Eire Ecology

Environmental Consultants

Bat Survey Report

Firlough Proposed Windfarm

DOCUMENT DETAILS

Project Title:	Firlough Windfarm
Document Title:	Bat Survey Report
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Date:	08/06/2023
Abstract:	The following report details the results of 2021 bat surveys undertaken for the Firlough Wind Farm, Co. Mayo. This bat report is required to assess the impacts of the proposed development on bat species within and surrounding the proposed wind farm site. The proposed Firlough Wind farm consists of 13 no. wind turbines.

EXECUTIVE SUMMARY

This document reports on the findings of bat surveys conducted in 2021 at the site of a proposed windfarm located c. 9.5km to the east of Ballina, Co. Mayo, within the townland of Carrowleagh. Surveys included pre-construction bat surveys focusing on proposed turbine locations, surrounding habitats and connectivity with the wider landscape.

Thirteen static detectors (SNH 2019) were placed within the site for a minimum of 10 nights in each of: spring (April-May), summer (June-mid-August) and autumn (mid-August-October). In addition, dusk and dawn bat detector surveys were conducted examining habitats onsite alongside potential roost features of structures in the wider landscape.

During static surveys, a total of seven species of bats were recorded in 2021: Common Pipistrelle, Soprano Pipistrelle, Nathusius Pipistrelle, Leisler's bat, Natterer's bat, Daubenton's bat and Brown long-eared bat. In addition, several unidentified Myotis species were recorded; several of which were likely whiskered bats.

The most frequently recorded species was Leisler's bat followed by Soprano Pipistrelle, and Common Pipistrelle, with lower levels of Myotis species and Brown long-eared bat detected.

Results show that without mitigation there will be a high level of impact at the majority of turbine locations for Leisler, with moderate activity for Common, Soprano and Nathusius's Pipistrelle (the main species affected by wind turbine collision).

Robust mitigation is proposed in order to negate the potential for high casualty levels including feathering turbine blades in low wind conditions, curtailment of cut-in speeds, creating buffers surrounding the turbines and a post construction monitoring program designed to examine the effectiveness of these mitigation measures.

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1 INTRODUCTION

This report details the findings of a bat survey completed as part of a planning application for the construction of a windfarm to the east of Ballina, Co. Mayo.

This report aims to;

- Identify species of bats using the site.
- Examine trees and buildings within and surrounding the site for roosting potential.
- Examine feeding and commuting routes.
- Potential impacts of bats by the proposed development.

In order to assess the presence and activity of bats within the proposed development grounds the following surveys were undertaken within and adjacent to the proposed planning boundary:

- Preliminary roost assessment
- Bat activity (walked, driven transects and emergence surveys); and
- Static detector (three survey periods).

All surveys adhered to SNH (2019) guidelines. Surveys were conducted prior to the release of (NIEA, 2021) and (SNH, 2021).

Activity surveys were conducted from June to August 2021 along predetermined walked transects. Static detector surveys were carried out between May and September 2021 in three rounds. The survey types were determined most appropriate to establish a baseline species assemblage, along with spatial and temporal distribution of species activity within the proposed planning boundary.

1.1 RELEVANT GUIDANCE DOCUMENTS

This report will draw on the following guidelines documents:

- Bats and onshore wind turbines: Survey, Assessment and Mitigations. Scottish Natural Heritage January, 2019.
- Bats and onshore wind turbines - Survey, Assessment and Mitigation. Scottish Natural Heritage. August 2021
- UNEP/EUROBATS: Guideline for consideration of bats in wind farm projects, Publication Series No. 3.
- Natural England Technical Information Note TIN051: Bats and onshore wind turbines – Interim Report
- Guide to Turbines and Wind Farms. Bat Conservation Ireland 2012.
- Bat Conservation Ireland Guidelines for consideration of bats in wind farm projects - Revision 2014
- Wind Turbine/Wind Farm Development Bat Survey Guidelines (BCI, 2012);
- NIEA (2011). Bat survey – specific requirements for wind farm proposals. Northern Ireland Environment Agency, Department of the Environment, Belfast.
- European Commission (2020). Guidance document on wind energy developments and EU nature legislation. Brussels, 18.11.2020 C(2020) 7730 final.

- National Roads Authority (2006) Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes
- Collins, J. (Editor) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edition). Bat Conservation Trust, London
- McAney, K. (2006) A conservation plan for Irish vesper bats, Irish Wildlife Manual No. 20 National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.
- Kelleher, C. & Marnell, F. (2006) Bat Mitigation Guidelines for Ireland. Irish Wildlife Manuals, No. 25. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.
- The status of EU protected habitats and species in Ireland: Conservation status in Ireland of habitats and species listed in the European Council Directive on the Conservation of Habitats, Flora and Fauna 92/43/EEC. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government.
- NRA (2006b). Guidelines for the Treatment of Bats during the Construction of National Road Schemes. National Roads Authority (now named Transport Infrastructure Ireland), Ireland.
- Aughney, T., Kelleher, C. & Mullen, D. (2008). Bat Survey Guidelines: Traditional Farm Buildings Scheme. The Heritage Council, Áras na hOidhreachta, Church Lane, Kilkenny.
- BTHK (2018). Bat Roosts in Trees – A Guide to Identification and Assessment for Tree-Care and Ecology Professionals. Pelagic Publishing, Exeter UK.
- European Commission (2021). Commission notice. Guidance document on the strict protection of animal species of Community interest under the Habitats Directive
- CIEEM (2021). Bat Mitigation Guidelines. A guide to impact assessment, mitigation and compensation for developments affecting bats. Beta version 1.0.
- NIEA, Natural Environment Division (2021). Guidance on Bat Surveys, Assessment and Mitigation for Onshore Wind Turbine Developments in Northern Ireland.

1.2 STATEMENT OF AUTHORITY

Bat surveys were undertaken by John Curtin BSc. John qualified in Environmental Science at NUI Galway in 2010 and has been working as an ecologist ever since. John has been conducting bat surveys at windfarm sites since 2012. He has also completed the Bat Conservation Ireland, Bat Detector Workshop and Bat Handling Workshop which are the standard training for the carrying out of bat surveys in Ireland. In addition, John is an active member of Bat Conservation Ireland, which monitor bat populations in Ireland, and facilitate the education of bat communities to the public.

John holds the following licences.

Description	Licence No
Licence to capture protected wild animals for educational, scientific or other purposes (bats)	C231/2020
Roost disturbance (bats)	Der/Bat 2020-114
Licence to photograph / film wild animals (bats)	06/2021

2 DESKTOP STUDY

2.1 BATS IN IRELAND – LEGISLATIVE PROTECTION

There are two main pieces of legislation which cover wildlife protection in Ireland – the Wildlife Act and the Habitats Regulations. These are outlined below, with particular reference to the protection afforded to bat species in Ireland.

2.1.1.1 The Wildlife Acts 1976 and 2000

The primary domestic legislation providing for the protection of wildlife in general, and the control of some activities adversely impacting upon wildlife is the Wildlife Act of 1976, as amended. The aims of the wildlife act according to the National Parks and Wildlife Service are "... to provide for the protection and conservation of wild fauna and flora, to conserve a representative sample of important ecosystems, to provide for the development and protection of game resources and to regulate their exploitation, and to provide the services necessary to accomplish such aims." All bat species are protected under the act. The Wildlife (Amendment) Act of 2000 amended the original Act to improve the effectiveness of the Act to achieve its aims.

It is an offence to:

- Intentionally kill, injure or take a bat
- Possess or control any live or dead specimen or anything derived from a bat
- Wilfully interfere with any structure or place used for breeding or resting by a bat
- Wilfully interfere with a bat while it is occupying a structure or place which it uses for that purpose

2.1.1.2 European Communities (Birds and Natural Habitats) Regulations 2011 to 2021

The EC (Birds and Natural Habitats) Regulations 2011-2021 provide strict protection for all of the Irish species listed on Annex IV of the EU's Habitats Directive. It does this by prohibiting certain activities which could impact on the conservation status of those species. Those activities may only be permitted by way of a derogation licence. All bat species found in Ireland are listed under Annex IV of the Directive, while the lesser horseshoe bat is afforded further protection under Annex II.

2.2 SITE LOCATION

The proposed site lies in the townland Carrowleagh (54.13719, -8.97251) (see **Figure 2-1** below).

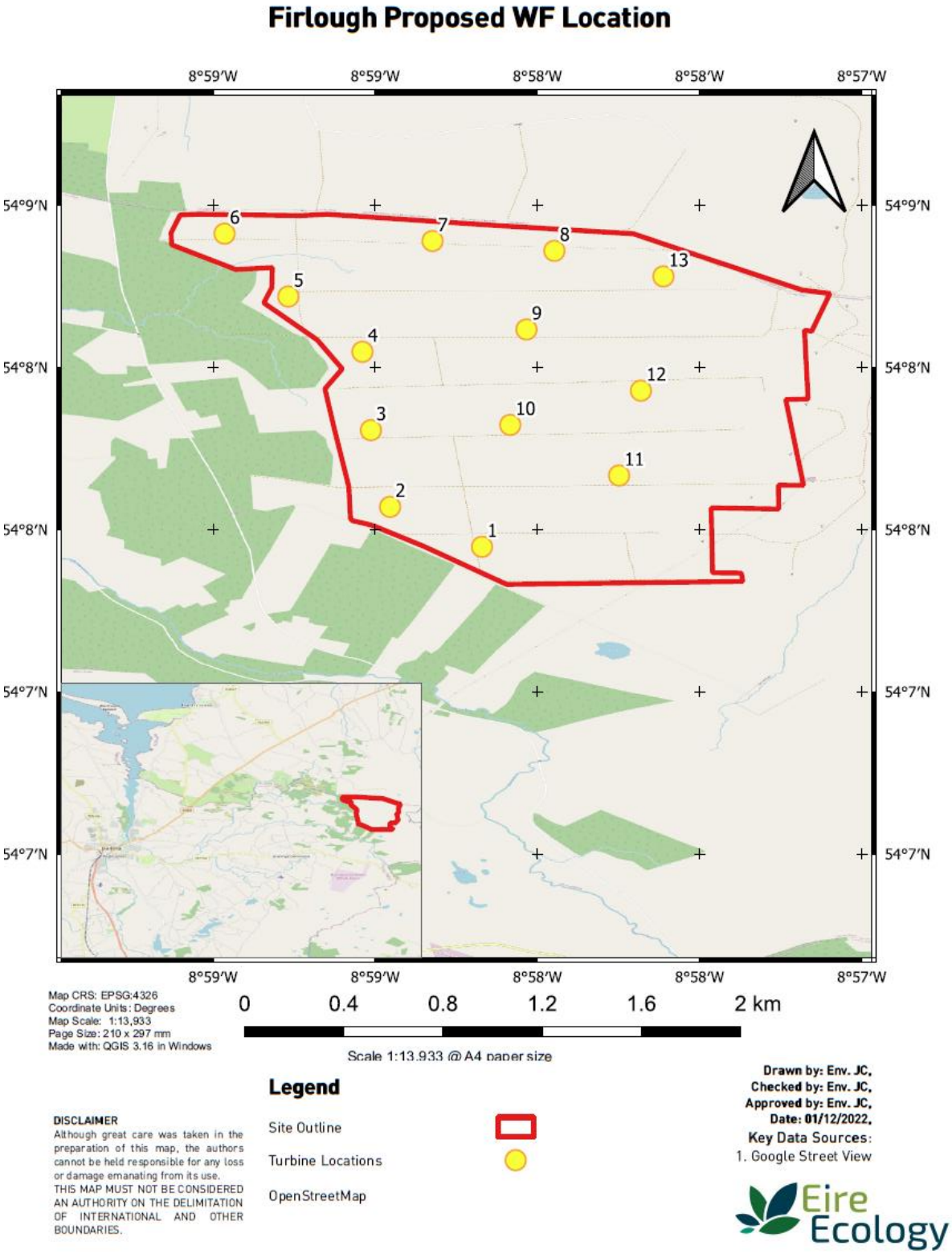

Figure 2-1: Location of proposed development

2.3 BAT SPECIES RECORDED IN THE SURROUNDING AREA

A data search was conducted in May 2021 and again in September 2022 to revise existing information from the footprint of the proposed planning boundary. The following information sources were examined:

- Known bat records within a 10 km radius of the proposed sites from the Bat Conservation Ireland database
- Adhoc and observational bat records from the National Bat Database held by the National Biodiversity Data Centre (www.biodiversityireland.ie)
- Review of Ordnance Survey mapping and aerial photography of the proposed wind farm boundaries and their environs (i.e. 200 m plus rotor radius of the boundary of the proposed development)
- Records of designated sites within a 15 km radius of the proposed sites where bats form part or all of the reason for designation (https://www.npws.ie/protected-sites)
- Collation of data on known caves within a 4 km radius of the proposed sites from the Cave Database for the Republic of Ireland, compiled by Trinity College (http://www.ubss.org.uk/search_irishcaves.php)
- Review of bat survey data from Ecological Impact Assessments from proposed and permitted developments within the wider environs of the site.

2.3.1 Bat Landscape

(Lundy, 2011) produced a landscape model by analysing data contained in the Irish National Bat Database, maintained by Bat Conservation Ireland and the National Lesser Horseshoe Bat database maintained by National Parks and Wildlife Service. The maps are a visualisation of the results of the analyses based on a 'habitat suitability' index. The index ranges from 0 to 100 with 0 being least favourable and 100 most favourable for bats.

Table 2-1 below shows the projected suitability for the subject site. The model shows all turbines are situated within a region of low bat importance with a slight improvement in bat suitability from turbines 1 to 10. One species showed amber suitability (turbines 1 to 10); Soprano Pipistrelle.

Table 2-1: Landscape model for areas of the site

Turbines	All bats result	Species	Suitability result
1 to 10	15.89 (green)	*Pipistrellus pygmaeus*	34
		Plecotus auritus	18
		Pipistrellus pipistrellus	26
		Rhinolophus hipposideros	2
		Nyctalus leisleri	23
		Myotis mystacinus	4
		Myotis daubentonii	23
		Pipistrellus nathusii	1
		Myotis nattereri	12
11 to 13	11.44 (green)	*Pipistrellus pygmaeus*	26

Turbines	All bats result	Species	Suitability result
		Plecotus auritus	13
		Pipistrellus pipistrellus	20
		Rhinolophus hipposideros	1
		Nyctalus leisleri	16
		Myotis mystacinus	7
		Myotis daubentoniid	13
		Pipistrellus nathusii	0
		Myotis nattereri	7

2.3.2 Historical Bat Records from the vicinity of the site

The NBDC and Bat Conservation Ireland database was consulted for details on bat records held for the site and the surroundings. The database was consulted on the 01/03/2021 and again on the 24/03/2022 for details on historical records from the site and the surrounding 10km. Results are outlined in **Table 2-2**. Five species have been recorded within 10km in addition to unidentified Myotis and an unknown bat. The closest historical roost is located 6.5km from the proposed site recorded in 2008. Two Soprano Pipistrelle bats were observed here. The subject site sits outside the core substance zone for this roost. Several ad hoc and transect records are also recorded in the surrounds.

Table 2-2 Irish bat species recorded in the surrounding 10km

Type of Record	*Species*	Distance from site	Date of last record	Details	Potential connectivity with subject site (for roost records)
Roost	*Pipistrellus pygmaeus*	6.5km to the north-west	2008	2 bats noted	BCT state the csz for Soprano Pipistrelle is 3km thus the subject site lies outside the csz for this roost.
Car transect	*Myotis spp., Nyctalus leisleri, Pipistrellus pipistrellus, Pipistrellus pygmaeus,*	3km west	2021	BCIreland Car Based Bat Monitoring Scheme	
	Nyctalus leisleri, Pipistrellus pipistrellus, Pipistrellus pygmaeus, Plecotus auritus, Unidentified bat	5.6km south-west	2021	BCIreland Car Based Bat Monitoring Scheme	
	Myotis spp., Nyctalus leisleri, Pipistrellus pipistrellus Pipistrellus pygmaeus,	6km north-west	2021	BCIreland Car Based Bat Monitoring Scheme	
Walked transect	*Myotis spp., Nyctalus leisleri, Pipistrellus pipistrellus Pipistrellus pygmaeus*	3.5km north	2011	Woodrow Sustainable Solutions	
Adhoc	*Myotis spp., Nyctalus leisleri, Pipistrellus pipistrellus, Pipistrellus pygmaeus*	4km south-west	2009	BATLAS 2010 Bunnyconnellan village	

Type of Record	*Species*	Distance from site	Date of last record	Details	Potential connectivity with subject site (for roost records)
	Unidentified bat	7km west	2020	Batlas 2020	
	Myotis daubentonii, Pipistrellus pygmaeus	7.46km South-west	2009	BATLAS 2010 Lough Brohly	
	Myotis daubentonii	7.8km north-east	2009	BATLAS 2010 Lough Easkey	
	Pipistrellus pygmaeus	8.7 north-east	2020	Batlas 2020 Rathgoonaun Ford	

3 SURVEY FINDINGS

3.1 SURVEY METHODOLOGY

3.1.1 Bat activity and emergence surveys

The bat detector used during the walked and driven surveys was a Wildlife Acoustics Inc. (Massachusetts, USA) Echo Meter Touch Pro which are triggered to record when a bat call is emitted louder than 18dB for 1sec. These detectors use full spectrum sampling; detecting all frequencies simultaneously, meaning that multiple bat calls can be recorded at the same time.

Night time surveys combined emergence surveys towards dusk and dawn and a combination of walked and driven transects of bat favourable habitats within and surrounding the study were conducted between June and August 2021 (Table 3-4).

Transects targeted a range of foraging and commuting habitats present within and surrounding the study area, those associated with linear features such as roadside margins, woodland plantation edges, hedgerows, treelines and waterbodies. Summaries of emergence and driven transects can be found in section 3.2 below while contact tables are displayed in Appendix C.

A contact describes a bat observed by the surveyor. This contact can range from a commuter passing quickly to a foraging bat circling a feature lasting for several minutes. Some observations contain multiple bats. When several bats of the same species are encountered together they are recorded under the one contact. A separate contact is recorded for each species. A contact finishes when the recorder assumes the bat is no longer present. It is likely that the same bat is recorded in several contacts throughout the night. This survey type cannot estimate abundance of bats, rather activity; *the amount of use bats make of an area / feature.*

Where possible, a positive identification to species level was made. Information on the behaviour was also recorded where available.

Bat activity is governed by the activity of their insect prey and insect abundance is in turn governed by weather conditions and climate. Insects, and therefore bats, are unlikely to be present at temperatures below 7°C or during periods of strong winds or heavy rainfall so surveying in such conditions is not possible. All field surveys were undertaken within the active bat season and during good weather conditions (dry conditions and temperature at 8°C and greater).Bats were identified by their ultrasonic calls coupled with behavioural and flight observations and on computer by sound analysis of recorded echolocation and social calls with dedicated software (Wildlife Acoustic's Kaleidoscope Pro; version 2.1.0)[1].

3.1.2 Habitats on site

The subject site consists primarily of cutover bog, gravel tracks, fragments of scrub bordering conifer plantation. Elevation on site ranges from c.110m to 170m, sloping downhill to the north-west. Streams can be found to the east (Weeloge; flowing north), south-west (Loughnagore, flowing west),

[1] *Although there are later editions to this software the surveyor manually verified all calls rather than depending on auto identification. It is the surveyors opinion that auto-id features frequently misidentify bat species*

west (Fir; flowing west) and to the north-west (Brusna; flowing north-west). Transects were completed along tracks within and outside the site.

3.1.3 Static bat detector surveys

Passive Static Bat Surveys involve leaving a static bat detector unit (with ultrasonic microphone) in a specific location and set to record for a specified period of time (i.e. a bat detector is left in the field, there is no observer present and bats which pass the monitoring unit are recorded and their calls are stored for analysis post surveying). The bat detector is effectively used as a bat activity data logger. This results in a far greater sampling effort over a shorter period of time. Bat detectors with ultrasonic microphones are used as the ultrasonic calls produced by bats cannot be heard by human hearing.

Song Meter Mini and SM4BAT Full spectrum bat recorders use Real Time recording as a technique to record bat echolocation calls and using specific software, the recorded calls are identified. It is these sonograms (2-d sound pictures) that are digitally stored on the SD card (or micro SD cards depending on the model) and downloaded for analysis. These results are depicted on a graph showing the number of bat passes per species per hour/night. Each bat pass does not correlate to an individual bat but is representative of bat activity levels. Some species such as the pipistrelles will continuously fly around a habitat and therefore it is likely that a series of bat passes within a similar time frame is one individual bat. On the other hand, Leisler's bats tend to travel through an area quickly and therefore an individual sequence or bat pass is more likely to be indicative of individual bats.

Per (SNH, 2019) & (SNH, 2021) guidance, static units (Song Meter SM4BAT and SM-Mini) were programmed to commence half an hour before sunset and finish half an hour after sunrise to ensure that bat species that emerge early in the evening and return to roosts late are recorded. Detectors were left out for a minimum of 10 consecutive nights across three survey periods: spring (April - May), summer (July - early August) and autumn (Mid to late August).

SNH (2021) guidance states that "Detectors should be placed at all known turbine locations at wind farms containing less than ten proposed turbines. Where developments have more than ten turbines, detectors should be placed within the developable area at ten potential turbine locations plus a third of additional potential turbine sites up to a maximum of 40 detectors for the largest developments". In total thirteen detectors were deployed.

The data was analysed with Wildlife Acoustic's Kaleidoscope Pro; version 2.1.0)[2]. This software identifies many of the calls made by Irish bats. All calls not labelled Soprano or Common Pipistrelle Bats were manually verified. Results presented below show some Myotis calls the surveyor is confident the bat is a Natterer's bat. Distinguishing between Myotis species recordings is difficult (unless distinctive social calls are recorded thus several calls are recorded to genus level only. These could be either Whiskered, Daubenton's or Natterer's bat. Similarly, several Pipistrelle calls were recorded with a peak frequency of around 40kHz. These calls are lower than expected for Common Pipistrelle but higher than typical for Nathusius's. Following the precautionary approach these calls have been included in ECOBAT as Nathusius Pipistrelle although it is likely many were Common

[2] There have been several updates to Kaleidoscope and the auto ID; Bats of UK 2.0.7. The author however feels auto-ID software regularly misidentifies bat calls that are not ID'ed as Common or Soprano Pipistrelle. As such all calls not identified as Common or Soprano Pipistrelle were manually verified. The software version used is adequate for organising data.

Pipistrelle. All detectors were set in open bog on a timber structure ensuring microphone height was set at 2.5m.

Table 3-1: Habitats surrounding proposed turbines with comments on static locations and landscape features suitable for bats

Turbine No	Approximate % of habitats within 200m of proposed turbine								Comments on static locations and landscape features suitable for bats	**Number of nights static deployed**
	Habitat 1	%	Habitat 2	%	Habitat 3	%	**Habitat 4**	%		
1	PB4	99	WD4	1	BL3	1	-	-	Set in previously cut bog. Conifer plantation located at outer edge of 200m buffer.	44 nights
2	PB4	98	WD4	1	FW1	1	BL3	1	Set in previously cut bog. Conifer plantation located at outer edge of 200m buffer. Tributary stream of Loughnagore also located towards outer edge of buffer to the south west.	44 nights
3	PB4	97	WD4	2	FW1	1	BL3	1	Set in previously cut bog. Conifer plantation located at outer edge of 200m buffer. Tributary stream of Owencam (Fir) also located towards outer edge of buffer to the west.	44 nights
4	PB4	94	WD4	5	FW1	1	BL3	1	Set in previously cut bog. Conifer plantation located at outer edge of 200m buffer. Tributary stream of Owencam (Fir) also located to south of turbine.	44 nights
5	PB4	89	WD4	10	BL3	1	-	-	Set in previously cut bog Conifer plantation located c. 140m to the west and south west.	44 nights
6	PB4	99	BL3	1	-	-	-	-	Set in previously cut bog. Conifer plantation located just outside edge of 200m buffer.	44 nights
7	PB4	99	BL3	1	-	-	-	-	Set in previously cut bog. SD card was removed from detector for Autumn survey so analysis focused on spring and summer periods only.	32 nights
8	PB4	99	BL3	1	-	-	-	-	Set in previously cut bog.	44 nights
9	PB4	99	BL3	1	-	-	-	-	Set in previously cut bog.	44 nights
10	PB4	99	BL3	1	-	-	-	-	Set in previously cut bog.	44 nights
11	PB4	99	BL3	1	-	-	-	-	Set in previously cut bog.	44 nights
12	PB4	99	BL3	1	-	-	-	-	Set in previously cut bog.	44 nights
13	PB4	98	FW1	1	BL3	1	-	-	Set in previously cut bog. Tributary stream of Weeloge found c. 85m to the east	44 nights

3.1.4 Survey and Analysis Limitations

- It is not always possible to identify a bat call to species level due to the recorded call not being clear. Recorded files from automated detectors may contain only fragments of a call, or the bat may be calling from a distance (from the detector) in which case it may not be clear enough to assign the call to a specific species. In these cases the call has been assigned to genus level;
- Some caution must be taken when comparing activity levels between species, as bias can be shown towards those species with 'louder' or 'lower frequency' echolocation calls. For example, Nyctalus species have louder and low frequency echolocation calls which carry further than the quieter and more broad-band brown long-eared bat echolocation calls;
- A bat contact is defined as a single detector file which contains at least one bat call. Multiple contacts at any given detector location do not necessarily indicate the presence of more than one bat and should therefore be interpreted as a level of activity rather than the number of bats recorded;
- For the purposes of this analysis, if more than 1 species was present within the recorded files the prominent species was identified as the species for the Ecobat analysis, therefore some species numbers may be under recorded;
- Guidelines in the use of Ecobat recommend a Reference Range of 200+ nights of bat data to be confident in the relative activity level. The reference range is the stratified dataset of bat results recorded in the same region, at the same time of year, by which percentile outputs can be generated. This comprises all records of nightly bat activity across Ireland. Where the reference range fell below this level the comparison inputs were broadened by increasing the date ranger beyond 30 days.
- Ecobat analysis regarding genus level identification currently. If a genus level ID has been entered into the spreadsheets, for example "Myotis" then all identified Myotis species (including nattereri, mystacinus and daubentonii) will be included in the total for the date of the Myotis. To counter this the species level passes were deducted from the genus level data prior to imputing.
- Following the conservative approach 40kHz activity was included with Nathusius Pipistrelle

3.1.5 Assessment of Potential Roost Habitats

3.1.5.1 Potential tree roosts

NEAI guidance recommends a search of trees within 200m of each turbine. Figure 3-1 shows each buffer. Trees were assessed with reference to the Bat Tree Habitat Key (Andrews, 2016) on the (give date). No trees with potential for hosting a bat roost is located within any of turbine buffer zones. Conifer plantation trees within the buffers have no potential to host bat roosts. In addition, all deciduous trees within the buffer zones were scrubby trees without cavities (the majority are willow) of no potential for bat roosts.

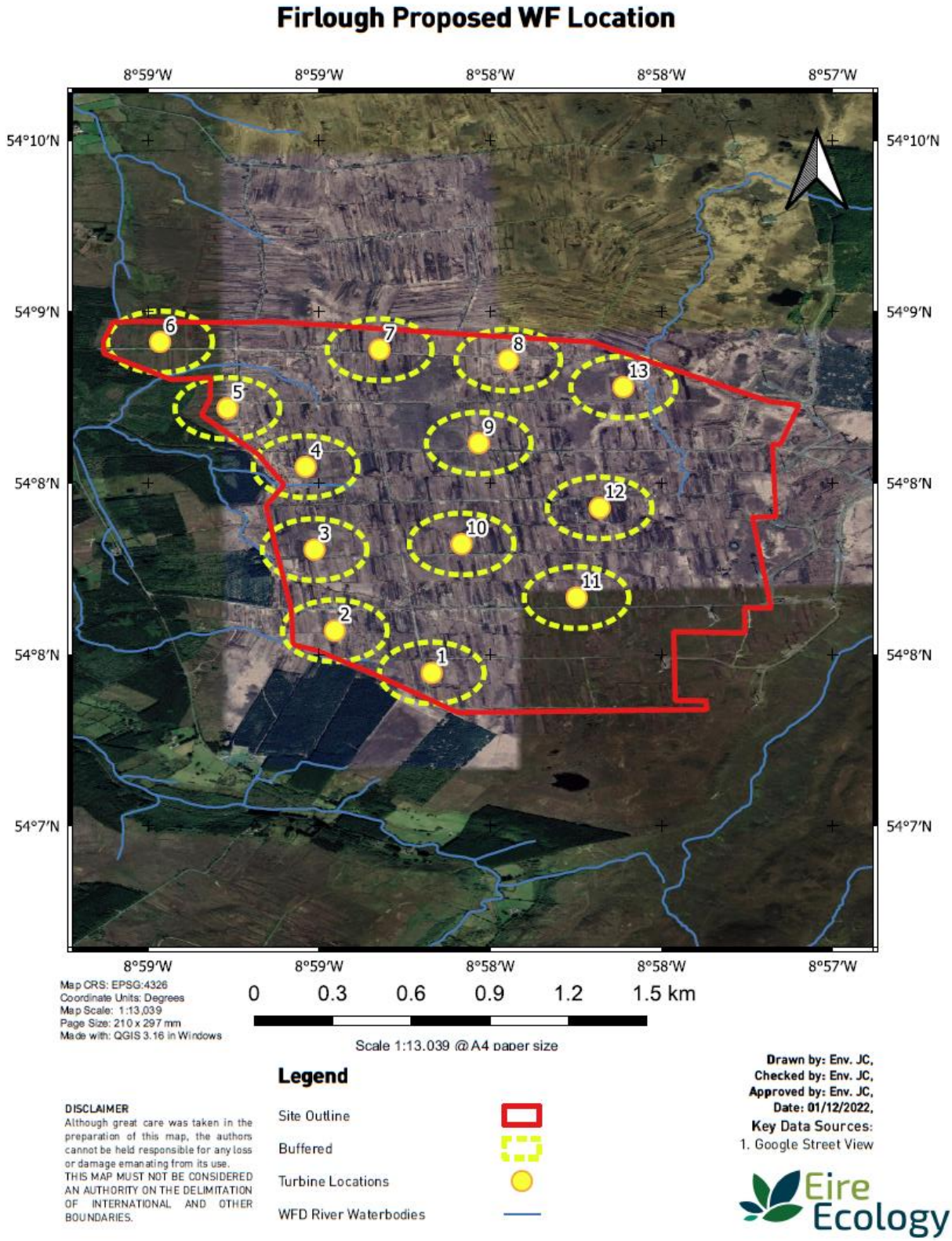

Figure 3-1: 200m buffer surrounding each turbine

3.1.5.2 Structures

No buildings or built structures suitable for usage by bats was found within 200m of any turbine location. Potential roost structures outside this zone were also examined. Several derelict sheds, dwellings and bridges were examined in the wider landscape. In situations where access was not possible the surveyor conducted night time surveys from the road examining bats and attempting to located commuting routes and roosts.

Table 3-2 Potential roost structures examined during daylight preliminary searches.

No	Lat	Long	Potential level	Distance to closest turbine	Details
1	54.13933	-8.99052	High	660m W of T4.	Derelict dwelling
2	54.15770	-8.995185	High	1.11km NW of T6	Derelict house with good bat roosting potential. Treeline to rear.
3	54.13580	-8.991780	Moderate	730m W of T3	Private occupied farmstead.
4	54.14266	-8.99484	Low	635m to W of T5	Bridge on road to north of derelict house 1. Constructed of concrete with minimal crevices. No signs of bats.
5	54.154684	-8.99420	Unknown	780m NW of T6	Private occupied house set off the road. No access possible.
6	54.14350	-8.992074	Medium	440m W of T5	Low potential bridge / culvert constructed of concrete
7	54.120783	-8.97851516	Low	930m SW of T1	Nice bridge to south of site. Crevices has been pointed thus minimal potential.

During the daylight search no evidence of bats were noted from any of the structures listed in Table 3-2. All of these were revisited during night time surveys baring structure 4 and 7 which had no potential and 5. This building was set 130m off the road to far to observe bat behaviour. The night time surveys did not reveal the presence of bat roosts from these structures or anywhere else.

3.2 BAT DETECTOR SURVEYS

Night-time bat surveys commenced thirty minutes prior to sunset and ran for approximately three hours whilst dawn surveys commenced two hours prior to sunrise and finished at sunrise.

Weather conditions were acceptable during each survey however drizzle occurred during dawn surveys on the 24th of June and 20th of August and drizzle /mist occurred on the 7th of July (full details can be found in Appendix C).

Table 3-3: Bat Survey Effort Summary 2021

Survey	Date	Survey type	Start Time	End Time	Location	Grid ref (Lat, Long) Start / Finish	Sunset / sunrise
1	23/06/2021	Roost survey	21:38	22:59	Examined derelict house (1), located 660m to the west of turbine 4.	54.13587, -8.97154	22:08
		Driven transect	23:00	00:38	Transect through site and western road.		
2	24/06/2021	Roost survey	02:59	04:59	Examined derelict house (2) to north along western road.	54.1577,-8.99518	04:59
3	07/07/2022	Roost survey	21:33	23:13	Emergence survey conducted on road as close to building 5 as possible.	54.1577,-8.99518	22:03
		Driven transect	23:14	00:33	Transect through site and western road.		
4	08/07/2022	Roost survey	03:08	05:08	Re-examined derelict house (2) as previous survey was conducted during drizzle	54.1577 -8.99518	05:10
5	19/08/2021	Roost survey	20:20	21:20	Examined farmstead (3) by road to west of proposed development	54.14759, -8.97601	20:52
		Driven transect	21:20	23:22	Transect through site and along western road		
6	20/08/2021	Re-entry survey	04:18	06:18	Re-entry survey conducted back at derelict house (1) previously surveyed on	54.1358, -8.97154	06:18

3.2.1 23rd to the 24th of June 2021

3.2.1.1 Dusk Survey

Four bats were identified to species level; Leisler's bat, Common and Soprano Pipistrelle and Brown Long-eared bat. The survey commenced with an emergence survey by building 1. No bat activity was recorded here and no evidence of roosting bats was found. At 22:59 a driven transect was conducted along the western road and through the site. Activity within the site was very low with two brief contacts from Common and Soprano Pipistrelle. A Leisler's bat and brown long-eared bat was recorded along the western road. Overall the survey recorded very low bat activity despite suitable conditions.

3.2.1.2 Dawn Survey

A dawn re-emergence survey was conducted at building 2 (to the north-west of the site). No bat activity was recorded. Drizzle occurred during the survey which, in the surveyor's experience should not exclude all bat activity.

3.2.2 07th to the 08th of July 2021

3.2.2.1 Dusk Survey

This survey commenced with the bat worker positioned along the western road examining dwelling (5) set off the road. No bat activity was recorded during the emergency period. Again activity during the transects was low with three species identified; Leisler's bat, Common and Soprano Pipistrelle. All bats were recorded along the western road rather than within the site.

3.2.2.2 Dawn Survey

A second roost survey was conducted by the derelict house (2) as the previous survey was conducted during drizzle. Again no bat activity was recorded during the survey despite suitable conditions.

3.2.3 19th to the 20th of August 2021

3.2.3.1 Dusk Survey

Three bats were identified to species level; Leisler's bat, Common and Soprano Pipistrelle. Activity was relatively low with occasional hunting Pipistrelles noted. A dusk emergence survey was conducted by a farmstead (3) to the west of the site. No emerging bats were observed. Occasional bat activity was recorded during the transect, with marked higher results noted from the western road than within the site.

3.2.3.2 Dawn Survey

A second roost survey was conducted by the derelict dwelling located to the west of the site (1) given this building showed highest bat potential, closest to the site. No bat activity was recorded during the survey.

3.2.4 Static Detector Results

The results of the static detector surveys deployed over three rounds (spring, summer and autumn) in 2021 are shown below. Overall eight bat species were recorded (Common Pipistrelle, Soprano Pipistrelle, Nathusius' pipistrelle, Leisler's bat, Brown Long-eared bat, Natterer's bat, Whiskered bat and Daubenton's bat). Where the call could not be identified to species, the identification was determined to the highest level possible. Several registrations were recorded with a peak frequency of 40kHz. These bats will have been either common or Nathusius's Pipistrelle. More detailed results are provided in Appendix D.

Table 3-4: Static Results

Common Name	Species	No. of recordings 2021
Brown long-eared bat	*Plecotus auritus*	152
Common pipistrelle	*Pipistrellus pipistrellus*	1825
Daubenton's bat	*Myotis daubentoniid*	9
Leisler's bat	*Nyctalus leisleri*	3284
Nathusius' pipistrelle	*Pipistrellus nathusii*	51
Natterer's bat	*Myotis nattereri*	40
Soprano pipistrelle	*Pipistrellus pygmaeus*	2137
Whiskered bat	*Myotis mystacinus*	6
40 kHz Pipistrelle	-	314
Myotis sp	*Myotis sp*	262
Total registrations		8080

Table 3-5: Static Results

Detector	Leisler's Bat	Common Pipistrelle	Soprano Pipistrelle	Nathusius Pipistrelle	Brown Long-eared	Unidentified Pipistrelle	Natterer's Bat	Whiskered / Daubenton's Bat	Daubenton's bat	Unidentified Myotis	Total	Minutes recorded	Bat passes per hour (BP/Hr)
1	292	332	327	11	24	15	6	2	0	24	1033	25974	2.4
2	316	162	144	8	21	194	2	0	0	24	871	25974	2.0
3	185	115	143	1	12	12	7	0	0	25	500	25974	1.2
4	224	94	155	0	9	7	1	0	0	22	512	25974	1.2
5	357	63	149	0	20	7	6	0	2	20	624	25974	1.4
6	299	65	147	4	9	3	1	0	0	21	549	25974	1.3
7	140	95	59	1	9	2	0	4	0	4	314	18117	1.0
8	253	163	123	6	10	7	1	0	0	30	593	25974	1.4
9	187	102	113	0	5	10	3	0	0	14	434	25974	1.0
10	226	181	173	3	11	15	1	0	0	22	632	25974	1.5
11	237	162	264	11	10	11	4	0	1	16	716	25974	1.7
12	217	151	175	3	5	13	4	0	0	16	584	25974	1.3
13	351	140	165	3	7	18	4	0	6	24	718	25974	1.7
Total	3284	1825	2137	51	152	314	40	6	9	262	8080	329805	1.5
Average BP/Hr[3]	0.60	0.33	0.39	0.01	0.03	0.06	0.01	0.00	0.00	0.05	-		

[3] Over the whole site combined

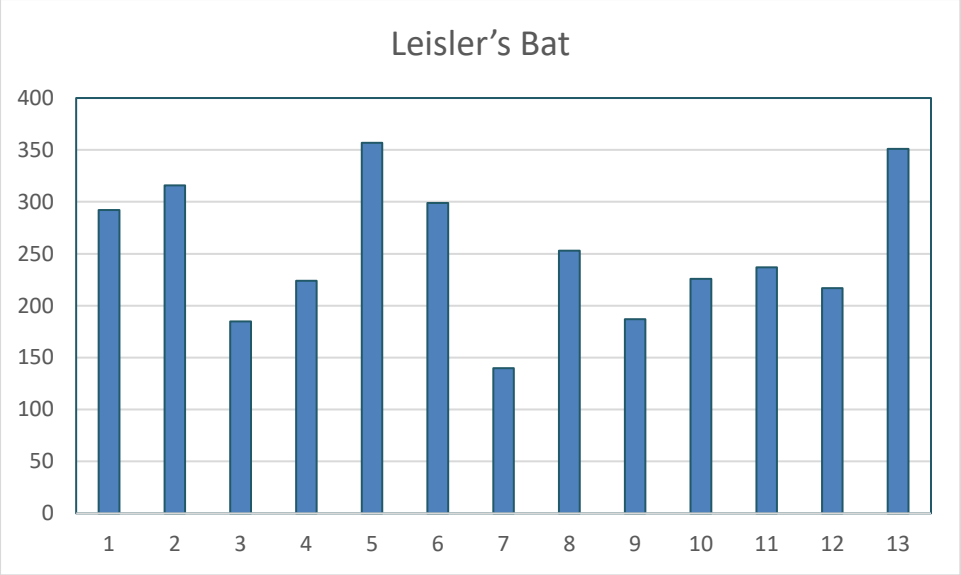

Figure 3-2: **Total number of bat passes recorded for Leisler's bat at each of the static locations**

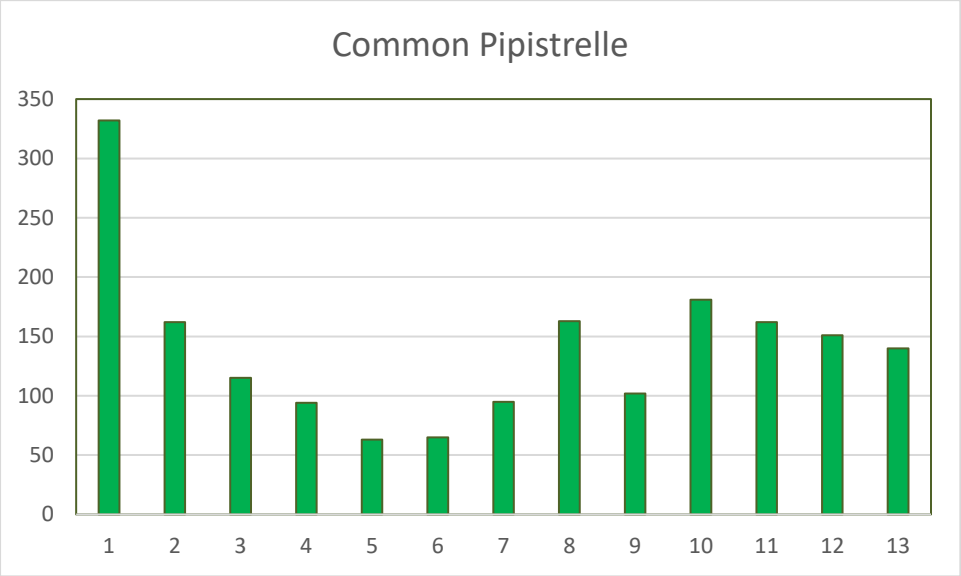

Figure 3-3: **Total number of bat passes recorded for Common Pipistrelle at each of the static locations**

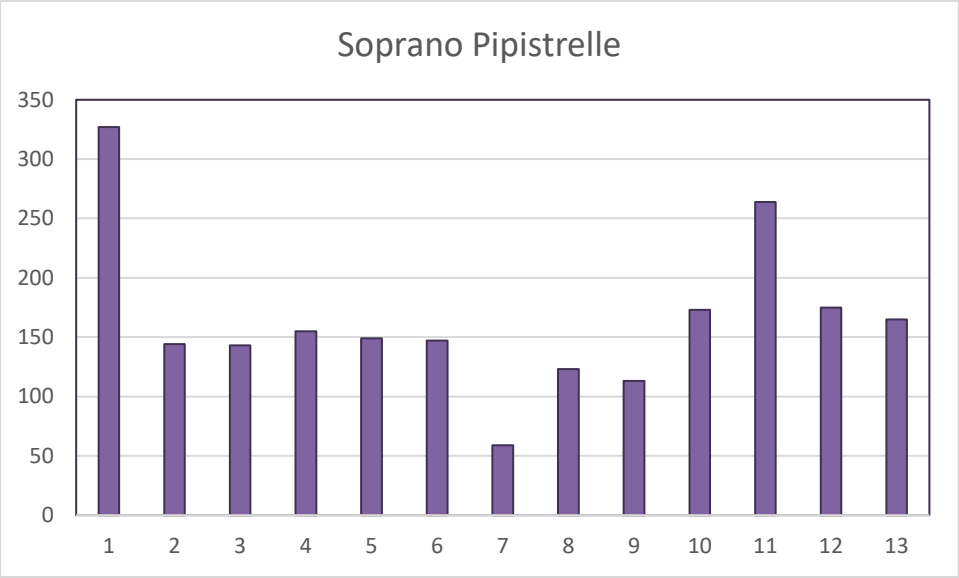

Figure 3-4: **Total number of bat passes recorded for Soprano Pipistrelle at each of the static locations**

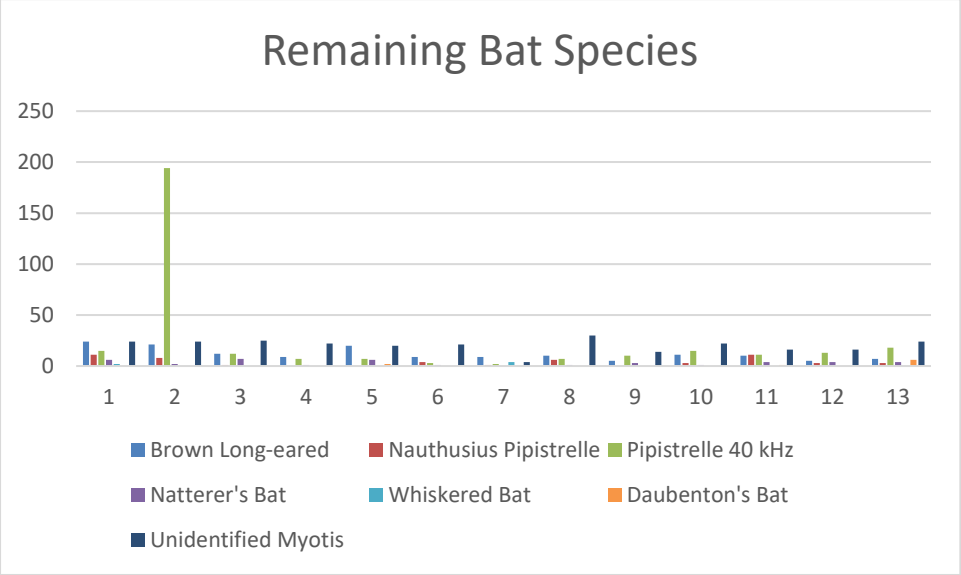

Figure 3-5: **Total number of bat passes recorded for remaining bat species at each of the static detector locations in 2021.**

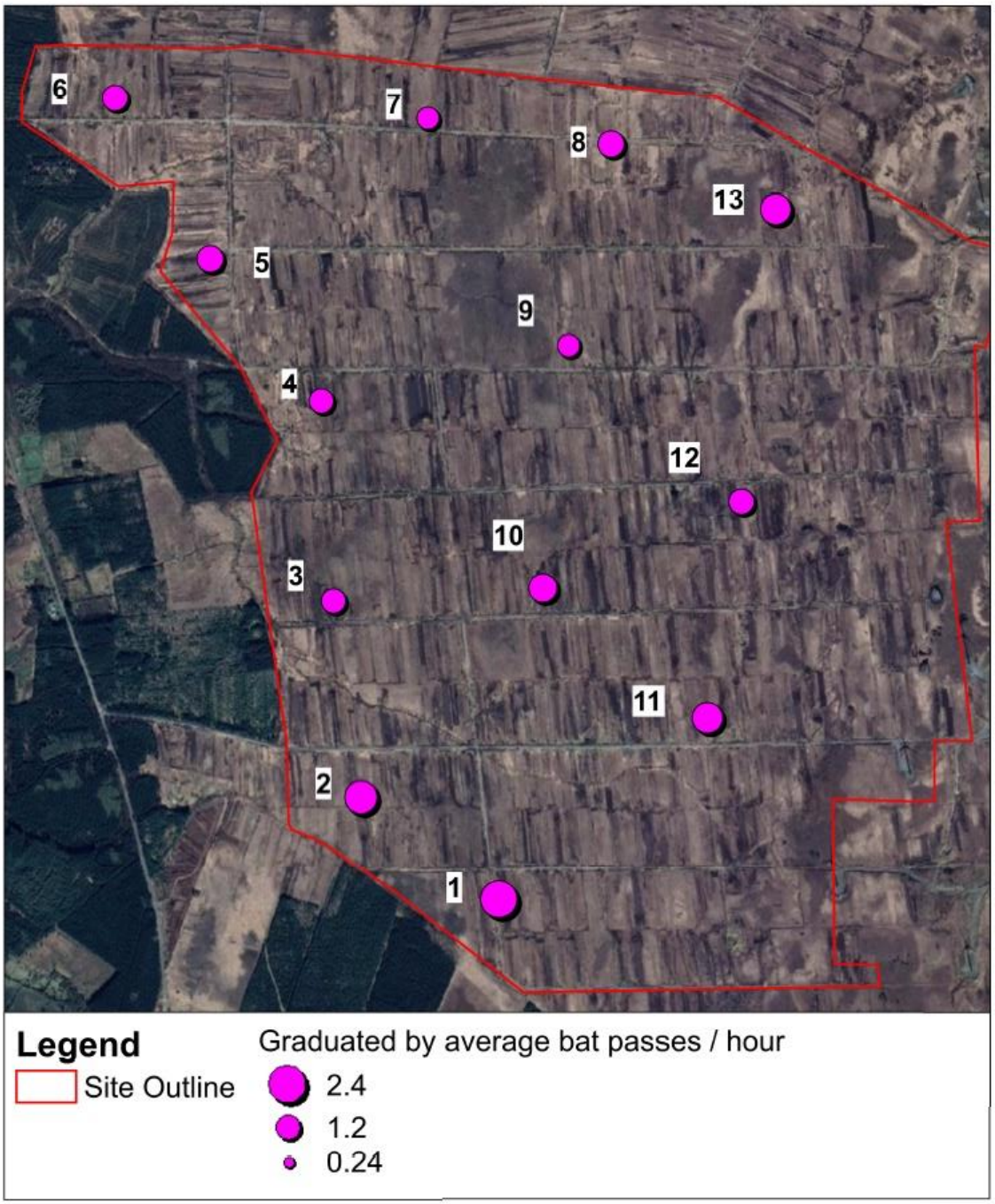

Figure 3-6: Level of activity based on average bat passes per hour per turbine.

Overall turbine locations within the site showed similar levels of bat activity, with highest bat passes recorded at turbines 1 and 2 at 2.39 and 2.01 bat passes per hour respectively. These turbines located to the south west of the site lie somewhat close to conifer plantation. All other turbines range from 1.66 to 1.0 bat passes per hour.

3.2.5 ECOBAT

Results from the static detector surveys were analysed using Ecobat (University of Exeter); a software package that standardizes and performs interpretation of bat activity data (Summary displayed in **Table 3-8 to 3-11** with full reports added as **Appendix E**). It compares static detector data with similar datasets set in similar habitats and ranks activity levels.

All recordings were made in full spectrum, retaining all amplitude and harmonic information from the original bat call for subsequent analysis. Bat calls were analysed using Kaleidoscope Pro (2.1.0) Software. All files were split to a maximum duration of 15 seconds and automatically identified to species level, or genus level as appropriate, using auto-ID bat classifiers (Bats of UK 2.0.7)[4].

In order to ensure quality, all calls not auto identified as Common or Soprano Pipistrelle were manually verified. The data was then entered into Ecobat and a report was subsequently generated. Ecobat is an online tool which makes assessments of bat activity levels by comparing data entered by the user with bat survey information from similar areas at the same time of year. Specifically, a median bat activity level is calculated which corresponds to a bat activity category (Table 3-7).

An individual bat can pass a particular feature on several occasions while foraging. It is therefore not possible to estimate the number of individual bats. In accordance with best practice guidance (Collins, 2016) an activity index is used; calculated from bat records per hour which allows analysis of bat activity to estimate abundance and/ or activity. The calculation is as follows:

BAI (Bat Activity Index) = Total number of bat records / number of hours of record

The reference range datasets were stratified to include:

- Only records from within 100 km^2 of the survey location (a 200km range was required for whiskered bats as the existing database range was not sufficient for 100km).
- Records using any make of bat detector.

Table 3-6: Median percentile range and corresponding bat activity

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

[4] *There have been several updates to Kaleidoscope and the auto ID; Bats of UK 2.0.7. The author however feels auto-ID software regularly misidentifies bat calls that are not ID'ed as Common or Soprano Pipistrelle. As such all calls not identified as Common or Soprano Pipistrelle were manually verified. The software version used is adequate for organising data.*

3.2.5.1 Survey Period 1 Results

Bat surveys were conducted for 18 nights between 15/04/2021 and 02/05/2021**,** using Wildlife Acoustics static bat detectors. No static location was deemed to have a High Bat Activity (for specific bat species) level based on the Percentile Median value.

Table 3-7: Detectors with at least one night of high bat activity during Spring

Species	Detector												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Common Pipistrelle	✓	✓	-	-	-	-	✓	-	-	✓	✓	✓	-
Soprano Pipistrelle	✓	✓	-	-	-	-	✓	-	✓	✓	✓	✓	-
Leisler's Bat	-	-	-	✓	✓	-	-	-	✓	✓	✓	✓	-
Nathusius Pipistrelle	-	✓	-	-	-	-	-	-	-	-	-		-

3.2.5.2 *Survey Period 2*

Bat surveys were conducted for 12 nights between 23/06/2021 and 06/07/2021**,** using Wildlife Acoustics static bat detectors. None of the static locations were deemed to have a High Bat Activity (for specific bat species) level based on the Percentile Median value.

Table 3-8: Detectors with at least one night of high bat activity during Summer period

Species	Detector												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Common Pipistrelle	✓	-	-	-	-	-	-	✓	-	-	-	-	-
Soprano Pipistrelle	✓	-	-	-	-	-	-	-	-	-	-	-	-
Leisler's Bat	-	✓	✓	✓	✓	✓	-	✓	-	✓	-	✓	✓

3.2.5.3 *Survey Period 3*

Bat surveys were conducted for 12 nights between 19/08/2021 and 30/08/2021 using Wildlife Acoustics static bat detectors.

No static locations were deemed to have a High Bat Activity (for specific bat species) level based on the Percentile Median value.

Table 3-9: Detectors with at least one night of high bat activity during Autumn period

Species	Detector

	1	2	3	4	5	6	7	8	9	10	11	12	13
Common Pipistrelle	✓	✓	✓	✓	-	-	-	✓	✓	✓	✓	✓	✓
Soprano Pipistrelle	✓	✓	✓	✓	✓	✓	-	✓	-	✓	✓	✓	✓
Leisler's Bat	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓

3.2.5.4 All Season Summary

Table 3-11 and 3-12 below provides a summary of bat activity from all survey periods combined and bat activity category based on median percentile. No static locations was deemed to have a High bat activity (for specific bat species) level based on the Percentile Median value. Highest activity level based on the percentile was from Leisler's bat with Moderate-High activity.

Table 3-10: Bat activity within each activity band for each species – all seasons combined

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	Median Percentile	Bat Activity Category based on median percentile
1	*Myotis*	0	2	2	3	6	33	Low to Moderate
	Myotis mystacinus	0	0	0	1	0	32	Low to Moderate
	Myotis nattereri	0	0	0	2	2	22	Low to Moderate
	Nyctalus leisleri	5	6	5	5	3	58	Moderate
	Pipistrellus nathusii	0	2	1	0	2	58	Moderate
	Pipistrellus pipistrellus	8	5	6	4	6	58	Moderate
	Pipistrellus pygmaeus	10	5	6	2	6	66	Moderate to High
	Plecotus auritus	0	0	2	3	8	11	Low
2	*Myotis*	0	0	5	1	7	11	Low
	Myotis nattereri	0	0	0	0	2	11	Low
	Nyctalus leisleri	6	12	5	3	4	66	Moderate to High
	Pipistrellus nathusii	5	1	2	3	12	11	Low
	Pipistrellus pipistrellus	2	7	8	2	5	56	Moderate
	Pipistrellus pygmaeus	2	7	7	1	7	53	Moderate
	Plecotus auritus	0	0	2	3	7	11	Low
3	*Myotis*	0	0	6	2	3	45	Moderate
	Myotis nattereri	0	0	0	2	3	11	Low
	Nyctalus leisleri	4	11	6	6	2	62	Moderate to High
	Pipistrellus nathusii	0	0	1	3	3	33	Low to Moderate
	Pipistrellus pipistrellus	1	7	7	1	4	58	Moderate
	Pipistrellus pygmaeus	3	6	4	3	7	45	Moderate

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	Median Percentile	Bat Activity Category based on median percentile
	Plecotus auritus	0	0	1	1	7	11	Low
4	*Myotis*	0	0	3	3	7	11	Low
	Myotis nattereri	0	0	0	0	1	11	Low
	Nyctalus leisleri	7	8	10	4	1	60	Moderate
	Pipistrellus nathusii	0	0	0	1	5	11	Low
	Pipistrellus pipistrellus	1	4	5	5	2	45	Moderate
	Pipistrellus pygmaeus	4	4	5	4	3	52	Moderate
	Plecotus auritus	0	0	1	2	2	33	Low to Moderate
5	*Myotis*	0	0	4	3	5	33	Low to Moderate
	Myotis daubentonii	0	0	0	0	2	11	Low
	Myotis nattereri	0	0	0	2	2	22	Low to Moderate
	Nyctalus leisleri	9	10	7	1	3	73	Moderate to High
	Pipistrellus nathusii	0	0	1	0	4	11	Low
	Pipistrellus pipistrellus	0	4	4	2	5	45	Moderate
	Pipistrellus pygmaeus	3	4	6	3	3	45	Moderate
	Plecotus auritus	0	1	1	3	5	22	Low to Moderate
6	*Myotis*	0	1	0	4	6	11	Low
	Myotis nattereri	0	0	0	0	1	11	Low
	Nyctalus leisleri	5	15	3	4	2	66	Moderate to High
	Pipistrellus nathusii	0	0	0	1	5	11	Low
	Pipistrellus pipistrellus	0	3	7	3	4	45	Moderate
	Pipistrellus pygmaeus	3	5	2	3	5	58	Moderate
	Plecotus auritus	0	0	0	1	7	11	Low
7	*Myotis*	0	0	0	3	0	33	Low to Moderate
	Myotis mystacinus	0	0	0	1	2	12	Low
	Nyctalus leisleri	0	12	2	2	3	62	Moderate to High
	Pipistrellus nathusii	0	0	1	0	0	45	Moderate
	Pipistrellus pipistrellus	2	2	3	3	5	33	Low to Moderate
	Pipistrellus pygmaeus	1	2	3	1	4	45	Moderate
	Plecotus auritus	0	0	0	2	5	11	Low
8	*Myotis*	0	0	6	2	7	33	Low to Moderate
	Myotis nattereri	0	0	0	0	1	11	Low
	Nyctalus leisleri	3	18	5	1	6	62	Moderate to High

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	Median Percentile	Bat Activity Category based on median percentile
	Pipistrellus nathusii	0	0	0	5	3	33	Low to Moderate
	Pipistrellus pipistrellus	3	5	5	6	7	39	Low to Moderate
	Pipistrellus pygmaeus	1	8	3	5	6	45	Moderate
	Plecotus auritus	0	0	1	1	5	11	Low
9	*Myotis*	0	0	1	1	8	11	Low
	Myotis nattereri	0	0	0	0	3	11	Low
	Nyctalus leisleri	4	17	3	4	5	66	Moderate to High
	Pipistrellus nathusii	0	0	1	2	3	22	Low to Moderate
	Pipistrellus pipistrellus	2	5	3	3	8	33	Low to Moderate
	Pipistrellus pygmaeus	1	7	5	4	5	49	Moderate
	Plecotus auritus	0	0	0	0	5	11	Low
10	*Myotis*	0	1	3	0	5	11	Low
	Myotis nattereri	0	0	0	0	1	11	Low
	Nyctalus leisleri	7	6	8	6	3	53	Moderate
	Pipistrellus nathusii	0	1	1	2	4	22	Low to Moderate
	Pipistrellus pipistrellus	3	6	9	1	2	53	Moderate
	Pipistrellus pygmaeus	4	6	4	4	7	45	Moderate
	Plecotus auritus	0	1	0	1	3	11	Low
11	*Myotis*	0	0	1	5	6	22	Low to Moderate
	Myotis daubentonii	0	0	0	0	1	11	Low
	Myotis nattereri	0	0	0	1	2	11	Low
	Nyctalus leisleri	9	10	7	3	5	64	Moderate to High
	Pipistrellus nathusii	0	1	2	0	6	11	Low
	Pipistrellus pipistrellus	2	7	5	3	5	56	Moderate
	Pipistrellus pygmaeus	6	4	4	1	4	69	Moderate to High
	Plecotus auritus	0	0	1	1	5	11	Low
12	*Myotis*	0	1	0	4	5	22	Low to Moderate
	Myotis nattereri	0	0	0	1	2	11	Low
	Nyctalus leisleri	7	16	3	3	4	71	Moderate to High
	Pipistrellus nathusii	0	0	2	2	4	22	Low to Moderate
	Pipistrellus pipistrellus	2	4	2	8	4	33	Low to Moderate
	Pipistrellus pygmaeus	4	6	4	3	9	45	Moderate

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	Median Percentile	Bat Activity Category based on median percentile
	Plecotus auritus	0	0	0	0	5	11	Low
13	*Myotis*	0	1	6	1	2	45	Moderate
	Myotis daubentonii	0	0	0	3	0	33	Low to Moderate
	Myotis nattereri	0	0	0	0	4	11	Low
	Nyctalus leisleri	8	13	5	2	6	71	Moderate to High
	Pipistrellus nathusii	0	0	3	3	6	22	Low to Moderate
	Pipistrellus pipistrellus	2	7	3	4	3	53	Moderate
	Pipistrellus pygmaeus	5	4	6	2	3	56	Moderate
	Plecotus auritus	0	0	0	1	5	11	Low

Table 3-11: **Summary showing the number of nights recorded bat activity fell into each activity band for each species across all detectors for all survey periods combined**

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**	**Median Percentile**	**Bat Activity Category**
Myotis	0	6	37	32	67	24.7	Low to Moderate
Myotis daubentoniid	0	0	0	5	5	19.8	Low
Myotis nattereri	0	0	0	8	24	12.8	Low
Myotis mystacinus	0	0	0	0	2	2	Low
Nyctalus leisleri	74	154	69	44	47	64.2	Moderate to High
Pipistrellus nathusii	5	5	15	22	57	24.0	Low to Moderate
Pipistrellus pipistrellus	28	66	67	45	60	46.7	Moderate
Pipistrellus pygmaeus	47	68	59	36	69	51.8	Moderate
Plecotus auritus	0	2	9	19	69	13.5	Low

4 ASSESSMENT OF POTENTIAL EFFECTS

Common, Nathusius's and Soprano Pipistrelle alongside Leisler's bats are high risk species for windfarm collisions; (SNH, 2019), (Fiona Mathews, 2015), (BCI, 2012). (NIEA, 2021) states that peaks of bat activity should be accounted for in addition to median levels to appropriately quantify risk. The report also noted the 'Leisler's bats, while fairly rare in Britain, are one of the commonest species found in Ireland. However, given their rarity in the rest of the UK, and indeed Europe, the Irish population is considered a global stronghold for the species and therefore we have an international responsibility for its protection'.

Table 2: *Level of potential vulnerability of populations of British bat species. (Adapted from Wray et al., 2010)*

Yellow = low population vulnerability

Beige = medium population vulnerability

Red = high population vulnerability

Relative abundance	England	Collision risk		
		Low collision risk	Medium collision risk	High collision risk
	Common species	Brown long eared bat		Common pipistrelle Soprano pipistrelle
	Rarer species	Daubenton's bat Natterer's bat Whiskered bat Brandt's bat Lesser horseshoe	Serotine bat	Nathusius' pipistrelle Noctule bat Leisler's bat
	Rarest species	Alcathoe bat Bechstein's bat Greater horseshoe Grey long eared bat	Barbastelle bat	

Figure 4-1: Level of potential vulnerability of populations of British bats.

4.1 RISK ASSESSMENT

A risk assessment has been completed with reference to Table 3a and b; bats and onshore wind turbine report (SNH, 2021), (SNH, 2019).

4.1.1 Initial site risk assessment

An initial risk assessment is based on an assessment of habitats and the size of the development. Habitat suitability is ranked either low, moderate and high while project size is ranked from small, medium and large. (SNH, 2021) states '*great caution must be exercised before concluding that a site is of low suitability for bats'* as '*high casualty rates have been observed at upland sites with no local woodlands or linear features*". Habitats surrounding the subject turbines are ranked as **Moderate**. The majority of the site consists of open bog with little connective features however to the west conifer plantation edge habitat can be found and a stream to the east and north.

The project size is ranked as large given the turbine size (reaching over 100m). The Firlough windfarm thus derives an Initial Site Risk Assessment Value of *4; High site risk*.

4.1.2 Overall risk assessment

The output from the initial site risk assessment is used in the below matrix to derive an overall risk assessment based on the activity level of high collision risk species. Common Pipistrelle, Soprano Pipistrelle and Leisler's bat are considered high collision. Ireland is considered the world stronghold for Leisler's bat with an estimated population of 73,000 – 130,000 (2007-2012) (Roche, 2014).

Site risk level (from Table 3a)	Ecobat activity category (or equivalent justified categorisation)					
	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

Figure 4-2 Risk assessment matrix (SNH, Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation, 2019)

Turbine No.	Risk Assessment based on Ecobat Results								Is location of static at turbine location?	Bat Habitat within 200m of turbine	If no mitigation is applied, what is the potential impact level?
	Leisler's bat		Common pipistrelle		Soprano pipistrelle		Nathusius's pipistrelle				
	Maximum Percentile	Median Percentile	Maximum Percentile	Median Percentile	Maximum Percentile	Median Percentile	Maximum Percentile	Median Percentile			
1	**20**	12	20	12	**20**	16	**16**	12	Yes	Yes. Conifers located at 200m edge	High
2	**20**	16	20	12	**20**	12	**20**	4		Yes. Conifers and stream located at 200m edge	High
3	**20**	16	20	12	**20**	12	**12**	8		Yes. Conifers and stream located at 200m edge	High
4	**20**	12	20	12	**20**	12	**8**	4		Yes. Stream located 110m, conifers at 150m.	Medium
5	**20**	16	16	12	**20**	12	**12**	4		Yes. Conifers located c. 140m	High
6	**20**	16	16	12	**20**	12	**8**	4		No. Conifers and stream located just outside 200m buffer	High
7	**16**	16	20	8	**20**	12	**12**	12		No.	High
8	**20**	16	20	8	**20**	12	**8**	8		No.	High
9	**20**	16	20	8	**20**	12	**12**	8		No.	High
10	**20**	12	20	12	**20**	12	**16**	8		No.	Medium
11	**20**	16	20	12	**20**	16	**16**	4		No.	High
12	**20**	16	20	8	**20**	12	**12**	8		No.	High
13	**20**	16	20	12	**20**	12	**12**	8		Yes. Stream located 85m.	High

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5 DISCUSSION

The methodology for the 2021 bat surveys at Firlough proposed wind farm adhered to SNH (2019) and (SNH, Bats and Onshore Wind Turbines – Survey, Assessment and Mitigation., 2021) guidance for assessing the impact of proposed wind farm developments on local bat species. Roost assessment (structures and initial tree surveys), emergence surveys and activity surveys were undertaken between June and August 2021. Three rounds of static detectors were also deployed, for a minimum of 10 nights per round per detector.

During activity surveys, a total of four species of bats were recorded: Soprano Pipistrelle, Common Pipistrelle, Leisler's bat and Brown Long-eared bat. The most commonly recorded species was Soprano and Common Pipistrelle, followed by Leisler's, with only a single Brown Long-eared bat noted.

During static surveys, a total of eight species of bats were recorded: Common Pipistrelle, Soprano Pipistrelle, Leisler's bat, Nathusius's Pipistrelle, Brown Long-eared bat, Natterer's, Whiskered and Daubenton's bat. Where the call could not be identified to species, the identification was determined to the highest possible level. The most commonly recorded species was Leisler's bat followed by Soprano and Common Pipistrelle, with lower levels from other species.

All bats recorded are classified as 'Least Concern' on the Irish Red List (2019) and protected under the EU Habitats Directive Annex IV and Wildlife Acts.

Due to the levels of nightly bat activity (with regard to median values as determined by Ecobat analysis) at each of the static locations, turbines 4 and 10 are the only turbines considered medium risk for all at risk bat species. All other turbines baring turbine 1 are high risk for Leisler's bats. Turbines 1 and 11 are high risk for Soprano Pipistrelle.

5.1 POTENTIAL IMPACTS

As outlined by Scottish Natural Heritage (2021), wind farms can affect bats in the following ways:

- Collision mortality, barotrauma and other injuries
- Loss or damage to commuting and foraging habitat
- Loss of, or damage to roosts
- Displacement of individuals or populations.

Furthermore, as indicated in Richardson et al (2021) Common Pipistrelle bats may be attracted to wind turbines. The study showed Common Pipistrelle activity was 37% higher at turbines than at control locations. The study further discussed, the observed higher levels of activity could be because there are more bats around turbines, or because animals spend more time in these locations relative to controls, even if the number of individual bats remains the same. We cannot distinguish between these possibilities using acoustic data. However, either way, higher levels of activity around turbines is likely to increase fatality risks and help to explain why fatality rates are often not predicted by acoustic surveys for bat activity conducted prior to facility construction.

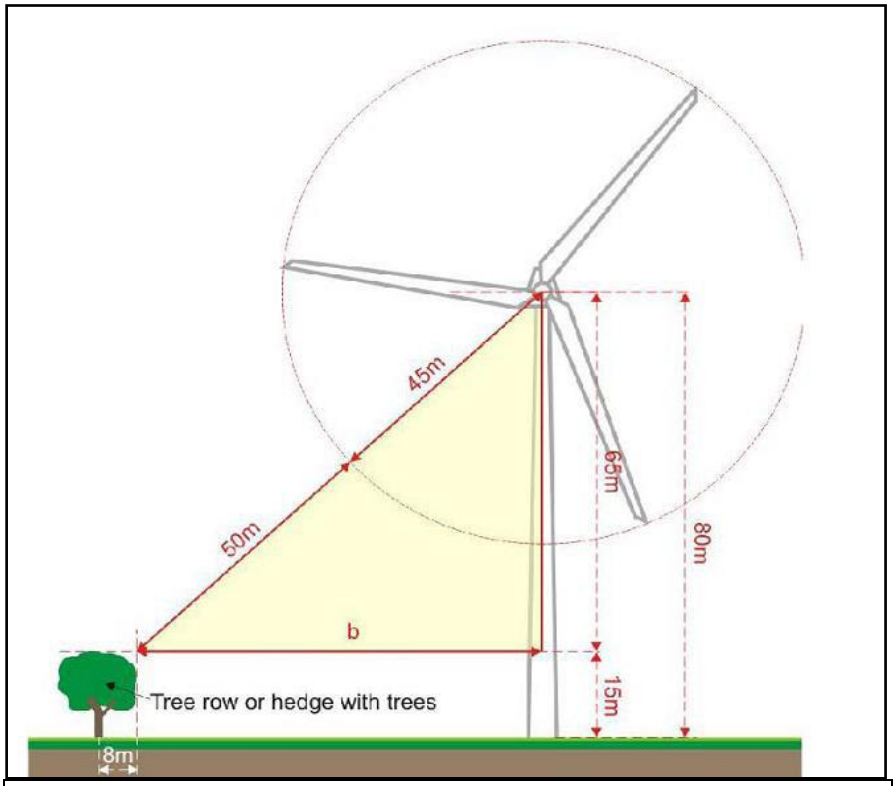
6 MITIGATION AND COMPENSATION

6.1.1 Mitigation during Construction Phase

6.1.1.1 Buffer Zone

Bats typically use woodland edge habitats for commuting and feeding purposes. Areas of conifer plantation should be felled in order to discourage bat species from flying close to turbines. Various publications provide guidelines on buffer zones surrounding turbines to reduce the favourability of the site for bat activity. Eurobats 'Guidelines for consideration of bats in wind farm projects' (Rodrigues, et al., 2015) recommend buffer zones of 200m from turbine base to high potential features whilst Natural England Bats (England, 2014) recommend 50m buffers from blade tip to tree. (NIEA, 2021) recommends a minimum buffer of 100m between the turbines at the edge of commercial forestry where wind farms are proposed to be key-holed.

The following formula will be used to calculate the required felling buffer for turbines for each turbine (taking into account the height of surrounding woodland/plantations at each turbine location):



$$b = \sqrt{\{(50 + bl)^2 - (hh - fh)^2\}}$$

where: b = the distance on the ground

between the edge of the canopy and the turbine (m)

bl = blade length (m) hh = hub height (m) fh = feature height (m)
$b = \sqrt{\{(50+ 77.5)^2 - (110.5 - 25)^2\}}$ b = 94.6m

The proposed wind turbines; have a

- Hub Height ranging from 110.5 to 102.5
- Rotor diameter ranging from 155 to 149m
- Tip Height ranging from 185 to 179m

All turbines are located a minimum of 140m from conifer plantation edge. At this distance a buffer of 85m from blade tip to forestry edge is achieved at all locations, adequately surpassing the typical 50m buffer. The only other shrub plants found within this buffer zone surrounding the proposed turbine locations are small crops of gorse or willow. These will be removed prior to the powering up of the turbines.

Construction operations within the wind farm site will take place during the hours of daylight where possible to minimise disturbances to faunal species at night. Some works along the cable route and wind farm site may occur at night but the project ecologist/ECoW shall limit night-time works to sections of the route / site which avoid sensitive features (e.g. mature treelines).

In addition, the following specific mitigation measures for bats are also now recommended:

6.1.1.2 Retention of trees

Any trees and treelines along approach roads and planned site access tracks will be retained unless felling is unavoidable. Retained trees should be protected from root damage by an exclusion zone of at least 7 metres or equivalent to canopy height. Such protected trees will be fenced off by adequate temporary fencing prior to other works commencing.

6.1.1.3 Compensation for loss of commuting routes

The subject site is situated within an open landscape; cutover blanket bog with little landscape features usable for most bat species. The construction will not result in the loss of significant amounts of such landscape features.

6.1.1.4 Lighting restrictions

In general, artificial light creates a barrier to bats so lighting should be avoided where possible. Construction operations within the wind farm site will take place during the hours of daylight where possible to minimise disturbances to faunal species at night. Some works along the cable route and wind farm site may occur at night but the project ecologist/ECoW shall limit night-time works to sections of the route / site which avoid sensitive features (e.g. mature treelines). Where lighting is required, directional lighting (i.e. lighting which only shines on work areas and not nearby countryside) will be used to prevent overspill.

This can be achieved by the design of the luminaire and by using accessories such as hoods, cowls, louvers and shields to direct the light to the intended area only.

6.1.1.5 Pre-construction Surveys

If two years lapse from between planning-stage surveys and installation of the wind turbines, it will be necessary to repeat one season of surveys during the activity period (EUROBATS, 2014). Future survey work will be completed according to best practice guidelines available (Hundt, 2012; Collins, 2016; SNH, 2019; 2021) and includes static detector, activity and roost inspection surveys.

6.1.2 Mitigation during Operational Phase

6.1.2.1 Feathering of Blades

Turbines should operate in a manner which restricts the rotation of the blades as far as is practicably possible below the manufacturer's specified cut-in speed. This is usually achieved by feathering the blades during low wind speeds; the angle of the blades is rotated to present the slimmest profile possible towards the wind, ensuring they do not rotate or 'idle' when not generating power.

Turbine blades spinning in low wind can kill bats, however bats cannot be killed by feathered blades which are not spinning (Horn *et al*., 2008). The feathering of turbine blades combined with increased cut-in speeds have been shown to reduce bat fatalities from 30% to 90% (NIEA, 2021), (SNH, Bats and Onshore Wind Turbines – Survey, Assessment and Mitigation., 2021), (Wellig S.D., 2018), (Rydell J., 2010), (Arnett, 2011) and (Baerwald, 2009).

As such, the feathering of blades to prevent 'idling' during low wind speeds is recommended for all turbines.

6.1.2.2 Cut-in Speeds/Curtailment

Increasing the cut-in speed above that set by the manufacturer can reduce the potential for bat/turbine collisions. A study by Arnett *et al*., (2011) showed a 50% decrease in bat fatality can be achieved by increasing the cut-in speed by 1.5 m/s.

Species with elevated risk of collision (Leisler's bat, Soprano and Common Pipistrelle) in particular would benefit from increasing the cut-in speed of turbines, as dictated on a case-by case basis depending on the activity levels recorded at each turbine.

Increased cut-in speeds will be implemented from commencement of operation on all turbines baring T4 and 10. Cut-in speeds restrictions will be operated according to specific weather conditions:

- Cut-in speeds will be increased during the bat activity season (01st of April to 30th October) where temperatures are optimal for bat activity (above 11 degrees) where wind speeds are at or below 5m/s from 30 minutes prior to sunset to 30 minutes after sunrise (Betts, 2020).

A literature review conducted by the author shows only windspeed and temperature parameters are currently considered when devising a bat curtailment program at windfarms. It is the authors opinion that rainfall could also be considered as a curtailment parameter as bats typically will be inhibited by heavy rainfall. Should a published study provide evidence that rainfall inhibits bat activity at windfarms this may be added as a curtailment feature in the future.

Due to the considerable unnecessary down time resulting from the proposed “blanket curtailment” (above) and the advances in smart curtailment a focused curtailment regime should be an option available to the developer from year two of operation.

Smart curtailment focuses on times and dates, corresponding with periods when the highest level of bat activity occurs within the site. Such a system involves the use of SCADA (Supervisory Control and Data Acquisitions) operating system (or equivalent) to only pause/feather the blades below a specified wind speed and above a specified temperature within specified time periods at individual turbines.

Post-constructions surveys will be undertaken for the first three years of operation to confirm if blanket curtailment restrictions can be amended in line with post-construction activity levels. The post construction surveys will be used to update the current curtailment regime (blanket curtailment) designed around the values for the key weather parameters and other factors that are known to influence collision risk. This will include all of the following:

- Wind speed in m/s (measured at nacelle height)
- Time after sunset
- Month of the year
- Temperature (ºC)
- Precipitation (mm/hr)

6.1.2.3 Post Construction surveys

Static acoustic and bat collision monitoring will take place for at least 3 years after construction, providing sufficient data to detect any significant change in bat activity relative to pre-construction levels. It will assess changes in bat activity patterns and the efficacy of mitigation to inform any changes to curtailment.

The feathering of turbine blades combined with increased cut-in speeds have been shown to reduce bat fatalities from 30% to 90% (Adams et al., 2021, Arnett et al., 2008, 2011, 2013; Baerwald et al., 2009). The most recent of studies showed a 63% decrease in fatalities (Adams et al., 2021). In addition to studies conducted internationally, Appendix F outlines results from a curtailment program carried out an existing Irish windfarm where Eire Ecology carried out a collision monitoring program. Results of the curtailment showed a 58% decrease in upper limits of estimated fatalities once curtailment was implemented.

6.1.2.4 Monitoring Curtailment

If, following the initial 3 years of post-construction surveys, bat activity increases above the baseline and/or remains consistently high and carcass searches indicate fatalities are occurring (refer below), increased cut-in speeds will continue. This will subsequently be monitored in years 5, 7, 10, 15, 20, 25 and 30 with further review after each monitoring period.

Alternatively, if it is found that the results of bat activity surveys and fatality searches confirm that the level of bat activity at turbine locations is low then consent will be sought from Mayo County Council (in consultation with NPWS) for the cessation in the requirement for these cut-in speeds / curtailment measures, or a reduction on the timing restrictions for these measures.

Where post construction acoustic surveys are undertaken, they will utilise full spectrum automatic detectors deployed, as a minimum, for one complete bat activity year (spring, summer and autumn).

Acoustic monitoring will be supplemented with thermal imaging cameras etc. to provide more detailed information on bat activity in the vicinity of turbines.

An assessment of static data gathered during operational surveillance will be completed using the online analysis tool Ecobat as recommended by SNH (2021) as a minimum, or other equivalent guidance as dictated by up-to date standards and practices.

6.1.2.5 Buffer zones

The vegetation-free buffer zones (refer to above) around the identified turbines will be managed and maintained during the operational life of the development.

Due to mitigation by design, turbines are proposed to be sited at a suitable separation distance from trees and trees or vegetation are to be removed to ensure a woodland-free buffer zone.

The immediate surroundings of individual turbines should be managed and maintained so that they do not attract insects (i.e. the concentration of insects in the wind turbine vicinity should be reduced as much as possible, but not such that insect abundancies affected elsewhere on the site). This should be achieved through physical management of habitats without the use of toxic substances.

6.1.2.6 Monitoring of mitigation measures

The success of the implemented mitigation measures for bats on the project should be monitored for a period of three years after construction and appropriate measures taken to enhance these if and where required. Should bat fatalities be found within the first three years of surveys additional mitigation measures will be implemented in order to prevent this from reoccurring.

6.1.2.7 Bat fatality monitoring

Whilst no significant residual impacts on bats are predicted, the proposed development could provide an opportunity to gain baseline data on bat/turbine interaction and it is recommended that the scheme be monitored for bat fatalities for the first three years of operation (post construction surveys) and subsequently in years 5, 7, 10, 15, 20, 25 and 30 as part of the additional curtailment monitoring schedule. A comprehensive onsite fatality monitoring programme is to be undertaken following published best practice (e.g. SNH 2021 or equivalent at the time of operation).

The primary components of the bat mortality programme are outlined below, and an assessment of bat mortality would essentially follow the same methodology:

a) Carcass removal trials to establish levels of predator removal of possible fatalities. This should be done following best recommended practice and with due cognisance of published effects such as predator swamping, whereby excessive placement of carcasses increases predator presence and consequently skews results.
b) Turbine searches for fatalities should be undertaken following best practice in terms of search area (minimum radius hub height) and at intervals selected to effectively sample fatality rates as determined by carcass removal trials in (a) above.
c) A standardised approach with a possible control group and/or variation in search techniques such as straight line transects/ randomly selected spiral transects/ dog searches will be

undertaken. This will provide a means of robustly estimating the post construction collision fatality impact (if any).

d) Recorded fatalities should be calibrated against known predator removal rates to provide an estimate of overall fatality rates.

Table 6-1: Monitoring schedule recommended for bat mitigation measures

Mitigation measure	Monitoring required	Description	Duration
Bat activity survey	Static placement at turbines	3 years of static monitoring at turbine locations in conjunction with placement of weather station. Assessment of bat activity compared with 2021 baseline survey	1, 2, 3 (and years 5, 7, 10, 15, 20, 25 and 30 should activity levels stay the same or increase)
Mortality study	Fatality monitoring	Corpse searches beneath turbines to assess the impact of operation on bats.	From initial operation conducted during years 1, 2, 3, 5, 7, 10, 15, 20 and 25 post construction.

7 RESIDUAL IMPACTS AFTER MITIGATION

Following extensive surveys within and surrounding the site, it is the authors opinion the landscape in which the proposed wind farm is situated is of high suitability for Leisler's bat and moderate suitability for Common, Soprano and Nathusius Pipistrelle.

With the implementation of the mitigation outlined above the potential risk of fatality from collision and/or barotrauma events to foraging and/or commuting high risk species such as pipistrelle and Leisler have been significantly reduced and the surveyor feels the development will **not have a long term negative impact on the local bat populations**.

8 REFERENCES

Andrews, H. (2016). *Bat Tree Habitat Key (3rd Edition).* AEcol, Bridgwater.

Arnett, E. &. (2011). Altering turbine speed reduces bat mortality at wind-energy facilities. *Frontiers in Ecology and the Environment. 9*, 209-214.

Baerwald, E. &. (2009). Geographic Variation in Activity and Fatality of Migratory Bats at Wind Energy Facilities. *90*.

BCI. (2010). *Bats & Lighting. Guidance Notes for planners, engineers, architects and developers.* Noticenature.

BCI. (2012). *Wind Turbine/Wind Farm Development Bat Survey Guidelines Version 2.8.* Bat Conservation Ireland.

BCT. (2016). *Bat Surveys for Professional Ecologists: Good Practice Guidelines 3rd edition.* Bat Conservation Trust.

BCT. (2018). *Bats and artificial lighting in the UK Guidance Note 08/18.* ILP.

BCT. (2020). *Core Sustenance Zones and habitats of importance for designing Biodiversity Net Gain for bats.* London: Bat Conservation Trust .

Bennett, V. a. (2014). Bats are not attracted to aviation lighting. *Anim Conserv, 17*, 354-358.

Betts, S. (2020). *Derrybrien Wind Farm Article 12 report.* Dublin: ESB.

Collins, J. (2016). *Bat Surveys for Professional Ecologists: Good Practice Guidlines (3rd edn).* London: Bat Conservation Trust.

England, N. (2014). *Bats and onshore wind turbines Interim guidance.*

Fiona Mathews, S. R. (2015). *Understanding the Risk to European Protected Species (bats) at Onshore Wind Turbine Sites to inform Risk Management.* University of Exeter.

Kelleher, C. &. (2006). *Bat Mitigation Guidelines.* Dublin: National Parks and Wildlife Service, Department of Environment, Heritage.

Lundy, M. A. (2011). *Landscape conservation for Irish bats & species specific roosting characteristics.* Bat Conservation Ireland.

NIEA, N. E. (2021). *Guidance on bat surveys, assessment and mitigation for onshore wind turbine developments in Northern Ireland.* Belfast: Department of Agriculture, Environment and Rural Affairs (Northern Ireland).

Richardson, S. &. (2021). Peaks in bat activity at turbines and the implications for mitigating the impact of wind energy developments on bats. *Scientific Reports. 11.*

Roche, N. A. (2014). *Irish bats in the 21st century.* Bat Conservation Ireland.

Rodrigues, L., Bach, L., Dubourg-Savage, M., Karapandža, B., Kovač, D., Kervyn, T., . . . Minderman, J. (2015). *Guidelines for consideration of bats in wind farm projects. Revision 2014.* EUROBATS.

Rydell J., B. L.-S.-J. (2010). Bat mortality at wind turbines in northwestern Europe. *Acta Chiropterologica, 12,*, 261–274.

Shiel, C. &. (1999). Evening emergence of two colonies of Leisler's bat (Nyctalus leisleri) in Ireland. *247*.

Smallwood, K. S. (2010). Novel Scavenger Removal Trials Increase Wind Turbine-Caused Avian Fatality Estimates. *The Journal of Wildlife Management, Vol 74.*, 1089-1097.

SNH. (2019). *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation.* Scottish Natural Heritage,Natural England and Natural Resources Wales.

SNH. (2021). *Bats and onshore wind turbines - survey, assessment and mitigation.* NatureScot (Scottish Natural Heritage), Natural England, Natural Resources Wales, RenewableUK, Scottish Power Renewables, Ecotricity Ltd, the University of Exeter and the Bat Conservation Trust (BCT).

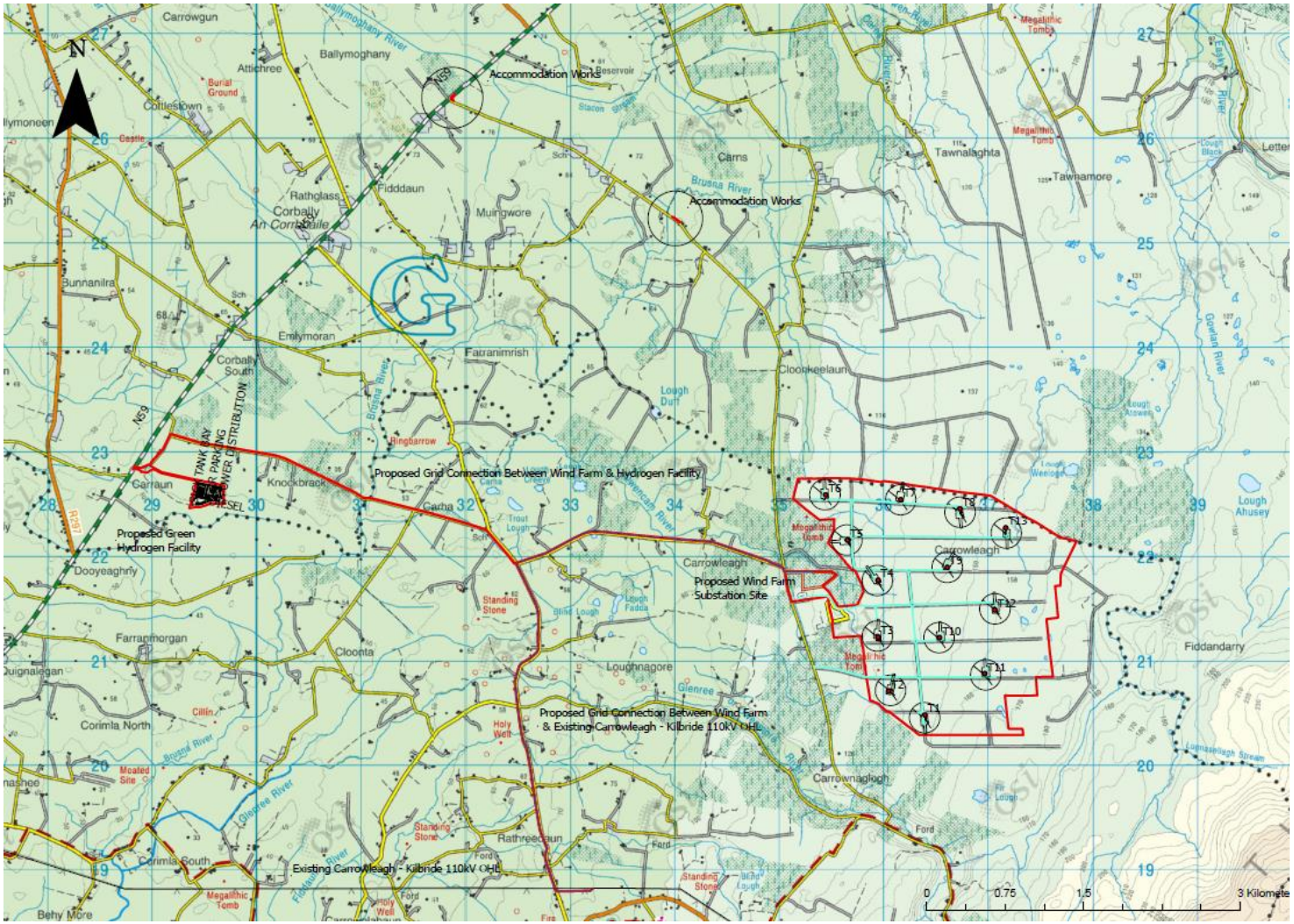
SNH. (2021). *Bats and Onshore Wind Turbines – Survey, Assessment and Mitigation.*

Voigt, C. &. (2021). The Impact Of Light Pollution On Bats Varies According To Foraging Guild And Habitat Context. *BioScience. 71.*, 1103–1109.

Wellig S.D., N. S. (2018). Mitigating the negative impacts of tall wind turbines on bats: vertical activity profiles and relationships to wind speed. *PLOS ONE, 13,*.

Wellig, S. D. (2018). Mitigating the negative impacts of tall wind turbines on bats: Vertical activity profiles and relationships to wind speed. *PloS one*.

Appendix A – Site Layout



Appendix B – Initial Roost Search – buildings

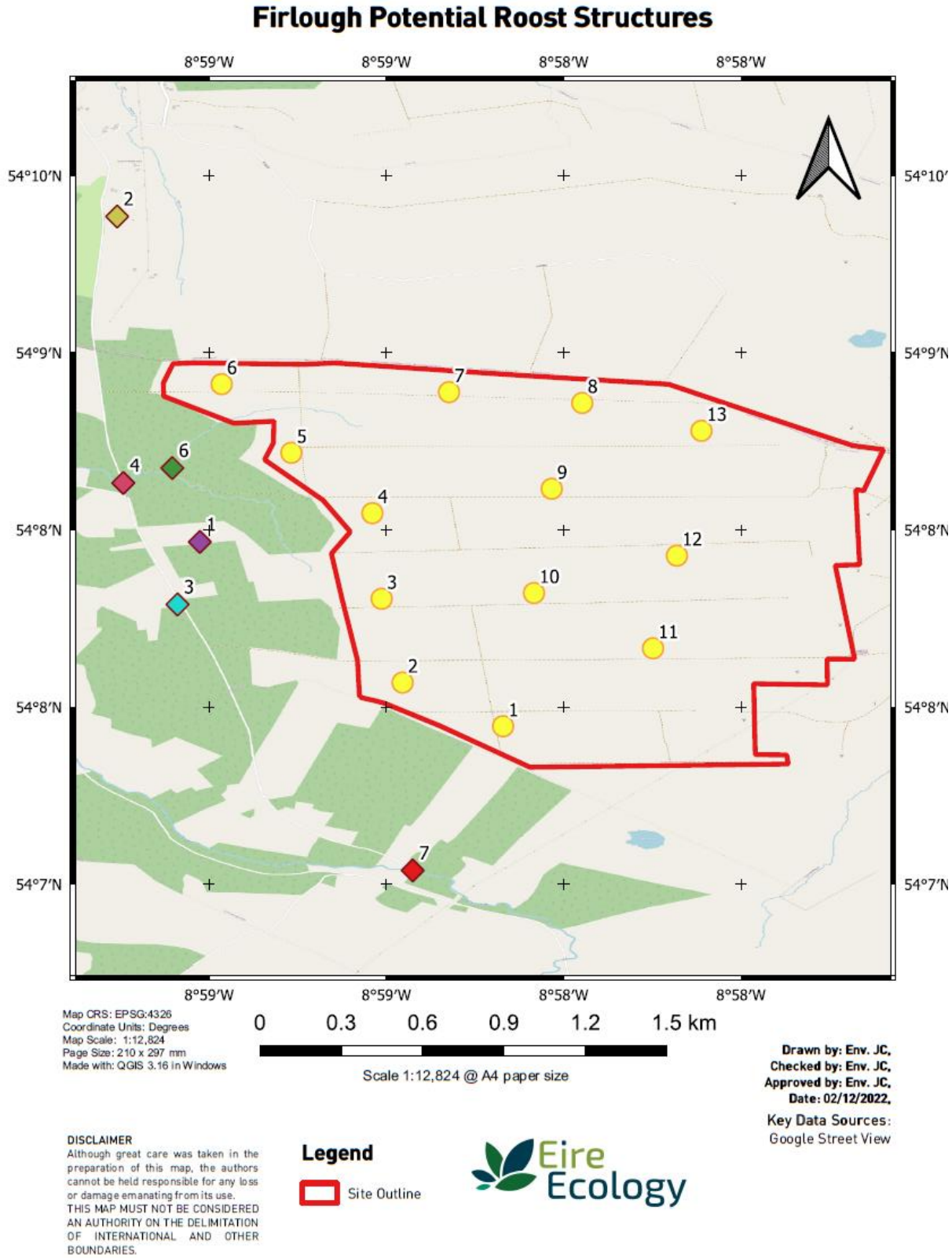


Table 2: Location of structures examined for the presence of bat roosts

No	Lat	Long	Potential level	Distance to closest turbine	Details
1	54.13933	-8.99052	High	660m W of T4.	Derelict dwelling
2	54.15770	-8.995185	High	1.11km NW of T6	Derelict house with good bat roosting potential. Treeline to rear.
3	54.13580	-8.991780	Moderate	730m W of T3	Private occupied farmstead.
4	54.14266	-8.99484	Low	635m to W of T5	Bridge on road to north of derelict house 1. Constructed of concrete with minimal crevices. No signs of bats.
5	54.154684	-8.99420	Unknown	780m NW of T6	Private occupied house set off the road. No access possible.
6	54.14350	-8.992074	Medium	440m W of T5	Low potential bridge / culvert constructed of concrete
7	54.120783	-8.97851516	Low	930m SW of T1	Nice bridge to south of site has been gunnetted thus minimal potential.

Plate 1: Structure 1. Derelict dwelling

Plate 2: Structure 2. Derelict dwelling to NW of site

Plate 3: Structure 2. Internal view of dwelling. Quite a lot of light exposure

Plate 4: Structure 5. Occupied dwelling

Plate 5: Structure 4. Concrete bridge

Plate 6: Structure 4. Concrete bridge

Plate 7: Structure 4. Concrete bridge

Plate 8: Structure 5. Dwelling to west of proposed windfarm.

Plate 9: Structure 6. No potential bridge

Plate 10: Structure 6.

Plate 11: Structure 7. Bridge to SW of proposed site

Plate 12: Structure 7. Joints are mortared.

Appendix C – Night-time surveys

Table 3: Weather data for walked surveys

Date	Sunset / sunrise	Start / finish	Temp	Wind speed m/s	Wind direction	Rain
23/06/2021	22:08	21:38	15.5	1.1	W	Dry
		00:38	15.0	1.2	W	Dry
24/06/2021	04:59	02:59	15.0	0.8	W	Drizzle
		04:59	15.5	0.7	W	Drizzle continued through the survey
07/07/2021	22:03	21:33	15.0	0.2	W	Dry
		00:33	13.0	0.6	W	Dry
08/07/2021	05:08	03:08	13.0	1.4	W	Dry
		05:08	13.0	1.6	W	Dry
19/08/2021	20:52	20:20	13.5	1.6	SW	Drizzle just stopped
		23:22	14.0	1.4	S	Dry
20/08/2021	06:18	04:18	15.0	0.9	SW	Drizzle showers
		06:18	13.5	1.6	SW	Drizzle

Table 4: 23rd to the 24th of June 2021

Contact No	Time	ID	Lat	Long	Details
1	23:28	Common Pip	54.1418956	-8.979695	Brief, within the site
2	23:38	Soprano Pip	54.1447240	-8.975778	Brief, within the site
3	00:15	Leisler's	54.1448693	-8.995587	By road W of site
4	00:23	Brown long-eared bat	54.1357614	-8.991500	Brief, close to building 5 by western road

Table 5: 07th to the 08th of July 2021

Contact No	Time	ID	Lat	Long	Details
1	23:21	Leisler's	54.13709	-8.99224	Two brief contacts within a minute. Along road to west of site
2	23:23	Soprano Pip	54.13792	-8.99271	Feeding Pipistrelle, recorded on western road
3	23:23	Leisler's	54.14285	-8.99502	Brief contact
4	23:27	Common Pip	54.14288	-8.99508	Feeding by forestry and stream along western road

Table 6: 19th to the 20th of August 2021

Contact No	Time	ID	Lat	Long	Details
1	21:27	Leisler's	54.14759	-8.97601	Brief contact
2	21:39	Leisler's	54.14742	-8.9694	Brief contact

Contact No	Time	ID	Lat	Long	Details
3	21:44	Leisler's	54.14742	-8.9694	Brief contact
4	21:49	Common Pip	54.14742	-8.9694	
5	22:03	Common Pip	54.14747	-8.97065	
6	22:04	Soprano Pip	54.1479	-8.97872	A couple of contacts from feeding bat
7	22:15	Soprano Pip	54.14785	-8.98901	
8	22:20	Soprano Pip	54.14785	-8.98901	
9	22:23	Common Pip	54.14785	-8.98901	
10	22:31	Common Pip	54.14426	-8.99544	
11	22:32	Soprano Pip	54.14347	-8.99331	
12	22:34	Soprano Pip	54.14359	-8.99225	
13	22:38	Soprano Pip	54.1437	-8.99333	
14	22:42	Soprano Pip	54.14361	-8.99234	
15	22:43	Common Pip	54.14337	-8.99384	A couple of contacts from feeding bat
16	22:44	Soprano Pip	54.14272	-8.99488	
17	22:45	Common Pip	54.14065	-8.99418	
18	22:46	Soprano Pip	54.13917	-8.99356	
19	22:53	Soprano Pip	54.13266	-8.97958	
20	23:18	Soprano Pip	54.13587	-8.97154	

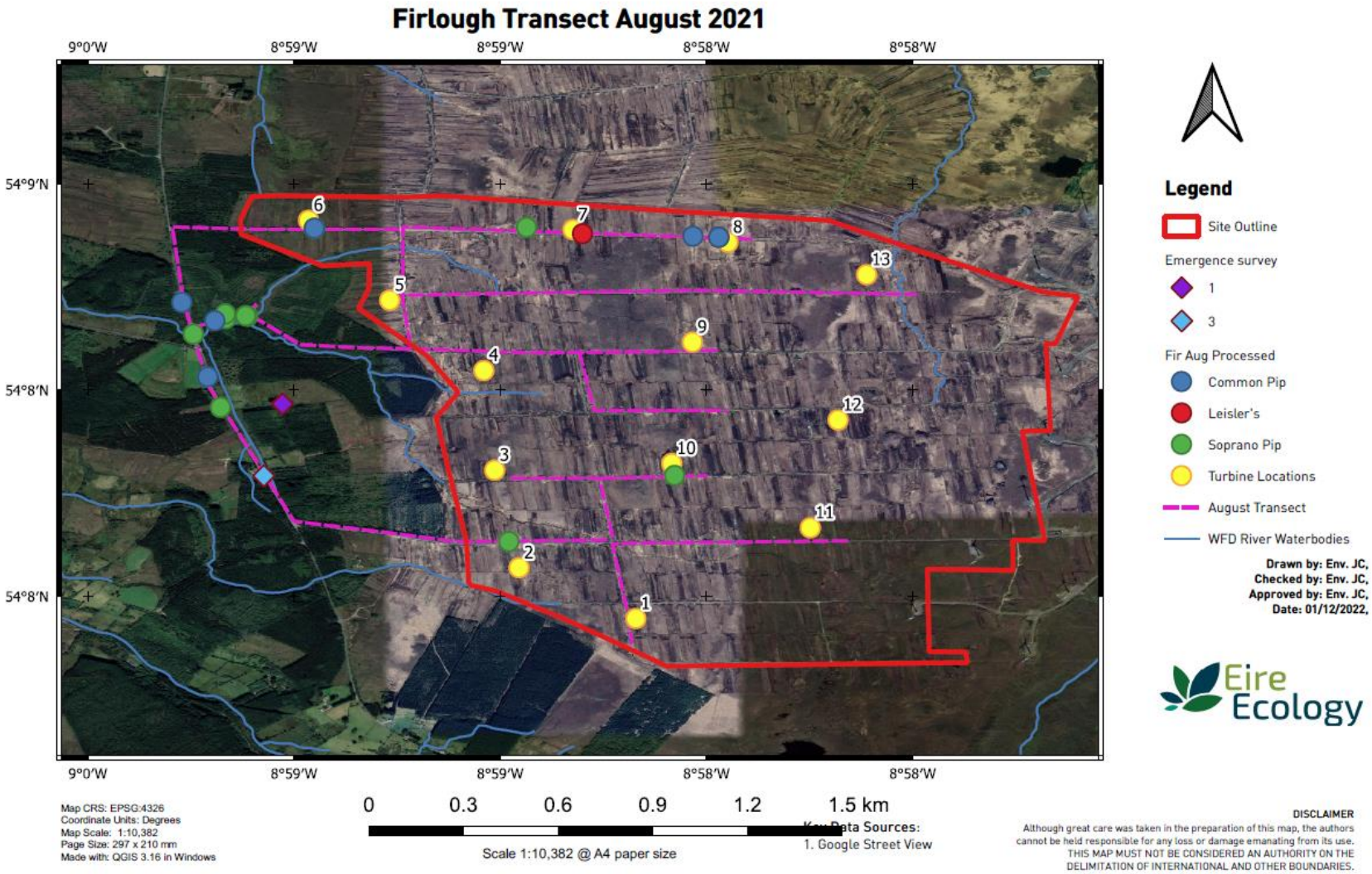


Figure 8-1 August dusk and dawn activity survey results

Appendix D – Static Results

Table 7: All static results per day. LB; Leisler's Bat, CP; Common Pipistrelle, SP; Soprano Pipistrelle, BLE; Brown Long-eared, NP; Nathuius Pipistrelle, 40P; 40kHz Pipistrelle, Nat; Natterers, Whis; Whiskered, Dau; Daubenton's, UM; Unidentified Myotis

Turbine	Total days per turbine	Days per season	Date	LB	CP	SP	BLE	NP	40P	Nat	Whis	Dau	UM	Total
1	1	1	15th/16th April	1	0	2	0	0	0	0	0	0	0	3
1	2	2	16th/17th April	0	1	0	0	0	0	0	0	0	0	1
1	3	3	17th/18th April	0	0	0	0	0	0	0	0	0	0	0
1	4	4	18th/19th April	0	0	0	0	0	0	0	0	0	0	0
1	5	5	19th/20th April	0	0	0	0	0	0	0	0	0	0	0
1	6	6	20th/21st April	0	1	0	0	0	0	0	0	0	0	1
1	7	7	21st/22nd April	0	0	0	1	0	0	0	0	0	0	1
1	8	8	22nd/23rd April	1	3	0	1	0	0	0	0	0	0	5
1	9	9	23rd/24th April	18	71	51	0	4	9	0	0	0	0	153
1	10	10	24th/25th April	5	2	4	0	0	0	0	0	0	0	11
1	11	11	25th/26th April	24	20	23	1	1	4	0	0	0	1	74
1	12	12	26th/27th April	7	19	17	0	6	0	0	0	0	0	49
1	13	13	27th/28th April	6	1	1	0	0	0	0	0	0	0	8
1	14	14	28th/29th April	1	0	0	0	0	0	0	0	0	0	1
1	15	15	29th/30th April	2	2	0	0	0	0	0	0	0	0	4
1	16	16	30th/1st April/May	0	0	0	0	0	0	0	0	0	0	0
1	17	17	1st/2nd May	0	0	0	0	0	0	0	0	0	0	0
1	18	18	2nd/3rd May	2	1	3	0	0	0	0	0	0	0	6
1	19	1	23rd/24th June	1	3	3	1	0	0	0	0	0	2	10
1	20	2	24th/25th June	0	0	1	0	0	0	0	0	0	0	1
1	21	3	25th/26th June	1	0	1	0	0	0	0	0	0	0	2

Turbine	Total days per turbine	Days per season	Date	LB	CP	SP	BLE	NP	40P	Nat	Whis	Dau	UM	Total
1	22	4	26th/27th June	0	0	1	0	0	0	0	0	0	0	1
1	23	5	27th/28th June	0	19	11	0	0	0	0	0	0	2	32
1	24	6	28th/29th June	6	6	7	0	0	0	0	0	0	0	19
1	25	7	29th/30th June	5	2	2	0	0	0	0	0	0	1	10
1	26	8	30th/1st June	10	9	26	0	0	0	0	0	0	1	46
1	27	9	1st/2nd July	1	15	24	0	0	0	1	0	0	5	46
1	28	10	2nd/3rd July	4	3	4	0	0	0	0	0	0	1	12
1	29	11	3rd/4th July	9	4	4	0	0	0	0	0	0	1	18
1	30	12	4th/5th July	0	0	0	0	0	0	0	0	0	0	0
1	31	13	5th/6th July	0	0	0	0	0	0	0	0	0	0	0
1	32	14	6th/7th July	2	0	0	0	0	0	0	0	0	0	2
1	33	1	19th/20th August	6	1	3	0	0	0	0	0	0	0	10
1	34	2	20th/21st August	2	0	0	0	0	0	0	0	0	0	2
1	35	3	21st/22nd August	4	2	1	1	0	0	0	0	0	0	8
1	36	4	22nd/23rd August	20	16	25	2	0	0	0	2	0	4	69
1	37	5	23rd/24th August	5	8	15	2	0	0	0	0	0	2	32
1	38	6	24th/25th August	2	5	10	5	0	0	0	0	0	0	22
1	39	7	25th/26th August	2	5	11	0	0	0	0	0	0	1	19
1	40	8	26th/27th August	43	1	1	1	0	0	0	0	0	0	46
1	41	9	27th/28th August	0	11	8	2	0	0	0	0	0	0	21
1	42	10	28th/29th August	54	54	29	1	0	1	1	0	0	2	142
1	43	11	29th/30th August	30	35	18	1	0	0	2	0	0	0	86
1	44	12	30th/31st August	18	12	21	5	0	1	2	0	0	1	60
2	1	1	15th/16th April	0	0	0	0	0	0	0	0	0	0	0
2	2	2	16th/17th April	0	0	0	0	0	0	0	0	0	0	0
2	3	3	17th/18th April	0	0	0	0	0	0	0	0	0	0	0

Turbine	Total days per turbine	Days per season	Date	LB	CP	SP	BLE	NP	40P	Nat	Whis	Dau	UM	Total
2	4	4	18th/19th April	0	0	0	1	0	1	0	0	0	0	2
2	5	5	19th/20th April	1	0	0	0	0	1	0	0	0	0	2
2	6	6	20th/21st April	0	0	1	0	0	1	0	0	0	0	2
2	7	7	21st/22nd April	0	0	0	0	0	0	0	0	0	0	0
2	8	8	22nd/23rd April	2	0	0	0	0	2	0	0	0	0	4
2	9	9	23rd/24th April	5	31	18	0	2	54	0	0	0	0	110
2	10	10	24th/25th April	1	10	4	0	0	15	0	0	0	0	30
2	11	11	25th/26th April	13	10	9	0	1	32	0	0	0	0	65
2	12	12	26th/27th April	33	10	4	0	1	47	0	0	0	0	95
2	13	13	27th/28th April	10	4	1	1	0	16	0	0	0	0	32
2	14	14	28th/29th April	1	0	0	0	0	1	0	0	0	0	2
2	15	15	29th/30th April	7	1	0	0	1	8	0	0	0	0	17
2	16	16	30th/1st April/May	1	0	0	0	0	1	0	0	0	0	2
2	17	17	1st/2nd May	0	0	0	0	0	0	0	0	0	0	0
2	18	18	2nd/3rd May	2	0	1	0	0	3	0	0	0	0	6
2	19	1	23rd/24th June	1	3	0	1	0	2	0	0	0	0	7
2	20	2	24th/25th June	9	1	1	0	0	1	0	0	0	0	12
2	21	3	25th/26th June	0	0	0	0	0	0	0	0	0	0	0
2	22	4	26th/27th June	0	0	1	0	0	0	0	0	0	0	1
2	23	5	27th/28th June	7	5	5	0	0	1	0	0	0	2	20
2	24	6	28th/29th June	10	3	7	0	0	2	1	0	0	2	25
2	25	7	29th/30th June	9	2	0	0	0	1	1	0	0	2	15
2	26	8	30th/1st June	9	4	3	0	0	1	0	0	0	4	21
2	27	9	1st/2nd July	2	1	4	0	0	0	0	0	0	3	10
2	28	10	2nd/3rd July	6	2	1	0	0	0	0	0	0	0	9

Turbine	Total days per turbine	Days per season	Date	LB	CP	SP	BLE	NP	40P	Nat	Whis	Dau	UM	Total
2	29	11	3rd/4th July	16	0	0	0	0	0	0	0	0	1	17
2	30	12	4th/5th July	0	0	0	0	0	0	0	0	0	0	0
2	31	13	5th/6th July	0	0	0	0	0	0	0	0	0	0	0
2	32	14	6th/7th July	4	0	0	0	0	0	0	0	0	0	4
2	33	1	19th/20th August	6	1	3	0	1	0	0	0	0	0	11
2	34	2	20th/21st August	2	0	1	1	0	0	0	0	0	0	4
2	35	3	21st/22nd August	5	1	0	2	0	0	0	0	0	0	8
2	36	4	22nd/23rd August	15	5	12	5	0	0	0	0	0	4	41
2	37	5	23rd/24th August	8	3	11	0	0	0	0	0	0	1	23
2	38	6	24th/25th August	1	7	5	1	0	0	0	0	0	0	14
2	39	7	25th/26th August	9	5	6	2	1	0	0	0	0	1	24
2	40	8	26th/27th August	0	0	2	0	0	0	0	0	0	1	3
2	41	9	27th/28th August	25	8	0	3	0	0	0	0	0	0	36
2	42	10	28th/29th August	34	18	13	2	1	3	0	0	0	1	72
2	43	11	29th/30th August	37	14	13	1	0	1	0	0	0	1	67
2	44	12	30th/31st August	25	13	18	1	0	0	0	0	0	1	58
3	1	1	15th/16th April	0	5	0	0	0	0	0	0	0	0	5
3	2	2	16th/17th April	0	0	0	0	0	0	0	0	0	1	1
3	3	3	17th/18th April	0	0	0	0	0	0	0	0	0	0	0
3	4	4	18th/19th April	0	0	0	0	0	0	0	0	0	0	0
3	5	5	19th/20th April	0	0	0	0	0	0	0	0	0	1	1
3	6	6	20th/21st April	0	0	0	0	0	0	0	0	0	0	0
3	7	7	21st/22nd April	0	0	0	0	0	0	0	0	0	0	0
3	8	8	22nd/23rd April	0	0	0	0	0	0	0	0	0	0	0
3	9	9	23rd/24th April	0	0	0	0	0	0	0	0	0	0	0
3	10	10	24th/25th April	0	0	0	0	0	0	0	0	0	0	0

Turbine	Total days per turbine	Days per season	Date	LB	CP	SP	BLE	NP	40P	Nat	Whis	Dau	UM	Total
3	11	11	25th/26th April	0	0	0	0	0	0	0	0	0	0	0
3	12	12	26th/27th April	0	0	0	0	0	0	0	0	0	0	0
3	13	13	27th/28th April	0	0	0	0	0	0	0	0	0	0	0
3	14	14	28th/29th April	0	0	0	0	0	0	0	0	0	0	0
3	15	15	29th/30th April	0	0	0	0	0	0	0	0	0	0	0
3	16	16	30th/1st April/May	0	0	0	0	0	0	0	0	0	0	0
3	17	17	1st/2nd May	0	0	0	0	0	0	0	0	0	0	0
3	18	18	2nd/3rd May	0	0	0	0	0	0	0	0	0	0	0
3	19	1	23rd/24th June	6	8	3	0	0	1	0	0	0	0	18
3	20	2	24th/25th June	19	3	1	0	0	0	0	0	0	0	23
3	21	3	25th/26th June	0	0	1	0	0	0	0	0	0	0	1
3	22	4	26th/27th June	0	0	3	0	0	0	0	0	0	4	7
3	23	5	27th/28th June	0	5	1	0	0	4	0	0	0	0	10
3	24	6	28th/29th June	9	14	3	0	0	2	0	0	0	0	28
3	25	7	29th/30th June	3	4	2	0	0	1	0	0	0	1	11
3	26	8	30th/1st June	8	5	7	1	0	0	0	0	0	2	23
3	27	9	1st/2nd July	16	10	6	0	0	0	1	0	0	2	35
3	28	10	2nd/3rd July	3	1	1	0	0	0	0	0	0	2	7
3	29	11	3rd/4th July	2	0	1	0	0	1	1	0	0	0	5
3	30	12	4th/5th July	0	0	0	0	0	0	0	0	0	0	0
3	31	13	5th/6th July	0	0	0	0	0	0	0	0	0	0	0
3	32	14	6th/7th July	0	0	0	0	0	0	0	0	0	0	0
3	33	1	19th/20th August	7	0	3	1	0	2	0	0	0	0	13
3	34	2	20th/21st August	2	1	2	1	0	0	0	0	0	0	6
3	35	3	21st/22nd August	6	1	2	1	0	0	0	0	0	0	10

Turbine	Total days per turbine	Days per season	Date	LB	CP	SP	BLE	NP	40P	Nat	Whis	Dau	UM	Total
3	36	4	22nd/23rd August	11	3	13	3	0	0	0	0	0	4	34
3	37	5	23rd/24th August	5	7	28	1	0	0	0	0	0	3	44
3	38	6	24th/25th August	2	7	11	1	0	0	0	0	0	3	24
3	39	7	25th/26th August	3	8	8	0	0	0	0	0	0	0	19
3	40	8	26th/27th August	2	2	1	0	0	0	0	0	0	0	5
3	41	9	27th/28th August	27	1	1	1	0	0	0	0	0	0	30
3	42	10	28th/29th August	29	19	7	2	0	0	2	0	0	0	59
3	43	11	29th/30th August	12	3	15	0	0	0	2	0	0	0	32
3	44	12	30th/31st August	13	8	23	0	1	1	1	0	0	2	49
4	1	1	15th/16th April	0	0	1	0	0	0	0	0	0	0	1
4	2	2	16th/17th April	0	0	0	0	0	0	0	0	0	0	0
4	3	3	17th/18th April	0	0	0	0	0	0	0	0	0	0	0
4	4	4	18th/19th April	0	0	0	0	0	0	0	0	0	0	0
4	5	5	19th/20th April	0	0	0	0	0	0	0	0	0	0	0
4	6	6	20th/21st April	0	0	0	0	0	0	0	0	0	0	0
4	7	7	21st/22nd April	0	0	0	0	0	0	0	0	0	0	0
4	8	8	22nd/23rd April	0	0	0	0	0	0	0	0	0	0	0
4	9	9	23rd/24th April	0	0	0	0	0	0	0	0	0	0	0
4	10	10	24th/25th April	0	0	0	0	0	0	0	0	0	0	0
4	11	11	25th/26th April	0	0	0	0	0	0	0	0	0	0	0
4	12	12	26th/27th April	0	0	0	0	0	0	0	0	0	0	0
4	13	13	27th/28th April	0	0	0	0	0	0	0	0	0	0	0
4	14	14	28th/29th April	0	0	0	0	0	0	0	0	0	0	0
4	15	15	29th/30th April	0	0	0	0	0	0	0	0	0	0	0
4	16	16	30th/1st April/May	0	0	0	0	0	0	0	0	0	0	0

Turbine	Total days per turbine	Days per season	Date	LB	CP	SP	BLE	NP	40P	Nat	Whis	Dau	UM	Total
4	17	17	1st/2nd May	0	0	0	0	0	0	0	0	0	0	0
4	18	18	2nd/3rd May	0	0	0	0	0	0	0	0	0	0	0
4	19	1	23rd/24th June	2	2	1	0	0	0	0	0	0	0	5
4	20	2	24th/25th June	5	0	0	0	0	0	0	0	0	0	5
4	21	3	25th/26th June	3	0	0	0	0	0	0	0	0	0	3
4	22	4	26th/27th June	0	0	2	0	0	0	0	0	0	0	2
4	23	5	27th/28th June	2	2	3	0	0	1	0	0	0	0	8
4	24	6	28th/29th June	18	3	2	0	0	2	0	0	0	1	26
4	25	7	29th/30th June	15	2	0	0	0	0	0	0	0	1	18
4	26	8	30th/1st June	13	2	5	0	0	0	0	0	0	0	20
4	27	9	1st/2nd July	12	3	5	0	0	0	0	0	0	1	21
4	28	10	2nd/3rd July	12	0	0	0	0	0	0	0	0	0	12
4	29	11	3rd/4th July	8	4	3	0	0	1	0	0	0	1	17
4	30	12	4th/5th July	0	0	0	0	0	0	0	0	0	0	0
4	31	13	5th/6th July	0	0	0	0	0	0	0	0	0	0	0
4	32	14	6th/7th July	4	0	0	0	0	0	0	0	0	0	4
4	33	1	19th/20th August	4	0	6	0	0	0	0	0	0	1	11
4	34	2	20th/21st August	5	2	1	1	0	0	0	0	0	0	9
4	35	3	21st/22nd August	2	1	2	0	0	0	0	0	0	1	6
4	36	4	22nd/23rd August	15	7	16	1	0	0	0	0	0	3	42
4	37	5	23rd/24th August	9	10	41	0	0	1	0	0	0	2	63
4	38	6	24th/25th August	0	4	11	2	0	0	0	0	0	2	19
4	39	7	25th/26th August	6	3	8	0	0	0	0	0	0	2	19
4	40	8	26th/27th August	0	0	2	0	0	0	0	0	0	0	2
4	41	9	27th/28th August	16	1	3	0	0	0	0	0	0	1	21
4	42	10	28th/29th August	44	11	9	0	0	1	0	0	0	0	65

Turbine	Total days per turbine	Days per season	Date	LB	CP	SP	BLE	NP	40P	Nat	Whis	Dau	UM	Total
4	43	11	29th/30th August	19	24	16	3	0	0	0	0	0	4	66
4	44	12	30th/31st August	10	13	18	2	0	1	1	0	0	2	47
5	1	1	15th/16th April	1	0	0	1	0	0	0	0	0	1	3
5	2	2	16th/17th April	0	1	0	2	0	0	0	0	0	0	3
5	3	3	17th/18th April	0	0	0	1	0	0	0	0	0	0	1
5	4	4	18th/19th April	1	0	0	0	0	0	0	0	0	0	1
5	5	5	19th/20th April	0	0	0	0	0	0	0	0	0	0	0
5	6	6	20th/21st April	0	0	0	0	0	0	0	0	0	0	0
5	7	7	21st/22nd April	0	0	0	0	0	0	0	0	0	0	0
5	8	8	22nd/23rd April	0	0	0	0	0	0	0	0	0	0	0
5	9	9	23rd/24th April	0	0	0	0	0	0	0	0	0	0	0
5	10	10	24th/25th April	0	0	0	0	0	0	0	0	0	0	0
5	11	11	25th/26th April	0	0	0	0	0	0	0	0	0	0	0
5	12	12	26th/27th April	0	0	0	0	0	0	0	0	0	0	0
5	13	13	27th/28th April	0	0	0	0	0	0	0	0	0	0	0
5	14	14	28th/29th April	0	0	0	0	0	0	0	0	0	0	0
5	15	15	29th/30th April	0	0	0	0	0	0	0	0	0	0	0
5	16	16	30th/1st April/May	0	0	0	0	0	0	0	0	0	0	0
5	17	17	1st/2nd May	0	0	0	0	0	0	0	0	0	0	0
5	18	18	2nd/3rd May	0	0	0	0	0	0	0	0	0	0	0
5	19	1	23rd/24th June	3	0	2	1	0	0	0	0	0	0	6
5	20	2	24th/25th June	4	0	0	0	0	0	0	0	0	0	4
5	21	3	25th/26th June	1	0	0	0	0	0	0	0	0	0	1
5	22	4	26th/27th June	0	1	0	0	0	0	0	0	0	0	1
5	23	5	27th/28th June	3	0	3	0	0	0	0	0	0	1	7

Turbine	Total days per turbine	Days per season	Date	LB	CP	SP	BLE	NP	40P	Nat	Whis	Dau	UM	Total
5	24	6	28th/29th June	21	0	2	0	0	0	0	0	0	2	25
5	25	7	29th/30th June	13	0	2	0	0	0	0	0	0	1	16
5	26	8	30th/1st June	8	3	3	0	0	1	0	0	0	0	15
5	27	9	1st/2nd July	17	2	3	0	0	0	0	0	0	1	23
5	28	10	2nd/3rd July	16	2	0	0	0	0	0	0	0	0	18
5	29	11	3rd/4th July	14	3	1	0	0	0	0	0	0	0	18
5	30	12	4th/5th July	0	0	0	0	0	0	0	0	0	0	0
5	31	13	5th/6th July	0	0	0	0	0	0	0	0	0	0	0
5	32	14	6th/7th July	36	1	1	0	0	0	0	0	0	0	38
5	33	1	19th/20th August	10	0	5	0	0	3	1	0	0	0	19
5	34	2	20th/21st August	0	0	0	1	0	0	0	0	0	1	2
5	35	3	21st/22nd August	7	1	3	0	0	0	0	0	0	0	11
5	36	4	22nd/23rd August	14	4	16	3	0	1	0	0	1	1	40
5	37	5	23rd/24th August	18	7	43	0	0	0	0	0	0	5	73
5	38	6	24th/25th August	6	1	11	2	0	0	1	0	0	2	23
5	39	7	25th/26th August	13	3	8	1	0	0	0	0	1	0	26
5	40	8	26th/27th August	1	0	1	0	0	0	0	0	0	0	2
5	41	9	27th/28th August	50	0	3	0	0	0	0	0	0	0	53
5	42	10	28th/29th August	45	12	12	0	0	0	0	0	0	2	71
5	43	11	29th/30th August	42	9	11	2	0	1	2	0	0	2	69
5	44	12	30th/31st August	13	13	19	6	0	1	2	0	0	1	55
6	1	1	15th/16th April	1	0	0	0	0	0	0	0	0	1	2
6	2	2	16th/17th April	0	0	0	0	0	0	0	0	0	0	0
6	3	3	17th/18th April	0	0	0	0	0	0	0	0	0	0	0
6	4	4	18th/19th April	0	0	0	0	0	0	0	0	0	0	0
6	5	5	19th/20th April	0	0	0	0	0	0	0	0	0	0	0

Turbine	Total days per turbine	Days per season	Date	LB	CP	SP	BLE	NP	40P	Nat	Whis	Dau	UM	Total
6	6	6	20th/21st April	0	0	0	1	1	0	0	0	0	0	2
6	7	7	21st/22nd April	0	0	0	0	0	0	0	0	0	0	0
6	8	8	22nd/23rd April	0	0	0	0	0	0	0	0	0	0	0
6	9	9	23rd/24th April	4	12	11	1	0	0	0	0	0	0	28
6	10	10	24th/25th April	2	3	5	0	0	1	0	0	0	0	11
6	11	11	25th/26th April	0	0	0	0	0	0	0	0	0	0	0
6	12	12	26th/27th April	0	0	0	0	0	0	0	0	0	0	0
6	13	13	27th/28th April	0	0	0	0	0	0	0	0	0	0	0
6	14	14	28th/29th April	0	0	0	0	0	0	0	0	0	0	0
6	15	15	29th/30th April	0	0	0	0	0	0	0	0	0	0	0
6	16	16	30th/1st April/May	0	0	0	0	0	0	0	0	0	0	0
6	17	17	1st/2nd May	0	0	0	0	0	0	0	0	0	0	0
6	18	18	2nd/3rd May	0	0	0	0	0	0	0	0	0	0	0
6	19	1	23rd/24th June	6	1	0	1	0	0	0	0	0	0	8
6	20	2	24th/25th June	13	0	0	0	0	0	0	0	0	0	13
6	21	3	25th/26th June	2	0	0	0	0	0	0	0	0	1	3
6	22	4	26th/27th June	0	0	1	0	0	0	0	0	0	0	1
6	23	5	27th/28th June	3	2	0	0	0	0	0	0	0	0	5
6	24	6	28th/29th June	13	1	1	0	0	1	0	0	0	0	16
6	25	7	29th/30th June	10	3	1	0	0	0	0	0	0	0	14
6	26	8	30th/1st June	9	1	1	0	0	0	0	0	0	1	12
6	27	9	1st/2nd July	7	0	2	1	0	0	0	0	0	0	10
6	28	10	2nd/3rd July	13	0	0	0	0	0	0	0	0	0	13
6	29	11	3rd/4th July	7	0	0	0	0	0	0	0	0	0	7
6	30	12	4th/5th July	0	0	0	0	0	0	0	0	0	0	0

Turbine	Total days per turbine	Days per season	Date	LB	CP	SP	BLE	NP	40P	Nat	Whis	Dau	UM	Total
6	31	13	5th/6th July	0	0	0	0	0	0	0	0	0	0	0
6	32	14	6th/7th July	25	1	0	0	0	0	0	0	0	0	26
6	33	1	19th/20th August	2	3	5	0	2	0	0	0	0	0	12
6	34	2	20th/21st August	2	0	0	0	0	0	0	0	0	2	4
6	35	3	21st/22nd August	2	2	1	0	0	0	0	0	0	2	7
6	36	4	22nd/23rd August	19	3	21	1	0	0	0	0	0	1	45
6	37	5	23rd/24th August	25	4	32	0	0	0	0	0	0	2	63
6	38	6	24th/25th August	3	5	14	1	1	0	0	0	0	1	25
6	39	7	25th/26th August	6	0	13	0	0	0	0	0	0	1	20
6	40	8	26th/27th August	13	0	2	0	0	0	0	0	0	0	15
6	41	9	27th/28th August	37	2	2	0	0	0	0	0	0	0	41
6	42	10	28th/29th August	50	4	6	1	0	1	1	0	0	0	63
6	43	11	29th/30th August	12	10	13	2	0	0	0	0	0	2	39
6	44	12	30th/31st August	13	8	16	0	0	0	0	0	0	7	44
7	1	1	15th/16th April	2	1	0	2	0	0	0	0	0	0	5
7	2	2	16th/17th April	0	0	0	2	0	0	0	0	0	0	2
7	3	3	17th/18th April	0	0	0	0	0	0	0	0	0	0	0
7	4	4	18th/19th April	0	0	0	0	0	0	0	0	0	0	0
7	5	5	19th/20th April	0	0	0	0	0	0	0	0	0	0	0
7	6	6	20th/21st April	0	0	0	0	0	0	0	0	0	0	0
7	7	7	21st/22nd April	0	0	0	0	0	0	0	0	0	2	2
7	8	8	22nd/23rd April	0	0	0	1	0	0	0	0	0	0	1
7	9	9	23rd/24th April	4	38	17	1	0	0	0	0	0	0	60
7	10	10	24th/25th April	0	1	2	0	0	0	0	0	0	0	3
7	11	11	25th/26th April	10	20	13	0	1	2	0	0	0	0	46
7	12	12	26th/27th April	14	1	0	1	0	0	0	0	0	0	16

Turbine	Total days per turbine	Days per season	Date	LB	CP	SP	BLE	NP	40P	Nat	Whis	Dau	UM	Total
7	13	13	27th/28th April	3	0	0	0	0	0	0	0	0	0	3
7	14	14	28th/29th April	0	0	0	0	0	0	0	0	0	0	0
7	15	15	29th/30th April	3	0	0	0	0	0	0	0	0	0	3
7	16	16	30th/1st April/May	0	0	0	0	0	0	0	0	0	0	0
7	17	17	1st/2nd May	0	0	0	0	0	0	0	0	0	0	0
7	18	18	2nd/3rd May	7	2	1	0	0	0	0	0	0	0	10
7	19	1	23rd June	8	2	3	0	0	0	0	0	0	0	13
7	20	2	24th June	4	0	1	0	0	0	0	0	0	0	5
7	21	3	25th June	0	0	0	0	0	0	0	0	0	0	0
7	22	4	26th June	0	1	0	0	0	0	0	1	0	1	3
7	23	5	27th June	8	5	4	0	0	0	0	0	0	0	17
7	24	6	28th June	13	2	1	0	0	0	0	0	0	0	16
7	25	7	29th June	2	3	0	0	0	0	0	0	0	0	5
7	26	8	30th June	13	8	13	0	0	0	0	2	0	0	36
7	27	9	01st July	14	6	1	1	0	0	0	1	0	1	24
7	28	10	2nd July	10	0	0	0	0	0	0	0	0	0	10
7	29	11	3rd July	12	4	3	1	0	0	0	0	0	0	20
7	30	12	4th July	0	0	0	0	0	0	0	0	0	0	0
7	31	13	5th July	0	0	0	0	0	0	0	0	0	0	0
7	32	14	6th July	13	1	0	0	0	0	0	0	0	0	14
8	1	1	15th/16th April	5	0	0	0	2	0	0	0	0	1	8
8	2	2	16th/17th April	1	0	0	0	0	0	0	0	0	0	1
8	3	3	17th/18th April	0	0	0	0	0	0	0	0	0	0	0
8	4	4	18th/19th April	0	0	0	0	0	0	0	0	0	0	0
8	5	5	19th/20th April	0	0	0	0	0	0	0	0	0	0	0

Turbine	Total days per turbine	Days per season	Date	LB	CP	SP	BLE	NP	40P	Nat	Whis	Dau	UM	Total
8	6	6	20th/21st April	0	0	0	0	0	0	0	0	0	0	0
8	7	7	21st/22nd April	0	1	0	0	0	0	0	0	0	0	1
8	8	8	22nd/23rd April	0	0	0	0	0	0	0	0	0	0	0
8	9	9	23rd/24th April	2	12	9	1	0	0	0	0	0	0	24
8	10	10	24th/25th April	1	1	1	0	0	0	0	0	0	0	3
8	11	11	25th/26th April	7	7	2	0	2	0	0	0	0	0	18
8	12	12	26th/27th April	14	1	3	1	0	0	0	0	0	0	19
8	13	13	27th/28th April	2	0	0	0	0	0	0	0	0	0	2
8	14	14	28th/29th April	0	0	0	0	0	0	0	0	0	0	0
8	15	15	29th/30th April	1	0	0	0	0	0	0	0	0	0	1
8	16	16	30th/1st April/May	0	0	0	0	0	0	0	0	0	0	0
8	17	17	1st/2nd May	0	0	0	0	0	0	0	0	0	0	0
8	18	18	2nd/3rd May	4	1	2	0	0	0	0	0	0	0	7
8	19	1	23rd/24th June	2	1	0	0	0	0	0	0	0	1	4
8	20	2	24th/25th June	1	0	0	0	0	0	0	0	0	0	1
8	21	3	25th/26th June	0	0	0	0	0	0	0	0	0	0	0
8	22	4	26th/27th June	1	1	1	0	0	0	0	0	0	0	3
8	23	5	27th/28th June	9	2	2	0	0	0	0	0	0	0	13
8	24	6	28th/29th June	9	5	5	0	0	0	0	0	0	0	19
8	25	7	29th/30th June	8	2	2	0	0	1	0	0	0	0	13
8	26	8	30th/1st June	15	3	2	0	0	1	0	0	0	1	22
8	27	9	1st/2nd July	14	16	1	0	0	0	0	0	0	0	31
8	28	10	2nd/3rd July	14	0	0	0	0	0	0	0	0	0	14
8	29	11	3rd/4th July	12	12	1	0	0	0	0	0	0	0	25
8	30	12	4th/5th July	0	0	0	0	0	0	0	0	0	0	0

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Turbine	Total days per turbine	Days per season	Date	LB	CP	SP	BLE	NP	40P	Nat	Whis	Dau	UM	Total
8	31	13	5th/6th July	0	0	0	0	0	0	0	0	0	0	0
8	32	14	6th/7th July	0	0	0	0	0	0	0	0	0	1	1
8	33	1	19th/20th August	4	1	7	1	0	0	0	0	0	3	16
8	34	2	20th/21st August	6	2	1	0	1	0	0	0	0	0	10
8	35	3	21st/22nd August	8	2	1	1	0	0	0	0	0	1	13
8	36	4	22nd/23rd August	13	9	13	3	0	0	0	0	0	3	41
8	37	5	23rd/24th August	0	4	11	0	0	0	0	0	0	2	17
8	38	6	24th/25th August	7	3	8	0	0	0	0	0	0	4	22
8	39	7	25th/26th August	6	4	11	0	1	1	0	0	0	2	25
8	40	8	26th/27th August	6	2	0	1	0	0	0	0	0	1	10
8	41	9	27th/28th August	6	2	6	0	0	0	0	0	0	1	15
8	42	10	28th/29th August	43	32	5	2	0	2	0	0	0	3	87
8	43	11	29th/30th August	23	29	11	0	0	2	0	0	0	3	68
8	44	12	30th/31st August	9	8	18	0	0	0	1	0	0	3	39
9	1	1	15th/16th April	1	1	0	1	0	0	0	0	0	0	3
9	2	2	16th/17th April	0	0	0	0	0	0	0	0	0	0	0
9	3	3	17th/18th April	0	0	0	0	0	0	0	0	0	0	0
9	4	4	18th/19th April	0	0	0	0	0	0	0	0	0	0	0
9	5	5	19th/20th April	0	0	0	0	0	0	0	0	0	0	0
9	6	6	20th/21st April	0	0	0	0	0	0	1	0	0	0	1
9	7	7	21st/22nd April	0	0	0	0	0	0	0	0	0	0	0
9	8	8	22nd/23rd April	2	0	0	0	0	0	0	0	0	0	2
9	9	9	23rd/24th April	5	10	21	0	0	3	0	0	0	0	39
9	10	10	24th/25th April	6	2	4	0	0	0	0	0	0	0	12
9	11	11	25th/26th April	6	11	6	1	0	2	0	0	0	0	26
9	12	12	26th/27th April	8	0	2	0	0	0	0	0	0	0	10

Turbine	Total days per turbine	Days per season	Date	LB	CP	SP	BLE	NP	40P	Nat	Whis	Dau	UM	Total
9	13	13	27th/28th April	3	1	0	0	0	0	0	0	0	0	4
9	14	14	28th/29th April	0	0	0	0	0	0	0	0	0	0	0
9	15	15	29th/30th April	4	0	0	0	0	0	0	0	0	0	4
9	16	16	30th/1st April/May	0	0	0	0	0	0	0	0	0	0	0
9	17	17	1st/2nd May	0	0	0	0	0	0	0	0	0	0	0
9	18	18	2nd/3rd May	4	0	0	0	0	0	0	0	0	0	4
9	19	1	23rd/24th June	0	4	1	0	0	0	0	0	0	0	5
9	20	2	24th/25th June	1	0	0	0	0	0	0	0	0	1	2
9	21	3	25th/26th June	1	0	0	0	0	0	0	0	0	1	2
9	22	4	26th/27th June	0	0	0	0	0	1	0	0	0	0	1
9	23	5	27th/28th June	0	1	2	0	0	0	0	0	0	0	3
9	24	6	28th/29th June	10	1	1	0	0	2	0	0	0	0	14
9	25	7	29th/30th June	6	3	2	0	0	0	0	0	0	0	11
9	26	8	30th/1st June	7	2	0	0	0	0	0	0	0	0	9
9	27	9	1st/2nd July	7	2	1	0	0	0	1	0	0	0	11
9	28	10	2nd/3rd July	9	0	2	0	0	0	0	0	0	0	11
9	29	11	3rd/4th July	14	3	3	0	0	1	0	0	0	0	21
9	30	12	4th/5th July	0	0	0	0	0	0	0	0	0	0	0
9	31	13	5th/6th July	0	0	0	0	0	0	0	0	0	0	0
9	32	14	6th/7th July	0	0	0	0	0	0	0	0	0	0	0
9	33	1	19th/20th August	8	1	4	0	0	0	0	0	0	0	13
9	34	2	20th/21st August	3	0	1	0	0	0	1	0	0	0	5
9	35	3	21st/22nd August	2	0	1	0	0	0	0	0	0	1	4
9	36	4	22nd/23rd August	16	6	10	1	0	1	0	0	0	4	38
9	37	5	23rd/24th August	1	9	12	0	0	0	0	0	0	1	23

Turbine	Total days per turbine	Days per season	Date	LB	CP	SP	BLE	NP	40P	Nat	Whis	Dau	UM	Total
9	38	6	24th/25th August	2	1	8	0	0	0	0	0	0	1	12
9	39	7	25th/26th August	3	1	4	0	0	0	0	0	0	1	9
9	40	8	26th/27th August	1	0	3	0	0	0	0	0	0	0	4
9	41	9	27th/28th August	13	1	0	0	0	0	0	0	0	1	15
9	42	10	28th/29th August	24	15	8	1	0	0	0	0	0	0	48
9	43	11	29th/30th August	13	18	7	1	0	0	0	0	0	1	40
9	44	12	30th/31st August	7	9	10	0	0	0	0	0	0	2	28
10	1	1	15th/16th April	0	0	1	0	0	0	0	0	0	0	1
10	2	2	16th/17th April	0	0	0	0	0	0	0	0	0	0	0
10	3	3	17th/18th April	0	0	0	0	0	0	0	0	0	0	0
10	4	4	18th/19th April	0	0	0	0	0	0	0	0	0	0	0
10	5	5	19th/20th April	0	1	0	0	0	0	0	0	0	0	1
10	6	6	20th/21st April	2	0	0	0	0	0	0	0	0	0	2
10	7	7	21st/22nd April	0	0	0	0	0	0	0	0	0	0	0
10	8	8	22nd/23rd April	3	0	0	0	0	0	0	0	0	0	3
10	9	9	23rd/24th April	9	32	18	0	0	7	0	0	0	0	66
10	10	10	24th/25th April	1	4	5	0	0	0	0	0	0	0	10
10	11	11	25th/26th April	19	26	18	1	3	0	0	0	0	0	67
10	12	12	26th/27th April	4	0	3	0	0	0	0	0	0	0	7
10	13	13	27th/28th April	5	0	0	0	0	1	0	0	0	0	6
10	14	14	28th/29th April	0	0	0	0	0	0	0	0	0	0	0
10	15	15	29th/30th April	5	0	0	0	0	0	0	0	0	0	5
10	16	16	30th/1st April/May	1	0	0	0	0	0	0	0	0	0	1
10	17	17	1st/2nd May	0	0	0	0	0	0	0	0	0	0	0
10	18	18	2nd/3rd May	4	8	1	0	0	0	0	0	0	0	13

Turbine	Total days per turbine	Days per season	Date	LB	CP	SP	BLE	NP	40P	Nat	Whis	Dau	UM	Total
10	19	1	23rd/24th June	2	4	3	0	0	1	0	0	0	1	11
10	20	2	24th/25th June	1	0	0	0	0	0	0	0	0	0	1
10	21	3	25th/26th June	0	0	0	0	0	0	0	0	0	0	0
10	22	4	26th/27th June	0	0	1	0	0	0	0	0	0	0	1
10	23	5	27th/28th June	0	3	2	0	0	1	0	0	0	0	6
10	24	6	28th/29th June	7	6	2	0	0	0	0	0	0	1	16
10	25	7	29th/30th June	6	0	1	0	0	0	0	0	0	0	7
10	26	8	30th/1st June	2	2	0	0	0	0	0	0	0	0	4
10	27	9	1st/2nd July	4	8	2	0	0	0	0	0	0	1	15
10	28	10	2nd/3rd July	1	1	1	0	0	0	0	0	0	0	3
10	29	11	3rd/4th July	20	5	2	0	0	1	0	0	0	0	28
10	30	12	4th/5th July	0	0	0	0	0	0	0	0	0	0	0
10	31	13	5th/6th July	0	0	0	0	0	0	0	0	0	0	0
10	32	14	6th/7th July	3	0	0	0	0	0	0	0	0	0	3
10	33	1	19th/20th August	0	3	5	1	0	0	0	0	0	0	9
10	34	2	20th/21st August	0	0	0	0	0	0	0	0	0	0	0
10	35	3	21st/22nd August	1	0	1	0	0	0	0	0	0	0	2
10	36	4	22nd/23rd August	16	8	14	6	0	0	0	0	0	4	48
10	37	5	23rd/24th August	4	4	22	2	0	0	0	0	0	1	33
10	38	6	24th/25th August	2	4	14	0	0	0	0	0	0	0	20
10	39	7	25th/26th August	7	4	12	0	0	0	0	0	0	1	24
10	40	8	26th/27th August	3	0	1	0	0	0	0	0	0	0	4
10	41	9	27th/28th August	36	4	10	0	0	0	0	0	0	0	50
10	42	10	28th/29th August	28	32	6	0	0	2	1	0	0	5	74
10	43	11	29th/30th August	18	10	12	0	0	2	0	0	0	4	46
10	44	12	30th/31st August	12	12	16	1	0	0	0	0	0	4	45

Turbine	Total days per turbine	Days per season	Date	LB	CP	SP	BLE	NP	40P	Nat	Whis	Dau	UM	Total
11	1	1	15th/16th April	0	0	0	0	0	0	0	0	0	0	0
11	2	2	16th/17th April	0	0	0	0	0	0	0	0	0	0	0
11	3	3	17th/18th April	0	0	0	0	0	0	0	0	0	0	0
11	4	4	18th/19th April	0	0	0	0	0	0	0	0	0	0	0
11	5	5	19th/20th April	0	0	0	0	0	0	0	0	0	0	0
11	6	6	20th/21st April	0	0	0	0	0	0	0	0	0	0	0
11	7	7	21st/22nd April	0	0	0	0	0	0	0	0	0	0	0
11	8	8	22nd/23rd April	2	0	0	0	0	0	0	0	0	0	2
11	9	9	23rd/24th April	18	49	109	0	5	5	0	0	0	0	186
11	10	10	24th/25th April	0	8	1	0	0	0	0	0	0	0	9
11	11	11	25th/26th April	4	12	23	0	1	0	2	0	0	0	42
11	12	12	26th/27th April	10	7	3	0	3	0	0	0	0	0	23
11	13	13	27th/28th April	3	1	0	0	0	0	0	0	0	0	4
11	14	14	28th/29th April	0	0	0	0	0	0	0	0	0	0	0
11	15	15	29th/30th April	0	2	1	0	0	0	0	0	0	0	3
11	16	16	30th/1st April/May	0	0	0	0	0	0	0	0	0	0	0
11	17	17	1st/2nd May	0	0	0	0	0	0	0	0	0	0	0
11	18	18	2nd/3rd May	0	0	0	0	0	0	0	0	0	0	0
11	19	1	23rd/24th June	1	0	1	0	0	1	0	0	0	0	3
11	20	2	24th/25th June	0	0	0	0	0	0	0	0	0	0	0
11	21	3	25th/26th June	0	0	0	0	0	0	0	0	0	0	0
11	22	4	26th/27th June	0	0	0	0	0	0	0	0	0	1	1
11	23	5	27th/28th June	1	1	1	0	0	0	0	0	0	0	3
11	24	6	28th/29th June	4	5	0	0	0	0	0	0	0	0	9
11	25	7	29th/30th June	7	1	2	0	0	0	0	0	0	2	12

Turbine	Total days per turbine	Days per season	Date	LB	CP	SP	BLE	NP	40P	Nat	Whis	Dau	UM	Total
11	26	8	30th/1st June	7	3	0	0	0	1	0	0	0	0	11
11	27	9	1st/2nd July	6	2	3	1	0	1	0	0	0	1	14
11	28	10	2nd/3rd July	1	1	0	0	0	0	0	0	0	0	2
11	29	11	3rd/4th July	2	0	0	0	0	0	0	0	0	0	2
11	30	12	4th/5th July	0	0	0	0	0	0	0	0	0	0	0
11	31	13	5th/6th July	0	0	0	0	0	0	0	0	0	0	0
11	32	14	6th/7th July	2	0	0	0	0	0	0	0	0	1	3
11	33	1	19th/20th August	2	2	3	0	0	0	0	0	0	0	7
11	34	2	20th/21st August	4	0	0	0	0	0	0	0	0	1	5
11	35	3	21st/22nd August	1	1	4	1	0	0	0	0	0	2	9
11	36	4	22nd/23rd August	17	14	15	2	0	0	0	0	0	2	50
11	37	5	23rd/24th August	6	4	14	0	0	1	0	0	0	1	26
11	38	6	24th/25th August	0	5	16	1	1	0	0	0	0	0	23
11	39	7	25th/26th August	4	4	8	1	0	0	0	0	0	2	19
11	40	8	26th/27th August	0	0	0	0	0	0	0	0	0	0	0
11	41	9	27th/28th August	37	11	17	1	0	0	0	0	0	0	66
11	42	10	28th/29th August	23	6	8	0	1	2	0	0	0	1	41
11	43	11	29th/30th August	53	15	23	3	0	0	1	0	1	1	97
11	44	12	30th/31st August	22	8	12	0	0	0	1	0	0	1	44
12	1	1	15th/16th April	0	0	0	0	0	0	0	0	0	0	0
12	2	2	16th/17th April	0	0	0	0	0	0	0	0	0	0	0
12	3	3	17th/18th April	0	0	0	0	0	0	0	0	0	0	0
12	4	4	18th/19th April	0	0	0	0	0	0	0	0	0	1	1
12	5	5	19th/20th April	0	0	0	0	0	0	0	0	0	1	1
12	6	6	20th/21st April	0	0	0	0	0	0	0	0	0	0	0
12	7	7	21st/22nd April	1	0	0	0	0	0	0	0	0	0	1

Turbine	Total days per turbine	Days per season	Date	LB	CP	SP	BLE	NP	40P	Nat	Whis	Dau	UM	Total
12	8	8	22nd/23rd April	0	0	1	0	0	0	0	0	0	0	1
12	9	9	23rd/24th April	11	67	39	0	0	5	0	0	0	0	122
12	10	10	24th/25th April	6	2	2	0	0	0	0	0	0	0	10
12	11	11	25th/26th April	1	11	12	0	3	0	0	0	0	0	27
12	12	12	26th/27th April	7	0	1	0	0	0	0	0	0	0	8
12	13	13	27th/28th April	10	0	0	0	0	0	0	0	0	0	10
12	14	14	28th/29th April	0	0	0	0	0	0	0	0	0	0	0
12	15	15	29th/30th April	0	0	1	0	0	0	0	0	0	0	1
12	16	16	30th/1st April/May	0	0	0	0	0	0	0	0	0	0	0
12	17	17	1st/2nd May	1	0	0	0	0	0	0	0	0	0	1
12	18	18	2nd/3rd May	6	0	1	0	0	0	0	0	0	0	7
12	19	1	23rd/24th June	2	2	1	0	0	0	0	0	0	0	5
12	20	2	24th/25th June	0	0	0	0	0	0	0	0	0	0	0
12	21	3	25th/26th June	0	0	0	0	0	0	0	0	0	0	0
12	22	4	26th/27th June	0	0	1	0	0	0	0	0	0	0	1
12	23	5	27th/28th June	6	2	2	0	0	0	0	0	0	1	11
12	24	6	28th/29th June	4	3	3	0	0	0	0	0	0	0	10
12	25	7	29th/30th June	15	0	4	0	0	0	0	0	0	0	19
12	26	8	30th/1st June	7	1	2	1	0	0	0	0	0	1	12
12	27	9	1st/2nd July	11	4	1	0	0	1	0	0	0	0	17
12	28	10	2nd/3rd July	1	0	0	0	0	0	0	0	0	0	1
12	29	11	3rd/4th July	17	2	3	0	0	1	0	0	0	0	23
12	30	12	4th/5th July	0	0	0	0	0	0	0	0	0	0	0
12	31	13	5th/6th July	0	0	0	0	0	0	0	0	0	0	0
12	32	14	6th/7th July	4	0	0	0	0	0	0	0	0	0	4

Turbine	Total days per turbine	Days per season	Date	LB	CP	SP	BLE	NP	40P	Nat	Whis	Dau	UM	Total
12	33	1	19th/20th August	1	2	7	1	0	1	0	0	0	0	12
12	34	2	20th/21st August	1	1	1	0	0	0	0	0	0	0	3
12	35	3	21st/22nd August	0	2	1	0	0	0	0	0	0	0	3
12	36	4	22nd/23rd August	12	8	21	1	0	0	2	0	0	4	48
12	37	5	23rd/24th August	7	2	16	0	0	0	0	0	0	2	27
12	38	6	24th/25th August	1	1	7	0	0	0	1	0	0	1	11
12	39	7	25th/26th August	10	9	11	1	0	0	1	0	0	0	32
12	40	8	26th/27th August	2	0	0	0	0	0	0	0	0	1	3
12	41	9	27th/28th August	23	2	4	0	0	2	0	0	0	0	31
12	42	10	28th/29th August	17	1	7	0	0	1	0	0	0	2	28
12	43	11	29th/30th August	19	12	15	1	0	2	0	0	0	2	51
12	44	12	30th/31st August	14	17	11	0	0	0	0	0	0	0	42
13	1	1	15th/16th April	2	0	0	0	0	0	0	0	0	0	2
13	2	2	16th/17th April	0	0	0	0	0	0	0	0	0	1	1
13	3	3	17th/18th April	0	0	0	0	0	0	0	0	0	0	0
13	4	4	18th/19th April	0	0	0	0	0	0	0	0	0	0	0
13	5	5	19th/20th April	0	0	0	0	0	0	0	0	0	0	0
13	6	6	20th/21st April	0	0	0	0	0	0	0	0	0	0	0
13	7	7	21st/22nd April	1	0	0	0	0	0	0	0	0	0	1
13	8	8	22nd/23rd April	4	0	0	0	0	0	0	0	0	0	4
13	9	9	23rd/24th April	6	7	6	0	2	0	0	0	0	0	21
13	10	10	24th/25th April	0	0	2	0	0	1	0	0	0	0	3
13	11	11	25th/26th April	6	3	5	0	0	0	0	0	0	0	14
13	12	12	26th/27th April	1	1	0	0	0	0	0	0	0	0	2
13	13	13	27th/28th April	3	0	0	0	0	0	0	0	0	0	3
13	14	14	28th/29th April	0	0	0	0	0	0	0	0	0	0	0

Turbine	Total days per turbine	Days per season	Date	LB	CP	SP	BLE	NP	40P	Nat	Whis	Dau	UM	Total
13	15	15	29th/30th April	6	0	0	0	0	0	1	0	0	0	7
13	16	16	30th/1st April/May	1	0	0	1	0	0	0	0	0	1	3
13	17	17	1st/2nd May	0	0	0	0	0	0	0	0	0	0	0
13	18	18	2nd/3rd May	4	1	1	0	0	0	0	0	0	0	6
13	19	1	23rd/24th June	3	2	4	0	0	3	0	0	0	0	12
13	20	2	24th/25th June	11	0	0	0	0	0	0	0	0	0	11
13	21	3	25th/26th June	0	0	0	0	0	0	0	0	0	0	0
13	22	4	26th/27th June	3	2	0	0	0	0	0	0	0	0	5
13	23	5	27th/28th June	4	7	1	0	0	2	1	0	0	0	15
13	24	6	28th/29th June	19	2	3	0	0	0	0	0	0	0	24
13	25	7	29th/30th June	11	0	0	0	0	0	1	0	0	0	12
13	26	8	30th/1st June	5	9	3	0	0	0	0	0	0	0	17
13	27	9	1st/2nd July	7	10	2	0	0	1	0	0	0	0	20
13	28	10	2nd/3rd July	19	0	0	0	0	0	0	0	0	0	19
13	29	11	3rd/4th July	86	4	3	0	0	1	0	0	0	0	94
13	30	12	4th/5th July	0	0	0	0	0	0	0	0	0	0	0
13	31	13	5th/6th July	0	0	0	0	0	0	0	0	0	0	0
13	32	14	6th/7th July	1	0	0	0	0	0	0	0	0	0	1
13	33	1	19th/20th August	1	0	3	1	0	1	0	0	0	3	9
13	34	2	20th/21st August	0	0	0	0	0	0	0	0	0	0	0
13	35	3	21st/22nd August	0	0	0	0	0	0	0	0	0	0	0
13	36	4	22nd/23rd August	22	10	26	2	0	2	0	0	2	2	66
13	37	5	23rd/24th August	6	6	22	1	0	1	0	0	2	2	40
13	38	6	24th/25th August	1	2	17	1	0	0	0	0	0	2	23
13	39	7	25th/26th August	13	4	8	1	0	0	0	0	0	0	26

Turbine	Total days per turbine	Days per season	Date	LB	CP	SP	BLE	NP	40P	Nat	Whis	Dau	UM	Total
13	40	8	26th/27th August	1	0	1	0	0	0	0	0	0	3	5
13	41	9	27th/28th August	16	1	8	0	0	0	0	0	0	0	25
13	42	10	28th/29th August	15	12	9	0	1	0	1	0	0	2	40
13	43	11	29th/30th August	48	27	18	0	0	3	0	0	2	1	99
13	44	12	30th/31st August	25	30	23	0	0	3	0	0	0	7	88

Appendix E – ECOBAT

Ecobat Bat Activity Analysis

Site Name: Firlough All Seasons

John Curtin

29/03/2022

9 Summary

Bat surveys were conducted at 5, 6, 8, 13, 3, 12, 7, 1, 9, 11, 2, 4, 10, for 42 nights between 2021-04-15 and 2022-08-30, using Wildlife Acoustics static bat detectors. The maximum of passes recorded in a single night was 109 passes, and 9 species were recorded.

The reference range dataset was stratified to include:

- Records from any time of year.
- Only records from within 100km^2 of the survey location.
- Records using any make of bat detector.

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10 Table 1

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

Location	Species/Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity
1	*Myotis*	0	2	2	3	6
1	*Myotis mystacinus*	0	0	0	1	0
1	*Myotis nattereri*	0	0	0	2	2
1	*Nyctalus leisleri*	5	6	5	5	3
1	*Pipistrellus nathusii*	0	2	1	0	2
1	*Pipistrellus pipistrellus*	8	5	6	4	6
1	*Pipistrellus pygmaeus*	10	5	6	2	6
1	*Plecotus auritus*	0	0	2	3	8

2	*Myotis*	0	0	5	1	7
2	*Myotis nattereri*	0	0	0	0	2
2	*Nyctalus leisleri*	6	12	5	3	4
2	*Pipistrellus nathusii*	5	1	2	3	12
2	*Pipistrellus pipistrellus*	2	7	8	2	5
2	*Pipistrellus pygmaeus*	2	7	7	1	7
2	*Plecotus auritus*	0	0	2	3	7
3	*Myotis*	0	0	6	2	3
3	*Myotis nattereri*	0	0	0	2	3
3	*Nyctalus leisleri*	4	11	6	6	2
3	*Pipistrellus nathusii*	0	0	1	3	3
3	*Pipistrellus pipistrellus*	1	7	7	1	4
3	*Pipistrellus pygmaeus*	3	6	4	3	7
3	*Plecotus auritus*	0	0	1	1	7
4	*Myotis*	0	0	3	3	7
4	*Myotis nattereri*	0	0	0	0	1
4	*Nyctalus leisleri*	7	8	10	4	1
4	*Pipistrellus nathusii*	0	0	0	1	5
4	*Pipistrellus pipistrellus*	1	4	5	5	2
4	*Pipistrellus pygmaeus*	4	4	5	4	3
4	*Plecotus auritus*	0	0	1	2	2
5	*Myotis*	0	0	4	3	5
5	*Myotis daubentonii*	0	0	0	0	2
5	*Myotis nattereri*	0	0	0	2	2
5	*Nyctalus leisleri*	9	10	7	1	3
5	*Pipistrellus nathusii*	0	0	1	0	4
5	*Pipistrellus pipistrellus*	0	4	4	2	5

5	*Pipistrellus pygmaeus*	3	4	6	3	3
5	*Plecotus auritus*	0	1	1	3	5
6	*Myotis*	0	1	0	4	6
6	*Myotis nattereri*	0	0	0	0	1
6	*Nyctalus leisleri*	5	15	3	4	2
6	*Pipistrellus nathusii*	0	0	0	1	5
6	*Pipistrellus pipistrellus*	0	3	7	3	4
6	*Pipistrellus pygmaeus*	3	5	2	3	5
6	*Plecotus auritus*	0	0	0	1	7
7	*Myotis*	0	0	0	3	0
7	*Myotis mystacinus*	0	0	0	1	2
7	*Nyctalus leisleri*	0	12	2	2	3
7	*Pipistrellus nathusii*	0	0	1	0	0
7	*Pipistrellus pipistrellus*	2	2	3	3	5
7	*Pipistrellus pygmaeus*	1	2	3	1	4
7	*Plecotus auritus*	0	0	0	2	5
8	*Myotis*	0	0	6	2	7
8	*Myotis nattereri*	0	0	0	0	1
8	*Nyctalus leisleri*	3	18	5	1	6
8	*Pipistrellus nathusii*	0	0	0	5	3
8	*Pipistrellus pipistrellus*	3	5	5	6	7
8	*Pipistrellus pygmaeus*	1	8	3	5	6
8	*Plecotus auritus*	0	0	1	1	5
9	*Myotis*	0	0	1	1	8
9	*Myotis nattereri*	0	0	0	0	3
9	*Nyctalus leisleri*	4	17	3	4	5
9	*Pipistrellus nathusii*	0	0	1	2	3

9	*Pipistrellus pipistrellus*	2	5	3	3	8
9	*Pipistrellus pygmaeus*	1	7	5	4	5
9	*Plecotus auritus*	0	0	0	0	5
10	*Myotis*	0	1	3	0	5
10	*Myotis nattereri*	0	0	0	0	1
10	*Nyctalus leisleri*	7	6	8	6	3
10	*Pipistrellus nathusii*	0	1	1	2	4
10	*Pipistrellus pipistrellus*	3	6	9	1	2
10	*Pipistrellus pygmaeus*	4	6	4	4	7
10	*Plecotus auritus*	0	1	0	1	3
11	*Myotis*	0	0	1	5	6
11	*Myotis daubentonii*	0	0	0	0	1
11	*Myotis nattereri*	0	0	0	1	2
11	*Nyctalus leisleri*	9	10	7	3	5
11	*Pipistrellus nathusii*	0	1	2	0	6
11	*Pipistrellus pipistrellus*	2	7	5	3	5
11	*Pipistrellus pygmaeus*	6	4	4	1	4
11	*Plecotus auritus*	0	0	1	1	5
12	*Myotis*	0	1	0	4	5
12	*Myotis nattereri*	0	0	0	1	2
12	*Nyctalus leisleri*	7	16	3	3	4
12	*Pipistrellus nathusii*	0	0	2	2	4
12	*Pipistrellus pipistrellus*	2	4	2	8	4
12	*Pipistrellus pygmaeus*	4	6	4	3	9
12	*Plecotus auritus*	0	0	0	0	5
13	*Myotis*	0	1	6	1	2
13	*Myotis daubentonii*	0	0	0	3	0

13	*Myotis nattereri*	0	0	0	0	4
13	*Nyctalus leisleri*	8	13	5	2	6
13	*Pipistrellus nathusii*	0	0	3	3	6
13	*Pipistrellus pipistrellus*	2	7	3	4	3
13	*Pipistrellus pygmaeus*	5	4	6	2	3
13	*Plecotus auritus*	0	0	0	1	5

11 Table 2

Summary table showing key metrics for each species recorded.

Location	Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded	Reference Range
1	*Myotis*	33	11 - 39	62	13	4924
1	*Myotis mystacinus*	33	0	33	1	49
1	*Myotis nattereri*	22	11 - 33	33	4	746
1	*Nyctalus leisleri*	58	45 - 68	92	24	5482
1	*Pipistrellus nathusii*	58	11 - 68	78	5	1052
1	*Pipistrellus pipistrellus*	58	43 - 65.5	94	29	6195
1	*Pipistrellus pygmaeus*	66	46.5 - 69.5	92	29	6714
1	*Plecotus auritus*	11	11 - 34.5	58	13	2528
2	*Myotis*	11	11 - 39	53	13	4924
2	*Myotis nattereri*	11	11 - 11	11	2	746
2	*Nyctalus leisleri*	66	49 - 69.5	90	30	5482
2	*Pipistrellus nathusii*	11	11 - 51	92	23	1052

2	*Pipistrellus pipistrellus*	56	40 - 63.5	88	24	6195
2	*Pipistrellus pygmaeus*	53	34.5 - 62	83	24	6714
2	*Plecotus auritus*	11	11 - 33	58	12	2528
3	*Myotis*	45	22 - 49	53	11	4924
3	*Myotis nattereri*	11	11 - 22	33	5	746
3	*Nyctalus leisleri*	62	47.5 - 65.5	88	29	5482
3	*Pipistrellus nathusii*	33	11 - 43	53	7	1052
3	*Pipistrellus pipistrellus*	58	39 - 63.5	83	20	6195
3	*Pipistrellus pygmaeus*	45	28 - 57	87	23	6714
3	*Plecotus auritus*	11	11 - 22	45	9	2528
4	*Myotis*	11	11 - 33	53	13	4924
4	*Myotis nattereri*	11	0	11	1	746
4	*Nyctalus leisleri*	60	53 - 68	91	30	5482
4	*Pipistrellus nathusii*	11	11 - 11	33	6	1052
4	*Pipistrellus pipistrellus*	45	33 - 59.5	86	17	6195
4	*Pipistrellus pygmaeus*	52	39 - 64	90	20	6714
4	*Plecotus auritus*	33	11 - 39	45	5	2528
5	*Myotis*	33	11 - 43	58	12	4924
5	*Myotis daubentonii*	11	11 - 11	11	2	249
5	*Myotis nattereri*	22	11 - 33	33	4	746
5	*Nyctalus leisleri*	73	57 - 76	92	30	5482

5	*Pipistrellus nathusii*	11	11 - 11	45	5	1052
5	*Pipistrellus pipistrellus*	45	28 - 55.5	78	15	6195
5	*Pipistrellus pygmaeus*	45	39 - 63	91	19	6714
5	*Plecotus auritus*	22	11 - 36.5	62	10	2528
6	*Myotis*	11	11 - 38.5	66	11	4924
6	*Myotis nattereri*	11	0	11	1	746
6	*Nyctalus leisleri*	66	54 - 74	92	29	5482
6	*Pipistrellus nathusii*	11	11 - 11	33	6	1052
6	*Pipistrellus pipistrellus*	45	28 - 53	76	17	6195
6	*Pipistrellus pygmaeus*	58	34.5 - 68.5	88	18	6714
6	*Plecotus auritus*	11	11 - 11	33	8	2528
7	*Myotis*	33	33 - 33	33	3	4924
7	*Myotis mystacinus*	11	11 - 11	33	3	49
7	*Nyctalus leisleri*	62	43 - 70	79	19	5482
7	*Pipistrellus nathusii*	45	0	45	1	1052
7	*Pipistrellus pipistrellus*	33	22 - 58	90	15	6195
7	*Pipistrellus pygmaeus*	45	22 - 63.5	82	11	6714
7	*Plecotus auritus*	11	11 - 22	33	7	2528
8	*Myotis*	33	11 - 39	53	15	4924
8	*Myotis nattereri*	11	0	11	1	746
8	*Nyctalus leisleri*	62	45 - 68	91	33	5482

8	*Pipistrellus nathusii*	33	22 - 33	33	8	1052
8	*Pipistrellus pipistrellus*	39	33 - 54.5	88	26	6195
8	*Pipistrellus pygmaeus*	45	34.5 - 58	83	23	6714
8	*Plecotus auritus*	11	11 - 22	45	7	2528
9	*Myotis*	11	11 - 11	53	10	4924
9	*Myotis nattereri*	11	11 - 11	11	3	746
9	*Nyctalus leisleri*	66	47 - 68.5	86	33	5482
9	*Pipistrellus nathusii*	22	11 - 33	45	6	1052
9	*Pipistrellus pipistrellus*	33	22 - 53	83	21	6195
9	*Pipistrellus pygmaeus*	49	33 - 58.5	84	22	6714
9	*Plecotus auritus*	11	11 - 11	11	5	2528
10	*Myotis*	11	11 - 53	62	9	4924
10	*Myotis nattereri*	11	0	11	1	746
10	*Nyctalus leisleri*	53	45 - 64	89	30	5482
10	*Pipistrellus nathusii*	22	11 - 39	66	8	1052
10	*Pipistrellus pipistrellus*	53	49 - 69	88	21	6195
10	*Pipistrellus pygmaeus*	45	34.5 - 60	85	25	6714
10	*Plecotus auritus*	11	11 - 36.5	62	5	2528
11	*Myotis*	22	11 - 33	45	12	4924
11	*Myotis daubentonii*	11	0	11	1	249
11	*Myotis nattereri*	11	11 - 11	33	3	746

11	*Nyctalus leisleri*	64	48 - 69	92	34	5482
11	*Pipistrellus nathusii*	11	11 - 42	73	9	1052
11	*Pipistrellus pipistrellus*	56	36.5 - 63.5	92	22	6195
11	*Pipistrellus pygmaeus*	69	43.5 - 75	95	19	6714
11	*Plecotus auritus*	11	11 - 22	45	7	2528
12	*Myotis*	22	11 - 36.5	62	10	4924
12	*Myotis nattereri*	11	11 - 11	33	3	746
12	*Nyctalus leisleri*	71	53 - 74	89	33	5482
12	*Pipistrellus nathusii*	22	11 - 39	58	8	1052
12	*Pipistrellus pipistrellus*	33	33 - 54.5	93	20	6195
12	*Pipistrellus pygmaeus*	45	32 - 56.5	90	26	6714
12	*Plecotus auritus*	11	11 - 11	11	5	2528
13	*Myotis*	45	28 - 53	66	10	4924
13	*Myotis daubentonii*	33	33 - 33	33	3	249
13	*Myotis nattereri*	11	11 - 11	11	4	746
13	*Nyctalus leisleri*	71	47.5 - 73.5	94	34	5482
13	*Pipistrellus nathusii*	22	11 - 39	45	12	1052
13	*Pipistrellus pipistrellus*	53	38.5 - 66	88	19	6195
13	*Pipistrellus pygmaeus*	56	41 - 66	87	20	6714
13	*Plecotus auritus*	11	11 - 11	33	6	2528

12 Figures

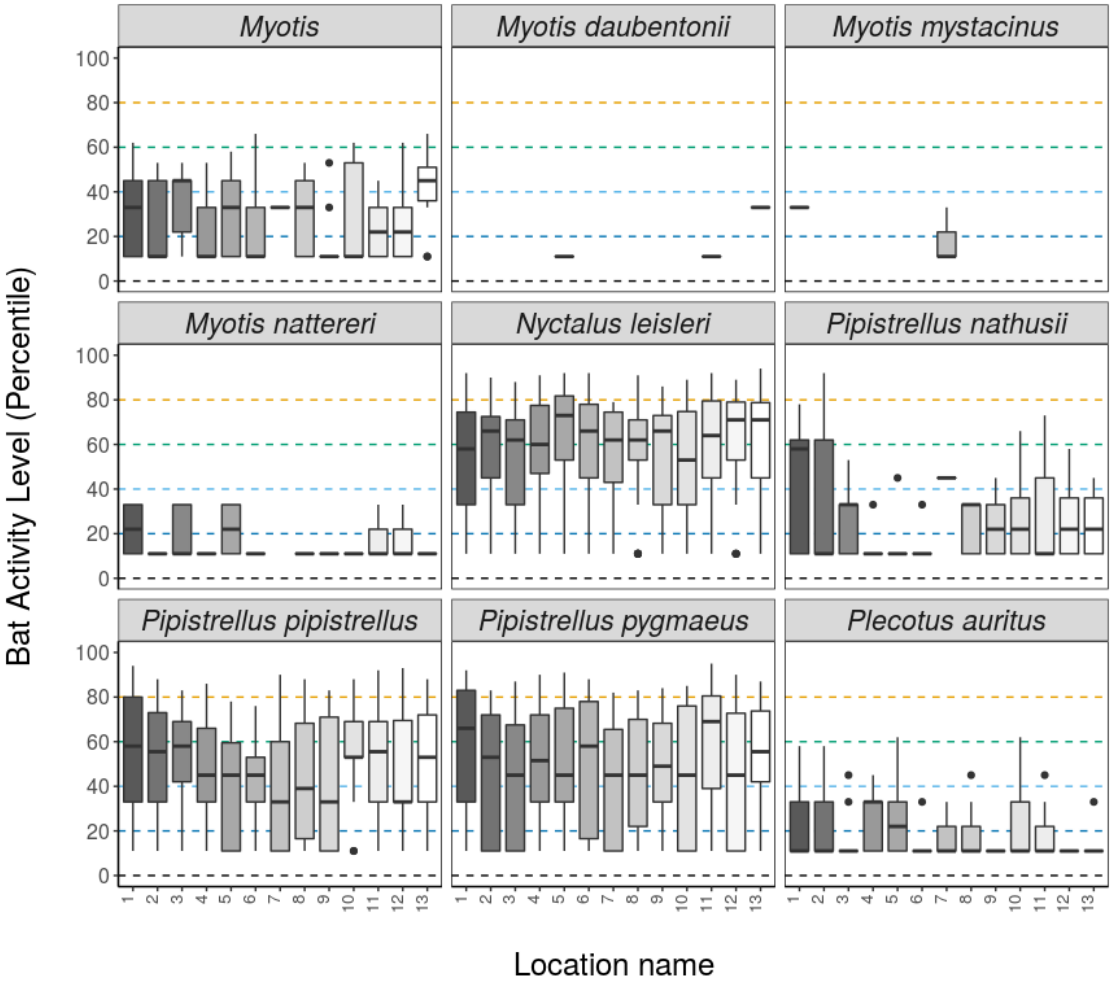
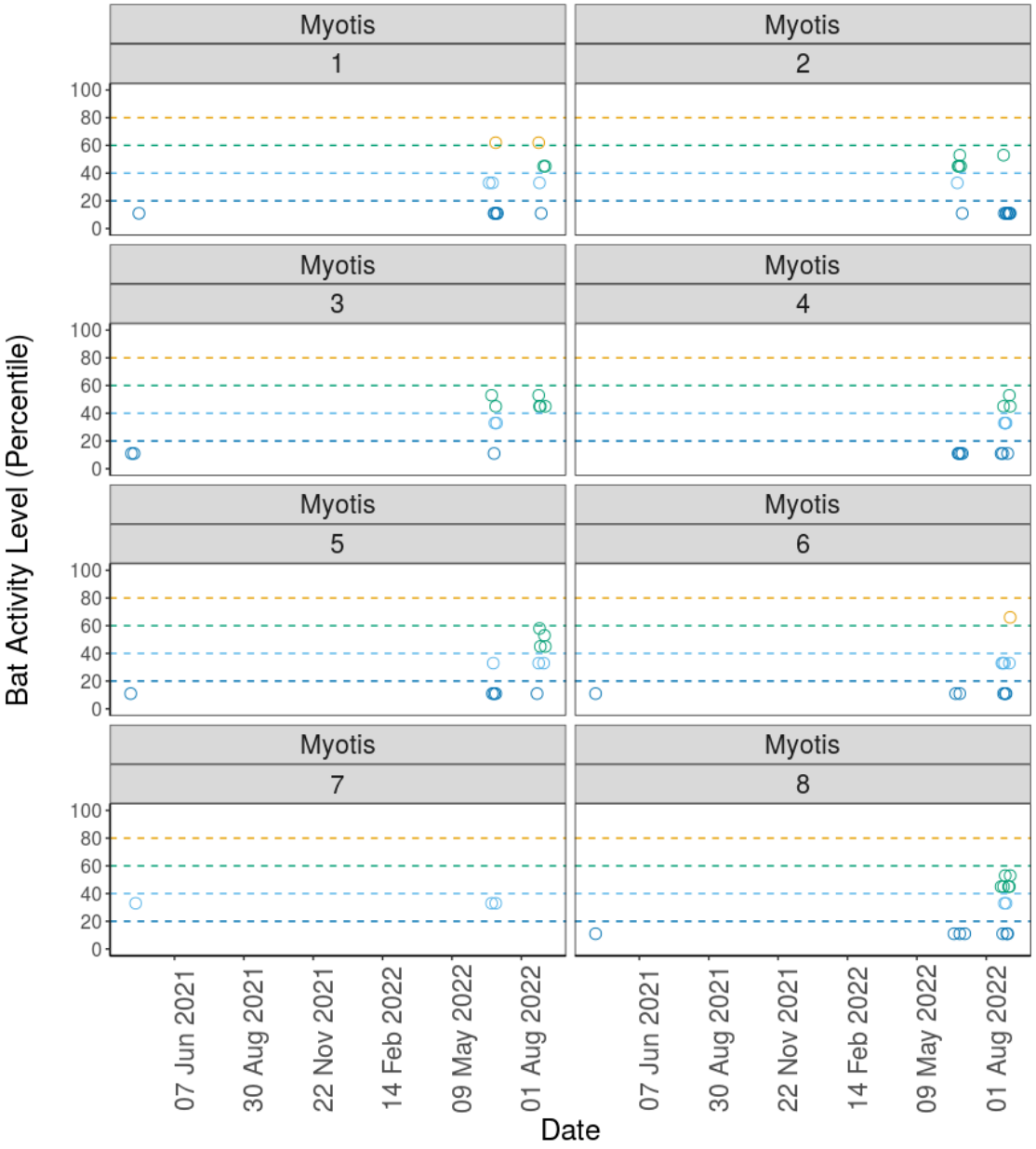


Figure 1. Differences in activity between static detector locations, split by species and location. The centre line indicates the median activity level whereas the box represents the interquartile range (the spread of the middle 50% of nights of activity)


Myotis
1
2
3
4
5
6
7
8
Bat Activity Level (Percentile)
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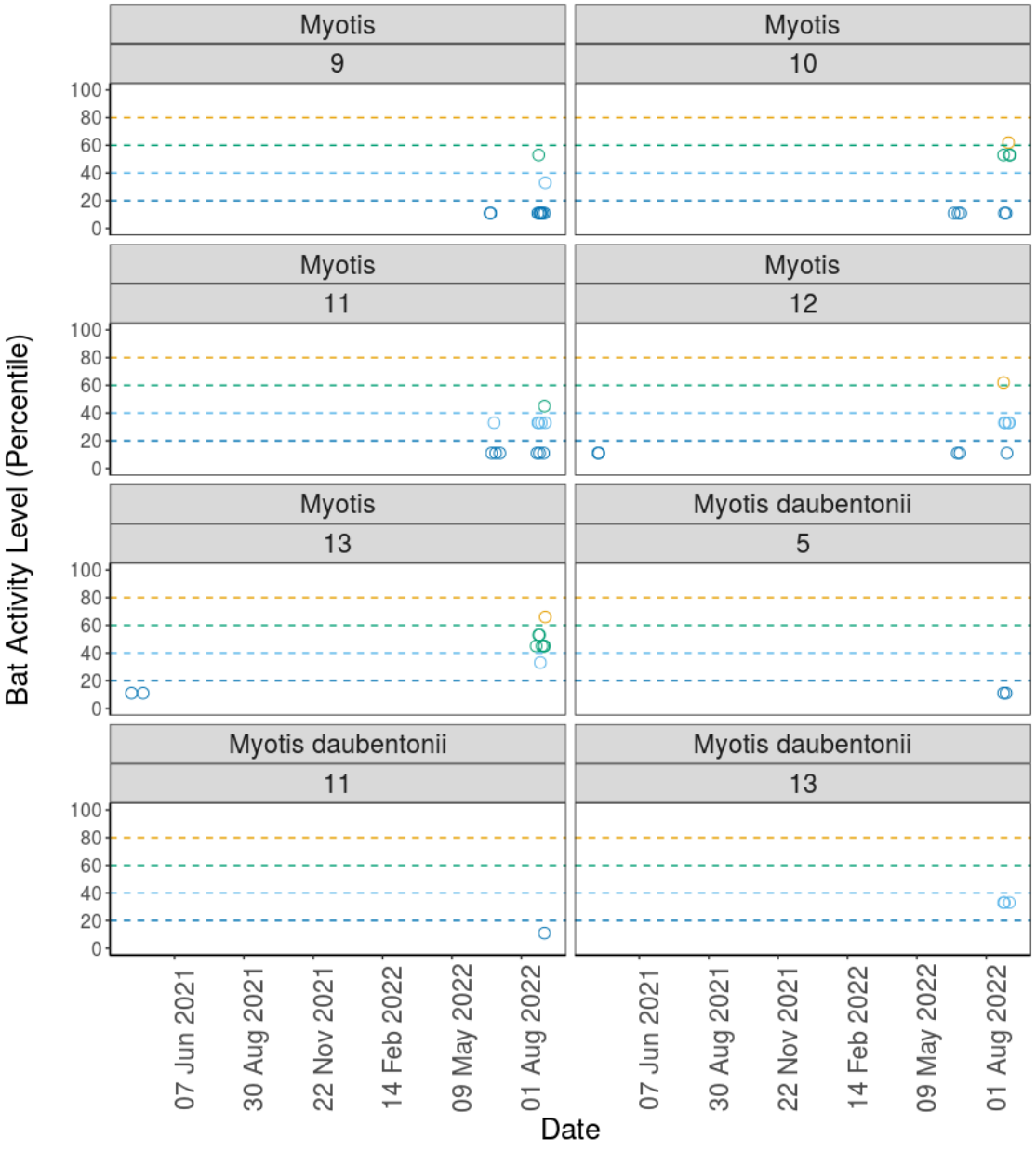
20
40
60
80
100
07 Jun 2021
30 Aug 2021
22 Nov 2021
14 Feb 2022
09 May 2022
01 Aug 2022
Date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Myotis
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Myotis
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Myotis
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Myotis
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Myotis daubentonii
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Myotis daubentonii
11
Myotis daubentonii
13
Bat Activity Level (Percentile)
100
80
60
40
20
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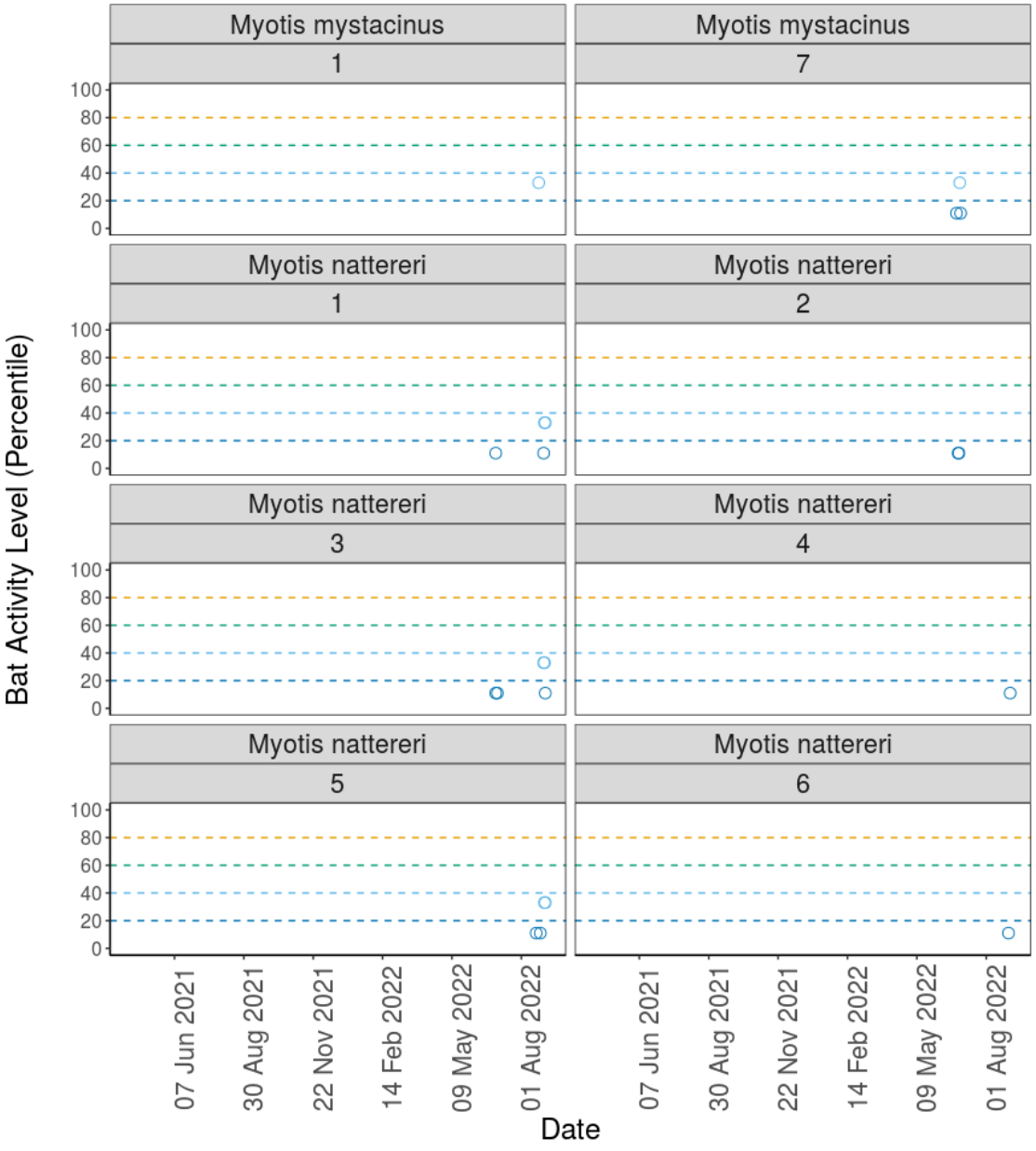
07 Jun 2021
30 Aug 2021
22 Nov 2021
14 Feb 2022
09 May 2022
01 Aug 2022
Date


Myotis mystacinus
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Myotis nattereri
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2
Myotis nattereri
3
Myotis nattereri
4
Myotis nattereri
5
Myotis nattereri
6
Bat Activity Level (Percentile)
100
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40
20
0
07 Jun 2021
30 Aug 2021
22 Nov 2021
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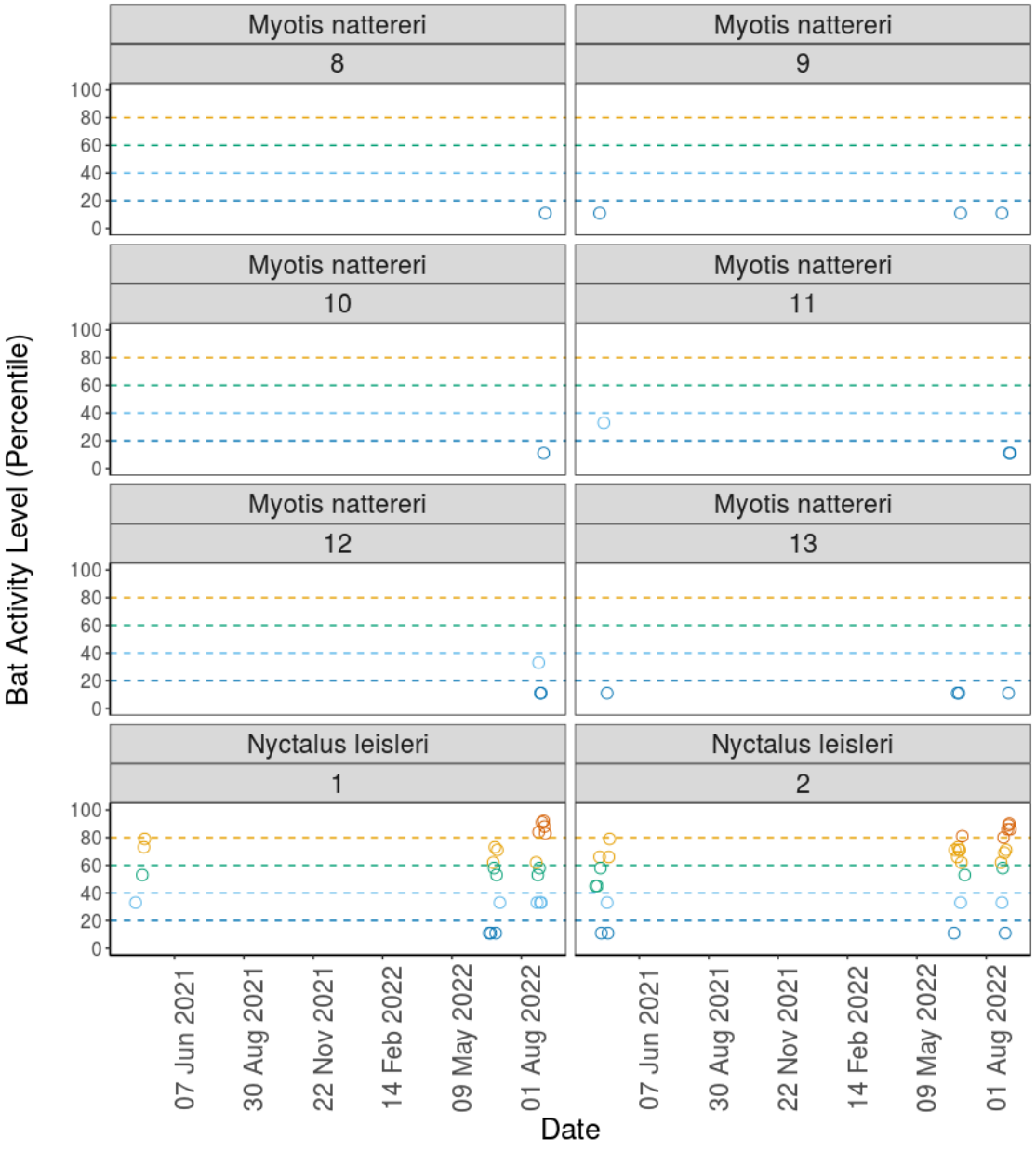
09 May 2022
01 Aug 2022
Date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Myotis nattereri
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Myotis nattereri
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Myotis nattereri
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Myotis nattereri
13
Nyctalus leisleri
1
Nyctalus leisleri
2
Bat Activity Level (Percentile)
100
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60
40
20
0
07 Jun 2021
30 Aug 2021
22 Nov 2021
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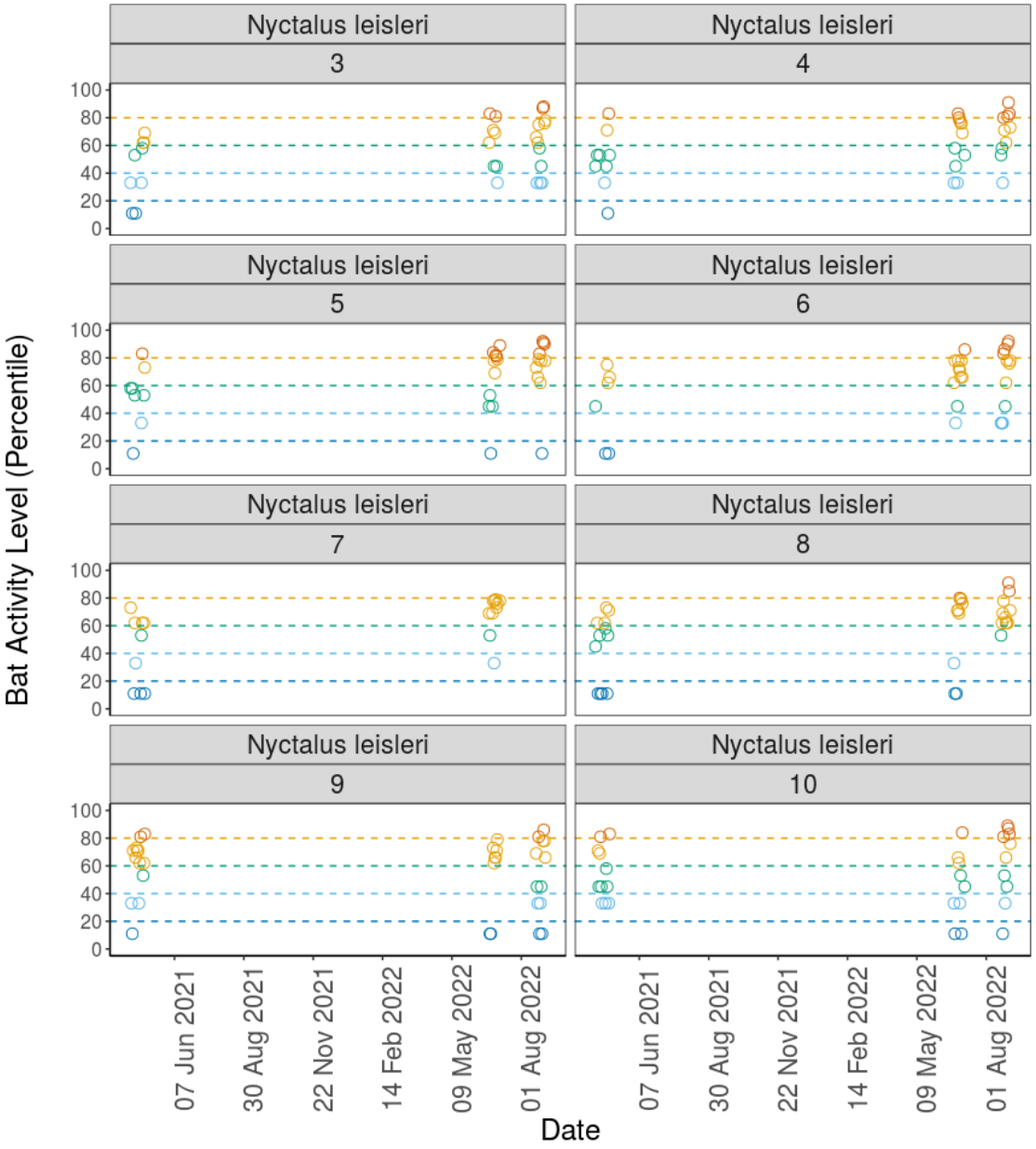
09 May 2022
01 Aug 2022
Date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4
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6
7
8
9
10
Bat Activity Level (Percentile)
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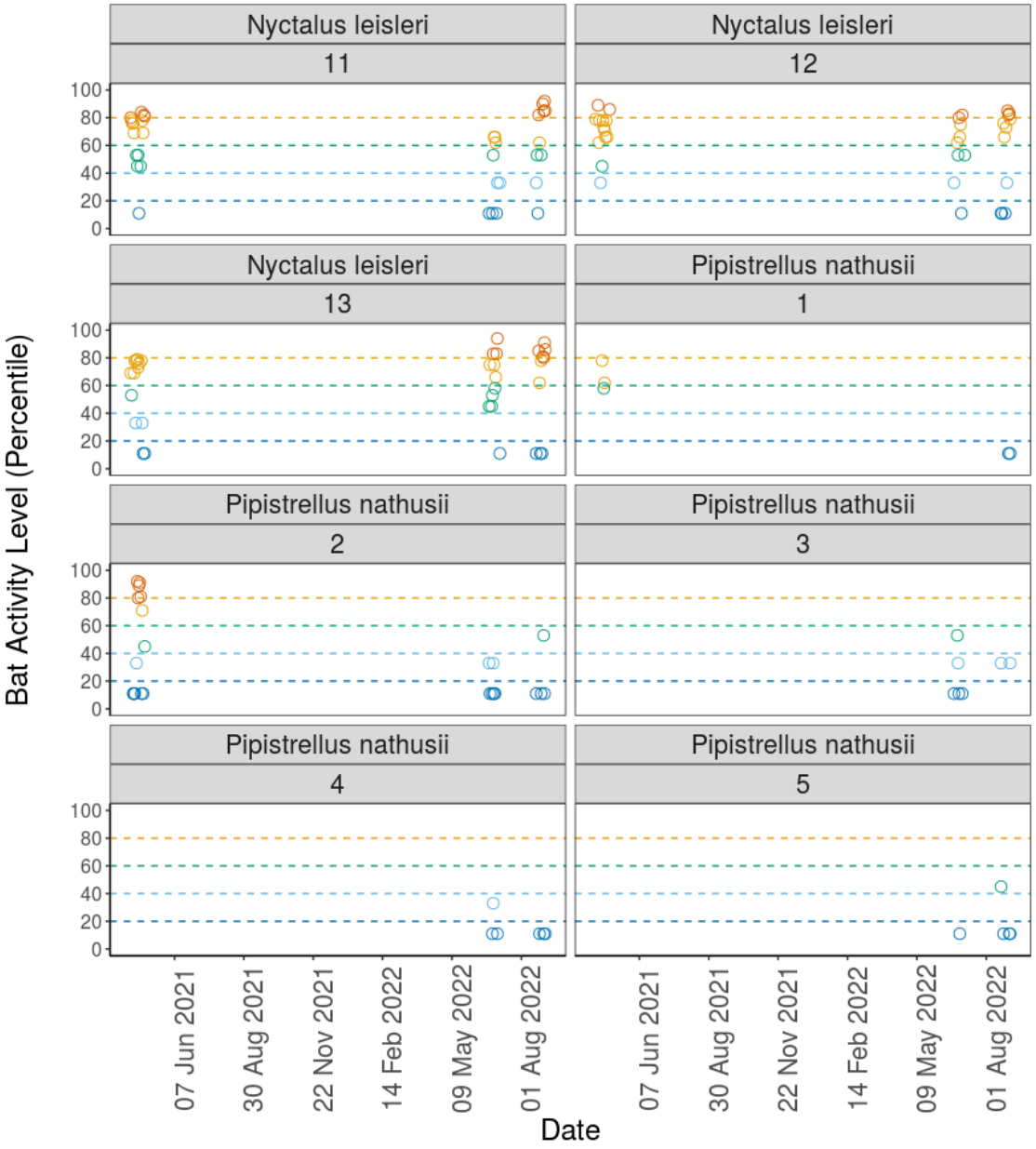
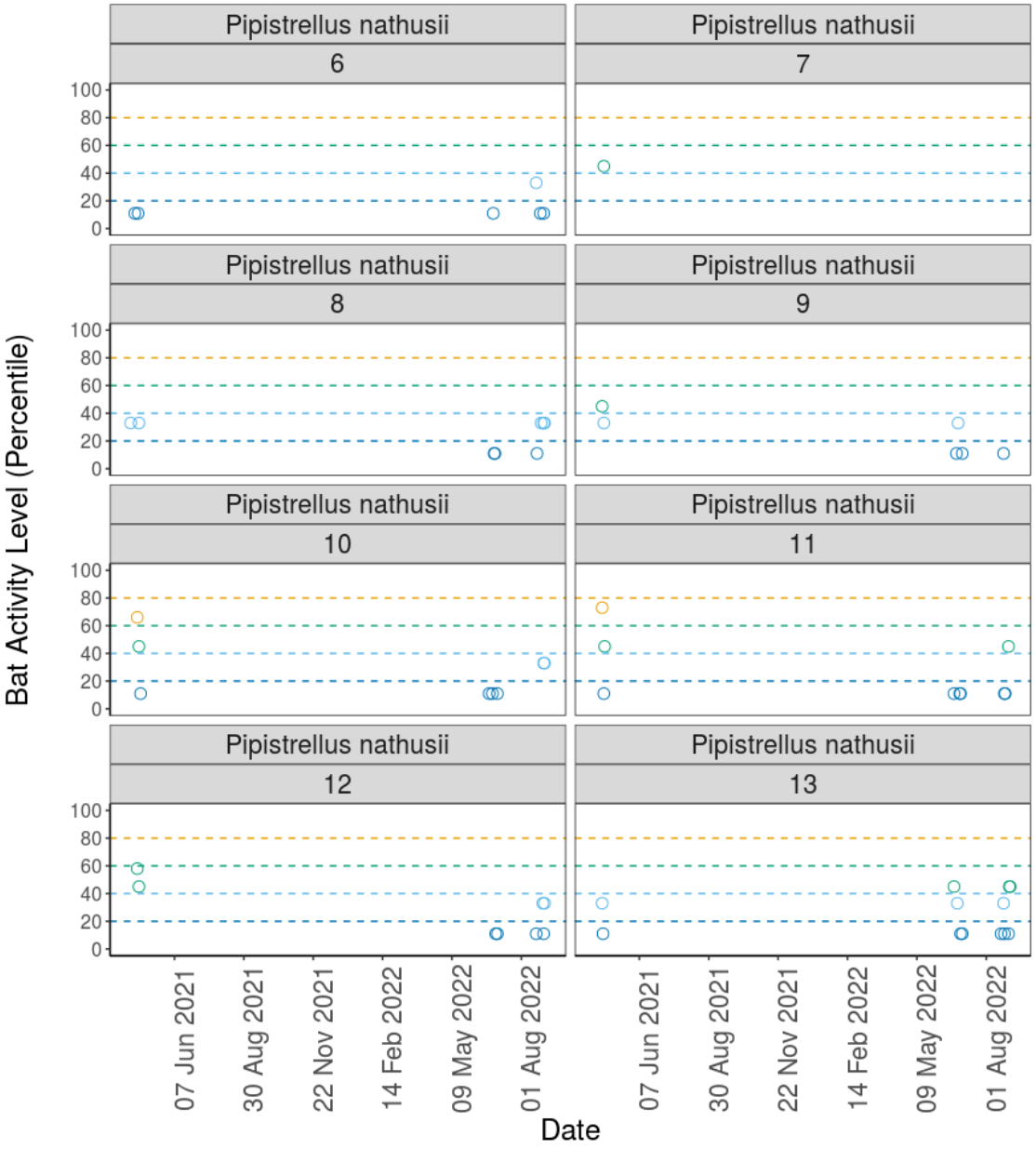
100
07 Jun 2021
30 Aug 2021
22 Nov 2021
14 Feb 2022
09 May 2022
01 Aug 2022
Date


Nyctalus leisleri
11
Nyctalus leisleri
12
Nyctalus leisleri
13
Pipistrellus nathusii
1
Pipistrellus nathusii
2
Pipistrellus nathusii
3
Pipistrellus nathusii
4
Pipistrellus nathusii
5
Bat Activity Level (Percentile)
100
80
60
40
20
0
07 Jun 2021
30 Aug 2021
22 Nov 2021
14 Feb 2022
09 May 2022
01 Aug 2022
Date


Pipistrellus nathusii
6
7
8
9
10
11
12
13
Bat Activity Level (Percentile)
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60
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100
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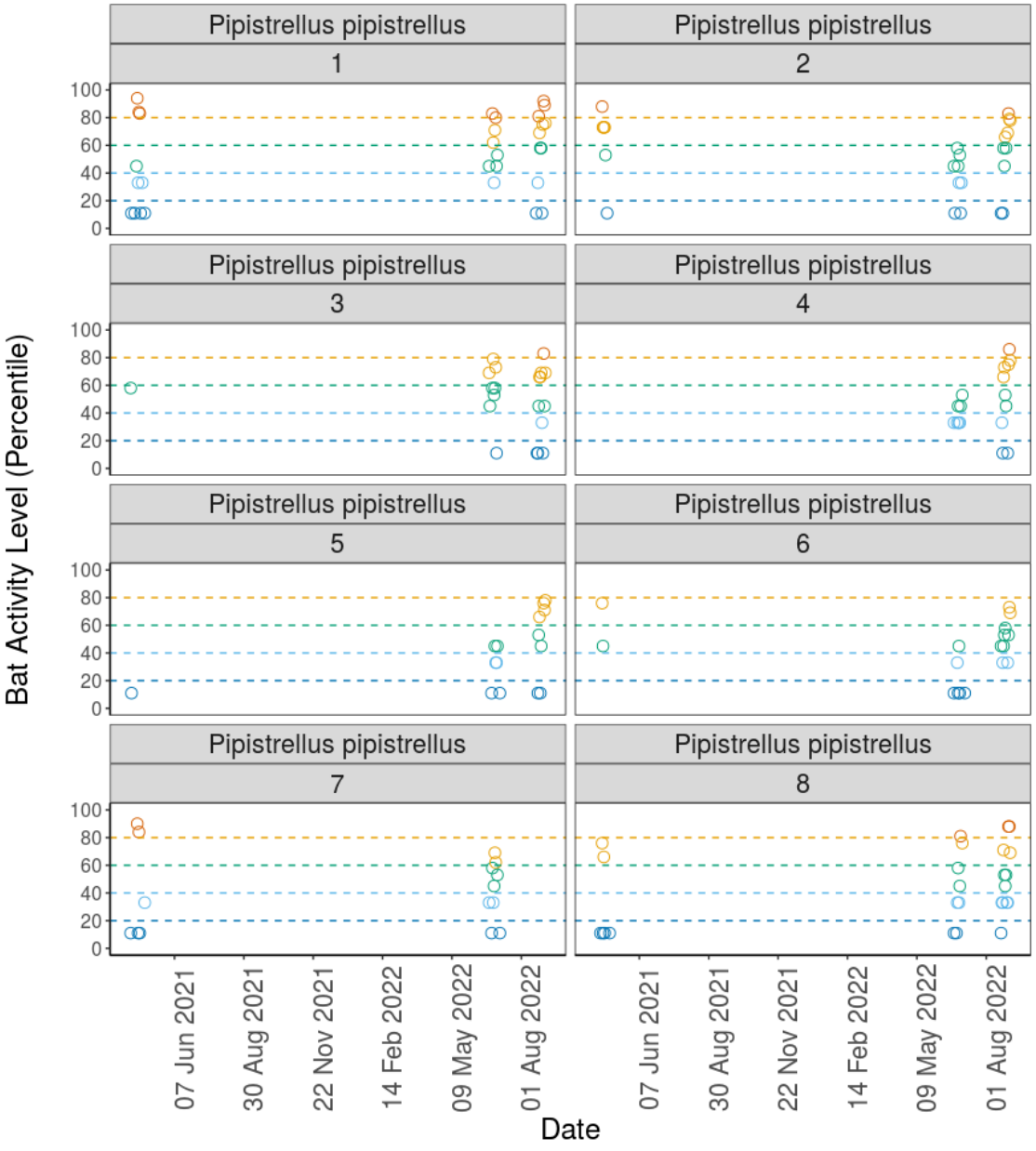
30 Aug 2021
22 Nov 2021
14 Feb 2022
09 May 2022
01 Aug 2022
Date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2
3
4
5
6
7
8
Bat Activity Level (Percentile)
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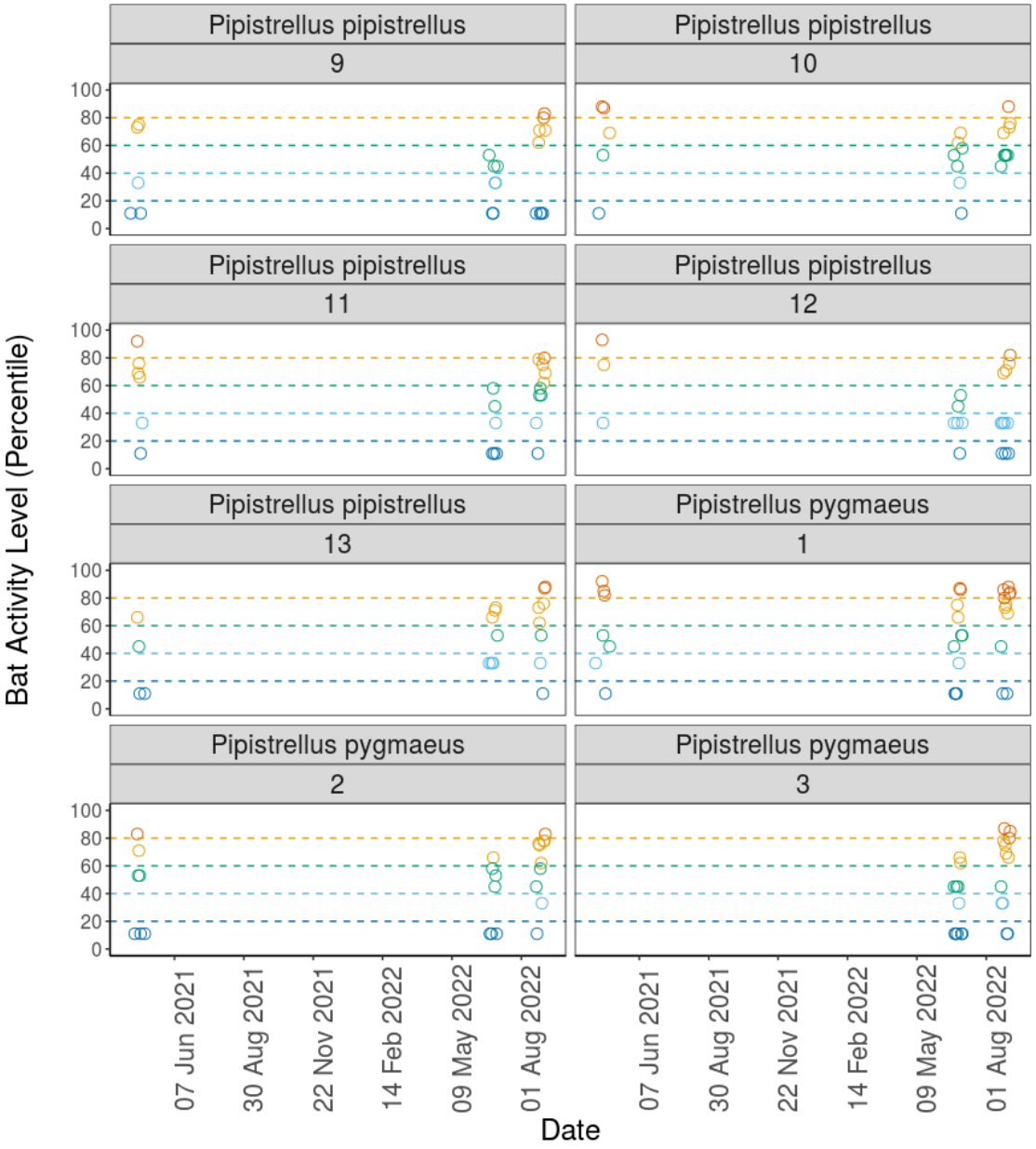
40
60
80
100
07 Jun 2021
30 Aug 2021
22 Nov 2021
14 Feb 2022
09 May 2022
01 Aug 2022
Date


Pipistrellus pipistrellus
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Pipistrellus pipistrellus
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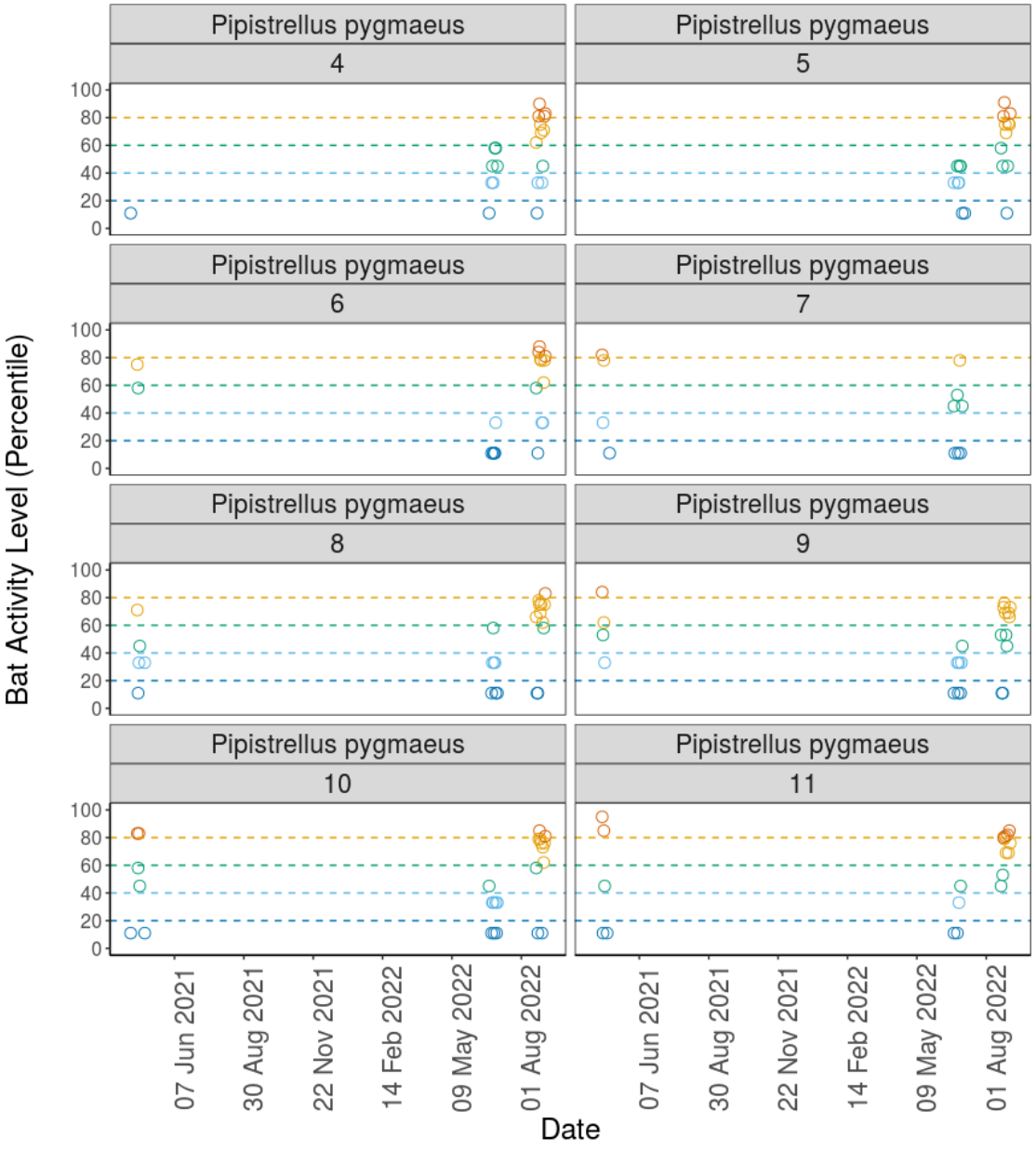
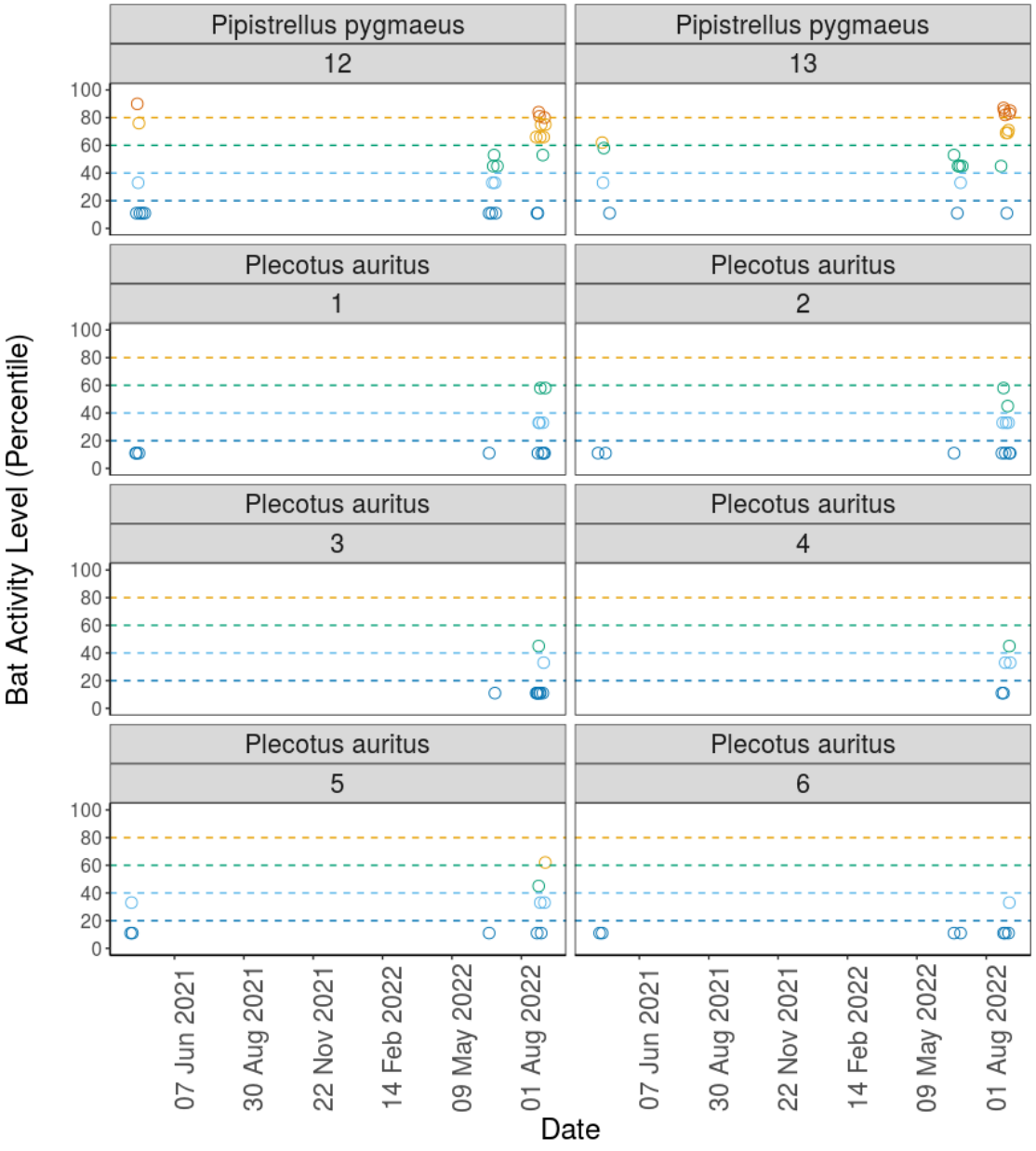
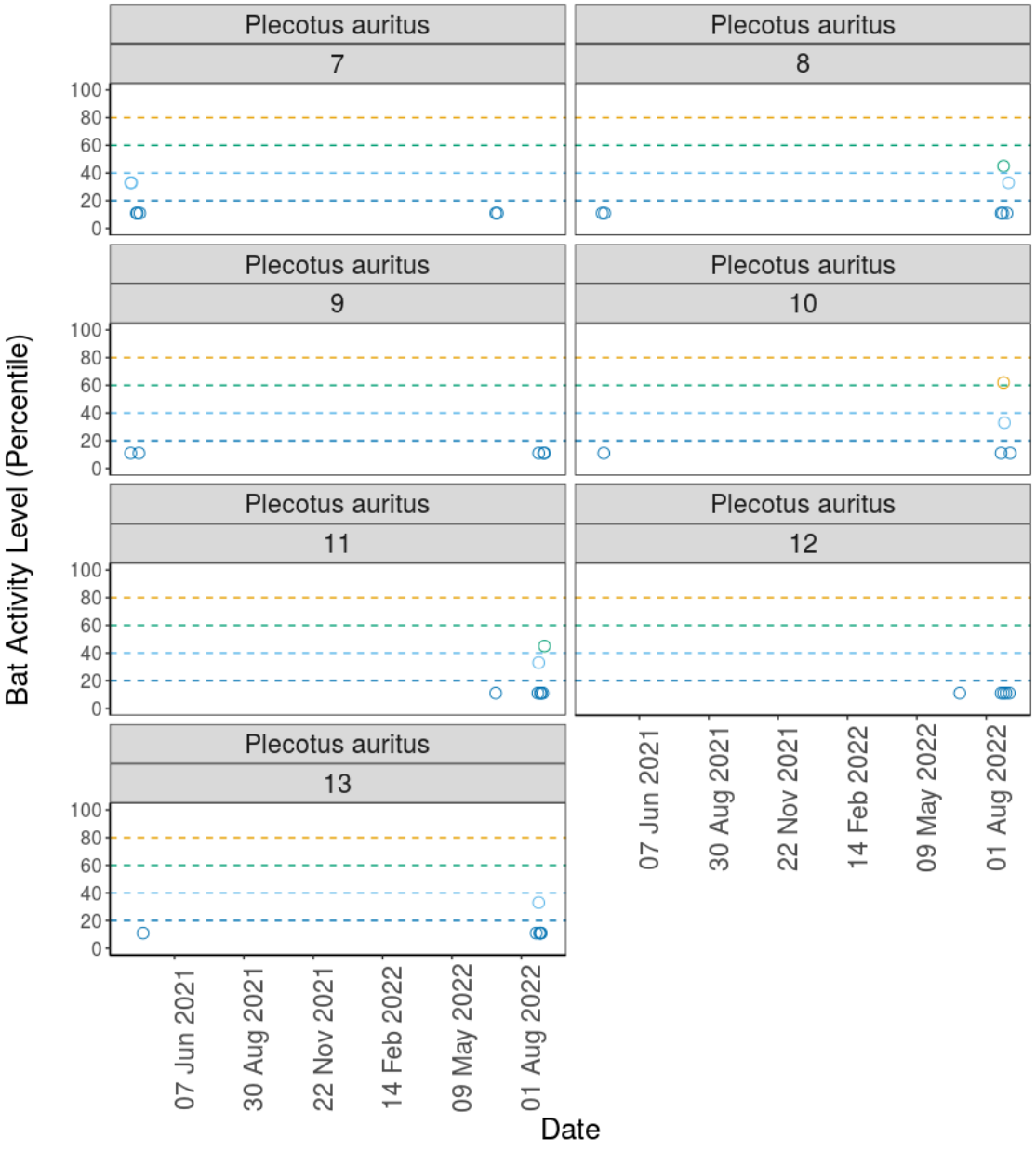
Pipistrellus pipistrellus
11
Pipistrellus pipistrellus
12
Pipistrellus pipistrellus
13
Pipistrellus pygmaeus
1
Pipistrellus pygmaeus
2
Pipistrellus pygmaeus
3
Bat Activity Level (Percentile)
0
20
40
60
80
100
07 Jun 2021
30 Aug 2021
22 Nov 2021
14 Feb 2022
09 May 2022
01 Aug 2022
Date


Pipistrellus pygmaeus
4
5
6
7
8
9
10
11
Bat Activity Level (Percentile)
0
20
40
60
80
100
07 Jun 2021
30 Aug 2021
22 Nov 2021
14 Feb 2022
09 May 2022
01 Aug 2022
Date


Pipistrellus pygmaeus
12
Pipistrellus pygmaeus
13
Plecotus auritus
1
Plecotus auritus
2
Plecotus auritus
3
Plecotus auritus
4
Plecotus auritus
5
Plecotus auritus
6
Bat Activity Level (Percentile)
0
20
40
60
80
100
07 Jun 2021
30 Aug 2021
22 Nov 2021
14 Feb 2022
09 May 2022
01 Aug 2022
Date



Info@EireEcology.ie

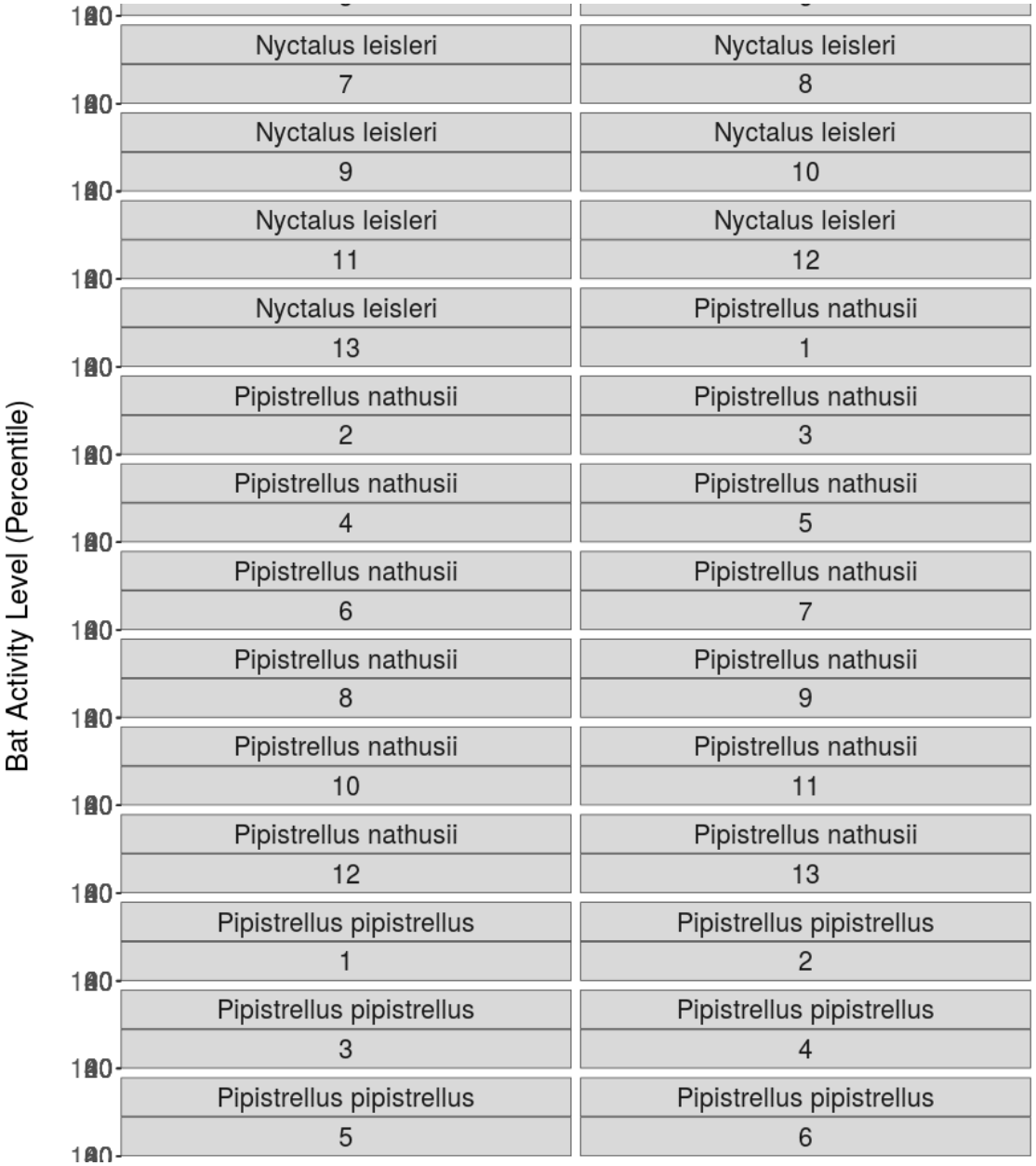


Figure 3. The relationship between recorded bat activity (percentile) and the temperature at sunset, split by species and location.

Appendix F – Curtailment Case Study

The subject site consisted of an existing windfarm in upland blanket bog and conifer plantation. A monitoring program was initiated in the summer of 2020 prior to curtailment and continued into 2021. The monitoring program consisted of two parts; placement of static bat detectors at turbine bases for 10 nights following Appendix 4 of SNH 2019. In addition to the placement of statics, dog lead collision monitoring was conducted by **Eire Ecology** staff at each of the turbine bases where statics were placed (again for ten days in a row). Weather data was also recorded from the onsite met mast. In this way fatalities could be linked with bat activity and weather conditions. Searcher efficiency and predation removal trials were also conducted.

Surveys were conducted at 46% of the turbines during the summer and autumn of 2020 with three bat fatalities found (prior to the implementation of curtailment). Curtailment commenced in September 2020 which stopped the operation of turbines when temperatures rose above 11 degrees Celsius and wind speed below 5 m/s between dusk and dawn each night (74% of total bat activity). No further bat fatalities occurred during the Autumn 2020 period despite levels of bat activity across the site higher than in summer.

In order to assess the effectiveness of the curtailment, surveys were repeated in 2021. The turbines were again monitored for ten nights in a row for the spring, summer and autumn periods of 2021. In total 120 days of carcase searches were conducted in 2021 (in addition to the 80 conducted in 2020). No bat fatalities were found in 2021.

Evidence of Absence V2 was used to estimate a maximum predicted overall number of fatalities from 2020 and 2021. The software predicted an overall fatality rate of no more than 0.44 bat fatalities per turbine (0.52 bat fatalities/MW/year) in 2020 (90% confidence) reducing to no more than 0.18 bat fatalities per turbine (0.22 bat fatalities/MW/year) in 2021 (90% confidence); a 58% decrease in upper limits of estimated fatalities.

The windfarm in question was installed before buffer zones were used as a mitigation. An analysis of distances from landscape features shows many of the turbines were located close to landscape features (73% of turbines had landscape features located within the recommended 50m buffer from wing tip to landscape feature); see table below. This appears to indicate that curtailment can work an alternative to buffer zones in some cases.

% of turbines	Distance to landscape feature
28	20m
38	21-40m
7	41-60m
4	60-95m
23	96m+