Nightly Bat Activity Analysis

Author: NA

13/02/2019

# Summary

Bat surveys were conducted on **55** nights between **2018-07-05** and **2018-09-15**, using **3** static bat detectors. Throughout this period **9** species were recorded. Detectors were placed at the following locations:

|  |  |  |
| --- | --- | --- |
| Detector ID | Latitude | Longitude |
| A3 | 55.15972 | -3.157717 |
| C13 | 55.17115 | -3.145067 |
| C9 | 55.16233 | -3.141583 |

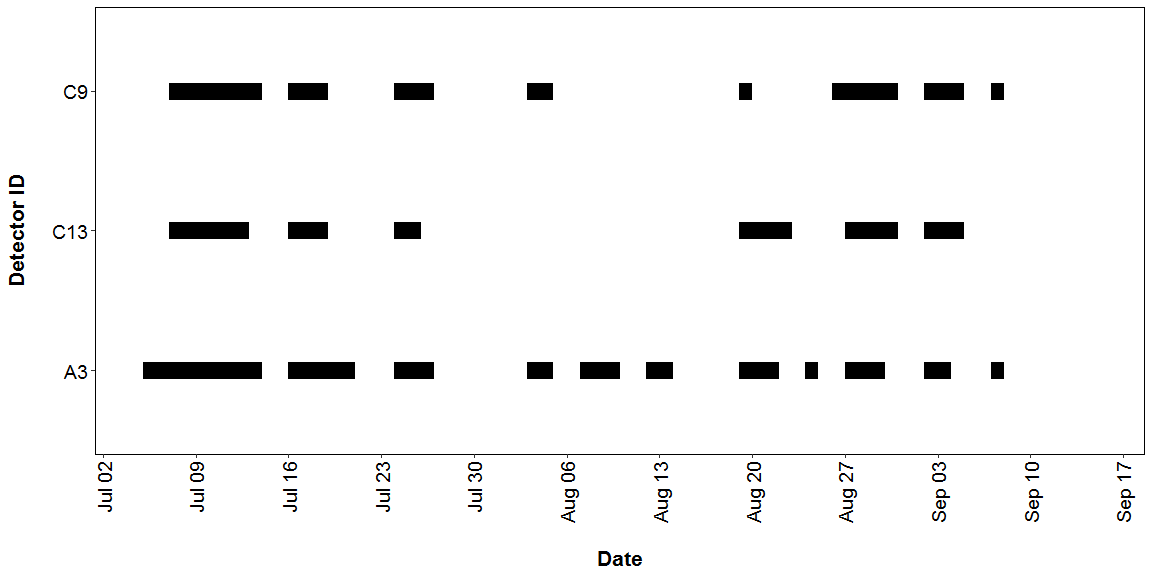
# Survey Nights

|  |  |
| --- | --- |
| Detector ID | No. of nights |
| A3 | 47 |
| C13 | 37 |
| C9 | 40 |

##### Page Break

# Survey Nights

Horizontal bars show when acoustic detectors were active.



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# Sunrise and Sunset Times

**The times of sunset and sunrise the following morning for surveys beginning on the date shown.**

|  |  |  |  |
| --- | --- | --- | --- |
| Night (y-m-d) | Sunset (hh:mm) | Sunrise (hh:mm) | Night Length (hours) |
| 2018-07-05 | 21:54 | 04:42 | 6.8 |
| 2018-07-06 | 21:54 | 04:43 | 6.8 |
| 2018-07-07 | 21:53 | 04:44 | 6.9 |
| 2018-07-08 | 21:52 | 04:46 | 6.9 |
| 2018-07-09 | 21:51 | 04:47 | 6.9 |
| 2018-07-10 | 21:50 | 04:48 | 7.0 |
| 2018-07-11 | 21:49 | 04:49 | 7.0 |
| 2018-07-12 | 21:48 | 04:51 | 7.0 |
| 2018-07-13 | 21:47 | 04:52 | 7.1 |
| 2018-07-14 | 21:46 | 04:53 | 7.1 |
| 2018-07-16 | 21:44 | 04:56 | 7.2 |
| 2018-07-17 | 21:43 | 04:58 | 7.3 |
| 2018-07-18 | 21:41 | 04:59 | 7.3 |
| 2018-07-19 | 21:40 | 05:01 | 7.3 |
| 2018-07-20 | 21:38 | 05:02 | 7.4 |
| 2018-07-21 | 21:37 | 05:04 | 7.5 |
| 2018-07-24 | 21:32 | 05:09 | 7.6 |
| 2018-07-25 | 21:31 | 05:11 | 7.7 |
| 2018-07-26 | 21:29 | 05:12 | 7.7 |
| 2018-07-27 | 21:27 | 05:14 | 7.8 |
| 2018-07-29 | 21:24 | 05:18 | 7.9 |
| 2018-08-03 | 21:14 | 05:27 | 8.2 |
| 2018-08-04 | 21:12 | 05:28 | 8.3 |
| 2018-08-05 | 21:10 | 05:30 | 8.3 |
| 2018-08-07 | 21:06 | 05:34 | 8.5 |
| 2018-08-08 | 21:04 | 05:36 | 8.5 |
| 2018-08-09 | 21:02 | 05:38 | 8.6 |
| 2018-08-10 | 21:00 | 05:40 | 8.7 |
| 2018-08-12 | 20:56 | 05:43 | 8.8 |
| 2018-08-13 | 20:53 | 05:45 | 8.9 |
| 2018-08-14 | 20:51 | 05:47 | 8.9 |
| 2018-08-16 | 20:47 | 05:51 | 9.1 |
| 2018-08-19 | 20:40 | 05:57 | 9.3 |
| 2018-08-20 | 20:37 | 05:59 | 9.4 |
| 2018-08-21 | 20:35 | 06:00 | 9.4 |
| 2018-08-22 | 20:33 | 06:02 | 9.5 |
| 2018-08-23 | 20:30 | 06:04 | 9.6 |
| 2018-08-24 | 20:28 | 06:06 | 9.6 |
| 2018-08-25 | 20:26 | 06:08 | 9.7 |
| 2018-08-26 | 20:23 | 06:10 | 9.8 |
| 2018-08-27 | 20:21 | 06:12 | 9.9 |
| 2018-08-28 | 20:18 | 06:14 | 9.9 |
| 2018-08-29 | 20:16 | 06:15 | 10.0 |
| 2018-08-30 | 20:13 | 06:17 | 10.1 |
| 2018-08-31 | 20:11 | 06:19 | 10.1 |
| 2018-09-02 | 20:06 | 06:23 | 10.3 |
| 2018-09-03 | 20:03 | 06:25 | 10.4 |
| 2018-09-04 | 20:01 | 06:27 | 10.4 |
| 2018-09-05 | 19:58 | 06:29 | 10.5 |
| 2018-09-07 | 19:53 | 06:32 | 10.7 |
| 2018-09-08 | 19:50 | 06:34 | 10.7 |
| 2018-09-09 | 19:48 | 06:36 | 10.8 |
| 2018-09-12 | 19:40 | 06:42 | 11.0 |
| 2018-09-14 | 19:35 | 06:45 | 11.2 |
| 2018-09-15 | 19:32 | 06:47 | 11.2 |

##### Page Break

# Counts of Bat Passes

## All detectors

**The total number of passes recorded for each species across all of the detectors.**

|  |  |  |
| --- | --- | --- |
| Species | Count (No) | Percentage of total (%) |
| Pipistrellus spp. | 6 | 0.1 |
| Common pipistrelle | 3341 | 68.8 |
| Soprano pipistrelle | 829 | 17.1 |
| Nathusius’ | 79 | 1.6 |
| Nyctalus spp. | 91 | 1.9 |
| Noctule | 407 | 8.4 |
| Leisler’s | 42 | 0.9 |
| Brown long-eared | 2 | 0.0 |
| Myotis spp. | 62 | 1.3 |
| Total | 4859 | 100.1 |

##### Page Break

# Counts of Bat Passes

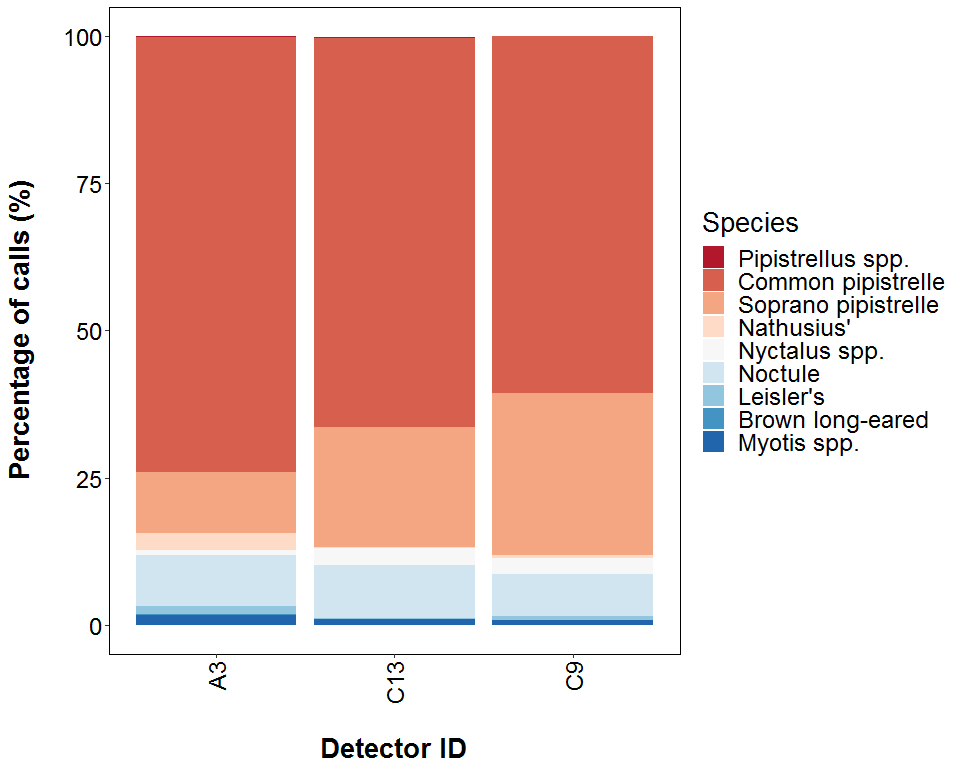
## Per Detector

**The number of passes recorded for each species at each detector.**

|  |  |  |  |
| --- | --- | --- | --- |
| Species | Detector ID | Count (No) | Percentage by Detector (%) |
| Pipistrellus spp. | A3 | 3 | 0.1 |
| Pipistrellus spp. | C13 | 3 | 0.2 |
| Common pipistrelle | A3 | 1799 | 74.0 |
| Common pipistrelle | C13 | 832 | 66.1 |
| Common pipistrelle | C9 | 710 | 60.7 |
| Soprano pipistrelle | A3 | 250 | 10.3 |
| Soprano pipistrelle | C13 | 257 | 20.4 |
| Soprano pipistrelle | C9 | 322 | 27.5 |
| Nathusius’ | A3 | 71 | 2.9 |
| Nathusius’ | C13 | 2 | 0.2 |
| Nathusius’ | C9 | 6 | 0.5 |
| Nyctalus spp. | A3 | 23 | 0.9 |
| Nyctalus spp. | C13 | 37 | 2.9 |
| Nyctalus spp. | C9 | 31 | 2.6 |
| Noctule | A3 | 211 | 8.7 |
| Noctule | C13 | 112 | 8.9 |
| Noctule | C9 | 84 | 7.2 |
| Leisler’s | A3 | 31 | 1.3 |
| Leisler’s | C13 | 3 | 0.2 |
| Leisler’s | C9 | 8 | 0.7 |
| Brown long-eared | A3 | 2 | 0.1 |
| Myotis spp. | A3 | 41 | 1.7 |
| Myotis spp. | C13 | 12 | 1.0 |
| Myotis spp. | C9 | 9 | 0.8 |

##### Page Break

# Species Composition of Passes at each Detector



##### Page Break

# Bat Passes per Month

## Per Detector

**The total number of bat passes of each species in each month at each detector.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Species | Detector ID | Jul | Aug | Sep |
| Pipistrellus spp. | A3 | 3 | 0 | 0 |
| Pipistrellus spp. | C13 | 1 | 2 | 0 |
| Common pipistrelle | A3 | 469 | 1285 | 45 |
| Common pipistrelle | C13 | 106 | 661 | 65 |
| Common pipistrelle | C9 | 63 | 565 | 82 |
| Soprano pipistrelle | A3 | 86 | 162 | 2 |
| Soprano pipistrelle | C13 | 26 | 210 | 21 |
| Soprano pipistrelle | C9 | 36 | 240 | 46 |
| Nathusius’ | A3 | 9 | 62 | 0 |
| Nathusius’ | C13 | 0 | 2 | 0 |
| Nathusius’ | C9 | 0 | 4 | 2 |
| Nyctalus spp. | A3 | 7 | 12 | 4 |
| Nyctalus spp. | C13 | 2 | 27 | 8 |
| Nyctalus spp. | C9 | 5 | 20 | 6 |
| Noctule | A3 | 132 | 53 | 26 |
| Noctule | C13 | 12 | 82 | 18 |
| Noctule | C9 | 16 | 64 | 4 |
| Leisler’s | A3 | 28 | 3 | 0 |
| Leisler’s | C13 | 0 | 2 | 1 |
| Leisler’s | C9 | 4 | 3 | 1 |
| Brown long-eared | A3 | 0 | 2 | 0 |
| Myotis spp. | A3 | 6 | 30 | 5 |
| Myotis spp. | C13 | 3 | 5 | 4 |
| Myotis spp. | C9 | 2 | 7 | 0 |

##### Page Break

## Nightly Bat Passes for each Month

# Median Per Detector

**The median number of bat passes of each species throughout each month. If NA, then no bat passes.**

Bat pass rates are often highly variable between nights, with some nights having few or no passes and other nights having high activity. In these circumstances, the median is likely to be a more useful summary of the ‘average’ activity than is the mean. For further information see: *Lintott, P. R., & Mathews, F. (2018). Basic mathematical errors may make ecological assessments unreliable. Biodiversity and Conservation, 27(1), 265-267.* <https://doi.org/10.1007/s10531-017-1418-5>

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Species | Detector ID | Jul | Aug | Sep |
| Pipistrellus spp. | A3 | 1.5 | NA | NA |
| Pipistrellus spp. | C13 | 1.0 | 2.0 | NA |
| Common pipistrelle | A3 | 13.5 | 16.0 | 6.5 |
| Common pipistrelle | C13 | 6.0 | 18.5 | 2.5 |
| Common pipistrelle | C9 | 1.5 | 10.0 | 1.0 |
| Soprano pipistrelle | A3 | 3.0 | 5.5 | 1.0 |
| Soprano pipistrelle | C13 | 3.0 | 11.0 | 5.0 |
| Soprano pipistrelle | C9 | 2.0 | 7.0 | 23.0 |
| Nathusius’ | A3 | 4.5 | 6.0 | NA |
| Nathusius’ | C13 | NA | 2.0 | NA |
| Nathusius’ | C9 | NA | 2.0 | 1.0 |
| Nyctalus spp. | A3 | 2.0 | 3.0 | 2.0 |
| Nyctalus spp. | C13 | 2.0 | 3.5 | 4.0 |
| Nyctalus spp. | C9 | 1.0 | 2.0 | 6.0 |
| Noctule | A3 | 5.0 | 3.0 | 9.0 |
| Noctule | C13 | 2.0 | 6.0 | 1.0 |
| Noctule | C9 | 1.0 | 5.0 | 2.0 |
| Leisler’s | A3 | 2.0 | 1.0 | NA |
| Leisler’s | C13 | NA | 1.0 | 1.0 |
| Leisler’s | C9 | 1.0 | 1.0 | 1.0 |
| Brown long-eared | A3 | NA | 2.0 | NA |
| Myotis spp. | A3 | 1.0 | 2.0 | 1.0 |
| Myotis spp. | C13 | 1.5 | 1.0 | 4.0 |
| Myotis spp. | C9 | 1.0 | 1.0 | NA |

##### Page Break

## Nightly Bat Passes for each Month

# Mean per Detector

# Survey Effort

**The number of survey nights per month per detector.**

|  |  |  |
| --- | --- | --- |
| Month | Detector ID | No of Survey Nights |
| Jul | A3 | 21 |
| Jul | C13 | 14 |
| Jul | C9 | 17 |
| Aug | A3 | 20 |
| Aug | C13 | 15 |
| Aug | C9 | 15 |
| Sep | A3 | 6 |
| Sep | C13 | 8 |
| Sep | C9 | 8 |

**The mean number of bat passes of each species per night throughout each month. Calculated with (Number of passes each month) / (Number of survey nights each month) for each detector. Values are given to 1 decimal place. We recommend using the median values given above, for the reasons stated above, but provide the mean values in the table below.**

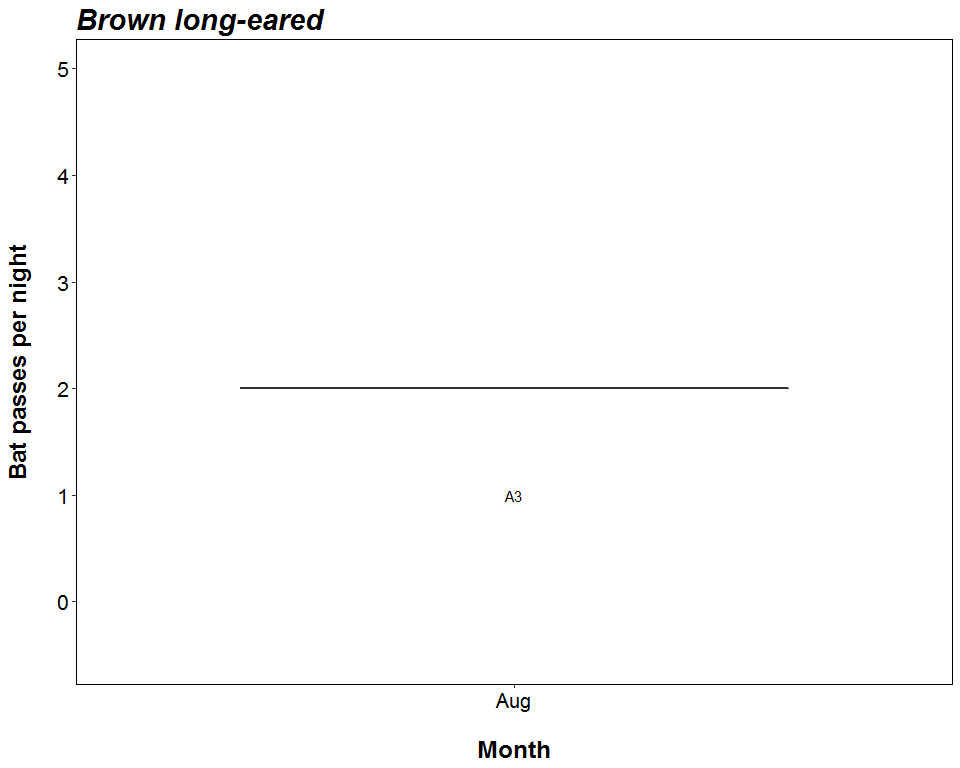
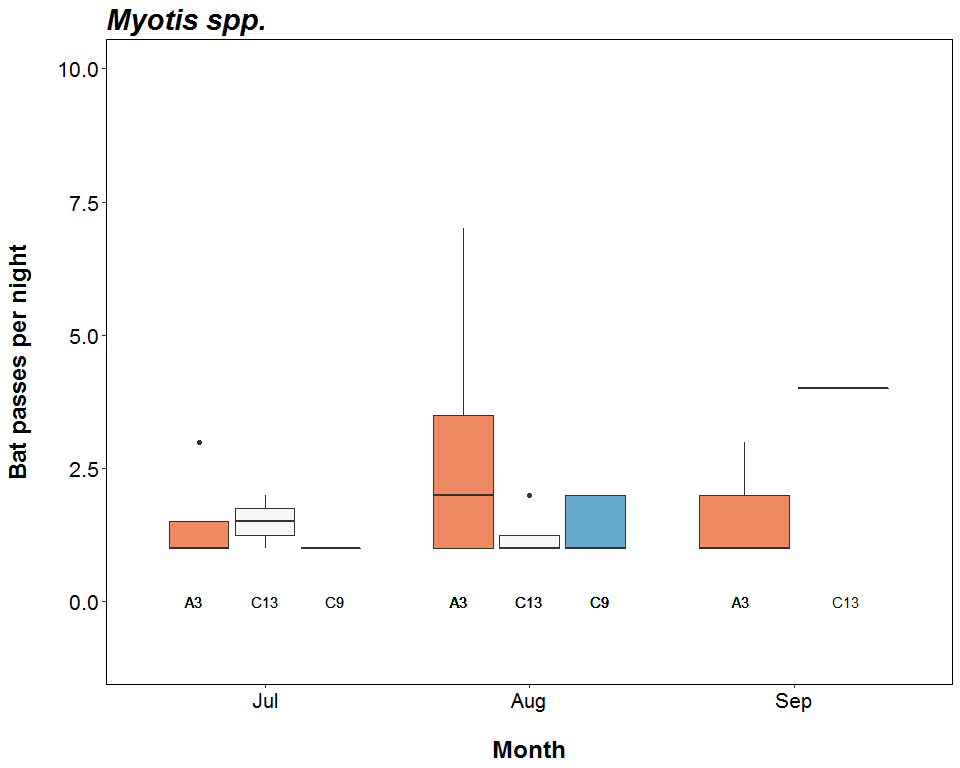
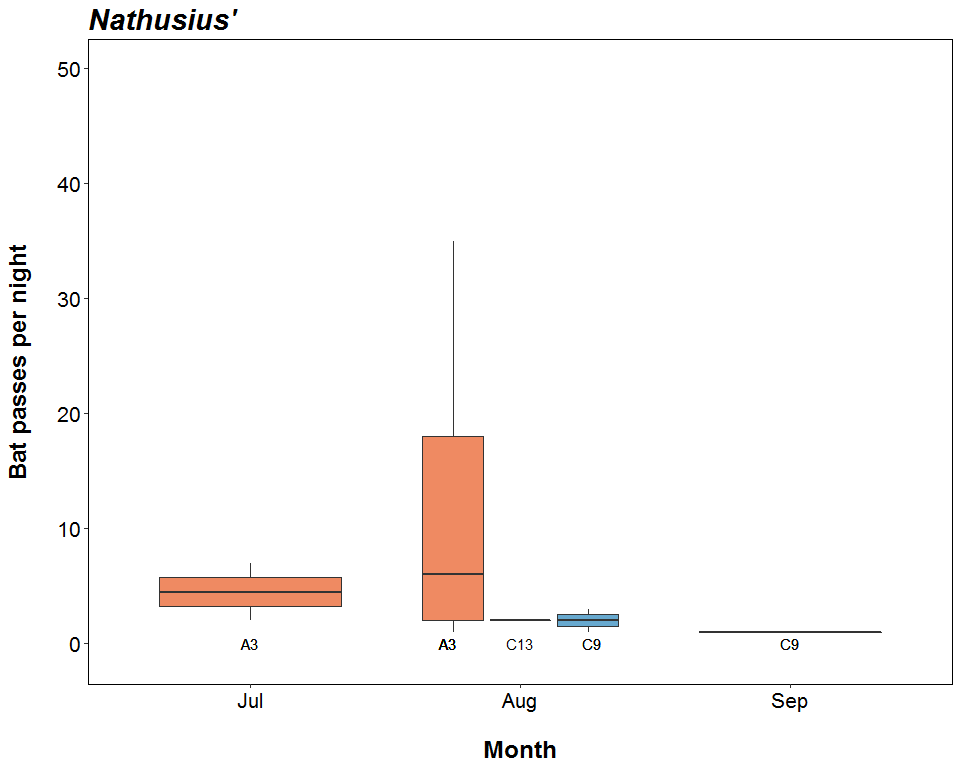
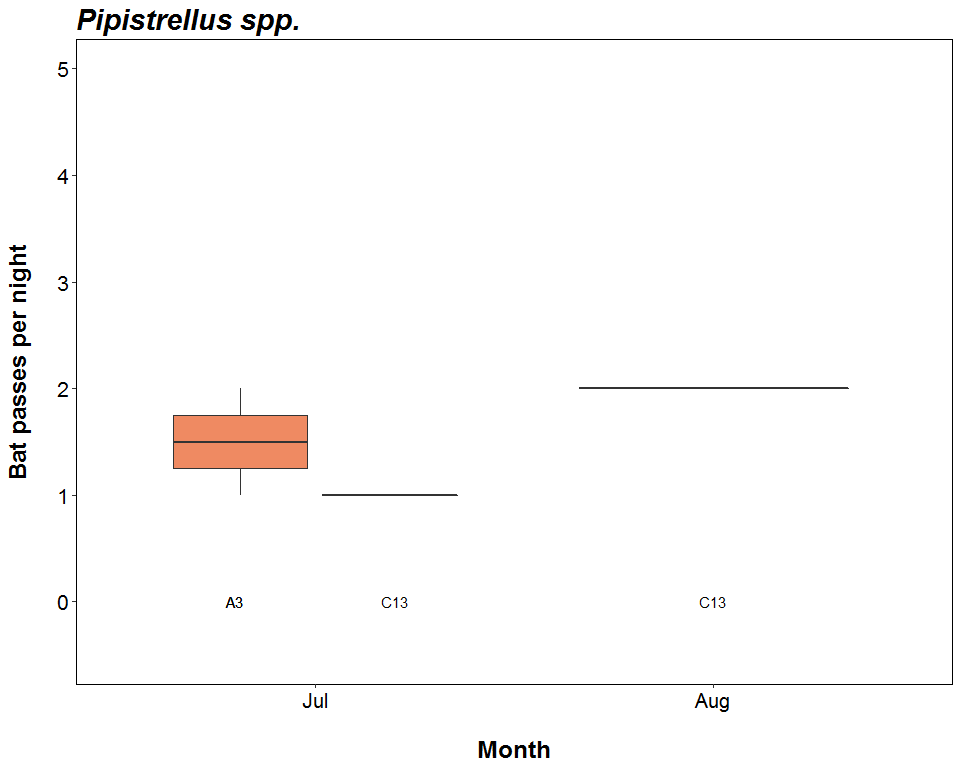
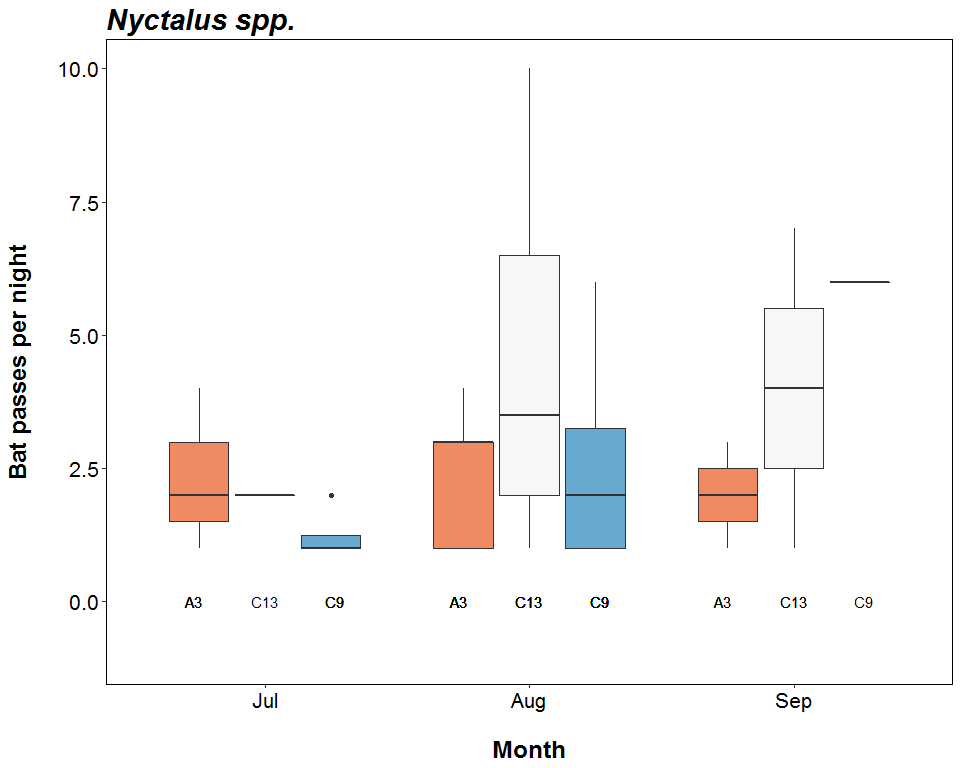
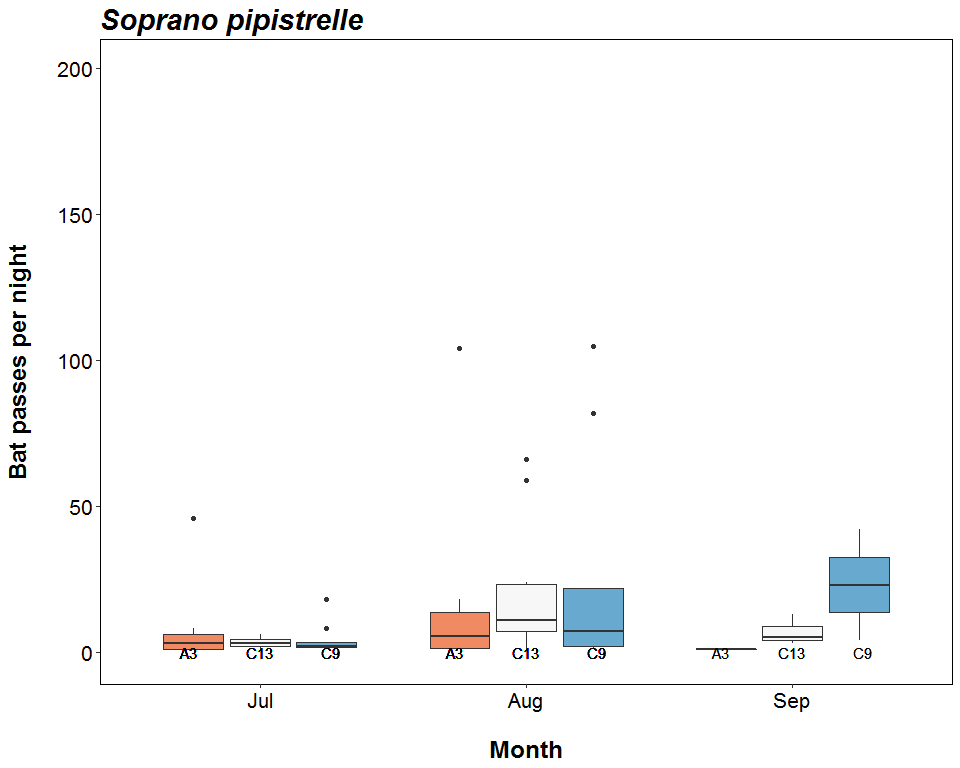
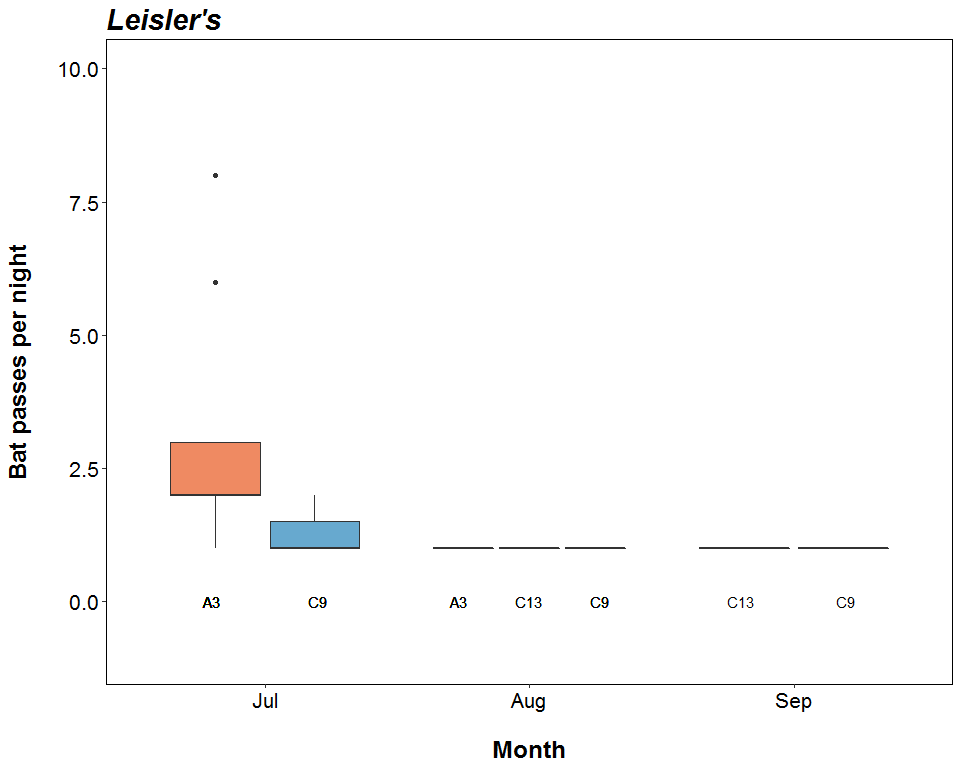
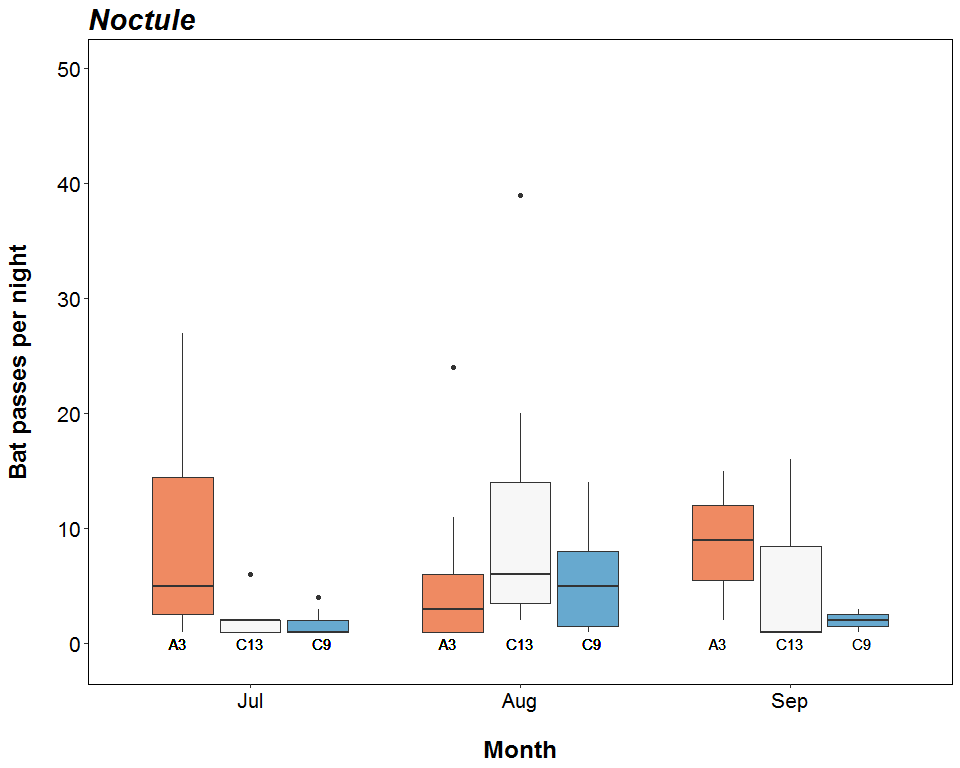
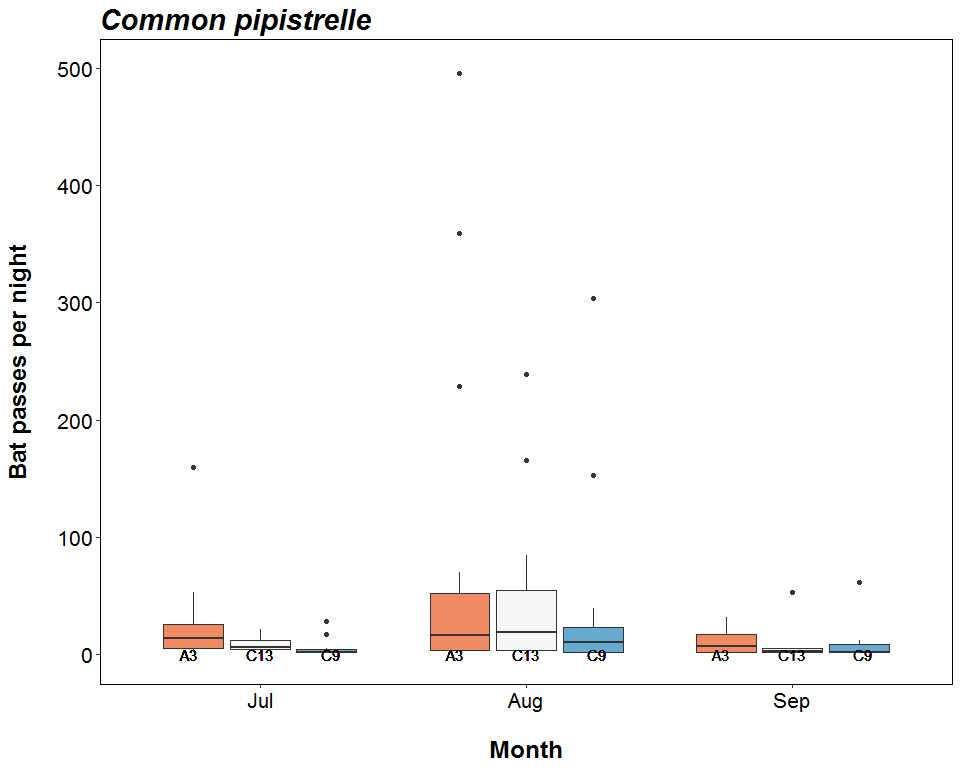
|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Species | Detector ID | Jul | Aug | Sep |
| Pipistrellus spp. | A3 | 0.1 | 0.0 | 0.0 |
| Pipistrellus spp. | C13 | 0.1 | 0.1 | 0.0 |
| Common pipistrelle | A3 | 22.3 | 64.2 | 7.5 |
| Common pipistrelle | C13 | 7.6 | 44.1 | 8.1 |
| Common pipistrelle | C9 | 3.7 | 37.7 | 10.2 |
| Soprano pipistrelle | A3 | 4.1 | 8.1 | 0.3 |
| Soprano pipistrelle | C13 | 1.9 | 14.0 | 2.6 |
| Soprano pipistrelle | C9 | 2.1 | 16.0 | 5.8 |
| Nathusius’ | A3 | 0.4 | 3.1 | 0.0 |
| Nathusius’ | C13 | 0.0 | 0.1 | 0.0 |
| Nathusius’ | C9 | 0.0 | 0.3 | 0.2 |
| Nyctalus spp. | A3 | 0.3 | 0.6 | 0.7 |
| Nyctalus spp. | C13 | 0.1 | 1.8 | 1.0 |
| Nyctalus spp. | C9 | 0.3 | 1.3 | 0.8 |
| Noctule | A3 | 6.3 | 2.6 | 4.3 |
| Noctule | C13 | 0.9 | 5.5 | 2.2 |
| Noctule | C9 | 0.9 | 4.3 | 0.5 |
| Leisler’s | A3 | 1.3 | 0.2 | 0.0 |
| Leisler’s | C13 | 0.0 | 0.1 | 0.1 |
| Leisler’s | C9 | 0.2 | 0.2 | 0.1 |
| Brown long-eared | A3 | 0.0 | 0.1 | 0.0 |
| Myotis spp. | A3 | 0.3 | 1.5 | 0.8 |
| Myotis spp. | C13 | 0.2 | 0.3 | 0.5 |
| Myotis spp. | C9 | 0.1 | 0.5 | 0.0 |

##### Page Break

# Bat Passes per Month

## Per Detector - Figures

Figures show boxplots for the number of bat passes by detector each month. The ‘box’ shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The ‘whiskers’ extend from the box and represent the ranges for the bottom 25% and the top 25% of the data values, excluding outliers. An outlier is any extreme value that lies further away from the box than 1.5 times the interquartile range. Outliers are shown as dots. Where very few passes are recorded it is not possible to produce the box, so the data are shown as a line.



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# Distribution of Bat Passes Across Hours of the Night

## All Detectors

**The total number of bat passes occuring during each hour after sunset.**

###### Hours After Sunset

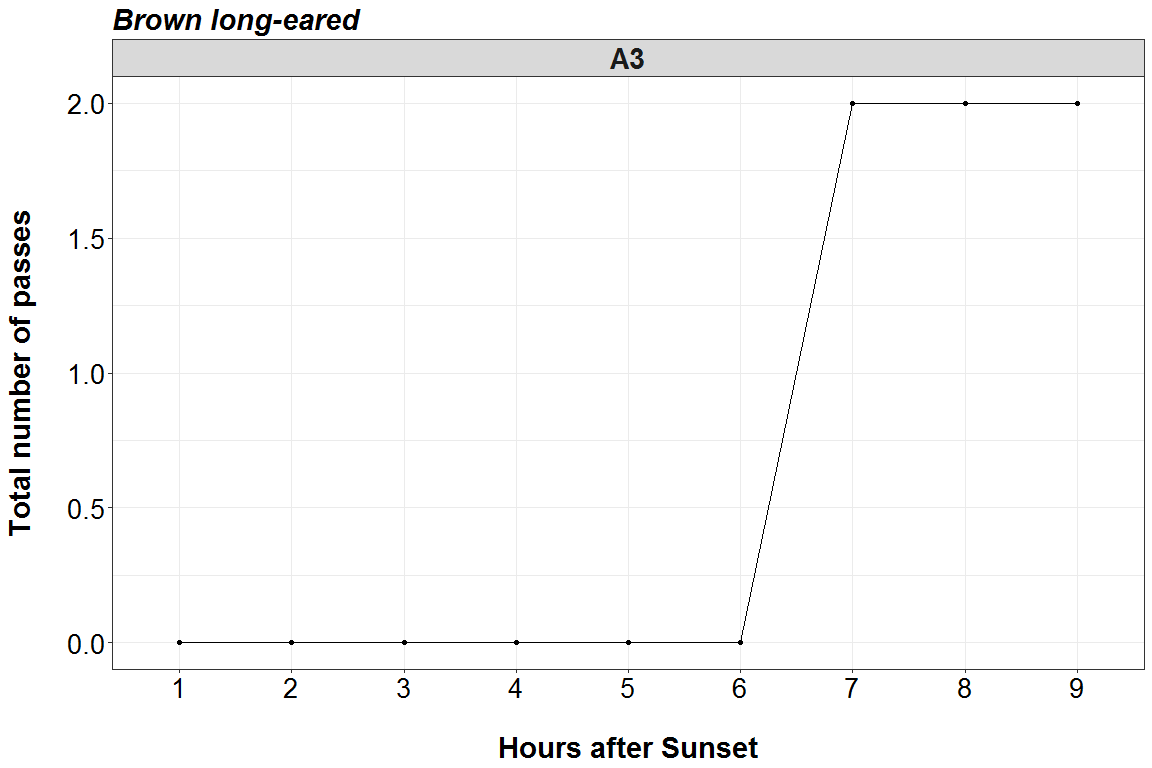
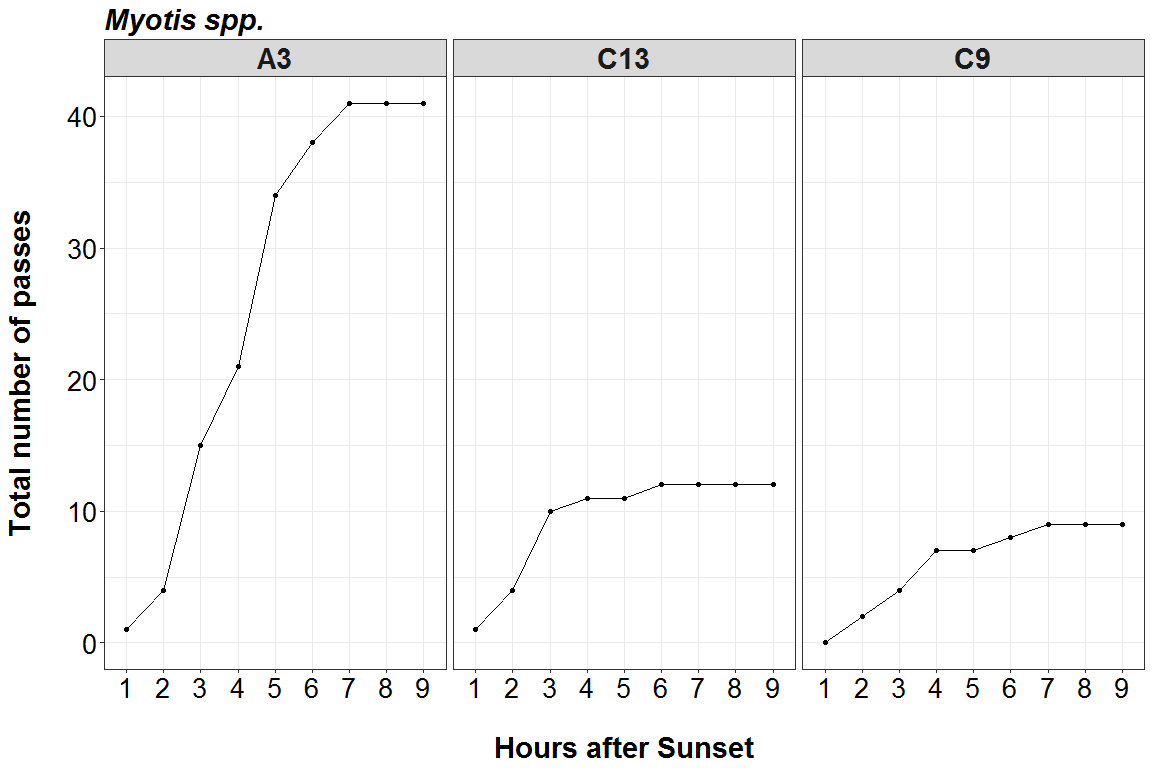
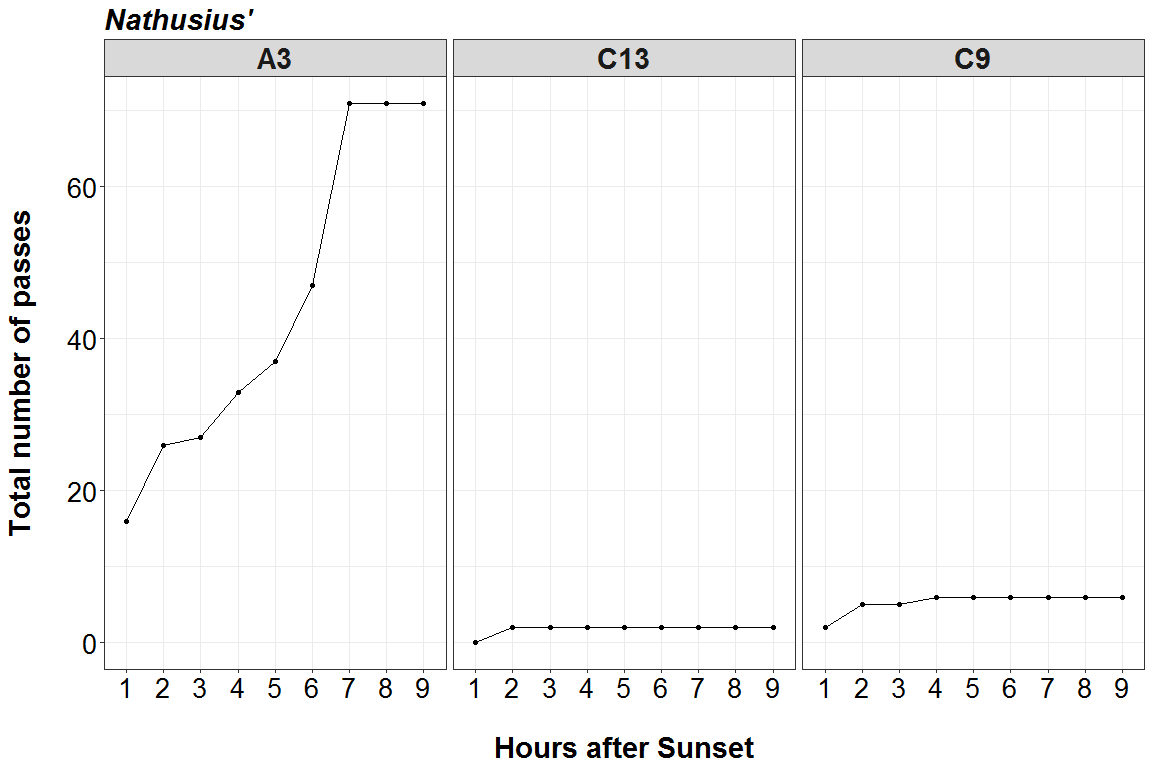
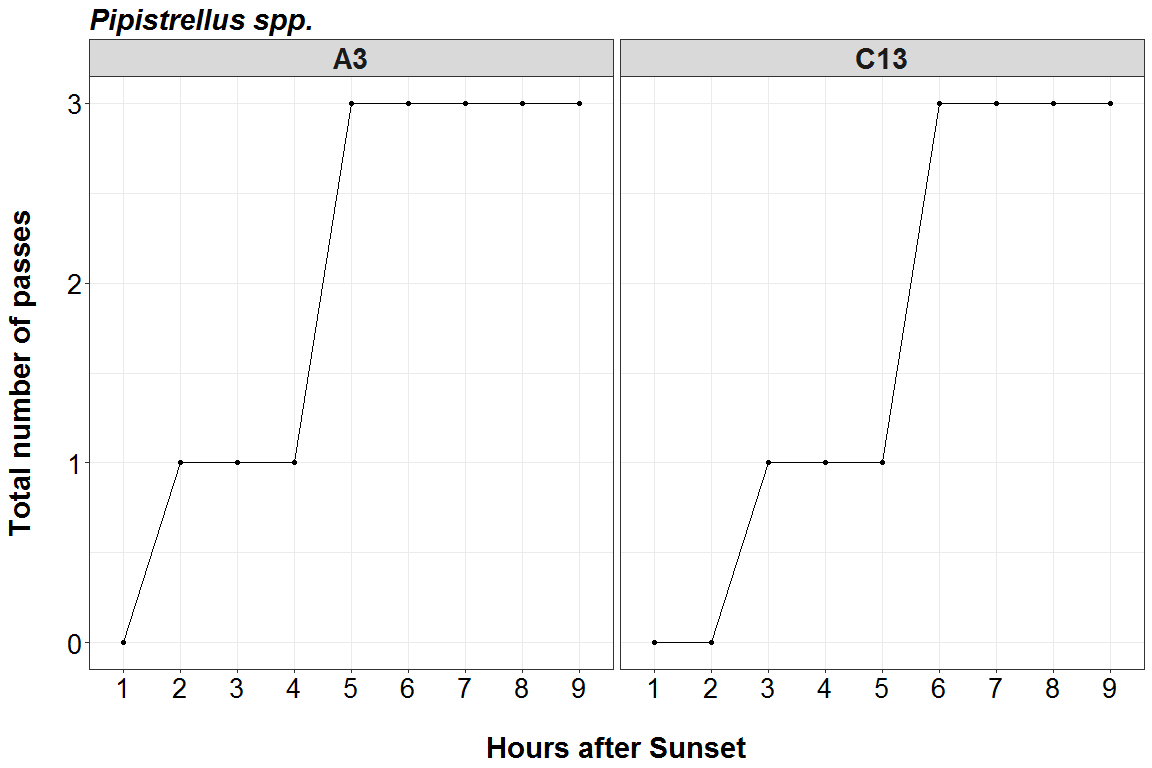
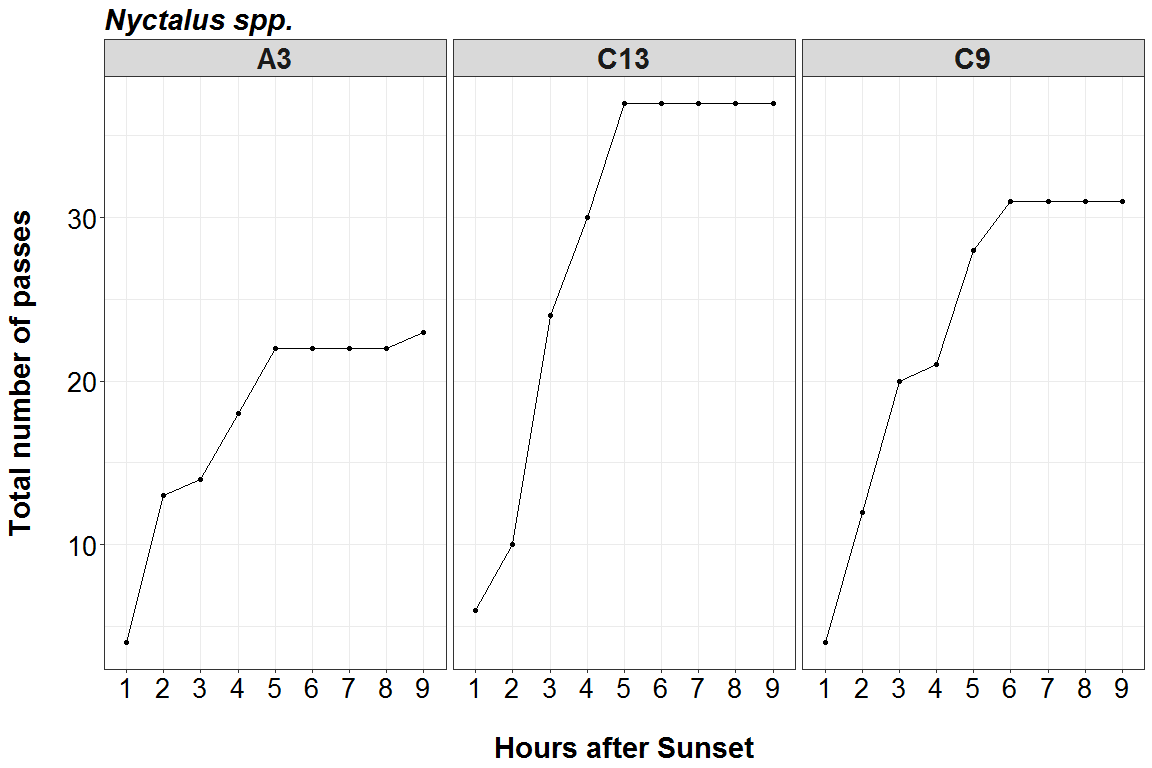
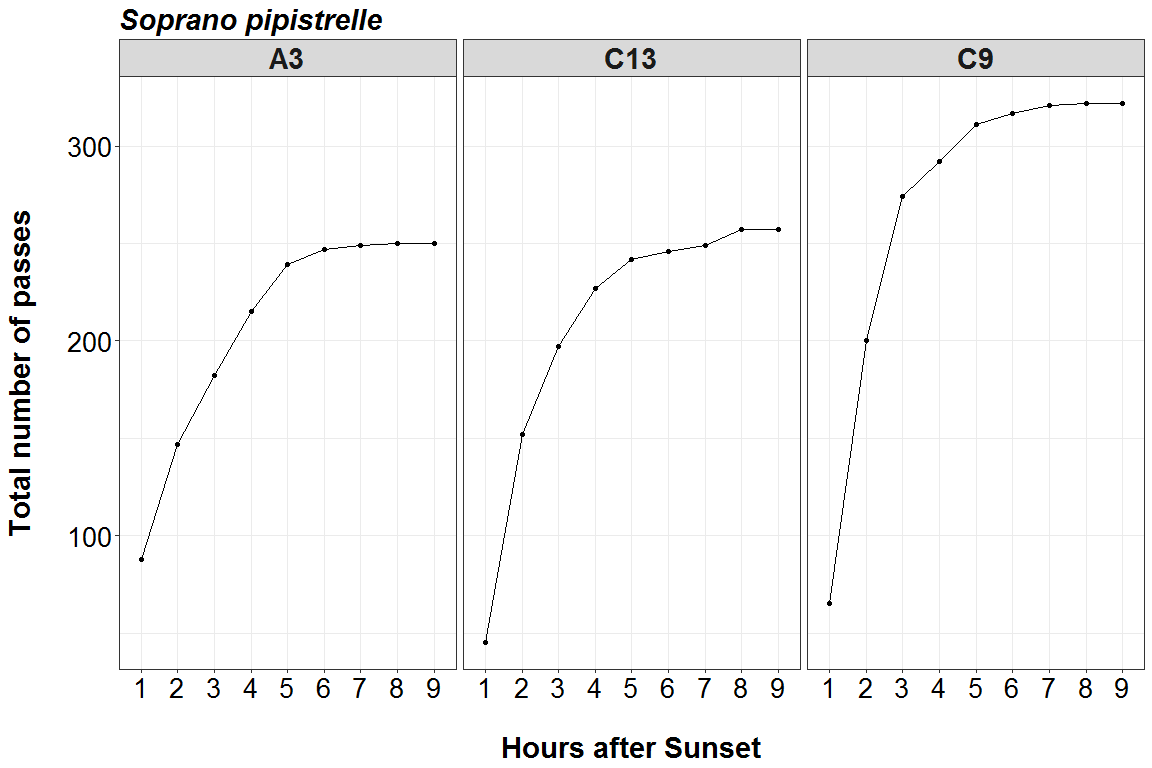
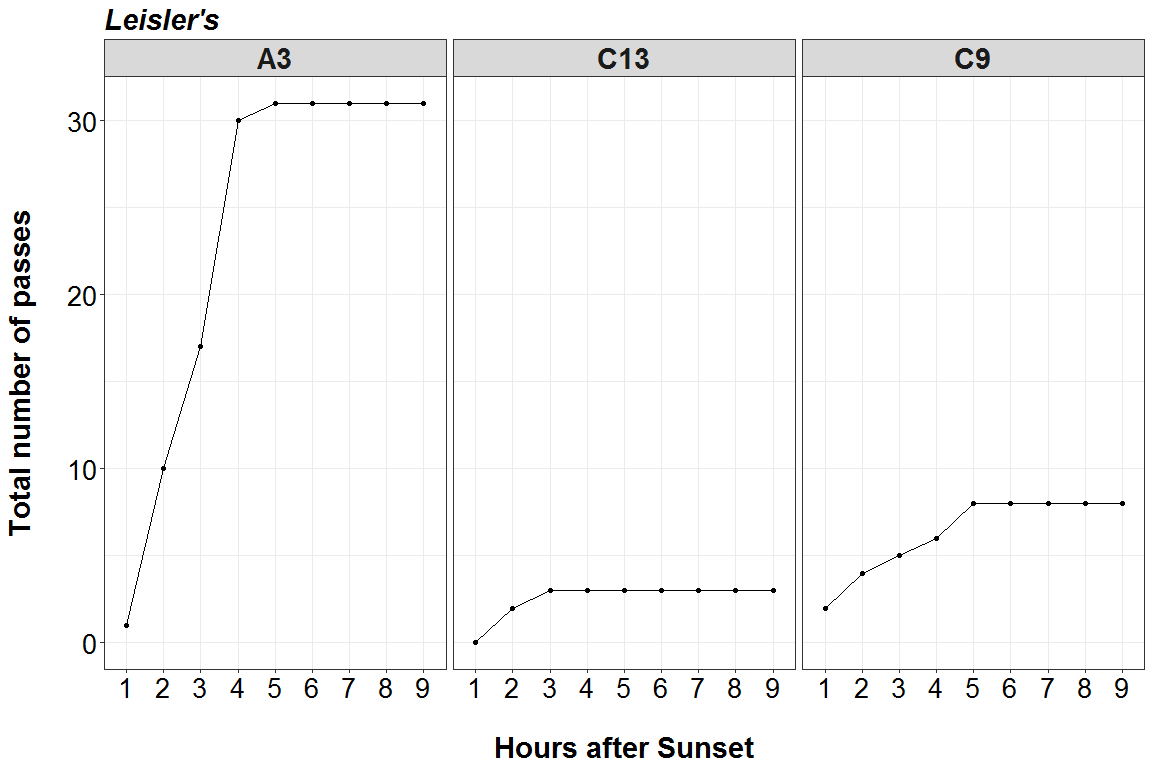
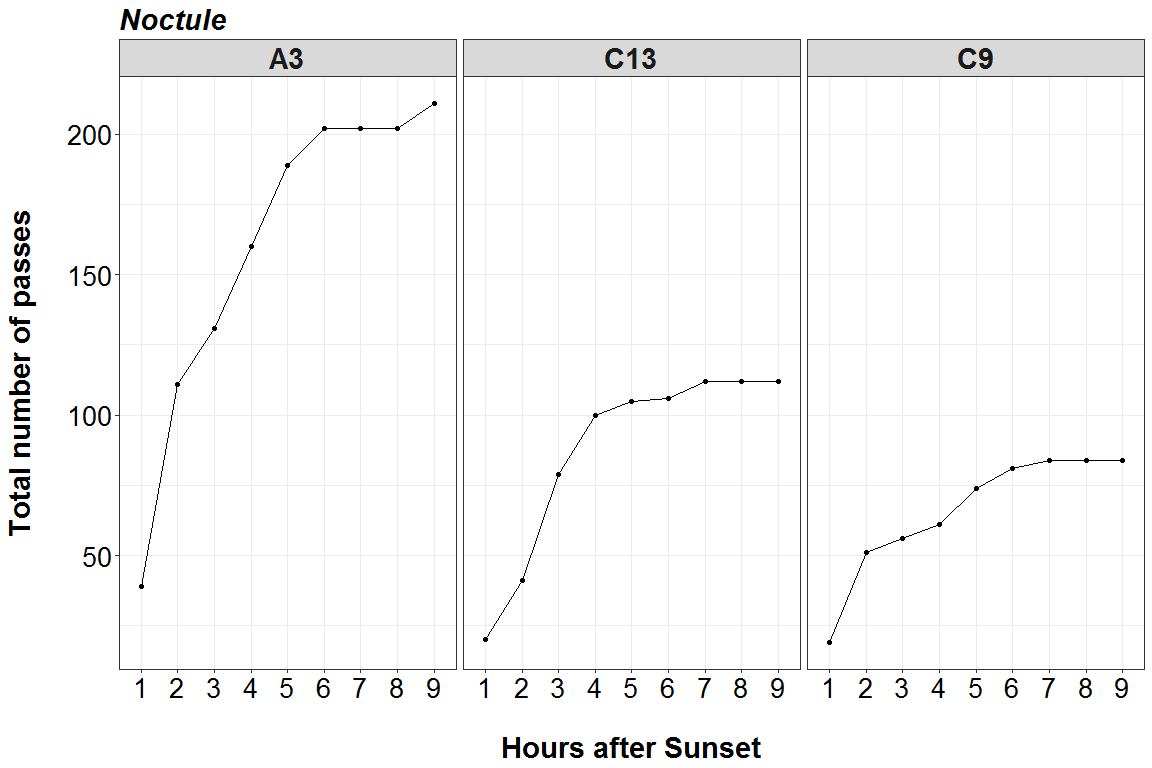
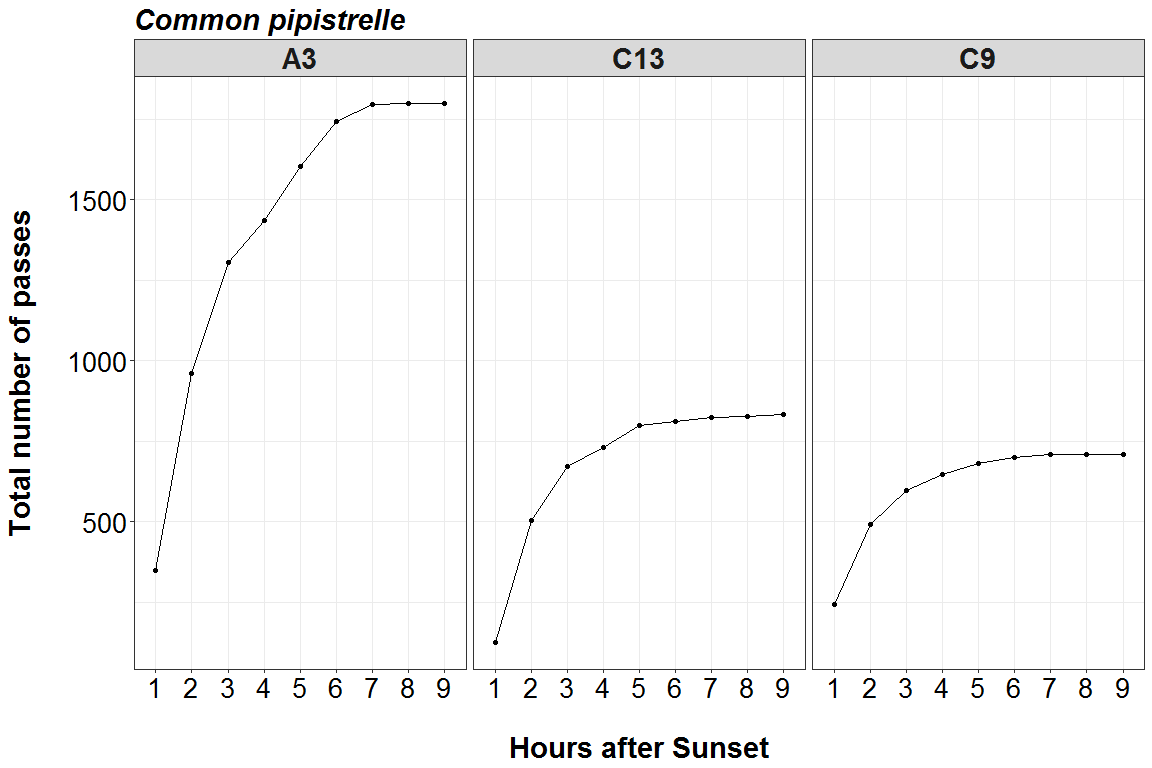
|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Species | Detector ID | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Pipistrellus spp. | A3 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| Pipistrellus spp. | C13 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 |
| Common pipistrelle | A3 | 350 | 611 | 345 | 128 | 170 | 137 | 54 | 4 | 0 |
| Common pipistrelle | C13 | 124 | 381 | 165 | 59 | 70 | 12 | 11 | 5 | 5 |
| Common pipistrelle | C9 | 242 | 249 | 107 | 47 | 37 | 16 | 11 | 1 | 0 |
| Soprano pipistrelle | A3 | 88 | 59 | 35 | 33 | 24 | 8 | 2 | 1 | 0 |
| Soprano pipistrelle | C13 | 45 | 107 | 45 | 30 | 15 | 4 | 3 | 8 | 0 |
| Soprano pipistrelle | C9 | 65 | 135 | 74 | 18 | 19 | 6 | 4 | 1 | 0 |
| Nathusius’ | A3 | 16 | 10 | 1 | 6 | 4 | 10 | 24 | 0 | 0 |
| Nathusius’ | C13 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nathusius’ | C9 | 2 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Nyctalus spp. | A3 | 4 | 9 | 1 | 4 | 4 | 0 | 0 | 0 | 1 |
| Nyctalus spp. | C13 | 6 | 4 | 14 | 6 | 7 | 0 | 0 | 0 | 0 |
| Nyctalus spp. | C9 | 4 | 8 | 8 | 1 | 7 | 3 | 0 | 0 | 0 |
| Noctule | A3 | 39 | 72 | 20 | 29 | 29 | 13 | 0 | 0 | 9 |
| Noctule | C13 | 20 | 21 | 38 | 21 | 5 | 1 | 6 | 0 | 0 |
| Noctule | C9 | 19 | 32 | 5 | 5 | 13 | 7 | 3 | 0 | 0 |
| Leisler’s | A3 | 1 | 9 | 7 | 13 | 1 | 0 | 0 | 0 | 0 |
| Leisler’s | C13 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Leisler’s | C9 | 2 | 2 | 1 | 1 | 2 | 0 | 0 | 0 | 0 |
| Brown long-eared | A3 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| Myotis spp. | A3 | 1 | 3 | 11 | 6 | 13 | 4 | 3 | 0 | 0 |
| Myotis spp. | C13 | 1 | 3 | 6 | 1 | 0 | 1 | 0 | 0 | 0 |
| Myotis spp. | C9 | 0 | 2 | 2 | 3 | 0 | 1 | 1 | 0 | 0 |

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# Distribution of Bat Passes Across Hours of the Night

## All Detectors

**Cumulative number of bat passes throughout the night.**

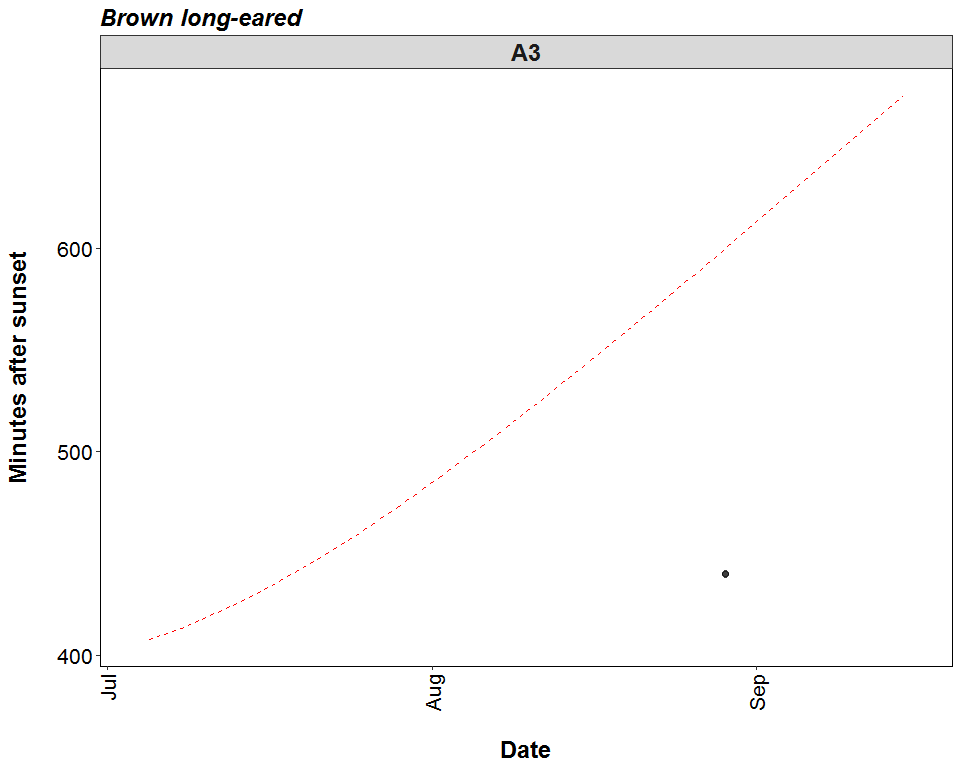
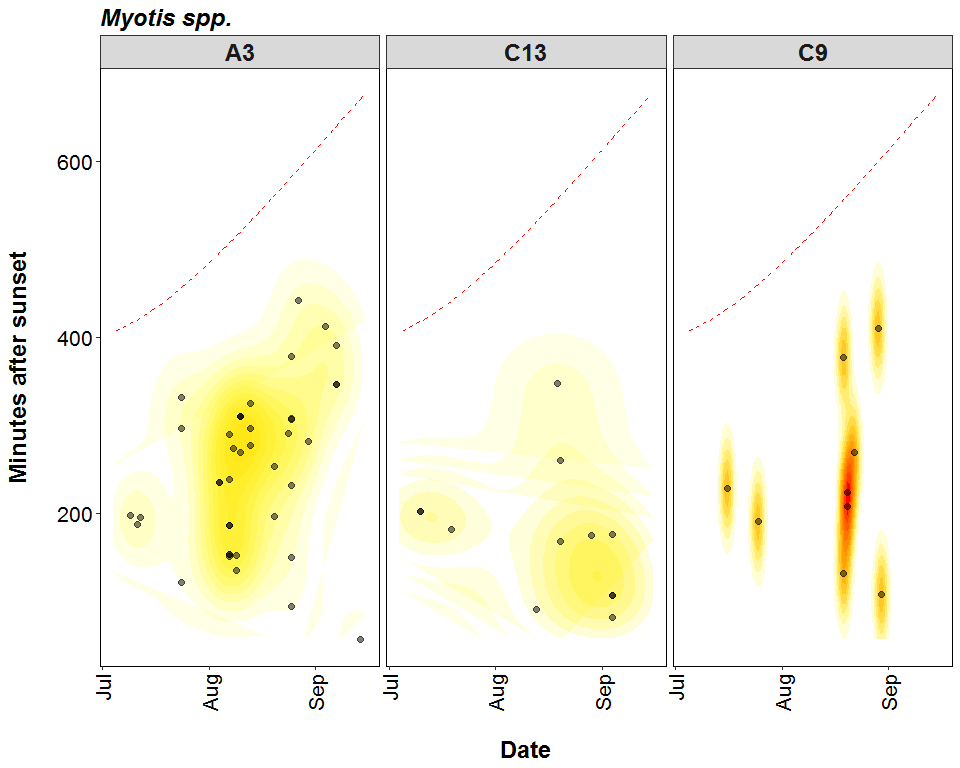
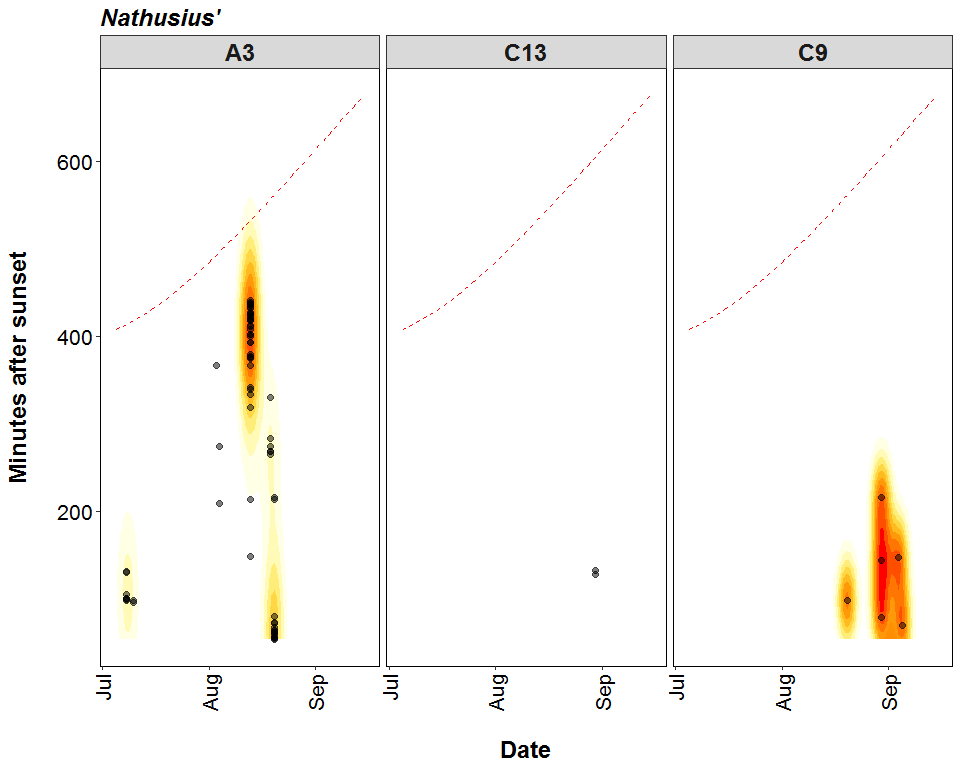
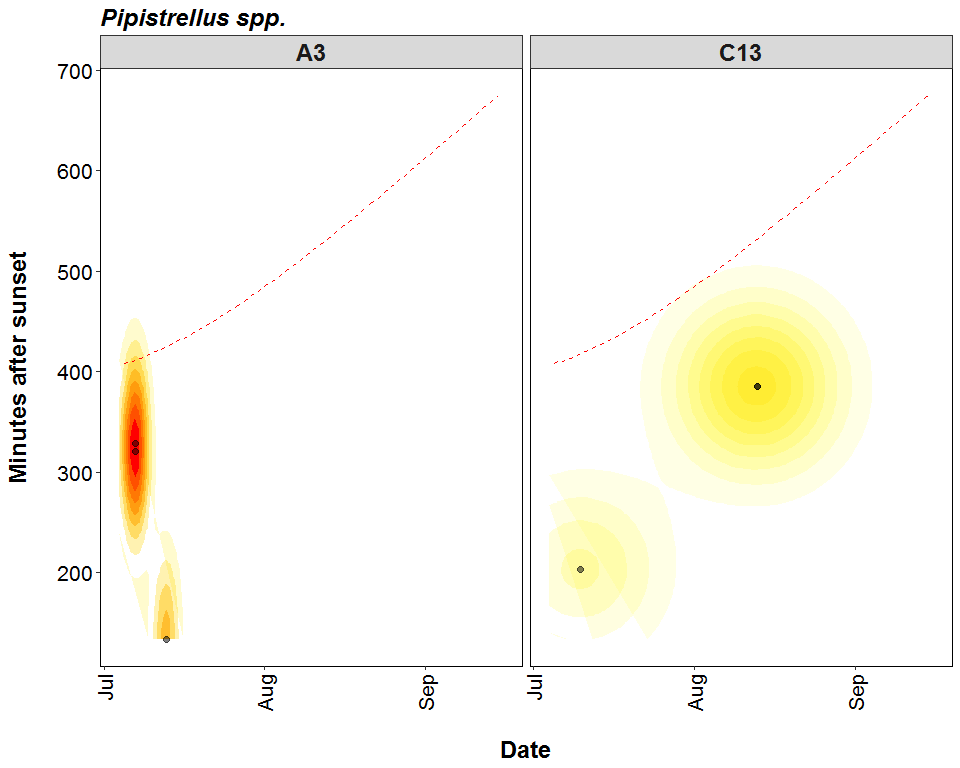
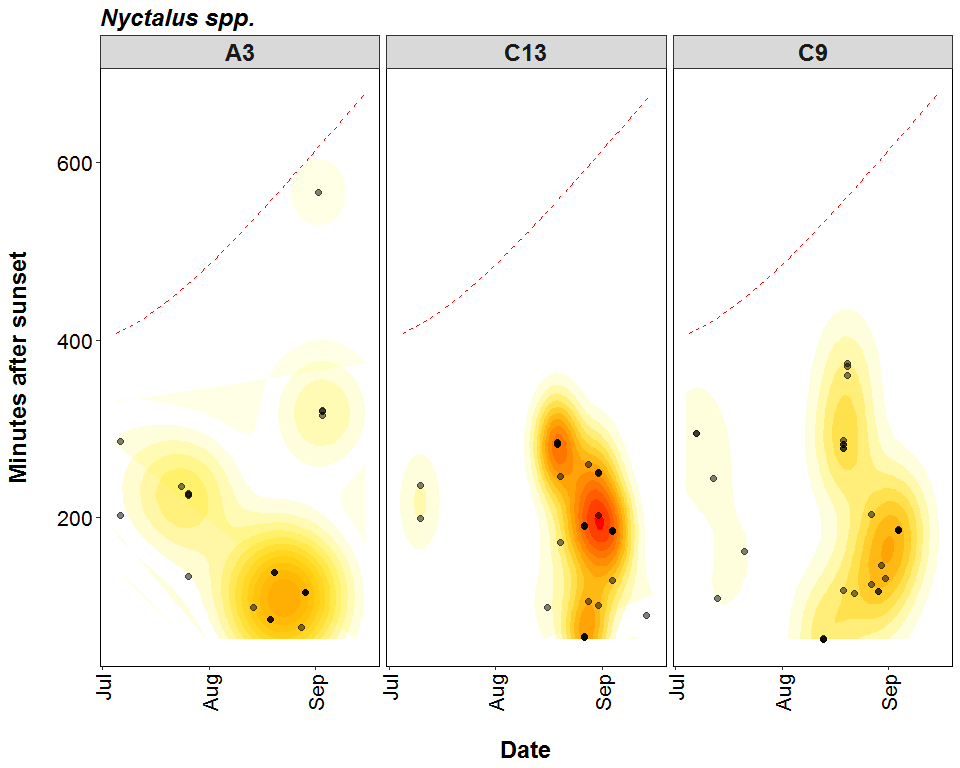
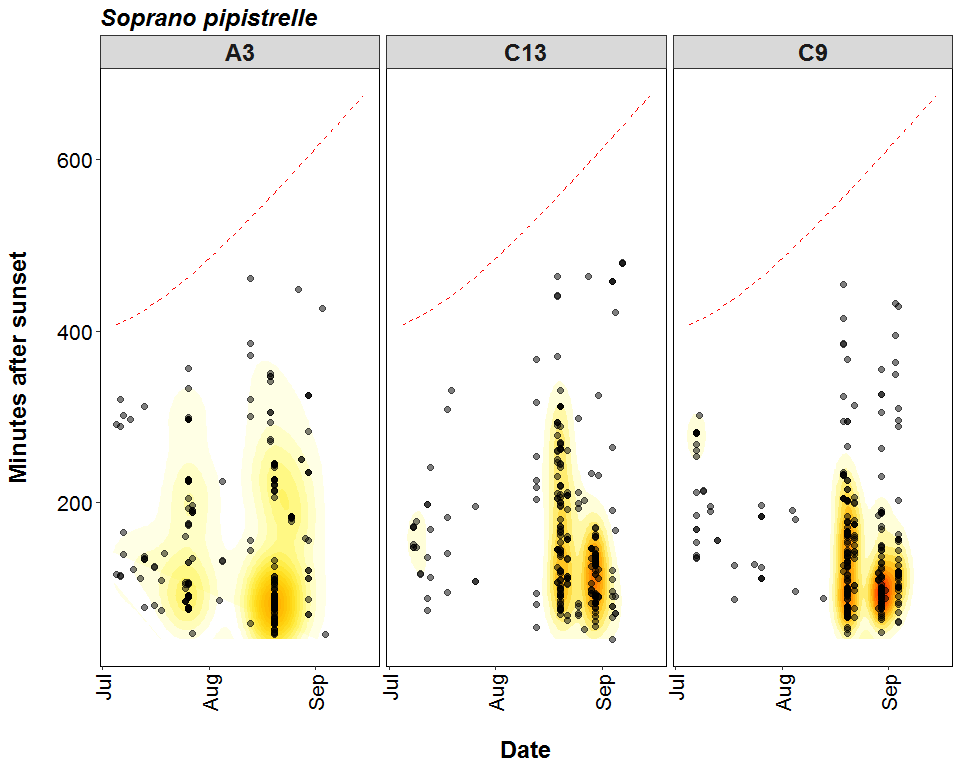
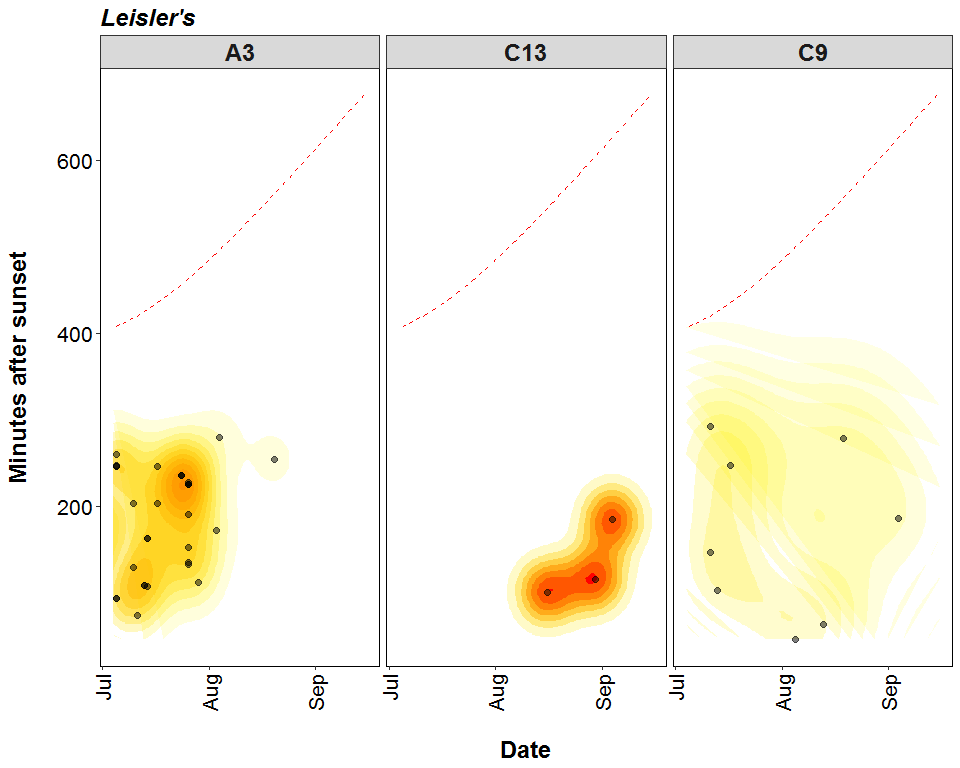
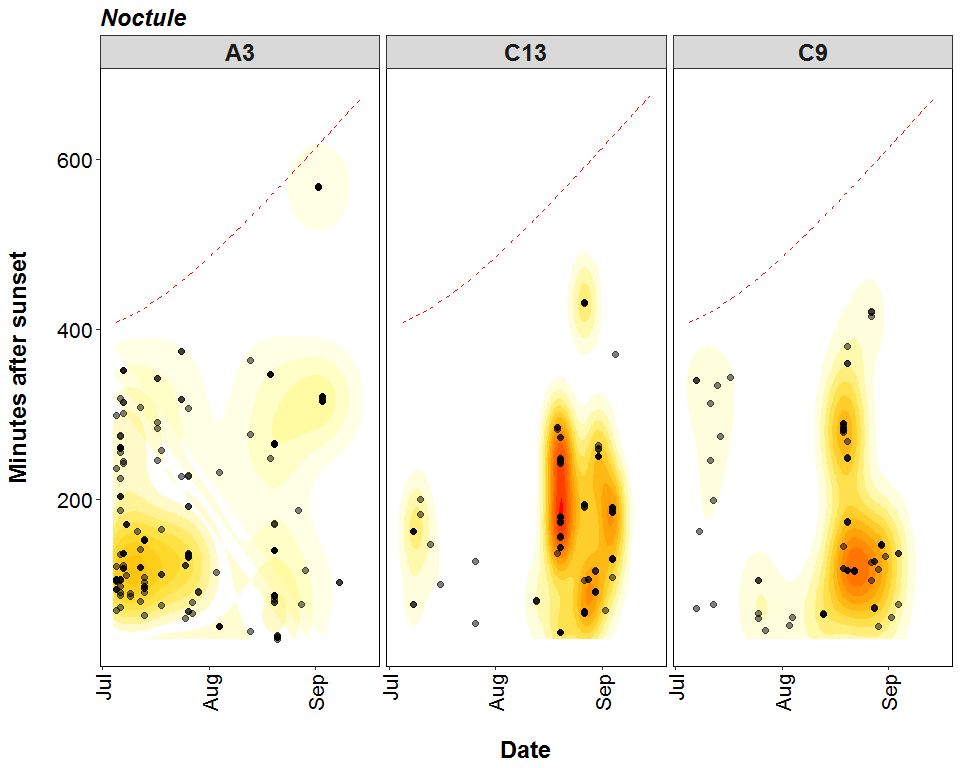
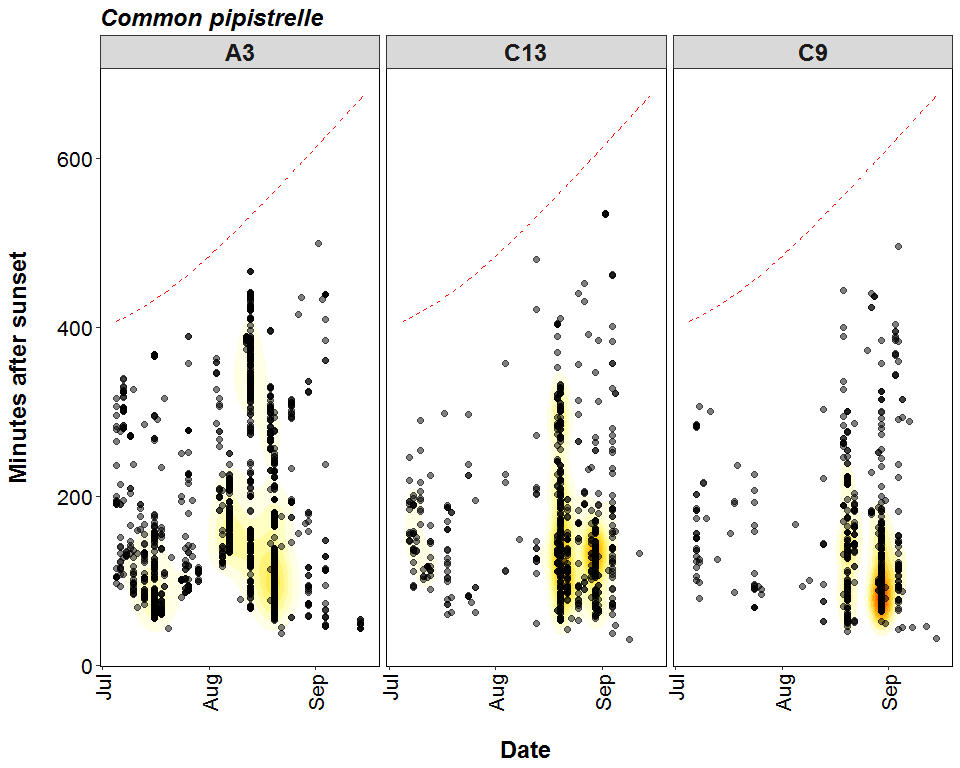


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# Distribution of Bat Activity Across the Night through Time

## Per Detector

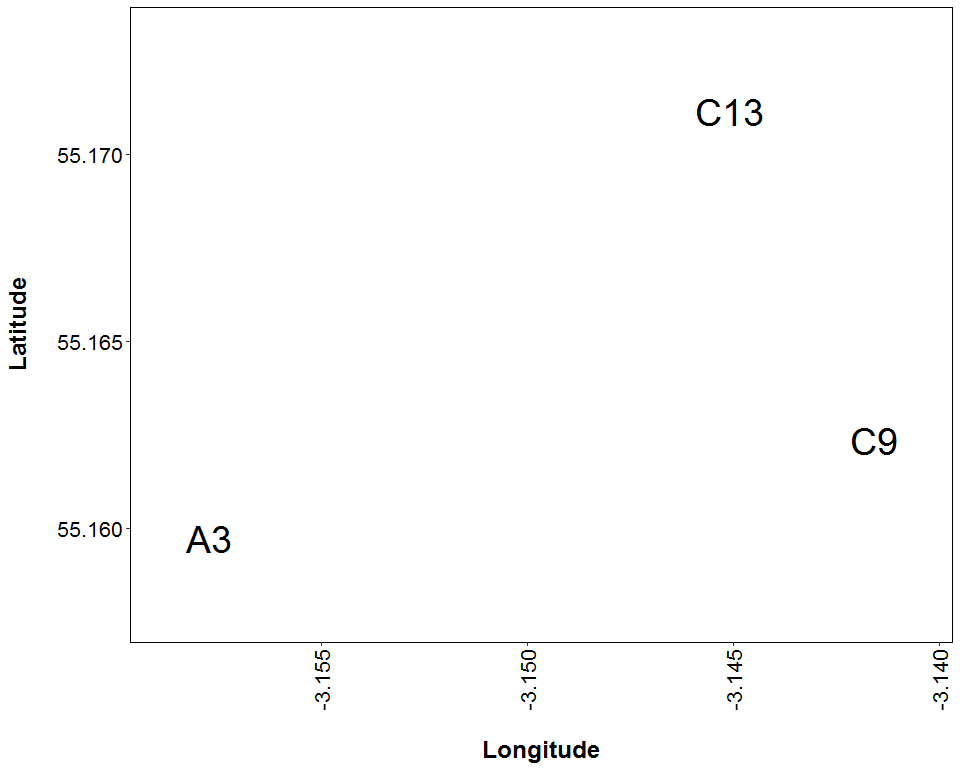
**Timing of bat calls plotted as minutes before/after sunset, whereby 0 on the y axis represents sunset. Sunrise throughout the survey period is depicted as the red dashed line. A kernel density**



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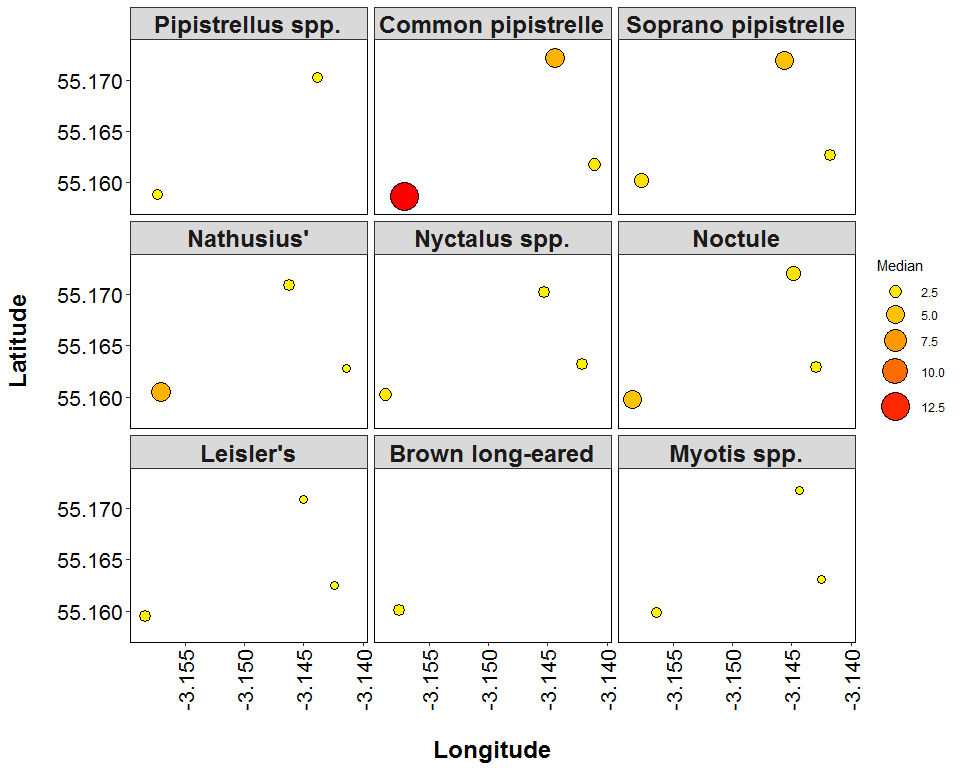
# Bat Activity per Detector Location

**Detector ID reference:**



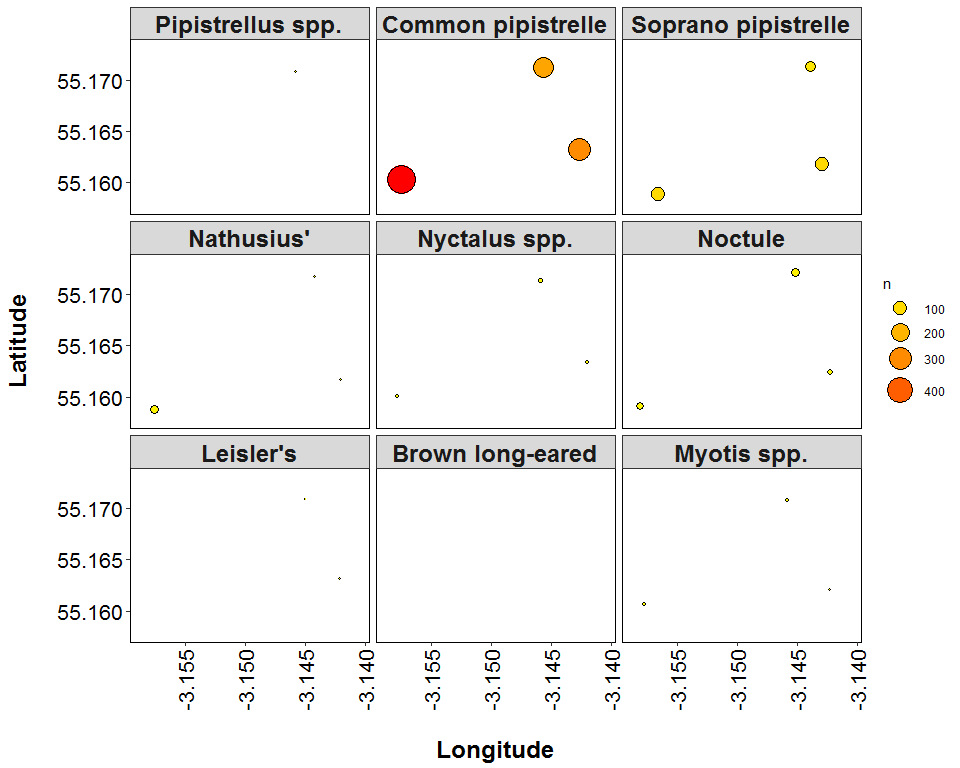
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**Median of the number of bat calls per night throughout the survey period - represented by the size and colour of the point at each detector location.**



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**Maximum number of bat calls recorded in a single night throughout the survey period - represented by the size and colour of the point at each detector location.**



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# Roost Emergence Time and Bat Observation

Based on: *Russ, Jon. 2012. British Bat Calls a Guide to Species Identification.* *Pelagic Publishing.*

For more information see <https://rbats-blog.updog.co/2018/05/29/bat-emergence/>

## Bat Passes Potentially Indicating Close Proximity to a Roost (Russ 2012) - Table

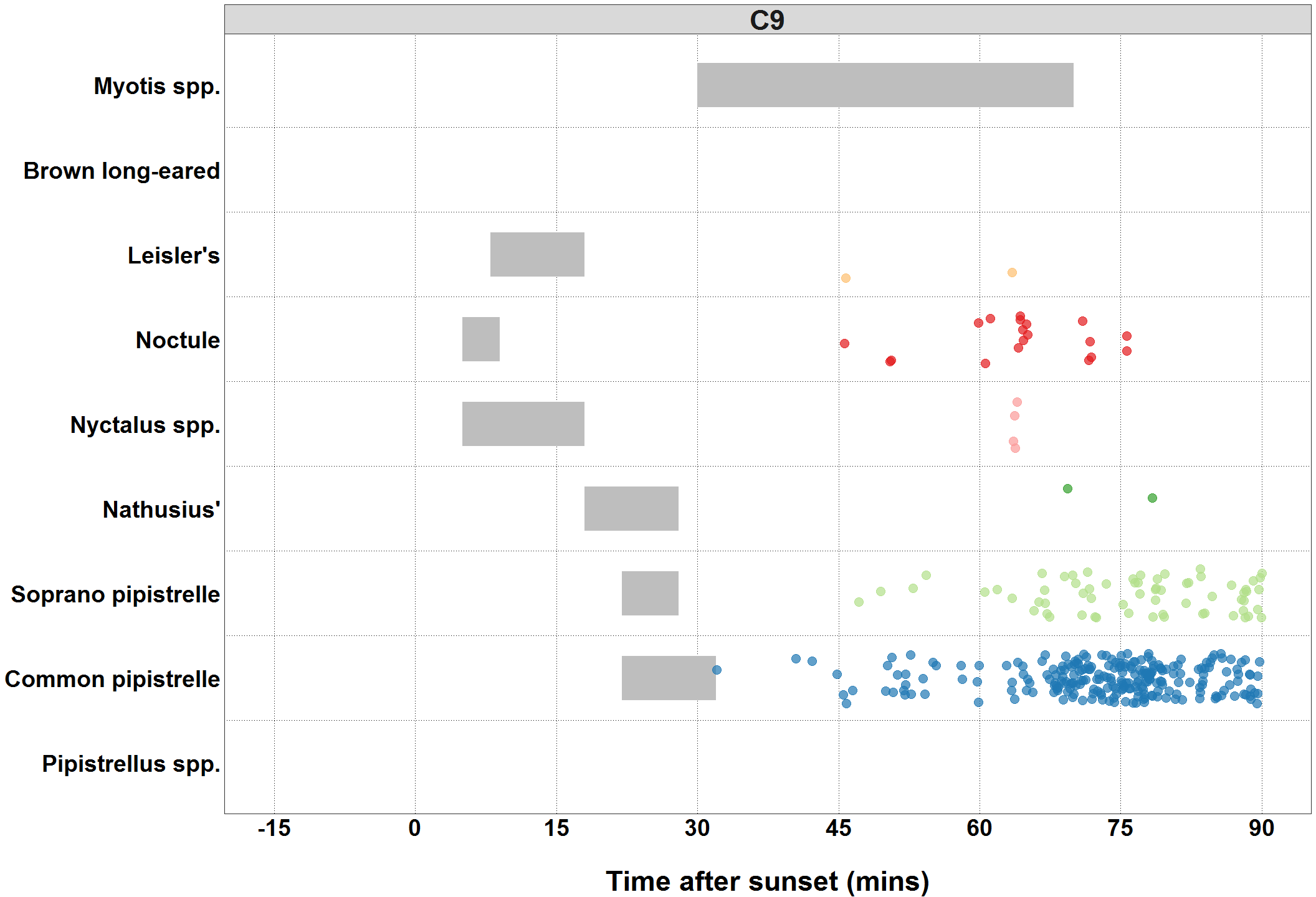
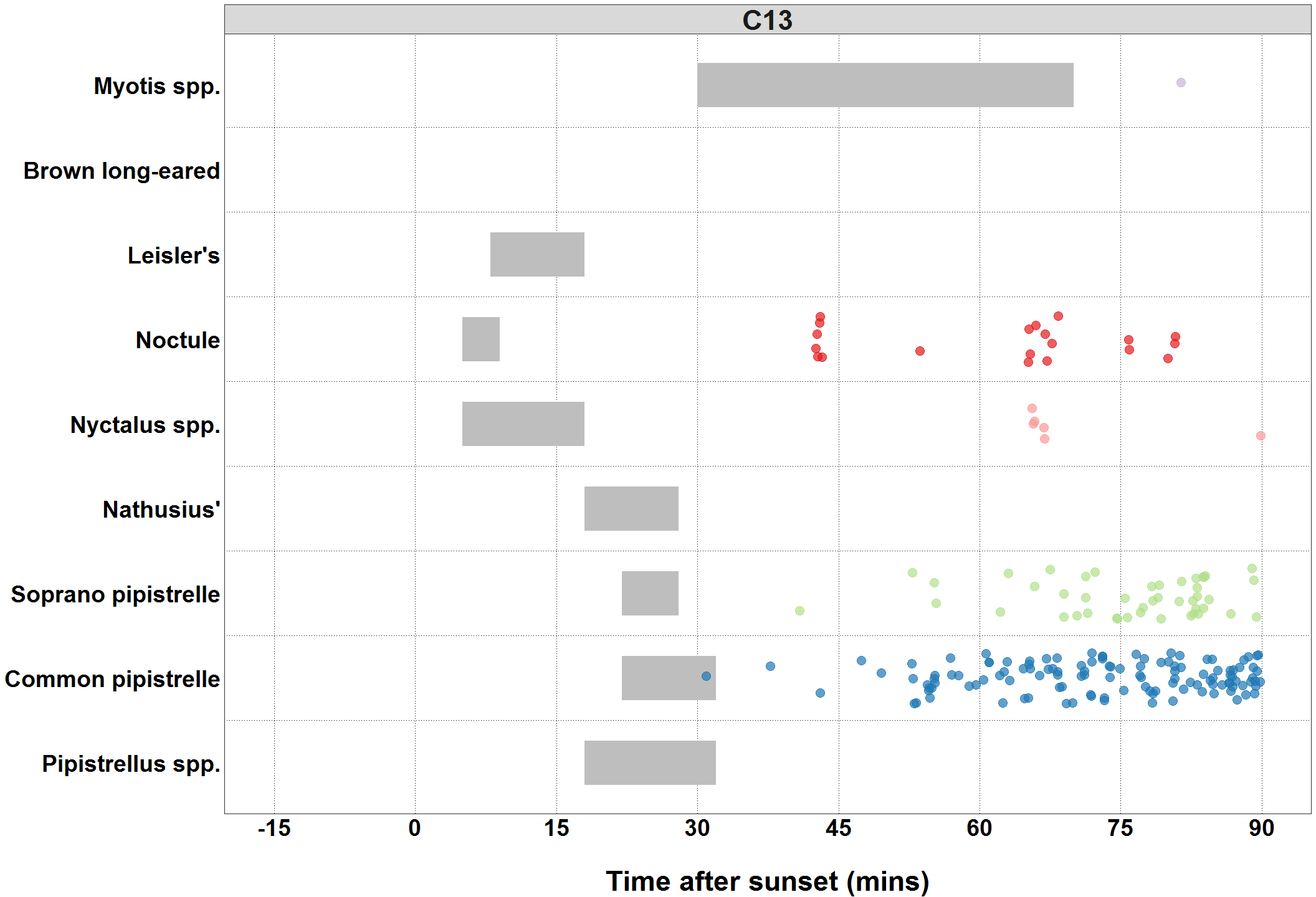
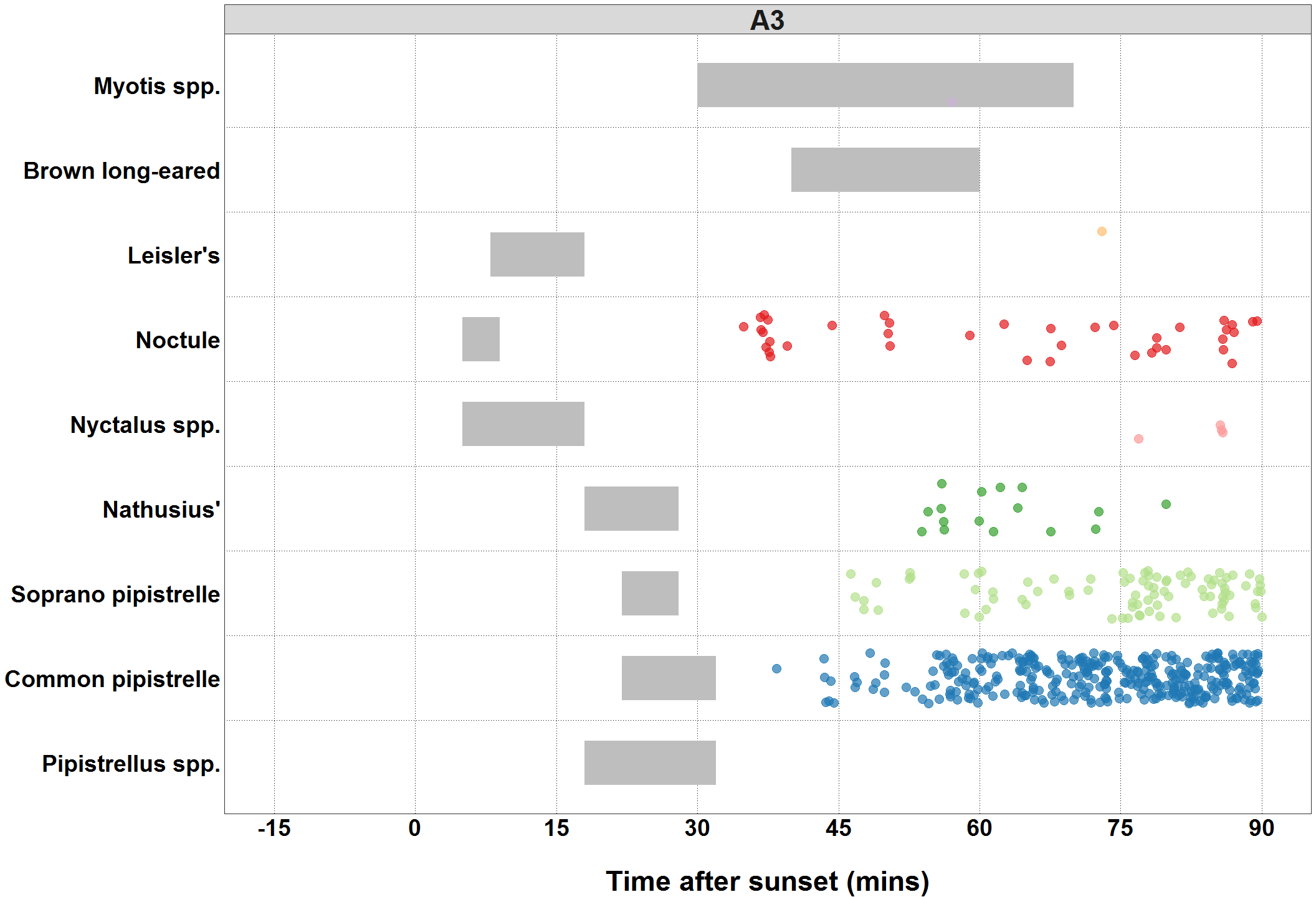
**Number of bat calls recorded within the species-specific emergence time range, and which therefore may potentially indicate the presence of a nearby roost.**

|  |  |  |  |
| --- | --- | --- | --- |
| Species | Detector ID | 2018-09-09 | 2018-09-14 |
| Common pipistrelle | C13 | 1 | 0 |
| Myotis spp. | A3 | 0 | 1 |

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### Bat Passes Potentially Indicating Close Proximity to a Roost (Russ 2012) - Figures

**Figures show time from 15 minutes before to 90 minutes after sunset. Species-specific emergence time ranges are shown as grey bars. Bat passes overlapping species-specific grey bars may potentially indicate the presence of a nearby roost.**



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### Bat Passes Potentially Indicating Close Proximity to a Roost (Maternity Period Only)

*Maternity period defined as 15th June - 30th July.*

[1] "No records near a roost during maternity period"

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### Bat Passes Potentially Indicating Close Proximity to a Roost (Maternity Period Only)

*Maternity period defined as 15th June - 30th July.*

