

## **Limekiln Wind Farm Extension**

### **Bat Survey Report**

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# 1 Introduction

## Background to commission

- 1.1 BSG Ecology was commissioned by Infinergy Ltd in June 2019 to complete bat survey work at the proposed Limekiln Wind Farm extension site, in support of an application to extend the consented Limekiln Wind Farm (hereafter referred to as the Consented Development) which is located to the west. Bat survey has been undertaken in July and September 2019 with a final survey scheduled for May 2020. The site, which is located to the south-east of the village Reay and north-west of Loch Thormaid and Loch Saorach, has an approximate central Ordnance Survey grid reference of ND 00265 60546 (see Figure 1, Section 5).

## Site description

- 1.2 The site is used primarily for growing sitka spruce *Picea sitchensis* and lodgepole pine *Pinus contorta* for the production of timber. There is a block of mixed plantation woodland at Achvarasdal that has sycamore *Acer pseudoplatanus*, whitebeam *Sorbus aria* and ash *Fraxinus excelsior* as well as sitka spruce. There is also a small plantation of broad-leaved trees close to Creag Mhòr.
- 1.3 One area in the centre of the survey area has been felled and was in the process of being re-stocked at the time of the botanical survey in July 2019.
- 1.4 The main habitat type in the forest rides is marshy grassland. This is dominated mostly by purple moor-grass *Molinia caerulea* with soft rush *Juncus effusus* being locally abundant. Unimproved acid grassland is largely restricted to the main access track, the drier banks of the Achvarasdal Burn and the areas immediately around the mixed plantation at Achvarasdal.
- 1.5 A dense stand of bracken *Pteridium aquilinum* covers the whole of the old sheepfold at Achvarasdal and it is also dominant along the south-facing slopes of Creag Mhòr and one of the forest rides that runs down to Achvarasdal. Bracken is dominant on parts of the east facing slopes of Cnoc an Ruighein Duibh and on the steep slopes of Gleann Saothair an Athaich.
- 1.6 There are areas of wet modified blanket bog along some rides on the east side of the site, whilst dry modified bog is mostly found along the fringes of the plantations bordering the valley with the Achvarasdal Burn. The areas of relatively unmodified bog are restricted to the summit of Cnoc an Ruighein Duibh and the shoulders of Gleann Saothair an Athaich.
- 1.7 The extensive topogenous fen at Achvarasdal Leans is considered to be groundwater dependent. At its northern margin there is a very species-poor version of the M9 type of fen vegetation. There may be some calcareous groundwaters in this area as well as close to the sheepfold at Achvarasdal where there is a small stand of black bog-rush dominated M10 vegetation. This is similar to the situation on the west side of the Achvarasdal Burn just down-slope of the limekiln at Aryleive, but those at Achvarasdal are very small in extent.
- 1.8 There are small pockets of wet and acid dry heath around the site where there is better drainage. The wet heath is restricted to the slopes of Cnoc an Ruighein Duibh. The acid dry heath is largely restricted to the rocky and better drained slopes around Creag Mhòr and on the steep slopes immediately to the west of Cnoc Saothair an Athaich in the centre of the site.

## Description of project

- 1.9 At the time that the bat survey work was commissioned, the proposed development included the installation of ten wind turbines. The scope of the survey was therefore developed with reference to the indicative ten turbine layout; however, the scheme has since been reduced to five proposed turbines with associated infrastructure.

**Aims of the Study**

1.10 The aims of the bat survey work were:

- To assess the habitats within the site to identify features that have potential to support roosting bats.
- To identify the species of bat using the site at different times of the year.
- To identify habitats that are favoured by foraging and commuting bats.
- To assess the level of bat activity within different parts of the site.
- To collect baseline information to inform an assessment of potential impacts on bats arising from the construction and operation of the proposed wind farm.

## 2 Methods

### Desk study

- 2.1 A search of the National Biodiversity Network Atlas was undertaken, which contains the majority of all recent records held by the Highlands Biological Recording Group. A search for all bat records was carried out on the 20 February 2020 for the site and a study area that extends 2 km from the site boundary. Online aerial photography of the site and its surroundings (Google Earth Pro, accessed on 20 February 2020) was examined to further assist in understanding the context of the Site and to identify and assess possible habitat linkages with other habitats or sites of ecological importance within the local area.

### Field survey

#### Roost Survey

- 2.2 SNH guidance (SNH *et al*, 2019) recommends that key features that could support maternity roosts and significant hibernation and/or swarming sites within 200 m plus rotor radius of the boundary of the proposed development should be subject to further investigation. Survey should establish presence or absence of roosts and if bats are present the species, numbers function of the roost and flight lines away from the roost.
- 2.3 A search of aerial and Ordnance Survey mapping indicated that there are no buildings present within the site or surrounding 200 m. Previous survey undertaken for the consented wind farm development to the west assessed the trees to be unsuitable for bat roosts due to their young age and species. As such the roost potential of the site was considered to be low however this was confirmed through observations during site visits to install bat monitoring equipment.

#### Static Bat Detector Survey

- 2.4 Bat survey of the site was carried out in line with current industry guidance (SNH *et al*, 2019) which recommends that static detectors should be placed to collect a representative sample of bat activity at or close to the proposed turbine locations. Static detectors were therefore placed at each of the turbine locations (ten locations at the time of survey commission), or on the nearest woodland edge. OS grid references for the monitoring locations are presented in Table 1.

Table 1: Monitoring locations

Location Reference	OS grid reference	Nearest turbine location	Distance from turbine in m
1	NC9906162284	T5	455
2	ND0005261856	T6	472
3	NC9974262278	T5	354
4	NC9910161741	T5	386
5	NC9950661540	T6	159
6	ND0034561417	T3	544
7	NC9971561116	T3	157
8	ND0042560893	T9	390
9	NC9982460408	T9	322
10	ND0027160098	T2	355
11	ND0065960332	T9	747
12	ND0001961636	T6	383

- 2.5 In addition to the ten detectors that were placed at proposed turbine locations, two detectors were placed within the site in areas assessed as being likely to provide higher value bat foraging habitat. These were location 11 which was situated adjacent to Loch Thormaid, and location 12 which is within a more open section of the site located adjacent to a forestry track.
- 2.6 A total of six detectors were deployed on site at any one time. These were then rotated to the next six monitoring locations to record a minimum of ten consecutive nights of data collection at each location. This approach to detector deployment gave greater flexibility for re-deployment if, for example, there was a detector failure or if an extended period of poor weather occurred during the monitoring period.
- 2.7 Survey work to date has been undertaken in July (Monitoring Period 1) and late August/early September 2019 (Monitoring Period 2), with additional monitoring scheduled for late April/May 2020).
- 2.8 Table 2 below shows the dates of each deployment for each monitoring location. The monitoring locations are shown on Figure 2 in Section 5.

Table 2: Dates of deployment at each monitoring location

Monitoring Period	Dates of deployment	Total number of nights deployed	Remote monitoring locations deployed
Monitoring period 1	11.07.19 - 25.07.19	14	1,2,5,6,9,11
	25.07.19 - 09.08.19	15	3,4,7,8,10,12
Monitoring period 2	03.09.19 - 13.09.19	11	1,2,5,6,9,11
	13.09.19 - 24.09.19	11	3,4,7,8,10,12

- 2.9 Monitoring was undertaken using Wildlife Acoustics Song Meter (SM4) bat detectors with external microphones. The SM4 detectors were configured to record above the level of ambient noise, such as noise generated by wind or rain, using an adaptive trigger set to 6 dB, and were set to define a bat pass as a call note of >2 ms duration, which is separated from another by more than one second. An external microphone was connected via a cable to the detector unit, and attached to either a pole or tree branch at approximately 2 m above ground level. For each night sampled, detectors were set to record from half an hour before sunset to half an hour after sunrise.
- 2.10 Weather conditions have been recorded concurrently with static bat monitoring. Weather was recorded from a single location within the site using a Davis Vantage Pro weather station, which was set up to record temperature, wind speed, wind direction, and rainfall.
- 2.11 The static detector and weather station locations are shown in Figure 2, Section 5.

### Data analysis

- 2.12 Recorded bat calls were converted using Wildlife Acoustics Kaleidoscope Pro Software. The software uses predefined classifiers to label bat calls to species<sup>1</sup>. These calls were then analysed by an experienced surveyor using Analook software to confirm the species labelled. Where possible, the bat was identified to species level but if this was not possible then genus was used.
- 2.13 For pipistrelle species the following criteria, based on measurements of peak frequency, were used to classify calls:
- common pipistrelle ≥42 and <49 kHz
  - soprano pipistrelle ≥51 kHz
  - Nathusius' pipistrelle <39 kHz
  - common pipistrelle / soprano pipistrelle ≥49 and <51 kHz
  - common pipistrelle / Nathusius' pipistrelle ≥39 and <42 kHz

<sup>1</sup>For more information on how Wildlife Acoustics Kaleidoscope Pro Software classifies bat calls please see: <https://www.wildlifeacoustics.com/products/kaleidoscope-software-ultrasonic>

- 2.14 Weather data were also analysed to check for any periods where conditions were poor and could have potentially affected levels of bat activity within the site. Poor conditions are considered to be high wind speeds or heavy rain.

**Limitations to methods**

- 2.15 The surveys completed to date have covered the summer and autumn seasonal periods. Due to the time of commission a spring survey has not been undertaken but is scheduled to be completed in May 2020.
- 2.16 All the detectors worked correctly during deployment, although many did not record bat activity for every night that they were deployed. It is assumed that this was due to a lack of bat activity within range of the detector, and not due to equipment failure, as all detectors were working correctly when tested prior to disassembly. Nights where no activity was recorded were also interspersed with nights when data were recorded, indicating that the detector was functioning at that time. This supports the conclusion that the lack of data on some monitoring nights was due to bat inactivity at that location.

### 3 Results and Interpretation

#### Desk study

- 3.1 A search of the NBN atlas identified three bat records within 2 km of the site. These included two records of common pipistrelle *Pipistrellus pipistrellus*, (dated 1970 and 2002) and one record for brown long eared bat *Plecotus auritus* (dated 1980).

#### Roost Survey

- 3.2 No buildings are present within the site and no trees with the potential to support bats were recorded during any of the site visits for bat monitoring, other protected species, or Phase 1 habitat survey. The trees within the site are generally semi-mature and homogenous in age, with the exception of the central section which has been felled and restocked in recent years. Conifers within the vicinity of proposed turbine locations have not yet achieved a height where potential roosting features are likely to be present. Overall the site is considered to be of low bat roosting suitability.

#### Bat survey data

- 3.3 Bat activity within the site was limited to a single genus of bat, *Pipistrellus* sp., which was also the finding of previous surveys completed in 2012 in support of the Consented Development. The majority of the recorded bat activity was attributed to common pipistrelle *Pipistrellus pipistrellus*. A small number of calls (2.5% during Monitoring Period 1 and 2.6% during the Monitoring Period 2) fall between the  $\geq 39$  and  $< 42$  kHz range and could be attributed to either common or Nathusius pipistrelle *Pipistrellus nathusii*, but these calls could not be determined to species level due to overlapping call parameters. A single call was attributed to soprano pipistrelle *Pipistrellus pygmaeus* during the July / August 2019 survey period.
- 3.4 Overall bat activity within the site was low, with the highest number of bat passes being recorded at Location 6 during Monitoring Period 1 (July/August): a total of 373 bat passes was recorded (an average of 37 per night). A total of 372 bat passes was recorded at Location 8 during the same monitoring period. By comparison the lowest number of bat passes was recorded at Location 9 where 1 bat pass was recorded during Monitoring Period 2 and 11 bat passes were recorded during Monitoring Period 1.
- 3.5 Bat activity was higher during the Monitoring Period 1 (July/August) with activity decreasing from a total of 2,053 bat passes in Monitoring Period 1 to 603 bat passes in Monitoring Period 2 (September). During Monitoring Period 2 the maximum recorded bat activity was 289 bat passes at Location 3: at all other locations that total number of bat passes was less than 85. Tables 3 and 4 below show the number of calls recorded at each monitoring location during each of the monitoring periods.

Table 3: Number of bat passes at each monitoring location during Monitoring Period 1.

Species	Total number of bat passes recorded at each location during Monitoring Period 1												Grand Total
	Location 1	Location 2	Location 3	Location 4	Location 5	Location 6	Location 7	Location 8	Location 9	Location 10	Location 11	Location 12	
40kHz pipistrelle	2	4			4	28					6		44
Common pipistrelle	300	33	268	125	245	345	129	372	11	40	83	58	2009
Soprano pipistrelle						1							1
<b>Total</b>	<b>302</b>	<b>37</b>	<b>268</b>	<b>125</b>	<b>249</b>	<b>373</b>	<b>129</b>	<b>372</b>	<b>11</b>	<b>40</b>	<b>89</b>	<b>58</b>	<b>2053</b>

Table 4: Number of bat passes at each monitoring location during Monitoring Period 2.

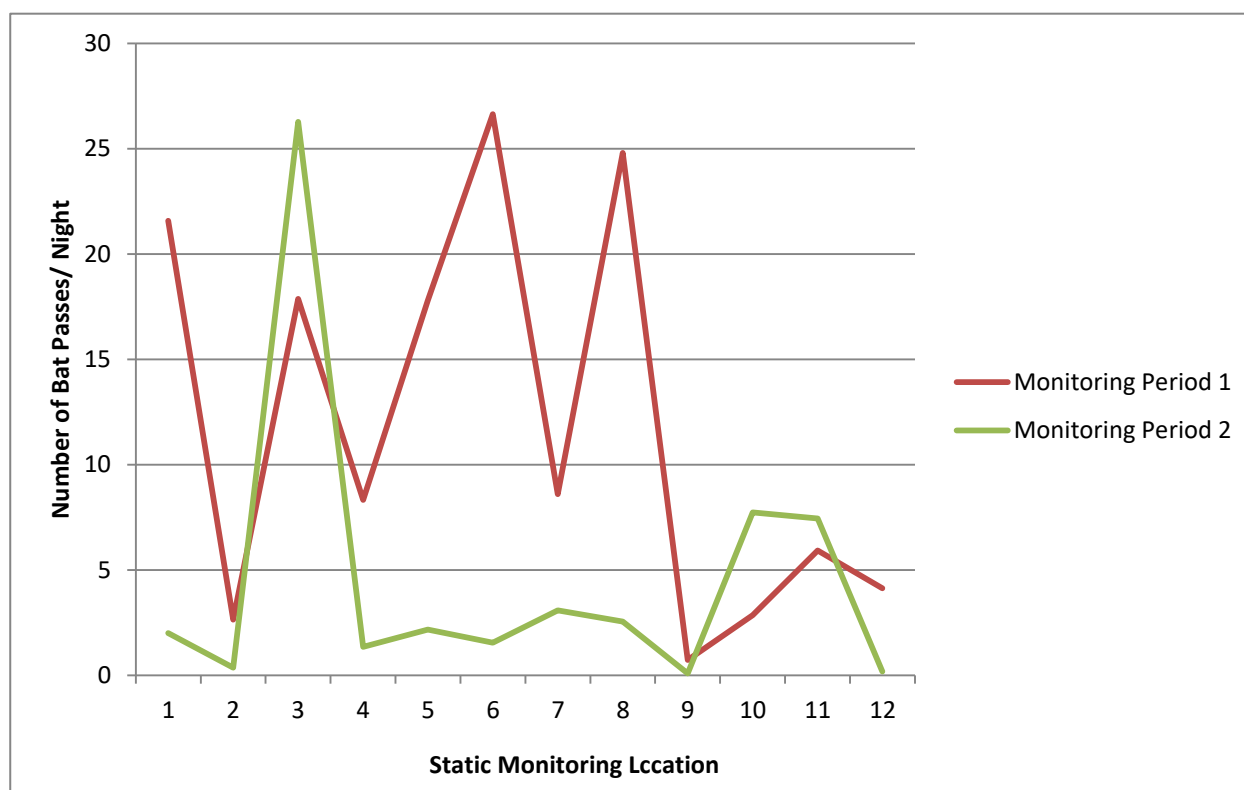
Species	Total number of bat passes recorded at each location during Monitoring Period 2												
	Location 1	Location 2	Location 3	Location 4	Location 5	Location 6	Location 7	Location 8	Location 9	Location 10	Location 11	Location 12	Grand Total
Soprano pipistrelle	1	1	1	2	1	1	2	1		3	3		16
Common pipistrelle	21	3	288	13	23	16	32	27	1	82	79	2	587
<b>Total</b>	<b>22</b>	<b>4</b>	<b>289</b>	<b>15</b>	<b>24</b>	<b>17</b>	<b>34</b>	<b>28</b>	<b>1</b>	<b>85</b>	<b>82</b>	<b>2</b>	<b>603</b>

3.6 The average number of bat passes recorded per night was highest at monitoring Location 1 (21.5 passes/night), Location 3 (17.8 passes/night), Location 6 (26.8 passes/night) and Location 8 (24.8 passes/night) during Monitoring Period 1, and highest at monitoring Location 3 (26.27 passes/night) during Monitoring Period 2. Locations 1 and 3 are situated towards the north of the site; Locations 6 and 8 are situated along the eastern site boundary, closer to Loch Thormaid (which is located to the south-east of the site), and along a forestry track, which could potentially form an open flyway through the plantation woodland.

3.7 Table 5 shows the average number of bat passes recorded per night at each location during each monitoring period. These data are illustrated in Graph 1.

Table 5: Average number of bat passes recorded per night at each monitoring location.

Location	1	2	3	4	5	6	7	8	9	10	11	12
Monitoring Period 1	21.6	2.6	17.9	8.3	17.8	26.6	8.6	24.8	0.7	2.9	5.9	4.1
Monitoring Period 2	2.0	0.4	26.3	1.4	2.2	1.6	3.1	2.6	0.1	7.7	7.5	0.2



Graph 1: Average number of bat passes recorded per night at each monitoring location

**Weather data**

- 3.8 Weather data are presented in Graphs 2 and 3 in Appendix 1. No significant periods of adverse weather were recorded during either Monitoring Period 1 or 2. Conditions during Monitoring Period 1 remained within optimum bat conditions throughout the survey. Optimal conditions were considered to be temperatures of 10°C or higher at sunset, rainfall less than 5 mm per day and average wind speed of less than 15 km/hour.
- 3.9 During Monitoring Period 2 temperatures were lower, falling within the range 7-10°C on the majority of evenings. One period of higher wind speed was also recorded, and on this occasion wind speed reached 15 km/h for two days. These weather conditions coincide with the lower levels of bat activity that were recorded during Monitoring Period 2 but are considered to be typical of the north of Scotland during the late summer / autumn period in which survey was undertaken.
- 3.10 None of the weather data collected during the two monitoring periods indicated extreme conditions that would trigger the need to repeat the bat monitoring.

## 4 Assessing Potential Risk to Bats

### Introduction

4.1 Wind farms can affect bats in the following ways (SNH *et al.*, 2019):

- Collision mortality, barotrauma 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;
- Displacement of individuals or populations (due to wind farm construction or because bats avoid the wind farm area).

4.2 To ensure that bats are protected by minimising the risk of collision, an assessment of impact at a site requires a detailed appraisal of:

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

4.3 The above information should be interpreted in the context of likely impacts on local populations. Relevant factors that should be considered include whether populations are at the edge of their range, cumulative effects, presence of protected areas designated for their bat interest and proximity to maternity roosts, key foraging areas or key flight routes, including possible migration routes.

4.4 The risk of mortality of bat species at wind farms was categorised by Natural England (2012) as high, medium and low, based on mortality data from monitoring studies at wind farms as well as habitat preferences, echolocation characteristics, weight, wing-shape, flight speed and height, hunting techniques, flight behaviour, and use of the landscape. This has since been amended in SNH *et al.* (2019) to re-classify common pipistrelle and soprano pipistrelle as "High Risk" based on evidence from a Defra-commissioned study (Mathews *et al.*, 2016). Table 6 assigns species of bats a category of likely level of risk of death through interaction with operational wind turbines.

Table 6: The likelihood of bat species being killed by wind turbines (based on Table 2 in SNH *et al.*, 2019).

High-risk	Medium-risk	Low-risk
Nathusius' pipistrelle	Serotine	<i>Myotis</i> <sup>2</sup> species
Common pipistrelle	Barbastelle	Long-eared bats
Soprano pipistrelle		Horseshoe bats
Noctule		
Leisler's bat		

<sup>2</sup> Refers to any bat species of the genus *Myotis*.

- 4.5 In addition, SNH *et al.* (2019) guidance assesses the potential threat (high, medium or low) posed to species populations from mortality caused by collision with wind turbines. Table 7 lists the likely risk to bat populations in Scotland to wind-farm related adverse effects, which is adapted from Wray *et al.* (2010). Table 6 has been amended to exclude species that do not occur in Scotland<sup>3</sup>.

Table 7: Threat to bat populations in Scotland from wind turbines (based on Table 2 in SNH *et al.*, 2019).

High-risk	Medium-risk	Low-risk
Nathusius' pipistrelle	Common pipistrelle	Brown long-eared bat
Noctule	Soprano pipistrelle	Daubenton's bat
Leisler's bat	Whiskered bat	Natterer's bat

#### Site Risk Level for Bats

- 4.6 Table 3a in SNH *et al.* (2019) sets out a matrix to derive an indicative risk for sites based on the habitats present and the scale of the proposed development. The site has been categorised as a "low site risk" (risk level = 2) according to the supporting definitions of low habitat risk and medium project size in Table 8 below and the matrix in Table 9. Note that, whilst the height of the turbines within the proposed development exceeds the defined height for "small" project size, the number of proposed turbines meets the definition for "small" project size. There is an operational wind farm development within 10 km to the east (Stemster Hill Wind Farm), which meets the definition for a "medium" project size.

Table 8: Descriptions of habitat risk and project size categories used to inform the site risk level for bats.

Habitat Risk	Description
<b>Low</b>	Small number of potential roost features, of low quality. Low quality foraging habitat that could be used by small numbers of foraging bats. Isolated site not connected to the wider landscape by prominent linear features.
<b>Moderate</b>	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 tree lines and streams.
<b>High</b>	Numerous suitable buildings, trees (particularly 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 or on the site. Extensive and diverse habitat mosaic of high quality for 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 of range and/or on an important flyway. Close to key roost and/or swarming site.
Project Size	Description
<b>Small</b>	Small scale development ( $\leq 10$ turbines). No other wind energy developments within 10 km. Comprising turbines $< 50$ m in height.
<b>Medium</b>	Larger developments (between 10 and 40 turbines). May have some other wind developments within 5 km. Comprising turbines 50-100 m in height.
<b>Large</b>	Largest developments ( $> 40$ turbines) with other wind energy developments within 5 km. Comprising turbines $> 100$ m in height.

<sup>3</sup> Based on information presented in <https://cdn.bats.org.uk/pdf/Bats-in-Scotland.pdf?mtime=20181101151315>, accessed March 2020.

Table 9: Site risk level derived from the outcome of Table 7 (taken from SNH *et al.*, 2019).

Site Risk Level	Project Size			
		Small	Medium	Large
Habitat Risk	Low	1	2	3
	Moderate	2	3	4
	High	3	4	5

Key: Green (1-2) - low/lowest site risk; Amber (3) - medium site risk; Red (4-5) - high/highest site risk.

### Bat activity assessment

- 4.7 The SNH *et al.* (2019) assessment of potential risk involves consideration of habitat and development related features, the relative vulnerability of each species of bat potentially at risk, and the bat activity output from the EcoBat tool.
- 4.8 The EcoBat tool relies on a baseline dataset that allows bat activity recorded at a site to be contextualised against reference levels recorded in the same region, at the same time of year etc. The 'reference range' is the stratified dataset by which percentile outputs can be generated.
- 4.9 The EcoBat tool generates a site-specific report that evaluates the recorded bat activity at each monitoring point and expresses it as a percentile that is generated by comparing it to the reference range. Percentiles provide a numerical indicator of the relative importance of a nights' worth of bat activity. For example, activity data in the 70<sup>th</sup> percentile would indicate that the recorded data was in the top 30% of activity for the reference range. The tool suggests the following cut-offs between activity categories:
- low activity: 0-20<sup>th</sup> percentiles;
  - low to moderate activity: 21<sup>st</sup>-40<sup>th</sup> percentiles;
  - moderate activity: 41<sup>st</sup>-60<sup>th</sup> percentiles;
  - moderate to high activity: 61<sup>st</sup>-80<sup>th</sup> percentiles; and
  - high activity: 81<sup>st</sup>-100<sup>th</sup> percentiles.
- 4.10 At the current time, the supporting database within the EcoBat tool that is used for activity level comparison is limited. The total available data within the 200 km reference range for comparison of bat activity is below the level recommended by EcoBat for meaningful analysis (the recommended comparison data set size is 2000+ nights; the maximum data set available for comparison against the survey data for the proposed development is 365 nights, i.e. less than 20% of the recommended comparison data set). Whilst the reference range used for comparison is expected to grow as adoption of the EcoBat tool for analysis of data increases, the limited data set available for this assessment means that the conclusions cannot be considered robust.

### Deriving an overall risk assessment

- 4.11 In order to derive an "overall risk assessment" for a wind farm development site, SNH *et al.* (2019) guidance suggests that an activity category is derived from comparison of the recorded activity of each species of high collision risk (as defined in Table 6 above) at the site against a data set (summarised in Tables 10 and 11 below). These scores should then be set against the "site risk level" (as defined in Table 8 above) using the matrix presented in Table 10 below (based on Table 3b in SNH *et al.*, 2019) to determine the level of overall risk. This analysis has been carried out for common pipistrelle (a medium risk species) as this was the only species recorded during the monitoring with the exception of a single bat call from a soprano pipistrelle.

Table 10: Overall risk assessment (taken from SNH *et al.*, 2019)

Site Risk Level (taken from Table 8)	Activity category					
	Nil (0)	Low (1)	Low- moderate (2)	Moderate (3)	Moderate- high (4)	High (5)
Lowest (1)	0	1	2	3	4	5
Low (2)	0	2	4	6	8	10
Moderate (3)	0	3	6	9	12	15
High (4)	0	4	8	12	15	18
Highest (5)	0	5	10	15	20	25

- 4.12 Taking into account the limitations associated with the use of the EcoBat tool, the output needs to be treated with caution and should only be used to inform the overall assessment and the conclusions reached. Table 10 provides a summary of the data output from the EcoBat tool for the monitoring undertaken during the periods 11.07.19 - 25.07.19, 25.07.19 - 09.08.19, 03.09.19 - 13.09.19 and 13.09.19 - 24.09.19. This equates to 25-26 nights of monitoring per location (see Table 1).
- 4.13 When interpreting the data in Tables 11 and 12 it is important to remember that the total number of nights where bat activity was recorded includes a range of activity levels as shown by the activity category. For example, at Location 1 bats were detected during 20 out of a total of 25 monitoring nights with the median percentile bat activity being described as 'moderate to high' (score 4) and the maximum percentile bat activity being described as 'high' (score 5). Taking into account the site risk level of 2, the overall risk score is 8 (moderate) for the median percentile bat activity and 10 (moderate) for maximum percentile bat activity.
- 4.14 Examination of Table 3 shows that the total number of bat passes recorded at Location 1 was 300 during Monitoring Period 1 and 21 during Monitoring Period 2. This equated to average bat passes per night of 21.6 for Monitoring Period 1 and 2.0 for Monitoring Period 2.
- 4.15 If a site risk level of 1 is used for the assessment (based on the proposed number of turbines, which indicates that the development is 'small' – score 1- and the habitat risk is 1 – see Table 9) the overall risk category for all monitoring locations is Low (for median percentile bat activity). When considering maximum percentile bat activity the overall risk category would be Low for three monitoring points and Medium (at the lower end of the Medium range) for nine monitoring points.
- 4.16 Overall, it is concluded that there is a low likelihood of the proposed development resulting in a significant impact on bats. Two species have been recorded using the site: common pipistrelle, which is the dominant species, and soprano pipistrelle, where only one bat call was recorded. Both species are considered to be medium risk with regard to population-related impacts. The monitoring data collected to date indicates that bat activity levels are low, i.e. low numbers of bat passes have been recorded. Analysis using EcoBat indicates that the overall risk category is Low or Medium for the monitoring points used, based on the assumption that the development is "medium" in size. If, however, the project is assumed to be "small" in size (based on turbine number alone) then the overall risk category is Low for all monitoring points. The EcoBat assessment is not considered to be robust due to the small number of data points available for comparison (the EcoBat report is provided in Appendix 2).

Table 11: Summary of bat activity with reference to the median percentile (data compared with the reference range using the EcoBat tool for *Pipistrellus pipistrellus*).

Monitoring location	Median percentile	Activity category	Nights recorded	Site level risk	Overall risk score	Overall risk category
1	68	Moderate to high (4)	20	2	8	Medium
2	22	Low to moderate (2)	5	2	4	Low
3	69	Moderate to high (4)	23	2	8	Medium
4	46	Moderate (3)	21	2	6	Medium
5	64	Moderate to high (4)	19	2	8	Medium
6	76	Moderate to high (4)	19	2	8	Medium
7	50	Moderate (3)	23	2	6	Medium
8	72	Moderate to high (4)	20	2	8	Medium
9	11	Low (1)	8	2	2	Low
10	40	Low to moderate (2)	17	2	4	Low
11	56	Moderate (3)	18	2	6	Medium
12	22	Low to moderate (2)	13	2	4	Low

Table 12: Summary of bat activity with reference to the maximum percentile (data compared with the reference range using the EcoBat tool for *Pipistrellus pipistrellus*).

Monitoring location	Max percentile	Activity category	Nights recorded	Site level risk	Overall risk score	Overall risk category
1	94	High (5)	20	2	10	Medium
2	54	Moderate (3)	5	2	6	Medium
3	98	High (5)	23	2	10	Medium
4	82	High (5)	21	2	10	Medium
5	90	High (5)	19	2	10	Medium
6	91	High (5)	19	2	10	Medium
7	75	moderate to high (4)	23	2	8	Medium
8	95	High (5)	20	2	10	Medium
9	22	Low to moderate (3)	8	2	6	Medium
10	81	High (5)	17	2	10	Medium
11	82	High (5)	18	2	10	Medium
12	86	High (5)	13	2	10	Medium

## 5 References

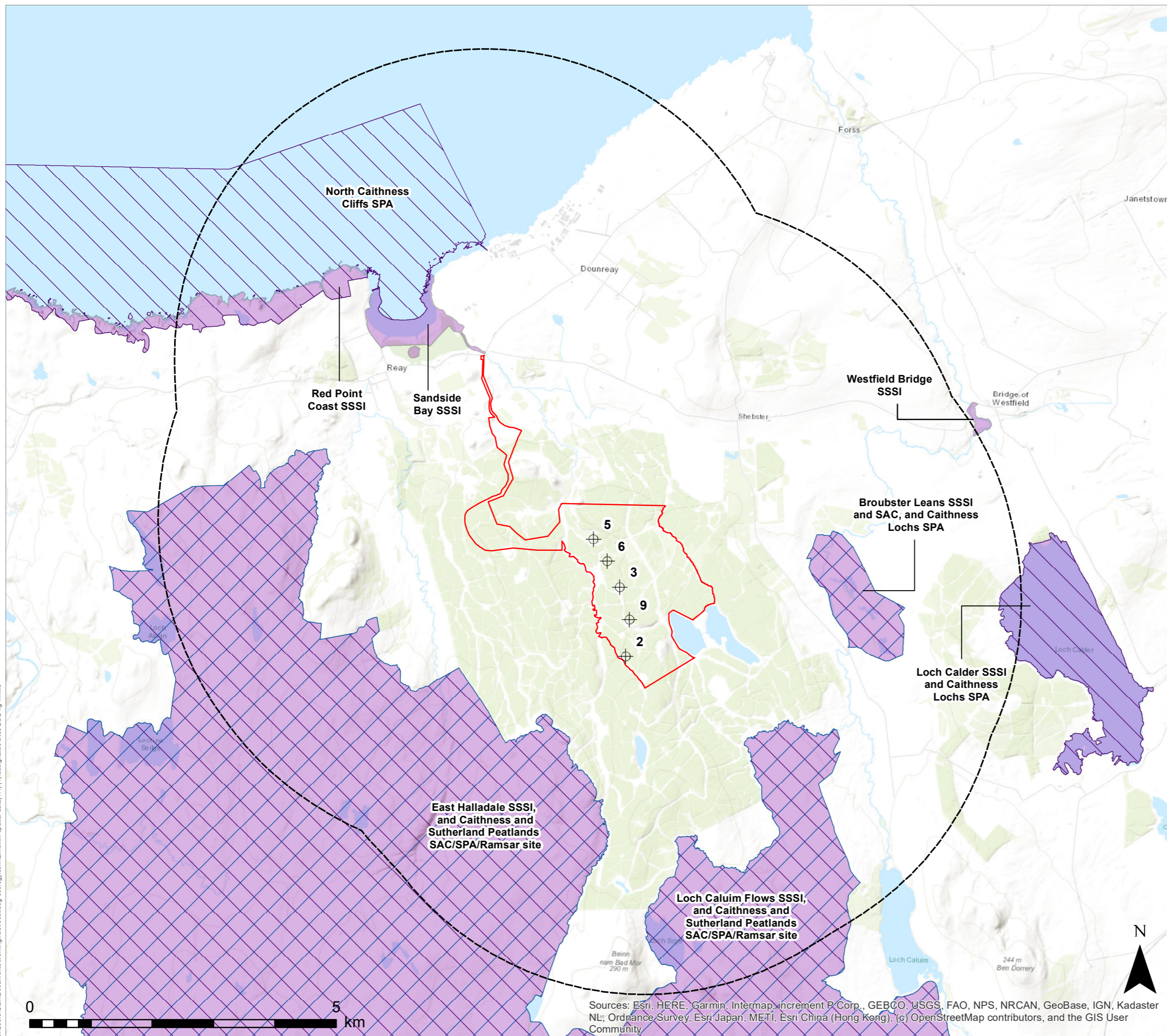
EcoBat tool, <http://www.ecobat.org.uk/> (accessed March 2020).

Scottish Natural Heritage, English Nature, Natural Resources Wales, Ecotricity Ltd, the University of Exeter and the Bat Conservation Trust. (2019). Bats and onshore wind turbines: survey, assessment and mitigation. Version: January 2019.

## 6 Figures

Figure 1: Site Location

Figure 2: Static monitoring point and weather station locations



### LEGEND

BSG | ecology

PROJECT TITLE  
LIMEKILN EXTENSION





Legend

Survey Area

Monitoring Point Location

Weather Station

BSG

ecology

OFFICE:

Newcastle

T:

0191 303 8964

JOB REF: P19-376

PROJECT TITLE

Limekiln Windfarm Extension

DRAWING TITLE

Figure 2: Bat detector monitoring locations and weather station location

DATE: 21.02.2020

CHECKED: SB

SCALE: 1:10,500

DRAWN: HN

APPROVED: SB

STATUS: DRAFT

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No dimensions are to be scaled from this drawing.  
All dimensions are to be checked on site.  
Area measurements for indicative purposes only.

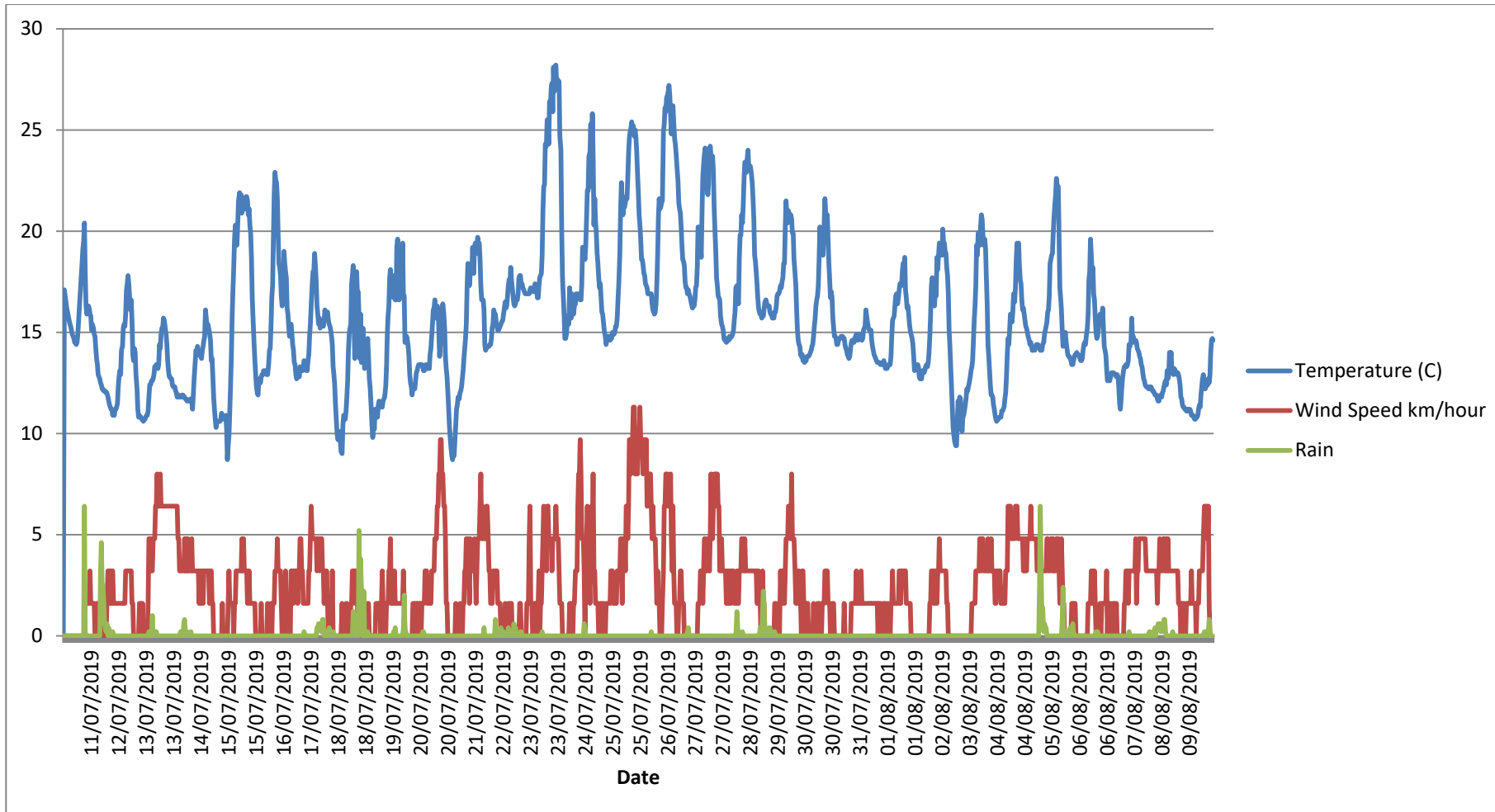
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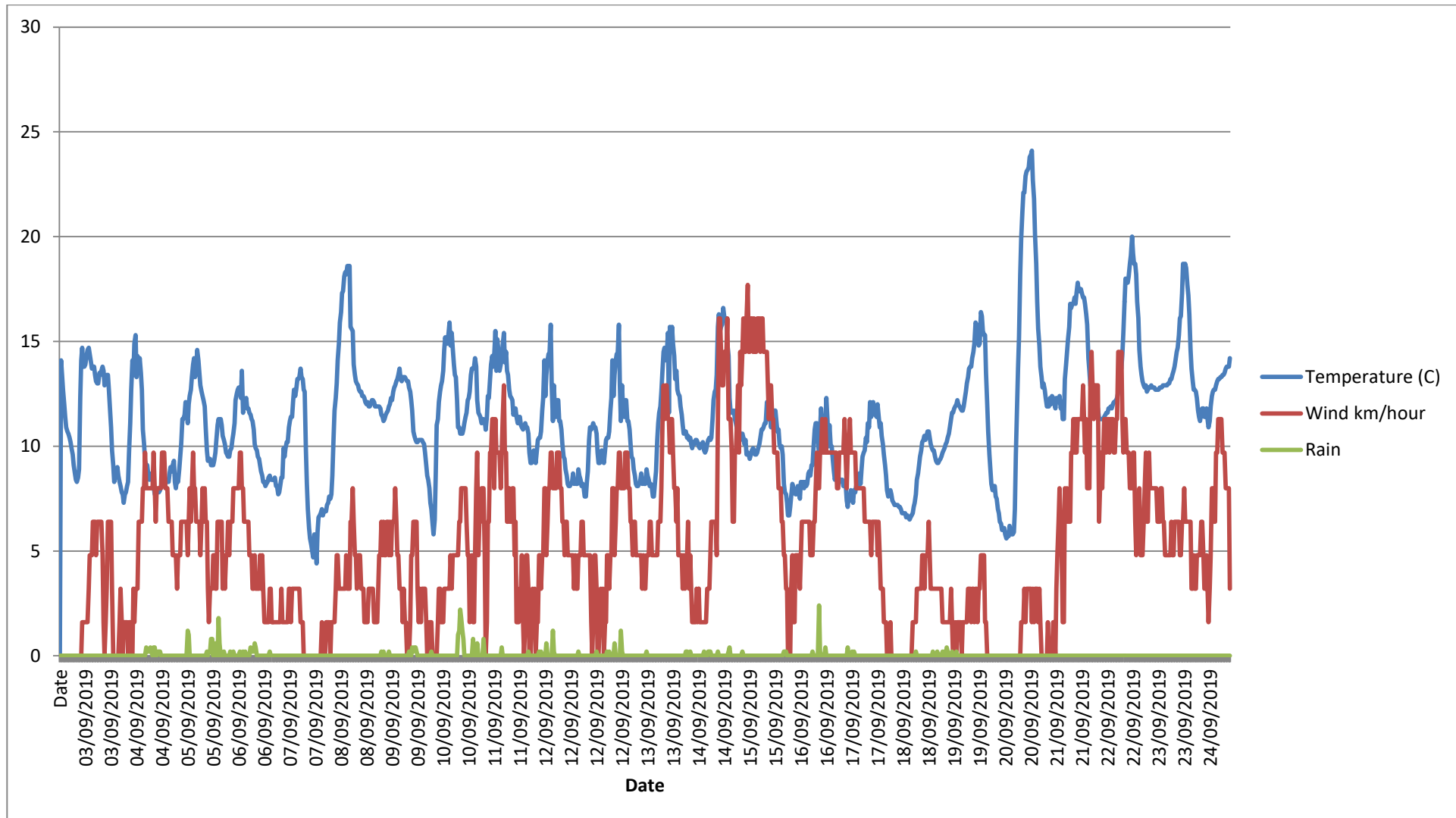
Sources: BSG Ecology survey data

## Appendix 1: Weather Data

Rainfall, temperature and wind speed for each Monitoring Period is illustrated in graphs 2 and 3 below.



Graph 2: Weather data for Monitoring Period 1



Graph 3: Weather data for Monitoring Period 2

## Appendix 2: EcoBat Report

# Ecobat Bat Activity Analysis

Site Name: Limekiln

Hannah

28/02/2020

## Summary

Bat surveys were conducted at D6, D5, D11, D1, D2, D10, D4, D7, D9, D12, D8, D3, for 56 nights between 2019-07-01 and 2019-09-23, using Wildlife Acoustics static bat detectors. The maximum of passes recorded in a single night was 140 passes, and 3 species were recorded.

The reference range dataset was stratified to include:

- Records from any time of year.
- Only records from within 200km<sup>2</sup> of the survey location.
- Records using any make of bat detector.

---

**Table 1**

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

Location	Species/Species Group	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
D1	<i>Pipistrellus</i>	0	0	0	1	1
D1	<i>Pipistrellus pipistrellus</i>	5	7	2	4	2
D10	<i>Pipistrellus</i>	0	0	0	1	1
D10	<i>Pipistrellus pipistrellus</i>	1	3	4	5	4
D11	<i>Pipistrellus</i>	0	0	0	2	4
D11	<i>Pipistrellus pipistrellus</i>	1	7	3	7	0
D12	<i>Pipistrellus pipistrellus</i>	1	1	1	4	6

D2	<i>Pipistrellus</i>	0	0	0	4	1
D2	<i>Pipistrellus pipistrellus</i>	0	0	1	11	3
D3	<i>Pipistrellus</i>	0	0	0	0	1
D3	<i>Pipistrellus pipistrellus</i>	6	10	3	2	2
D4	<i>Pipistrellus</i>	0	0	0	1	0
D4	<i>Pipistrellus pipistrellus</i>	1	4	6	6	4
D5	<i>Pipistrellus</i>	0	0	0	0	5
D5	<i>Pipistrellus pipistrellus</i>	3	9	3	3	1
D6	<i>Pipistrellus</i>	0	0	1	7	5
D6	<i>Pipistrellus pipistrellus</i>	8	4	1	3	3
D6	<i>Pipistrellus pygmaeus</i>	0	0	0	0	1
D7	<i>Pipistrellus</i>	0	0	0	0	2
D7	<i>Pipistrellus pipistrellus</i>	0	4	10	5	4
D8	<i>Pipistrellus</i>	0	0	0	0	1
D8	<i>Pipistrellus pipistrellus</i>	8	6	3	1	2
D9	<i>Pipistrellus pipistrellus</i>	0	0	0	4	4

**Table 2**

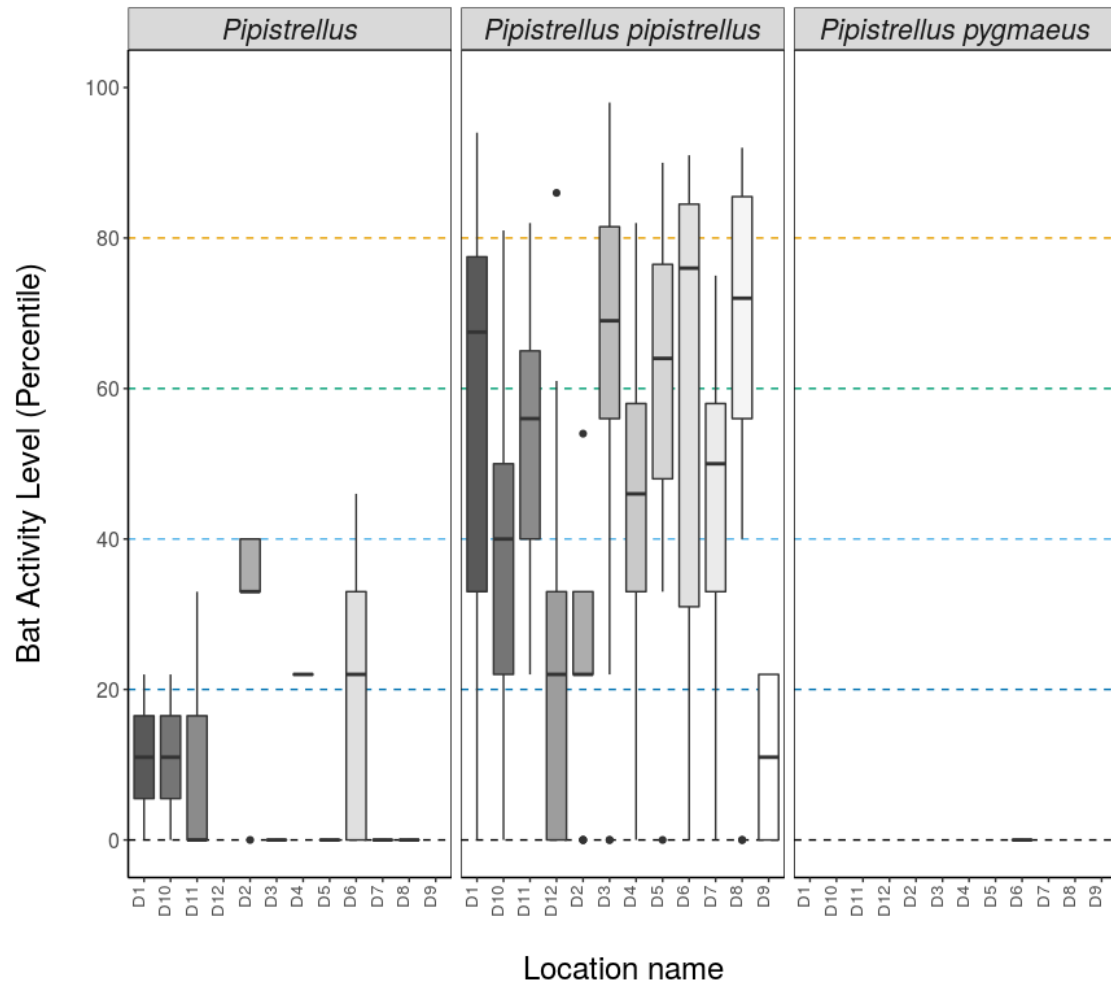
Summary table showing key metrics for each species recorded.

Location	Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded	Reference Range
D1	<i>Pipistrellus</i>	11	11 - 11	22	2	365
D1	<i>Pipistrellus pipistrellus</i>	68	52 - 77	94	20	312
D10	<i>Pipistrellus</i>	11	11 - 11	22	2	365
D10	<i>Pipistrellus pipistrellus</i>	40	36 - 63	81	17	312

D11	<i>Pipistrellus</i>	0	11 - 11	33	6	365
D11	<i>Pipistrellus pipistrellus</i>	56	36 - 59.5	82	18	312
D12	<i>Pipistrellus pipistrellus</i>	22	36 - 59.5	86	13	312
D2	<i>Pipistrellus</i>	33	33 - 40	40	5	365
D2	<i>Pipistrellus pipistrellus</i>	22	22 - 33	54	15	312
D3	<i>Pipistrellus</i>	0	0	0	1	365
D3	<i>Pipistrellus pipistrellus</i>	69	61.5 - 79	98	23	312
D4	<i>Pipistrellus</i>	22	0	22	1	365
D4	<i>Pipistrellus pipistrellus</i>	46	43 - 59	82	21	312
D5	<i>Pipistrellus</i>	0	0 - 0	0	5	365
D5	<i>Pipistrellus pipistrellus</i>	64	54.5 - 72.5	90	19	312
D6	<i>Pipistrellus</i>	22	22 - 39.5	46	13	365
D6	<i>Pipistrellus pipistrellus</i>	76	55.5 - 84	91	19	312
D6	<i>Pipistrellus pygmaeus</i>	0	0	0	1	93
D7	<i>Pipistrellus</i>	0	0 - 0	0	2	365
D7	<i>Pipistrellus pipistrellus</i>	50	45 - 59.5	75	23	312
D8	<i>Pipistrellus</i>	0	0	0	1	365
D8	<i>Pipistrellus pipistrellus</i>	72	64.5 - 82	92	20	312
D9	<i>Pipistrellus pipistrellus</i>	11	11 - 11	22	8	312

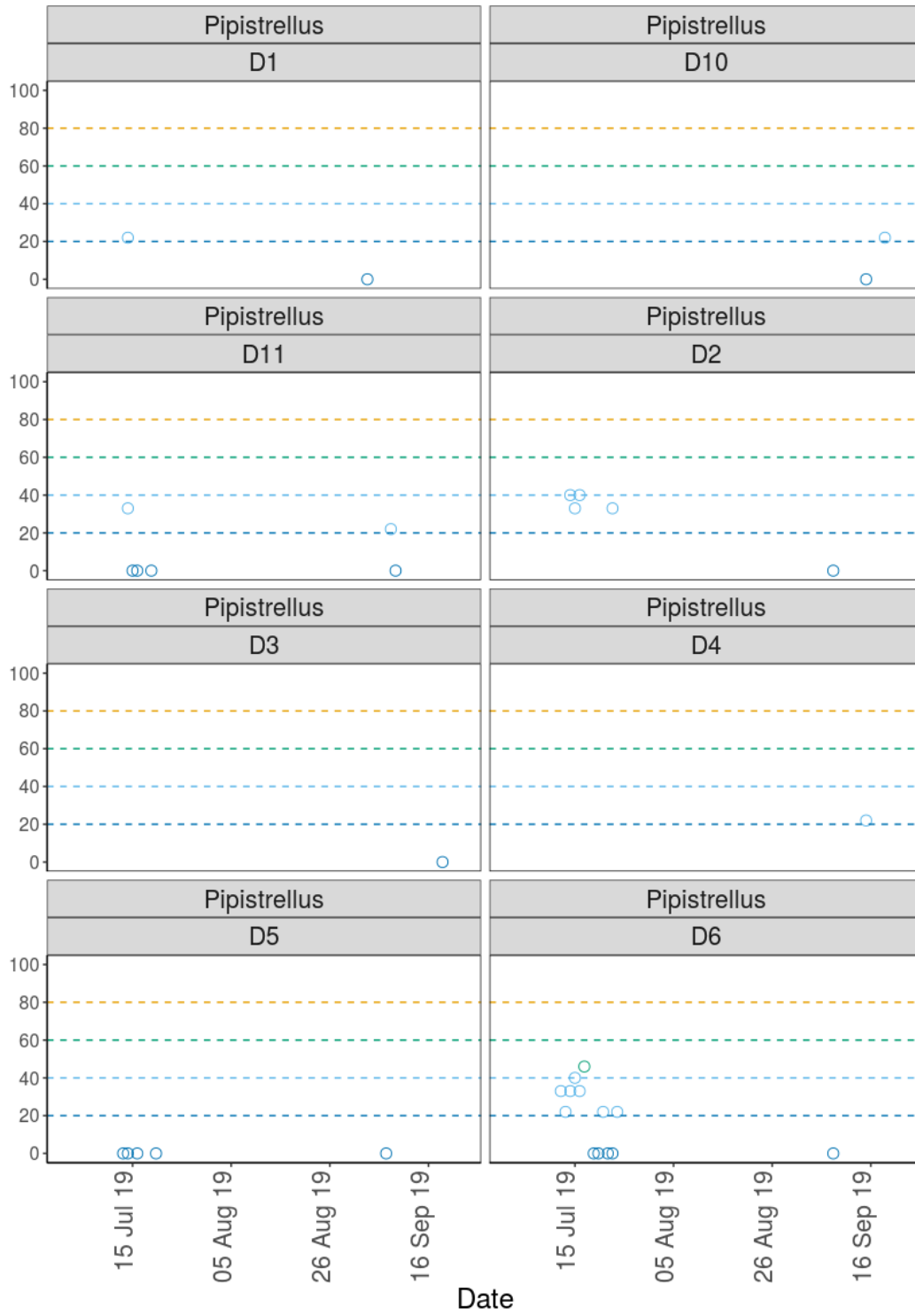
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## Figures

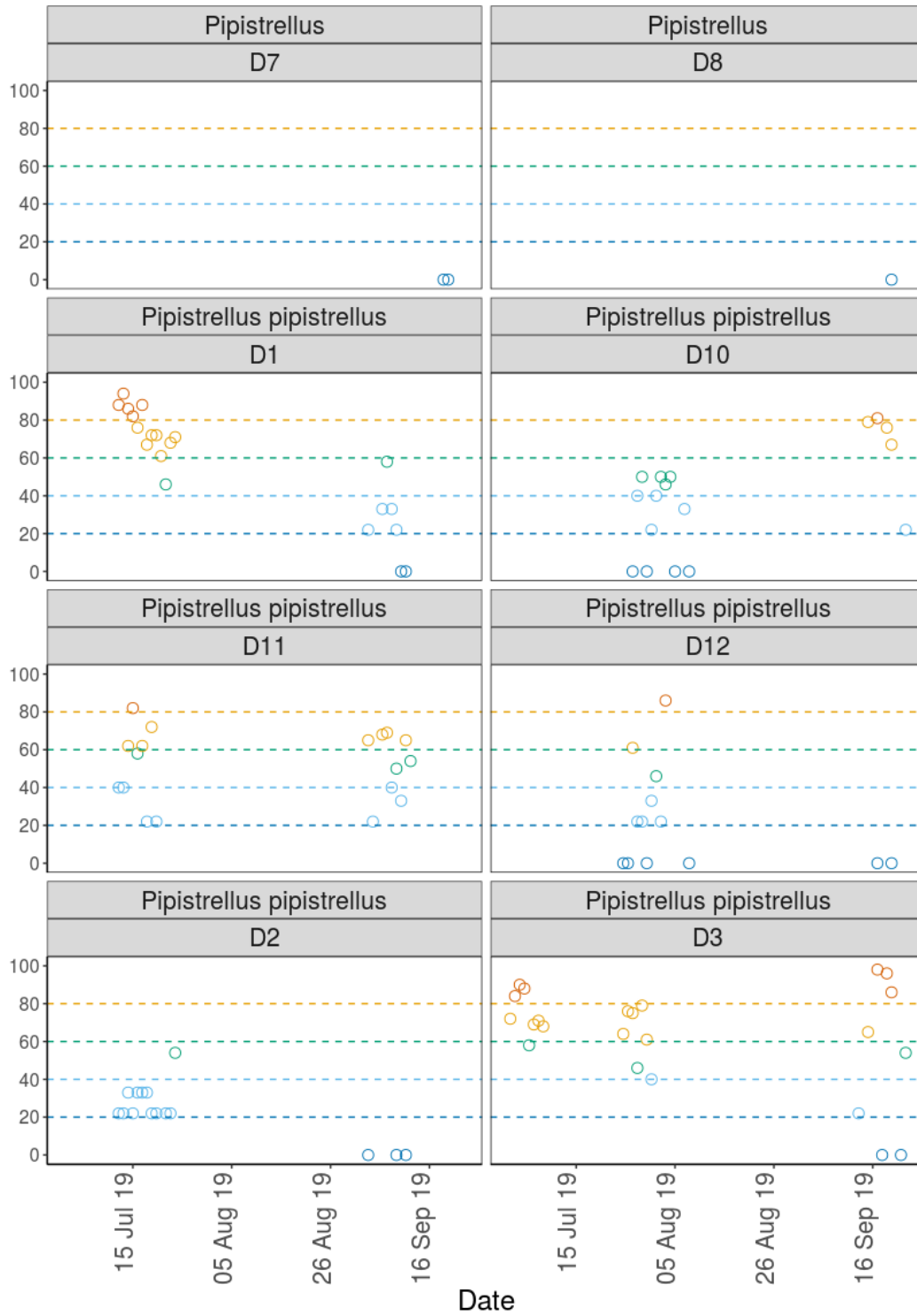


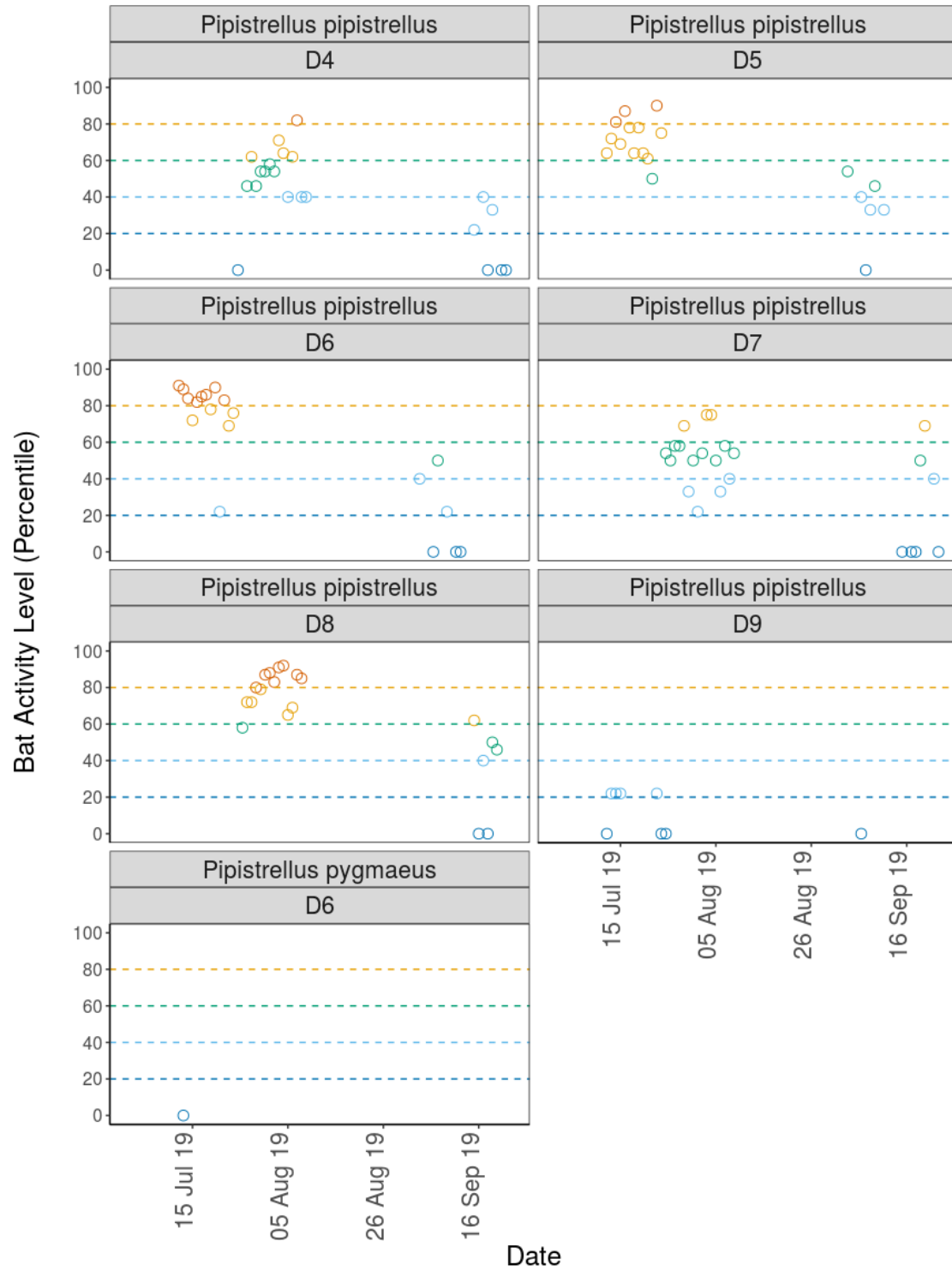
**Figure 1.** Differences in activity between static detector locations, split by species and location. The centre line indicates the median activity level whereas the box represents the interquartile range (the spread of the middle 50% of nights of activity)

Bat Activity Level (Percentile)



Bat Activity Level (Percentile)





**Figure 2.** The activity level (percentile) of bats recorded across each night of the bat survey, split by location and species.