



ARCUS

**TORRANCE WIND FARM EXTENSION II**

**TECHNICAL APPENDIX 10.3:  
BAT SURVEYS**

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## 1 INTRODUCTION

This Technical Appendix (TA) describes the methods and results of the Bat Surveys undertaken to obtain baseline ecological information, to inform the Ecological Impact Assessment (EcIA) of the proposed Torrance Wind Farm Extension II (the Proposed Development).

The following terminology is used throughout this TA:

- **The Proposed Development:** the whole physical process involved in the development of the land at Torrance Wind Farm Extension II, including construction and operation (not a piece of land);
- **The site:** all land with the potential to support the Proposed Development (as shown by the red-line boundary in Figure 1, Annex A);
- **Bat Survey Area (BSA):** accessible areas of land within and up to 200 metres (m) plus rotor radius (estimated at 100 m<sup>1</sup>) (as defined for Roost Surveys in current NatureScot guidance<sup>2</sup>) from the turbine envelope that could support features utilised by roosting or swarming bats (as shown in Figure 1, Annex A)
- **Remote Static Survey Locations (RSSLs):** positions where ultrasonic bat acoustic detectors were situated at, or in close proximity to, proposed turbine locations within the site boundary (as shown in Figure 1, Annex A).

### 1.1 Site Background

The site, centred on Ordnance Survey National Grid Reference (OSNGR) NS 90222 65493, is adjacent to the operational Torrance Wind Farm and is located approximately 1 kilometre (km) north of Harthill, North Lanarkshire (as shown in Figure 1, Annex A).

The site is dominated by agricultural land, much of which is used for livestock grazing. Within the southern half of the site, which is separated from the north by an unnamed tributary of the How Burn; an area of coniferous and mixed woodland is present. Several small watercourses are located within the BSA, and one waterbody is located immediately east of the site, south of Torrance Farm and within the footprint of the existing Torrance Wind Farm.

The site is accessed via the B718 which bisects the site north to south. Several occupied farm dwellings lie within the site boundary, including Netherton Farm, in the south of the site and Loan Farm in the centre of the site. Hill Farm and Torrance Farm are located within the BSA to the north-west and east of the site, respectively.

## 2 BASELINE METHODS

### 2.1 Desk Study

To provide context for the results of the Bat Surveys, a search was carried out in October 2021 for recent (0-20 years) biological records via The Wildlife Information Centre (TWIC) and The North Lanarkshire Biological Records Centre (BRC). A search radius of 5 km from the BSA was applied to bat species of low to medium population vulnerability wind turbines<sup>2</sup> with a 10 km search radius applied to species of high population vulnerability, such as Leisler's bat (*Nyctalus leisleri*), noctule bat (*Nyctalus noctula*) and Nathusius' pipistrelle (*Pipistrellus nathusii*).

<sup>1</sup> At the time of the baseline bat surveys the final Development design was not known; therefore, rotor radius was conservatively estimated at 100 meters. Design finalisation would later confirm rotor radius to be 84 meters.

<sup>2</sup> NatureScot. (2021) Bats and Onshore Wind Turbines: Survey, Assessment And Mitigation [online]. Available at: <[https://www.nature.scot/sites/default/files/2021-08/Bats%20and%20onshore%20wind%20turbines%20survey%20assessment%20and%20mitigation\\_0.pdf](https://www.nature.scot/sites/default/files/2021-08/Bats%20and%20onshore%20wind%20turbines%20survey%20assessment%20and%20mitigation_0.pdf)> (Accessed December 2022)

The criteria applied for the search of designated sites of ecological interest is provided in Table 1, below. Details for the designations of sites were sought from the NatureScot Site Link website<sup>3</sup>.

**Table 1: Search Criteria for Designated Sites**

Protection	Designation	Search radius
Non-statutory	Ancient Woodland Inventory (AWI)	1 km
	Site of Interest for Nature Conservation (SINC)	
	Local Nature Reserves (LNR)	
Statutory	Local Nature Reserves (LNR)	5 km
	Sites of Special Scientific Interest (SSSI)	
	National Nature Reserves (NNR)	
	Ramsar Sites	10 km
Special Area of Conservation (SAC)		

## 2.2 Field Survey

In accordance with NatureScot guidelines<sup>2</sup>, Bat Surveys were carried out between April and October 2021 (the Survey Season), with all survey work undertaken by Arcus. Lead Surveyors are members of the Chartered Institute of Ecology and Environmental Management (CIEEM) and of at least capable level of competence in undertaking bat surveys; as per CIEEM's Competency Framework<sup>4</sup>.

### 2.2.1 Roost Surveys

No Roost Surveys were carried out as woodland areas within the site, which are dominated by conifer plantation, are considered to be of extremely limited suitability for roosting bats. In addition, no buildings within the BSA will be affected by the Proposed Development, which are located within operational farms and Heart of Scotland Services and situated more than 50 m from any Development infrastructure.

### 2.2.2 Bat Activity Surveys

In accordance with current NatureScot guidance<sup>2</sup>, a ground-level static survey was undertaken to identify the species assemblage and activity levels at the site (the Remote Static Survey). A total of ten bat detectors, full spectrum Anabat Swift bat detectors (hereby referred to as Anabats), were deployed at ground-level (detectors secured to 1 m high posts or existing fence lines within the BSA) for a minimum of ten consecutive nights each season. The Anabats were set to record from approximately half an hour before sunset until approximately half an hour after sunrise.

The Survey Season comprised of the following three seasonal Survey Sessions, as defined in current NatureScot guidance<sup>2</sup>;

- Survey Session 1: April/May (Spring);
- Survey Session 2: June-mid-August (Summer); and,
- Survey Session 3: Mid-August-October (Autumn).

Remote Static Surveys were undertaken across the three Survey Sessions in 2021 (see Table 2).

<sup>3</sup> NatureScot (2021) *SiteLink*. Available online at <https://sitelink.nature.scot/home> [Accessed November 2021]

<sup>4</sup> CIEEM. (2021) *Competency Framework*. Chartered Institute of Ecology and Environmental Management [online]. Available at: <https://cieem.net/wp-content/uploads/2022/01/Competency-Framework-2022-Web.pdf> (accessed December 2022).

**Table 2: Remote Static Survey Dates**

Survey Session	Deployment Period	Survey Hours (per Anabat)	Survey Hours (per Session)
<b>1 (spring)</b>	14/04/2021 – 27/04/2021	143.65	1436.5
<b>2 (summer)</b>	09/06/2021 - 23/06/2021	113.82	1138.2
<b>3 (autumn)</b>	17/08/2021 - 30/08/2021	134.29	1187.95
<b>Total</b>			<b>3762.65</b>

In order to collect comparative data, all ten Anabats were deployed at the same Remote Static Survey Locations (RSSL), labelled RSSL A-J, across each Survey Sessions (as described in Table 3; and shown on Figure 1, Annex 1). Anabats were also located to allow for comparisons in recorded bat activity between two broad dominant habitat types; these are defined as open (i.e., open areas lacking high value linear habitat features with 50 m), or edge (i.e., within 50 m of woodland edges, or a linear feature such as a hedgerow or watercourse).

**Table 3: Remote Static Survey Locations**

RSSL ID	Habitat Description	Location to Current Site and Layout	Habitat Type
A	On fence line facing burn, in area of farmland.	Outside Site Boundary	Edge
B	Within forest ride, facing farmland.	Next to proposed turbine	Edge
C	On fence line within grazed pasture.	Outside Site Boundary	Open
D	On fence line within grazed pasture.	On proposed recreational path	Open
E	Within broadleaved woodland.	Next to proposed turbine	Edge
F	On fence line within grazed pasture.	Outwith proposed layout	Open
G	Edge of plantation forest.	Next to proposed turbine	Edge
H	On fence line within grazed pasture, next to How Burn.	Next to proposed turbine	Edge
I	On fence line within grazed pasture.	Outwith proposed layout	Open
J	Within forest ride.	Next to proposed turbine	Edge

## 2.3 Data Analysis

### 2.3.1 Bat Call Analysis

Ultrasonic recordings captured during all activity surveys were subject to detailed analysis using audio software BatExplorer and Anabat Insight, with reference to bat species call identification guidance<sup>5</sup>, to enable identification of bat species.

<sup>5</sup> Russ, J (2012) British Bat Calls: A Guide to Species Identification. Pelagic Publishing

Although analysis of ultrasonic recordings does enable identification of bat species, there are some limitations associated with species identification from acoustic monitoring. Echolocation calls from bats in the same genus often exhibit a large degree of overlap in their call structures, making definitive identification difficult. Additionally, a bat will vary the structure of its echolocation calls to reflect its needs. This behaviour results in a large degree of variation in the call structure of any given bat species and can also result in the structure of echolocation calls overlapping with those of other bat species.

Other limiting factors which may affect the recording of a bat echolocation call include (but are not strictly limited to):

- The distance and direction of the bat in relation to a bat detector;
- The amount and type of 'clutter' in the vicinity of a bat detector;
- Weather conditions; and
- The frequency response of the bat detector microphone.

There is significant overlap in the call parameters between the two most common Scottish bat species; soprano pipistrelle (*Pipistrellus pygmaeus*) and common pipistrelle (*Pipistrellus pipistrellus*)<sup>7</sup>, therefore where this overlap exists, identifications may be restricted to genus level, and defined as *Pipistrellus* species (sp.).

Anabat bat detectors record bat echolocation as individual files containing bat calls within set periods of time (up to a maximum of 20 seconds), as opposed to the total individual bat calls. Additionally, it is often difficult (or not possible in the case of remote monitoring), to distinguish between a single bat passing the detector several times and several bats passing once in succession. Following identification and analysis, bat data is quantified as the number of files recorded containing bat calls (bat files), not the number of actual calls in real time. Following analysis, baseline data was interpreted to give an indication of bat activity. Remote Static Survey data was expressed using an index known as the Bat Activity Index (BAI).

### **2.3.2 Bat Activity Index (BAI)**

The length of the night (hours of darkness) varies throughout the Survey Season by up to 40%, and thus the period over which bats may be active also varies significantly. As Remote Static Surveys are carried out over at least ten nights, the survey period of each Survey Session will be seen to vary. In order to carry out more detailed interpretation of the results, this temporal bias requires some correction. To correct for temporal bias in levels of bat activity, all bat Remote Static Survey data was interpreted using the BAI.

Within this report, the value of the BAI is expressed as passes (i.e., bat files) per hour (pph). The BAI may not identify the overall abundance of bats (i.e., in terms of absolute number of registrations), but it helps to identify the highest intensities of habitat use by bats during the available recording time. Through the application of the BAI, data can be interpreted by RSSL, taxa, habitat feature or Survey Session, and used to determine spatial patterns in activity within the BSA, as well as temporal patterns across the Survey Season.

BAI was calculated for each RSSL by dividing the number of recorded Anabat files by the total number of sampling hours (between 0.5 hours before sunset to 0.5 hours after sunrise), to provide the mean number of bat pph.

The mean BAI for each Survey Session recorded across all RSSL was calculated by dividing the number of recorded Anabat files by the total number of detector hours per session (total session sampling hours multiplied by number of detectors).

The mean BAI across the Survey Season, for example BAI per species, was calculated by dividing the number of recorded Anabat files across the Survey Season per species, by



the total number of detector hours across the total Survey Season (sampling hours multiplied by number of detectors).

A summary of the bat activity recorded during Remote Static Surveys expressed by BAI, is presented in Table 7. This table presents the mean BAI per RSSL across all three Survey Sessions. A table presenting the levels of activity expressed as BAI per species at each RSSL during each Survey Session is presented in Annex C (Table C2).

### 2.3.3 Ecobat

A measure of relative bat activity was obtained using the online tool Ecobat<sup>6</sup>. The tool compares the data from the BSA with bat survey information collected from similar areas at the same time of year. Ecobat uses the total bat passes for each night for each species and compares this to the values in the systems reference database. Ecobat generates a percentile rank for each night of activity and its associated level of relative bat activity.

Based on the median percentile Ecobat uses the following categories to define bat activity:

- low activity: 0-20th percentiles;
- low to moderate activity: 21st-40th percentiles;
- moderate activity: 41st-60th percentiles;
- moderate to high activity: 61st-80th percentiles; and
- high activity: 81st-100th percentiles.

The reference database includes surveys from the National Bats and Wind Turbine Project and other research studies, as well as data submitted by users. Each output is given an associated Reference Range, which is the number of nights for each bat species that the data were compared to. A Reference Range of over 200 is recommended to be confident in the relative activity level. However, the reference range depends on the number of records held within the Ecobat database for a given species in a given area.

The Reference Range was stratified to include:

- Records from all time periods.
- Only records from within 100 km radius of the survey location.
- Records using any make of bat detector.

### 2.3.4 Risk Assessment

Bat activity and the presence of species of high population vulnerability are not the only factors when considering potential impacts at a wind farm site. NatureScot guidance<sup>Error! Bookmark not defined.</sup> describes a two-stage process for assessing the site-based risk factors and potential impacts of a wind farm development on bats.

An initial site risk assessment determines the potential site risk based on a consideration of habitat and development-related features, based on the criteria summarised in Table 4.

**Table 4: Criteria for Initial Site Risk Assessment \***

Site Risk (1-5) **	Project Size			
		Small	Medium	Large
Habitat Risk	Low	1	2	3
	Moderate	2	3	4
	High	3	4	5

<sup>6</sup> The Mammal Society (2017). Ecobat. Available at: <http://www.ecobat.org.uk/>. Accessed on: November 2022.

**Key:** Green (1-2) - low/lowest site risk; Amber (3) - medium site risk; Red (4-5) - high/highest site risk.  
**\*\*** Some sites could conceivably be assessed as being of no (0) risk to bats. This assessment is only likely to be valid in more extreme environments, such as above the known altitudinal range of bats, or outside the known geographical distribution of any resident British species.

Habitat Risk	Description
Low	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
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 (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
Small	Small scale development (≤10 turbines). No other wind energy developments within 10 km. Comprising turbines <50m in height.
Medium	Larger developments (between 10 and 40 turbines). May have some other wind developments within 5 km. Comprising turbines 50-100m in height.
High	Largest developments (>40 turbines) with other wind energy developments within 5 km. Comprising turbines >100m in height.

\* As informed by published guidelines **Error! Bookmark not defined.** current scientific research and professional opinion of Arcus ecologists.

As described in Table 5, an overall risk assessment is then established by considering the site assessment in relation to the bat activity output from Ecobat, combined with the relative population vulnerability of each species of bat present. In addition, the overall risk assessment is determined in conjunction with the professional judgement of Arcus.

**Table 5: Criteria for Overall Risk Assessment**

Site Risk	Nil (0)	Low (1)	Mod-Mod (2)	Moderate (3)	Mod-High (4)	High (5)
Lowest (1)	Low (0)	Low (1)	Low (2)	Low (3)	Low (4)	Medium (5)
Low (2)	Low (0)	Low (2)	Low (4)	Medium (6)	Medium (8)	Medium (10)
Medium (3)	Low (0)	Low (3)	Medium (6)	Medium (9)	Medium (12)	High (15)
High (4)	Low (0)	Low (4)	Medium (8)	Medium (12)	High (16)	High (20)

Highest (5)	Low (0)	Medium (5)	Medium (10)	High (15)	High (20)	High (25)
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## 2.4 Survey Limitations

### 2.4.1 Roost Surveys

Woodland within the BSA is dominated by conifer plantation that is considered to be of low suitability to bats; with Sitka spruce not typically producing features (e.g. gaps or cavities in its trunk or bark) that could be used by roosting bats<sup>7</sup>. As per NatureScot guidance<sup>1</sup>, trees categorised as having Low suitability to support roosting bats are unlikely to support significant roosts and, if present, would not be subject to further assessment until the pre-construction stage. Surveyors also considered the suitability of other trees encountered during wider protected species; although, none were recorded (as described in Technical Appendix 10.2: Protected Species Surveys). Therefore, whilst a roost survey of conifer plantation was not completed, this is not considered to be a significant limitation.

The need for Roost Surveys was originally based on an indicative site layout comprising ten proposed turbines. Through design development, the site boundary was largely reduced to reflect a reduction in the number of proposed turbines from ten to four (as shown on Figure 1, Annex A); although, a new cycleway was included within the Proposed Development after baseline surveys were completed.

There is a stone-built bridge located in the north, adjacent to the site near Loan Birch Wood (as shown on Figure 1, Annex A). The bridge is located outwith the BSA (over 300 m from the nearest proposed turbine) and will not be physically affected by the Proposed Development. A single-lane road passes over the bridge, which will not be the primary route for construction-related traffic (main Site access will be taken from Harthill Services). Given the distance between Development infrastructure and the bridge, it is unlikely that the temporary construction work would cause a significant change to the levels of disturbance over and above what any potential roost within the bridge is already exposed to. Therefore, whilst a roost survey of the bridge was not completed, this is not considered to be a significant limitation. However, should there be potential for the Proposed Development to affect the bridge; further surveys may be required to verify the presence or likely absence of roosting bats in potential roost features and ensure suitable mitigation measures are implemented during the construction to safeguard roosting bats.

Within the site there are also several farm dwellings; however, only one of these, Netherton Farm, is situated within the BSA. The buildings are located at the periphery of the BSA (near Remote Static Survey Location B on Figure 1, Annex A). None of the buildings at Netherton Farm will be physically affected by the Proposed Development. Furthermore, any bats utilising potential roost features within Netherton Farm will be habituated to the level of disturbance that a busy, operational farm would typically incur. Given the distance between Development infrastructure and Netherton Farm, it is unlikely that the temporary construction work in these areas would cause a significant change to the levels of disturbance over and above what any potential roost within Netherton Farm is already exposed to. Therefore, whilst a roost survey of buildings at Netherton Farm was not completed, this is not considered to be a significant limitation. However, should there be potential for the Proposed Development to affect buildings at Netherton Farm; further surveys may be required to verify the presence or likely absence of roosting bats in potential roost features and ensure suitable mitigation measures are implemented during the construction to safeguard roosting bats.

<sup>7</sup> Andrews (2018) Bat Roosts in Trees; A guide to identification and assessment for tree-care and ecology professionals. Pelagic Publishing

### **2.4.2 Remote Static Surveys**

The Remote Static Surveys were originally based on a greater number of proposed turbines and a more extensive Site boundary. Through design development, the number of proposed turbines was reduced from ten to four, and the site boundary also reduced to reflect these changes.

The Remote Static Survey for bats was based on an indicative site layout comprising ten proposed turbines, with a total of ten bat acoustic detectors located as close as possible to each proposed turbine location. Where possible, detectors were situated close to habitat features of value to foraging/commuting bats to help provide a representative sample of bat activity. As a result of design development, some proposed turbine locations have been micro-sited a small distance away from the bat acoustic detectors. However, proposed turbine locations remain in close proximity to habitat features that the position of bat acoustic detectors was also referenced against (e.g. woodland edges, lines of trees, field margins, etc.). Therefore, minor changes in proposed turbine locations are not considered to present a significant limitation.

It is noted that a small area of the site boundary extends into the Heart of Scotland Services, close to the eastbound off-slip from the M8 motorway. This minor change to the site boundary was a result of design development. Bat Surveys were not undertaken within this area of Heart of Scotland Services, which largely comprises hard standing and maintained grassland verge. The high-speed motorway likely presents a significant barrier to animal dispersal from potential habitats to the south of the major road corridor. Small areas not surveyed within Heart of Scotland Services are likely to be subject to high levels of disturbance from regular vehicle usage and, as such, not likely to regularly utilised by bats. Therefore, this is not considered to be a significant limitation.

### 3 BASELINE RESULTS

#### 3.1 Desk Study

##### 3.1.1 Designated Sites

No statutory nor non-statutory sites designated for bats were identified within the Desk Study Area.

##### 3.1.2 Bat Species Records

Table 6 provides a summary of bat species recorded within a 5 km radius of the BSA, as returned by TWIC and North Lanarkshire BRC. No species of high potential vulnerability (i.e., *Nyctalus* sp. or *Nathusius'* pipistrelle) identified within 10 km of the BSA.

**Table 6: Bat Records within Desk Study Area**

Species	Conservation Status	Nearest record to BSA	Year of Record(s)
Common Pipistrelle	EPS <sup>8</sup> , SBL <sup>9</sup> , LBAP <sup>10</sup>	1 km grid square within north-east BSA	2005-2019 (56 records)
Soprano Pipistrelle	EPS, SBL, LBAP	"	2008-2019 (56 records)
<i>Pipistrellus</i> sp.	EPS, SBL, LBAP	"	2007-2011 (29 records)
<i>Myotis</i> sp.	EPS, SBL, LBAP	"	2007-2019 (12 records)
Natterer's Bat	EPS, LBAP	"	2010 (1 record)

#### 3.2 Field Surveys

##### 3.2.1 Remote Static Surveys

A total of 2,217 bat passes (see Table C1 Annex C) were recorded over a total of 3917.6 survey hours across the Survey Season, giving a 'total mean BAI' (across the Survey Season by location as well as the mean across each of the RSSL's by Survey Season) of 0.57 passes per hour (pph).

The following species/genus were detected within the BSA:

- Common pipistrelle;
- Soprano pipistrelle;
- *Myotis* sp.; and
- *Nyctalus* sp.

Of the total activity recorded, the majority (57.60 %) was attributed to common pipistrelle, with 40.96 % attributed to soprano pipistrelle. Both *Myotis* sp. And *Nyctalus* sp. Were recorded infrequently, making up 0.90 % and 0.54 % of the total activity recorded, respectively. Table 7, overleaf provides a summary of the Mean Bat Activity Index across the site.

<sup>8</sup> European Protected Species, Habitats Regulations (1994) Available online at <http://www.legislation.gov.uk/ukxi/1994/2716/contents/made> [Accessed 11/01/20]

<sup>9</sup> Scottish Government (2020) Scottish Biodiversity List. Available at: <https://www.nature.scot/doc/scottish-biodiversity-list>. Accessed on: October 2022.

<sup>10</sup> North Lanarkshire Council (2014) Local Biodiversity Action Plan. Available at <https://www.northlanarkshire.gov.uk/leisure-parks-and-culture/countryside-and-parks/countryside-management-and-biodiversity-0/our-local-biodiversity>

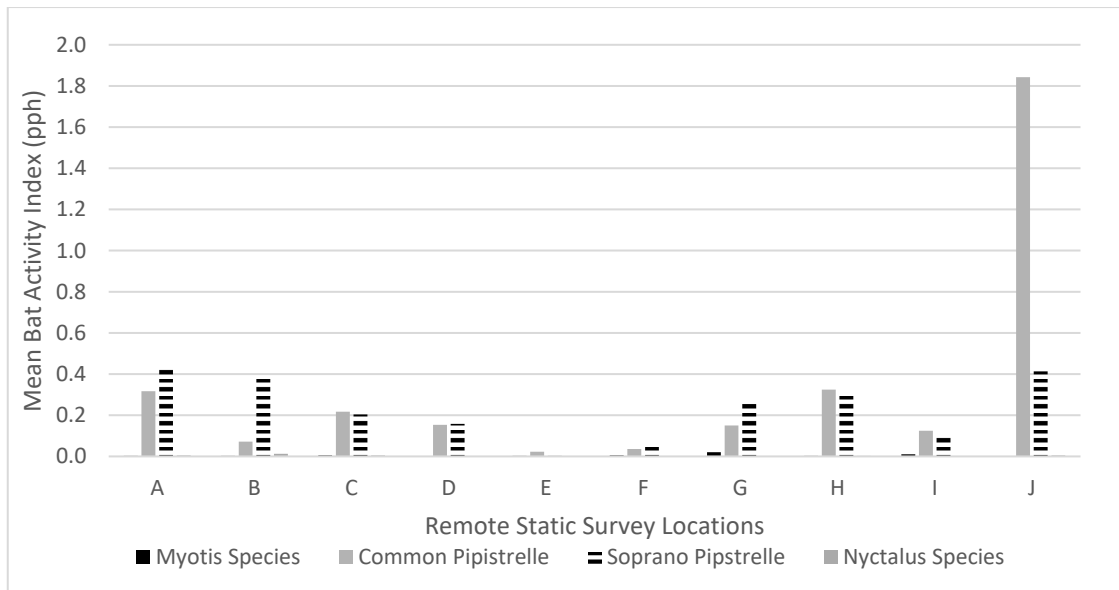
**Table 7: Summary of Mean Bat Activity Index**

RSSL	Common Pip	Soprano Pip	Myotis Sp.	Nyctalus Sp.	Mean Total
<b>A</b>	0.32	0.43	0.00	0.01	0.75
<b>B</b>	0.07	0.39	0.00	0.01	0.47
<b>C</b>	0.22	0.20	0.01	0.01	0.43
<b>D</b>	0.15	0.16	0.00	0.00	0.31
<b>E</b>	0.02	0.00	0.00	0.00	0.03
<b>F</b>	0.04	0.06	0.01	0.00	0.10
<b>G</b>	0.15	0.26	0.02	0.00	0.43
<b>H</b>	0.32	0.31	0.00	0.00	0.64
<b>I</b>	0.13	0.10	0.01	0.00	0.24
<b>J</b>	1.84	0.41	0.00	0.01	2.26
Survey Session	Common Pip	Soprano Pip	Myotis Sp.	Nyctalus Sp.	Mean Total
<b>1 (spring)</b>	0.03	0.03	0.00	0.00	0.06
<b>2 (summer)</b>	0.57	0.31	0.00	0.01	0.89
<b>3 (autumn)</b>	0.43	0.38	0.01	0.00	0.83
<b>Season</b>	<b>0.33</b>	<b>0.23</b>	<b>0.01</b>	<b>0.01</b>	<b>0.57</b>

The design of Remote Static Surveys allowed for the collection of comparative datasets sufficient to draw robust conclusions on spatial and temporal distributions of bat activity across the site during the Survey season. A summary of these distributions is detailed in Sections 3.2.1.1 and 3.2.1.2.

### 3.2.1.1 Spatial Variation in Bat Activity

During the Survey Season bat activity was recorded at every RSSL, however, notable spatial variation in the level of activity was evident (as shown on Chart 1). Three of the RSSLs recorded mean activity levels above the total mean BAI (0.57 pph), these were RSSLs A (0.75 pph), H (0.64 pph) and J (2.62 pph). Activity at these three RSSLs constituted 64.45 % of all bat passes recorded. All of these RSSLs were situated within edge habitat, with RSSL J was positioned within a woodland ride, RSSL A located on a fence line within close proximity to a small burn and RSSL H situated on a fence in an open field near How Burn (as shown on Figure 1, Annex A). Both woodland and watercourses are considered to be attractive navigational features for commuting bats as well as providing foraging opportunities.



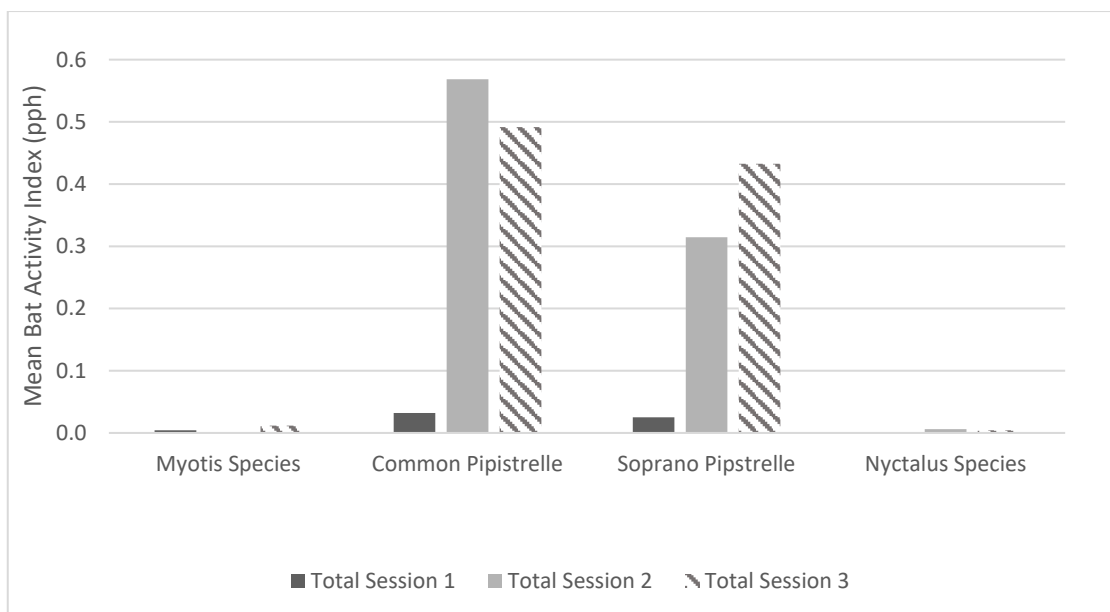
**Chart 1: Spatial Variation in Total Bat Activity (mean BAI) across the Survey Season**

### 3.2.1.2 Temporal Variation in Bat Activity

In addition to spatial variation, bat activity recorded notable temporal variation in the overall levels of bat activity, as well as the species abundances recorded. Session 1 recorded the lowest number of bat passes at just 88, representing only 3.97 % of the total activity recorded across the whole Survey Season. Activity levels across Session 2 and Session 3 were broadly similar with 1,012 bat passes and 1,117 bat passes recorded, respectively. This equates to 45.65 % and 50.38 % of the total activity recorded, respectively.

Due to longer day length during the summer months (and therefore less hours of darkness in which bats are active), it should be noted that the number of survey hours during Session 2 was less than Sessions 1 and 3 (as shown in Table 3). However, this temporal bias is accounted for within the BAI to enable comparisons between each Survey Sessions (Annex C, Table C2). Therefore, Session 2 has a total mean BAI of 0.89 pph, compared with that of Session 1, mean BAI (0.06 pph) and Session 3 has a mean BAI (0.83 pph).

Species abundances were broadly consistent through the Survey Season; with common and soprano pipistrelle dominating the species recorded.



**Chart 2: Temporal Variation in Total Bat Activity (mean BAI) across the Survey Season**

## 4 ECOBAT ASSESSMENT

### 4.1 Site Wide Analysis Summary

Table 8 presents a summary of the total number of bat passes recorded for each species/genus across all RSSLs, based on the total number of nights that activity was recorded. Overall, based on the median percentile, both *Myotis* and *Nyctalus* sp. bats were within the Low activity category whereas common and soprano pipistrelle were recorded within the Moderate activity category.

**Table 8: Summary of median and maximum percentiles for each bat species recorded within the BSA throughout the Survey Season**

Species	Median Percentile	95% CIs	Maximum Percentile	Nights Recorded
Common pipistrelle	55 (Moderate)	66.5 - 84.5	98 (High)	159
Soprano pipistrelle	55 (Moderate)	59 - 80.5	95 (High)	159
<i>Myotis</i> sp.	2 (Low)	2 - 2	55 (Moderate)	18
<i>Nyctalus</i> sp.	2 (Low)	2 - 2	55 (Moderate)	8

Table 9, overleaf, shows the distribution of activity for each species/genus, based on the total number of nights that activity was recorded; and classified using the Ecobat activity categories. The only species recorded to have nights of High activity were common and soprano pipistrelle; however, nights of High activity represented less than 20 % and 15 % respectively for these species.



**Table 9: Summary of the nights of bat recordings throughout the Survey Season within each activity category**

Species	Nights of Activity				
	High	Moderate/ High	Moderate	Low / Moderate	Low
Common pipistrelle	30	39	43	0	47
Soprano pipistrelle	21	56	42	0	40
Myotis sp.	0	0	1	0	17
Nyctalus sp.	0	0	3	0	5

## 4.2 Spatial and Temporal Variation of Bat Activity

### 4.2.1.1 Common pipistrelle

RSSL J recorded a 'High' level of activity for common pipistrelle, which as discussed in Section 3.3.1.1 RSSL J recorded the highest levels of activity of all detector locations. A further two locations categorised as 'Moderate to High' activity, the majority of which were associated with forest edge habitats. Conifer plantation edges are known to offer suitable commuting and foraging habitat. The remaining seven locations recorded 'Low', 'Low to Moderate' and 'Moderate' levels of activity. The highest levels of activity overall (Moderate) were recorded in autumn, with activity levels lowest (Low-Moderate) in spring.

### 4.2.1.2 Soprano pipistrelle

'Moderate to High' levels of activity were recorded for soprano pipistrelle at four locations within the BSA during the surveys, most of which were associated with conifer plantation edge habitats, known to offer suitable commuting and foraging habitat. The remaining six locations recorded 'Low', 'Low to Moderate' or 'Moderate' levels of activity. As with common pipistrelle, the highest levels of activity (Moderate-High) overall were recorded in autumn, with activity levels extremely low (Low) in spring.

### 4.2.1.3 Nyctalus species

'Low to Moderate' levels of activity were recorded for *Nyctalus* sp. At two locations within the BSA during the surveys, both of which are outwith the site. Three other locations recorded 'Low' levels of activity with the remaining five locations recording no activity. There was some temporal variation determined, with activity levels highest (Low-Moderate) in summer and lowest in spring (no passes).

### 4.2.1.4 Myotis species

'Low' levels of activity were recorded for *Myotis* spp. at eight locations within the BSA during the surveys, with the remaining two locations recording no activity. There was some temporal variation determined, with activity levels highest (Low-Moderate) in autumn and lowest in summer (no passes).

## 5 RISK ASSESSMENT

### 5.1.1.1 Initial Site Risk Assessment

Based on the Low habitat risk and Small project size, the Proposed Development is considered to present a Low risk to bats, achieving an initial risk assessment score of 2; based on the assessment criteria described in Table 4

### 5.1.1.2 Overall Risk Assessment

Evaluating the overall site risk of a bat population to wind farms is based on two factors: Ecobat activity level recorded and initial site risk level. These factors are multiplied to generate an overall risk assessment score per species of either Low (0-4), Moderate (5-12) or High (15 – 25), refer to Table 5

The Ecobat assessment identified average site activity levels (median and maximum percentiles) for the following bat species:

- Common pipistrelle: Medium (score of 3) to High (score of 5);
- Soprano pipistrelle: Medium (score of 3) to High (score of 5);
- *Myotis sp.*: Low (score of 0) to Medium (score of 3); and
- *Nyctalus sp.*: Low (score of 0) to Medium (score of 3).

By multiplying the above Ecobat risk assessment scores with the initial risk assessment score of 2, the following risk assessment score for 'Median' and 'Maximum' percentiles was obtained for the following bat species.

- Common pipistrelle: Medium (6) to Medium (10);
- Soprano pipistrelle: Medium (6) to Medium (10);
- *Nyctalus sp.*: Low (2) to Medium (6); and
- *Myotis sp.*: Low (2) to Medium (6).

## 6 DISCUSSION

### 6.1 Species

The Remote Static Survey recorded at least four species of bat utilising habitats within the BSA including common pipistrelle, soprano pipistrelle, *Myotis sp.* and *Nyctalus sp.* Approximately 98 % of bat calls were identified as either common pipistrelle or soprano pipistrelle.

The collision vulnerability of different bat species when considering the impact of new wind farm developments, based on the criteria described in NatureScot guidance<sup>Error! Bookmark not defined.</sup> and Wray *et al.* 2010<sup>11</sup>, is:

- Common pipistrelle – widespread in Scotland with High Risk of collision;
- Soprano pipistrelle – widespread in Scotland with High Risk of collision;
- *Myotis sp.* – rare in Scotland with Low Risk of collision; and
- *Nyctalus sp.* – rare in Scotland with High Risk of collision.

*Pipistrellus* and *Nyctalus* species of bat are the most vulnerable that frequently forage and commute over tree-lines at potential collision height with wind turbines. However, it should also be noted that the majority of flights for both common pipistrelle and soprano pipistrelle (the dominant species recorded within the site) are typically between 2 m and 10 m above the ground<sup>12,13</sup>.

<sup>11</sup> Wray, S., Wells, D., Long, E. and Mitchell-Jones, T. (2010) *Valuing Bats in Ecological Impact Assessment*. Institute of Ecology and Environmental Management. In Practice (70), p. 23-2

<sup>12</sup> BCT. (2010) *Species Factsheets: Soprano pipistrelle*. Bat Conservation Trust [online]. Available at: <https://www.bats.org.uk/about-bats/what-are-bats/uk-bats> (accessed December 2022).

<sup>13</sup> BCT. (2010) *Species Factsheets: Common pipistrelle*. Bat Conservation Trust [online]. Available at: <https://www.bats.org.uk/about-bats/what-are-bats/uk-bats> (accessed December 2022).

## 6.2 Site Utilisation

The Remote Static Survey recorded a total mean BAI of 0.57 pph, which approximates to one bat pass every hour and 41 minutes in real time.

RSSLs J, A and H recorded the highest activity and BAI scores for all species. These locations were all edge habitats in close proximity to woodland, trees and/or watercourses. RSSLs E, F and I recorded the lowest activity and BAI scores for all species, which was in the western extent of the BSA where linear features are less extensive.

Session 2 (summer) recorded the highest mean total BAI score (see Table 7), while Session 3 (autumn) received the highest activity levels for most species (excluding *Nyctalus* sp.) by looking at the median percentiles from Table B2, Annex B. Session 1 (spring) recorded the lowest BAI and activity levels for most species (excluding *Myotis* sp.).

## 7 CONCLUSION

The BSA was dominated by common and widespread bat species (*Pipistrellus* sp.); considered to be of Medium population vulnerability<sup>Error! Bookmark not defined.</sup> in terms of the Proposed Development.

In summary, habitats throughout the BSA were considered to offer extremely limited suitability for roosting bats and Low suitability for foraging and commuting bats. The outcome of the overall risk assessment is that the Proposed Development presents a 'Medium' risk to common pipistrelle and soprano pipistrelle; and 'Low to Medium' risk to *Myotis* and *Nyctalus* species of bats.

## **ANNEX A**

### **Figures**

- Figure 1: Bat Survey Area and Remote Static Survey Locations (RSSL)





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- Site Boundary
- Future Application Boundary
- Bat Survey Area (300m Buffer of Turbine Envelope)
- Remote Static Survey Locations
- ⊕ Proposed Turbine Location
- + Bridge with Potential Roost Features

1:9,500 Scale @ A3

Produced By: ST	Ref: 3959-REP-024
Checked By: SC	Date: 2/16/2023

**Bat Survey Area and RSSLs**  
 Figure 10.3.1



## ANNEX B

### Ecobat Analysis of Spatial Variation in Bat Activity

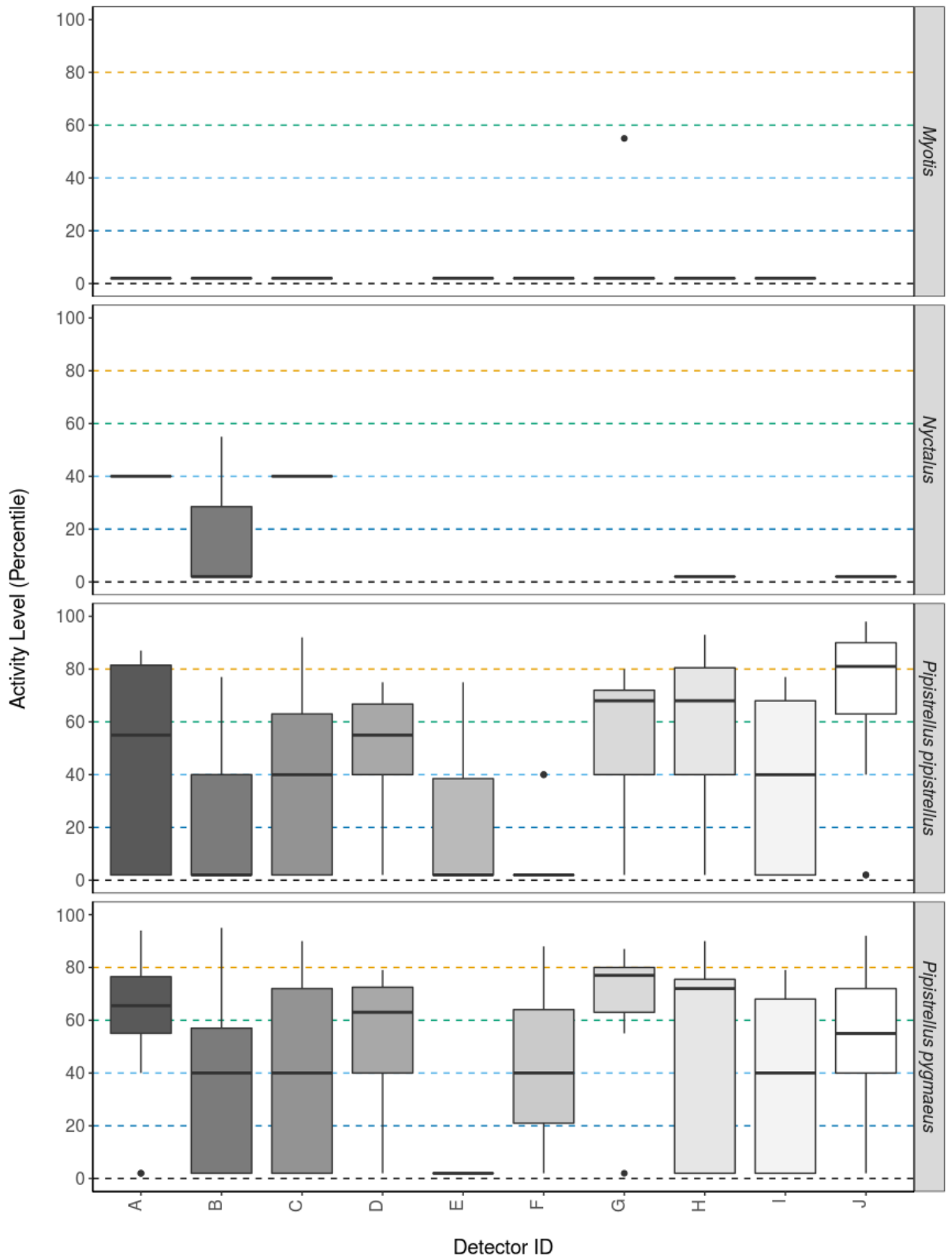
Table B1 below shows the Ecobat output of key metrics for each bat species recorded at each RSSL within the BSA.

**Table B1: Median and maximum percentiles for each species at each RSSL**

Detector Location	Species	Median Percentile	95% CIs	Maximum Percentile	Nights Recorded	Reference Range
A	<i>Myotis</i> sp.	2	0	2	1	3,551
	<i>Nyctalus</i> sp.	40	0	40	1	2,660
	Common pipistrelle	55	28.5 - 67.5	87	19	7,443
	Soprano pipistrelle	66	51.5 - 72.5	94	22	11,480
B	<i>Myotis</i> sp.	2	0	2	1	3,551
	<i>Nyctalus</i> sp.	2	2 - 2	55	3	2,660
	Common pipistrelle	2	2 - 28.5	77	14	7,443
	Soprano pipistrelle	40	28.5 - 51.5	95	28	11,480
C	<i>Myotis</i> sp.	2	2 - 2	2	2	3,551
	<i>Nyctalus</i> sp.	40	0	40	1	2,660
	Common pipistrelle	40	21 - 51.5	92	20	7,443
	Soprano pipistrelle	40	21 - 60.5	90	17	11,480
D	Common pipistrelle	55	32.5 - 61.5	75	18	7,443
	Soprano pipistrelle	63	32.5 - 70	79	15	11,480
E	<i>Myotis</i> sp.	2	0	2	1	3,551
	Common pipistrelle	2	2 - 2	75	3	7,443
	Soprano pipistrelle	2	0	2	1	11,480
F	<i>Myotis</i> sp.	2	2 - 2	2	2	3,551
	Common pipistrelle	2	2 - 21	40	9	7,443
	Soprano pipistrelle	40	2 - 88	88	3	11,480
G	<i>Myotis</i> sp.	2	2 - 2	55	6	3,551
	Common pipistrelle	68	40.5 - 72.5	80	13	7,443
	Soprano pipistrelle	77	59 - 80.5	87	13	11,480
H	<i>Myotis</i> sp.	2	0	2	1	3,551

Detector Location	Species	Median Percentile	95% CIs	Maximum Percentile	Nights Recorded	Reference Range
	<i>Nyctalus</i> sp.	2	0	2	1	2,660
	Common pipistrelle	68	40 - 76	93	15	7,443
	Soprano pipistrelle	72	37 - 72	90	19	11,480
I	<i>Myotis</i> sp.	2	2 - 2	2	4	3,551
	Common pipistrelle	40	21 - 58.5	77	15	7,443
	Soprano pipistrelle	40	21 - 65.5	79	12	11,480
J	<i>Nyctalus</i> sp.	2	2 - 2	2	2	2,660
	Common pipistrelle	81	66.5 - 84.5	98	33	7,443
	Soprano pipistrelle	55	39.5 - 63	92	29	11,480

The information within Table B1 is also represented graphically in the boxplot depicted by Chart B1.



**Chart B1: Boxplot displaying the spatial variation in the activity level (percentile) of bats recorded. 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).**



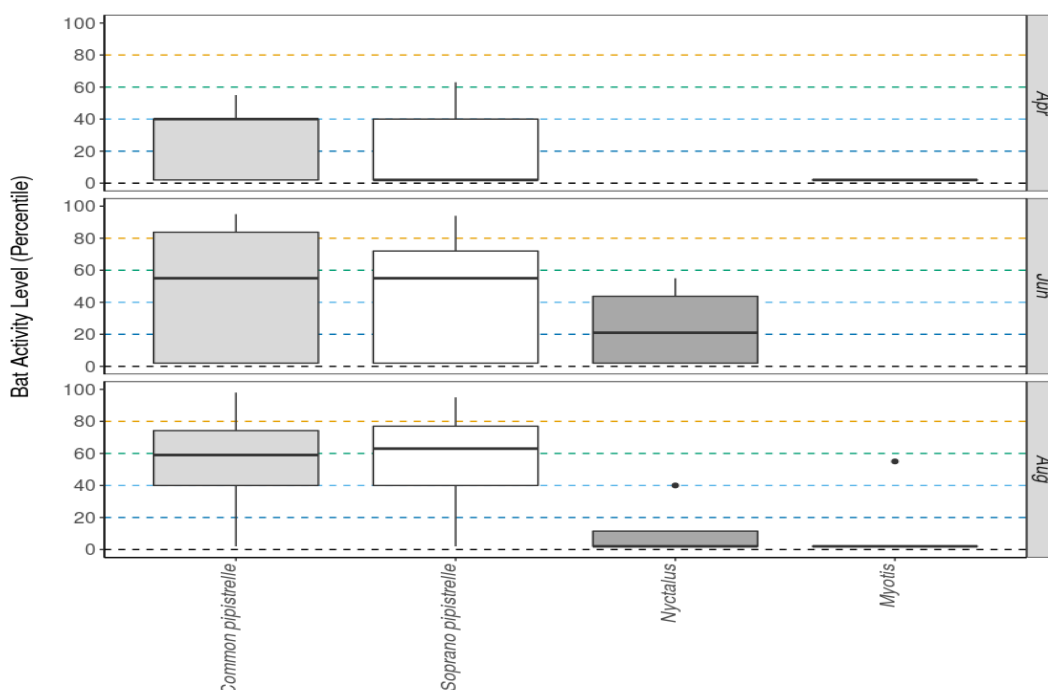
### Ecobat Analysis of Temporal Variation in Bat Activity

Table B2 shows the Ecobat output of key metrics for each bat species recorded throughout each Survey Session.

**Table B2: Median and maximum percentiles for each species during each Survey Session**

Survey Session	Species	Median Percentile	95 % CIs	Maximum Percentile	Nights Recorded
Spring (April)	<i>Myotis sp.</i>	2	2 - 2	2	5
	<i>Nyctalus sp.</i>	N/a	N/a	N/a	0
	Common pipistrelle	40	66.5 – 84.5	55	19
	Soprano pipistrelle	2	66.5 – 84.5	63	21
Summer (June)	<i>Myotis sp.</i>	N/a	N/a	N/a	0
	<i>Nyctalus sp.</i>	21	2 - 2	55	4
	Common pipistrelle	55	66.5 – 84.5	95	66
	Soprano pipistrelle	55	66.5 – 84.5	94	64
Autumn (August)	<i>Myotis sp.</i>	2	2 - 2	55	13
	<i>Nyctalus sp.</i>	2	2 - 2	40	4
	Common pipistrelle	59	59 – 80.5	98	74
	Soprano pipistrelle	63	59 – 80.5	95	74

The information within Table B2 is also represented graphically in the boxplot depicted by Chart B2 below.



**Chart B2: Boxplot displaying the temporal variation in the activity level (percentile) of bats recorded 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)**

## ANNEX C

### Bat Activity Data

**Table C1: Total Bat Passes recorded during Remote Static Surveys, by Taxa, Detector Location and Session.**

Session	Detector Location	<i>Myotis sp.</i>	<i>Nyctalus sp.</i>	Common Pipistrelle	Soprano Pipistrelle	Total per Location
<b>1</b>	A	1	0	1	2	<b>4</b>
	B	1	0	1	16	<b>18</b>
	C	0	0	0	0	<b>0</b>
	D	0	0	0	0	<b>0</b>
	E	0	0	0	0	<b>0</b>
	F	2	0	7	3	<b>12</b>
	G	0	0	0	0	<b>0</b>
	H	1	0	5	6	<b>12</b>
	I	0	0	4	1	<b>5</b>
	J	0	0	14	4	<b>18</b>
<b>Total Session 1</b>		<b>5</b>	<b>0</b>	<b>32</b>	<b>32</b>	<b>69</b>
<b>2</b>	A	0	2	96	119	<b>217</b>
	B	0	3	10	18	<b>31</b>
	C	0	0	51	40	<b>91</b>
	D	0	0	8	14	<b>22</b>
	E	0	0	0	0	<b>0</b>
	F	0	0	3	0	<b>3</b>
	G	0	0	0	1	<b>1</b>
	H	0	1	119	113	<b>233</b>
	I	0	0	8	3	<b>11</b>
	J	0	1	333	50	<b>384</b>
<b>Total Session 2</b>		<b>0</b>	<b>7</b>	<b>628</b>	<b>358</b>	<b>993</b>
<b>3</b>	A	0	0	12	46	<b>58</b>
	B	0	2	15	115	<b>132</b>
	C	2	2	33	40	<b>77</b>
	D	0	0	52	49	<b>101</b>
	E	1	0	9	1	<b>11</b>
	F	0	0	1	20	<b>21</b>
	G	8	0	61	101	<b>170</b>
	H	0	0	0	0	<b>0</b>
	I	4	0	37	37	<b>78</b>
	J	0	1	398	108	<b>507</b>
<b>Total Session 3</b>		<b>15</b>	<b>5</b>	<b>618</b>	<b>517</b>	<b>1,155</b>
<b>Grand Total</b>		<b>20</b>	<b>12</b>	<b>1,278</b>	<b>907</b>	<b>2,217</b>

**Table C2: The mean Nightly Pass Rate (bat passes per hour, per night) recorded during Remote Static Surveys, by Taxa and Detector Location. If NA, then no bat passes were recorded.**

Session	Detector Location	<i>Myotis sp.</i>	<i>Nyctalus sp.</i>	Common Pipistrelle	Soprano Pipistrelle	Total per Location
<b>1</b>	A	0.01	NA	0.01	0.01	<b>0.03</b>
	B	0.01	NA	0.01	0.13	<b>0.15</b>
	C	NA	NA	NA	NA	<b>0.00</b>
	D	NA	NA	NA	NA	<b>0.00</b>
	E	0.01	NA	NA	NA	<b>0.01</b>
	F	0.01	NA	0.07	0.02	<b>0.10</b>
	G	NA	NA	NA	NA	<b>0.00</b>
	H	0.01	NA	0.06	0.05	<b>0.11</b>
	I	NA	NA	0.04	0.01	<b>0.05</b>
	J	NA	NA	0.13	0.03	<b>0.16</b>
<b>Total Session 1</b>		<b>0.00</b>	<b>NA</b>	<b>0.03</b>	<b>0.03</b>	<b>0.06</b>
<b>2</b>	A	NA	0.02	0.98	1.05	<b>2.04</b>
	B	NA	0.03	0.10	0.16	<b>0.28</b>
	C	NA	NA	0.47	0.35	<b>0.82</b>
	D	NA	NA	0.07	0.12	<b>0.19</b>
	E	NA	NA	NA	NA	<b>0.00</b>
	F	NA	NA	0.03	NA	<b>0.03</b>
	G	NA	NA	NA	0.01	<b>0.01</b>
	H	NA	0.01	1.05	0.99	<b>2.05</b>
	I	NA	NA	0.07	0.03	<b>0.10</b>
	J	NA	0.01	2.93	0.44	<b>3.38</b>
<b>Total Session 2</b>		<b>NA</b>	<b>0.01</b>	<b>0.57</b>	<b>0.31</b>	<b>0.89</b>
<b>3</b>	A	NA	NA	0.09	0.34	<b>0.43</b>
	B	NA	0.01	0.11	0.86	<b>0.98</b>
	C	0.01	0.01	0.24	0.30	<b>0.57</b>
	D	NA	NA	0.39	0.36	<b>0.74</b>
	E	NA	NA	0.07	0.01	<b>0.07</b>
	F	NA	NA	0.01	0.15	<b>0.16</b>
	G	0.06	NA	0.44	0.74	<b>1.24</b>
	H	NA	NA	NA	NA	<b>0.00</b>
	I	0.03	NA	0.26	0.28	<b>0.57</b>
	J	NA	0.01	2.75	0.80	<b>3.56</b>
<b>Total Session 3</b>		<b>0.01</b>	<b>0.00</b>	<b>0.43</b>	<b>0.38</b>	<b>0.83</b>
<b>Grand Total</b>		<b>0.01</b>	<b>0.01</b>	<b>0.33</b>	<b>0.23</b>	<b>0.57</b>