Millennium East Wind Farm

Environmental Impact Assessment (EIA) Report

Technical Appendix 6.3: Bats

avianecology

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1 INTRODUCTION

1.1.1 This Technical Appendix has been prepared to accompany **Chapter 6: Ecology** of Millennium East Wind Farm ('the Proposed Development') EIA Report.

1.1.2 It presents detailed methodologies and results of desk studies and field surveys completed to establish baseline conditions with regards to bat species, in order to inform the design and assessment of the Proposed Development.

1.1.3 It should be read with reference to Figure 6.5 Bat Activity Survey Plan, presented in Volume 2a of the **EIA Report:**

1.1.4 Only common names are used throughout this appendix. Scientific names are provided in **Annex 1**.

1.2 Aims of the Study

1.2.1. The aims of the bat surveys were to:

- Assess the habitats within the Site to identify:
    - features that have the potential to support maternity roosts and significant hibernation roosts; and
    - the location and extent of commuting and foraging habitat used by bats;
- Identify bat species assemblage using the Site, and temporal and spatial variations in use;
- Assess the level of activity of bats within the site; and,
- Assess the potential risks to bats in line with NatureScot guidance (2021)[1].

1.3 Terminology

1.3.1 To aid clarity, throughout this appendix and **Chapter 6: Ecology**, the following terms are used to describe components of the Site:

- Development Area: defined as that part of the Site where the wind turbines and associated infrastructure, including new track and substation are proposed; and
- Access Route: defined as that part of the Site encompassing the existing Millennium Wind Farm access track from the A887 to the Development Area.

1.3.2 The Site, the boundary of which is shown in red as the Application Boundary on **Figure 2.1** and all figures accompanying **Chapter 6: Ecology**, therefore comprises the Development Area, the Access Route, and also small areas to the north and north-west of the Access Route proposed for habitat creation, enhancement and management under the outline Biodiversity Enhancement Management Plan (oBEMP; see **Technical Appendix 6.7**).

1.3.3 Due to the iterative approach to design that has been ongoing throughout the baseline survey period, the Site boundary and survey scope has evolved over the course of baseline studies. The bat surveys

[1] NatureScot (2019) Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation. Revised 2021: https://www.nature.scot/doc/bats-and-onshore-wind-turbines-survey-assessment-and-mitigation#6.1%C2%A0+Assessing+bat+activity+levels [Accessed November 2024]

were undertaken based on early iterations of the site boundary and preliminary indicative turbine locations (the 'Study Area'; as shown on **Figure 6.5**).

1.4 Site Overview

1.4.1 The Proposed Development is located within the administrative area of The Highland Council Local Planning Authority (hereafter referred to as 'the Council'). The Site's centre point is at National Grid Reference: E228745, N809613). The Site is located approximately 5.2 km west of Fort Augustus, southwest of Invermoriston, and north of Invergarry.

1.4.2 The Site sits within broadly undulating upland moorland, gently sloping downwards from southwest to northeast. The elevations of the Site range from 670 m Above ordnance datum (AOD) at the mid-western section of the Site, to the Site access junction by A887 at 129 m AOD.

1.4.3 The twenty-six wind turbines of the operational Millennium Wind Farm lie immediately to the southwest. The operational wind turbines are arranged in three arrays, at elevations ranging from 460 m AOD to 700 m AOD.

1.4.4 Full habitat descriptions are provided in **Appendix 6.1** Habitats and Vegetation.

2 METHODOLOGY

2.1.1 The approach to baseline information gathering with regards to bats has been undertaken with reference to current NatureScot guidance 'Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation' (NatureScot, 2021).

2.1.2 Additional pieces of guidance and peer reviewed literature have also been referred to as appropriate and are referenced where relevant.

2.2 Desk Study

2.2.1 A desk study was undertaken to inform the approach to field survey work and provide context for subsequent assessment.

2.2.2 The desk study has included a review of:

- Aerial imagery and Ordinance Survey (OS) maps to identify any features of potential value to foraging, commuting or roosting bats;
- A review of SiteLink[2] to identify the proximity of the Proposed Development to any national or internationally designated sites for nature conservation, with bat qualifying interests;
- A review of existing bat records within 10 km of the Study Area, including species and roost records, obtained from Highland Biological Recording Group (HBRG);
- A review of the Proposed Development's location in relation to species known ranges in Scotland, with reference to the most recent UK Habitats Directive[3] Article 17 Report[4]; and,

[2] https://sitelink.nature.scot/home [Accessed November 2024].
[3]Council Directive 92/43/EEC.
[4]https://jncc.gov.uk/our-work/article-17-habitats-directive-report-2019-species/#regularly-occurring-species-vertebrate-species-mammals-terrestrial [Accessed November 2024].

- The location of other wind farm developments within 5 km of the Proposed Development, including the number of turbines and their size, through a review of Highland Wind Turbine Map[5].

2.3 Field Surveys

2.3.1 The following baseline surveys have been completed:

- Habitat Assessment;
- Preliminary Roost Assessment; and,
- Ground-level Static Bat Activity Surveys.

2.3.2 The Habitat and Preliminary Roost Assessments and surveys were undertaken by Mr M. Wood, a suitably competent ecologist, with considerable experience of undertaking bat surveys for proposed wind farm developments at comparable sites across Scotland.

Habitat Assessment

2.3.3 An initial habitat assessment of the Study Area was undertaken on 16th October 2023, to appraise the potential value of habitats within the Site for commuting and foraging bats, using the criteria detailed within Bat Conservation Trust (BCT) guidance (Collins, 2016[6]). The assessment was informed through a review of aerial imagery and comprised a daylight walkover of potentially suitable habitat features within the Site.

Preliminary Roost Assessment

2.3.4 Structures and trees with the potential to support maternity roosts and significant hibernation and/ or swarming sites within 277.5 m (200 m of the Study Area, plus the candidate turbine blade length of 77.5 m) were identified through a review of aerial imagery and the preliminary habitat assessment.

2.3.5 Daytime, ground-level preliminary roost assessments in accordance with Collins guidance[6], were undertaken on 16th October 2023. Identified trees and structures were assessed from ground level and not subject to endoscope inspection or aerial inspection of elevated features.

Ground-level Static Surveys

2.3.6 Automated static detectors were deployed within the Study Area in May, June and August 2022 and September 2023, sampling the spring, summer and autumn periods (Spring: April – May; Summer: June - mid-August; Autumn: mid-August - September) in accordance with NatureScot guidance[1] (for deviations from guidance, see Section 2.6: Limitations).

2.3.7 The survey methodology employed the use of automated monitoring stations (MSs), each consisting of a full spectrum 'Song Meter SM4 Acoustic Recorder', fitted with a single omnidirectional microphone or a full spectrum ‘Song Meter SM Mini Bat Recorder’, attached to a 1 m high wooden stake.

2.3.8 Automated detectors were programmed to commence recording approximately 30 minutes before sunset and finish recording approximately 30 minutes after sunrise, with all automated detectors set

[5] https://highland.maps.arcgis.com/apps/webappviewer/index.html?id=5ec04b13a9b049f798cadbd5055f1787 [Accessed November 2024].

[6] Collins, J. (2016). Bat Surveys for Professional Ecologists: Good Practice Guidelines 3rd edition. Bat Conservation Trust, London. It is noted that the 4th edition of this guidance was published in October 2023

up to record simultaneously, to allow comparison of activity recorded across the Study Area for the same monitoring period.

2.3.8. The total deployment duration of static monitoring is detailed in **Table 2.1**. Full bat activity survey effort is presented in **Annex 2**.

2.3.9. The Proposed Development comprises eight turbines, but based on early iterations of the Proposed Development a total of six MSs were deployed. The location of these is illustrated in **Figure 6.5** and detailed in **Table 2.2**.

2.3.9 Minimum mitigation requirements for bats was considered in selecting locations for MS placement, including habitat feature setback distances, as outlined within current NatureScot guidance[1], whilst ensuring a representative sampling of activity within different habitat types of potential interest to bats within the Site was obtained.

2.3.10. Automated detectors were deployed for a minimum of ten consecutive nights during each monitoring period at the onset of an appropriate weather window for bat activity i.e. forecast temperatures of >8°C (at dusk), maximum ground level wind speeds of 5m/s and no, or only very light, rainfall.

Table 2.1: Total deployment duration of monitoring station (MS) during each monitoring period

Monitoring Period	**Recording Location**	**Period Start**	**Period End**	**Total Deployment Duration (No. of nights)**
Spring	MS 1 - 6	24/05/2022	07/06/2022	14
Summer	MS 1 - 6	01/08/2022	18/08/2022	17
Autumn	MS 1 - 6	13/09/2023	27/09/2023	14
				45

Table 2.2: Monitoring station (MS) recording period summary.

MS Ref.	Grid Ref.	Phase 1 Habitat Classification	Linear Feature within 50m	Nearest Turbine	Phase 1 Habitat Classification at Nearest Turbine	No. of Successful Recording Nights (nights of unsuitable weather removed)			
						Spring	Summer	Autumn	Total
MS 1	NH 27102 08703	Lichen/bryophyte heath (D3/D2)	N/A	T1 (270 m south-east)	Wet dwarf shrub heath (D2)	4	11	4	19
MS 2	NH 27773 08811	Wet dwarf shrub heath (D2)	N/A	T3 (343 m north-east)	Wet dwarf shrub heath (D2)	4	11	4	19
MS 3	NH 27999 08230	Blanket bog (E1.6.1)	Watercourse	T2 (203 m north-west)	Blanket bog/Wet dwarf shrub heath (E1.6.1/D2)	4	0	4	8
MS 4	NH 28843 08948	Blanket bog (E1.6.1)	Watercourse	T4 (204 m west) T5 (359 m east south-east) T8 (542 m north north-west)	T4 – Blanket bog (E1.6.1) T5 – Blanket bog (E1.6.1) T8 – Wet dwarf shrub/Blanket bog (D2/E1.6.1)	4	11	4	19
MS 5	NH 29783 08800	Blanket bog (E1.6.1)	Watercourse	T6 (169 m south-east)	Blanket bog (E1.6.1)	4	11	4	19
MS 6	NH 30634 08266	Wet modified bog (E1.7)	Watercourse	T7 (454 m west)	Blanket bog (E1.6.1)	4	11	4	19
						24	**55**	**24**	**103**

2.4 Weather Data

2.4.1 Weather data were collected from a weather station deployed within the Site at NH 27773 08811 (or the Time and Date[7] website and World Weather Online website[8] where needed) for the static deployment periods. Temperature, rainfall and wind speed at dusk were collected. Weather conditions are summarised in **Annex 4**.

2.4.2 Weather data was also analysed to check for any periods of poor weather which could have affected bat activity. Nights of unsuitable weather on which no bats were recorded were removed from the data set.

2.5 Data Analysis and Assumptions of Bat Activity

2.5.1 Analysis and interpretation of bat activity has followed principles presented within BCT[6] and NatureScot[1] guidance.

2.5.2 Digital sonograms were analysed using Kaleidoscope Pro Version 5.3.3. A sample selection of sonograms was also manually checked prior to uploading to *Ecobat*, through Kaleidoscope Viewer and Analook (Titley Scientific).

2.5.3 As bat detectors record the passage of echolocating bats during surveys, this enables an estimation of relative bat activity levels at a particular location or feature within a study area, for subsequent use in assessment.

2.5.4 For the purpose of sonogram analysis, bat activity was taken as the number of 'bat registered calls' i.e., a sequence of echolocation calls consisting of two or more call notes (pulse of frequency), not separated by more than one second (White and Gehrt, 2001[9] and Gannon *et al*., 2003[10]), with a minimum call note length of two milliseconds (Weller *et al.,* 2009[11]).

2.5.5 It should be noted that as an individual bat can pass a particular location or feature on several occasions while foraging it is not possible to estimate the number of individual bats recorded.

Assessment of Relative Activity Levels

2.5.6 In accordance with NatureScot guidance[1], *Ecobat*[12] was used to provide an objective interpretation of the relative importance of bat activity levels recorded within the Site.

2.5.7 Relative levels of activity are determined by *Ecobat* by comparison to a reference data set, the 'reference range'. When uploading data into the *Ecobat* tool, the reference range was stratified to only include the following records from the reference data set:

- Only records from within +/- 1 month from the survey start date.
- Only records from within the region of Scotland North.

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[7] https://www.timeanddate.com/weather/@2649183/historic [Accessed November 2024].

[8] https://www.worldweatheronline.com/fort-augustus-weather-history/highland/gb.aspx [Accessed November 2024].

[9] White, E. & Gehrt, S. (2001). Effects of recording media on echolocation data from broadband bat detectors. Wildlife Society Bulletin, 29, pp. 974-978.

[10] Gannon, W., Sherwin, R. and Haymond, S. (2003). On the importance of articulating assumptions when conducting acoustic studies of habitat use by bats. Wildlife Society Bulletin, 31, pp. 45-61.

[11] Weller, T.J., Cryan, P.M., O'Shea, T.J. (2009) Broadening the focus of bat conservation and research in the USA for the 21st century. Endang Species Res 8:129–145.

[12] Ecobat (mammal.org.uk) [Accessed November 2024]

2.5.8 The reference range of each species given by *Ecobat* are provided below:

- Common pipistrelle – 28,743 records;
- Soprano pipistrelle – 4,167 records; and
- Myotis species – 70 records.

2.5.9 For each night that bat activity is recorded, *Ecobat* reports the percentile and associated confidence limits of the data against the software's reference range. These are then categorised from Low to High in line with parameters set out in NatureScot guidance[1].

2.6 Limitations

Field Surveys

2.6.1 It is recommended in NatureScot guidance[1] that for developments of between one and ten turbines, one MS is deployed in the location of each proposed turbine. Due to a change in layout to the Proposed Development, increasing from six to eight turbines after the completion of surveys, only six MSs were deployed and were not placed at the locations of the proposed turbines. Additionally, due to an unforeseen detector malfunction, bat activity data captured at MS 3 during the summer could not be retrieved. However, due to:

- the homogenous nature of the habitats present between the surveyed and non-surveyed areas;
- the fact that the majority of MSs were in the same habitat type as the proposed turbine locations,
- the high altitude, upland nature of the Development Area and the generally low value to bats of the habitats present; and
- the overall low bat activity levels recorded within the Site.

2.6.2 This is not considered to be a substantial limitation to the validity of the assessment conclusions.

2.6.3 The spring deployment period, from 24th May 2022 to 7th June 2022, spans the cut-off point of the spring survey period, ending in the summer survey period, as set out in the NatureScot guidance[1]. However, due to the latitude and altitude of the Site, spring is likely to start and end later in the year at this location. Therefore, the additional days within the spring deployment period spanning into the start of summer survey period are not considered to be a substantial constraint as the weather during the additional days is more likely to be typical of spring rather than summer in the context of bat activity.

2.6.4 Due to a pause in project programme for to commercial considerations, surveys were split over two calendar years, with the spring and summer activity surveys carried out in 2022 and the autumn deployment completed in 2023. However, it is considered unlikely there is notable annual variation in bat activity levels at this location such to significantly change the outcome of the analysis, and so it is considered this will not affect the validity of the data to inform impact assessment.

2.6.5 Weather constraints including temperatures < 8°C and/ or winds > 5 m/s were recorded at dusk on 11 nights during the spring deployment period, 11 nights during the summer deployment period and every night (18 nights) during the autumn deployment period; in total 40 of 45 nights with poor weather. These weather conditions are likely to be representative for sites at this latitude and altitude; bat activity was still recorded on 13 of these nights and so has been included within the analysis and is not considered to represent a limitation to the validity of the assessment. Although it is recognised that poor weather can affect bat activity, excluding these data from the analysis skews the dataset and would remove some high collision risk species (pipistrelle species) from the dataset. Subsequently inclusion of these nights represents a precautionary approach.

2.6.6 Due to an unforeseen weather station malfunction it was not possible to retrieve the weather data for the summer and autumn deployment period. Instead, the weather data for this static deployment period was obtained from the Time and Date website and/or World Weather Online website. Weather masts in this area are very limited with the closest mast being at Fort Augustus for both websites, approximately 5 km east. As a result, the weather data for summer and autumn may not be totally accurate for the Site; however, considering that the weather was poor for the majority of nights (29 of 33) and bats were recorded on limited nights (19 of 33), it is likely that the weather data obtained is a good representation of on-site conditions and therefore this is not considered to represent a substantial limitation to the data.

2.6.7 As a result of poor weather, the spring and autumn deployment periods failed to record during the recommended minimum of 10 consecutive nights of suitable weather, as set out in the NatureScot guidance[1]. Both seasons only had bats recorded on a total of four nights each, and in the majority of those nights weather conditions were still considered unsuitable (i.e. bats were active on those nights even though temperatures were < 8°C and/ or winds > 5 m/s). As mentioned above, weather conditions represented are likely typical at the location and so 10 consecutive nights of suitable weather as per guidance is unlikely to be achievable during spring and autumn when weather conditions are more unstable.

2.6.8 No preliminary roost assessment has been carried out for trees within the Access Route. However, these are distant from the turbines and other infrastructure associated with the Proposed Development, and minimal upgrade works are expected to the track in discrete locations. Should there be any impacts to trees along the route, these will be subject to pre-commencement survey for roost potential and mitigation implemented as required in accordance with a species protection plan (SPP).

Sonogram Analysis

2.6.9 Kaleidoscope software can identify certain bat species from sonograms, but some species within the *Myotis* and *Nyctalus* genus can be difficult to distinguish. In some cases, calls may be partially heard or distorted by external factors like passing cars, rain or wind, resulting in unknown or genus-only labels. Species such as brown long-eared bat have lower detectability and may not be detected on automated static detectors at the same rate as other species (such as *Pipistrellus* and *Nyctalus* species) due to their hunting strategies in less open habitats and quieter echolocation calls they produce when commuting and hunting. Survey results have been carefully interpreted across species.

Ecobat Tool

2.6.10 The *Ecobat* tool has been offline for a period of time and unavailable for use in assessments. It has now been made available again and has been confirmed by the mammal society as being appropriate to inform assessment (Ross Clifton[13] pers comm) however, some outputs (but not all) are still noted to be anomalous and so caution and professional judgement has been applied in interpreting the results. Where numbers from the *Ecobat* output are known to be wrong, the results as per the Avian Ecology (AEL) dataset has been used in their place. This is applicable only to the percentage spread of activity per month, and does not affect the overall analysis.

2.6.11 The tool does, however, provide a guide for discussion along with Site-specific circumstances (e.g., habitats present, desk study information) and its use is advised in accordance with NatureScot guidance[1].

2.6.12 *Ecobat* only considers nights with bat passes, which can skew results and elevate risk levels. Therefore, *Ecobat* output is regarded as an indicative assessment and to be considered alongside desk study

[13] The data and research officer with the mammal society

information and professional judgement, rather than conclusive evidence of the importance of a site for bats.

3 RESULTS

3.1 Desk Study

Statutory Designated Sites for Nature Conservation

3.1.1 In review of Sitelink, the Site is not located within 10 km of any national or internationally designated site for nature conservation, with bat qualifying interests.

3.1.2 In consultation with the HBRG, no non-statutory designated sites for nature conservation with bat interest are located within 2 km of the Study Area.

Existing Bat Records

3.1.3 In consultation, the HBRG returned nine bat records from within 10 km of the Study Area dated within the last 10 years (2014-2024); four common pipistrelle, two soprano pipistrelle and two brown long-eared bat.

3.1.4 HBRG also returned historic records (older than 10 years) of common pipistrelle (five records), soprano pipistrelle (three records), pipistrelle species (11 records), Daubenton's bat (three records), Natterer's bat (four records) and brown long-eared bat (eight records), within 10km of the Study Area.

3.1.5 Full existing bat records are presented in **Annex 3**.

UK Bat Species Range

3.1.6 In review of the UK Habitats Directive Article 17 Report 'Habitats Directive Report 2019: Species Conservation Status Assessments 2019' based on Mathews *et al*. (2018[14]), the Site is located within the known UK distribution range for common pipistrelle, soprano pipistrelle, Daubenton's bat and brown long-eared bat.

Other Wind Developments

3.1.7 In review of Highland Wind Turbine map, the Site is located within 5 km of four additional wind farm developments as summarised in **Table 3.1**.

Table 3.1: Wind farm developments within 5 km of the Site.

Wind Farm	Location	Description
Millennium Wind Farm	c. 600 m between nearest turbines.	The proposed development is an extension of this. Constructed and operational, comprising 26 turbines.
Beinneun Wind Farm	c. 3.47 km between nearest turbines.	Constructed, comprising 25 turbines.

[14] Mathews, F., Kubasiewicz, L.M., Gurnell, J., Harrower, C., McDonald, R.A., Shore, R.F (2018). A review of the population and conservation status of British Mammals. A report by the Mammal Society under contract to Natural England, Natural Resources Wales and Scottish Natural Heritage.

Wind Farm	Location	Description
Beinneun Extension	c. 3.77 km between nearest turbines.	Extension of the above. Constructed, comprising 7 turbines.
Beinneun 2 Wind Farm	c. 3 km between nearest turbines	Additional extension of the above. Currently in scoping/screening for 22 turbines.

3.2 Field Surveys

Habitat Assessment

3.2.1 Habitats within the Site are considered to be of low habitat risk for bats, in accordance with criteria presented in NatureScot guidance (2019)1.

3.2.2 The predominantly blanket bog and wet dwarf shrub heath habitats of the proposed turbine buffers and wider Site provide relatively poor foraging opportunities for bat species. The numerous waterbodies and watercourses within the Site and plantation woodland parcels to the north-west of the Site offer more suitable foraging opportunities and also connectivity with potentially higher value habitats within the wider landscape.

Preliminary Roost Assessment of Buildings and Trees

3.2.3 Potential roost features within the Site were limited; the Site is dominated by open bog and heath with limited trees, which offers negligible roost opportunities within proximity to the proposed turbines. The plantation woodland to the north-west of the Site may offer some roost opportunities, however these are likely to be low suitability and so as a whole the Site is unlikely to support maternity or significant hibernation roosts.

Weather Conditions

3.2.4 The weather conditions throughout the majority of the survey dates (31 out of 47) were unsuitable per the criteria set out in guidance[1]; with either temperatures < 8°C and/or wind speed > 5m/s. Of these 31 dates, 26 dates recorded no bat activity and so as a result these dates were excluded from the bat activity survey dataset. This included the majority of the spring and autumn deployment nights. Nights excluded are listed below:

Spring

A total of ten nights excluded:

- 24th May – 31st May 2022;
- 2nd June 2022;
- 6th June 2022.

Autumn

A total of 11 nights excluded:

13th – 14th September 2023;
17th – 21st September 2023;
23rd – 24th September 2023;
26th September 2023.

Summer

A total of six nights excluded

- 2nd August 2022;
- 5th – 7th August 2022;
  16th August 2022;
  18th August 2022

3.2.5 That resulted in the total recording nights (all 6 detectors combined) dropping from 253 to 103 once unsuitable nights have been removed from the data set.

3.2.6 Weather data are presented in **Annex 4**.

Bat Activity Surveys

Summary of Results and Activity Levels

3.2.7 Bats were detected on 18 dates between 24/05/2022 and 25/09/2023, out of a possible 47 recording dates from 6 MSs.

3.2.8 Species identified are presented in **Table 3.2** along with potential collision risk and population vulnerability as described in NatureScot guidance[1].

3.2.9 Overall, a total of 846 bat passes were recorded over a total of 103 survey nights (successful nights at all 6 detectors combined; see **Table 2.2**), as summarised in **Table 3.3**.

3.2.10 The full *Ecobat* output report is included as **Annex 5**.

Table 3.2: Bat species recorded, collision risk and population vulnerability.

Species	Collision Risk	Population Vulnerability
Common pipistrelle	High	Medium
Soprano pipistrelle	High	Medium
Myotis species	Low	Low/medium

Table 3.31: Total number of bat passes.

Species	Passes (No.)	Percentage of total (%)	Mean Passes per Night
Common pipistrelle	410	48.5	3.98
Soprano pipistrelle	425	50.2	4.13
Myotis species	11	1.3	0.11

Species	Passes (No.)	Percentage of total (%)	Mean Passes per Night
Total	**846**	**100**	**8.21**

Ecobat Results

3.2.11 **Table 3.4** presents the number of nights species activity was recorded at each activity band.

3.2.12 **Table 3.5** presents the key metrics of the *Ecobat* output for each species. Data from all monitoring locations are used to provide Site-wide averages/medians.

Table 3.4: Number of nights recorded bat activity fell into each activity band or each species within the Site.

Species/Species Group	Exceptional Activity	High Activity	Moderate/ High Activity	Moderate Activity	Low/ Moderate Activity	Low Activity
Common pipistrelle	0	0	0	0	2	33
Soprano pipistrelle	0	0	0	7	7	22
Myotis species	1	0	0	2	0	0

Table 3.5: Percentiles for each species within the Site.

Species/Species Group	Total Passes	Nights Recorded	Passes per Night		Median Percentile [15]	95% Cis[16]	Max Percentile[17]
			Recorded[18]	Included in *Ecobat*[19]			
Common pipistrelle	410	35	3.98	8.91	3	7 - 17	20
Soprano pipistrelle	425	36	4.13	9.24	12	6.5 - 38	52
Myotis species	11	3	0.11	0.24	54	54 - 54	100
Total	**846**	**74**	**8.21**	**18.39**			

Species Assemblage Summary

3.2.13 Soprano pipistrelle was the most frequently recorded species representing 50.2% of all recordings. The species was recorded on 36 nights out of 103 and representing 4.13 passes per night for the survey

[15] A numerical representation of average activity levels relative to the surrounding landscape (within Scotland North) for each night of surveying.
[16] An indication of the confidence in the median percentile.
[17] A numerical representation of maximum activity levels on any one night relative to the surrounding landscape (within Scotland North) for each night of surveying
[18] Total recorded nights for the survey period (minus nights of unsuitable weather where no bats were recorded) was 103.
[19] A total of 46 nights out of the possible 103 were included in *Ecobat*'s analysis. Nights when weather is suitable but no bats are recorded are excluded, which results in an increase in passes per night average.

period. When compared with activity at other sites (*Ecobat* reference range and percentiles) soprano pipistrelle activity was concluded to be low at the 12th median percentile.

3.2.14 Common pipistrelle represented 48.5% of all recordings. The species was recorded on 35 nights out of 103 and representing 3.98 passes per night for the survey period. When compared with activity at other sites (*Ecobat* reference range and percentiles) common pipistrelle activity was concluded to be low at the 3rd median percentile.

3.2.15 Myotis species represented 1.3% of all recordings. The species was recorded on 3 nights out of 103 and representing 0.11 passes per night for the survey period. When compared with activity at other sites (*Ecobat* reference range and percentiles), myotis species activity was concluded to be moderate at the 54th median percentile.

Spatial Distribution

3.2.16 The *Ecobat* output median and mean nightly pass rate (passes per hour, per night) of each species, at each detector for all months is presented in **Table 36**. The use of the median value is recognised to provide the more accurate representation of activity, as bat activity levels between nights can be highly variable, and thus the median provides a more reliable value than the mean or maximum (Lintott and Mathews, 2018[20]). In addition, the dataset is unlikely to be normally distributed, therefore the median is the most appropriate metric to report.

3.2.17 Data for 'Includes Absences' and 'Excludes Absences' are included in **Table 3.6**. Includes absences takes into account nights when no registrations of a species were recorded and therefore lowers the overall medians and means (note this does not include any nights when no bats of any species were recorded as these are filtered out by *Ecobat* in the initial data upload to the *Ecobat* tool).

3.2.18 When absences are excluded medians and means are higher and show peaks in the data, which is especially useful for sites with low bat activity when peaks can be easily overlooked in large data sets.

3.2.19 Common pipistrelle activity was recorded at all six detectors. Highest activity was at MS 6 with a median pass rate of 2.9. The median pass rate for all other MS locations was below 1. Overall, each MS is considered to be low activity level.

3.2.20 Soprano pipistrelle activity was recorded at five of the detectors, with no activity at MS 3. Highest activity was at MS 2 a median pass rate of 1.9, followed by two other MS locations with a pass rate greater than 1; MS 6 (1.4) and MS1 (1.2). The remaining two detectors had a median pass rate below 1. Overall, each MS is considered to be low activity level.

3.2.21 Myotis species activity was recorded at only one of the detectors; MS 6. The median pass rate at MS 6 was 0.2. Myotis species activity is considered to be very low.

[20] Lintott, P.R. & Mathews, F. (2018) Basic mathematical errors may make ecological assessments unreliable. Biodiversity and Conservation 27: 265-7.

Table 3.6: Median and Mean bat pass rate per species, per detector.
Detector locations not included recorded no bat passes.

Species	Detector ID	Total Bat Passes	Nights Recorded	Median Pass Rate (passes per hour/night)		Mean Pass Rate (passes per hour/night)	
				Incl. Absences	Excl. Absences	Incl. Absences	Excl. Absences
Common pipistrelle	MS 1	29	5	0.9	0.9	0.7	0.7
	MS 2	83	5	0.4	0.6	1.4	1.6
	MS 3	4	1	0.4	0.4	0.4	0.4
	MS 4	120	8	0.2	0.7	1.5	1.9
	MS 5	41	8	0.5	0.7	0.6	0.8
	MS 6	133	8	0.4	2.9	1.7	2.8
Soprano pipistrelle	MS 1	41	4	0.9	1.2	1	1.2
	MS 2	105	5	1.3	1.9	2.8	3.4
	MS 3	0	0	N/A	N/A	N/A	N/A
	MS 4	102	8	0.1	0.5	1.4	1.8
	MS 5	62	10	0.2	0.6	1	1.1
	MS 6	115	9	0.6	1.4	1.4	2
Myotis species	MS 1	0	0	N/A	N/A	N/A	N/A
	MS 2	0	0	N/A	N/A	N/A	N/A
	MS 3	0	0	N/A	N/A	N/A	N/A
	MS 4	0	0	N/A	N/A	N/A	N/A
	MS 5	0	0	N/A	N/A	N/A	N/A
	MS 6	11	3	0	0.2	0.1	0.3
Total		**846**	**74**				

Table 3.7: Percentiles for each species per detector location for the whole survey period.

Species	Detector ID	Median Percentile	95% CIs	Max Percentile	Nights Recorded	Activity Level (Median Percentile)	Activity Level (Max Percentile)
Common pipistrelle	MS 1	3	3 - 3	4	5	Low	Low
	MS 2	2	14 - 14	14	5	Low	Low
	MS 3	1	0	1	1	Low	Low
	MS 4	3	11.5 - 18	18	8	Low	Low
	MS 5	3	2 - 5	5	8	Low	Low

Species	Detector ID	Median Percentile	95% CIs	Max Percentile	Nights Recorded	Activity Level (Median Percentile)	Activity Level (Max Percentile)
	MS 6	13	7 - 17	20	8	Low	Low
Soprano pipistrelle	MS 1	15	1 - 31	31	4	Low	Low to moderate
	MS 2	22	22 - 52	52	5	Low to moderate	Moderate
	MS 4	6	21 - 51	51	8	Low	Moderate
	MS 5	7	6.5 - 38	38	10	Low	Low to moderate
	MS 6	17	12.5 - 44	48	9	Low	Moderate
Myotis species	MS 6	54	54 - 54	100	3	Moderate	High

Table 3.8: The number of nights sampled (detectors were operational for), the number of nights bats were recorded and the total number of bat recorded per monitoring station. Percentage distribution of no. bats is also presented.

Detector ID	No. Nights Sampled	No. of nights Bats were Recorded	Percentage of Nights Bats were Recorded	Total No. Bats recorded	Percentage Distribution of No. Bats
MS 1	19	5	26.3%	70	8.27%
MS 2	19	6	31.6%	188	22.22%
MS 3	8	1	12.5%	4	0.47%
MS 4	19	10	52.6%	222	26.24%
MS 5	19	11	57.9%	103	12.17%
MS 6	19	13	68.4%	259	30.61%
			Total	**846**	**100%**

Temporal Activity

3.2.22 Activity levels were calculated by *Ecobat* per species (or species group) per month to allow for temporal variations in bat activity, as presented in **Table 3.9**. Median and maximum percentiles and corresponding activity levels are presented.

3.2.23 Common pipistrelle was recorded every month, however only August registered a median and max percentile. This is likely due to the very low number of bat calls registered in June and September, being 4 and 6 bat passes respectively. The median in August was in the 4th percentile; which equates to low activity levels.

3.2.24 Soprano pipistrelle was, like common pipistrelle, being recorded every month, but with only August registering a median and max percentile. Again, this is likely due to the very low number of bat calls

registered in June and September, being 3 and 3 respectively. The median in August was in the 17th percentile; which equates to low activity levels.

3.2.25 Myotis species was recorded in June and September, with no bat passes recorded in August. September recorded the highest median at the 77th percentile; which equates to moderate to high activity levels. The median in June was in the 54th percentile; which equates to moderate activity levels.

Table 3.9: Percentiles for each species each month within the site.

Species	Recording Period (Month)	Median Percentile[21]	95% CIs	Max Percentile[21]	Nights Recorded	Ecobat Activity Level	
						Median Percentile	Max Percentile
Common pipistrelle	Spring (June)	0	7 - 17	0	4	Low	Low
	Summer (August)	4	7 - 17	20	28	Low	Low
	Autumn (September)	0	11.5 - 18	0	3	Low	Low
Soprano pipistrelle	Spring (June)	0	6.5 - 38	0	3	Low	Low
	Summer (August)	17	6.5 - 38	52	30	Low	Moderate
	Autumn (September)	0	6.5 - 38	0	3	Low	Low
Myotis species	Spring (June)	54	54 - 54	54	1	Moderate	Moderate
	Autumn (September)	77	54 - 54	100	2	Moderate to high	High

Table 3.10: The number of nights sampled (detectors were operational for), the number of nights bats were recorded and the total number of bats recorded per season. Percentage distribution of no. bats is also presented.

Recording Period	No. Nights Sampled	No. of nights Bats were Recorded	Percentage of Nights Bats were Recorded	Total No. Bats recorded[22]	Percentage Distribution of No. Bats
Spring (June)	24	10	41.7%	8 (8)	0.9% (0.8%)
Summer (August)	55	32	58.2%	819 (1,006)	96.8% (97.4%)

[21] Numbers showing as 0 are likely as the percentile is <1, so 0.5 for example. Likely as a result of the low number of bat passes for each species per month.

[22] For this part of the analysis, the *Ecobat* report returned different, incorrect totals of number of bats recorded per season (the numbers in brackets) than in other tables within the *Ecobat* report and AEL's data. The number of bat passes from the AEL dataset, and included in other *Ecobat* output tables (e.g. Table 3.3, Table 3.5, Table 3.6 and Table 3.8 above) total 846 bat passes. As such, percentage distribution of bats per season has been calculated and presented using total bat passes from the AEL dataset rather than those returned from *Ecobat* for this parameter. The total returned from the *Ecobat* report for this analysis is substantially more during summer than that of other *Ecobat* tables and AEL's input dataset, but the percentage distribution of activity across the seasons is comparable.

Recording Period	No. Nights Sampled	No. of nights Bats were Recorded	Percentage of Nights Bats were Recorded	Total No. Bats recorded[22]	Percentage Distribution of No. Bats
Autumn (September)	24	7	29.2%	19 (19)	2.2% (1.8%)
			Total	**846 (1,033)**	**99.9% (100%)**

Potential bat roosts within or close to the site

3.2.26 The *Ecobat* tool identified the possible presence of roosts within proximity of the Site based on recording of activity at the Site within the species-specific emergence times.

3.2.27 *Ecobat* analysis showed that activity was recorded within the species-specific emergence time for common and/or soprano pipistrelle at two monitoring locations. This is detailed in **Table 3.11**.

Table 3.11: Bat activity recorded within the species-specific emergence time

Detector ID	Species/Species Group	Nights Recorded	Peak Count	Month of Peak Count
MS 4	Common pipistrelle	1	1	August
MS 6	Common pipistrelle	1	1	August
MS 6	Soprano pipistrelle	1	1	September

3.2.28 Based on the *Ecobat* analysis above, it is considered possible that there are small roosts comprising low numbers of bats in the wider area (potentially in the plantation to the north and east of the Proposed Development), although due to the low number of nights recorded and peak count it is considered unlikely that these will be significant roosts such as maternity roosts, and are more likely to represent individual bats emerging from roosts on the periphery of the Study Area early to forage throughout the Study Area during calm, warmer nights.

3.2.29 The full *Ecobat* output is presented in **Annex 5**.

4 ASSESSMENT OF THE POTENTIAL RISKS TO BATS

4.1 Risk Assessment

4.1.1 In accordance with NatureScot guidance[1], a risk assessment has been carried out to identify the potential risk to bat populations. Wind farm developments can impact upon bat species as a result of:

- collision mortality and other injuries (although it is important to consider these in the context of other forms of anthropogenic mortality);
- loss or damage to commuting and foraging habitat, (wind farms may form barriers to commuting or seasonal movements, and can result in severance of foraging habitat);
- loss of, or damage to, roosts; and,
- displacement of individuals or populations (due to wind farm construction or because bats avoid the wind farm area).

4.1.2 To ensure that bat species are protected by minimising the risk of collision, NatureScot guidance[1] advises that an assessment of impact for a proposed wind farm development, requires a detailed appraisal of:

- the level of activity of all bat species recorded at the site assessed both spatially and temporally;
- the risk of turbine-related mortality for all bat species recorded at the Site during bat activity surveys; and
- the effect on the species' population status if predicted impacts are not mitigated.

Assessing Potential Risk

4.1.3 NatureScot guidance[1] presents a two-stage process for assessing the potential risk to bats as a result of onshore wind turbine developments:

- Stage 1 - gives an indication of the potential risk level of a site, based on a consideration of habitat and development-related features; and
- Stage 2 – uses the output of Stage 1 (i.e., the potential risk level of a site) to provide an overall risk assessment based on the recorded activity level of high collision risk species.

4.1.4 The assessment is intended to assist in the identification of those developments which are of greatest concern in terms of potential collision risks at the population level and inform the potential requirements for mitigation.

4.2 Stage 1 – Initial Site Risk Assessment

4.2.1 In accordance with NatureScot guidance[1] an assessment of the potential risk level of the Proposed Development, has been undertaken based on a consideration of habitat and development-related features detailed in Table 3a of the NatureScot guidance[1].

4.2.2 The values and classification criteria provided within Table 3a of NatureScot guidance[1] are intended to be taken as a guide, with habitat and development-related features at proposed wind farm sites

rarely matching rigid descriptions. Professional judgement has therefore been applied to interpret and assign risk categories and conclude on the overall risk level for the Site.

4.2.3 The Site has been assessed as having an overall 'Site Risk' of **3**, represent a **Medium Site Risk**:

- The Site 'Habitat Risk is classified as **Low**.
- The Site 'Project Size' is classified as being **Large**, comprising a development of six turbines of up to 200 m tip height, with three other operational wind farm developments (Millenium x26 turbines; Beinneun x25 turbines; Beinneun Extension x7 turbines) and one other currently in scoping/screening (Beinneun 2 x22 turbines) located within 5 km of the Site (distances measures between the nearest turbines). This totals 58 currently operational turbines within 5km, potentially rising to 80 operational turbines with the completion of Beinneun 2.

4.3 Stage 2 – Overall Risk Assessment

4.3.1 In accordance with NatureScot guidance[1], Stage 2 should be carried out separately for all high collision risk species recorded, which includes the following species recorded during bat activity surveys for the Proposed Development:

- Common pipistrelle; and,
- Soprano pipistrelle.

4.3.2 In order to derive an 'Overall Risk Assessment' the determined Bat Activity Category derived from the *Ecobat* Tool Output Report is compared against the site Risk Level (Stage 1) using the matrix presented in Table 3b in NatureScot guidance[1] to determine the level of overall risk. This is presented for both the median percentile and max percentile per MS location and per month in **Table 4.1** and **Table 4.2**.

4.3.3 The matrix provided in Table 3b of the guidance is intended to be interpreted as a guide, therefore the Overall Risk Category concluded in **Tables 4.1** and **4.2** is determined with due recognition of the *Ecobat* output, acknowledgement of its limitations and using professional judgement on the basis of all other available information.

4.3.4 In conclusion, in recognition of all available information, the Overall Risk Assessment is considered to fall under "Low Site Risk" for common pipistrelle and "Low/Medium Site Risk" for soprano pipistrelle.

4.3.5 Increased risk is identified at the maximum percentile, as to be expected; with soprano pipistrelle having an Overall Risk Assessment of Medium at every MS location and during August. These areas of increased risk can help to inform mitigation strategies, if required.

Table 5.2: Overall Risk Assessment (Table 3b from NatureScot guidance1) per MS location. Key: green = Low, Amber = Medium, Red = High

Species / species group	MS Location	Median Percentile	Percentile Category	Overall Risk Assessment (Stage 2)		Species / species group	MS Location	Max Percentile	Percentile Category	Overall Risk Assessment (Stage 2)
Common pipistrelle	MS1	3	Low	3		Common pipistrelle	MS1	4	Low	3
	MS2	2	Low	3			MS2	14	Low	3
	MS3	1	Low	3			MS3	1	Low	3
	MS4	3	Low	3			MS4	18	Low	3
	MS5	3	Low	3			MS5	5	Low	3
	MS6	13	Low	3			MS6	20	Low	3
Soprano pipistrelle	MS1	15	Low	3		Soprano pipistrelle	MS1	31	Low to moderate	6
	MS2	22	Low to moderate	6			MS2	52	Moderate	9
	MS4	6	Low	3			MS4	51	Moderate	9
	MS5	7	Low	3			MS5	38	Low to moderate	6
	MS6	17	Low	3			MS6	48	Moderate	9

Table 5.3: Overall Risk Assessment (Table 3b from NatureScot guidance1) per season. Key: green = Low, Amber = Medium, Red = High

Species / species group	Season (Month)	Median Percentile	Percentile Category	Overall Risk Assessment (Stage 2)		Species / species group	Season (Month)	Max Percentile	Percentile Category	Overall Risk Assessment (Stage 2)
Common pipistrelle	Spring (June)	0	Low	0		Common pipistrelle	Spring (June)	0	Low	0
	Summer (August)	4	Low	3			Summer (August)	20	Low	3
	Autumn (September)	0	Low	0			Autumn (September)	0	Low	0
Soprano pipistrelle	Spring (June)	0	Low	0		Soprano pipistrelle	Spring (June)	0	Low	0
	Summer (August)	17	Low	3			Summer (August)	52	Moderate	9
	Autumn (September)	0	Low	0			Autumn (September)	0	Low	3

ANNEX 1: SCIENTIFIC NAMES

Table A1.1 below provides full scientific names of species referenced within the report.

Table A1.1: Species Names.

Common Name	Scientific Name
Common pipistrelle	*Pipistrellus pipistrellus*
Soprano pipistrelle	*Pipistrellus pygmaeus*
Pipistrelle species	*Pipistrellus sp.*
Daubenton's bat	*Myotis daubentoniid*
Natterer's bat	*Myotis nattereri*
Myotis species	*Myotis sp.*
Brown long-eared bat	*Plecotus auritas*
Nyctalus species	*Nyctalus sp.*

ANNEX 2: BAT ACTIVITY SURVEY EFFORT

Table A4.1 below provides further details of bat activity surveys.

Table A4.1: Bat Activity Survey Effort

MS Ref.	MS Grid Ref.	Date Start	Date End	No. Nights
MS1	NH 27102 08703	24/05/2022	07/06/2022	14
MS2	NH 27773 08811	24/05/2022	07/06/2022	14
MS3	NH 27999 08230	24/05/2022	07/06/2022	14
MS4	NH 28843 08948	24/05/2022	07/06/2022	14
MS5	NH 29783 08800	24/05/2022	07/06/2022	14
MS6	NH 30634 08266	24/05/2022	07/06/2022	14
MS1	NH 27102 08703	01/08/2022	18/08/2022	17
MS2	NH 27773 08811	01/08/2022	18/08/2022	17
MS3	NH 27999 08230	Detector failure	Detector failure	Detector failure
MS4	NH 28843 08948	01/08/2022	18/08/2022	17
MS5	NH 29783 08800	01/08/2022	18/08/2022	17
MS6	NH 30634 08266	01/08/2022	18/08/2022	17
MS1	NH 27102 08703	13/09/2023	27/09/2023	14
MS2	NH 27773 08811	13/09/2023	27/09/2023	14
MS3	NH 27999 08230	13/09/2023	27/09/2023	14
MS4	NH 28843 08948	13/09/2023	27/09/2023	14
MS5	NH 29783 08800	13/09/2023	27/09/2023	14
MS6	NH 30634 08266	13/09/2023	27/09/2023	14

ANNEX 3: EXISTING BAT RECORDS – HBRG

Table A2.1 provides details of bat records provided by HBRG within 10 km of the Site.

Table A2.1: Existing Bat Records

Species	Date	Grid Reference	Abundances	Comment
Common pipistrelle	08/08/2018	NH302010	1 Count of Juvenile	Dead.
Common pipistrelle	15/10/2019	NH328146	c. 30 Count	Foraging around building (roosting in adjacent building?).
Common pipistrelle	03/06/2019	NH302010	1 Count of Adult	Under roof slates.
Common pipistrelle	01/05/2019 - 09/08/2019	NH3028901067	1 Count	14 roost access points throughout the roof. Summer non breeding roost.
Soprano pipistrelle	01/05/2019 - 09/08/2019	NH3028901067	23 Count	14 roost access points throughout the roof. Summer non breeding roost.
Soprano pipistrelle	03/07/2020 - 10/08/2020	NH376086	439 Count	2 maternity roosts in roof void south east, 176 and 263 bats.
Soprano pipistrelle	15/10/2019	NH328146	c. 50 Count	Foraging around building (roosting in adjacent building?).
Brown long-eared bat	09/08/2019	NH302010	1 Count of Adult	Present in loft.
Brown long-eared bat	08/08/2018	NH302010	1 Count of Adult	Present in loft.
Brown long-eared bat	01/05/2019 - 09/08/2019	NH3028901067	1 Count	In the attic. Summer non breeding roost.
Historic Records				
Unidentified bat	16/02/2013	NH404174	1 Count	Foraging at dusk in mild weather.
Unidentified bat	12/07/1994	NH307010		Bats seen in bridge crevices
Unidentified bat	2002	NH322144		Roosting in carport. Good numbers in area.
Daubenton's bat	12/07/2004 - 31/08/2004	NH382091	>16 Count	Frequent recorded activity. Roosting with Natterer's.
Daubenton's bat	July 1994	NH380075	12 Count	
Daubenton's bat	12/07/2004 - 31/08/2004	NH382091	roost of 1 Count	
Natterer's bat	12/07/2004 - 31/08/2004	NH382091	3 roosts: Count	
Natterer's bat	09/07/2010	NH274132		Bat detector.
Natterer's bat	12/07/2004 - 31/08/2004	NH382091	>106 Count	3 roosts. Frequent recorded activity. Roosting with Soprano pipistrelle and Daubenton's (separate roosts).
Natterer's bat	13/08/2011	NH2713		Bat detector.

Pipistrelle species	08/06/1994	NH286128		In FC bat box
Pipistrelle species	09/09/1996	NH286128		In FC bat box
Pipistrelle species	09/09/1996	NH338148		In FC bat box
Pipistrelle species	10/06/1993	NH286128		In FC bat box
Pipistrelle species	15/02/1994	NH406173		
Pipistrelle species	16/09/1993	NH286128		In FC bat box
Pipistrelle species	19/08/1993	NH286128		In FC bat box
Pipistrelle species	22/09/1989	NH221237		Droppings. Droppings in 8 bat boxes. Ref: Velander, K (co-ord) (1988). HBRG Bat Survey 1987-88 (H003). From IMAG database.
Pipistrelle species	24/09/1993	NH221237		In FC bat box
Pipistrelle species	25/08/1994	NH286128		In FC bat box
Pipistrelle species	15/05/2000	NH4519		
Common pipistrelle	12/07/2004 - 31/08/2004	NH382091		
Common pipistrelle	12/07/2004 - 31/08/2004	NH382091		Frequent recorded activity. Probably a number of non-breeding roosts.
Common pipistrelle	13/08/2011	NH2713		Bat detector.
Common pipistrelle	17/02/2013	NH355086	3 Count	Foraging at dusk in mild weather. ID confirmed with bat detector
Common pipistrelle	17/02/2013	NH358087	1 Count	Foraging at dusk in mild weather. ID confirmed with bat detector
Soprano pipistrelle	12/07/2004 - 31/08/2004	NH382091		
Soprano pipistrelle	12/07/2004 - 31/08/2004	NH382091	77 Count	Large roost. Frequent recorded activity. Roosting with Natterer's.
Soprano pipistrelle	13/08/2011	NH2713		Bat detector.
Brown long-eared bat	12/07/2004 - 31/08/2004	NH382091		
Brown long-eared bat	12/07/2004 - 31/08/2004	NH382091		Frequent recorded activity of "silent" bat. Flight behaviour etc suggested Brown long-eared.
Brown long-eared bat	16/07/1993	NH286128	1 male Count	In FC bat box
Brown long-eared bat	17/09/1986	NH377091	3 roosting Count	From IMAG database.
Brown long-eared bat	01/08/1994	NH221237	2males Count	In 2 separate FC bat boxes
Brown long-eared bat	01/09/1996	NH221237	3 males Count	In 3 separate FC bat boxes
Brown long-eared bat	05/08/1986	NH310010	1 roosting Count	From IMAG database.
Brown long-eared bat	08/08/1986	NH298012	40 roosting Count	From IMAG database.

ANNEX 4: WEATHER CONDITIONS

Table A5.1 below provides weather conditions for Bat Activity Survey periods. Text in red highlights unsuitable weather conditions.

Table A5.1: Weather Conditions.

Date	Temp at Dusk (°C)	Maximum Wind Speed (m/s)	Rainfall (mm)
24/05/2022	5.6	3.6	0
25/05/2022	4.8	4	0.3
26/05/2022	3.8	5.4	0.8
27/05/2022	5.1	3.1	0.8
28/05/2022	3.3	4	0
29/05/2022	4.2	1.8	0
30/05/2022	4.5	0	0
31/05/2022	5.2	1.8	0
01/06/2022	8.3	1.8	0
02/06/2022	7.2	0.9	0
03/06/2022	8.4	0.9	0
04/06/2022	8.9	2.2	0
05/06/2022	7.9	1.3	0
06/06/2022	6.8	1.3	0
07/06/2022	14.8	0	0
01/08/2022	13	3.9	1.3
02/08/2022	10	11.1	0
03/08/2022	5	5.4	0.3
04/08/2022	3	8.9	0
05/08/2022	7	8	0
06/08/2022	9	14.6	0
07/08/2022	10	11.2	0
08/08/2022	12	11.2	0
09/08/2022	10	11.6	0
10/08/2022	12	13.6	0
11/08/2022	11	5.8	0
12/08/2022	14	5.4	0
13/08/2022	15	2.7	0
14/08/2022	13	3.6	0
15/08/2022	10	3.1	0.5
16/08/2022	3	6.3	0.1
17/08/2022	6	7.2	0.5

Date	Temp at Dusk (°C)	Maximum Wind Speed (m/s)	Rainfall (mm)
18/08/2022	5	13.6	0
13/09/2023	2	19.7	3.6
14/09/2023	4	9.8	0
15/09/2023	4	3.6	0
16/09/2023	4	2.2	0
17/09/2023	7	9.4	0.4
18/09/2023	2	13	0.7
19/09/2023	7	1.1	1.3
20/09/2023	3	18.3	0.6
21/09/2023	3	9.8	0.1
22/09/2023	3	7.6	0.1
23/09/2023	3	13	0
24/09/2023	9	16.1	4.7
25/09/2023	6	18.3	0
26/09/2023	5	13	0.1

ANNEX 5: ECOBAT TOOL OUTPUT REPORT

Ecobat Report
2025-02-19

Geo filter: region, Time filter: +- 1 month

Summary

Bats were detected on **18** nights between **01/06/2022** and **25/09/2023**, using **6** static bat detectors. Throughout this period, **3** species were recorded. **Table 1.** Detectors were placed at the following locations:

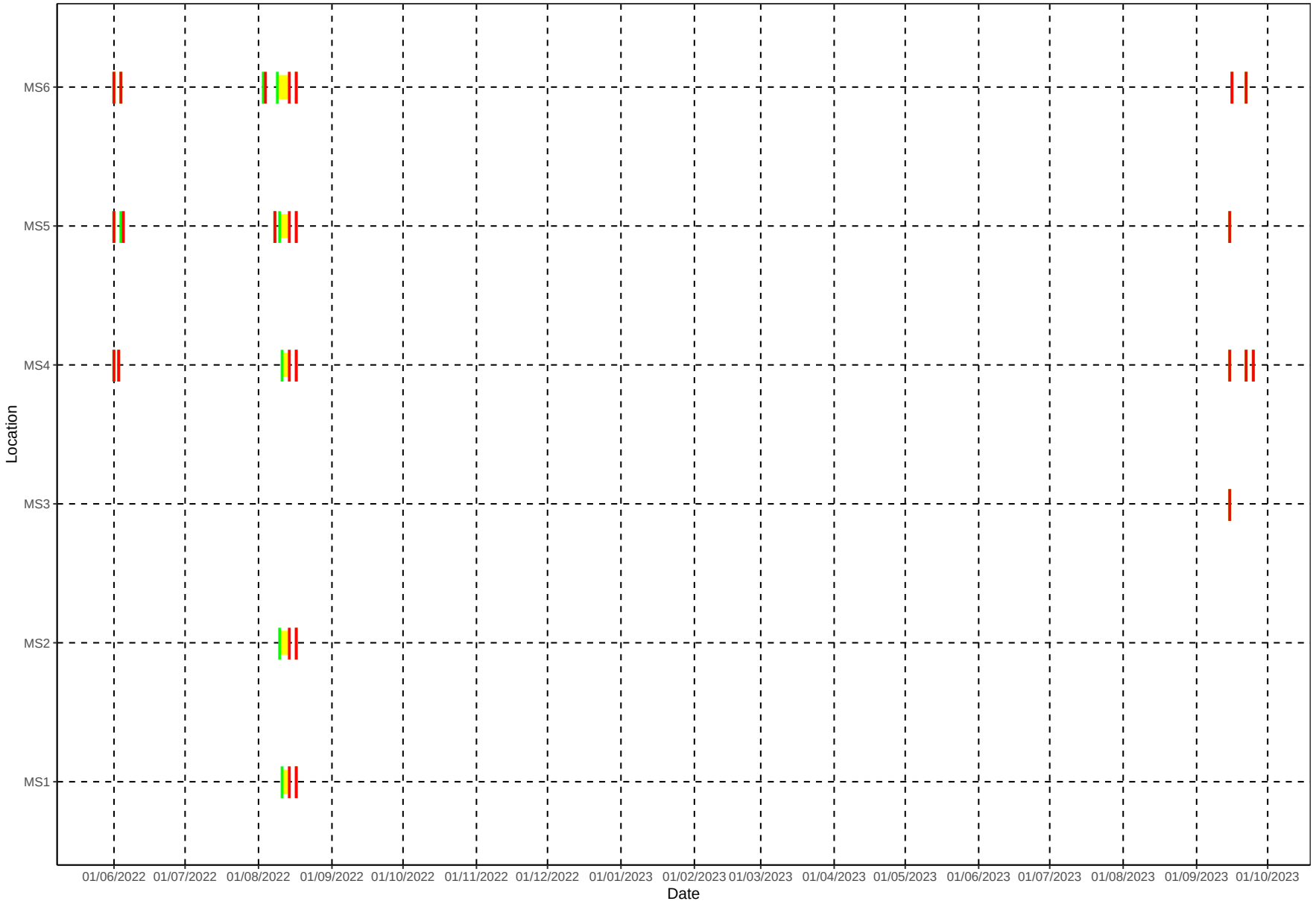
Detector ID	Latitude	Longitude
MS1	57.13659	-4.858669
MS2	57.13781	-4.847671
MS3	57.13269	-4.843541
MS4	57.13944	-4.830108
MS5	57.13846	-4.814494
MS6	57.13399	-4.800088

Survey Nights

Table 2. The number of nights that bats were detected on each recorder. This is not the same as the number of nights that detectors were active if there were nights when no bats were detected.

Detector ID	No. of Nights
MS1	5
MS2	6
MS3	1
MS4	10
MS5	11
MS6	13

Figure 1. Horizontal bars show nights when acoustic detectors recorded bats.


MS6
MS5
MS4
MS3
MS2
MS1
Location
01/06/2022
01/07/2022
01/08/2022
01/09/2022
01/10/2022
01/11/2022
01/12/2022
01/01/2023
01/02/2023
01/03/2023
01/04/2023
01/05/2023
01/06/2023
01/07/2023
01/08/2023
01/09/2023
01/10/2023
Date

Part 1: Percentile Analysis

This first part of the analysis looks at the relative activity levels of the bats you recorded. We take your value for the total bat passes each night for each species, and compare this to the values in our reference database. We tell you what percentile your data falls at, and therefore what the relative activity level is. For example, if the reference database has values of 5, 10, 15, 20 and you submit a value of 18, this will be the 80th percentile, and be classed as high activity.

Per Detector

Table 3. Summary table showing the number of nights recorded bat activity fell into each activity band for each species.

Detector ID	Species/Species Group	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
MS1	Pipistrellus pipistrellus	0	0	0	0	0	5
MS1	Pipistrellus pygmaeus	0	0	0	0	1	3
MS2	Pipistrellus pipistrellus	0	0	0	0	0	5
MS2	Pipistrellus pygmaeus	0	0	0	2	1	2
MS3	Pipistrellus pipistrellus	0	0	0	0	0	1
MS4	Pipistrellus pipistrellus	0	0	0	0	0	8
MS4	Pipistrellus pygmaeus	0	0	0	2	1	5
MS5	Pipistrellus pipistrellus	0	0	0	0	0	8
MS5	Pipistrellus pygmaeus	0	0	0	0	3	7
MS6	Myotis	1	0	0	2	0	0
MS6	Pipistrellus pipistrellus	0	0	0	0	2	6
MS6	Pipistrellus pygmaeus	0	0	0	3	1	5

Table 4. Summary table showing key metrics for each species recorded. The reference range is the number of nights for each species that your data were compared to. We recommend a Reference Range of 200+ to be confident in the relative activity level.

Detector ID	Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded	Reference Range
MS1	Pipistrellus pipistrellus	3	3 - 3	4	5	28743
MS1	Pipistrellus pygmaeus	15	1 - 31	31	4	4167
MS2	Pipistrellus pipistrellus	2	14 - 14	14	5	28743
MS2	Pipistrellus pygmaeus	22	22 - 52	52	5	4167
MS3	Pipistrellus pipistrellus	1	0	1	1	28743
MS4	Pipistrellus pipistrellus	3	11.5 - 18	18	8	28743
MS4	Pipistrellus pygmaeus	6	21 - 51	51	8	4167
MS5	Pipistrellus pipistrellus	3	2 - 5	5	8	28743
MS5	Pipistrellus pygmaeus	7	6.5 - 38	38	10	4167
MS6	Myotis	54	54 - 54	100	3	70
MS6	Pipistrellus pipistrellus	13	7 - 17	20	8	28743
MS6	Pipistrellus pygmaeus	17	12.5 - 44	48	9	4167

Figure 2. The recorded activity of bats during the survey. The centre line indicates the median activity level whereas the box represents the interquartile range (the spread of the middle 50% of nights of activity).

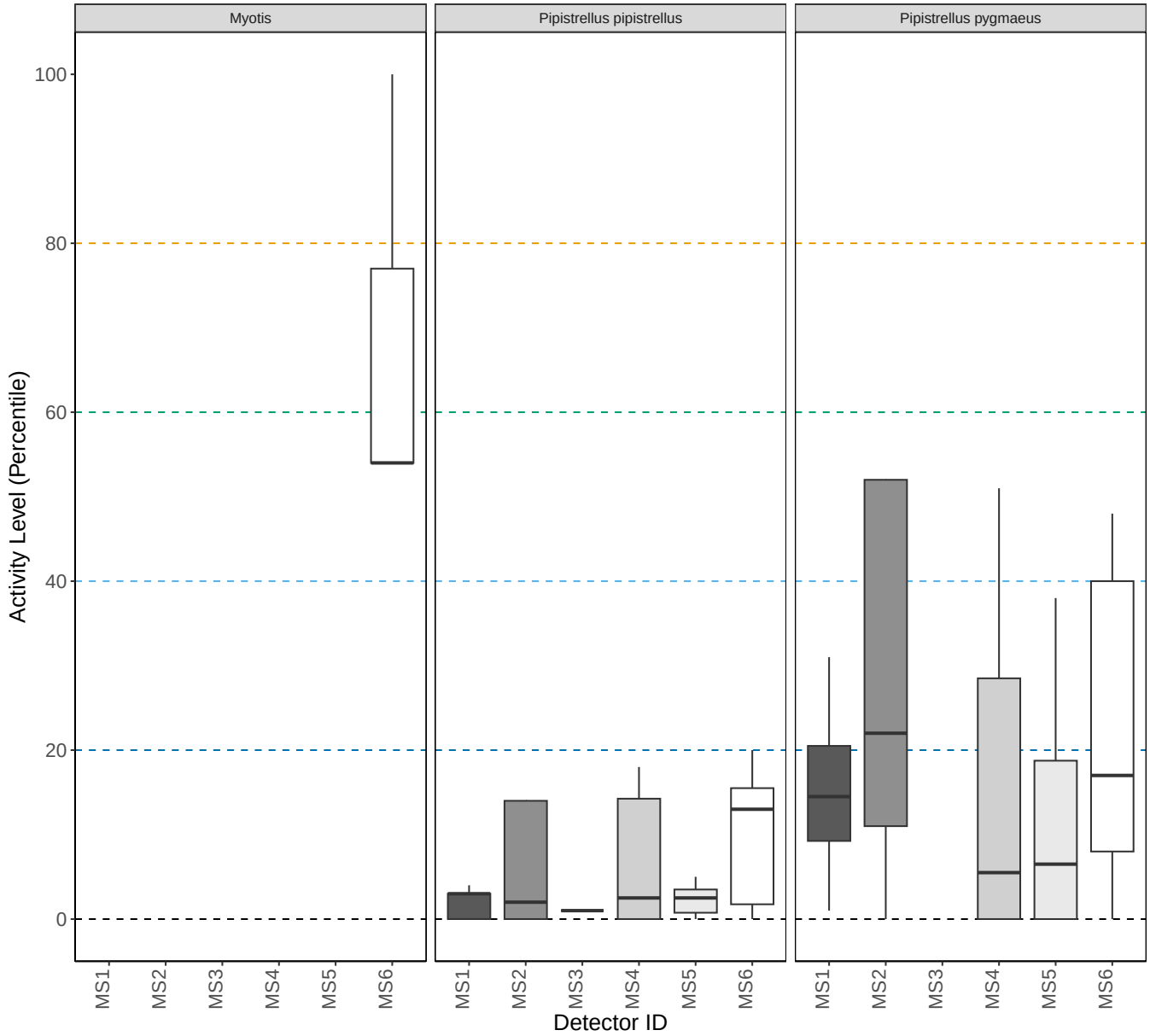
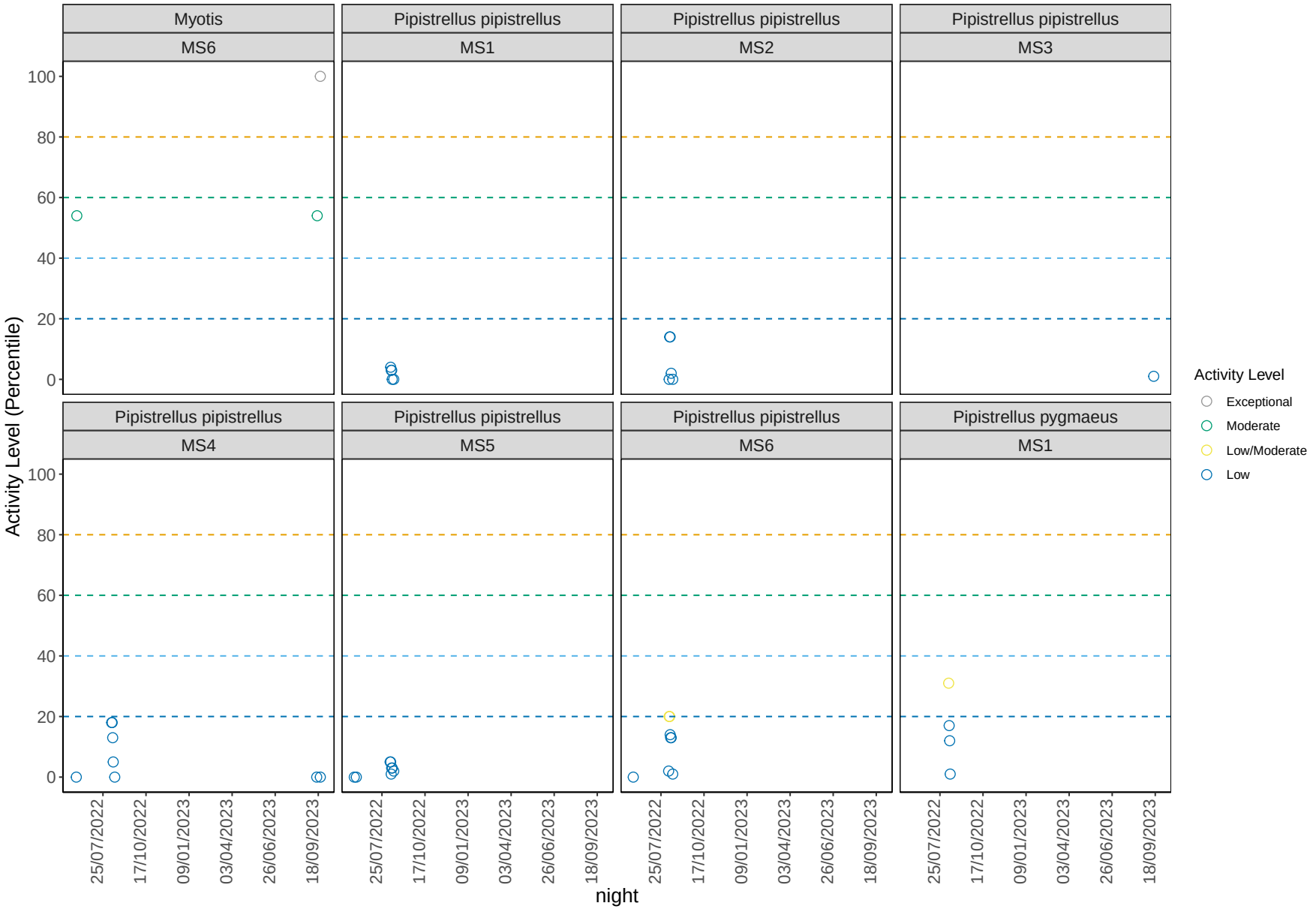
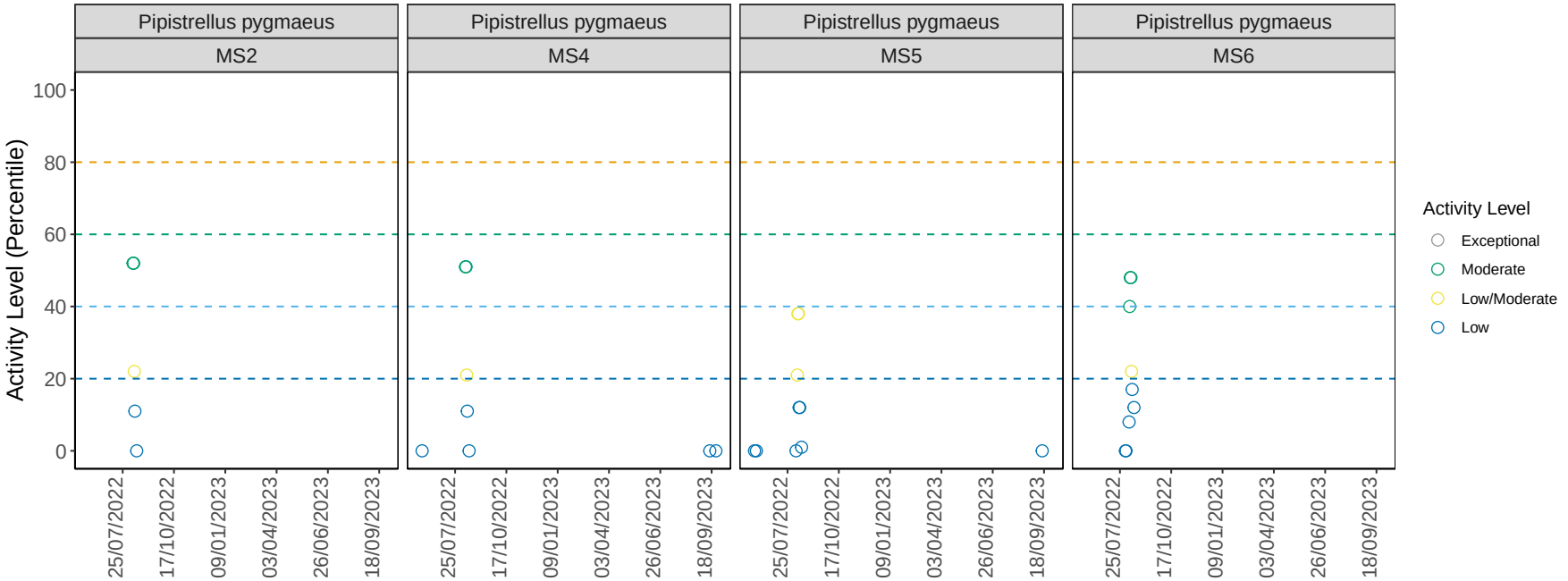

Myotis
Pipistrellus pipistrellus
Pipistrellus pygmaeus
Activity Level (Percentile)
100
80
60
40
20
0
MS1
MS2
MS3
MS4
MS5
MS6
Detector ID

Figure 3. The activity level (percentile) of bats recorded across each night of the bat survey.


Myotis
MS6
Pipistrellus pipistrellus
MS1
Pipistrellus pipistrellus
MS2
Pipistrellus pipistrellus
MS3
Pipistrellus pipistrellus
MS4
Pipistrellus pipistrellus
MS5
Pipistrellus pipistrellus
MS6
Pipistrellus pygmaeus
MS1
Activity Level (Percentile)
100
80
60
40
20
0
25/07/2022
17/10/2022
09/01/2023
03/04/2023
26/06/2023
18/09/2023
night
Activity Level
Exceptional
Moderate
Low/Moderate
Low


Pipistrellus pygmaeus
MS2
Pipistrellus pygmaeus
MS4
Pipistrellus pygmaeus
MS5
Pipistrellus pygmaeus
MS6
Activity Level (Percentile)
100
80
60
40
20
0
25/07/2022
17/10/2022
09/01/2023
03/04/2023
26/06/2023
18/09/2023
Activity Level
Exceptional
Moderate
Low/Moderate
Low

night

Per Detector, Per Month

Table 5. Summary table showing the number of nights recorded bat activity fell into each activity band for each species at each detector during each month.

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
MS1	Pipistrellus pipistrellus	Aug	0	0	0	0	0	5
MS1	Pipistrellus pygmaeus	Aug	0	0	0	0	1	3
MS2	Pipistrellus pipistrellus	Aug	0	0	0	0	0	5
MS2	Pipistrellus pygmaeus	Aug	0	0	0	2	1	2
MS3	Pipistrellus pipistrellus	Sep	0	0	0	0	0	1
MS4	Pipistrellus pipistrellus	Jun	0	0	0	0	0	1
MS4	Pipistrellus pipistrellus	Aug	0	0	0	0	0	5
MS4	Pipistrellus pipistrellus	Sep	0	0	0	0	0	2
MS4	Pipistrellus pygmaeus	Jun	0	0	0	0	0	1
MS4	Pipistrellus pygmaeus	Aug	0	0	0	2	1	2
MS4	Pipistrellus pygmaeus	Sep	0	0	0	0	0	2
MS5	Pipistrellus pipistrellus	Jun	0	0	0	0	0	2
MS5	Pipistrellus pipistrellus	Aug	0	0	0	0	0	6
MS5	Pipistrellus pygmaeus	Jun	0	0	0	0	0	2
MS5	Pipistrellus pygmaeus	Aug	0	0	0	0	3	4

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
MS5	Pipistrellus pygmaeus	Sep	0	0	0	0	0	1
MS6	Myotis	Jun	0	0	0	1	0	0
MS6	Myotis	Sep	1	0	0	1	0	0
MS6	Pipistrellus pipistrellus	Jun	0	0	0	0	0	1
MS6	Pipistrellus pipistrellus	Aug	0	0	0	0	2	5
MS6	Pipistrellus pygmaeus	Aug	0	0	0	3	1	5

Table 6. Summary table showing key metrics for each species recorded per month. Please note that we cannot split the reference range by month, hence this column is not shown in this table.

Detector ID	Species/Species Group	month	Median Percentile	95% CIs	Max. Percentile	Nights Recorded
MS1	Pipistrellus pipistrellus	Aug	3	3 - 3	4	5
MS1	Pipistrellus pygmaeus	Aug	15	1 - 31	31	4
MS2	Pipistrellus pipistrellus	Aug	2	14 - 14	14	5
MS2	Pipistrellus pygmaeus	Aug	22	22 - 52	52	5
MS3	Pipistrellus pipistrellus	Sep	1	0	1	1
MS4	Pipistrellus pipistrellus	Jun	0	11.5 - 18	0	1
MS4	Pipistrellus pipistrellus	Aug	13	11.5 - 18	18	5
MS4	Pipistrellus pipistrellus	Sep	0	11.5 - 18	0	2
MS4	Pipistrellus pygmaeus	Jun	0	21 - 51	0	1
MS4	Pipistrellus pygmaeus	Aug	21	21 - 51	51	5
MS4	Pipistrellus pygmaeus	Sep	0	21 - 51	0	2
MS5	Pipistrellus pipistrellus	Jun	0	2 - 5	0	2
MS5	Pipistrellus pipistrellus	Aug	3	2 - 5	5	6
MS5	Pipistrellus pygmaeus	Jun	0	6.5 - 38	0	2
MS5	Pipistrellus pygmaeus	Aug	12	6.5 - 38	38	7
MS5	Pipistrellus pygmaeus	Sep	0	6.5 - 38	0	1
MS6	Myotis	Jun	54	54 - 54	54	1
MS6	Myotis	Sep	77	54 - 54	100	2
MS6	Pipistrellus pipistrellus	Jun	0	7 - 17	0	1
MS6	Pipistrellus pipistrellus	Aug	13	7 - 17	20	7
MS6	Pipistrellus pygmaeus	Aug	17	12.5 - 44	48	9

Per Site

In this 'Per Site' section of the analysis, all values are taken from across all of the detectors to provide site-wide averages/medians.

Table 7. Summary table showing the number of nights recorded bat activity fell into each activity band for each species.

Species/Species Group	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
Myotis	1	0	0	2	0	0
Pipistrellus pipistrellus	0	0	0	0	2	33
Pipistrellus pygmaeus	0	0	0	7	7	22

Table 8. Summary table showing key metrics for each species recorded.

Species/Species Group	Median Percentile	95% CIs	Max. Percentile	Nights Recorded
Myotis	54	54 - 54	100	3
Pipistrellus pipistrellus	3	7 - 17	20	35
Pipistrellus pygmaeus	12	6.5 - 38	52	36

Figure 4. The activity level (percentile) of bats recorded across each night of the bat survey for the **entire site**.

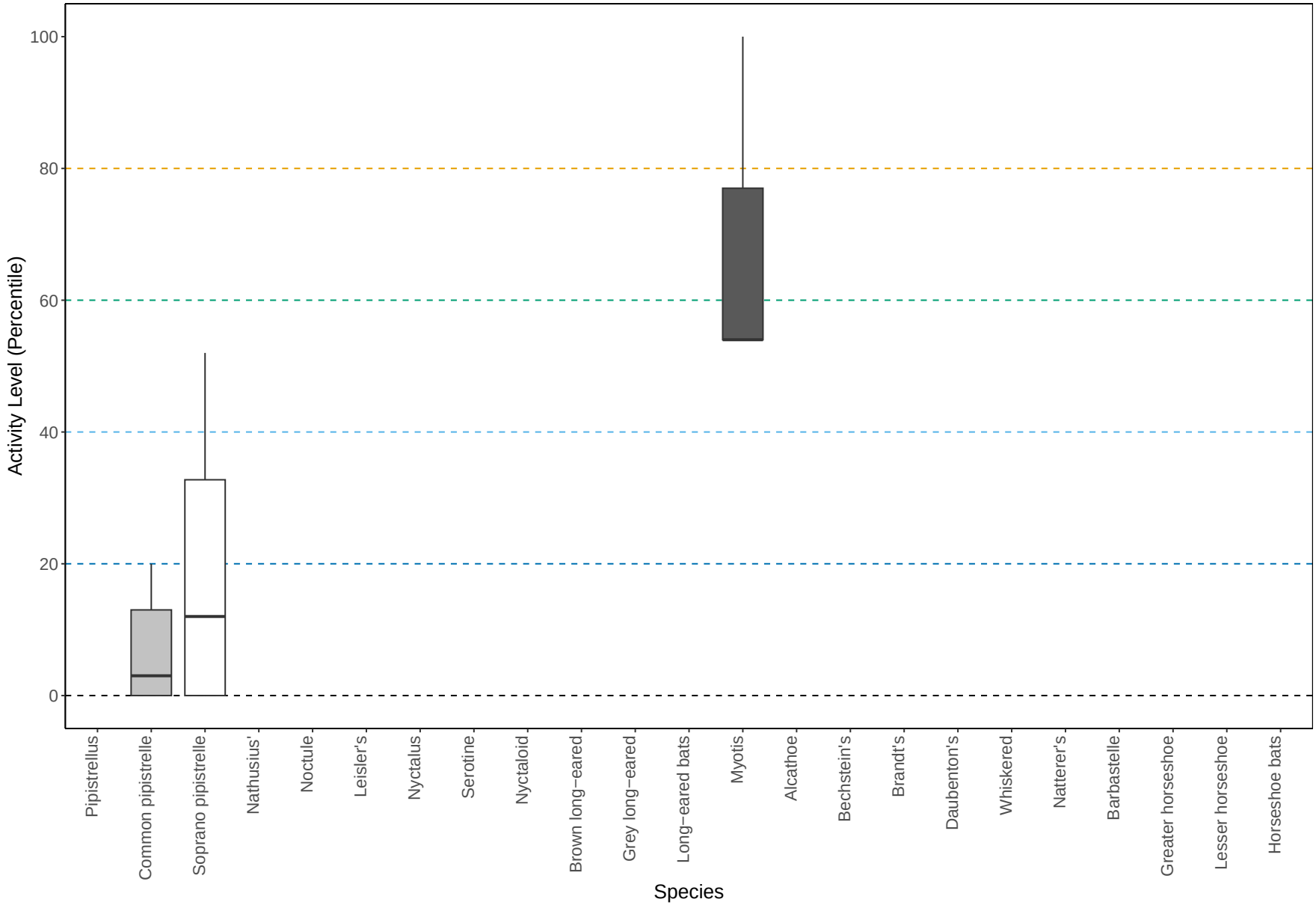
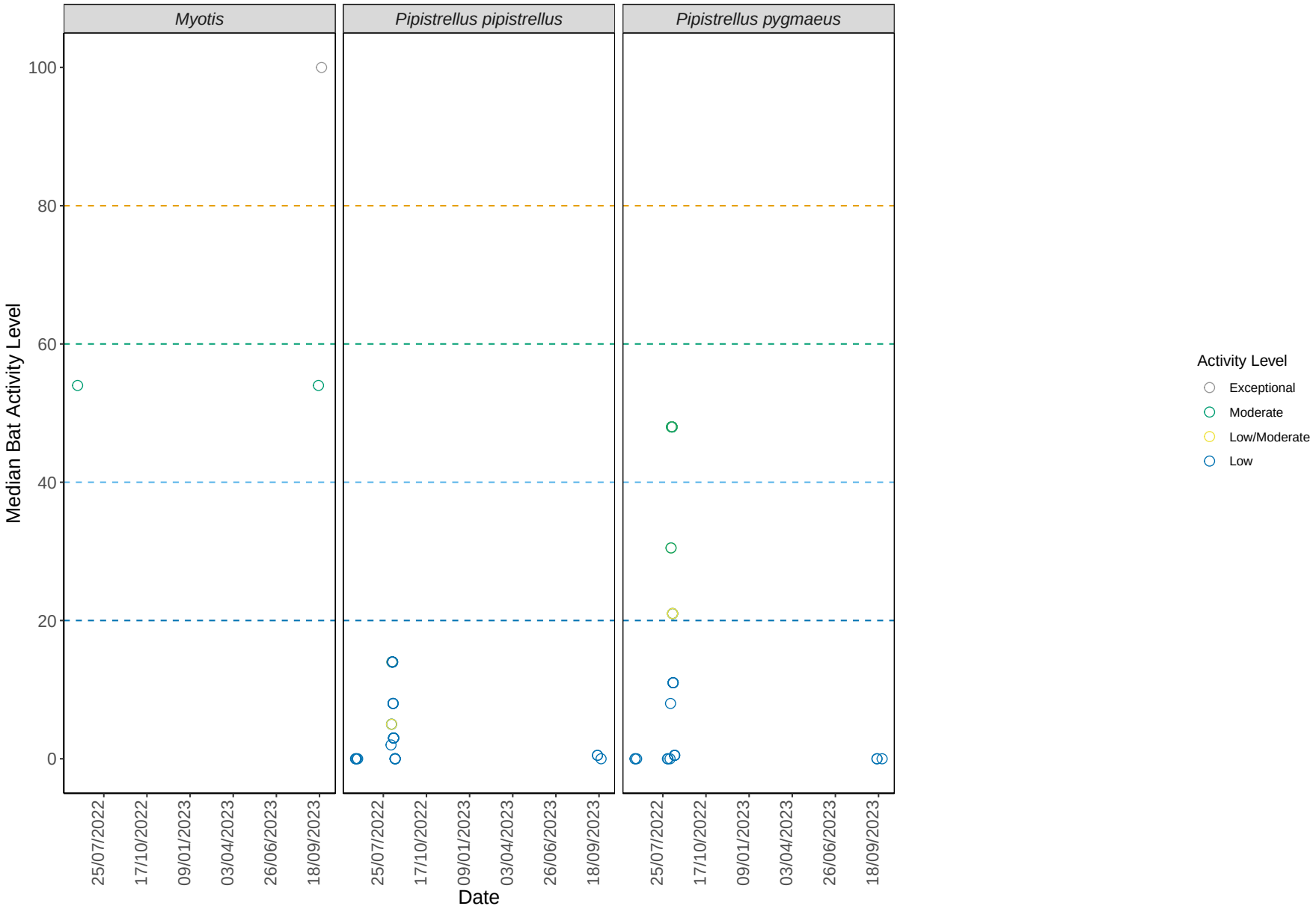

Activity Level (Percentile)
100
80
60
40
20
0
Pipistrellus
Common pipistrelle
Soprano pipistrelle
Nathusius'
Noctule
Leisler's
Nyctalus
Serotine
Nyctaloid
Brown long−eared
Grey long−eared
Long−eared bats
Myotis
Alcathoe
Bechstein's
Brandt's
Daubenton's
Whiskered
Natterer's
Barbastelle
Greater horseshoe
Lesser horseshoe
Horseshoe bats
Species

Figure 5. The median activity levels of bats recorded across all detectors each night.


Myotis
Pipistrellus pipistrellus
Pipistrellus pygmaeus
Median Bat Activity Level
100
80
60
40
20
0
25/07/2022
17/10/2022
09/01/2023
03/04/2023
26/06/2023
18/09/2023
Date
Activity Level
Exceptional
Moderate
Low/Moderate
Low

Per Site, Per Month

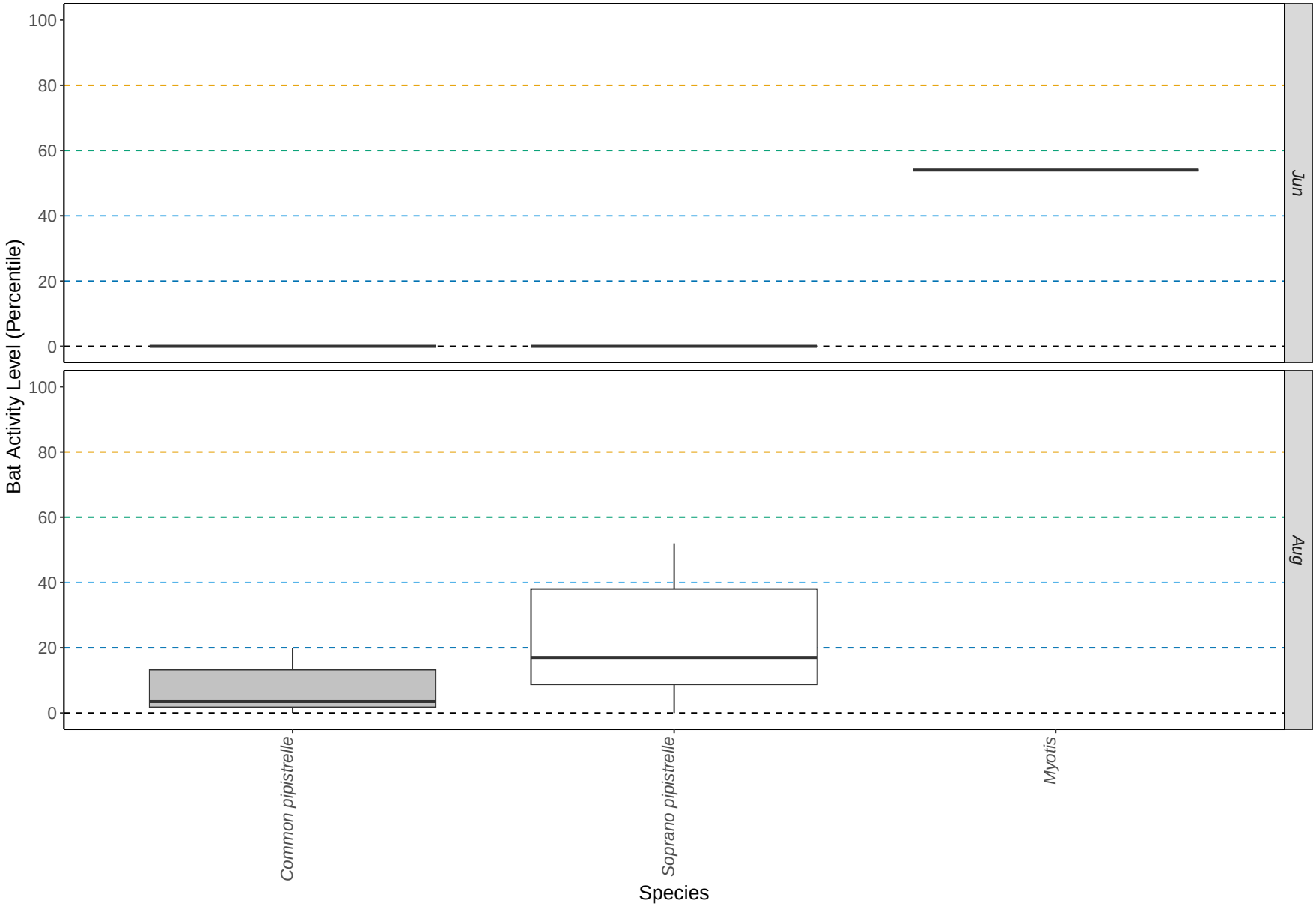
Table 9. Summary table showing the number of nights recorded bat activity fell into each activity band for each species during each month.

Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
Myotis	Jun	0	0	0	1	0	0
Myotis	Sep	1	0	0	1	0	0
Pipistrellus pipistrellus	Jun	0	0	0	0	0	4
Pipistrellus pipistrellus	Aug	0	0	0	0	2	26
Pipistrellus pipistrellus	Sep	0	0	0	0	0	3
Pipistrellus pygmaeus	Jun	0	0	0	0	0	3
Pipistrellus pygmaeus	Aug	0	0	0	7	7	16
Pipistrellus pygmaeus	Sep	0	0	0	0	0	3

Table 10. Summary table showing key metrics for each species recorded per month.

Species/Species Group	month	Median Percentile	95% CIs	Max. Percentile	Nights Recorded
Myotis	Jun	54	54 - 54	54	1
Myotis	Sep	77	54 - 54	100	2
Pipistrellus pipistrellus	Jun	0	7 - 17	0	4
Pipistrellus pipistrellus	Aug	4	7 - 17	20	28
Pipistrellus pipistrellus	Sep	0	11.5 - 18	1	3
Pipistrellus pygmaeus	Jun	0	6.5 - 38	0	3
Pipistrellus pygmaeus	Aug	17	6.5 - 38	52	30
Pipistrellus pygmaeus	Sep	0	6.5 - 38	0	3

Figure 6. The activity level (percentile) of bats recorded across each night of the bat survey for the entire site, split between months.


Bat Activity Level (Percentile)
100
80
60
40
20
0
Jun
Aug
Common pipistrelle
Soprano pipistrelle
Myotis
Species

Part 2: Nightly Analysis

Entire Survey Period

Sunrise and Sunset Times

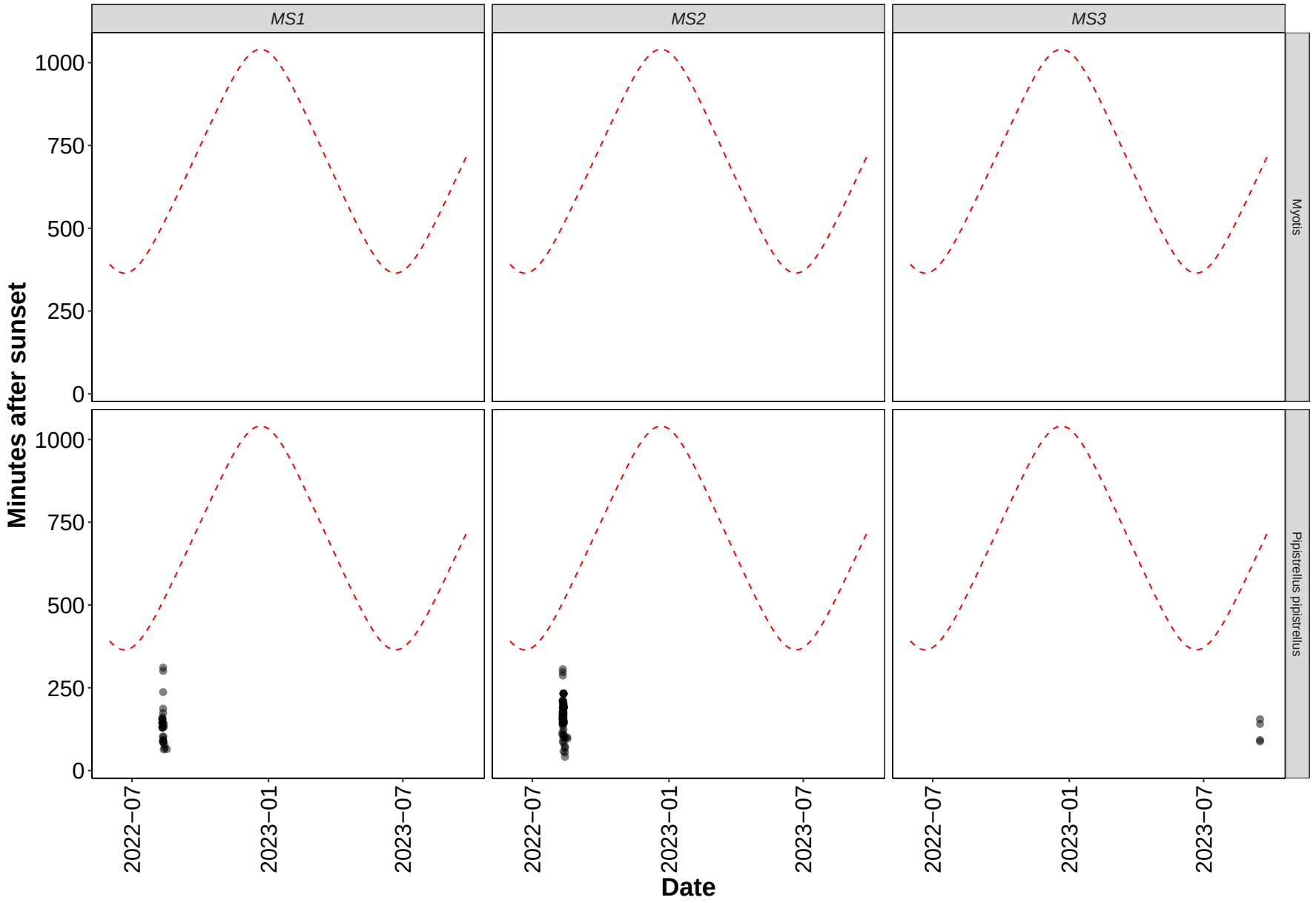
Table 11. The times of sunset and sunrise the following morning for surveys beginning on the date shown.

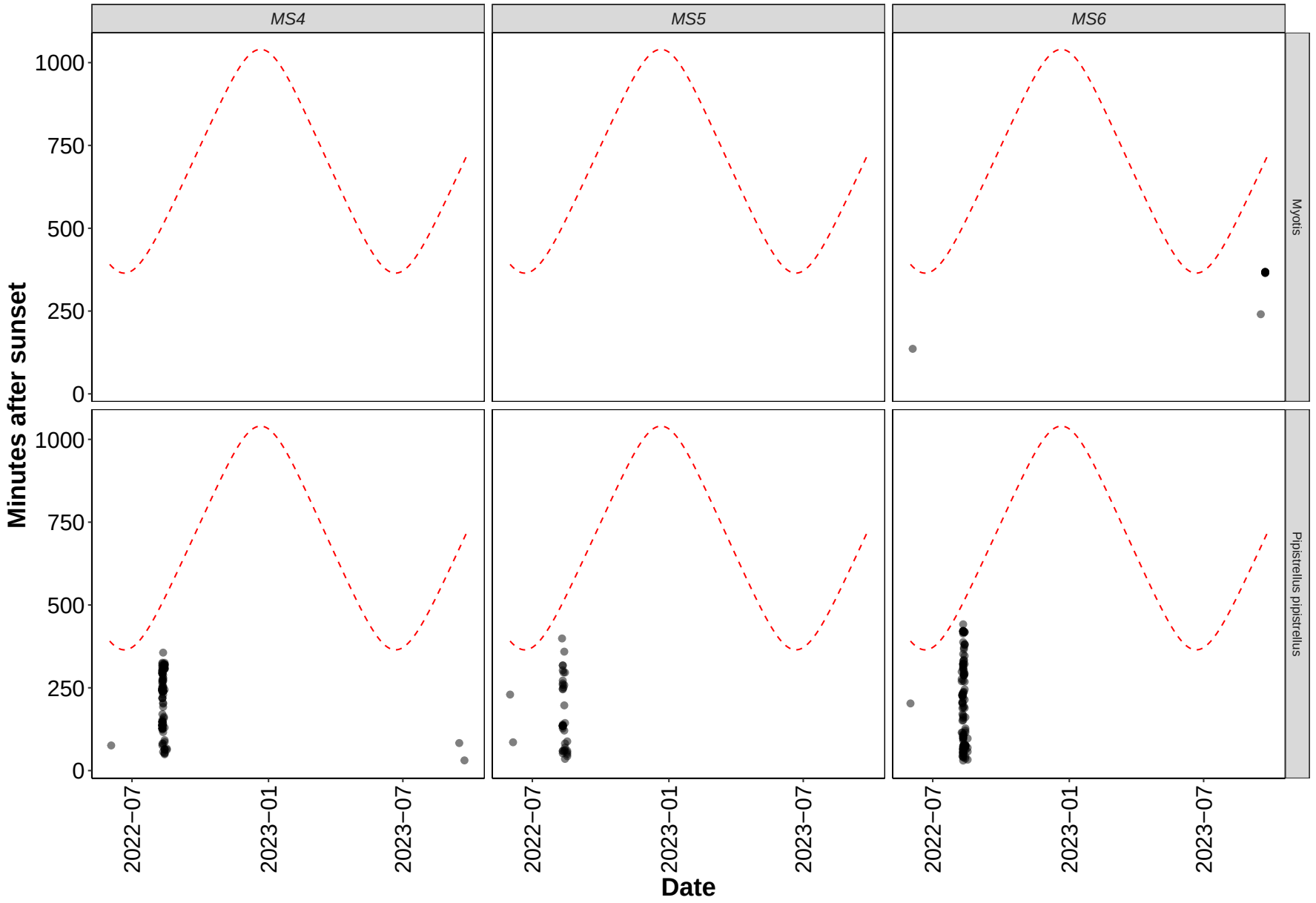
Night (y-m-d)	Sunset (h:m)	Sunrise (h:m)	Night Length (hours)
2022-06-01	22:02	04:33	6.5
2022-06-03	22:05	04:31	6.4
2022-06-04	22:06	04:30	6.4
2022-06-05	22:07	04:29	6.4
2022-08-03	21:31	05:24	7.9
2022-08-04	21:29	05:26	8.0
2022-08-08	21:20	05:34	8.2
2022-08-09	21:17	05:36	8.3
2022-08-10	21:15	05:38	8.4
2022-08-11	21:13	05:40	8.5
2022-08-12	21:10	05:42	8.5
2022-08-13	21:08	05:44	8.6
2022-08-14	21:06	05:46	8.7
2022-08-17	20:58	05:53	8.9
2023-09-15	19:41	06:52	11.2
2023-09-16	19:39	06:54	11.3
2023-09-22	19:22	07:06	11.7
2023-09-25	19:14	07:12	12.0

Distribution of Bat Activity Across the Night through Time

Per Detector

Figure 7. 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. Colours indicate kernel densities, with darkest colours showing peaks of activity. These colours are comparative only within each plot, and do not account for overall activity.


MS1
MS2
MS3
Myotis
Pipistrellus pipistrellus
Minutes after sunset
0
250
500
750
1000
2022−07
2023−01
2023−07
Date


MS4
MS5
MS6
Myotis
Pipistrellus pipistrellus
Minutes after sunset
0
250
500
750
1000
2022−07
2023−01
2023−07
Date

Roost Emergence Time and Bat Observation

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

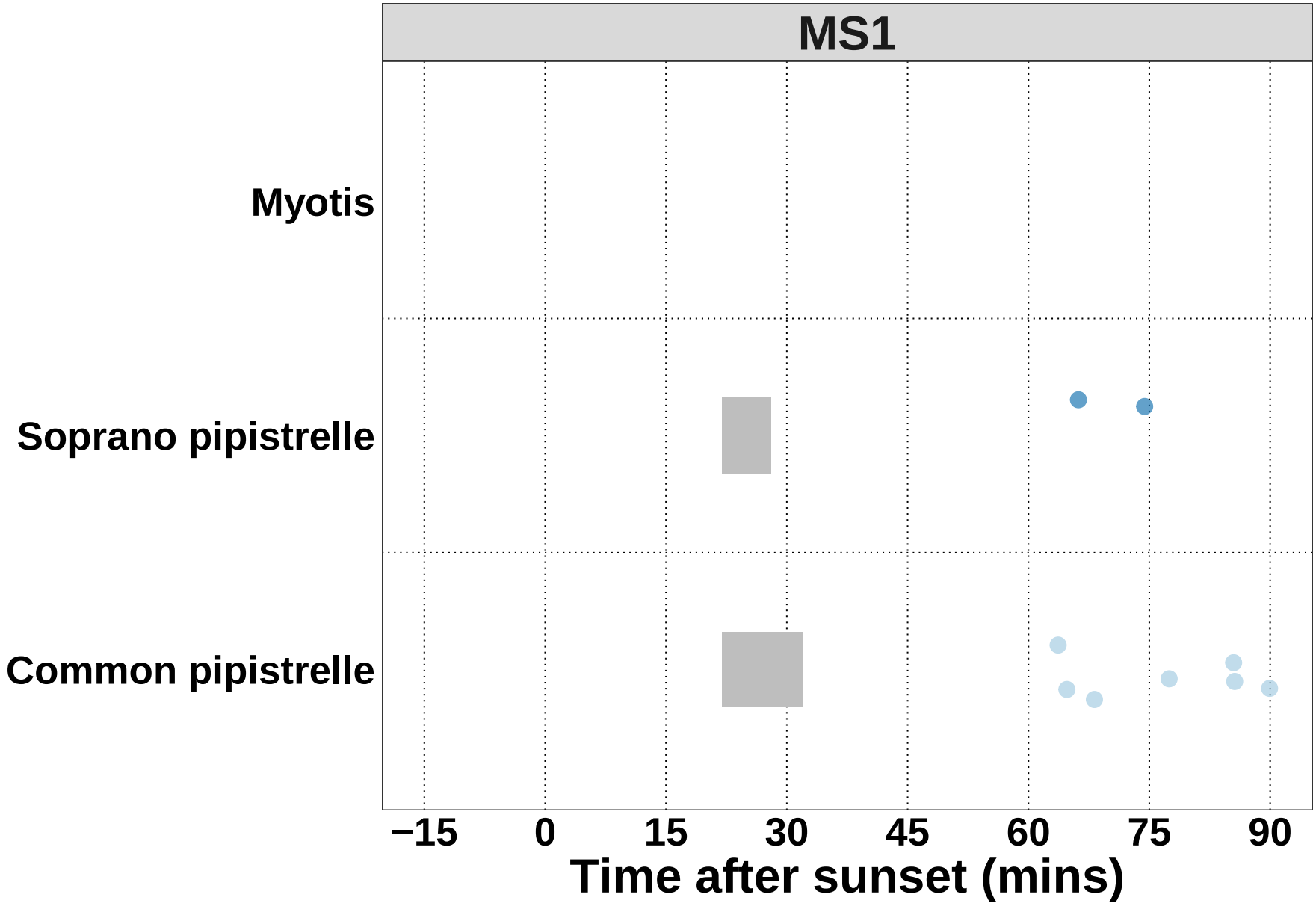
Bat Passes Potentially Indicating Close Proximity to a Roost (Russ 2012)

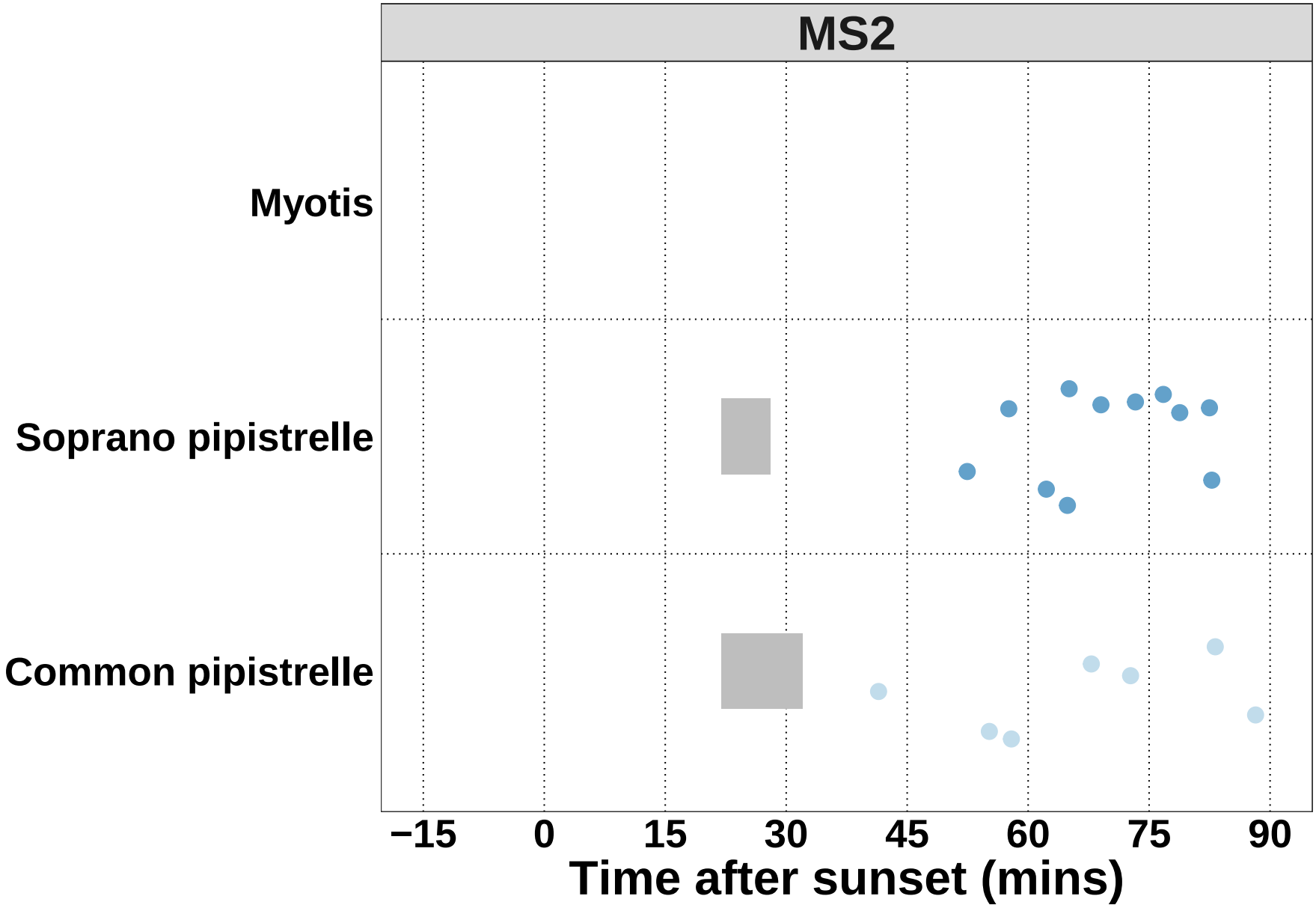
Table 12. Number of bat calls recorded before the upper time of the species-specific emergence time range, and which therefore may potentially indicate the presence of a nearby roost.

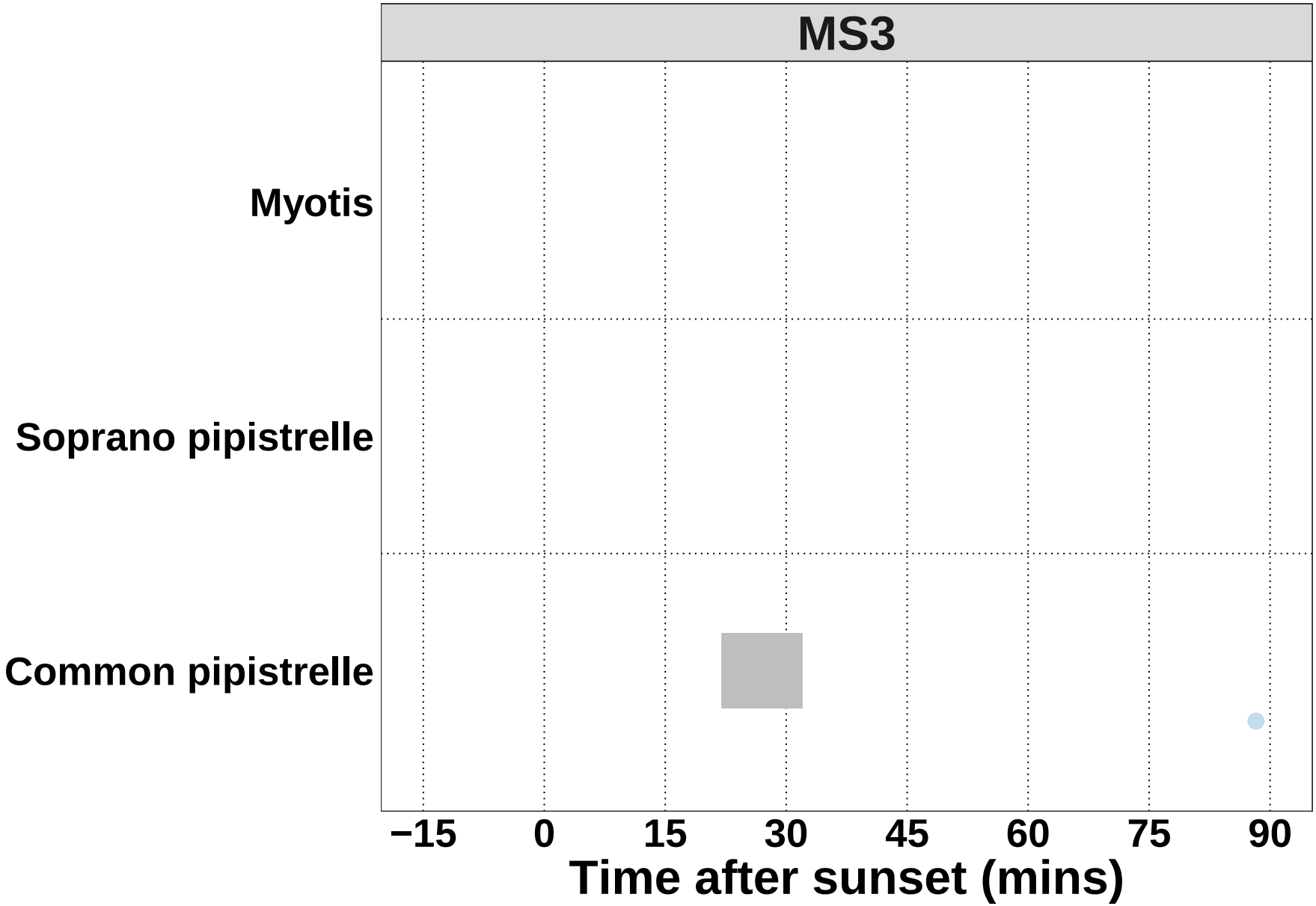
Species	Detector ID	2022-08-11	2022-08-17	2023-09-22
Common pipistrelle	MS4	0	0	1
Common pipistrelle	MS6	1	0	0
Soprano pipistrelle	MS6	0	1	0

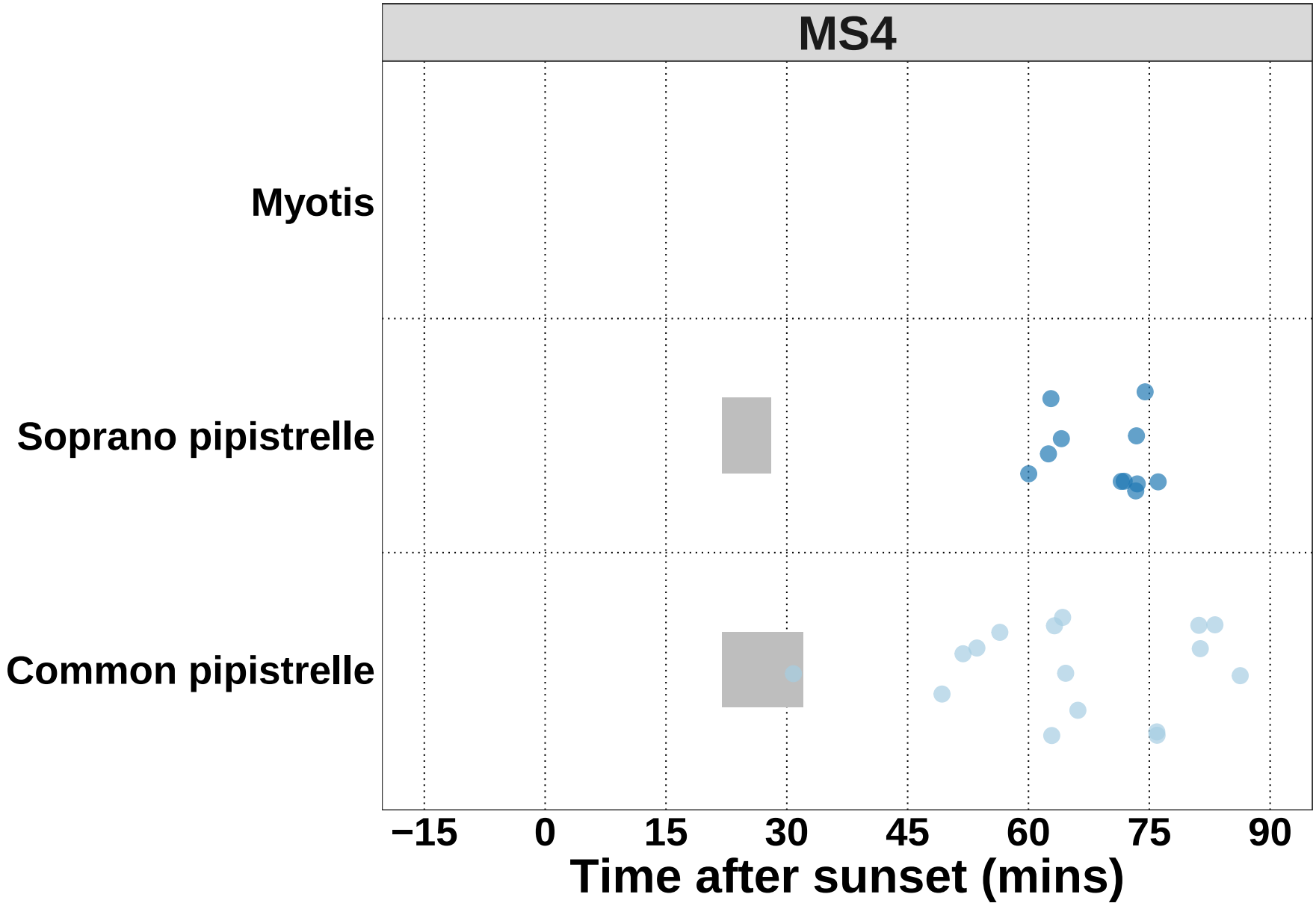
Bat Passes Potentially Indicating Close Proximity to a Roost (Russ 2012)

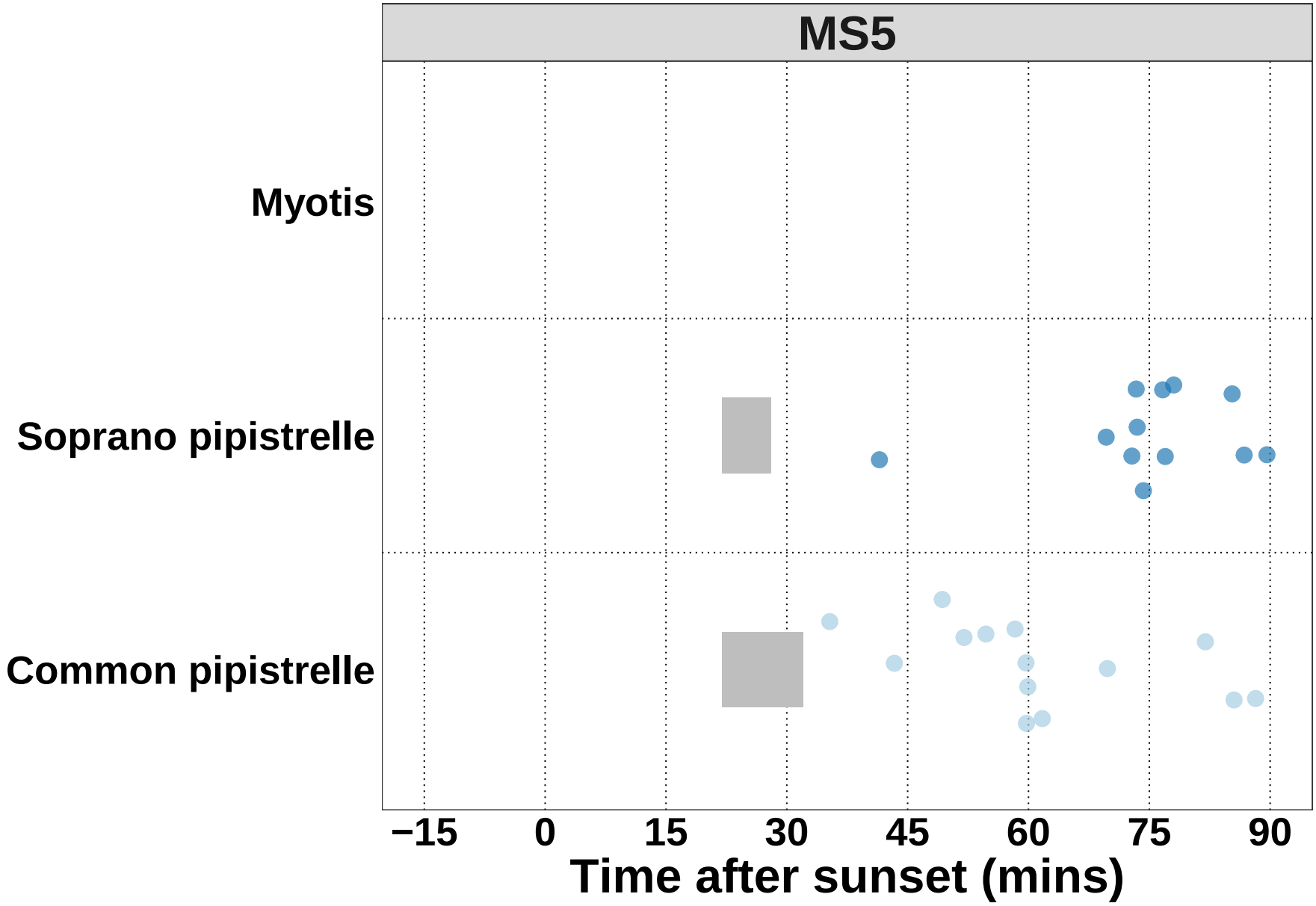
Figure 8. Time from 15 minutes before to 90 minutes after sunset. Species-specific emergence time ranges are shown as grey bars. Bat passes overlapping species-specific grey bars, or occuring earlier than this time range, may potentially indicate the presence of a nearby roost.

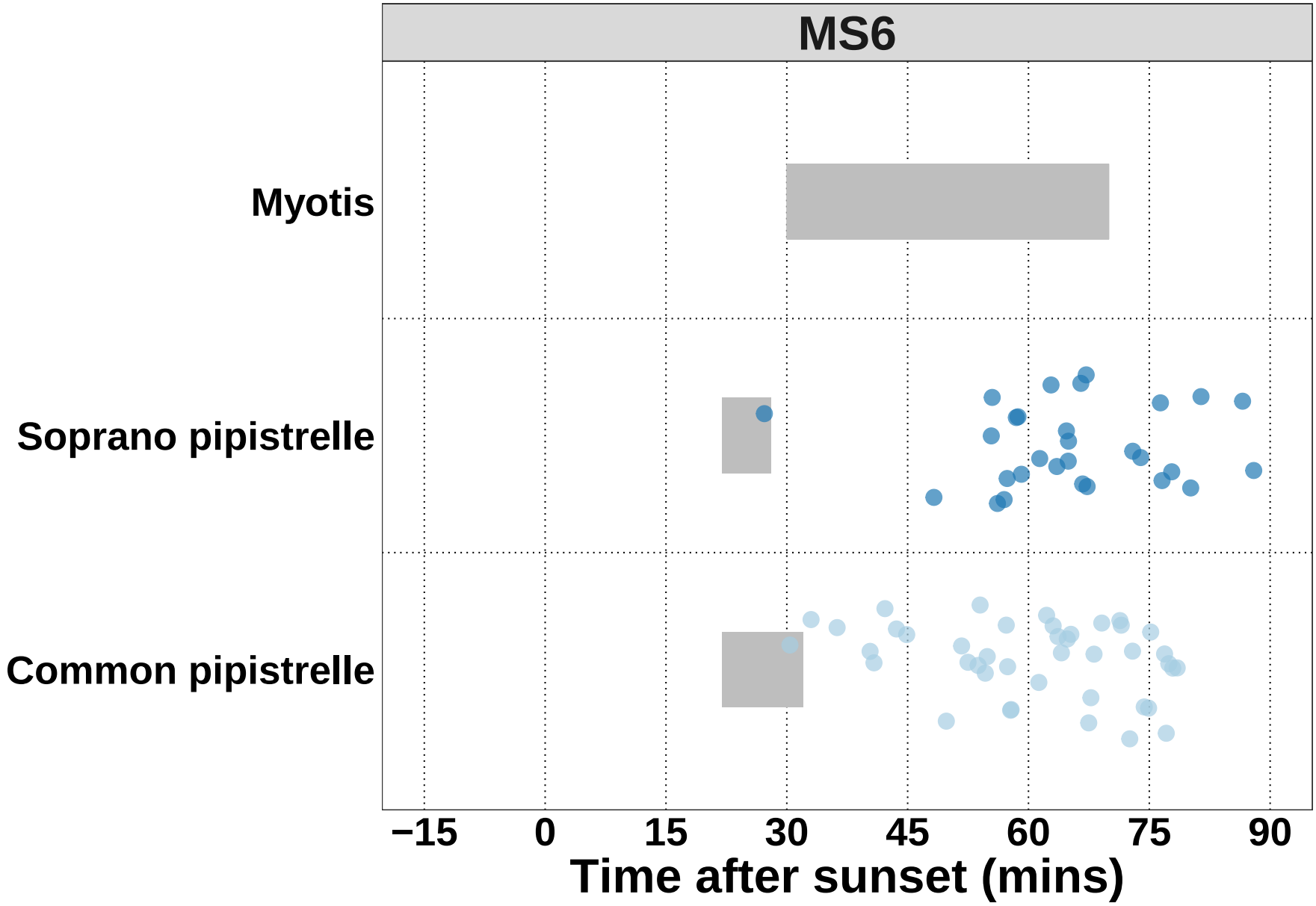

MS1
Myotis
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)


MS2
Myotis
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)


MS3
Myotis
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)


MS4
Myotis
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)


MS5
Myotis
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)


MS6
Myotis
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

Count of Bat Passes

All Detectors

Table 14. The total number of passes recorded for each species across all of the detectors.

The 'Total' percentage may not be exactly 100% due to rounding of the percentages per species.

Species	Passes (no.)	Percentage of Total (%)
Myotis	11	1.3
Pipistrellus pipistrellus	410	48.5
Pipistrellus pygmaeus	425	50.2
Total	846	100.0

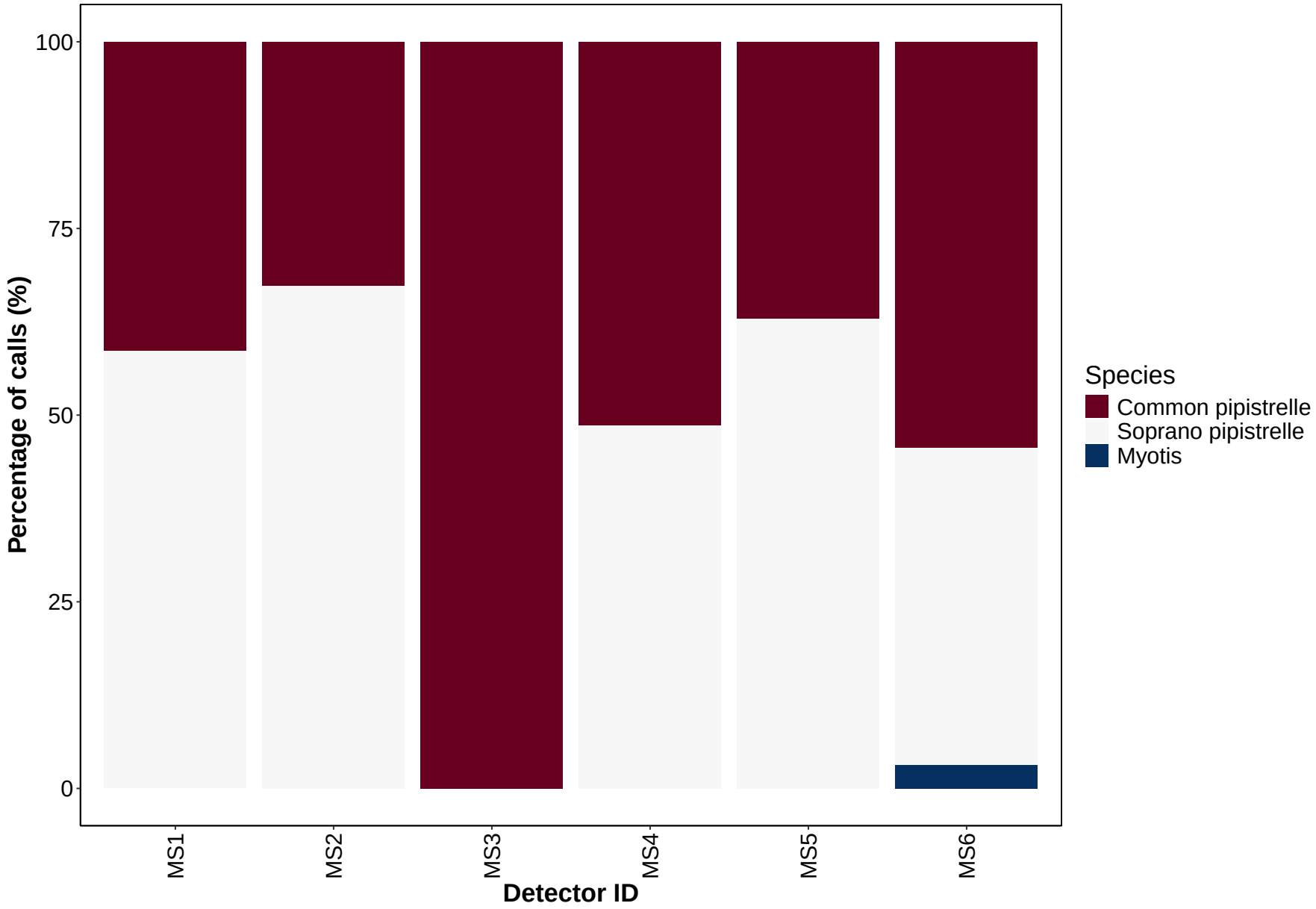
Per Detector

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

Species	Detector ID	Count (no.)	Percentage by Detector (%)
Common pipistrelle	MS1	29	41.428571
Common pipistrelle	MS2	83	44.148936
Common pipistrelle	MS3	4	100.000000
Common pipistrelle	MS4	120	54.054054
Common pipistrelle	MS5	41	39.805825
Common pipistrelle	MS6	133	51.351351
Soprano pipistrelle	MS1	41	58.571429
Soprano pipistrelle	MS2	105	55.851064
Soprano pipistrelle	MS4	102	45.945946
Soprano pipistrelle	MS5	62	60.194175
Soprano pipistrelle	MS6	115	44.401544
Myotis	MS6	11	4.247104

Species Composition

Figure 10. Percentage species composition of passes at each detector.


100
75
50
25
0
Percentage of calls (%)
MS1
MS2
MS3
MS4
MS5
MS6
Detector ID
Species
Common pipistrelle
Soprano pipistrelle
Myotis

Part 2a: Presence Only

THE NEXT SECTION OF THE REPORT FEATURES THE RAW DATA SUPPLIED TO ECOBAT AND ONLY TAKES INTO ACCOUNT THE PRESENCE, AND NOT THE ABSENCE, OF EACH BAT SPECIES. FOR EACH NIGHT, THERE IS NO 'ZERO DATA' FOR WHEN SPECIES WERE NOT DETECTED.

Nighlty Bat Passes Per Hour

Median Per Detector

Table 16. The median Nightly Pass Rate (bat passes per hour, per night) of each species. 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	Median Pass Rate
Common pipistrelle	MS1	0.9
Common pipistrelle	MS2	0.6
Common pipistrelle	MS3	0.4
Common pipistrelle	MS4	0.7
Common pipistrelle	MS5	0.7
Common pipistrelle	MS6	2.9
Soprano pipistrelle	MS1	1.2
Soprano pipistrelle	MS2	1.9
Soprano pipistrelle	MS4	0.5
Soprano pipistrelle	MS5	0.6
Soprano pipistrelle	MS6	1.4
Myotis	MS6	0.2

Mean Per Detector

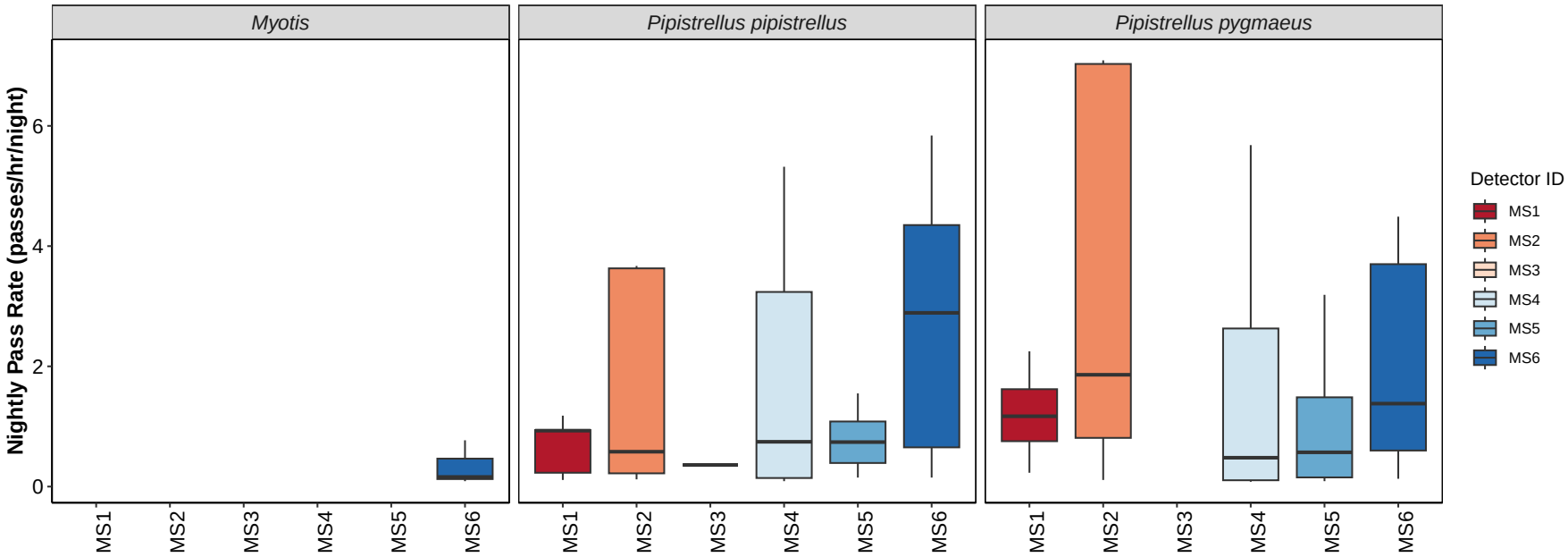
Table 17. The mean Nightly Pass Rate (bat passes per hour, per night) of each species at each detector. Values are given to 1 decimal place.

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	Mean Pass Rate
Common pipistrelle	MS1	0.7
Common pipistrelle	MS2	1.6
Common pipistrelle	MS3	0.4
Common pipistrelle	MS4	1.9
Common pipistrelle	MS5	0.8
Common pipistrelle	MS6	2.8
Soprano pipistrelle	MS1	1.2
Soprano pipistrelle	MS2	3.4
Soprano pipistrelle	MS4	1.8
Soprano pipistrelle	MS5	1.1
Soprano pipistrelle	MS6	2.0
Myotis	MS6	0.3

Per Detector

Figure 11. Boxplots for the number of bat passes per hour each night, for each detector. 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.


Myotis
Pipistrellus pipistrellus
Pipistrellus pygmaeus
Nightly Pass Rate (passes/hr/night)
0
2
4
6
MS1
MS2
MS3
MS4
MS5
MS6
Detector ID

Detector ID

Split by Month

Total Bat Passes per Detector each Month

Table 18. The total number of bat passes of each species in each month at each detector.

This table simply tells you how many bats of each species were recorded passing each detector during each month. These numbers are not standardised by the night length, or how many nights each detector was active for during each month.

Species	Detector ID	Jun	Aug	Sep
Common pipistrelle	MS1	0	29	0
Common pipistrelle	MS2	0	70	0
Common pipistrelle	MS3	0	0	4
Common pipistrelle	MS4	1	125	2
Common pipistrelle	MS5	2	51	0
Common pipistrelle	MS6	1	191	0
Soprano pipistrelle	MS1	0	41	0
Soprano pipistrelle	MS2	0	144	0
Soprano pipistrelle	MS4	1	118	2
Soprano pipistrelle	MS5	2	87	1
Soprano pipistrelle	MS6	0	150	0
Myotis	MS6	1	0	10

Survey Effort

Table 19. The number of survey nights per month per detector.

month	Detector ID	No. of Survey Nights
Jun	MS4	2
Jun	MS5	3
Jun	MS6	2
Aug	MS1	5
Aug	MS2	6
Aug	MS4	5
Aug	MS5	7
Aug	MS6	9
Sep	MS3	1
Sep	MS4	3
Sep	MS5	1
Sep	MS6	2

Nightly Bat Passes for Each Month

Median Per Detector

Table 20. The median Nightly Pass Rate (bat passes per hour, per night) 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	Jun	Aug	Sep
Common pipistrelle	MS1	NA	0.9	NA
Common pipistrelle	MS2	NA	0.6	NA
Common pipistrelle	MS3	NA	NA	0.4
Common pipistrelle	MS4	0.2	2.6	0.1
Common pipistrelle	MS5	0.2	0.9	NA
Common pipistrelle	MS6	0.1	2.9	NA
Soprano pipistrelle	MS1	NA	1.2	NA
Soprano pipistrelle	MS2	NA	1.9	NA
Soprano pipistrelle	MS4	0.1	1.6	0.1
Soprano pipistrelle	MS5	0.2	0.9	0.1
Soprano pipistrelle	MS6	NA	1.4	NA
Myotis	MS6	0.2	NA	0.4

Mean Per Detector

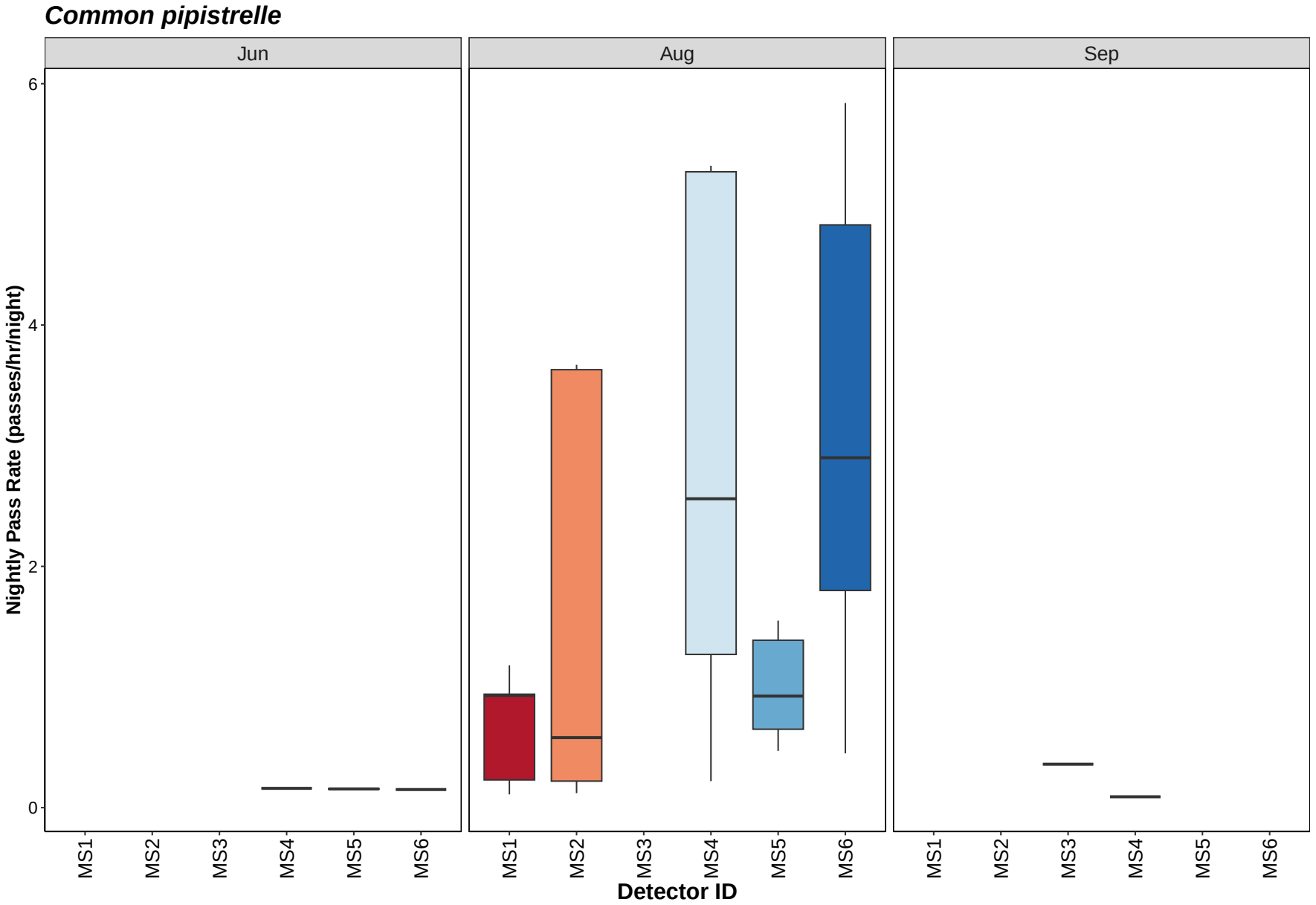
Table 21: The mean Nightly Pass Rate (bat passes per hour, per night) of each species throughout each month. Values are given to 1 decimal place.

We recommend using the median values given above, for the reasons stated above, but provide the mean values in the table below.

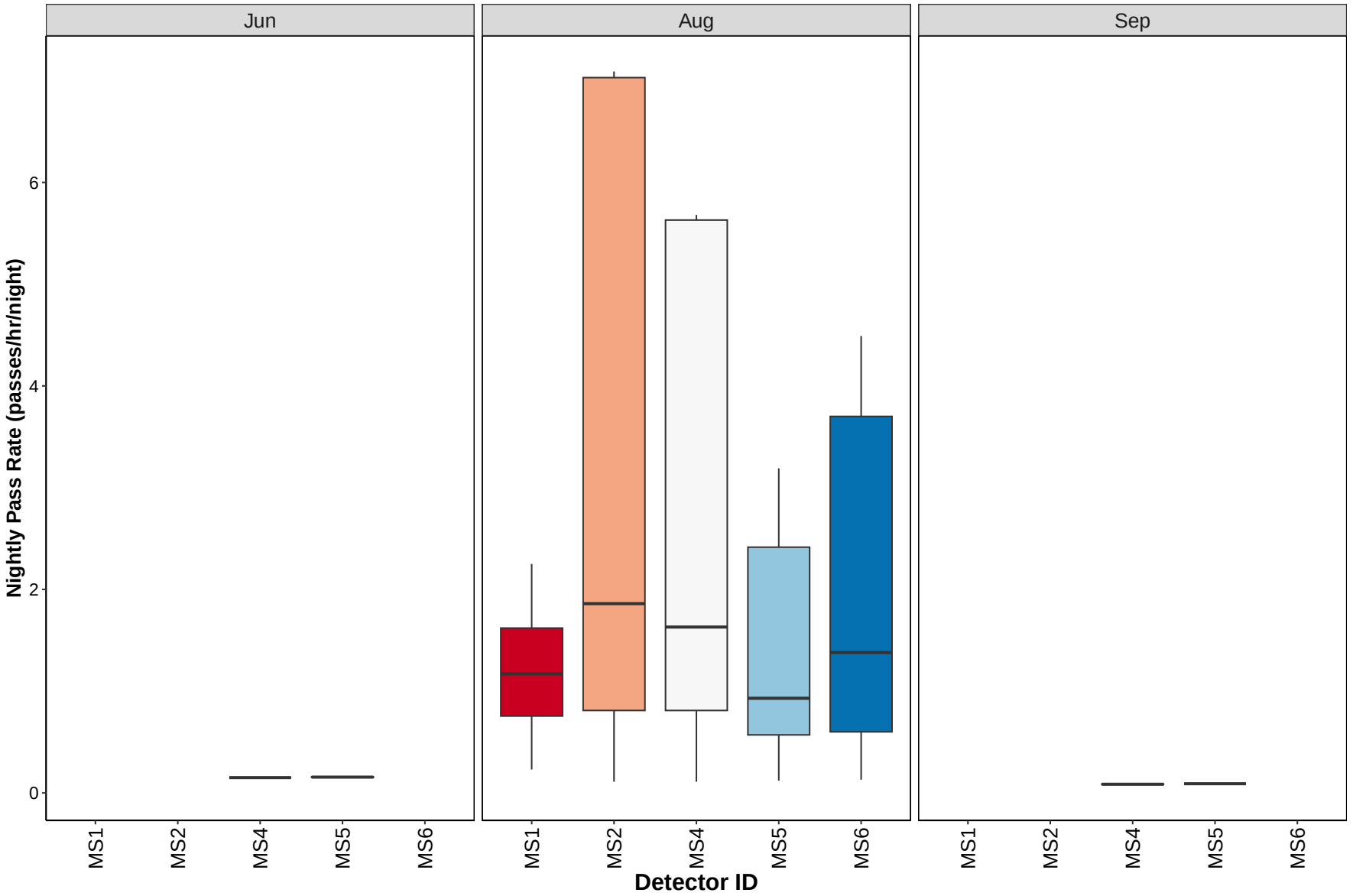
Species	Detector ID	Jun	Aug	Sep
Common pipistrelle	MS1	NA	0.7	NA
Common pipistrelle	MS2	NA	1.6	NA
Common pipistrelle	MS3	NA	NA	0.4
Common pipistrelle	MS4	0.2	2.9	0.1
Common pipistrelle	MS5	0.2	1.0	NA
Common pipistrelle	MS6	0.1	3.2	NA
Soprano pipistrelle	MS1	NA	1.2	NA
Soprano pipistrelle	MS2	NA	3.4	NA
Soprano pipistrelle	MS4	0.1	2.8	0.1
Soprano pipistrelle	MS5	0.2	1.5	0.1
Soprano pipistrelle	MS6	NA	2.0	NA
Myotis	MS6	0.2	NA	0.4

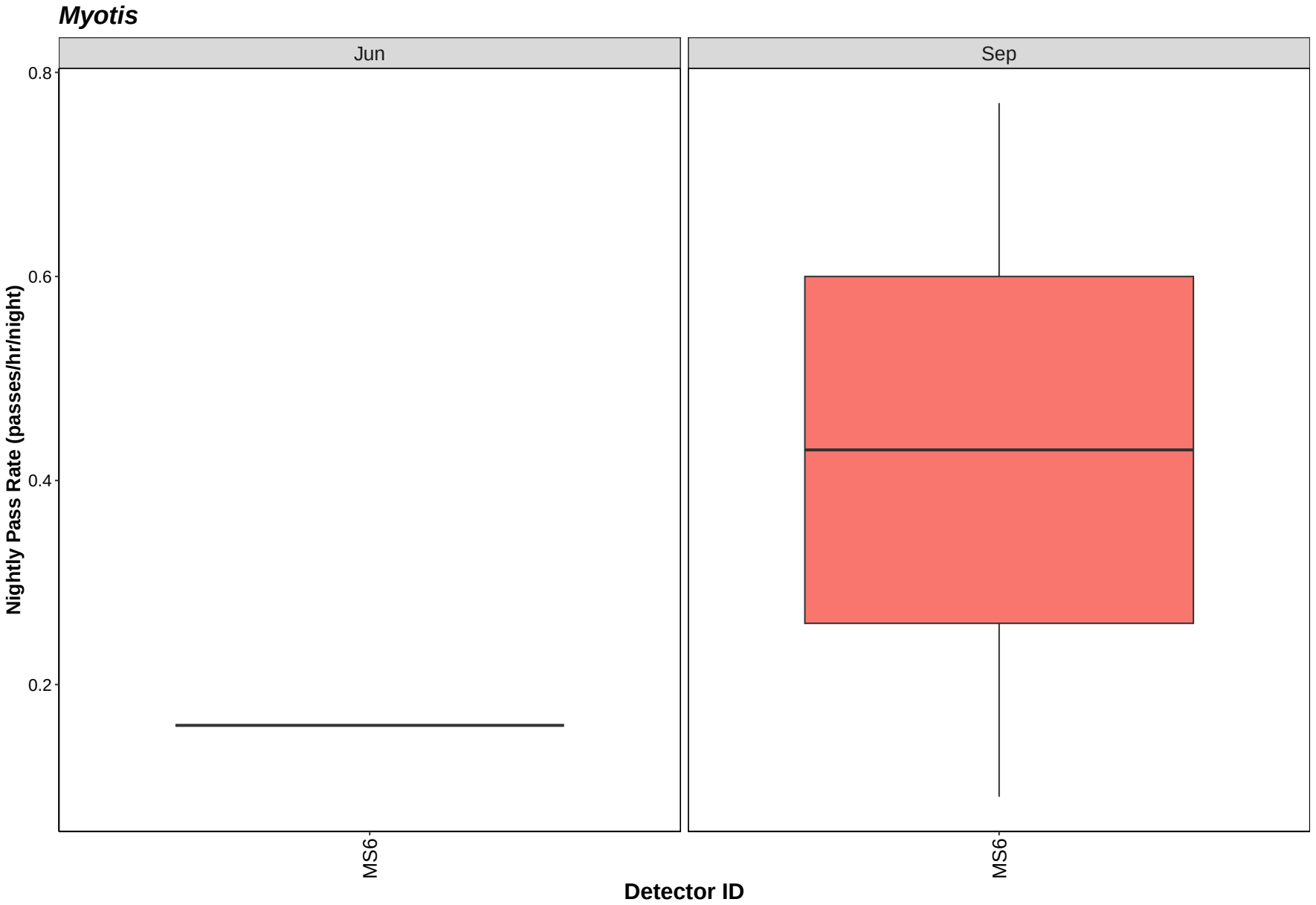
Per Detector

Figure 12. Figures show boxplots for the number of bat passes per hour by detector, for 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.


Common pipistrelle
Jun
Aug
Sep
Nightly Pass Rate (passes/hr/night)
0
2
4
6
MS1
MS2
MS3
MS4
MS5
MS6
Detector ID

Soprano pipistrelle




Myotis
Jun
Sep
0.8
0.6
0.4
0.2
Nightly Pass Rate (passes/hr/night)
MS6
MS6
Detector ID

Bat Activity per Detector Location

Figure 13. Detector ID reference:

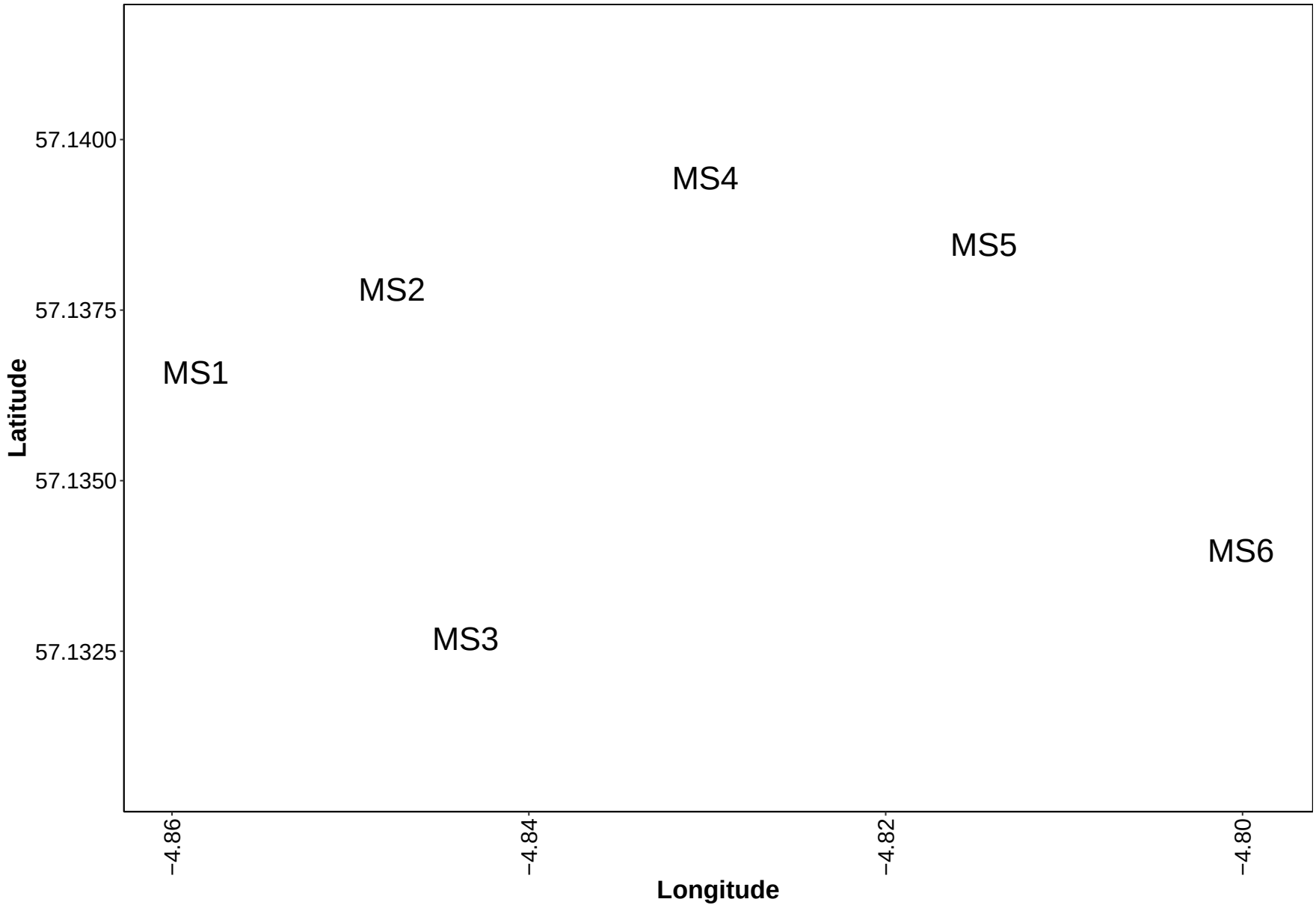

MS4
MS5
MS2
MS1
MS3
MS6
57.1400
57.1375
57.1350
57.1325
Latitude
−4.86
−4.84
−4.82
−4.80
Longitude

Figure 14. Median Nightly Pass Rate (bat passes/hr/night) throughout the survey period - represented by the size and colour of the point at each detector location.

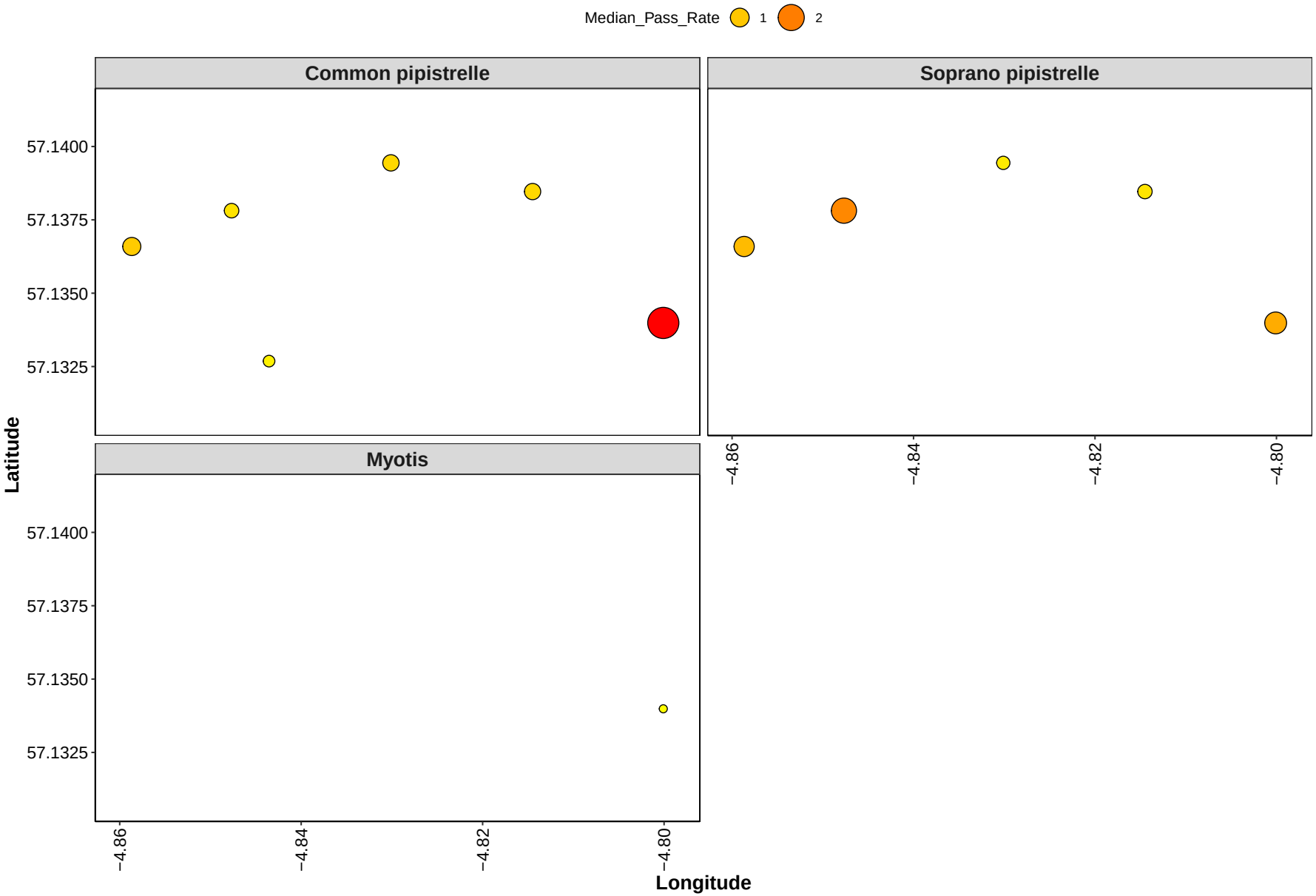
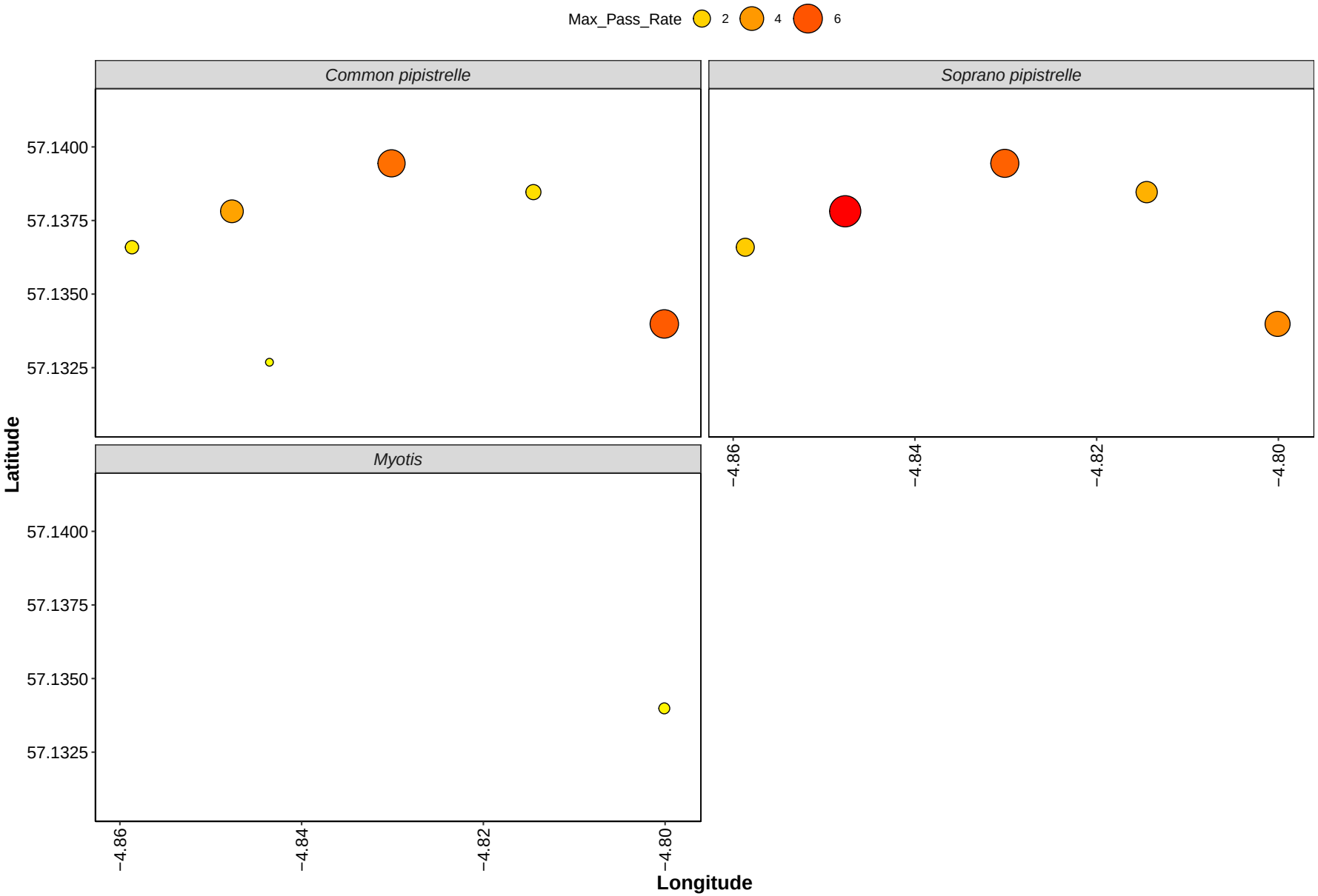

Median_Pass_Rate
1
2
Common pipistrelle
Soprano pipistrelle
Myotis
Latitude
57.1400
57.1375
57.1350
57.1325
−4.86
−4.84
−4.82
−4.80
Longitude

Figure 15. Maximum Nightly Pass Rate (bat passes/hr/night) recorded in a single night throughout the survey period - represented by the size and colour of the point at each detector location.


Max_Pass_Rate
2
4
6
Common pipistrelle
Soprano pipistrelle
Myotis
Latitude
57.1400
57.1375
57.1350
57.1325
−4.86
−4.84
−4.82
−4.80
Longitude

Part 2b: Includes Absences

THE NEXT SECTION OF THE REPORT FEATURES THE DATA SUPPLIED TO ECOBAT BUT TAKES INTO ACCOUNT SPECIES ABSENCES, AND THEREFORE INCLUDES 'ZERO DATA' FOR WHEN SPECIES WERE NOT DETECTED AT EACH DETECTOR ON A NIGHT. THIS DRAMATICALLY LOWERS THE MEANS AND MEDIANS OF THE DATA PRESENTED.

Nightly Bat Pass Rate

Median per Detector

Table 22. The median Nightly Pass Rate (bat passes per hour, per night) of each species. 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	Median Pass Rate
Common pipistrelle	MS1	0.9
Common pipistrelle	MS2	0.4
Common pipistrelle	MS3	0.4
Common pipistrelle	MS4	0.2
Common pipistrelle	MS5	0.5
Common pipistrelle	MS6	0.4
Myotis	MS1	0.0
Myotis	MS2	0.0
Myotis	MS3	0.0
Myotis	MS4	0.0
Myotis	MS5	0.0
Myotis	MS6	0.0
Soprano pipistrelle	MS1	0.9
Soprano pipistrelle	MS2	1.3
Soprano pipistrelle	MS3	0.0
Soprano pipistrelle	MS4	0.1
Soprano pipistrelle	MS5	0.2
Soprano pipistrelle	MS6	0.6

Mean per Detector

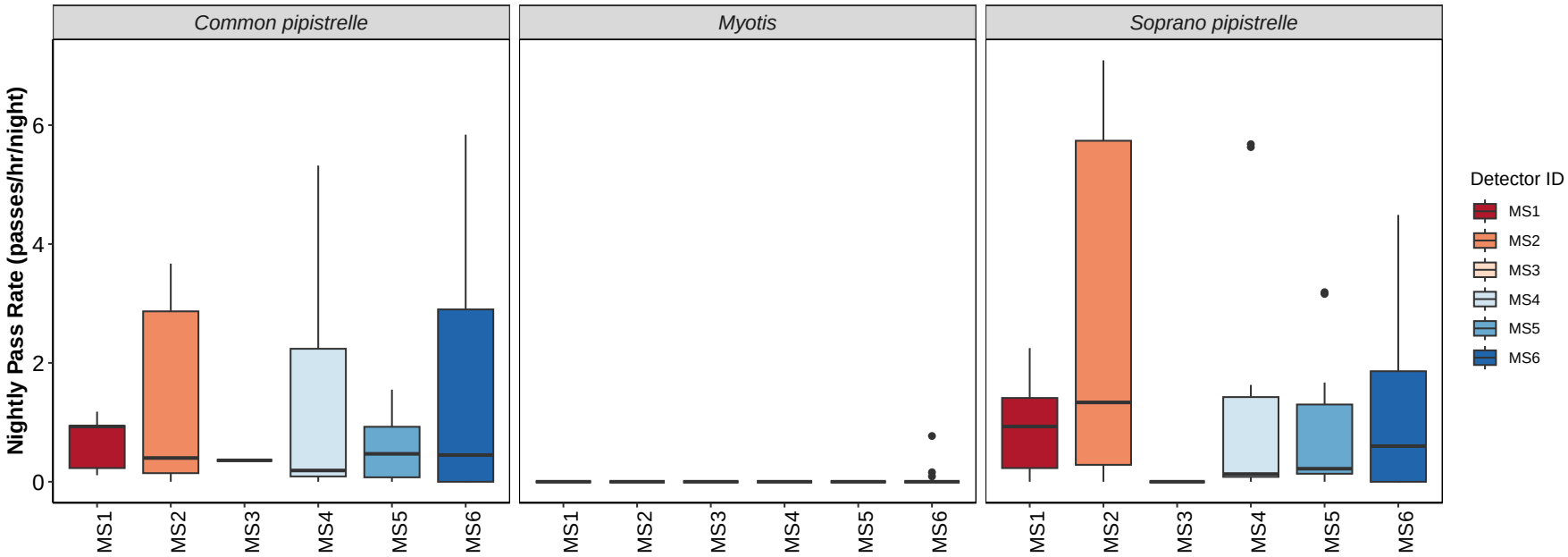
Table 23. The mean Nightly Pass Rate (bat passes per hour, per night) of each species at each detector. Values are given to 1 decimal place.

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	Mean Pass Rate
Common pipistrelle	MS1	0.7
Common pipistrelle	MS2	1.4
Common pipistrelle	MS3	0.4
Common pipistrelle	MS4	1.5
Common pipistrelle	MS5	0.6
Common pipistrelle	MS6	1.7
Myotis	MS1	0.0
Myotis	MS2	0.0
Myotis	MS3	0.0
Myotis	MS4	0.0
Myotis	MS5	0.0
Myotis	MS6	0.1
Soprano pipistrelle	MS1	1.0
Soprano pipistrelle	MS2	2.8
Soprano pipistrelle	MS3	0.0
Soprano pipistrelle	MS4	1.4
Soprano pipistrelle	MS5	1.0
Soprano pipistrelle	MS6	1.4

Per Detector

Figure 16. Figures show boxplots for the number of bat passes per hour each night, for each detector. 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.


Common pipistrelle
Myotis
Soprano pipistrelle
Nightly Pass Rate (passes/hr/night)
0
2
4
6
MS1
MS2
MS3
MS4
MS5
MS6
Detector ID
MS1
MS2
MS3
MS4
MS5
MS6

Detector ID

Survey Effort

Table 24. The number of nights bats were detected per month per detector.

month	Detector ID	No. of Survey Nights
Jun	MS4	2
Jun	MS5	3
Jun	MS6	2
Aug	MS1	5
Aug	MS2	6
Aug	MS4	5
Aug	MS5	7
Aug	MS6	9
Sep	MS3	1
Sep	MS4	3
Sep	MS5	1
Sep	MS6	2

Nighlty Bat Pass Rate for Each Month

Median per Detector

Table 25. The median Nightly Pass Rate (bat passes per hour, per night) 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	Aug	Jun	Sep
Common pipistrelle	MS1	0.9	NA	NA
Common pipistrelle	MS2	0.4	NA	NA
Common pipistrelle	MS3	NA	NA	0.4
Common pipistrelle	MS4	2.6	0.1	0.1
Common pipistrelle	MS5	0.9	0.1	0.0
Common pipistrelle	MS6	2.9	0.1	0.0
Myotis	MS1	0.0	NA	NA
Myotis	MS2	0.0	NA	NA
Myotis	MS3	NA	NA	0.0
Myotis	MS4	0.0	0.0	0.0
Myotis	MS5	0.0	0.0	0.0
Myotis	MS6	0.0	0.1	0.4
Soprano pipistrelle	MS1	0.9	NA	NA
Soprano pipistrelle	MS2	1.3	NA	NA
Soprano pipistrelle	MS3	NA	NA	0.0
Soprano pipistrelle	MS4	1.6	0.1	0.1
Soprano pipistrelle	MS5	0.9	0.1	0.1
Soprano pipistrelle	MS6	1.4	0.0	0.0

Mean per Detector

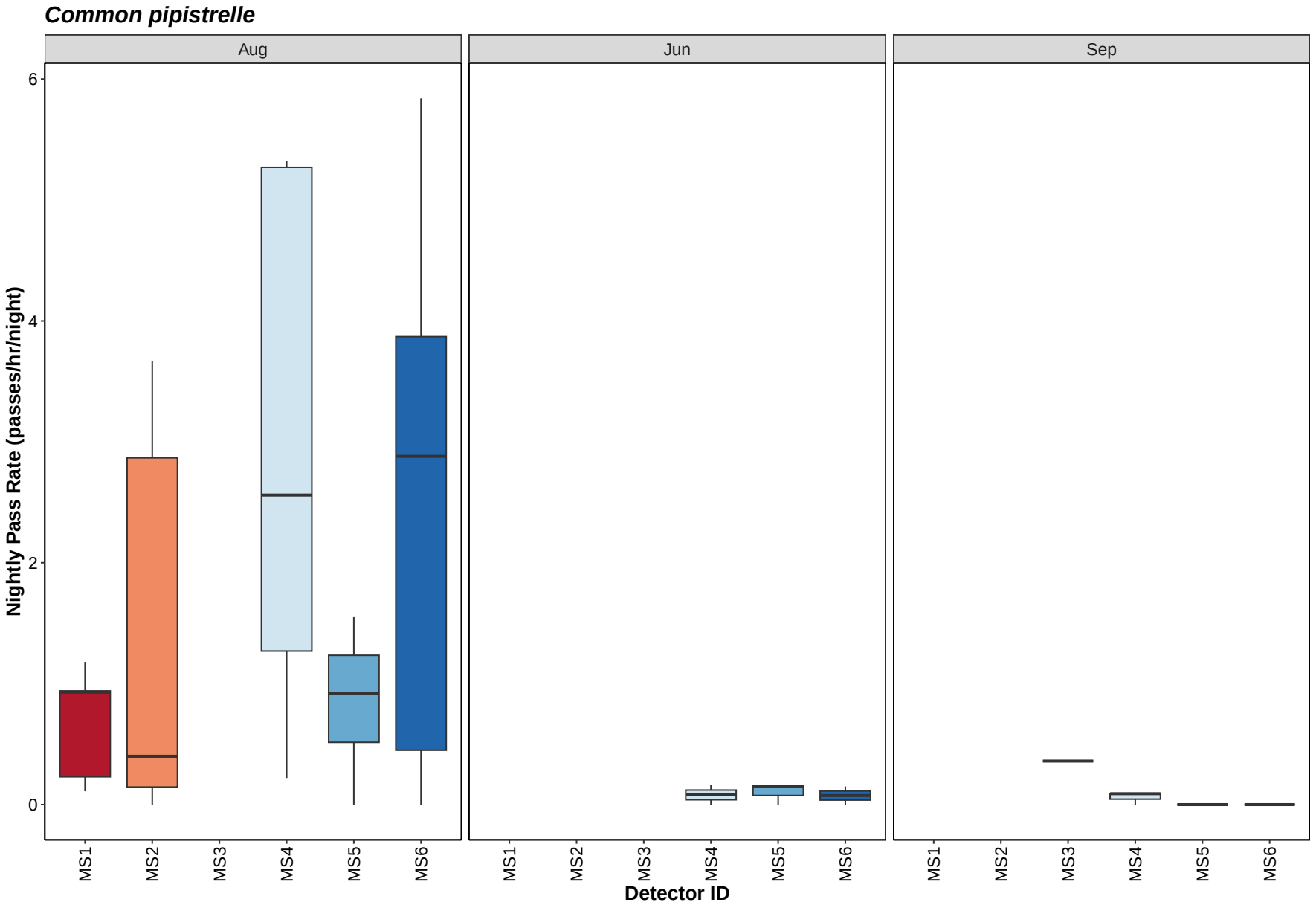
Table 26. The mean Nightly Pass Rate (bat passes per hour, per night) of each species throughout each month. Values are given to 1 decimal place.

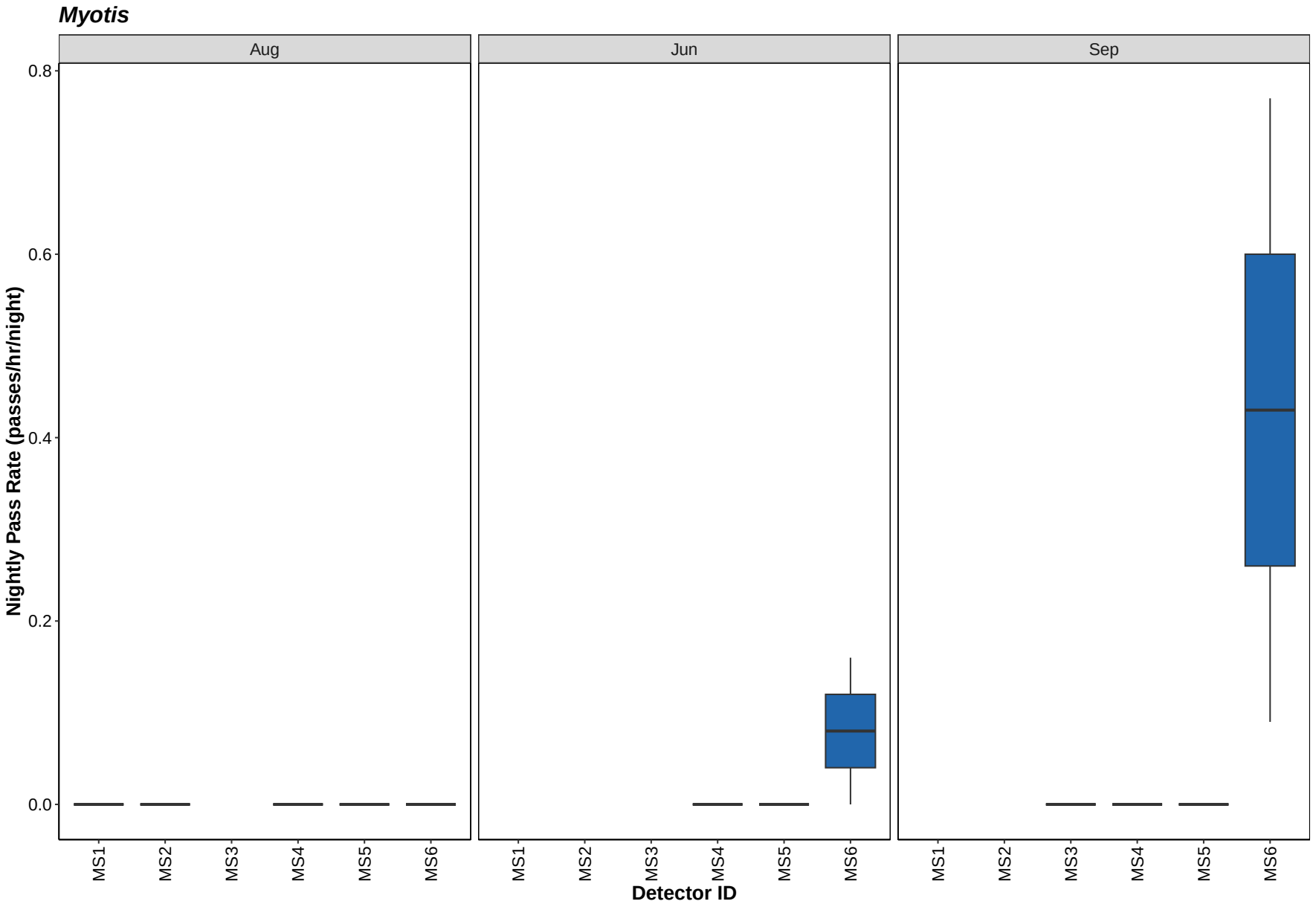
We recommend using the median values given above, for the reasons stated above, but provide the mean values in the table below.

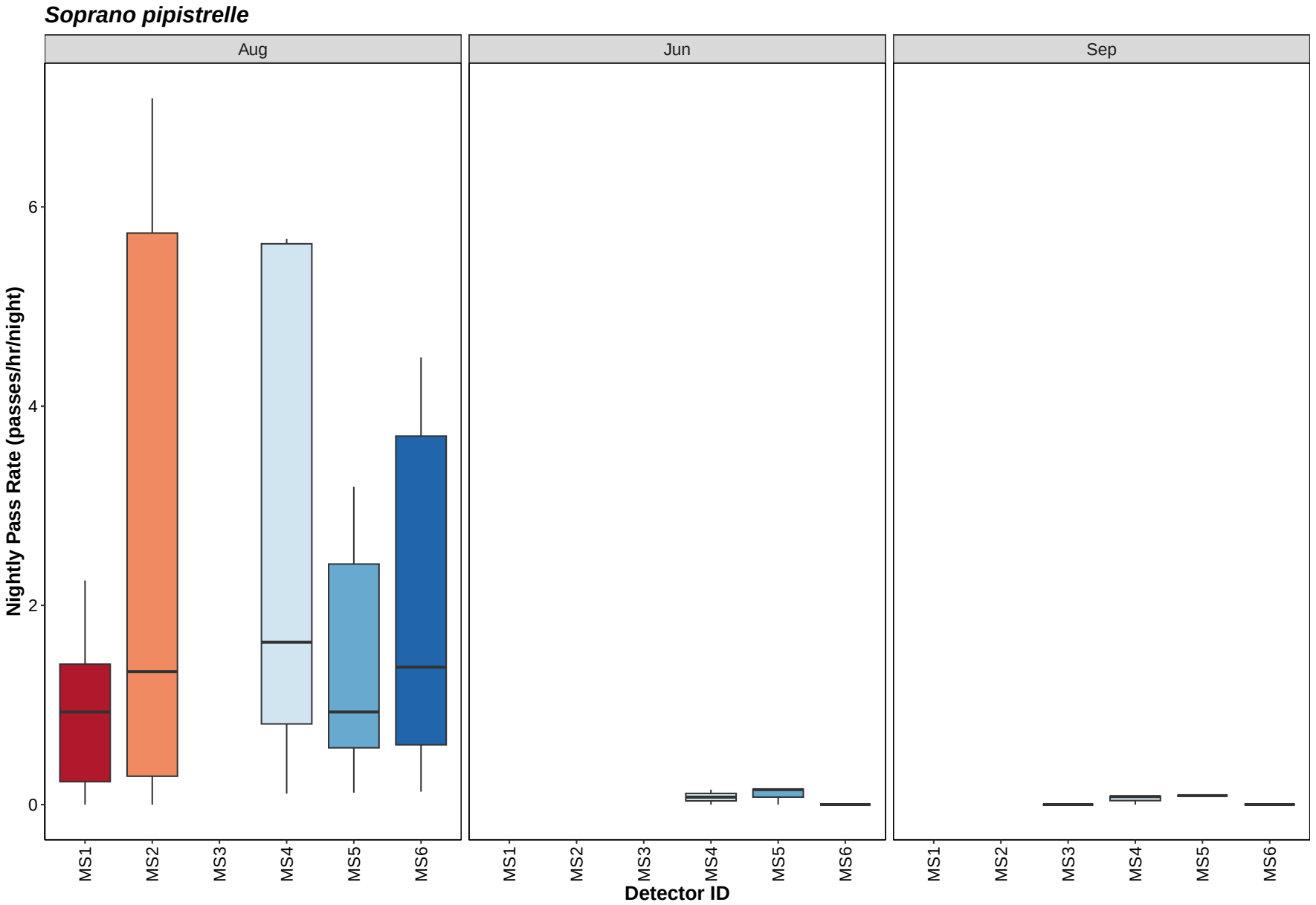
Species	Detector ID	Aug	Jun	Sep
Common pipistrelle	MS1	0.7	NA	NA
Common pipistrelle	MS2	1.4	NA	NA
Common pipistrelle	MS3	NA	NA	0.4
Common pipistrelle	MS4	2.9	0.1	0.1
Common pipistrelle	MS5	0.9	0.1	0.0
Common pipistrelle	MS6	2.5	0.1	0.0
Myotis	MS1	0.0	NA	NA
Myotis	MS2	0.0	NA	NA
Myotis	MS3	NA	NA	0.0
Myotis	MS4	0.0	0.0	0.0
Myotis	MS5	0.0	0.0	0.0
Myotis	MS6	0.0	0.1	0.4
Soprano pipistrelle	MS1	1.0	NA	NA
Soprano pipistrelle	MS2	2.8	NA	NA
Soprano pipistrelle	MS3	NA	NA	0.0
Soprano pipistrelle	MS4	2.8	0.1	0.1
Soprano pipistrelle	MS5	1.5	0.1	0.1
Soprano pipistrelle	MS6	2.0	0.0	0.0

Per Detector

Figure 17. Figures show boxplots for the number of bat passes per hour by detector, for 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.


Common pipistrelle
Aug
Jun
Sep
Nightly Pass Rate (passes/hr/night)
0
2
4
6
MS1
MS2
MS3
MS4
MS5
MS6
Detector ID


Myotis
Aug
Jun
Sep
Nightly Pass Rate (passes/hr/night)
0.0
0.2
0.4
0.6
0.8
MS1
MS2
MS3
MS4
MS5
MS6
Detector ID


Soprano pipistrelle
Aug
Jun
Sep
Nightly Pass Rate (passes/hr/night)
0
2
4
6
MS1
MS2
MS3
MS4
MS5
MS6
Detector ID

Bat Activity per Detector Location

Figure 18. Detector ID reference:

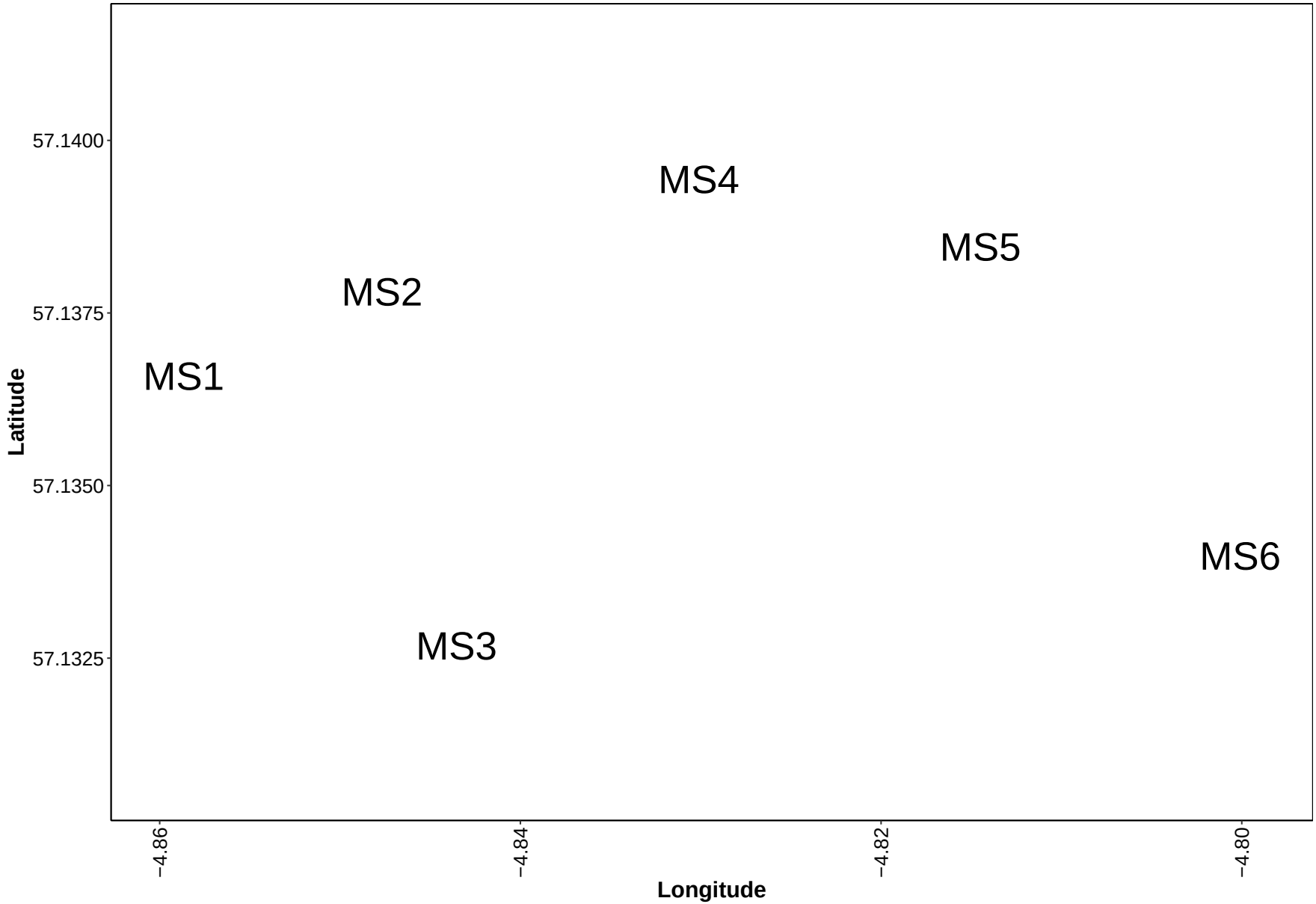

MS4
MS5
MS2
MS1
MS6
MS3
57.1400
57.1375
57.1350
57.1325
Latitude
−4.86
−4.84
−4.82
−4.80
Longitude

Figure 19. Median Nightly Pass Rate (bat passes/hr/night) throughout the survey period - represented by the size and colour of the point at each detector location.

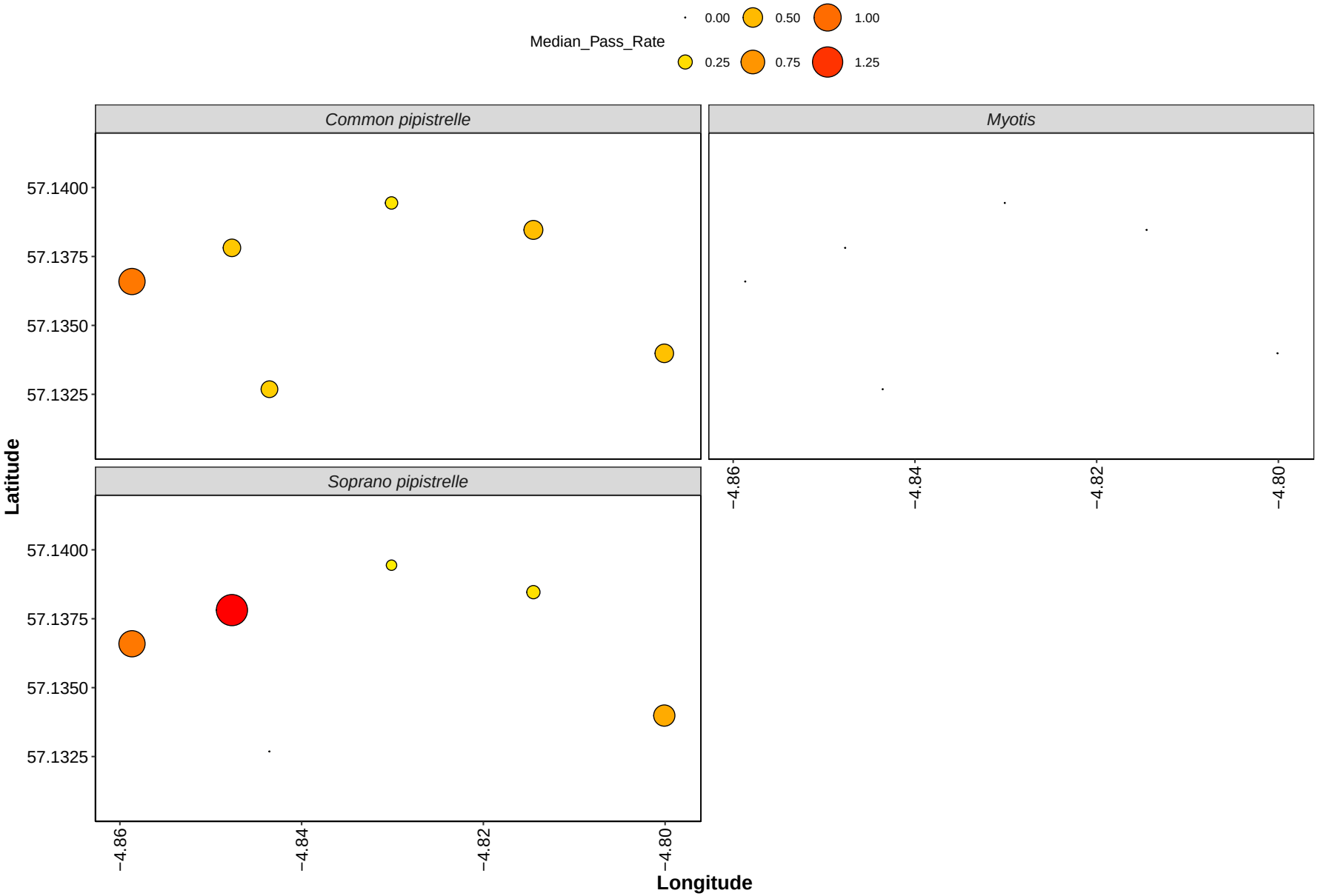
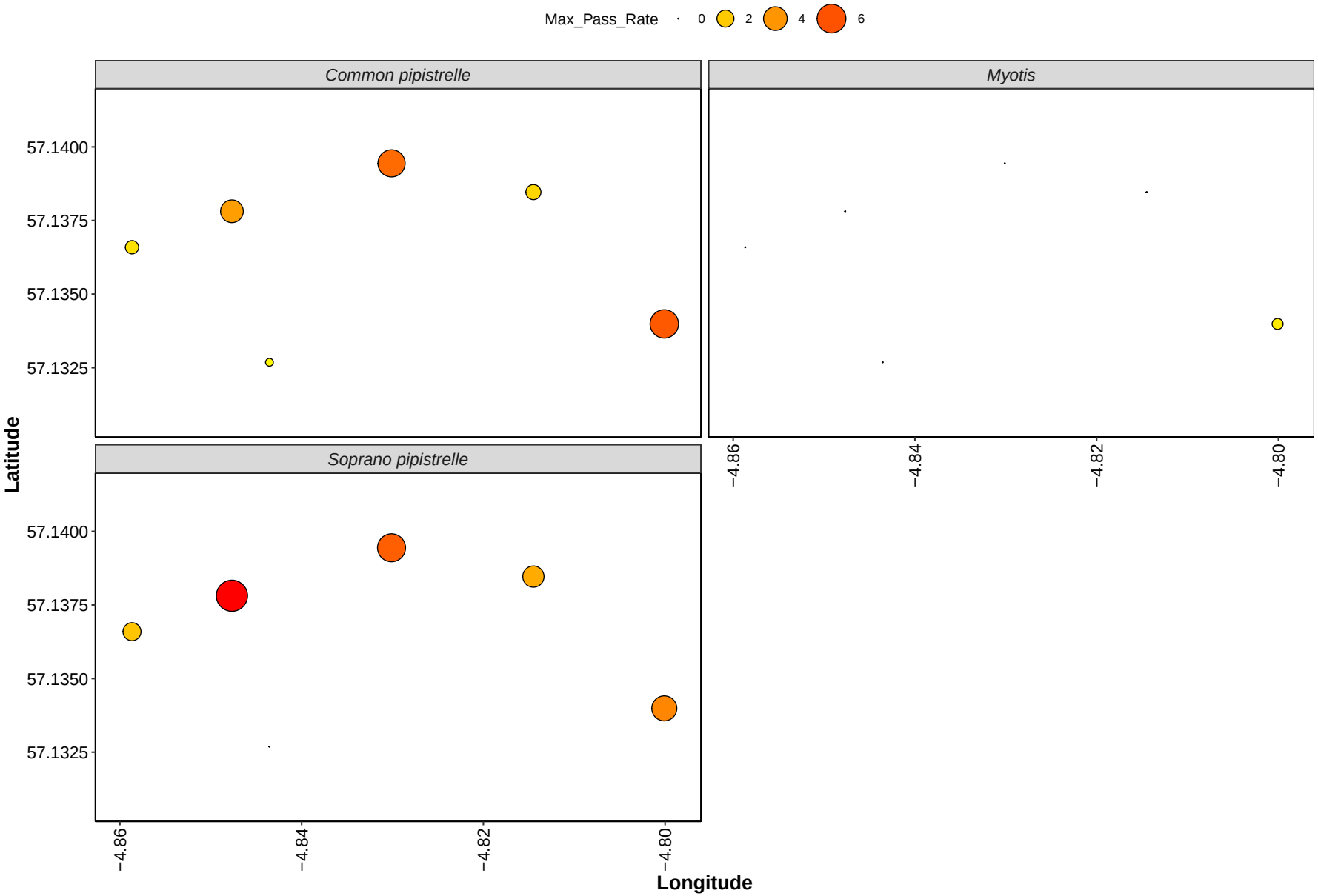

Median_Pass_Rate
0.00
0.25
0.50
0.75
1.00
1.25
Common pipistrelle
Myotis
Soprano pipistrelle
57.1400
57.1375
57.1350
57.1325
−4.86
−4.84
−4.82
−4.80
Latitude
Longitude

Figure 20. Maximum Nightly Pass Rate (bat passes/hr/night) recorded in a single night throughout the survey period - represented by the size and colour of the point at each detector location.


Max_Pass_Rate
0
2
4
6
Common pipistrelle
Myotis
Soprano pipistrelle
57.1400
57.1375
57.1350
57.1325
−4.86
−4.84
−4.82
−4.80
Latitude
Longitude

Thank you for using Ecobat!