Environmental Impact Assessment Report

Teindland Wind Farm

Volume 3

TA A6.6: Bat Survey Report

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Bat Survey Report

TEINDLAND WIND FARM

Wildlife Consulting

cairn ECOLOGY

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1 INTRODUCTION

1.1.1 Cairn Ecology Ltd was appointed by Wildlife Consulting to undertake ground-level automated static surveys for bats at a proposed windfarm site, Teindland (the Proposed Development) situated approximately 9.6 kilometres (km) southeast of Elgin, and approximately 2.7 km north of Rothes; Central Ordnance Survey Grid Reference: NJ29325352 (hereafter referred to as 'the Site').

1.1.2 The Site is characterised by upland forestry. The habitat composition includes extensive coniferous plantation woodland, primarily composed of sitka spruce (*Picea sitchensis)* with interspersed areas of Scots pine (*Pinus sylvestris)* and mixed broadleaf plantings. Between plantation blocks, open habitats such as heath communities and bare ground existing forestry tracks are present.

1.1.3 Several small burns and drainage ditches traverse the Site.

1.1.4 The ground-level static surveys were undertaken with the following aims:

- Assess bat activity: Identify activity levels, including spatial and temporal variation species composition, and relative abundance across the Site.
- Understand habitat use: Determine how bats utilise the Site for foraging, commuting, and potential roosting purposes.
- Evaluate risk: Assess potential impacts of the Proposed Development on local bat populations.
- Inform mitigation: Provide data to guide mitigation strategies if required.
- Ensure compliance: Fulfil regulatory requirements and inform the planning processes.

1.1.5 The survey results aim to identify any constraints (if present) to, or potential impacts of, the Proposed Development, particularly concerning habitat disturbance or adverse impacts on bats such as changed in bat behaviour at sensitive times of the year or collision risk at particular turbine locations.

1.1.6 The data collected will be used to inform mitigation measures and if required species protection plan(s), which may be required to support a European Protected Species (EPS) derogation licence application.

1.1.7 This report outlines the methodologies employed to collect and analyse bat data collected at the Site and summarises the findings.

2 LEGISLATION

2.1.1 All bat species within the UK are fully protected by law. Within Scotland, bats are primarily protected under the conservation (Natural Habitat &c) Regulations 1994 (as amended) which transposes the Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora (The Habitats Directive) into domestic law. Together with the Wildlife and Countryside Act 1981 (as amended) and the Nature Conservation (Scotland) Act 2004, it is an offence to intentionally and/or recklessly:

- Deliberately capture, injure or kill a wild bat;
- Harass a wild bat or group of wild bats;
- Disturb a wild bat in a roost (any structure or place it uses for shelter or protection);
- Disturb a wild bat while it is rearing or otherwise caring for its young (this would be a 'maternity' roost);
- obstruct access to a bat roost or to otherwise deny the animal use of the roost
- disturb such a wild bat in a manner that is, or in circumstances which are, likely to significantly affect the local distribution or abundance of that species;
- to disturb a wild bat in a manner that is, or in circumstances which are, likely to impair its ability to survive, breed or reproduce, or rear or otherwise care for its young; and,
- possess, control, transport, exchange or sell a bat or parts of a bat, alive or dead.

3 METHODS

3.1 Automated Static Detector Surveys

3.1.1 Full spectrum automated bat static detectors were deployed at ground level across the Site to monitor bat activity.

3.1.2 In line with to NatureScot's guidelines for bat surveys on wind farms, (NatureScot *et al.*, 2021) a total of 13 static detectors were deployed, corresponding to the planned turbine locations (Figure 1, Appendix A). These locations were selected to align with the draft design of the wind farm, ensuring that the survey data is representative of the Proposed Development footprint.

3.1.3 Each of the 13 detectors (deployed at locations Location 1-L13, Figure 1 Appendix A) were mounted on a 1 m wooden stake and securely placed within at least 50 m of each of the proposed turbine locations, as illustrated in Figure 1. Detectors were left to record continuously for a minimum of 10 consecutive nights per survey period. Wildlife Acoustics Song Meter Minis (SMM) were primarily utilised for acoustic data collection. These devices were programmed to operate from 30 minutes before sunset until 30 minutes after sunrise to capture nocturnal bat activity.

3.1.4 Each location was selected to representatively capture bat activity relative to the turbine positions.

3.1.5 The surveys were conducted across three distinct seasonal periods (spring, summer, and autumn) to capture any potential seasonal variations in bat activity. The deployment and retrieval dates of the automated detector surveys are summarised in Table 1.

Table 1. Survey Dates and Number of Nights Surveyed

Season	Date deployed	Date retrieved	Nights of survey	No. of statics
Spring	23/05/24	02/06/24	10	13
Summer	09/07/2024 29/6/2024 (Location 5)	20/07/24 09/07/24 (Location 5)	10	13
Autumn	18/09/24	28/09/24	10	13

3.1.6 Historic weather data was gathered from a publicly available online resource[1] for the month of the deployment periods.

3.2 Data Analysis

3.2.1 Following collection of acoustic data, it was analysed by Suitably Qualified Ecologists (SQEs) using Wildlife Acoustics Kaleidoscope v.5.4.9. software package.

3.2.2 Where possible, bat calls were identified to species level using parameters set out in Russ (2013). However, species of the genus *Myotis* were unable to be identified to species level as their calls are similar in structure and have overlapping call parameters, making species identification problematic (Russ, 2013). For *Pipistrellus* species, the following criteria based on measurements of peak frequency were used to classify calls:

- Common pipistrelle (*Pipistrellus pipistrellus*) ≥ 42 and <50kHz;
- Soprano pipistrelle (*Pipistrellus pygmaeus*) ≥ 51kHz;
- Common / Nathusius' *Pipistrellus nathusii* pipistrelle ≥39 and <42kHz.

3.2.3 In addition, the following categories were used for calls which cannot be identified with confidence due to the overlap in call characteristics between species or species groups:

- *Myotis* species.

[1] www.weatherunderground.com

3.3 Ecobat

3.3.1 Ecobat is a free online tool that gives context to acoustic data recorded from bat surveys. Users upload their data and receive a report which gives a wide range of tables and graphs to explain more about the data they've collected compared to bat records already held in the Ecobat database.

3.4 Site Activity Level

3.4.1 Following the bat data analysis outlined above, the data was uploaded on to The Mammal Society Ecobat software[2] to give a measure of relative bat activity across the Site. Ecobat is an online tool that also compares bat data collected by automated static bat detectors across the same range for all time records.

3.4.2 Through generating a percentile rank for each night of bat activity recorded, the Ecobat tool can identify the number of nights in which the level of bat activity, as collected by an automated bat detector, could be considered to represent 'high', 'moderate/ high', 'low/moderate', or 'low' in the context of the geographical region, as shown in Table 2 (extracted from Section 6.1 Table 1 of NatureScot *et al.*, 2021).

Table 2. Percentile score and categorised level of bat activity

Percentile score	Bat activity level
81 to 100	High
61 to 80	Moderate to High
41 to 60	Moderate
21 to 40	Low to Moderate
0 to 20	Low

[2] https://mammal.org.uk/current-research/bat-recording-tools

3.5 Potential Collision Risk Assessment

3.5.1 Vulnerability to collision is presumed to be dependent on the location of turbines in relation to species abundance, in addition to specific bat species and their behaviour, as predefined by Section 6.4, Table 2 of guidance (NatureScot *et al.*, 2021). By looking at the potential vulnerability of species recorded on Site combined with relative bat activity recorded at the Site this can inform an assessment of potential collision risk. Table 2 of the guidance is reproduced for ease in Table 3 below.

Table 3. Level of potential vulnerability of populations of bat species in Scotland.

Relative abundance	Low Collision risk	Medium Collision Risk	High Collision Risk
Common	n/a Low Popoulation Vulnerability	n/a Low Population Vulnerability	common pipistrelle soprano pipistrelle Medium Population Vulnerability
Rarer Species	Brown long-eared Daubenton's Natterer's Low Population Vulnerability	n/a Medium Population Vulnerability	n/a High Population vulnerability
Rarest Species	Whiskered Brandt's Medium Population Vulnerability	n/a High Population Vulnerability	Nathusius pipistrelle Noctule Leisler's High Population vulnerability

Stage 1 - Site-Level Risk

3.5.2 Bat activity on a site and the presence of species of a high population vulnerability are not the only factors when considering collision risk to bats at a wind farm site. The project size and habitats also play a big factor. Nature Scots guidance outlines a two-stage process for this (NatureScot *et al*, 2021). Using the outputs from Ecobat, the assessment of potential collision risk for bats has been carried out following the two-stage process) for all those species identified on the Development Site that are listed as 'high collision risk'.

3.5.3 Stage 1 - the 'Site-level' risk for the Proposed Development was determined by the project size and habitat characteristics, using the matrix outlined in Table 4 below, extracted from NatureScot's best practice guidelines (NatureScot *et al*., 2021). For full details on how habitat risk and project size is determined see Appendix B.

Table 6. Stage 1 – Initial Site risk assessment (reproduced from NatureScot *et al*, 2021).

Site risk level (1-5)	**Project size**			
Habitat risk	=	Small	Medium	Large
	Low	1	2	3
	Moderate	2	3	4
	High	3	4	5

Stage 2 - Overall Risk Assessment

3.5.4 An overall risk assessment was then made by considering the initial Site risk assessment in relation to the bat activity output from Ecobat and taking onto account the population vulnerability of each species. The scores in the table are a product of multiplying 'Site Risk' level and the Ecobat activity category. In addition, the overall risk assessment is determined in conjunction with professional judgement of Cairn Ecology Ltd.

3.5.5 In summary Low = 0-4, Medium =5-12 and High = 12-25.

Table 7: Criteria for overall risk assessment. (reproduced from NatureScot *et al*, 2021).

Site Risk Level (1-5)	**Project Size/Habitat**					
Lowest (1)	0	1	2	3	4	5
Low (2)	0	2	4	6	8	10
Medium (3)	0	3	6	9	12	15
High (4)	0	4	8	12	15	18
Highest (5)	0	5	10	15	20	25

3.6 Limitations

3.6.1 The primary objective of these surveys was to quantify bat activity levels across the Site, particularly at the proposed turbine locations. Where species-level identification was not feasible, data at the genus level still provided valuable insights and was not considered a significant limitation.

3.6.2 The Ecobat analysis tool provides a variety of outputs that are useful for interpreting the importance of the Site with respect to bat activity and distribution. However, it is important to note that these outputs are considered in the context of the wider data collection from third parties, and the accuracy of results requires a considerable number of records to be present. A reference range (i.e. the number of nights for each species that the data is compared to) of at least 200 is recommended to be confident in the relative activity level.

3.6.3 No weather data collection was possible at each detector location. No extreme weather events are known to have occurred in the deployment period or location that would have a significant impact on bat activity recorded.

3.6.4 No detector was deployed at L12 in spring.

4 RESULTS

4.1 Automated Static Detector Surveys

4.1.1 A total of 9360 bat passes were recorded over the entire monitoring period from at least four species over 30 monitoring nights equating to an overall bat activity rate of 24 bats per night (B/n). Prior to using the Ecobat software data was analysed to determine a rate of bat activity across the Site.

4.1.2 Table 8 provides details of the total number of bat passes (and B/n) recorded at each detector location shown on Figure 1 over 2024 survey period.

4.1.3 Static detectors deployed at L3 (20% of total bat activity)), L10 (19% of total bat activity) and L9 (11% of total bat activity) the highest number of bat passes were notable during Autumn. These locations are in proximity to habitat features such as young plantation woodland, but that are near edges/rides and linear features like burns that link to surrounding habitat containing potential roosting opportunities (farm buildings, houses in nearby townships etc.), The habitat surrounding these locations are recognised as highly suitable habitat for bat foraging and commuting activity.

4.1.4 No data for L12 was gathered in spring due to no detector deployed at this location in spring (see limitations). Static detectors placed at L11 recorded no bat activity in spring despite detectors being active throughout the monitoring period. No bat activity was recorded at Location 1 in Autumn. No bat activity was recorded at L8 in Spring and Autumn.

4.1.5 Graph 1 illustrates the number of bat passes recorded across the Site at each of the proposed turbine locations (Figure 1, Appendix A), across the entire 2024 monitoring period.

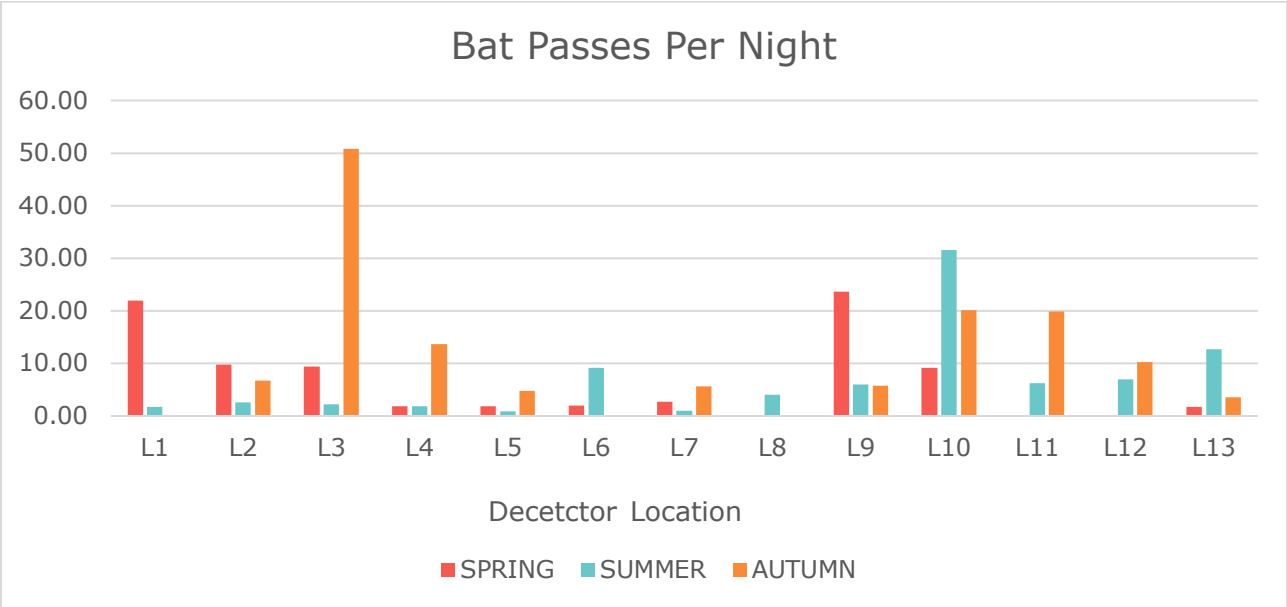
4.1.6 Graph 2 illustrates the distribution of bat passes across the Site at each of the proposed turbine locations during each of the three survey seasons (spring, summer and autumn).

4.1.7 Most bat passes being recorded during the autumn were at L3 and in summer at L10.

Table 8. Detector locations and total number of bat passes (spring, summer, autumn) and bat passes per night (B/n).

Detector Location	Number of Nights	Bat Passes (B/n)				Percentage (%)
		Spring	Summer	Autumn	Total	
L1	30	657 (21.9)	51 (1.70)		708 (1.82)	8%
L2	30	292 (9.73)	76 (2.53)	202 (6.73)	570 (1.46)	6%
L3	30	282 (9.40)	68 (2.27)	1524 (50.80)	1874 (4.81)	20%
L4	30	55 (1.83)	54 (1.80)	410 (13.67)	519 (1.33)	6%
L5	30	57 (1.90)	28 (0.93)	142 (4.73)	227 (0.58)	2%

Detector Location	Number of Nights	Bat Passes (B/n)				Percentage (%)
		Spring	Summer	Autumn	Total	
L6	30	58 (1.93)	273 (9.10)		331 (0.85)	4%
L7	30	80 (2.67)	30 (1.00)	169 (5.63)	279 (0.72)	3%
L8	30		123 (4.10)		123 (0.32)	1%
L9	30	711 (23.70)	180 (6.00)	173 (5.77)	1064 (2.73)	11%
L10	30	274 (9.13)	947 (31.57)	604 (20.13)	1825 (4.68)	19%
L11	30		188 (6.27)	595 (19.83)	783 (2.01)	8%
L12	30		210 (7.00)	308 (10.27)	518 (1.33)	6%
L13	30	52 (1.73)	382 (12.73)	105 (10.27)	539 (1.33)	6%
All Detectors	**390**	**2518 (6.46)**	**2610 (6.69)**	**4232 (10.85)**	**9360 (24)**	**100%**



Graph 1: Rate of bat passes per night (B/n) per location per month.

4.2 Ecobat

4.2.1 Relevant details for the collision risk assessment of the Site have been extracted from the output results from Ecobat; provided below and in Appendix C.

4.2.2 Of the species recorded, the highest number of bat passes was attributed to by common pipistrelle (n=5450, 58.2% of total bat activity) followed by soprano pipistrelle (n=3202, 34.2% of total bat activity). *Myotis* sp. accounted for 3.4% of overall bat activity (n=316) whilst brown long-eared bat made up less than 4.2 % of bat activity (n=391).

Species Variation

4.2.3 Table 9 presents a summary of the Ecobat output representing the total number of bat passes recorded for each species across all locations, based on the total number of nights that activity was recorded. Overall, based on the median percentile common and soprano pipistrelle bat activity was in the Low activity category, *Myotis* and brown long-eared bat Low to Moderate category.

Table 9. A summary of the Ecobat output representing the total number of bat passes recorded for each species across all locations.

Species	Median Percentile	95% CIs	Maximum Percentile	Nights Recorded
Common pipistrelle	4	9-17.5	49	262
Soprano pipistrelle	9	9.5 – 22.5	100	234
Myotis	40	43.5-73.5	100	101
Brown long-eared bat	39	39.5-91.5	100	1

4.2.4 Table 10 shows the distribution of activity for each species based on the total number of nights of activity was recorded and classified using the Ecobat categories. Species with exceptional activity levels on site was soprano pipistrelle, *Myotis* and brown long-eared bat. Brown long eared bat had High activity on 13 nights and 34 nights at Moderate to High activity levels.

Table 10. Distribution of activity for each species based on the total number of nights of activity was recorded and classified using the Ecobat categories.

Species	Nights of Activity					
	Exceptional	High	Moderate/High	Moderate	Low/Moderate	Low
Common pipistrelle	0	0	0	10	27	225
Soprano pipistrelle	3	7	4	19	39	162
Myotis	2	3	9	39	48	0
Brown long-eared bat	1	13	34	12	25	42

Spatial and Temporal Variation

4.2.5 Table 11 and Table 12 (Appendix C) presents key spatial and temporal metrics for each species provided from Ecobat.

4.2.6 High activity levels (above 81 percentile) of brown long-eared bat were recorded at L11 (due to High activity recorded in summer) and Moderate to High activity recorded at L8 (Moderate to High in summer). Moderate Myotis activity levels (between 41 to 60 median percentile) were recorded at L9 and L10 (highest activity being in spring and autumn period, respectively Table 12). Common and soprano pipistrelle activity were primarily Low at all locations (soprano pipistrelle was moderate at L9 and Moderate to High in Autumn at L3).

4.2.7 The reference range provided with Ecobat outputs are the number of nights of each species that data was compared to in the same region. A reference range of 200+ is recommended to be confident in the relative activity level provided by Ecobat. The reference range for Myotis was 375 and for brown long eared bat it was 531. The range for both Myotis and brown long-eared bat were both above the recommended 200+ range scale and as such this means that the activity level for both Myotis sp. and brown long-eared bat may be interpreted with confidence.

4.2.8 The reference range for common pipistrelle was 33783 and soprano pipistrelle was 6944. The activity levels for both common pipistrelle and soprano pipistrelle species should be interpreted with confidence.

Roost Proximity

4.2.9 The number of bat calls recorded at each automated detector location within the species-specific typical emergence times (outlined in Russ 2012), was plotted on graphs to illustrate potential proximity to roosts and is provided in Appendix C. Species-specific emergence time ranges are shown as grey bars. Bat passes overlapping species-specific grey bars, or occurring earlier than this time range, may potentially indicate the presence of a nearby roost.

4.2.10 The timing of bat passes suggests a Myotis roost in proximity to L10 (see Appendix C, roost proximity). The majority of Myotis activity at L10 was in August.

4.2.11 The timing of bat passes at suggest brown long-eared bat roosts in proximity to L6, L7, L10, L11, L12 (see Appendix C, roost proximity).

4.2.12 The data suggests common pipistrelle and soprano pipistrelle bats are also roosting in proximity to the proposed windfarm locations within the plantation woodland, as all locations that recorded data except L1 had this species recorded during typical emergence time frames.

4.3 Potential Collision Risk Assessment

Stage 1 - Site-Level Risk

4.3.1 The development comprises 12 turbines, classifying it as a ‘medium-sized’ project (NatureScot *et al.*, 2021).

4.3.2 The Site is located within a typical upland commercial forestry landscape in northern Scotland, characterised by young coniferous plantation woodland interspersed with open habitats such as upland heath communities.

4.3.3 Linear features, including small burns and drainage ditches, traverse the Site and may support foraging and commuting bats.

4.3.4 There are various structures such as farm steadings and houses in local townships surrounding the plantation woodland that are likely to provide roosting habitat. In addition to this, mature forestry stands in the surrounding area may provide occasional roosting opportunities while younger plantations and felled compartments are likely to have lower suitability for roosting but retain some ecological value for foraging and shelter.

4.3.5 Using the matrix provided in NatureScot's best practice guidelines (NatureScot *et al.*, 2021) provided in Appendix B, the medium project size combined with the habitat characteristics results in an overall site risk classification of Medium (3) (Table 13).

Table 13. Initial site risk assessment (reproduced from NatureScot *et al*, 2021).

Site risk level (1-5)	Project size	Project size	Project size	Project size
Habitat risk	=	Small	Medium	Large
Habitat risk	Low	1	2	3
Habitat risk	Moderate	2	**3**	4
Habitat risk	High	3	4	5

Key: 1-2=low site risk, 3=medium site risk, 4-5=high site risk.

Stage 2 - Overall Risk Assessment

4.3.6 Collision risk, relative abundance, and species-specific vulnerability were assessed using the NatureScot guidance matrix. This evaluation on overall risk to each species recorded on site considers species-specific collision for each species recorded within the Site, factoring in recorded activity levels, species-specific behavioural patterns, and habitat use across the Site. Findings are summarised in Table 14.

Table 14: Collision Risk and Vulnerability by Species

Bat species on Site	Relative abundance	Collision risk	Potential vulnerability	Activity on Site	Overall Risk
Soprano pipistrelle	Common	High	Medium	Low	Moderate
Common pipistrelle	Common	High	Medium	Low	Moderate

Bat species on Site	Relative abundance	Collision risk	Potential vulnerability	Activity on Site	Overall Risk
Myotis sp.	Rare	Low	Low	Low to Moderate	Low
Brown long-eared bat	Rare	Low	Low	Low to Moderate	Low

REFERENCES

1. Collins, J. (ed.) (2023) *Bat Surveys for Professional Ecologists: Good Practice Guidelines*. 4th edn. London: Bat Conservation Trust.

2. NatureScot, 2021. *Bats and onshore wind turbines: survey, assessment and mitigation*. [online] Available at: https://www.nature.scot/doc/bats-and-onshore-wind-turbines-survey-assessment-and-mitigation

3. Russ, J. (2012*) British Bat Calls: A Guide to Species Identification. Pelagic Publishing, Exeter.*

APPENDIX A: FIGURES

Figure 1: Static detector locations

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APPENDIX B: HABITAT SUITABILITY ASSESSMENT AND PROJECT SIZE

Habitat Assessment and Project Size was determined using the following criteria outlined in the tables below (as taken directly from NatureScot *et al*., 2021).

Habitat Description	Description
Low	Small number of potential roost features, of low quality. Low quality foraging that habitat could be used by small numbers of foraging bats. Isolated site not connected to the wider landscape by prominent linear features.
Moderate	Buildings, trees or other structures with moderate-high potential as roost sites on or near the site. Habitat could be used extensively by foraging bats. Site is connected to the wider landscape by linear features such as scrub, tree lines and streams
High	Numerous suitable buildings, trees (articularly mature ancient woodland) or other structures with moderate-high potential as roost sites on or near the site, and/or confirmed roosts present close to ot o the site. Extensive and diverse habitat mosaic of high quality foraging bats. Site is connected to the wider landscape by a network of strong linear features such as rivers, blocks of woodland and mature hedgerows. At/near edge pf range and/or on an important flyway. Close to key roost and/or swarming site.

Project Size	Description
Small	Small scale development (≤ 10 turbines). No other wind energy developments within 10km. Comprising turbines ≤ 50 m in height.
Medium	Larger developments (between 10 and 40 turbines). May have some other wind development within 5km. Comprising turbines 50-100m in height.
Large	Largest developments (≥ 40 turbines) with other wind energy developments within 5km. Comrising turbines >100m in height.

APPENDIX C: ECOBATS OUTPUT

Table 11. Key metrics for each species recorded at each automated detector location.

Detector	Species	Median Perce tile	95% CIs	Maximum Percentile	Nights Recorded	Activity Level
L1	Common Pipistrelle	4	3-23	42	15	Low
	Soprano pipistrelle	3	2-25	37	12	Low
	Myotis	24	24-24	40	4	Low - Moderate
	Brown long-eared bat	15	15-27	39	6	Low
L2	Common Pipistrelle	4	4.5-10.5	17	25	Low
	Soprano pipistrelle	14	11.5-30	55	21	Low
	Myotis	40	24-43.5	47	5	Low - Moderate
	Brown long-eared bat	39	27-64	83	11	Low - Moderate
L3	Common pipistrelle	14	10-27.5	49	22	Low
	Soprano pipistrelle	8	11-69	87	18	Low
	Myotis	32	24-40	40	6	Low - Moderate
	Brown long-eared bat	52	27-71	90	9	Moderate
L4	Common Pipistrelle	3	3-7.5	20	25	Low
	Soprano pipistrelle	6	5.5-13	96	27	Low
	Myotis	24	24-37.5	51	9	Low - Moderate
	Brown long-eared bat	52	39.5-69.5	87	13	Moderate
L5	Common Pipistrelle	2	2-8.5	15	20	Low
	Soprano pipistrelle	9	6.5-19.5	37	18	Low

Detector	Species	Median Perce tile	95% CIs	Maximum Percentile	Nights Recorded	Activity Level
	Myotis	40	32-55	55	6	Low - Moderate
	Brown long-eared bat	15	15-15	15	2	Low
L6	Common Pipistrelle	2	2-10.5	39	16	Low
	Soprano pipistrelle	9	6.5-11	14	13	Low
	Myotis	40	32-40	40	5	Low - Moderate
	Brown long-eared bat	15	15-15	15	6	Low
L7	Common Pipistrelle	2	2-8	15	22	Low
	Soprano pipistrelle	5	5-18	49	18	Low
	Myotis	24	24-32	40	6	Low - Moderate
	Brown long-eared bat	52	39-71	78	9	Moderate
L8	Common Pipistrelle	3	2.5-15	15	9	Low
	Soprano pipistrelle	6	6-6	9	5	Low
	Myotis	40	40-40	40	4	Low - Moderate
	Brown long-eared bat	64	33.5-80.5	83	7	Moderate to High
L9	Common Pipistrelle	0	2-8.5	16	23	Low
	Soprano pipistrelle	41	26.5-52	93	27	Moderate
	Myotis	58	43.5-73.5	100	15	Moderate
	Brown long-eared bat	15	15-39	64	12	Low
L10	Common Pipistrelle	15	12.5-24	41	27	Low
	Soprano pipistrelle	13	9.5-22.5	100	28	Low

Detector	Species	Median Perce tile	95% CIs	Maximum Percentile	Nights Recorded	Activity Level
	Myotis	47	35.5-55	84	23	Moderate
	Brown long-eared bat	64	39.5-64	83	21	Moderate to High
L11	Common Pipistrelle	16	9-17.5	36	18	Low
	Soprano pipistrelle	17	11.5-33	54	12	Low
	Myotis	24	24-37.5	51	8	Low - Moderate
	Brown long-eared bat	81	39.5-91.5	100	8	High
L12	Common Pipistrelle	13	9-17	23	16	Low
	Soprano pipistrelle	10	7.5-23	37	14	Low
	Myotis	24	24-24	24	2	Low - Moderate
	Brown long-eared bat	70	39-74	78	10	High
L13	Common Pipistrelle	4	4-15.5	27	24	Low
	Soprano pipistrelle	4	6.5-24.5	40	21	Low
	Myotis	24	24-24	51	8	Low - Moderate
	Brown long-eared bat	39	27-58.5	90	13	Low - Moderate

Temporal Variation

Table 12 shows metrics for each species recorded per month.

Detector	Species	Season	Median Perce tile	95% CIs	Maximum Percentile	Nights Recorded	Activity Level
L1	Common Pipistrelle	Spring	29	3-23	42	8	Low - Moderate
		Spring (June)	0	3-23	0	1	Low

Detector	Species	Season	Median Percentile	95% CIs	Maximum Percentile	Nights Recorded	Activity Level
		Summer	2	3-23	4	6	Low
		Autumn					
	Soprano pipistrelle	Spring	11	2-25	37	5	Low
		Summer	2	2-25	14	7	Low
		Autumn					
	Myotis	Spring	24	24-24	40	4	Low - Moderate
		Summer					
		Autumn					
	Brown long-eared bat	Spring					
		Summer	15	15-27	39	6	Low
		Autumn					
L2	Common Pipistrelle	Spring	2	4.5-10.5	17	8	Low
		Summer	5	4.5-10.5	7	9	Low
		Autumn	4	4.5-10.5	14	8	Low
	Soprano pipistrelle	Spring	41	11.5-30	55	7	Moderate
		Spring (June)	11	11.5-30	11	1	Low
		Summer	4	11.5-30	14	5	Low
		Autumn	20	11.5-30	36	8	Low
	Myotis	Spring					
		Summer	24	24-43.5	24	1	Low - Moderate
		Autumn	40	24-43.5	47	4	Low - Moderate
	Brown long-eared bat	Spring	39	27-64	39	1	Low - Moderate
		Summer	15	27-64	15	3	Low
		Autumn	64	27-64	83	7	Moderate – High
L3	Common pipistrelle	Spring	11	10-27.5	40	7	Low
		Spring (June)	6	10-27.5	6	1	Low
		Summer	6	10-27.5	14	5	Low
		Autumn	32	10-27.5	49	9	Low - Moderate

Detector	Species	Season	Median Percentile	95% CIs	Maximum Percentile	Nights Recorded	Activity Level
	Soprano pipistrelle	Spring	2	11-69	11	5	Low
		Spring (June)	0	11-69	0	1	Low
		Summer	0	11-69	0	3	Low
		Autumn	65	11-69	87	9	Moderate -High
	Myotis	Spring					
		Summer	24	24-40	24	1	Low - Moderate
		Autumn	40	24-40	40	5	Moderate
	Brown long-eared bat	Spring	15	27-71	15	1	Low
		Summer					
		Autumn	52	27-71	90	8	Moderate
L4	Common Pipistrelle	Spring	2	3-7.5	4	6	Low
		Spring (June)	1	3-7.5	1	1	Low
		Summer	3	3-7.5	5	7	Low
		Autumn	7	3-7.5	20	11	Low
	Soprano pipistrelle	Spring	2	5.5-13	16	8	Low
		Spring (June)	2	5.5-13	2	1	Low
		Summer	4	5.5-13	9	12	Low
		Autumn	9	5.5-13	96	6	Low
	Myotis	Spring	24	24-37.5	24	2	Low - Moderate
		Spring (June)	24	24-37.5	24	1	Low - Moderate
		Summer	24	24-37.5	24	2	Low - Moderate
		Autumn	38	24-37.5	51	4	Low - Moderate
	Brown long-eared bat	Spring	27	39.5-69.5	39	2	Low - Moderate
		Summer	15	39.5-69.5	15	1	Low
		Autumn	64	39.5-69.5	87	10	Moderate - High
L5	Common Pipistrelle	Spring	0	2-8.5	2	6	Low
		Spring /Summer (June)	1	2-8.5	2	2	Low
		Summer	0	2-8.5	3	3	Low
		Autumn	3	2-8.5	15	9	Low

Detector	Species	Season	Median Percentile	95% CIs	Maximum Percentile	Nights Recorded	Activity Level
	Soprano pipistrelle	Spring	23	6.5-19.5	37	4	Low - Moderate
		Spring (June)	8	6.5-19.5	9	2	Low
		Summer	7	6.5-19.5	13	2	Low
		Autumn	7	6.5-19.5	16	10	Low
	Myotis	Spring					
		Summer					
		Autumn	40	32-55	55	6	Low - Moderate
	Brown long-eared bat	Spring	15	15-15	15	1	Low
		Summer					
		Autumn	15	15-15	15	1	Low
L6	Common Pipistrelle	Spring	1	2-10.5	2	7	Low
		Spring (June)	2	2-10.5	2	1	Low
		Summer	7	2-10.5	39	8	Low
		Autumn					
	Soprano pipistrelle	Spring	8	6.5-11	14	6	Low
		Spring (June)	11	6.5-11	11	1	Low
		Summer	8	6.5-11	9	6	Low
		Autumn					
	Myotis	Spring	24	32-40	24	1	Low - Moderate
		Spring (June)	40	32-40	40	1	Low - Moderate
		Summer	40	32-40	40	3	Low - Moderate
		Autumn					
	Brown long-eared bat	Spring	15	15-15	15	1	Low
		Summer	15	15-15	15	5	Low
		Autumn					
L7	Common Pipistrelle	Spring	1	2-8	10	5	Low
		Spring (June)	1	2-8	1	1	Low
		Summer	0	2-8	3	7	Low
		Autumn	4	2-8	15	9	Low
	Soprano pipistrelle	Spring	5	5-18	30	6	Low
		Spring (June)	2	5-18	2	1	Low
		Summer	5	5-18	6	4	Low

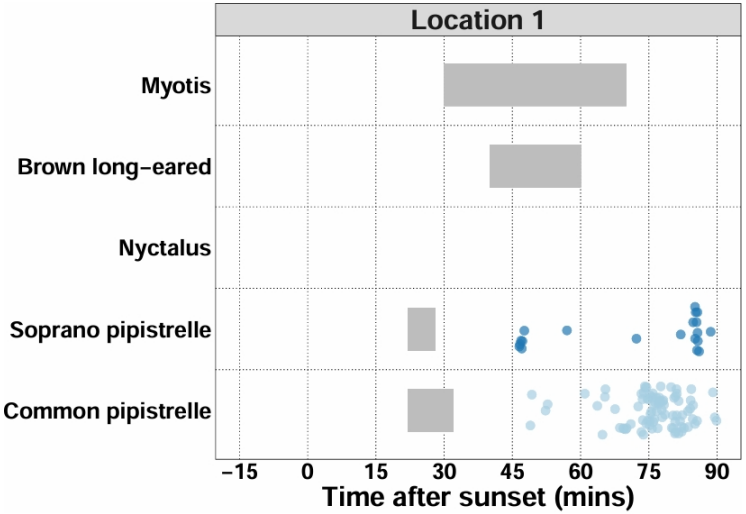
Detector	Species	Season	Median Percentile	95% CIs	Maximum Percentile	Nights Recorded	Activity Level
		Autumn	17	5-18	49	7	Low
	Myotis	Spring	24	24-32	24	1	Low - Moderate
		Spring (June)	24	24-32	24	1	Low - Moderate
		Summer					
		Autumn	32	24-32	40	4	Low - Moderate
	Brown long-eared bat	Spring					
		Summer					
		Autumn	52	39-71	78	9	Moderate
L8	Common pipistrelle	Spring					
		Summer	3	2.5-15	15	9	Low
		Autumn					
	Soprano pipistrelle	Spring					
		Summer	6	6-6	9	5	Low
		Autumn					
	Myotis	Spring					
		Summer	40	40-40	40	4	Low - Moderate
		Autumn					
	Brown long-eared bat	Spring					
		Summer	64	33.5-80.5	83	7	Moderate - High
		Autumn					
L9	Common pipistrelle	Spring	2	2-8.5	6	6	Low
		Spring (June)	0	2-8.5	0	1	Low
		Summer	1	2-8.5	6	8	Low
		Autumn	0	2-8.5	16	8	Low
	Soprano pipistrelle	Spring	67	26.5-52	93	9	Moderate -High
		Spring (June)	53	26.5-52	53	1	Moderate
		Summer	31	26.5-52	52	8	Low - Moderate
		Autumn	13	26.5	42	9	Low
	Myotis	Spring	67	43.5-73.5	100	6	Moderate - High
		Spring (June)	100	43.5-73.5	100	1	High
		Summer	58	43.5-73.5	58	3	Moderate

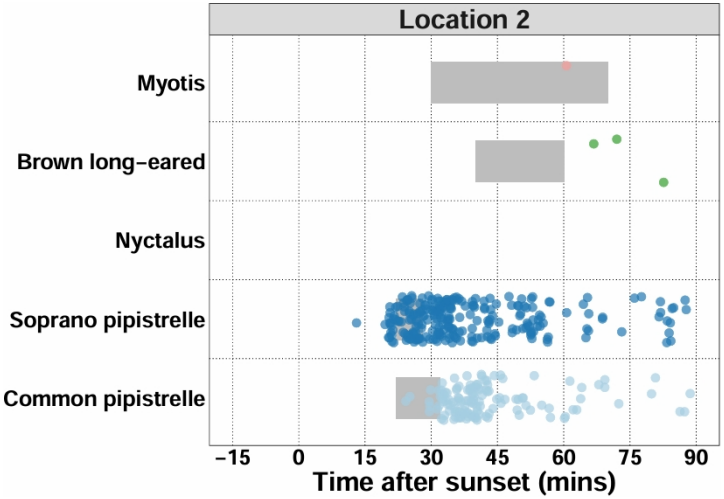
Detector	Species	Season	Median Percentile	95% CIs	Maximum Percentile	Nights Recorded	Activity Level
		Autumn	40	43.5-73.5	40	5	Low - Moderate
	Brown long-eared bat	Spring	15	15-39	39	4	Low
		Summer	15	15-39	52	5	Low
		Autumn	39	15-39	64	3	Low - Moderate
L10	Common pipistrelle	Spring	10	12.5-24	26	7	Low
		Spring (June)	16	12.5-24	16	1	Low - Moderate
		Summer	33	12.5-24	41	9	Low - Moderate
		Autumn	2	12.5-24	28	10	Low
	Soprano pipistrelle	Spring	6	9.5-22.5	17	9	Low
		Spring (June)	6	9.5-22.5	6	1	Low
		Summer	27	9.5-22.5	40	8	Low - Moderate
		Autumn	14	9.5-22.5	100	10	Low
	Myotis	Spring	24	35.5-55	24	5	Low-Moderate
		Spring (June)	24	35.5-55	24	1	Low-Moderate
		Summer	40	35.5-55	47	7	Low-Moderate
		Autumn	70	35.5-55	84	10	Moderate - High
	Brown long-eared bat	Spring	15	39.5-64	15	2	Low
		Spring (June)	15	39.5-64	15	1	Low
		Summer	64	39.5-64	83	10	Moderate - High
		Autumn	58	39.5-64	70	8	Moderate
L11	Common pipistrelle	Spring					
		Summer	4	9-17.5	18	9	Low
		Autumn	16		36	9	Low
	Soprano pipistrelle	Spring					
		Summer	12	11.5-33	14	4	Low

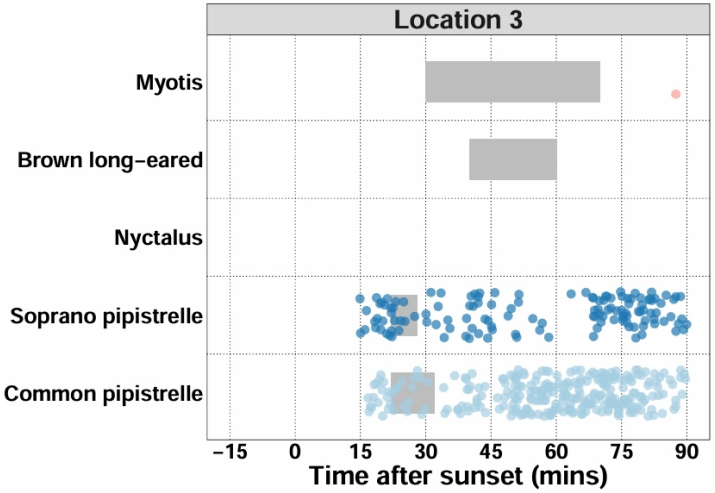
Detector	Species	Season	Median Percentile	95% CIs	Maximum Percentile	Nights Recorded	Activity Level
		Autumn	25	11.5-33	54	8	Low-Moderate
	Myotis	Spring					
		Summer	24	24-37.5	24	2	Low-Moderate
		Autumn	32	24-37.5	51	6	Low-Moderate
	Brown long-eared bat	Spring					
		Summer	83	39.5-91.5	100	7	High
		Autumn	15	39.5-91.5	15	1	Low
L12	Common pipistrelle	Spring					
		Summer	16	9-17	18	7	Low
		Autumn	11	9-17	23	9	Low
	Soprano pipistrelle	Spring					
		Summer	9	7.5-23	22	6	Low
		Autumn	10	7.5-23	37	8	Low
	Myotis	Spring					
		Summer					
		Autumn	24	24-24	24	2	Low-Moderate
L13	Common Pipistrelle	Spring	4	4-15.5	6	7	Low
		Spring (June)	3	4-15.5	3	1	Low
		Summer	24	4-15.5	27	9	Low-Moderate
		Autumn	0	4-15.5	5	7	Low
	Soprano pipistrelle	Spring	2	6.5-24.5	4	4	Low
		Spring (June)	0	6.5-24.5	0	1	Low
		Summer	23	6.5-24.5	40	8	Low – Moderate
		Autumn	7	6.5-24.5	30	8	Low
	Myotis	Spring	24	24-24	24	4	Low – Moderate
		Summer	24	24-24	24	1	Low – Moderate
		Autumn	24	24-24	51	3	Low – Moderate

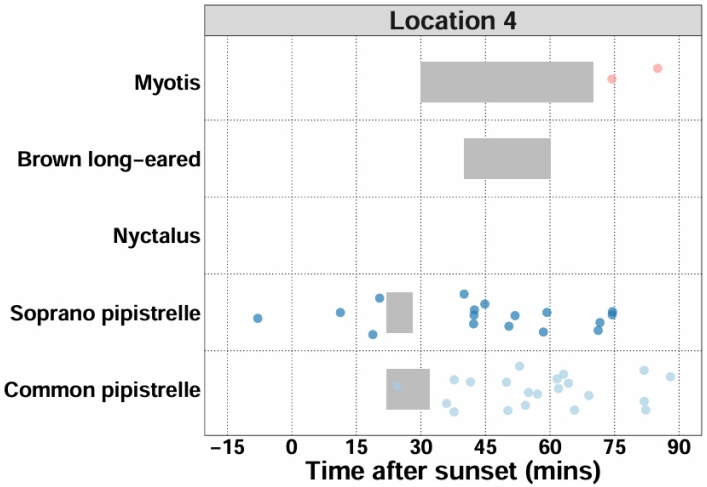
Potential Roosting

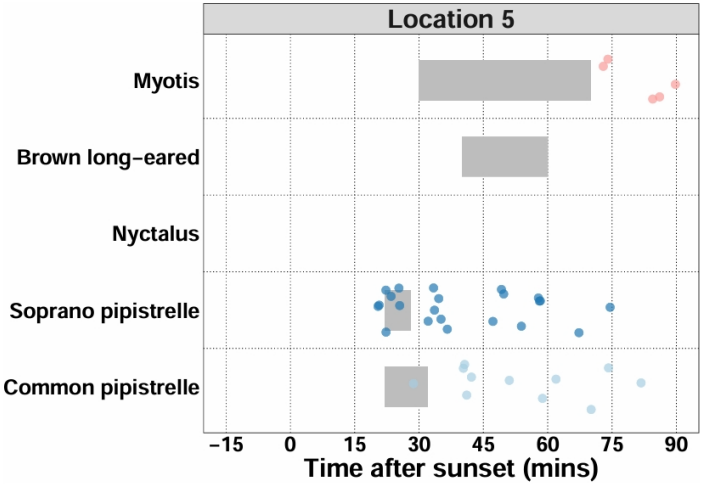
The tables below present the number of bat calls recorded at each automated detector location (Figure 1, Appendix A) within the species-specific typical emergence times (outlined in Russ 2012), suggesting proximity to a roost. Time from 15 minutes before to 90 minutes after sunset. Species-specific emergence time ranges are shown as grey bars. Bat passes overlapping species-specific grey bars, or occurring earlier than this time range, may potentially indicate the presence of a nearby roost.

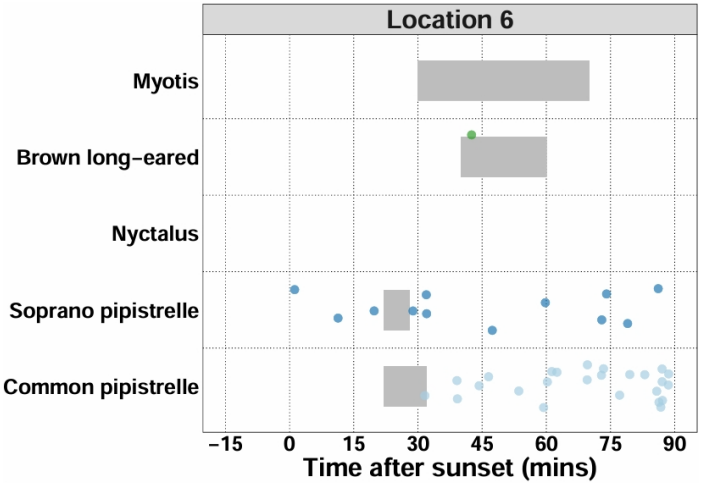


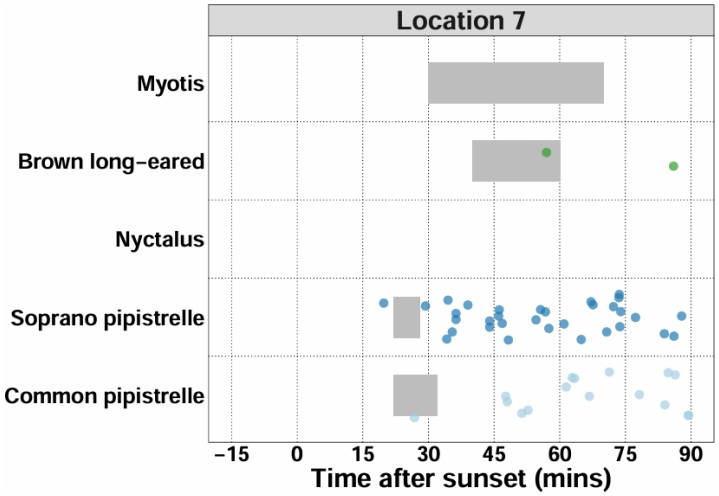


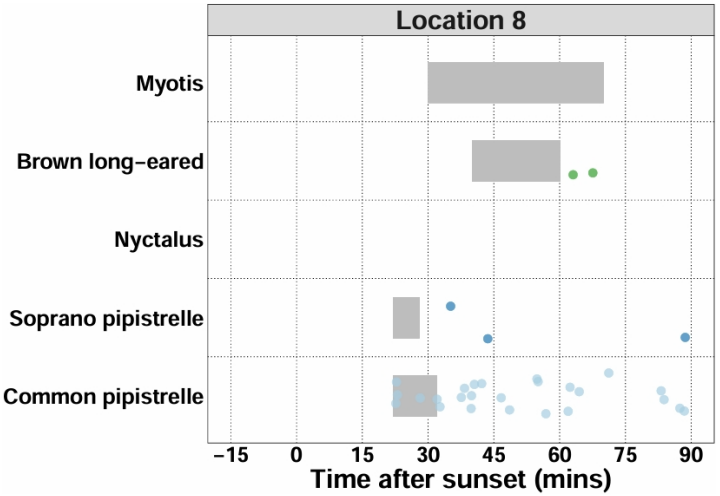

Location 3
Myotis
Brown long-eared
Nyctalus
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

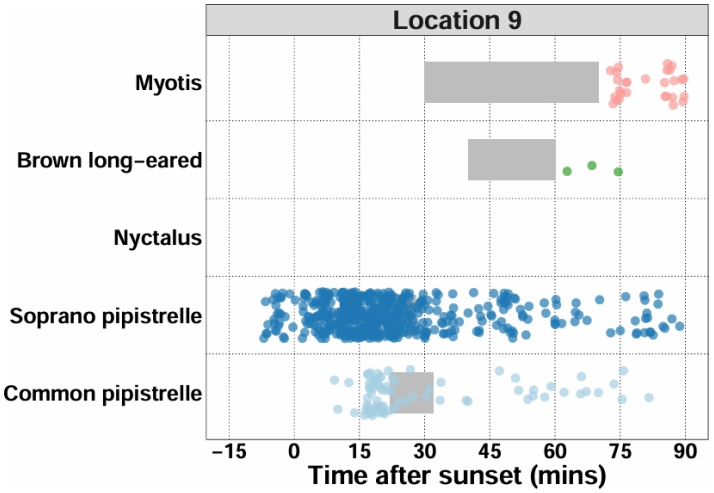

Location 4
Myotis
Brown long-eared
Nyctalus
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

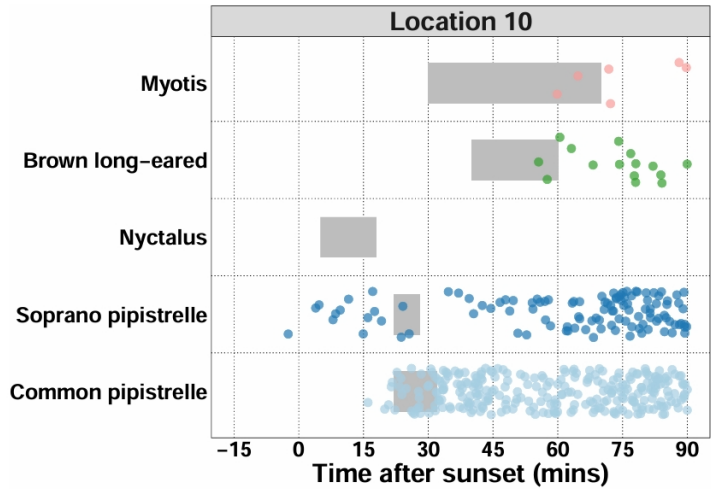

Location 5
Myotis
Brown long-eared
Nyctalus
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

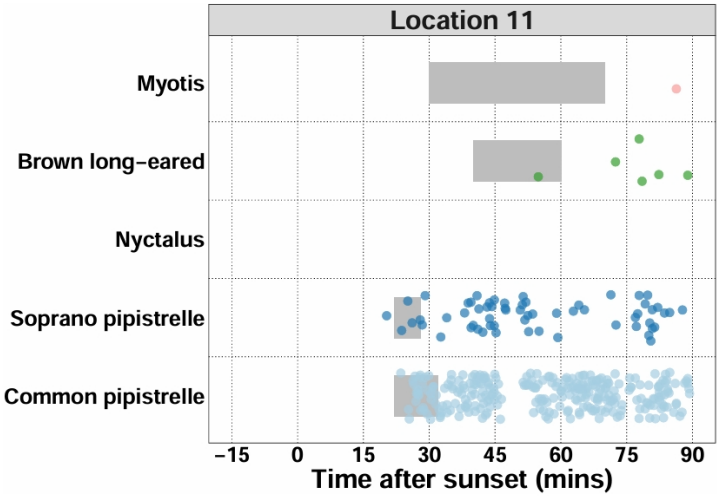

Location 6
Myotis
Brown long-eared
Nyctalus
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

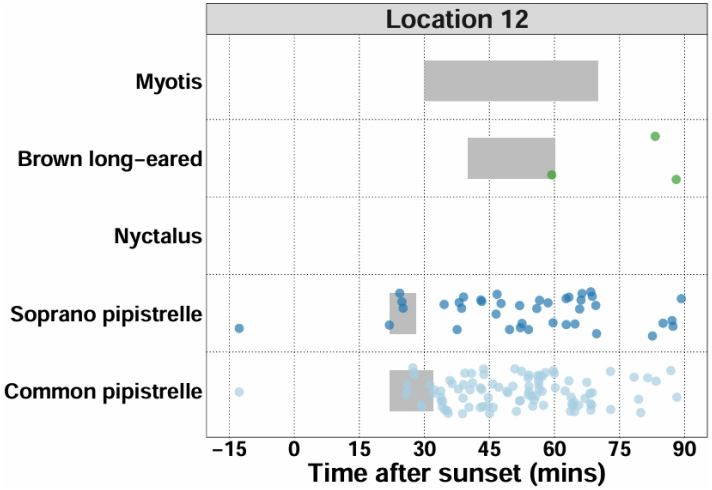

Location 7
Myotis
Brown long-eared
Nyctalus
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

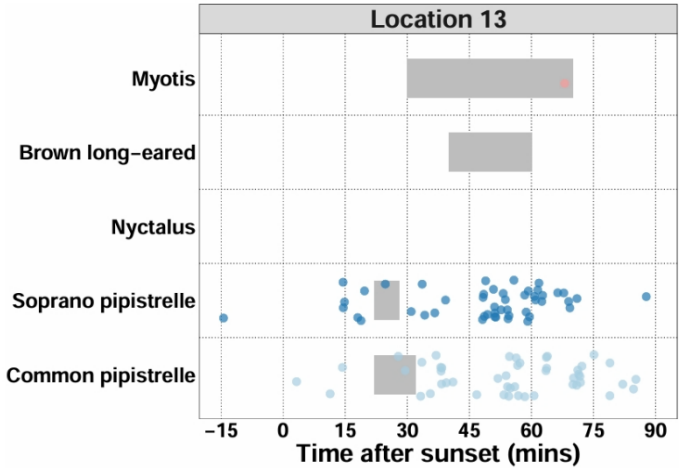

Location 8
Myotis
Brown long-eared
Nyctalus
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)


Location 9
Myotis
Brown long-eared
Nyctalus
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)


Location 10
Myotis
Brown long-eared
Nyctalus
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)


Location 11
Myotis
Brown long-eared
Nyctalus
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)


Location 12
Myotis
Brown long-eared
Nyctalus
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)


Location 13
Myotis
Brown long-eared
Nyctalus
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)