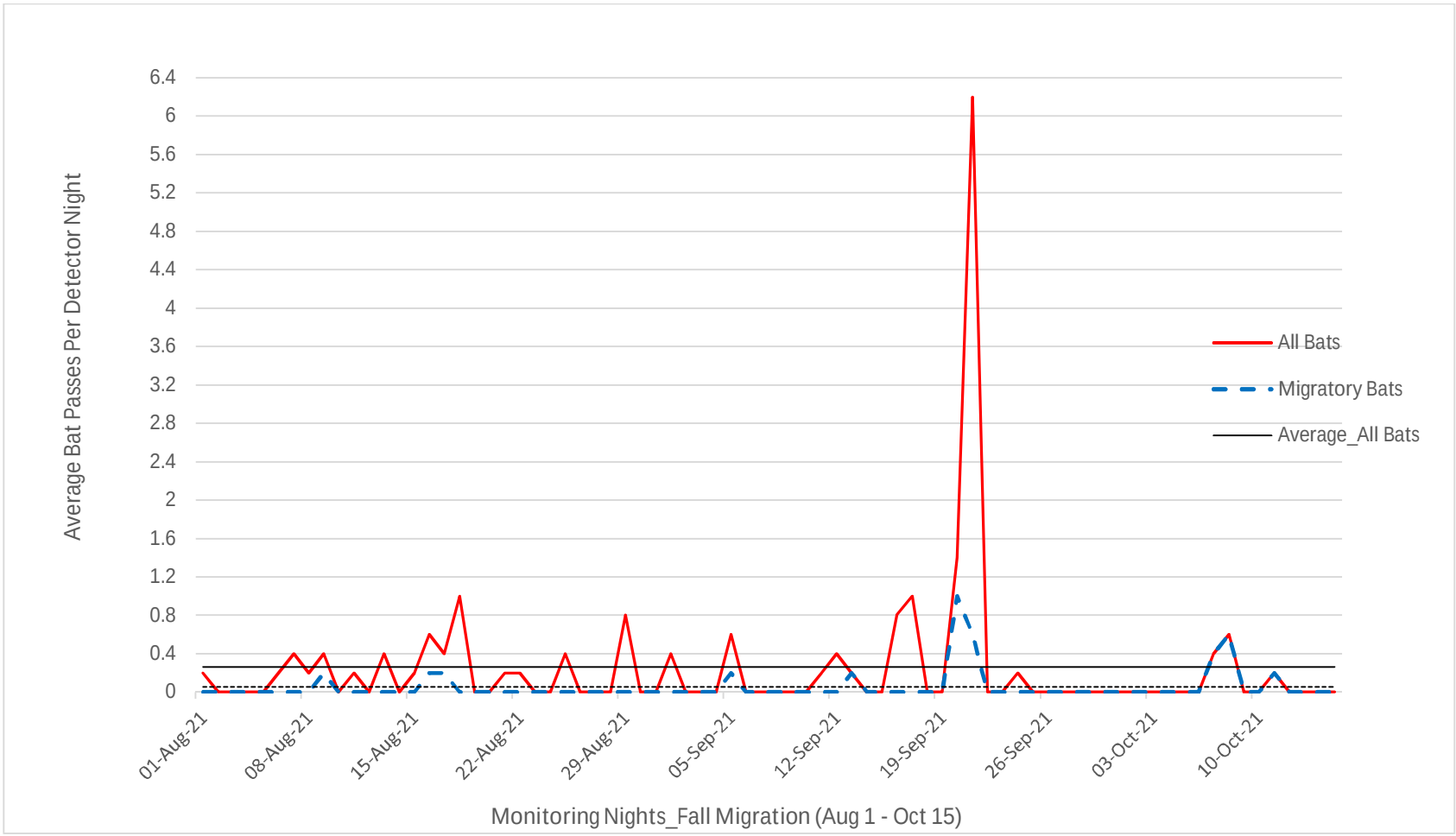


Figure J-5: Average Number of Bat Passes per Detector Night – Fall Migration

3.3 June 1 to Oct 15, 2021 In-Aggregate

Of the 105 bat passes recorded during the June 1 to October 15 monitoring period, 82% (or 86 bat passes) were recorded during the months of August and September 2021 (inclusive). The month of September alone was responsible for 54% (or 57 bat passes) of the 105 recorded bat passes. A total of six and seven bat passes were recorded in the months of June and July, respectively, with the remaining six bat passes recorded between October 1 and October 15.

The total number of bat passes per species/species group (and broken down by migratory and non-migratory species) per month is presented in Figure J-6. As illustrated in Figure J-7, the MYOTID species group accounted for 72% (or 76 bat passes) of the 105 bat passes recorded during the survey period, of which 62% (or 47 bat passes) of the 76 MYOTID passes occurred during the month of September alone.

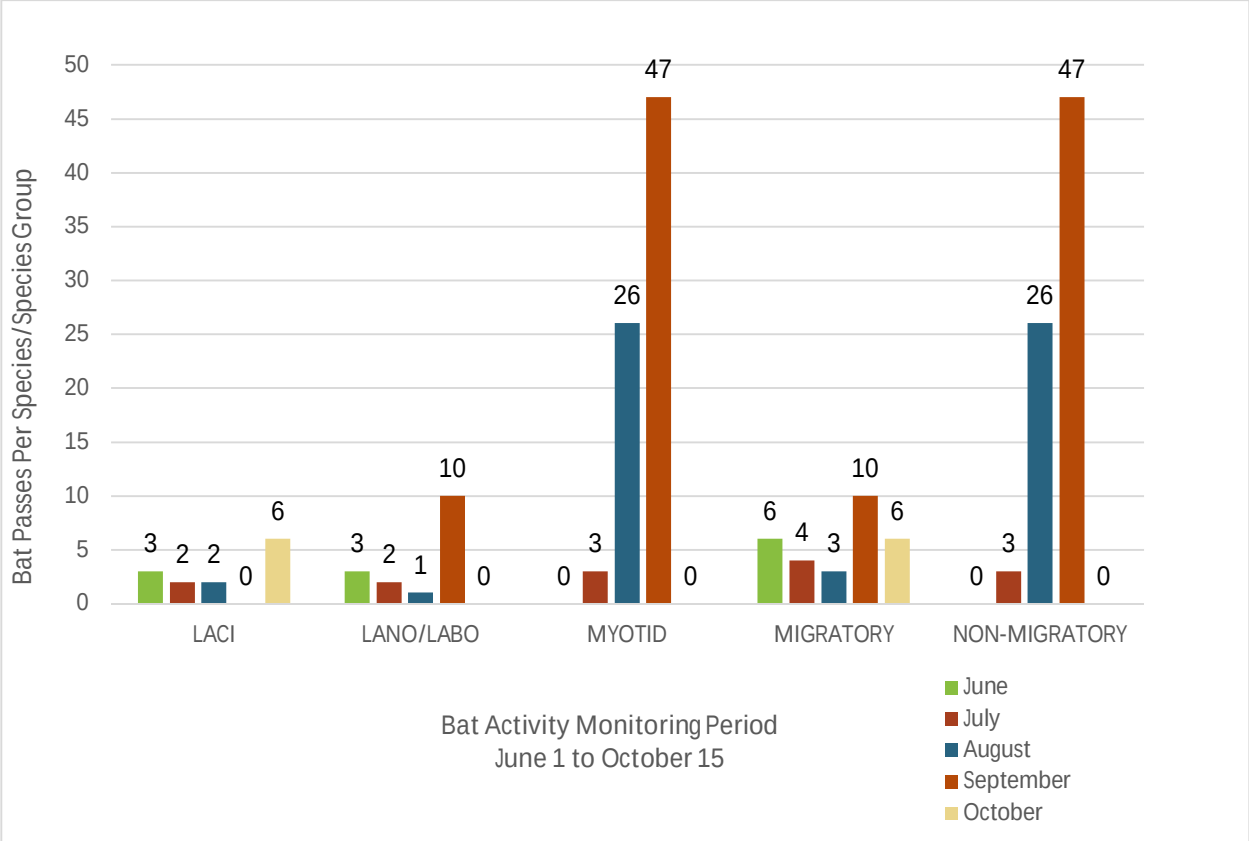


Figure J-6: Total Number of Bat Passes per Species/Species Group by Month – Survey Period

Figure J-8 summarizes the number of bat passes (illustrated as All Bats and Migratory Bats) per detector night throughout the survey period, as well as the average number of bat passes per detector night (illustrated as Average_All Bats and Average_Migratory Bats). The average 'All Bats' and 'Migratory Bats'

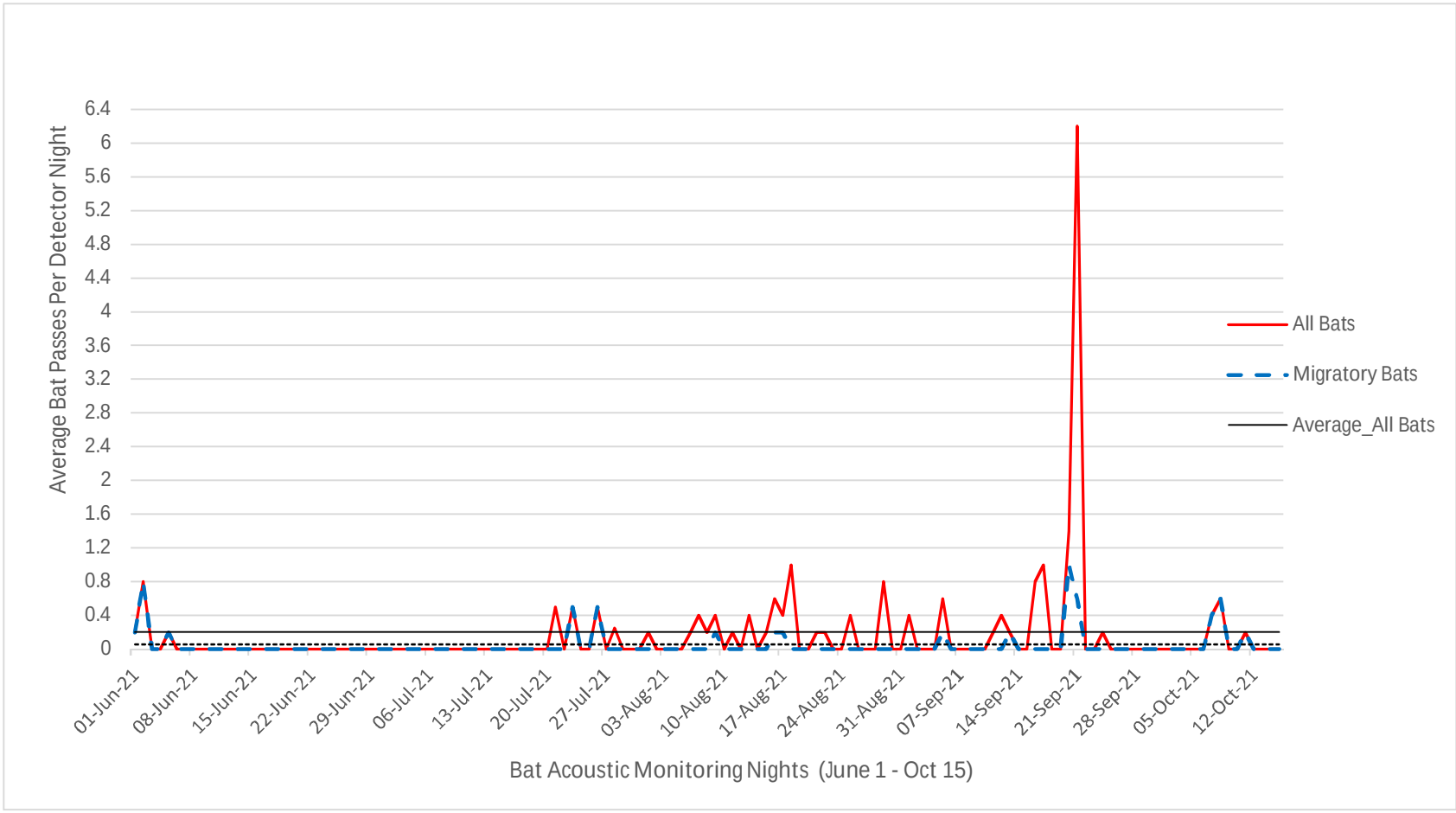


Figure J-7: Average Number of Bat Passes per Night – 2021 Survey Period

passes per detector night during the entire survey period was calculated at 0.20 and 0.06 bat passes, respectively.

Based on Dillon's experience on similar bat acoustic programs throughout the country, both the total number of bat passes (n= 105) and the average bat passes per detector night (during the breeding period, fall migration, and entire survey period) are considered very low. As discussed above, fewer data are available during the breeding period as a result of meter malfunctions in between battery checks and later mobilization dates for stations that occurred after June 1st. Although the total numbers of bat passes will be skewed lower as a result of fewer detector nights relative to the migratory season, the calculations of average bat passes per detector night factor in level of detector nights.

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