Technical Appendix 8.7

Bat Survey 2019

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BAT SURVEY REPORT- POLSKEOCH AND EUCHANHEAD

Bat Survey Report 2019

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Bat Survey Report
Polskeoch and Euchanhead
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EXECUTIVE SUMMARY

RPS was commissioned by Scottish Power Renewables (SPR) to undertake bat surveys to assess potential impacts to bat species from the proposed wind farm. The aim of the surveys undertaken from May to September 2019 was to identify the bat species present on site, assess their activity level, locate roosts at significant risk of disturbance and assess the potential risk level to each species.

Activity surveys, comprising the deployment of static bat detectors, were completed during the bat activity season from May to September covering the activity periods of spring migration, summer maternity and autumn dispersal/mating. A desk study was carried out in support of the field surveys.

The desk survey returned a number of bat species and roosts found within the survey area or the 10 km search radius. One statutory designated site (Chanlockfoot SSSI) lies 5 km to the east.

Static detectors were deployed at thirteen locations; eleven on Polskeoch and a further two on Euchanhead. 541 survey nights were undertaken, with a total of 5710 files with bat passes collected (704 during spring, 1563 during summer and 3443 during autumn). A minimum of six species of bats were recorded: common pipistrelle, soprano pipistrelle, Daubenton's, Leisler's, noctule and brown long-eared bats.

When data from similar sites was compared using the online comparison tool Ecobat (in line with current guidance), bat activity levels at this site were assessed as moderate. However, the surveys have highlighted the presence of two species of bat that are deemed to be relatively vulnerable due to their rarity and collision risk; Leisler's and noctule.

An assessment of risk from the development concerning bat displacement and mortality was made using parameters outlined in the most recent industry standard guidance. Overall the development is considered as presenting medium risk to bats.

1 INTRODUCTION

1.1 Background

RPS was commissioned by Scottish Power Renewables (SPR) to undertake bat surveys to assess potential impacts on bat species of the proposed Polskeoch and Euchanhead Wind Farm. The proposed Wind Farm is located approximately 12.3 km southwest of Sanquhar, Dumfries and Galloway (central Ordnance Survey (OS) grid reference NS 701 017). The site location and provisional turbine layout are shown in Figure 1. Proposed scope for the site includes up to 14 wind turbines on the Polskeoch Wind Farm, and five wind turbines at the Euchanhead site (located to the north of the main Polskeoch Site).

The aims of the surveys undertaken from May to September 2019 were to:

- identify the bat species present on site;
- locate roosts at significant risk of disturbance;
- assess their activity level; and
- investigate the potential risk level to each species.

All surveys were completed under the current bat survey guidelines (SNH et al, 2019). This report is written for SPR for the purpose of the planning application for this site only. It should not be used to support any other schemes without previous consent.

1.2 Relevant Protected Species Legislation

This section describes the legislation pertaining to bat species which may be present on site, and hence informs the requirement for all ecological surveys to be conducted.

1.2.1 The Conservation of Habitats and Species Regulations 1994 (as amended)

The Habitats Directive is transposed into law in Scotland through the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended).

This legislation makes it an offence to deliberately or recklessly disturb European Protected Species (EPS). Their places of shelter are fully protected, and it is an offence to damage, destroy or obstruct access to or otherwise deny the animal use of a breeding site or resting site, whether deliberately or not. It is also an offence to disturb in a manner that is, or in circumstances which are, likely to significantly affect the local distribution or abundance of the species, disturb in a manner, or circumstances which are, likely to impair its ability to survive, breed or reproduce, or rear or otherwise care for its young. Any activity which is likely to affect these species requires prior consultation with the relevant statutory nature conservation organisation (i.e. Scottish Natural Heritage (SNH)) and may require a licence to be issued before they can be carried out.

2 METHODOLOGY

2.1 Desk Study

A desk study was undertaken, to current guidance, to support the field surveys. The following groups were approached for data on 09 September 2019:

- South West Scotland Environmental Information Centre (SWSEIC) were contacted for records for all bat species within a 10 km buffer of the site boundary.
- Dumfries and Galloway Bat Group.

Aerial imagery (Google Earth Pro, May 2019) and Ordnance Survey maps were studied to determine topographic and landscape features which might affect bats' use of the site and surrounding area.

In addition, the location of other wind energy developments (including the number of turbines and their size (within the surrounding 10 km was sought in order to inform an assessment of cumulative pressure.

2.2 Field Surveys

2.2.1 Habitat Assessment

An assessment of the survey area was carried out on 01 May 2019 by an experienced RPS ecologist. The potential value of the habitats and features present for foraging and commuting bats was assessed, using the criteria from the current guidance (Collins, 2016), displayed in Table 1.

Table 1: Bat Habitat Suitability Criteria

Suitability	Description of Roosting Habitat	Foraging and Commuting Habitat
Negligible	Negligible habitat features on site not likely to be used by roosting bats.	Negligible habitat features on site not likely to be used by commuting or foraging bats.
Low	A structure with one or more potential roost sites that could be used by individual bats opportunistically. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions and/or suitable surrounding habitat to be used on a regular basis or by larger numbers of bats (i.e. unlikely to be suitable for maternity or hibernation).	Habitat that could be used by small numbers of commuting bats such as gappy hedgerow or un-vegetated streams, but isolated, i.e. not very well connected to the surrounding landscape by other habitat. Suitable, but isolated habitat that could be used by small numbers of foraging bats such as a lone tree (not in a parkland situation) or a patch of scrub.
Moderate	A structure or tree of sufficient size and age to contain potential roost features but with none seen from the ground or features seen with only very limited roosting potential.	Continuous habitat connected to the wider landscape that could be used by bats for commuting such as lines of trees and scrub or linked back gardens. Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water.
High	A structure or tree with one or more potential roost sites that could be used by bats due to its size, shelter, protection, conditions and surrounding habitat but unlikely to support a roost of high conservation status (with respect to roost type only – the assessments in this table are made irrespective of species conservation status, which is established after presence is confirmed).	Continuous, high-quality habitat that is well connected to the wider landscape that is likely to be used regularly by commuting bats such as river valleys, streams, hedgerows, lines of trees and woodland edge. Site close to and connected to known roosts.

Table reproduced from Bat Conservation Trust (BCT) Guidance (Collins, 2016)

Preliminary Roost Assessment

A roost assessment was undertaken by an experienced RPS surveyor on 01 May 2019 on four structures with the potential to support roosting bats: Polskeoch Bothy, Tin Hut and Polskeoch Farmhouse and Garage. The locations of the structures are shown in Figure 1.

The assessment followed the methodology detailed in Collins (2016) and comprised an inspection of all accessible areas of the structures to identify features likely to be used by roosting bats.

Bat presence may be indicated by:

- presence of bat droppings;
- staining at regularly used access points;
- corpses; and
- scratches.

The structures were classified for their potential to support roosting bats using criteria detailed in Table 1 above. The suitability for the habitat to support foraging/commuting bats and connectivity to the wider area was also assessed.

2.2.2 Roost Surveys

Dusk Emergence and Dawn Re-entry Surveys

Dusk emergence and dawn re-entry surveys were carried out by experienced surveyors. Dates and times of surveys and weather conditions for the surveys are detailed in Table 2 below. Bat calls were recorded using Anabat bat detectors recording to an internal CF card for analysis. Recordings were analysed with specialised software AnalookW by an experienced ecologist to confirm the bat species present.

Dusk emergence surveys started half an hour before sunset and ran until at least 1 ½ hours after sunset. Dawn re-entry surveys ran from at least 1 ½ hours before sunrise until 15 minutes after sunrise.

Table 2: Summary of Bat Survey Conditions

Date	Location	Sunset / Sunrise	Time		Weather Conditions at Beginning of Survey			
			Start	End	Temp (C)	Wind (m/s)	Cloud (oktas)	Rain*
13/08/19	Bothy	05:44	04:14	06:14	7	3	8	3
17/09/19		19:28	19:00	21:00	17	0	5	0
25/08/19		20:24	19:54	21:54	19	0	1	0
13/08/19	Tin hut	05:44	04:14	06:14	7	3	8	3
27/08/19	House	06:09	04:40	06:40	13	0	7	0
13/08/19		20:55	20:29	22:29	11	0	4	0
18/09/19	Garage	06:53	05:23	07:23	6	0	3	0
15/08/19		20:50	20:24	22:24	13	1	2	0

2.2.3 Activity Surveys

Ground-level Static Surveys

Activity surveys, comprising of the deployment of static recorders were completed throughout the main bat activity season (May to September) covering the three key activity periods: spring migration, maternity and dispersal/mating. The surveys were designed using an indicative turbine layout, prior to receiving infrastructure plans. Therefore, following guidance, they were designed to sample the indicative developable site's habitats at the time of commissioning.

To comply with current industry guidance (SNH, 2019), static detectors where deployed for a minimum of 10 nights in each of: spring, summer and autumn, deployment dates are shown in Table A.1, in Appendix A. Under current guidance detectors should be placed at ten potential turbine locations, plus a third of additional potential turbine sites to a maximum of 40 detectors (SHN, 2019), therefore for a site of this size

13 static detectors were used. Locations 01-11 were located in the proposed Polskeoch site while Locations 12-13 were located in the proposed Euchanhead site (Figure 1). A split deployment method for seasonal deployments was employed according to equipment availability at the time the surveys were commissioned. The locations were grouped as Locations 02, 04, 05, 07, 10, 11, 13 and Locations 01, 03, 06, 08, 09, 12 with a detector deployed at Location 05 throughout as a control.

SNH were consulted about the planned approach to the deployment as the new guidance had been published in January 2019 and there were some clarifications required. The SNH response is included in Appendix B. It was agreed that given this was the first year of the new guidance being implemented that some flexibility in the types of detectors used and deployments would be accepted for this year only.

Song Meter SM2BAT and an Anabat Express bat detectors recording to an SD card were used for the static monitoring. The types of detectors used at each location are shown in Table A.1, in Appendix A The Song Meter bat detectors were programmed to record in full spectrum. Omnidirectional microphones were used on all detectors, and where possible detectors were placed 2 m above the ground. They were programmed to begin recording an hour before sunset and stop one hour after sunrise. Standard guidance recommends recording within 30 minutes of sunset and sunrise; however, extending this to 1 hour of sunrise and sunset allows for the assessment of any early emerging species on the site.

Weather Data

The daily weather data for the static recording deployment periods was provided by the client from the SPR MET mast located at OS grid reference NS 67604 05217. RPS was supplied with the data from the SRP Met mast with readings taken at 10 m intervals.

Daily rainfall was collected from the Scottish Environment Protection Agency (SEPA) rainfall data website. The weather station used was Eliock weather station [1] (accessed on 21 October 2019). The weather station numbered 115562 is located at OS grid reference NS 79666 07398.

2.3 Data Analysis

Recordings from the bat activity surveys were analysed with specialised software (either Analook W, Version 4.4a for the Anabat Express and Kaleidoscope Pro, Version 5.1.9g for the Song Meters) to confirm bat species present.

Sound files collected using the Anabat Express were analysed by an experienced ecologist using Analook W, Version 4.4a.

Sound files collected using the SM2BAT Song Meters were analysed by an experienced ecologist using Kaleidoscope Pro software which compares the echolocation pulses to an integrated library of bat calls, and automatically identifies to species. Following the batch analysis of all calls, 10% of all Pipistrelle spp. calls and noise files were manually checked. All calls of Myotis spp., Nyctalus spp. and calls with no auto-identification or with multiple bats within the same call were checked manually to confirm identification.

During manual analysis, calls were assigned to species according to their key parameters and where applicable their peak frequency, as shown in Table 3 (Russ 1999).

Table 3: Bat Species and their Call Frequency Parameters

Species	Latin Name	Call Frequency
Soprano pipistrelle	*Pipistrellus pygmaeus*	FM/qCF calls above 52 kHz
Pipistrellus spp.	-	FM/qCF calls between 40 and 42 kHz, and, 48 and 52 kHz
Common pipistrelle	*Pipistrellus*	FM/qCF calls between 40 kHz and 48 kHz

[1] https://apps.sepa.org.uk/rainfall

Species	Latin Name	Call Frequency
Nathusius' pipistrelle	*Pipistrellus nathusii*	FM/qCF calls below 40 kHz
Natterer's bat	*Myotis nattereri*	FM call with wide range between 23 and 107 kHz
Daubenton's bat	*Myotis daubentonii*	FM call with wide range between 30 and 81 kHz
Myotis spp.	-	FM calls greater than 30 kHz
Brown Long-eared bat	*Plecotus auritus*	FM calls greater than 30 kHz with two harmonics
Noctule	*Nyctalus noctula*	FM/qCF calls below 23 kHz
Leisler's bat	*Nyctalus leisleri*	qCF calls between 23 and 28 kHz
Nyctalus spp.	-	Low (less than 30 kHz) qCF or FM calls

FM – Frequency modulated call; CF – constant frequency call; qCF – quasi-constant frequency call. Bats combine variation within their echolocation pulses to create different call 'shapes'. These call shapes can be described in terms of the degree of FM, CF and qCF components they contain.

Not all calls could be positively assigned to species. Call frequencies and shapes can be shared by bat species within the same genus according to the habitat they are flying in, i.e. in an open field or in a cluttered woodland. For example, both Leisler's bat and noctule can echolocate at the same frequency and with the same call shape and therefore were assigned to the *Nyctalus* spp. category and not necessarily identified to species level. Similarly, a bat was classified as *Myotis* spp. if differences in call shape and frequency between Daubenton's bats and Natterer's bats could not be discerned.

2.3.1 Bat Activity Indices

Static detectors record bats as they pass but there is no observer to record whether one bat passes a hundred times, or a hundred bats pass in succession, or the direction of flight. Therefore, in order to standardise the data and enable some comparison of deployment nights, the accepted approach is to use bat 'passes' as a unit of activity.

Numbers of bat 'passes' recorded are used as the standard measure to create a relative index of bat activity. During transects, the number of times a bat was encountered is described as the number of bat passes. A bat 'pass' was defined as a series of ≥ 2 consecutive echolocation calls having <1 second separating each call, and up to 10 seconds long (Hayes, 1997; Cook *et al*., 2008).

For automated detector data, the index of bat activity used was the number of files recorded each night which contained bat calls, taken as the number of bat passes per night (bppn). As one file has been taken to equating to one bat pass, an average nightly activity index was calculated for each detector deployment. The Bat Activity Index (BAI) also removes any bias created by the variation in the duration of the static detector deployment periods.

2.3.2 Ecobat

The Ecobat[2] tool is an online freely available means of comparing activity levels found on this site with other sites within a given radius at the same time of year and in comparable weather conditions.

The reference range comparison dataset was stratified to include:

- only records from within 30 days of the survey date;
- only records from within 100 km^2 of the survey area.

Ecobat generates a percentile rank for each night of activity and provides a numerical way of interpreting the levels of activity recorded at a site across regions in Britain. The percentiles provide a numerical indicator of the relative importance of a nights' worth of bat activity by comparing it other sites within 100 km and 30 days

[2] http://www.ecobat.org.uk/

of the record. Percentiles can then be assigned to activity categories (low, moderate, high) to provide a quantifiable measure of bat activity (Table 4).

Table 4: Percentile Score and Categorised Level of Bat Activity

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

2.3.3 Risk Assessment

The risk to bats from wind turbines is from death either by direct collision or death through injury (including barotrauma[3]). The impact of a single bat death is unlikely to be significant on any scale, but cumulative losses of individual bats could potentially threaten the viability of local or even national populations. The relevance of the loss of a single bat on local populations depends on the size of a local population, and the online tool Ecobat uses relevant data sets allowing consideration of location within the assessment.

The risk assessment carried out within this report follows that outlined in the current guidance (SNH *et al*., 2019). Tables 5 and 6 below present the factors to consider when assessing potential risk to bats. Table 5 gives an indication of potential site risk based on a consideration of habitat and development related features. Project Size and Habitat Risk criteria are outlined in Table D.1 and D.2 in Appendix D.

Table 5: Initial Site Risk Assessment

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

Table adapted from SNH et al. (2019). Green (1-2) - low/lowest site risk; Amber (3) - medium site risk; Red (4-5) - high/highest site risk.

An overall assessment of risk can then be made by considering the site assessment in relation to the bat activity output from Ecobat, which considers the relative vulnerability of each species of bat present, at the population level (Table 6).

Table 6: Overall Risk Assessment

Site Risk Level (from Table 5)	Ecobat 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
Med (3)	0	3	6	9	12	15
High (4)	0	4	8	12	15	18
Highest (5)	0	5	10	15	20	25

Table adapted from SNH *et al.* (2019). Overall assessment: Low (green) 0 – 4; Medium (amber) 5 – 12; High (red) 15 – 25.

[3] Barotrauma is when soft tissues, such as the lungs, are damaged due to the sudden change in air pressure in the wake of rotating turbine blades. It results in fatal internal bleeding (Baerwald *et al*., 2009).

2.4 Limitations to Study

2.4.1 Desk Based Assessment

The desk study data is third party controlled data, purchased for the purposes of this report only. RPS cannot vouch for its accuracy and cannot be held liable for any error(s) in these data. On contacting the Dumfries and Galloway Bat Group we received an email stating that their data was held on the NBN Atlas.

2.4.2 Surveys

Due to equipment availability at the time the surveys were commissioned, a split deployment method was employed with one detector (Location 05) deployed throughout the three deployment periods as a control. Due to equipment failure (including damage to microphones) the bat detectors failed at Locations 08, 11 and 12 during the first deployment, and Locations 03 and 12 in the third deployment. However, it is considered that sufficient data was collected from neighbouring detectors to represent the level of bat activity there. Some detectors were not operative for the entire deployment period (for example, Location 02 in the spring deployment, and Location 09 in the summer deployment), this seems to have been due to batteries being drained more quickly than anticipated. It is still considered that across the entire survey period that these detectors captured adequate data to give a representation of the bat activity at these locations.

2.4.3 Ecobat Limitations

There are limitations associated with this assessment in so far as the use of the Ecobat analysis tool as required by SNH (2019)[2] is reliant on third party data, and the accuracy of the results returned using the Ecobat tool requires a substantial amount of records to be present. One of the limitations in the Ecobat format is the lack of consideration of nights with a count of zero bat passes.

3 RESULTS

3.1 Desk Study

3.1.1 Bat Records

Table 7 and 8 below detail all the bat records returned from SWSEIC.

Table 7: Bat Species Recorded on Site

Scientific Name	Common Name	Number of records	First recorded	Last recorded
Myotis	Unidentified Bat	14	2016	2016
Myotis mystacinus/brandtii	Whiskered/Brandt's Bat	9	2016	2016
Myotis daubentonii	Daubenton's Bat	11	2016	2016
Myotis nattereri	Natterer's Bat	18	2016	2016
Nyctalus	Nyctalus Bat species	1	2016	2016
Nyctalus leisleri	Leisler's	10	2016	2016
Nyctalus noctula	Noctule Bat	2	2016	2016
Pipistrellus	Pipistrelle Bat species	53	2000	2018
Pipistrellus	Common Pipistrelle	35	2015	2018
Pipistrellus pygmaeus	Soprano Pipistrelle	47	2008	2018
Plecotus auritus	Brown Long-eared Bat	7	2009	2016

Table 8: Bat Roosts Recorded

Scientific Name	Common Name	Date	Location	Grid Reference	Spatial accuracy	1km Sq	10km Sq
Chiroptera	Bats	27/10/1995	No site name available	NS777092	100	NS7709	NS70
Chiroptera	Bats	31/10/1995	No site name available	NX804979	100	NX8097	NX89
Chiroptera	Bats	07/07/2000	No site name available	NX798931	100	NX7993	NX79
Chiroptera	Bats	26/10/2006	No site name available	NX724916	100	NX7291	NX79
Chiroptera	Bats	13/02/2007	No site name available	NX804985	100	NX8098	NX89
Pipistrellus	Pipistrelle Bat species	07/07/2000	No site name available	NX793907	100	NX7990	NX79
Pipistrellus	Pipistrelle Bat species	23/11/2001	No site name available	NX835999	100	NX8399	NX89
Pipistrellus	Pipistrelle Bat species	07/07/2002	No site name available	NX767894	100	NX7689	NX78
Pipistrellus	Pipistrelle Bat species	24/06/2004	No site name available	NS731122	100	NS7312	NS71
Pipistrellus	Pipistrelle Bat species	27/07/2006	No site name available	NS727126	100	NS7212	NS71
Pipistrellus	Pipistrelle Bat species	06/10/2006	No site name available	NS737115	100	NS7311	NS71
Pipistrellus	Pipistrelle Bat species	06/10/2006	No site name available	NS737115	100	NS7311	NS71
Pipistrellus	Pipistrelle Bat species	22/09/2018	Tynron, near Thornhill	NX800931	100	NX8093	NX89
Pipistrellus pipistrellus	Common Pipistrelle	10/08/2015		NX7791	1000	NX7791	NX79
Pipistrellus pipistrellus	Common Pipistrelle	22/09/2018	Tynron, near Thornhill	NX800931	100	NX8093	NX89
Pipistrellus pygmaeus	Soprano Pipistrelle	2008	Moniaive. Hastings Hall, Moniaive	NX776912	100	NX7791	NX79
Pipistrellus pygmaeus	Soprano Pipistrelle	03/05/2008	Breconside. Breconside, Thornhill	NS836025	100	NS8302	NS80
Pipistrellus pygmaeus	Soprano Pipistrelle	August 2013	Tynron	NX807931	100	NX8093	NX89
Pipistrellus pygmaeus	Soprano Pipistrelle	22/08/2016	Kirkconnel (Polveoch Terrace)	NS735121	100	NS7312	NS71
Pipistrellus pygmaeus	Soprano Pipistrelle	06/05/2018	Tynron, near Thornhill	NX799931	100	NX7993	NX79
Pipistrellus pygmaeus	Soprano Pipistrelle	30/08/2018	Tynron, near Thornhill	NX800931	100	NX8093	NX89
Pipistrellus pygmaeus	Soprano Pipistrelle	22/09/2018	Tynron, near Thornhill	NX800931	100	NX8093	NX89

Scientific Name	Common Name	Date	Location	Grid Reference	Spatial accuracy	1km Sq	10km Sq
Pipistrellus pygmaeus	Soprano Pipistrelle	22/09/2018	Tynron, near Thornhill	NX800931	100	NX8093	NX89
Plecotus auritus	Brown Long-eared Bat	16/09/2009	Drumlanrig Castle. Drumlanrig	NX843987	100	NX8498	NX89

3.1.2 Statutory Designated Sites

Chanlockfoot Site of Special Scientific Interest (SSSI), lies 5 km to the east of the Site. The area forms part of the Upper Nithsdale Woods Special Area of Conservation.

3.1.3 Non-Statutory Designated Sites

Two non-statutory designated sites were found within 2 km of the Site:

- Afton Uplands Provisional Local Wildlife Site (LWS) - An extensive upland site which encompasses a range of upland mire, montane heath and grassland habitats. Has alpine clubmoss and juniper. The montane sedge, *Carex bigelowii*, is frequent over the summit of Craigbraneoch and Blackcraig; and

- Glen Afton LWS - Semi-natural valley woodland, scrub and semi-improved grassland. Predominantly alder and birch with good shrub and ground layers.

3.1.4 Other Wind Energy Developments in Proximity to the Site

Image 01 and Table 9 present the details of other operational wind farms within 10 km of the site boundary as collated from the My Grid GB website[5] (accessed 27 November 2019). There are two operational wind farms within 10 km; Sanquhar Community, 5.7 km to the north, and Whiteside Hill 7.3 km to the north east of the proposed Polskeoch wind farm.

Table 9: Wind Farms within 10 km of the Site Boundary

Wind Farm Name	Distance and Direction from Site	Grid Reference	Description	Connecting Habitat
Sanquhar Community Wind farm	5.7 km north	NS 70311 07479	9 wind turbines in open moorland	Linked by plantation woodland and watercourses
Whiteside Hill Wind farm	7.3 km north east	NS 71440 08920	10 turbines in open moorland	Linked by plantation woodland and watercourses

[5] www.mygridgb.co.uk/map/

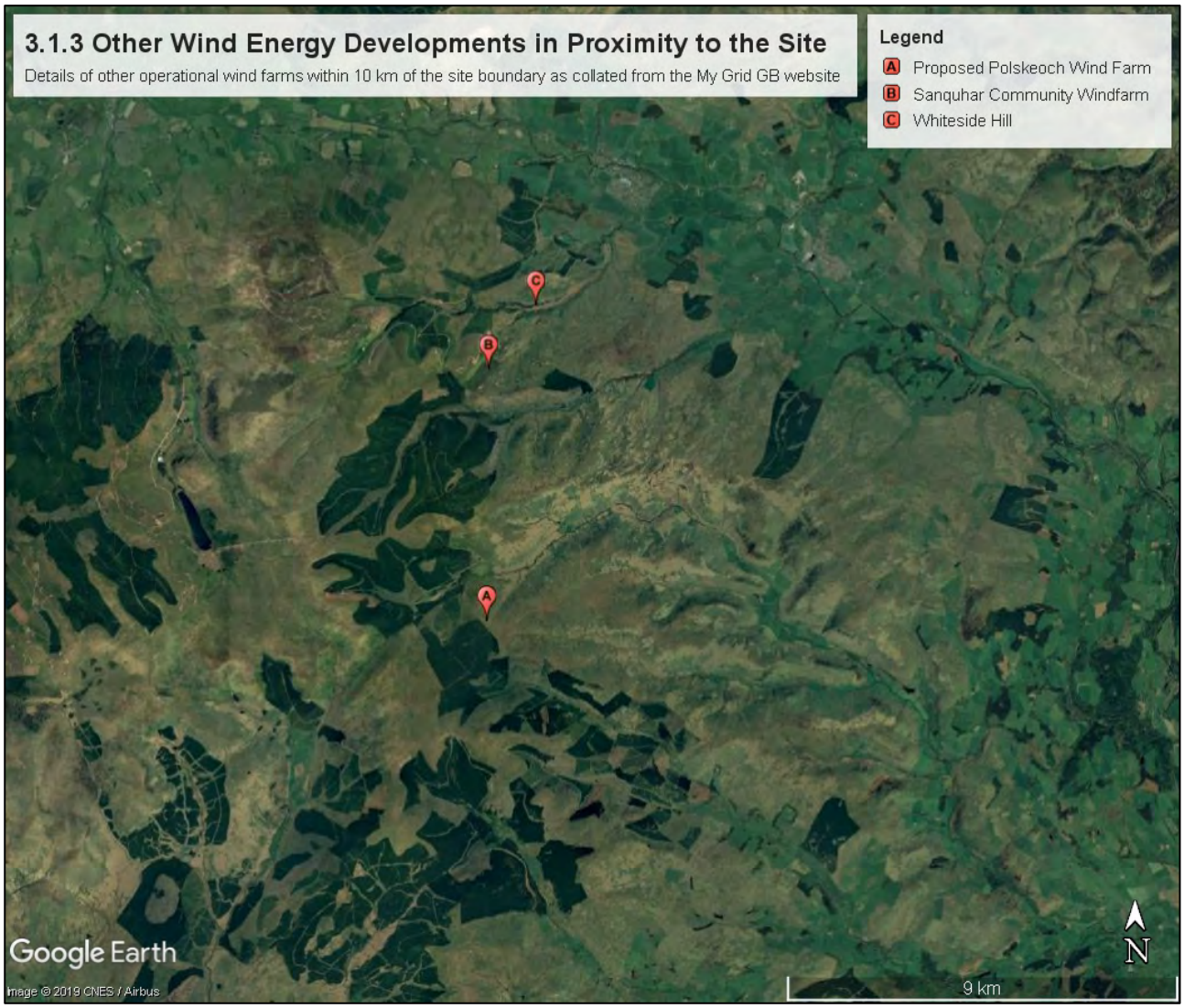


Image 01: Other wind energy developments in proximately to the site.

3.2 Field Survey Results

3.2.1 Site and Surrounding Habitat Assessment for Bats

The Polskeoch Site comprised coniferous forestry plantation dominated by Sitka spruce (*Picea sitchensis*) interspersed with rides of varying sizes, and open moorland to the west of the site. A number of water courses flow into the site including the Shinnel Water, Polskeoch Burn and the Polvaddoch Burn. A small amount of farm land is located towards the north east of the site around Lamgarroch. The turbine locations are predominantly located within the mapped coniferous plantation. Construction of the wind farm will initially involve 'key-holing' of the forestry to allow turbine erection, prior to the remaining forestry being systematically removed over a period of two years.

The Euchanhead Site located to the north comprises heavily grazed open moorland with a number of small water courses flowing west downhill through open moorland to the larger water course (Kello Water). The east of the site is dominated by coniferous forestry plantation also dominated by Sitka spruce.

3.2.2 Roost Surveys

Preliminary Roost Assessment

Four structures were assessed for their potential to support roosting bats, the locations of these in respect to the site are shown in Figure 1.

Of the four buildings assessed; one was deemed to have high bat roosting potential (The Bothy), two were deemed to have moderate roosting potential (the Farm House and Garage) and one was deemed to have low bat roosting potential (the Tin Hut). Detailed descriptions and assessment are given in Table 10.

Table 10: Potential Roost Assessments

Location	OS Grid References	Habitat	Photographs
Bothy	NS 68548 01878	Single storey of brick construction with wet harled walls. The Bothy has a pitched corrugated tin roof with wooden sarking and beams. The interior comprises a large area used for sleeping by the general public with a smaller storage area. The occasional scattered dropping was noted around the building. Potential bat roosting features include gaps at the eaves and apex. Given the potential roosting features the Bothy was assessed as having high bat roosting potential	 **Photo 01**. North facing aspect of Bothy.
Tin Hut	NS 68380 02096	The Tin Hut is a small single storey structure constructed of corrugated metal with wooden beams. There were no signs of droppings; however, pellets (possibly owl) were noted on the floor indicating that the structure could be utilised by a roosting owl. The potential roosting features are limited to behind the beams. Due to the limited roosting features the Tin hut has been assessed as having low roosting potential.	 **Photo 02**. South facing aspect of the Tin Hut.
Farm House	NS 68676 02309	A detached house, with pitched tile roof and UPVC down pipes and barge boards. The house is in a good condition with well fitted cladding and UPVC windows, meaning there are few obvious access points. The house is fitted with solar panels. Potential roosting features include the apex of gable ends. Due to the limited roost access features the Farm House has been accessed as having moderate roosting potential.	 **Photo 03**. South facing aspect of the Farm House.

Location	OS Grid References	Habitat	Photographs
Garage	NS 68662 02286	Adjacent to the Farm House the garage is a single story, detached building, pebble dashed with wooden windows and two metal garage doors. The garage has a pitched corrugated concrete or possibly asbestos roof and with UPVC under the wooden cladding. There are few obvious roost access points, with potential for access at the apex of the roof or under the eaves, but overall this building is in good condition. Due to the limited roosting features the garage has been accessed as having moderate roosting potential.	 **Photo 04**. North facing aspect of the Garage.

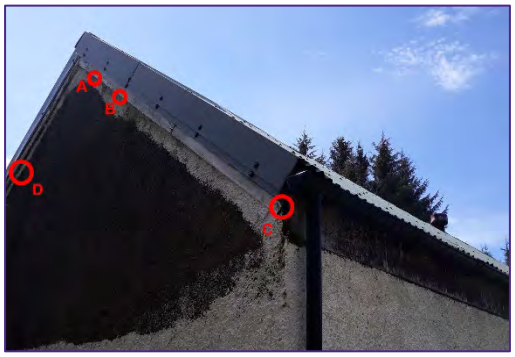
The surrounding conifer plantation dominated by Sitka spruce is generally deemed to have low roosting potential and no other trees were identified as having roosting potential. Due to the changing nature of commercial woodland there is a possibility this could change in the future, especially where standing deadwood has been left during harvesting operations.

Dusk Emergency and Re-entry Surveys

During the dusk emergence and dawn re-entry surveys five confirmed roost access points were identified in the Bothy, and a further one in the Farm House (Table 11):

- The south east of the bothy was found support a maternity roost for soprano pipistrelle bats with a peak count of 83;
- The north west aspect of the bothy was found to support an individual roosting bat therefore this has been assessed as non-breeding summer roosts; and
- The farm house was found to support individual roosting bats therefore this has been assessed as non-breeding summer roost.

Table 11: Roost Access Points

Location	Comments	Photo References
Bothy	**18 August 2019**- two bats were observed entering the building. One soprano pipistrelle entered the apex of the roof on the south east face of the building, Point E in Photo 06. The second bat entry was a single Pipistrelle Spp. entering the Apex of the roof at point A on Photo 5. **26 August 2019**- a single pipistrelle species bat was observed exiting Point E at 20:43. To the north west of the building 23 soprano pipistrelles exited Point A. A further 39 soprano pipistrelles were observed exiting from Point B, seven pipistrelles were observed exiting from Point C and a further 13 exited from Point D. A total of 83 bats were observed exiting the building. The survey also reported a potential brown long eared exiting the roost at Point A, however this was not picked up by the bat detector. **17 September 2019**- two soprano pipistrelles were observed exiting at Point E. Eight bats were observed exiting the building at Point A. Overall, the surrounding habitat provided good foraging and commuting habitat for bats.	 **Photo 05.** Roost entry points on north west aspect of the building.

Location	Comments	Photo References
		 **Photo 06**. Roost entry points on the south east aspect of the building.
Farm House	**13 August 2019**- a single pipistrelle species bat emerged from the apex of the roof at 21:15 and flew west. **27 August 2019**- No bats entered the building however they were observed swarming briefly at the chimney, however they flew off.	 **Photo 07**. Roost access point in roof of the Farm House.

Further surveys on both the Garage and Tin Shed did not record any roosting bats; however, due to the high levels of bat activity in the area the use of these buildings by bat species in the future cannot be ruled out.

Hibernation Potential

Pipistrelle species bats are known to hibernate in the same roosts they utilise in the summer. The Bothy is a confirmed roost, with high numbers of bat utilising it, a precautionary assessment of the building is that it has high potential for winter roosting bats. The Farm House, Garage and Tin Shed were deemed to have low hibernaculum potential, due to the low numbers of bats using them.

3.2.3 Activity Surveys

Static Detector Locations

As per the current guidance detectors were placed at turbine locations. Care was taken to ensure that the locations chosen represented each of the main habitat types. Table 12 below briefly describes the habitat at each location and whether it is located near or on linear features such as tree lines or water courses.

Table 12: Habitat at Static Monitoring Locations

Location	OS Grid References	Habitat	Photographs
01	NS 66075 03026	Located in a wide forest ride, on the banks of Polvaddoch Burn. The immediate habitat is marshy grassland, with conifer plantation on either side.	No photograph.
02	NS 66354 02861	Located to the north of a clear fell area, with a small burn (Pot Burn) to the north and plantation with windfall to the north.	 **Photo 08**. Location of static detector 2.
03	NS 66896 02121	Located on open moorland, between two stands of plantation woodland.	No photograph.
04	NS 67692 02197	Located in conifer plantation woodland, on the intersection of large forest rides and on the forest access track.	 **Photo 09**. Location of static detector 4.
05	NS 69286 01383	Located in conifer plantation woodland, on forest ride, with mature plantation to one side and young plantation to the other.	 **Photo 10**. Location of static detector 5.

Location	OS Grid References	Habitat	Photographs
06	NS 69295 00928	Located in conifer plantation woodland, on the forest track. On the boundary of semi - mature plantation and clear-fell.	 **Photo 11**. Location of static detector 6.
07	NS 69648 00523	Located on a forest ride, with marshy grassland, 10 m from the forest track. The surrounding forest is mature conifer plantation.	 **Photo 12**. Location of static detector 7.
08	NX 69402 99395	Located in conifer plantation woodland, on forest ride, along the eastern edge of clear-fell.	 **Photo 13**. Location of static detector 8.
09	NS 70599 00005	Located in mature conifer plantation woodland, on the track, surrounded by conifer plantation woodland with open marshy grassland rides nearby.	 **Photo 14**. Location of static detector 9.

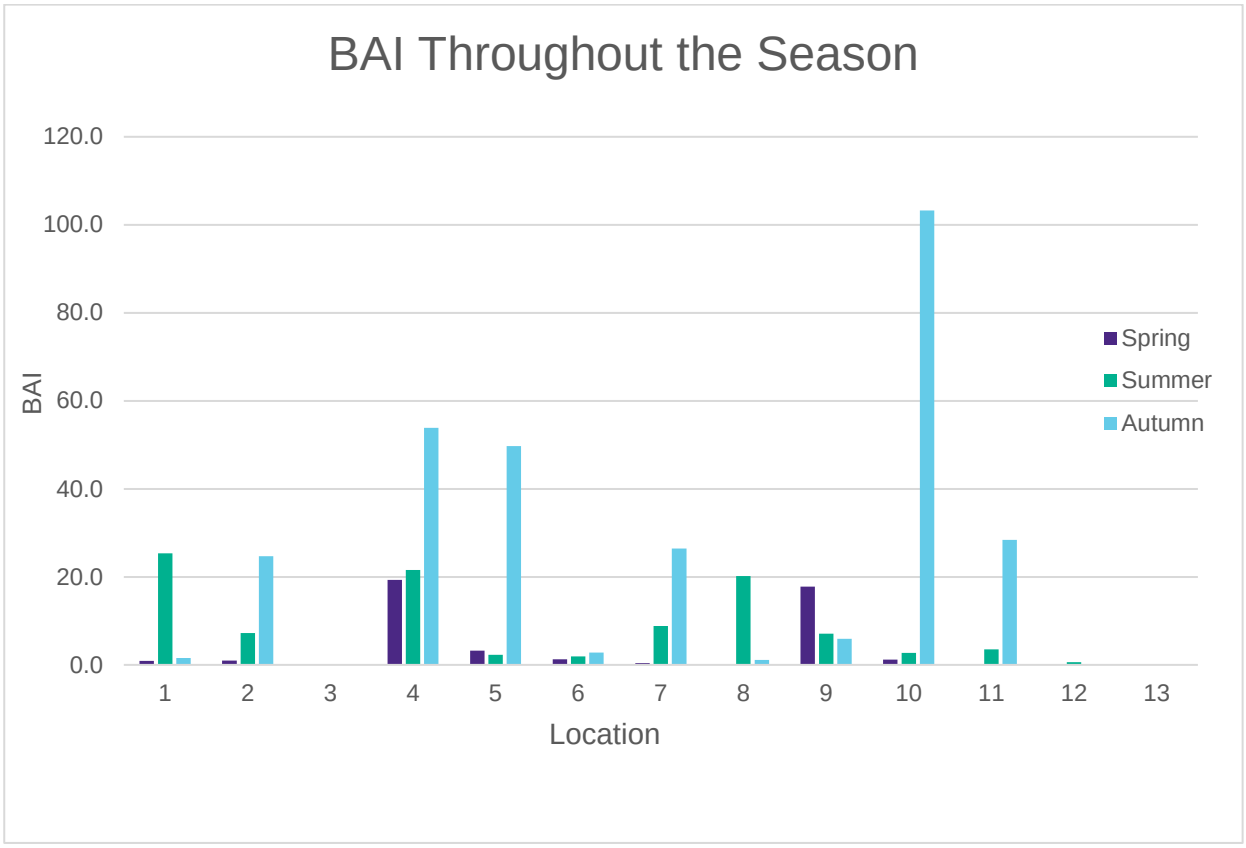
Location	OS Grid References	Habitat	Photographs
10	NX 70561 99553	Located in conifer plantation woodland, on forest ride, along the south eastern edge of clear-fell. The surrounding habitat is marshy grassland, with the forest track less than 10 m away, providing a linear feature for commuting bats.	 **Photo 15**. Location of static detector 10.
11	NX 71198 98945	Located in a large forest ride with open moorland to the south and the Nether Grain Burn flowing south to north. Dense conifer plantation to the north and south of this location with forestry operations nearby.	 **Photo 16**. Location of static detector 11.
12	NS 66854 05930	Located on open moorland, with marshy grassland surrounding. This area is extremely open, with the closest linear feature being the plantation tree line, over 350 m to the south.	 **Photo 17**. Location of static detector 12.
13	NS 67425 07141	Located on open moorland, with marshy grassland surrounding. This area is extremely open, with the closest linear feature being the plantation tree line, over 250 m to the north east.	 **Photo 18**. Location of static detector 13.

Summary of Activity Levels

From the 13 locations a total of 541 survey nights were undertaken, with a total of 5710 (704 during spring, 1563 during summer and 3443 during autumn) files with bat passes collected.

A minimum of six species of bats were recorded: common pipistrelle, soprano pipistrelle, Daubenton's, Leisler's, noctule and brown long-eared bats. Some calls were not distinguishable between the two species of pipistrelle and are referred to as *Pipistrelle* Spp, as are calls between *Myotis* Spp. and *Nyctalus* Spp. which are therefore referred to as *Myotis* and *Nyctalus*.

Table A.1 in Appendix A provides the total number of bat passes at each location in each season. In addition, it lists the bat activity index, which is the average number of bat passes per night. Graph 01 displays the BAI over deployment period (bat passes per night (bppn)).



Graph 01 Bat Activity Index Throughout the Season

Graph 01 compares activity levels throughout the seasons for each location. A peak in activity levels can be seen during the autumn deployment, particularly at Location 10. Location 10 is adjacent to a forest track providing a linear feature for commuting bats, flanked by plantation woodland.

During the spring survey BAI is overall low, with peaks at Location 04, Location 09 and to a lesser extent Location 05.

The summer survey period showed higher activity than that in spring, with high activity at Location 04 and 5. Activity levels during summer also increased from spring activity levels at Location 01 and to a lesser extent Location 08.

Autumn shows a further increase in level of activity across the site, with Location 10 being the most active of any location throughout the season. Location's 04, 05 and 11 also show higher levels of activity.

3.3 Ecobat Analysis

Bat activity data for Polskeoch was uploaded and analysed by Ecobat. Table 13 summarises the data including:

- maximum bat activity taken as the night with the most bat passes;
- maximum bat activity level taken as the highest assessed bat activity level from the Ecobat results;
- average bat activity (bppn); and
- bat activity level taken as the most common assessment for the location and deployment from Ecobat results.

As detailed in the methods Section 2.3.2 the assessment is taken from a reference range; only records from within 30 days of the survey date and only records from within 100 km^2 of the survey area. For these deployment dates the sample size of Ecobat comparison reference range is as follows:

Spring
Myotis- 172
Pipistrellus pipistrellus- 627
Pipistrellus pygmaeus- 559
Pipistrellus- 742
Myotis daybentonii-19
Plecotus auritus- 35

Summer
Myotis- 613
Pipistrellus- 2305
Pipistrellus pipistrellus- 1864
Pipistrellus pygmaeus- 1864
Nyctalus leisleri- 901
Nyctalus- 1335
Nyctalus noctula- 495

Autumn
Myotis- 655
Nyctalus- 967
Pipistrellus- 2045
Pipistrellus pygmaeus- 1664
Nyctalus leisleri- 561
Nyctalus noctula- 370
Pipistrellus pipistrellus- 1514
Myotis daubentonii- 53
Plecotus auritus- 59

Table 13: Summary of Bat Activity Data throughout the Survey Season

Survey period	Location	Maximum bat activity (bat passes)	Maximum Bat activity level (low, moderate, high)	Bat activity (bat passes per night)	Bat activity level (low, moderate, high)
Spring	01	5	Moderate	0.9	Moderate
Spring	02	7	Moderate/high	1.0	Moderate/high
Spring	03	0	No bat calls	0.0	No bat calls
Spring	04	201	High	19.3	Low
Spring	05	1	Low	3.2	Low
Spring	06	2	Low/moderate	1.3	Low
Spring	07	2	Low/moderate	0.4	Low
Spring	08			**Failure**	
Spring	09	119	High	17.8	High
Spring	10	7	Moderate/high	1.2	Low
Spring	11			**Failure**	
Spring	12			**Failure**	
Spring	13	1	Low	0.1	Low
Summer	01	88	High	25.4	Moderate
Summer	02	56	High	7.3	Low
Summer	03	0	No bat calls	0.0	No bat calls
Summer	04	106	High	21.6	Moderate/high
Summer	05	18	High	2.3	Low
Summer	06	4	Moderate	1.9	Low
Summer	07	83	High	8.8	Low
Summer	08	110	High	20.2	High
Summer	09	21	High	7.1	Moderate
Summer	10	12	Moderate/high	2.8	Low
Summer	11	28	High	3.5	Low
Summer	12	4	Moderate	0.6	Low/moderate
Summer	13	1	Low	0.1	Low
Autumn	01	22	High	1.6	Low
Autumn	02	144	High	24.7	High
Autumn	03			**Failure**	
Autumn	04	224	High	53.9	High
Autumn	05	105	High	49.8	High
Autumn	06	10	Moderate/high	2.8	Moderate
Autumn	07	237	Moderate/high	26.4	Low
Autumn	08	6	Moderate/high	1.1	Low
Autumn	09	45	High	5.9	Low
Autumn	10	587	High	103.3	High
Autumn	11	130	High	28.4	Moderate/high
Autumn	12			**Failure**	
Autumn	13	0	No bat calls	0.0	No bat calls

During the spring deployment only Location 03 recorded no bat passes. Peaks of moderate to high bat activity levels were recorded at Location 01, 02 and 09. The rest of the locations recorded low bat activity levels.

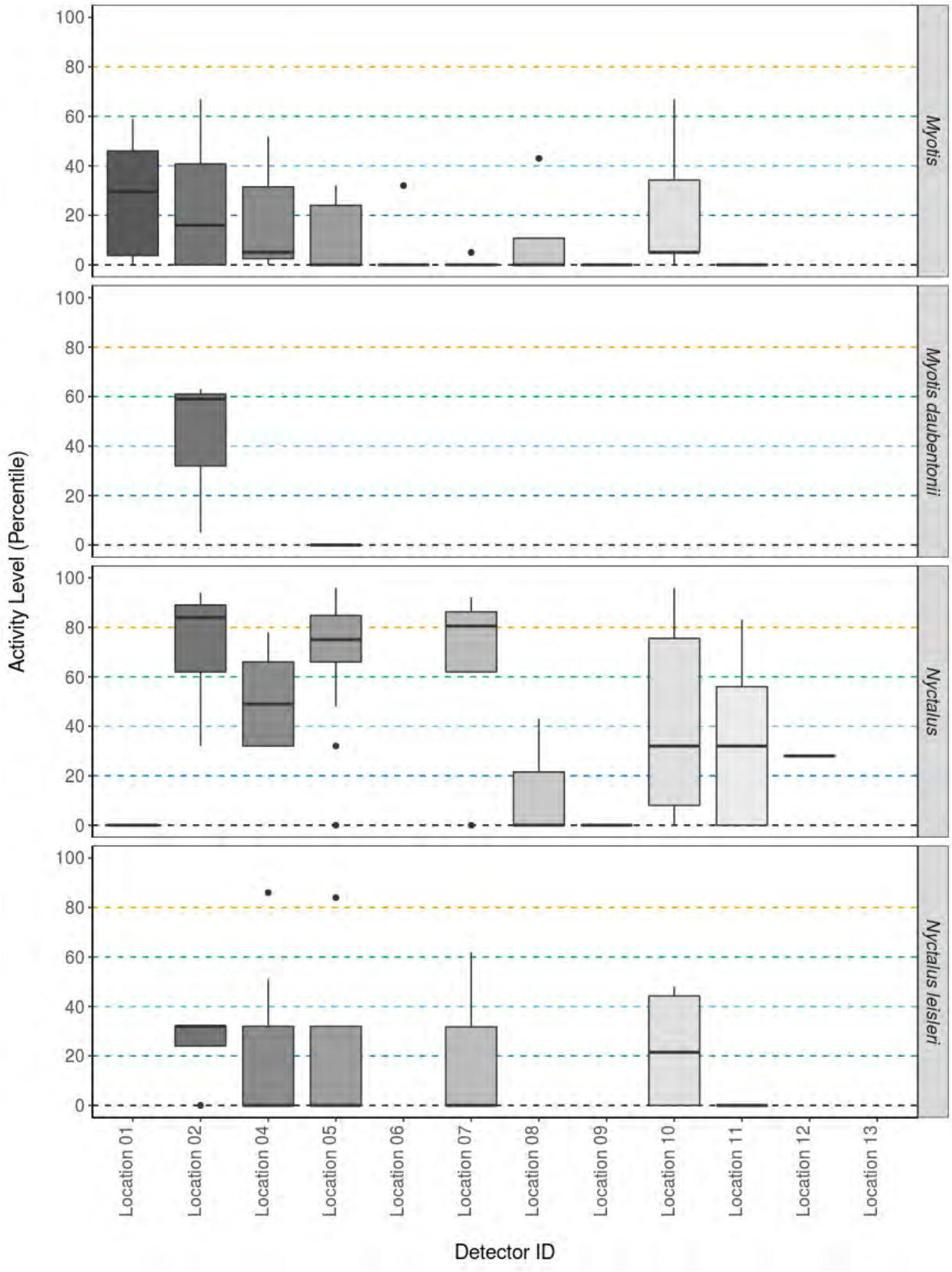
During the summer deployment high bat activity levels were recorded at Location 08 with moderate/high bat activity levels at Location 04. Location 01 and 09 experienced moderate bat activity levels. Location 12

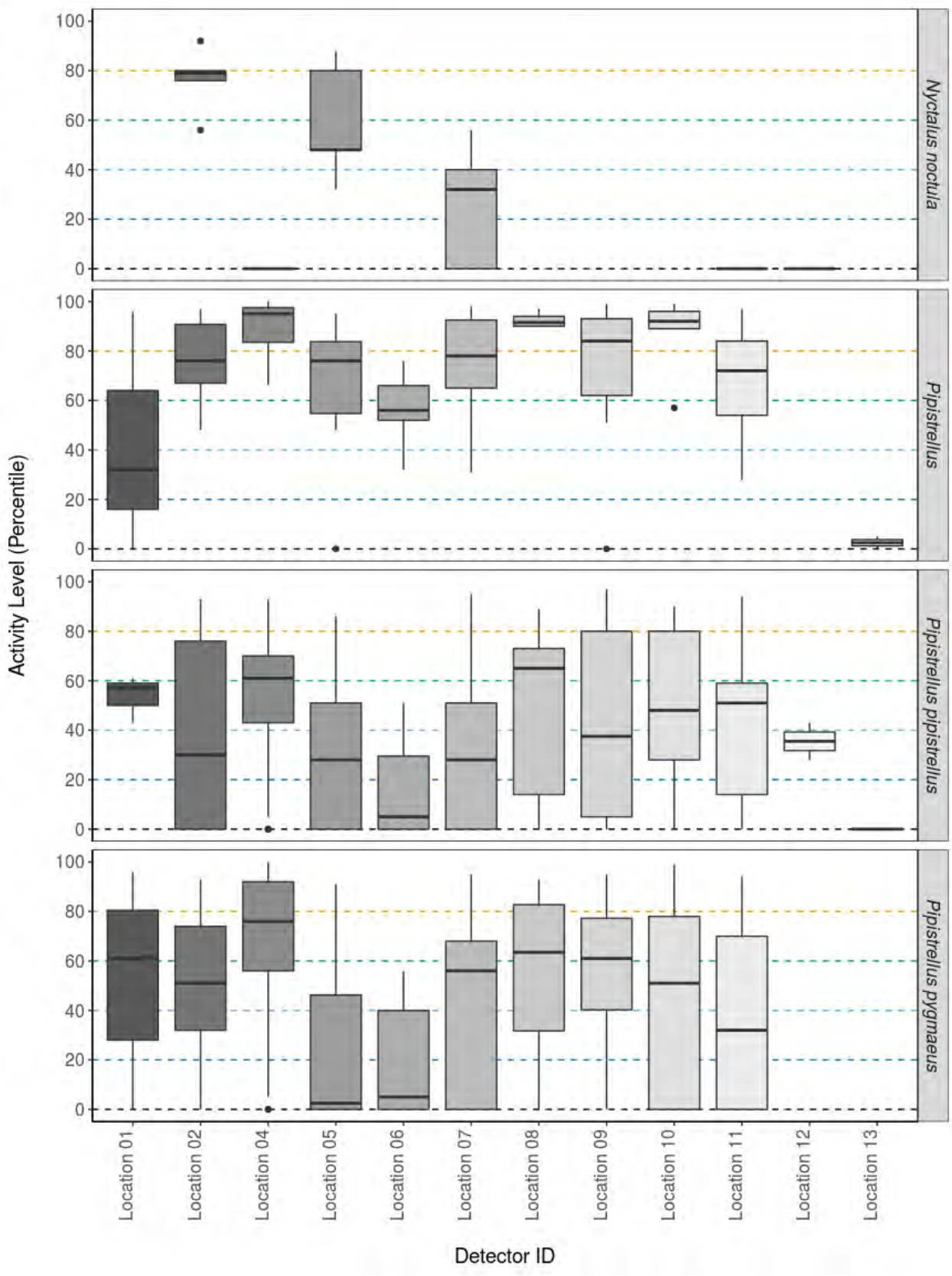
experienced low/moderate and six locations (02, 05, 06, 07, 10, 11 and 13) experienced low bat activity levels. Location 03 had no bat calls recorded.

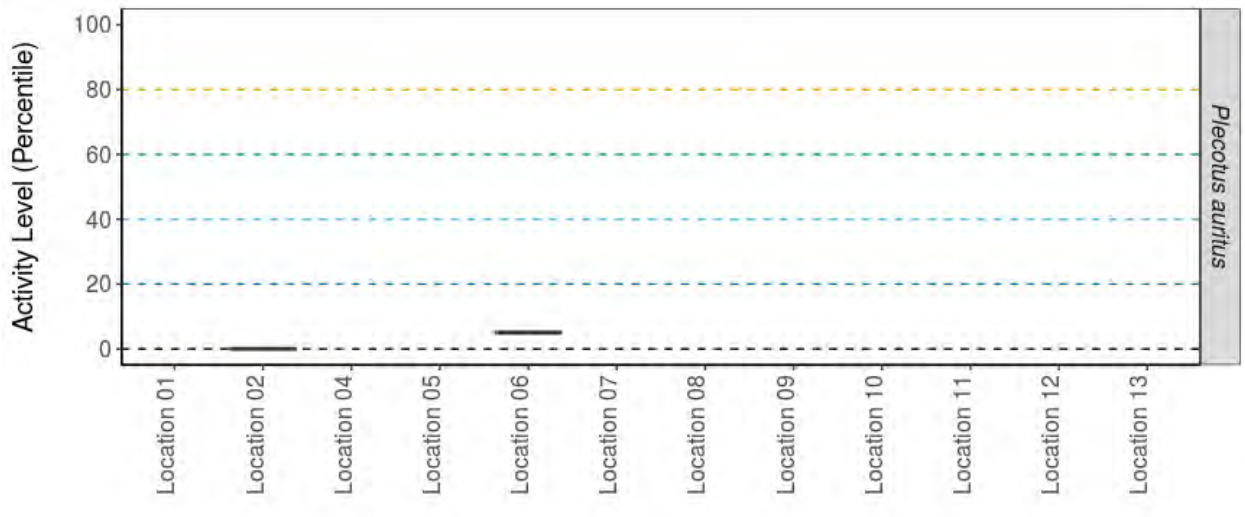
During the autumn deployment high bat activity levels were recorded at Locations 02, 04, 05 and 10. Location 11 experienced moderate/high bat activity levels and Location 06 recorded moderate bat activity levels. Locations 01,07, 08, 09 experienced low bat activity levels. No bat calls were recorded at Location 13.

3.4 Overall Species Distribution

Bat activity data for Polskeoch was uploaded and analysed using Ecobat. Throughout the entire survey period bat activity across the site is considered to be moderate, as shown in Table 13. Graph 02 below highlights the general bat activity across the site.


Activity Level (Percentile)
100
80
60
40
20
0
Myotis
Myotis daubentonii
Nyctalus
Nyctalus leisleri
Location 01
Location 02
Location 04
Location 05
Location 06
Location 07
Location 08
Location 09
Location 10
Location 11
Location 12
Location 13
Detector ID


Activity Level (Percentile)
100
80
60
40
20
0
Nyctalus noctula
Pipistrellus
Pipistrellus pipistrellus
Pipistrellus pygmaeus
Location 01
Location 02
Location 04
Location 05
Location 06
Location 07
Location 08
Location 09
Location 10
Location 11
Location 12
Location 13
Detector ID



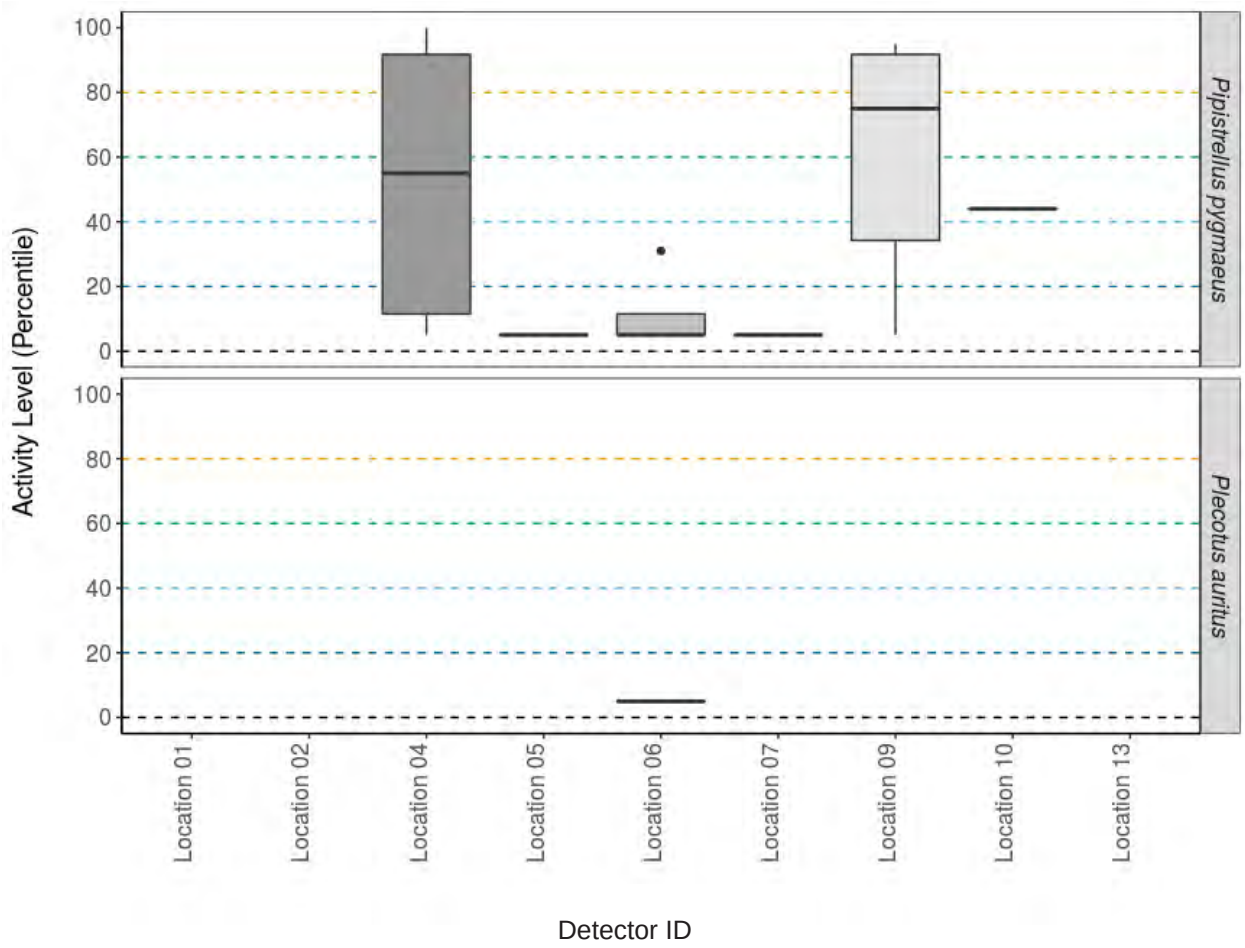
Graph 02 Differences in activity between static detector locations, split by species and location. The centre line indicates the median activity level whereas the box represents the interquartile range (the spread of the middle 50% of nights of activity).

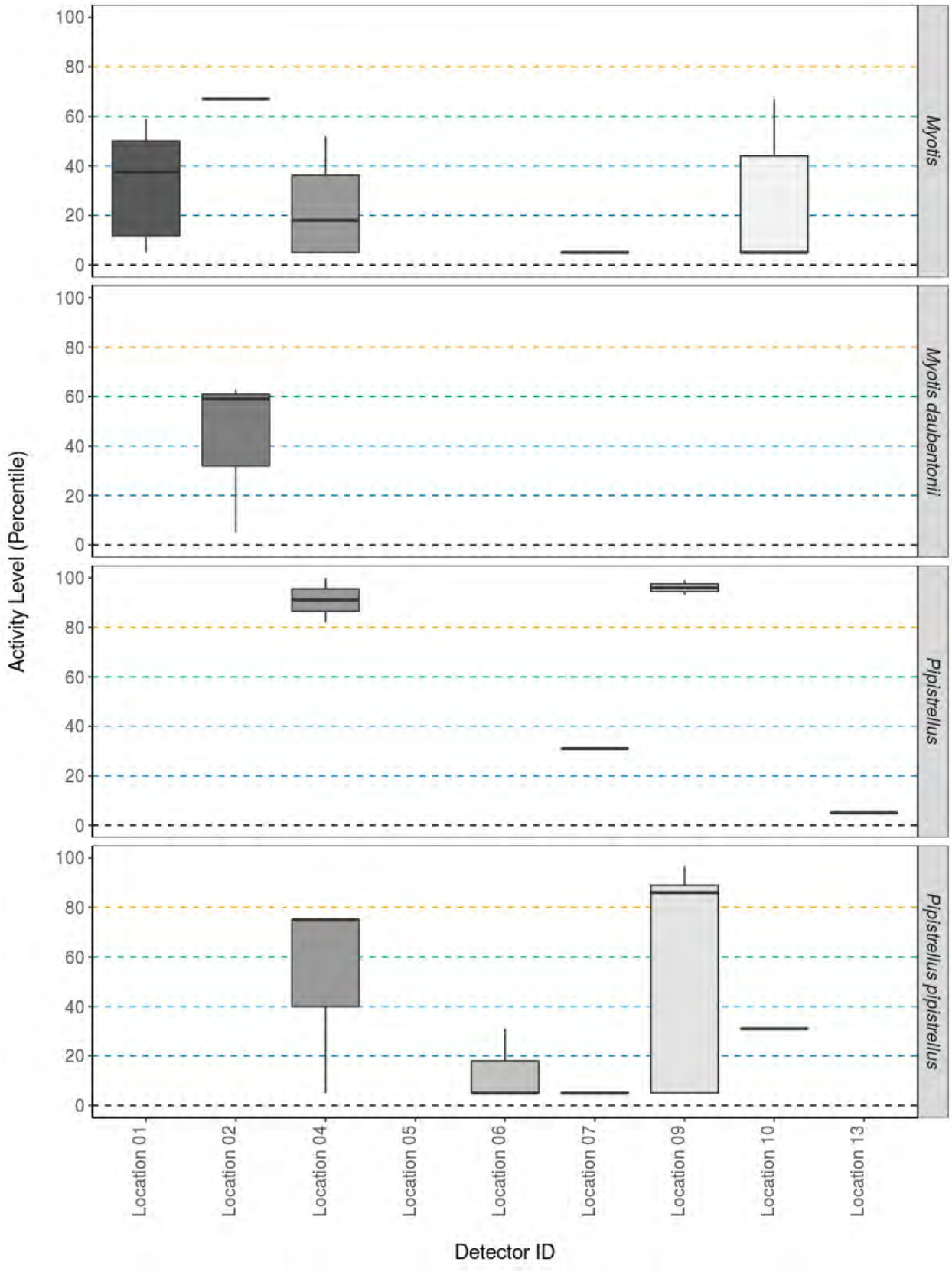
Key points:

- Common pipistrelles were recorded at all locations (except Location 03), the genre of *Pipistrelle* was the most common recorded;
- *Nyctalus* Spp. were recorded at all locations apart from; 03 and 13. They were at higher levels at Location 02, 05 and 07;
- *Myotis* Spp. were recorded at all locations apart from; 03, 12 and 13. Overall, they were recorded at moderate-low levels; and
- Brown long-eared bats were only recorded at Locations 02 and 06, at low levels.

3.4.1 Spring Species Distribution

Graph 03 below is an output from the Ecobat tool and shows the spatial distribution of bat species across the site during the spring deployment.


Activity Level (Percentile)
100
80
60
40
20
0
Pipistrellus pygmaeus
Plecotus auritus
Location 01
Location 02
Location 04
Location 05
Location 06
Location 07
Location 09
Location 10
Location 13
Detector ID



Graph 03 Differences in spring 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)

Key details are:

- Myotis species were recorded at Locations 01, 02, 04, 07 and 10;
- Brown long-eared were only recorded at Location 06, this was at low levels; and
- The pipistrelle genus was recorded the site, apart from Location 01 and 02.

As presented in Table 14 the activity level of each species at each location has been compared with similar sites by the Ecobat tool.

Table 14: Summary Table for Spring showing the Number of Nights Recorded Bat Activity Fell into Each Activity Band for Each Species

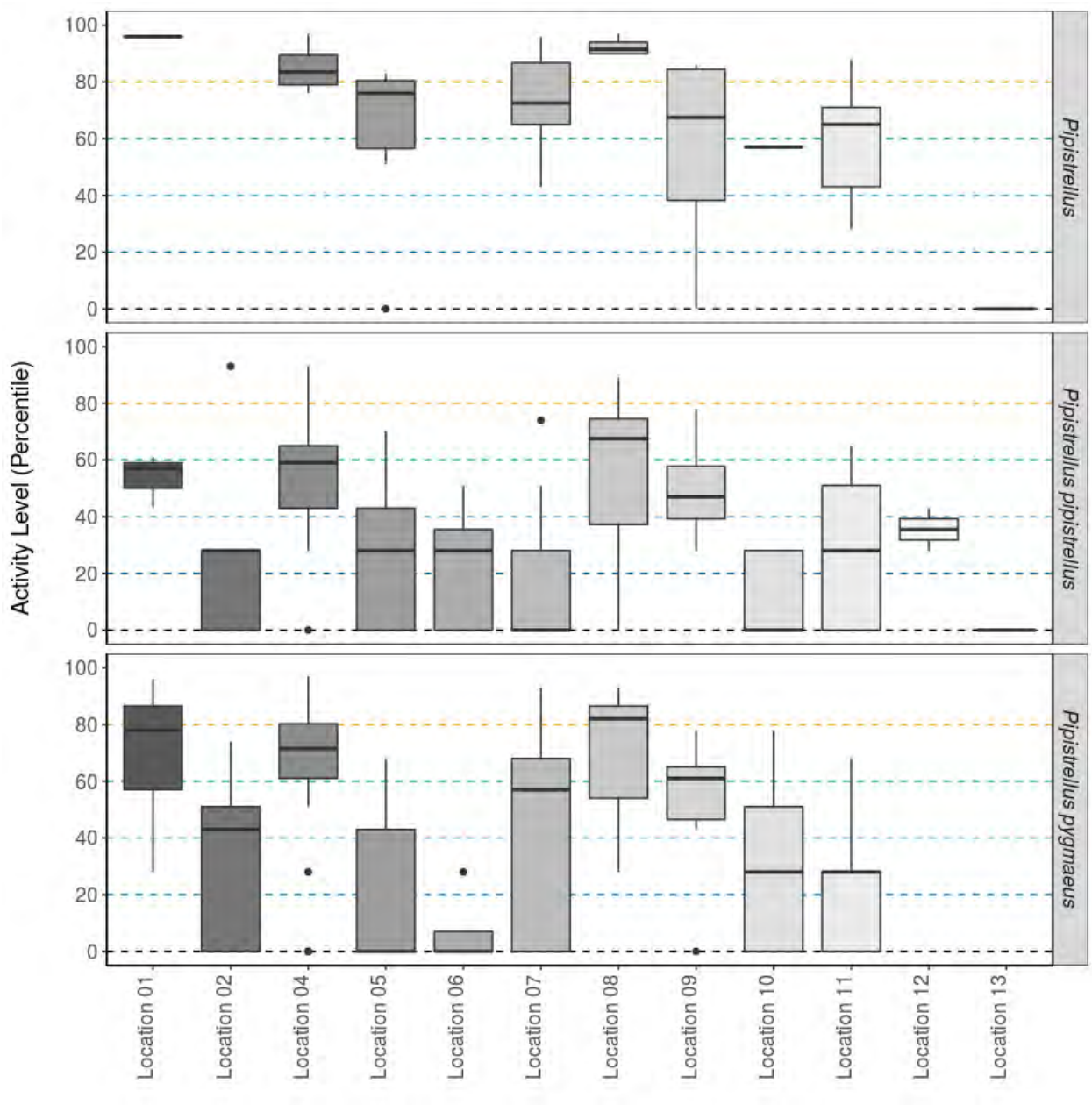
Location	Species/Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity
Location 01	*Myotis*	0	0	3	1	2
Location 02	*Myotis*	0	1	0	0	0
	Myotis daubentonii	0	1	1	0	1
Location 04	*Myotis*	0	0	1	1	2
	Pipistrellus	2	0	0	0	0
	Pipistrellus pipistrellus	0	2	0	0	1
	Pipistrellus pygmaeus	2	1	0	1	2
Location 05	*Pipistrellus pygmaeus*	0	0	0	0	1
Location 06	*Pipistrellus pipistrellus*	0	0	0	1	2
	Pipistrellus pygmaeus	0	0	0	1	3
	Plecotus auritus	0	0	0	0	1
Location 07	*Myotis*	0	0	0	0	1
	Pipistrellus	0	0	0	1	0
	Pipistrellus pipistrellus	0	0	0	0	2
	Pipistrellus pygmaeus	0	0	0	0	2
Location 09	*Pipistrellus*	2	0	0	0	0
	Pipistrellus pipistrellus	3	0	0	0	2
	Pipistrellus pygmaeus	3	2	1	0	2
Location 10	*Myotis*	0	1	1	0	3
	Pipistrellus pipistrellus	0	0	0	1	0
	Pipistrellus pygmaeus	0	0	1	0	0
Location 13	*Pipistrellus*	0	0	0	0	1

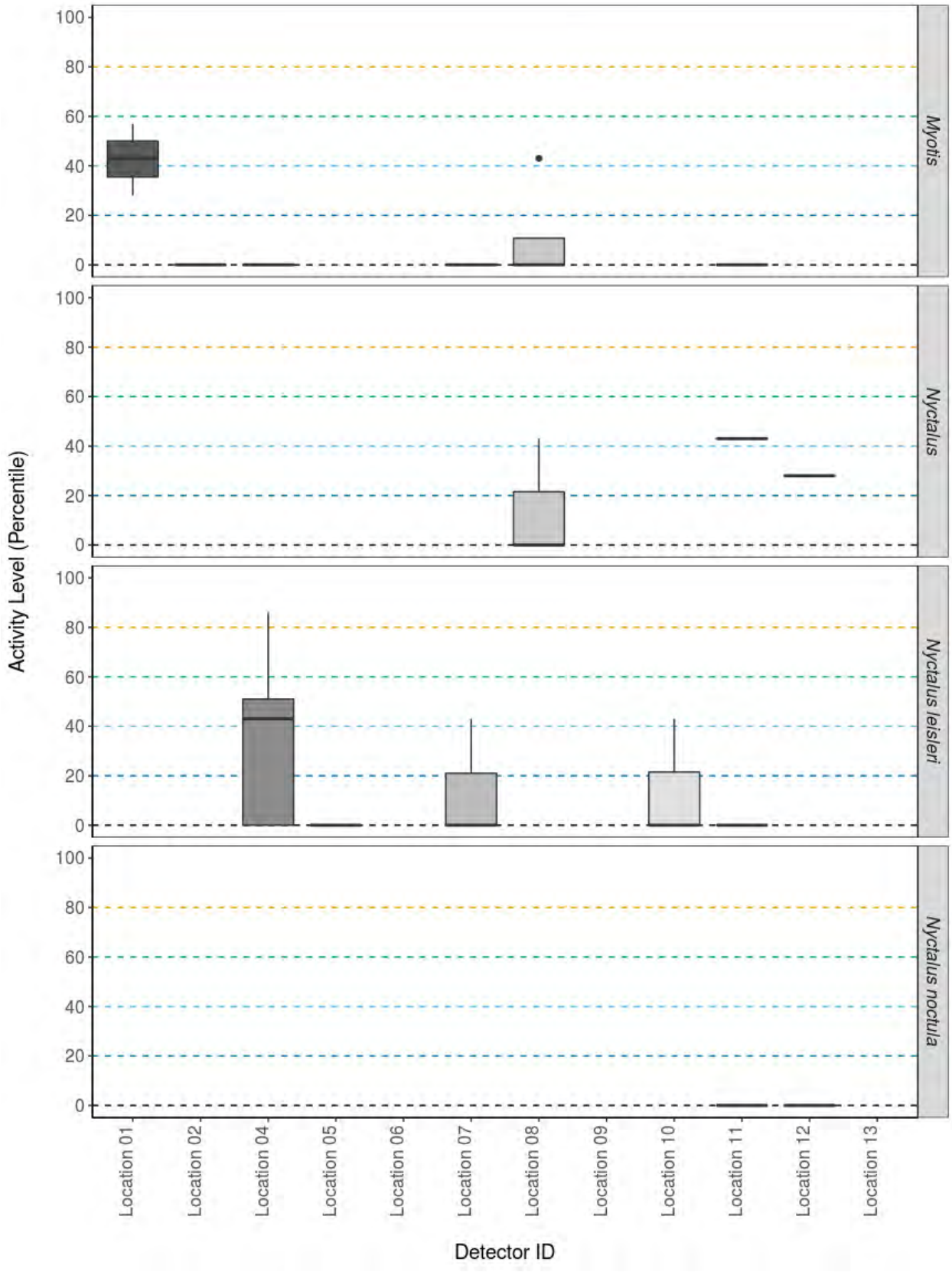
The key details are:

- The maximum level of activity at Location 01 was three nights of moderate activity;
- Location 02 was only used by *Myotis* Spp. and Daubenton's both of these were recorded for a single night of moderate/high activity;
- Pipistrelle genus was only recorded at high activity levels for 12 nights across the site, this was at Location 04 and 09. These were also the only nights of high activity levels; and
- Brown long-eared bats were only recorded at Location 06, this was for one night at low levels.

3.4.2 Summer Species Distribution

Graph 04 below is an output from the Ecobat tool and shows the spatial distribution of bat species across the site during the summer deployment.





Graph 04 Differences in summer 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)

Key points are:

- Common pipistrelles were observed at all locations during the summer deployment period, making them the most abundant species during summer;
- Soprano pipistrelle were observed in all locations other than 12 and 13;
- Leisler's were recorded at Locations; 04, 05, 07 ,10 and 11;
- Noctules were recorded at Locations 11 and 12;
- Nyctalus spp. were also recorded at Locations 08, 11 and 12; and
- Myotis species were observed in low numbers, apart from Location 01 where they were observed in moderate numbers.

As presented in Table 15 the activity level of each species at each location has been compared with similar sites by the Ecobat tool.

Table 15: Summary Table for Summer 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
Location 01	*Myotis*	0	0	2	1	0
	Pipistrellus	1	0	0	0	0
	Pipistrellus pipistrellus	0	1	2	0	0
	Pipistrellus pygmaeus	4	3	2	2	0
Location 02	*Myotis*	0	0	0	0	1
	Pipistrellus pipistrellus	1	0	0	2	2
	Pipistrellus pygmaeus	0	1	3	0	3
Location 04	*Myotis*	0	0	0	0	2
	Nyctalus leisleri	1	0	2	0	2
	Pipistrellus	3	1	0	0	0
	Pipistrellus pipistrellus	1	7	5	2	1
	Pipistrellus pygmaeus	5	9	1	1	2
Location 05	*Nyctalus leisleri*	0	0	0	0	1
	Pipistrellus	2	2	1	0	1
	Pipistrellus pipistrellus	0	2	3	3	5
	Pipistrellus pygmaeus	0	3	3	2	13
Location 06	*Pipistrellus pipistrellus*	0	0	2	2	3
	Pipistrellus pygmaeus	0	0	0	1	3
Location 07	*Myotis*	0	0	0	0	2
	Nyctalus leisleri	0	0	1	1	4
	Pipistrellus	3	2	1	0	0
	Pipistrellus pipistrellus	0	1	1	2	6
	Pipistrellus pygmaeus	2	4	2	0	5
Location 08	*Myotis*	0	0	1	0	3
	Nyctalus	0	0	1	0	2
	Pipistrellus	4	0	0	0	0
	Pipistrellus pipistrellus	1	3	0	1	1
	Pipistrellus pygmaeus	4	1	1	1	0
Location 09	*Pipistrellus*	2	0	1	0	1

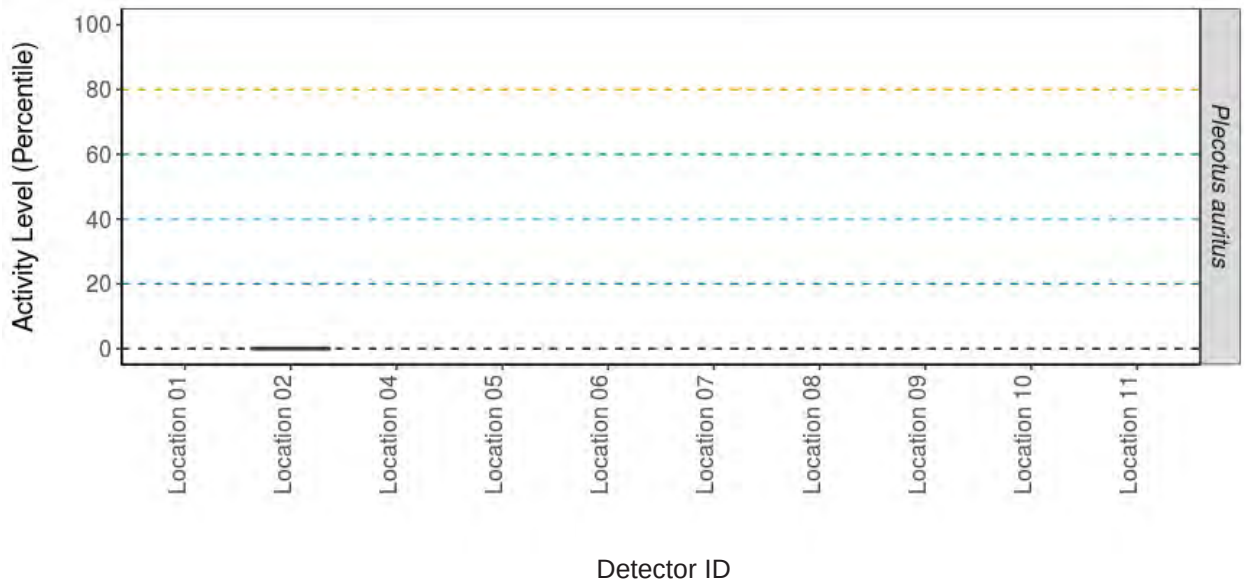
Location	Species/Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity
	Pipistrellus pipistrellus	0	1	2	1	0
	Pipistrellus pygmaeus	0	3	2	0	1
Location 10	*Nyctalus leisleri*	0	0	1	0	2
	Pipistrellus	0	0	1	0	0
	Pipistrellus pipistrellus	0	0	0	2	3
	Pipistrellus pygmaeus	0	3	3	1	6
Location 11	*Myotis*	0	0	0	0	1
	Nyctalus	0	0	1	0	0
	Nyctalus leisleri	0	0	0	0	2
	Nyctalus noctula	0	0	0	0	1
	Pipistrellus	1	3	2	1	0
	Pipistrellus pipistrellus	0	1	2	2	3
	Pipistrellus pygmaeus	0	2	0	3	4
Location 12	*Nyctalus*	0	0	0	1	0
	Nyctalus noctula	0	0	0	0	1
	Pipistrellus pipistrellus	0	0	1	1	0
Location 13	*Pipistrellus*	0	0	0	0	1
	Pipistrellus pipistrellus	0	0	0	0	1

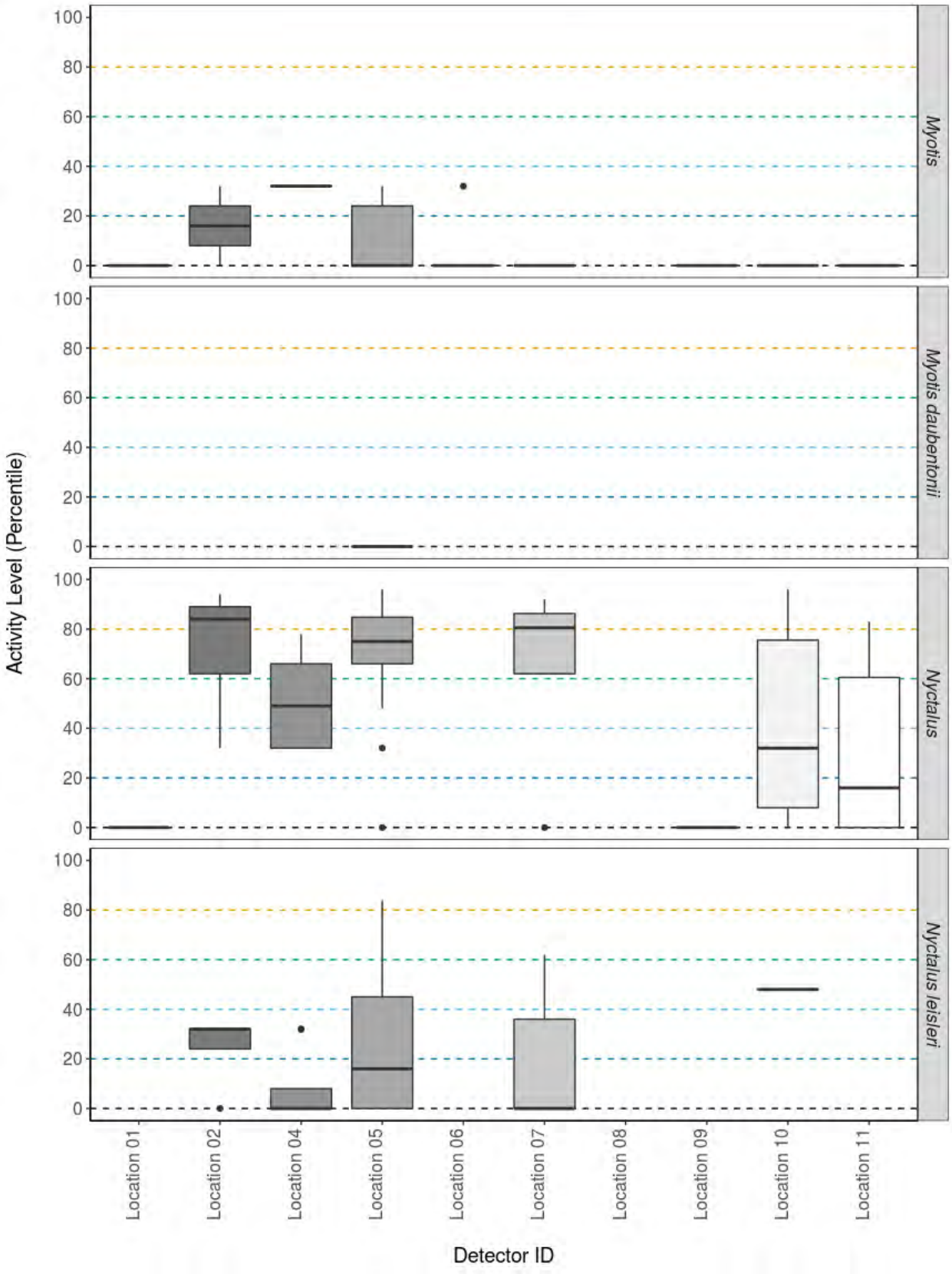
The key details are:

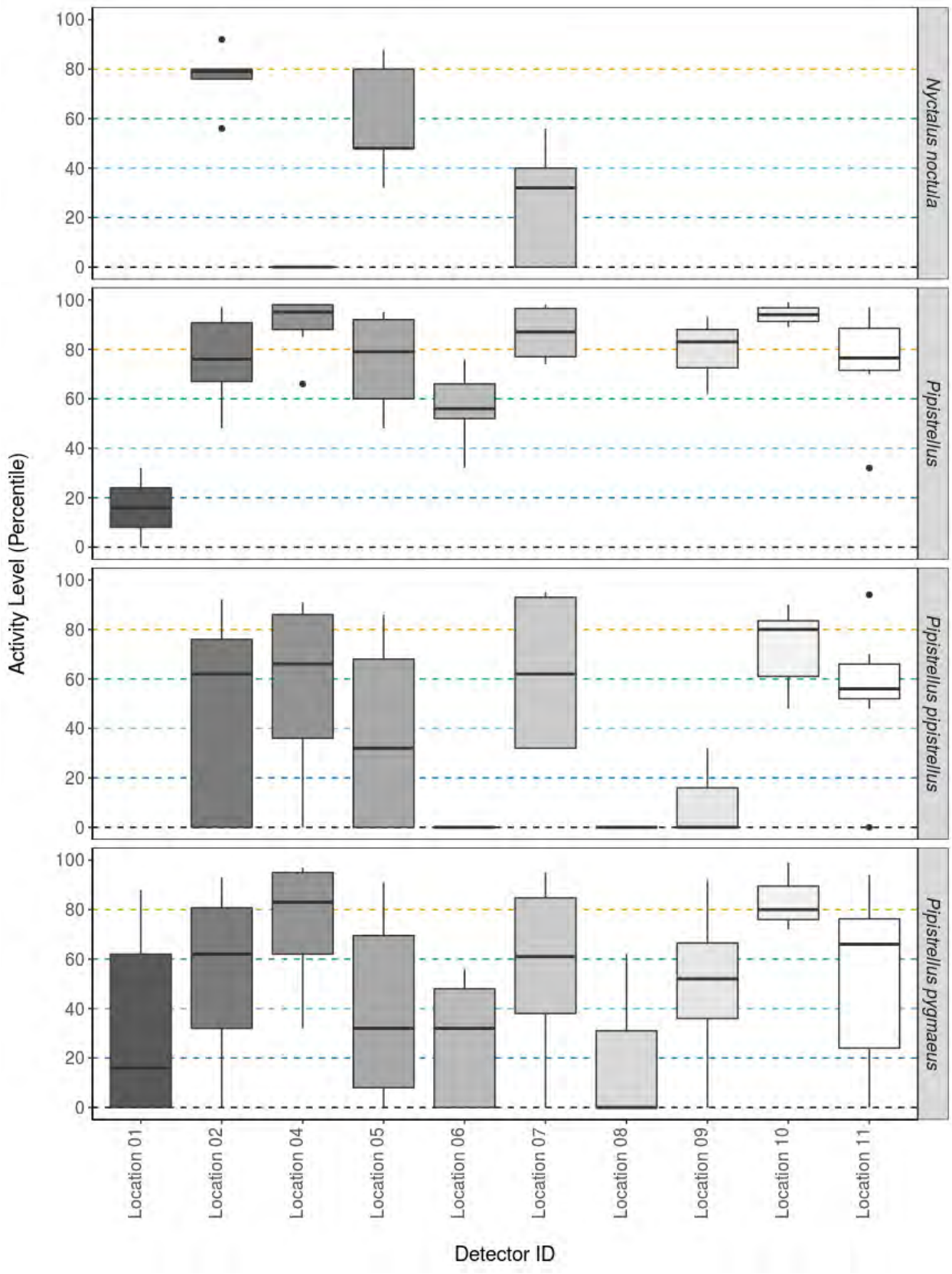
- At Location 01 on one night, pipistrelle species were recorded at high activity levels on five nights;
- Leisler's were recorded at high activity levels at Location 04 otherwise they were recorded at no more than moderate activity levels; and
- Myotis species were observed at moderate levels for three nights at Locations 01 and 08.

3.4.3 Autumn Species Distribution

Graph 05 below is an output from the Ecobat tool and shows the spatial distribution of bat species across the site during the autumn deployment.




Activity Level (Percentile)
100
80
60
40
20
0
Myotis
Myotis daubentonii
Nyctalus
Nyctalus leisleri
Location 01
Location 02
Location 04
Location 05
Location 06
Location 07
Location 08
Location 09
Location 10
Location 11
Detector ID



Graph 05 Differences in autumn 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)

The key details are:

- Soprano and common pipistrelles were recorded across locations at high or moderate/high activity levels;
- Nyctalus species were recorded at Locations; 01, 02, 04, 05, 07, 09, 10 and 11. This ranged from low to high levels;
- Brown long-eared bats were only noted at Location 02 at low levels; and
- Myotis species were recorded at Locations; 01, 02, 04, 05, 06, 07, 09, 10 and 11.

As presented in Table 16 the activity level of each species at each location has been compared with similar sites by the Ecobat tool.

Table 16: Summary Table for Autumn 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
Location 01	*Myotis*	0	0	0	0	3
	Nyctalus	0	0	0	0	1
	Pipistrellus	0	0	0	1	1
	Pipistrellus pygmaeus	1	2	0	1	4
Location 02	*Myotis*	0	0	0	1	1
	Nyctalus	5	2	1	1	0
	Nyctalus leisleri	0	0	0	3	1
	Nyctalus noctula	2	2	1	0	0
	Pipistrellus	4	4	2	0	0
	Pipistrellus pipistrellus	1	4	0	1	3
	Pipistrellus pygmaeus	4	2	0	3	1
	Plecotus auritus	0	0	0	0	1
Location 04	*Myotis*	0	0	0	1	0
	Nyctalus	0	3	0	3	0
	Nyctalus leisleri	0	0	0	2	6
	Nyctalus noctula	0	0	0	0	1
	Pipistrellus	8	1	0	0	0
	Pipistrellus pipistrellus	4	2	1	1	2
	Pipistrellus pygmaeus	11	2	1	3	0
Location 05	*Myotis*	0	0	0	2	4
	Myotis daubentonii	0	0	0	0	1
	Nyctalus	5	4	1	1	1
	Nyctalus leisleri	1	0	0	1	2
	Nyctalus noctula	3	1	3	2	0
	Pipistrellus	3	1	2	0	0
	Pipistrellus pipistrellus	2	1	0	2	3
	Pipistrellus pygmaeus	2	1	1	3	3
Location 06	*Myotis*	0	0	0	1	4
	Pipistrellus	0	3	3	1	0
	Pipistrellus pipistrellus	0	0	0	0	1
	Pipistrellus pygmaeus	0	0	5	2	4
Location 07	*Myotis*	0	0	0	0	2

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
	Nyctalus	4	3	0	0	1
	Nyctalus leisleri	0	1	1	0	4
	Nyctalus noctula	0	0	2	2	3
	Pipistrellus	2	2	0	0	0
	Pipistrellus pipistrellus	2	1	0	2	0
	Pipistrellus pygmaeus	2	1	1	1	1
Location 08	*Pipistrellus pipistrellus*	0	0	0	0	1
	Pipistrellus pygmaeus	0	1	0	0	2
Location 09	*Myotis*	0	0	0	0	2
	Nyctalus	0	0	0	0	2
	Pipistrellus	2	1	0	0	0
	Pipistrellus pipistrellus	0	0	0	1	2
	Pipistrellus pygmaeus	1	1	2	1	1
Location 10	*Myotis*	0	0	0	0	1
	Nyctalus	2	0	0	2	2
	Nyctalus leisleri	0	0	1	0	0
	Pipistrellus	4	0	0	0	0
	Pipistrellus pipistrellus	4	1	2	0	0
	Pipistrellus pygmaeus	5	2	0	0	0
Location 11	*Myotis*	0	0	0	0	2
	Nyctalus	1	1	1	1	4
	Pipistrellus	4	3	0	1	0
	Pipistrellus pipistrellus	1	2	3	0	1
	Pipistrellus pygmaeus	3	4	1	1	3

The key details are:

- Nyctalus species were recorded at high levels at Locations 02, 05, 07, 10 and 11; and
- A total 93 nights of high activity levels were recorded across all species and all locations.

3.5 Weather Conditions

Looking at the optimum weather conditions as detailed in the current guidance there were three nights of suitable weather conditions in spring, nine in summer and seven in autumn. All nights whether the weather conditions were considered optimal or sub optimal were considered.

The temperature and wind speed were collected from a Met mast at 40 m height. Due to the height the data was collected this may not be as accurate a representation of the conditions at ground level as it is likely temperatures will be lower and wind speed will be higher. Precipitation was largely low throughout the deployments periods.

Although weather conditions were outside the parameters given in the guidance pertaining to suitable survey conditions it is not felt that these conditions have impacted adversely on the data as a whole given the species composition and activity levels recorded.

The weather data for temperature and wind speed is represented in graphical form with the daily rainfall shown in tabular form in Appendix C.

4 DISCUSSION AND CONCLUSION

4.1 Species

4.1.1 Data Search

The desk study returned a number of records of bats and bat roosts within 10 km of the Site since 2000. Eight species of bats were identified in the area including: whiskered/Brandt's, Daubenton's, Natterer's, noctule, Leisler's, brown long-eared, common pipistrelle and soprano pipistrelle. Several pipistrelle species (common and soprano pipistrelle) and one brown long-roost were also identified in the data search.

4.1.2 Field Surveys

The dusk emergence and dawn re-entry surveys completed on four buildings with in the site identified a common soprano maternity roost (the Bothy) and two non-breeding pipistrelle species bat roosts (the Bothy and the Farm House)

The activity surveys undertaken between May and October 2019 on the Polskeoch and Euchanhead sites identified the presence of a minimum of six species of bats: common pipistrelle, soprano pipistrelle, Daubenton's, Leisler's, noctule and brown long-eared bats.

Tables E.1 and E.2 in Appendix E outline the collision vulnerability of different bat species when considering the impact of new wind farm developments. The species identified at risk are:

- Noctule- high collision risk and rare species;
- Leisler's- rare species and high collision risk;
- Common and soprano pipistrelle – widespread species with high collision risk;
- Myotis species – rare species with low collision risk;
- Daubenton's- rarer species with low risk of collision; and
- Brown long-eared - rarer species with low risk of collision.

Noctule and Leisler's bats are the most vulnerable species due to their flight activity habits and their rarity. In particular, they frequently forage and commute high over treetops at potential turbine Rotor Sweep Height (RSH), and therefore may be subject to greater risk from turbines than any other species identified during the activity surveys.

4.2 Use of the Site by Bats

The results of the static detector surveys during show peak activity during the autumn dispersal/mating season.

It should be noted that the highest activity levels were recorded across the Polskeoch Site and that the two detector locations within Euchanhead site generally recorded much lower activity levels with limited species recorded. This is likely due to the more exposed aspect of the location the bats possibly preferring to utilise the good foraging and commuting habitat nearby in the form of woodland edges, watercourses and forest tracks and rides.

Key results of the study in general are:

- Highest levels of activity were observed during the autumn;
- Nyctalus species were recorded at high levels across the site, particularly in autumn related to the dispersal of bats from their summer roosts to their mating/transient autumn roosts;

- Pipistrelle genus were recorded all locations across the site in summer and autumn;
- Confirmed maternity roost was found in the bothy; and
- Two further non-breeding summer roosts where discovered at the bothy and the farm house.

Consequently, this data shows that the Polskeoch Site is of importance for breeding, commuting and foraging bats due to activity levels, the species composition and the nearby roosts.

The Euchanhead Site is deemed to be of negligible importance for breeding bats and limited importance for commuting and foraging bats given the activity levels at Locations 12 and 13 and the lack of nearby roosting opportunities.

4.3 Comparative Activity Levels

When detector data from similar sites were compared using the Ecobat tool it is evident bat activity levels at Polskeoch and Euchanhead are comparable to other sites with similar habitats assessed to have a moderate activity level. This result is based on our interpretation of all activity survey results and the comparison drawn between these results and data from similar wind farm projects using Ecobat.

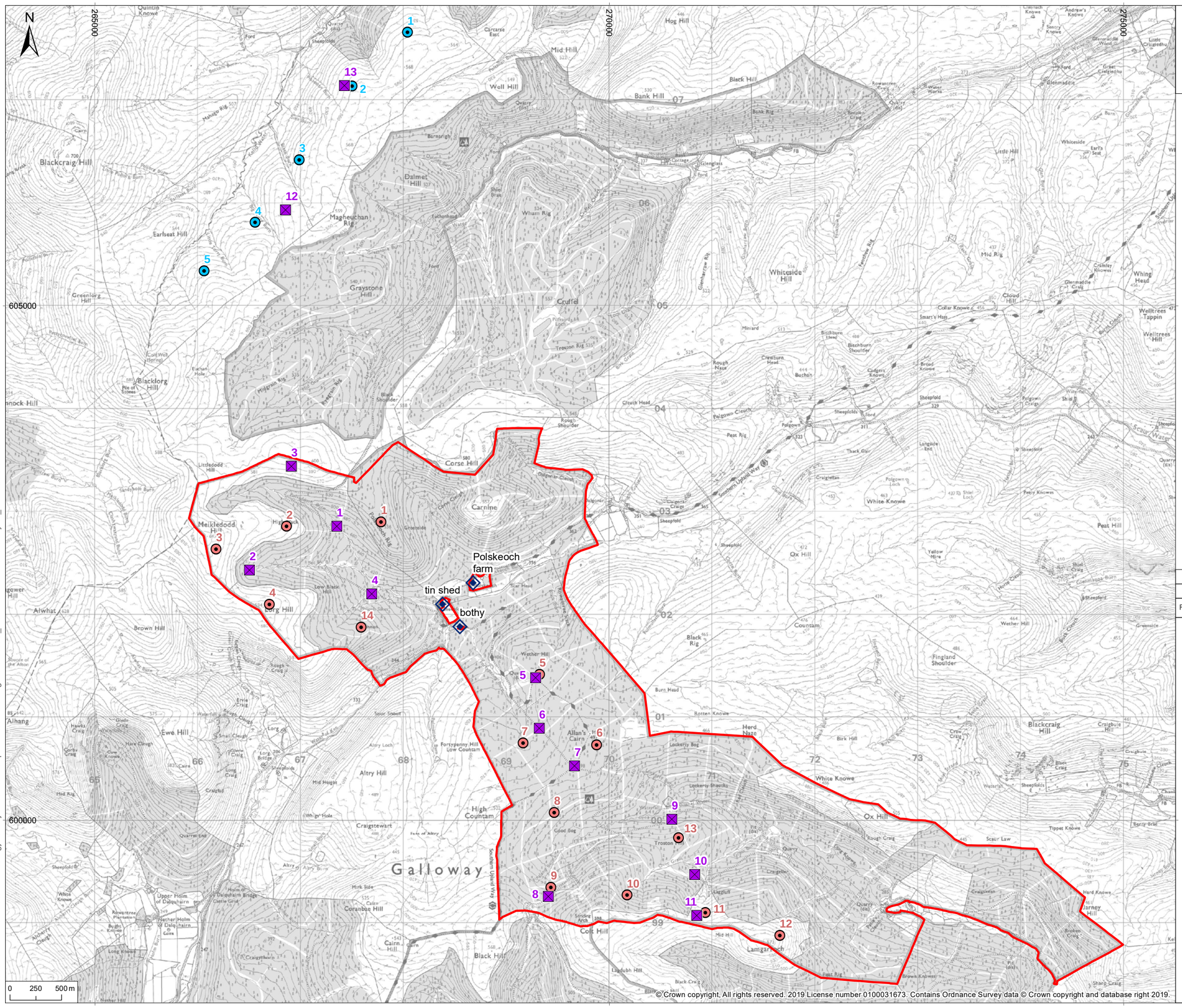
4.4 Risk Assessment

An assessment of risk from the development can be made using parameters outlined in the most recent industry standard guidance (SNH et al., 2019; see Tables 5 and 6 in Section 2.3.3 of this report).

The project size is of a large scale, which includes developments comprising turbines over 100 m in height. The value of the habitats and features present for foraging, commuting and roosting bats was assessed, using the criteria from current guidance (Collins, 2016). The habitat risk is considered to be moderate, as the site contains a small number structures with potential roosting features. Although the coniferous forestry plantation and open moorland offers limited quality foraging habitat that could be used by small numbers of foraging bats there are a number of watercourses offering good foraging and commuting habitat. The woodland edges and forestry tracks and rides with the watercourses offers good connectivity to the wider environment. Therefore, the initial site risk assessment score for the site is high (according to the parameters presented in Table 5).

Given the site risk level is high, and the Ecobat activity category is moderate (as compared to a reference range), the overall risk assessment for the development is considered as presenting medium risk to bats (see Table 6). The scores in the table are a product of multiplying site risk level and the Ecobat activity category.

Figures



Notes
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Legend

- Polskeoch site boundary
- Proposed Polskeoch turbine location
- Proposed Euchanhead turbine location
- Potential bat roost
- Bat detector location

Detector ID, Location

1: Polskeoch Burn 1
2: Meikledod Hill
3: Lorg Hill
4: Polskeoch Burn 2
5: Wether Hill
6: Forest track
7: Track & Southern Upland Way
8: Colt Hill
9: Troston Hill (N)
10: Troston Hill (S)
11: Lamgarroch
12: Euchanhead Moorland 1
13: Euchanhead Moorland 2

Rev	Description	By	CB	Date

MAKING COMPLEX EASY

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T: +44(0)131 555 5011 E: rpsed2@rpsgroup.com

Client: Scottish Power Renewables

Project: Polskeoch Wind Farm

Title: Provisional turbine layout and static detector locations

Status	Drawn By	PM/Checked By
FINAL	KAG	HL
Project Number	**Scale @ A3**	**Date Created**
SEC8555	1:35,000	DEC 2019
Figure Number		**Rev**
1		**-**

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Appendix A

Static Detector Results

Table A.1: Static Detector Results: Bat Activity Levels

Location	Grid reference	Dates deployed		Type of detector used	Nights Deployed	Number of nights operative	Nights Operative (%)	Nights Bats Recorded (Activity Period)	Files with Bat Activity Recorded	BAI Over Total Deployment Period (bppn)
Spring Deployment										
01	NS 67352 02855	16/05/19	03/06/19	Anabat Express	18	17	94	6	16	0.9
02	NS 66505 02430	01/05/19	16/05/19	Song Meter	18	14	78	3	14	1.0
03	NS 66911 03439	17/05/19	03/06/19	Anabat Express	18	18	100	0	0	0.0
04	NS 67692 02197	01/05/19	16/05/19	Anabat Express	15	15	100	6	290	19.3
05	NS 69286 01383	01/05/19	03/06/19	Anabat Express	33	31	94	1	100	3.2
06	NS 69321 00893	16/05/19	03/06/19	Song Meter	18	8	44	6	10	1.3
07	NS 69665 00527	01/05/19	16/05/19	Anabat Express	15	15	100	4	6	0.4
08	NX 69408 99256	16/05/19	03/06/19	**Failure**						
09	NX 70610 00010	16/05/19	03/06/19	Anabat Express	18	14	78	8	249	17.8
10	NX 70831 99474	01/05/19	16/05/19	Anabat Express	15	15	100	5	18	1.2
11	NX 70852 99074	01/05/19	16/05/19	**Failure**						
12	NX 66854 05930	17/05/19	03/06/19	**Failure**						
13	NX 67425 07141	01/05/19	17/05/19	Anabat Express	16	14	88	1	1	0.1
Summer Deployment										
01	NS 67352 02855	04/07/19	25/07/19	Song Meter	21	11	52	11	279	25.4
02	NS 66505 02430	13/06/19	04/07/19	Song Meter	21	11	52	8	80	7.3
03	NS 66911 03439	04/07/19	25/07/19	Anabat Express	21	4	19	0	0	0.0
04	NS 67692 02197	13/06/19	04/07/19	Anabat Express	21	21	100	18	453	21.6
05	NS 69286 01383	13/06/19	26/07/19	Anabat Express	43	43	100	25	100	2.3
06	NS 69321 00893	04/07/19	25/07/19	Anabat Express	21	10	48	8	19	1.9
07	NS 69665 00527	13/06/19	04/07/19	Anabat Express	21	21	100	17	185	8.8
08	NX 69408 99256	04/07/19	25/07/19	Anabat Express	21	12	57	8	242	20.2

Location	Grid reference	Dates deployed		Type of detector used	Nights Deployed	Number of nights operative	Nights Operative (%)	Nights Bats Recorded (Activity Period)	Files with Bat Activity Recorded	BAI Over Total Deployment Period (bppn)
09	NX 70610 00010	04/07/19	25/07/19	Anabat Express	21	9	43	7	64	7.1
10	NX 70831 99474	13/06/19	04/07/19	Anabat Express	21	21	100	14	58	2.8
11	NX 70852 99074	13/06/19	04/07/19	Anabat Express	21	21	100	13	74	3.5
12	NX 66854 05930	05/07/19	25/07/19	Anabat Express	20	11	55	3	7	0.6
13	NX 67425 07141	13/06/19	05/07/19	Anabat Express	22	22	100	2	2	0.1
Autumn Deployment										
01	NS 67352 02855	02/09/19	01/10/19	Anabat Express	29	29	100	10	45	1.6
02	NS 66505 02430	15/08/19	02/09/19	Anabat Express	18	18	100	12	444	24.7
03	NS 66911 03439	02/09/19	01/10/19	**Failure**						
04	NS 67692 02197	15/08/19	02/09/19	Anabat Express	18	18	100	17	970	53.9
05	NS 69286 01383	15/08/19	02/09/19	Anabat Express	18	8	44	14	398	49.8
06	NS 69321 00893	02/09/19	01/10/19	Anabat Express	29	18	62	11	51	2.8
07	NS 69665 00527	15/08/19	02/09/19	Anabat Express	18	17	94	8	449	26.4
08	NX 69408 99256	02/09/19	01/10/19	Song Meter	29	7	24	3	8	1.1
09	NX 70610 00010	02/09/19	01/10/19	Song Meter	29	12	41	6	71	5.9
10	NX 70831 99474	15/08/19	02/09/19	Song Meter	18	7	39	8	723	103.3
11	NX 70852 99074	15/08/19	02/09/19	Song Meter	18	10	32	12	281	28.4
12	NX 66854 05930	03/09/19	01/10/19	**Failure**						
13	NX 67425 07141	15/08/19	03/09/19	Anabat Express	19	19	100	0	0	0.0

Appendix B

SNH Communications

MEMO

Date: 26 April 2020
To: Robert Raynor <Robert.Raynor@nature.scot>
From: Thomas Goater <thomas.goater@rpsgroup.com>
Pages: 1 inc. this page
Regarding: Bats & windfarms guidance

RE: Bats & windfarms guidance - RE: Webform submission from: Feedback

Thomas

Further to our telephone conversation, firstly, I should emphasise that a great deal of time and energy went into preparing the new guidance by a range of UK bat specialists from a range of backgrounds, including ecologists from the industry, so the final product was a collective output based on numerous iterations and extensive debate and discussion. Deviations from it are therefore not something we support, although we accept that in this, the first year of its implementation, some flexibility over the type of detectors being used is acceptable in some situations, e.g a mixture of full spectrum and zero-crossing detectors if insufficient of the former are available. The expectation though, is that consultancies will need to replace existing z-c detectors with full spectrum ones over time.

As discussed on the telephone, I don't think we can support the idea of "extending" the spring sampling period to mid-June; even in a late spring there ought to be sufficient time during April and May to obtain at least 10 nights' of field data. With regard to your other proposal - to split the deployment of detectors spatially by undertaking the surveillance in 2 equal time periods within each of the 3 survey seasons - the guidance does not explicitly preclude this, so I've given it some further consideration and discussed it with others involved in preparing the guidance. We think this would be acceptable *for this year only*, provided there is still a clear time break between a surveillance period in one season and one in the next season, i.e. they should not run directly into one-another. To minimise any spatial effects, I suggest that the available detectors are deployed across the whole site in each of the 2 time periods, as opposed to sampling one half of the site in time period 1 and the other half in time period 2, thereby generating data from fairly evenly-spaced locations across the site over both time periods in each season. We will need to consider how best to clarify this issue in the planned review of the guidance in 2020.

I hope this helps and clarifies our position.

Kind regards,

Rob

All SNH email addresses have now changed to @nature.scot, so my new email address is robert.raynor@nature.scot . Please update your contacts, thank you.

Rob Raynor | Policy & Advice Officer (Mammals)

Scottish Natural Heritage | Great Glen House | Leachkin Road | Inverness | IV3 8NW | **t:** 01463 725244

Dualchas Nàdair na h-Alba | Taigh a' Ghlinne Mhòir | Rathad na Leacainn | Inbhir Nis | IV3 8NW

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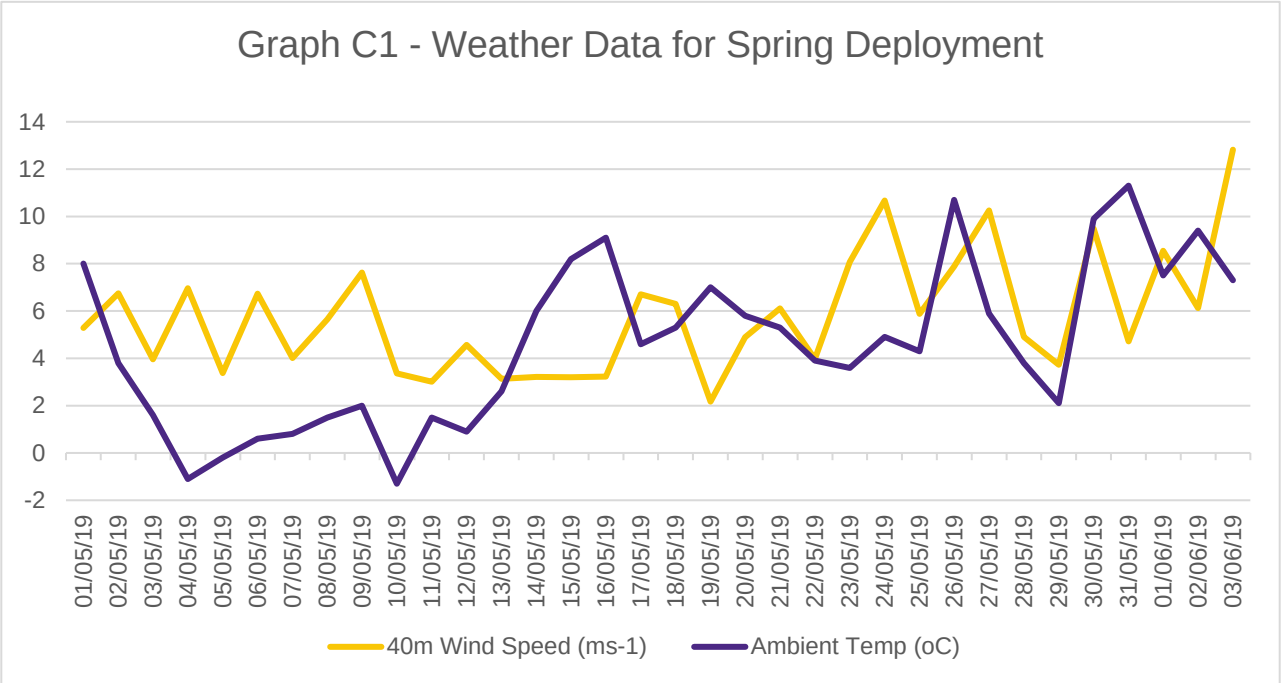
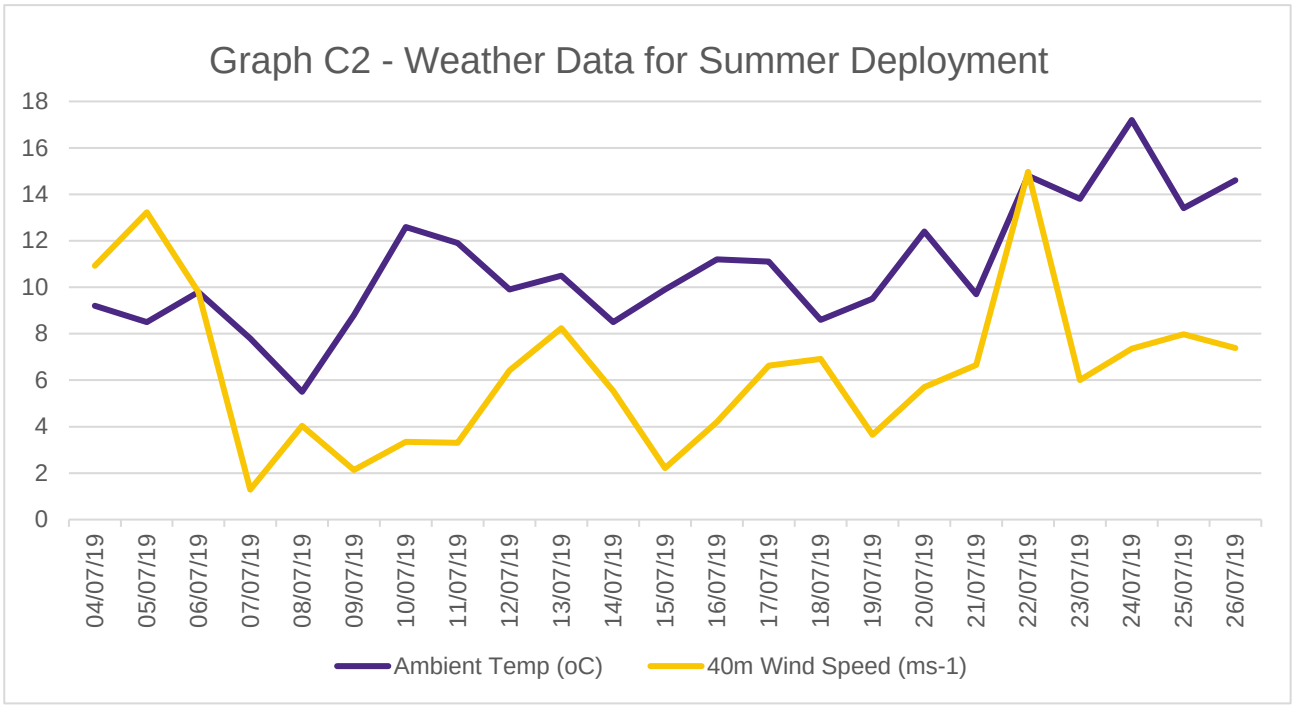
Appendix C

Weather Data





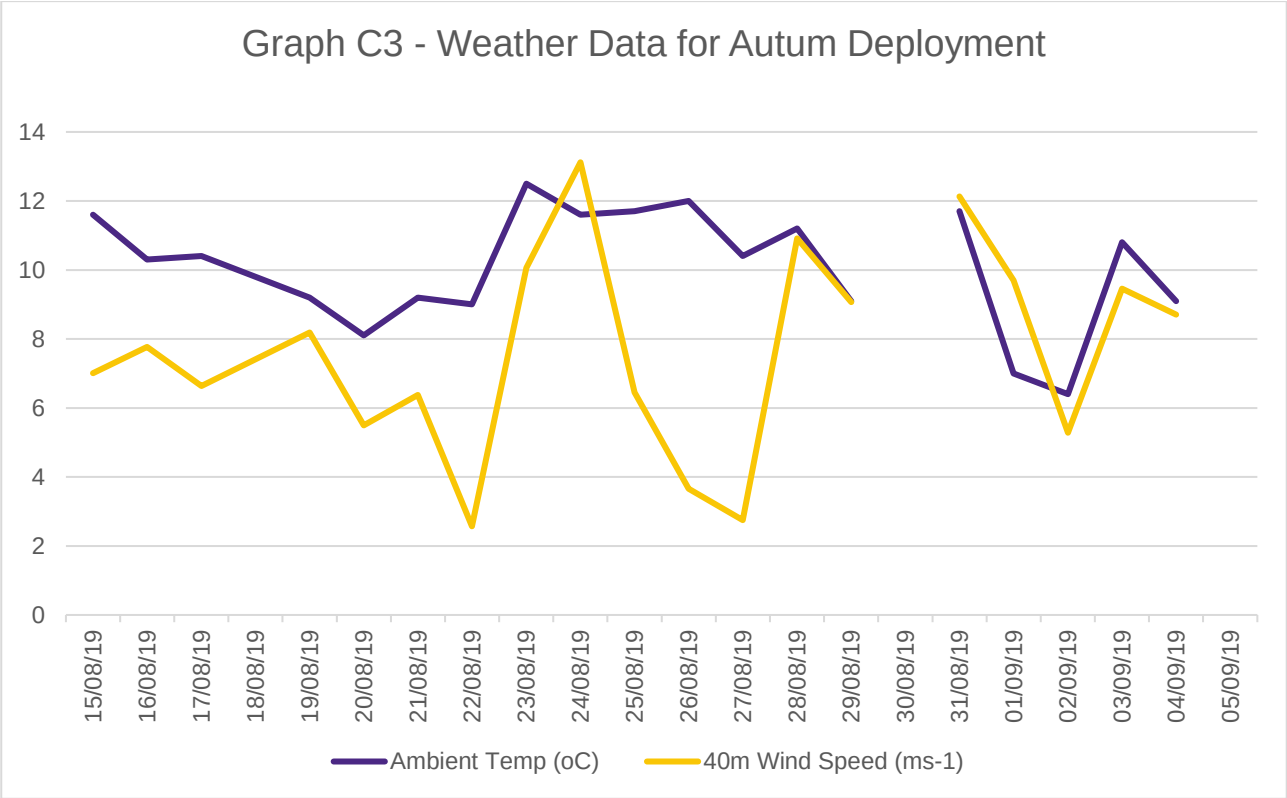


Table C.17: Daily Rainfall Data from SEPA Eliock Weather Station (mm)

Spring Deployment		Summer Deployment		Autumn Deployment	
01/05/19	2.6	04/07/19	0	15/08/19	0
02/05/19	2.2	05/07/19	0.6	16/08/19	9.2
03/05/19	0	06/07/19	0	17/08/19	7.4
04/05/19	0	07/07/19	0	19/08/19	1.6
05/05/19	0	08/07/19	2.4	20/08/19	0.8
06/05/19	5.8	09/07/19	5.4	21/08/19	11.6
07/05/19	7.4	10/07/19	8.6	22/08/19	1
08/05/19	1.4	11/07/19	0	23/08/19	0
09/05/19	0.4	12/07/19	0	24/08/19	0
10/05/19	1.4	13/07/19	0	25/08/19	0
11/05/19	0	14/07/19	0	26/08/19	0
12/05/19	0	15/07/19	0	27/08/19	0.2
13/05/19	0	16/07/19	0.2	28/08/19	0.2
14/05/19	0	17/07/19	5.4	29/08/19	4.4
15/05/19	0	18/07/19	2.2	30/08/19	11.8
16/05/19	0	19/07/19	9.4	31/08/19	1.6
17/05/19	3.6	20/07/19	0	01/09/19	2.4
18/05/19	2.2	21/07/19	18.2	02/09/19	4.2
19/05/19	0	22/07/19	0	03/09/19	6.6
20/05/19	0	23/07/19	2.8	04/09/19	2.6
21/05/19	0	24/07/19	0	05/09/19	4.8
22/05/19	0	25/07/19	0	06/09/19	0

23/05/19	0	26/07/19	0.8	07/09/19	0
24/05/19	0			08/09/19	16.2
25/05/19	7			09/09/19	2.4
26/05/19	0			10/09/19	8.8
27/05/19	0			11/09/19	0
28/05/19	4			12/09/19	2.2
29/05/19	5.4			13/09/19	0
30/05/19	10.6			14/09/19	0.6
31/05/19	4			15/09/19	0
01/06/19	12.8			16/09/19	0
02/06/19	6			17/09/19	0
03/06/19	3			18/09/19	0
				19/09/19	0
				20/09/19	0
				21/09/19	7.4
				22/09/19	5.4
				23/09/19	12
				24/09/19	23.4

Appendix D

Initial Site Risk Assessment

Table D.1: Initial Site Risk Assessment – Habitat Risk

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 of 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 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 an important fly way. Close to key roost and/or swarming site.

Table D.2: Initial Site Risk Assessment – Project Size

Project Size	Description
Small	Small scale development (≤ 10 turbines). No other wind farm developments within 10km. 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.
Large	Largest developments (>40 turbines). Other wind energy developments within 5km. Comprising turbines >100m in height.

Appendix E

Bats and Windfarms

Bats are at risk of mortality not only by direct collision with wind turbines, but also by barotrauma due to the very low air pressure in the wake of rotating turbine blades (Baerwald *et al*., 2009). Barotrauma causes damage to soft tissues such as the lungs resulting in fatal internal bleeding. Bats will travel long distances to and from roosting sites, often via preferential commuting routes. The potential mortality risk from wind turbines can be significant if these intersect preferential commuting routes or include areas of high foraging activity. In order to assess the potential impact of a proposed wind energy development on bats, the new guidance concerning bats and onshore wind turbines published in 2019 (SNH *et al*., 2019) recommends study and assessment of bat activity within the proposed wind energy development site and the surrounding landscape.

British bat species have slow reproduction cycles, mostly with only one young being born per year. Therefore, populations are vulnerable to even small losses of individual adult bats. Female bats spend the summer in maternity roosts, in which they give birth and rear their young. The same individual bats may return to the same maternity roost sites every year. Cumulative losses of individual bats from a particular roost site could potentially threaten the viability of a local breeding population.

Studies in the United States and mainland Europe have identified the autumn migration period (commuting to hibernating sites) as the peak risk period for bat mortality at wind turbines in these countries, accounting for about three-quarters of all bat deaths. The species affected make mass migrations on narrow routes, which have resulted in high mortality where these intersect with wind energy sites. The remaining quarter of deaths are of local resident species. High mortality rates have also been found throughout the year where wind turbines are positioned close to bat roosts, commuting or foraging routes.

In the UK there is a lack of data regarding the behaviour of bats during the migratory season and UK bats are believed to migrate to a lesser degree than individuals of the same species in mainland Europe. In the UK, there is no evidence of the narrow-front mass migrations mentioned above. However, there is growing evidence of short distance migrations even up to 100 km (between summer sites, autumn swarming or mating sites, and winter sites) for some UK species. There is also a lack of data on bat activity or bat mortality at operational UK wind farm sites. Therefore, any assessment of the potential impacts on bats must take regard of the potential similarities with foreign observations and can only be approximate.

During the main bat activity season, from approximately May until September (in Scotland; bats are active from April to October in warmer climates), bats commute from their roosts to their feeding sites. Flight activity habits vary between species with some making regular flights at ‘rotor swept height’ (RSH); noctule bats usually commute along distinct routes, high over treetops and also feed high, often within RSH. Most species stay low during commuting and make use of landscape features such as hedges or trees but may still forage at higher altitudes and reach the RSH. European studies have shown the highest number of deaths in the following species; noctule, common pipistrelles and Nathusius’ pipistrelles. The very few UK records that have been collated show deaths of common pipistrelle, soprano pipistrelle, Natterer’s bat, and noctule. These records are mostly incidental observations during other studies.

Different species have different flight patterns, flight heights, foraging strategies and echolocation calls and therefore have different risk of collision with wind turbines. Table E.1 categorises which bat species are potentially most vulnerable to collision based on physical and behavioural characteristics.

Table E.1: Collision Vulnerability of Different Bat Species

Factor	Risk of Turbine Impact		
	Low Risk	Medium Risk	High Risk
Habitat preference	Bats preferring cluttered habitat	Bats able to exploit background cluttered space	Bats preferring to use open habitat
Echolocation characteristics	• Short range • High frequency • Low intensity • Detection distance ~15m	Intermediate – more plastic in their echolocation	• Long range • Low frequency • High intensity • Detection distance ~80m
Wing shape	• Low wing loading • Low aspect ratio • Broadest wings	Intermediate	• High wing loading • High aspect ratio • Narrow wings
Flight speed	Slow	Intermediate	Fast
Flight behaviour and use of landscape	• Manoeuvre well • Will travel in cluttered habitat • Keeps close to vegetation Gaps may be avoided	Some flexibility	• Less able to manoeuvre • May avoid cluttered habitat • Can get away from unsuitable habitat quickly • Commute across open landscape
Hunting techniques	• Hunt close to vegetation • Exploit richer food sources in cluttered habitat • Gleaners	• Hunt in edge and gap habitat • Aerial hawkers	• Less able to exploit insect abundance in cluttered habitat • Aerial hawker • Feed in open
Migration	Local or regional movements.	Regional migrant in some parts of range	Long-range migrant in some parts of range
Conclusion	**Myotis spp.** **Long eared-bats** **Horseshoe bats**	**Serotine** **Barbastelle**	**Common pipistrelle** **Soprano pipistrelle** **Noctule** **Leisler's bat** **Nathusius' pipistrelle**

Table adapted from SNH *et al*. (2019).

When assessing the impact of a proposed wind farm on bat mortality, it is important to consider not only the bat activity recorded on site and the collision vulnerability of different bat species but also the level of potential vulnerability of populations of British bat species. In this way, negative impacts on the Favourable Conservation Status (FCS) at both the local and national level of rare or vulnerable species can be avoided. This comprehensive assessment can help to inform the assessment of potential risk and guide the decision-making process in relation to the mitigation options considered for the wind farm development. Table E.2 presents the level of potential vulnerability of populations of Scottish bat species.

Table E.2: Potential Vulnerability of Scottish Bat Populations

Relative Abundance	Collision Risk		
	Low Collision Risk	Medium Collision Risk	High Collision Risk
Widespread species			Common pipistrelle Soprano pipistrelle
Rarer species	Brown long-eared bat Daubenton's bat Natterer's bat		
Rarest species	Whiskered bat Brandt's bat		Nathusius' pipistrelle Noctule bat Leisler's bat

Table adapted from Wray *et al*. (2010). Yellow – low population vulnerability; Orange – medium population vulnerability; Red – high population vulnerability.

Appendix F

Upper Nithsdale LMP Management Map

Forest Enterprise Scotland
Managing the National Forest Estate

Forestry Commission Scotland
Coimisean na Coilltearachd Alba

Dumfries & Borders Forest District

Upper Nithsdale Composite Land Management Plan
Management Map

Date: 16 August 2018

Scale (at A0):
1:18,000

N

- Plan area
- Forest Roads
- Planned roads
- Planned forwarder tracks
- Phase 1 felling (2018 - 2022)
- Phase 2 felling (2023 - 2027)
- Phase 3 felling (2028 - 2032)
- Phase 4 felling (2033 - 2037)
- Phase 5 felling (2038 - 2042)
- Phase 6 felling (2043 - 2047)
- Phase 7 felling (2048 - 2052)
- After 2052
- Natural reserve
- Long term retention
- Minimum Intervention
- Low impact silviculture
- Open

Scotland's National Forest Estate is responsibly managed to the UK Woodland Assurance Standard.

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