



ARCUS

**SHEPHERDS' RIG WIND FARM
APPENDIX 9.3:
BATS**

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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 Environmental/Ecological Impact Assessment (EIA/EcIA) of the proposed Shepherd's Rig Wind Farm.

This TA will present the methods and results of bat surveys undertaken in 2018, and will support Environmental Impact Assessment Report - Chapter 9: Ecology in addition to:

- TA 9.1:Habitats & Botany ¹
- TA 9.2:Protected Species²;
- TA 9.4: Fisheries³.

The aim of the bat surveys was to obtain detailed information regarding the occurrence and distribution of bats within the Bat Survey Area (Figure 1, Appendix A), to provide an accurate and robust baseline on which to base an EcIA.

The following terminology is used throughout this TA:

- **The Development:** the whole physical process involved in the development of the land at Shepherd's Rig Wind Farm, including the wind farm construction and operation (not a piece of land);
- **The Site:** all land with the potential to support the Development (as shown in Figure 1, Appendix A);
- **Bat Survey Area:** the land within which the bat surveys were undertaken (shown as in Figure 1, Appendix A). In accordance with Bat Conservation Trust (BCT) survey guidelines (2012)⁴, the Bat Survey Area (BSA) is defined as an area a minimum of 200 metres (m) of the proposed Turbine Layout. As the final Turbine Layout (Figure 1, Appendix A) was not defined at the time of survey, the BSA represents the extent of the boundary of the Site with a 200 m buffer applied.

1.1 Site Background

The Site, centred on national grid reference NX 62306 94337, lies approximately 5 kilometres (km) east of the village of Carsphairn, Dumfries and Galloway. The Site is accessed through forestry gates in the south and east via the B729 between Carsphairn in the west and Moniave in the east.

Marscalloch Hill is located within the southern section of the Site and Craigengillian Hill in the northern section. Black Burn and Craigengillian Burn are situated within the northern section of the Site and Dry Burn is located in the south of the Site. Notable watercourses outwith the Site include; the Water of Deugh (situated approximately 1 km to the south-west), the Water of Ken (parallel to the eastern boundary of the Site) and Polifferie Burn (parallel to the north-eastern boundary of the Site). The Water of Deugh and the Water of Ken converge, forming Kendoon Loch, approximately 1.4 km south-west of the Site. Habitats within the Site are dominated by coniferous plantation woodland of various ages (included recently felled woodland), and the landscape surrounding the Site is comprised of primarily coniferous plantation and grassland habitats (including livestock pasture).

¹ Bear Environmental (2018) REPORT No. 1001-117: Shepherd's Rig Ecological Appraisal: Extended Phase 1 Habitat Report.

² Arcus (2018) Shepherd's Rig Technical Appendix 9.2: Protected Species.

³ Galloway Fisheries Trust (2018) Commissioned Report No. RMAD26: Electrofishing and habitat survey to cover the proposed Shepherd's Rig Wind Farm

⁴ Hundt, L. (2012). Bat Surveys – Good Practice Guidelines 2nd edition. Bat Conservation Trust, London.

2 BASELINE METHODS

2.1 Desk Study

To provide context for the results of the bat field surveys, a search for recent (0-20 years) biological records was carried out via the publically available resources, such as the National Biodiversity Network (NBN) database⁵, and via a data request to the South West Scotland Environmental Information Centre (SWSEIC). A search radius of 5 km from the BSA was applied to bat species of low to medium risk from wind turbines (as defined by Mitchell-Jones, 2014⁶) with a 10 km search radius applied to high risk species, such as Leisler's bat (*Nyctalus leisleri*), noctule bat (*Nyctalus noctula*) and Nathusius' pipistrelle (*Pipistrellus nathusii*).

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 Scottish Natural Heritage (SNHi Information Service) Site Link website⁷ and from SWSEIC.

Table 1: Search Criteria for Designated Sites of Relevance to Bats

Protection	Designation	Search radius
Non-statutory	Ancient Woodland Inventory (AWI)	2 km
	Site of Interest for Nature Conservation (SINC)	
	Local Nature Reserves (LNR)	
Statutory	Sites of Special Scientific Interest (SSSI)	5 km
	National Nature Reserves (NNR)	
	Ramsar Sites Special Area of Conservation (SAC)	10 km

2.2 Field Survey

2.2.1 Bat Survey Area

Bat surveys were carried out with reference to BCT survey guidelines^{4,8} between May and September 2018 (the Survey Season), with all survey work undertaken by Arcus. The Site was considered to be of low risk to bats and therefore a low risk survey effort was applied⁴ to the BSA. This was established with consideration of the assessment criteria used to determine the survey effort for wind farm developments as, presented within BCT survey guidelines (Chapter 10)⁴ in conjunction with recently published local research⁹, and the professional opinion of Arcus bat ecologists. The Assessment criteria and corresponding bat survey effort required, in accordance with BCT guidance, is outlined in Table 2 below.

Although it acknowledged that *Nyctalus* bats (Leisler's and noctule bats) are known to be present in Dumfries and Galloway, recent studies carried out by SNH into high risk species in southern Scotland, places the Site in an area of low occurrence of both Leisler's and noctule bats, and in an area of lowest "exposure" to windfarms (a prediction based on occurrence, activity levels and maximum known foraging radius). Furthermore, as these

⁵ National Biodiversity Network (online) Available online at: www.nbn.org.uk. Accessed January 2018.

⁶ Mitchell-Jones, T, Carlin, C (2014) : Natural England Technical Information Note TIN051 - Bats and onshore wind turbines Interim guidance (3rd Edition), Natural England 2014, ISBN 978-1-78354-095-2

⁷ Scottish Natural Heritage SiteLink. Last accessed 29/01/2018 [online], <https://gateway.snh.gov.uk/sitelink/>

⁸ Collins, J. (ED.) (2016). Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edition). The Bat Conservation Trust, London

⁹ Newson, S.E., Evans, H.E., Gillings, S., Jarrett, D & Wilson, M.W (2017) A survey of high risk bat species across southern Scotland. *Scottish Natural Heritage Commissioned Report No. 1008*

species are known to primarily utilise mature broadleaved woodland habitats, the Site was considered of low suitability for *Nyctalus* bats.

Table 2: Site Risk & Survey Effort Assessment Criteria for Windfarm Developments

Low risk site Assessment criteria for windfarm developments (BCT, 2012⁴)			
Quality of habitat and number of habitat features likely to affect bat mortality rates if altered by development*	Species likely to use the site*	Importance of roosts, of species likely to use site, which may be affected by development*	Potential risk level of development
Small number of potential roost features.	Low number, medium risk species	Parish	Low
Low quality foraging habitat that could be used by small number of foraging bats. Isolated Site not connected to the wider landscape by prominent linear features.	High number, medium risk species		
* As informed by published guidelines Error! Bookmark not defined. , current scientific research and professional opinion of Arcus ecologists.			
Minimum standards for bat activity surveys at proposed onshore wind turbine developments, considered of low risk to bats (BCT, 2012⁴)			
Ground level transect surveys	One year (the Survey Season) of data. One visit per transect once seasonally (Spring, Summer and Autumn). Up to 200 m + rotor radius from turbine/potential turbine locations.		
Remote static surveys at ground level	One year of data. One deployment for five consecutive nights for each single (or pair of) locations within the Survey Season, per seasonal period (Spring, Summer and Autumn). Up to 200m + rotor radius from turbine/potential turbine locations.		

In light of the above justifications, the Survey Season comprised of the following three seasonal survey sessions;

- Survey Session 1: April/May (Spring);
- Survey Session 2: June/July (Summer); and,
- Survey Session 3: late August/September (Autumn)

2.2.2 Transect Activity Surveys

Transect Surveys were carried out with reference to BCT survey guidelines⁴ and aimed to provide an indication of the bat activity occurring within and around the BSA. The activity surveys were not intended to provide an exhaustive account of the local bat community; rather, they sought to identify the most likely species present and their general patterns of behaviour (e.g. foraging and commuting routes) with respect to the BSA.

A single transect was driven at a consistent speed of approximately 10 miles per hour using existing public roads and forestry tracks. Transect surveys were carried out seasonally across the three Survey Sessions taking place between May and September 2018 (Table 3). Each transect took place between 30 minutes before sunset until approximately two hours after sunset. Transects included a series of ten, five minute spot counts, and were designed with reference to accessibility and habitat features (see Table 4). Vehicle engine and lights were turned off during spot counts as to not bias the results. The start and end point of each transect survey (the direction in which it was driven) was varied across the

Survey Season, to reduce temporal and spatial bias. The transect route and Spot Count Locations are present in Figure 2 (Appendix A).

Table 3: Summary of Activity Transect Surveys Timings & Weather Condition

Survey Session	Date	Survey Period (Time)		Weather Conditions							
				Temp (°C)		Wind Speed (Beaufort)		Cloud Cover (Oktas)		Rain Scale (0-3)	
		Start	End	S*	*E	S*	*E	S*	*E	S*	*E
1	15/05/2018	20:55	23:42	10	7	2	2	4	2	0	0
2	11/07/2018	21:47	00:02	16	14	0	0	7	7	0	0
3	28/09/2018	20:13	22:26	10	11	0	0	7	7	0	0
Start (S) / *End (*E)											

Surveyors recorded bat activity with an Echo Meter Touch Pro 2 ultrasonic bats detector connected to iPhones, which recorded, time stamped, auto IDed and mapped all bat calls. All bat passes during the survey were recorded through bat detectors; however, visual observation was also made on a number of passes, which helped confirm identification. In addition to the digital recordings, information about bat registrations was also recorded manually using the Collector ArcGIS mapping software app installed on surveyors smart phones and included, if possible:

- Direction of flight;
- Bat behaviour, e.g. foraging, commuting; and
- Environmental variables, including cloud cover, wind strength, precipitation and air temperature (recorded at the start and end of each transect survey).

Table 4: Transect Spot Count Locations and Habitat Descriptions

Spot Count Number	GPS Location		Habitat Description
	X	Y	
1	262568	591229	At site entrance with mature plantation next to watercourse.
2	262559	592494	At hairpin bend of track. Edge of mature conifer plantation and felled/re-planted plantation.
3	261817	591837	Quarry at end of spur in road in open area.
4	261892	593116	At deer tower near watercourse and woodland ride within mature conifer plantation.
5	262370	594088	End of track within felled and immature conifer plantation.
6	262891	593001	Within felled conifer plantation.
7	262747	593474	Within felled and mature conifer plantation.
8	263539	595121	On track out with boundary of the Site, next to watercourse (Water of Ken).
9	262399	594958	Edge of mature conifer plantation and felled plantation.
10	262522	596049	Edge of mature conifer plantation and felled plantation.

2.2.3 Remote Static Activity Surveys

In addition to Transect Surveys, Remote Static Activity Surveys (hereby referred to as Static Surveys) were undertaken across the three Survey Sessions in 2018 (see Table 5, below). A total of nine AnaBats were deployed at ground level for a minimum of five consecutive nights across a range of habitat types (Table 5 and Figure 3 (Appendix A)), as per BCT guidance. The AnaBats were set to record from approximately half an hour before sunset until approximately half an hour after sunrise.

Table 5: Remote Static Survey Dates

Survey Session	Deployment Period	Survey Hours (per AnaBat)	Survey Hours (per Session)
1	15/05/2018 - 21/05/2018	54	477
2	12/07/2018 - 16/07/2018	32	288
3	29/08/2018 - 03/09/2018	54	486
Total			1251

In order to collect comparative data, all AnaBats were deployed at the same nine Remote Static Survey Locations (RSSL) (labelled as RSSL A-I) across the three Survey Sessions (see Table 6). 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 6: Remote Static Survey Locations

RSSL ID	GPS Location		Habitat Description	Habitat Type
	X	Y		
A	262583	592469	Juvenile conifer plantation with recent re-planting evident.	Edge
B	262077	592142	At road junction between mature and juvenile conifer plantation.	Edge
C	261956	593032	Mature conifer plantation within 50m of Black burn. Recently felled plantation in wider area.	Edge
D	262410	594180	Felled plantation with some recent replanting evident in wider area.	Open
E	262587	593015	Edge of mature conifer plantation and felled plantation.	Edge
F	262714	593472	Mature conifer plantation in close proximity to watercourse, and on edge of area of felled plantation.	Edge
G	262544	595045	Next to watercourse and along mature conifer plantation and felled plantation edge.	Edge
H	262131	595375	In area of felled plantation.	Open
I	262917	595754	Edge of mature and juvenile conifer plantation.	Edge

2.2.4 Roost Surveys

2.2.4.1 Bat Roost Suitability Assessment

Surveys to identify potential bat roosting habitats within trees and structures were carried out during the Extended Phase 1 Habitat Survey in April 2018¹ and during Protected Species Surveys in June 2018². The aim of this survey was to identify actual or potential roost sites

and to assess if further surveys, such as emergence/re-entry surveys were required to inform the assessment of bat habitat use across the Bat Survey Area. Surveys included inspection of structures with the aim to identify Potential Roost Features (PRFs) such as woodpecker tree holes, cavities and cracks within tree branches and trucks.

Following the roost suitability assessment any built structure with at least low suitability, or any trees with at least moderate suitability would be subject to roost activity surveys⁸ in order to confirm the presence of roosting bats, or to provide enough justification to be confident of a negative result (i.e.: no evidence of roosts being recorded).

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 such as Analook W, Bat Sound and Wave Surfer, with reference to bat species call identification guidance¹⁰, to enable identification of bat species.

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.

Species identification is therefore applied with a level of confidence, especially where deterministic call characteristics are not present within a recording.

Four species belonging to the *Myotis* genus are known to be resident in Scotland: Natterer's bat (*Myotis nattereri*), Daubenton's bat (*Myotis daubentonii*), whiskered bat (*Myotis mystacinus*) and Brandt's bat (*Myotis brandtii*)**Error! Bookmark not defined..** There is a large amount of overlap between the characteristics of the echolocation calls of these congeneric species and so a definitive identification of *Myotis* bats to species level is rarely possible from frequency division recordings alone¹⁰. As such, all calls from *Myotis* species (sp.) bats were identified to genus as "unidentified *Myotis*" species, or "*Myotis* genus".

Furthermore, there is significant overlap in the call parameter between the two of the most common Scottish bat species; soprano pipistrelles and common pipistrelle^{10,11}, therefore where this overlap exists, identifications may be restricted to genus level, and defined a *Pipistrellus* sp.

AnaBat bat detectors record bat echolocation as individual files containing bat calls within set periods of time (usually 11 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

¹⁰ Russ, J (2012) British Bat Calls: A Guide to Species Identification. Pelagic Publishing

¹¹ SNH (2015) Trend Note- Trends of Bats in Scotland. Available online at: <https://www.nature.scot/sites/default/files/A1759538%20-%20Trend%20Note%20024%20-%20Bats%20in%20Scotland%202015.pdf> Accessed September 2018.

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, using two separate methods. Activity from transect data was expressed as the total number of bat passes to give a general impression of the levels of bat activity as well as the species composition, however Static Survey data was expressed using of an index known as the Bat Activity Index (BAI). The value of expressing transect data as BAI was considered negligible, due to the short time period surveys were carried out across.

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 Static Surveys are carried out over at least five 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 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 Static Surveys expressed by BAI, is presented in Table 10 (below). This table presents the mean BAI per RSSL across all Survey Sessions. A table presenting the levels of activity expressed as BAI per species at each RSSL during each Survey Session is presented in Appendix B (Appendix Table 2).

3 BASELINE RESULTS

3.1 Desk Study

3.1.1 Designated Sites

No statutory or non-statutory sites designated for bats were recorded within 10 km of the Site.

3.1.2 Bat Species Records

Table 7 provides a summary of bat species recorded within the Desk Study Area, as returned by the SWSEIC and a search of publically available records. No details on the nature of these records was available but it assumed that these are primarily bat flight records or known bat roosts.

Table 7: Bat Records within Desk Study Area

Species	Latin name	Date of Record	No of Records	Closest Proximity to Site
Daubenton's bat	<i>Myotis daubentonii</i>	2016	5	6.9 km
Natterer's bat	<i>Myotis nattereri</i>	2016	4	0.7 km
Noctule bat	<i>Nyctalus noctula</i>	2016	17	3.6 km
Common Pipistrelle	<i>Pipistrellus pipistrellus</i>	2008-2016	11	0.7 km
Soprano Pipistrelle	<i>Pipistrellus pygmaeus</i>	2016	13	0.7 km
Brown Long-eared bat	<i>Plecotus auritus</i>	2003-2016	4	9.5 km
<i>Myotis</i> species	<i>Myotis</i> sp.	2006	6	3.0 km
Whiskered/ Brandt's Bat	<i>Myotis mystacinus/ brandtii</i>	2016	2	2.9 km

3.2 Field Surveys

3.2.1 Transect Activity Surveys

The following species were recorded within the Bat Survey Area during Transect Activity Surveys:

- Common pipistrelle;
- Soprano pipistrelle;
- Leisler's bat;
- Noctule bat
- Daubenton's bat;
- *Myotis* sp.; and,
- *Pipistrellus* sp.

A total of 284 bat passes were recorded across the Survey season, with 66.73% of activity recorded during Session 3. Bat activity was recorded throughout the transect route at all Spot Count Locations, with no prominent spatial variation in activity evident. A summary of the bat activity recorded is presented in Table 9 (below)

Table 9: Summary of Bat Activity Recorded on Transect Surveys

Survey Session	Species						Total
	<i>Myotis</i> Sp.	Leisler's bat	Noctule bat	45* pip	55* pip	<i>Pipistrellus</i> Sp	
1	0	0	0	9	43	3	55
2	0	7	0	11	21	9	48
3	1	0	11	31	130	8	181
Total	1	7	11	51	194	20	284

*45 Pip = common pipistrelle/55 Pip = soprano pipistrelle

The most abundantly recorded species was soprano pipistrelle, which constituted 67.95% of activity recorded, with common pipistrelle making up 18.95% of activity, and 7.04% of

activity being classified as *pipistrellus* sp. Leisler's bats and noctule bat were recorded rarely and made up 2.46% and 3.87% of activity respectively, with *Myotis* sp. comprising the remaining 0.70% of activity.

As the Transect Activity Surveys represent a snap shot of activity over a small period of time, it is not considered feasible to draw robust conclusions on spatial or temporal distributions; however, the majority of activity was recorded with 50 m of watercourses and forest edges, habitat features known to be utilised by commuting and foraging bats⁶.

3.2.2 Remote Static Activity Survey

A total of 9,522 bat passes (see Appendix Table 1, Appendix B) were recorded over a total of 1251 survey hours across the Survey Season, giving a total mean BAI of 7.61 pph for the Site.

Of the activity recorded, 56.01% was attributed to soprano pipistrelle, with 17.85% and 23.86% attributed to common pipistrelle and *pipistrellus* sp. respectively. Leisler's bat and noctule bat were recorded infrequently, making up 1.10% and 0.44% of activity recorded, respectively. The remaining 0.73% of activity was attributed to *Myotis* sp., and brown-long eared bat.

The following species/genus were detected within the Bat Survey Area:

- Common pipistrelle;
- Soprano pipistrelle;
- Leisler's bat;
- Noctule bat;
- Brown long-eared bat (BLE);
- *Myotis* sp.; and
- *Pipistrellus* sp.

The design of Static Surveys allowed for the collection of comparative datasets sufficient to draw robust conclusions on spatial or temporal distributions of bat activity across the Site during the Survey season. A summary of these distributions is detailed in Section 3.2.2.1 and 3.2.2.2, below.

3.2.2.1 Spatial Activity Variation

Bat activity was recorded at the majority of RSSLs (Appendix A, Figure 4) across all three Survey Sessions (bats were not recorded at RSSL B during Session 1); however, notable spatial variation in the level of activity was evident. A total of four RSSLs recorded mean activity levels above the overall survey mean (7.61 pph), these were; RSSLs C (9.03 pph), D (8.32 pph), E (19.71 pph) and F (17.45 pph). Activity at these four RSSLs constituted 83.30% of all bat passes recorded, with RSSLs E & F making up 54.64% alone. All four RSSLs were recorded within the centre of the Bat Survey Area (see Figure 3, Appendix A) where conifer plantation habitat dominated, but notably included areas subject to recent clear felling or replanting activity.

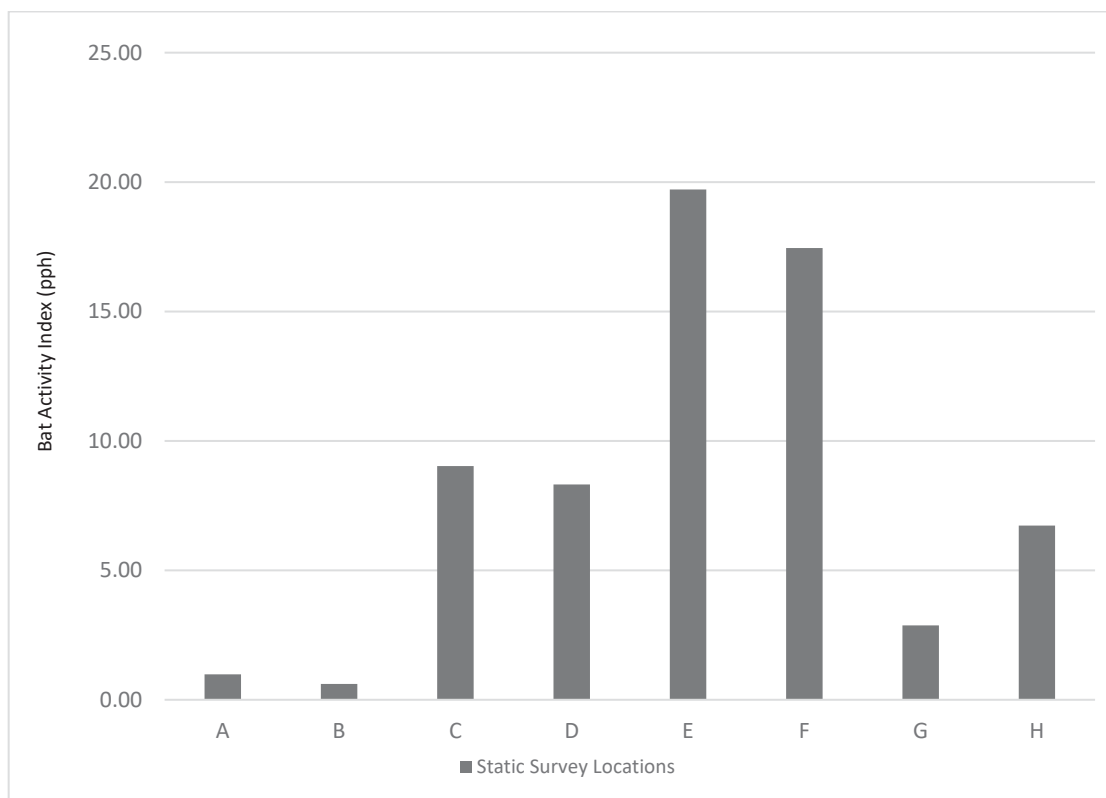


Chart 1: Spatial Variation in Total Bat Activity (mean BAI) across the Survey Season

3.2.2.2 Temporal Activity Variation

In addition to spatial variation, bat activity recorded notable temporal variation in the overall levels of activity, as well as the species abundances recorded, and the level of activity recorded spatially. The highest level of activity was recorded in Session 2, although this constituted 46.35% of all bats recorded, the survey period for Session 2 was lower than Sessions 1 & 3. Once this temporal bias was corrected for (via the application of the BAI), Session 2 has a total mean BAI of 15.32 pph, markedly higher than 2.47 pph and 8.09 pph, recorded over Sessions 1&3 respectively.

Table 10: Summary of Mean Bat Activity Index (pph)

RSSL	Myotis Sp.	45* Pip	55* Pip	Pip* Sp.	BLE	Leisler's Bat	Noctule Bat	Mean Total
A	0.04	0.18	0.30	0.29	0.01	0.16	0.01	0.99
B	0.01	0.11	0.17	0.26	0.00	0.00	0.06	0.61
C	0.01	0.91	4.32	3.75	0.00	0.01	0.01	9.03
D	0.02	1.39	3.75	2.91	0.00	0.23	0.03	8.32
E	0.10	2.99	12.24	4.18	0.00	0.18	0.02	19.71
F	0.11	3.08	11.78	2.45	0.00	0.02	0.01	17.45
G	0.10	0.63	1.19	0.76	0.00	0.10	0.09	2.87
H	0.04	2.08	3.47	1.12	0.01	0.01	0.01	6.73
I	0.06	0.77	0.86	0.51	0.00	0.04	0.06	2.30

Survey Session	Myotis Sp.	45 Pip	55 Pip	Pip Sp.	BLE	Leisler's Bat	Noctule Bat	Mean Total
1	0.04	0.90	1.16	0.37	0.00	0.00	0.00	2.47
2	0.04	2.47	9.71	2.83	0.00	0.18	0.10	15.32
3	0.08	1.15	4.09	2.64	0.00	0.11	0.03	8.09
Season	0.05	1.36	4.26	1.82	0.00	0.08	0.03	7.61

**45 Pip = common pipistrelle/55 Pip = soprano pipistrelle/Pip Sp = pipistrellus species*

Species abundances were broadly consistent through the Survey Season; however, the most abundant pipistrelle species recorded in Session 1 was common pipistrelle, yet in Session 2 & 3 soprano pipistrelle otherwise dominated the species recorded. Furthermore, *Nyctalus* species were not recorded in Session 1.

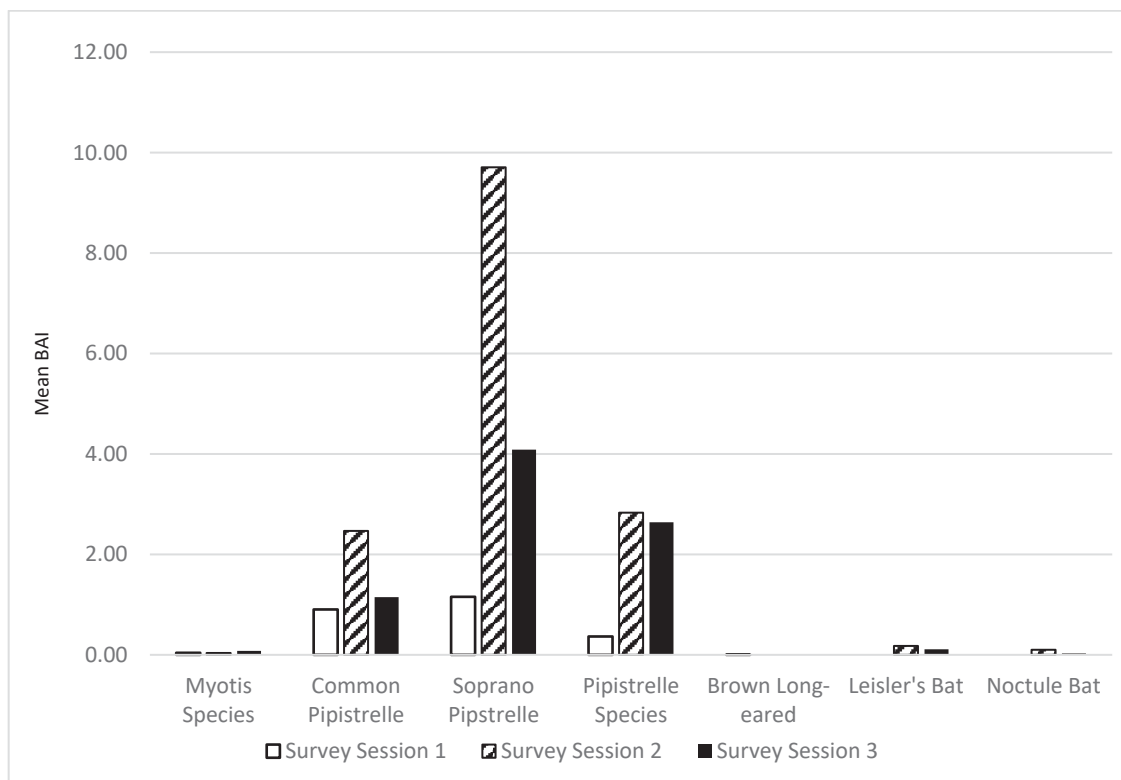


Chart 2: Temporal Variation in Bat Activity (Mean BAI) by Taxa across Survey Sessions

3.2.3 Preliminary Roost Assessment Surveys

Preliminary Roost Assessment Surveys did not record any features with suitability to support roosting bats within the BSA. This was due to the majority of habitats within the Site comprising of coniferous plantation woodland. Coniferous tree generally show low to negligible potential to support bats due to their lack of potential roosting features⁸.

3.2.4 Site Utilisation Summary

Recent clear felling or replanting activity within conifer plantation habitat in the centre of the BSA, where the highest level of activity was recorded, has created a broad mosaic of mature and juvenile conifer woodland, as well as open areas of clear fell, providing edge habitats suitable for both foraging and commuting for bats. It is also likely that bats would take advantage of existing rides and watercourses, such as Black Burn. It is likely that activity was notably higher in this area, specifically at RSSL E & F, due to the creation of

these woodland edge habitats, as well as the proximity to, and evident connectivity (via rides, tracks and watercourse) with, the Water of Ken, located in the east, out with of the Survey Area.

The above is also reflected in species abundances and the spatial variation recorded across the Survey Season. The highest levels of activity were recorded in the above areas when soprano pipistrelle, a species more strongly associated with riparian habitats than common pipistrelle **Error! Bookmark not defined.**, was the dominant species recorded (Sessions 2 & 3). However when compared to Session 1, when common pipistrelle was the most abundant species, activity at these RSSLs were notably lower, with activity in general less localised, particularly in regards to the utilisation of riparian habitats. Although it is not possible to ascertain the reason for this species variation, the results are important in demonstrating how bat utilisation across the season can vary, and the various factors that can influence this.

Although clear felling is evident in the northern part of the Site, the lack of connective edge habitat, as well as the isolated, exposed nature and increased topography of the edge habitats in the area, are likely important factors in accounting for the relatively low levels of bat activity record in the area. Lower activity in the southern part of the Site is likely due to lack of clear fell habitats, meaning suitable edge habitat is limited to the existing tracks and rides within the conifer plantation. This demonstrates that although clear felling has been shown to be an important factor in providing suitable habitat for foraging and commuting bats, it is this habitat's proximity to suitable edge features in the wider area, including those out with the Site, which gives the habitat its value.

4 CONCLUSION

The levels of activity of both foraging and commuting bats recorded across the BSA was considered to be low overall, and dominated by common and widespread bat species. Activity did however, vary notably across the BSA, from no activity (at RSSL B during Session 1) to 62.25 pph (at RSSL E in Session 2). Although this latter activity level is notably higher in the context of the BSA, this level of activity is still considered relatively low when compared to the levels of activity expected at a site of greater habitat suitability.

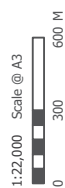
The lack of broadleaved woodland with the BSA is likely the reason for such a limited presence of woodland specialist species, such as high risk *Nyctalus* species, and likely accounts for the dominance of soprano and common pipistrelles, common and widespread species, with broad habitats requirements **Error! Bookmark not defined.** Furthermore no bat roosts were recorded within the BSA.

APPENDIX A

Figures

- Figure 1: Bat Survey Area
- Figure 2: Transect route and Spot Count Locations
- Figure 3: Remote Static Activity Survey Locations
- Figure 4: Remote Static Activity Survey Result Summary

- The Site
- Turbine Layout
- Tracks and Hardstandings



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Bat Survey Area
 Figure 1

Shepherd's Rig Wind Farm
 Technical Appendix 9.3



- The Site
- Bat Survey Area
- Spot Count Locations
- Bat Transect Route

1:24,000 Scale @ A3



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Checked By: SC Date: 05/10/2018

Transect Route and Spot Count Locations
Figure 2

Shepherd's Rig Wind Farm Technical Appendix 9.3



- The Site
- Bat Survey Area
- Remote Static Survey Locations

1:24,000 Scale @ A3



Produced By: CW

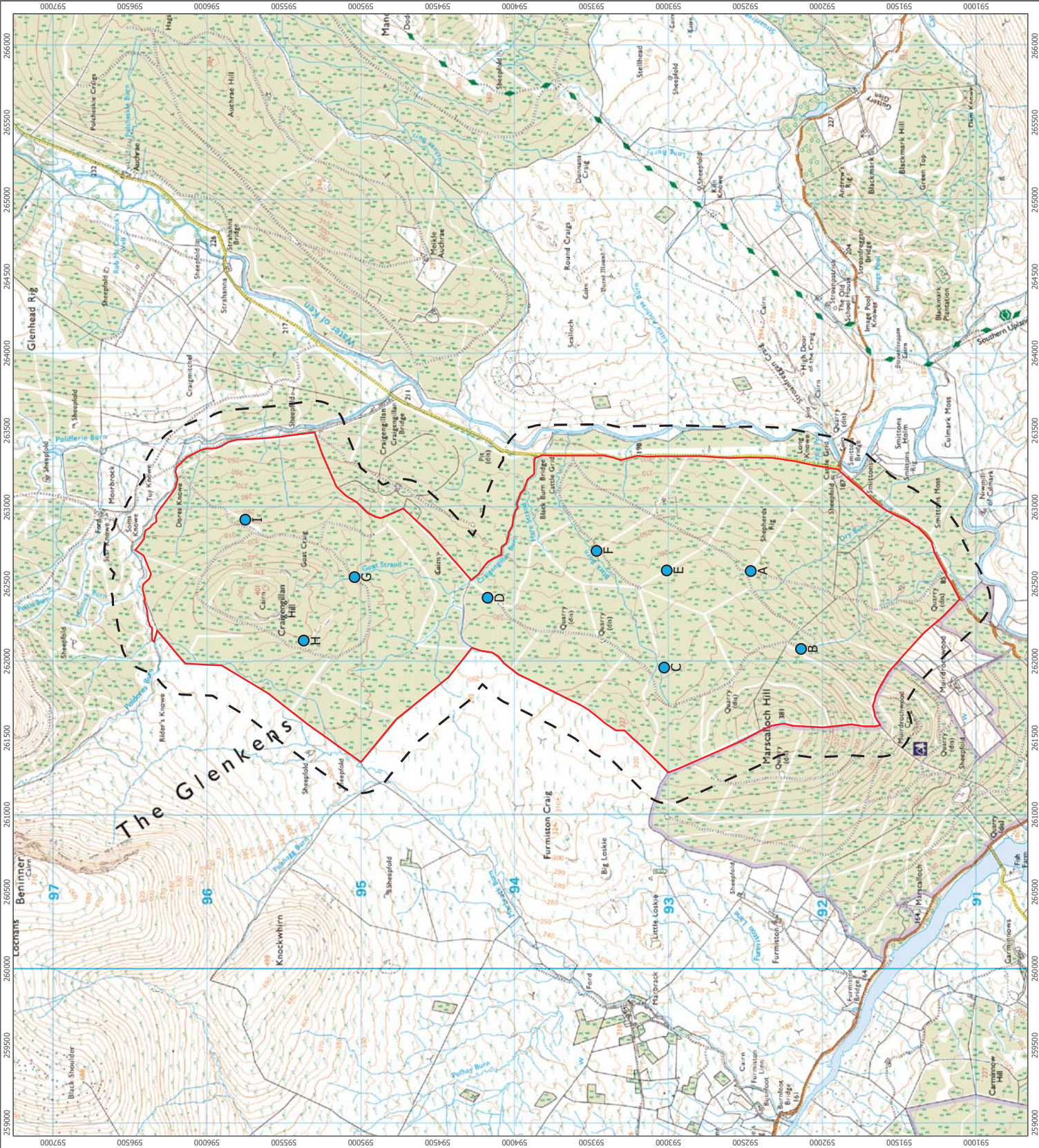
Ref: 2966-REP-042

Checked By: SC

Date: 05/10/2018

Remote Static Survey Locations
Figure 3

Shepherd's Rig Wind Farm
Technical Appendix 9.3



- The Site
- Bat Survey Area
- Turbine Layout
- Total Mean BAI (pph)**
- ≤1pph
- 1.0-5.0pph
- 5.1-10.0pph
- 10.1-15.0pph
- 15.1-20.0pph

1:24,000 Scale @ A3



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Checked By: SC Date: 05/10/2018

**Remote Static Survey
Result Summary**
Figure 4

**Shepherd's Rig Wind Farm
Technical Appendix 9.3**



APPENDIX B

Detailed Survey Data

Appendix Table 1: Total Bat Passes recorded during Remote Static Activity Surveys, by Taxa and RSSL

RSSL	<i>Myotis</i> Species	Common Pipistrelle	Soprano Pipistrelle	<i>Pipistrellus</i> Species	Brown Long-eared Bat	Leisler's Bat	Noctule Bat	RSSL Total
Survey Session 1								
A	0	1	3	5	1	0	0	10
B	0	0	0	0	0	0	0	0
C	1	1	3	4	0	0	0	9
D	0	3	8	2	0	0	0	13
E	9	49	140	59	0	0	0	257
F	6	106	140	30	0	0	0	282
G	3	33	27	27	0	0	0	90
H	0	237	230	47	0	0	0	514
I	0	0	0	0	0	0	0	0
Species Total	19	430	551	174	1	0	0	1175
Survey Session 2								
A	3	19	24	31	0	23	1	101
B	1	12	12	19	0	0	9	53
C	0	1	3	1	0	0	0	5
D	0	11	39	14	0	0	0	64
E	1	324	1229	414	0	21	3	1992
F	1	283	1241	243	0	0	0	1768
G	2	19	65	25	0	5	11	127
H	2	30	157	50	0	0	1	240

RSSL	<i>Myotis</i> Species	Common Pipistrelle	Soprano Pipistrelle	<i>Pipistrellus</i> Species	Brown Long-eared Bat	Leisler's Bat	Noctule Bat	RSSL Total
I	1	12	26	18	0	2	4	63
Species Total	11	711	2796	815	0	51	29	4413
Survey Session 3								
A	2	5	15	5	0	0	0	27
B	0	4	12	17	0	0	0	33
C	1	126	599	520	0	2	2	1250
D	3	180	478	391	0	32	4	1088
E	4	46	345	112	0	4	0	511
F	9	42	268	70	0	3	1	393
G	9	36	75	55	0	9	1	185
H	3	24	99	60	1	1	0	188
I	7	96	95	53	0	3	5	259
Species Total	38	559	1986	1283	1	54	13	3934
Season Total	68	1700	5333	2272	2	105	42	9522

Appendix Table 2: Mean BAI recorded during Static Activity Surveys, by Taxa and Survey Location

Survey Location	<i>Myotis</i> Species	Common Pipistrelle	Soprano Pipistrelle	<i>Pipistrellus</i> Species	Brown Long-eared	Leisler's Bat	Noctule Bat	Location Total
Survey Session 1								
A	0.00	0.02	0.06	0.09	0.02	0.00	0.00	0.19
B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C	0.02	0.02	0.06	0.07	0.00	0.00	0.00	0.17
D	0.00	0.06	0.15	0.04	0.00	0.00	0.00	0.24
E	0.17	0.91	2.59	1.09	0.00	0.00	0.00	4.76
F	0.11	1.96	2.59	0.56	0.00	0.00	0.00	5.22

Survey Location	<i>Myotis</i> Species	Common Pipistrelle	Soprano Pipistrelle	<i>Pipistrellus</i> Species	Brown Long-eared	Leisler's Bat	Noctule Bat	Location Total
G	0.06	0.61	0.50	0.50	0.00	0.00	0.00	1.67
H	0.00	4.39	4.26	0.87	0.00	0.00	0.00	9.52
I	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Species Total	0.04	0.90	1.16	0.37	0.00	0.00	0.00	2.47
Survey Session 2								
A	0.09	0.59	0.75	0.97	0.00	0.72	0.03	3.16
B	0.03	0.38	0.38	0.59	0.00	0.00	0.28	1.66
C	0.00	0.03	0.09	0.03	0.00	0.00	0.00	0.16
D	0.00	0.34	1.22	0.44	0.00	0.00	0.00	2.00
E	0.03	10.13	38.41	12.94	0.00	0.66	0.09	62.25
F	0.03	8.84	38.78	7.59	0.00	0.00	0.00	55.25
G	0.06	0.59	2.03	0.78	0.00	0.16	0.34	3.97
H	0.06	0.94	4.91	1.56	0.00	0.00	0.03	7.50
I	0.03	0.38	0.81	0.56	0.00	0.06	0.13	1.97
Species Total	0.04	2.47	9.71	2.83	0.00	0.18	0.10	15.32
Survey Session 3								
A	0.04	0.09	0.28	0.09	0.00	0.00	0.00	0.50
B	0.00	0.07	0.22	0.31	0.00	0.00	0.00	0.61
C	0.02	2.33	11.09	9.63	0.00	0.04	0.04	23.15
D	0.06	3.33	8.85	7.24	0.00	0.59	0.07	20.15
E	0.07	0.85	6.39	2.07	0.00	0.07	0.00	9.46
F	0.17	0.78	4.96	1.30	0.00	0.06	0.02	7.28
G	0.17	0.67	1.39	1.02	0.00	0.17	0.02	3.43
H	0.06	0.44	1.83	1.11	0.02	0.02	0.00	3.48

Survey Location	<i>Myotis</i> Species	Common Pipistrelle	Soprano Pipistrelle	<i>Pipistrellus</i> Species	Brown Long-eared	Leisler's Bat	Noctule Bat	Location Total
I	0.13	1.78	1.76	0.98	0.00	0.06	0.09	4.80
Species Total	0.08	1.15	4.09	2.64	0.00	0.11	0.03	8.09
Season Total	0.05	1.36	4.26	1.82	0.00	0.08	0.03	7.61