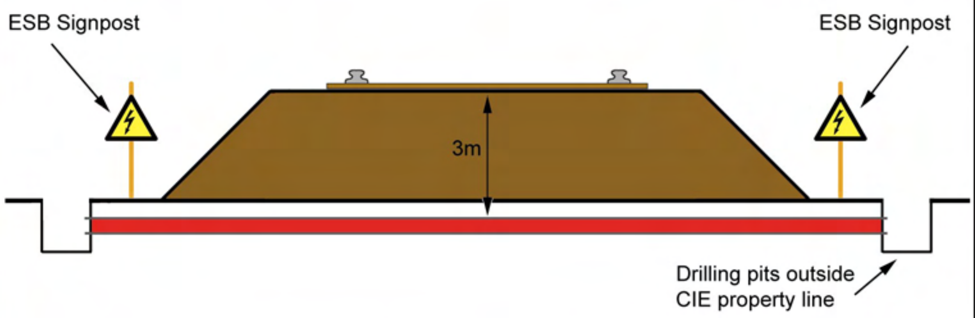
Standard Specification for ESB 38kV Networks Ducting/Cabling

ESB Networks

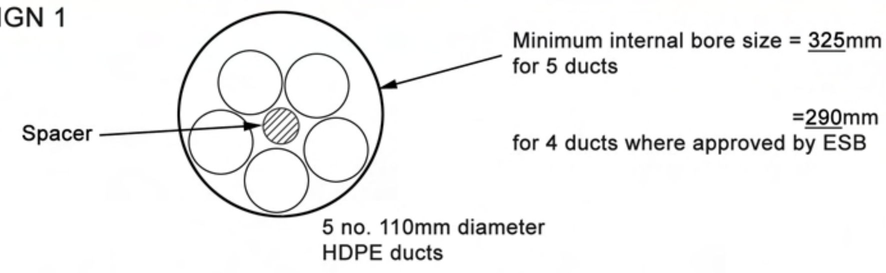
10A 38kV Railway Crossing Details



Formal licence for crossing and approval regquired from CIE.
Accurately record crossing location & erect marker posts.

10B Directional Drill/Thrust Bore Duct Bore Details

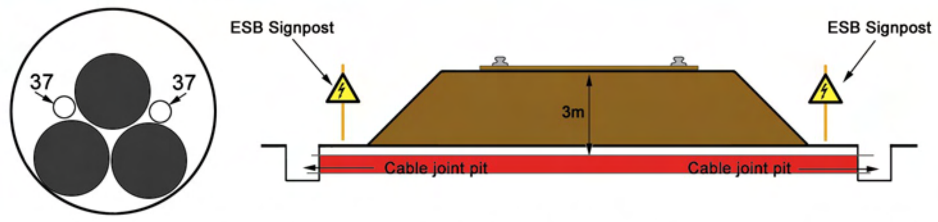
DESIGN 1



Alternatively use 2 x 37mm HDPE ducts for comms cables with C2 chamber on each side of the crossing to permit pulling along entire route. (See 10C)
Completed interstitial space to be bentonited thoroughly to maintain cable rating. Accurately record crossing location & erect marker posts.

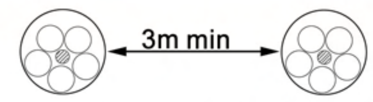
10C Directional Drill/Thrust Bore Duct Bore Details

ALTERNATIVE DESIGN

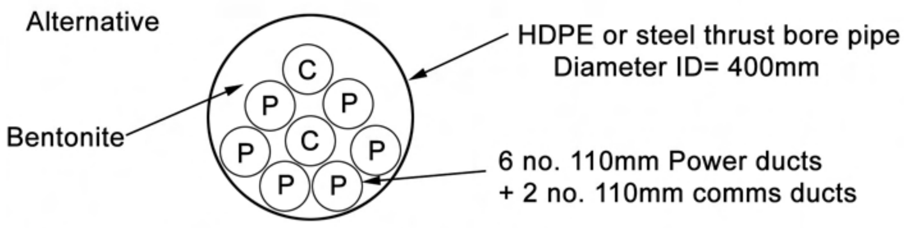


Install 1 no. 200mm SDR 17.6 duct with 3 no. short length cables pulled into this pipe along with 2 x 37mm comms ducts.
Full cable joint bays are required on either side of crossing along with C2 chambers for this design .
This method is used where it is not not practical to install large diameter pipe -eg. risk of ground upheaval or presence of obstructions.
Completed interstitial space to be thoroughly bentonited to maintain cable rating.
Accurately record crossing location & erect marker posts.

10D Double Circuit Bore Crossing

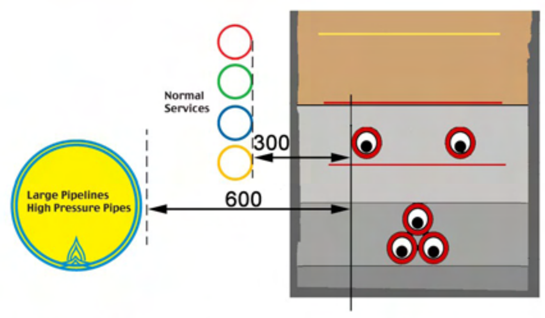


Separate drilling for each circuit crossing



2 no. sets of 110mm HDPE ducts - 8 ducts in total.
All crossings to be accurately recorded and signposts erected given impracticality of marker tape. If both circuits = 40MVA then use 630 Cu cable

12 Mininimum Standard Clearances to Other Services

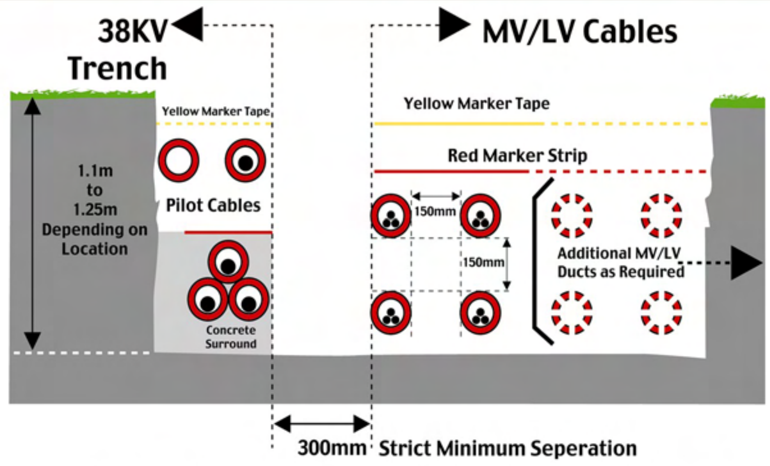


Clearances less than the above at pinch points and crossings requires placement of additional mechanical protection (concrete slab/brick) and agreement of ESB

ESB ducts must never be laid over other services on parallel runs, except with the written prior agreement of the other utilities and ESB

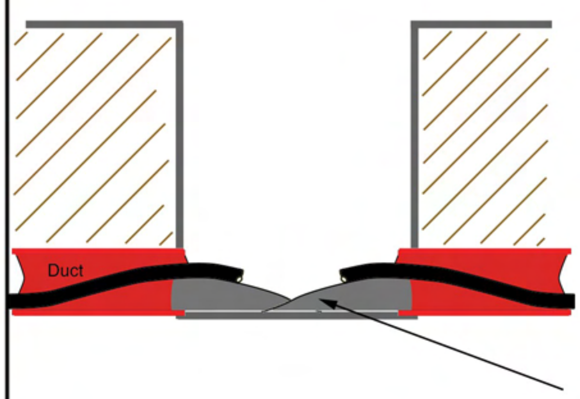
Other services must never be laid directly over ESB ducts on parallel runs

13 Combined MV & 38kV Cable Runs



Where it is impractical to avoid such trench runs, the seperation of 300mm should be strictly controlled and monitored to minimise derating (See MV/LV manual page 180)

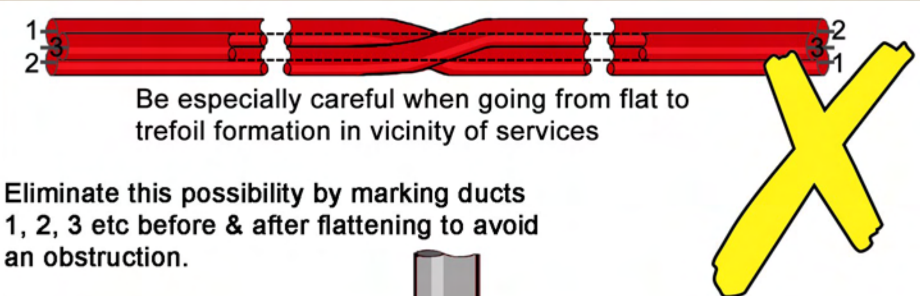
14 Sealing and Protection of 38kV Cables Once They Exit Ducts



Ducts to be thoroughly using ESB approved water sealant and 4hr fire rating approved for firestop.
NB - All joint bay duct entries to be thoroughly sealed to prevent sand washout and subsidence.

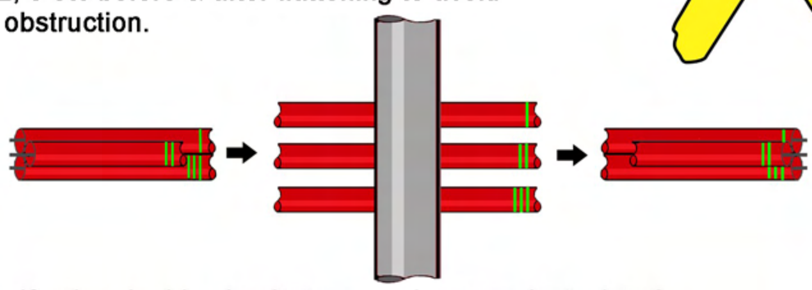
Sandbags or other durable support for cable as it exits ducts to prevent damage to cable sheath

15 Duct Crossovers Are Not Allowed



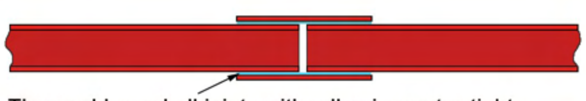
Be especially careful when going from flat to trefoil formation in vicinity of services

Eliminate this possibility by marking ducts 1, 2, 3 etc before & after flattening to avoid an obstruction.



NB. If using double circuit, tape mark power ducts 1 to 6

16 Crossing Dumps/Contaminated Ground

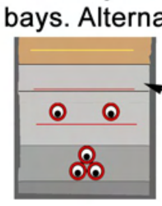


Thoroughly seal all joints with adhesive water-tight duct jointing compound and pressure test for airtightness.
Gasketed couplers alone are inadequate.

Fusion welded couplers are also acceptable but require red over-taping.

NB. Avoid whenever possible due to: Subsidence, methane gas & severe thermal derating risks.
Seek advice from ug networks section to ensure rating of cable is adequate (derating of 50% can occur)
NB. Waste oils and chemicals can also seriously damage cables

Seal all duct joints with duct adhesive compound or use continuous duct lengths & seal all duct ends in joint bays. Alternatively weld pipes.



Concrete is continued up to 300mm of final surface to offset derating
(CBM4 - 15N after 7 days)

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APPENDIX 5

ISMP

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CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

ANNAGH WIND FARM, CO, CORK

INVASIVE SPECIES MANAGEMENT PLAN

Prepared for: **EMPower Ltd.**

Date: **November 2021**

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1. INTRODUCTION

1.1 Introduction

Annagh Wind Farm Limited, a subsidiary of EMP Energy Limited (EMPower) intends to apply to Cork County Council for planning permission to construct the proposed Annagh Wind Farm, near Charleville, County Cork. The proposed development for which consent is being sought is as follows:

- Construction of 6 no. wind turbines with a blade tip height of 175m, rotor diameter of 150m and a hub height of 100m;
- Construction of turbine foundations and crane pad hardstanding areas;
- Construction of new site tracks and associated drainage infrastructure;
- Upgrading of existing tracks and associated drainage infrastructure where necessary;
- Upgrade of entrance onto Local Road L1322;
- All associated drainage and sediment control including the installation of new watercourse or drain crossings and the re-use or upgrading of existing internal watercourse and drain crossings;
- Construction of 1 no. permanent onsite 38kV electrical substation to ESBN specifications including:
  - Control building with welfare facilities;
  - Electrical infrastructure;
  - Parking;
  - Wastewater holding tank;
  - Rainwater harvesting;
  - Security fencing;
  - All associated infrastructure, services and site works.
- 1 no. temporary construction site compound and associated ancillary infrastructure including parking;
- Tree felling to facilitate construction and operation of the proposed development;
- Installation of medium voltage (20/33kV) and communication underground cabling between the proposed turbines and the proposed on-site substation and associated ancillary works;
- Erection of 1 no. permanent meteorological mast with a height of 100m above ground level and associated access track;
- Installation of medium voltage (up to 38kV) underground cabling between the proposed on-site substation and the existing Charleville substation and associated ancillary works. The proposed grid connection cable works will include 2 no. watercourse crossings and the installation of 8 no. pre-cast joint bays;
- All associated site development works;
- A 10 year planning permission and 35 year operational life from the date of commissioning of the entire wind farm.

Large components associated with the wind farm construction will be transported to site via the identified turbine delivery route (TDR). It is proposed that turbine deliveries shall approach the site from the North via Foynes Port, the N69, the N18, the M20, the N20 and L1322. Temporary accommodating works will be required at selected locations along the TDR to facilitate the delivery of large components to the site.

These temporary accommodating works (referred to as TDR Nodes) will be the subject of subsequent consent process outside of the current application. No other works along the TDR outside of the TDR Node locations are required.

The above can be summarised into three elements as follows:

- The Wind Farm Site: The proposed wind farm site includes lands in the townlands of Annagh North, Coolcaum, Cooliney and Fiddane County Cork. The site is accessed from the L1322 local road, which meets the N20 at Ballyhea, approximately 4km to the east of the proposed site entrance.
- The Grid Connection Route (GCR): It is proposed to supply the power from Annagh Wind Farm to the Irish electricity network via an underground 38kV cable to the existing Charleville 110kV Substation. The GCR passes through the townlands of Cooliney, Rathnacally, Farranshonikeen, Ardnageehy and Clashganniv. The proposed grid connection will travel along the L1322 upon leaving the wind farm site and terminate at Charleville 110 kV substation in the townland of Rathnacally, County Cork.
- The Turbine Delivery Route (TDR): The proposed Turbine Delivery Route passes through the townlands of Ballyhay, Clashganniv, Ardnageehy, Farranshonikeen, Rathnacally and Cooliney , Rathnacally, Farranshonikeen, Ardnageehy, Clashganniv, and Ballyhay after leaving the N20 at Ballyhay. Prior to this the TDR traverses the N69, M20, and N20 after exiting the Port of Foynes, County Limerick.

The information in this Invasive Species Management Plan has been compiled by Fehily Timoney & Company (FT), on behalf of the applicant. It provides information on the control of invasive species during construction works and maintenance associated with the proposed development as described above.

1.2 Legislation

In Ireland, it is an offence to spread and propagate species listed in the third schedule of S.I. No. 477/2011 European Communities (Birds and Natural Habitats) Regulations 2011 to 2021. Under Regulation 49 paragraph (2) "*Save in accordance with a licence granted under paragraph (7), any person who plants, disperses, allows or causes to disperse, spreads or otherwise causes to grow in any place specified in relation to such plant in the third column of Part 1 of the Third Schedule, any plant which is included in Part 1 of the Third Schedule, shall be guilty of an offence*".

Additionally, Article 52(7) of the Wildlife Act, 1976 (as amended) states that '*Any person who— [...] plants or otherwise causes to grow in a wild state in any place in the State any species of flora, or the flowers, roots, seeds or spores of flora, ['refers only to exotic ISMP species thereof'][...] otherwise than under and in accordance with a licence granted in that behalf by the Minister shall be guilty of an offence.*'

In keeping with these pieces of legislation, the overall aim of this management plan is to put in place systems to control the spread of invasive species during construction and operation of the proposed development.

This document provides background information on the non-native invasive species present, mapping of their location, and their extent within the proposed development. It provides a legal context, sources of information including policy and guidelines to which cognisance has been paid, and the means of controlling the species safely using prevention, containment, treatment, monitoring, follow up treatment, record keeping and appropriate disposal as might be necessary.

1.3 Non-Native Invasive Species

The National Biodiversity Data Centre (Invasive Alien Species in Ireland) has published a Catalogue of Ireland's Non-native Species (CINS)[1] which provides species profiles, species distribution, identification keys, ecology, pathways of introduction, and risk assessment score. This Catalogue includes the 66 regulated Invasive Alien Species of Union concern identified in '*Regulation on the prevention and management of the introduction and spread of invasive alien species [1143/2014]*', as well as the 48 non-native High Impact[2] species and 78 Medium Impact[3] species in Ireland as identified in the national Prioritisation Risk Assessment carried out in 2013. Also included are the Watch List[4] species which are species with potential to become invasive (at a high risk level) if introduced to Ireland.

In 2014 a second detailed assessment of the risks and uncertainties surrounding a particular species, group of species or pathway of concern was carried out, called the '*Non-native species APplication based Risk Analysis (NAPRA)*'. Not all non-native species present in Ireland were included in the risk assessment. The list of species for which the risk assessments were conducted are available online at http://nonnativespecies.ie/species-list/.

For clarity, the non-native invasive species considered for inclusion in this management plan are those listed in Ireland's Catalogue of Non-native Species and those subject to risk assessment in 2014.

[1] https://species.biodiversityireland.ie/?keyword=Catalogue%2520of%2520Irelands%2520Non-native%2520Species

[2] https://www.biodiversityireland.ie/wordpress/wp-content/uploads/Invasives_taggedlist_HighImpact_2013RA-1.pdf

[3] https://www.biodiversityireland.ie/wordpress/wp-content/uploads/Invasives_taggedMediumImpact_2013RA-2.pdf

[4] https://www.biodiversityireland.ie/wordpress/wp-content/uploads/Invasives_tagged_PotentialHighmpact_2013RA-1.pdf

2. METHODOLOGY

2.1 Relevant Guidance

This management plan has been devised in consideration of the following relevant guidance:

- Ireland's Invasive Species Website: https://invasives.ie/
- NRA, (2010). Guidelines on the Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads. Revision 1, December 2010. National Roads Authority
- IW-AMP-SOP-009 Information and Guidance Document on Japanese knotweed
- O'Flynn, C., Kelly, J. and Lysaght, L. (2014). Ireland's invasive and non-native species – trends in introductions. National Biodiversity Data Centre Series No. 2. Ireland
- Tu, M., (2009). Assessing and Managing Species within Protected Areas. Protected Area Quick Guide Series. Editor J., Ervin, Arlington, VA. The Nature Conservancy, 40 pp.
- Stokes et al., (2004). Invasive Species in Ireland. Unpublished report to Environment and Heritage Service and National Parks and Wildlife Service. Quercus, Queens University Belfast, Belfast.
- Circular Letter NPWS 2/08 Use of Herbicide Spray on Vegetated Road Verges (National Parks and Wildlife Service 2008)

2.2 Desktop Study

A desktop study was carried out to identify existing records of invasive flora species both within and adjacent to the proposed development. The suitability of the habitats within the proposed development footprint were also considered in determining the potential for invasive species, having regard to the species profiles and ecology set out in the Catalogue of Ireland's Non-native Species. The following sources of information were used:

- OSI Aerial photography and 1:50000 mapping;
- National Parks and Wildlife Service (NPWS) mapping;
- National Biodiversity Data Centre (NBDC) mapping and datasets;
- Note there are no botanical records available from the Botanical Society of Britain and Ireland 2km Grid square R51D, which encompasses the proposed wind farm development.

2.3 Mapping and Evaluation of Invasive Species

An invasive species survey of the main wind farm site was undertaken on 29th June, 2nd, 14th and 15th July 2020 by FT ecologists. A site survey along the grid connection and turbine delivery route nodes were undertaken between the 10th – 11th June 2021 (FT ecologists). The location and extent of the invasive species were recorded using a handheld GPS.

The extent of invasive species recorded within the proposed Annagh wind farm and GCR is presented in Figure 3-1The invasive species recorded at TDR Nodes are detailed in Table 3-3.

3. EXISTING ENVIRONMENT

3.1 Desktop Records

Historical records of invasive species from the relevant national datasets were assessed through the National Biodiversity Data Centre on the 26th August 2021. A total of four invasive species were identified within both 2 km and 10 km grid squares encompassing the wind farm site and the 1km grid square overlapping the grid connection (listed in Table 3-1 below):

Table 3-1: Historical invasive species records within 10km and 2km grid squares overlapping Wind Farm and 1km squares overlapping the Grid Connection Route and TDR Nodes

Species	1km (Grid Cable Route/TDR Nodes)	2km (wind farm)	10km (wind farm)	Invasive Impact	Legal Status	Recorded in study area
Cherry Laurel *Prunus laurocerasus*	R5219 (GCR) (Nodes 10.5 – 10.7)	-	R51	High Risk	None	Planted along northern boundary of study area.
Japanese Knotweed *Fallopia japonica*	None (GCR)	-	R41	High Risk	Third Schedule	No
Sycamore *Acer pseudoplatanus*	R5219 (GCR) (Nodes 10.5 – 10.7)	-	R41, R51	Medium Risk	None	Present in some treelines in northern part of study area.
Russian-vine *Fallopia baldschuanica*	None (GCR)	-	R51	Medium Risk	None	No
Winter Heliotrope *Petasites fragrans*	R5053 (Node 4)	-	-	Low Risk	None	No
Canadian Waterweed *Elodea canadensis*	R5455 (Nodes 5 & 6)	-	-	High Risk	Third Schedule	No
Giant Hogweed *Heracleum mantegazzianum*	R5238 (Node 8)	-	-	High Risk	Third Schedule	No

3.2 Results of Field Survey and Mapping

The field survey detected 13 non-native invasive species during surveys of the proposed Annagh wind farm, GCR, and TDR. Within these, a total of nine have had their invasiveness risk evaluated, while a further four have not been formally assessed in terms of invasiveness (NBDC, 2021). One of the species recorded is Third Schedule listed (Spanish Bluebell).

The non-native species recorded at the wind farm site, GCR and TDR Nodes are listed below in Table 3-2, while specific results for TDR Nodes are detailed in Table 3-3.

The location of invasive/non-native species recorded at the wind farm site and along the GCR are shown in Figure 3-1.

Table 3-2: Non-native species and relevant project elements (Third Schedule listed species shown in bold)

Species	Risk of Invasiveness (NBDC Classification)	Wind farm	Grid Connection	TDR
Cherry Laurel *Prunus laurocerasus*	High	✓	✓	✓
Sycamore *Acer pseudoplatanus*	Medium	✓	✓	✓
Wilson's Honeysuckle *Lonicera nitida*	Not assessed	✓	✓	✓
Montbretia *Crocosmia* X *crocosmiflora*	Not assessed	✓	X	X
Snowberry *Symphoricarpos albus*	Low	X	✓	✓
Flowering Currant *Ribes sanguineum*	Not assessed	X	✓	X
Red Osier Dogwood *Cornus sericea*	Low	X	X	✓
Old Man's Beard *Clematis vitalba*	Medium	X	X	✓
Butterfly Bush *Buddleja davidii*	Medium	X	X	✓
Norway Maple *Acer platanoides*	Low	X	X	✓
Spanish Bluebell *Hyacinthoides hispanica*	**Low**	X	X	✓
Small-leaved Lime *Tilia cordata*	Not assessed	X	X	✓
Turkey Oak *Quercus cerris*	Medium	X	X	✓

Table 3-3 below details the invasive species recorded at TDR Nodes, including the relative location of plant growths to TDR Node footprints:

Table 3-3: Invasive/Non-native Species at TDR Nodes (Third Schedule listed species shown in bold)

Species	Invasive Impact	Location
Node 2 – Port Access Road/N69		
Red Osier Dogwood *Cornus sericea*	Low Risk	Node 2.0 - Ornamental planting in oversail area footprint
Old Man's Beard *Clematis vitalba*	Medium Risk	Node 2.0 - Growing in pine tree in oversail area footprint
Butterfly Bush *Buddleja davidii*	Medium Risk	Node 2.3 - Ornamental planting immediately adjacent to outer extent of trailer path
Node 4 – Clarina Roundabout		
Norway Maple *Acer platanoides*	Low Risk	Ornamental planting in load bearing footprint
Spanish Bluebell *Hyacinthoides hispanica*	Low Risk/ **Third Schedule**	Ornamental outside load bearing footprint (c. 10m away)
Node 5 -Mungret Interchange – Western Roundabout		
Norway Maple *Acer platanoides*	Low Risk	Ornamental planting in load bearing footprint
Small-Leaved Lime *Tilia cordata*	Not assessed	Ornamental planting outside load bearing & oversail footprint
Node 6 -Mungret Interchange – Eastern Roundabout		
Norway Maple *Acer platanoides*	Low Risk	Ornamental planting outside load bearing & oversail footprint
Small-Leaved Lime *Tilia cordata*	Not assessed	Ornamental planting outside load bearing & oversail footprint
Node 7 – M20/N20 Off-ramp Southbound		
Red Osier Dogwood *Cornus sericea*	Low Risk	Ornamental planting in oversail area footprint
Turkey Oak *Quercus cerris*	Medium Risk	Ornamental planting in oversail area footprint
Node 8 – N20 Right Curve Ballymacrory		
No invasive species.	-	-
Node 9 – N20/L1322 Junction Ballyhea		
No invasive species.	-	-
Node 10 – L1322		
Sycamore *Acer pseudoplatanus*	Medium Risk	Node 10.3 – in hedgerow in oversail area footprint;

Species	Invasive Impact	Location
		Node 10.5 – grassy bank/hedgerow in oversail area footprint; Node 10.10 – grassy bank/hedgerow in oversail area footprint Node 10.11 – in woodland in bell-mouth entrance footprint
Wilson's Honeysuckle *Lonicera nitida*	Not assessed	Node 10.3 – in hedgerow in oversail area footprint Node 10.11 – in woodland in bell-mouth entrance footprint
Cherry Laurel *Prunus laurocerasus*	High Risk	Node 10.6 – in garden immediately adjacent to oversail area footprint
Snowberry *Symphoricarpus albus*	Low Risk	Node 10.9 – in hedgerow in oversail area footprint; Node 10.10 – in hedgerow in oversail area footprint

3.3 Location and links to Sensitive Habitats

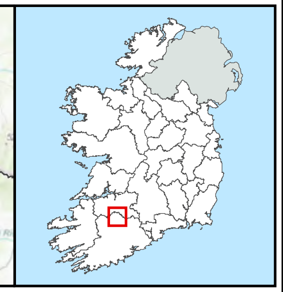
Montbretia is present along the Oakfront River, which is a tributary of the River Awbeg, part of which is within the Blackwater (Cork/Waterford) SAC. This species could spread via the river network by transportation of seeds and/or disturbed corms. Spread could occur unaided, or through disturbance of plants and movement of vector material. However, it is noted that no proposed works overlap the area where Montbretia is located.

Invasive species near watercourses could be spread via drainage channels and streams if vector material enters the hydrological network. An indirect effect could arise from siltation and nutrient input caused by disturbance of drains, riverbanks or adjacent ground if mechanical clearance is undertaken (including excavation and mechanical destruction of vegetation).

The inappropriate use of herbicides near watercourses could have negative effects on aquatic ecology.

Where invasive species are present in hedgerows, their removal may affect the hedgerow through collateral damage of adjacent native species, and by the physical alteration resulting from removal of invasive shrubs which contribute to the structure of the hedgerow.

Path: R:\Map Production\2020\P2359\Workspace\EIAR\P2359_GIS_Fig8-9_InvasiveSpecies_A3.mxd



Legend

Site Boundary

Underground Cable Route

Invasive Species:

Cherry Laurel

Flowering Currant

Montbretia

Snowberry

Sycamore

Wilson's Honeysuckle

TITLE: Invasive Species at Site Entrance and along Grid Connection			
PROJECT: Annagh Wind Farm			
FIGURE NO:	3.1		
CLIENT:	EMP Group		
SCALE:	1:18000	**REVISION:**	0
DATE:	13/10/2021	**PAGE SIZE:**	A3

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0 0.25 0.5 1 Kilometers

4. INVASIVE/NON-NATIVE SPECIES ACCOUNTS

The International Union for Conservation of Nature (IUCN) in their 'IUCN Guidelines for the Prevention of Biodiversity Loss Caused by Alien Invasive Species' 2000 paper describes non-native invasive species (referred to as an invasive species) as:

> "*an alien species which becomes established in natural or semi-natural ecosystems or habitat, is an agent of change, and threatens native biological diversity*".

The 13 non-native species listed below were recorded at the proposed main windfarm site, grid connection route and/or TDR Nodes. Accounts of these species, summaries of their ecology, growth and management periods, and distribution are included below. The species in bold are included in the Third Schedule.

It is noted that within the group of species not included in the 2014 NAPRA risk assessment, only Montbretia is known to be aggressively invasive. Small-Leaved Lime is unlikely to pose problems outside of semi-natural native woodland settings.

Species formally identified as invasive:

- **Spanish Bluebell (*Hyacinthoides hispanica*)**
- Sycamore (*Acer pseudoplatanus*)
- Cherry Laurel (*Prunus laurocerasus*)
- Snowberry (*Symphoricarpos albus*)
- Red Osier Dogwood (*Cornus sericea*)
- Old Man's Beard (*Clematis vitalba*)
- Butterfly Bush (*Buddleja davidii*)
- Norway Maple (*Acer platanoides*)
- Turkey Oak (*Quercus cerris*)

Non-native species not yet risk assessed for invasiveness:

- Flowering Currant (*Ribes sanguineum*)
- Small-Leaved Lime (*Tilia cordata*)
- Wilson's Honeysuckle (*Lonicera nitida*)
- Montbretia (*Crocosmia* X *crocosmiflora*)

The following species: Spanish Bluebell, Butterfly Bush, and Flowering Currant are outside but adjacent to the proposed footprint of works. As such measures have been included on a precautionary basis in the event they need to be implemented (i.e. if they spread or there is a risk of interaction with seeds/underground plant material due to proximity). Small-leaved Lime is outside the proposed footprint; no measures are required for this species. Montbretia is outside the proposed footprint and no interaction with works is likely. Measures to remove Montbretia are proposed in order to enhance the ecology of the Site.

4.1 Sycamore (*Acer pseudoplatanus*)

4.1.1 Species Ecology

The Sycamore tree can grow up to 35m tall and has a distinctive fruit with wings. Originally it was thought to be damaging to native woodlands and to support a much narrower range of diversity than native species. However, it has been shown to support a wide range of lichens and other species. The principal concern would be Sycamore dominated woodlands, though Sycamore seedlings are out competed by ash under Sycamore canopy and vice versa, suggesting that there is a pattern of succession in mixed woodlands. Undisturbed woodlands have relatively few Sycamore trees compared to disturbed sites, even when Sycamore trees are present at nearby sites. Poor growth of Sycamore in dry conditions suggests that careful management of forests can mitigate any effects of sycamore invasion. Sycamore is of medium invasive impact when growing in native woodland areas.

Plate 4-1: Sycamore Leaf. Source : Biodiversityireland.ie (August 2021)

4.1.2 Timeframe

Control and disposal of plant material is best carried out before seeds are produced. As is common with invasive species, careful monitoring and follow-up applications of herbicides may be necessary.

4.2 Cherry Laurel (*Prunus laurocerus*)

4.2.1 Species Ecology

Cherry Laurel is an evergreen shrub that forms dense thickets comprised of either a single stem or multiple stems (especially if it has been trimmed). The thick evergreen 5-15cm long oblong-ovate leaves are glossy green on the surface and pale underneath. Leaves are arranged alternately on short leaf stalks and leaf edges are toothed with pointed tips. Small white fragrant flowers are held in clusters (racemes) and flowers are comprised of five petals and many yellow stamens. The fruits are purple/black and cherry-like and held in clusters.

Plate 4-2: Cherry Laurel. Source: Kingcounty.gov (August 2021)

4.2.2 Timeframe

Cherry Laurel can be cut down at any time of year; the herbicide glyphosate can also be applied throughout the year, however May to October inclusive is a sub-optimal period. Of principle concern when cutting and/or moving vegetation or surrounding soil would be the movement of viable seeds. As such the optimal time for cutting would be outside the flowering and fruiting period.

4.3 Wilson's Honeysuckle (*Lonicera nitida*)

4.3.1 Species Ecology

Wilson's Honeysuckle is a woody shrub with many thin, round glandular/hairy stems, arching branches and a bushy growth habit. The leaves are miniscule, opposite, oval, green and waxy. Flowers are also small, usually in pairs at leaf-axils, five-lobed, white-pale yellow, and covered in glands with a robust stigma extending above the petals (Plate 4-3).

Plate 4-3: Wilson's Honeysuckle. Source: naturespot.org.uk; credit: Graham Calow (August 2021)

It is widely planted and established, and primarily associated with roadsides and hedgerows. This plant produces berries, which could potentially be dispersed by animals or human intervention. Its risk of impact on native Irish species has not been assessed.

4.3.2 Timeframe

Physical control should preferably be undertaken before seeds are produced, to reduce the likelihood of reproductive spread.

4.4 Montbretia (*Crocosmia* X *crocosmiflora*)

4.4.1 Species Ecology

Montbretia (*Crocosmia* X *crocosmiflora*) is an invasive perennial that grows from underground corms. The X within its scientific name indicates it is a hybridised species. The species was developed in France for horticultural use and has since escaped and is naturalised throughout Ireland. Montbretia can survive in most open habitat types such as wet grassland, gardens and roadsides.

Due to fast growth rates, Montbretia outcompetes other species, dominating the habitats to which it is introduced. This dominance can impact native species and processes within these habitats. Dense tussocks of Montbretia can prevent the regeneration of seedlings and saplings, thus preventing natural re-generation of woodland (DAFM, 2016).

Montbretia flowers are reddish to orange in colour. They can be between 25 to 55mm long and are arranged loosely along two opposite sides of the flower stem, in a zig-zag formation (Plate 4-4). They have a hollow tubular corolla with six petals. The green leaves are 'grass-like', long, narrow, soft, and hairless. Leaves also have pointed tips and can reach 30-80cm long.

Montbretia spreads vegetatively using underground corms and rhizome fragments. The corm is bulb-like and stores energy for survival during the winter months. It is estimated that each Montbretia plant can produce 14 new corms annually. These corms are thought to break off from the parent plant, thus spreading further into the habitat. The corms, corm fragments and rhizomes can be spread unintentionally because of ground disturbance, dumping of garden waste and by attaching to machinery.

Plate 4-4: Montbretia flowers. Source: Wildflowersofireland.net (August 2021)

4.4.2 Timeframe

Montbretia growth begins in early spring with leaves sprouting from the ground in March. The plant flowers between July and September. The most effective time to remove Montbretia is just before full flowering occurs in summer (DAFM, 2016).

4.5 Snowberry (*Symphoricarpos albus*)

Snowberry is an invasive, often overlooked, species that is often present in hedgerows. Other than its pale white fruit, the species seems to blend into the other species within the habitat. Snowberry is a twiggy and straggly plant, which can reach over 2.5m high, often suspended using suckers. Snowberry impacts habitats and species as it forms dense thickets that outcompete native vegetation.

4.5.1 Species Ecology

Snowberry produces small pale-pink 'funnel-shaped' flowers with five pale-petalled flowers (4-6mm across), which flower from June to September. Its oval leaves are small and untoothed. In autumn the berries are round (1.5-2cm diameter) and whiten when ripe. Each berry contains two seeds. This plant was introduced from North America. It is thought that bird species within Ireland have not yet adapted to feed upon berries of such a colour, as no native plant in Ireland holds ripe white berries.

Plate 4-5: Snowberry berry and leaves. Source: www.nonnativespecies.org (August 2021)

4.5.2 Timeframe

Snowberry comes into flower from June to September; their berries are ripe in Autumn. As such, the optimal time for treatment would be outside the flowering and fruiting period.

4.6 Red Osier Dogwood (*Cornus sericea*)

4.6.1 Species Ecology

Red Osier Dogwood is a deciduous shrub that stands up to 6m tall. Between June and July (and sporadically in autumn) it produces small dense creamy white-yellow flowers. These flowers are four-petalled (8-10mm) in a flat topped head, with a faintly foetid smell. This species produces white berries. The leaves are pointed ovals in shape with tapering points, opposite, stalked with prominent veins and redden in autumn. These red leaves make it easy to identify in winter. Plate 4-6 displays characteristic features of red osier dogwood.

Red Osier Dogwood has the potential to outcompete native hedgerow or woodland. It has only been recorded in a few wetland habitats across Ireland. It is classified by the National Biodiversity Data Centre as having a risk of low impact on native Irish species.

Pointed oval leaves showing characteristic reddening, red veins and white berries.

Creamy white flowers in a flat top head

Red twigs

Plate 4-6: Characteristic features of Red Osier Dogwood. Source: www.wikipedia.org (August 2021)

4.6.2 *Timeframe*

Red Osier Dogwood spreads via its seeds contained within its white berry-like fruits or frequently via vegetative runners, resulting in colonies of shrubs. Therefore, it is recommended to avoid treatment during fruiting, and conduct treatment in winter and spring.

4.7 Old Man's Beard (*Clematis vitalba*)

4.7.1 *Species Ecology*

This deciduous perennial is a climber that can reach heights of 10-15m meters and will use structures and other plants to climb. The flower produces 2cm (across) fragrant cream flowers comprised of four sepals and many spread out stamens. Flowers are borne in clusters from July to September. Seed clusters are produced and have a feathered (achenes) appearance and are white to grey in colour. Leaves are opposite pinnately compound with three to five levels and are elliptical shaped with rough toothed margins.

Plate 4-7: Old Man's Beard leaves. Source: woodlandtrust.org (Dec 2020)

This garden escapee reproduces predominantly via seed, but re-growth from vegetative material has also been known to occur. It is mainly found in alkaline soils and is common along Irish roadsides and hedgerows. This plant impacts surrounding plants by using them as a climbing frame and competing for light. It can form a dense carpet covering the crowns of trees. It has been assessed by the National Biodiversity Data Centre as having a medium risk of impact on native Irish species.

4.7.2 Timeframe

Removal is most successful when carried out in winter when the vines can be more easily removed.

4.8 Butterfly Bush (*Buddleia davidii*)

4.8.1 Species Ecology

The Butterfly Bush is a multi-stemmed shrub that can reach 4m in height. From June to September, the arching branches bear conical panicles of lilac flowers, which may occasionally be white, pink, red or purple. Leaves are long and serrated along the edges. In the winter, flower heads and seed capsules remain despite the plant being deciduous. Up to 3 million seeds are produced per plant and can remain dormant in the soil for many years. Butterfly Bush is common throughout Ireland. It spreads through abundant seed dispersal by wind and draught behind vehicles. While being a valuable source of nectar, especially for butterflies, *Buddleia* can cause structural damage to buildings by rooting in cracks in masonry.

Plate 4-8: Butterfly Bush (*Buddleia daviddii*) Source: wildflowers of Ireland (Dec 2020)

4.8.2 *Timeframe*

Optimal time for treatment and/or movement of material is outside of flowering and seed-bearing periods and treatment should be undertaken in winter and spring.

4.9 Norway Maple (*Acer platanoides*)

4.9.1 Species Ecology

The Norway Maple is deciduous broadleaf tree that reaches heights of 25m. The bark of this tree is grey with fine ridges. Twigs are slender and brown with small white spots. In winter, this species is identified by individual green and red buds. Leaves are palmate, five-lobes and with few pointed teeth (Plate 4-9). Flowers are bright green growing in clusters up to 30. Winged seeds fall in autumn and are dispersed by wind. It is classified as having a low risk of impact by the National Biodiversity Data Centre.

Plate 4-9: Norway Maple Fruit and Leaves. Credit: Tim Gatney/Alamy Stock Photo, Source: woodlandtrust.org.uk (August 2021)

4.9.2 Timeframe

Removal of Norway Maple should occur before flowering to ensure seeds are not produced, leading to further dispersal.

4.10 Spanish Bluebell (*Hyacinthoides hispanica*)

4.10.1 Species Ecology

Spanish Bluebell (*Hyacinthoides hispanica*) is native to the Iberian Peninsula. It was introduced into Britain and Ireland as an ornamental plant but since has become invasive. The main threats associated with the species include hybridisation with the native Bluebell (*Hyacinthoides non-scripta*) and their ability to spread out competes other flora thus limiting the species diversity of an area.

The species is abundant in terrestrial dry woodlands and gardens. The species, unlike Japanese Knotweed, can spread both by seed and vegetatively, through the growth of roots leading to new bulbs being formed. The Native and Spanish Bluebell are closely related species, thus making hybridisation easier, which has negative implications for the native population.

Spanish Bluebell is a perennial herb with white spherical bulbs. It has narrow green leaves of 20 to 50cm in length. Each bulb has 4-6 leaves that become erect before flowering, then collapse later in the season . Their bell-shaped flowers are visible from April to June and are a lilac to blue colour. Anthers, within the flower are blue, in comparison to those of the native species, which are creamy white. The Spanish Bluebell dies back once seeds have been produced in late summer.

Plate 4-10: Spanish Bluebell (Paul, 2016)

4.10.2 Timeframe

The optimal time for treatment is in spring before flowers emerge; this will prevent the plant reproducing sexually and setting seed.

4.11 Small-Leaved Lime (*Tilia cordata*)

4.11.1 Species Ecology

The small leaved lime is a deciduous tree reaching over 20m in height. The grey-brown bark is smooth and develops flaky plates as it ages. The brown-red twigs appear shiny in sunlight. Leaves are heart shaped, between 3-8 cm in length and feature a pointed tip.

These leaves are hairless on top but have reddish-brown tufts on vein-joints on the leaf underside. This hermaphroditic species has green-yellow flowers with five petals, which grow in clusters of four to ten. Fruits are smooth with pointed tips (Plate 4-11).

Plate 4-11: Leaves of Small Leaved Lime. Source: woodlandtrust.org.uk, Credit: Paul Sterry/WTML (August 2021).

This introduced species has not been assessed by the National Biodiversity Data Centre for Invasiveness and is long-established in Ireland.

4.11.2 Timeframe

Removal of Small Leaved Lime should occur before flowering to ensure fruits and seeds are not produced, leading to further dispersal.

4.12 Turkey Oak (*Quercus cerris*)

4.12.1 Species Ecology

Turkey Oak is a deciduous broadleaved tree growing up to 40m tall. The deeply fissured dark grey bark can sometimes be scaly. The dark green leaves (9-12cm long) have 4-9 lobes, which are pointed and glossy with a felted underside. This tree produces small yellow catkins and small flowers. Following pollination, acorns are produced. These acorns have a green-brown tip with an orange base, with a cup covered in long scales. This species is host to three species of gall wasp, which damage native oak species upon moving from Turkey Oak, which acts as a vector for these gall wasps. The Turkey Oak was assessed to have a risk of medium impact as an invasive species by the National Biodiversity Data Centre.

Plate 4-12: Characteristic features (Acorns, Catkins, Leaves) of the Turkey Oak. Source: WoodlandTrust.org.uk, Credit: Clare Topping/WTML; Zoonar Gmbh/Alamy Stock Photo; FLPA/Alamy Stock Photo (August 2021).

4.12.2 *Timeframe*

Removal of Turkey Oak should occur before flowering to ensure fruits and seeds are not produced, leading to further dispersal.

4.13 Flowering Currant (*Ribes sanguineum*)

4.13.1 Species Ecology

This is a deciduous flowering shrub with bright green palmate leaves and an upright growth form made up of many thin stems. The bright pink flowers are borne in drooping bunches at the tips of branches. Plate 4-13 displays characteristic features of Flowering Currant.

Plate 4-13: Characteristic features of Flowering Currant. Source: wikipedia.org, Credit: Mark Robinson (August 2021).

It was introduced from North America in the 1800s and has since become naturalised, aided by birds that feed on its berries and disperse it's seed. Its risk of impact on native Irish species has not been assessed.

4.13.2 Timeframe

Physical control should preferably be undertaken before seeds are produced, to reduce the likelihood of reproductive spread.

5. PROPOSED MEASURES FOR THE MANAGEMENT OF INVASIVE SPECIES WITHIN AND ADJACENT TO THE PROPOSED DEVELOPMENT

It is recommended that a qualified and competent specialist in the treatment of invasive plant species, with appropriate experience and expertise, is employed for the duration of the project to ensure that all the measures proposed in relation to the Invasive Species Management Plan are implemented.

Specific consideration will be given to particular locations, due to their potential for disturbance during works. It is proposed to fell Sycamore trees at the site entrance, which contains Sycamore and Wilson's Honeysuckle; Cherry Laurel is also present in an adjacent hedgerow within the site entrance footprint. The footprint of proposed works at a number of TDR Nodes also overlaps invasive species growth (see Table 3-3), with potential for spread arising from ground works and/or vegetation trimming. It is noted that control measures along the TDR are only required at Nodes where works may interact with invasive species.

Control and removal of Montbretia (located outside the proposed development footprint) is advocated to enhance the site's environment and prevent the site acting as a reservoir for the spread of invasive species to other areas. This species is present near the entrance along the Oakfront stream, but not in the footprint of works.

As a general rule, where invasive species are within the footprint of proposed works, they must be contained and disposed of correctly. Where they are outside the proposed footprint, avoidance can be relied on where feasible to prevent their spread.

As such, options for avoidance, control and removal are detailed below.

5.1 General Measures

While it is extremely important and more efficient to contain invasive species at the point of infestation, care shall be taken ensure that invasive species are not spread outside the site.

Invasive Species Ireland (ISI) notes that invasive non-native species are the second greatest threat (after habitat destruction) to worldwide biodiversity. Invasive species negatively impact Ireland's native species by changing habitats and ultimately threatening ecosystems, which impacts on biodiversity as well as economics, as they are costly to eradicate.

Halting the spread of non-native invasive species can be achieved via prevention, containment, treatment and eradication (ISI, 2021).

5.1.1 Prevention

Prevention of the spread of invasive species will be achieved by:

- The full implementation of the invasive species management plan in conjunction with a competent and experienced Invasive Species Specialist Contractor.
- Supervision of control measures and treatment works by an appropriately qualified ecologist or invasive species specialist.

- Raising awareness of site workers via toolbox talks given by a suitably qualified person as part of site introduction, informing workers what to look out for and what procedure to follow if they observe an invasive species.
- Only planting or sowing native species within the proposed Annagh Wind Farm site, GCR and TDR will be allowed.
- Where invasive species are physically removed, disturbed soil will be seeded or replanted (including 5cm deep mulch) with native plant species. This will prevent the colonisation of bare soil by invasive species in the area.
- Unwanted material originating from the site will be transported off site by an appropriately licensed waste contractor and disposed of properly at a suitably licenced facility.
- Signs will warn people working there that there is invasive species contamination.
- Stockpiles of soil contaminated Spanish Bluebell and or other invasive species are to be indicated clearly with appropriate signs and isolated.
- Ensure good hygiene practices.
- Remove the build-up of soil on equipment.
- Keep equipment clean.
- Do not move fouled equipment from one site to another.
- All vehicles exiting the site will be washed down with a pressure washer to prevent the transport of seeds, since this cannot be prevented comprehensively by any other measure.
- Wastewater from washing facilities will be stored securely and treated to prevent spread outside the site.
- Footwear and clothing of operatives working near invasive species will be checked for seeds, fruits, or other viable material before exiting the site.

5.1.2 Containment

The three most common ways a site can become infected are:

1. Importation of infected soil.
2. Contamination on vehicles and equipment.
3. Illegal dumping.

Containment of invasive species will be achieved by:

- A pre-construction survey to reconfirm the findings of the EIAR during the growing season immediately prior to the construction phase. This will mark out the extent of invasive plant species. This survey shall inform the finalised draft of the invasive species management plan prior to the commencement of works. Prior to the construction phase, invasive species are to be treated (Section 5.2 for treatment methods).
- Cordoning of invasive species outside the works footprint shall include a buffer of 1m surrounding the area of infestation.

This will prevent plants with underground rhizomes being transported to other sections of the site and it will also prevent contact with plants which could result in the transport of seed, fruit or vegetation to other parts of the site. No construction works will occur within exclusion zones prior to the eradication of invasive species.

- No machinery or personnel shall be allowed within exclusion zones. Similarly, there shall be no storage of materials within or adjacent exclusion zones.
- No soil or vegetation shall be removed from this area unless it is contained and is transported via an appropriately licensed waste contractor to a suitably licenced facility for treatment.
- Informing all site staff through toolbox talks as part of site inductions.
- Any new sightings of invasive plant species shall be relayed to construction staff and the developer. These areas shall follow the same protocol as current infested areas.
- It is possible, particularly in the first year of control, that new plants will sprout following the initial removal/treatment, either because shade suppression will be reduced or due to soil disturbance. As such, several additional visits will likely be required. Three visits, May/June, July/August and September/October should be sufficient to catch all regrowth, although, a cautionary approach is advisable. Plants that germinate after September/October are very unlikely to have sufficient time to complete their life cycle and produce seeds.

5.1.3 Prevent Spread:

- Import only clean soil from known sources.
- Ensure all vehicles and equipment are cleaned to avoid cross contamination.
- Follow instructions provided for containment of invasive species (Section 5.1.2).
- Promote native species and biodiversity, only native species are to be introduced to the site.
- Report all sightings.

5.2 Species-Specific Measures

5.2.1 Sycamore

Generally, site-wide control measures for this species are not required; however, Sycamore will not be planted as part of landscaping. Control will focus on the correct disposal of cut material in areas where Sycamore felling and trimming is required. Sycamore reproductive plant material is required to be carefully disposed of.

The contractor must appropriately dispose of Sycamore plant material in accordance with the NRA (2010) guidelines, where cut, pulled or mown non-native invasive plant material arises, its disposal will not lead to a risk of further spread of the plants. Care will be taken near watercourses as water is a fast medium for the dispersal of plant fragments and seeds. Material that contains flower heads or seeds will be disposed of by burial at a depth of no less than 2m, or disposal to licensed landfill in the case of non-native invasive species. All disposals will be carried out in accordance with the Waste Management Acts.

5.2.2 Cherry Laurel

Four options for the treatment of Cherry Laurel have been proposed. Any one or a combination of these four options shall be used to eradicate Cherry Laurel from the site and avoid the spread of the species. However, the following general recommendations will be adhered to as part of the plan:

- No treatment measures to take place in these areas without supervision and agreement by appointed Cherry Laurel eradication specialist.
- The Cherry Laurel plant contains cyanide and as per good practice will only be handled with gloves. This plant will be disposed of via an appropriately licensed waste facility.
- Equipment, clothing and footwear is to be checked following treatment operations and cleared of fruits/seeds as necessary.

Option 1 – Cut to stump and dig out stump; bury onsite

This method involves cutting the main stem of the plant down near ground level and digging out the stump and any visible roots. This option is not usually practical in areas where there are other invasive plants present as the disturbed soil can allow for the setting of seeds or the spread of rhizomes of adjacent species (ISI, 2008).

Option 2 – Cut to stump and treat stump with herbicide

This method involves cutting the main stem of the plant down near ground level, and applying herbicide to the freshly cut wound.

The herbicide concentrations used, and timings of applications vary according to which chemical is used. When treating many stems, vegetable dye added to herbicide is useful for highlighting the stems that have and haven't been treated. The use of a brush or other such applicator will provide an accurate application and prevent damaging adjacent non-target plants via spray drift. Please see table below for best treatment time (ISI, 2008).

Since the 26th November 2015, only a DAFM-registered professional user can apply Plant Protection Products that are authorised for professional use. As such any application of herbicide must be carried out by a professional user. Since the 26th November 2016, it has been a requirement for sprayers to have passed a Pesticide Application Equipment Test before being used to apply professional use Plant Protection Products.

Option 3 – Cut to main stem and inject stem with herbicide

This method involves the 'drill and drop' method where the main stem is cut, and a hole drilled into the cut. The main drawback to this technique is that the plant is left in place to rot, which can take a decade or more. Please see Table 5-1 below for best treatment time (ISI, 2008).

Option 4 - Cut back to stump and spray regrowth with herbicide

This application involves cutting a main stem down near ground level and then treating the new stems with herbicide. This method is the least effective as some stems may be missed and not treated. Also, the application of herbicide is generally via spraying, which can result in adjacent non-target plants being killed off. Please see Table 5-1 below for the best treatment times(ISI, 2008).

Cutting	J	F	M	A	M	J	J	A	S	O	N	D
Glyphosate	J	F	M	A	M	J	J	A	S	O	N	D
Tryclopyr*	J*	F*	M*	A*	M*	J*	J*	A*	S*	O*	N*	D*
Ammonium sulphate	J	F	M	A	M	J	J	A	S	O	N	D

■ Optimum treatment time. Remember to consider breeding birds before embarking on a programme.
■ Suboptimum treatment time but can be effective. In the case of glyphosate based herbicides consider higher concentrations 25--100% during this time period.
* Suitable for treatment any time after cutting and appearance of new growth.

Figure 5-1: Optimum time for the treatment of Cherry Laurel (ISI, 2008).

Any reproductive plant material will be carefully disposed of following NRA (2010) Guidelines (See Section 5.2.1). Any equipment used will be inspected and thoroughly cleaned, as will the footwear and clothing of operatives removing invasive species material. Any material arising from cleaning of equipment and footwear will be disposed of in a manner which will not cause the spread of invasive species.

5.2.3 Montbretia

Two options for the treatment of Montbretia at the site have been proposed to avoid the spread of this species. It is noted that Montbretia was not recorded within the project footprint, and removal will therefore be an enhancement measure. The following general recommendations will be adhered to as part of the plan:

- No treatment measures of Montbretia are to be conducted without supervision and agreement by the appointed invasive species specialist.
- No material shall be taken from areas of infestation, unless for disposal. All material will be either deep buried (2m) or transported by an appropriately licensed waste contractor and received by an appropriately licensed facility.
- As Montbretia was recorded along a stream, treatment options are restricted.

Option 1 – Digging

In the case of small stands, digging by hand can be used to extract corms and additional root system from the site. This must be completed before seeds are produced, pre-July. If corms are damaged lost during excavation it is likely that new growth would form from these. Tools and PPE must be cleaned before exit from the area of infestation. Subsequent excavated materials will be buried onsite, or removed from the site, using appropriately licenced transport, to an appropriately licenced facility equipped to deal with such volumes (IWS, 2018). Any areas of disturbed soil will be seeded with native grass species and compacted to prevent sediment runoff. As such, digging must be carried out during spring/early summer to allow time for grass to establish.

Option 2 – Chemical Treatment

A herbicide such may be applied by wiper application to avoid spray drift to other habitats and the adjacent river. This must only be undertaken by a trained operative and approved pesticide user at a time when dry weather is forecast to persist for several days. Follow up treatment may be required for a number of years if regrowth occurs.

Any reproductive plant material will be carefully disposed of following NRA (2010) Guidelines (See Section 5.2.1). Any equipment used will be inspected and thoroughly cleaned, as will the footwear and clothing of operatives removing invasive species material. Any material arising from cleaning of equipment and footwear will be disposed of in a manner which will not cause the spread of invasive species.

5.2.4 Snowberry

The primary means of preventing spread of this species due to the works is predicted to be avoidance, as it is located in hedgerows bordering the L1322.

In the event of interaction of works with Snowberry, one option for the treatment of Snowberry at the site has been proposed to avoid the spread of the species. The following general recommendations will be adhered to as part of the plan:

- Snowberry is spread both by seed, a buffer area of 1m will be left to prevent further contact with plants, possibly causing seeds to fall or become attached to machinery or people. Disturbed seeds may result in the propagation of a new snowberry population elsewhere.
- Staff shall be made aware of this buffer zone when working within areas of infestation.
- Areas of infestation will be fenced off from other works areas including a buffering distance of up to 1m to create exclusion zones.
- Construction works will not be allowed within exclusion zones until the species has been fully removed but may continue outside of these areas.
- No treatment measures to take place in these areas without supervision and agreement by appointed eradication specialist.
- All machinery and vehicles operating within areas of infestation to be thoroughly checked and if necessary cleaned prior to leaving the area to protect against further spreading of snowberry.
- No material shall be taken from areas of infestation, unless for disposal. All material will be either deep buried (2m) or transported by an appropriately licensed waste contractor and received by an appropriately licensed facility.
- All staff shall be made aware of nature of threat via toolbox talks as part of site inductions. Toolbox talks shall be undertaken with all personnel accessing the site to ensure that the details of the invasive species management plan are adhered to and to raise awareness of the potential treat of invasive species.
- Wheel washes shall be put in place at entry and exit points, if considered appropriate. Wastewater from these facilities will need to be stored and treated to avoid further outbreaks.
- If operating within an area of known infestation all machinery, vehicles, equipment, foot ware and clothing will need to be cleaned thoroughly (if necessary, using steam cleaners) in a contained area to avoid further contamination.

Option 1- Excavation

Excavation of the entire root system is thought to be a very effective method of Snowberry control. This must be done before the plants' seeds ripen in autumn. Plant matter from this process can be disposed of using a licenced landfill site or may be buried to a depth of over 2m.

Any reproductive plant material will be carefully disposed of following NRA (2010) Guidelines (See Section 5.2.1). Any equipment used will be inspected and thoroughly cleaned, as will the footwear and clothing of operatives removing invasive species material. Any material arising from cleaning of equipment and footwear will be disposed of in a manner which will not cause the spread of invasive species.

5.2.5 Old Man's Beard

Old Man's Beard, present within the oversail area of Node 2 at the TDR will be treated using the following option.

Option 1- Physical Removal

Seedlings can be pulled out of the ground and larger plants can be cut to the stem (and foliage will die) and roots and stem removed. Roots can then be grubbed out with material stored above the ground, so plants cannot take root again.

For more mature plants, the stem can be cut near ground level and herbicide applied to the outer rim of the stem. The stem is likely to produce regrowth in the next growing season and herbicide will need to be applied to this growth. Glyphosate can be used in late spring and summer and Triclopyr can be applied in summer. This is the preferred option where plants infest the crowns of trees.

The contractor must appropriately dispose of Old Man's Beard plant material and soil containing plant material in accordance with the NRA (2010) guidelines, where cut, pulled or mown non-native invasive plant material arises, its disposal will not lead to a risk of further spread of the plants. Care will be taken near watercourses as water is a fast medium for the dispersal of plant fragments and seeds. Material that contains flower heads or seeds will be disposed of either by composting or burial at a depth of 2m, or disposal to licensed landfill in the case of non-native invasive species. All disposals will be carried out in accordance with the Waste Management Acts.

5.2.6 Butterfly Bush

Butterfly Bush which is present adjacent to TDR Node 2 is likely to spread within the area regardless of potential transport by humans, due to its mode of spread by wind. Nonetheless, efforts will be taken to prevent the spread of this species as follows:

- Disturbing ripe seed heads will be avoided during the turbine delivery by implementing an exclusion zone;
- Bags will be placed over the flower spikes to avoid dislodging and spreading seeds during the turbine delivery;
- Machinery will be checked for the presence of seed to avoid accidental transportation.

If this species has spread into the proposed works zone prior to TDR works and trimming/felling are required any reproductive plant material will be carefully disposed of following NRA (2010) Guidelines (See Section 5.2.1). Any equipment used will be inspected and thoroughly cleaned, as will the footwear and clothing of operatives removing invasive species material. Any material arising from cleaning of equipment and footwear will be disposed of in a manner which will not cause the spread of invasive species.

5.2.7 Norway Maple

Control of Norway Maple along the TDR will focus on the correct disposal of cut material in areas where felling and trimming is required. It is vital that reproductive Norway Maple plant material is carefully disposed of. The contractor must appropriately dispose of Norway Maple plant material in accordance with the NRA (2010) guidelines, where cut or mown non-native invasive plant material arises, its disposal will not lead to a risk of further spread of the plants. Care will be taken near watercourses as water is a fast medium for the dispersal of plant fragments and seeds. Material that contains flower heads or seeds will be disposed of by burial at a depth of no less than 2m, or disposal to licensed landfill in the case of non-native invasive species. All disposals will be carried out in accordance with the Waste Management Acts.

Any material arising from cleaning of equipment and footwear will be disposed of in a manner which will not cause the spread of invasive species.

Norway Maple will not be intentionally planted as part of landscaping.

5.2.8 Spanish Bluebell

Care will be taken to avoid disturbing Spanish Bluebell, which is present outside the load bearing footprint at Node 4. This will be achieved by cordoning off the area during TDR Node works. Staff will be made aware of this buffer zone.

In the event this species has spread to the proposed works area prior to TDR Node works, any plants in the footprint will be dug out and stored securely but at TDR Node 4. Any equipment used to excavate the plants will be inspected and thoroughly cleaned, as will the footwear and clothing of operatives removing Spanish Bluebells material. Any such material will be retained and stored with the excavated Spanish Bluebell material.

It should be noted that Third Schedule species plant material cannot be moved offsite without a licence from the NPWS and as such a licence for transport and availability of a suitably licenced facility will be required to be in place before any works affecting Spanish Bluebell commence.

5.2.9 Small-Leaved Lime

Small-Leaved Lime is unlikely to pose an invasion threat. Furthermore, it is outside the footprint of proposed works. Therefore, no treatment measures are necessary.

No intentional planting of Small-Leaved Lime will occur.

5.2.10 *Turkey Oak*

Turkey Oak present in the oversail footprint of Node 7 of the TDR will be assessed prior to TDR Node works. If trimming and felling are required any reproductive plant material will be carefully disposed of following NRA (2010) Guidelines (See Section 5.2.1). Any equipment used will be inspected and thoroughly cleaned, as will the footwear and clothing of operatives removing invasive species material. Any material arising from cleaning of equipment and footwear will be disposed of in a manner which will not cause the spread of invasive species.

Furthermore, no intentional planting of this species will be undertaken.

5.2.11 *Red Osier Dogwood*

Red Osier Dogwood, present in the oversail footprint of Node 2 and Node 7 of the TDR will be assessed prior to TDR Node works. If trimming and felling are required any reproductive plant material will be carefully disposed of following NRA (2010) Guidelines (See Section 5.2.1). Any equipment used will be inspected and thoroughly cleaned, as will the footwear and clothing of operatives removing invasive species material. Any material arising from cleaning of equipment and footwear will be disposed of in a manner which will not cause the spread of invasive species.

Furthermore, no intentional planting of this species will be undertaken.

5.2.12 *Flowering Currant*

This species is unlikely to be affected by GCR works and as such the primary means of prevention of spread is avoidance.

If interaction with this species is unavoidable, any reproductive plant material will be carefully disposed of following NRA (2010) Guidelines (See Section 5.2.1). Any equipment used will be inspected and thoroughly cleaned, as will the footwear and clothing of operatives removing invasive species material. Any material arising from cleaning of equipment and footwear will be disposed of in a manner which will not cause the spread of invasive species.

5.2.13 *Wilson's Honeysuckle*

In the removal of Wilson's Honeysuckle from the site entrance, one option is proposed for control and prevention of spread.

Excavation

- Excavate stems and rootstock. Ensure all root material are excavated.
- Physical control must preferably be undertaken before seeds are produced, to reduce the likelihood of reproductive spread.
- If being stockpiled on-site, plant material must be stored securely, monitored and re-growth treated with herbicide where necessary.
- Alternatively, plant material may be buried to a depth of 1m.
- Disposal at a licensed facility is also an option.
- Any machinery used for excavating and transporting plant material must be washed thoroughly in a designated area following operations.

Any reproductive plant material will be carefully disposed of following NRA (2010) Guidelines (See Section 5.2.1). Any equipment used will be inspected and thoroughly cleaned, as will the footwear and clothing of operatives removing invasive species material. Any material arising from cleaning of equipment and footwear will be disposed of in a manner which will not cause the spread of invasive species.

6. MANAGEMENT PLAN

The management of any invasive species is achieved by the assessment and mapping of the invasive species, containment once found, continual monitoring and record keeping as well as the safe disposal of invasive species material.

6.1 Containment

For the efficient use of resources, namely financial and physical effort, it is important to prevent the further spread of invasive species by containment. Containment will be achieved via:

- Cordoning off the area of infestation using demarcation fencing to prevent further spread of seed by people or machinery.
- Mark the cordoned off area with an information/warning sign.
- Toolbox talks to be carried out for all maintenance workers working within the site.
- Landholder to be informed of location of the invasive species and the management plan.
- To help with monitoring of the infestation, the area is to be outlined with spray paint.
- Ensure anyone treating the infestation is a suitably qualified trained and certified professional who follows the management plan.
- The site will be re-surveyed prior to treatment / construction works to confirm the findings of the original survey.
- Follow up surveys will be carried out post-construction to determine effectiveness of treatment and trigger further treatment if required.

6.2 Schedule

The schedule for treatment is detailed in Table 6.1.

Re-surveys for all invasive species will be required, to ensure that treatment measures were effective, and to trigger further treatment if necessary.

Please note that the schedule and treatment method may require amendment following any given site visit.

Table 6-1: Schedule of measures to eradicate and prevent spread of invasive species at the proposed Annagh Wind Farm

Year	Details of measures
1	• A pre-construction survey (to reconfirm the findings of the EIAR) will be undertaken during the growing season to mark out the extent of invasive species within the footprint of the project prior to any works commencing on-site. • Invasive species material that is to be retained onsite will be buried in advance of other works, and no further excavation or disturbance of these areas will take place. • Invasive species material that is to be retained onsite will be buried in advance of other works, and no further excavation or disturbance of these areas will take place. • All invasive species observed shall include a buffer of up to 1m surrounding the area of infestation. This will prevent plants with underground rhizomes being transported to other sections of the site and it will also prevent contact with plants, which could result in the transport of seed, fruit or vegetation. • Treatment of invasive species using one or more of the treatment options proposed in Section 5. • Only once treatment has been completed and invasive species have been removed from within the area of works/buried securely will works commence. • Toolbox talk shall be given to all personnel accessing the site. • Site to be monitored continually for signs of regrowth of all invasive species during operation. Disposal of ALL cut and excavated plant matter, if chosen to be processed off-site, must be done so through a licenced waste processor. Adequate licences may also need to be obtained for the transportation of such matter.
2 - 5	• For 5 years following construction, site to be monitored annually for signs of regrowth of invasive species. • Monitoring of material collected during equipment washing for signs of growth during following growing season.

6.3 Mapping, Evaluating and Record Keeping

During each treatment the following will take place before control treatments:

- Check that the area of infestation is still cordoned off and a warning/information sign is still in place;
- Photographs of the area(s) of invasive species infestation;
- Map the extent via recording GPS coordinates and measure the length and width of infestation and plot on map;
- Evaluate the status/condition of the infestation;
- If the infestation has spread spray paint the extent of the new area (for comparison on next visit);
- Make sure step 1-5 are recorded.

At the end of each site visit the recorded data will be compared with the findings of this report and where required the management plan shall be updated. A short report on the progress of treatment works, and any subsequent monitoring will be produced annually during the construction and monitoring periods.

6.4 Appropriate Disposal

6.4.1 Storage

As outlined in Section 5, all cut and excavated plant matter will be stored securely in line with the relevant treatment methodology.

6.4.2 Disposal

Deep Burial (onsite)

Burial of plant matter and possible contaminated soil from within the proposed site will be completed as per the species-specific measures discussed in Section 5. Invasive species material generated within the site may be disposed of within the planning boundary, in accordance with the measures detailed in Section 5.

Licensed Disposal

Disposal of plant matter and soil generated off-site (i.e. at TDR Nodes not encompassed by planning boundary) will be completed through an appropriately licenced haulier and waste facility. It is noted that all invasive species material disposed of off-site requires acceptance at a licensed facility. In addition to this, Third Schedule-listed species such as Spanish Bluebell also require an additional licence for transportation.

7. CONCLUSION

There is a legal obligation not to spread plants listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011-2021; the relevant species (associated with TDR Node 4) therefore that of principal concern, are Spanish Bluebell (*Hyacinthoides hispanica*).

Environmental best practice, and the need to prevent the spread of the other invasive species present on-site to European sites, dictates the need to take measures to prevent the spread of these species.

Various treatment measures are advocated for the invasive species present on-site, with several options available in most cases.

It is recommended that a competent, licenced and experienced invasive species management contractor is appointed to eradicate invasive species from the site. Any operatives applying herbicides must be appropriately trained and certified.

A dedicated invasive species survey is required to be undertaken by the appointed contractor to reconfirm the findings of the preplanning surveys.

All invasive species present on-site will be required to be cordoned off prior to any treatment works, with exclusion zones in place as specified in Section 5.

A quarantine zone where equipment washing, and inspection of clothing and footwear can be carried out will be established at the site entrance prior to treatment works and remain in operation until all vegetation has been removed or buried.

Following burial, areas should remain cordoned off, with appropriate methodologies in place to ensure no disturbance occurs during subsequent works.

Treatment works will be supervised by an appropriately licenced invasive species specialist.

Yearly monitoring for re-growth of invasive species is recommended for up to five years following construction.

With the implementation of the measures detailed in this document, the spread of invasive plant species will not result from any activities associated with the proposed project. The primary measures are avoidance, control, correct disposal, and sanitation of equipment. Where specified, localised eradication will also be carried out, to enhance habitats and remove reservoirs for further infestation.

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APPENDIX 8.2

Marsh Fratillary Report

Annagh Wind Farm – Ecology

Insect Survey, September 2020

Ken Bond, 26/11/2020

Introduction

The Annagh windfarm site was visited on three days in September 2020 in order to assess its importance for insects, particularly the Lepidoptera (butterflies and moths). The survey included an assessment of its suitability for Marsh Fritillary.

Methods

The site was visited on September 16th and 17th, and again on 25th September. Insects were recorded from daytime observation of flying specimens as well as from leaf-mines and other feeding signs. A 15W Actinic light-trap was used in the woodland clearing within the plantation of mainly *Quercus* and *Betula pubescens.* Insects were sampled in this area, including a number of leaf-miners on birch, oak and Rowan. Areas of higher floristic diversity were assessed for possible occurrence of *Euphydryas aurinia* Marsh Fritillary.

Results

The Annagh wind farm survey area consists of three main broad types of habitat: 1) cattle-grazed damp grassland with areas of *Juncus* spp.; 2) mixed woodland, mainly of a birch-oak mixture, or of Sitka spruce; and 3) herb-rich damp grassland. The first of these areas consists of a relatively poor fauna dominated by grasses and rushes. The deciduous woodland sections consist of relatively young birch and oak, with marginal *Salix* spp. and a few other species such as Rowan *Sorbus aucuparia*. While these tree species are likely to develop a more diverse associated fauna over time, they appear to have a limited insect fauna at present. Type 3) habitat is confined to relatively limited areas; the main ones being the triangular field centred at about R502176, and the woodland clearing centred at R500173. Although several records were obtained from types 1) and 2) habitat, the main areas of insect diversity were the herb-rich fields and clearings, and it was here that the search for Marsh Fritillary webs was concentrated.

<u>Investigation of possible occurrence of Marsh fritillary on site</u>

While very small scattered patches of the butterfly's foodplant, *Succisa pratensis* (Devil's-bit Scabious), were found locally on the site, including the margins of the large damp *Juncus* grassland in the central part; by far the most extensive are of *S. pratensis* was found in the triangular field centred at about IGR R502176, and this was inspected in detail on September 25th. A series of transects were walked over a period of 2 hours. Although *S. pratensis* was found to be widely scattered here, no trace of Marsh Fritillary larval webs was found. Much of the habitat is considered suitable for the presence of Marsh Fritillary, but the site is well separated from areas of similar habitat occupied by the species, so it is possible that it occurred here in the past, but declined to an unsustainable level at some stage. This field exhibited a moderately high level of cattle grazing, but probably not so high as to prevent the occurrence of Marsh Fritillary. It is also possible that it occurred on this site before extensive planting of conifers took place, while aerial photography suggests that suitable habitat may still occur at Irish Grid R490161, but this is outside the survey area. The woodland clearing at R500173 contains small areas of *S. pratensis*, particularly along a raised ditch beside an ill-defined stream, but no traces of larval webs were found here. According to the distribution maps at biodiversity.ie (https://maps.biodiversityireland.ie/Species/77487), there are no historical records of the species from the area (Irish Grid 10km squares R41 and R51), nor are there records from adjacent areas of North Cork or Co. Limerick.

Impacts of construction of wind turbines and service roads

Wind Turbine T02 is located within the triangular field (centre of field at R502176), with a road leading south from it across the southern part of the field. Care should be taken during construction to avoid excessive damage to the vegetation adjacent to the hard standing and road and minimise changes to the hydrology of the field, in order to retain the damp and floristically diverse habitat. Similarly, construction of turbine T04 and the road leading eastwards from it should be carried out with the minimum possible impact on the existing woodland margin and the drainage ditches south of the small woodland clearing at R500173.

APPENDIX I – list of insects and other invertebrates recorded at Annagh Wind Farm, September 2020

LEPIDOPTERA (buttterflies and moths)

Daytime records

Aglais urticae SMALL TORTOISESHELL. One, Annagh North, R500166
Colias croceus CLOUDED YELLOW. One Annagh North, R502183, 17.ix.2020
Pararge aegeria SPECKLED WOOD. Four, Annagh North, R500166
Phragmatobia fuliginosa RUBY TIGER. Larva, Annagh North, R499173
Pieris napi GREEN-VEINED WHITE. Several at various locations
Vanessa atalanta RED ADMIRAL. One, Annagh North, R500166

Moths recorded at Actinic Light-trap, plantation clearing at IGR 4968217278

Colostygia pectinataria GREEN CARPET (9)
Dysstroma truncata COMMON MARBLED CARPET (2)
Ennomos alniaria CANARY-SHOULDERED THORN (2)
Ennomos quercinaria AUGUST THORN (2)
Gortyna flavago FROSTED ORANGE (1)
Opisthograptis luteolata BRIMSTONE MOTH (3)
Xanthia togata PINK-BARRED SALLOW (2)

<u>Other records of LEPIDOPTERA (moths)</u>

Coleophora alticolella (a Micro moth). Larval cases numerous on *Juncus effusus* in the extensive rushy, cattle-grazed pasture
Coleophora serratella (a Micro moth). Larval case on *Betula pubescens.*
Phyllonorycter oxyacanthae. Tenanted mine on *Crataegus monogyna*, R506172, Annagh North, 25.ix.2020
Phyllonorycter salicicolella. Leaf-mine with larva on *Salix cinerea*.
Phyllonorycter sorbi. Leaf-mines on *Sorbus aucuparia.*
Phyllonorycter spinicolella. Tenanted leaf-mine on *Prunus spinosa*, R506172, Annagh North, 25.ix.2020
Phyllonoryctyer quercifoliella. Leaf-mine with cocoon on *Quercus robur*.
Stigmella atricapitella. Vacated leaf-mine on *Quercus robur*.
Stigmella hybnerella. Vacated leaf-mine on *Crataegus monogyna*, R506172, Annagh North, 25.ix.2020
Stigmella plagicolella. Vacated leaf mine on *Prunus spinosa*, R506172, Annagh North, 25.ix.2020

Daytime records –other insect orders

ODONATA (damselflies and dragonflies)

Sympetrum striolatum COMMON DARTER. One, Annagh North, R500166

DIPTERA

Cerodontha iraeos. Leaf-mine on *Iris pseudacorus*
Agromyza idaeina. Two leaf-mines on *Filipendula ulmaria*
Phytomyza ranunculi. Leaf-mine on *Ranunculus* in large rushy pasture

HEMIPTERA

Palomena prasina GREEN SHIELDBUG
Aphrophora alni ALDER SPITTLEBUG

HYMENOPTERA

Profenusa pygmaea. Tenanted and vacated leaf-mines on *Quercus robur*

Spiders – ARANEAE

Araneus diadematus GARDEN SPIDER. One male.

Other species records

CRUSTACEA -ISOPODA

Oniscus asellus COMMON SHINY WOODLOUSE (1)

MOLLUCSA -GASTROPODA

Accinea putris COMMON AMBER SNAIL. Abundant in damp areas in plantation clearings.

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APPENDIX 8.3

Bat Surveys Report

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ANNAGH WIND FARM

BAT SURVEY 2020 REPORT

Prepared for: EMPower Ltd.

EMPower

Date: **November 2021**

NOTE: THIS REPORT CONTAINS SENSITIVE INFORMATION ON LOCATIONS OF BAT ROOSTS

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1. EXECUTIVE SUMMARY

The methodology for the 2020 and 2021 bat survey at Annagh wind farm adhered to Scottish National Heritage guidance published 2019 (SNH (2019) guidance) for assessing the impact of proposed wind farm developments on bat species. The guidance has been updated since the surveys took place, however the changes to the guidance were minor and the survey methodology is in line with the 2021 guidance. Monthly activity surveys were undertaken between May and September 2020. Three rounds of static detectors were also deployed during this time period, for at least ten nights per round per detector. A further two rounds of static detector surveys were undertaken between July and October 2021. Along with roost surveys undertaken in 2021 (refer to Appendix A for the full report) including bat vantage point surveys in August 2021.

During activity surveys, a total of five species of bats were recorded: common pipistrelle, soprano pipistrelle, leisler's bat, natterer's bat, and whiskered bat. The most commonly recorded species was soprano pipistrelle, followed by leisler's and common pipistrelle, with much lower levels of myotis spp. (natterer's bat and whiskered bat) detected.

During static surveys, a total of eight species of bats were recorded in both 2020 and 2021: common pipistrelle, soprano pipistrelle, nathusius pipistrelle, leisler's bat, natterer's bat, daubenton's bat, whiskered bat and brown long-eared bat. The most commonly recorded species for 2020 was soprano pipistrelle, followed by leisler's and common pipistrelle, with much lower levels of myotis spp. (natterer's bat, daubenton's bat and whiskered bat) and brown long-eared bat detected.

During the roost surveys a maternity roost for soprano and common pipistrelle and minor pipistrelle roosts were identified within the study area (refer to Appendix A). The vantage point surveys further identified a potential leisler's roost within the north east of the study area.

As part of the ongoing environmental constraints study to inform the layout of the proposed development and the associated mitigation by design, some of the locations of turbines changed between the 2020 and 2021 survey periods. Therefore, turbine siting had potential to be placed within plantation woodlands, which may undergo extensive habitat alteration. Locating detectors within woodland will not represent the conditions post-construction. In order to provide representative data of how bats may adapt to and use the potential new habitat that would be created at/after construction, the static detectors were sited in open areas including existing nearby roads/clearings within the forestry of the study area. This is a more conservative approach that would provide higher activity levels than placing at the actual turbine location enclosed in forestry currently.

Static locations A3, A8 and AT6 provide representative data of how bats may adapt to and use the potential new habitat that would be created from the construction of the turbines within plantation woodland. Static locations A6 and AT4 provide representative data of how bats use open spaces within the study area. Static locations A5, AT1, AT2 and AT3 provide representative data of how bats use edge ecology (woodland edge adjacent to agricultural field) within the study area. . Static location A2, A7, AT4 and AT5 provide representative data of how bats use linear ecology (hedgerow and treelines) within the study area.

The location of static detectors in open areas within plantation woodland and felled woodland stands, as well as edge ecology, was undertaken to assess the bat activity levels along these corridors and the potential activity levels for bats post felling. Therefore the baseline is a worse case representation of the Site overall.

All bats recorded during surveys are classified as 'Least Concern' on the Irish Red List No. 12 (Marnell 2019) and protected under the EU Habitats Directive Annex IV and Wildlife Acts. The site is outside the geographical range for the EU Habitats Directive Annex II listed species lesser horseshoe bat. No records of this species were identified within the 2020 or 2021 surveys.

2. INTRODUCTION

This report details the results of the bat surveys carried out during 2020 and 2021. In addition to the desktop study, the following surveys were undertaken within the study area[1] of the proposed development:

- roost surveys;
- vantage point surveys
- bat activity (walked and driven transects); and
- static detector (three survey periods 2020 and two survey periods 2021).

All surveys adhered to SNH (2019) guidelines at the time of survey, which are still compliant with the updated SNH guidance for 2021.

Monthly activity surveys were conducted from May to September 2020 along predetermined walked transects. Static detector surveys were carried out between April and September 2020 in three rounds and between July and October 2021 in two rounds. Bat roost surveys (including a vantage point survey) were also conducted between March and September 2021.

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.

2.1 Site Location

The proposed wind farm site is located in north County Cork, approximately 45km north of Cork City. The Site is located approximately 6km south west of Charleville and approximately 8km north west of Buttevant.

The Site is located in a rural area. The settlement pattern in the area is linear, made up of one-off rural housing and farmyards generally located along the local road network. The nearest settlement is the village of Churchtown which is located approximately 3km to the south of the Site.

The Site is situated within a single sub-catchment as defined by the WFD, the Awbeg [Buttevant]_SC_010 and two sub-basins Oakfront_010 and Awbeg (Buttevant) (West)_020.

The main hydrology feature within the Site is the Oakfront Stream and the Fiddane 18/Ardglass 18 Stream. There is one hydrological feature associated with the GCR, the Rathnacally Stream. All surface runoff within the Oakfront_010, Awbeg (Buttevant) (West)_020 and Awbeg (Buttevant)_010 sub-basins drain to the Awbeg [Buttevant] [West], which forms part of the Blackwater River (Cork/Waterford) SAC. This river runs south east where it meets the River Blackwater, approximately 25km south east of the Site.

[1] The study area comprises the land ownership boundary plus a survey buffer of 200m plus rotor radius as per SNH 2019 as 2021 guidance

The wind farm site and GCR are located within the Fertile Plain and Moorland Ridge landscape character area (Cork County Development Plan, 2014). It is made up of low lying landscape, which comprises an extensive area of predominantly flat or gently undulating topography.

The landscape is dominated by intensive mosaic farmland with patches of forestry throughout. The wind farm site is made up of agricultural pastures and broadleaf forestry.

Corine 2018 landcover[2] has determined the habitats to comprise pastures, broad-leaved forest, Heterogeneous agricultural areas and coniferous forest.

There are three European designated sites within 15km and five national designated sites (no Natural Heritage Areas (NHA) and five proposed Natural Heritage Areas (pNHA)) present within 10 km of the proposed planning boundary.

Habitats

Habitat surveys were carried out over 29th June and 22nd, 14th and 15th July 2020 determined the habitats within the proposed planning boundary and were mapped in accordance with '*Best Practice Guidance for Habitat Survey and Mapping*' (Smith *et al*., 2011) published by the Heritage Council. Refer to Appendix B for the habitat map of the wind farm site.

The wind farm site habitat survey study area encompasses a mixture of habitat types, with wooded habitats (Mixed broadleaved woodland WL1 and Immature woodland WS2) composed of broadleaved and mixed broad-leaf/conifer plantations forming a large portion. Agricultural land comprising Improved agricultural grassland GA1 and Wet grassland GS4 dominates the remainder.

Hedgerows WL1, Treelines WL2 and Drainage ditches FW4 delineate field boundaries, and Lowland depositing rivers FW2 flow through and adjacent to the study area.

Other habitats present, either in pure form or various mosaic combinations include Conifer plantation WD4, Marsh GM1, Dry meadows & grassy verges GS2, Scrub WS1, Recolonising bare ground ED3, Reed and large sedge swamps FS1, Artificial pond FL8 and Buildings and artificial surfaces BL3.

The grid connection originates within the proposed wind farm site and traverses plantation woodland and agricultural fields before exiting the site to join the L1322. As such the section within the main wind farm study area was surveyed during habitat surveys on 2nd, 14th and 15th July 2020. A walkover survey of the remainder of the grid connection (section along L1322 and un-named local road) which included a habitat survey was carried out between the 10th – 11th June 2021.

The section within the main wind farm study area originates within Immature woodland WS2, and then traverses Wet grassland GS4, Wet grassland/Improved agricultural grassland mosaic GS4/GA1, Improved agricultural grassland GA1, Mixed broadleaved woodland WD1 and Mixed broadleaved/conifer woodland WD2. The linear habitats intersected along this section comprise Hedgerow WL1, Treelines WL2, Lowland rivers FW2 (Oakfront Stream), and Drainage ditches FW4.

Upon exiting the agricultural holdings in which the main wind farm is located, the grid connection traverses the L1322 and an un-named local road until it reaches Charleville 110 kV substation.

[2] The Corine Land Cover (CLC) inventory is a Pan-European landuse and landcover mapping programme. It supplies spatial data on the state of the European environmental landscape and how it is changing over time.

The dominant habitat along this section is Buildings and artificial surfaces BL3 represented by road surfaces, however the road verges which contain Dry meadows and grassy verges GS2 would also be traversed by the grid connection.

The roads are bounded by Hedgerows WL1, Treelines WL2 and a mosaic of these habitats. Other habitats abutting the grid connection include Improved agricultural grassland GA2, Scrub WS1, Amenity grassland GA1, Flower beds and borders BC4, Spoil and bare ground ED2, Dry meadows and grassy verges/Earth banks mosaic GS2/BL2 and Buildings and artificial surfaces BL3.

This section of the grid connection intersects Lowland rivers FW2 at one point (Rathnacally Stream). The associated bridge is categorised as Buildings and artificial surfaces BL3.

A walkover of the TDR was undertaken at the TDR Nodes (points of interest along the route where accommodation works and/or special trailer manoeuvres may be required) on 10th June 2021.

Path: R:\Map Production\2020\P2359\Workspace\CEMP\P2359_GIS_Fig1-1_SiteLocation_A3.mxd

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
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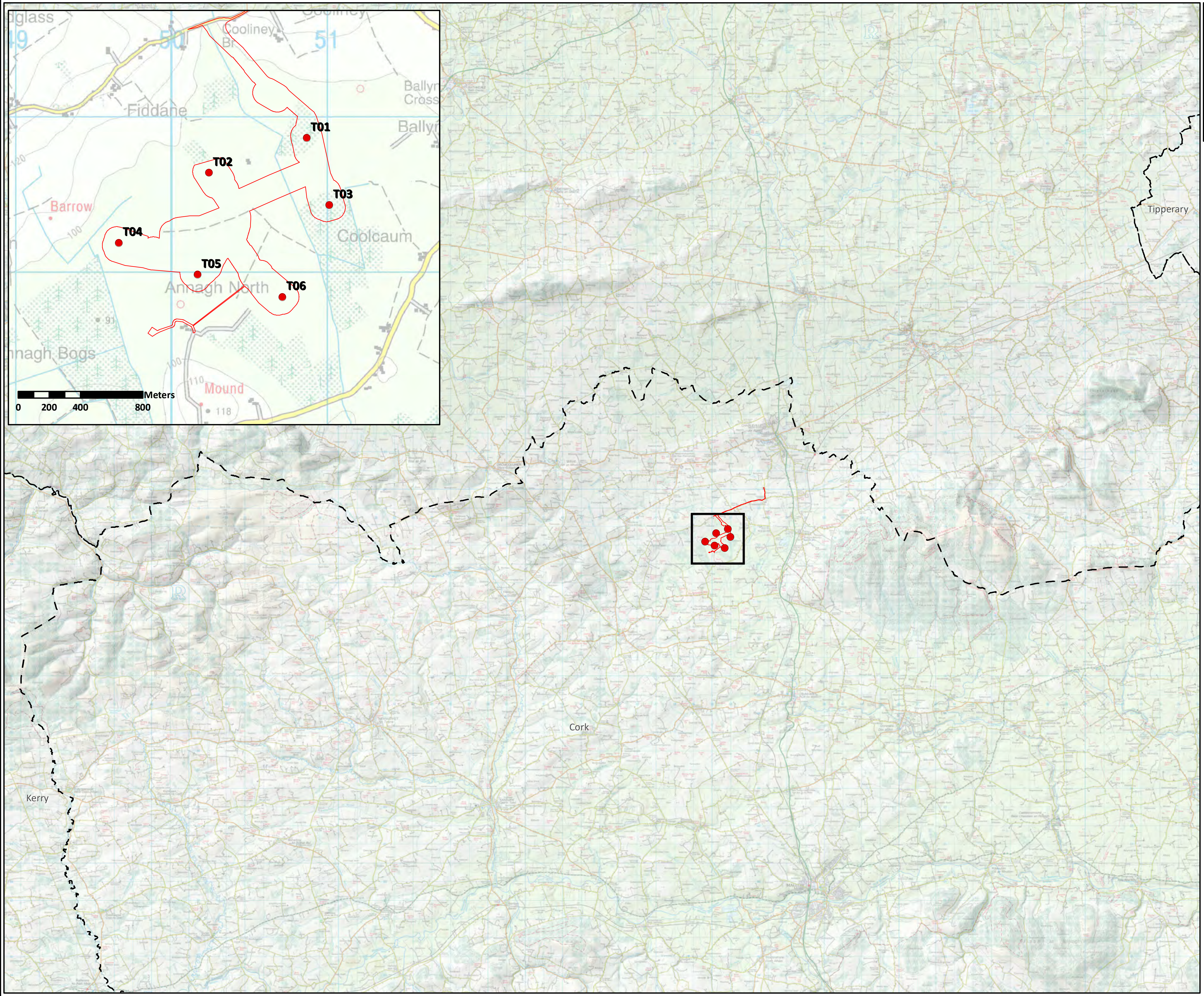

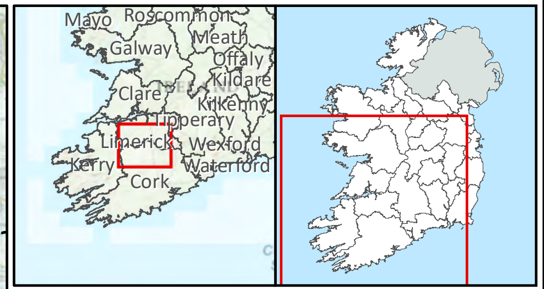

Legend

- County Boundaries
- Proposed Site Boundary
- Proposed Turbine Layout

TITLE: Site Location	
PROJECT: Annagh Wind Farm, Co. Cork	
FIGURE NO: 1.1	
CLIENT: EMPower	
SCALE: 1:200000	**REVISION:** 0
DATE: 14/10/2021	**PAGE SIZE:** A3

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2.2 Bat Species

Bats belong to the Order Chiroptera and to date, nine species are recorded as resident in Ireland. These nine species are divided into two families:

1. Vespertilionidae, which contains nine Irish species (daubenton's bat, natterer's bat, whiskered bat, leisler's bat, brown long-eared bat, soprano pipistrelle, common pipistrelle and nathusius's pipistrelle; and;
2. Rhinolophidae, which contain one Irish species, the Lesser Horseshoe bat.

See Appendix C for species details.

Brandt's bat *Myotis brandii* has only been recorded once in Ireland from a site in Co. Wicklow and is classified as a vagrant. In 2013, a single male greater horseshoe bat *Rhinolophus ferrumequinum* was recorded in Co. Wexford. In 2020 an individual was also recorded in Glendalough, Co. Wicklow. Both were considered to be vagrants. The development is outside the distribution range for Lesser Horseshoe bat (Bat Conservation Ireland (BCI), 2020).

2.3 Legislation

Irish Legislation

In the Republic of Ireland, under Schedule 5 of the Wildlife Acts 1976 to 2019, all bats and their roosts are protected by law. It is an offence to disturb either without the appropriate licence. This Act was further strengthened by the Wildlife Amendment Act 2000.

E.U. Legislation

Under the Habitats Directive 1992 (EEC 92/43), each member state of the E.U. was requested to identify habitats of national importance and priority species of flora and fauna. These habitats are now designated as Special Areas of Conservation (SAC).

In Ireland, all bat species are classified as Annex IV species under the Habitats Directive. Annex IV species are species in need of strict protection. Lesser Horseshoe bat is also classified as an Annex II species (Priority Species). Annex II species require the designation of Special Areas of Conservation specifically for their protection.

All species of bat in Ireland are strictly protected under the Habitats Directive to include deliberate disturbance of these species, particularly during the periods of breeding, rearing and hibernation. It also specifies deterioration or destruction of breeding or resting places.

International Legislation

Ireland has ratified two international wildlife laws pertaining to bats:

a) The Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention, 1982) – part of this convention stipulates that all bat species and their habitats are to be conserved.
b) The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979, Enacted 1983). This was instigated to protect migrant species across all European boundaries.

2.4 Relevant Guidance Documents

This report will draw on guidelines already available in Europe and will use the following documents:

- 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.

2.4.1 Relevant Wind Farm Guidance Documents

A large array of publications has been produced to date on the potential impact of wind turbines on bats. It is important to be aware of these publications to understand the recommended survey protocols and accepted bat mitigation measures implemented across Europe to address potential impacts of wind turbines on local bat populations.

These include:

- 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.

3. METHODOLOGY

3.1 Desktop Study

A data search was conducted in May 2021 and reviewed in October 2021 in order to collate existing information from the footprint of the proposed planning boundary. The data search comprised the following information sources:

- Collation of known bat records within a 4km radius[3] of the proposed sites 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[4]);
- 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 Lesser Horseshoe bat records within a 15 km radius of the proposed sites from the National Parks and Wildlife Service Lesser Horseshoe bat database (https://www.npws.ie);
- 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); and
- Review of bat survey data from Ecological Impact Assessments from proposed and permitted developments within the wider environs of the site.

3.1.1 Bat Landscapes

Bat Conservation Ireland produced a landscape conservation guide for Irish bat species using their database of species records collated during the 2000-2009 survey seasons. An analysis of the habitat and landscape associations of all bat species deemed resident in Ireland was undertaken and reported in Lundy *et al.*, 2011. The degree of favourability ranges from 0 – 100, with 0 being least favourable and 100 most favourable for bats. The values of the grid squares represent the range of habitat suitability values the bat species can tolerate within each individual square.

A caveat is attached to the model and it is that the model is based on records held on the Bat Conservation Ireland database, while core areas have been identified, areas outside the core area should not be discounted as unimportant as bats are a landscape species and can travel many kilometres between roosts and foraging areas nightly and seasonally.

[3] A 4km radius search distance was selected to encompass records of bat roosts within Core Sustenance Zones (CSZ) of the study area for Irish species of bat. A CSZ refers to the area surrounding a communal bat roost within which habitat availability and quality will have a significant influence on the conservation status of the colony using the roost (Collins, 2016).

[4] As per SNH (2019) guidance.

3.1.2 Designated Sites

A search was made for designated sites within 15 km of the proposed planning boundary. These included sites designated at the European level (in the context for bats, this refers to Special Areas for Conservation or SACs) and the Irish level (Natural Heritage Areas or NHAs and proposed Natural Heritage Areas or pNHAs). The Habitats Directive (Article 6) forms a basis for the designation of SACs. Further information on the context of SACs for bats is given in section 2.3.

NHAs are areas considered important for the habitats present or which holds species of plants and animals whose habitat needs protection. Under the Wildlife Amendment Act (2000), NHAs are legally protected from damage from the date they are formally proposed for designation.

All pNHAs were published on a non-statutory basis in 1995 but have not since been statutorily proposed or designated. However, for the purposes of this assessment all pNHAs have been considered as fully designated sites.

Both NHAs and pNHAs may be designated due to the presence of bats.

3.2 2020 Surveys

The 2020 bat surveys were undertaken in accordance with SNH (2019 and 2021), Rodrigues et al (2015) and Collins (2016).

A total of six no. bat activity surveys, and three no. static detector surveys were carried out during 2020 and two no. static detector surveys were carried out during 2021 (refer to Table 3-1 for details) within the study area. Further surveys included roost and vantage point surveys within the study area (refer to Appendix A) along with roost surveys of trees and bridges along the turbine delivery route and grid connection route:

Table 3-1: Bat Surveys 2020 and 2021

Survey Type	Survey Date	Surveyor
Bat Activity Survey 1 - Dusk	08/05/2020	Karen Banks
Bat Activity Survey 2 – Dusk	25/06/2020	Karen Banks
Bat Activity Survey 3 – Dusk	28/06/2020	Karen Banks
Bat Activity Survey 4 – Dusk	28/07/2020	Karen Banks
Bat Activity Survey 5 – Dusk	27/08/2020	Karen Banks
Bat Activity Survey 6 – Dusk	21/09/2020	Karen Banks
Static Detector Survey	23/04/2020 – 05/05/2020	Ben O'Dwyer and Jason Guile
Static Detector Survey	21/07/2020 – 31/07/2020	Ben O'Dwyer and Jason Guile
Static Detector Survey	15/09/2020 – 01/10/2020	Ben O'Dwyer and Jason Guile
Static Detector Survey	21/07/2021 – 25/08/2021	Ben O'Dwyer and Jason Guile
Static Detector Survey	13/09/2021 – 07/10/2021	Ben O'Dwyer and Jason Guile

Survey Type	Survey Date	Surveyor
Preliminary Ecological Assessment	March 2021	Karen Banks
Emergence Surveys	10/06/2021 – 19/06/2021	Karen Banks
Vantage Point Surveys	09/08/2021 31/08/2021	Karen Banks

3.2.1 Surveyor Information

The activity surveys were undertaken by Karen Banks of Greenleaf Ecology. Karen is an ecologist with 15 years' experience in the field of ecological assessment. She holds a BSc in Environment and Development from Durham University, and is a full member of the Chartered Institute of Ecology and Environmental Management. Karen specialises in ecological field surveys, is a skilled botanical surveyor and a licensed bat surveyor. Within her career Karen has completed Appropriate Assessments (AA) covering the transport, energy and land use sectors, with work including assessment of Plans at the national, regional and local level; and numerous AAs of projects. She has also completed Ecological Impact Assessments (EcIA) including those for housing developments, flood alleviation schemes, wind farms and transport infrastructure.

The static detector surveys deployment was carried out by Ben O'Dwyer and analysis by Jason Guile. Ben has over 4 years' experience in the ecology sector and holds a BSc in Wildlife Biology from Institute of Technology Tralee. Ben is an experienced bat surveyor having conducted a number of surveys for projects including renewable energy. He is currently licensed by NPWS to photograph/film wild animals (15/2021).

Jason has over 10 years' experience and holds a BSc in Marine Biology/Oceanography from the University of Wales, Bangor and a HND in Coastal Conservation with Marine Biology from Blackpool and Fylde College. He was the lead ecologist on a range of projects in the UK, including large scale infrastructural, such as HS2 phase 2b and Midland Mainline Electrification. Since moving to Ireland he has been lead ecologist / author (Environmental Impact Assessment Reports, Appropriate Assessment Screening reports and Natura Impact Statements) for a number of projects including urban planning applications and commercial regeneration sites. With FT, Jason is lead ecologist for a number of renewable energy projects including Smithstown Solar Farm and Croaghaun Wind Farm. Jason is an experienced bat surveyor, first gaining a class license to observe bats from Natural England in 2017 is currently licensed by NPWS for roost disturbance (Ref: DER/BAT 2020-88).

3.2.2 Preliminary Ecological Assessment and Emergence Surveys

A walkover survey of areas identified as potential roosting habitats during the desk top study were undertaken in March 2021. Refer to Appendix A for methodology

Dusk surveys of structures within the study area that were identified as being of moderate to high potential for bats during the roost inspection surveys were undertaken between 10th June and 19th June 2021. Refer to Appendix A for methodology.

3.2.3 Bat activity surveys

Transects of bat favourable habitats within the study area were walked and activity recorded using an Echo Meter Touch Pro (Full Spectrum). Transects were undertaken between May and September 2020 (Table 3-1).

Surveys targeted a range of foraging and commuting habitats present within the study area, those associated with linear features such as roadside margins, woodland plantation edges, hedgerows, treelines and waterbodies. Full details of transects are shown in Table 3-2 and Figure 3-1 below.

Bat surveying was conducted using a Frequency Division Detector System. Frequency Division detectors record bat ultrasonic calls on a continuous basis and stores the information onto an internal SD memory card. Frequency Division is a technique used to convert the inaudible bat echolocation calls to audible sounds. The bat detectors used a Full Spectrum Analysis to make the real-time recorded calls visible for display purposes. It is these sonograms (2-d sound pictures) that are digitally stored on a SD card and downloaded for analysis. Each time a bat is detected, an individual time and GPS stamped (date and time to the second) file is recorded.

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).

Nocturnal bat activity is mainly bi-modal taking advantage of increased insect numbers on the wing in the periods after dusk and before dawn, with a lull in activity in the middle of the night. This is particularly true of 'hawking' species – i.e. bats which capture prey in the open air. However, 'gleaning' species remain active throughout the night as prey is available on foliage for longer periods. Gleaning is the term for taking prey from foliage or the ground.

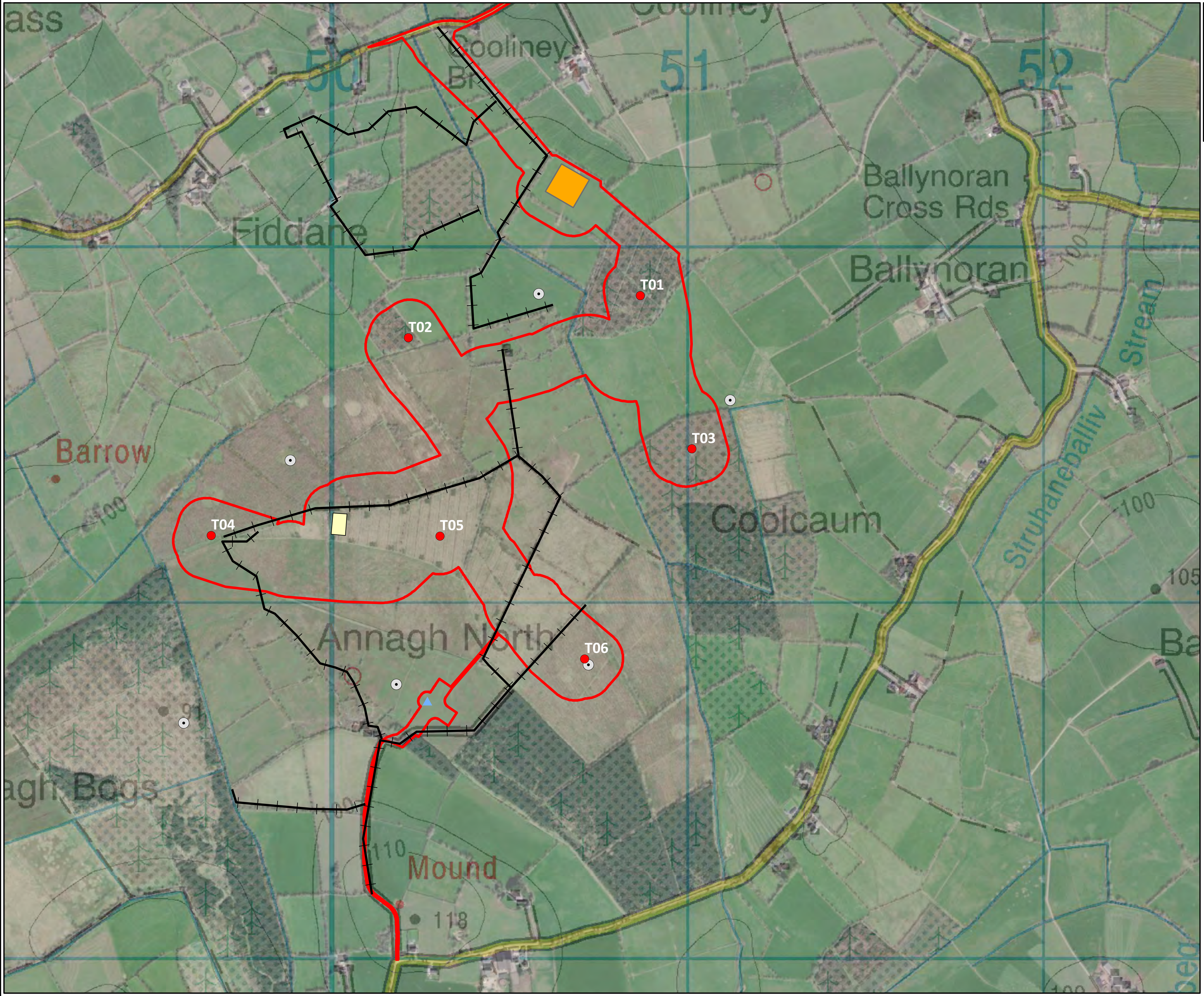
Bats were identified by their ultrasonic calls coupled with behavioural and flight observations and on computer by sound analysis of recorded echolocation and social calls with dedicated software (BatExplorer spectrogram sound analysis software Version 2.1.6.0).

Table 3-2: Transect Details

Transect Name		Start Time	End Time
1	08/05/2020	21:05	23:30
2	25/06/2020	21:45	00:00
3	28/06/2020	21:45	23:45
4	28/07/2020	21:15	23:30
5	27/08/2020	20:15	22:50
6	21/09/2020	19:20	21:55

Refer to Appendix B for habitats crossed during the transect surveys.

Path: R:\Map Production\2020\P2359\Workspace\EIAR\P2359_GIS_Fig8-2_BatSurveys_A3 - Copy_EOS.mxd



Legend

- Site Boundary
- Substation
- Construction Compound
- Met Mast
- Transect
- Turbine Layout
- Turbine Layout (original)

TITLE:	Bat Activity Transect Route
PROJECT:	Annagh Wind Farm, Co. Cork
FIGURE NO:	3.1
CLIENT:	EMPower
SCALE: 1:10500	REVISION: 0
DATE: 19/07/2021	PAGE SIZE: A3

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3.2.4 Static 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 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. Full spectrum bat recorders were utilised for all of the static surveys as recommended in the revised SNH (2021) guidelines. 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 (2021) guidance, static units (Song Meter SM4BAT) 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 (June-mid-August) and autumn (mid-August-October). See Table 3.3 below for further details.

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".

At key-holed woodland/plantation sites (and other proposals involving extensive habitat alteration), pre-application survey data may not represent the situation post-construction, as the habitat available for bats will change following construction. Automated survey locations should therefore also include open areas including existing nearby rides/clearings in the forestry, to provide an indication of how bats may adapt to and use the new habitat created through turbine construction.

It should be noted that, due to the ongoing development of the project, the static detectors were not placed at known turbine locations. They were places in open areas within plantation woodland and felled woodland stands, as well as edge ecology, to assess the bat activity levels along these corridors and the potential activity levels for bats post felling. Therefore the baseline is a worse case representation of the Site overall. The location of the static detectors are presented in Figure 3-2 below.

The data was analysed with Kaleidoscope 5.3.9g software (Bats of Europe 5.2.1).

Table 3-3: Details of static detector deployment 2020/2021

Static Detector ID.	Habitat types at static location	Closest turbine number (final design)	Habitat types at turbine location	Spring		Summer		Autumn	
				Start Date	Number of nights deployed[5]	Start Date	Number of nights deployed	Start Date	Number of nights deployed
A2	Treeline/ hedgerow adjacent to stream and agricultural land	1	Plantation woodland	23/04/20	12	21/07/20	10	15/09/20	17
A3	Woodland edge adjacent to a grassed clearing within the plantation woodland	4	Wet grassland, marsh and plantation woodland	23/04/20	12	21/07/20	10	15/09/20	17
A5	Woodland edge at the northeast corner of plantation woodland	3	Plantation woodland	23/04/20	12	21/07/20	10	15/09/20	17
A6	On dead spruce within marsh habitat	4	Wet grassland, marsh and plantation woodland	23/04/20	12	21/07/20	10	15/09/20	10
A7	On hedgerow along the eastern boundary of the agricultural field	5	Wet grassland	23/04/20	12	21/07/20	10	15/09/20	10
A8	Small clearing within dense plantation woodland	6	Plantation woodland	23/04/20	12	21/07/20	10	15/09/20	10
AT1	Woodland edge at of plantation woodland and junction with hedgerow	1	Plantation woodland	N/A	N/A	21/07/21	35	N/A	N/A

[5] Note that data will be recorded for the morning on the date of collection. Thus, if a detector was left out on 09/05/2020 and collected on 20/05/2020, the detector will have been left out for a total of 11 complete nights. However, there will be 12 unique dates where data was (potentially) recorded.

Static Detector ID.	Habitat types at static location	Closest turbine number (final design)	Habitat types at turbine location	Spring		Summer		Autumn	
				Start Date	Number of nights deployed[5]	Start Date	Number of nights deployed	Start Date	Number of nights deployed
	at right angle to woodland								
AT2	Woodland edge at the southeast corner of plantation woodland	2	Agricultural field adjacent to plantation woodland			21/07/21	35	13/09/21	24
AT3	Treeline/ hedgerow adjacent to plantation woodland and grassland	3	Plantation woodland			21/07/21	13	13/09/21	24
AT4	Defunct hedgerow and wet grassland	4	Wet grassland, marsh and plantation woodland			N/A	N/A	13/09/21	24
AT5	Wet grassland and drainage ditch	5	Wet grassland			21/07/21	13	13/09/21	24
AT6	Path (clearing) between two plantation woodland stands	3 & 6	Plantation woodland			21/07/21	13	13/09/21	24

Path: R:\Map Production\2020\P2359\Workspace\EIAR\P2359_GIS_INFO_BatSurveys_A3.mxd

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
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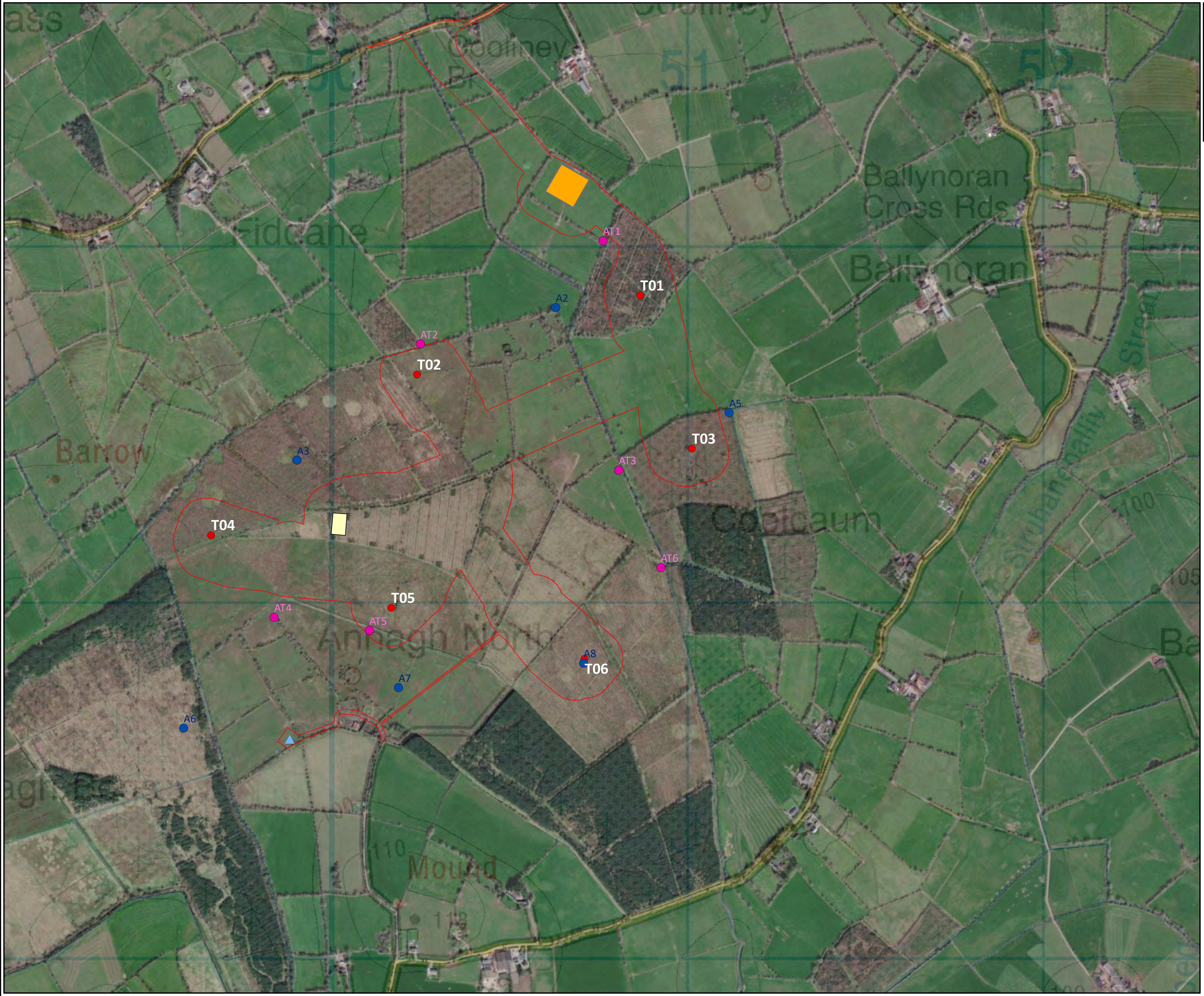

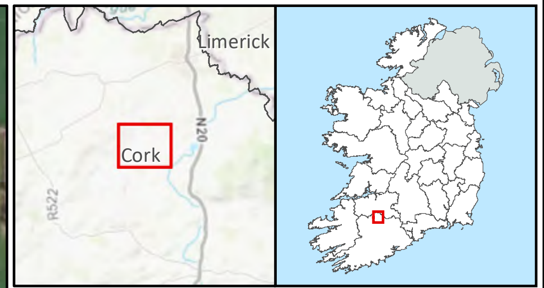

Legend

- Site Boundary
- Substation
- Construction Compound
- Met Mast
- Turbine Layout
- Static Detector Locations 2020
- Static Detector Locations 2021

TITLE:	Static Detector Locations
PROJECT:	Annagh Wind Farm, Co. Cork
FIGURE NO:	3.2
CLIENT:	EMPower
SCALE: 1:10500	REVISION: 0
DATE: 22/11/2021	PAGE SIZE: A3

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3.2.5 Vantage Point Surveys

Vantage Point surveys are particularly useful for observing early commuting and foraging species such as noctule bats whilst it is still light. The surveys were carried out on 9th and 31st August 2021 during clear weather conditions. Two surveyors observed the Site from vantage points providing clear views of the study area.

VP 1 550115, 616205 (ITM)

VP 2 550037, 616468 (ITM)

The surveys were carried out prior to and during dusk to search for bat emergence activity associated with buildings. The surveyors used infra-red scopes in line with Fawcett 2021 to improve detection of bats in low light conditions.

3.3 Data Analysis

3.3.1 Ecobat

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 (5.3.9) 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 Europe 5.2.1).

In order to determine appropriate quality assurance a randomly generated 10% sample of the files were manually checked (including noise and noID files).

The data was then entered into Ecobat [6] 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 3.5).

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 recording.

Table 3-4: Median percentile range and corresponding bat activity

Percentile Median	Bat Activity
81 to 100	High
61 to 80	Moderate to High
41 to 60	Moderate

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

Percentile Median	Bat Activity
21 to 40	Low to Moderate
0 to 20	Low

3.4 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 for the 2020/2021 survey results;
- 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+ files 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. Although there is an increased uptake in the use of Ecobat in Ireland, some of the reference ranges remain below 200, therefore the results are more conservative.
- Ecobat analysis regarding genus level identification is currently flawed. If a genus level ID has been entered into the spreadsheets, for example "Pipistrellus" then all identified pipistrellus species (including pipistrellus, pygmeaus and nathusius) will be included in the total for the date of the Pipistrellus genus entry. Therefore all genus level results are over exaggerated for the 2020 results and have been omitted from the 2021 results.
- Due to the cattle rotation within the study area and the placement of static detectors, some of the units were deployed for longer periods than others during the 2021 surveys. However, in order to provide the best representation of activity on Site, the analysis has been conducted on all data obtained and not reduced to have all deployment schedules matching.
- Static location AT4 was not surveyed during the summer period due to cattle being present for the duration of the deployment. The impact assessment of the 2021 results at this location is based on the autumn results only.
- Static detector AT1 failed to record during the autumn survey period, therefore there are no results available. The impact assessment of the 2021 results at this location is based on the summer results only.

4. RESULTS

4.1 Desktop Survey

BCI records indicate two known bat roosts within 10 km of point R5052117435 (central point within the proposed wind farm site). One roost at c. 9km southeast for brown long-eared bats and one roost at c. 10km southeast for leisler bats [7]. Four of the nine known Irish species of bat (Bat conservation Ireland) have also been recorded (observed) within 10km of point R5052117435. These are common pipistrelle, soprano pipistrelle, leisler's bat, and daubenton's bat.

Review of existing records form NPWS (10 km radius of wind farm site boundary) and NBDC (10km grid squares R41 and R51) indicates that no bat species have previously been recorded within 10 km of the proposed wind farm site boundary.

Review of the NPWS Lesser Horseshoe bat database indicates that there are no records of roosts within a 2.5 km buffer (Core Sustenance Zone (CSZ)) of the proposed wind farm site boundary (NPWS 2018).

The Cave Database for the Republic of Ireland does not hold any records of caves within a 4 km radius of the proposed wind farm site boundary.

4.1.1 Bat Landscapes

The bat landscape association model (Lundy *et al,* 2011) suggests that the proposed wind farm site boundary is part of a landscape that is of moderate suitability for bat species as a whole. The landscape suitability is high for common pipistrelle and soprano pipistrelle, moderate for brown long-eared bat, leisler's bat, daubenton's bat and natterer's bat, and low for whiskered bat, lesser horseshoe bat and nathusius' Pipistrelle. Refer to Plate 1 below for the NBDC map highlighting the bat landscape for all bats.

[7] It should be noted that BCI data for roost locations are only given to a four-figure grid refence which is equal to 1 km squared.

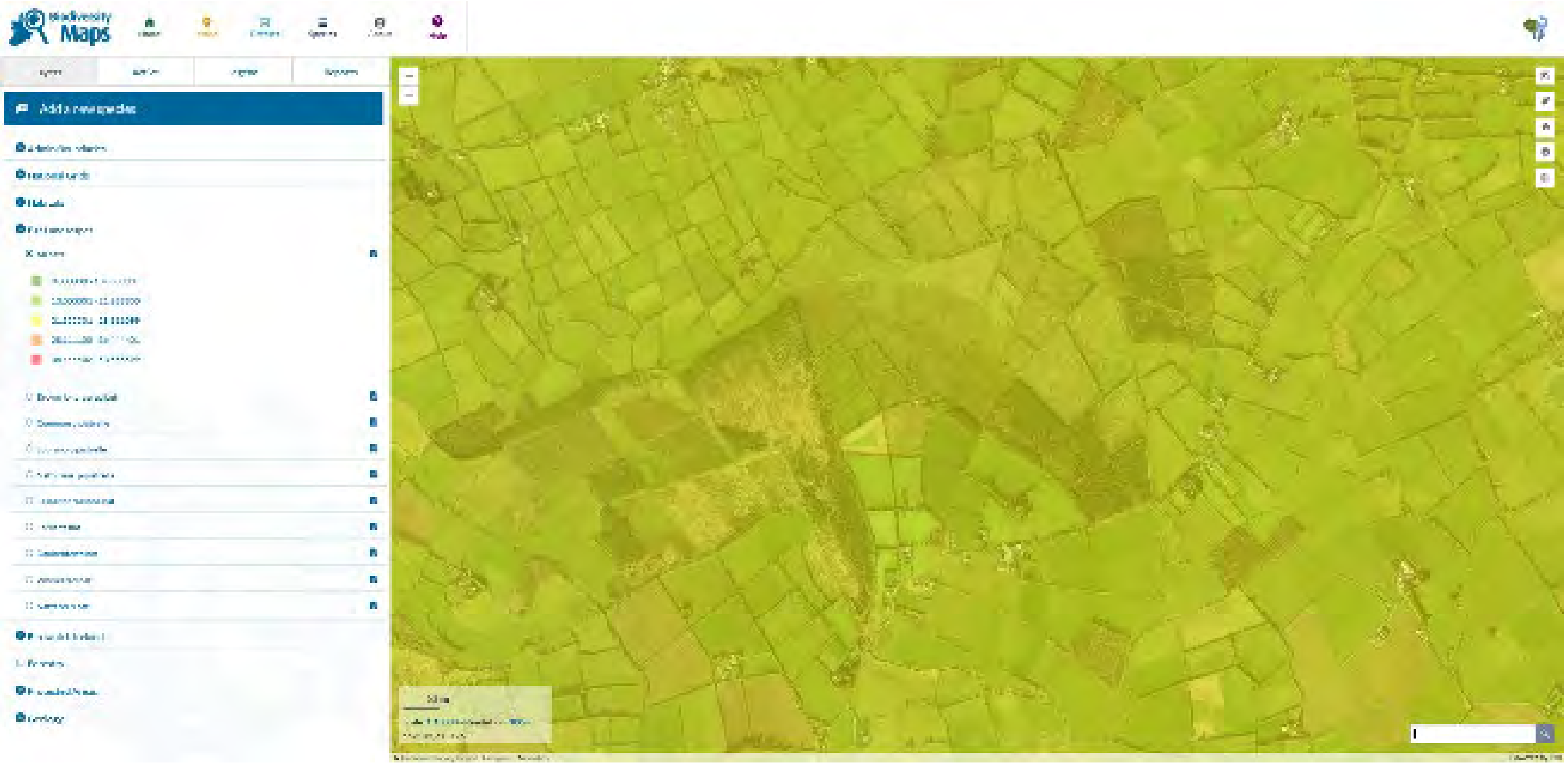

Plate 1: NBDC map highlighting the bat landscape for all bats (accessed November 2021)

4.1.2 Designated Sites

European Sites
There are three European sites within 15km of the proposed wind farm site boundary, namely: the Blackwater River (Cork/Waterford) SAC (002170), Ballyhoura Mountains SAC (002036) and Kilcolman Bog SPA (004095).

No European site designated for bats are located within 15km of the proposed wind farm site boundary.

National Sites

There are no NHA's and five pNHAs present within 10 km of the proposed wind farm site boundary.

Eagle Lough pNHA (001049), Ballyhoura Mountains pNHA (002036), Kilcolman Bog pNHA (000092), Ballinvonear Pond pNHA (000012) and Mountrussel Wood pNHA (002088).

There are no Nationally designated sites within 10km of the proposed planning boundary for which bats are a qualifying feature.

4.2 Bat Roost surveys

4.2.1 Bat Roost Inspection Survey

4.2.1.1 Trees

No trees within the study area were confirmed as roost sites. No trees of moderate or high potential for roosting bats (as defined in Table 2 1) were recorded at the study area. A total of 5 trees supporting features such as heavy Ivy growth and hazard beams that may have potential for individual/ small numbers of bats to roost opportunistically were recorded at the centre of the study area in the vicinity of the Oakfront Stream. These trees are classified as being of low suitability to support roosting bats.

4.2.1.2 Structures

A total of eleven buildings/clusters of buildings were identified in the preliminary ecological appraisal as being of potential to support roosting bats.

Cluster 1 was identified as comprising High suitability for bats; buildings 9 and 10 are comprise Moderate suitability for bats; buildings 2 and 7 comprise Low- Moderate suitability for bats; buildings 3, 4, 5, 6 and 11 comprise Low suitability for bats; and building 8 comprises Negligible suitability for bats.

4.2.1.3 Bridges

Two bridges over the Oakfront Stream are present within the study area. No features of suitability for roosting bats were recorded within either bridge and both bridges are classified as Grade 0.[8] A low stone culvert is present to the north-east of the study area. The culvert was low-lying and obscured by vegetation.

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[8] *0 = no potential (no suitable crevices); 1 = crevices present may be of use to bats; 2 = crevices ideal for bats but no evidence of usage; and 3 = evidence of bats (e.g. bats present, droppings, grease marks, urine staining, claw marks or the presence of bat fly pupae) (Billington and Norman, 1997).

The culvert supported some crevices that may be of use by bats, but no evidence of bats was recorded. This culvert is classified as Grade 1.

Refer to Appendix A for full list of results and determination.

4.2.2 Emergence Roost Survey

Emergence roost surveys were undertaken of structures within the land ownership boundary and accessible structures within the land ownership buffer (both within study area) that were of moderate to high suitability for roosting bats.

Cluster 1
One pipistrelle bat (not echolocating so species unknown) was recorded emerging from underneath the roof tiles on the southern elevation of the dwelling. Common pipistrelle, soprano pipistrelle and leisler were recorded foraging.

Building 2
A total of three common pipistrelle were recorded emerging from the doorway of the outbuildings. leisler's bat was recorded commuting overhead and natterer's bat were recorded foraging.

Building 10
A total of 75 common and soprano pipistrelle bats were counted emerging from the side of the chimney breast of the dwelling. One leisler's bat was recorded commuting overhead at sunset, indicating the potential presence of a roost near to this building.

Building 11
No bats were recorded emerging from the derelict dwelling or outbuildings during the emergence survey.

Refer to Appendix A for full results.

4.3 Vantage Point Surveys 2021

The potential presence of a leisler's bat roost at a farmhouse c. 710m north of T01 (Building 9. Refer to Appendix A) was indicated by observations during the VP survey on 9th August 2021. The next survey round on 31st August 2021 did not detect the same activity at that location, indicating the roost may have been vacated in the intervening period.

4.4 Bat Activity Surveys 2020

The results of the six bat activity surveys carried out in 2020 are presented below in Table 4.2, Plate 2 and Figures 4.1 to 4.6. Weather conditions for each of the survey dates are presented in Table 4.1.

Overall, five bat species were recorded (common pipistrelle, soprano pipistrelle, leisler's bat, natterer's bat, and whiskered bat). In situations where the call could not be identified to species, the identification was determined to genus level or recorded as NoID.

The most commonly recorded species was soprano pipistrelle, followed by leisler's and common pipistrelle, with much lower levels of myotis spp., natterer's bat and whiskered bat detected.

The highest level of activity recorded for soprano pipistrelle was during the transects on 8th May 2020 (68 passes) and 28th July 2020 (54 passes). The highest level of activity recorded for leisler's bat was during the transect on 8th May 2020 with 87 passes while the highest level of activity recorded for common pipistrelle was during the transect on 28th July 2020 with 35 passes.

Table 4-1: Weather Conditions per Survey

Date	Sunset	Start	Finish	Temp (°C)	Wind (Beaufort)	Cloud (Oktas)	Precipitation
08/05/2020	21:13	21:05	23:30	13	2	4	None
25/06/2020	21:57	21:45	00:00	16	2	6	None
28/06/2020	21:57	21:45	23:45	11	5	6	None
28/07/2020	21:29	21:15	23:30	11	2	4	None
27/08/2020	20:35	20:15	22:50	13	2	8	one light rain shower
21/09/2020	19:34	19:20	21:55	11	5	2	None

Table 4-2: Analysis BatLogger Data - Survey Results

	08/05/2020	25/06/2020	28/06/2020	28/07/2020	27/08/2020	21/09/2020
Common pipistrelle (CP)	21	14	23	35	6	4
Soprano pipistrelle (SP)	68	24	14	54	13	35
Pipistrelle spp. (Pip)	0	1	3	0	1	0
Leisler's (Lei)	87	9	20	1	3	4
Myotis spp. (My)	0	1	0	0	1	0
Whiskered/Brandt's (Whi)	0	1	0	0	0	0
Natterer's (Nat)	0	0	0	0	0	1
NoID	0	0	1	0	0	1
Total	**176**	**48**	**60**	**90**	**23**	**43**

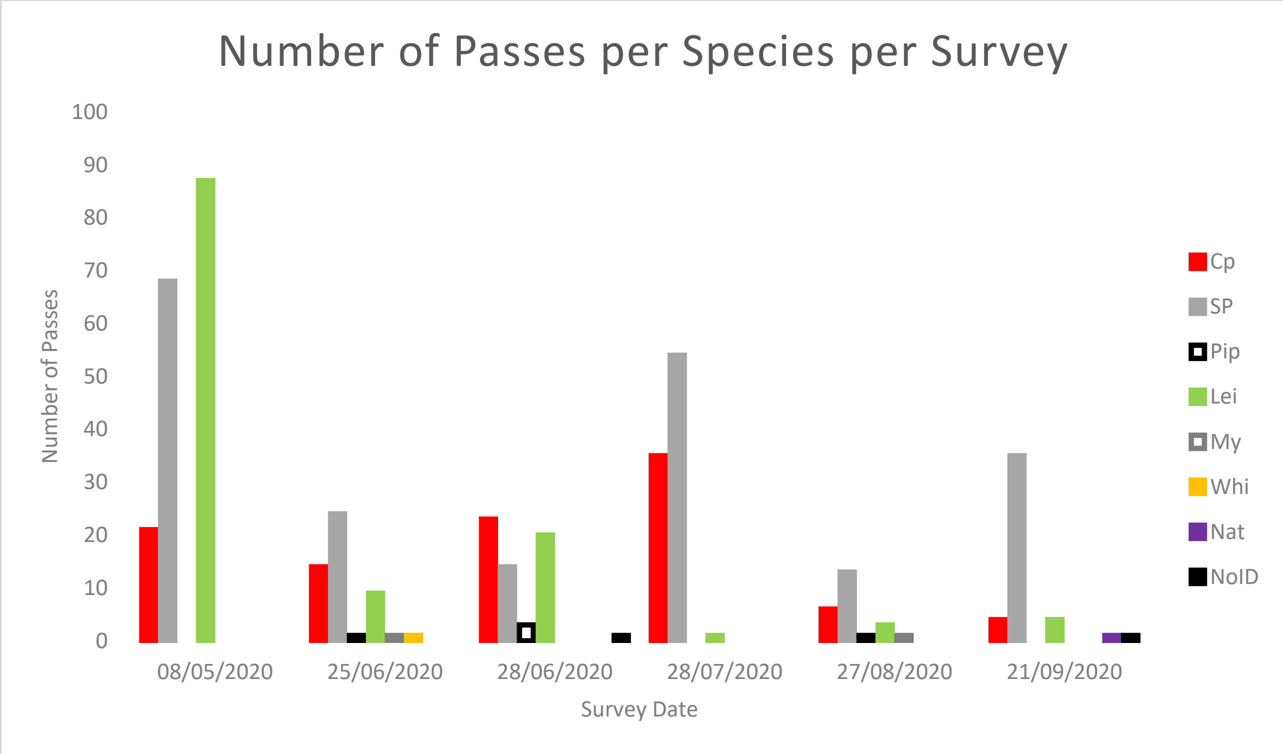

Plate 2: 2020 Activity Survey

Path: R:\Map Production\2020\P2359\Workspace\EIAR\P2359_GIS_INFO_BatSurveys_A3.mxd

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
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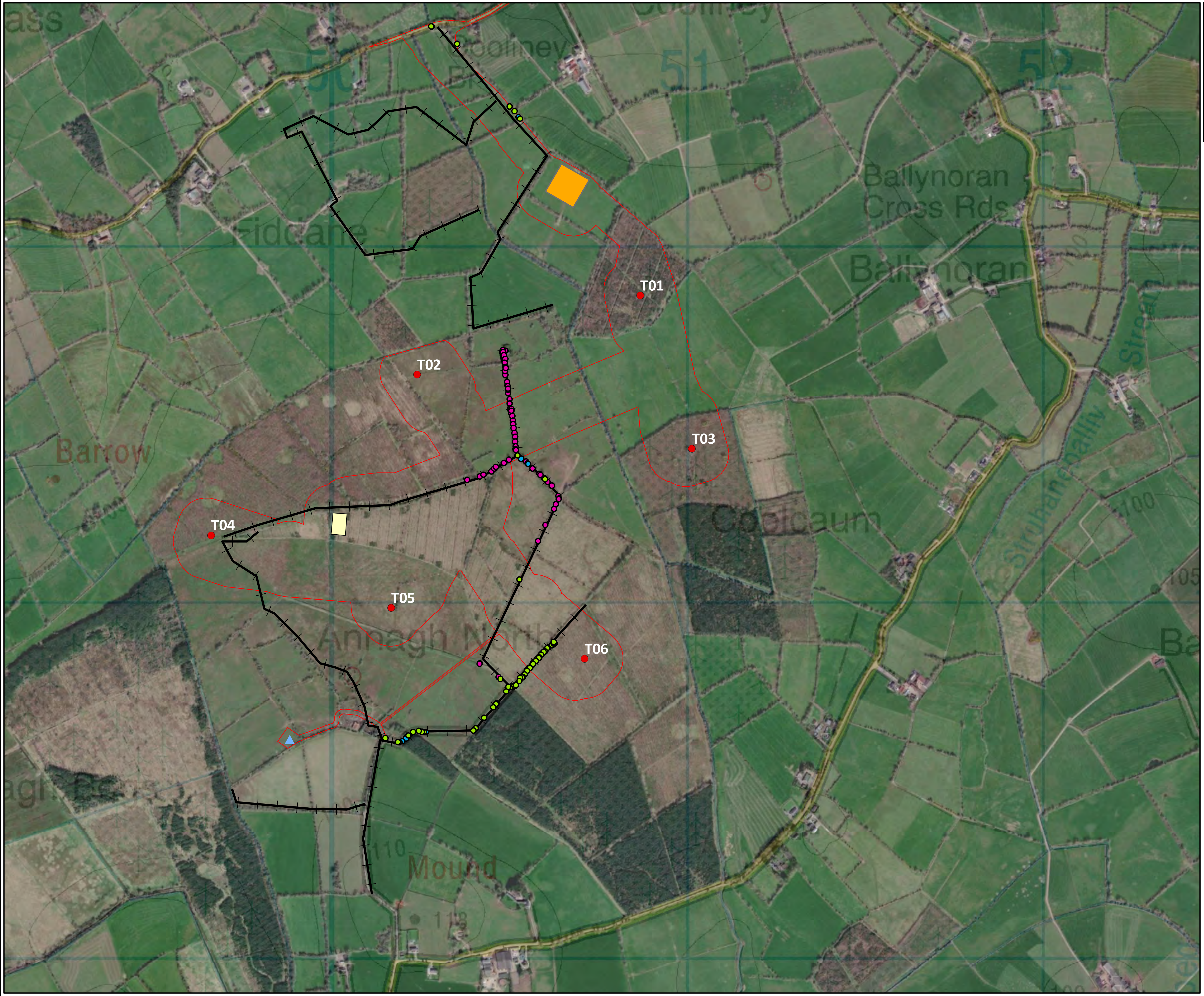

Legend

- Site Boundary
- Substation
- Construction Compound
- Met Mast
- Turbine Layout
- Transect

Species:

- NSL
- Ppip
- Ppyg

Kilometers: 0, 0.25, 0.5, 1

TITLE: Bat Activity Survey 08/05/2020	
PROJECT: Annagh Wind Farm, Co. Cork	
FIGURE NO: 4.1	
CLIENT: EMPower	
SCALE: 1:10500	**REVISION:** 0
DATE: 22/11/2021	**PAGE SIZE:** A3

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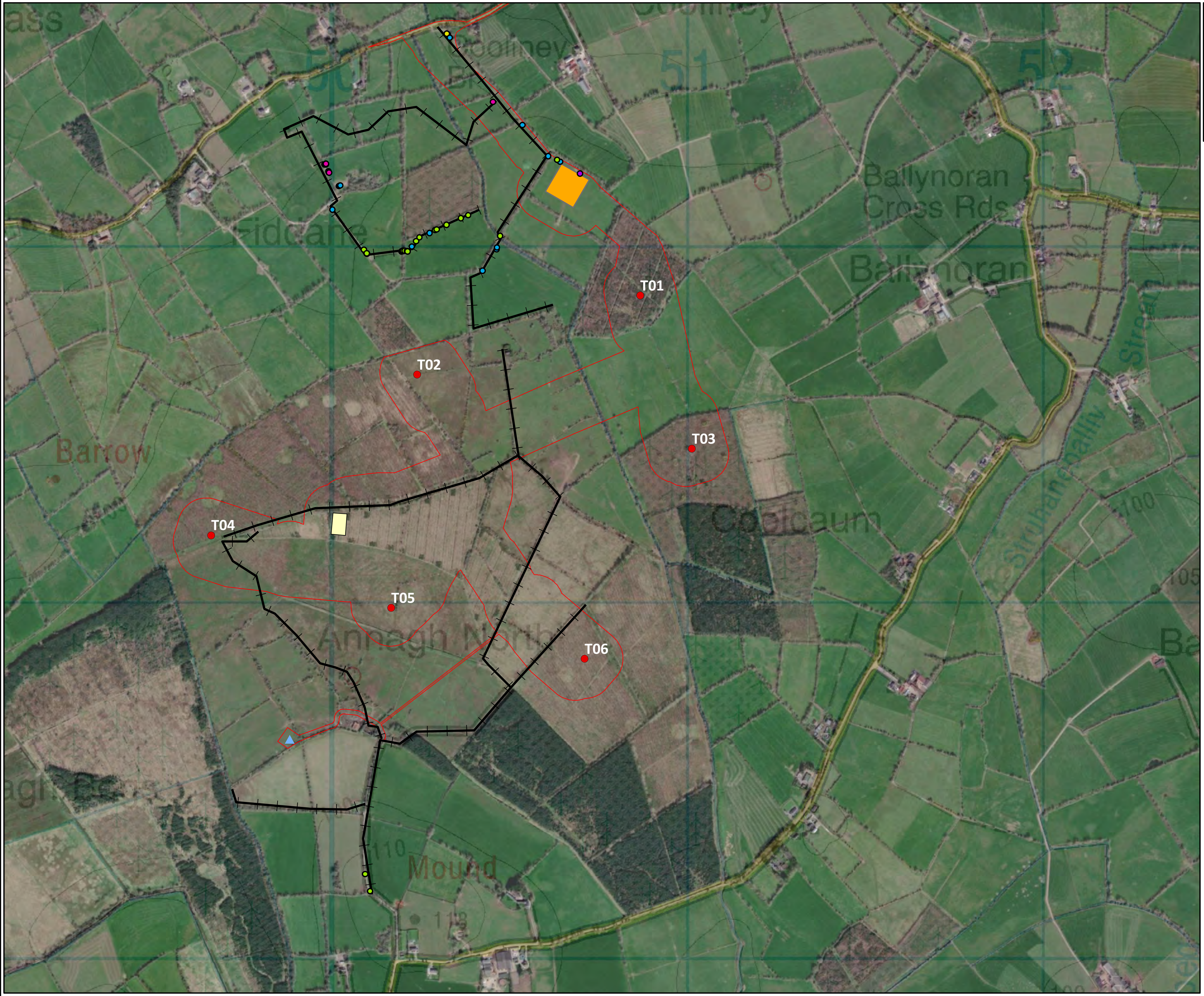

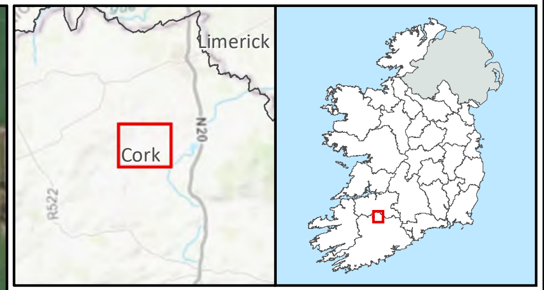

Legend

- Site Boundary
- Substation
- Construction Compound
- Met Mast
- Turbine Layout
- Transect

Species:

- MbraMmys
- MySp
- NSL
- PSp
- Ppip
- Ppyg

TITLE: Bat Activity Survey 25/06/2020	
PROJECT: Annagh Wind Farm, Co. Cork	
FIGURE NO: 4.2	
CLIENT: EMPower	
SCALE: 1:10500	**REVISION:** 0
DATE: 22/11/2021	**PAGE SIZE:** A3

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0 0.25 0.5 1 Kilometers

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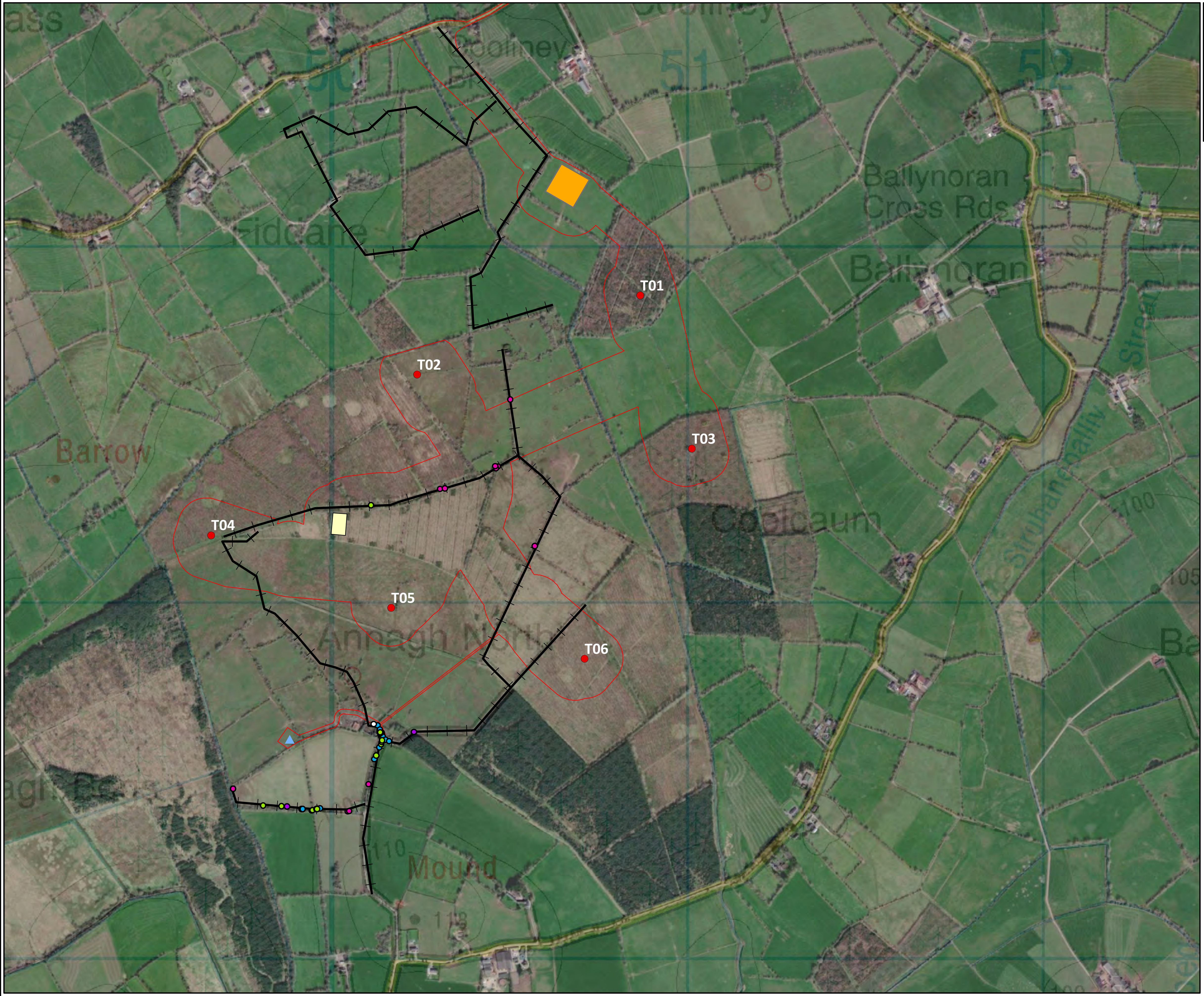

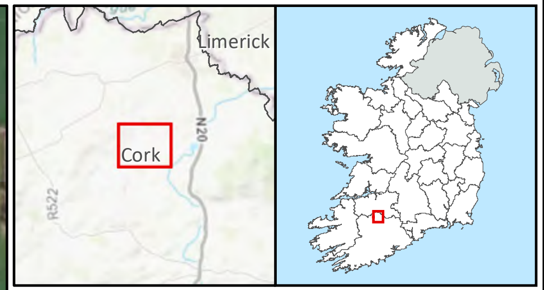

Legend

- Site Boundary
- Substation
- Construction Compound
- Met Mast
- Turbine Layout
- Transect

Species:

- NSL
- PSp
- Ppip
- Ppyg
- UnID

TITLE: Bat Activity Survey 28/06/2020	
PROJECT: Annagh Wind Farm, Co. Cork	
FIGURE NO: 4.3	
CLIENT: EMPower	
SCALE: 1:10500	**REVISION:** 0
DATE: 22/11/2021	**PAGE SIZE:** A3

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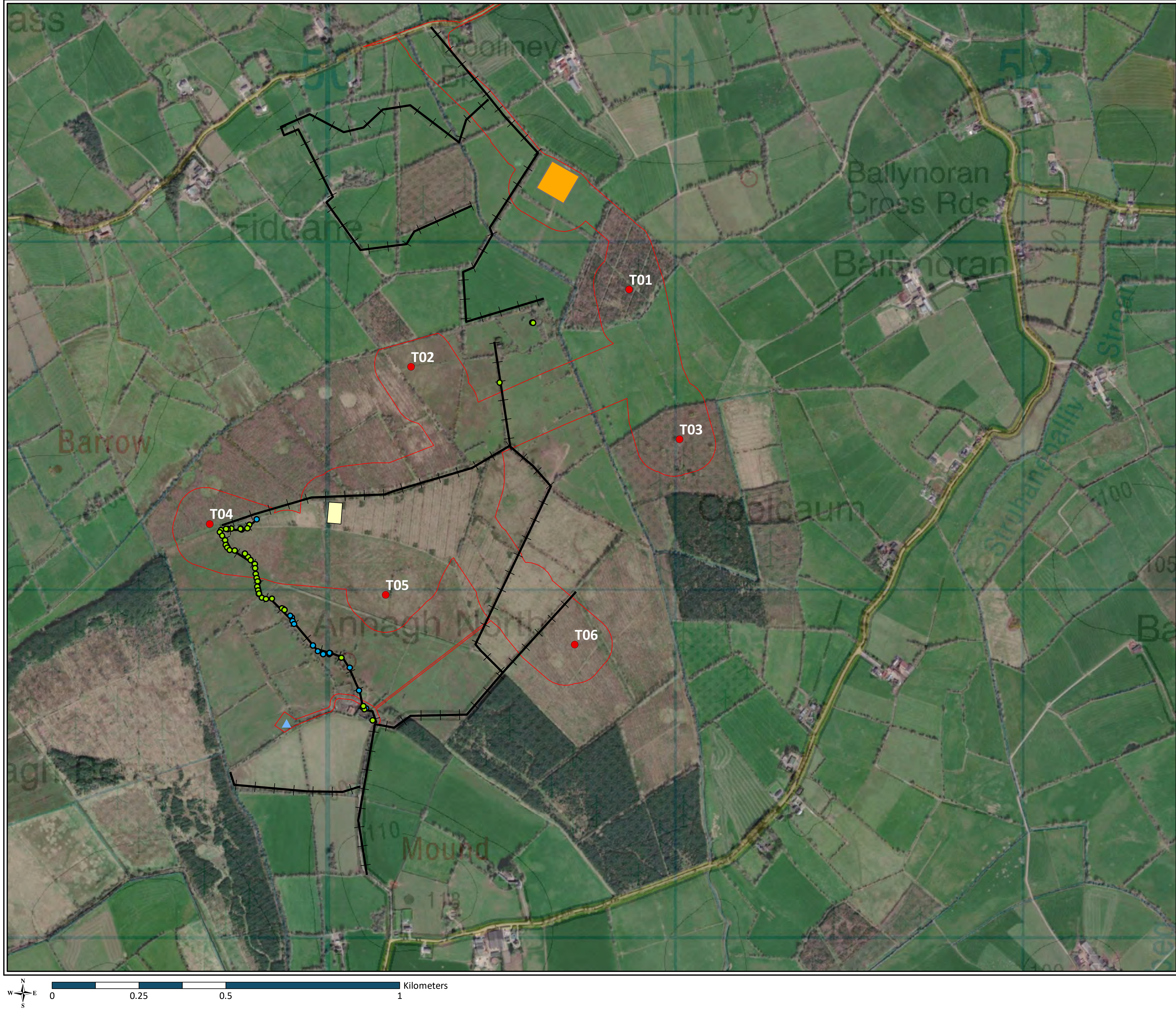
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community



Legend

- Site Boundary
- Substation
- Construction Compound
- Met Mast
- Turbine Layout
- Transect

Species:

- NSL
- Ppip
- Ppyg

TITLE: Bat Activity Survey 28/07/2020	
PROJECT: Annagh Wind Farm, Co. Cork	
FIGURE NO: 4.4	
CLIENT: EMPower	
SCALE: 1:10500	**REVISION:** 0
DATE: 22/11/2021	**PAGE SIZE:** A3

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Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
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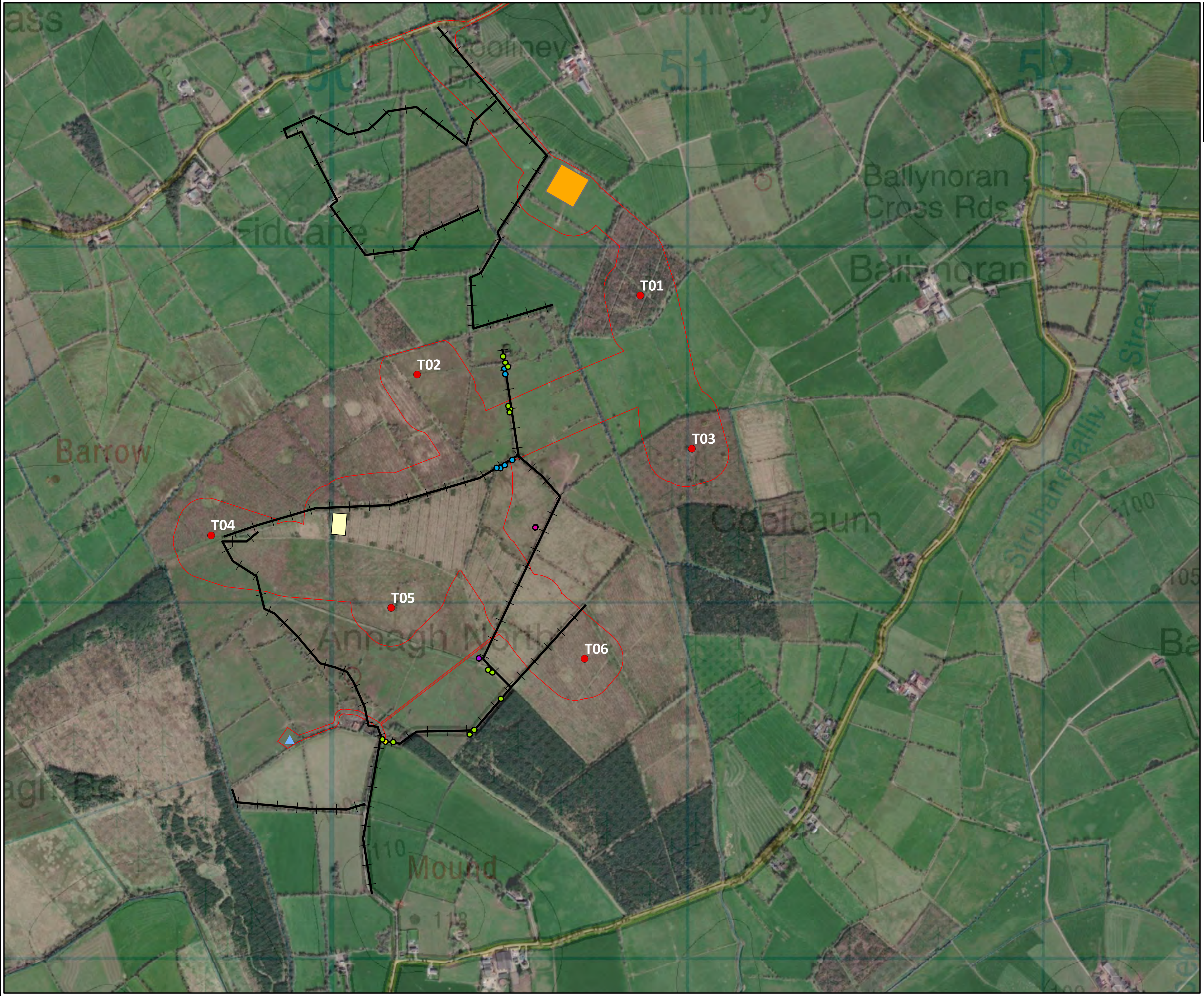

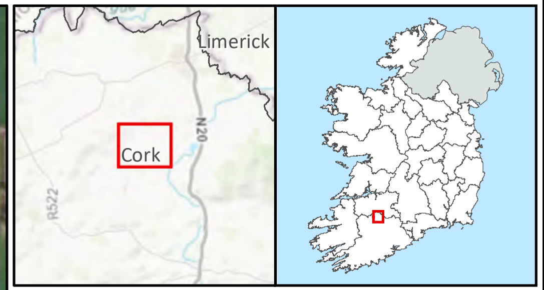

Legend

- Site Boundary
- Substation
- Construction Compound
- Met Mast
- Turbine Layout
- Transect

Species:

- MySp
- NSL
- PSp
- Ppip
- Ppyg

TITLE: Bat Activity Survey 27/08/2020	
PROJECT: Annagh Wind Farm, Co. Cork	
FIGURE NO: 4.5	
CLIENT: EMPower	
SCALE: 1:10500	**REVISION:** 0
DATE: 22/11/2021	**PAGE SIZE:** A3

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0 0.25 0.5 1 Kilometers

Path: R:\Map Production\2020\P2359\Workspace\EIAR\P2359_GIS_INFO_BatSurveys_A3.mxd

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
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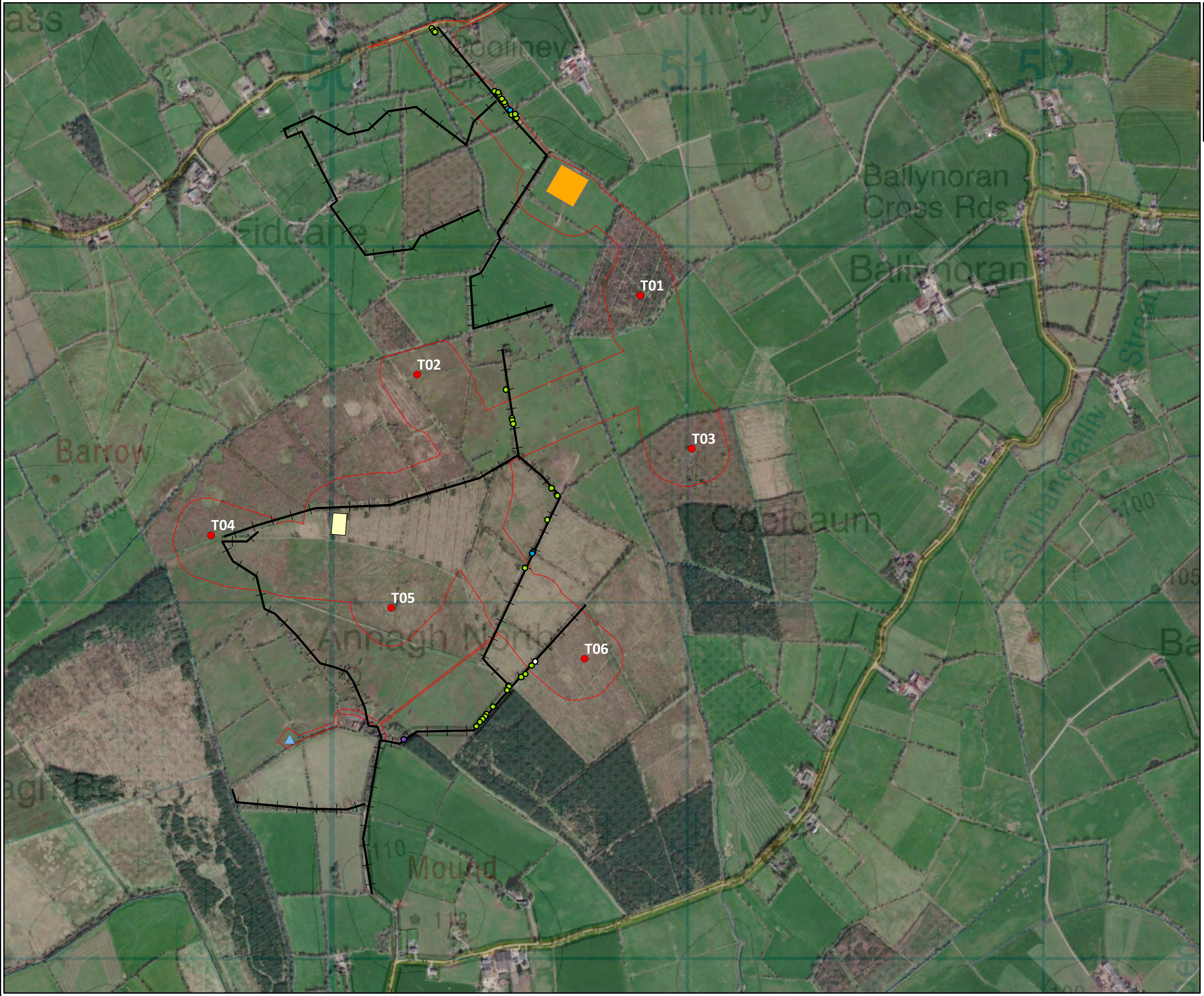

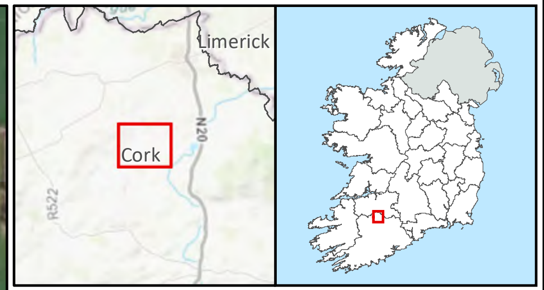

Legend

- Site Boundary
- Substation
- Construction Compound
- Met Mast
- Turbine Layout
- Transect

Species:

- Mnat
- NSL
- NycLei
- Ppip
- Ppyg
- UnID

TITLE: Bat Activity Survey 21/09/2020	
PROJECT: Annagh Wind Farm, Co. Cork	
FIGURE NO: 4.6	
CLIENT: EMPower	
SCALE: 1:10500	**REVISION:** 0
DATE: 22/11/2021	**PAGE SIZE:** A3

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0 0.25 0.5 1 Kilometers

4.5 Bat Static Detector Surveys 2020

Table 4.3 below summarises the results, in relation to bat species, recorded on the static detectors deployed in 2020. Six static units were deployed during each survey period. Overall, eight bat species were recorded (common pipistrelle, soprano pipistrelle, nathusius' pipistrelle, leisler's bat, brown long-eared bat, natterer's bat, daubenton's bat and whiskered bat). Where the call could not be identified to species, the identification was determined to genus level. The graphs within Plate 3 to Plate 8 below show the number of bat passes (per species) recorded at each static detector location over the three surveillance periods.

Table 4-3: Summary results of Static Bat Detectors deployed during survey periods 1 to 3

Static Detector No. and location habitats	Species detected during Period 1 23rd April to 5th May 2020 (Night 1 – 13)	Species detected during Period 2 21st to 31st July 2020 (Night 14 – 24)	Species detected during Period 3 15th September to 1st October 2020 (Night 25 – 41) [9]
A2 Treeline / hedgerow / drainage ditch / agricultural / pasture	Myotis sp. Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Pipistrelle sp. Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	Myotis sp. Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Pipistrelle sp. Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	Myotis sp. Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Pipistrelle sp. Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat
A3 Plantation woodland / clearing / grassland	Myotis sp. Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Pipistrelle sp. Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	Myotis sp. Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Pipistrelle sp. Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	Myotis sp. Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Pipistrelle sp. Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat
A5 Plantation woodland / agricultural	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Pipistrelle sp.	Myotis sp. Daubenton's bat Whiskered bat Natterer's bat Leisler's bat	Myotis sp. Daubenton's bat Whiskered bat Natterer's bat Leisler's bat

[9] Note: The static detectors A6, A7 and A8 were deployed for 10 nights during period 3 (15th to 24th September), while the remaining static detectors A2, A3 and A5, were deployed for a further seven nights over (15th September to 1st October). Analysis is based on the number of nights the bats were detected on each recorder.

Static Detector No. and location habitats	Species detected during Period 1 23rd April to 5th May 2020 (Night 1 – 13)	Species detected during Period 2 21st to 31st July 2020 (Night 14 – 24)	Species detected during Period 3 15th September to 1st October 2020 (Night 25 – 41) [9]
grassland/ wet grassland / marsh	Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	Pipistrelle sp. Common pipistrelle Soprano pipistrelle Brown long-eared bat	Pipistrelle sp. Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat
A6 Marsh / Scrub	Myotis sp. Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	Myotis sp. Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Pipistrelle sp. Common pipistrelle Soprano pipistrelle Brown long-eared bat	Myotis sp. Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Pipistrelle sp. Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat
A7 Hedgerow / treeline / agricultural / pasture / drainage ditch	Myotis sp. Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Pipistrelle sp. Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	Myotis sp. Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Pipistrelle sp. Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	Myotis sp. Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Pipistrelle sp. Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat
A8 Plantation Woodland	Myotis sp. Daubenton's bat Leisler's bat Pipistrelle sp. Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	Leisler's bat Common pipistrelle Soprano pipstrelle	Myotis sp. Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Pipistrelle sp. Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat

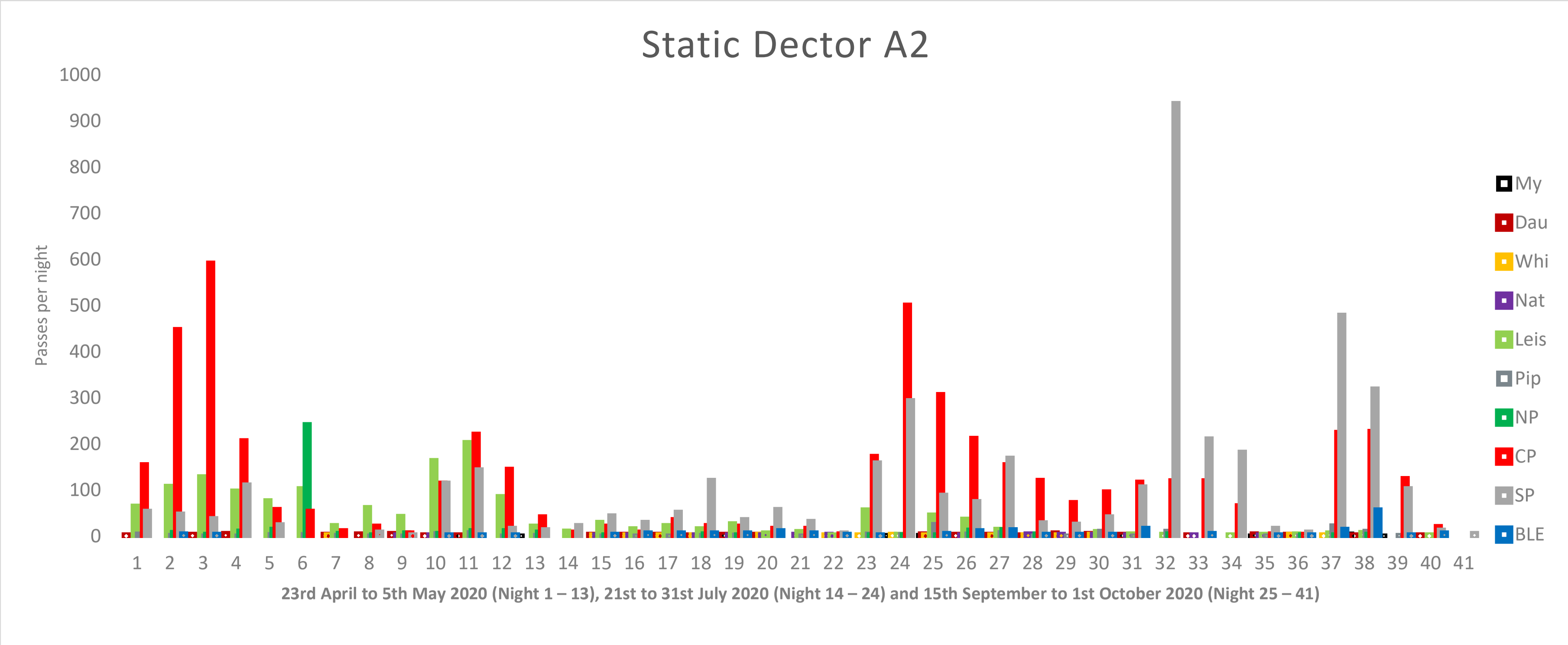


Plate 3: Total number of nightly bat passes recorded at static location A2

The static unit A2 recorded eight species of bat and bat passes identified to genus level for *Myotis* spp and *Pipistrellus* spp. A higher level of activity was recorded in period 1 (23rd April to 5th May 2020) and period 3 (15th September to 1st October 2020) compared to period 2 (21st to 31st July 2020). During period 1 and period 3 a higher level of common pipistrelle was recorded while leisler's bat passes were recorded at higher levels in Period 1 and soprano pipistrelle were recorded at higher levels in Period 3. Nathusius pipistrelle had a spike in activity on day 6 (28/04/2020) with 240 passes, while soprano pipistrelle spiked in activity on day 32 (22/09/2020) with 936 passes. A much lower level of bat activity for all bat species recorded was noted during Period 2.

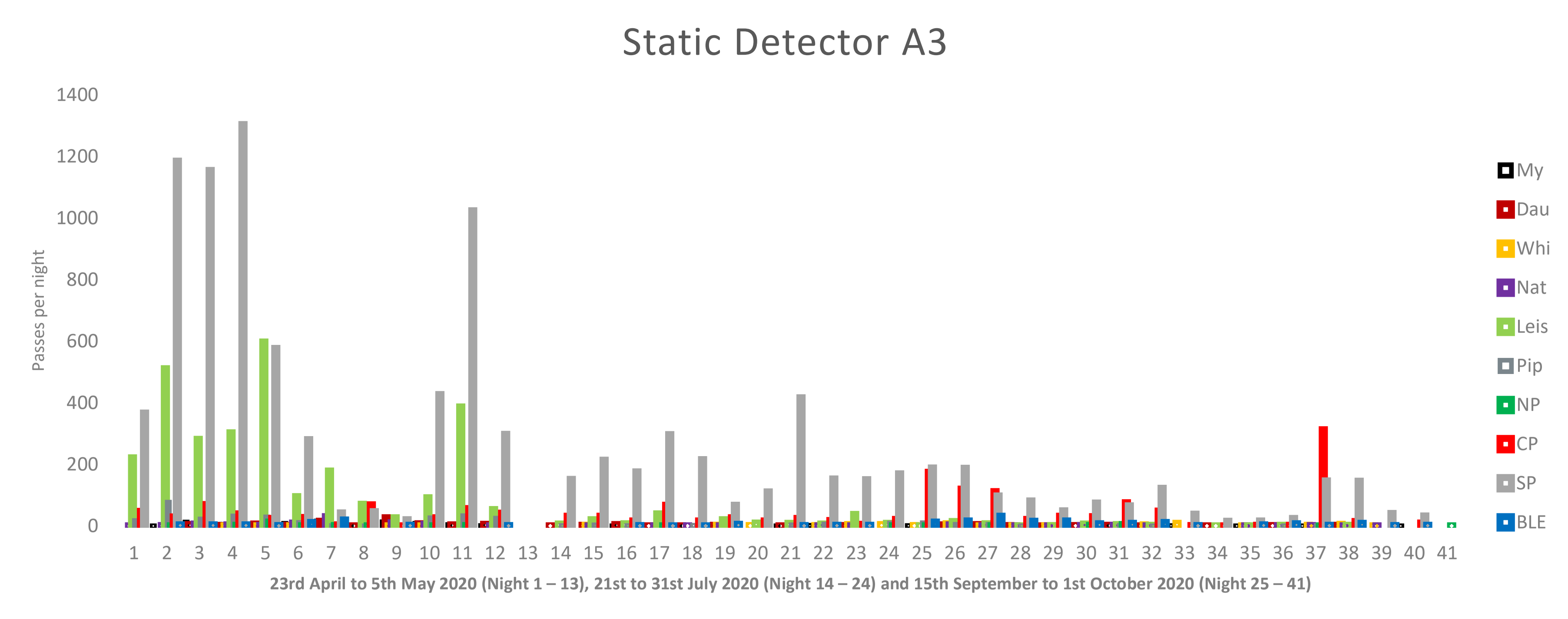


Plate 4: Total number of nightly bat passes recorded at static location A3

The static unit A3 recorded eight species of bat and bat passes identified to genus level for *Myotis* spp and *Pipistrellus* spp. A higher level of activity was recorded in period 1 (23rd April to 5th May 2020) compared to period 2 (21st to 31st July 2020) and period 3 (15th September to 1st October 2020). During period 1 and period 2 a higher level of soprano pipistrelle was recorded, while leisler's bat passes were recorded at a higher level during period 1. Soprano pipistrelle had a particularly high peak of activity on days 2, 3, 4 (24, 25, 26/04/2020) and 11 (03/05/2020). A much lower level of bat activity for all bat species recorded was noted during Period 3.

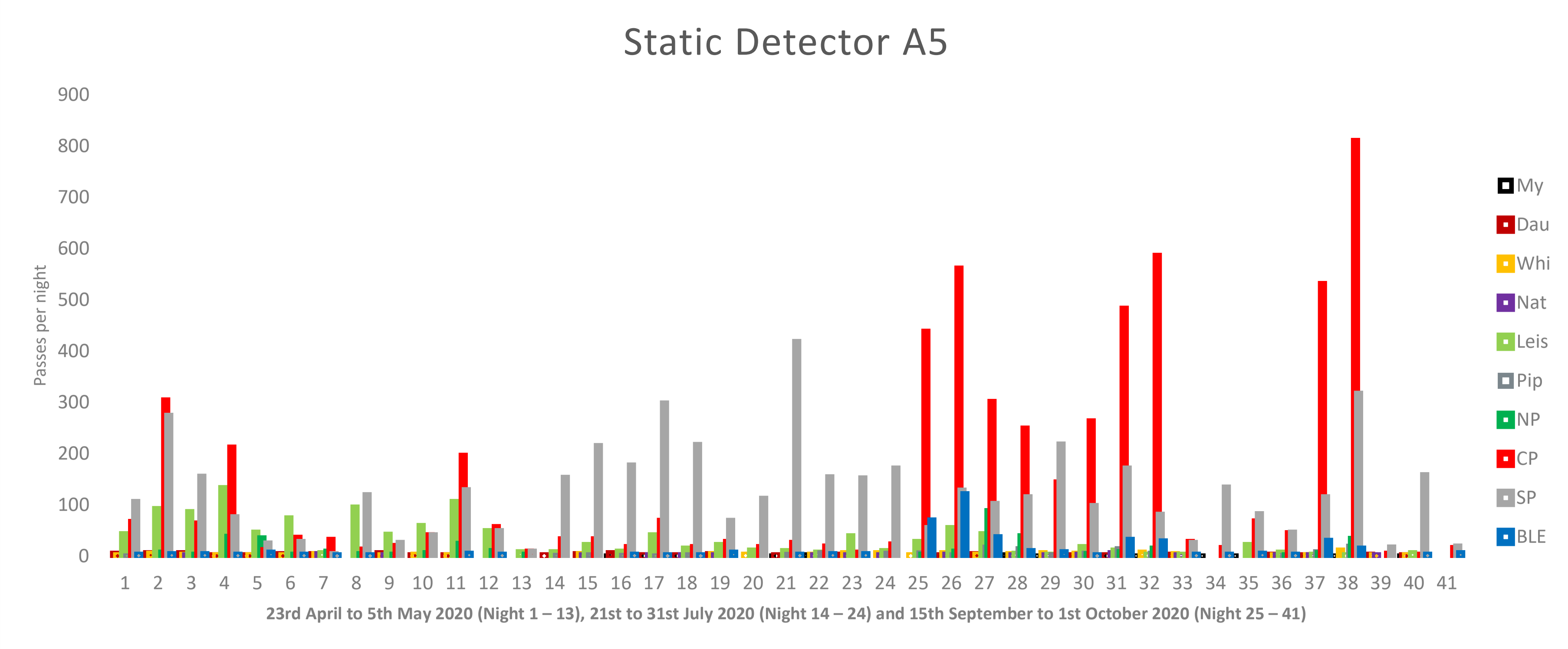


Plate 5: Total number of nightly bat passes recorded at static location A5

The static unit A5 recorded eight species of bat and bat passes identified to genus level for *Myotis* spp and *Pipistrellu*s spp. A higher level of activity was recorded for common pipistrelle and soprano pipistrelle compared to the rest of the bat species for all periods. The highest level of activity for common pipistrelle was recorded in period 3 (15th September to 1st October 2020) with a particularly high peak of activity on day 38 (28/09/2020) with a 809 passes, whilst leisler's bat passes were recorded at higher levels in Period 1 (23rd April to 5th May 2020) and soprano pipistrelle were recorded at higher levels in Period 2 (21st to 31st July 2020).

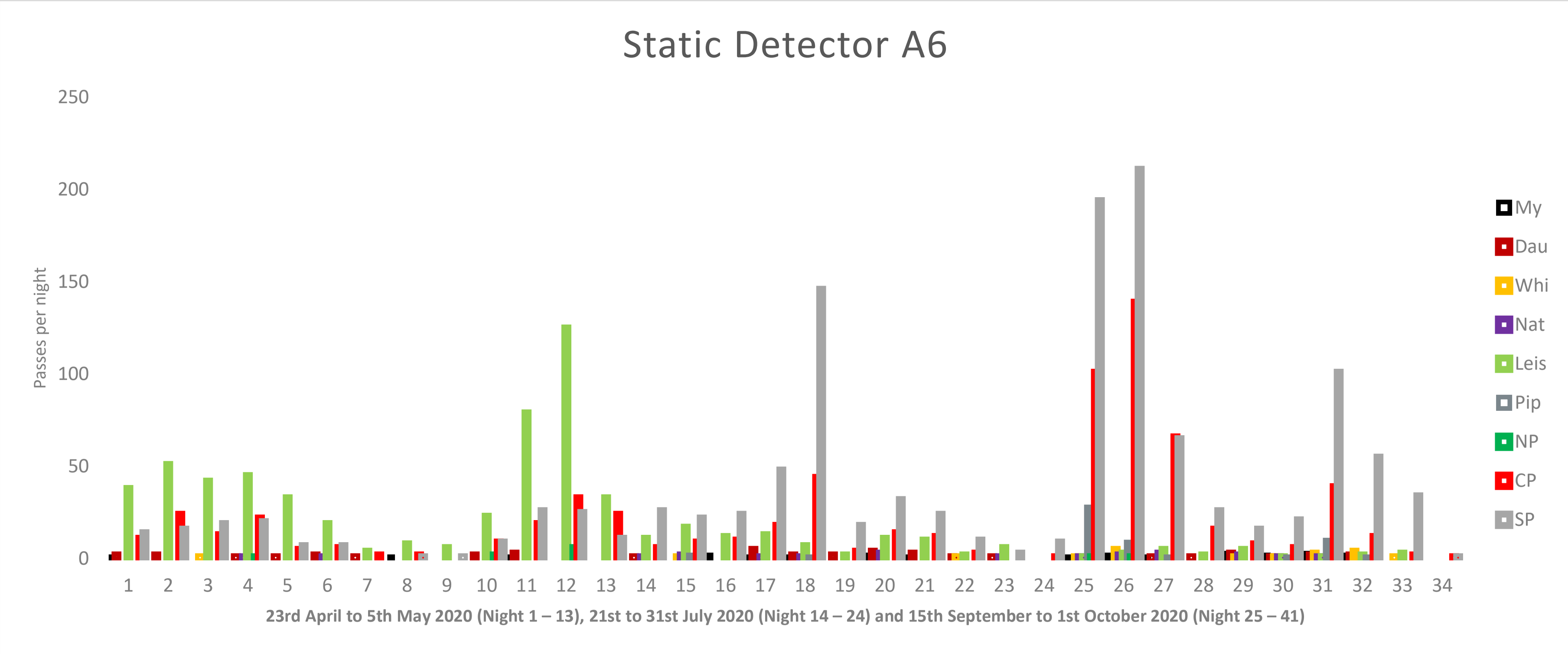


Plate 6: Total number of nightly bat passes recorded at static location A6

The static unit A6 recorded eight species of bat and bat passes identified to genus level for *Myotis* spp and *Pipistrellus* spp. A higher level of activity was recorded in period 3 (15th to 24th September 2020) for common pipistrelle and soprano pipistrelle with a peak in activity on days 25 (15/09/2020) and 26 (16/09/2020). leisler's bat passes were recorded at higher levels in Period 1 (23rd April to 5th May 2020) with a peak of 125 passes on day 12 (04/05/2020). There was no nathusius' pipistrelle activity recorded for period 2 (21st to 31st July 2020) and no brown long-eared bat activity recorded for all survey periods.

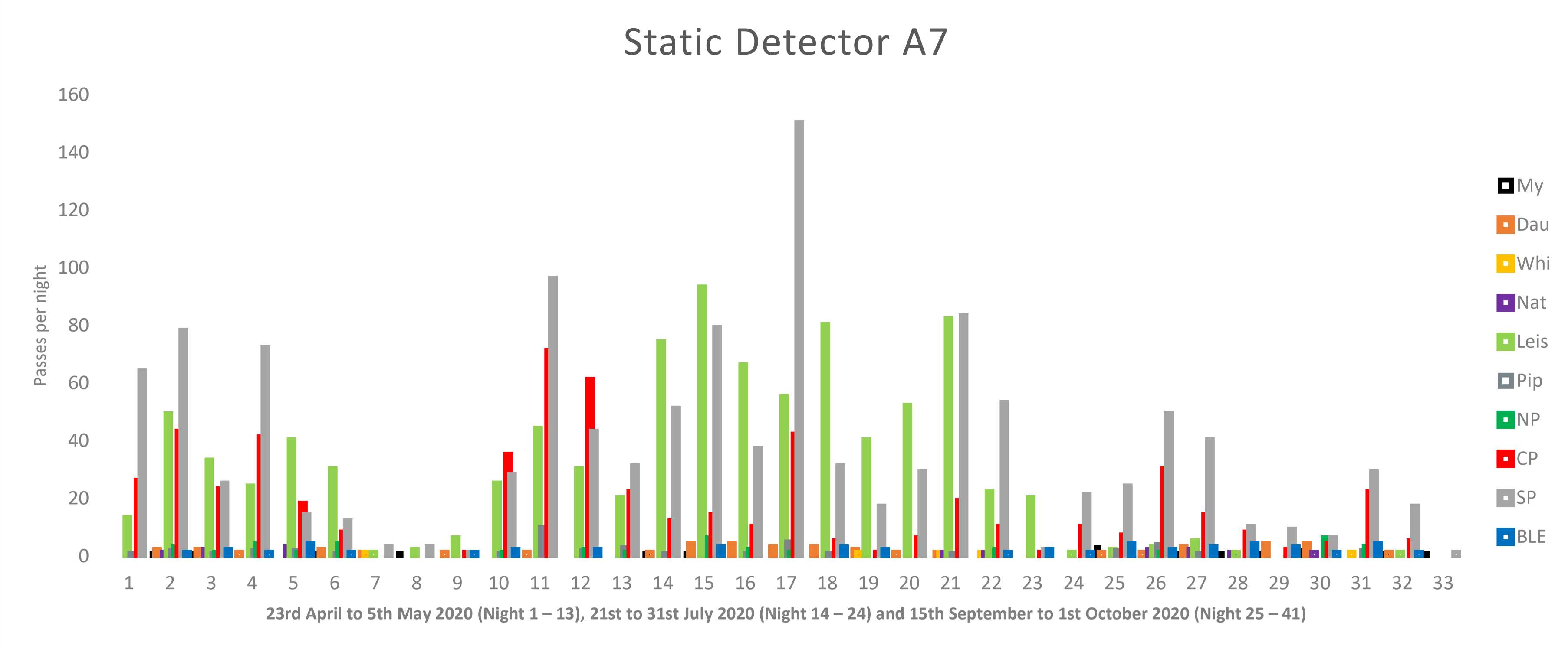


Plate 7: Total number of nightly bat passes recorded at static location A7

The static unit A7 recorded eight species of bat and bat passes identified to genus level for *Myotis* spp and *Pipistrellus* spp. A higher level of activity was recorded in period 1 (23rd April to 5th May 2020) and period 2 (21st to 31st July 2020) compared to period 3 (15th to 24th September 2020). During period 1 and period 2 a higher level of soprano pipistrelle and leisler's bat was recorded with soprano pipistrelle having a particularly high peak of activity on day 17 (24/07/2020) with 150 passes. A much lower level of bat activity for all bat species recorded was noted during Period 3.

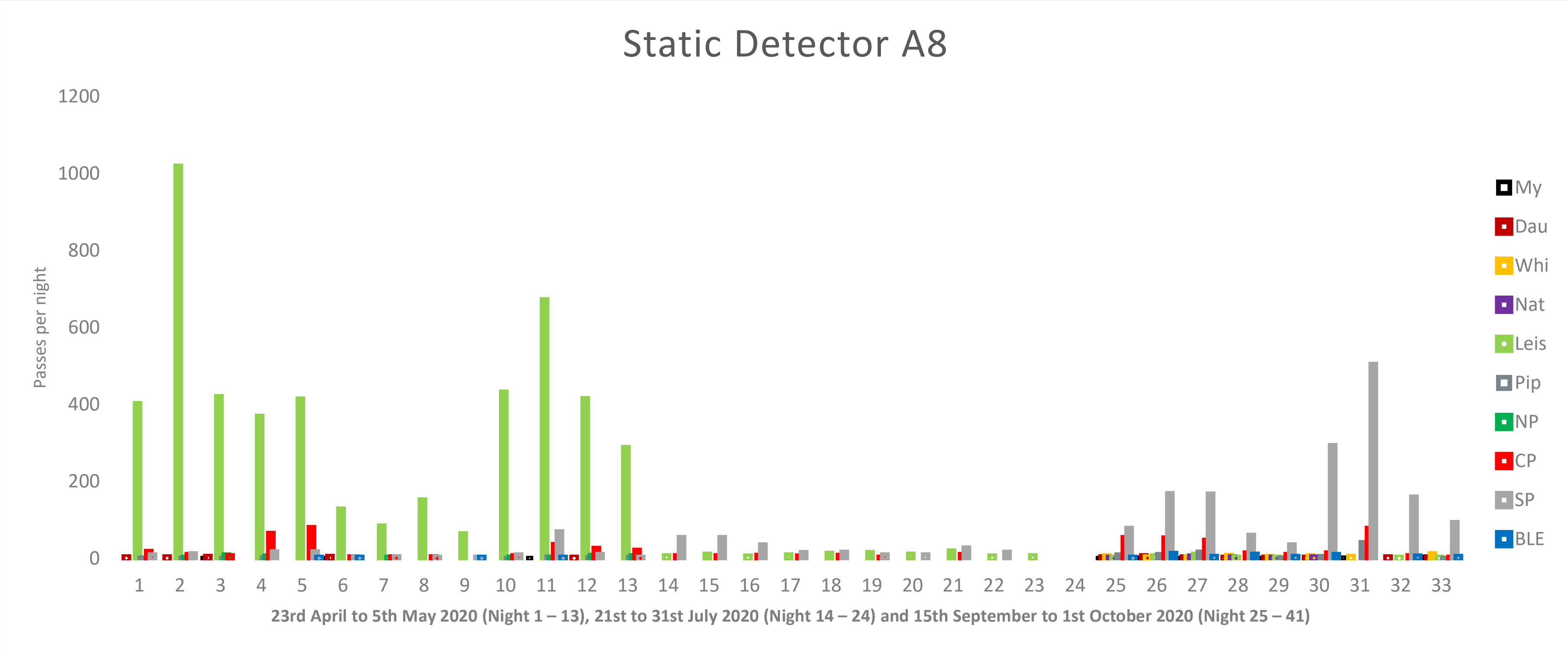


Plate 8: Total number of nightly bat passes recorded at static location A7

The static unit A8 recorded eight species of bat and bat passes identified to genus level for *Myotis* spp and *Pipistrellu*s spp. within period 3 (15th to 24th September 2020) only. A much lower level of bat activity for all bat species recorded was noted during Period 2 (21st to 31st July 2020) with only common pipistrelle, soprano pipistrelle and leisler's bat recorded. The highest activity was recorded for leisler's bat in period 1 (23rd April to 5th May 2020) with a particularly high peak on day 2 (24/04/2020) with 1017 passes. Soprano pipistrelle was the highest recorded species during period 3.

Eight species of bats were recorded during the three survey periods with a total of 53,735 recordings over the three survey periods. The most commonly recorded species was common pipistrelle, followed by leisler's and soprano pipistrelle. Much lower levels of activity of brown long-eared bat, daubenton's bat, nathusius' pipistrelle, natterer's bat, and whiskered bat were detected. Brown long-eared bat is present on-site, but this species is very quiet and sometimes hunts without echolocating, therefore this species may be under-recorded by the static detectors.

The graphs within Plates 9 to Plate 11 show the number of passes for individual species (common pipistrelle, soprano pipistrelle and leisler's bat) at each static detector location for the full survey period of 2020. Locations A2 and A5 have the highest number of passes of common pipistrelle, A3 has the highest number of passes for soprano pipistrelle, while A3 and A8 have the highest number of passes of leisler's bat.

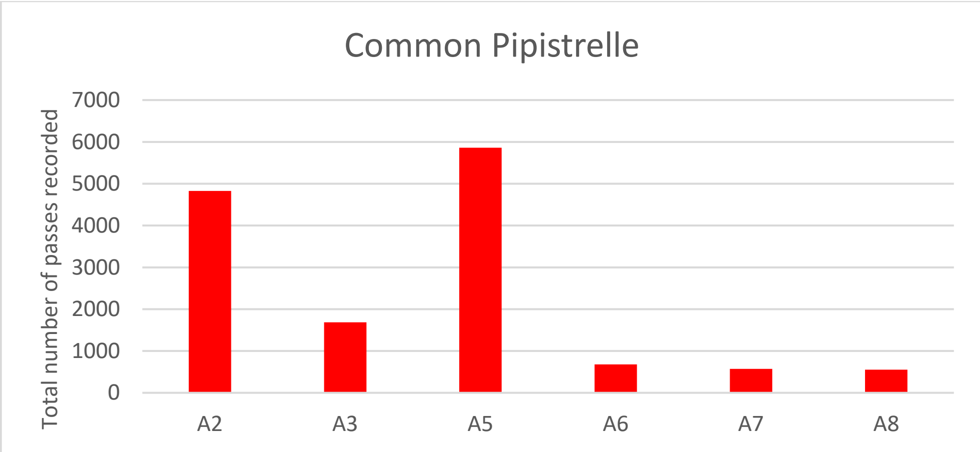


Plate 9: Total number of bat passes recorded for common pipistrelles at each of the static detector locations during 2020.

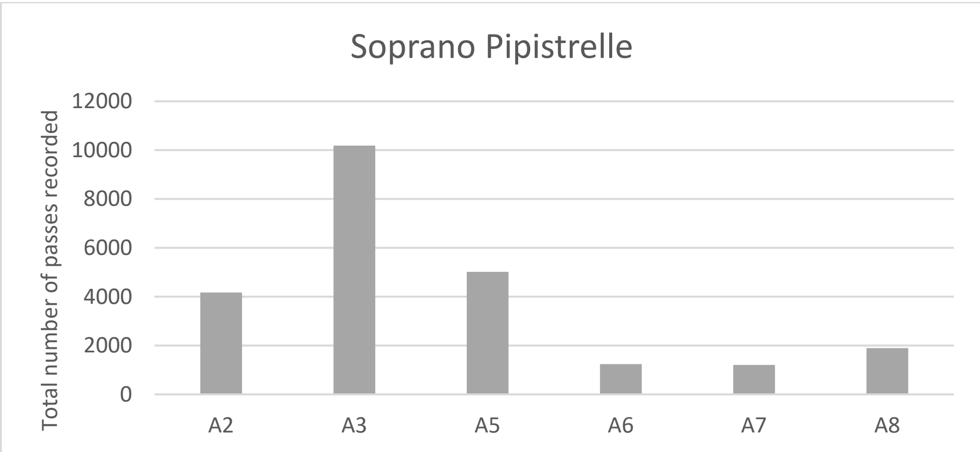


Plate 10: Total number of bat passes recorded for soprano pipistrelles at each of the static detector locations during 2020.

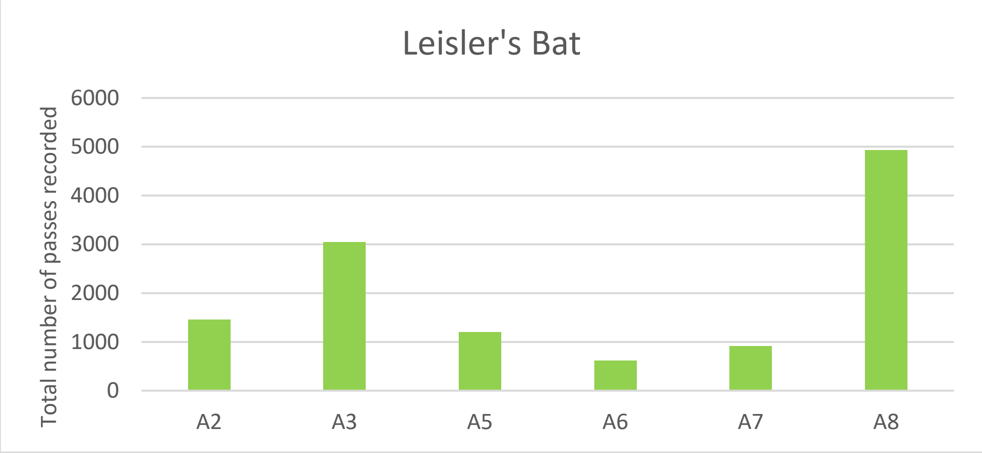


Plate 11: Total number of bat passes recorded for leisler's bat at each of the static detector locations during 2020

Static location A5 had the highest number of passes for brown long-eared bat recorded during the surveillance surveys (n= 405 passes). Static locations A2 and A5 had the highest number of passes for nathusius' Pipistrelle bat recorded during the surveillance surveys (n= 351 and n=331 passes respectively). While static location A3 had the highest number of passes for the remaining bat species Myotis spp. (n= 109 passes), daubenton's bat (n= 120 passes), natterer's bat (n= 101 passes) and pipistrellus spp. (n= 347 passes) recorded during the surveillance surveys. Refer to Plate 12 for all remaining bat species results.

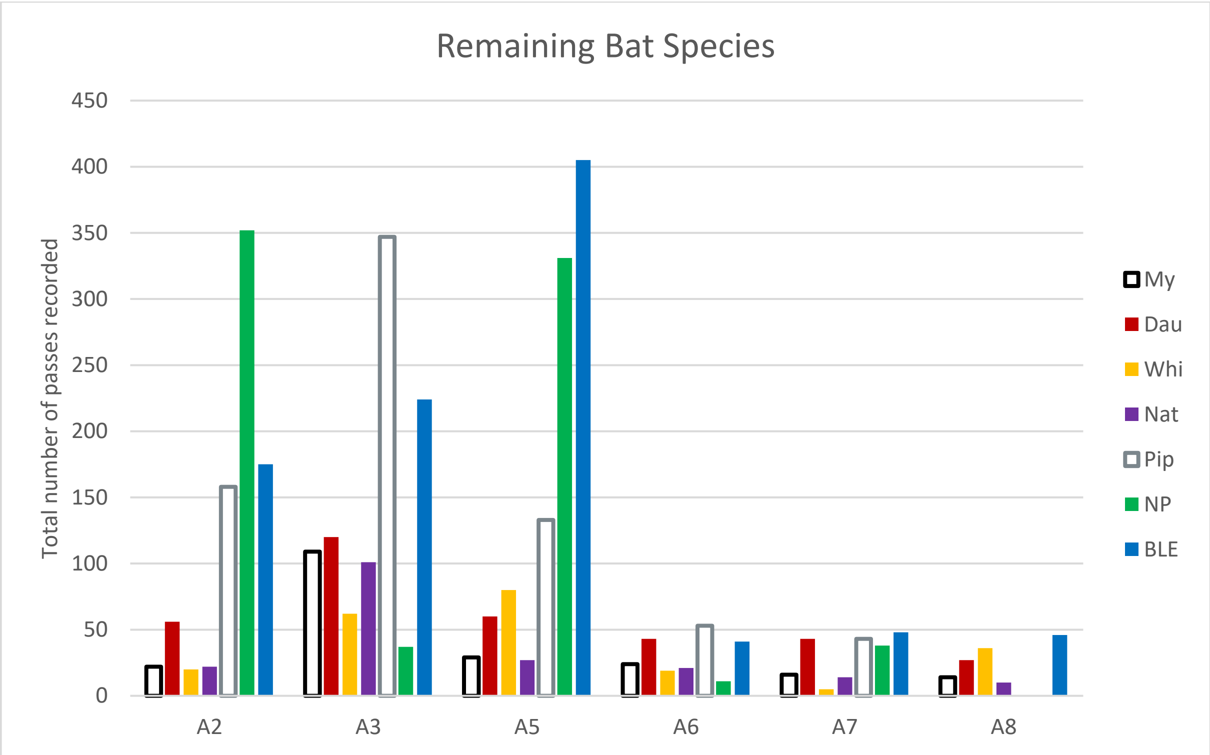


Plate 12: Total number of bat passes recorded for remaining bat species at each of the static detector locations in 2020.

4.6 Bat Static Detector Surveys 2021

Table 4.4 below summarises the results, in relation to bat species, recorded on the static detectors deployed in 2021. Five static units were deployed during each survey period. Overall eight bat species were recorded (common pipistrelle, soprano pipistrelle, nathusius' pipistrelle, leisler's bat, brown long-eared bat, natterer's bat, daubenton's bat and whiskered bat). The graphs within Plate 13 to Plate 18 below show the number of bat passes (per species) recorded at each static detector location over the three surveillance periods.

Table 4-4: Summary results of Static Bat Detectors deployed during survey periods 1 to 3

Static Detector No. and location habitats	Species detected during Period 2 21st July to 24th August 2021 (Night 1 – 36) [10]	Species detected during Period 3 13th September to 7th October 2021 (Night 25 – 41)
AT1 Woodland edge at of plantation woodland and junction with hedgerow at right angle to woodland	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	N/A
AT2 Woodland edge at the southeast corner of plantation woodland	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat
AT3 Treeline/ hedgerow adjacent to plantation woodland and grassland	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	Daubenton's bat Whiskered bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat
AT4	N/A	Daubenton's bat Natterer's bat Leisler's bat

[10] Note: The static detectors AT3, AT5 and AT6 were deployed for 13 nights during period 2 (21st July to 3rd August), while the remaining static detectors AT1 and AT2 were deployed for 35 nights (21st July to 25th August). Analysis is based on the number of nights the bats were detected on each recorder.

Static Detector No. and location habitats	Species detected during Period 2 21st July to 24th August 2021 (Night 1 – 36) [10]	Species detected during Period 3 13th September to 7th October 2021 (Night 25 – 41)
Defunct hedgerow and wet grassland		Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat
AT5 Wet grassland and drainage ditch	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	Daubenton's bat Whiskered bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat
AT6 Path (clearing) between two plantation woodland stands	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat

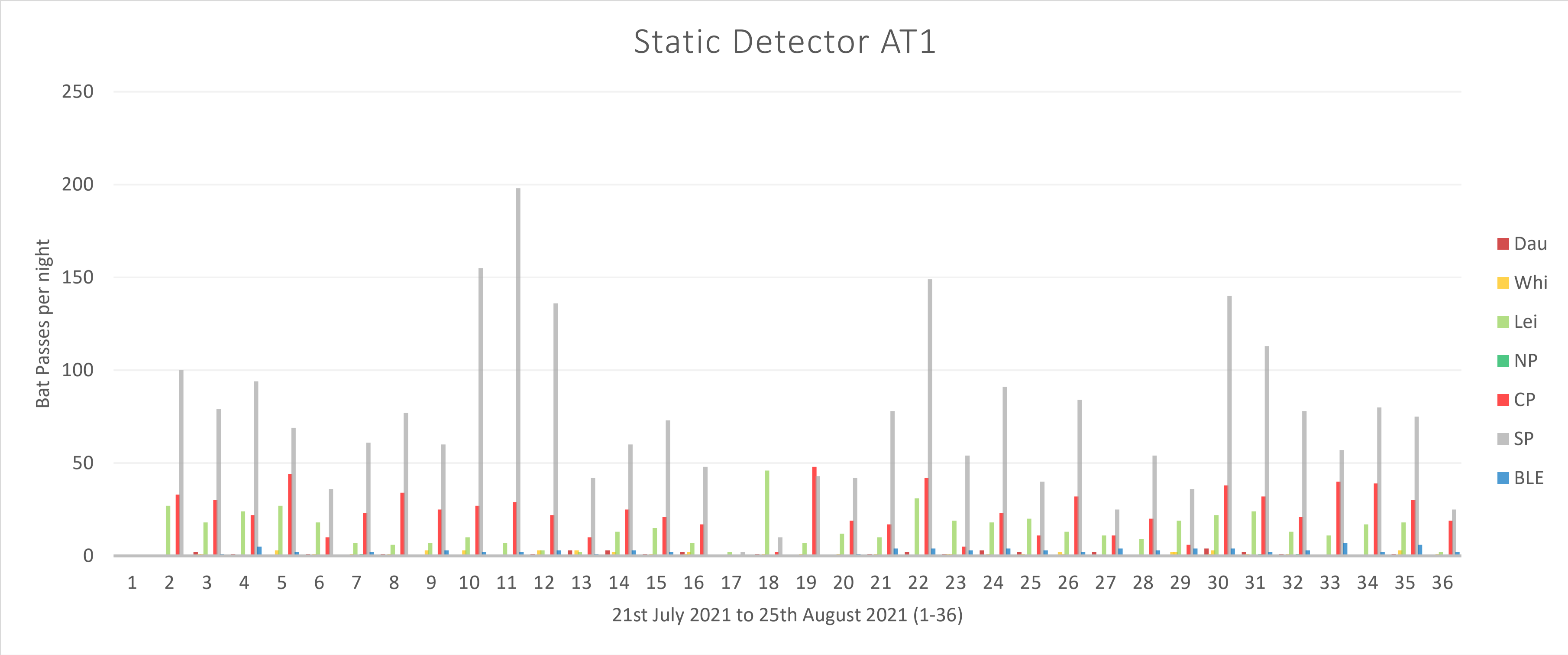


Plate 13: Total number of nightly bat passes recorded at static location AT1

The static unit AT1 recorded eight species of bat. Soprano pipistrelle shows the highest activity level for the period which spiked in activity on day 11 (31/07/2021) with 198 passes. Common pipistrelle and leisler's bat have the next highest activity levels for the period showing consistent activity throughout. There is no spike in activity for the common pipistrelle, while leisler's bat have a spike in activity on day 18 with 46 passes. A much lower level of bat activity can be seen for the remaining bat species.

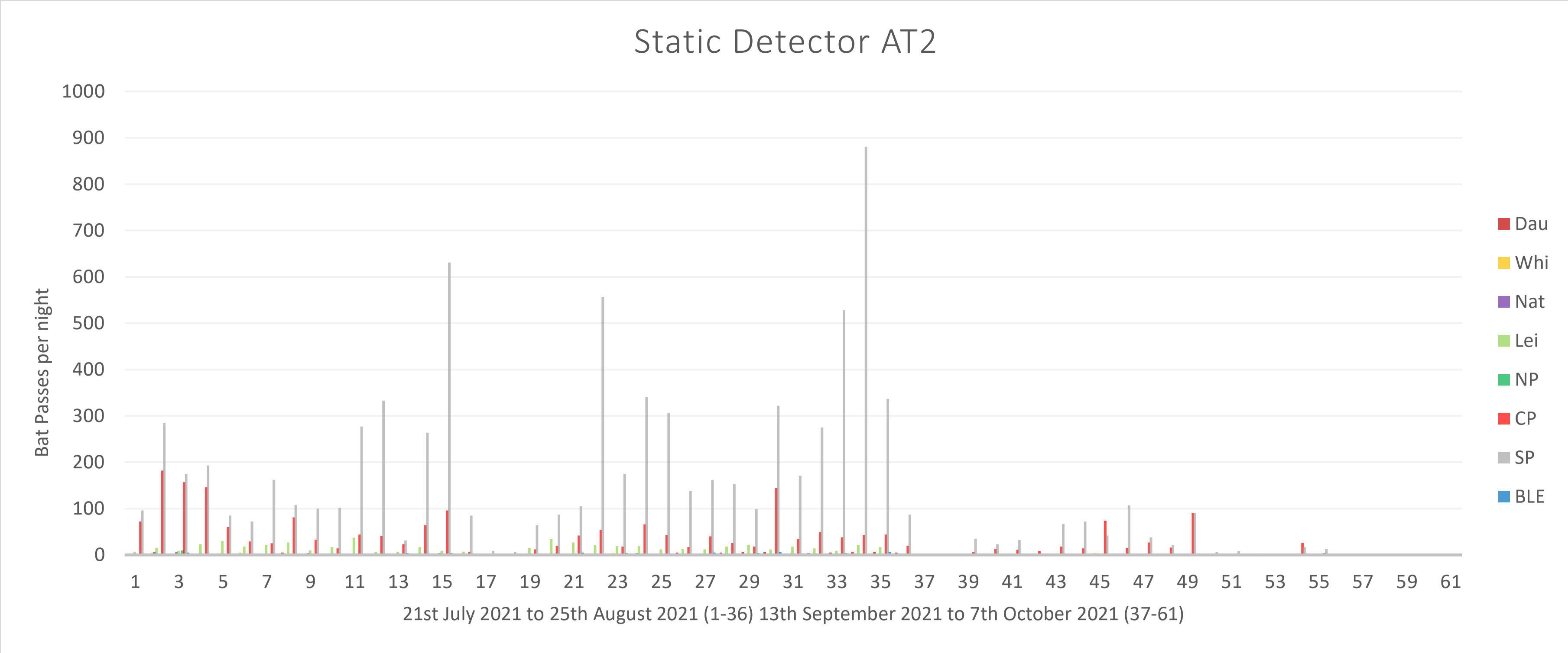


Plate 14: Total number of nightly bat passes recorded at static location AT2

The static unit AT2 recorded eight species of bat. Soprano pipistrelle shows the highest activity level for during period 2, which shows spikes in activity on days 15 (04/08/2021), 22 (11/08/2021) and 34 (23/08/2021) with 631, 557 and 881 passes respectively. Period 3 shows a much lower level of activity for the species. Although a much lower level of activity is recorded for common pipistrelle (next highest activity levels for period 2) there is a spike in activity on days 2 (22/07/2021), 3 (23/07/2021), 4 (24/07/2021) and 30 (19/08/2021) with 182, 157, 146 and 144 passes respectively. A much lower level of bat activity can be seen for the remaining bat species for both survey periods. Survey period 3 shows a much lower level of activity at this location than period 2.

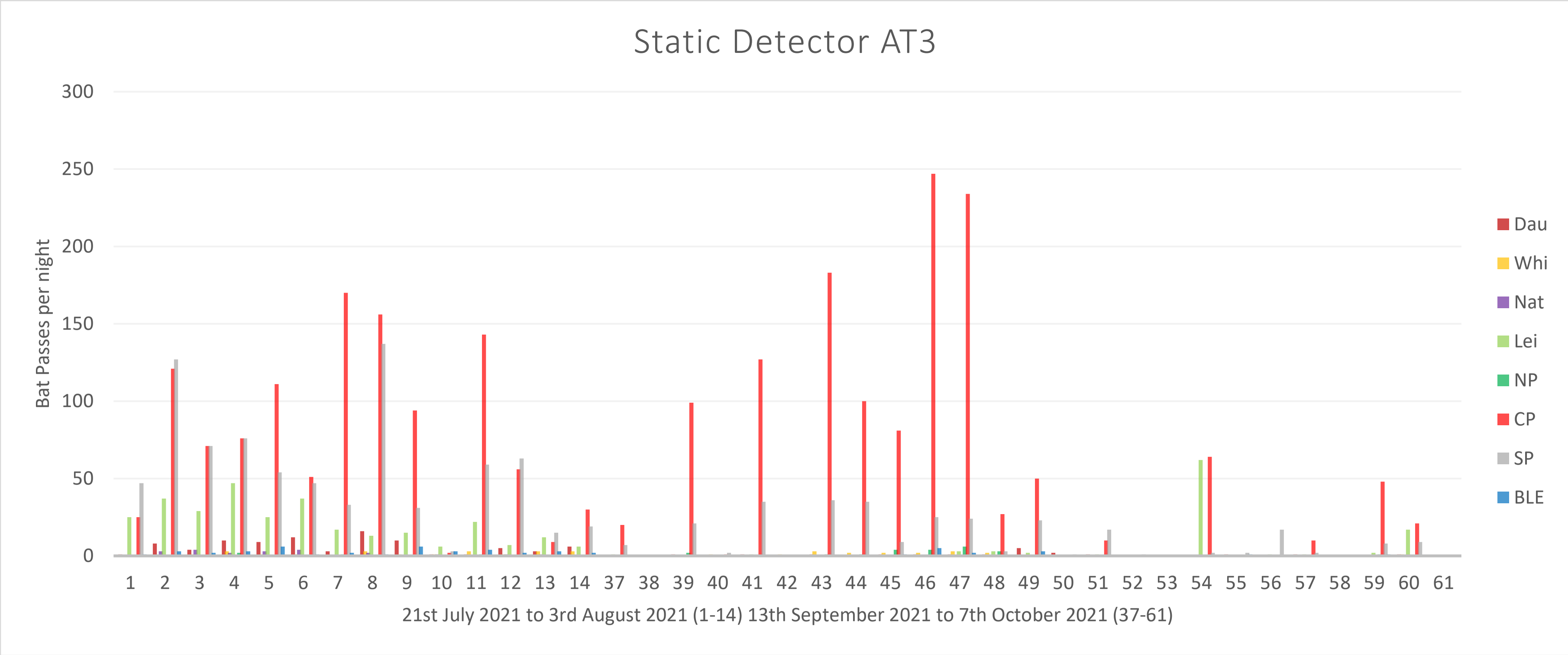


Plate 15: Total number of nightly bat passes recorded at static location AT3

The static unit AT3 recorded eight species of bat. Common and soprano pipistrelle show the highest activity level for period 2, while common pipistrelle shows the highest activity levels in period 3 with a spike in activity on days 46 (22/09/2021) and 47 (23/09/2021) with 247 and 234 passes respectively. leisler activity shows a spike on days 54 (30/09/2021) and 60 (06/10/2021) with 62 and 17 passes respectively, while the remainder of period 3 shows 1 or 2 passes for the species. A much lower level of bat activity can be seen for the remaining bat species for both survey periods with period 3 showing a much lower level of activity at this location than period 2.

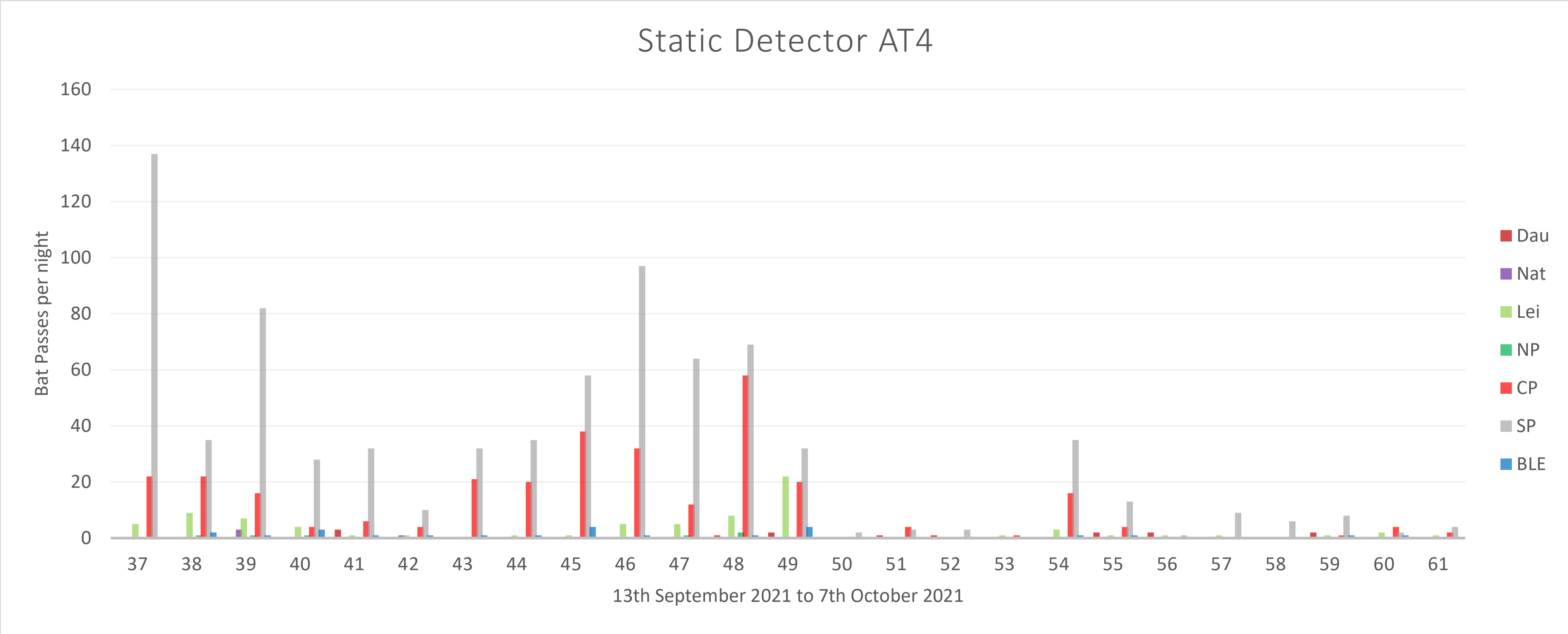


Plate 16: Total number of nightly bat passes recorded at static location AT4

The static unit AT4 recorded seven species of bat. Whiskered bat were not recorded at this location during period 3. Soprano pipistrelle has the highest activity levels at this location with spikes on days 37 (13/09/2021), 39 (15/09/2021) and 46 (22/09/2021) with 137, 82 and 97 passes respectively. Common pipistrelle shows a spike in activity on day 48 with 58 passes. A much lower level of bat activity can be seen for the remaining bat species for survey period 3.

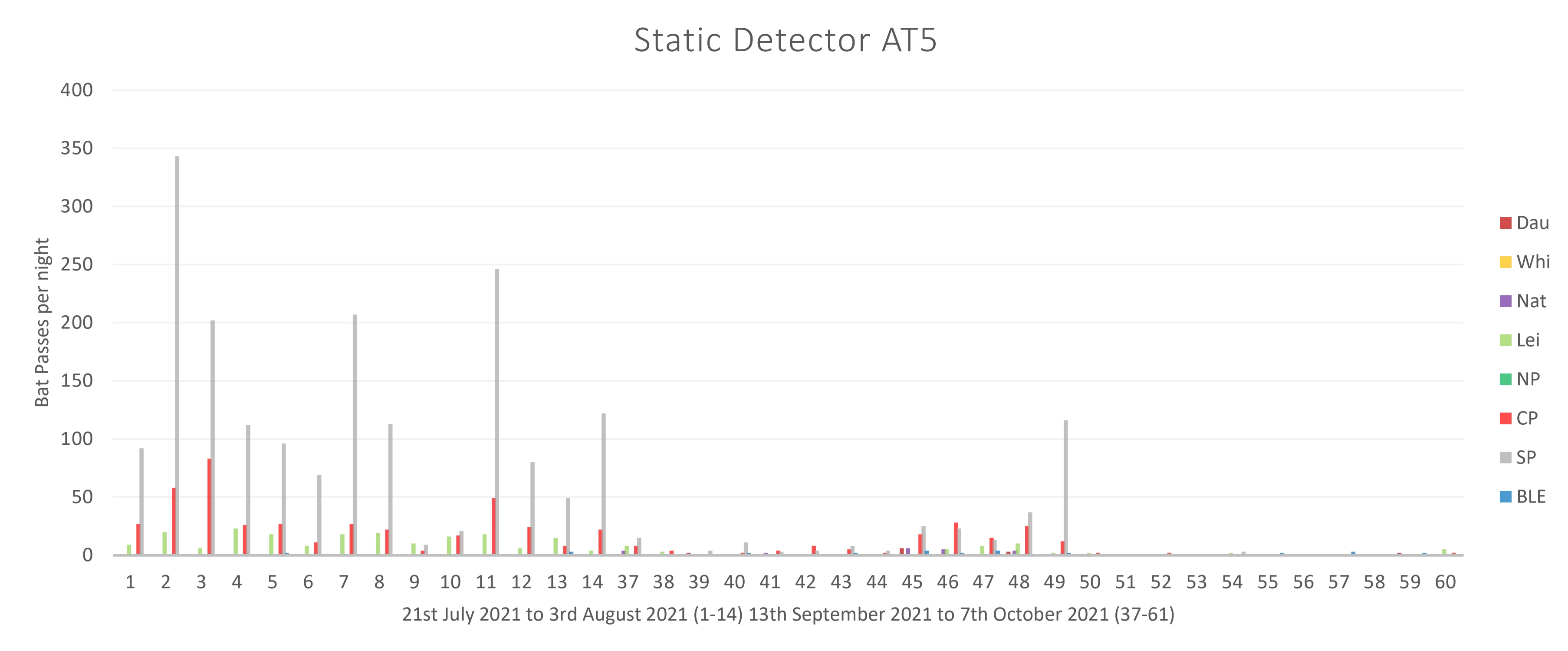


Plate 17: Total number of nightly bat passes recorded at static location AT5

The static unit AT5 recorded eight species of bat. Soprano pipistrelle shows the highest activity level for during period 2, with spikes in activity on days 2 (22/07/2021) and 11 (31/07/2021) with 343 and 246 passes respectively. Period 3 shows a much lower level of activity for the species with a spike on day 49 (25/09/2021) with 116 passes. A much lower level of bat activity can be seen for the remaining bat species for both survey periods. Survey period 3 shows a much lower level of activity at this location than period 2 with almost no activity after day 49 (25/09/2021).

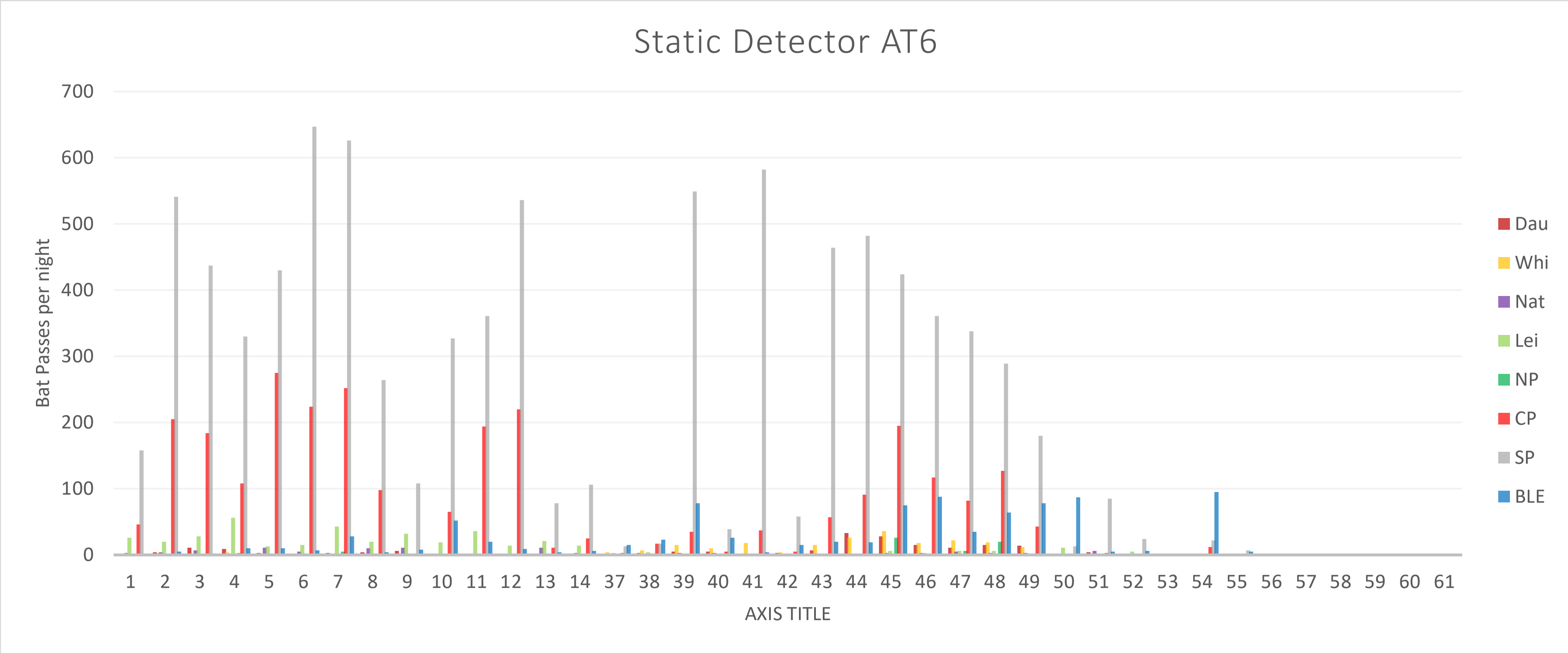


Plate 18: Total number of nightly bat passes recorded at static location AT6

The static unit AT6 recorded eight species of bat. Soprano pipistrelle shows the highest activity levels for both period 2 and period 3 with spikes in activity on days 6 (26/07/2021) and 7 (27/07/2021) of period 2 and days 39 (15/09/2021) and 41 (17/09/2021) of period 3, with 647, 626, 549 and 582 passes respectively. The next highest activity is from common pipistrelle with spikes on days 5 (25/07/2021) and 45 (21/09/2021), with 275 and 195 respectively. Location AT6 also shows the highest activity levels for brown long-eared bat with spikes in activity on days 10 and 54 with 52 and 95 passes respectively. A much lower level of bat activity can be seen for the remaining bat species for both survey periods. Survey period 3 shows no activity after day 55 (01/10/2021).

Eight species of bats were recorded during the two survey periods with a total of 37,313 recordings. The most commonly recorded species was soprano pipistrelle, followed by common pipistrelle and leisler's bat. Much lower levels of activity of brown long-eared bat, daubenton's bat, nathusius' pipistrelle, natterer's bat, and whiskered bat were detected. Brown long-eared bat is present on-site, but this species is very quiet and sometimes hunts without echolocating, therefore this species may be under-recorded by the static detectors.

The graphs within Plates 19 to Plate 21 show the number of passes for individual species (common pipistrelle, soprano pipistrelle and leisler's bat) at each static detector location for the full survey period of 2021. Locations AT6 has the highest number of passes for common pipistrelle, AT2 and AT6 have the highest number of passes for soprano pipistrelle, while AT1 and AT2 have the highest number of passes of leisler's bat (AT1 shows activity level for period 2 only).

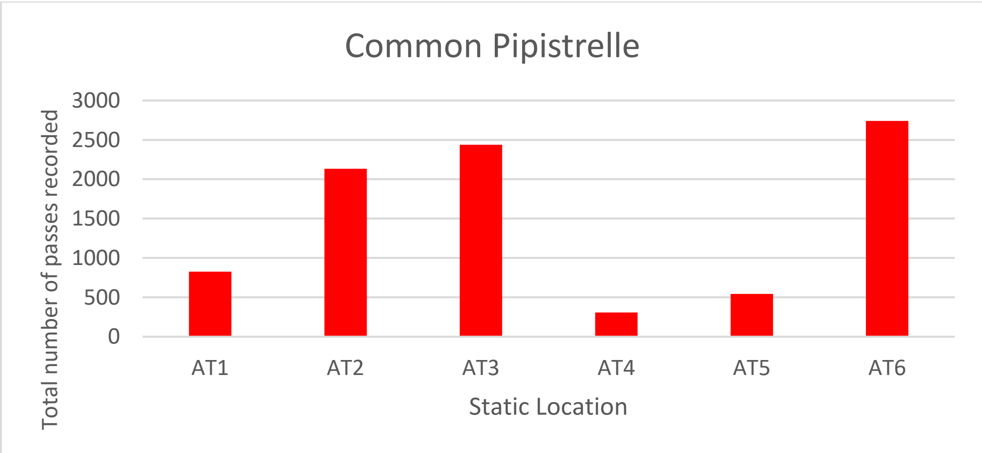


Plate 19: Total number of bat passes recorded for common pipistrelle at each of the static detector locations during 2020.

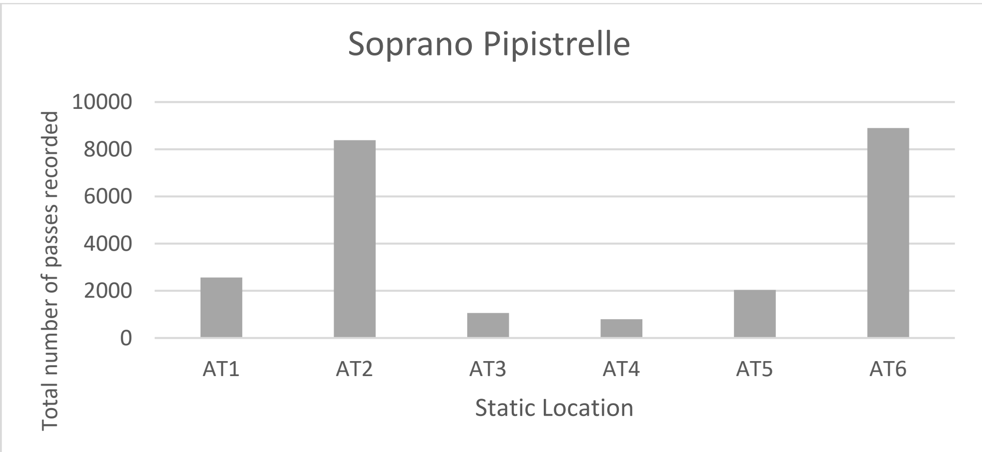


Plate 20: Total number of bat passes recorded for soprano pipistrelles at each of the static detector locations during 2020.

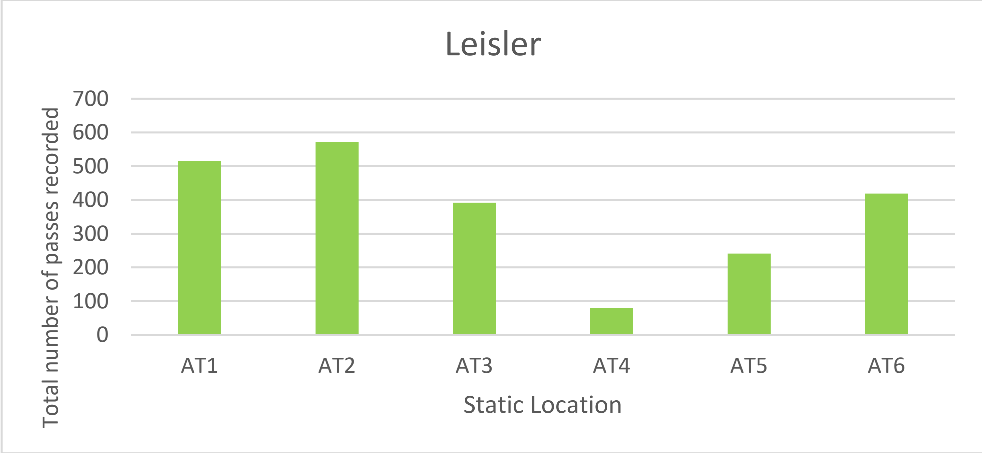


Plate 21: Total number of bat passes recorded for leisler's bat at each of the static detector locations during 2020

Static location AT6 has the highest number of passes, recorded during the surveillance surveys of 2021, for all the remaining species including brown long-eared bat (n= 405 passes), daubenton's bat (n=191 passes), whiskered bat (n=230 passes), natterer's bat (n=109) and nathusius' pipistrelle (n=72). Refer to Plate 22.

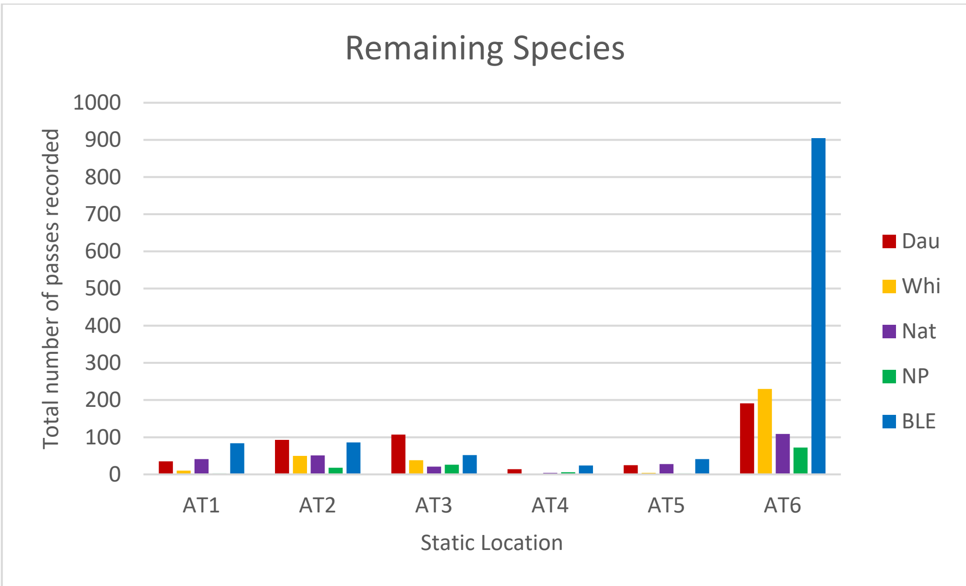


Plate 22: Total number of bat passes recorded for remaining bat species at each of the static detector locations in 2020.

4.7 Ecobat

The static data for each survey period were uploaded and analysed using the Ecobat tool. This analysis was undertaken for each survey period of 2020 and 2021 separately. Where groups of detectors were deployed for different dates within a survey period, those that were deployed for the same dates were analysed together (details are provided for each survey period below). The reference range datasets were stratified to include:

- Only records from within 30 days of the survey date.
- Only records from within 100 km^2 of the survey location.
- Records using any make of bat detector.

The Ecobat tool provides a series of summary tables to enable analysis of the bat activity level at each static location. These are presented below, and categorisation of activity level is based on the following table:

Table 4-5: Percentile Score and Categorised Level of Bat Activity

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

4.7.1 Survey Period 1 2020

A summary showing the number of nights recorded bat activity within each activity band for each species is presented below in Table 4-6. Refer to Appendix D for the full Ecobat analysis report

Bat surveys were conducted for 12 nights between 23/04/2020 and 04/05/2020**,** using Wildlife Acoustics static bat detectors.

All of the six static locations had at least one night of High Activity during the survey period.

The following Static locations are deemed to have a High Bat Activity (for specific bat species) level based on the Median Percentile value:

- A2, A3, A5, A7 and A8 for Pipistrelle sp.;
- A2, A3, A5 and A7 for soprano pipistrelle;
- A2, A3 and A5 for common pipistrelle; and
- A2, A3, A5, A6 and A8 for Leiser's bats.

Refer to Plates 23 and 24 below.

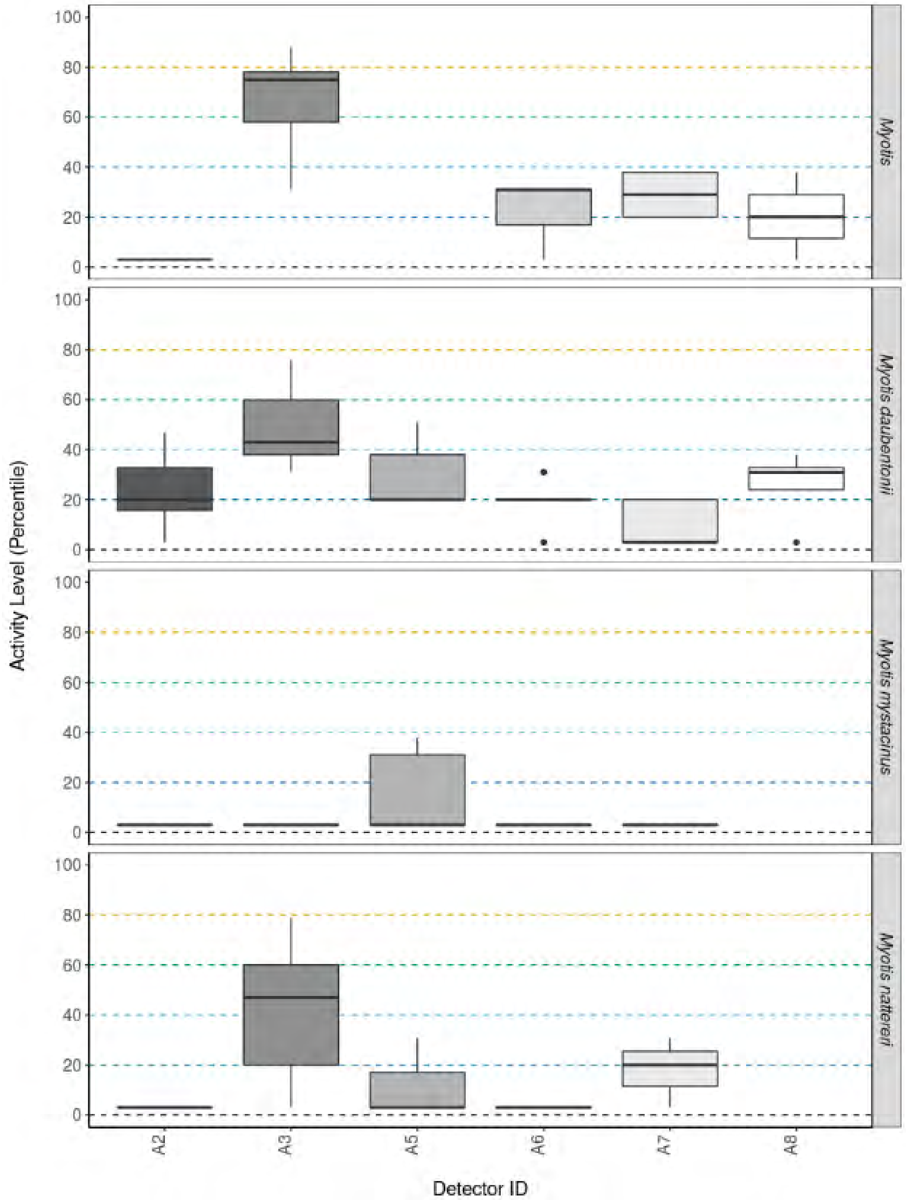
Table 4.7, along with Plates 25 and 26 show the number of nights recorded bat activity fell into each activity band for each species across all of the detectors. They identify Pipistrellus spp. as having high bat activity (per median percentile) across all detectors for period 1.

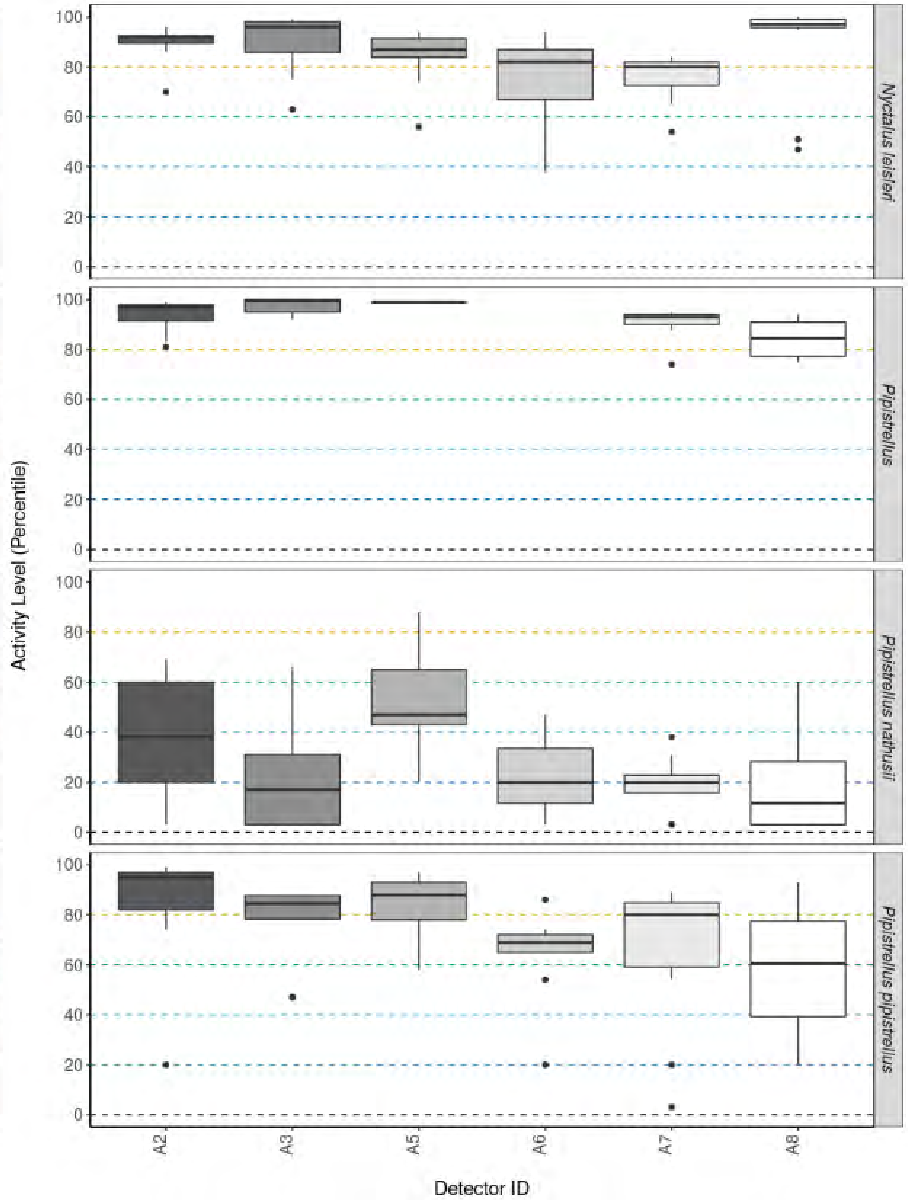
Table 4-6: Bat activity within each activity band for each species – Survey period 1

Location	Species/ Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity	Median Percentile	Bat Activity Category
A2	*Myotis*	0	0	0	0	2	3	Low
A2	*Myotis daubentonii*	0	0	1	5	2	20	Low
A2	*Myotis mystacinus*	0	0	0	0	1	3	Low
A2	*Myotis nattereri*	0	0	0	0	2	3	Low
A2	*Nyctalus leisleri*	10	1	0	0	0	92	High
A2	*Pipistrellus*	10	0	0	0	0	97	High
A2	*Pipistrellus nathusii*	0	3	1	3	2	38	Low to Moderate
A2	*Pipistrellus pipistrellus*	8	2	0	1	0	95	High
A2	*Pipistrellus pygmaeus*	6	2	2	1	0	82	High
A2	*Plecotus auritus*	0	0	0	2	4	3	Low
A3	*Myotis*	2	4	2	1	0	75	Moderate to High
A3	*Myotis daubentonii*	0	3	2	4	0	43	Moderate
A3	*Myotis mystacinus*	0	0	0	0	5	3	Low
A3	*Myotis nattereri*	0	3	2	2	2	47	Moderate
A3	*Nyctalus leisleri*	9	3	0	0	0	96	High
A3	*Pipistrellus*	10	0	0	0	0	100	High
A3	*Pipistrellus nathusii*	0	1	0	2	3	17	Low
A3	*Pipistrellus pipistrellus*	6	2	2	0	0	85	High
A3	*Pipistrellus pygmaeus*	10	0	0	0	0	99	High
A3	*Plecotus auritus*	0	1	2	4	1	35	Low to Moderate
A5	*Myotis daubentonii*	0	0	2	7	0	20	Low

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
A5	*Myotis mystacinus*	0	0	0	4	5	3	Low
A5	*Myotis nattereri*	0	0	0	1	2	3	Low
A5	*Nyctalus leisleri*	9	2	1	0	0	87	High
A5	*Pipistrellus*	1	0	0	0	0	99	High
A5	*Pipistrellus nathusii*	1	2	4	2	0	47	Moderate
A5	*Pipistrellus pipistrellus*	8	2	1	0	0	88	High
A5	*Pipistrellus pygmaeus*	7	3	1	0	0	89	High
A5	*Plecotus auritus*	0	0	2	5	3	20	Low
A6	*Myotis*	0	0	0	2	1	31	Low to Moderate
A6	*Myotis daubentonii*	0	0	0	6	1	20	Low
A6	*Myotis mystacinus*	0	0	0	0	1	3	Low
A6	*Myotis nattereri*	0	0	0	0	2	3	Low
A6	*Nyctalus leisleri*	6	3	1	1	0	82	High
A6	*Pipistrellus nathusii*	0	0	1	1	1	20	Low
A6	*Pipistrellus pipistrellus*	1	6	1	1	0	69	Moderate to High
A6	*Pipistrellus pygmaeus*	0	7	1	2	0	71	Moderate to High
A6	*Plecotus auritus*	0	0	0	0	5	3	Low
A7	*Myotis*	0	0	0	4	0	29	Low to Moderate
A7	*Myotis daubentonii*	0	0	0	3	4	3	Low
A7	*Myotis mystacinus*	0	0	0	0	1	3	Low
A7	*Myotis nattereri*	0	0	0	2	1	20	Low
A7	*Nyctalus leisleri*	5	5	1	0	0	80	Moderate to High
A7	*Pipistrellus*	6	1	0	0	0	93	High
A7	*Pipistrellus nathusii*	0	0	0	6	2	20	Low

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
A7	*Pipistrellus pipistrellus*	5	2	1	1	1	80	Moderate to High
A7	*Pipistrellus pygmaeus*	6	2	1	1	1	85	High
A7	*Plecotus auritus*	0	0	0	5	1	26	Low to Moderate
A8	*Myotis*	0	0	0	2	1	20	Low
A8	*Myotis daubentonii*	0	0	0	3	1	31	Low to Moderate
A8	*Nyctalus leisleri*	10	0	2	0	0	97	High
A8	*Pipistrellus*	4	2	0	0	0	85	High
A8	*Pipistrellus nathusii*	0	1	0	2	3	12	Low
A8	*Pipistrellus pipistrellus*	2	3	2	3	0	61	Moderate to High
A8	*Pipistrellus pygmaeus*	1	3	3	1	3	51	Moderate
A8	*Plecotus auritus*	0	0	0	0	4	3	Low


Myotis
Myotis daubentonii
Myotis mystacinus
Myotis nattereri
Activity Level (Percentile)
Detector ID
A2
A3
A5
A6
A7
A8
0
20
40
60
80
100


Nyctalus leisleri
Pipistrellus
Pipistrellus nathusii
Pipistrellus pipistrellus
Activity Level (Percentile)
Detector ID
A2
A3
A5
A6
A7
A8
0
20
40
60
80
100

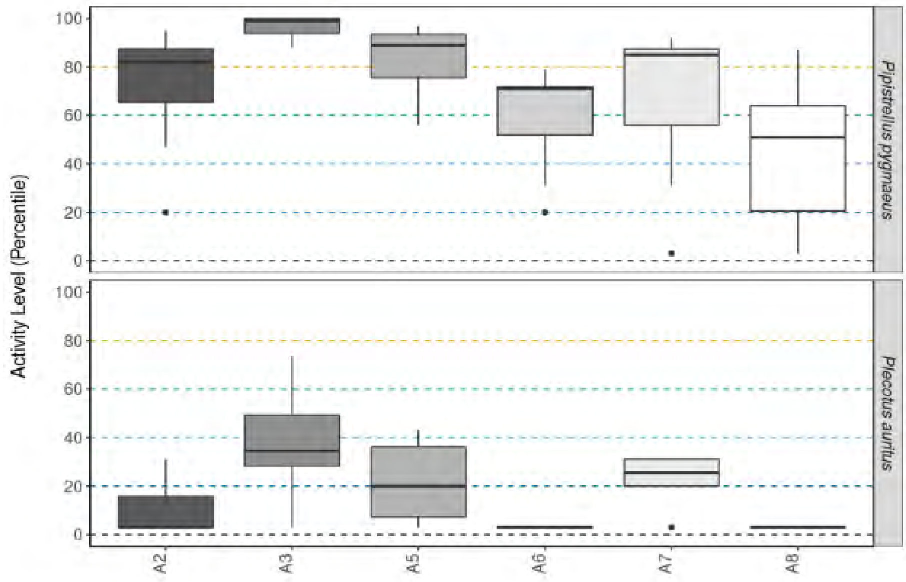
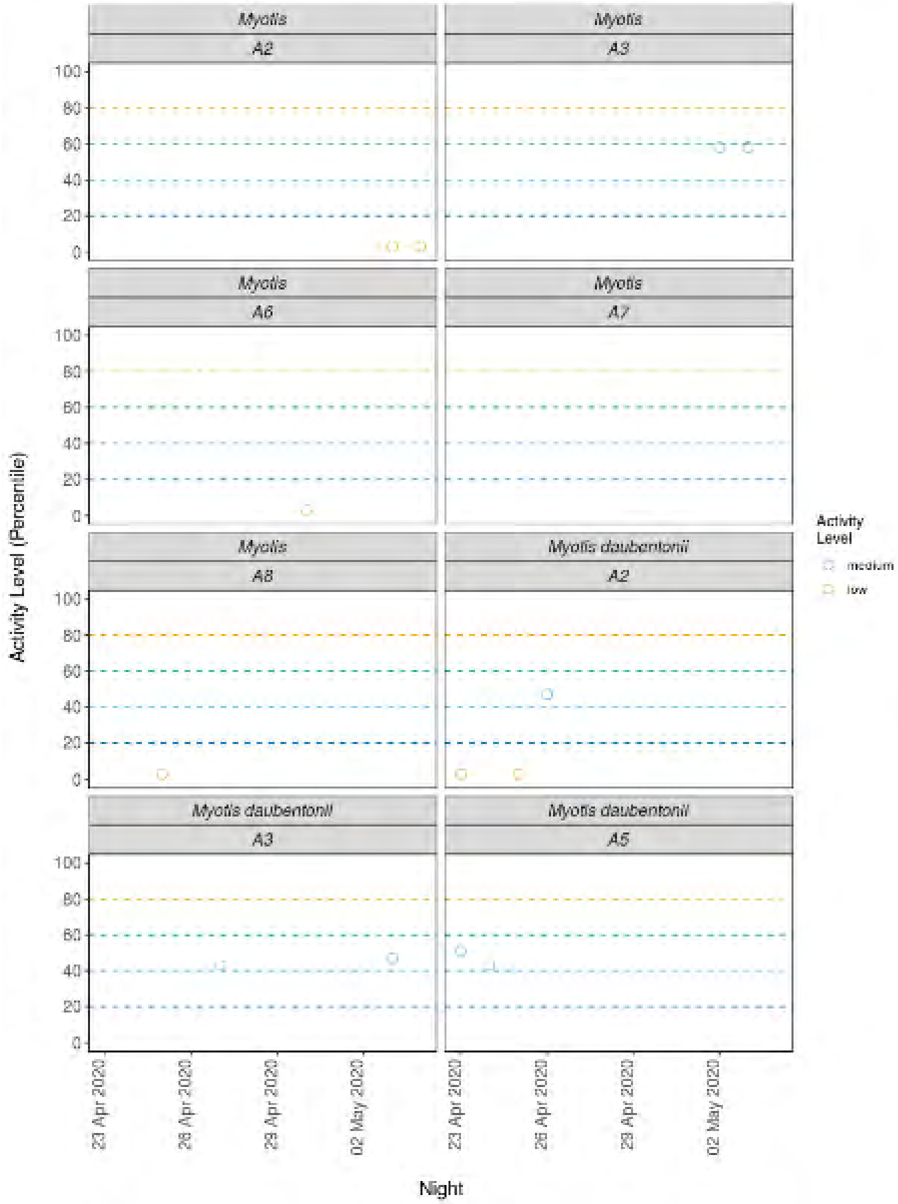
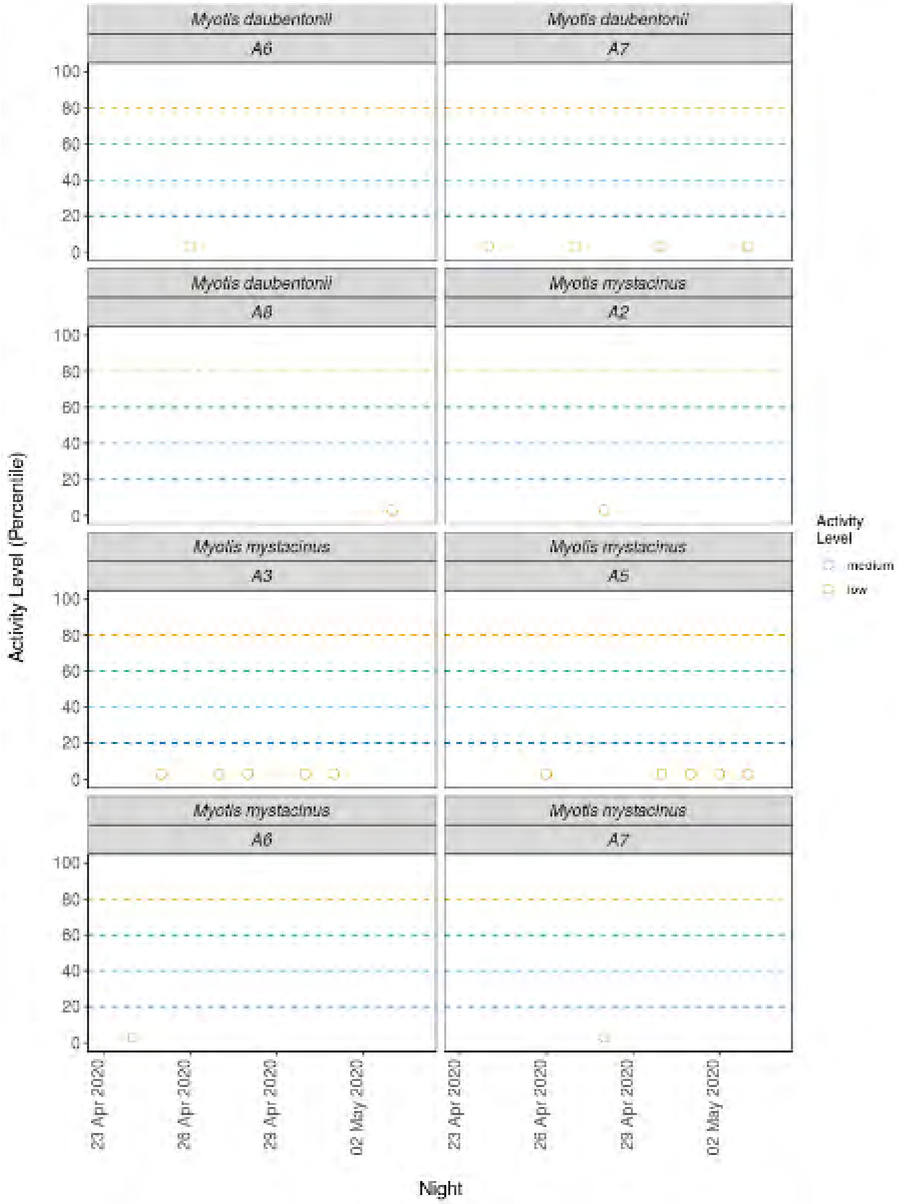
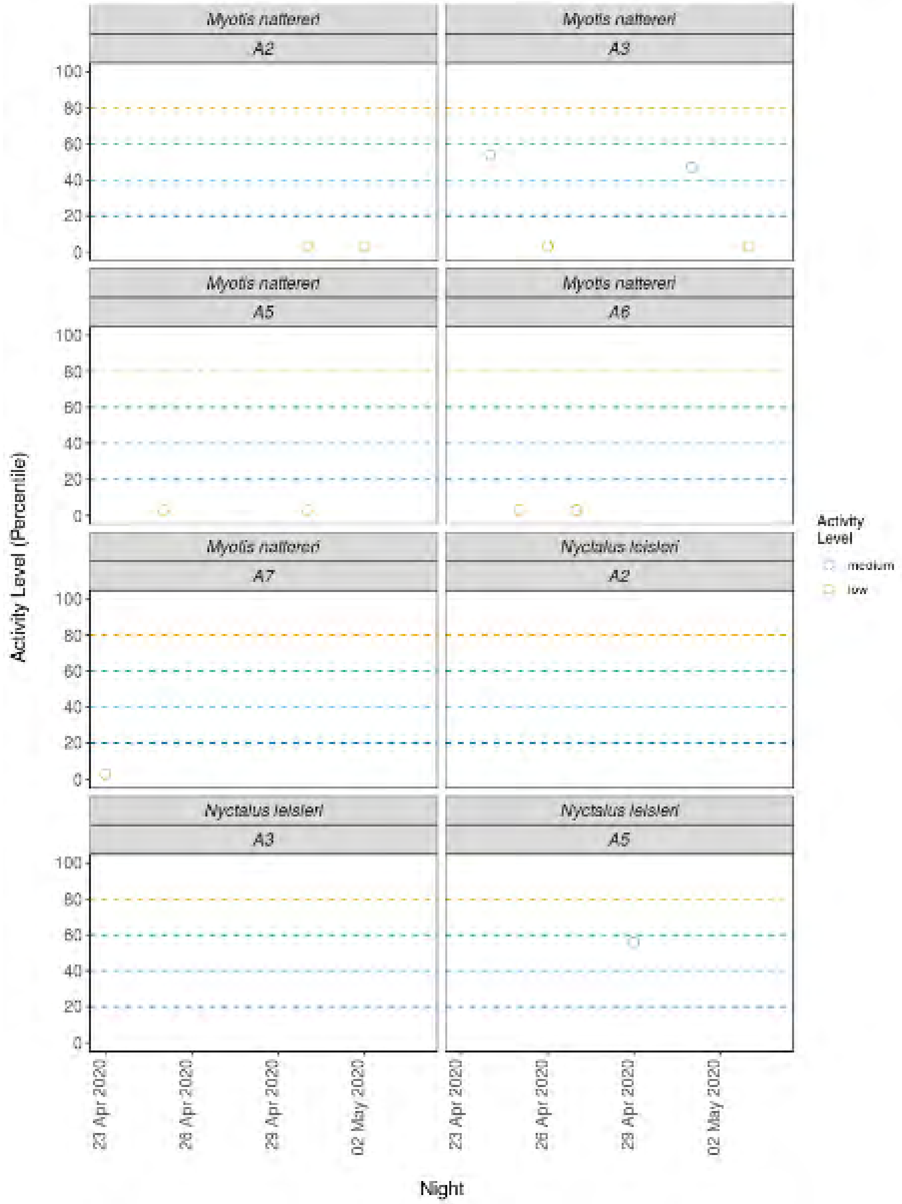
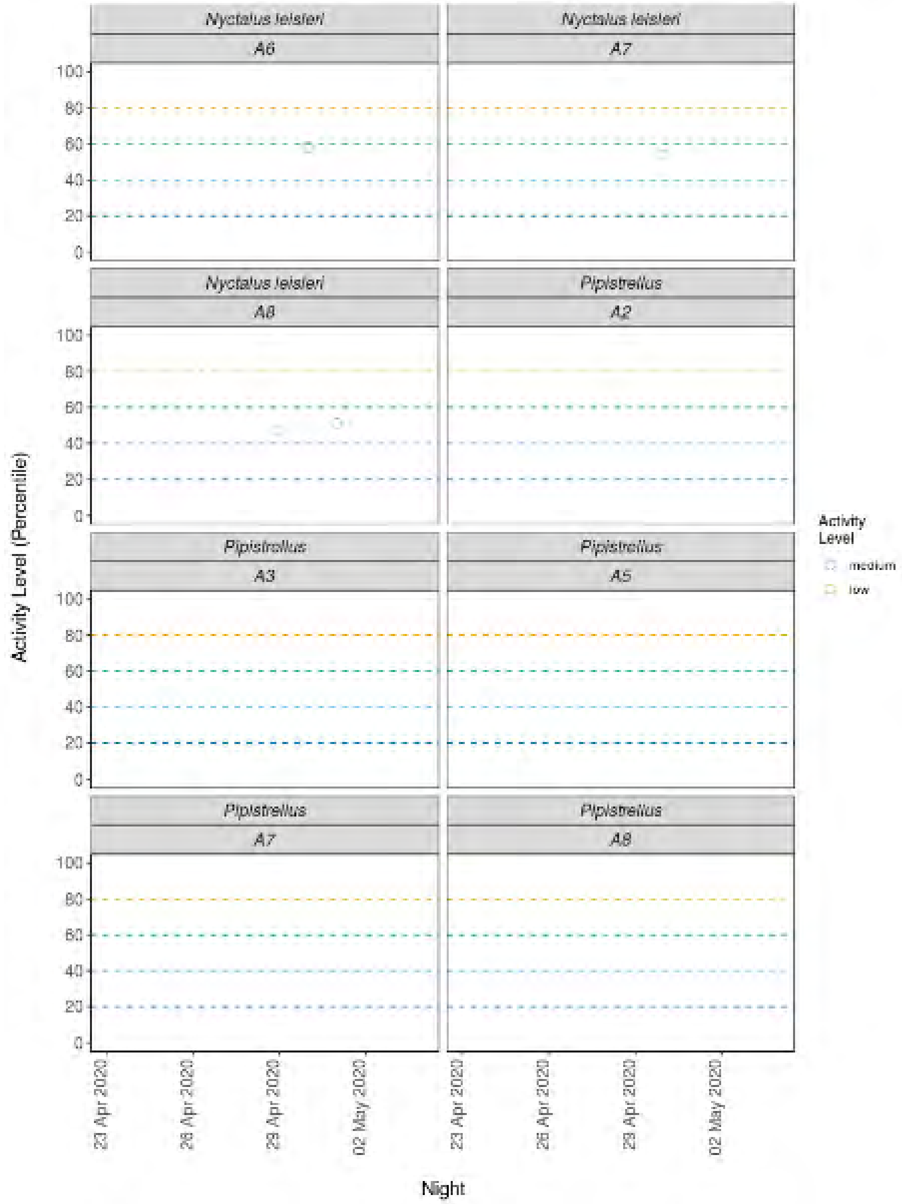


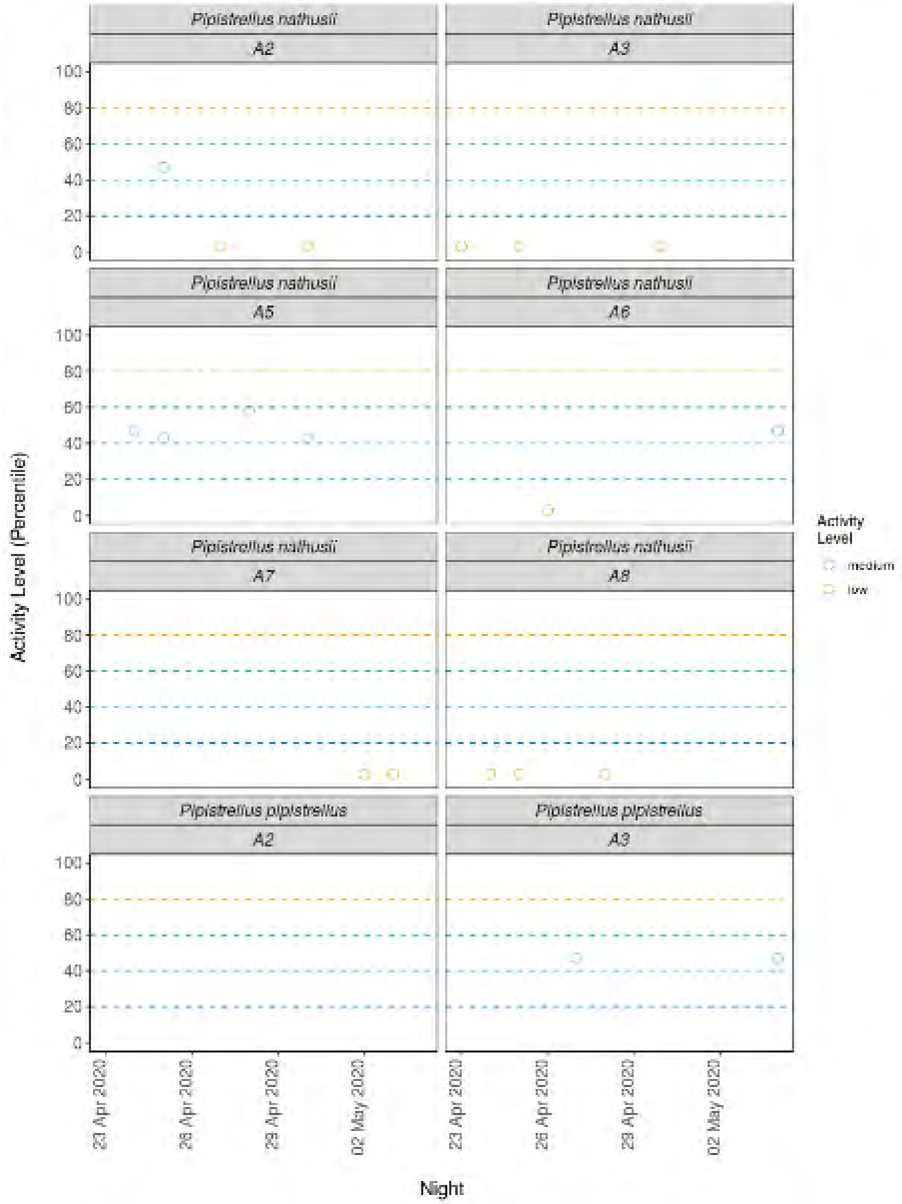
Plate 23: Differences in activity between static detector locations, split by species and location. The centre line indicates the median activity level whereas the box represents the interquartile range (the spread of the middle 50% of nights of activity)

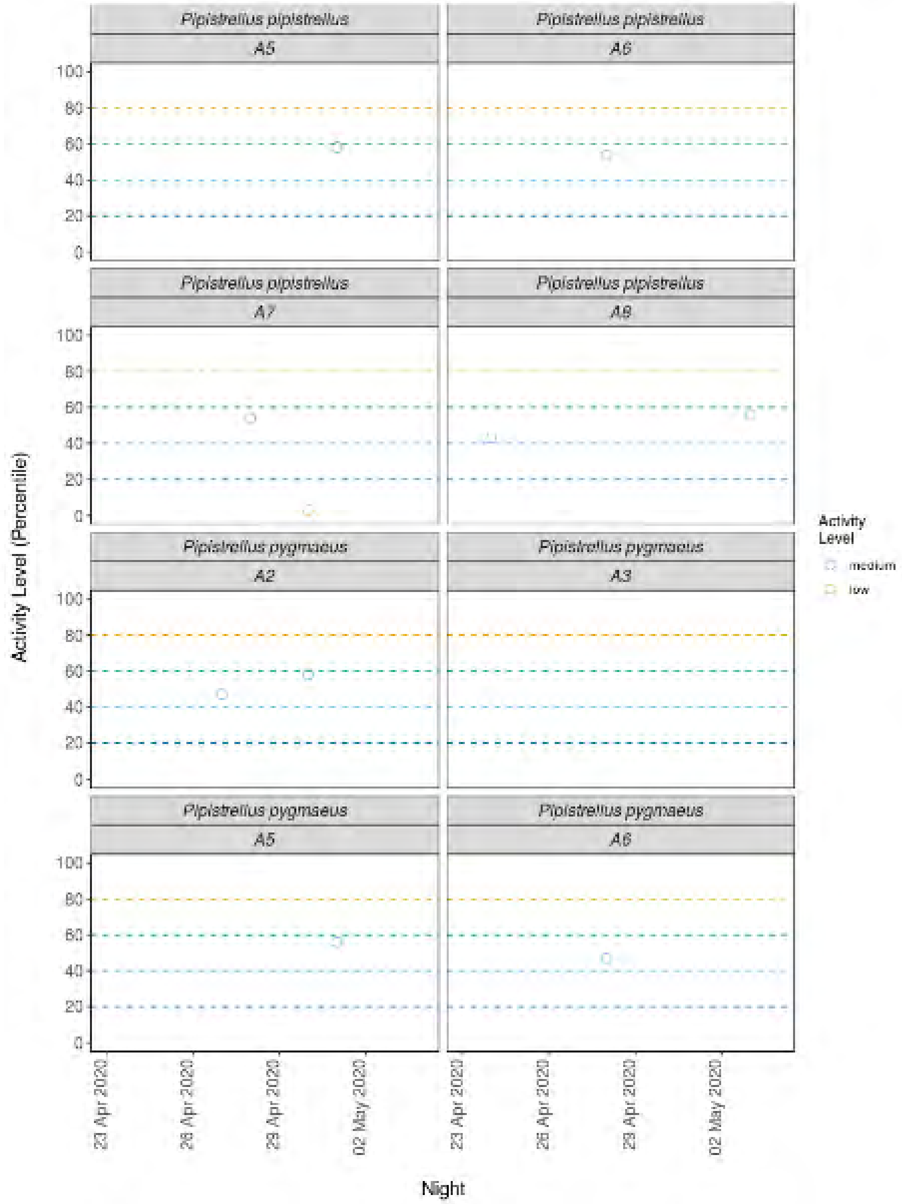

Myotis
A2
Myotis
A3
Myotis
A6
Myotis
A7
Myotis
A8
Myotis daubentonii
A2
Myotis daubentonii
A3
Myotis daubentonii
A5
Activity Level (Percentile)
100
80
60
40
20
0
23 Apr 2020
26 Apr 2020
29 Apr 2020
02 May 2020
Night
Activity Level
medium
low


Myotis daubentonii
A6
Myotis daubentonii
A7
Myotis daubentonii
A8
Myotis mystacinus
A2
Myotis mystacinus
A3
Myotis mystacinus
A5
Myotis mystacinus
A6
Myotis mystacinus
A7
Activity Level (Percentile)
100
80
60
40
20
0
23 Apr 2020
26 Apr 2020
29 Apr 2020
02 May 2020
Night
Activity Level
medium
low


Myotis nattereri
A2
Myotis nattereri
A3
Myotis nattereri
A5
Myotis nattereri
A6
Myotis nattereri
A7
Nyctalus leisleri
A2
Nyctalus leisleri
A3
Nyctalus leisleri
A5
Activity Level (Percentile)
100
80
60
40
20
0
23 Apr 2020
26 Apr 2020
29 Apr 2020
02 May 2020
Night
Activity Level
medium
low


Nyctalus leisleri
A6
Nyctalus leisleri
A7
Nyctalus leisleri
A8
Pipistrellus
A2
Pipistrellus
A3
Pipistrellus
A5
Pipistrellus
A7
Pipistrellus
A8
Activity Level (Percentile)
100
80
60
40
20
0
23 Apr 2020
26 Apr 2020
29 Apr 2020
02 May 2020
Night
Activity Level
medium
low


Pipistrellus nathusii
A2
Pipistrellus nathusii
A3
Pipistrellus nathusii
A5
Pipistrellus nathusii
A6
Pipistrellus nathusii
A7
Pipistrellus nathusii
A8
Pipistrellus pipistrellus
A2
Pipistrellus pipistrellus
A3
Activity Level (Percentile)
100
80
60
40
20
0
23 Apr 2020
26 Apr 2020
29 Apr 2020
02 May 2020
Night
Activity Level
medium
low


Pipistrellus pipistrellus
A5
Pipistrellus pipistrellus
A6
Pipistrellus pipistrellus
A7
Pipistrellus pipistrellus
A8
Pipistrellus pygmaeus
A2
Pipistrellus pygmaeus
A3
Pipistrellus pygmaeus
A5
Pipistrellus pygmaeus
A6
Activity Level (Percentile)
100
80
60
40
20
0
23 Apr 2020
26 Apr 2020
29 Apr 2020
02 May 2020
Night
Activity Level
medium
low

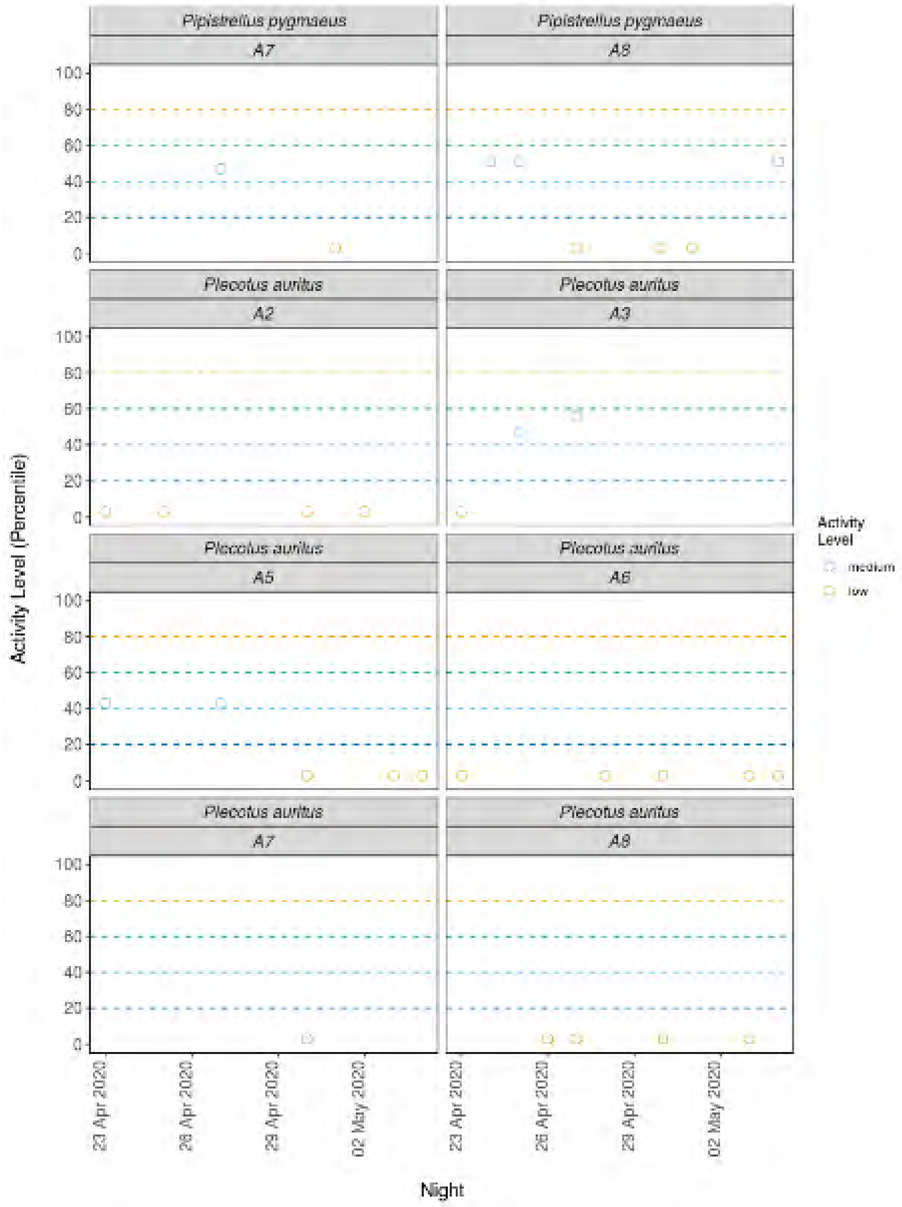


Plate 24: The activity level (percentile) of bats recorded across each night of the bat survey – Survey period 1

Table 4-7: Summary showing the number of nights recorded bat activity fell into each activity band for each species across all of the detectors – Survey period 1

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	2	4	2	9	4	38	Low to Moderate
Myotis daubentonii	0	3	5	28	8	20	Low
Myotis mystacinus	0	0	0	4	13	3	Low
Myotis nattereri	0	3	2	5	9	20	Low
Nyctalus leisleri	49	14	5	1	0	88	High
Pipistrellus	31	3	0	0	0	94	High
Pipistrellus nathusii	1	7	6	16	11	31	Low to Moderate
Pipistrellus pipistrellus	30	17	7	6	1	79	Moderate to High
Pipistrellus pygmaeus	30	17	8	5	4	79	Moderate to High
Plecotus auritus	0	1	4	16	18	20	Low

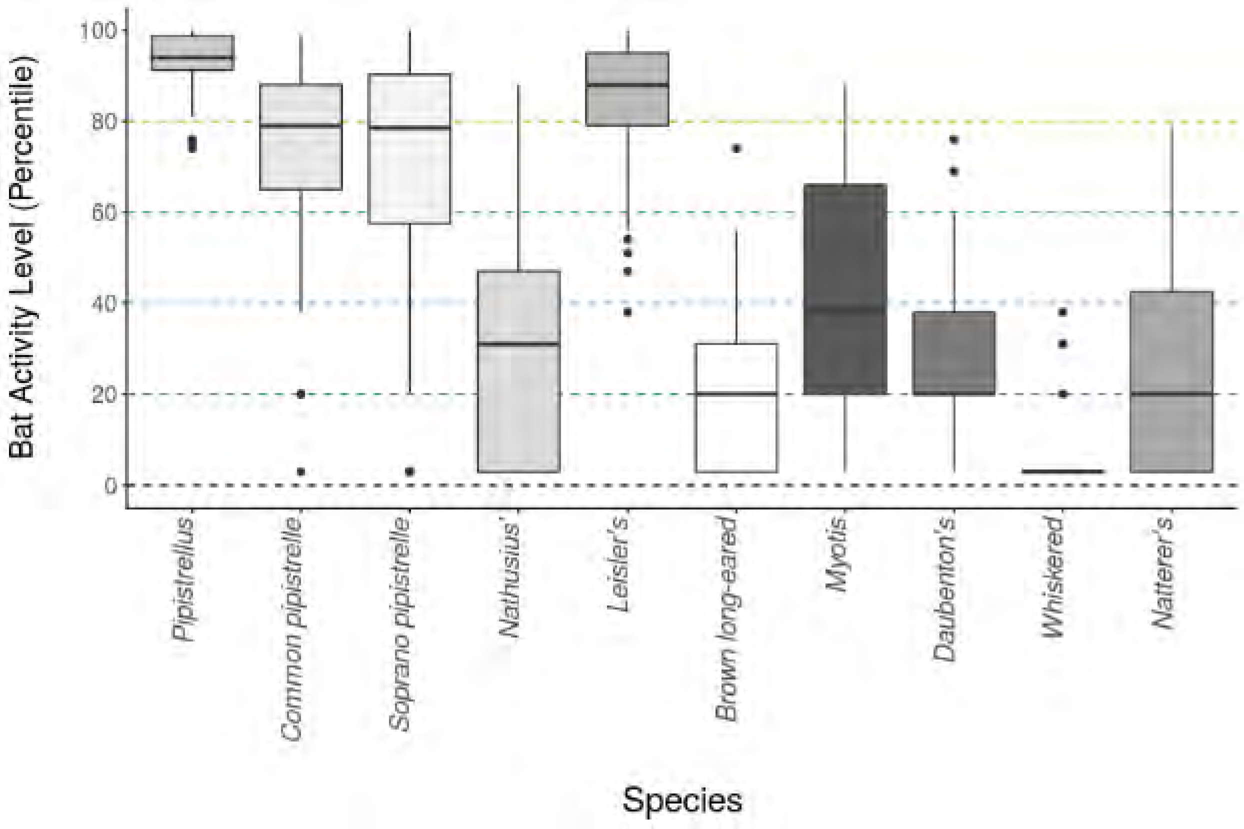
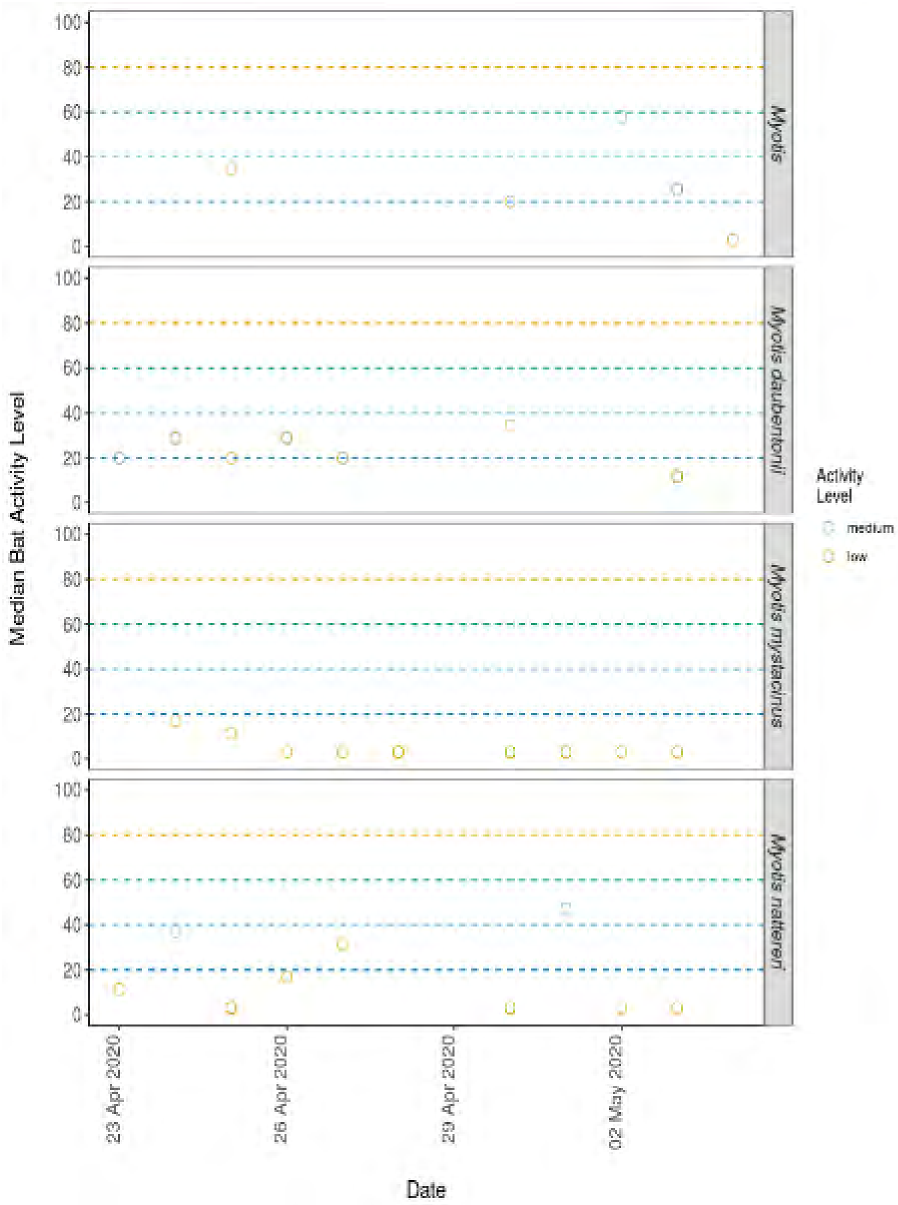
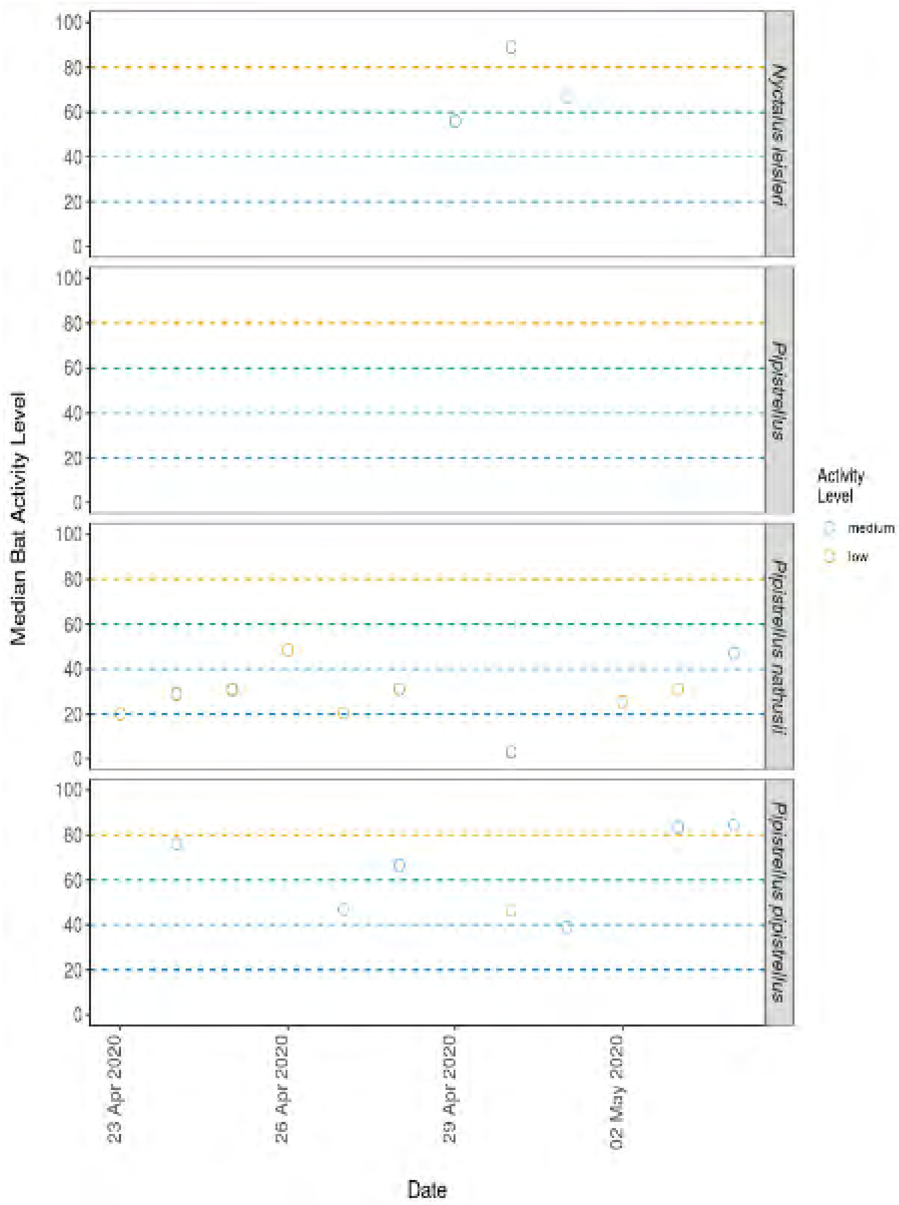


Plate 25: The activity level (percentile) of bats recorded across each night of the bat survey for the entire site – Survey period 1.


Myotis
Myotis daubentonii
Myotis mystacinus
Myotis natteri
Median Bat Activity Level
Date
23 Apr 2020
26 Apr 2020
29 Apr 2020
02 May 2020
Activity Level
medium
low


Nyctalus leisleri
Pipistrellus
Pipistrellus nathusii
Pipistrellus pipistrellus
Median Bat Activity Level
Date
23 Apr 2020
26 Apr 2020
29 Apr 2020
02 May 2020
Activity Level
medium
low

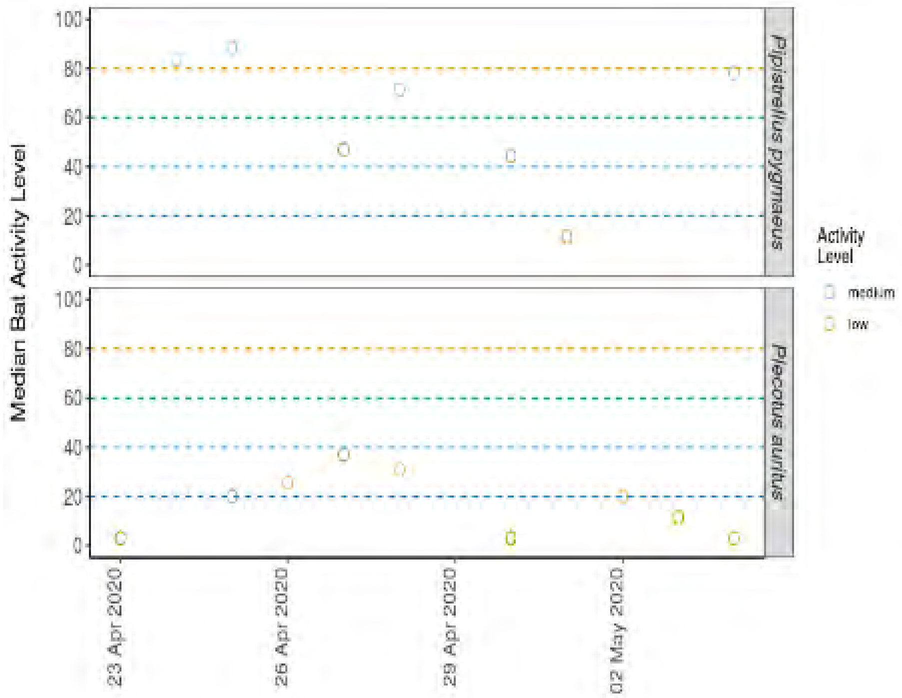
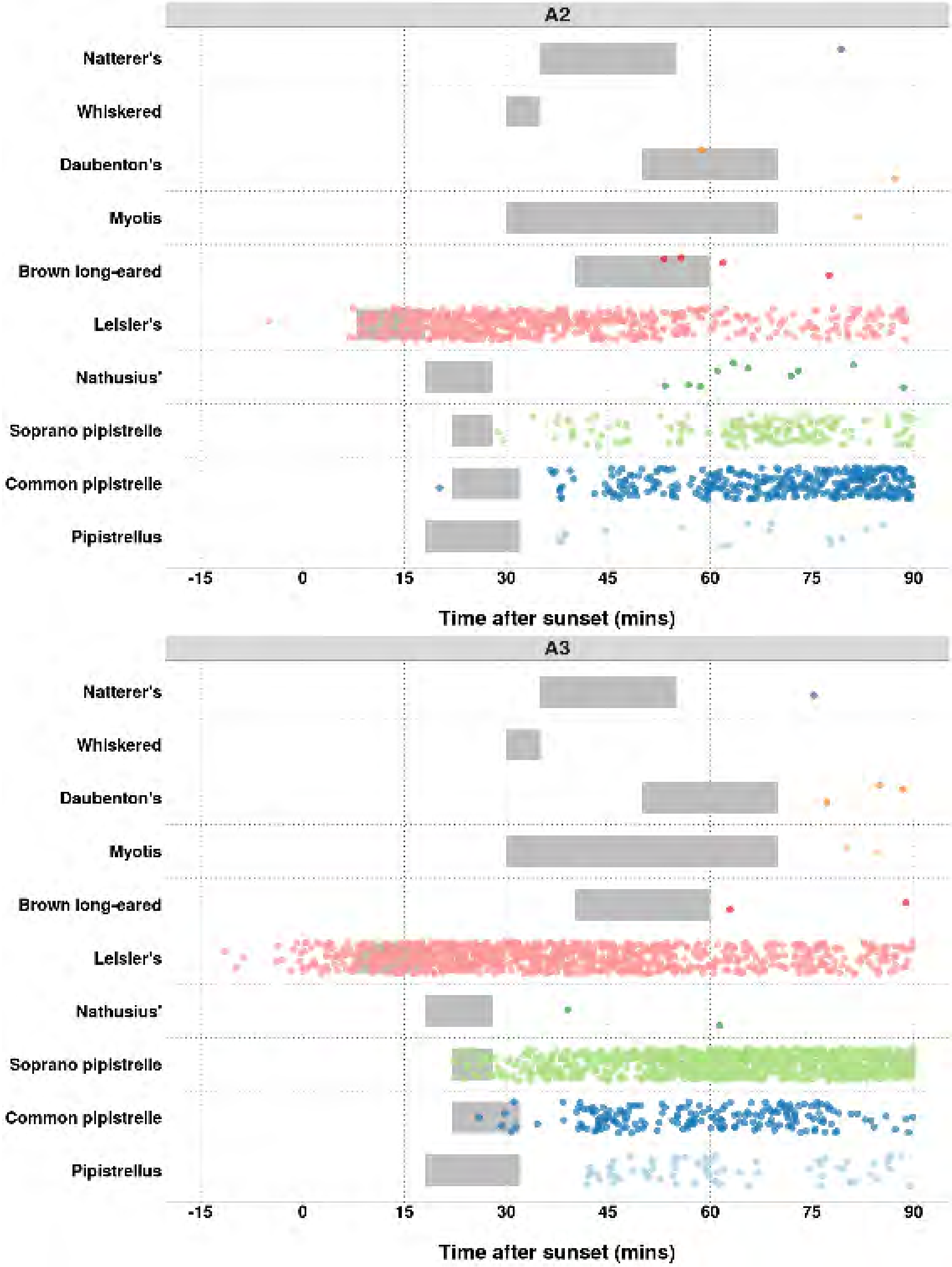


Plate 26: The median activity levels of bats recorded across all detectors each night – Survey period 1.

Due to the number of the recorded passes occurring within the species-specific emergence time ranges based on Russ 2012, the Ecobat analysis has identified a potential roost may be present near static locations A2, A3, A6 and A8 for leisler bats. Along with a potential roost near static locations A3 for soprano pipistrelle. Refer to Plate 27 which shows passes in relation to the time from 15 minutes before to 90 minutes after sunset. Species-specific emergence time ranges are shown as grey bars. Bat passes overlapping species-specific grey bars, or occurring earlier than this time range, may potentially indicate the presence of a nearby roost.


A2
Natterer's
Whiskered
Daubenton's
Myotis
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
Pipistrellus
-15
0
15
30
45
60
75
90
Time after sunset (mins)
A3
Natterer's
Whiskered
Daubenton's
Myotis
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
Pipistrellus
-15
0
15
30
45
60
75
90
Time after sunset (mins)

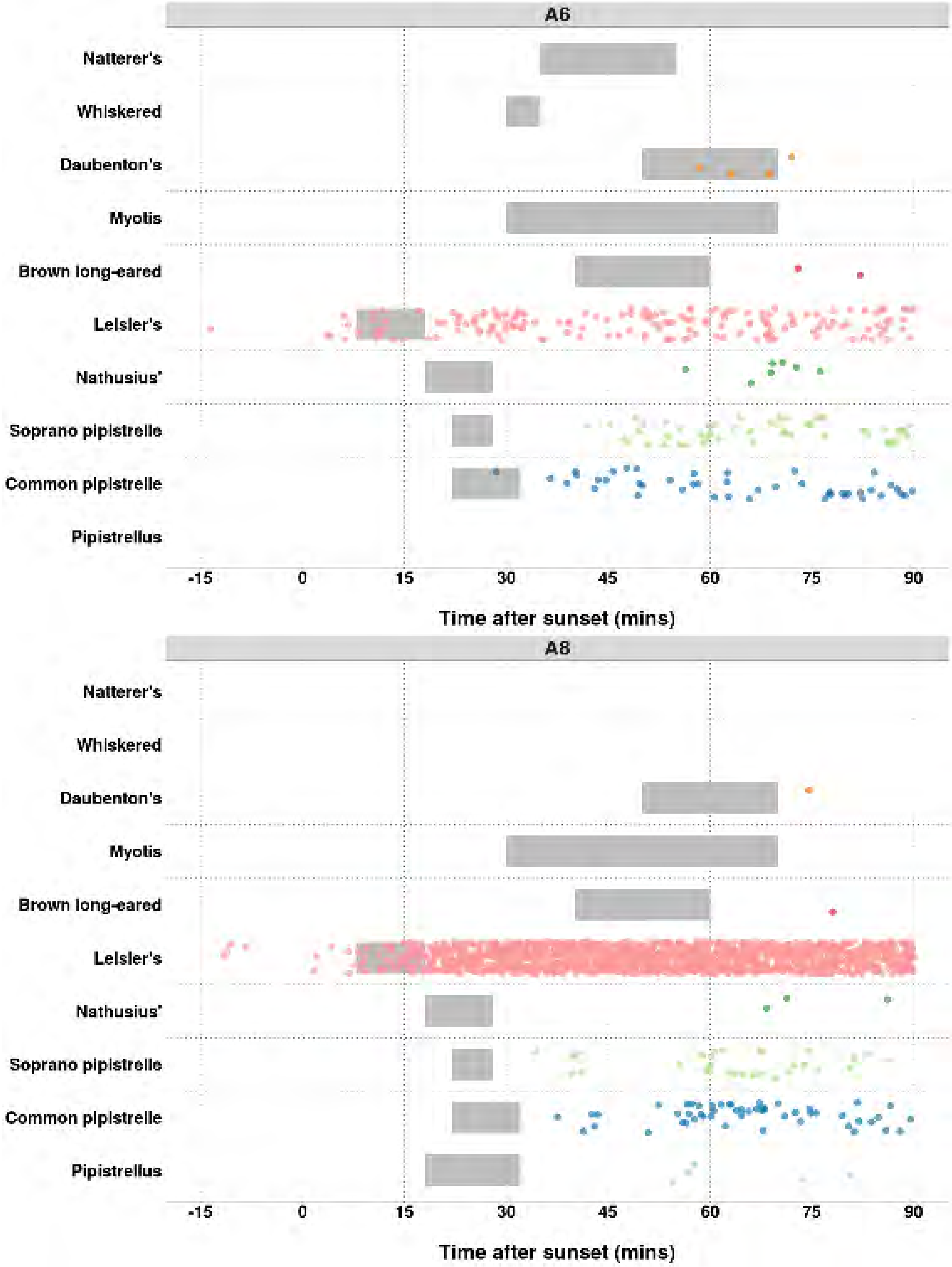


Plate 27: Time from 15 minutes before to 90 minutes after sunset, potentially indicating the presence of a nearby roost – Survey period 1.

4.7.2 Survey Period 2 2020

A summary showing the number of nights recorded bat activity within each activity band for each species is presented below in Table 4-8. Refer to Appendix D for the full Ecobat analysis report

Bat surveys were conducted for 10 nights between 21/07/2020 and 30/07/2020 using Wildlife Acoustics static bat detectors. However Static location A8 only recorded three species during the survey period.

All of the six static locations had at least one night of High Activity during the survey period.

The following Static locations are deemed to have a High Bat Activity (for specific bat species) level based on the Median Percentile value:

- A2, A3, A5 and A7 for Pipistrelle sp.;
- A3, A5 and A7 for soprano pipistrelle; and
- A7 for Leiser's bats.

Refer to Plates 28 and 29 below.

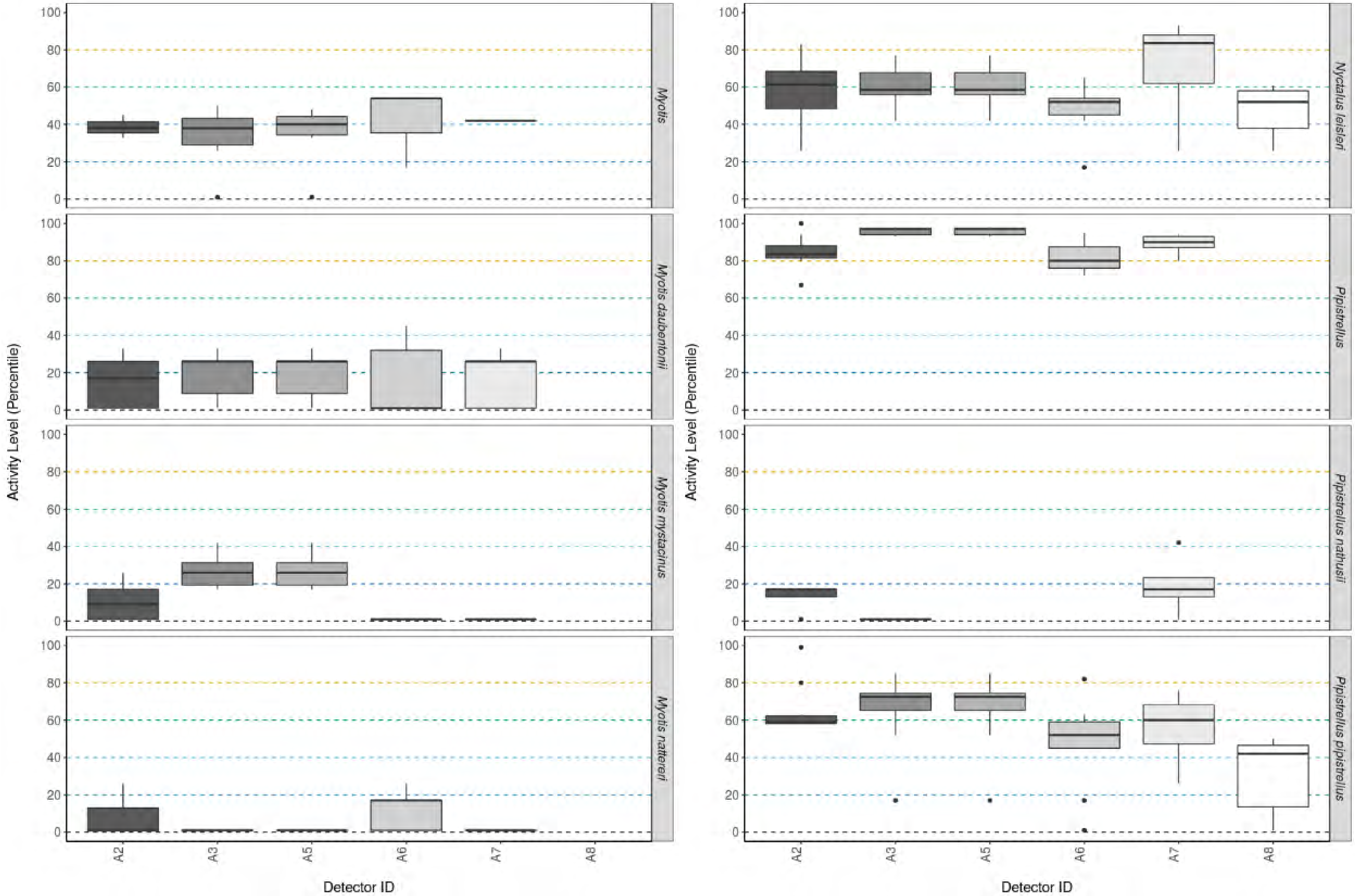
Table 4.9, along with Plates 30 and 31 show the number of nights recorded bat activity fell into each activity band for each species across all of the detectors. They identify Pipistrellus spp. and leisler's bat as having high bat activity (per median percentile) across all detectors for period 2.

Table 4-8: Bat activity within each activity band for each species – Survey period 2

Location	Species/ Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity	Median Percentile	Bat Activity Category
A2	*Myotis*	0	0	1	2	0	38	Low to Moderate
A2	*Myotis daubentonii*	0	0	0	2	3	17	Low
A2	*Myotis mystacinus*	0	0	0	1	5	9	Low
A2	*Myotis nattereri*	0	0	0	1	5	1	Low
A2	*Nyctalus leisleri*	1	5	2	2	0	62	Moderate to High
A2	*Pipistrellus*	7	1	0	0	0	84	High
A2	*Pipistrellus nathusii*	0	0	0	0	4	17	Low
A2	*Pipistrellus pipistrellus*	1	3	6	0	0	59	Moderate
A2	*Pipistrellus pygmaeus*	4	5	1	0	0	77	Moderate to High
A2	*Plecotus auritus*	0	0	2	4	3	33	Low to Moderate
A3	*Myotis*	0	0	2	3	1	38	Low to 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
A3	*Myotis daubentonii*	0	0	0	4	3	26	Low to Moderate
A3	*Myotis mystacinus*	0	0	1	3	2	26	Low to Moderate
A3	*Myotis nattereri*	0	0	0	0	6	1	Low
A3	*Nyctalus leisleri*	0	4	6	0	0	59	Moderate
A3	*Pipistrellus*	7	0	0	0	0	97	High
A3	*Pipistrellus nathusii*	0	0	0	0	2	1	Low
A3	*Pipistrellus pipistrellus*	2	6	1	0	1	73	Moderate to High
A3	*Pipistrellus pygmaeus*	8	1	1	0	0	93	High
A3	*Plecotus auritus*	0	0	1	2	4	17	Low
A5	*Myotis*	0	0	3	2	1	40	Low to Moderate
A5	*Myotis daubentonii*	0	0	0	4	3	26	Low to Moderate
A5	*Myotis mystacinus*	0	0	1	3	2	26	Low to Moderate
A5	*Myotis nattereri*	0	0	0	0	8	1	Low
A5	*Nyctalus leisleri*	0	4	6	0	0	59	Moderate
A5	*Pipistrellus*	7	0	0	0	0	97	High
A5	*Pipistrellus pipistrellus*	2	6	1	0	1	73	Moderate to High
A5	*Pipistrellus pygmaeus*	8	1	1	0	0	93	High
A5	*Plecotus auritus*	0	0	1	2	4	17	Low
A6	*Myotis*	0	0	2	0	1	54	Moderate
A6	*Myotis daubentonii*	0	0	1	2	4	1	Low
A6	*Myotis mystacinus*	0	0	0	0	2	1	Low
A6	*Myotis nattereri*	0	0	0	1	4	17	Low
A6	*Nyctalus leisleri*	0	1	7	0	1	52	Moderate
A6	*Pipistrellus*	2	1	0	0	0	80	Moderate to High
A6	*Pipistrellus pipistrellus*	1	1	5	0	2	52	Moderate
A6	*Pipistrellus pygmaeus*	1	6	2	0	0	72	Moderate to High
A6	*Plecotus auritus*	0	0	0	2	4	9	Low
A7	*Myotis*	0	0	1	0	0	42	Moderate
A7	*Myotis daubentonii*	0	0	0	5	3	26	Low to Moderate
A7	*Myotis mystacinus*	0	0	0	0	3	1	Low

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
A7	*Myotis nattereri*	0	0	0	0	2	1	Low
A7	*Nyctalus leisleri*	6	2	0	2	0	84	High
A7	*Pipistrellus*	5	0	0	0	0	90	High
A7	*Pipistrellus nathusii*	0	0	1	0	3	17	Low
A7	*Pipistrellus pipistrellus*	0	4	3	1	0	60	Moderate
A7	*Pipistrellus pygmaeus*	5	3	0	1	0	83	High
A7	*Plecotus auritus*	0	0	0	2	4	17	Low
A8	*Nyctalus leisleri*	0	2	4	3	0	52	Moderate
A8	*Pipistrellus pipistrellus*	0	0	4	1	2	42	Moderate
A8	*Pipistrellus pygmaeus*	1	4	1	0	2	69	Moderate to High


Myotis
Myotis daubentonii
Myotis mystacinus
Myotis nattereri
Nyctalus leisleri
Pipistrellus
Pipistrellus nathusii
Pipistrellus pipistrellus
Activity Level (Percentile)
Detector ID
A2
A3
A5
A6
A7
A8
0
20
40
60
80
100

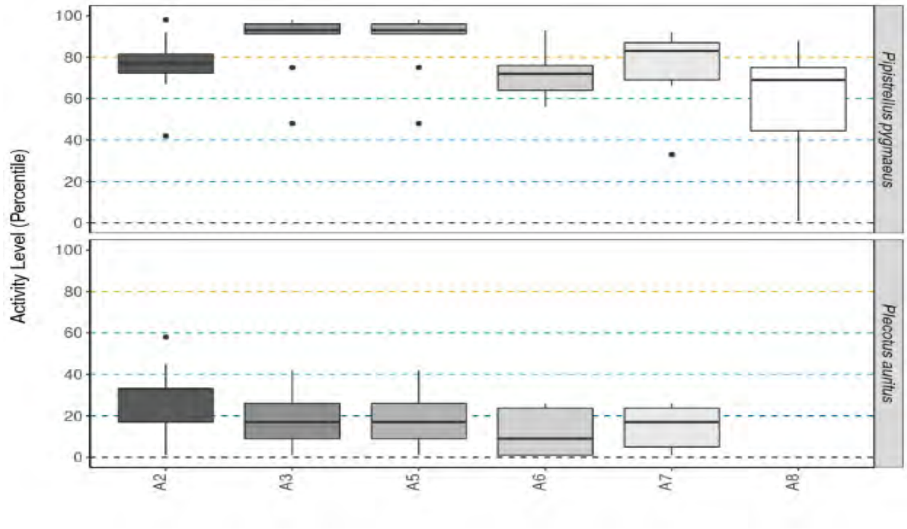
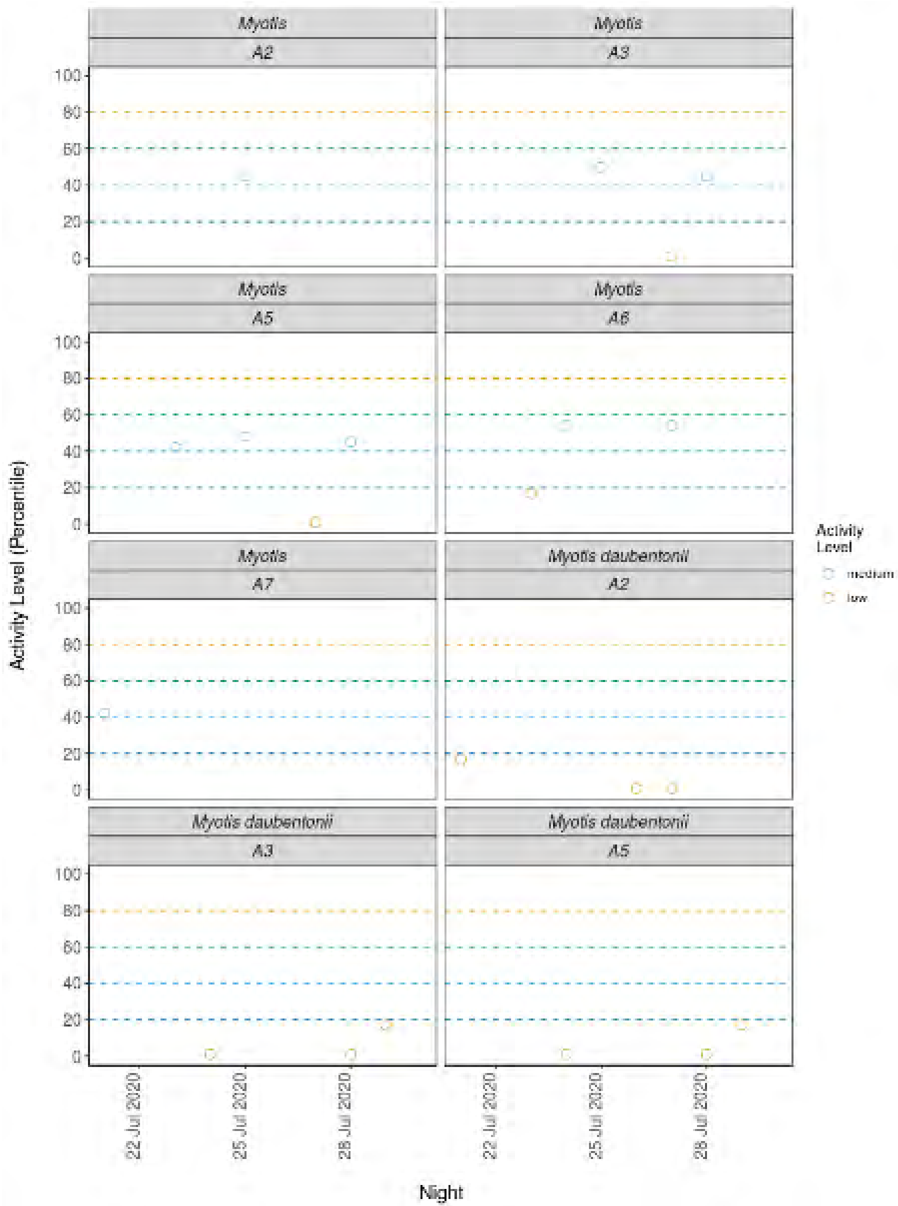
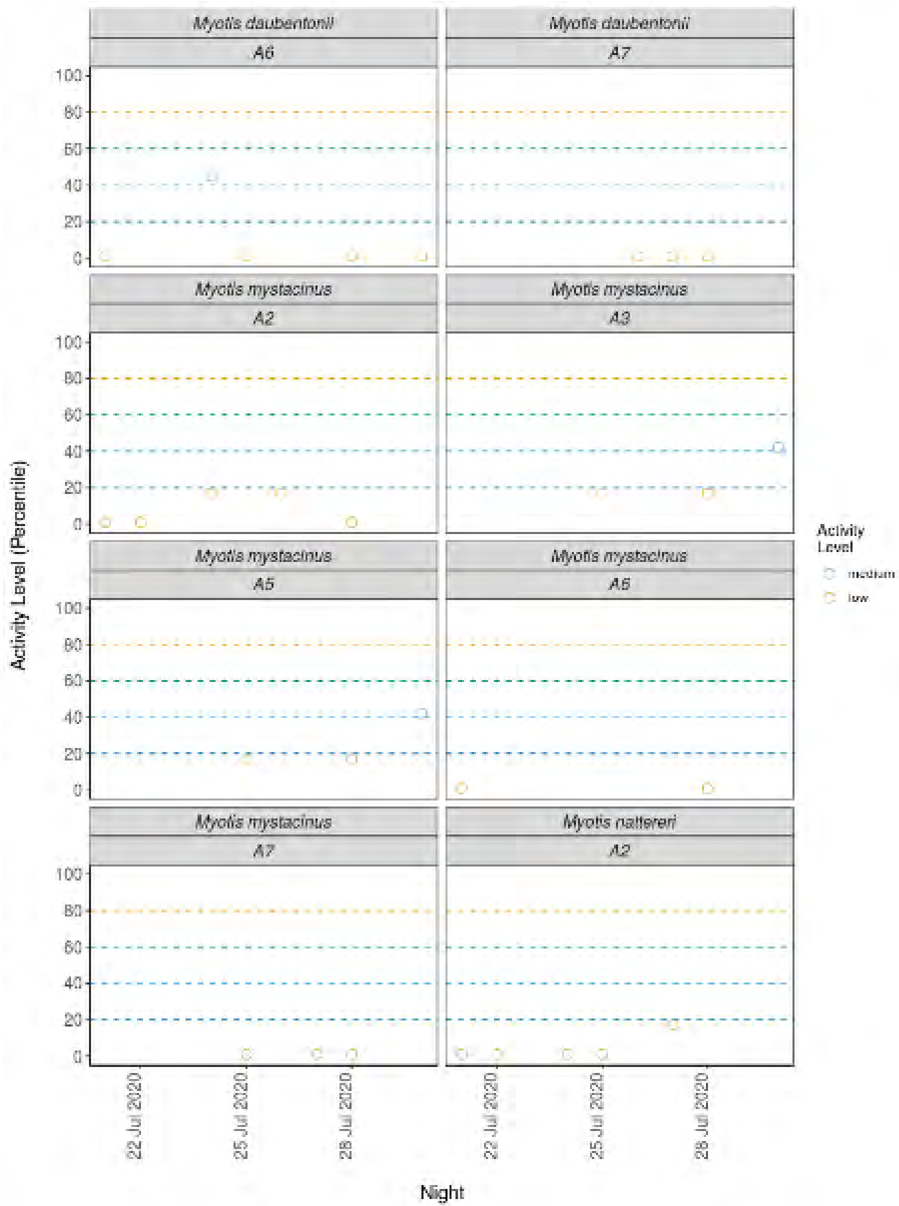
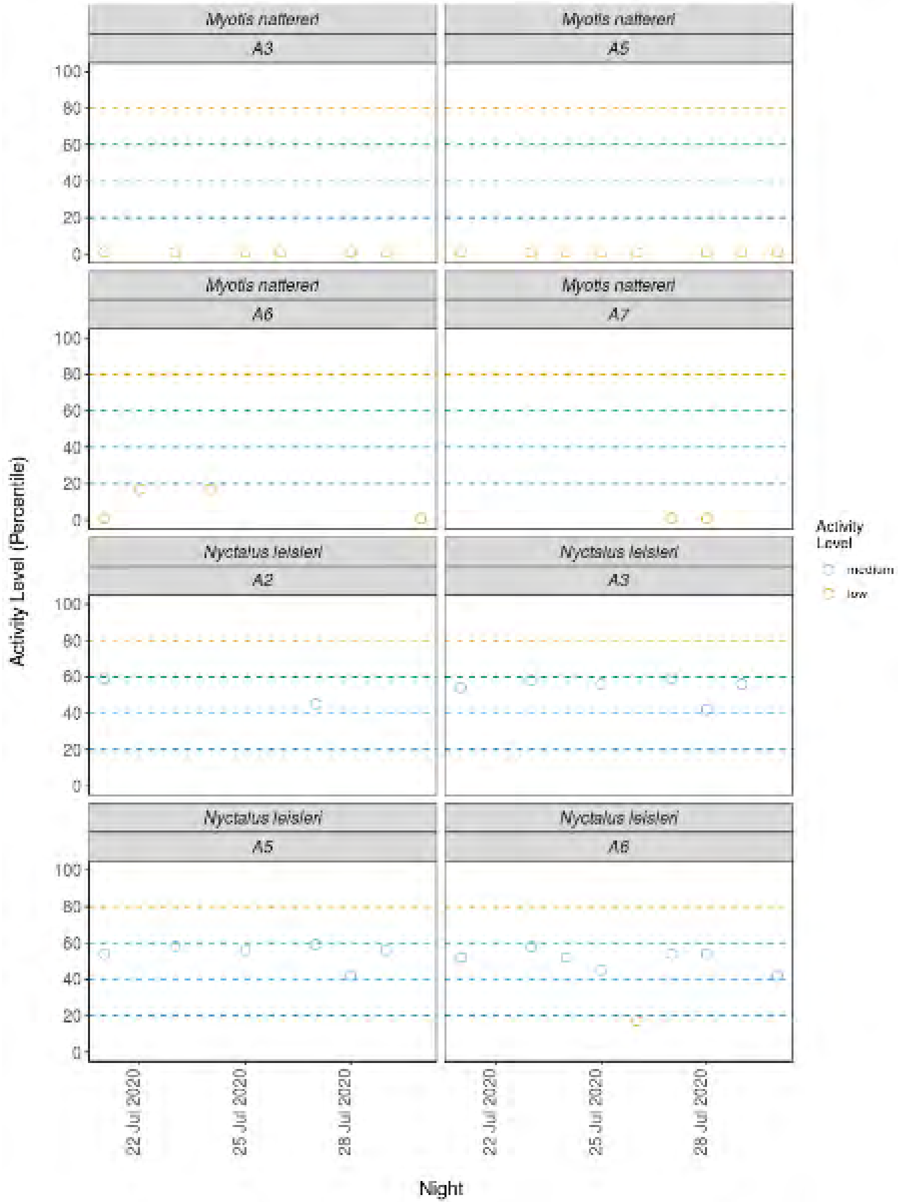
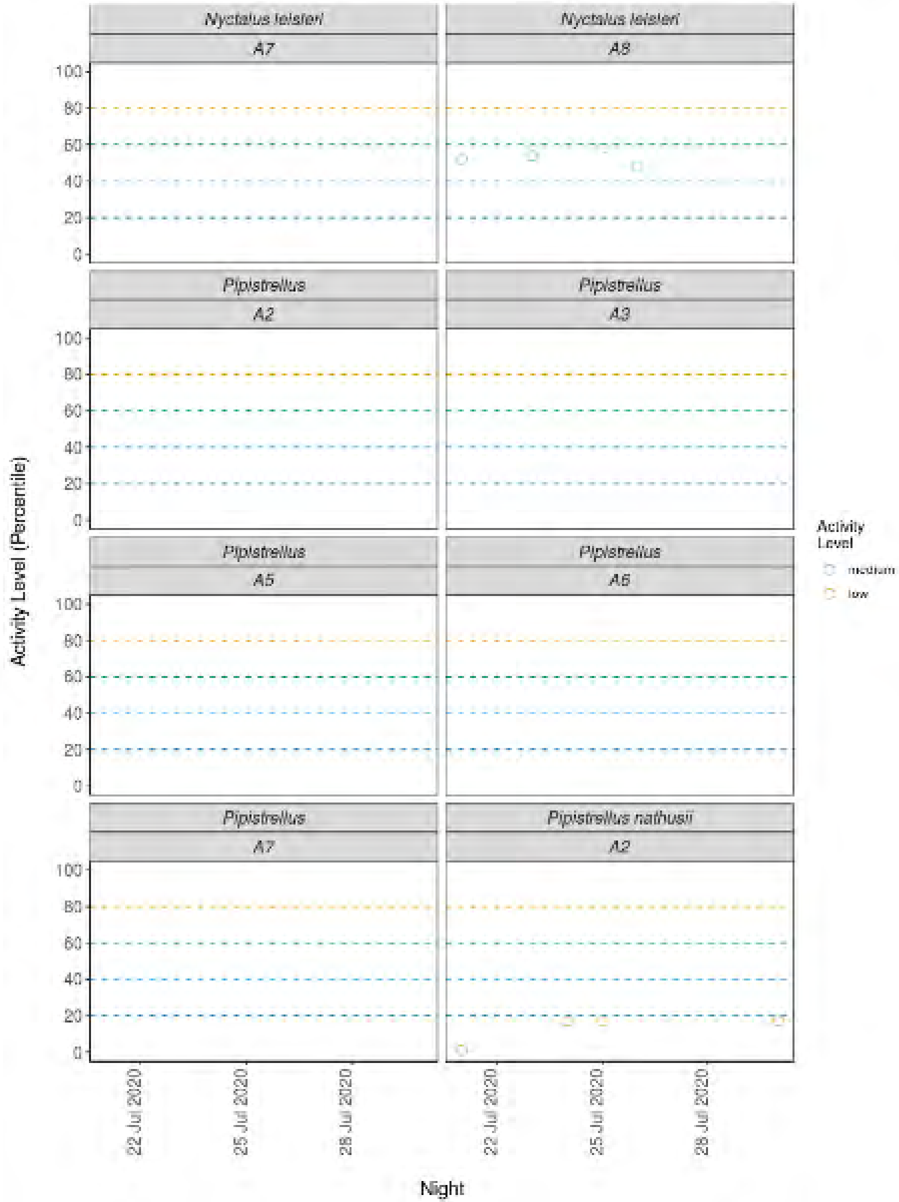


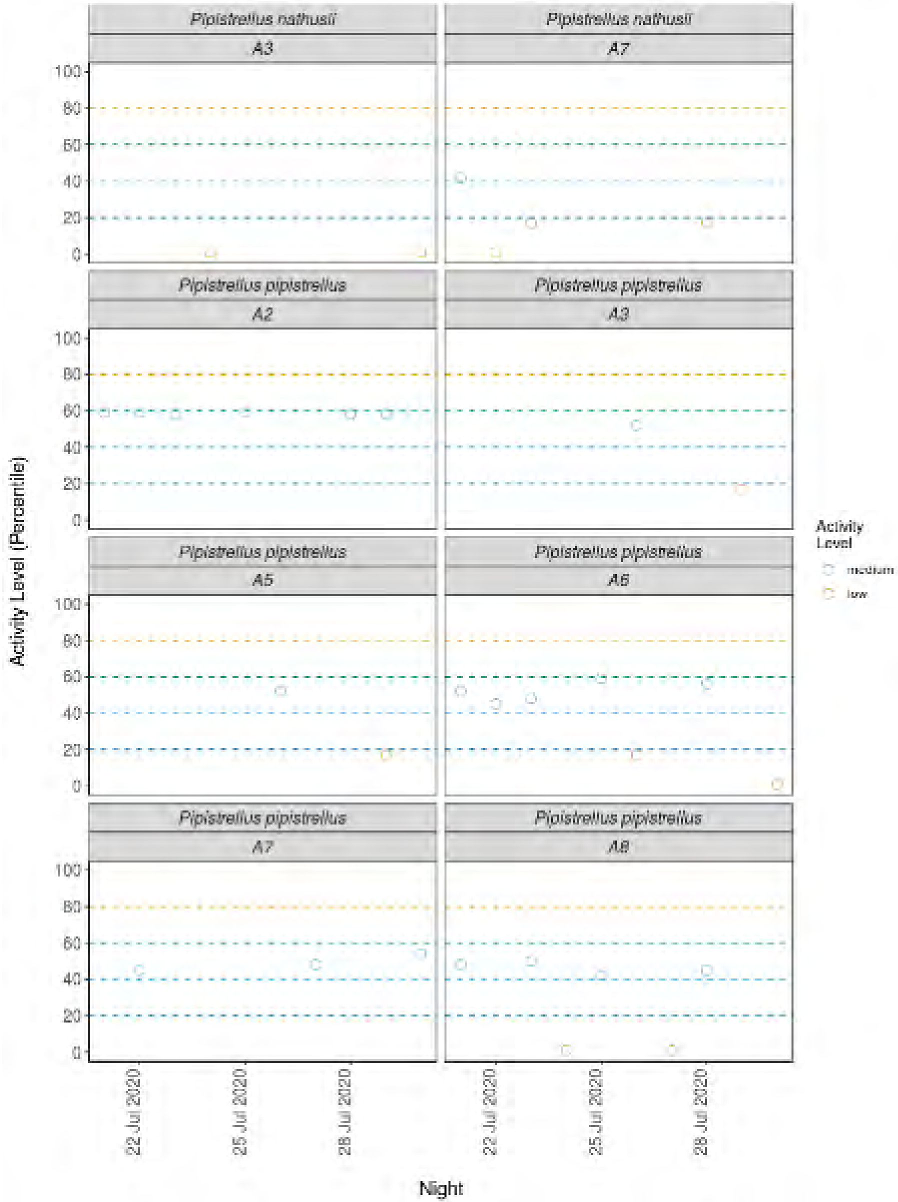
Plate 28: Differences in activity between static detector locations, split by species and location. The centre line indicates the median activity level whereas the box represents the interquartile range (the spread of the middle 50% of nights of activity)

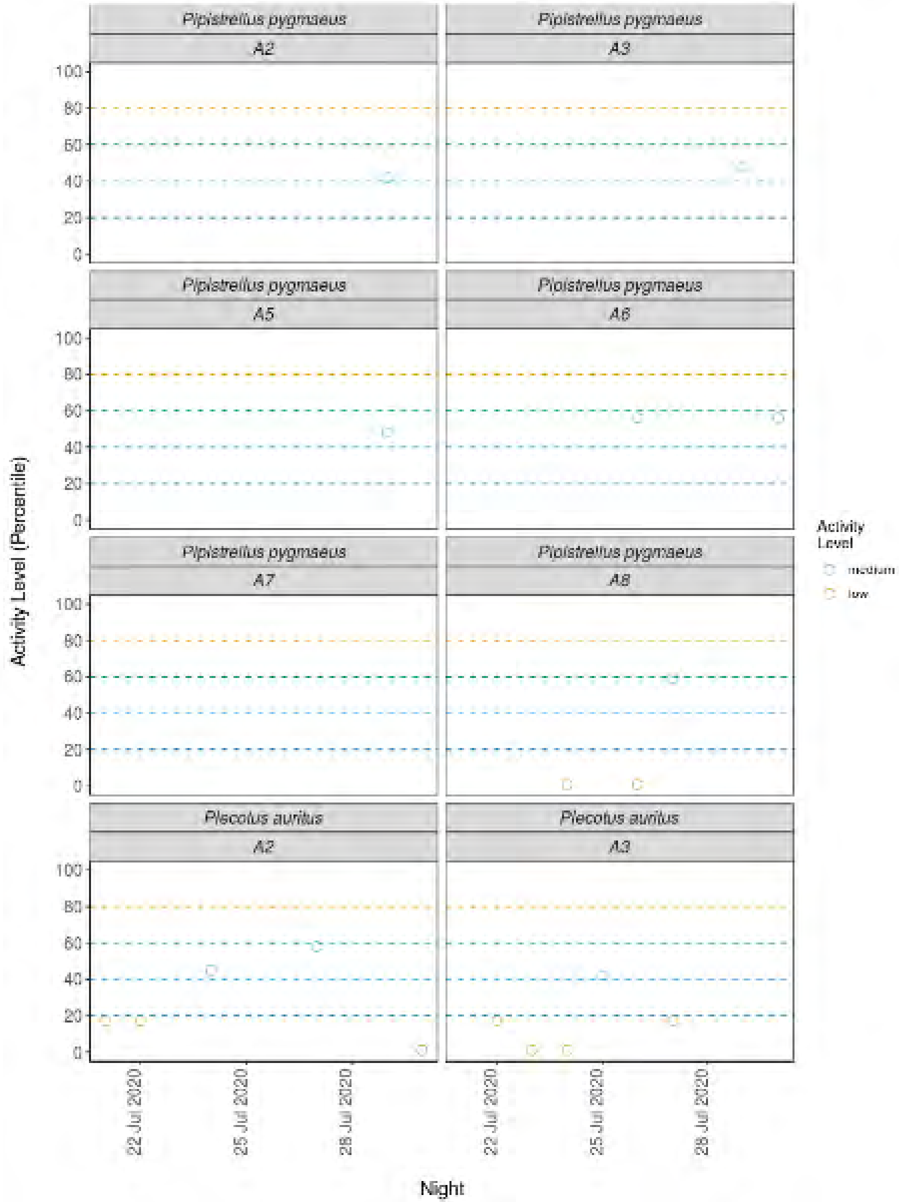

Myotis
A2
Myotis
A3
Myotis
A5
Myotis
A6
Myotis
A7
Myotis daubentonii
A2
Myotis daubentonii
A3
Myotis daubentonii
A5
Activity Level (Percentile)
Night
22 Jul 2020
25 Jul 2020
28 Jul 2020
Activity Level
medium
low


Myotis daubentonii
A6
Myotis daubentonii
A7
Myotis mystacinus
A2
Myotis mystacinus
A3
Myotis mystacinus
A5
Myotis mystacinus
A6
Myotis mystacinus
A7
Myotis nattereri
A2
Activity Level (Percentile)
Night
22 Jul 2020
25 Jul 2020
28 Jul 2020
Activity Level
medium
low


Myotis nattereri
A3
Myotis nattereri
A5
Myotis nattereri
A6
Myotis nattereri
A7
Nyctalus leisleri
A2
Nyctalus leisleri
A3
Nyctalus leisleri
A5
Nyctalus leisleri
A6
Activity Level (Percentile)
100
80
60
40
20
0
22 Jul 2020
25 Jul 2020
28 Jul 2020
Night
Activity Level
medium
low


Nyctalus leisleri
A7
Nyctalus leisleri
A8
Pipistrellus
A2
Pipistrellus
A3
Pipistrellus
A5
Pipistrellus
A6
Pipistrellus
A7
Pipistrellus nathusii
A2
Activity Level (Percentile)
100
80
60
40
20
0
22 Jul 2020
25 Jul 2020
28 Jul 2020
Night
Activity Level
medium
low


Pipistrellus nathusii
A3
Pipistrellus nathusii
A7
Pipistrellus pipistrellus
A2
Pipistrellus pipistrellus
A3
Pipistrellus pipistrellus
A5
Pipistrellus pipistrellus
A6
Pipistrellus pipistrellus
A7
Pipistrellus pipistrellus
A8
Activity Level (Percentile)
0
20
40
60
80
100
22 Jul 2020
25 Jul 2020
28 Jul 2020
Night
Activity Level
medium
low


Pipistrellus pygmaeus
A2
Pipistrellus pygmaeus
A3
Pipistrellus pygmaeus
A5
Pipistrellus pygmaeus
A6
Pipistrellus pygmaeus
A7
Pipistrellus pygmaeus
A8
Plecotus auritus
A2
Plecotus auritus
A3
Activity Level (Percentile)
0
20
40
60
80
100
22 Jul 2020
25 Jul 2020
28 Jul 2020
Night
Activity Level
medium
low

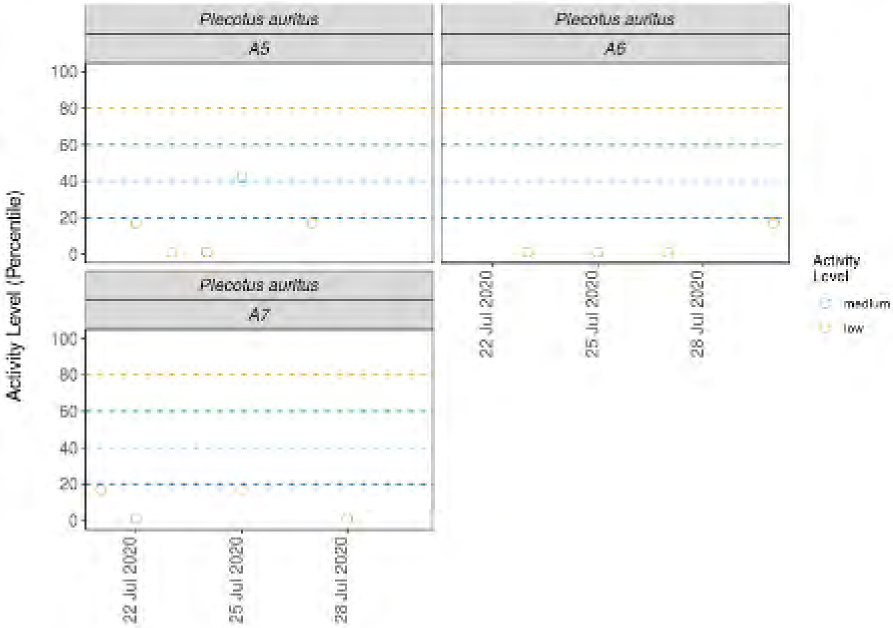


Plate 29: The activity level (percentile) of bats recorded across each night of the bat survey – Survey period 2

Table 4-9: Summary showing the number of nights recorded bat activity fell into each activity band for each species across all of the detectors – Survey period 2

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	0	9	7	3	38	Low to Moderate
Myotis daubentonii	0	0	1	17	16	26	Low to Moderate
Myotis mystacinus	0	0	2	7	14	17	Low
Myotis nattereri	0	0	0	2	25	1	Low
Nyctalus leisleri	7	18	25	7	1	58	Moderate
Pipistrellus	28	2	0	0	0	94	High
Pipistrellus nathusii	0	0	1	0	9	17	Low
Pipistrellus pipistrellus	6	20	20	2	6	59	Moderate
Pipistrellus pygmaeus	27	20	6	1	2	78	Moderate to High
Plecotus auritus	0	0	4	12	19	17	Low

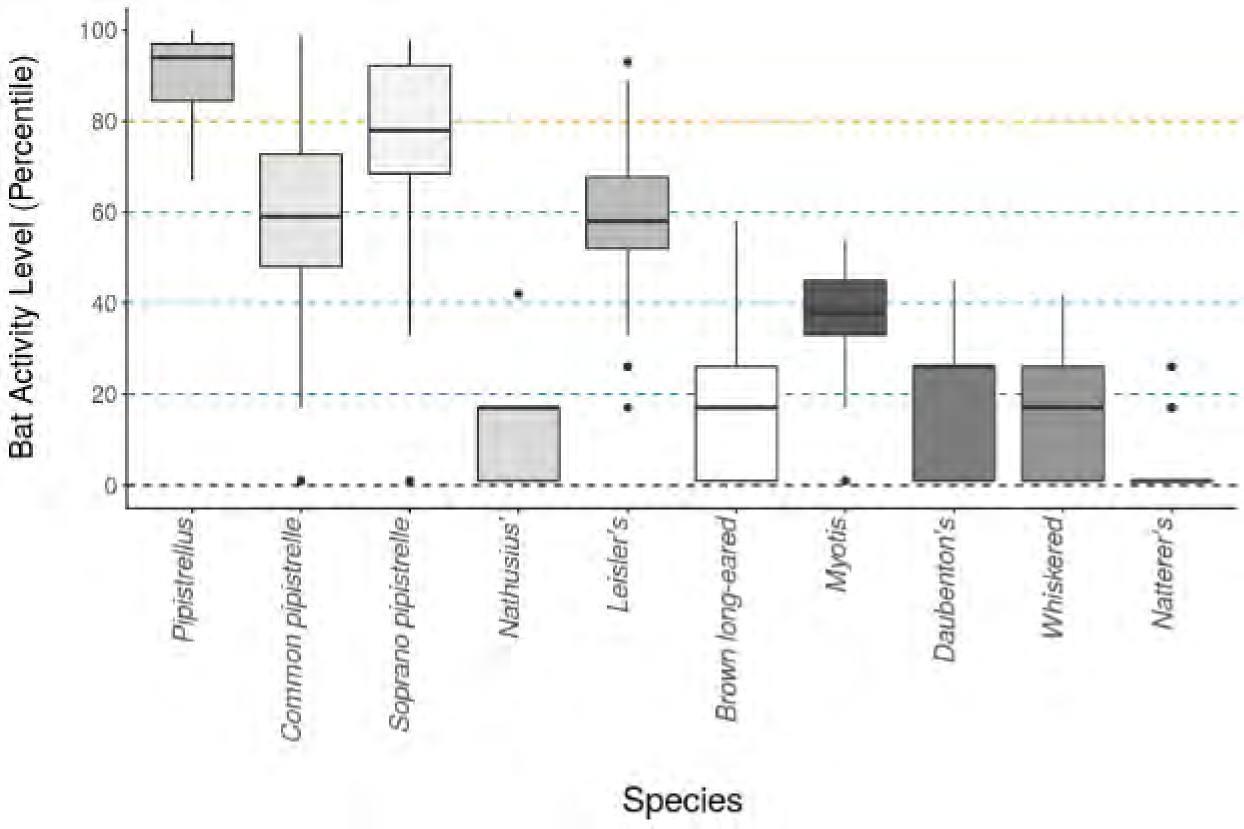
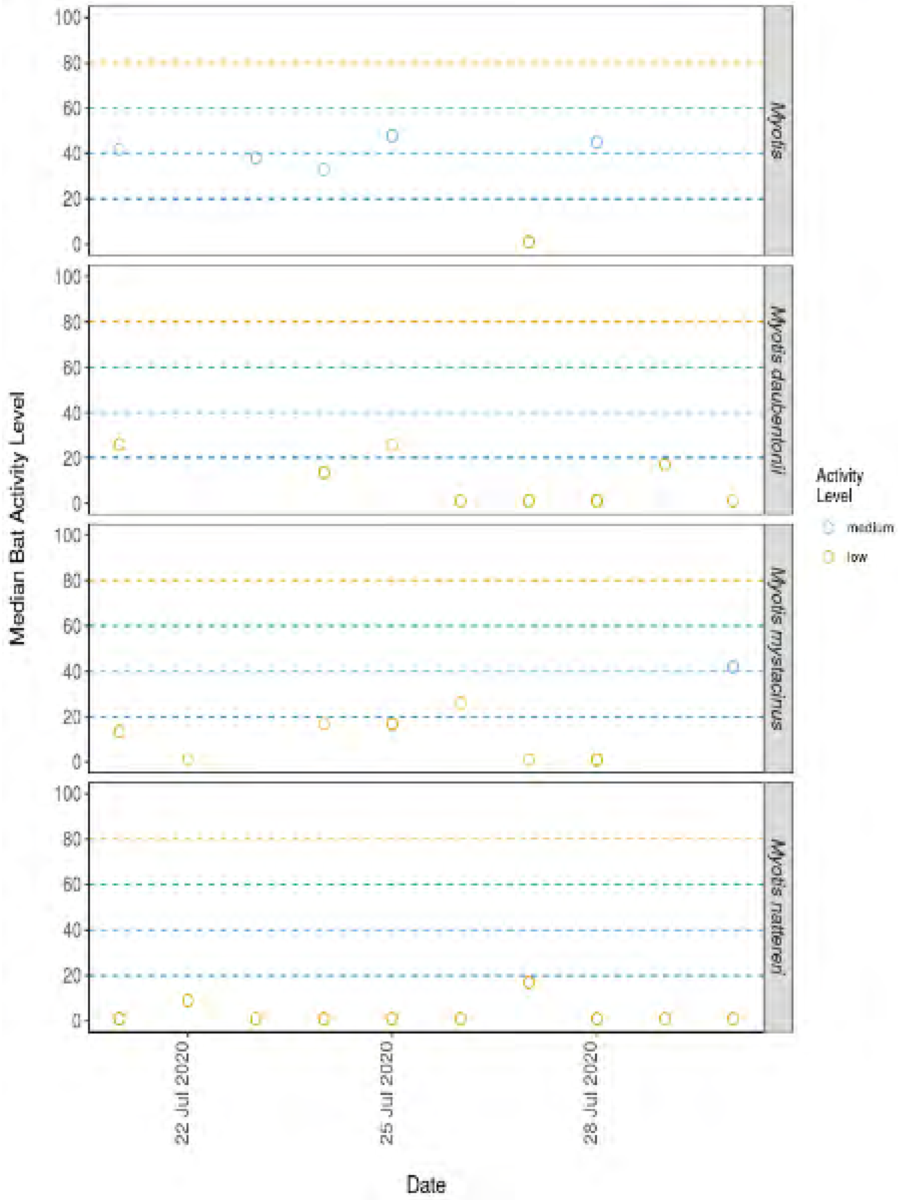
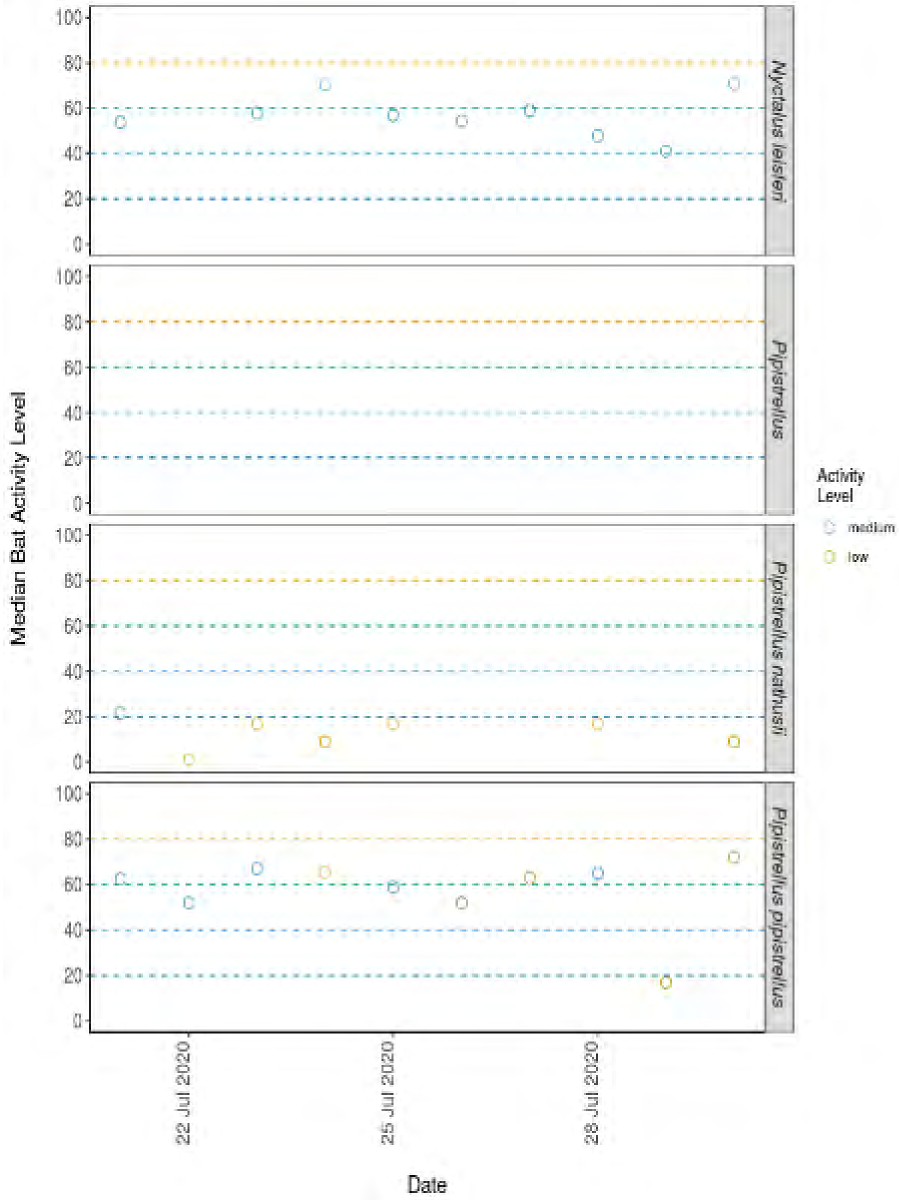


Plate 30: The activity level (percentile) of bats recorded across each night of the bat survey for the entire site – Survey period 2


Median Bat Activity Level
Myotis
Myotis daubentonii
Myotis mystacinus
Myotis nattereri
100
80
60
40
20
0
22 Jul 2020
25 Jul 2020
28 Jul 2020
Date
Activity Level
medium
low


Median Bat Activity Level
Nyctalus leisleri
Pipistrellus
Pipistrellus nathusii
Pipistrellus pipistrellus
100
80
60
40
20
0
22 Jul 2020
25 Jul 2020
28 Jul 2020
Date
Activity Level
medium
low

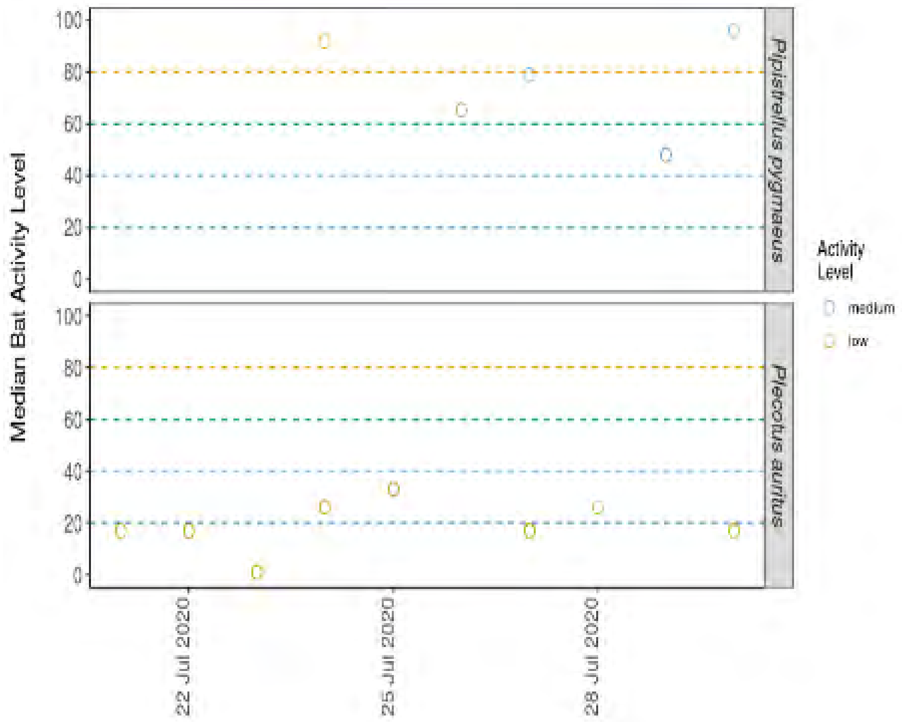
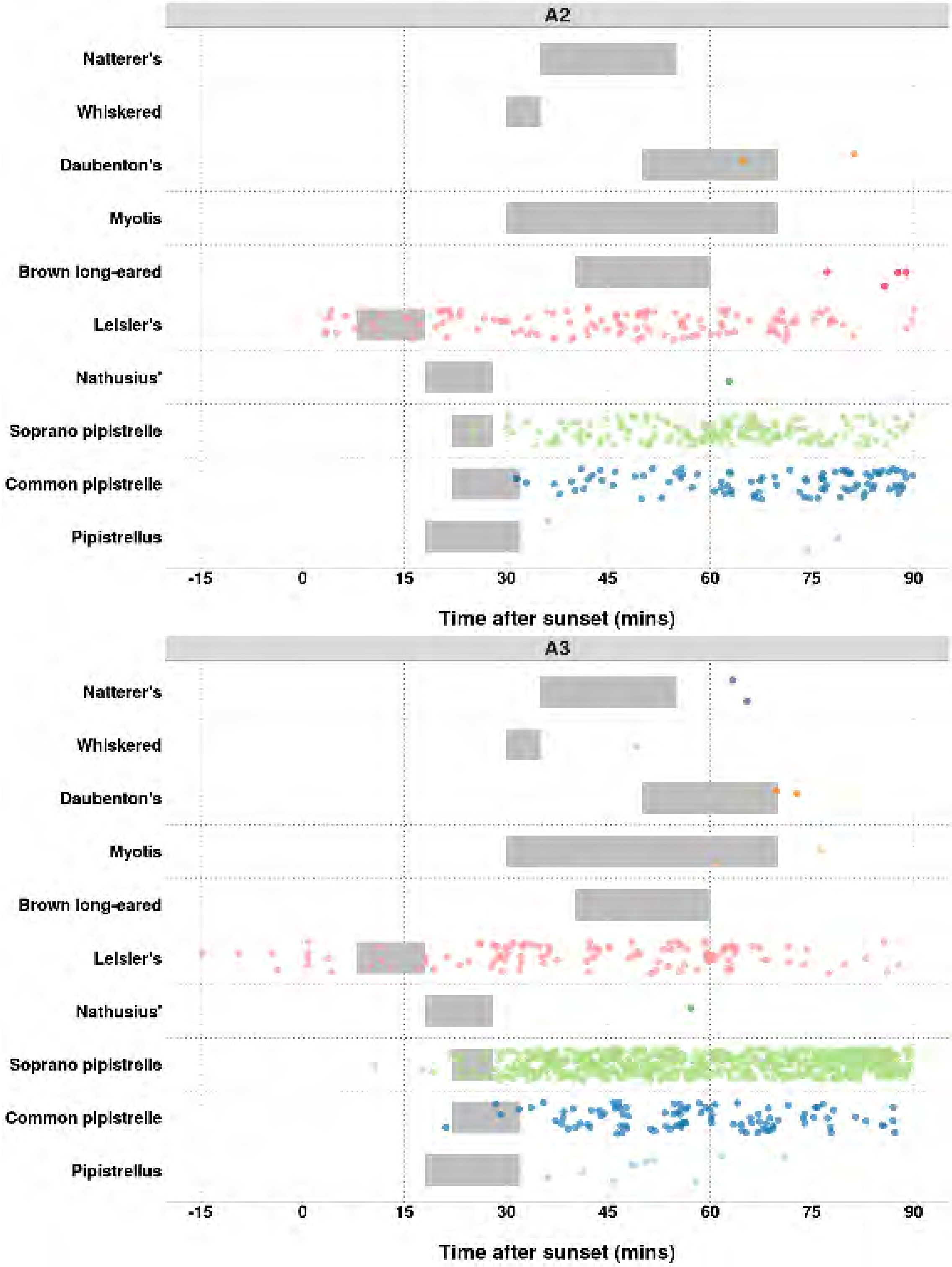
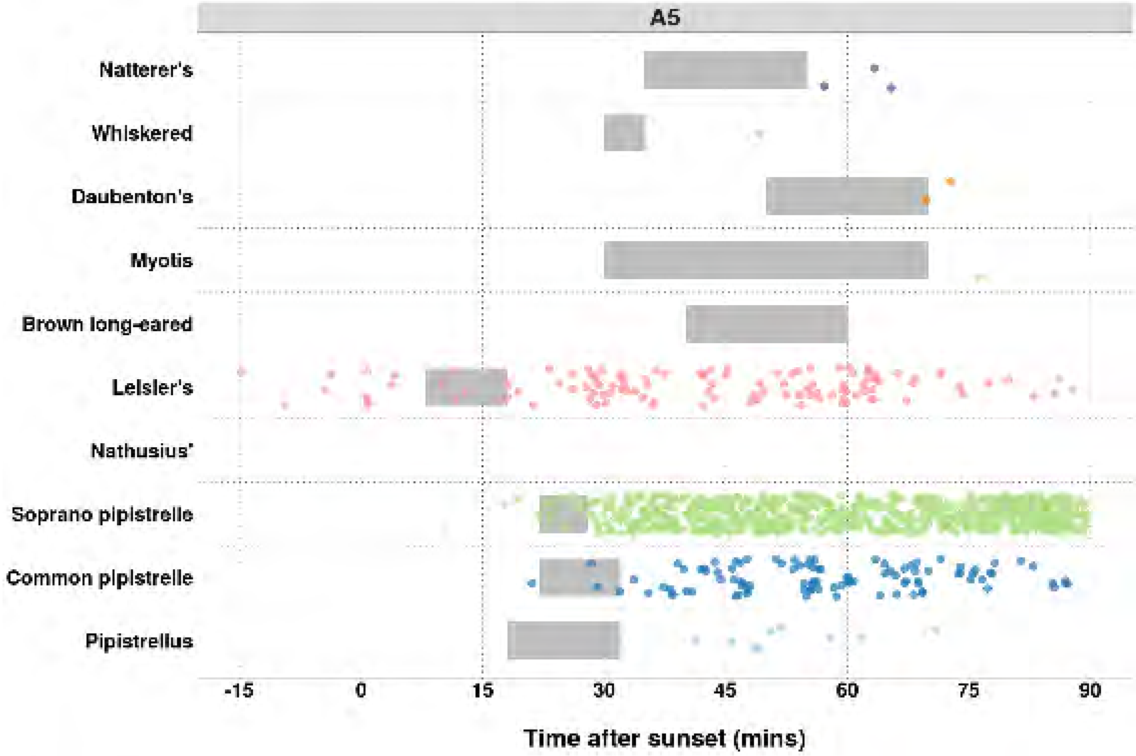
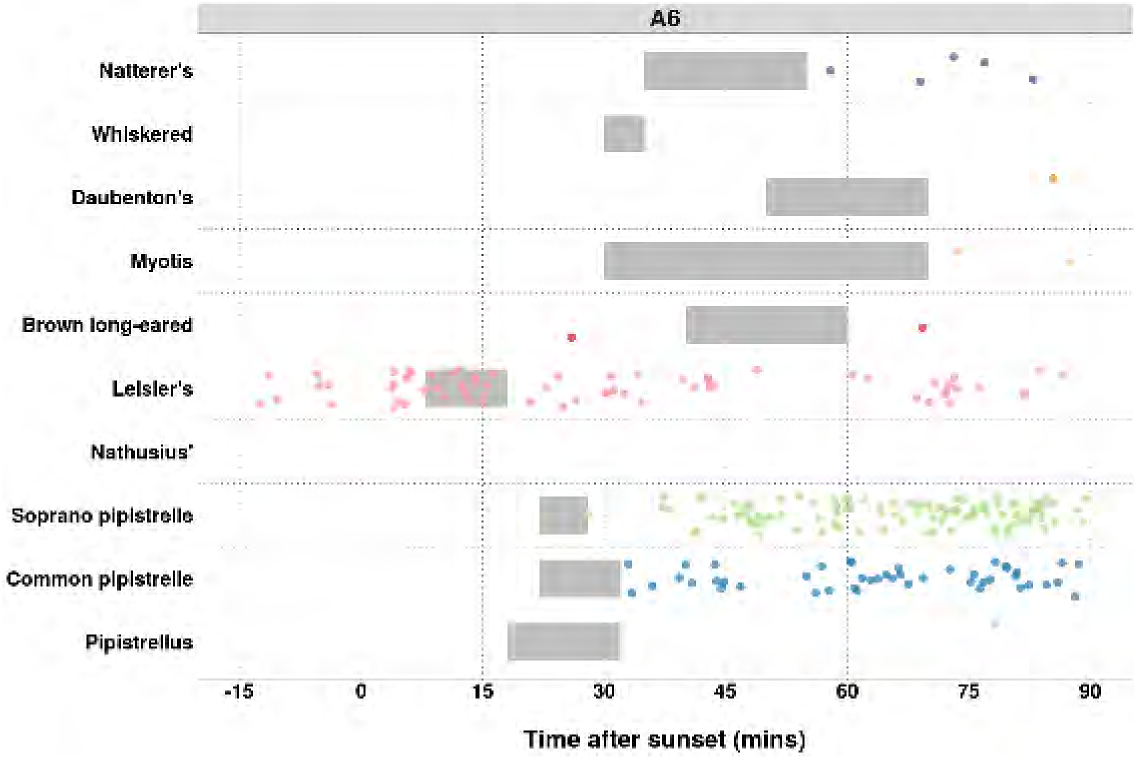


Plate 31: The median activity levels of bats recorded across all detectors each night – Survey period 2.

Due to the number of the recorded passes occurring within the species-specific emergence time ranges based on Russ 2012, the Ecobat analysis has identified a potential roost may be present near all static locations for leisler bats. Along with a potential roost near static locations A3 and A5 for soprano pipistrelle. Refer to Plate 32 which shows passes in relation to the time from 15 minutes before to 90 minutes after sunset.


A2
Natterer's
Whiskered
Daubenton's
Myotis
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
Pipistrellus
-15
0
15
30
45
60
75
90
Time after sunset (mins)
A3
Natterer's
Whiskered
Daubenton's
Myotis
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
Pipistrellus
-15
0
15
30
45
60
75
90
Time after sunset (mins)


A5
Natterer's
Whiskered
Daubenton's
Myotis
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
Pipistrellus
-15
0
15
30
45
60
75
90
Time after sunset (mins)


A6
Natterer's
Whiskered
Daubenton's
Myotis
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
Pipistrellus
-15
0
15
30
45
60
75
90
Time after sunset (mins)

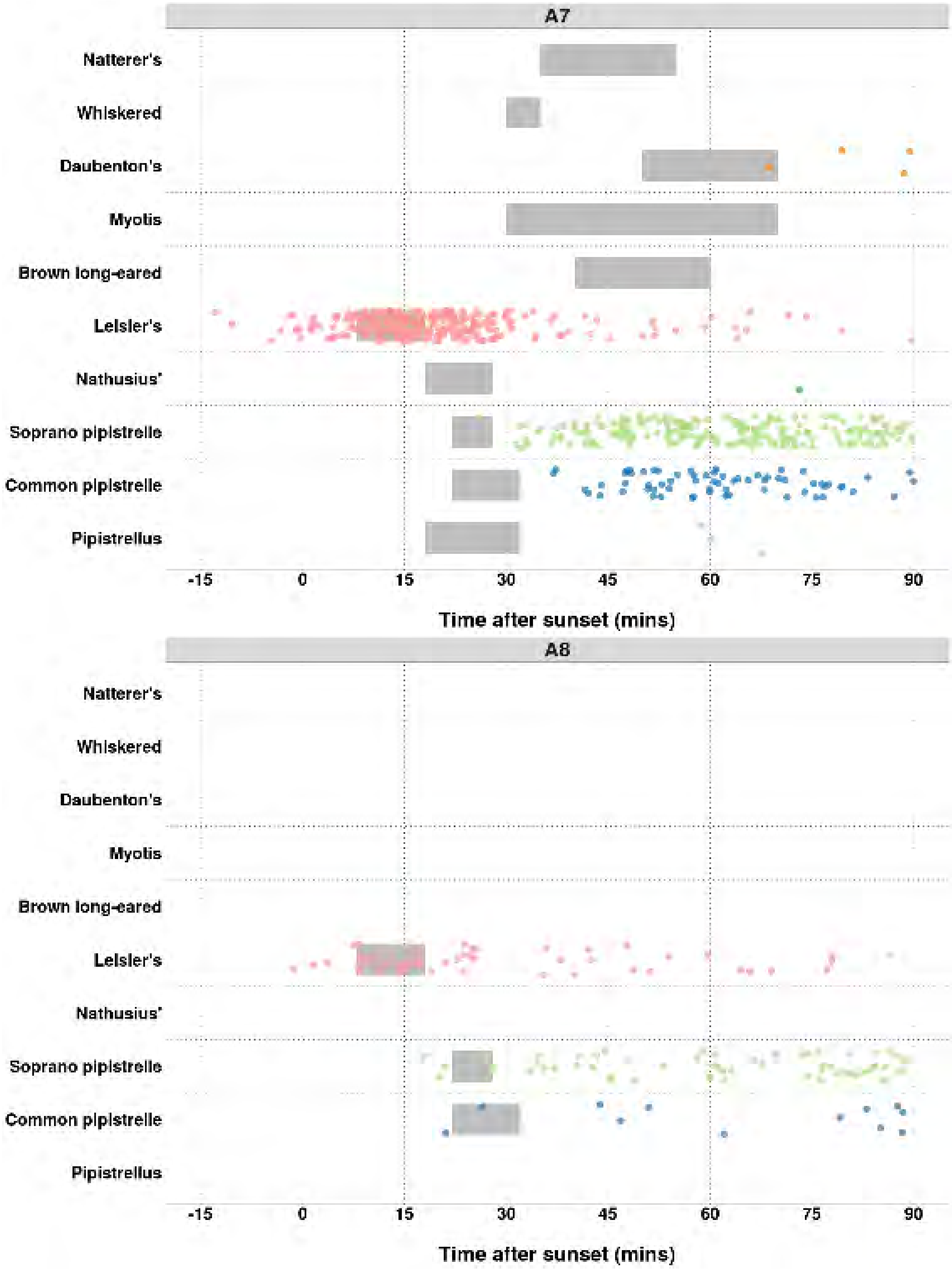


Plate 32: Time from 15 minutes before to 90 minutes after sunset, potentially indicating the presence of a nearby roost – Survey period 2

4.7.3 Survey Period 3 2020

A summary showing the number of nights recorded bat activity within each activity band for each species is presented below in Table 4-10. Refer to Appendix D for the full Ecobat analysis report

Bat surveys were conducted for 17 nights between 15/09/2020 and 01/10/2020 for static locations A2, A3 and A5 and for 10 nights between 15/09/2020 and 24/09/2020 for static locations A6, A7 and A8, using Wildlife Acoustics static bat detectors. Analysis is based on the number of nights the bats were detected on each recorder, therefore the nights no bats were detected have not been provided within the analysis.

All of the six static locations had at least one night of High Activity during the survey period.

The following Static locations are deemed to have a High Bat Activity (for specific bat species) level based on the Median Percentile value:

- all locations for Pipistrelle sp.;
- A2, A3, A5 , A6 and A8 for soprano pipistrelle; and
- A2 and A5 for common pipistrelle.

Refer to Plates 33 and 34 below.

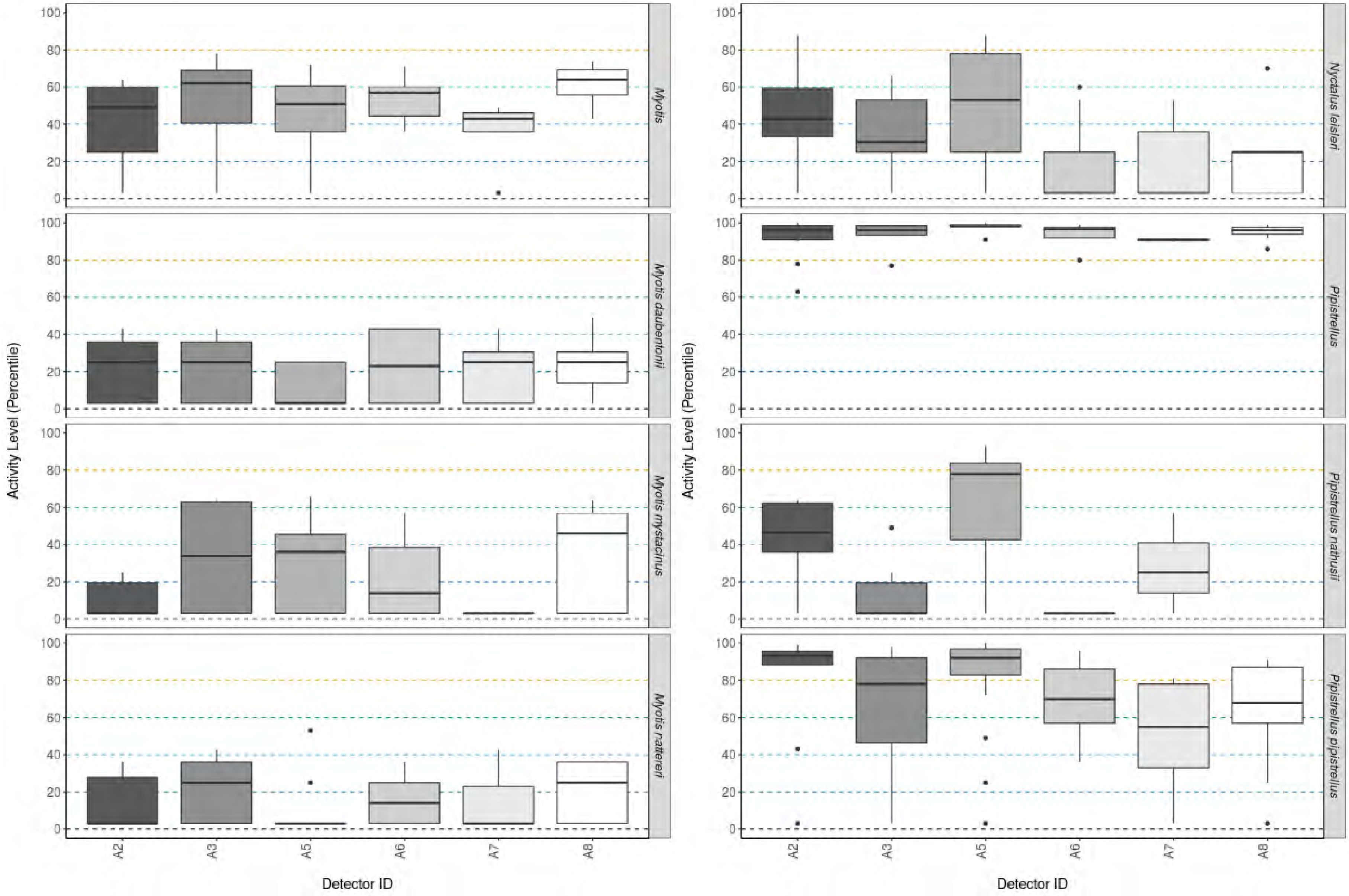
Table 4.11, along with Plates 35 and 36 show the number of nights recorded bat activity fell into each activity band for each species across all of the detectors. They identify Pipistrellus spp., common pipistrelle and soprano pipistrelle as having high bat activity (per median percentile) across all detectors for period 3.

Table 4-10: Summary showing the number of nights recorded bat activity fell into each activity band for each species at each static location and bat activity category based on median percentile – Survey period 3

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
A2	*Myotis*	0	1	4	3	1	49	Moderate
A2	*Myotis daubentonii*	0	0	2	6	4	25	Low to Moderate
A2	*Myotis mystacinus*	0	0	0	2	4	3	Low
A2	*Myotis nattereri*	0	0	0	2	4	3	Low
A2	*Nyctalus leisleri*	2	1	4	3	2	43	Moderate
A2	*Pipistrellus*	9	2	0	0	0	96	High
A2	*Pipistrellus nathusii*	0	2	1	2	1	47	Moderate
A2	*Pipistrellus pipistrellus*	11	0	2	0	1	93	High
A2	*Pipistrellus pygmaeus*	9	3	2	1	1	84	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
A2	*Plecotus auritus*	1	1	4	5	3	36	Low to Moderate
A3	*Myotis*	0	4	2	0	2	62	Moderate to High
A3	*Myotis daubentonii*	0	0	2	5	4	25	Low to Moderate
A3	*Myotis mystacinus*	0	3	1	1	3	34	Low to Moderate
A3	*Myotis nattereri*	0	0	1	5	3	25	Low to Moderate
A3	*Nyctalus leisleri*	0	2	2	6	2	31	Low to Moderate
A3	*Pipistrellus*	6	1	0	0	0	96	High
A3	*Pipistrellus nathusii*	0	0	1	1	4	3	Low
A3	*Pipistrellus pipistrellus*	7	2	2	2	1	78	Moderate to High
A3	*Pipistrellus pygmaeus*	10	4	1	0	1	89	High
A3	*Plecotus auritus*	2	5	3	3	1	62	Moderate to High
A5	*Myotis*	0	3	5	3	1	51	Moderate
A5	*Myotis daubentonii*	0	0	0	4	6	3	Low
A5	*Myotis mystacinus*	0	1	3	4	4	36	Low to Moderate
A5	*Myotis nattereri*	0	0	1	1	7	3	Low
A5	*Nyctalus leisleri*	3	3	3	3	1	53	Moderate
A5	*Pipistrellus*	9	0	0	0	0	98	High
A5	*Pipistrellus nathusii*	3	1	1	1	1	78	Moderate to High
A5	*Pipistrellus pipistrellus*	13	1	1	1	1	92	High
A5	*Pipistrellus pygmaeus*	14	2	0	0	0	94	High
A5	*Plecotus auritus*	4	2	3	4	2	43	Moderate
A6	*Myotis*	0	1	4	2	0	57	Moderate
A6	*Myotis daubentonii*	0	0	2	0	2	23	Low to Moderate
A6	*Myotis mystacinus*	0	0	2	1	3	14	Low
A6	*Myotis nattereri*	0	0	0	3	3	14	Low
A6	*Nyctalus leisleri*	0	0	2	2	5	3	Low
A6	*Pipistrellus*	3	1	0	0	0	97	High
A6	*Pipistrellus nathusii*	0	0	0	0	2	3	Low
A6	*Pipistrellus pipistrellus*	3	2	3	1	0	70	Moderate to High
A6	*Pipistrellus pygmaeus*	5	3	0	0	1	84	High
A6	*Plecotus auritus*	0	0	4	2	2	40	Low to Moderate
A7	*Myotis*	0	0	4	2	1	43	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
A7	*Myotis daubentonii*	0	0	1	3	3	25	Low to Moderate
A7	*Myotis mystacinus*	0	0	0	0	1	3	Low
A7	*Myotis nattereri*	0	0	1	0	2	3	Low
A7	*Nyctalus leisleri*	0	0	1	1	3	3	Low
A7	*Pipistrellus*	3	0	0	0	0	91	High
A7	*Pipistrellus nathusii*	0	0	1	1	1	25	Low to Moderate
A7	*Pipistrellus pipistrellus*	2	1	3	0	2	55	Moderate
A7	*Pipistrellus pygmaeus*	3	2	2	1	1	64	Moderate to High
A7	*Plecotus auritus*	0	0	2	4	1	36	Low to Moderate
A8	*Myotis*	0	4	2	0	0	64	Moderate to High
A8	*Myotis daubentonii*	0	0	1	4	2	25	Low to Moderate
A8	*Myotis mystacinus*	0	1	4	0	3	46	Moderate
A8	*Myotis nattereri*	0	0	0	3	2	25	Low to Moderate
A8	*Nyctalus leisleri*	0	1	0	2	2	25	Low to Moderate
A8	*Pipistrellus*	7	0	0	0	0	96	High
A8	*Pipistrellus pipistrellus*	4	1	2	1	1	68	Moderate to High
A8	*Pipistrellus pygmaeus*	9	0	0	0	0	93	High
A8	*Plecotus auritus*	0	2	3	3	1	43	Moderate


Activity Level (Percentile)
Myotis
Myotis daubentonii
Myotis mystacinus
Myotis nattereri
Nyctalus leisleri
Pipistrellus
Pipistrellus nathusii
Pipistrellus pipistrellus
A2
A3
A5
A6
A7
A8
Detector ID

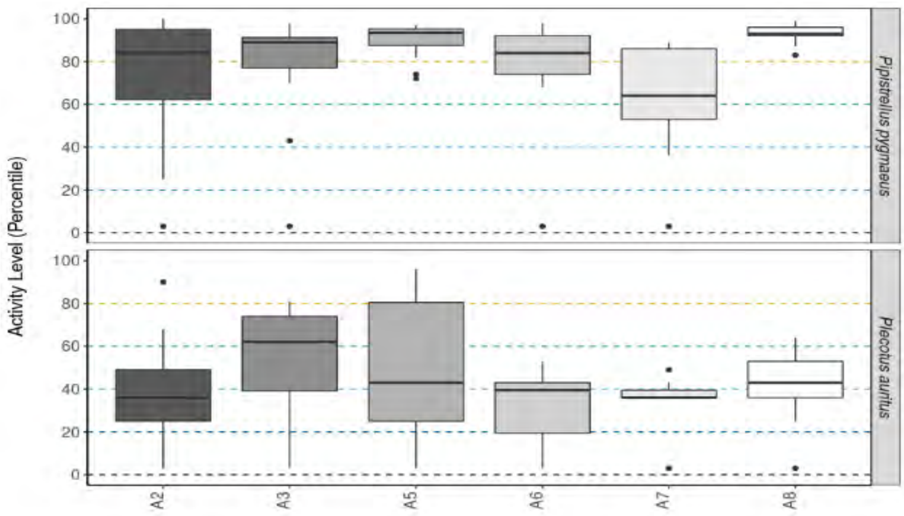
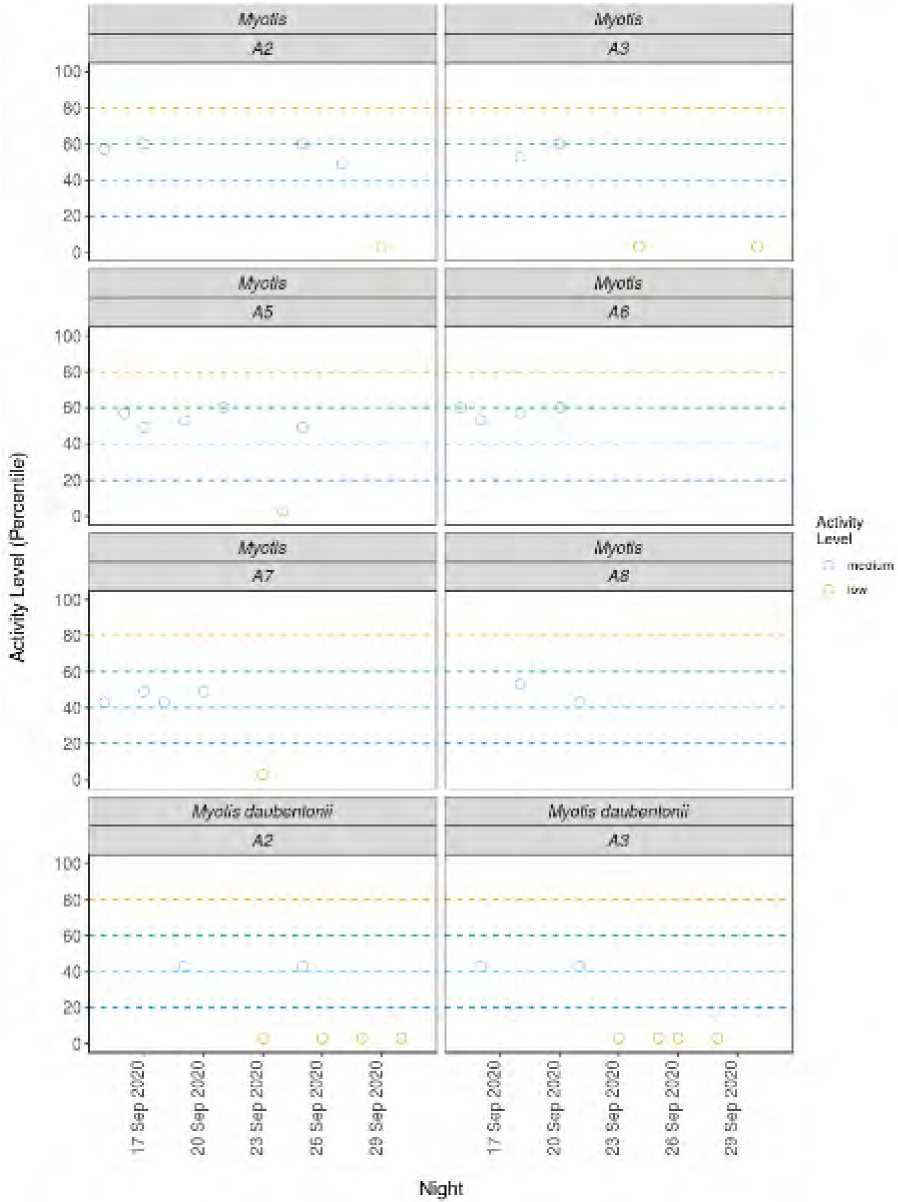
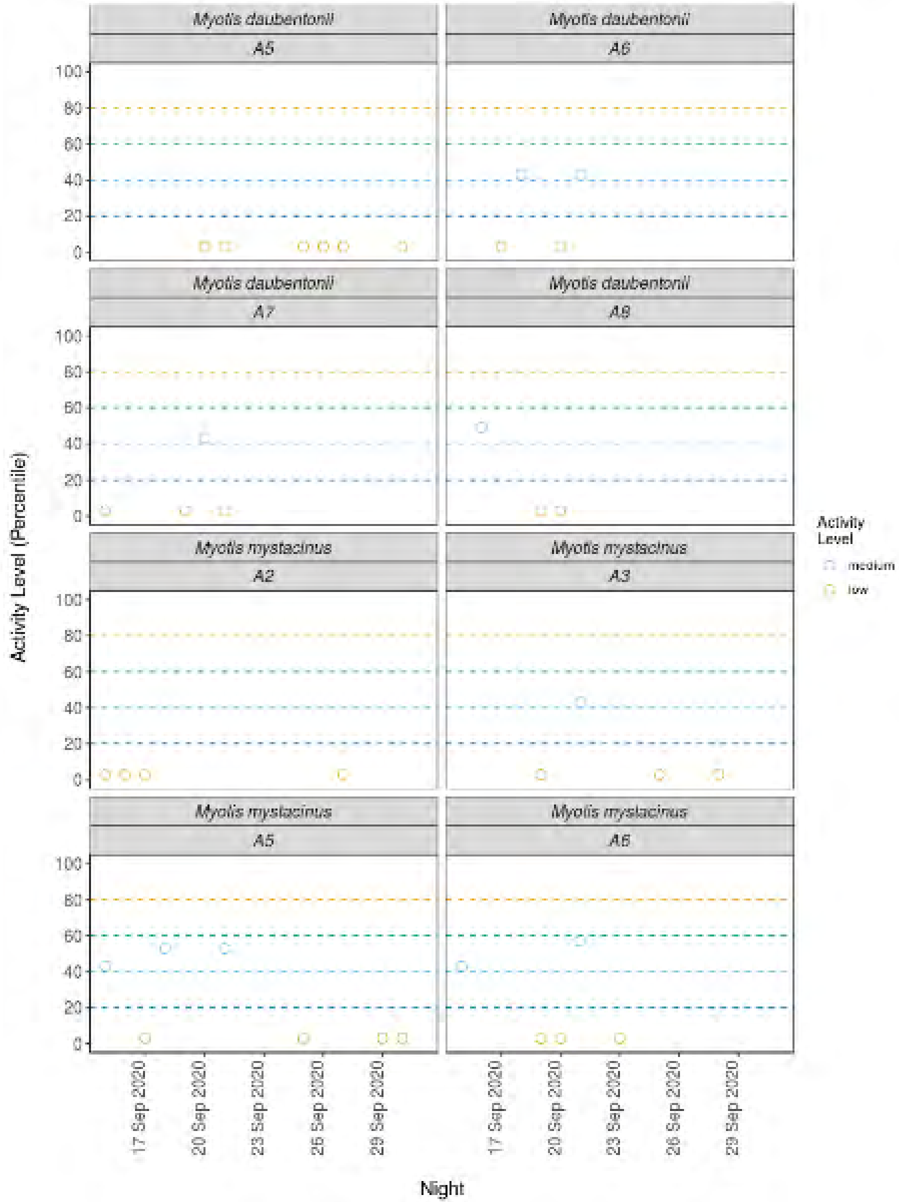
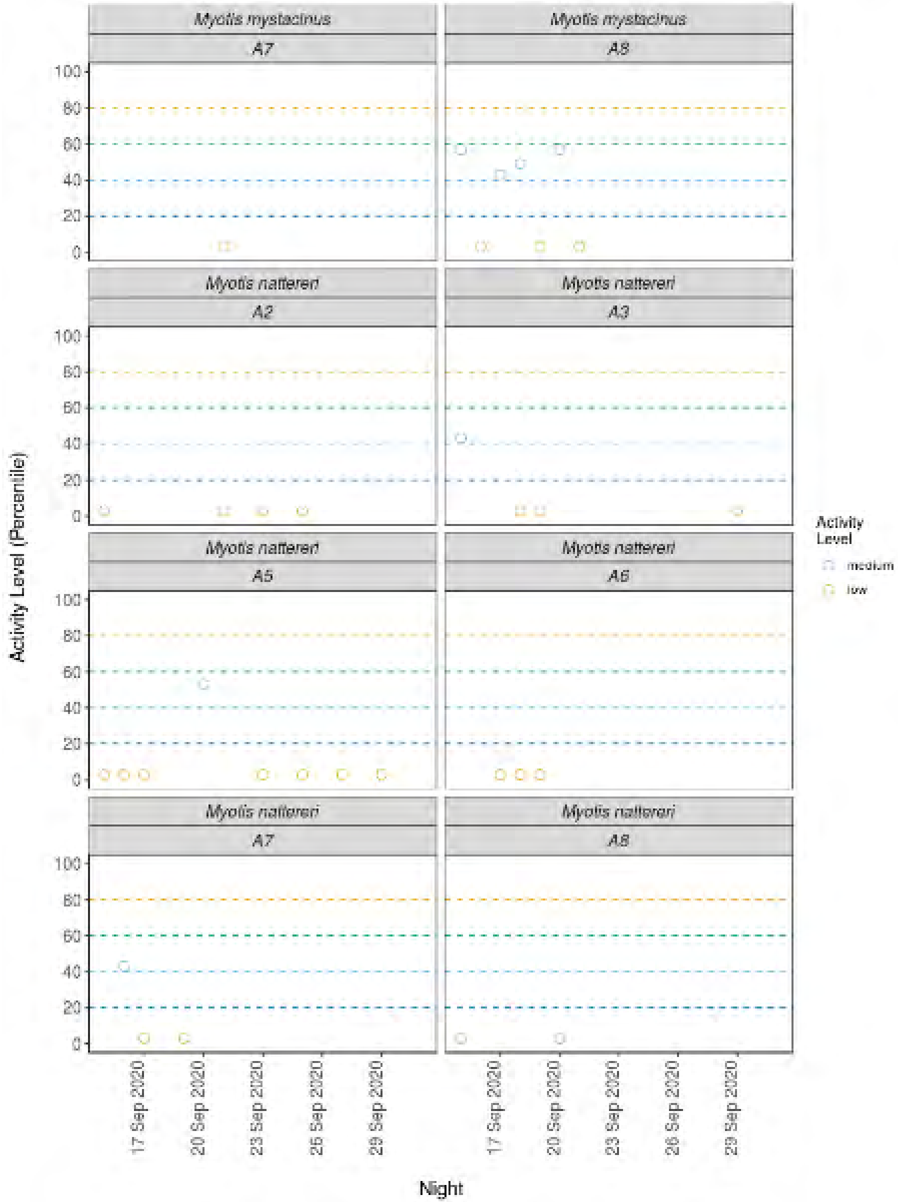
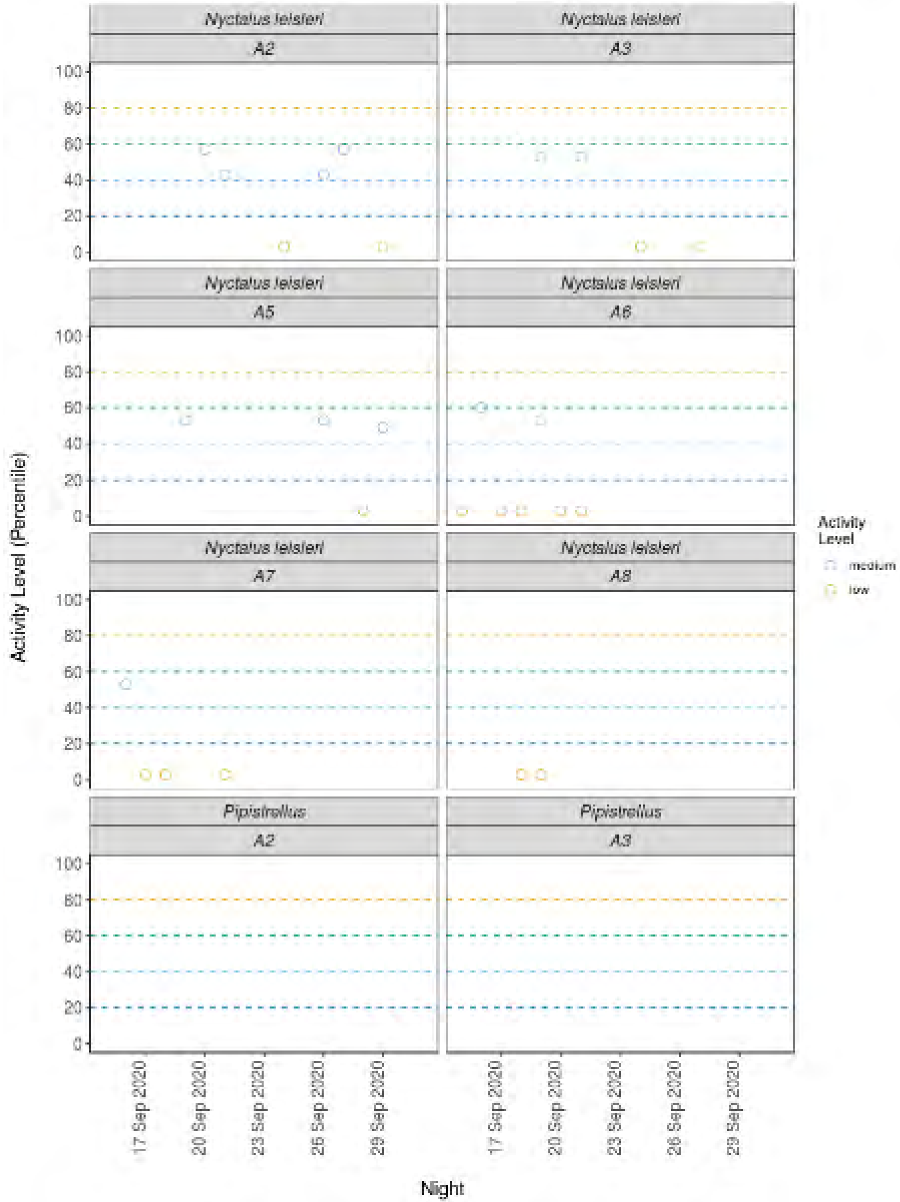


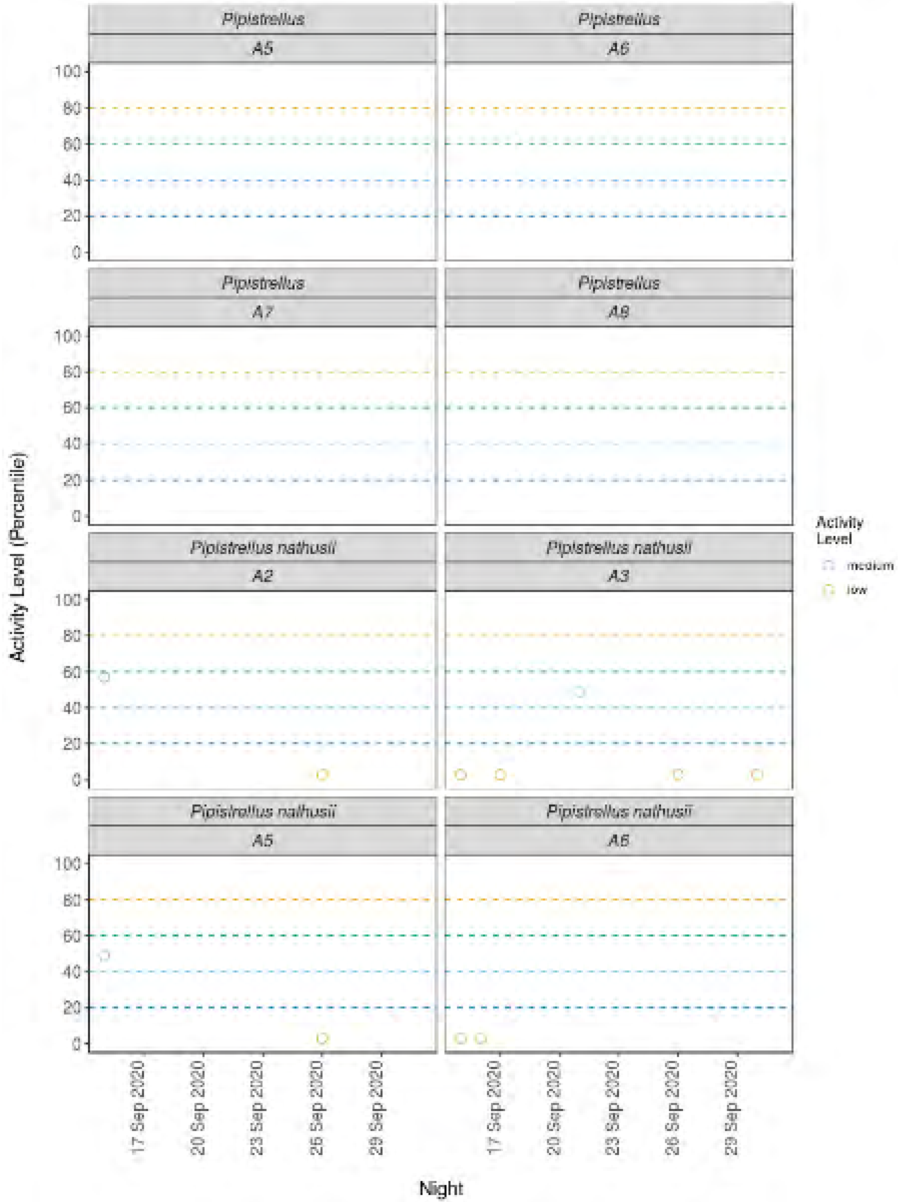
Plate 33: Differences in activity between static detector locations, split by species and location. The centre line indicates the median activity level whereas the box represents the interquartile range (the spread of the middle 50% of nights of activity) – Survey period 3

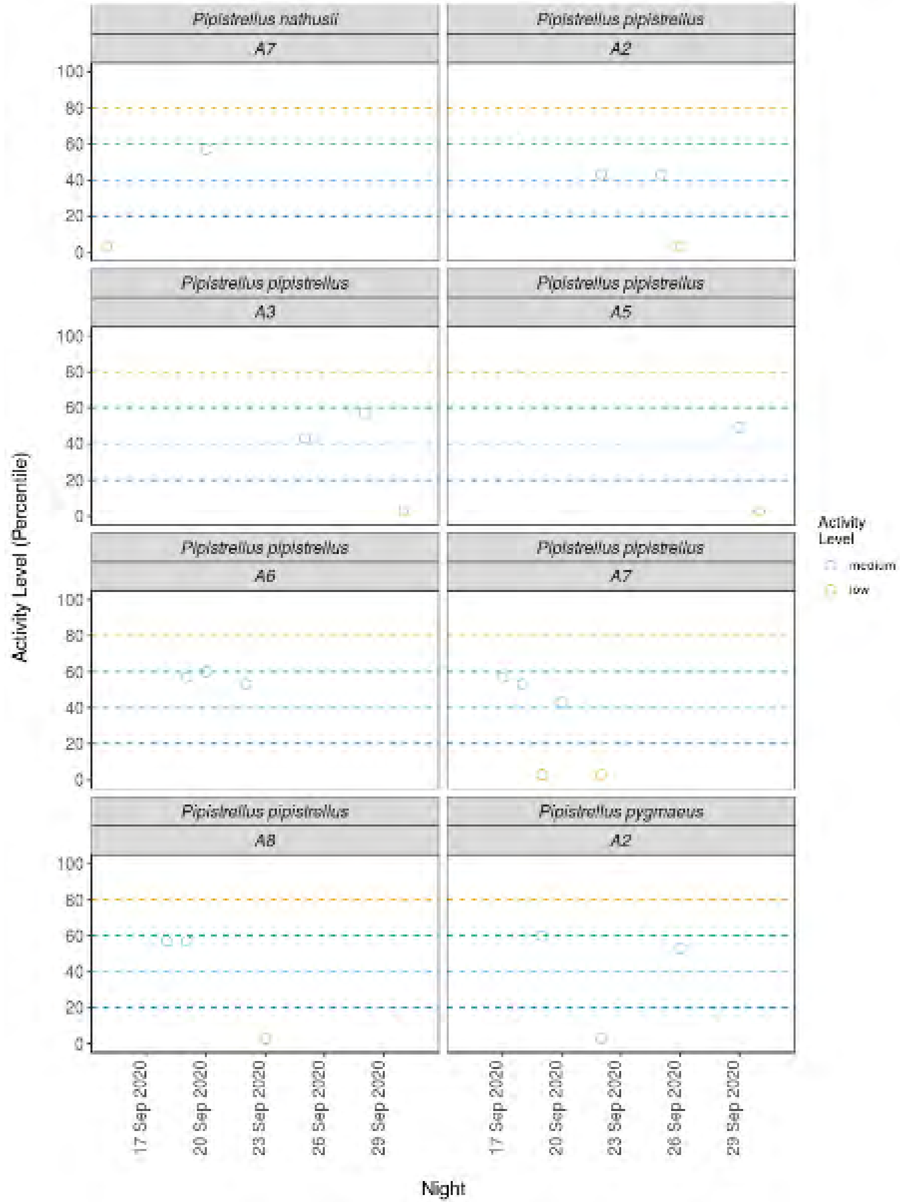

Myotis
A2
Myotis
A3
Myotis
A5
Myotis
A6
Myotis
A7
Myotis
A8
Myotis daubentonii
A2
Myotis daubentonii
A3
Activity Level (Percentile)
Night
Activity Level
medium
low


Myotis daubentonii
A5
Myotis daubentonii
A6
Myotis daubentonii
A7
Myotis daubentonii
A8
Myotis mystacinus
A2
Myotis mystacinus
A3
Myotis mystacinus
A5
Myotis mystacinus
A6
Activity Level (Percentile)
Night
Activity Level
medium
low


Myotis mystacinus
A7
Myotis mystacinus
A8
Myotis nattereri
A2
Myotis nattereri
A3
Myotis nattereri
A5
Myotis nattereri
A6
Myotis nattereri
A7
Myotis nattereri
A8
Activity Level (Percentile)
Night
Activity Level
medium
low


Nyctalus leisleri
A2
Nyctalus leisleri
A3
Nyctalus leisleri
A5
Nyctalus leisleri
A6
Nyctalus leisleri
A7
Nyctalus leisleri
A8
Pipistrellus
A2
Pipistrellus
A3
Activity Level (Percentile)
Night
Activity Level
medium
low


Pipistrellus
A5
Pipistrellus
A6
Pipistrellus
A7
Pipistrellus
A8
Pipistrellus nathusii
A2
Pipistrellus nathusii
A3
Pipistrellus nathusii
A5
Pipistrellus nathusii
A6
Activity Level (Percentile)
0
20
40
60
80
100
17 Sep 2020
20 Sep 2020
23 Sep 2020
26 Sep 2020
29 Sep 2020
Night
Activity Level
medium
low


Pipistrellus nathusii
A7
Pipistrellus pipistrellus
A2
Pipistrellus pipistrellus
A3
Pipistrellus pipistrellus
A5
Pipistrellus pipistrellus
A6
Pipistrellus pipistrellus
A7
Pipistrellus pipistrellus
A8
Pipistrellus pygmaeus
A2
Activity Level (Percentile)
0
20
40
60
80
100
17 Sep 2020
20 Sep 2020
23 Sep 2020
26 Sep 2020
29 Sep 2020
Night
Activity Level
medium
low

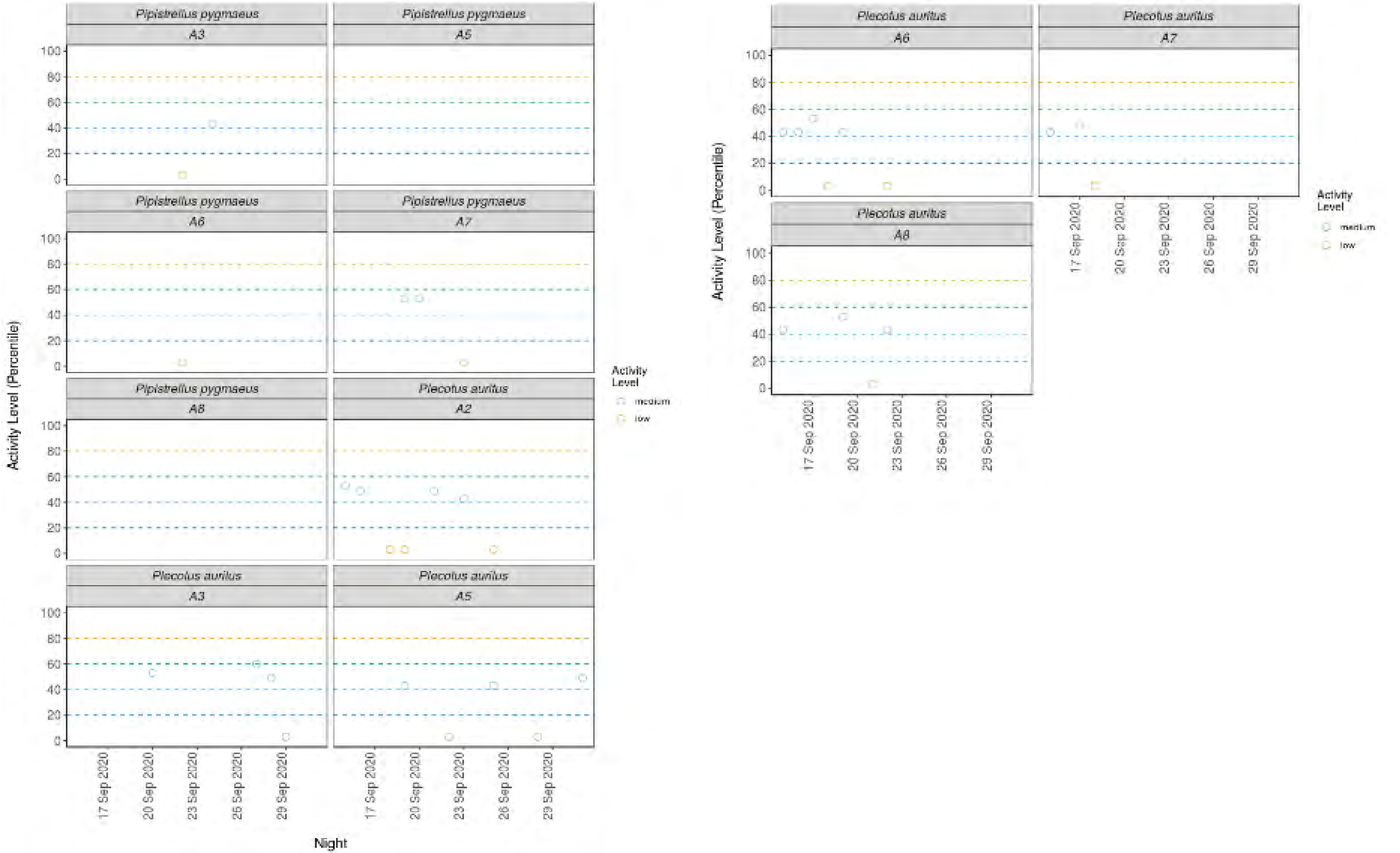


Plate 34: The activity level (percentile) of bats recorded across each night of the bat survey – Survey period 3

Table 4-11: Summary showing the number of nights recorded bat activity fell into each activity band for each species across all of the detectors – Survey period 3

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	13	21	10	5	53	Moderate
Myotis daubentonii	0	0	8	22	21	25	Low to Moderate
Myotis mystacinus	0	5	10	8	18	25	Low to Moderate
Myotis nattereri	0	0	3	14	21	3	Low
Nyctalus leisleri	5	7	12	17	15	36	Low to Moderate
Pipistrellus	37	4	0	0	0	97	High
Pipistrellus nathusii	3	3	4	5	9	36	Low to Moderate
Pipistrellus pipistrellus	40	7	13	5	6	84	High
Pipistrellus pygmaeus	50	14	5	2	4	89	High
Plecotus auritus	7	10	19	21	10	43	Moderate

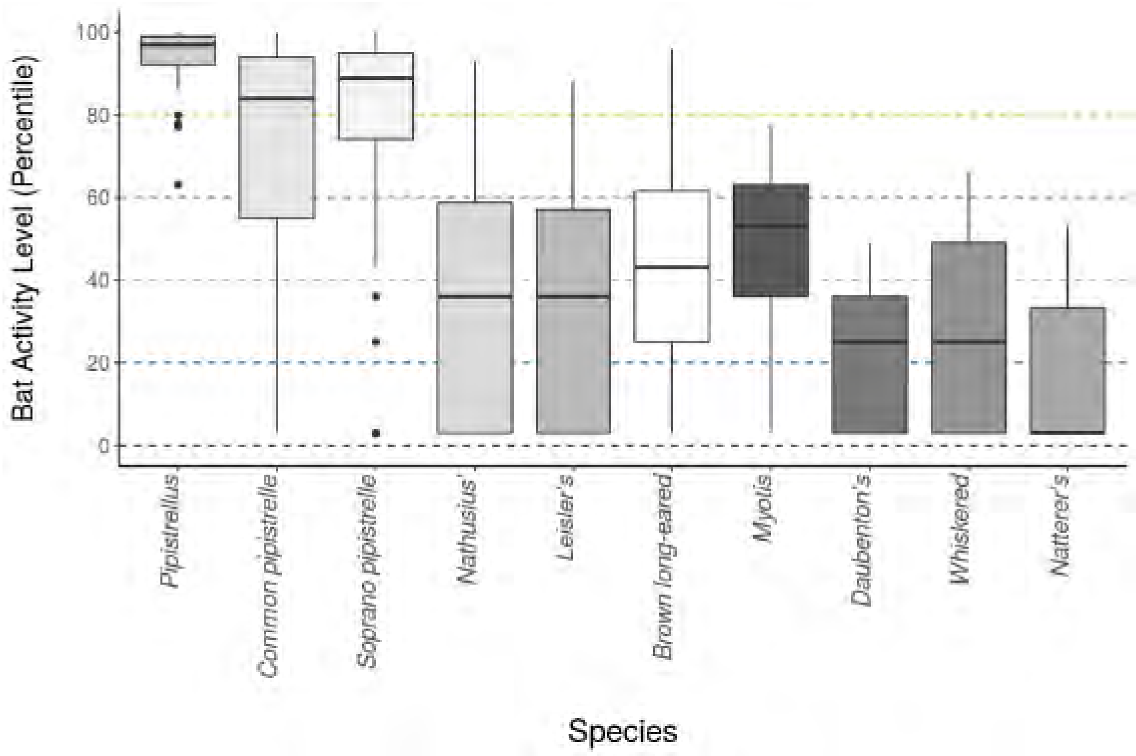
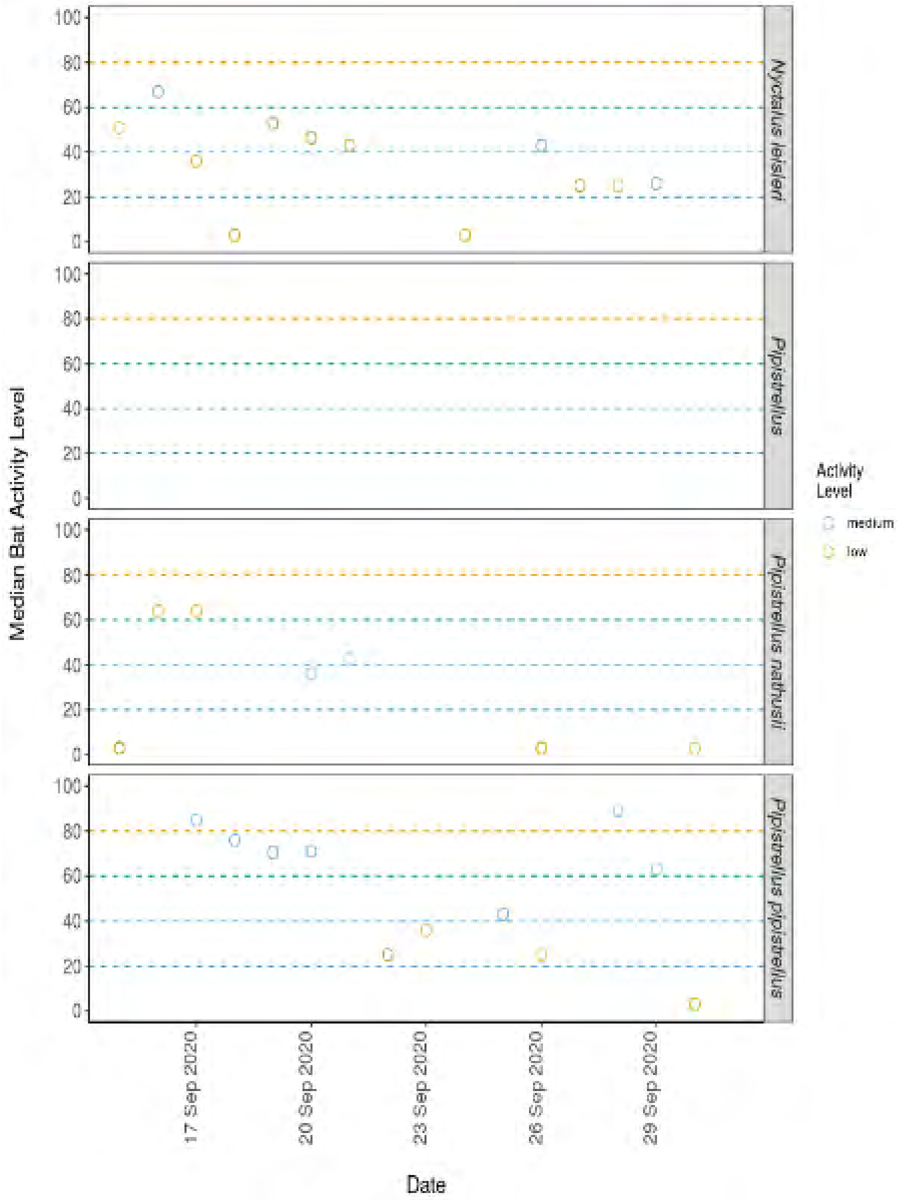
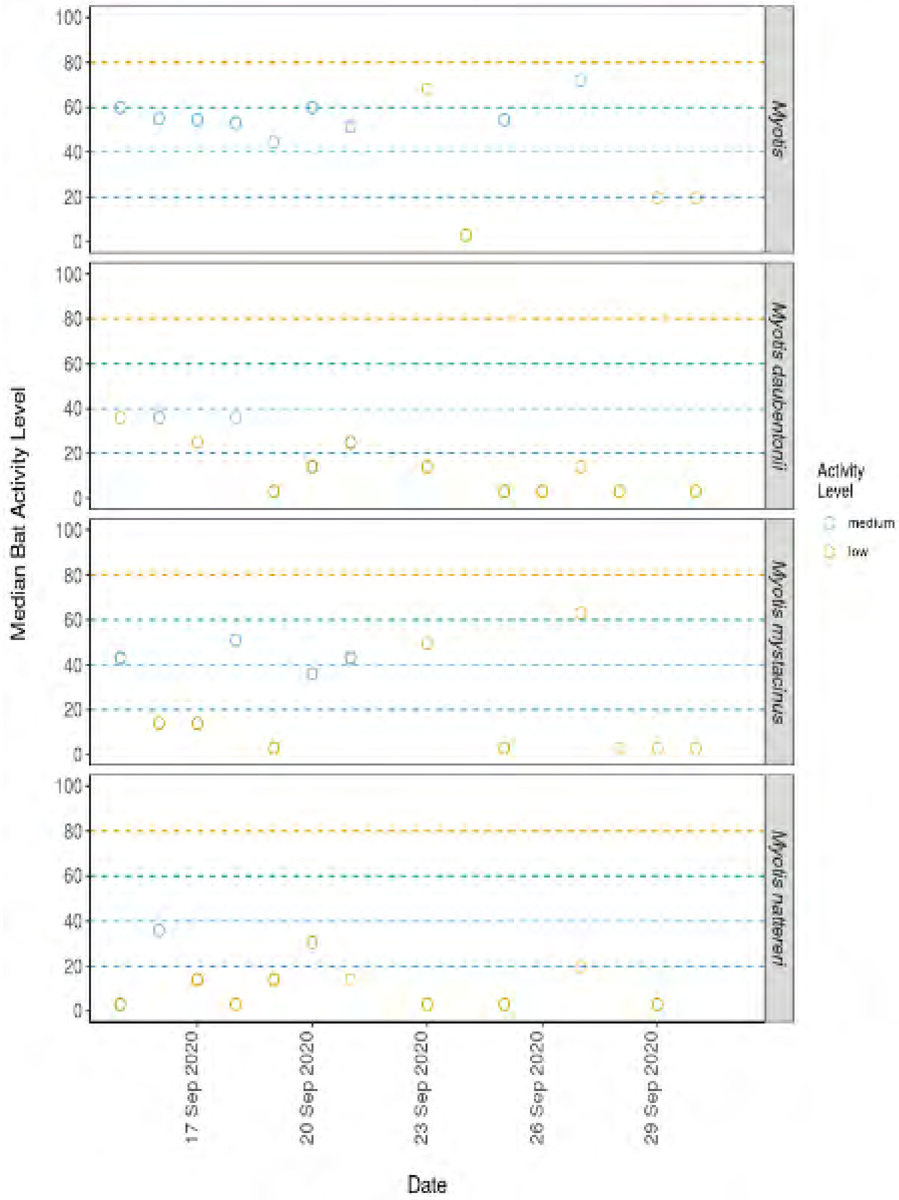


Plate 35: The activity level (percentile) of bats recorded across each night of the bat survey for the entire site – Survey period 3.


Nyctalus leisleri
Pipistrellus
Pipistrellus nathusii
Pipistrellus pipistrellus
Median Bat Activity Level
Date
17 Sep 2020
20 Sep 2020
23 Sep 2020
26 Sep 2020
29 Sep 2020
Activity Level
medium
low


Myotis
Myotis daubentonii
Myotis mystacinus
Myotis nattereri
Median Bat Activity Level
Date
17 Sep 2020
20 Sep 2020
23 Sep 2020
26 Sep 2020
29 Sep 2020
Activity Level
medium
low

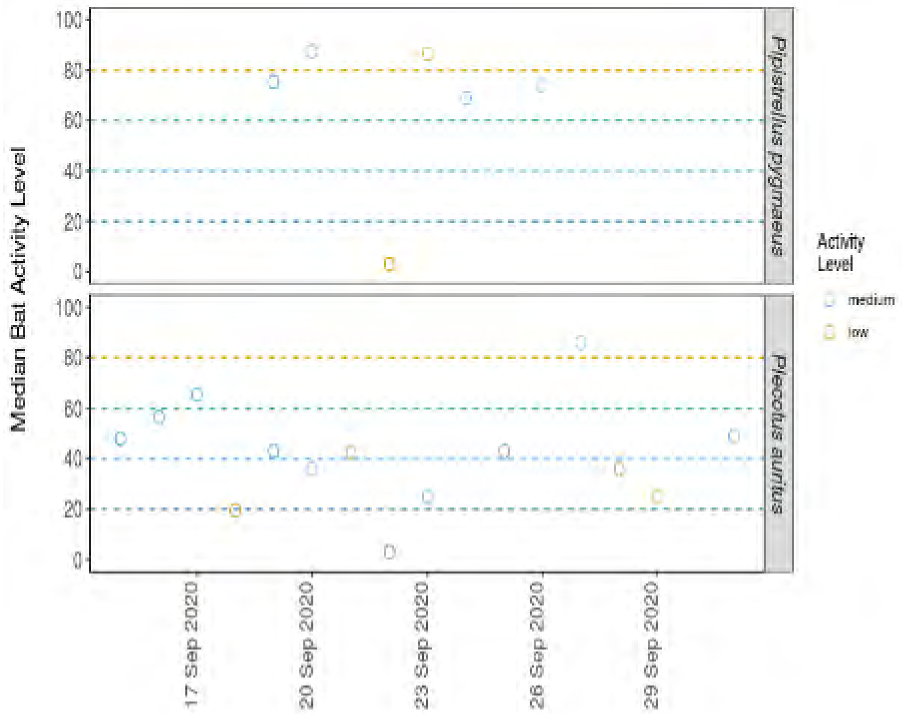
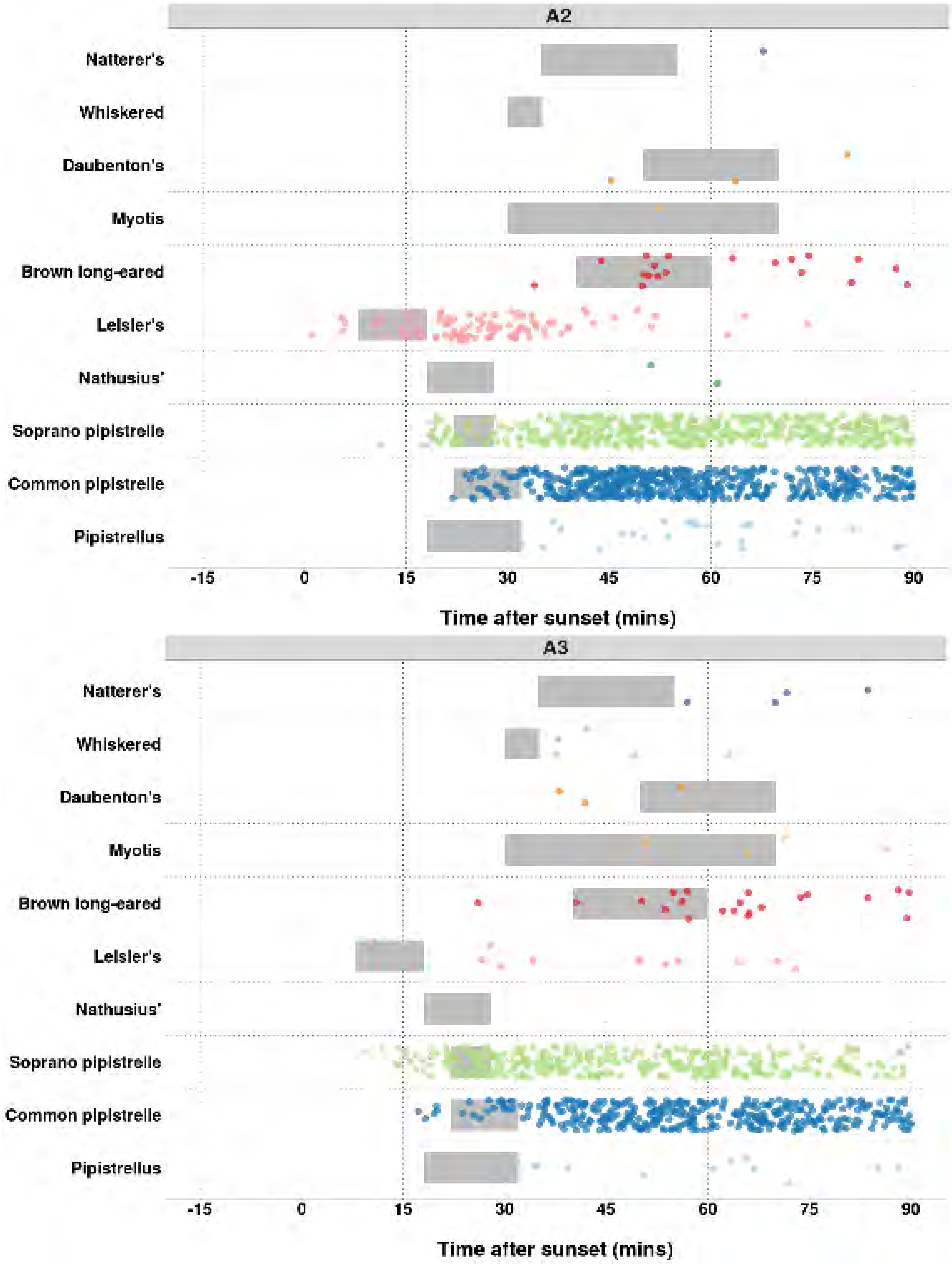


Plate 36: The median activity levels of bats recorded across all detectors each night – Survey period 3.

Due to the number of the recorded passes occurring within the species-specific emergence time ranges based on Russ 2012, the Ecobat analysis has identified a potential roost may be present near static location A2 for leisler bats. Along with a potential roost near static locations A2, A3 and A5 for common pipistrelle and soprano pipistrelle. Refer to Plate 37 which shows passes in relation to the time from 15 minutes before to 90 minutes after sunset.


A2
Natterer's
Whiskered
Daubenton's
Myotis
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
Pipistrellus
-15
0
15
30
45
60
75
90
Time after sunset (mins)
A3
Natterer's
Whiskered
Daubenton's
Myotis
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
Pipistrellus
-15
0
15
30
45
60
75
90
Time after sunset (mins)

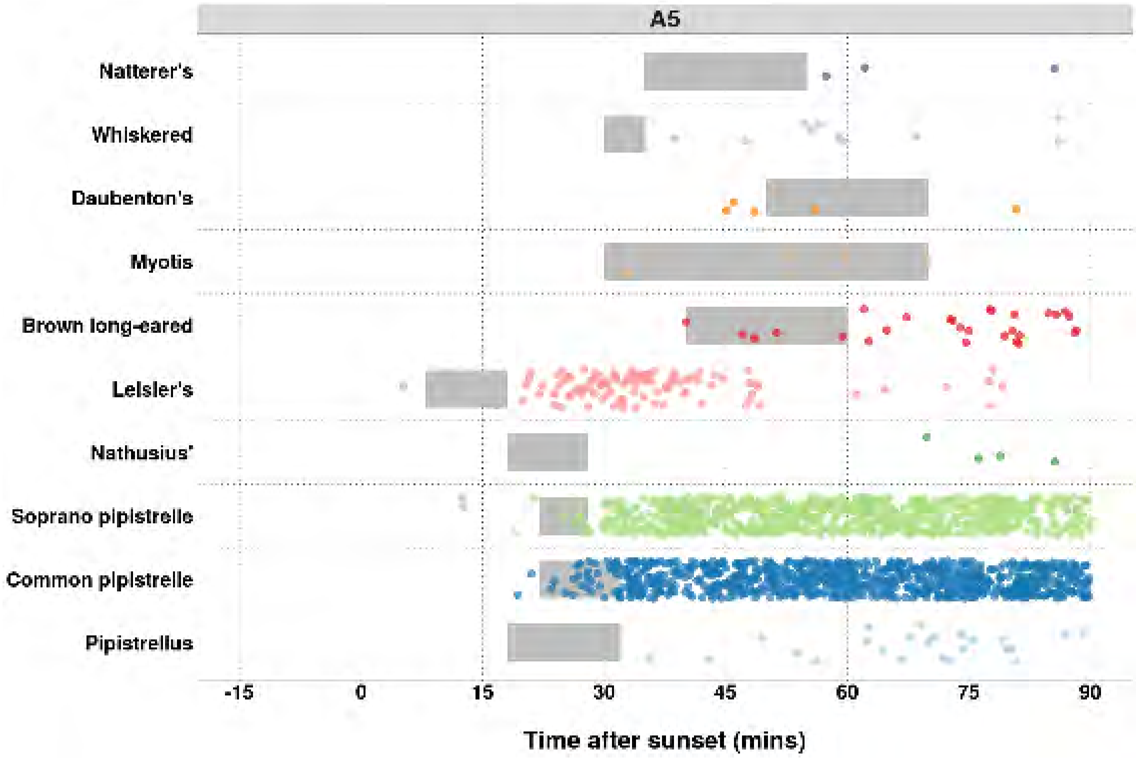


Plate 37: Time from 15 minutes before to 90 minutes after sunset, potentially indicating the presence of a nearby roost – Survey period 3.

4.7.4 Survey Period 2 2021

A summary showing the number of nights recorded bat activity within each activity band for each species is presented below in Table 4-12. Refer to Appendix E for the full Ecobat analysis report

Bat surveys were conducted for 35 nights between 21/07/2021 and 24/08/2021 for static locations AT1 and AT2 and for 13 nights between 21/07/2021 and 03/08/2021 for static locations AT3, AT5 and AT6, using Wildlife Acoustics SM4BAT-FS static bat detectors. Analysis is based on the number of nights the bats were detected on each recorder, therefore the nights no bats were detected have not been provided within the analysis, This is available within the Ecobat report in Appendix E.

All of the five static locations had at least one night of High Activity during the survey period.

The following Static locations are deemed to have a High Bat Activity (for specific bat species) level based on the Median Percentile value:

- AT1, AT2, AT5 and AT6 for soprano pipistrelle; and
- AT2, AT3 and AT6 for common pipistrelle.

Refer to Plates 38 and 39 below.

Table 4.13, along with Plates 40 and 41 show the number of nights recorded bat activity fell into each activity band for each species across all of the detectors. They identify Pipistrellus spp., common pipistrelle and soprano pipistrelle as having high bat activity (per median percentile) across all detectors for period 2.

Table 4-12: Bat activity within each activity band for each species – Survey period 2

Location	Species/ Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity	Median Percentile	Bat Activity Category
AT1	*Myotis daubentonii*	0	0	0	7	14	14	Low
AT1	*Myotis mystacinus*	0	0	0	1	6	11	Low
AT1	*Myotis nattereri*	0	0	1	10	13	20	Low
AT1	*Nyctalus leisleri*	2	10	15	8	0	54	Moderate
AT1	*Pipistrellus nathusii*	0	0	1	1	1	35	Low to Moderate
AT1	*Pipistrellus pipistrellus*	5	27	2	0	1	77	Moderate to High
AT1	*Pipistrellus pygmaeus*	28	5	1	1	0	85	High
AT1	*Plecotus auritus*	0	0	6	14	7	31	Low to 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
AT2	*Myotis daubentonii*	0	0	1	13	10	22	Low to Moderate
AT2	*Myotis mystacinus*	0	0	2	3	13	7	Low
AT2	*Myotis nattereri*	0	0	2	5	12	15	Low
AT2	*Nyctalus leisleri*	0	15	16	2	1	58	Moderate
AT2	*Pipistrellus nathusii*	0	0	1	3	3	27	Low-Moderate
AT2	*Pipistrellus pipistrellus*	22	10	0	2	1	82	High
AT2	*Pipistrellus pygmaeus*	32	2	0	0	1	94	High
AT2	*Plecotus auritus*	0	0	0	14	15	18	Low
AT3	*Myotis daubentonii*	0	5	3	2	3	55	Moderate
AT3	*Myotis mystacinus*	0	0	2	4	5	24	Low to Moderate
AT3	*Myotis nattereri*	0	0	2	3	4	24	Low to Moderate
AT3	*Nyctalus leisleri*	0	9	1	2	1	66	Moderate to High
AT3	*Pipistrellus nathusii*	0	0	1	0	2	20	Low
AT3	*Pipistrellus pipistrellus*	6	3	1	1	1	82	High
AT3	*Pipistrellus pygmaeus*	6	4	0	2	1	80	Moderate to High
AT3	*Plecotus auritus*	0	0	4	6	2	36	Low to Moderate
AT5	*Myotis daubentonii*	0	0	0	0	6	4	Low
AT5	*Myotis mystacinus*	0	0	0	0	4	2	Low
AT5	*Myotis nattereri*	0	0	0	0	2	5	Low
AT5	*Nyctalus leisleri*	0	2	8	1	2	50	Moderate
AT5	*Pipistrellus nathusii*	0	0	0	0	1	18	Low
AT5	*Pipistrellus pipistrellus*	3	7	3	0	0	75	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
AT5	*Pipistrellus pygmaeus*	11	2	0	0	0	90	High
AT5	*Plecotus auritus*	0	0	0	1	5	14	Low
AT6	*Myotis daubentonii*	0	1	5	3	2	41	Moderate
AT6	*Myotis mystacinus*	0	0	0	5	4	24	Low to Moderate
AT6	*Myotis nattereri*	0	1	5	3	4	33	Low to Moderate
AT6	*Nyctalus leisleri*	0	9	4	0	0	67	Moderate to High
AT6	*Pipistrellus nathusii*	0	1	2	0	3	33	Low to Moderate
AT6	*Pipistrellus pipistrellus*	12	0	1	0	0	92	High
AT6	*Pipistrellus pygmaeus*	13	0	0	0	0	97	High
AT6	*Plecotus auritus*	0	2	8	3	0	46	Moderate

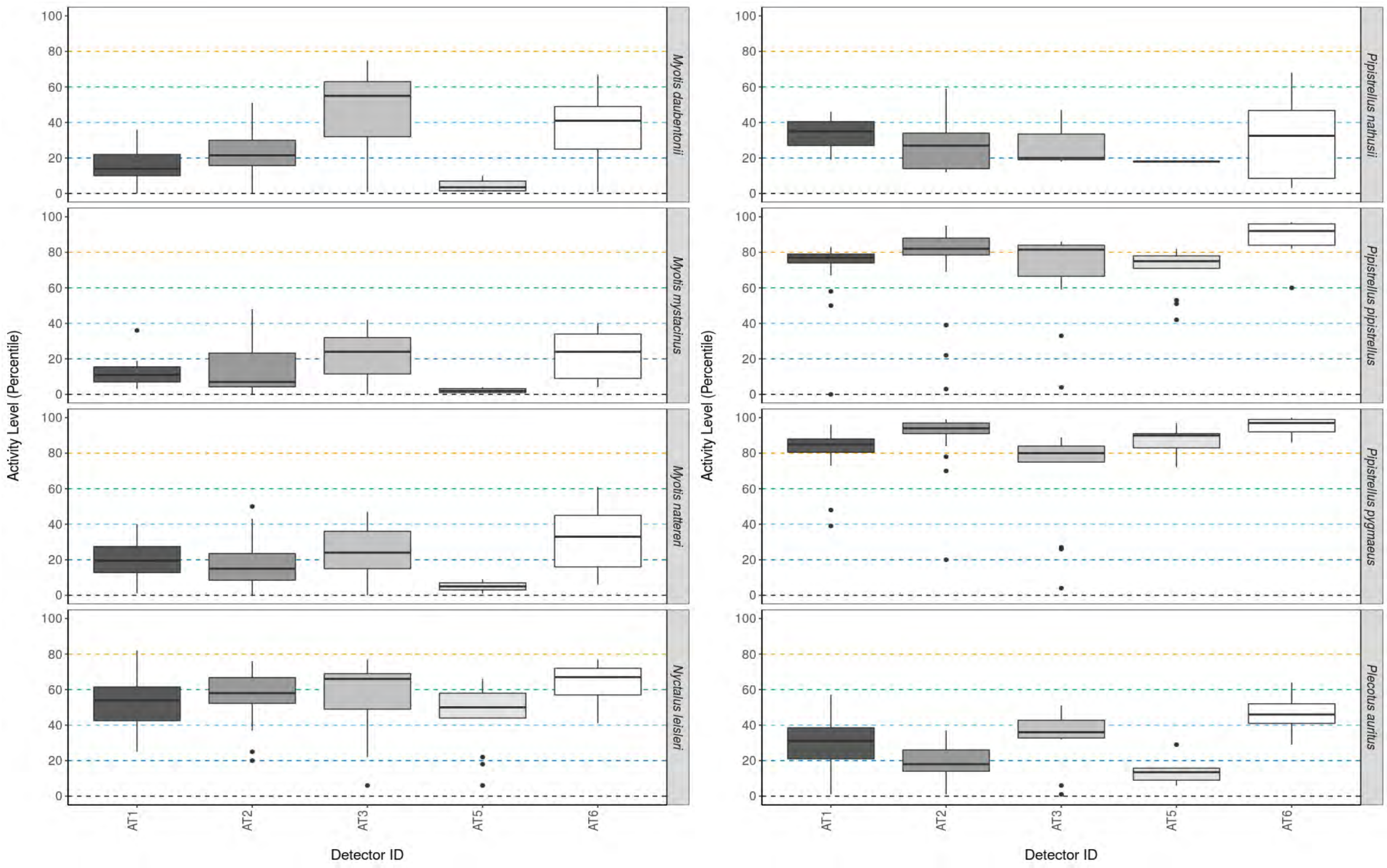
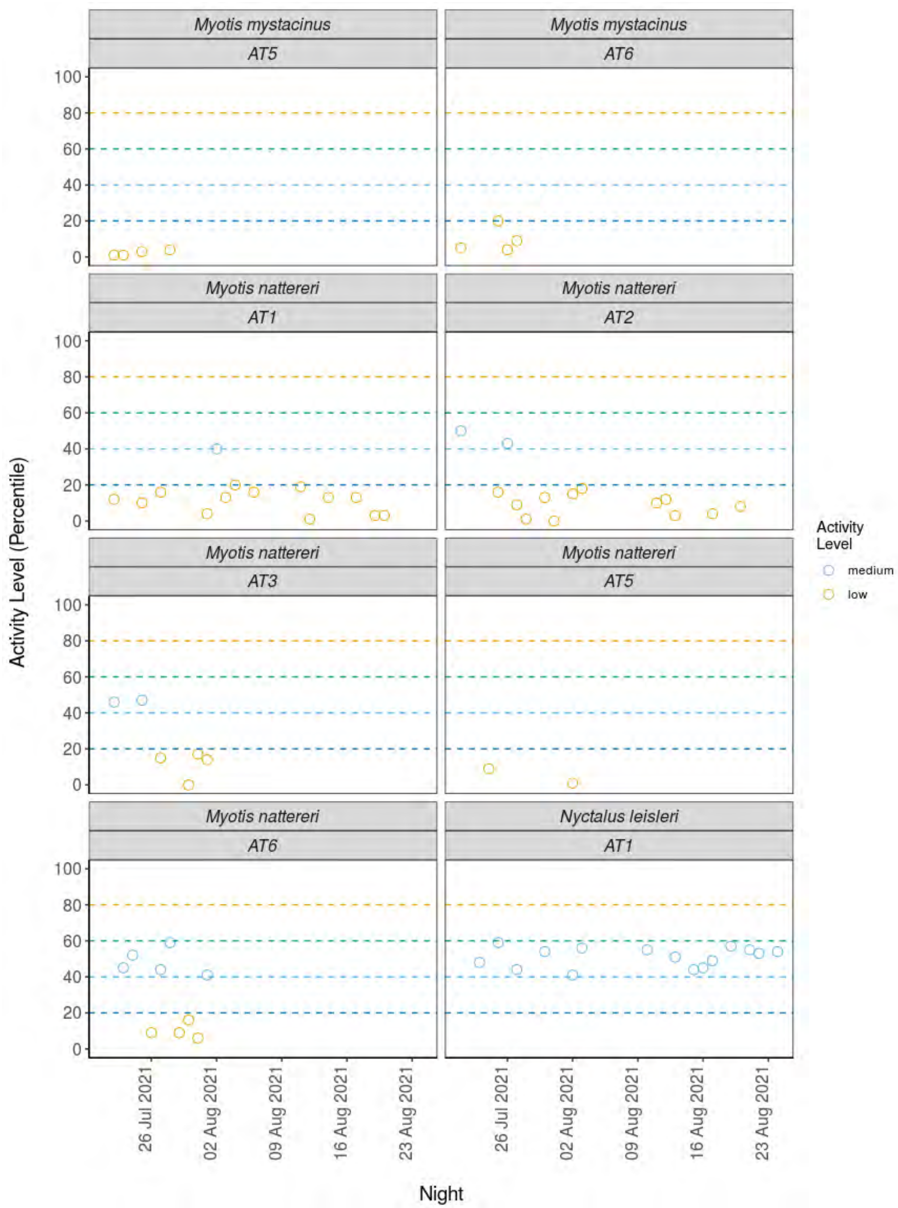
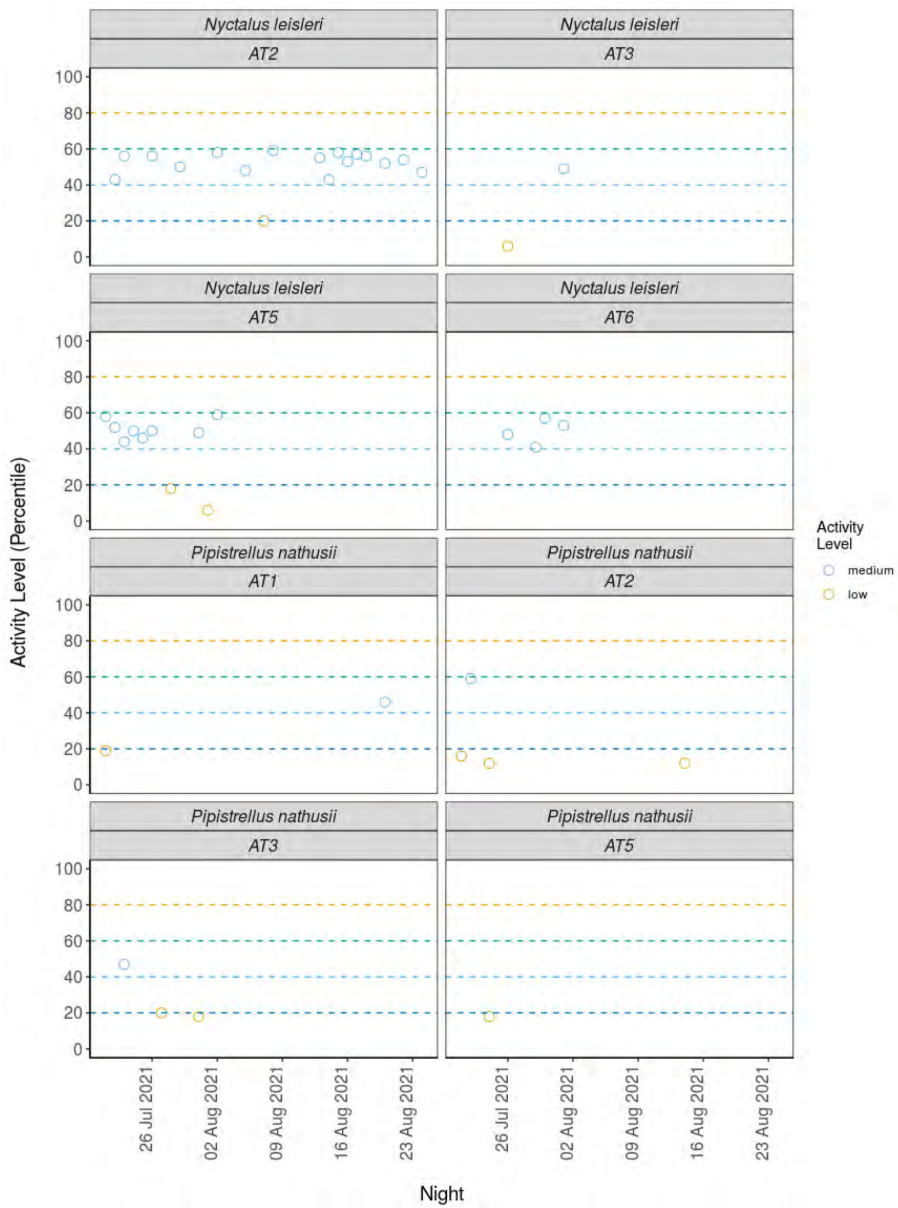
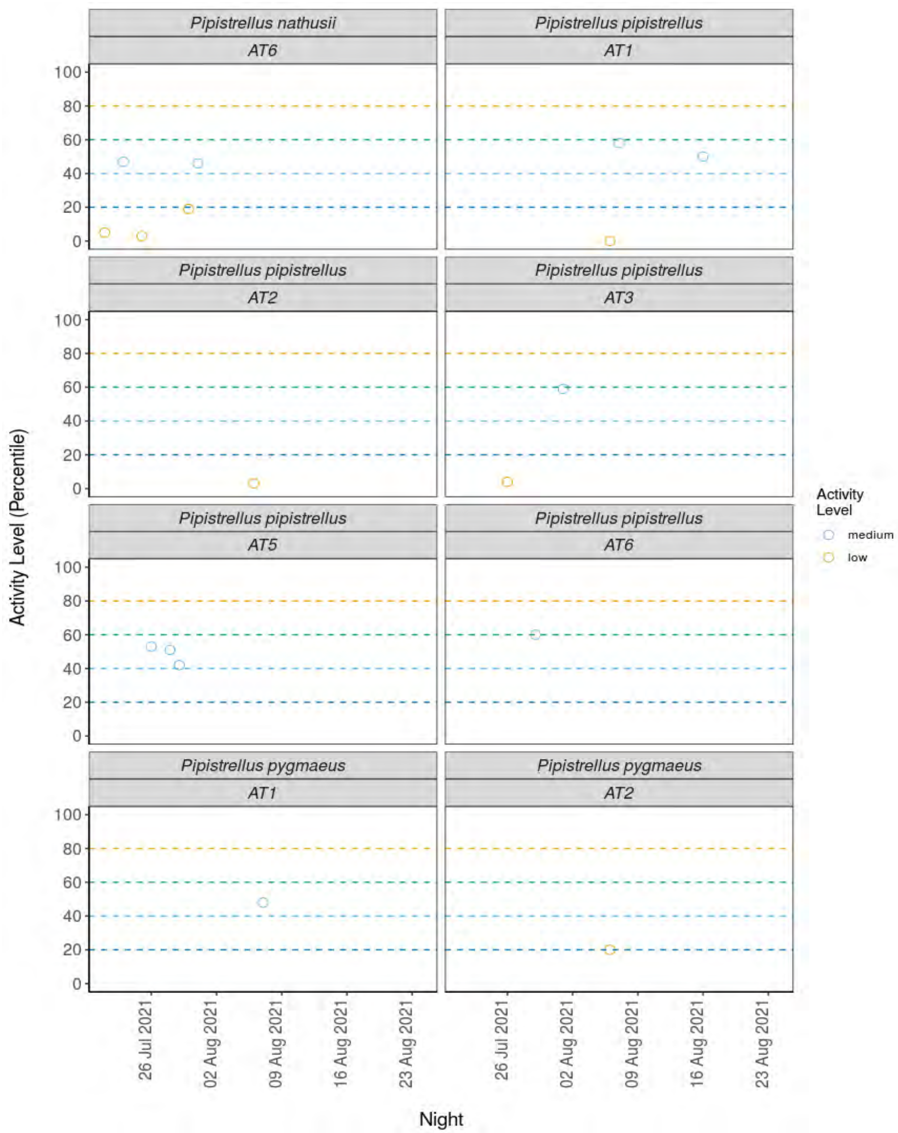


Plate 38: Differences in activity between static detector locations, split by species and location. The centre line indicates the median activity level whereas the box represents the interquartile range (the spread of the middle 50% of nights of activity) – Survey period 2


Myotis mystacinus AT5
Myotis mystacinus AT6
Myotis nattereri AT1
Myotis nattereri AT2
Myotis nattereri AT3
Myotis nattereri AT5
Myotis nattereri AT6
Nyctalus leisleri AT1
Activity Level (Percentile)
Night
26 Jul 2021
02 Aug 2021
09 Aug 2021
16 Aug 2021
23 Aug 2021
Activity Level
medium
low


Nyctalus leisleri AT2
Nyctalus leisleri AT3
Nyctalus leisleri AT5
Nyctalus leisleri AT6
Pipistrellus nathusii AT1
Pipistrellus nathusii AT2
Pipistrellus nathusii AT3
Pipistrellus nathusii AT5
Activity Level (Percentile)
Night
26 Jul 2021
02 Aug 2021
09 Aug 2021
16 Aug 2021
23 Aug 2021
Activity Level
medium
low



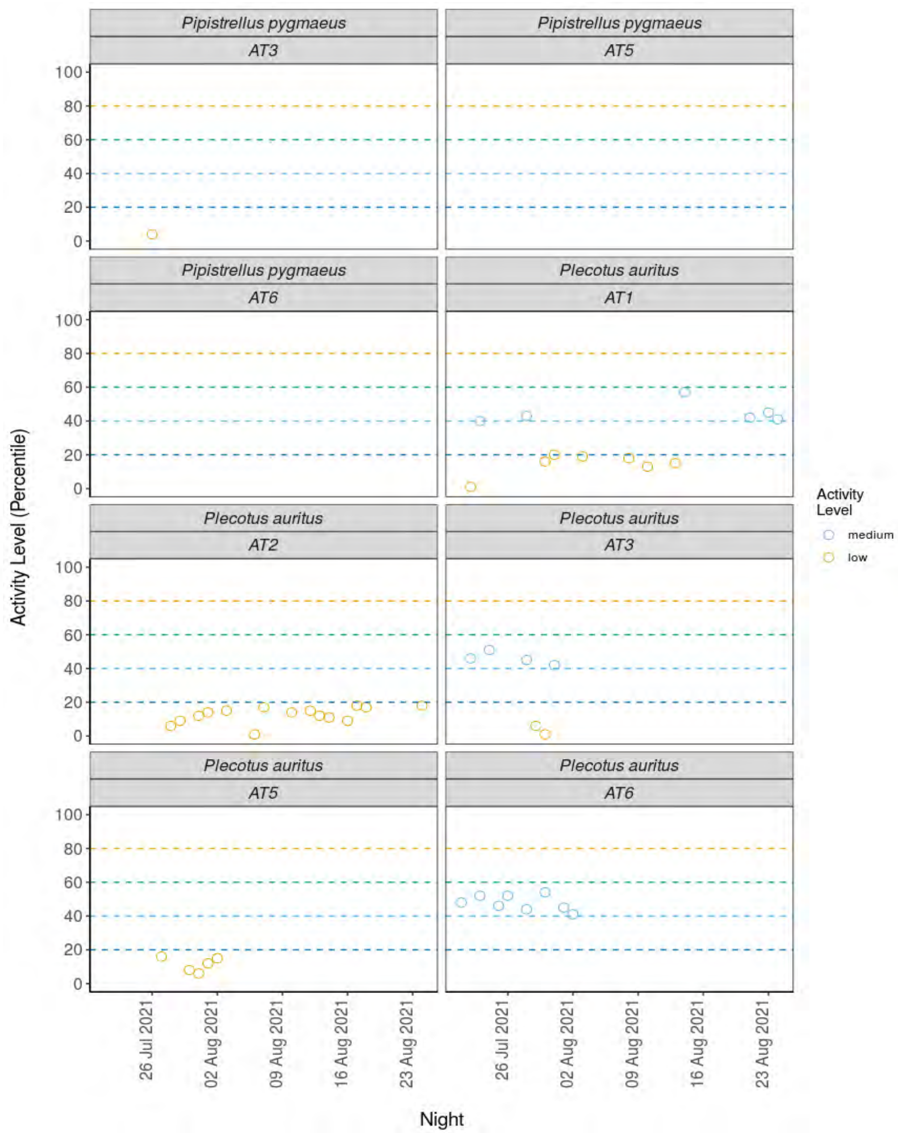


Plate 39: The activity level (percentile) of bats recorded across each night of the bat survey – Survey period 2

Table 4-13: Summary showing the number of nights recorded bat activity fell into each activity band for each species across all of the detectors – Survey period 2

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 daubentonii	0	6	9	25	35	21	Low to Moderate
Myotis mystacinus	0	0	4	13	32	11	Low
Myotis nattereri	0	1	10	21	35	19	Low
Nyctalus leisleri	2	45	44	13	4	57	Moderate
Pipistrellus nathusii	0	1	5	4	10	24	Low to Moderate
Pipistrellus pipistrellus	48	47	7	3	3	79	Moderate to High
Pipistrellus pygmaeus	90	13	1	3	2	88	High
Plecotus auritus	0	2	18	38	29	28	Low to Moderate

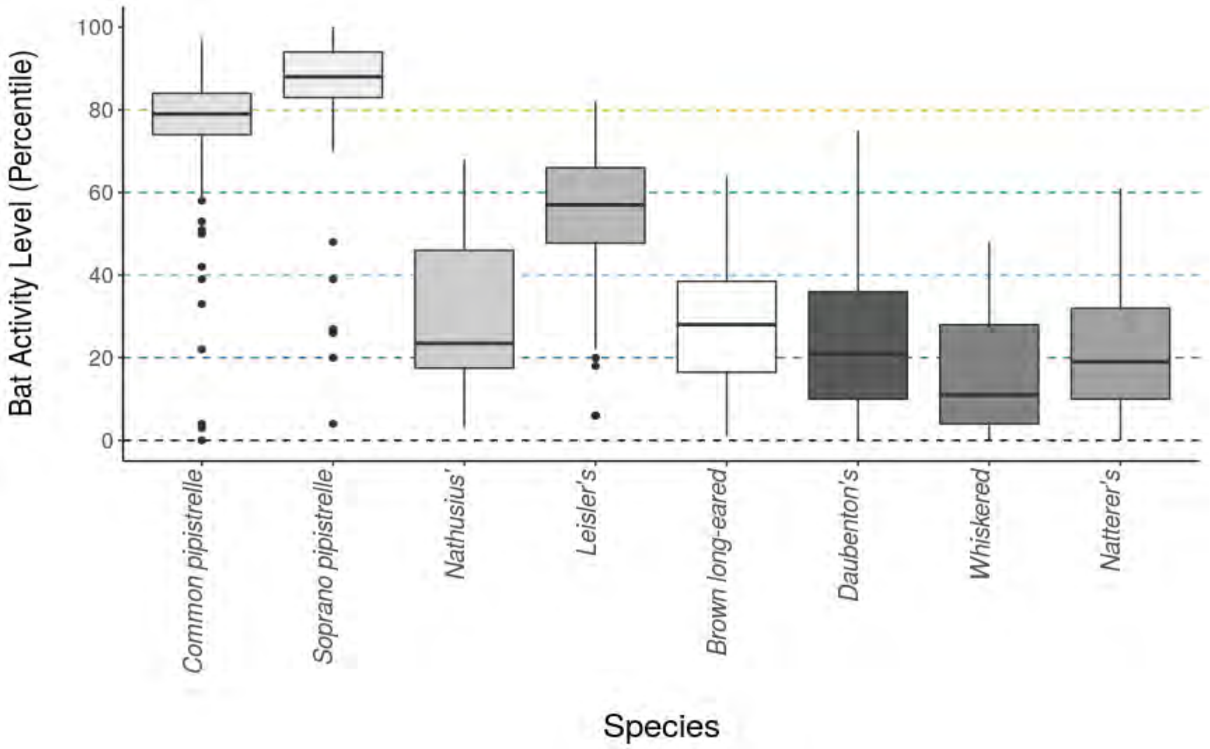


Plate 40: The activity level (percentile) of bats recorded across each night of the bat survey for the entire site – Survey period 2

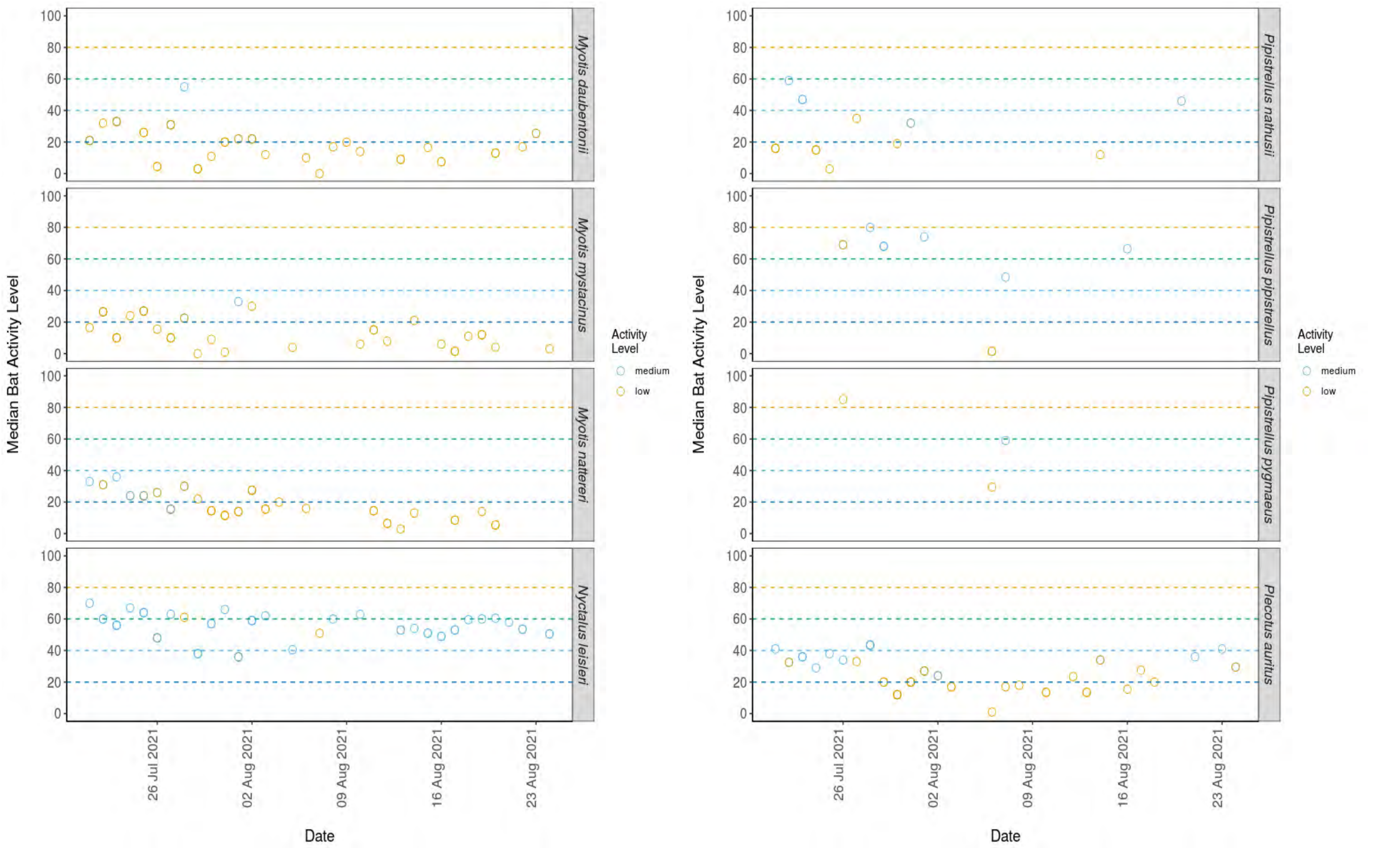
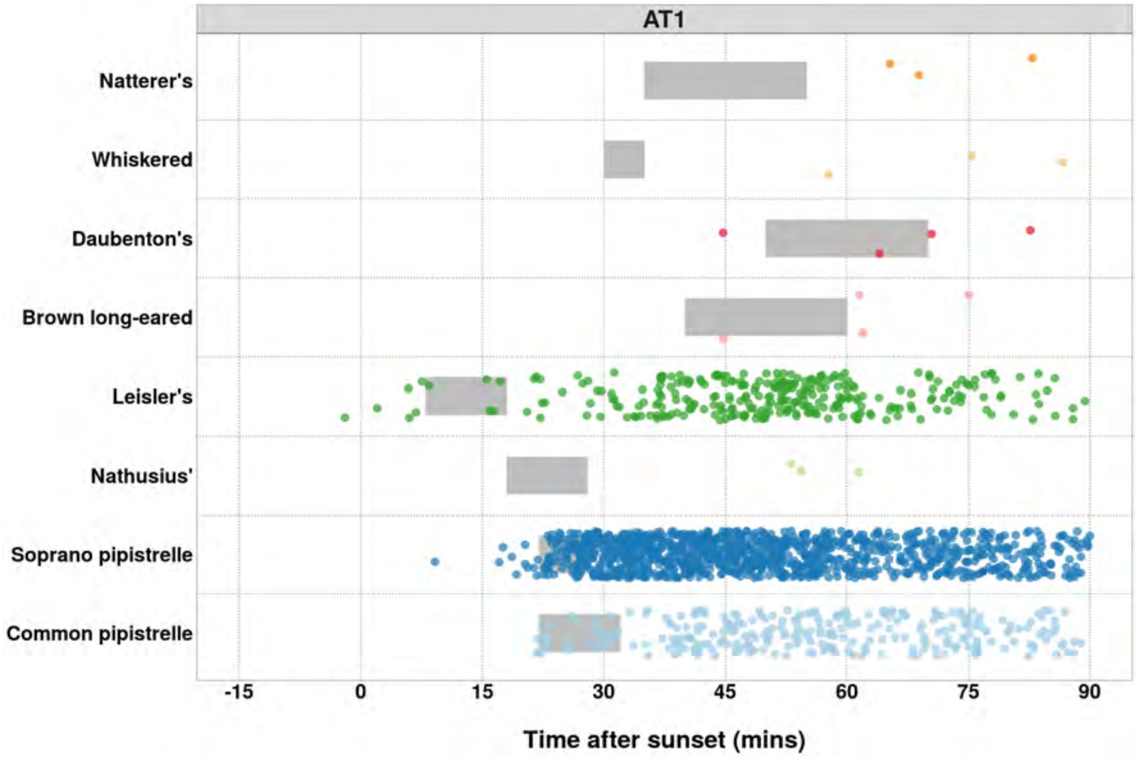
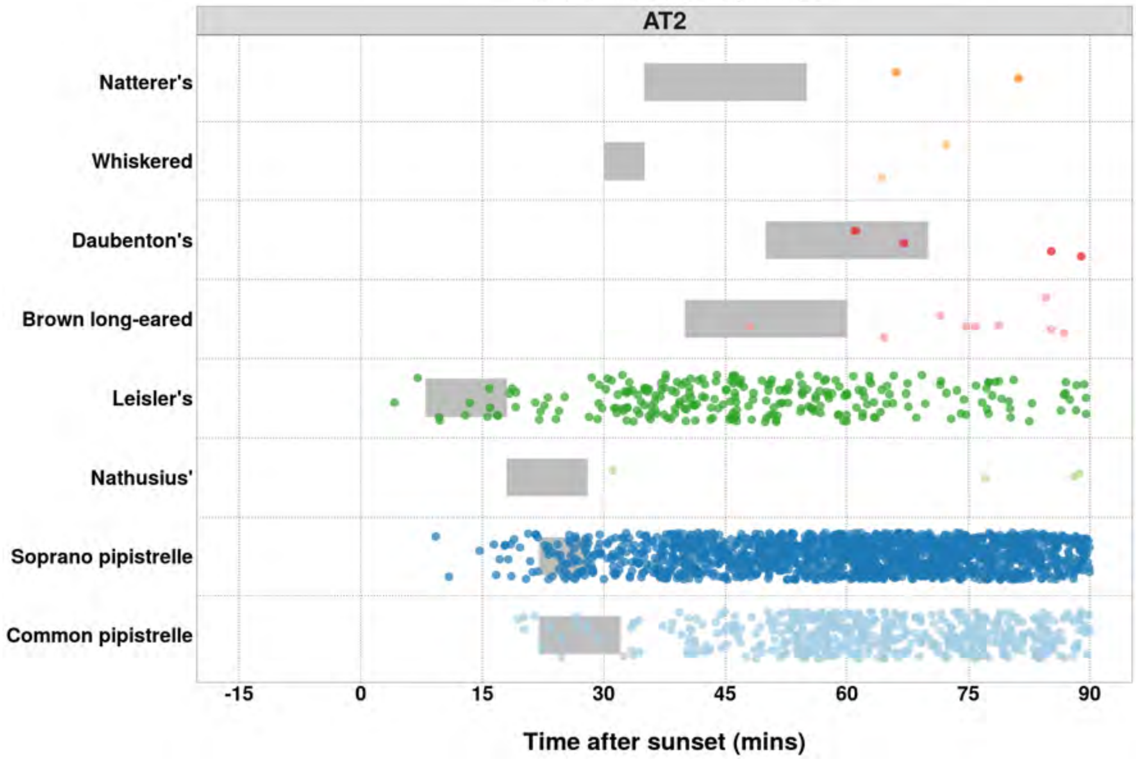
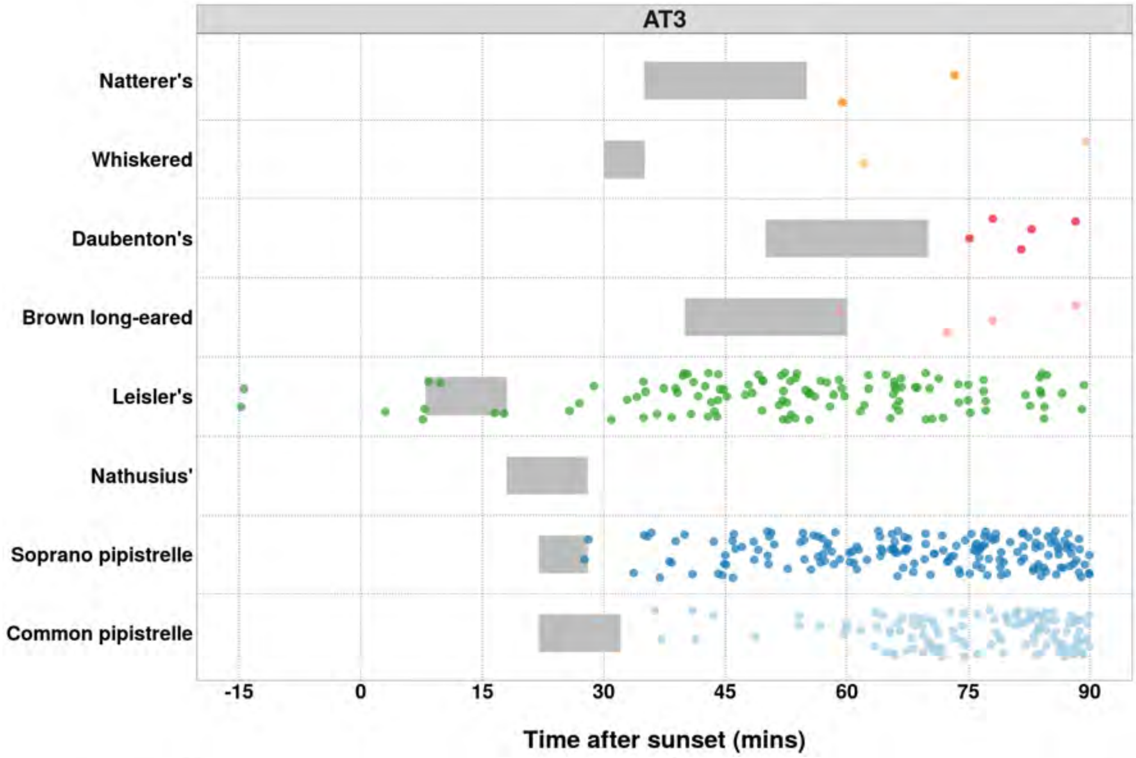


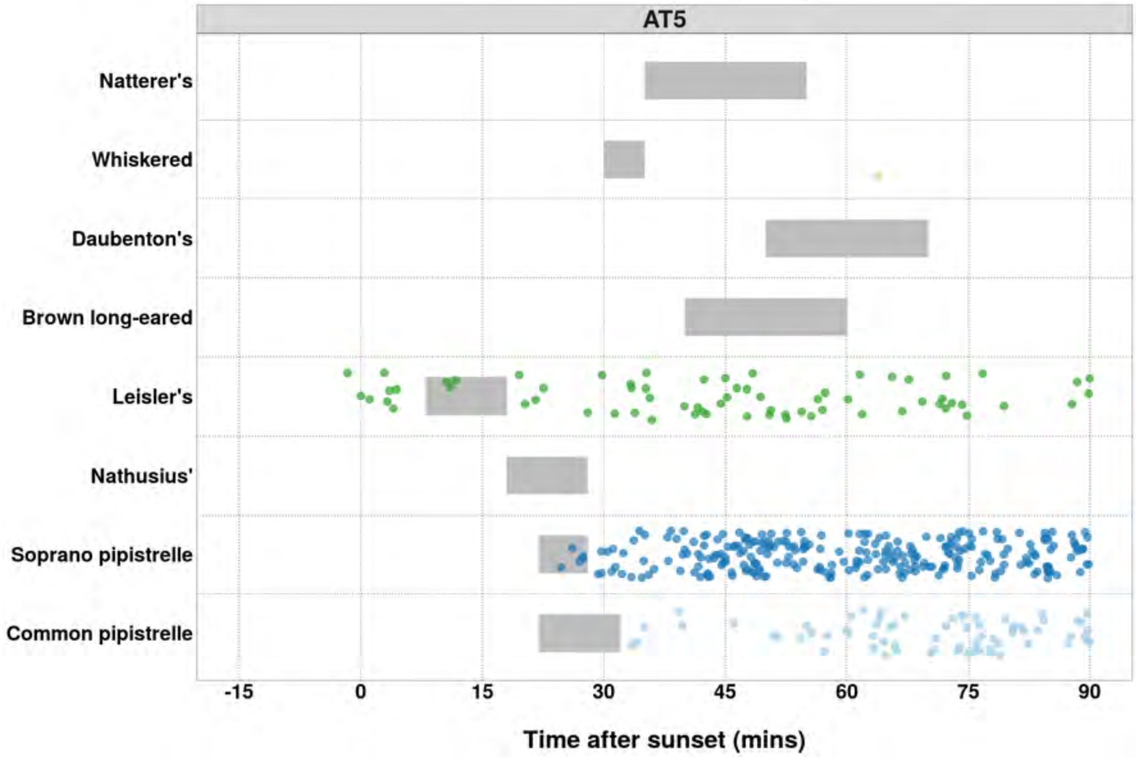
Plate 41: The median activity levels of bats recorded across all detectors each night – Survey period 2.

Due to the number of the recorded passes occurring within the species-specific emergence time ranges based on Russ 2012, the Ecobat analysis has identified a potential roost may be present near all static location for leisler bats. Along with a potential roost near static locations AT1 and AT2 for soprano pipistrelle. Refer to Plate 42 which shows passes in relation to the time from 15 minutes before to 90 minutes after sunset.






AT3
Natterer's
Whiskered
Daubenton's
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
-15
0
15
30
45
60
75
90
Time after sunset (mins)


AT5
Natterer's
Whiskered
Daubenton's
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
-15
0
15
30
45
60
75
90
Time after sunset (mins)

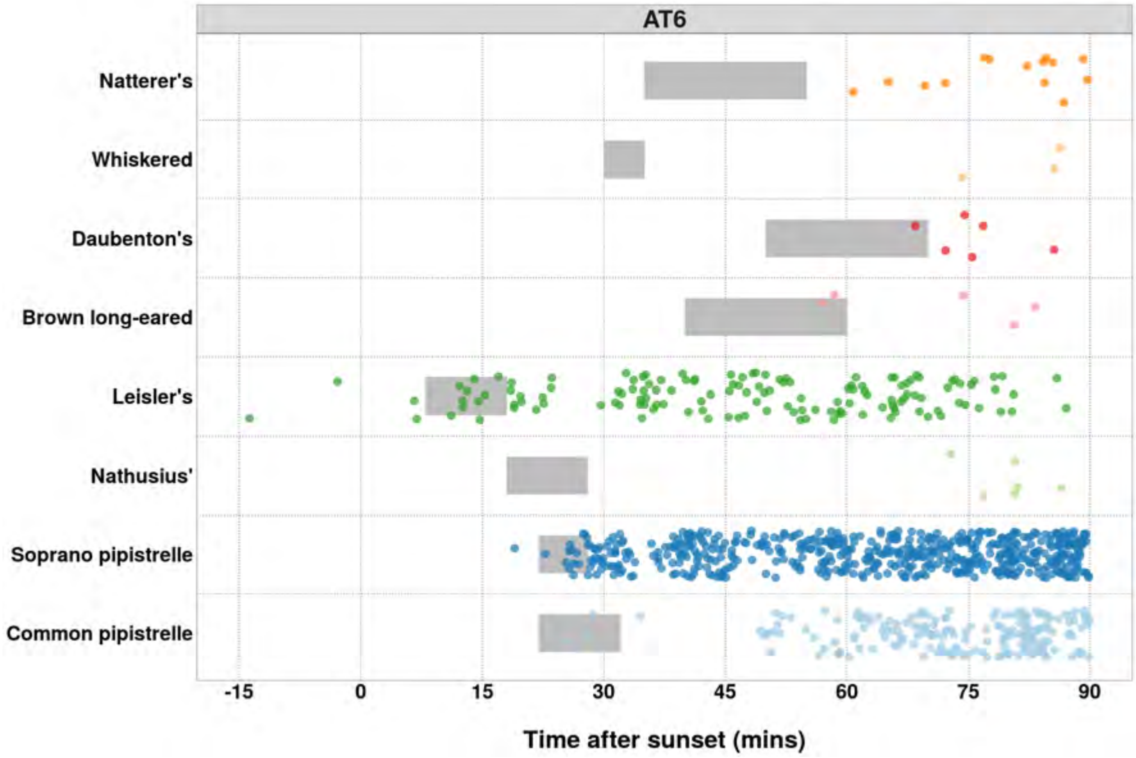


Plate 42: Time from 15 minutes before to 90 minutes after sunset, potentially indicating the presence of a nearby roost – Survey period 2.

4.7.5 Survey Period 3 2021

A summary showing the number of nights recorded bat activity within each activity band for each species is presented below in Table 4-14. Refer to Appendix E for the full Ecobat analysis report

Bat surveys were conducted for 18 nights for static locations AT2, AT3 and AT6, for 23 nights for static location AT5 and for 24 nights for static location AT4, between 13/09/2021 and 07/10/2021 using Wildlife Acoustics SM4BAT-FS static bat detectors. Analysis is based on the number of nights the bats were detected on each recorder, therefore the nights no bats were detected have not been provided within the analysis, This is available within the Ecobat report in Appendix E.

All of the five static locations had at least one night of High Activity during the survey period.

The following Static locations are deemed to have a High Bat Activity (for specific bat species) level based on the Median Percentile value:

- AT6 for soprano pipistrelle;
- AT3 and AT6 for common pipistrelle; and
- AT6 for brown long-eared bat

Refer to Plates 43 and 44 below.

Table 4-15, along with Plates 45 and 46 show the number of nights recorded bat activity fell into each activity band for each species across all of the detectors. They identify Pipistrellus spp., common pipistrelle and soprano pipistrelle as having high bat activity (per median percentile) across all detectors for period 3.

Table 4-14: Bat activity within each activity band for each species – Survey period 3

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
AT2	*Myotis daubentonii*	0	0	0	2	5	3	Low
AT2	*Myotis mystacinus*	0	0	1	2	4	3	Low
AT2	*Myotis nattereri*	0	0	0	0	2	3	Low
AT2	*Nyctalus leisleri*	0	0	0	1	3	3	Low
AT2	*Pipistrellus nathusii*	0	0	0	0	2	3	Low
AT2	*Pipistrellus pipistrellus*	4	6	2	1	2	69	Moderate to High
AT2	*Pipistrellus pygmaeus*	8	4	1	1	4	78	Moderate to High
AT2	*Plecotus auritus*	0	0	0	0	3	3	Low

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
AT3	*Myotis daubentonii*	0	0	1	1	9	3	Low
AT3	*Myotis mystacinus*	0	0	0	5	3	30	Low to Moderate
AT3	*Nyctalus leisleri*	1	1	0	4	6	14	Low
AT3	*Pipistrellus nathusii*	0	0	3	2	3	30	Low to Moderate
AT3	*Pipistrellus pipistrellus*	10	5	0	0	1	89	High
AT3	*Pipistrellus pygmaeus*	4	7	2	5	0	72	Moderate to High
AT3	*Plecotus auritus*	0	0	1	1	5	3	Low
AT4	*Myotis daubentonii*	0	0	0	4	5	3	Low
AT4	*Myotis nattereri*	0	0	0	1	2	3	Low
AT4	*Nyctalus leisleri*	0	2	4	5	8	24	Low to Moderate
AT4	*Pipistrellus nathusii*	0	0	0	2	2	14	Low
AT4	*Pipistrellus pipistrellus*	5	5	6	0	3	63	Moderate to High
AT4	*Pipistrellus pygmaeus*	11	2	5	4	2	68	Moderate to High
AT4	*Plecotus auritus*	0	0	1	6	5	24	Low to Moderate
AT5	*Myotis daubentonii*	0	0	2	3	4	24	Low to Moderate
AT5	*Myotis nattereri*	0	0	4	1	3	34	Low to Moderate
AT5	*Nyctalus leisleri*	0	1	2	8	4	24	Low to Moderate
AT5	*Pipistrellus nathusii*	0	0	0	0	2	3	Low
AT5	*Pipistrellus pipistrellus*	2	3	6	2	3	52	Moderate
AT5	*Pipistrellus pygmaeus*	2	5	4	4	3	56	Moderate
AT5	*Plecotus auritus*	0	0	1	8	8	24	Low to Moderate
AT6	*Myotis daubentonii*	1	5	6	0	0	59	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
AT6	*Myotis mystacinus*	4	4	5	1	0	69	Moderate to High
AT6	*Myotis nattereri*	0	0	5	4	3	30	Low to Moderate
AT6	*Nyctalus leisleri*	0	1	7	6	3	35	Low to Moderate
AT6	*Pipistrellus nathusii*	1	1	2	2	1	43	Moderate
AT6	*Pipistrellus pipistrellus*	9	2	3	2	1	82	High
AT6	*Pipistrellus pygmaeus*	13	2	1	1	0	96	High
AT6	*Plecotus auritus*	10	5	1	0	1	82	High

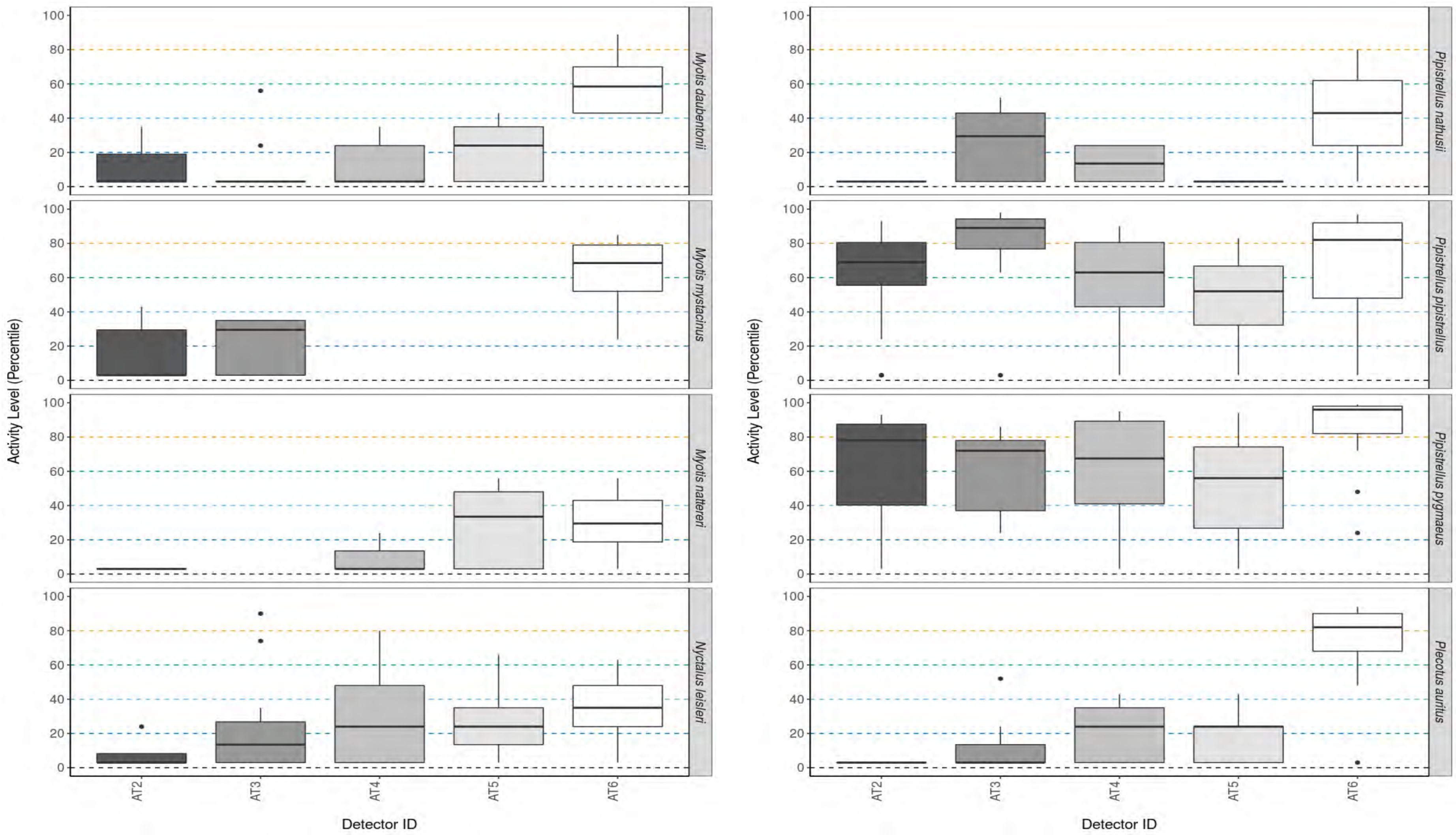
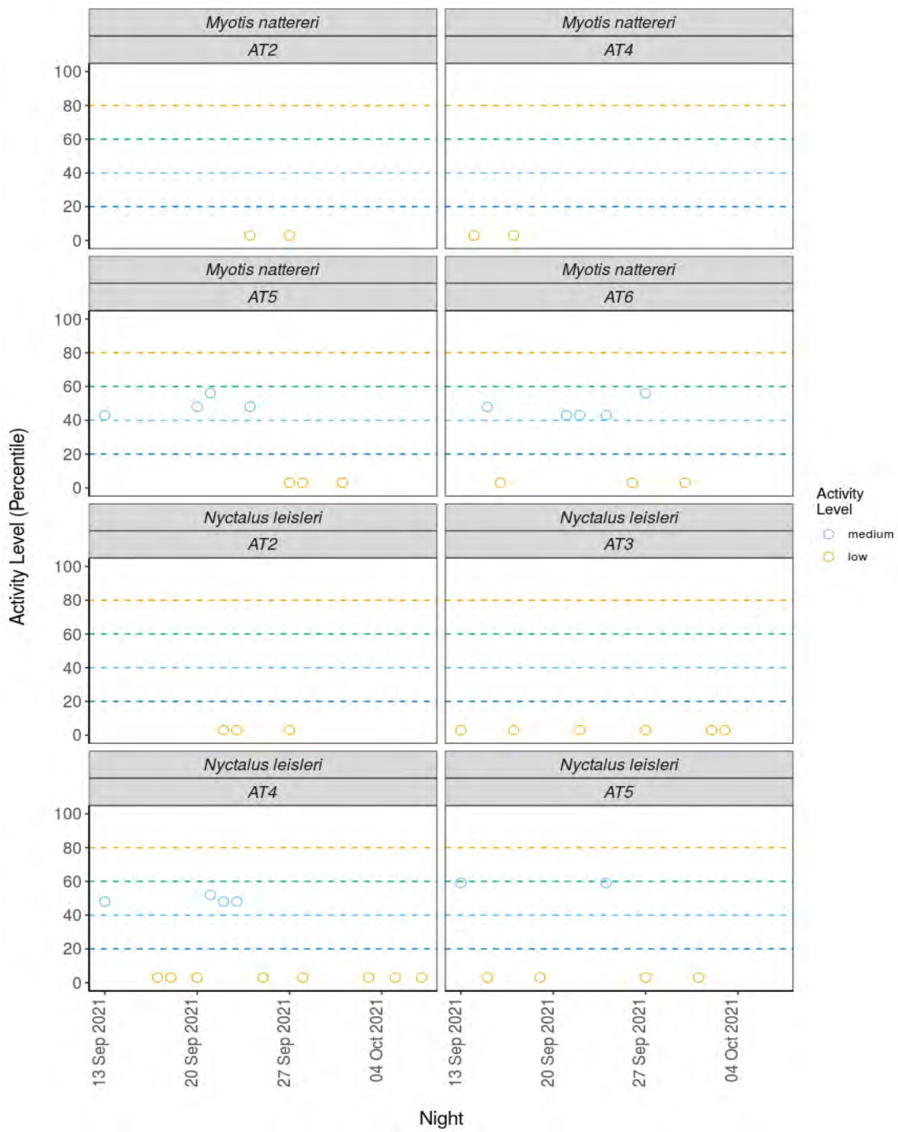
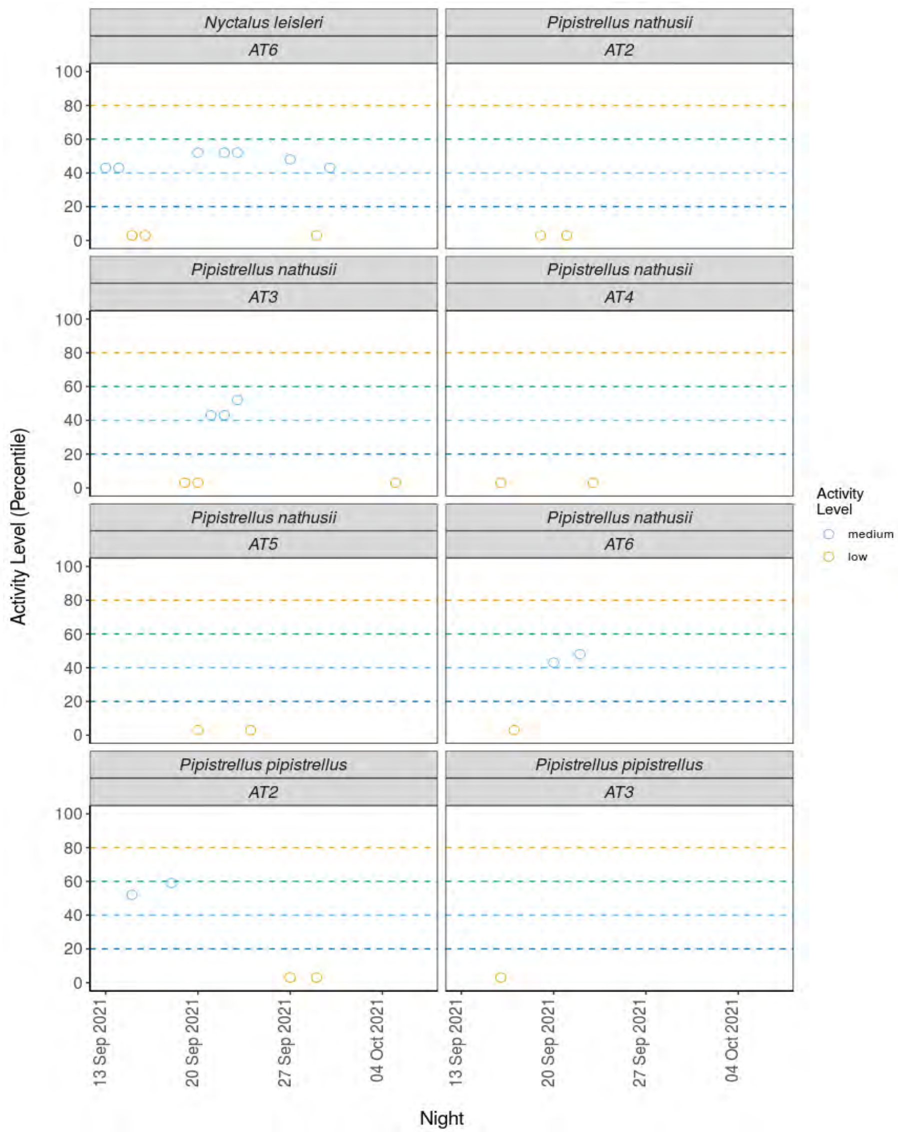
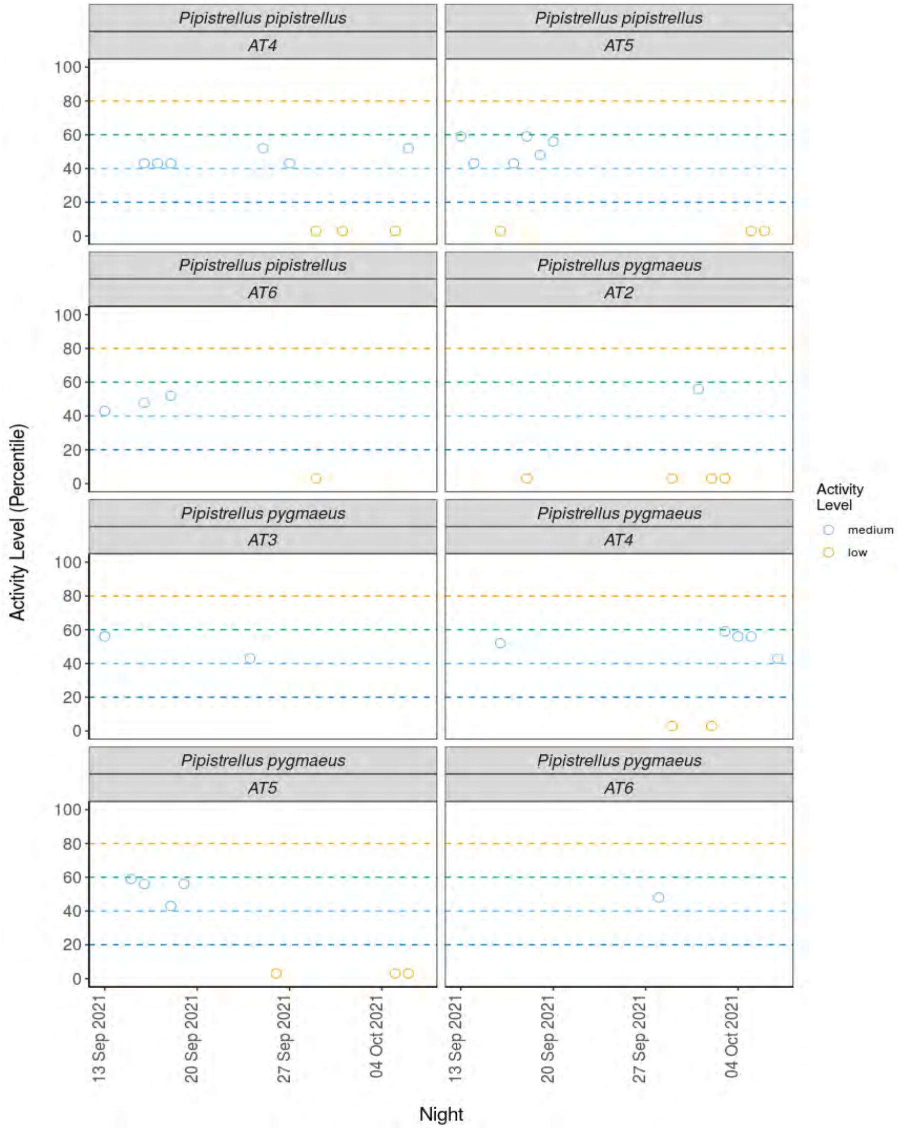


Plate 43: Differences in activity between static detector locations, split by species and location. The centre line indicates the median activity level whereas the box represents the interquartile range (the spread of the middle 50% of nights of activity) – Survey period 3


Myotis nattereri AT2
Myotis nattereri AT4
Myotis nattereri AT5
Myotis nattereri AT6
Nyctalus leisleri AT2
Nyctalus leisleri AT3
Nyctalus leisleri AT4
Nyctalus leisleri AT5
Activity Level (Percentile)
100
80
60
40
20
0
13 Sep 2021
20 Sep 2021
27 Sep 2021
04 Oct 2021
Night
Activity Level
medium
low


Nyctalus leisleri AT6
Pipistrellus nathusii AT2
Pipistrellus nathusii AT3
Pipistrellus nathusii AT4
Pipistrellus nathusii AT5
Pipistrellus nathusii AT6
Pipistrellus pipistrellus AT2
Pipistrellus pipistrellus AT3
Activity Level (Percentile)
100
80
60
40
20
0
13 Sep 2021
20 Sep 2021
27 Sep 2021
04 Oct 2021
Night
Activity Level
medium
low

12



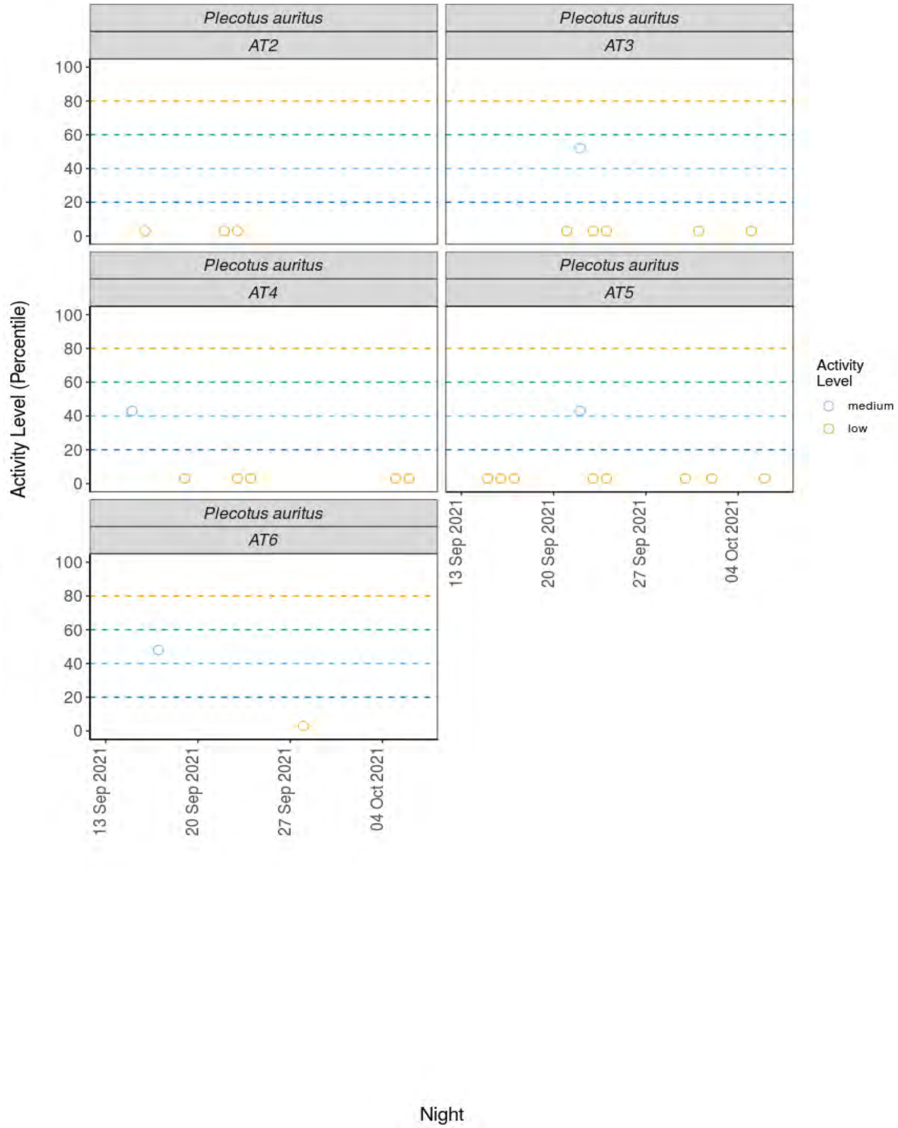


Plate 44: The activity level (percentile) of bats recorded across each night of the bat survey – Survey period 3

Table 4-15: Summary showing the number of nights recorded bat activity fell into each activity band for each species across all of the detectors – Survey period 3

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 daubentonii	1	5	9	10	23	24	Low to Moderate
Myotis mystacinus	4	4	6	8	7	35	Low to Moderate
Myotis nattereri	0	0	9	6	10	24	Low to Moderate
Nyctalus leisleri	1	5	13	24	24	24	Low to Moderate
Pipistrellus nathusii	1	1	5	6	10	24	Low to Moderate
Pipistrellus pipistrellus	30	21	17	5	10	71	Moderate to High
Pipistrellus pygmaeus	38	20	13	15	9	75	Moderate to High
Plecotus auritus	10	5	4	15	22	24	Low to Moderate

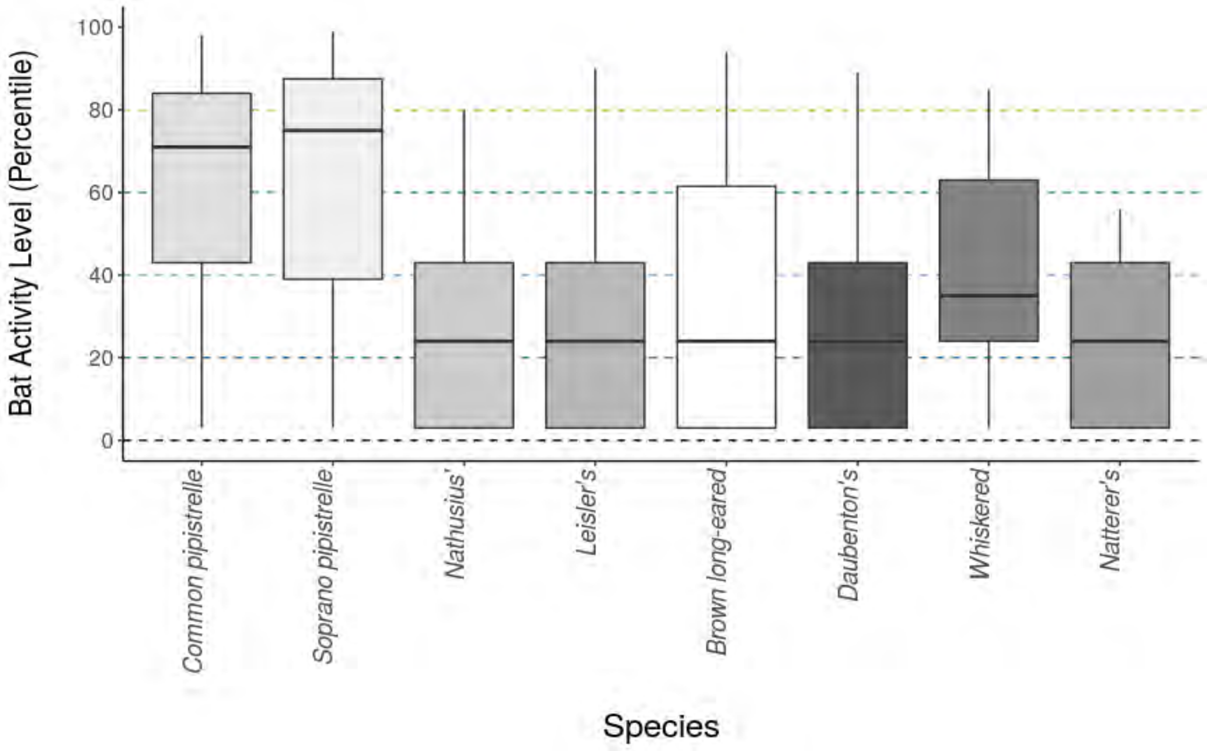


Plate 45: The activity level (percentile) of bats recorded across each night of the bat survey for the entire site – Survey period 3

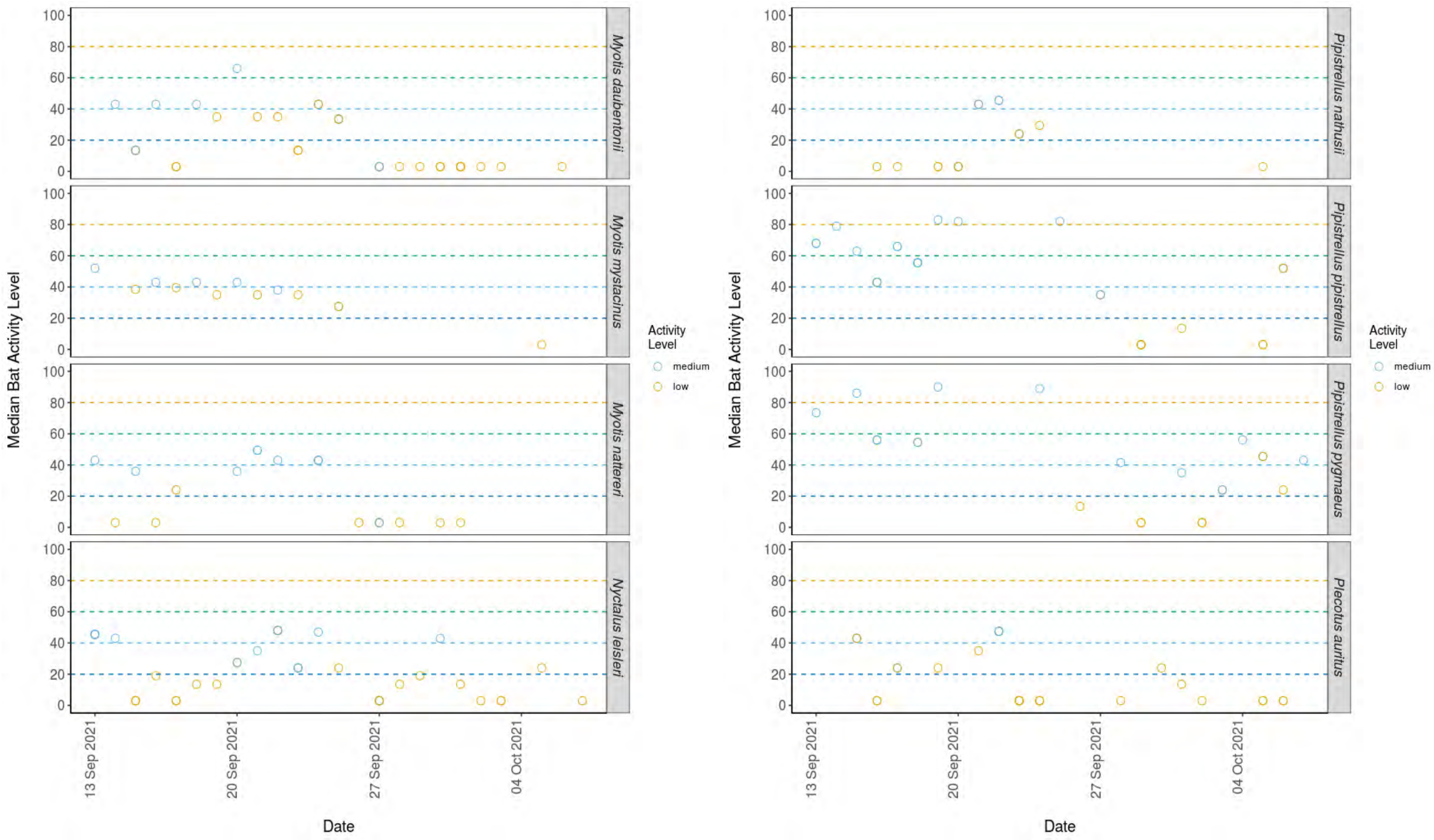


Plate 46: The median activity levels of bats recorded across all detectors each night – Survey period 3.

Due to the number of the recorded passes occurring within the species-specific emergence time ranges based on Russ 2012, the Ecobat analysis has identified a potential roost may be present near static locations AT2 and AT6 for soprano pipistrelle. Along with a potential roost near static locations AT2 for common pipistrelle. Refer to Plate 47 which shows passes in relation to the time from 15 minutes before to 90 minutes after sunset.

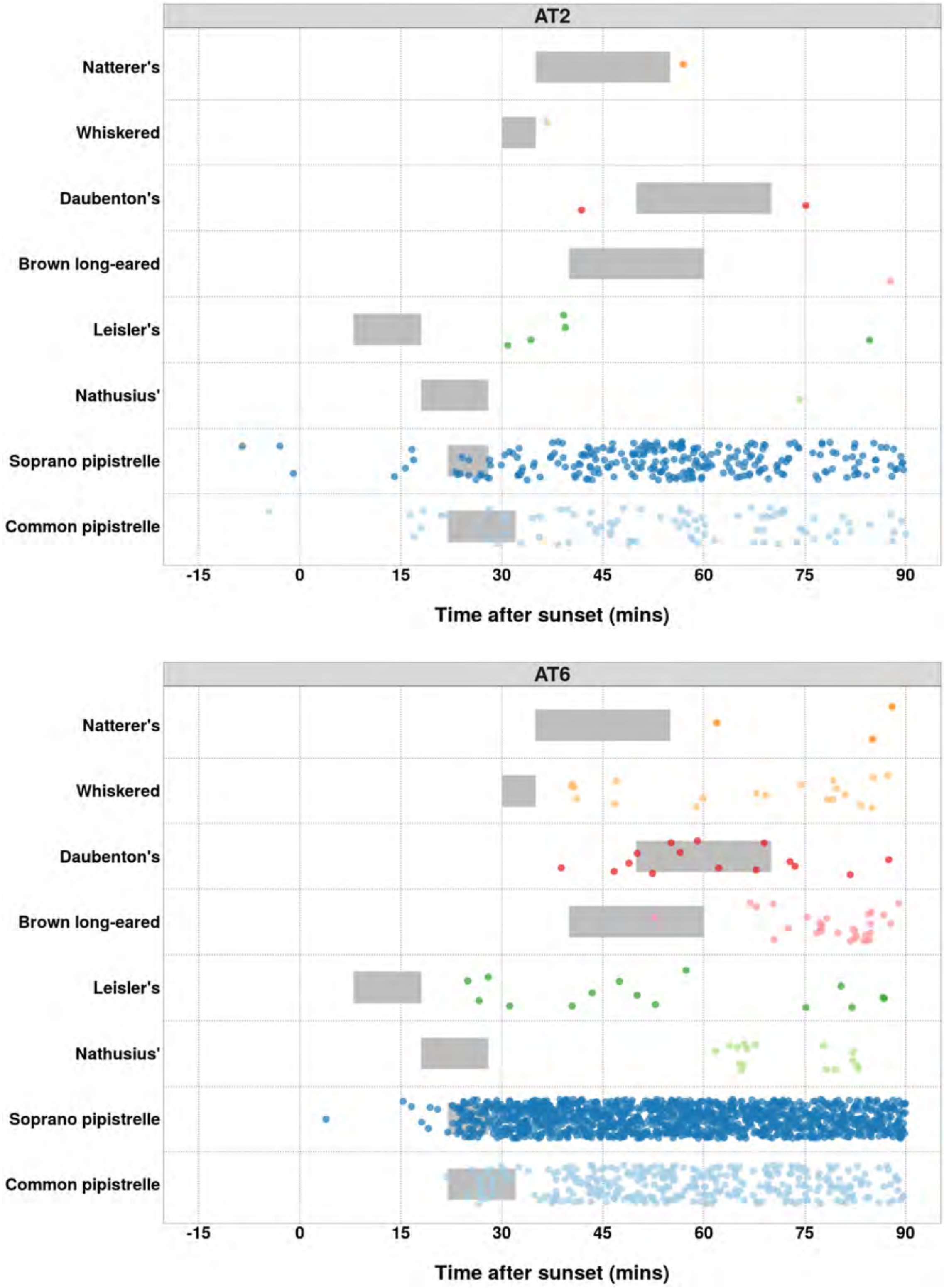


Plate 47: Time from 15 minutes before to 90 minutes after sunset, potentially indicating the presence of a nearby roost – Survey period 3.

5. ECOLOGICAL EVALUATION

A Site Risk Assessment, Impact Assessment and Habitat Assessment have been carried out using all available data for the Site. These assessments are used to determine the level of impact the Site may have on a local bat population if the potential impacts were to remain un-mitigated.

5.1 Site Risk Assessment

Wind farms can affect bats in the following ways (SNH, 20121:

1. Collision mortality, barotrauma [11] and other injuries (although it is important to consider these in the context of other forms of anthropogenic mortality)
2. Loss or damage to commuting and foraging habitat, (wind farms may form barriers to commuting or seasonal movements, and can result in severance of foraging habitat);
3. Loss of, or damage to, roosts;
4. Displacement of individuals or populations (due to wind farm construction or because bats avoid the wind farm area).

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

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

In addition, further consideration with regards to the local population are included in the assessment process:

- Is the bat species at the edge of its range
- Cumulative effects
- Presence of protected sites
- Proximity of maternity and winter roosts
- Key foraging areas
- Key flight lines
- Possible migration routes.

(11) *It should also be noted that although mortality of bats at wind farms include barotrauma (that results from exposure to the pressure variations caused by rotating turbine blades) as first presented by Baerwald et al. (2008) a number of studies since, including NREL (2012). *Reducing Bat Fatalities From Interactions with Operating Wind Turbines* and Lawson et al. (2020). *An investigation into the potential for wind turbines to cause barotrauma in bats*, dispute the hypothesis that barotrauma is responsible for a significant number of wind-turbine-related bat fatalities. However, the more recent studies have been undertaken on several mammal species (representative of bat species) as there is no data available on pressure change levels that cause barotrauma in bats.

Eight species of bat were recorded during the 2020 and 2021 bat surveys at Annagh. The table below provides an ecological valuation of each bat species and the collision risk factor in relation to wind farms. Four of the bat species recorded are considered to be High risk (leisler's bat, nathusius' pipistrelle, soprano pipistrelle and common pipistrelle).

Table 5-1: Ecological evaluation of the bat species recorded during the bat survey (CIEEM Guidelines, 2021) and "Bat Risk" in relation to Wind Turbines (SNH, 2021 and EC, 2020).

Ecological Value	Geographical Scale of Importance	Bat Risk
International	Leisler's bat	High
Regional	Brown long-eared bat Natterer's bat Nathusius' pipistrelle	Low Low High
County		
Local	Soprano pipistrelle Common pipistrelle Whiskered bat Daubenton's bat	High High Low Low
Negligible		

Using the SNH guidelines outlined in Table 5-2 the risk assessment criteria for the Site was determined to be:

- Project Size = **Medium** (<10 turbines, however, other wind energy developments within 10km)
- Habitat Risk = **High** (Confirmed roosts (including maternity) present close to the site, suitable foraging habitat and connectivity to the wider landscape via strong linear features was identified)

Therefore, a Site Risk Assessment score value of **4** was applied to the Site as a whole.

Table 5-2: Stage 1 - Initial site risk assessment extracted from SNH (2019/2021) guidance documents

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

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

* Some sites could conceivably be assessed as being of no (0) risk to bats. This assessment is only likely to be valid in more extreme environments, such as above the known altitudinal range of bats, or outside the known geographical distribution of any resident British species.

Habitat Risk	Description
Low	Small number of potential roost features, of low quality. Low quality foraging habitat that could be used by small numbers of foraging bats. Isolated site not connected to the wider landscape by prominent linear features.
Moderate	Buildings, trees or other structures with moderate-high potential as roost sites on or near the site. Habitat could be used extensively by foraging bats. Site is connected to the wider landscape by linear features such as scrub, tree lines and streams.
High	Numerous suitable buildings, trees (particularly mature ancient woodland) or other structures with moderate-high potential as roost sites on or near the site, and/or confirmed roosts present close to or on the site. Extensive and diverse habitat mosaic of high quality for foraging bats. Site is connected to the wider landscape by a network of strong linear features such as rivers, blocks of woodland and mature hedgerows. At/near edge of range and/or on an important flyway. Close to key roost and/or swarming site.

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

5.2 Impact Assessment

The Impact assessment is determined by multiplying the Site Risk Assessment value (4 as outlined above) by the Ecobat median (most frequent activity category) and maximum (highest activity category recorded) activity values converted to the percentile score as shown in Table 3.5.

The median activity levels for each of the High Risk (leisler, common pipistrelle, soprano pipistrelle and nathusius' pipistrelle) species were converted to the percentile score and an average taken over the three survey periods for 2020.

The Impact Assessment is then carried out for the individual turbines using the overall site assessment value (4) and compared to the Risk Assessment Matrix (Table 5.3) in order to determine the level of overall risk to the population.

It should be noted that the Impact Assessment is based on the median values to determine overall risk to population.

Table 5-3: Risk Assessment Matrix

	Ecobat activity percentile					
Site Risk	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
Medium (3)	0	3	6	9	12	15
High (4)	0	4	8	12	15	18
Highest (5)	0	5	10	15	20	25

Overall assessment value (i.e. Turbine Risk value) is then compared to the ranges below:

Low Overall Risk (0-4)	Medium Overall Risk (5-12)	High Overall Risk (13-25)

5.2.1 Evaluation of 2020 survey results

With regards to the 2020 surveys, the Ecobat Median Percentile for leisler's bat, locations A3, A6, A7 and A8 have a Medium Risk Factor, while locations A2 and A5 have a High Risk Factor. All locations have a High Risk Factor with regards to the Ecobat maximum percentile. This is presented Table 5-4:

Table 5-4: Risk Assessment for each proposed turbine location – Leisler's Bat

Bat detector ID No.	Site risk value	Ecobat Maximum Percentile	Turbine risk (site risk x Ecobat maximum percentile)	Ecobat median percentile	Turbine risk (site risk x Ecobat median percentile)
A2	4	5	**20**	4	**16**
A3	4	4	**16**	3	**12**
A5	4	5	**20**	4	**16**
A6	4	4	**16**	3	**12**
A7	4	4	**16**	3	**12**
A8	4	4	**16**	3	**12**

With regards to the 2020 surveys, the Ecobat Median for common pipistrelle, location A7 has a Medium Risk Factor, while the remaining locations have a High risk factor. All locations have a High Risk Factor with regards to the Ecobat maximum percentile. This is presented in Table 5-5:

Table 5-5: Risk assessment for each proposed turbine location – Common pipistrelle

Turbine No.	Site risk value	Ecobat Maximum Percentile	Turbine risk (site risk x Ecobat maximum percentile)	Ecobat median percentile	Turbine risk (site risk x Ecobat median percentile)
A2	4	5	**20**	4	**16**
A3	4	5	**20**	4	**16**
A5	4	5	**20**	5	**20**
A6	4	5	**20**	4	**16**
A7	4	5	**20**	3	**12**
A8	4	4	**16**	4	**16**

With regards to the 2020 surveys, the Ecobat Median and Maximum Percentiles for soprano pipistrelle, all the locations have a High Risk factor. This is presented in Table 5-6:

Table 5-6: Risk assessment for each proposed turbine location – Soprano pipistrelle

Turbine No.	Site risk value	Ecobat Maximum Percentile	Turbine risk (site risk x Ecobat maximum percentile)	Ecobat median percentile	Turbine risk (site risk x Ecobat median percentile)
A2	4	5	**20**	5	**20**
A3	4	5	**20**	5	**20**
A5	4	5	**20**	5	**20**
A6	4	5	**20**	4	**16**
A7	4	5	**20**	5	**20**
A8	4	5	**20**	4	**16**

With regards to the 2020 surveys, the Ecobat Median for nathusius pipistrelle, locations A2 and A5 have a Medium Risk Factor, while the remaining locations have a Low risk factor. With regards to the maximum percentile location A8 has a Low Risk Factor, while the remaining locations have a Medium Risk Factor. This is presented in Table 5-7:

Table 5-7: Risk assessment for each proposed turbine location – Nathusius' pipistrelle

Turbine No.	Site risk value	Ecobat Maximum Percentile	Turbine risk (site risk x Ecobat maximum percentile)	Ecobat median percentile	Turbine risk (site risk x Ecobat median percentile)
A2	4	3	**12**	2	**8**
A3	4	3	**12**	1	**4**
A5	4	3	**12**	2	**8**
A6	4	2	**8**	1	**4**
A7	4	3	**12**	1	**4**
A8	4	1	**4**	0	**0**

5.2.2 Evaluation of 2021 survey results

With regards to the 2021 surveys, the Ecobat Median Percentile for leisler's bat, all locations have a Medium Risk Factor. With regards to the Ecobat maximum percentile location AT2 has a Medium Risk Factor, while the remaining locations have a high Risk Factor. This is presented Table 5-8:

Table 5-8: Risk Assessment for each proposed turbine location – Leisler's Bat

Bat detector ID No.	Site risk value	Ecobat Maximum Percentile	Turbine risk (site risk x Ecobat maximum percentile)	Ecobat median percentile	Turbine risk (site risk x Ecobat median percentile)
AT1	4	5	**20**	3	**12**
AT2	4	3	**12**	2	**8**
AT3	4	5	**20**	3	**12**
AT4	4	4	**16**	2	**8**
AT5	4	4	**16**	3	**12**
AT6	4	4	**16**	3	**12**

With regards to the 2021 surveys, the Ecobat Median and Maximum Percentiles for common pipistrelle, all the locations have a High Risk factor. This is presented in Table 5-9:

Table 5-9: Risk assessment for each proposed turbine location – Common pipistrelle

Turbine No.	Site risk value	Ecobat Maximum Percentile	Turbine risk (site risk x Ecobat maximum percentile)	Ecobat median percentile	Turbine risk (site risk x Ecobat median percentile)
AT1	4	5	**20**	4	**16**
AT2	4	5	**20**	5	**20**
AT3	4	5	**20**	5	**20**
AT4	4	5	**20**	4	**16**
AT5	4	5	**20**	4	**16**
AT6	4	5	**20**	5	**20**

With regards to the 2020 surveys, the Ecobat Median and Maximum Percentiles for soprano pipistrelle, all the locations have a High Risk factor. This is presented in Table 5-10:

Table 5-10: Risk assessment for each proposed turbine location – Soprano pipistrelle

Turbine No.	Site risk value	Ecobat Maximum Percentile	Turbine risk (site risk x Ecobat maximum percentile)	Ecobat median percentile	Turbine risk (site risk x Ecobat median percentile)
AT1	4	5	**20**	5	**20**
AT2	4	5	**20**	5	**20**
AT3	4	5	**20**	4	**16**
AT4	4	5	**20**	4	**16**
AT5	4	5	**20**	4	**16**
AT6	4	5	**20**	5	**20**

With regards to the 2020 surveys, the Ecobat Median for nathusius pipistrelle, locations A2 and A5 have a Medium Risk Factor, while the remaining locations have a Low risk factor. With regards to the maximum percentile location A8 has a Low Risk Factor, while the remaining locations have a Medium Risk Factor. This is presented in Table 5-11:

Table 5-11: Risk assessment for each proposed turbine location – Nathusius' pipistrelle

Turbine No.	Site risk value	Ecobat Maximum Percentile	Turbine risk (site risk x Ecobat maximum percentile)	Ecobat median percentile	Turbine risk (site risk x Ecobat median percentile)
AT1	4	3	**12**	2	**8**
AT2	4	2	**8**	2	**8**
AT3	4	3	**12**	2	**8**
AT4	4	2	**8**	1	**4**
AT5	4	1	**4**	1	**4**
AT6	4	4	**16**	3	**12**

5.3 Habitat Assessment

The habitat assessment determines the value of the habitat to bat species with regards to potential roosting, commuting or foraging value as indicated by current guidelines and literature including (but not limited to) Collins 2016, Denzinger 2013, Kirkpatrick 2016 and Finch 2020.

Plantation woodland

A study by Kirkpatrick (2016) identified that, although bat associations with plantation habitat features are separated into two broad guilds (those using more complex habitats such as soprano pipistrelle and Myotis spp., and open space foragers such as noctule and to some extent common pipistrelle), all species preferentially used stand edges. Plantation edges may also allow both clutter tolerant and clutter sensitive bats access to navigate both within and around stands of plantation. The study further concluded that a possible reason for the higher activity levels found at forestry edges may be due to providing protection from the wind for weak flying prey or acting as windbreaks collecting airborne insects blown in from adjacent open or felled areas and also providing protection from predators.

The edge ecology is considered as *High Ecological value for bats*, while the dense woodland stands (internal ecology) are of *Low Ecological value* for bats at the Site.

Agricultural field (wet grassland)

A study carried out in the UK by Finch *et al*. (2020) found that bat activity for open agricultural habitats is lower than that of linear features and that bats are more likely to be associated with treelines (including mature trees within hedgerows) compared to other linear feature types. The study also found that, of all the records of bat activity, only 10% of the common pipistrelle activity was recorded within open habitats (e.g., agricultural fields). Soprano pipistrelle also showed to statistically favour linear habitats.

The agricultural fields are considered as *Low Ecological value* for bats.

Hedgerow (with/without treeline)

As highlighted in Fitch *et al.* (2020), bats are more likely to be associated with treelines (including mature trees within hedgerows) compared to other linear feature types. Therefore, the hedgerow bounding the fields are considered *Moderate to High Ecological value* due to the foraging and commuting potential.

5.4 Summary of Assessments

Table 5-12: Summary of bat survey data and assessment

Static Detector ID	Risk Assessment Leisler's Bat		Risk Assessment Common Pipistrelle		Risk Assessment Soprano Pipistrelle		Risk Assessment Nathusius Pipistrelle		Clarifying Comment	Bat Habitat within 200m	Bat Habitat along wind farm access tracks	Bat along wind farm access tracks	If no mitigation is applied, what is the potential impact level to the High Risk species?
	Ecobat Maximum Percentile	Ecobat Median Percentile	Ecobat Maximum Percentile	Ecobat Median Percentile	Ecobat Maximum Percentile	Ecobat Median Percentile	Ecobat Maximum Percentile	Ecobat Median Percentile	Is Static at Turbine Location (Y/N)				Taking into consideration the clarifying comment
A2	20	16	20	16	20	20	12	8	N	Y	Y	Y	High
A3	16	12	20	16	20	20	12	4	N	Y	Y	Y	High
A5	20	16	20	20	20	20	12	8	N	Y	Y	Y	High
A6	16	12	20	16	20	16	8	4	N	Y	Y	Y	High
A7	16	12	20	12	20	20	12	4	N	Y	Y	Y	High
A8	16	12	16	16	20	16	4	0	Y	Y	Y	Y	High
AT1	20	12	20	16	20	20	12	8	N	Y	Y	Y	High
AT2	12	8	20	20	20	20	8	8	N	Y	Y	Y	High
AT3	20	12	20	20	20	16	12	8	N	Y	Y	Y	High
AT4	16	8	20	16	20	16	8	4	N	Y	Y	Y	High
AT5	16	12	20	16	20	16	4	4	N	Y	Y	Y	High
AT6	16	12	20	20	20	20	16	12	N	Y	Y	Y	High

The assessments identified an overall potential for impact on the bat population at the Site as High for common and soprano pipistrelle, Medium for leisler's bat and Low for nathusius' pipistrelle should no mitigation be applied.

6. DISCUSSION

The methodology for the 2020 bat surveys at Annagh wind farm adhered to SNH (2019 and 2021) guidance for assessing the impact of proposed wind farm developments on local bat species. Monthly activity surveys were undertaken between May and September 2020. Three rounds of static detectors were also deployed during this time period, for a minimum of 10 nights per round per detector. Further survey effort was also undertaken during the 2021 survey period with two rounds of static detector surveillance periods between July and October. Along with roost surveys undertaken in 2021 (refer to Appendix A for the full report) including bat vantage point surveys in August 2021.

During activity surveys, a total of five species of bats were recorded: common pipistrelle, soprano pipistrelle, leisler's bat, natterer's bat, and whiskered bat. The most commonly recorded species was soprano pipistrelle, followed by leisler's and common pipistrelle, with much lower levels of myotis spp. (natterer's bat and whiskered bat) detected.

During the roost surveys a maternity roost for soprano and common pipistrelle and a minor pipistrelle roost were identified within the study area (refer to Appendix A). The vantage point surveys further identified a leisler's roost within the study area.

During static detector surveys of 2020 a total of eight species of bat were recorded. In addition to the five species identified during activity surveys, daubenton's bat, nathusius' pipistrelle and brown long-eared bat were also recorded. Soprano pipistrelle was the most frequently recorded species across the six static locations. In comparison natterer's bat, daubenton's bat and whiskered bat were the least recorded species across the six static locations.

The Ecobat analysis of the 2020 results showed all six of the static detector locations (A2-A8) recorded at least one night of high bat activity during period one (spring), period two (summer) and period three (autumn) for at least one species of bat. The species identified as having nights of high activity are leisler's bat, common pipistrelle and soprano pipistrelle.

During static detector surveys of 2021 a total of eight species of bat were recorded, all of which are the same of the previous (2020) year. Furthermore, all six of the static locations (AT1-AT6) recorded at least one night of high bat activity for at least one species of bat. Once again, the species identified as having nights of high activity are leisler's bat, common pipistrelle and soprano pipistrelle.

The 2021 static results show a lower level of activity for leisler's bat and a slightly higher level of activity for nathusius pipistrelle within the study area than that recorded in 2020.

The Ecobat analysis of the 2020 and 2021 results, further identified a potential roost for leisler's bat within the vicinity of the study area, along with a potential roost for soprano pipistrelle and common pipistrelle within the vicinity of northern section of the study area. This analysis was confirmed during the roost surveys undertaken in 2021. A common and soprano pipistrelle maternity roost was identified to the east of the study area, and a minor pipistrelle roost was confirmed to the north and north west of the study area. While a leisler roost was identified to the north east of the study area during the vantage point surveys.

Due to the habitats present on Site, turbine siting had potential to be placed within plantation woodlands, which may undergo extensive habitat alteration, locating detectors within woodland will not represent the conditions post-construction (as outlined by SNH 2019 and 2021).

Furthermore, Kirkpatrick (2016) identified open space and felled woodland stands are used by both open and edge-space foragers, strengthening the argument that placing detectors within woodland stands does not represent the situation post-construction.

Therefore, in order to provide representative data of how bats may adapt to and use the potential new habitat that would be created at/after construction, the static detectors were sited in open areas including existing nearby roads/clearings within the forestry of the study area. This is a more conservative approach that would provide higher activity levels than placing at the actual turbine location enclosed in forestry currently.

Turbines T1, T3 and T6 are all located within areas of plantation woodland. Static locations A3, A8 and AT6 provide representative data of how bats may adapt to and use the potential new habitat that would be created from the construction of the turbines. The assessments show there is a potential moderate to high impact risk for leisler bats, a potential high impact risk for common and soprano pipistrelle and a low to moderate impact risk for nathusius pipistrelle at these proposed turbine locations in the absence of mitigation, based on this conservative assessment.

Turbine T2 is located within an agricultural field (wet grassland) adjacent to a large plantation woodland to the west and a smaller plantation to the north. As stated in the habitat assessment, bat activity for open agricultural habitats is lower than that of linear features. Static locations A6 and AT4 provide representative data of how bats use open spaces within the study area. The assessments show there is a potential moderate impact risk for leisler bats, a potential high impact risk for common and soprano pipistrelle and a potential low impact risk for nathusius pipistrelle at these proposed turbine locations in the absence of mitigation, based on this conservative assessment.

Turbine 4 is located on the boundary between an agricultural field (wet grassland, marsh) and plantation woodland. The edge ecology of the plantation is favoured by bat species within the Study area. Static locations A5, AT1, AT2 and AT3 provide representative data of how bats use the edge ecology (woodland edge adjacent to agricultural field) within the study area. However, as stated above, due to the extensive change in habitat for this area, static locations A3, A8 and AT6 provide representative data of how bats may adapt to and use the potential new habitat that would be created from the construction of the turbine. The assessments show there is a potential moderate to high impact risk for leisler bats, a potential high impact risk for common and soprano pipistrelle and a potential low to moderate impact risk for nathusius pipistrelle at these proposed turbine locations in the absence of mitigation, based on this conservative assessment.

Turbine T5 is located within an agricultural field (wet grassland) impacting the existing north / south hedgerow. The study conducted by Fitch (2020) identified that historic hedgerow[12] do not influence the direction of flight for bat species. Therefore the hedgerow to be removed as part of T5 construction will not influence the bat species to commute via the turbine location. Static location A2, A7, AT4 and AT5 provide representative data of how bats use linear ecology within the study area. The assessments show there is a potential moderate to high impact risk for leisler bats, a potential high impact risk for common and soprano pipistrelle and a potential low to moderate impact risk for nathusius pipistrelle at these proposed turbine locations in the absence of mitigation, based on this conservative assessment.

The location of static detectors in open areas within plantation woodland and felled woodland stands, as well as edge ecology, was undertaken to assess the bat activity levels along these corridors and the potential activity levels for bats post felling. Therefore the baseline is a worse case representation of the Site overall.

[12] Over the last 100 years, agricultural land has become more homogeneous, with increased land parcel sizes. To facilitate this increase in parcel size, many historical linear features have been removed altogether, including hedgerow that has previously been used by bats as part of their commuting route.

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

6.1 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. Soprano pipistrelle shows no increase in activity between the turbine and 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 common pipistrelles 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 common pipistrelle activity conducted prior to facility construction.

6.2 Mitigation Measures

6.2.1 Mitigation during Construction Phase

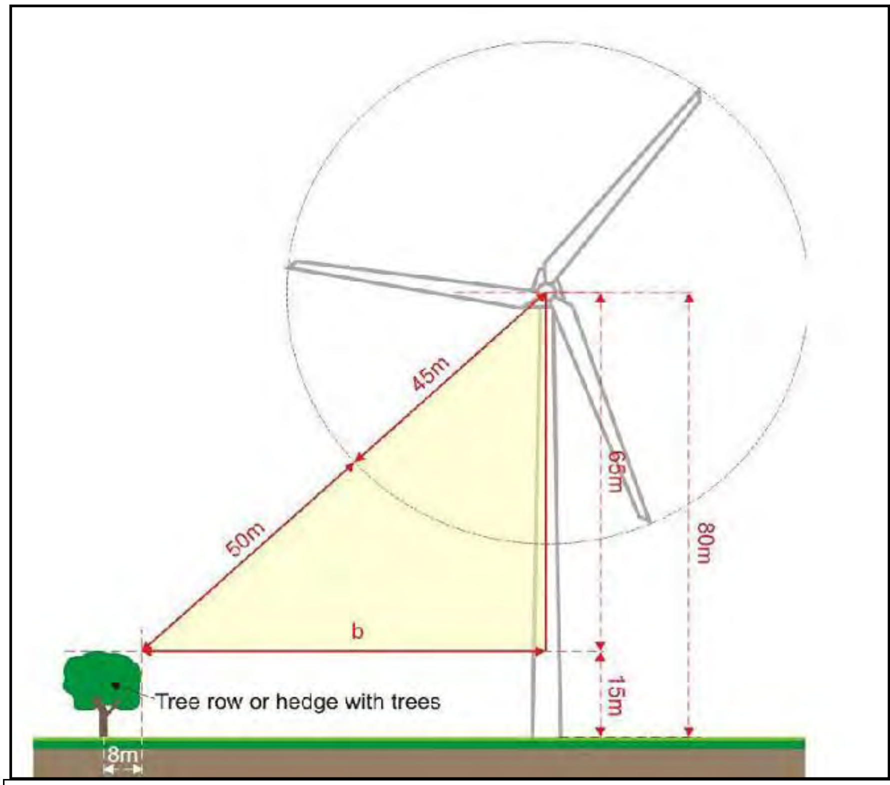
Buffer Zone

To minimize risk to bat populations, a buffer zone is recommended around any treeline, hedgerow, woodland feature, into which no part of the turbine should intrude.

According to SNH (2021 guidance:

> *"The Eurobats guidance recommends a 200m buffer around woodland areas. There is, however, currently no scientific evidence to support this distance in the UK and it is recommended that a distance of 50m between turbine blade tip and nearest woodland (or other key habitat features such as wetlands etc.) is adequate mitigation in most, lower risk situations. Exceptionally, larger buffers may be appropriate, e.g. near major swarming and hibernation sites. The longevity of wind farms should also be taken into account and the maximum growth, or management, of woodland and other relevant habitat features considered in their planning.*

Distances will need to be taken into account during the design phase of the proposed Annagh Wind Farm Development. The following formula will be used to calculate the required felling buffer 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)

$$b = \sqrt{(50 + 75)^2 - (100 - fh)^2}$$

Note: fh for each turbine location is given in column 3 of Table 6-1: *below*

Locations representative of the habitat types and features at turbine locations were surveyed, and the bat activity survey findings recorded informed the application of the 50m blade tip buffer described above at all six proposed turbine locations. Surrounding habitats, height of surrounding trees and felling buffer calculated using the above equation are included in Table 6-1: below. Note that the tree heights have been increased to allow for growth prior to felling, thereby expanding the buffers.

To minimize risk to bat populations, a buffer zone is required around any treeline, hedgerow, woodland feature, into which no part of the turbine should intrude. The buffers for each turbine are presented in Table 6-1.

Table 6-1: Assessment of potential turbine/bat conflict zones (based on proposed turbine blade length 75m)

Turbine number	Habitats Requiring Felling	Surrounding Tree Height (fh/m)	Tree Height allowing for growth (m)	Felling Buffer Radius (m)
1	Mixed broadleaved/conifer woodland	7	9	86
2	Mixed broadleaved/conifer woodland	7	9	86
3	Mixed broadleaved woodland	12	15	92
4	Mixed broadleaved woodland	7	9	86
5	Immature woodland	4.5	6	82
6	Mixed broadleaved woodland	7	9	86

Existing trees will be cleared around all six turbines to provide a vegetation-free buffer zone around each turbine. All buffers will be maintained throughout the lifetime of the wind farm.

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

Supervision of vegetation clearance

An ecologist/ECoW will supervise areas where vegetation, scrub and hedgerow removal will occur prior to and during construction as appropriate (e.g., ecologist may be required during some clearance works of areas where vegetation is too dense to check beforehand). This will ensure that any site-specific issues in relation to wildlife not currently present (e.g., Bat roost locations) on site will be discovered prior to commencement of works to allow appropriate mitigation measures to be put in place. In the event that an issue arises, the NPWS will be informed and the relevant guidelines will be implemented as appropriate (e.g. NRA guidelines).

Retention of trees

Several species of bats roost in trees. Treelines and mature trees within the wind farm site will be avoided and retained intact. Overall impacts on these areas will be reduced through modified design and sensitivity during construction. 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.

Tree Felling Measures along the turbine delivery route

Where mature trees with low bat roosting potential are proposed to be felled, these trees will be left in situ for 24 hours prior to disposal. This will allow any bats present to escape.

Compensation for loss of commuting routes/Diversion from felling buffers

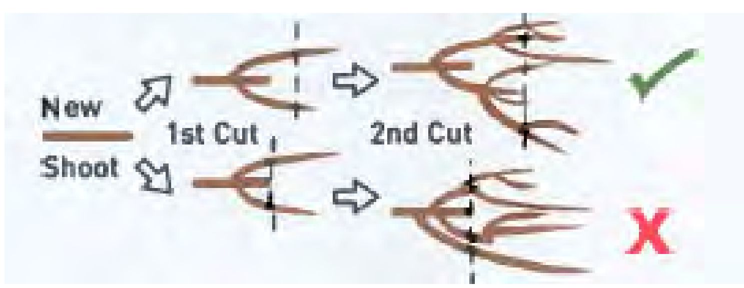
Linear features such as hedgerows and treelines serve as commuting corridors for bats (and other wildlife). The magnitude of habitat loss is Imperceptible. The total length of hedgerow to be removed is 277m (2.3 % of this habitat type within the study area), although it is noted that a large proportion of this is either within or bounding forestry blocks and as such is better considered as woodland edge in terms of bat habitat. A total of 11m (0.4% of this habitats type in study area) of treelines will be lost. This is made up of two parallel 5.5-metre lengths along the Oakfront stream. Felling around turbines will alter commuting and foraging routes associated with existing woodland edges.

Where woodland edges are affected by turbine felling buffers, bats will be directed away from tree-free buffers along an alternative commuting route. This will be achieved by planting new pollinator-friendly hedgerows along Lines A-F (Appendix F). Willow and Alder will also be included in these hedgerows due to their rapid growth and tolerance of damp soils. These species will be planted directly into the soil, or alternatively in 1m high embankments if the soil is too wet. These embankments will be constructed using excavated material from nearby roads and hard standings. It is proposed to create double lines of hedgerow, with Alder and Willow on one side, and pollinator-friendly hedgerow species listed below on the other. Planting of these species will be staggered to prevent excessive shading and aid establishment of the hedgerows.

All hedgerow planting is required to use plants of native provenance. The landscaping contractor is required to be informed well in advance to allow the acquisition of suitable native stock. 2–3-year-old alder and willow trees are required for hedgerows A-F, to help accelerate establishment. These will be supplemented with planting of whips.

The following fast-growing damp tolerant species are to planted along the inner edges of these hedgerows: grey willow *Salix cinerea,* goat willow *Salix caprea,* and alder *Alnus glutinosa.* The following native fruiting hedgerow species are to planted along the outer edges of these hedgerows: whitethorn *Crataegus monogyna* (75% of total), blackthorn *Prunus spinosa*, bird cherry *Prunus padus,* elder *Sambucus nigra,* dog rose *Rosa canina,* crab apple *Malus sylvestris,* field rose *Rosa arvensis.*

Tightly cut hedgerows with flat tops provide little benefit to wildlife, taller and bulky hedgerows are required as this provides more shelter for wildlife. When the hedgerows are maintained, stems will be cut a little above the last cut (see Plate 6-1) as cutting back to the exact same point depletes the energy of the hedgerow, forms a build-up of scar tissue which discourages new growth.



Source:Teagasc

Plate 6-1: Hedgerow Level of Cut

Light annual cutting of hedgerows is not good for wildlife as it limits the production of flowers and fruit. The sites hedgerows will be cut every three to four years in rotation if cutting is required, as this will leave areas of undisturbed hedgerows. Cutting equipment used will be sharp so as not to shatter or fray the hedge. Shattering and fraying allows for disease to enter plants and can lead to decay and weaken the vigour of the hedgerow.

A finger-bar cutter is recommended as the most appropriate tool to minimise fraying and smashing of branches (Heritage Council, 2017). A flail-type hedge cutter is unsuitable for hedge trimming in situations where hedgerow health is a priority.

Hedgerow maintenance will not be carried out between the 1st of March and 31st of August as this is the nesting period for birds and any maintenance at this time will disturb breeding; this is in keeping with the Wildlife Act 1976 (as amended).

Habitat retention, replacement and landscaping

Habitat replacement and landscaping could compensate for or add to the wildlife value of the area and also provide areas of aesthetic as well as wildlife interest. In general, landscape design should aim to retain the quality of the landscape and ensure its protection within the landscaping programme. Existing hedgerows and semi-natural scrub or semi-natural grasslands within the study area outside of the footprint of the development will be retained and incorporated into the landscaping. Disturbed areas will be allowed to recolonise naturally.

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.

Pre-construction Surveys

If three 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.

6.2.2 Mitigation during Operational Phase

Reduced rotation speed while idling (Feathering of Blades)

Turbines will 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 (SNH 2021). 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 reduction in speed resulting from feathering compared with normal idling may reduce fatality rates by up to 50% (SNH 2021).

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

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.

Although the proposed turbine locations are within areas of the Site that will have lower activity levels than the linear features and edge ecology recorded during surveys (open areas and plantation woodland), the locations within the site identified to represent areas post-construction (within plantation woodland) and open space have a moderate to high activity level. Therefore, increased cut-in speeds will be implemented from commencement of operation. Cut-in speeds will be increased during the bat activity season (April-October) and/or where weather conditions are optimal for bat activity (see below) from 30 minutes prior to sunset and to 30 minutes after sunrise at all turbines.

Cut-in speeds restrictions will be operated according to specific weather conditions:

1. When the air temperature is above approximately 10 to 11°C at nacelle height.
2. Generally, bat activity peaks at a wind speed range of 5.0 to 6.5m/s (at nacelle height).

Due to the considerable unnecessary down time resulting from the proposed "blanket curtailment" (above) and the advances in smart curtailment a focused curtailment regime is proposed as described below from year four of operation.

This ill focus on times and dates, corresponding with periods when the highest level of bat activity occur within the Site. This includes the use of the 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.

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)

Post Construction surveys

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.

During years one to three of operation (under blanket curtailment restrictions) bat activity will be measured continuously between April and mid-October at each turbine location, in combination with carcass surveys. In addition, wind speed and temperature data will be continuously recorded at the nacelle height of each turbine.

Modern remotely-operated wind turbines as proposed here allow cut-in speeds to be controlled centrally/automatically, facilitating an operation regime designed to minimise harmful impacts to bats.

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).

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 reduced (to low) then consent will be sought from Cork 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 season.

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

Due to the level of leisler activity within the study area, nacelle-level surveys[13] are also proposed for the post construction surveys. These will be used to identify the level of leisler bat activity above the tree canopy and within the height of the rotor-swept area.

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.

Buffer zones

The vegetation-free buffer zones (refer to section 6.2.1 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.

[13] Used to supplement ground-based equipment designed to replicate the survey effort undertaken at the pre-application stage (see Roemer et al., 2017). They are particularly useful at woodland key-holed sites.

Monitoring of mitigation measures

The success of the implemented mitigation measures for bats on the project should be monitored for a period of no less than three years post construction and appropriate measures taken to enhance these if and where required..

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 mortality programme are outlined below:

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. No turbines which are used for carcass removal trials should be used for subsequent fatality monitoring.
b) Turbine searches for fatalities should be undertaken following best practice in terms of search area (focusing on hard standing) and at intervals selected to effectively sample fatality rates as determined by carcass removal trials in (a) above. [14]
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.

[14] Suitably trained dogs with handlers are significantly more efficient and faster than humans in locating carcasses and should preferably be used to achieve more robust results. Dog searches are, however, resource-demanding and may not always be necessary to identify if a problem exists.

Table 6-2: Monitoring schedule recommended for bat mitigation measures

Mitigation measure	Monitoring required	Description	Duration
Newly planted hedgerows	Ensure viable growth of planting	Planted material shall be checked periodically over the growing season to remove dead material. Any dead material shall be replaced within the same season with viable stock according to age/height restrictions already specified in mitigation.	From time of planting to 1 year post construction
Bat boxes and tubes	Monitor bat use	Bat boxes and tubes to be placed at locations removed from wind farm as determined by project ecologist/ECoW at least 1 season before construction start. These shall be examined by a licensed bat specialist according to NPWS recommendations. Records should be submitted to *Bat Conservation Ireland* for inclusion in its bat distribution database. If the boxes / tubes are not used within the first three years of deployment re-site if necessary. Annual cleaning required if well used by bats or if used by birds. Replacement if damaged/lost.	From mounting to 3 years post construction.
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, 25 and 30 post construction.

7. CONCLUSION

In general (according to Lundy *et al,* 2011), the landscape in which the proposed wind farm is situated is of high suitability for common pipistrelle and soprano pipistrelle, moderate suitability for leisler's bat, brown long-eared bat, daubenton's bat and natterer's bat, and low for whiskered bat, lesser horseshoe bat and nathusius' Pipistrelle.

Eight species of bats have been recorded as present within the study area during the 2020/ 2021 bat surveys. All are listed as 'Least Concern' on the Irish Red List (2019), and Annex IV of the EU Habitats Directive.

This report identifies that the bat activity levels with the Site (as a worst case scenario) are high and the proposed turbines have been sighted within areas of expected lower activity (open space and plantation woodland), in order to reduce the potential for impact to the bat population of the area. Furthermore, with the implementation of extensive mitigation outlined above (section 6.2) 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 (Behr, O. et al., 2017).

The assessment has been undertaken in regard to all the latest available guidance and the mitigation proposed include those that have been previously described in guidance relating to windfarms and/or have direct evidence supporting there efficacy at reducing / avoiding impacts.

The resulting impact of the proposed project on local bat populations, with implemented mitigation measures, the favourable conservation status (FCS) of bat species will be unaffected and all species confirmed or expected on or near the study areas are predicted to persist.

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FEHILY TIMONEY

CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

APPENDIX A

Bat Roost Survey Report

Bat Roost Survey

Annagh Wind Farm Development

Charleville

Co. Cork

Draft Report, prepared for Fehily Timoney & Co.

By Karen Banks MCIEEM

14th July, 2021

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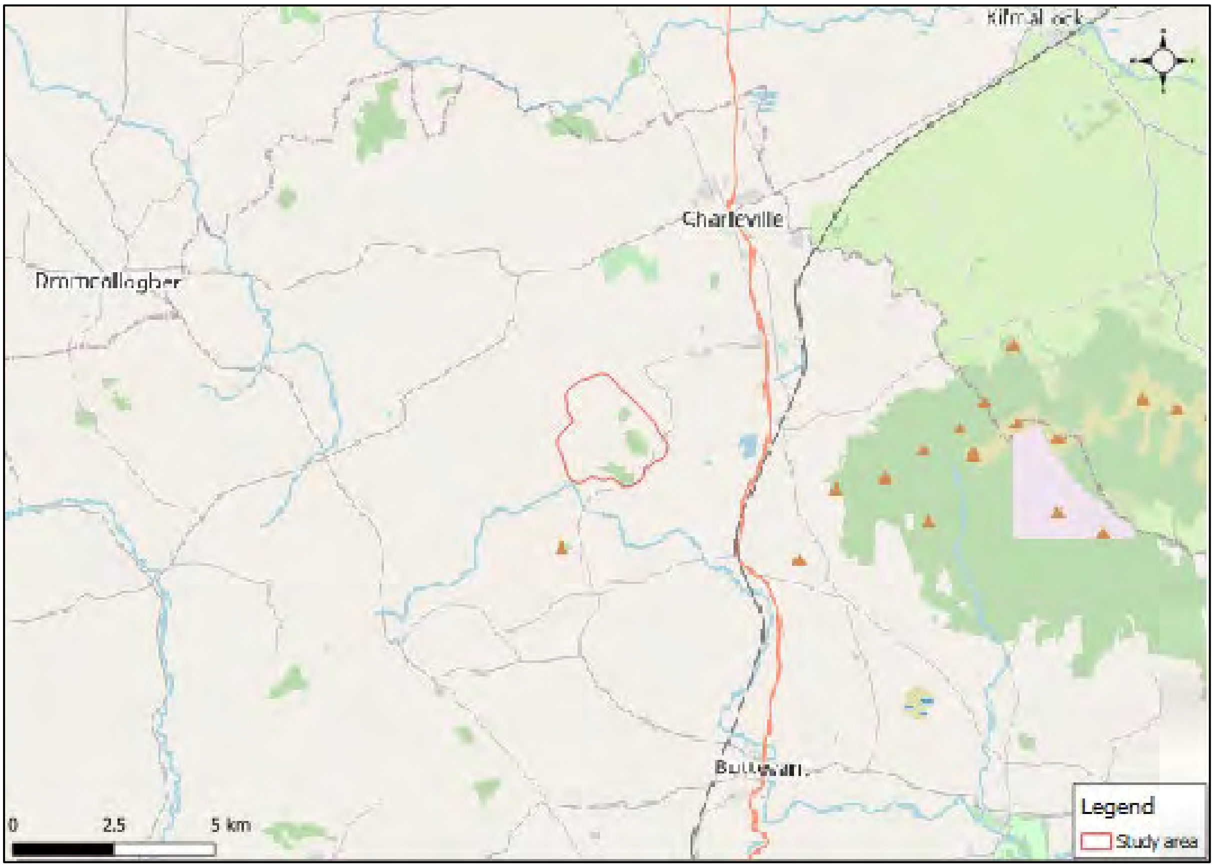
1 Introduction

Greenleaf Ecology were commissioned by Fehily Timoney to undertake bat roost surveys of the proposed Annagh Wind Farm development located in the townlands of Fiddane, Cooliney, Coolcaum and Annagh North, Co. Cork.

1.1 Study Area

The study area comprises the land ownership boundary plus a survey buffer of 200m plus rotor radius.[1] The proposed site is located within the land ownership boundary (as detailed in the EIAR prepared for Annagh Wind Farm). The location of the wind farm study area, as defined above is illustrated in Figure 1-1.

Figure 1-1: Study area location



1.2 Proposed Works

For a description of the proposed development please refer to the EIAR prepared for Annagh Wind Farm.

1.3 Legislative Context

All Irish bats are protected under the Wildlife Act (Revised). Also, the EC Directive on The Conservation of Natural Habitats and of Wild Fauna and Flora (Habitats Directive 1992), seeks to protect rare species, including bats, and their habitats, and requires that appropriate monitoring of populations be

[1] As per SNH (2019)

undertaken. Across Europe they are further protected under the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1982), which, in relation to bats, exists to conserve all species and their habitats. The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979, enacted 1983) was instigated to protect migrant species across all European boundaries. The Irish government has ratified both these conventions.

All bats are listed in Annex IV of the EU Habitats Directive (92/43/EC) and the Lesser Horseshoe bat is further listed under Annex II of the same Directive.

Local Planning Authorities are required to give consideration to nature conservation interests under the guidance of the SEA Directive 2001/42/EC. This Directive states that the protected status afforded to bats means that planning authorities must consider their presence in order to reduce the impact of developments through mitigation measures.

Destruction, alteration or evacuation of a known bat roost is a notifiable action under current legislation and a derogation licence has to be obtained from the National Parks and Wildlife Service (NPWS) before works can commence.

In addition, it should be noted that any works interfering with bats and especially their roosts, may only be carried out under a licence to derogate from Regulation 23 of the Habitats Regulations 1997, (which transposed the EU Habitats Directive into Irish law) issued by the NPWS. The details with regards to appropriate assessments, the strict parameters within which derogation licences may be issued and the procedures by which and the order in relation to the planning and development regulations such licences should be obtained, are set out in Circular Letter NPWS 2/07 "Guidance on Compliance with Regulation 23 of the Habitats Regulations 1997 - strict protection of certain species/applications for derogation licences" issued on behalf of the Minister of the Environment, Heritage and Local Government on the 16th of May 2007.

1.4 Objectives

The objectives of the bat surveys were to assess:

- Whether actual or potential bat roosts are present, and if so where;
- What species of bat use the study area for roosting;
- How many bats do these roosts support; and
- What types of bat roost are present.

2 Methodology

2.1 Desk Study

A pre-survey data search was conducted in order to collate existing information from the study area and the surrounding area on bat activity, roosts and landscape features that may be used by bats. The data search comprised the following information sources:

- Collation of known bat records within a 4km radius[2] of the study area 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 study area and its environs;
- Records of designated sites within a 15km radius of the study area where bats form part or all of the reason for designation (https://www.npws.ie/protected-sites);
- Collation of lesser horseshoe bat records within a 4km radius of the study area from the National Parks and Wildlife Service lesser horseshoe bat database (https://www.npws.ie);
- Collation of data on known caves within a 4km radius of the study area from the Cave Database for the Republic of Ireland, complied by Trinity College (http://www.ubss.org.uk/search_irishcaves.php); and
- Review of bat survey data from Ecological Impact Assessments from proposed and permitted developments within the wider environs of the study area.

2.2 Field Survey

This bat survey and assessment was undertaken in accordance with the following guidelines:-

- Andrews, H. (2018) Bat Roosts in Trees. A guide to identification and assessment for tree-care and ecology professionals. Pelagic Publishing.
- Bat Conservation Ireland (2010) G*uidance notes for Planners, Engineers, Architects, and Developers*;
- Collins, J. (ed.) (2016) *Bat Surveys for Professional ecologists: Good Practice Guidelines (3rd ed.)*. The Bat Conservation Trust, London;
- Scottish Natural Heritage (2019) *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation*. Scottish Natural Heritage and
- Kelleher, C. & Marnell, F. (2006). *Bat Mitigation Guidelines for Ireland*.

2.2.1 Surveyor Information

The survey was undertaken by Karen Banks, MCIEEM.

Karen is an ecologist with 15 years' experience in the field of ecological assessment. She holds a BSc in Environment and Development from Durham University and is a full member of the Chartered Institute of Ecology and Environmental Management. Karen is an experienced and skilled bat surveyor, first gaining a scientific licence to disturb bats from Natural England, UK in 2008. Karen is trained in bat handling and capture methods and currently holds a bat disturbance licence granted by the NPWS. Karen has undertaken bat survey and assessment for numerous projects, including bridge repair and replacement works, domestic dwelling repair and demolition works, wind farm developments and large-scale infrastructure projects such as flood relief schemes, road developments and pipeline

[2] A 4km radius search distance was selected to encompass records of bat roosts within Core Sustenance Zones (CSZ) of the study area for Irish species of bat. A CSZ refers to the area surrounding a communal bat roost within which habitat availability and quality will have a significant influence on the conservation status of the colony using the roost (Collins, 2016).

schemes. Karen has also represented Cork County Council as an expert witness for bats at an Oral Hearing.

2.2.2 Bat Roost Survey

2.2.2.1 Preliminary Ecological Appraisal

A walkover survey of areas identified as potential roosting habitats during the desk top study were undertaken in March 2021. Roosting habitat was assessed using the criteria outlined in Table 2-1[3].

Table 2-1: Criteria for Assessing the Potential Suitability of the Study Area for Bats

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

[3] Collins, J. (ed.) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). The Bat Conservation Trust, London

2.2.2.2 Bat Roost Inspection Survey

Trees

Detailed inspections of the exterior of trees were undertaken on 18th March 2021 to look for features that bats could use for roosting (Potential Roost Features, or PRFs) from ground level. The aim of the surveys was to determine the actual or potential presence of bats and the need for further survey and/or mitigation.

Detailed inspections of each potential tree roost within the study area were undertaken. The inspections were carried out in daylight hours from ground level, and information was compiled on the tree, PRFs and evidence of bats. All trees surveyed were numbered and marked on a map and a description of each PRF observed was recorded. PRFs that may be used by bats include:

- Rot holes;
- Hazard beams;
- Other horizontal or vertical cracks or splits (e.g. frost cracks) in stems or branches;
- Lifting bark;
- Knotholes arising from naturally shed branches or branches previously pruned back to the branch collar;
- Man-made holes (e.g. flush cuts) or cavities created by branches tearing out from parent stems;
- Cankers in which cavities have developed;
- Other hollows or cavities;
- Double leaders forming compression forks with included bark and potential cavities;
- Gaps between overlapping stems or branches;
- Partially detached ivy with stem diameters in excess of 50mm; and
- Bat or bird boxes.

Signs of a bat roost (excluding the actual presence of bats), include:

- Bat droppings in, around or below a PRF;
- Odour emanating from a PRF;
- Audible squeaking at dusk or in warm weather; and
- Staining below the PRF.

It should be noted that bats or bat droppings are the only conclusive evidence of a roost and many roosts have no external signs. Therefore, this survey and evaluation was relatively basic as only those PRFs at ground level could be inspected closely to ascertain their true potential to support roosting bats. Trees were categorised according to the highest suitability PRF present.

Structures

Buildings and bridges within the proposed wind farm study area were subject to a visual inspection for evidence of, and potential for, bats in March 2021 and June 2021. The exterior of the structures was visually assessed for potential bat access points and evidence of bat activity using binoculars, a high-powered torch and an endoscope (Explorer Premium 8803 with 9mm camera). Features such as crevices and small gaps in the bridge or building structure, such as between the brick or stonework, beneath roofing material, at eaves and around window frames which had potential as bat access points into the buildings were inspected. Evidence that these features/ access points were actively being used by bats includes staining within the gaps, urine staining and bat droppings. Indicators that potential access points are not actively used by bats include general detritus and cobwebs within the access point. A note of potential features used by bats was made where present.

Where possible, internal inspections of these structures was undertaken. Internal inspections involved looking for features that may be suitable for roosting bats, such as joints and crevices in wood, holes or crevices between stonework in the walls and searching for bat droppings, urine stains and feeding signs on the floor.

2.2.2.3 Emergence Roost Survey

Dusk surveys of structures within the study area that were identified as being of moderate to high potential for bats during the roost inspection surveys were undertaken between 10th June and 19th June 2021. The purpose of the surveys was to watch and listen for bats exiting from bat roosts to determine the presence or absence of bats at the time of survey. The dusk emergence surveys commenced approximately 15 minutes before sunset and ended approximately 90 minutes after sunset. The survey was undertaken in suitable weather conditions (avoiding periods of very heavy rain, strong winds (> Beaufort Force 5), mists and dusk temperatures below (12°C)). Two people surveyed the structures (Karen Banks and Cathál MacPartholan).

Anabat Walkabout detectors were utilised for the survey, which record bat echolocation calls directly on to an internal SD memory card. Each time a bat is detected, an individual time-stamped (date and time to the second) file is recorded. Data were then downloaded and all recordings were analysed using the Anabat Insight spectrogram sound analysis software Version 1.9.7.

3 Results

3.1 Existing Bat Data

The review of existing records of bat species in the study area indicates that the National Biodiversity Data Centre (NBDC) do not hold any records of bats from within a 4km radius of the study area. It is noted that this is likely due to lack of survey effort at the proposed site and its vicinity, rather than a lack of bats.

There are no records of lesser horseshoe bats on the National Parks and Wildlife Service (NPWS) database from within a 4km radius of the study area.

The bat landscape association model (Lundy *et al,* 2011) suggests that the study area is part of a landscape that is of moderate suitability for bats including common pipistrelle (*Pipistrellus pipistrellus*), soprano pipistrelle, brown long-eared, Leisler's, Daubenton's, natterer's (*Myotis nattereri*) and whiskered bat (*M. mystacinus*). The study area and its environs are of low suitability for Nathusius' pipistrelle (*P. nathusii*) and is outside of the core distribution range for lesser horseshoe bat (*Rhinolophus hipposideros*) (Roche *et al*, 2014).

The Cave Database for the Republic of Ireland does not hold any records of caves within a 4km radius of the study area.

The bat assessment undertaken between 2016 and 2019 for the proposed underground electricity cable for a proposed solar farm adjacent to the northwest of the study area recorded common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, Leisler's bat, Natterer's bat and brown long-eared bat. A soprano pipistrelle was roosting in the barn at the western extremity of the site. Natterer's bat activity within the farmyard towards the east of here implies the presence of a roost of this species within the surrounding area. Both common and soprano pipistrelle were present here close to sunset and sunrise and are roosting within buildings very nearby.[4]

3.1.1 Designated Sites

There are no European sites within a 15km radius or nationally designated sites within a 10km radius of the study area which include bats as a Qualifying Interest (QI).

3.2 Bat Roost Survey

3.2.1 Preliminary Ecological Appraisal

Review of aerial photography for the study area at Annagh indicates that the study area predominantly comprises improved agricultural grassland and wet grassland bound by hedgerows and treelines; with planted broadleaved and conifer forestry. The 2nd order watercourse Oakfront Stream flows from north to south through the east of the study area and the 2nd order watercourse the Ardglass Stream flows through the west of the study area (study area illustrated in Figure 1-1).

The Oakfront Stream, Ardglass Stream, hedgerows and treelines and broadleaved and conifer plantations provide connectivity to other foraging areas in the wider landscape. In accordance with the criteria outlined in Table 2-1, the commuting and foraging habitats over most of the study area are of high suitability for bats. A summary of foraging and roosting habitats for Irish bats is included in **Appendix A**.

[4] Keeley, B. et al (2020) Underground electricity cable between a proposed solar farm at Fiddane, Ballyhea, Charleville, Co. Cork and Charleville 110kV ESB Substation at Clashgannive, Ballyhea Co. Cork: Biodiversity Evaluation and Ecological Impact Assessment. Wildlife Surveys.

3.2.2 Bat Roost Inspection Survey

3.2.2.1 Trees

No trees within the study area were confirmed as roost sites. No trees of moderate or high potential for roosting bats (as defined in Table 2-1) were recorded at the study area. A total of 5 trees supporting features such as heavy Ivy growth and hazard beams that may have potential for individual/ small numbers of bats to roost opportunistically were recorded at the centre of the study area in the vicinity of the Oakfront Stream. These trees are classified as being of low suitability to support roosting bats.

3.2.2.2 Structures

A total of eleven buildings/clusters of buildings were identified in the preliminary ecological appraisal as being of potential to support roosting bats. These are detailed in Table 3-1.

Table 3-1: Buildings with bat potential located within the study area

Building number and Grid Reference (ITM)	Description	Suitability to Support Roosting Bats
Cluster 1 **Grid Ref: 549616,618218**	A 2-storey farmhouse with rendered walls and a slate hip-roof. Access was gained to the exterior of one side of the building. Potential entry points for bats were present under chimney flashing and behind guttering. Two of the outhouses were constructed of stone with a corrugated roof. Other outbuildings included concrete block buildings with a corrugated roof and steel framed sheds with corrugated walls and roof.	2 no. bat droppings were recorded on top of the roof of a car parked adjacent to the house. The dwelling is of **high** Suitability for bats.
Building 2 **Grid Ref: 549547,618502**	Occupied dwelling and 2 no outbuildings. The outbuildings were constructed of stone and block with a corrugated roof and timber beams.	Dwelling considered to be of **low** suitability for roosting bats in light of the material of its construction and its state of repair based on exterior inspection. Scattered bat droppings were present throughout the outbuildings. Outbuildings were considered to be of **low- moderate** suitability for bats as they may be used by individual/ small numbers of bats but do not support appropriate conditions for roosts of high conservation value (i.e. maternity or hibernation roosts).
Building 3 **Grid Ref: 549769,618427**	Occupied dwelling. External inspection undertaken from a distance using binoculars.	Considered to be of **low** suitability for roosting bats in light of the material of its construction and its state of repair based on observation using binoculars from within the study area.
Building 4 **Grid Ref: 549761,618491**	Occupied dwelling and small slate outbuilding. External inspection undertaken from the public road.	Considered to be of **low** suitability for roosting bats in light of the material of its construction and its

Building number and Grid Reference (ITM)	Description	Suitability to Support Roosting Bats
		state of repair based on observation from the public road.
Building 5 **Grid Ref: 549842,618504**	Occupied dwelling and small slate outbuilding. External inspection undertaken from the public road.	Considered to be of **low** suitability for roosting bats in light of the material of its construction and its state of repair based on observation from the public road.
Building 6 **Grid Ref: 549958,618636**	Derelict 2-storey dwelling constructed of brick and stone with a tile roof. Windows were broken and there were several missing roof slates. No soffits or fascia boards were present. Internal inspection was limited to downstairs rooms due to bad state of repair of the structure.	The building was open and draughty with limited potential roosting features. May be used by individual/ small numbers of bats but is unsuitable to support a roost of high conservation value. **Low** suitability for roosting bats.
Building 7 **Grid Ref: 550045,618508**	Occupied dwelling and outbuildings. External inspection undertaken from the public road.	Dwelling considered to be of **low** suitability for roosting bats in light of the material of its construction and its state of repair based on external inspection from within the study area using binoculars. Outbuildings potentially of **low-moderate** suitability based on material of construction and state of repair.
Building 8 **Grid Ref: 550367618668**	Derelict dwelling with no roof and no visible potential roosting features.	**Negligible** potential.
Building 9 **Grid Ref: 550628,618574**	Occupied 2-storey dwelling with rendered walls and slate tile roof. External inspection undertaken from farmyard. Two stone outbuildings constructed of stone with a slate tile roof. Roof tiles are not lined. Potential entry points for bats in gaps around doors and roof tiles and under ridge tiles.	Dwelling potentially of **moderate** suitability for roosting bats based on the material of its construction and its state of repair as viewed from the farmyard. No evidence of bats was recorded in the outbuildings. Outbuildings were considered to be of **low** suitability for bats as they do not support appropriate conditions for roosts of high conservation value (i.e. maternity or hibernation roosts).
Building 10 **Grid Ref: 551570,617147**	2-storey dwelling with rendered walls and a slate tile roof. Dwelling in good state of repair and no obvious entry/exit points were recorded. External inspection undertaken from farmyard. 2-storey outbuilding with rendered walls and a corrugated roof. Potential entry points present around doors and windows. Internally the building supports wooden beams with	Dwelling and outbuildings appear to be of **moderate** suitability for bats.

Building number and Grid Reference (ITM)	Description	Suitability to Support Roosting Bats
	wooden slats against the wall. No evidence of bats recorded.	
Building 11 **Grid Ref: 550060,616713**	2-storey derelict house with rendered walls and a slate tile roof. The structure is in a bad state of repair and the windows, door and several roof tiles are missing. There are several entry/exit points via the door, windows and gaps in roof tiles. The building is open and the roof space would be draughty. There are potential roosting spaces for individual/ small numbers of bats in the soffits. No evidence of bats was recorded internally or externally. Outbuildings in the courtyard are constructed of stone with a slate tile roof. There are no windows or doors and several roof tiles are missing.	The dwelling and outbuildings were open and draughty with limited potential roosting features. May be used by individual/ small numbers of bats but is unsuitable to support a roost of high conservation value. **Low** suitability for roosting bats.

Bridges

Two bridges over the Oakfront Stream are present within the study area , one to the north and one to the south. No features of suitability for roosting bats were recorded within either bridge and both bridges are classified as Grade 0.[5] A low stone culvert is present to the north-east of the study area. The culvert was low-lying and obscured by vegetation. The culvert supported some crevices that may be of use by bats, but no evidence of bats was recorded. This culvert is classified as Grade 1.

3.2.3 Emergence Roost Survey

Emergence roost surveys were undertaken of structures within the land ownership boundary and accessible structures within the land ownership buffer (both within study area) that were of moderate to high suitability for roosting bats. The emergence surveys were undertaken by two surveyors in June 2021.

Cluster 1

One pipistrelle bat (not echolocating so species unknown) was recorded emerging from underneath the roof tiles on the southern elevation of the dwelling during the emergence survey undertaken on 10th June 2021. Common pipistrelle and soprano pipistrelle were recorded foraging around the treelines in the garden of the dwelling and two Leisler's bats was recorded foraging overhead from twelve minutes after sunset, but were not observed emerging from the dwelling.

Building 2

[5] *0 = no potential (no suitable crevices); 1 = crevices present may be of use to bats; 2 = crevices ideal for bats but no evidence of usage; and 3 = evidence of bats (e.g. bats present, droppings, grease marks, urine staining, claw marks or the presence of bat fly pupae) (Billington and Norman, 1997).

A total of three common pipistrelle were recorded emerging from the doorway of the outbuildings during the emergence survey undertaken on 19th June 2021. Leisler's bat was recorded commuting overhead 33 minutes after sunset. Natterer's bat was recorded foraging along the treeline adjacent to the outbuildings 41 minutes after sunset, indicating the potential presence of a roost nearby.

Building 10

A total of 75 common and soprano pipistrelle bats were counted emerging from the side of the chimney breast of the dwelling during the emergence survey undertaken on 18th June 2021.

One Leisler's bat was recorded commuting overhead at sunset, indicating the potential presence of a roost near to this building.

Building 11

No bats were recorded emerging from the derelict dwelling or outbuildings during the emergence survey undertaken on 11th June 2021.

3.3 Interpretation and Evaluation of Survey Results

Presence/ absence: One pipistrelle bat was recorded emerging from the house present to the north-west of the study area (Grid ref: 549616,618218).

Three common pipistrelle were recorded emerging from the outbuildings present to the north of the study area (Grid ref: 549547,618502).

Seventy five common and soprano pipistrelle were recorded emerging from the dwelling at the east of the study area (Grid Ref: 551570,617147).

Population size class assessment: The dwelling and outbuildings to the north of the study area support minor summer pipistrelle roosts of individual/ small group of males. The dwelling at the east of the study area supports a maternity roost of common and soprano pipistrelle.

Site status assessment: The habitats within the study area provide suitable foraging and commuting areas along the Oakfront Stream, Ardglass Stream, hedgerows and treelines and broadleaved and conifer plantations. The summer emergence surveys confirmed the presence of one maternity roost for common and soprano pipistrelle and two minor pipistrelle roosts within the study area. Natterer's bat was recorded early in the evening towards the north-west of the study area, indicating the likely presence of a roost in the vicinity.

In winter bats may roost in parts of buildings in cooler areas with stable temperatures. The potential for bats to hibernate in dwellings at the periphery of the study area cannot be excluded, however the outbuildings surveyed are unlikely to provide stable temperatures in the winter. No caves or other underground features are known to exist at the proposed study area and its environs.

The bridges over the Oakfront Stream were considered to be of negligible suitability for roosting bats.

No trees of moderate or high suitability for roosting bats were recorded in the study area.

Figure 3-1: Location map of bat roosts recorded within the proposed wind farm study area at Annagh

4 Assessment

This section provides a general commentary on constraints and potential impacts of the proposed wind farm in relation to bat roosts.

4.1 Constraints

The outbuildings situated in the north of the study area at Annagh support two minor summer roosts of pipistrelle bats and the dwelling in the south-east of the study area supports a common and soprano pipistrelle maternity roost. As detailed in Section 1.1, all Irish bats are protected under the Wildlife Act (Revised). Destruction, alteration or evacuation of a known bat roost is a notifiable action under current legislation and a derogation licence has to be obtained from the National Parks and Wildlife Service (NPWS) before works can commence.

In addition, it should be noted that any works interfering with bats and especially their roosts, may only be carried out under a licence to derogate from Regulation 23 of the Habitats Regulations 1997, (which transposed the EU Habitats Directive into Irish law) issued by the NPWS.

4.2 Potential Impacts

This section provides a general high-level overview of potential impacts on the pipistrelle roost sites recorded within the study area at Annagh. A more detailed assessment of the potential impact of the proposed wind farm development at Annagh on bats can be found in the EIAR for the proposed development.

As outlined by Scottish Natural Heritage (2019), 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

5 Recommendations

No demolition or construction works are proposed to the structures that are the subject of this report. As such, loss of, or damage to roosts will be avoided.

Disturbance of occupied roosts should be prevented by restricting construction activities in their vicinity.

There should be no direct illumination of known bat roosts as identified in this report (Figure 3-2). Lighting shall be directed away from the roosts by the use of directional lighting (i.e. lighting which only shines on the proposed works and not nearby countryside) to prevent overspill. This shall be achieved by the design of the luminaire and by using accessories such as hoods, cowls, louvres and shields to direct the light to the intended area only.

If, for unforeseen reasons, works to a structure identified as a bat roost become unavoidable it will be necessary to apply for a derogation licence from NPWS wildlife licencing section before works are allowed. The destruction of known roosts cannot proceed without a derogation licence (Section 23 & 34 licence prescribed under the Wildlife Act 1976 (as amended); and Section 54 of the European Communities (Birds and Natural Habitats) Regulations 2011 (as amended) being in place and specific mitigation measures being approved in advance with NPWS.

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Appendix A: Description of Irish Bat Species

Ireland has ten known bat species from two distinct families. Each is briefly described below. For a more comprehensive overview see Roche *et al* (2014). The conservation status of each species is derived from NPWS (2019).

__Vespertilionidae:__

Common pipistrelle (*Pipistrellus pipistrellus*)

This species was only recently separated from its sibling, the soprano or brown pipistrelle *P. pygmaeus*, which is detailed below (Barratt et al, 1997). The common pipistrelle's echolocation calls peak at 45 kHz. The species forages along linear landscape features such as hedgerows and treelines as well as within woodland. The conservation status of this species is Favourable.

Soprano pipistrelle (*Pipistrellus pygmaeus*)

The soprano pipistrelle's echolocation calls peak at 55 kHz, which distinguishes it readily from the common pipistrelle on detector. The pipistrelles are the smallest and most often seen of our bats, flying at head height and taking small prey such as midges and small moths. Summer roost sites are usually in buildings but tree holes and heavy ivy are also used. Roost numbers can exceed 1,500 animals in mid-summer. The conservation status of this species is Favourable.

Nathusius' pipistrelle (*Pipistrellus nathusii*)

Nathusius' pipistrelle is a recent addition to the Irish fauna and has mainly been recorded from the north-east of the island in Counties Antrim and Down (Richardson, 2000) and also in Fermanagh, Longford and Cavan. It has also been recorded in Counties Cork and Kerry (Kelleher, 2005). However, the known resident population is enhanced in the autumn months by an influx of animals from Scandinavian countries. The conservation status of this species is Favourable.

Leisler's bat (*Nyctalus leisleri*)

This species is Ireland's largest bat, with a wingspan of up to 320mm; it is also the third most common bat, preferring to roost in buildings, although it is sometimes found in trees and bat boxes. It is the earliest bat to emerge in the evening, flying fast and high with occasional steep dives to ground level, feeding on moths, caddis-flies and beetles. The echolocation calls are sometimes audible to the human ear being around 15 kHz at their lowest. The audible chatter from their roost on hot summer days is sometimes an aid to location. The conservation status of this species is Favourable.

Brown long-eared bat (*Plecotus auritus*)

This species of bat is a 'gleaner', hunting amongst the foliage of trees and shrubs, and hovering briefly to pick a moth or spider off a leaf, which it then takes to a sheltered perch to consume. They often land on the ground to capture their prey. Using its nose to emit its echolocation, the long-eared bat 'whispers' its calls so that the insects, upon which it preys, cannot hear its approach (and hence, it needs oversize ears to hear the returning echoes). As this is a whispering species, it is extremely difficult to monitor in the field as it is seldom heard on a bat detector. Furthermore, keeping within the foliage, as it does, it is easily overlooked. It prefers to roost in old buildings. The conservation status of this species is Favourable.

Natterer's bat (*Myotis nattereri*)

This species has a slow to medium flight, usually over trees but sometimes over water. It usually follows hedges and treelines to its feeding sites, consuming flies, moths, caddis-flies and spiders. Known roosts are usually in old stone buildings but they have been found in trees and bat boxes. The Natterer's bat is one of our least studied species and further work is required to establish its status in Ireland. The conservation status of this species is Favourable.

Daubenton's bat (*Myotis daubentonii*)

This bat species prefers feeding close to the surface of smooth water, either over rivers, canals, ponds, lakes or reservoirs but it can also be found foraging in woodlands. Flying at 15 kilometres per hour, it gaffs insects with its over-sized feet as they emerge from the surface of the water - feeding on caddis flies, moths, mosquitoes, midges etc. It is often found roosting beneath bridges or in tunnels and also makes use of hollows in trees. The conservation status of this species is Favourable.

Whiskered bat (*Myotis mystacinus*)

This species, although widely distributed, has been rarely recorded in Ireland. It is often found in woodland, frequently near water. Flying high, near the canopy, it maintains a steady beat and sometimes glides as it hunts. It also gleans spiders from the foliage of trees. Whiskered bats prefer to roost in buildings, under slates, lead flashing or exposed beneath the ridge beam within attics. However, they also use cracks and holes in trees and sometimes bat boxes. The conservation status of this species is Favourable.

Brandt's bat (*Myotis brandtii*)

According to NPWS (2013), whiskered and Brandt's bats are cryptic species and can only be told apart using DNA techniques. Brand't bat has been confirmed only once from Ireland; a single specimen found in 2003 in Wicklow (Mullen, 2006). Following this discovery, an intensive re-survey, involving DNA testing, was undertaken of all known whiskered bat roosts in Ireland, by the Centre for Irish Bat Research. Woodland mist-netting was also conducted for the species. Despite the extensive survey-work, no further Brandt's bats were identified. The most recent Red Data List for Irish Mammals (Marnell *et al*. 2009) lists Brandt's bat as data deficient. There is no evidence of any roosts for this species in the country and at present the single record for the species is considered an anomaly. Boston et al (2010) concluded that "M. brandtii …. cannot currently be considered a resident species. This species is now considered a vagrant to the country and consequently, a detailed assessment has not been carried out.

<u>Rhinolophidae:</u>

Lesser horseshoe bat (*Rhinolophus hipposideros*)

This species is the only representative of the Rhinolophidae or horseshoe bat family in Ireland. It differs from our other species in both habits and looks, having a unique nose leaf with which it projects its echolocation calls. It is also quite small and, at rest, wraps its wings around its body. Lesser horseshoe bats feed close to the ground, gleaning their prey from branches and stones. It often carries its prey to a perch to consume, leaving the remains beneath as an indication of its presence. The echolocation call of this species is of constant frequency and, on a heterodyne bat detector, sounds like a melodious warble. The species is confined to six counties along the Atlantic seaboard: Mayo, Galway, Clare, Limerick, Kerry and Cork. The current Irish national population is estimated at 12,500 animals. This species is listed on Annex II of the EC Habitats Directive and 41 Special Areas of

Conservation have been designated in Ireland for its protection. Where it occurs, it is often found roosting within farm buildings. The conservation status of this species is Inadequate.

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APPENDIX B

Habitat Map

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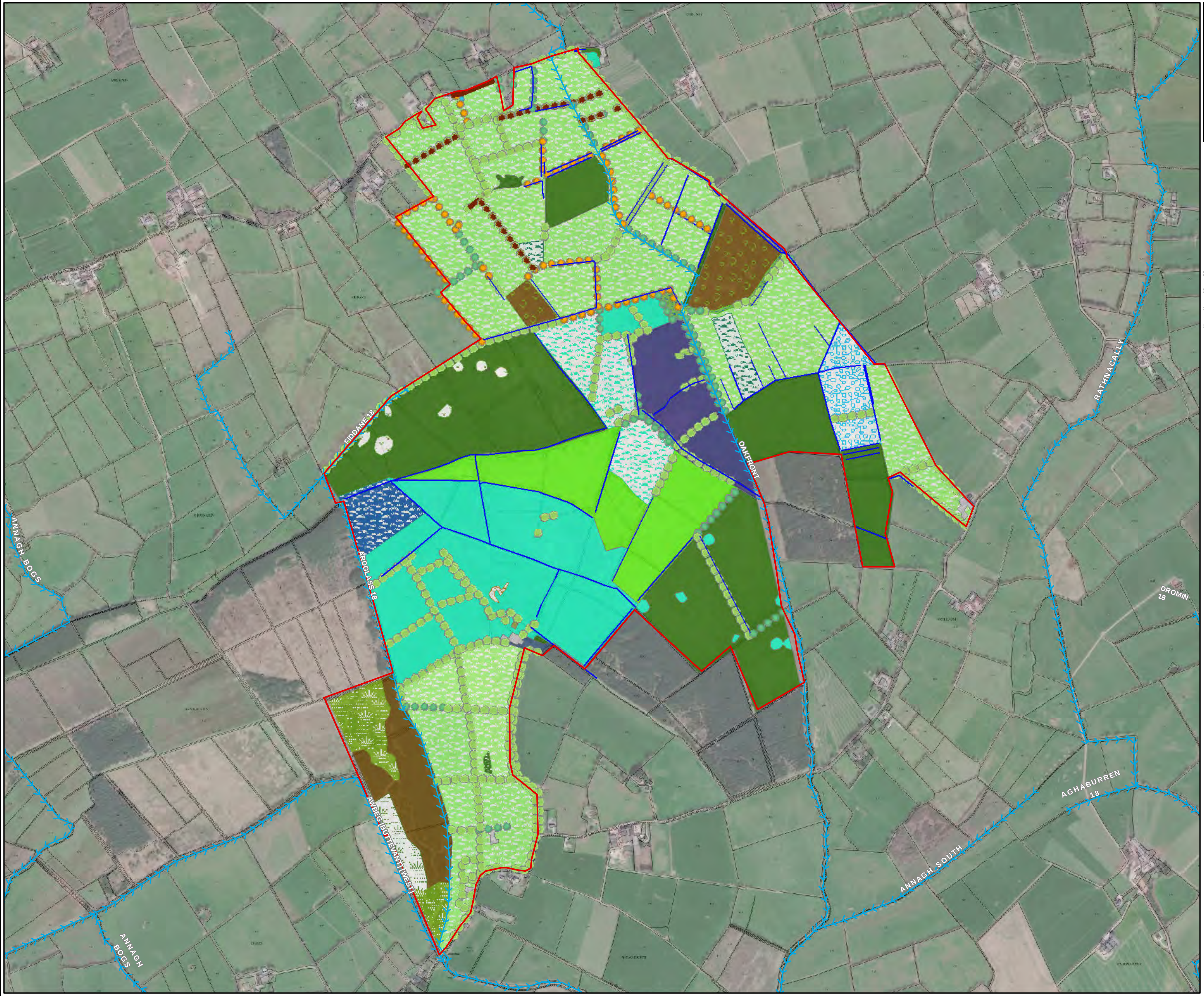

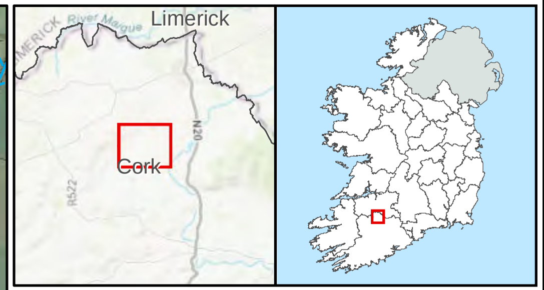

Legend

- Study Area
- Rivers

Linear Habitats

- BL2 Earth banks
- ED2 Spoil and bare ground
- FW4 Drainage ditches
- WL1 Hedgerows
- WL1/BL2 Hedgerows / Earth banks
- WL1/WL2 Hedgerows / Treelines
- WL2 Treelines

Habitat Areas

- BL1 Stone walls and other stonework
- BL3 Buildings and artificial surfaces
- ED3/WS1 Recolonising bare ground / Scrub
- ED5 Refuse and other waste
- FL8 Other artificial lakes and ponds
- FS1/WD1 Reed and large sedge swamps / (Mixed) broadleaved woodland
- FS1/WD4 Reed and large sedge swamps / Conifer plantation
- GA1 Improved agricultural grassland
- GA1 Improved agricultural grassland (Rank)
- GS4 Wet grassland
- GS4 Wet grassland [Wet Meadow]
- GS4/GA1 Wet grassland / Improved agricultural grassland
- GS4/GM1 Wet grassland / Marsh
- GS4/GM1/WD4 Wet grassland / Marsh / Conifer plantation
- GS4/GS2 Wet grassland / Dry meadows and grassy verges
- GS4/WS1 Wet grassland / Scrub
- WD1 (Mixed) broadleaved woodland
- WD1/WS1 (Mixed) broadleaved woodland / Scrub
- WD2 Mixed broadleaved/conifer woodland
- WD4 Conifer plantation
- WS1 Scrub
- WS2 Immature woodland

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PROJECT:	Annagh Wind Farm		
FIGURE NO:	8.10		
CLIENT:	EMP Group		
SCALE:	1:12500	**REVISION:**	0
DATE:	14/07/2021	**PAGE SIZE:**	A3

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APPENDIX C

Description of Irish Bat Species

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This species was only recently separated from its sibling, the soprano or brown pipistrelle *P. pygmaeus*, which is detailed below (Barratt et al, 1997). The common pipistrelle's echolocation calls peak at 45 kHz. The species forages along linear landscape features such as hedgerows and treelines as well as within woodland. The conservation status of this species is Favourable.

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The soprano pipistrelle's echolocation calls peak at 55 kHz, which distinguishes it readily from the common pipistrelle on detector. The pipistrelles are the smallest and most often seen of our bats, flying at head height and taking small prey such as midges and small moths. Summer roost sites are usually in buildings but tree holes and heavy ivy are also used. Roost numbers can exceed 1,500 animals in mid-summer. The conservation status of this species is Favourable.

Nathusius' pipistrelle (*Pipistrellus nathusii*)
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This species of bat is a 'gleaner', hunting amongst the foliage of trees and shrubs, and hovering briefly to pick a moth or spider off a leaf, which it then takes to a sheltered perch to consume. They often land on the ground to capture their prey. Using its nose to emit its echolocation, the long-eared bat 'whispers' its calls so that the insects, upon which it preys, cannot hear its approach (and hence, it needs oversize ears to hear the returning echoes). As this is a whispering species, it is extremely difficult to monitor in the field as it is seldom heard on a bat detector. Furthermore, keeping within the foliage, as it does, it is easily overlooked. It prefers to roost in old buildings. The conservation status of this species is Favourable.

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Whiskered bat (*Myotis mystacinus*)
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Brandt's bat (*Myotis brandtii*)
According to NPWS (2013), whiskered and Brandt's bats are cryptic species and can only be told apart using DNA techniques. Brand't bat has been confirmed only once from Ireland; a single specimen found in 2003 in Wicklow (Mullen, 2006). Following this discovery, an intensive re-survey, involving DNA testing, was undertaken of all known whiskered bat roosts in Ireland, by the Centre for Irish Bat Research. Woodland mist-netting was also conducted for the species. Despite the extensive survey-work, no further Brandt's bats were identified. The most recent Red Data List for Irish Mammals (Marnell *et al*. 2009) lists Brandt's bat as data deficient. There is no evidence of any roosts for this species in the country and at present the single record for the species is considered an anomaly. Boston et al (2010) concluded that "*M. brandtii* …. cannot currently be considered a resident species. This species is now considered a vagrant to the country and consequently, a detailed assessment has not been carried out.

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Lesser horseshoe bat (*Rhinolophus hipposideros*)
This species is the only representative of the Rhinolophidae or horseshoe bat family in Ireland. It differs from our other species in both habits and looks, having a unique nose leaf with which it projects its echolocation calls. It is also quite small and, at rest, wraps its wings around its body. Lesser horseshoe bats feed close to the ground, gleaning their prey from branches and stones. It often carries its prey to a perch to consume, leaving the remains beneath as an indication of its presence. The echolocation call of this species is of constant frequency and, on a heterodyne bat detector, sounds like a melodious warble. The species is confined to six counties along the Atlantic seaboard: Mayo, Galway, Clare, Limerick, Kerry and Cork. The current Irish national population is estimated at 12,500 animals. This species is listed on Annex II of the EC Habitats Directive and 41 Special Areas of Conservation have been designated in Ireland for its protection. Where it occurs, it is often found roosting within farm buildings. The conservation status of this species is Favourable.

FEHILY TIMONEY

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APPENDIX D

Ecobat Analysis Reports for Periods 1 – 3 2020

This report was produced free of charge by the Mammal Society to support evidence-based conservation of bats.

The following analyses are based on data supplied by the user to the Mammal Society's Ecobat website. The outputs are designed to assist decision-making, but do not replace expert interpretation by the user. The creation of the Ecobat tool was supported by the Natural Environment Research Council (NERC).

Bat Activity Analysis

Site Name: Annagh

Author: Fehily Timoney

31/05/2021

Summary

Bats were detected on **12** nights between **2020-04-23** and **2020-05-04**, using **6** static bat detectors. Throughout this period **10** species were recorded. **Table 1.** Detectors were placed at the following locations:

Detector ID	Latitude	Longitude
A6	52.29963	-8.739770
A3	52.30642	-8.735358
A7	52.30073	-8.730829
A8	52.30140	-8.723312
A2	52.31032	-8.724717
A5	52.30781	-8.717422

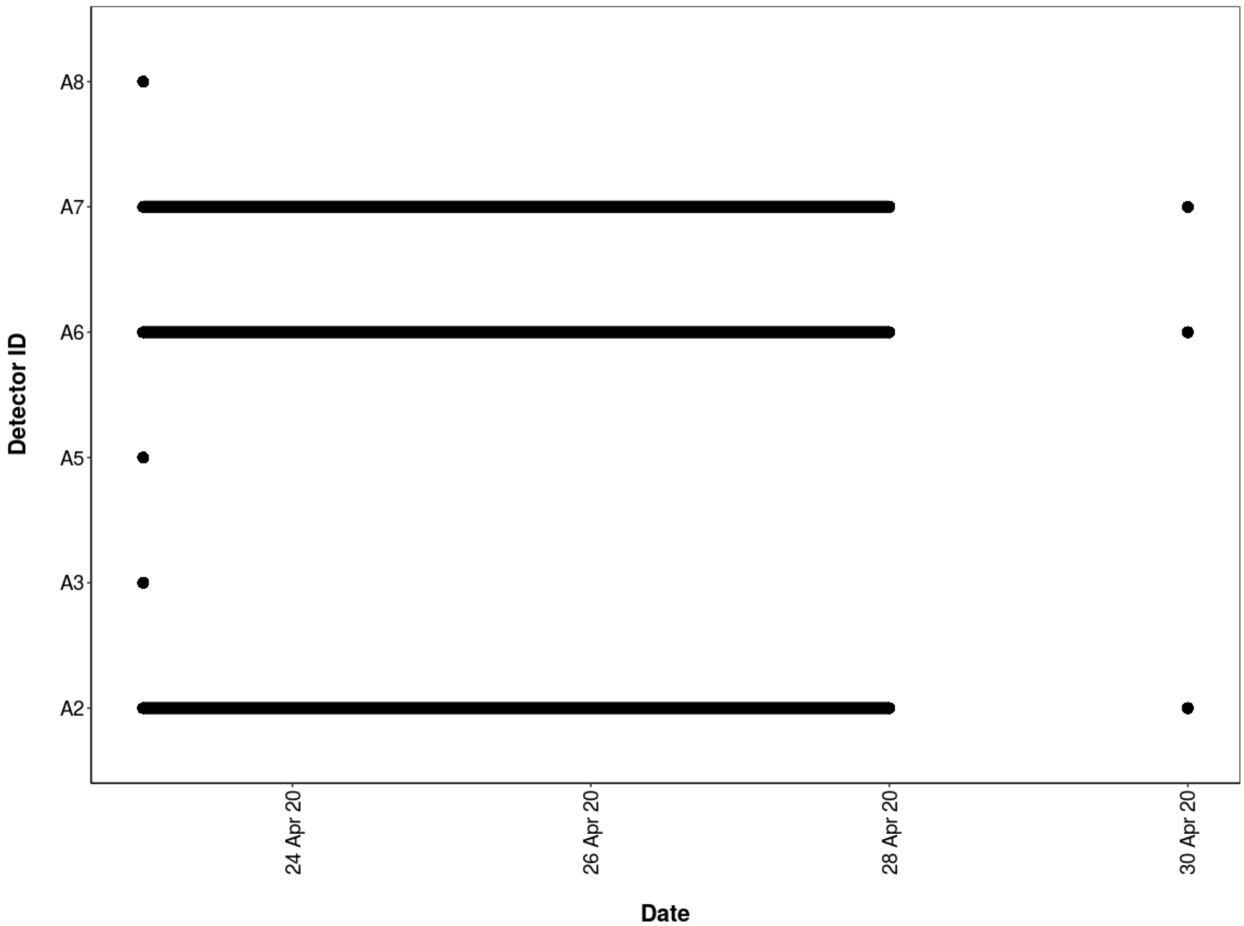
Survey Nights

Table 2. The number of nights that bats were detected on each recorder. This is not the same as the number of nights that detectors were active if there were nights when no bats were detected.

Detector ID	No. of nights
A2	11
A3	12
A5	12
A6	11
A7	11
A8	12

Survey Nights

Figure 1. Horizontal bars show nights when acoustic detectors recorded bats.



PART 1: Percentiles Analysis

This first part of the analysis looks at the relative activity levels of the bats you recorded. We take your value for the total bat passes each night for each species, and compare this to the values in our reference database. We tell you what percentile your data falls at, and therefore what the relative activity level is. For example, if the reference database has values of 5, 10, 15, 20 and you submit a value of 18, this will be the 80th percentile, and be classed as high activity.

The reference range dataset was stratified to include:

- Only records from within 30 days of the survey date.
- Only records from within 100km radius of the survey location.
- Records using any make of bat detector.

PER DETECTOR

Table 3. Summary table showing the number of nights recorded bat activity fell into each activity band for each species.

Detector ID	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
A2	*Myotis*	0	0	0	0	2
A2	*Myotis daubentonii*	0	0	1	5	2
A2	*Myotis mystacinus*	0	0	0	0	1
A2	*Myotis nattereri*	0	0	0	0	2
A2	*Nyctalus leisleri*	10	1	0	0	0
A2	*Pipistrellus*	10	0	0	0	0
A2	*Pipistrellus nathusii*	0	3	1	3	2
A2	*Pipistrellus pipistrellus*	8	2	0	1	0
A2	*Pipistrellus pygmaeus*	6	2	2	1	0
A2	*Plecotus auritus*	0	0	0	2	4
A3	*Myotis*	2	4	2	1	0
A3	*Myotis daubentonii*	0	3	2	4	0
A3	*Myotis mystacinus*	0	0	0	0	5
A3	*Myotis nattereri*	0	3	2	2	2
A3	*Nyctalus leisleri*	9	3	0	0	0
A3	*Pipistrellus*	10	0	0	0	0
A3	*Pipistrellus nathusii*	0	1	0	2	3
A3	*Pipistrellus pipistrellus*	6	2	2	0	0
A3	*Pipistrellus pygmaeus*	10	0	0	0	0
A3	*Plecotus auritus*	0	1	2	4	1

A5	*Myotis daubentonii*	0	0	2	7	0
A5	*Myotis mystacinus*	0	0	0	4	5
A5	*Myotis nattereri*	0	0	0	1	2
A5	*Nyctalus leisleri*	9	2	1	0	0
A5	*Pipistrellus*	1	0	0	0	0
A5	*Pipistrellus nathusii*	1	2	4	2	0
A5	*Pipistrellus pipistrellus*	8	2	1	0	0
A5	*Pipistrellus pygmaeus*	7	3	1	0	0
A5	*Plecotus auritus*	0	0	2	5	3
A6	*Myotis*	0	0	0	2	1
A6	*Myotis daubentonii*	0	0	0	6	1
A6	*Myotis mystacinus*	0	0	0	0	1
A6	*Myotis nattereri*	0	0	0	0	2
A6	*Nyctalus leisleri*	6	3	1	1	0
A6	*Pipistrellus nathusii*	0	0	1	1	1
A6	*Pipistrellus pipistrellus*	1	6	1	1	0
A6	*Pipistrellus pygmaeus*	0	7	1	2	0
A6	*Plecotus auritus*	0	0	0	0	5
A7	*Myotis*	0	0	0	4	0
A7	*Myotis daubentonii*	0	0	0	3	4
A7	*Myotis mystacinus*	0	0	0	0	1
A7	*Myotis nattereri*	0	0	0	2	1
A7	*Nyctalus leisleri*	5	5	1	0	0
A7	*Pipistrellus*	6	1	0	0	0
A7	*Pipistrellus nathusii*	0	0	0	6	2

A7	*Pipistrellus pipistrellus*	5	2	1	1	1
A7	*Pipistrellus pygmaeus*	6	2	1	1	1
A7	*Plecotus auritus*	0	0	0	5	1
A8	*Myotis*	0	0	0	2	1
A8	*Myotis daubentonii*	0	0	0	3	1
A8	*Nyctalus leisleri*	10	0	2	0	0
A8	*Pipistrellus*	4	2	0	0	0
A8	*Pipistrellus nathusii*	0	1	0	2	3
A8	*Pipistrellus pipistrellus*	2	3	2	3	0
A8	*Pipistrellus pygmaeus*	1	3	3	1	3
A8	*Plecotus auritus*	0	0	0	0	4

Table 4. Summary table showing key metrics for each species recorded. The reference range is the number of nights for each species that your data were compared to. We recommend a Reference Range of 200+ to be confident in the relative activity level.

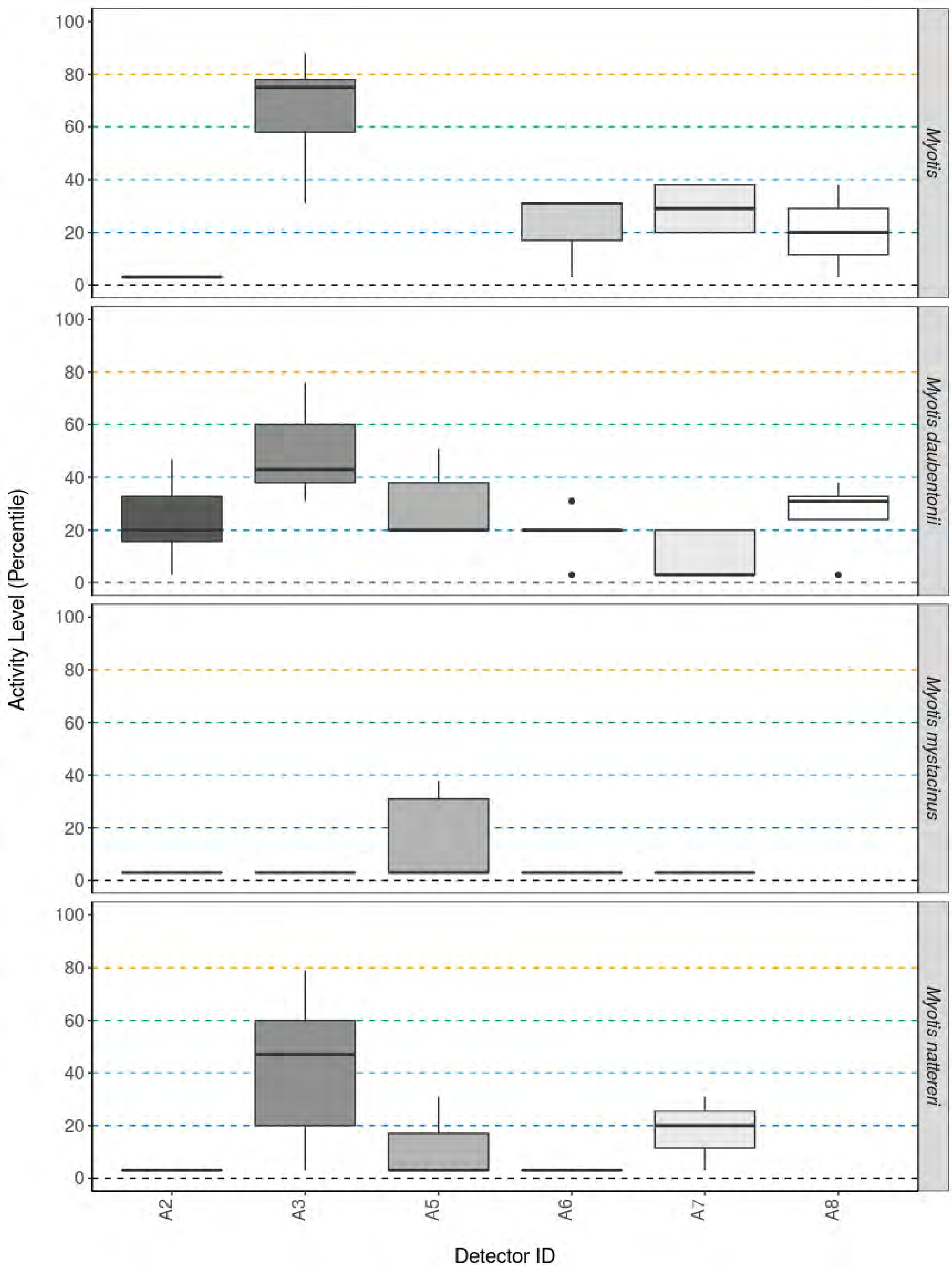
Detector ID	Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded	Reference Range
A2	*Myotis*	3	3 - 3	3	2	754
A2	*Myotis daubentonii*	20	11.5 - 38	47	8	55
A2	*Myotis mystacinus*	3	0	3	1	21
A2	*Myotis nattereri*	3	3 - 3	3	2	38
A2	*Nyctalus leisleri*	92	83 - 93	96	11	1041
A2	*Pipistrellus*	97	89 - 98	99	10	1287
A2	*Pipistrellus nathusii*	38	17 - 60	69	9	203
A2	*Pipistrellus pipistrellus*	95	59.5 - 97	99	11	1075
A2	*Pipistrellus pygmaeus*	82	54 - 88	95	11	937
A2	*Plecotus auritus*	3	3 - 17	31	6	379
A3	*Myotis*	75	54 - 81.5	88	9	754
A3	*Myotis daubentonii*	43	38 - 61.5	76	9	55
A3	*Myotis mystacinus*	3	3 - 3	3	5	21
A3	*Myotis nattereri*	47	20 - 60	79	9	38
A3	*Nyctalus leisleri*	96	80.5 - 97.5	99	12	1041
A3	*Pipistrellus*	100	96 - 100	100	10	1287
A3	*Pipistrellus nathusii*	17	3 - 34.5	66	6	203
A3	*Pipistrellus pipistrellus*	85	65.5 - 87.5	88	10	1075

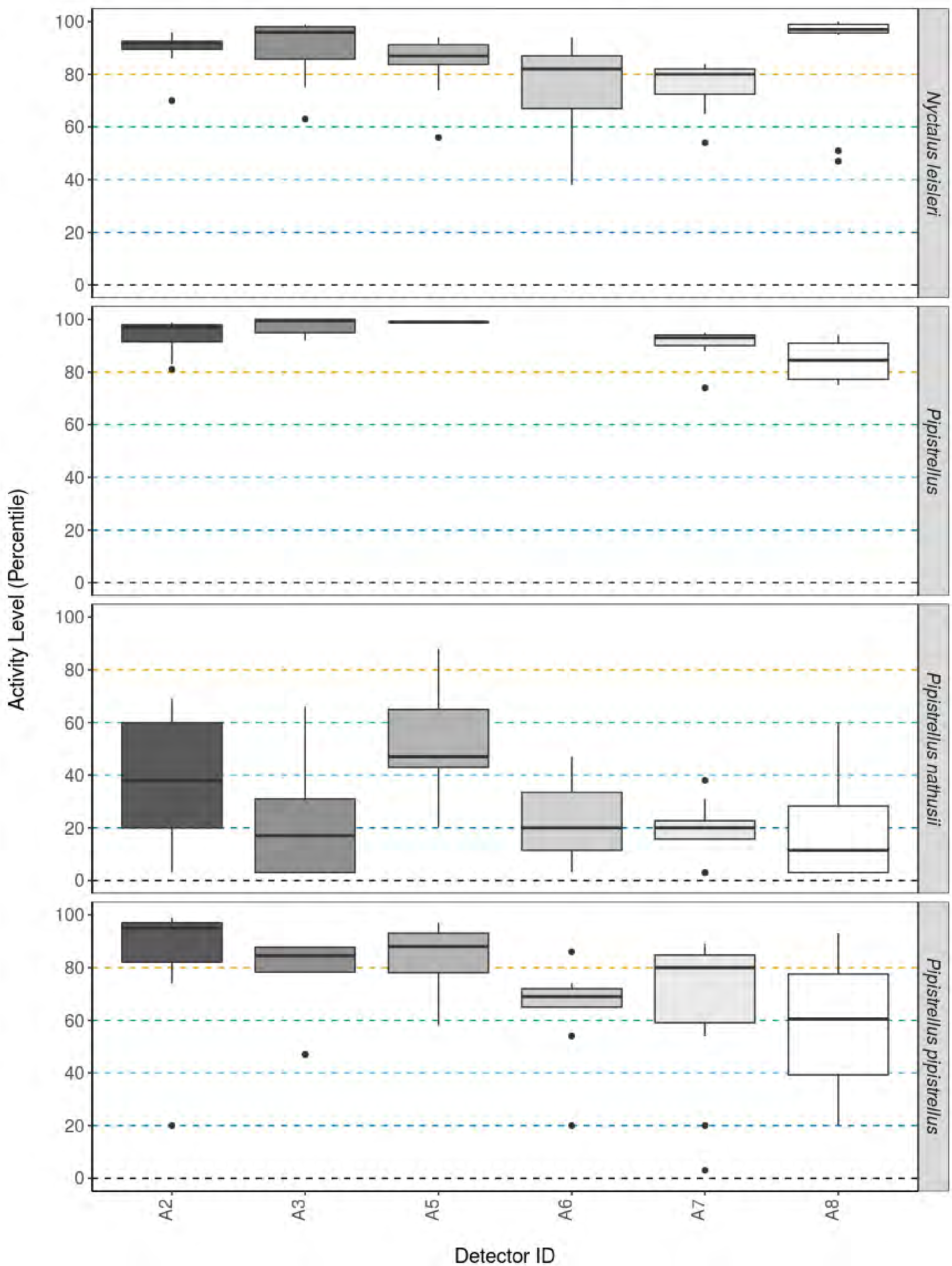
A3	*Pipistrellus pygmaeus*	99	93.5 - 100	100	10	937
A3	*Plecotus auritus*	35	17 - 56	74	8	379
A5	*Myotis daubentonii*	20	20 - 35.5	51	9	55
A5	*Myotis mystacinus*	3	3 - 25.5	38	9	21
A5	*Myotis nattereri*	3	3 - 3	31	3	38
A5	*Nyctalus leisleri*	87	77 - 91	94	12	1041
A5	*Pipistrellus*	99	0	99	1	1287
A5	*Pipistrellus nathusii*	47	38 - 69	88	9	203
A5	*Pipistrellus pipistrellus*	88	73.5 - 93	97	11	1075
A5	*Pipistrellus pygmaeus*	89	73 - 93	97	11	937
A5	*Plecotus auritus*	20	11.5 - 37	43	10	379
A6	*Myotis*	31	31 - 31	31	3	754
A6	*Myotis daubentonii*	20	11.5 - 25.5	31	7	55
A6	*Myotis mystacinus*	3	0	3	1	21
A6	*Myotis nattereri*	3	3 - 3	3	2	38
A6	*Nyctalus leisleri*	82	62.5 - 87	94	11	1041
A6	*Pipistrellus nathusii*	20	3 - 47	47	3	203
A6	*Pipistrellus pipistrellus*	69	45 - 76.5	86	9	1075
A6	*Pipistrellus pygmaeus*	71	45.5 - 73	79	10	937
A6	*Plecotus auritus*	3	3 - 3	3	5	379
A7	*Myotis*	29	20 - 38	38	4	754
A7	*Myotis daubentonii*	3	3 - 11.5	20	7	55

A7	*Myotis mystacinus*	3	0	3	1	21
A7	*Myotis nattereri*	20	3 - 31	31	3	38
A7	*Nyctalus leisleri*	80	68 - 82	84	11	1041
A7	*Pipistrellus*	93	81 - 94.5	95	7	1287
A7	*Pipistrellus nathusii*	20	11.5 - 29	38	8	203
A7	*Pipistrellus pipistrellus*	80	42.5 - 85.5	89	10	1075
A7	*Pipistrellus pygmaeus*	85	45.5 - 88	92	11	937
A7	*Plecotus auritus*	26	17 - 31	31	6	379
A8	*Myotis*	20	3 - 38	38	3	754
A8	*Myotis daubentonii*	31	17 - 34.5	38	4	55
A8	*Nyctalus leisleri*	97	73.5 - 99	100	12	1041
A8	*Pipistrellus*	85	76 - 92	94	6	1287
A8	*Pipistrellus nathusii*	12	3 - 31.5	60	6	203
A8	*Pipistrellus pipistrellus*	61	38 - 79	93	10	1075
A8	*Pipistrellus pygmaeus*	51	27 - 66	87	11	937
A8	*Plecotus auritus*	3	3 - 3	3	4	379

###Figures

Figure 2. The recorded activity of bats during the survey. The centre line indicates the median activity level whereas the box represents the interquartile range (the spread of the middle 50% of nights of activity)


Activity Level (Percentile)
Detector ID
Myotis
Myotis daubentonii
Myotis mystacinus
Myotis nattereri
A2
A3
A5
A6
A7
A8
0
20
40
60
80
100


Activity Level (Percentile)
Nyctalus leisleri
Pipistrellus
Pipistrellus nathusii
Pipistrellus pipistrellus
100
80
60
40
20
0
A2
A3
A5
A6
A7
A8
Detector ID

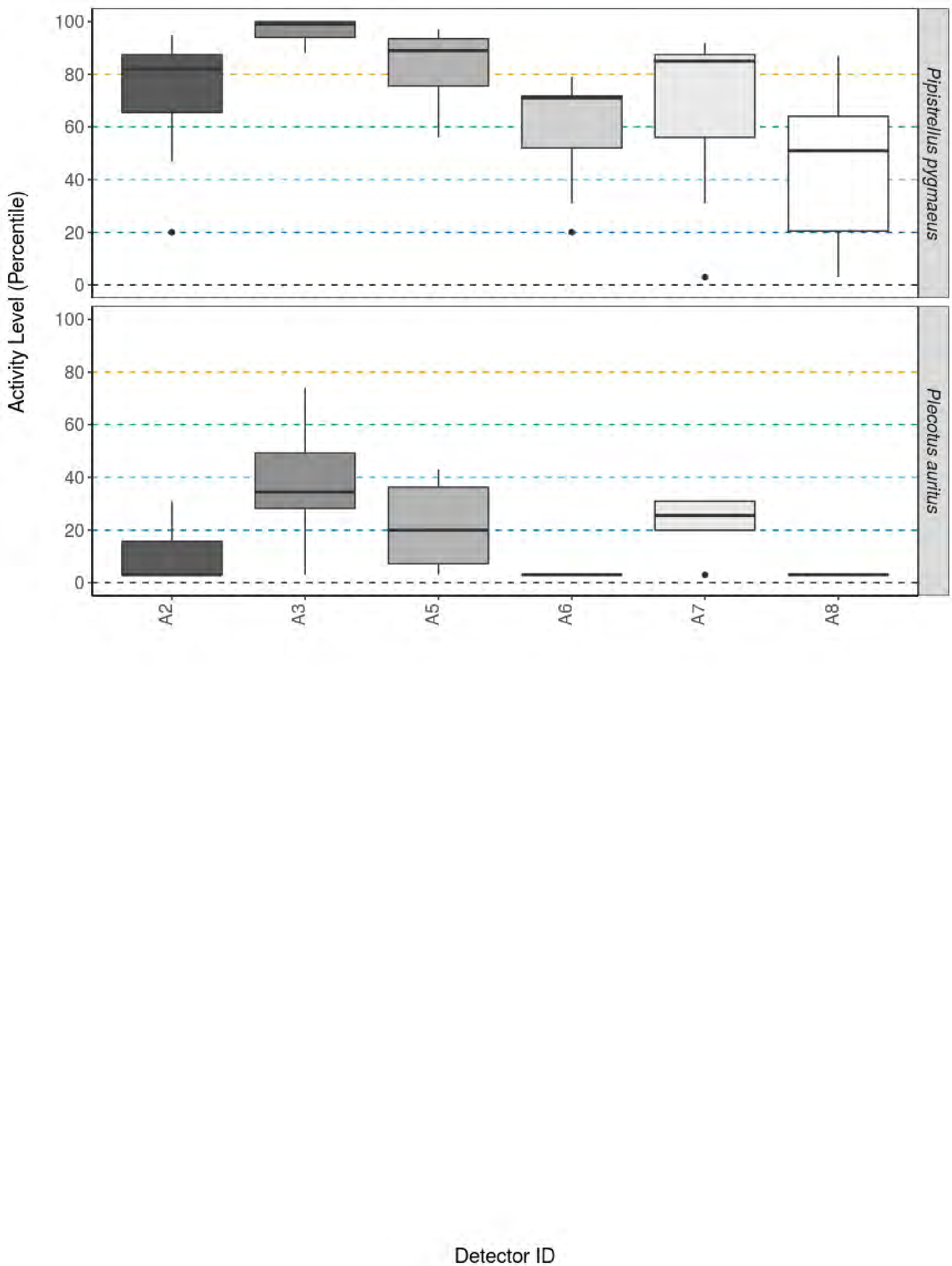
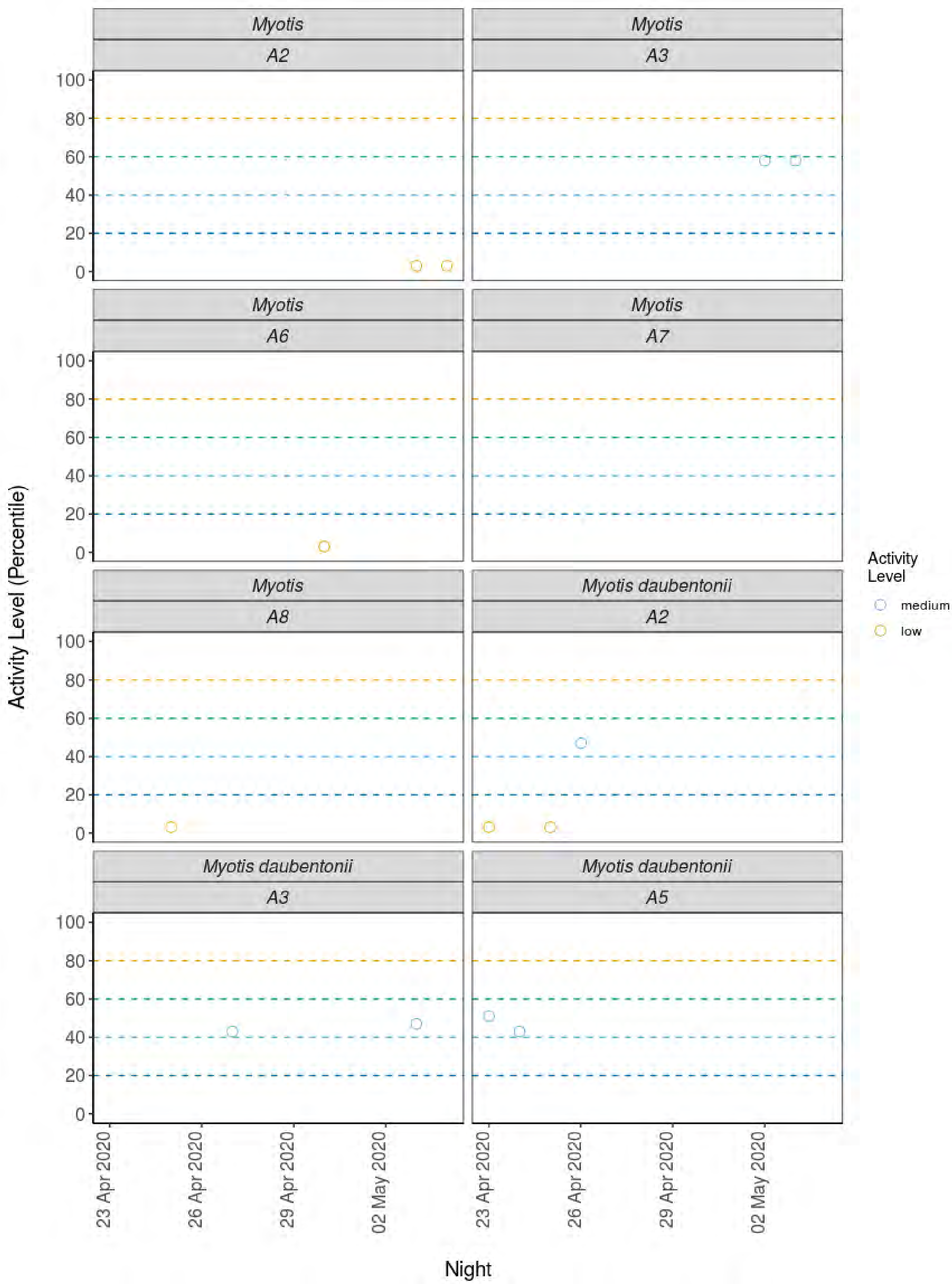
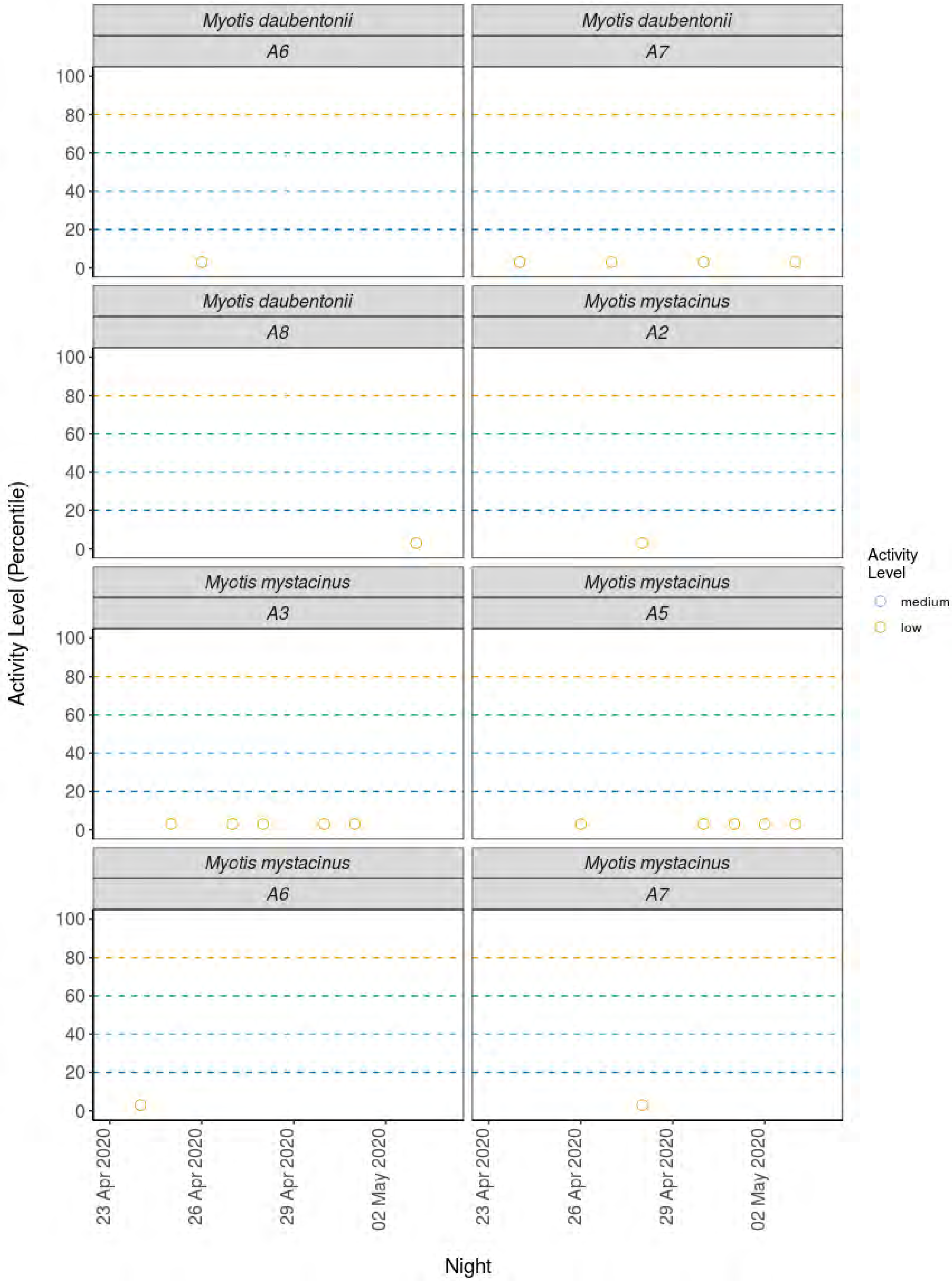

Activity Level (Percentile)
100
80
60
40
20
0
Pipistrellus pygmaeus
Plecotus auritus
A2
A3
A5
A6
A7
A8
Detector ID

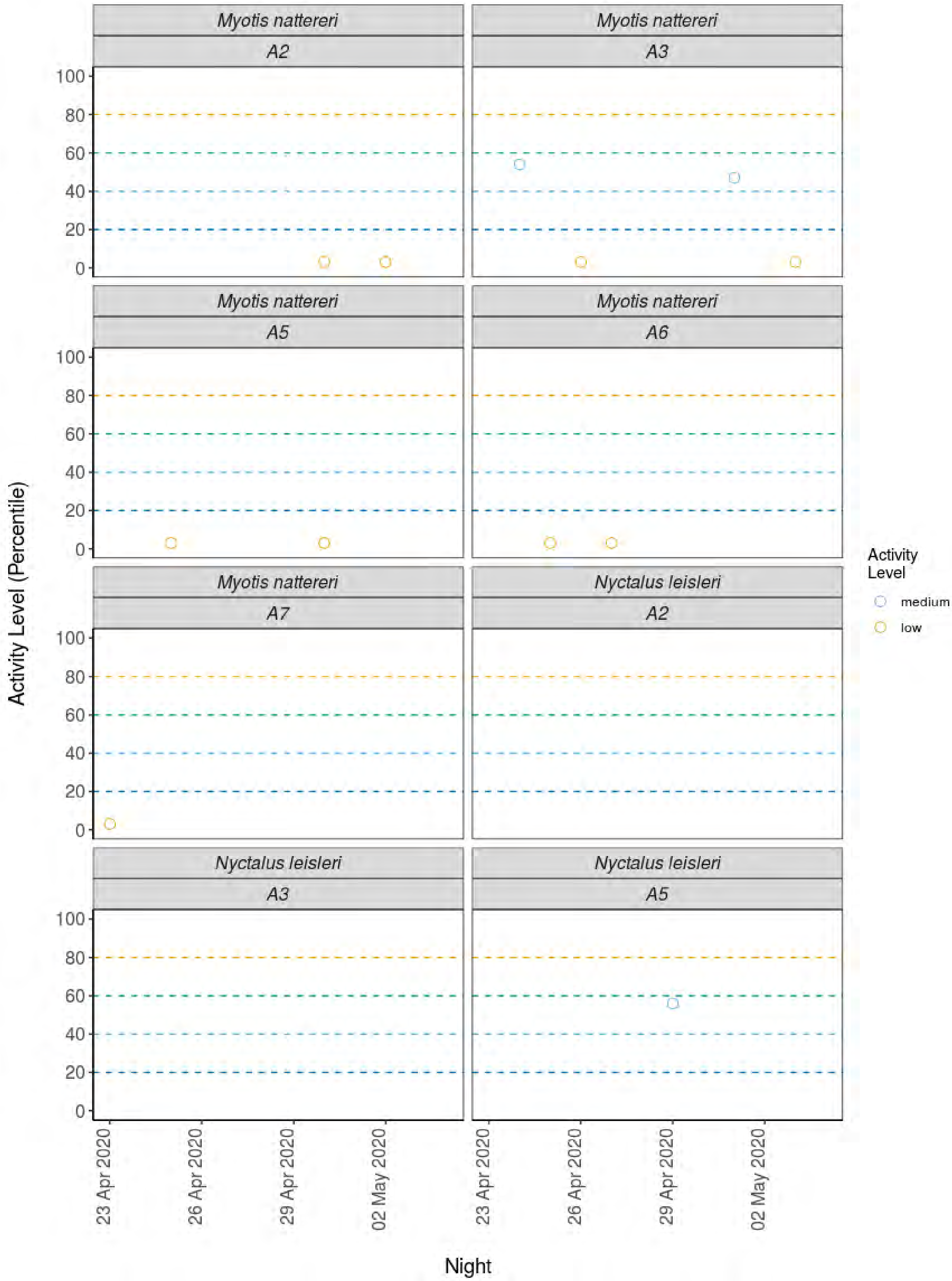
Figure 3. The activity level (percentile) of bats recorded across each night of the bat survey.



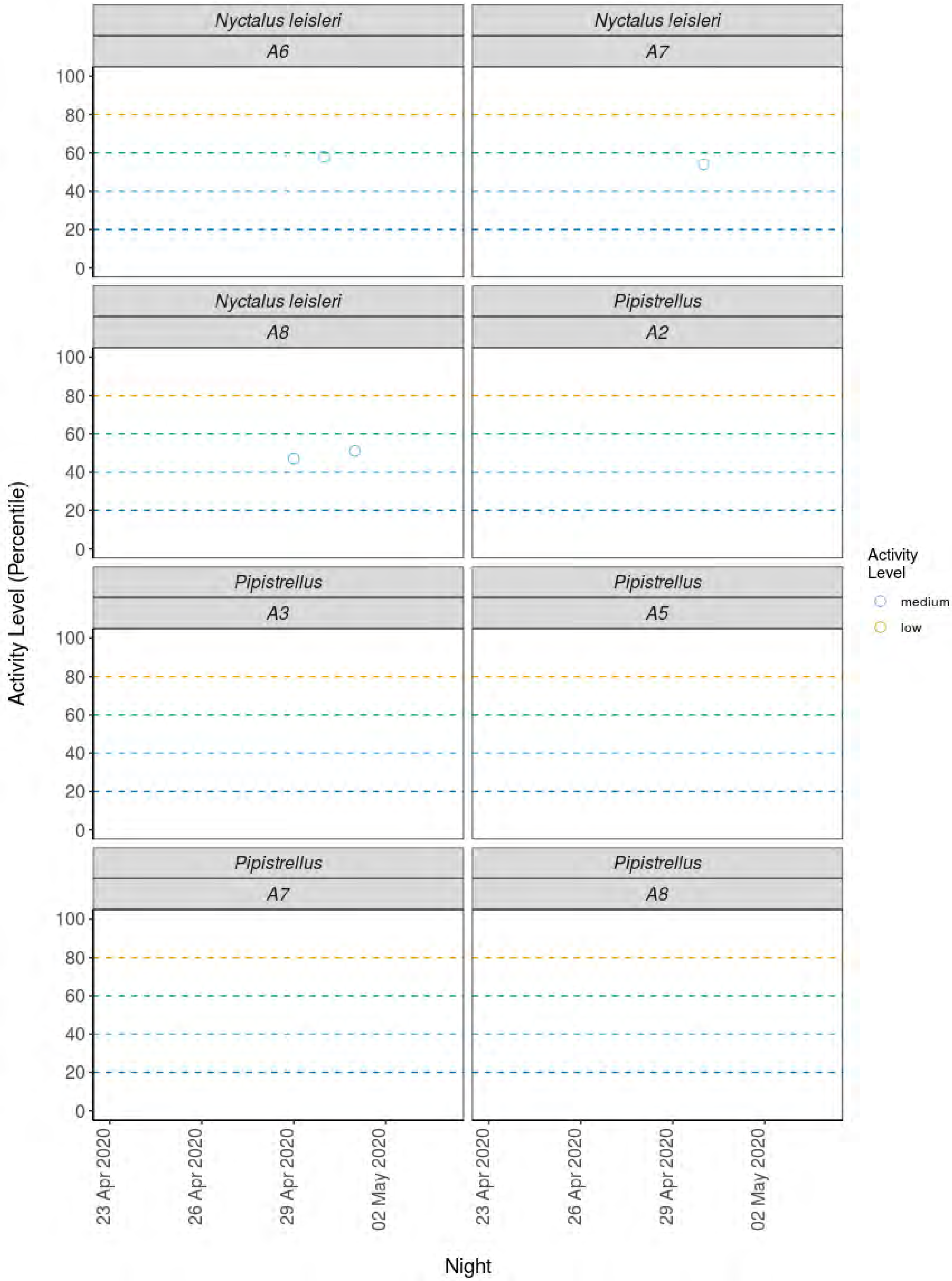
Myotis
A2
Myotis
A3
Myotis
A6
Myotis
A7
Myotis
A8
Myotis daubentonii
A2
Myotis daubentonii
A3
Myotis daubentonii
A5
Activity Level (Percentile)
100
80
60
40
20
0
23 Apr 2020
26 Apr 2020
29 Apr 2020
02 May 2020
Night
Activity Level
medium
low



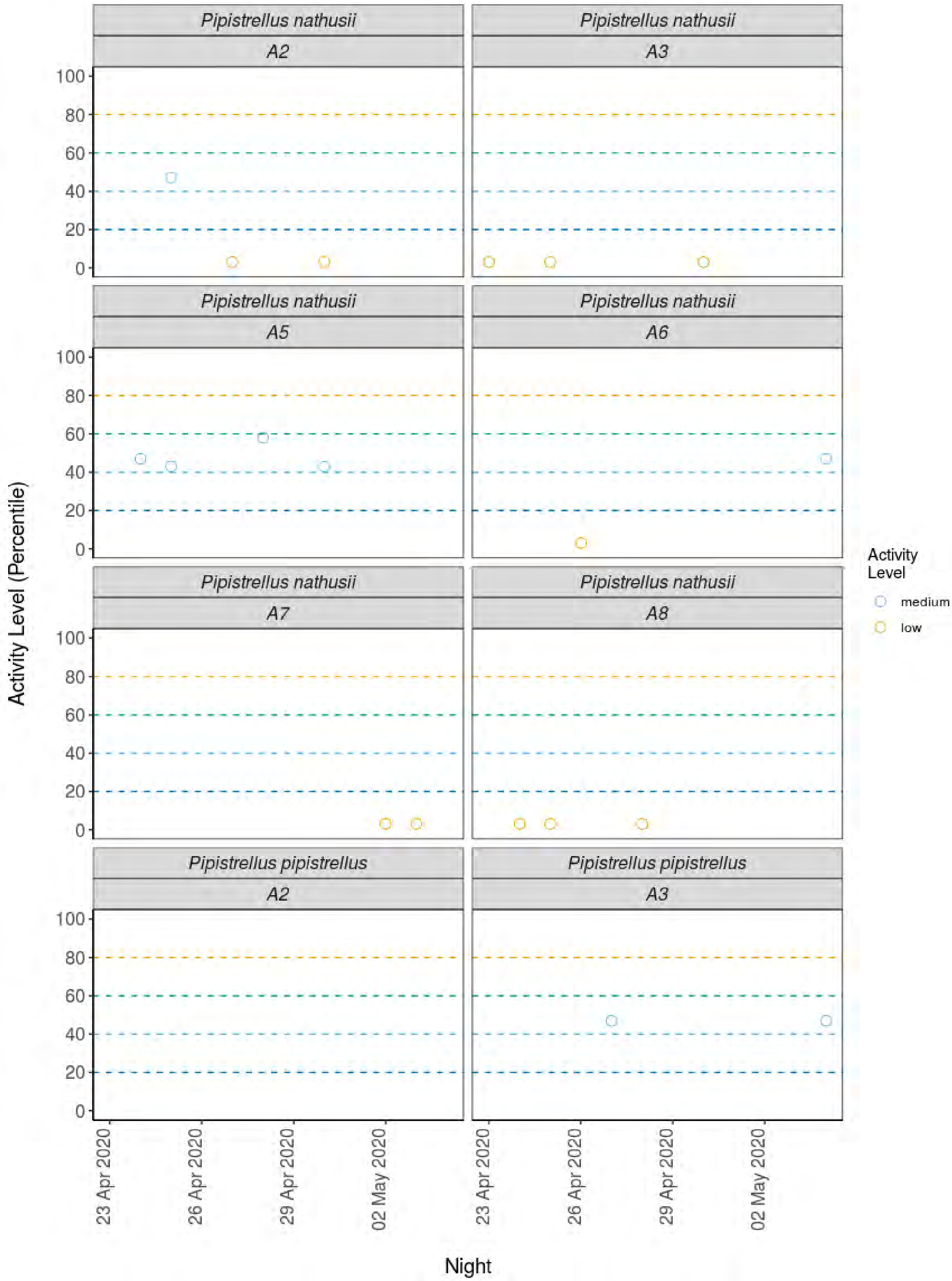
Myotis daubentonii
A6
Myotis daubentonii
A7
Myotis daubentonii
A8
Myotis mystacinus
A2
Myotis mystacinus
A3
Myotis mystacinus
A5
Myotis mystacinus
A6
Myotis mystacinus
A7
Activity Level (Percentile)
100
80
60
40
20
0
23 Apr 2020
26 Apr 2020
29 Apr 2020
02 May 2020
Night
Activity Level
medium
low



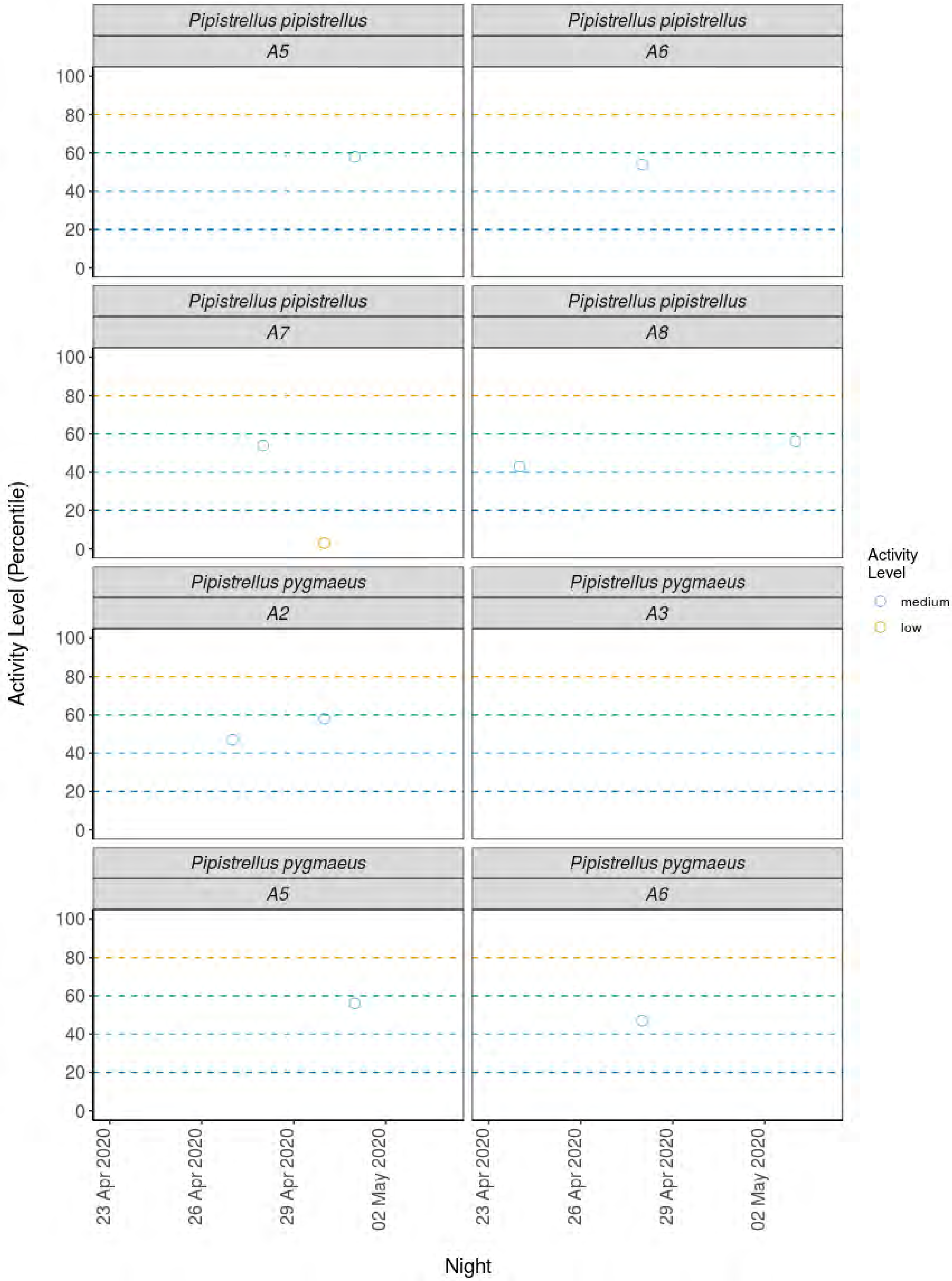
Myotis nattereri
A2
Myotis nattereri
A3
Myotis nattereri
A5
Myotis nattereri
A6
Myotis nattereri
A7
Nyctalus leisleri
A2
Nyctalus leisleri
A3
Nyctalus leisleri
A5
Activity Level (Percentile)
100
80
60
40
20
0
23 Apr 2020
26 Apr 2020
29 Apr 2020
02 May 2020
Night
Activity Level
medium
low

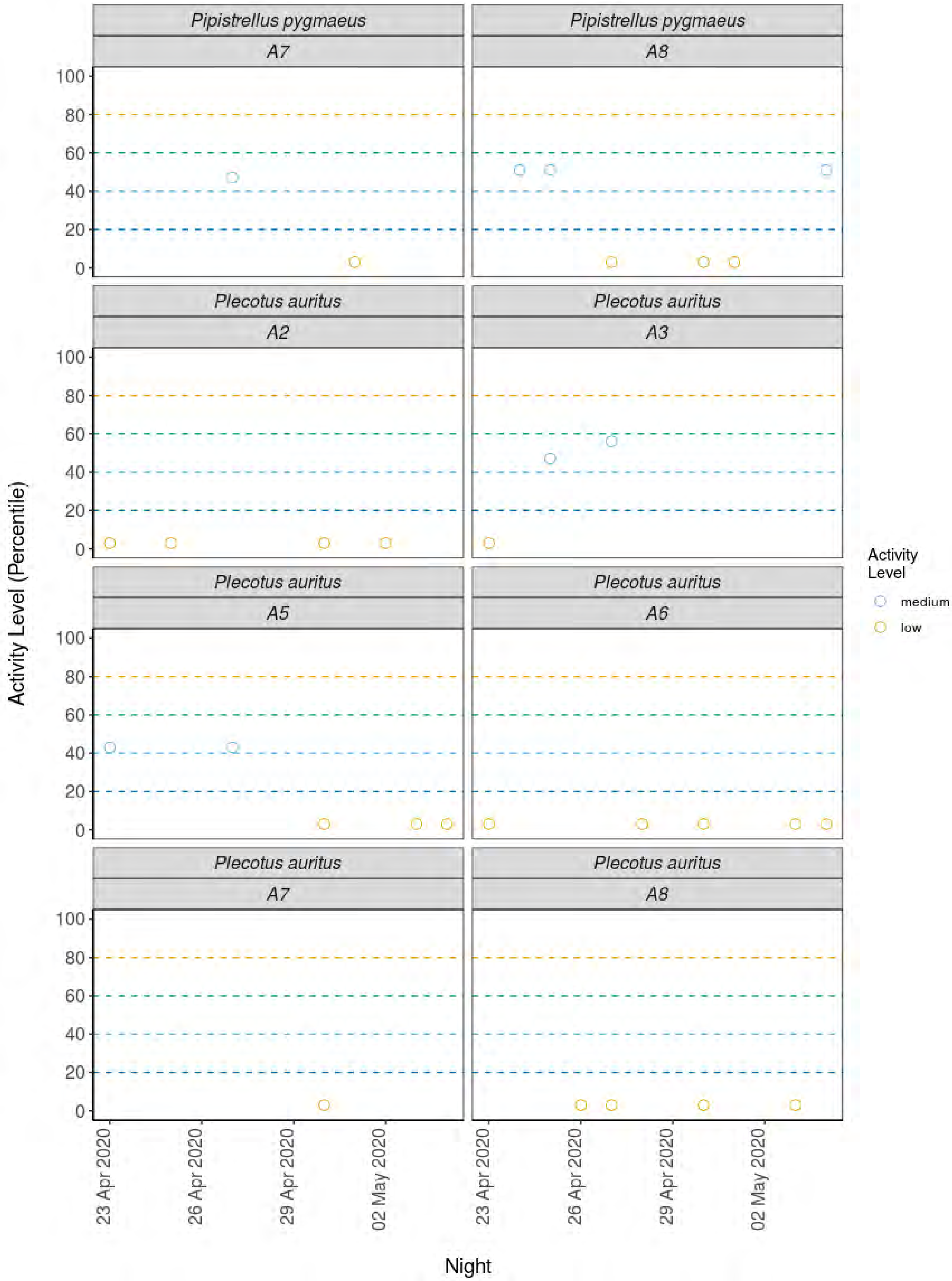


Nyctalus leisleri
A6
Nyctalus leisleri
A7
Nyctalus leisleri
A8
Pipistrellus
A2
Pipistrellus
A3
Pipistrellus
A5
Pipistrellus
A7
Pipistrellus
A8
Activity Level (Percentile)
100
80
60
40
20
0
23 Apr 2020
26 Apr 2020
29 Apr 2020
02 May 2020
Night
Activity Level
medium
low



Pipistrellus nathusii
A2
Pipistrellus nathusii
A3
Pipistrellus nathusii
A5
Pipistrellus nathusii
A6
Pipistrellus nathusii
A7
Pipistrellus nathusii
A8
Pipistrellus pipistrellus
A2
Pipistrellus pipistrellus
A3
Activity Level (Percentile)
0
20
40
60
80
100
23 Apr 2020
26 Apr 2020
29 Apr 2020
02 May 2020
Night
Activity Level
medium
low


Pipistrellus pipistrellus
A5
Pipistrellus pipistrellus
A6
Pipistrellus pipistrellus
A7
Pipistrellus pipistrellus
A8
Pipistrellus pygmaeus
A2
Pipistrellus pygmaeus
A3
Pipistrellus pygmaeus
A5
Pipistrellus pygmaeus
A6
Activity Level (Percentile)
0
20
40
60
80
100
23 Apr 2020
26 Apr 2020
29 Apr 2020
02 May 2020
Night
Activity Level
medium
low



Pipistrellus pygmaeus
A7
Pipistrellus pygmaeus
A8
Plecotus auritus
A2
Plecotus auritus
A3
Plecotus auritus
A5
Plecotus auritus
A6
Plecotus auritus
A7
Plecotus auritus
A8
Activity Level (Percentile)
100
80
60
40
20
0
23 Apr 2020
26 Apr 2020
29 Apr 2020
02 May 2020
Night
Activity Level
medium
low

PER DETECTOR, PER MONTH

Table 5. Summary table showing the number of nights recorded bat activity fell into each activity band for each species at each detector during each month.

Detector ID	Species/Species Group	Month	Nights of High Activity	Nights of Moderate / High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity
A2	*Myotis*	May	0	0	0	0	2
A2	*Myotis daubentonii*	Apr	0	0	1	3	2
A2	*Myotis daubentonii*	May	0	0	0	2	0
A2	*Myotis mystacinus*	Apr	0	0	0	0	1
A2	*Myotis nattereri*	Apr	0	0	0	0	1
A2	*Myotis nattereri*	May	0	0	0	0	1
A2	*Nyctalus leisleri*	Apr	7	0	0	0	0
A2	*Nyctalus leisleri*	May	3	1	0	0	0
A2	*Pipistrellus*	Apr	7	0	0	0	0
A2	*Pipistrellus*	May	3	0	0	0	0
A2	*Pipistrellus nathusii*	Apr	0	1	1	2	2
A2	*Pipistrellus nathusii*	May	0	2	0	1	0
A2	*Pipistrellus pipistrellus*	Apr	5	2	0	0	0
A2	*Pipistrellus pipistrellus*	May	3	0	0	1	0
A2	*Pipistrellus pygmaeus*	Apr	4	1	2	0	0
A2	*Pipistrellus pygmaeus*	May	2	1	0	1	0
A2	*Plecotus auritus*	Apr	0	0	0	1	3

A2	*Plecotus auritus*	May	0	0	0	1	1
A3	*Myotis*	Apr	2	3	0	1	0
A3	*Myotis*	May	0	1	2	0	0
A3	*Myotis daubentonii*	Apr	0	2	1	3	0
A3	*Myotis daubentonii*	May	0	1	1	1	0
A3	*Myotis mystacinus*	Apr	0	0	0	0	4
A3	*Myotis mystacinus*	May	0	0	0	0	1
A3	*Myotis nattereri*	Apr	0	3	1	2	1
A3	*Myotis nattereri*	May	0	0	1	0	1
A3	*Nyctalus leisleri*	Apr	7	1	0	0	0
A3	*Nyctalus leisleri*	May	2	2	0	0	0
A3	*Pipistrellus*	Apr	7	0	0	0	0
A3	*Pipistrellus*	May	3	0	0	0	0
A3	*Pipistrellus nathusii*	Apr	0	1	0	1	3
A3	*Pipistrellus nathusii*	May	0	0	0	1	0
A3	*Pipistrellus pipistrellus*	Apr	4	2	1	0	0
A3	*Pipistrellus pipistrellus*	May	2	0	1	0	0
A3	*Pipistrellus pygmaeus*	Apr	7	0	0	0	0
A3	*Pipistrellus pygmaeus*	May	3	0	0	0	0
A3	*Plecotus auritus*	Apr	0	1	2	3	1
A3	*Plecotus auritus*	May	0	0	0	1	0
A5	*Myotis daubentonii*	Apr	0	0	2	5	0
A5	*Myotis daubentonii*	May	0	0	0	2	0

A5	*Myotis mystacinus*	Apr	0	0	0	4	2
A5	*Myotis mystacinus*	May	0	0	0	0	3
A5	*Myotis nattereri*	Apr	0	0	0	1	2
A5	*Nyctalus leisleri*	Apr	7	0	1	0	0
A5	*Nyctalus leisleri*	May	2	2	0	0	0
A5	*Pipistrellus*	Apr	1	0	0	0	0
A5	*Pipistrellus nathusii*	Apr	1	0	4	1	0
A5	*Pipistrellus nathusii*	May	0	2	0	1	0
A5	*Pipistrellus pipistrellus*	Apr	5	2	0	0	0
A5	*Pipistrellus pipistrellus*	May	3	0	1	0	0
A5	*Pipistrellus pygmaeus*	Apr	5	2	0	0	0
A5	*Pipistrellus pygmaeus*	May	2	1	1	0	0
A5	*Plecotus auritus*	Apr	0	0	2	4	1
A5	*Plecotus auritus*	May	0	0	0	1	2
A6	*Myotis*	Apr	0	0	0	1	1
A6	*Myotis*	May	0	0	0	1	0
A6	*Myotis daubentonii*	Apr	0	0	0	4	1
A6	*Myotis daubentonii*	May	0	0	0	2	0
A6	*Myotis mystacinus*	Apr	0	0	0	0	1
A6	*Myotis nattereri*	Apr	0	0	0	0	2
A6	*Nyctalus leisleri*	Apr	3	3	1	0	0
A6	*Nyctalus leisleri*	May	3	0	0	1	0
A6	*Pipistrellus nathusii*	Apr	0	0	0	0	1

A6	*Pipistrellus nathusii*	May	0	0	1	1	0
A6	*Pipistrellus pipistrellus*	Apr	0	4	1	1	0
A6	*Pipistrellus pipistrellus*	May	1	2	0	0	0
A6	*Pipistrellus pygmaeus*	Apr	0	4	1	2	0
A6	*Pipistrellus pygmaeus*	May	0	3	0	0	0
A6	*Plecotus auritus*	Apr	0	0	0	0	3
A6	*Plecotus auritus*	May	0	0	0	0	2
A7	*Myotis*	Apr	0	0	0	4	0
A7	*Myotis daubentonii*	Apr	0	0	0	3	3
A7	*Myotis daubentonii*	May	0	0	0	0	1
A7	*Myotis mystacinus*	Apr	0	0	0	0	1
A7	*Myotis nattereri*	Apr	0	0	0	2	1
A7	*Nyctalus leisleri*	Apr	3	3	1	0	0
A7	*Nyctalus leisleri*	May	2	2	0	0	0
A7	*Pipistrellus*	Apr	3	1	0	0	0
A7	*Pipistrellus*	May	3	0	0	0	0
A7	*Pipistrellus nathusii*	Apr	0	0	0	5	0
A7	*Pipistrellus nathusii*	May	0	0	0	1	2
A7	*Pipistrellus pipistrellus*	Apr	2	2	1	1	1
A7	*Pipistrellus pipistrellus*	May	3	0	0	0	0
A7	*Pipistrellus pygmaeus*	Apr	3	2	1	1	0
A7	*Pipistrellus pygmaeus*	May	3	0	0	0	1

A7	*Plecotus auritus*	Apr	0	0	0	3	1
A7	*Plecotus auritus*	May	0	0	0	2	0
A8	*Myotis*	Apr	0	0	0	1	1
A8	*Myotis*	May	0	0	0	1	0
A8	*Myotis daubentonii*	Apr	0	0	0	3	0
A8	*Myotis daubentonii*	May	0	0	0	0	1
A8	*Nyctalus leisleri*	Apr	7	0	1	0	0
A8	*Nyctalus leisleri*	May	3	0	1	0	0
A8	*Pipistrellus*	Apr	2	1	0	0	0
A8	*Pipistrellus*	May	2	1	0	0	0
A8	*Pipistrellus nathusii*	Apr	0	0	0	1	3
A8	*Pipistrellus nathusii*	May	0	1	0	1	0
A8	*Pipistrellus pipistrellus*	Apr	1	2	1	3	0
A8	*Pipistrellus pipistrellus*	May	1	1	1	0	0
A8	*Pipistrellus pygmaeus*	Apr	0	2	2	1	2
A8	*Pipistrellus pygmaeus*	May	1	1	1	0	1
A8	*Plecotus auritus*	Apr	0	0	0	0	3
A8	*Plecotus auritus*	May	0	0	0	0	1

Table 6. Summary table showing key metrics for each species recorded per month. Please note that we cannot split the reference range by month, hence this column is not shown in this table.

Detector ID	Species/Species Group	Month	Median Percentile	95% CIs	Max Percentile	Nights Recorded
A2	*Myotis*	May	3	3 - 3	3	2
A2	*Myotis daubentonii*	Apr	20	11.5 - 38	47	6
A2	*Myotis daubentonii*	May	26	11.5 - 38	31	2
A2	*Myotis mystacinus*	Apr	3	0	3	1
A2	*Myotis nattereri*	Apr	3	3 - 3	3	1
A2	*Myotis nattereri*	May	3	3 - 3	3	1
A2	*Nyctalus leisleri*	Apr	92	83 - 93	94	7
A2	*Nyctalus leisleri*	May	92	83 - 93	96	4
A2	*Pipistrellus*	Apr	97	89 - 98	99	7
A2	*Pipistrellus*	May	97	89 - 98	98	3
A2	*Pipistrellus nathusii*	Apr	29	17 - 60	69	6
A2	*Pipistrellus nathusii*	May	60	17 - 60	69	3
A2	*Pipistrellus pipistrellus*	Apr	96	59.5 - 97	99	7
A2	*Pipistrellus pipistrellus*	May	92	59.5 - 97	96	4
A2	*Pipistrellus pygmaeus*	Apr	82	54 - 88	94	7
A2	*Pipistrellus pygmaeus*	May	82	54 - 88	95	4
A2	*Plecotus auritus*	Apr	3	3 - 17	31	4
A2	*Plecotus auritus*	May	12	3 - 17	20	2
A3	*Myotis*	Apr	77	54 - 81.5	88	6
A3	*Myotis*	May	58	54 - 81.5	77	3

A3	*Myotis daubentonii*	Apr	41	38 - 61.5	76	6
A3	*Myotis daubentonii*	May	47	38 - 61.5	60	3
A3	*Myotis mystacinus*	Apr	3	3 - 3	3	4
A3	*Myotis mystacinus*	May	3	3 - 3	3	1
A3	*Myotis nattereri*	Apr	54	20 - 60	79	7
A3	*Myotis nattereri*	May	25	20 - 60	47	2
A3	*Nyctalus leisleri*	Apr	97	80.5 - 97.5	99	8
A3	*Nyctalus leisleri*	May	87	80.5 - 97.5	98	4
A3	*Pipistrellus*	Apr	100	96 - 100	100	7
A3	*Pipistrellus*	May	99	96 - 100	100	3
A3	*Pipistrellus nathusii*	Apr	3	3 - 34.5	66	5
A3	*Pipistrellus nathusii*	May	31	3 - 34.5	31	1
A3	*Pipistrellus pipistrellus*	Apr	84	65.5 - 87.5	88	7
A3	*Pipistrellus pipistrellus*	May	85	65.5 - 87.5	88	3
A3	*Pipistrellus pygmaeus*	Apr	99	93.5 - 100	100	7
A3	*Pipistrellus pygmaeus*	May	99	93.5 - 100	100	3
A3	*Plecotus auritus*	Apr	38	17 - 56	74	7
A3	*Plecotus auritus*	May	20	17 - 56	20	1
A5	*Myotis daubentonii*	Apr	31	20 - 35.5	51	7
A5	*Myotis daubentonii*	May	20	20 - 35.5	20	2
A5	*Myotis mystacinus*	Apr	26	3 - 25.5	38	6

A5	*Myotis mystacinus*	May	3	3 - 25.5	3	3
A5	*Myotis nattereri*	Apr	3	3 - 3	31	3
A5	*Nyctalus leisleri*	Apr	90	77 - 91	93	8
A5	*Nyctalus leisleri*	May	83	77 - 91	94	4
A5	*Pipistrellus*	Apr	99	0	99	1
A5	*Pipistrellus nathusii*	Apr	45	38 - 69	88	6
A5	*Pipistrellus nathusii*	May	65	38 - 69	73	3
A5	*Pipistrellus pipistrellus*	Apr	88	73.5 - 93	97	7
A5	*Pipistrellus pipistrellus*	May	86	73.5 - 93	95	4
A5	*Pipistrellus pygmaeus*	Apr	89	73 - 93	97	7
A5	*Pipistrellus pygmaeus*	May	82	73 - 93	93	4
A5	*Plecotus auritus*	Apr	20	11.5 - 37	43	7
A5	*Plecotus auritus*	May	3	11.5 - 37	38	3
A6	*Myotis*	Apr	17	31 - 31	31	2
A6	*Myotis*	May	31	31 - 31	31	1
A6	*Myotis daubentonii*	Apr	20	11.5 - 25.5	20	5
A6	*Myotis daubentonii*	May	26	11.5 - 25.5	31	2
A6	*Myotis mystacinus*	Apr	3	0	3	1
A6	*Myotis nattereri*	Apr	3	3 - 3	3	2
A6	*Nyctalus leisleri*	Apr	79	62.5 - 87	88	7
A6	*Nyctalus leisleri*	May	87	62.5 - 87	94	4
A6	*Pipistrellus nathusii*	Apr	3	3 - 47	3	1

A6	*Pipistrellus nathusii*	May	34	3 - 47	47	2
A6	*Pipistrellus pipistrellus*	Apr	68	45 - 76.5	74	6
A6	*Pipistrellus pipistrellus*	May	69	45 - 76.5	86	3
A6	*Pipistrellus pygmaeus*	Apr	67	45.5 - 73	72	7
A6	*Pipistrellus pygmaeus*	May	73	45.5 - 73	79	3
A6	*Plecotus auritus*	Apr	3	3 - 3	3	3
A6	*Plecotus auritus*	May	3	3 - 3	3	2
A7	*Myotis*	Apr	29	20 - 38	38	4
A7	*Myotis daubentonii*	Apr	12	3 - 11.5	20	6
A7	*Myotis daubentonii*	May	3	3 - 11.5	3	1
A7	*Myotis mystacinus*	Apr	3	0	3	1
A7	*Myotis nattereri*	Apr	20	3 - 31	31	3
A7	*Nyctalus leisleri*	Apr	80	68 - 82	84	7
A7	*Nyctalus leisleri*	May	78	68 - 82	82	4
A7	*Pipistrellus*	Apr	91	81 - 94.5	94	4
A7	*Pipistrellus*	May	94	81 - 94.5	95	3
A7	*Pipistrellus nathusii*	Apr	20	11.5 - 29	38	5
A7	*Pipistrellus nathusii*	May	3	11.5 - 29	20	3
A7	*Pipistrellus pipistrellus*	Apr	74	42.5 - 85.5	85	7
A7	*Pipistrellus pipistrellus*	May	89	42.5 - 85.5	89	3
A7	*Pipistrellus pygmaeus*	Apr	79	45.5 - 88	92	7
A7	*Pipistrellus pygmaeus*	May	87	45.5 - 88	90	4

A7	*Plecotus auritus*	Apr	31	17 - 31	31	4
A7	*Plecotus auritus*	May	20	17 - 31	20	2
A8	*Myotis*	Apr	21	3 - 38	38	2
A8	*Myotis*	May	20	3 - 38	20	1
A8	*Myotis daubentonii*	Apr	31	17 - 34.5	38	3
A8	*Myotis daubentonii*	May	3	17 - 34.5	3	1
A8	*Nyctalus leisleri*	Apr	97	73.5 - 99	100	8
A8	*Nyctalus leisleri*	May	98	73.5 - 99	100	4
A8	*Pipistrellus*	Apr	81	76 - 92	94	3
A8	*Pipistrellus*	May	88	76 - 92	92	3
A8	*Pipistrellus nathusii*	Apr	3	3 - 31.5	31	4
A8	*Pipistrellus nathusii*	May	40	3 - 31.5	60	2
A8	*Pipistrellus pipistrellus*	Apr	43	38 - 79	93	7
A8	*Pipistrellus pipistrellus*	May	79	38 - 79	83	3
A8	*Pipistrellus pygmaeus*	Apr	51	27 - 66	76	7
A8	*Pipistrellus pygmaeus*	May	59	27 - 66	87	4
A8	*Plecotus auritus*	Apr	3	3 - 3	3	3
A8	*Plecotus auritus*	May	3	3 - 3	3	1

PER SITE

In this 'Per Site' section of the analysis, all values are taken from across all of the detectors to provide site-wide averages/medians.

Table 7. Summary table showing the number of nights recorded bat activity fell into each activity band for each species.

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
Myotis	2	4	2	9	4
Myotis daubentonii	0	3	5	28	8
Myotis mystacinus	0	0	0	4	13
Myotis nattereri	0	3	2	5	9
Nyctalus leisleri	49	14	5	1	0
Pipistrellus	31	3	0	0	0
Pipistrellus nathusii	1	7	6	16	11
Pipistrellus pipistrellus	30	17	7	6	1
Pipistrellus pygmaeus	30	17	8	5	4
Plecotus auritus	0	1	4	16	18

Table 8. Summary table showing key metrics for each species recorded.

Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded
Myotis	38	54 - 81.5	88	21
Myotis daubentonii	20	38 - 61.5	76	44
Myotis mystacinus	3	3 - 3	38	17
Myotis nattereri	20	3 - 31	79	19
Nyctalus leisleri	88	83 - 93	100	69
Pipistrellus	94	96 - 100	100	34
Pipistrellus nathusii	31	38 - 69	88	41
Pipistrellus pipistrellus	79	73.5 - 93	99	61
Pipistrellus pygmaeus	79	93.5 - 100	100	64
Plecotus auritus	20	3 - 3	74	39

###Figures

Figure 4. The activity level (percentile) of bats recorded across each night of the bat survey for the **entire site**.

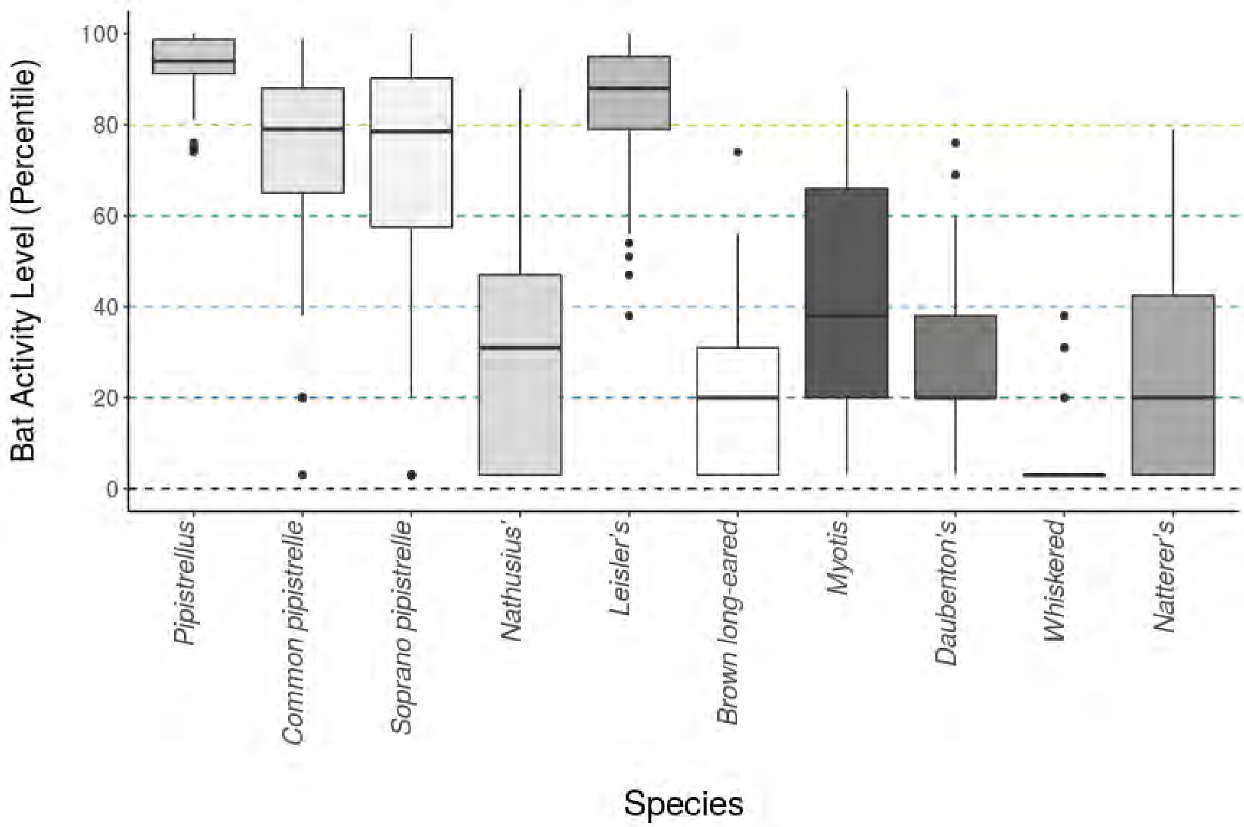
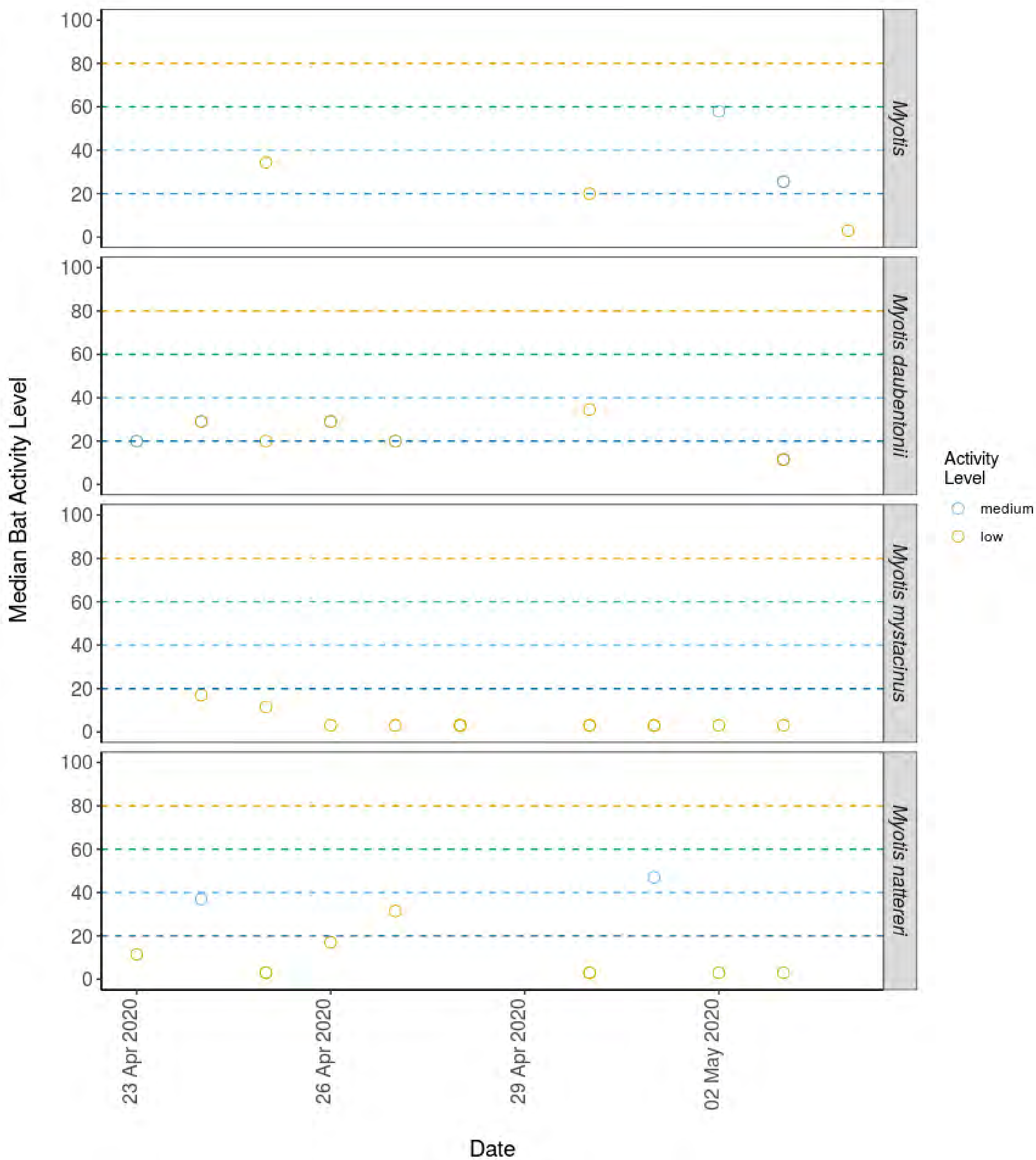
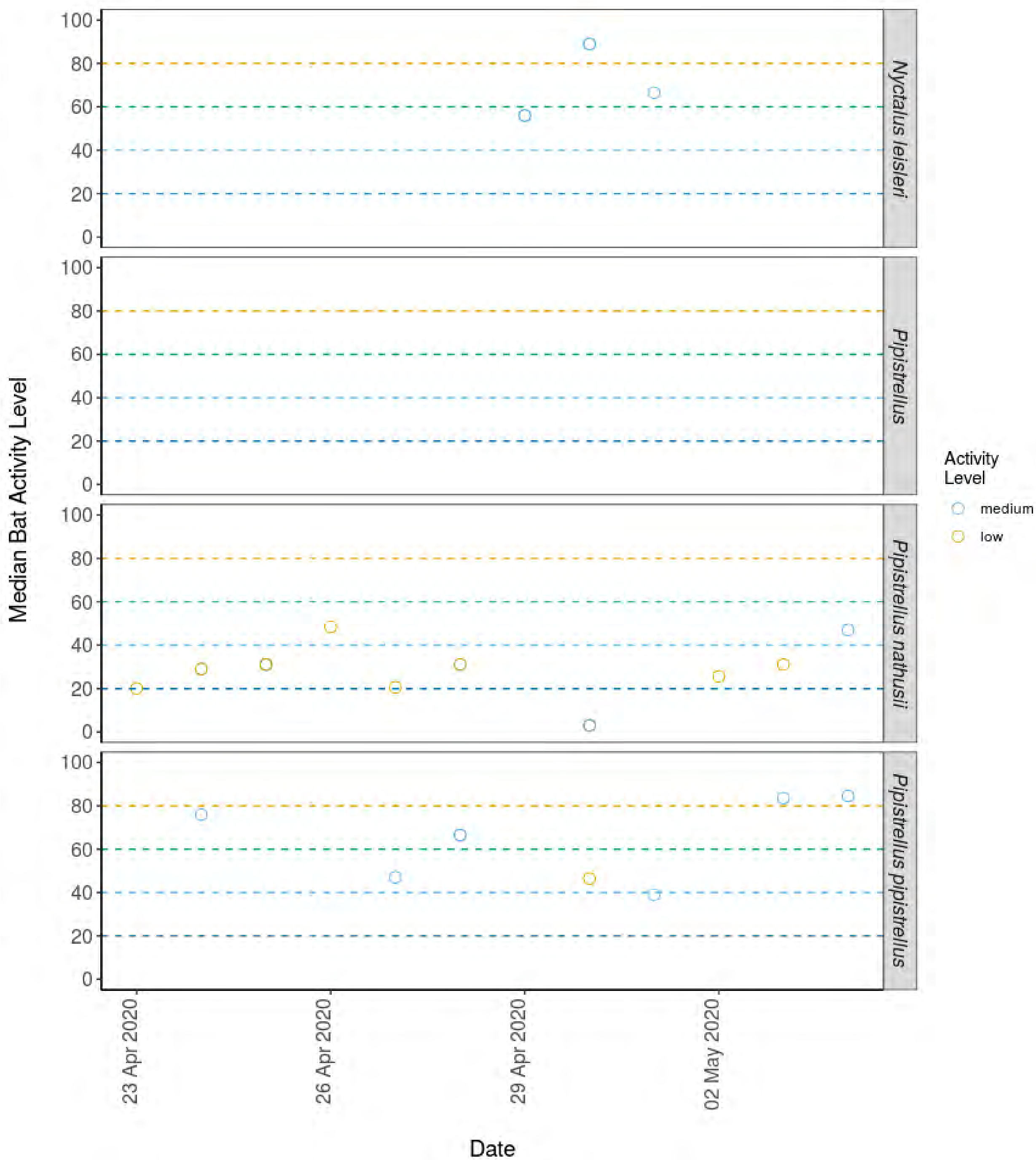


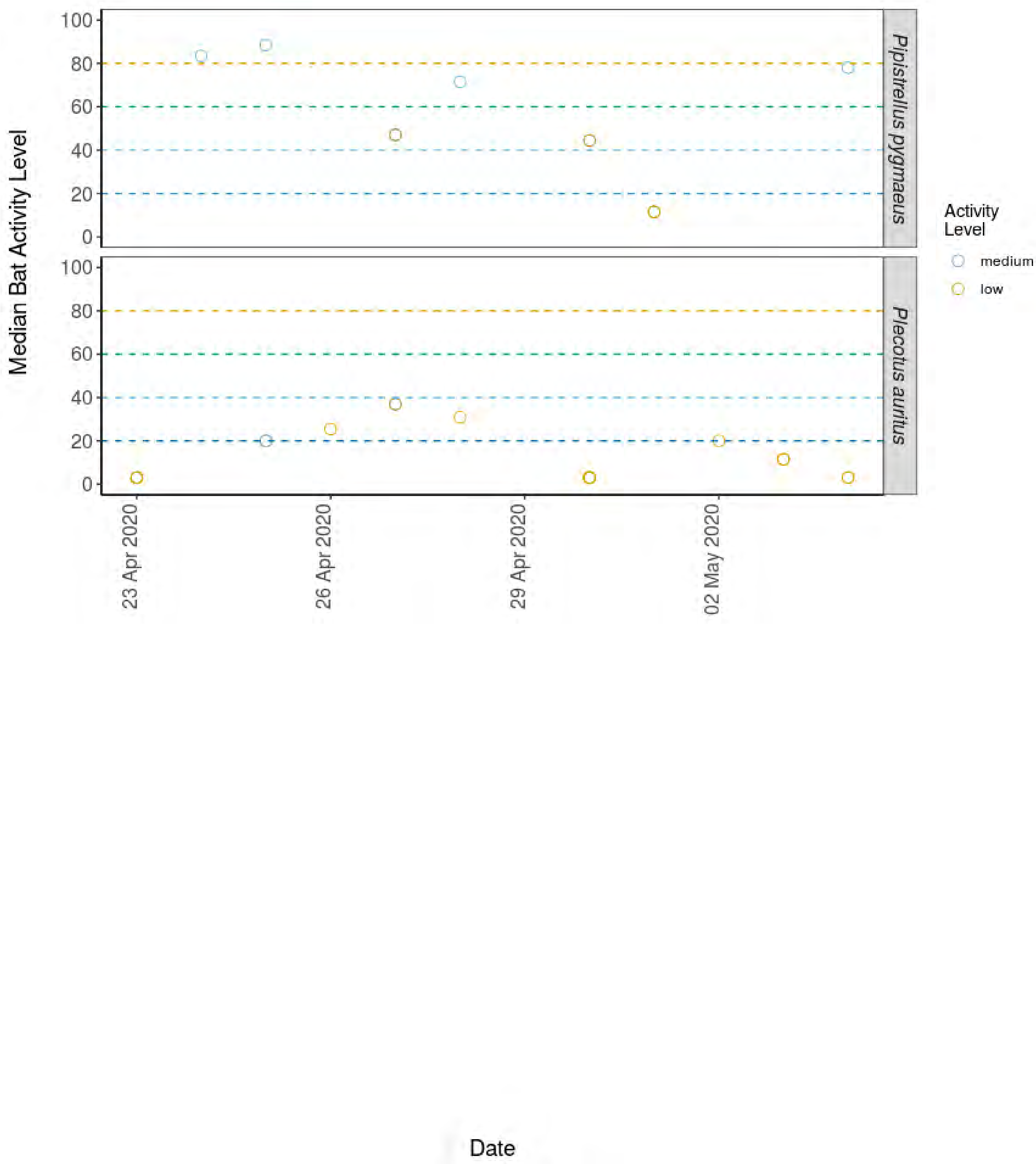
Figure 5. The median activity levels of bats recorded across all detectors each night.



Median Bat Activity Level
100
80
60
40
20
0
Myotis
Myotis daubentonii
Myotis mystacinus
Myotis nattereri
23 Apr 2020
26 Apr 2020
29 Apr 2020
02 May 2020
Date
Activity Level
medium
low



Median Bat Activity Level
Date
23 Apr 2020
26 Apr 2020
29 Apr 2020
02 May 2020
Nyctalus leisleri
Pipistrellus
Pipistrellus nathusii
Pipistrellus pipistrellus
Activity
Level
medium
low


Median Bat Activity Level
100
80
60
40
20
0
Pipistrellus pygmaeus
Plecotus auritus
23 Apr 2020
26 Apr 2020
29 Apr 2020
02 May 2020
Activity Level
medium
low
Date

PER SITE, PER MONTH

Table 9. Summary table showing the number of nights recorded bat activity fell into each activity band for each species during each month.

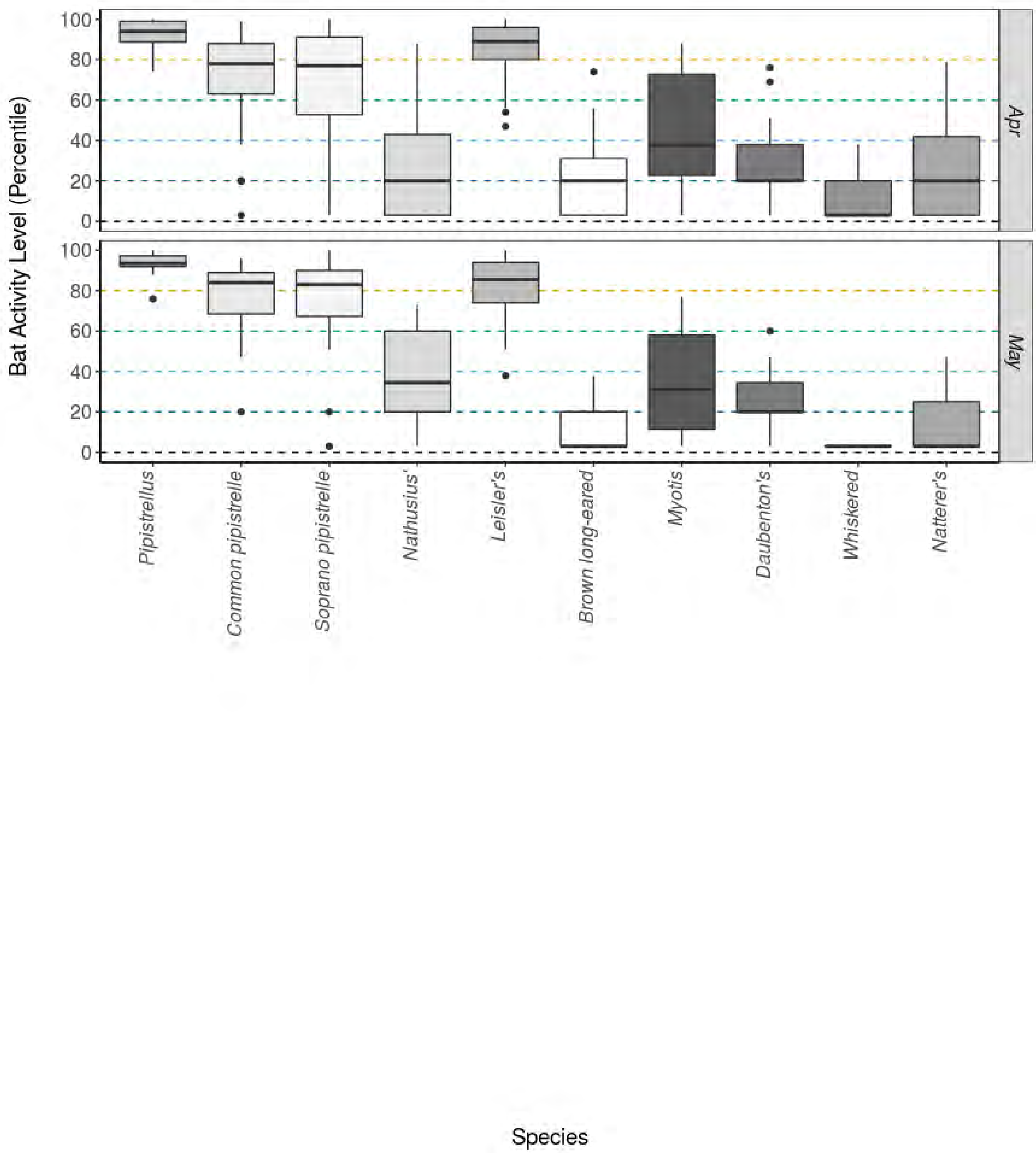
Species/Species Group	Month	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity
Myotis	Apr	2	3	0	7	2
Myotis	May	0	1	2	2	2
Myotis daubentonii	Apr	0	2	4	21	6
Myotis daubentonii	May	0	1	1	7	2
Myotis mystacinus	Apr	0	0	0	4	9
Myotis mystacinus	May	0	0	0	0	4
Myotis nattereri	Apr	0	3	1	5	7
Myotis nattereri	May	0	0	1	0	2
Nyctalus leisleri	Apr	34	7	4	0	0
Nyctalus leisleri	May	15	7	1	1	0
Pipistrellus	Apr	20	2	0	0	0
Pipistrellus	May	11	1	0	0	0
Pipistrellus nathusii	Apr	1	2	5	10	9
Pipistrellus nathusii	May	0	5	1	6	2
Pipistrellus pipistrellus	Apr	17	14	4	5	1
Pipistrellus pipistrellus	May	13	3	3	1	0
Pipistrellus pygmaeus	Apr	19	11	6	4	2
Pipistrellus pygmaeus	May	11	6	2	1	2
Plecotus auritus	Apr	0	1	4	11	12
Plecotus auritus	May	0	0	0	5	6

Table 10. Summary table showing key metrics for each species recorded per month.

Species/Species Group	Month	Median Percentile	95% CIs	Max Percentile	Nights Recorded
Myotis	Apr	38	54 - 81.5	88	14
Myotis	May	31	54 - 81.5	77	7
Myotis daubentonii	Apr	20	38 - 61.5	76	33
Myotis daubentonii	May	20	38 - 61.5	60	11
Myotis mystacinus	Apr	3	3 - 3	38	13
Myotis mystacinus	May	3	3 - 3	3	4
Myotis nattereri	Apr	20	3 - 31	79	16
Myotis nattereri	May	3	3 - 3	47	3
Nyctalus leisleri	Apr	89	83 - 93	100	45
Nyctalus leisleri	May	86	83 - 93	100	24
Pipistrellus	Apr	94	96 - 100	100	22
Pipistrellus	May	94	96 - 100	100	12
Pipistrellus nathusii	Apr	20	38 - 69	88	27
Pipistrellus nathusii	May	35	38 - 69	73	14
Pipistrellus pipistrellus	Apr	78	73.5 - 93	99	41
Pipistrellus pipistrellus	May	84	73.5 - 93	96	20
Pipistrellus pygmaeus	Apr	77	93.5 - 100	100	42
Pipistrellus pygmaeus	May	83	93.5 - 100	100	22
Plecotus auritus	Apr	20	3 - 3	74	28
Plecotus auritus	May	3	3 - 3	38	11

###Figures

Figure 6. The activity level (percentile) of bats recorded across each night of the bat survey for the entire site, split between months.



PART 2: Nightly Analysis

ENTIRE SURVEY PERIOD

Sunrise and Sunset Times

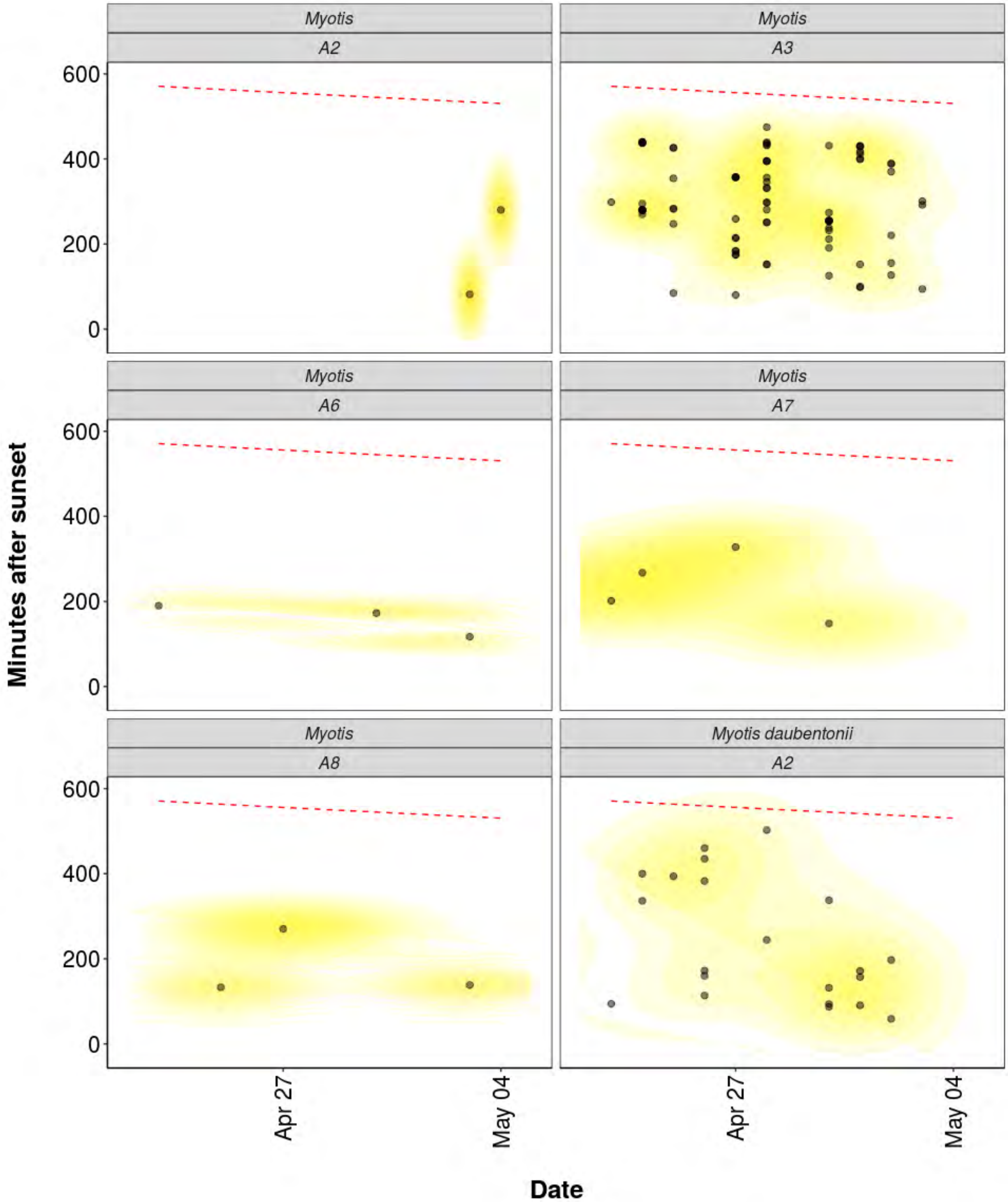
Table 11. The times of sunset and sunrise the following morning for surveys beginning on the date shown.

Night (y-m-d)	Sunset (hh:mm)	Sunrise (hh:mm)	Night Length (hours)
2020-04-23	20:47	06:18	9.5
2020-04-24	20:49	06:16	9.5
2020-04-25	20:51	06:14	9.4
2020-04-26	20:53	06:12	9.3
2020-04-27	20:54	06:10	9.3
2020-04-28	20:56	06:08	9.2
2020-04-29	20:58	06:06	9.1
2020-04-30	20:59	06:04	9.1
2020-05-01	21:01	06:02	9.0
2020-05-02	21:03	06:00	9.0
2020-05-03	21:05	05:59	8.9
2020-05-04	21:06	05:57	8.8

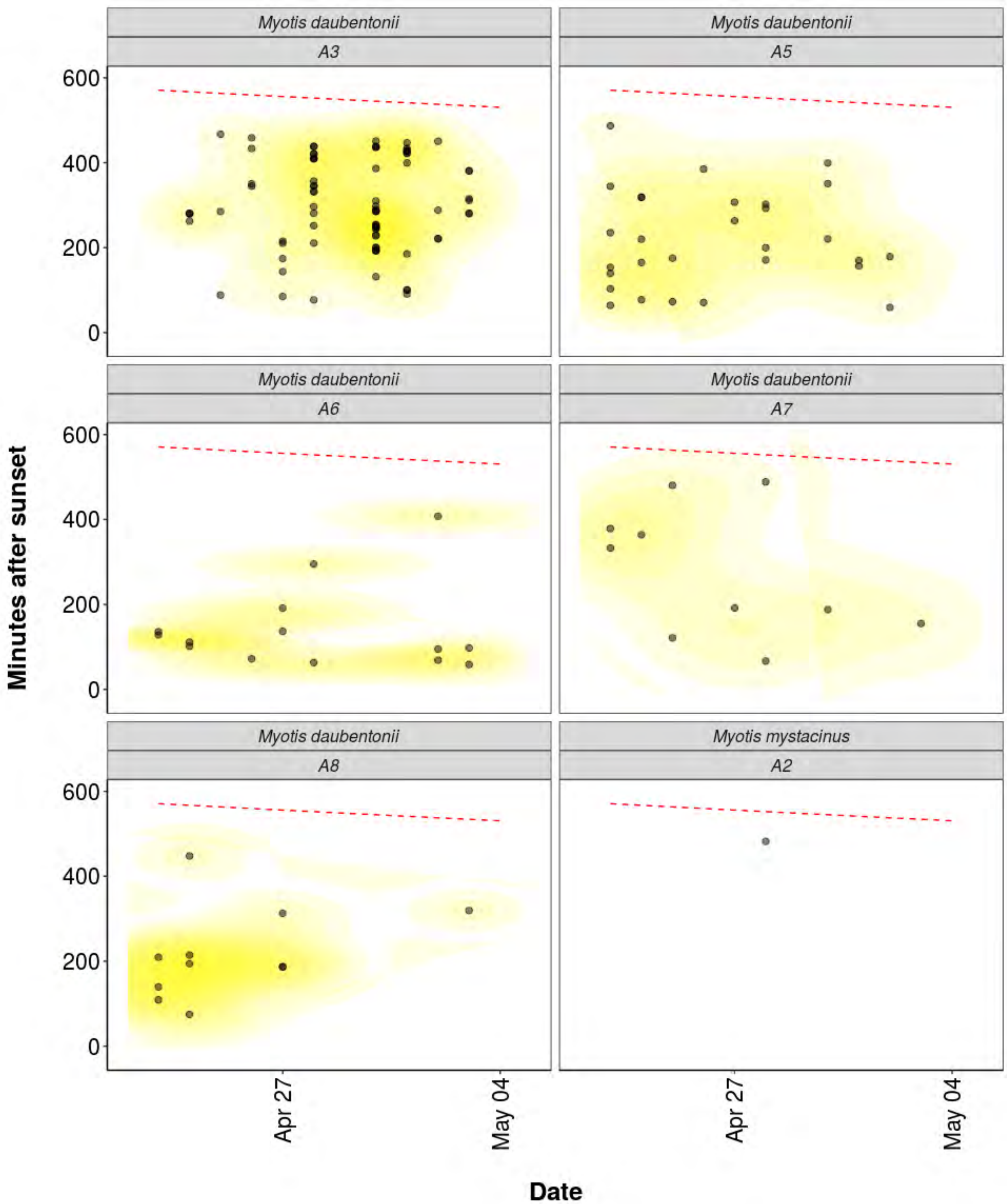
Distribution of Bat Activity Across the Night through Time

Per Detector

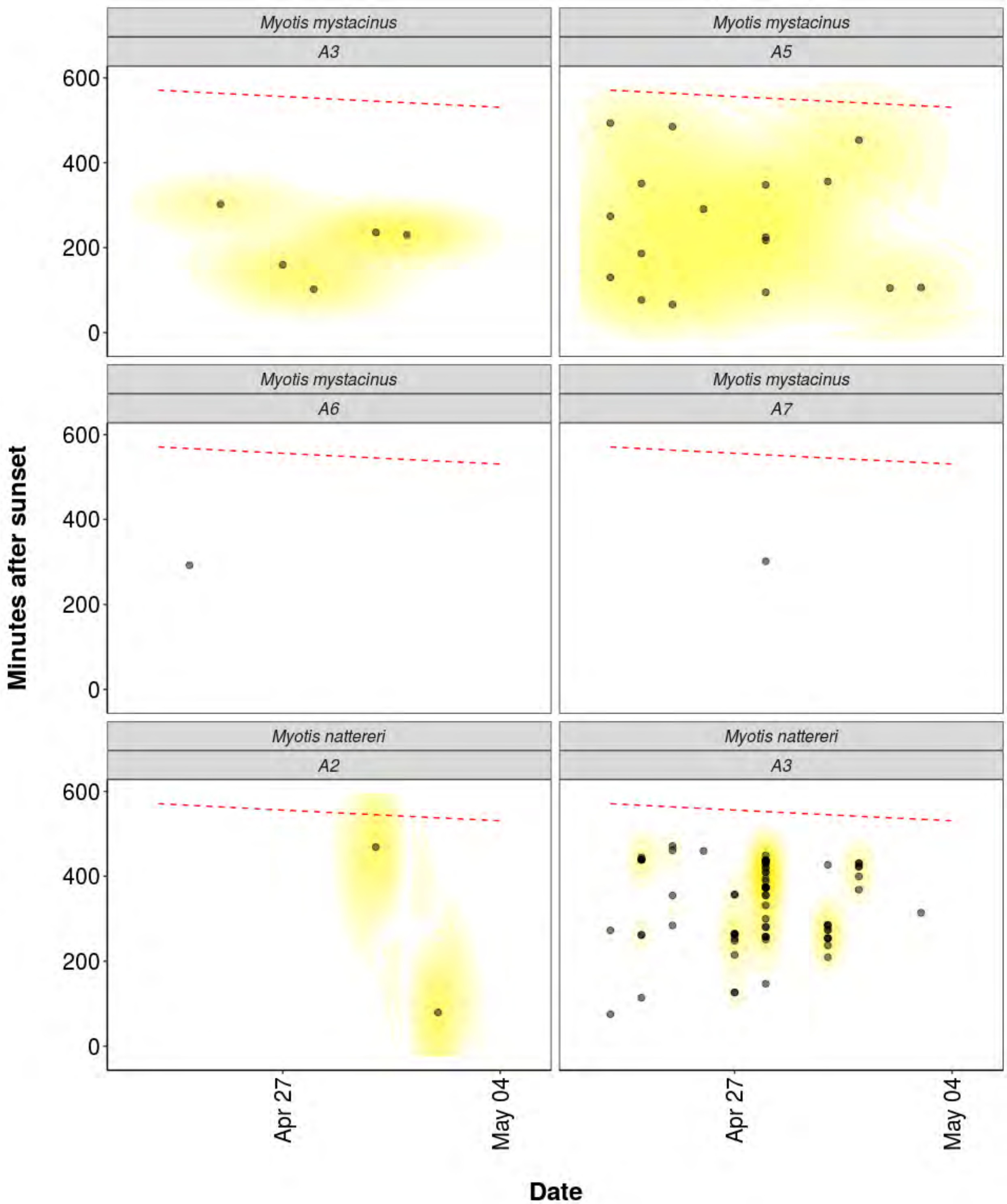
Figure 7. Timing of bat calls plotted as minutes before/after sunset, whereby 0 on the y axis represents sunset. Sunrise throughout the survey period is depicted as the red dashed line. Colours indicate kernel densities, with darkest colours showing peaks of activity. These colours are comparative only within each plot, and do not account for overall activity.



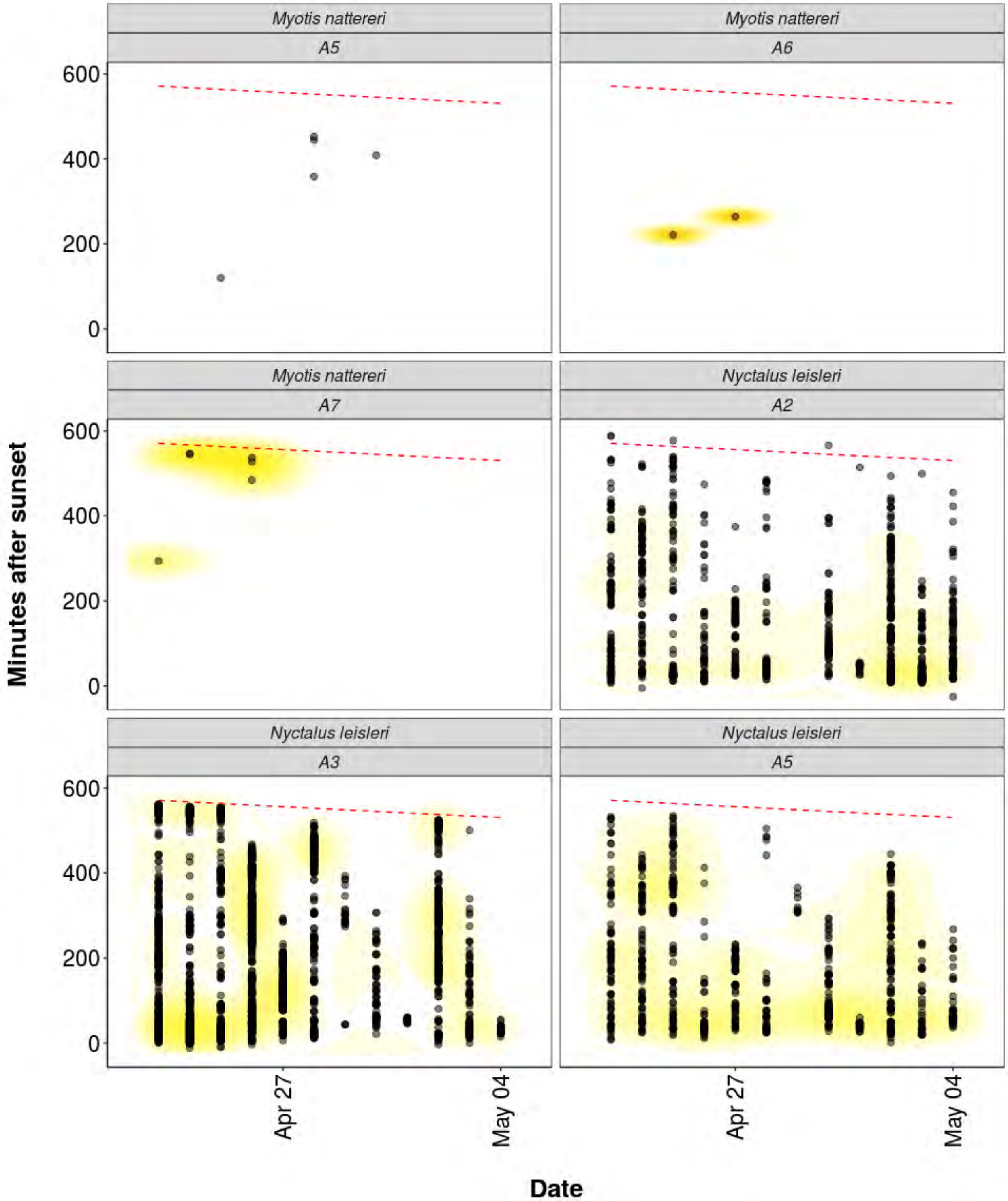
Myotis
A2
Myotis
A3
Myotis
A6
Myotis
A7
Myotis
A8
Myotis daubentonii
A2
600
400
200
0
Minutes after sunset
Apr 27
May 04
Date



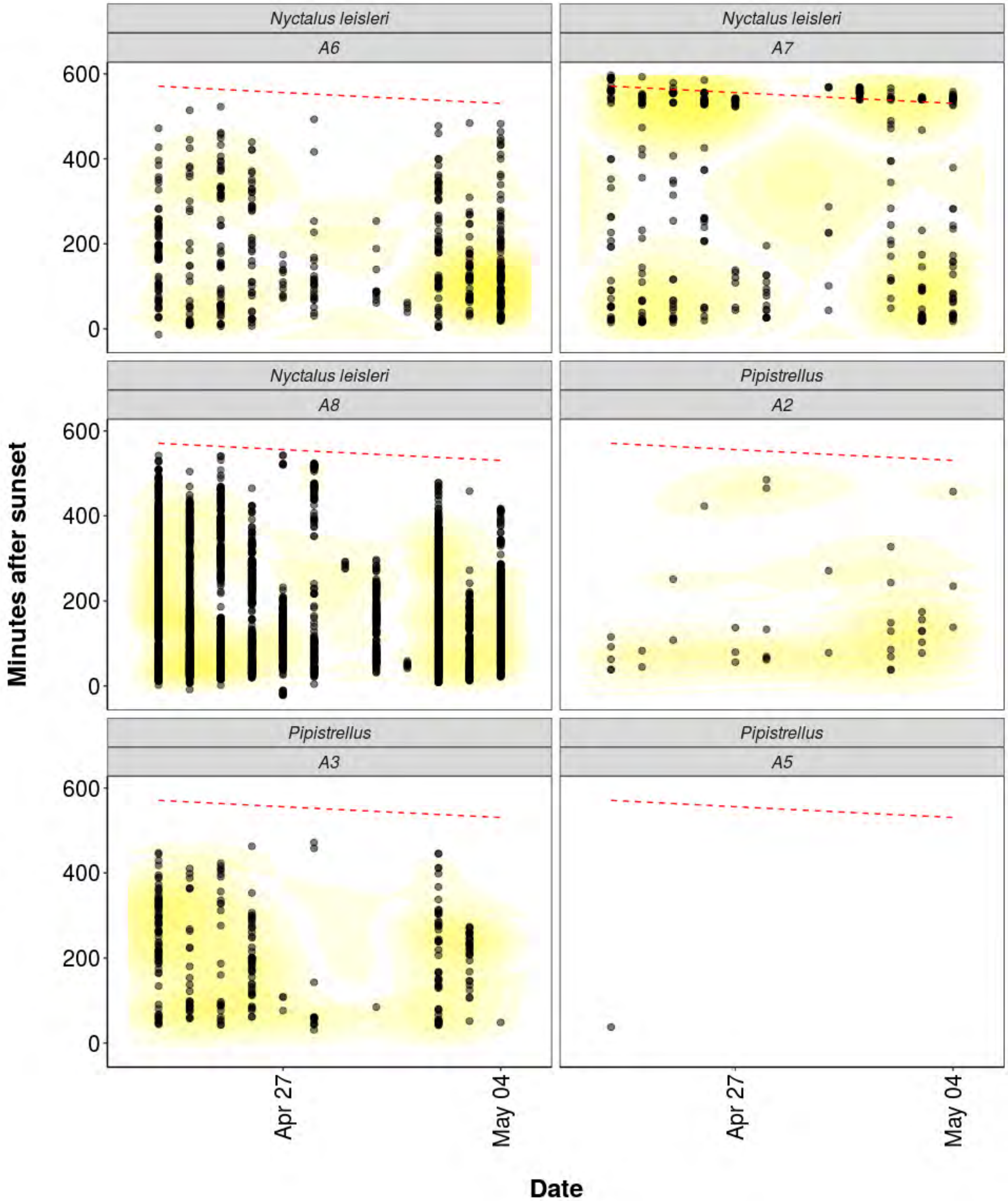
Myotis daubentonii
A3
Myotis daubentonii
A5
Myotis daubentonii
A6
Myotis daubentonii
A7
Myotis daubentonii
A8
Myotis mystacinus
A2
Minutes after sunset
600
400
200
0
Apr 27
May 04
Date

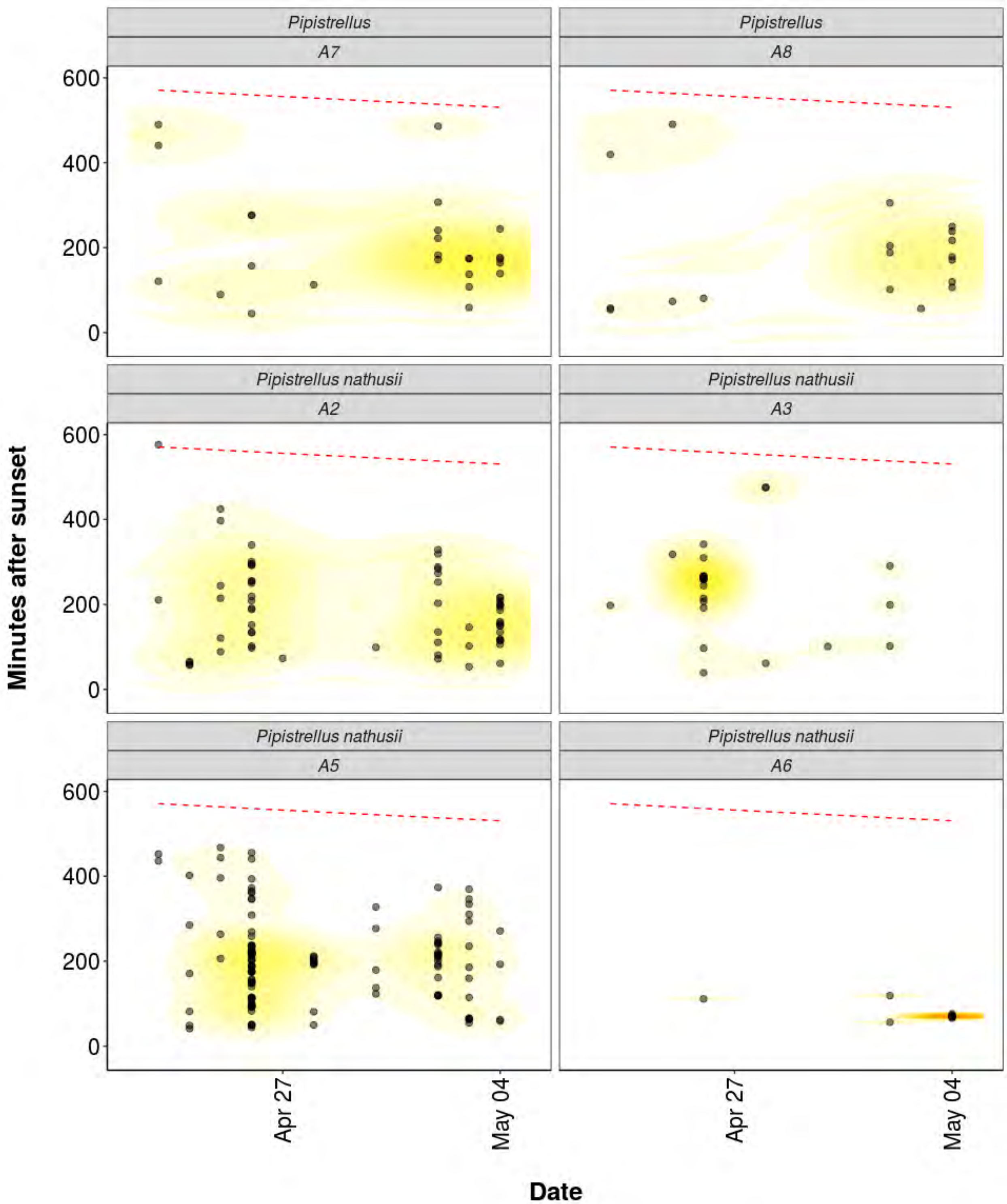


Myotis mystacinus
A3
Myotis mystacinus
A5
Myotis mystacinus
A6
Myotis mystacinus
A7
Myotis nattereri
A2
Myotis nattereri
A3
Minutes after sunset
0
200
400
600
Apr 27
May 04
Date

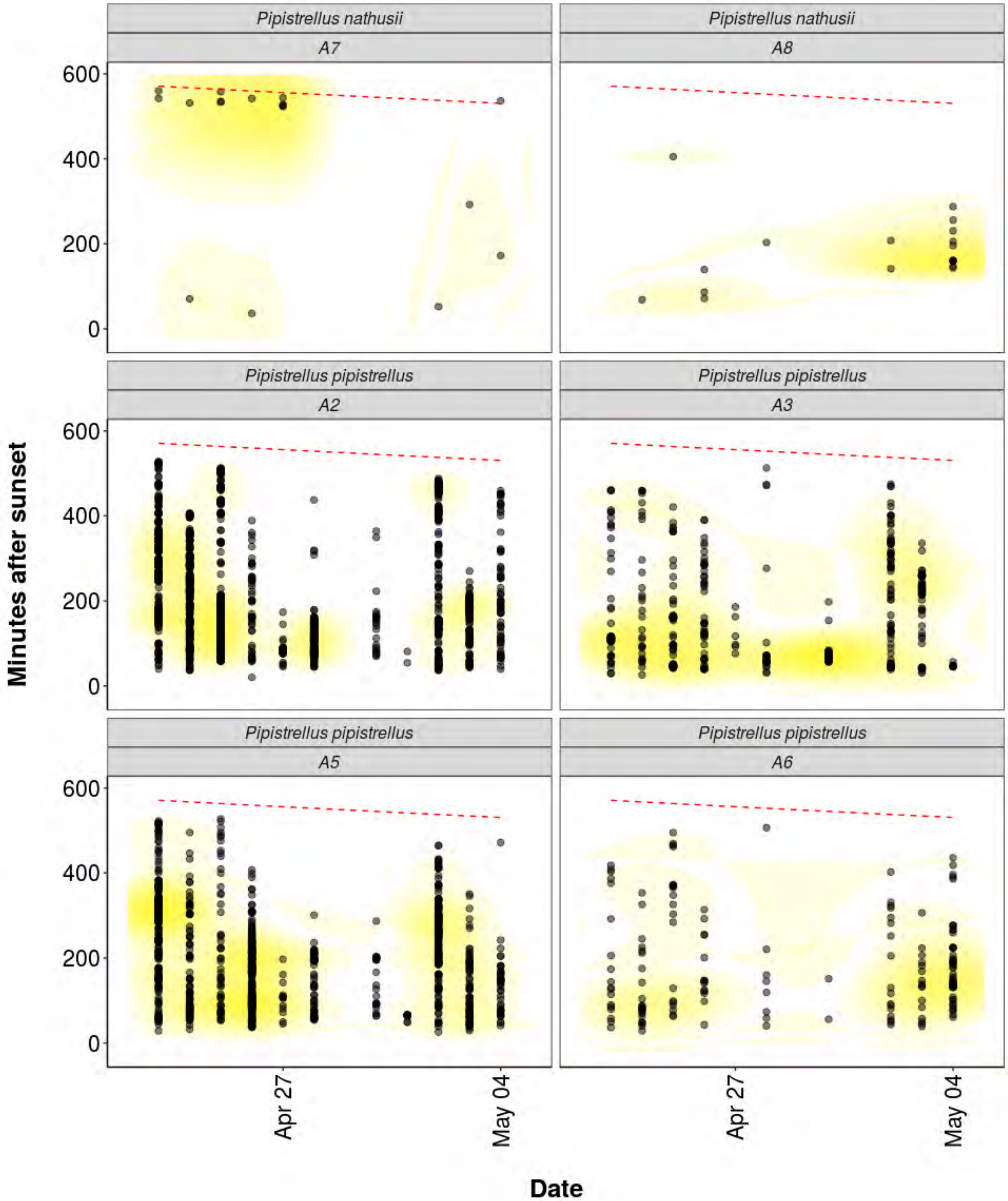


Myotis nattereri
A5
Myotis nattereri
A6
Myotis nattereri
A7
Nyctalus leisleri
A2
Nyctalus leisleri
A3
Nyctalus leisleri
A5
600
400
200
0
Minutes after sunset
Apr 27
May 04
Date

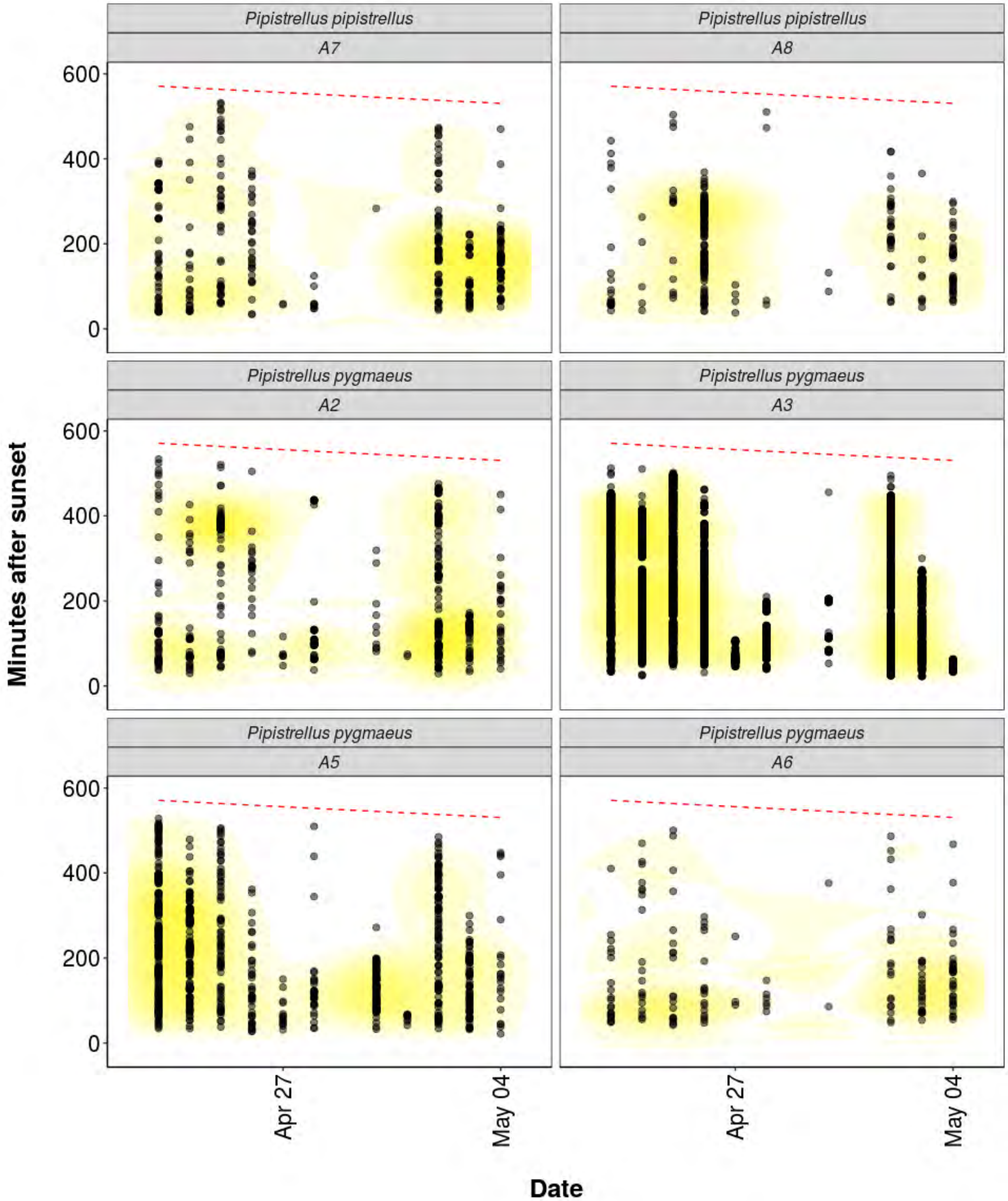

Nyctalus leisleri
A6
Nyctalus leisleri
A7
Nyctalus leisleri
A8
Pipistrellus
A2
Pipistrellus
A3
Pipistrellus
A5
600
400
200
0
Minutes after sunset
Apr 27
May 04
Date



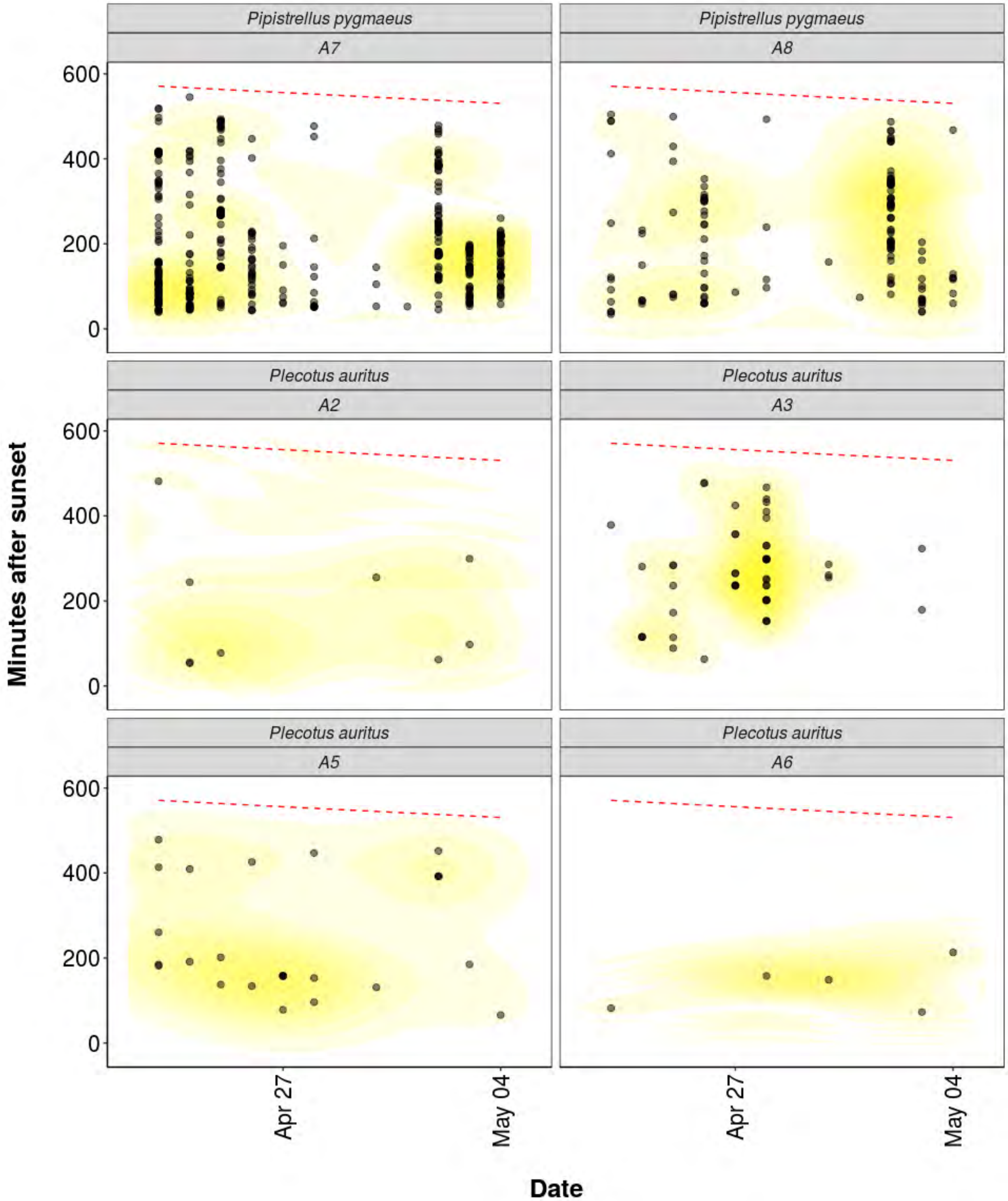
Pipistrellus
A7
Pipistrellus
A8
Pipistrellus nathusii
A2
Pipistrellus nathusii
A3
Pipistrellus nathusii
A5
Pipistrellus nathusii
A6
600
400
200
0
Minutes after sunset
Apr 27
May 04
Date



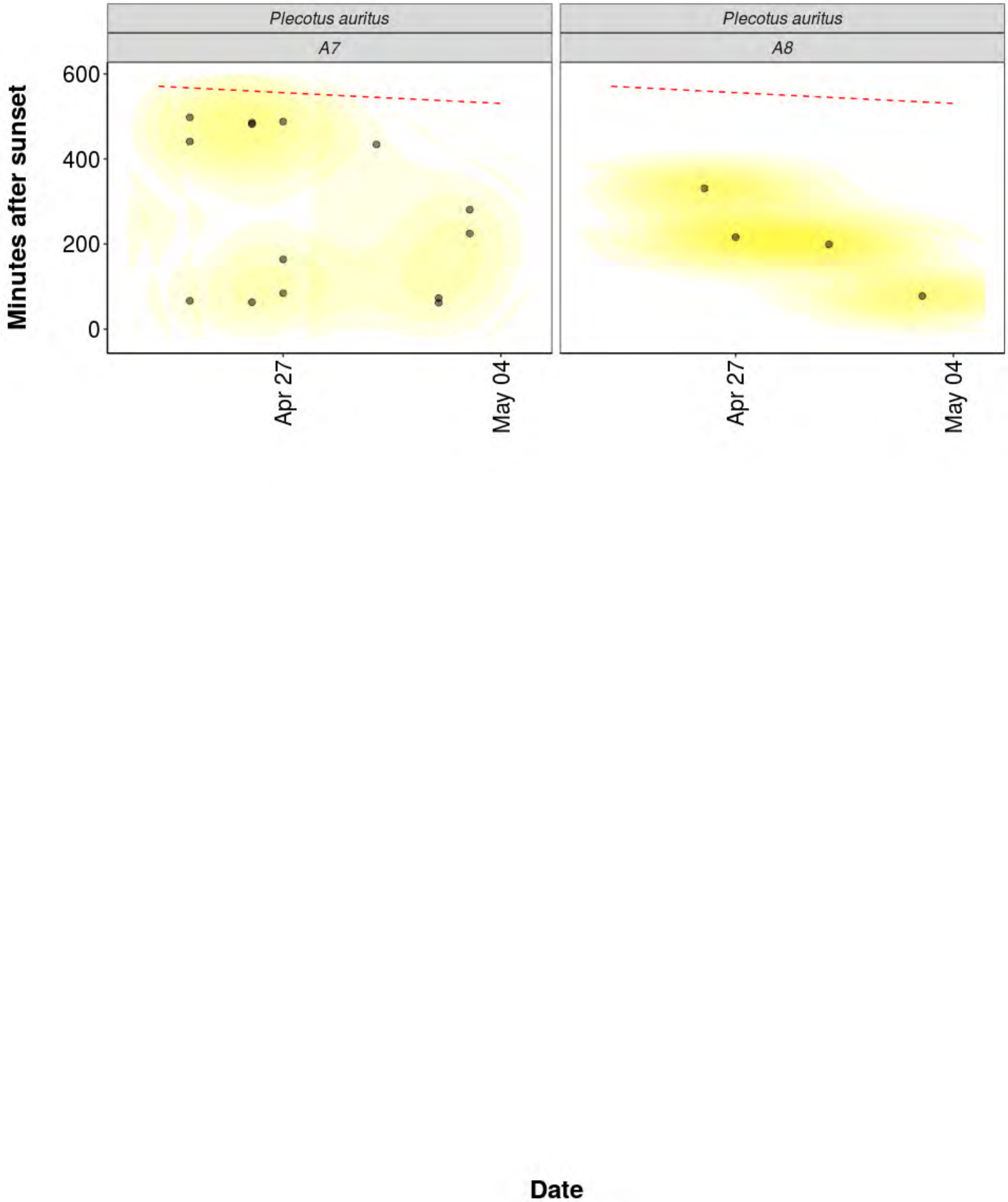
Pipistrellus nathusii
A7
Pipistrellus nathusii
A8
Pipistrellus pipistrellus
A2
Pipistrellus pipistrellus
A3
Pipistrellus pipistrellus
A5
Pipistrellus pipistrellus
A6
Minutes after sunset
600
400
200
0
Apr 27
May 04
Date



Pipistrellus pipistrellus
A7
Pipistrellus pipistrellus
A8
Pipistrellus pygmaeus
A2
Pipistrellus pygmaeus
A3
Pipistrellus pygmaeus
A5
Pipistrellus pygmaeus
A6
Minutes after sunset
600
400
200
0
Apr 27
May 04
Date



Pipistrellus pygmaeus
A7
Pipistrellus pygmaeus
A8
Plecotus auritus
A2
Plecotus auritus
A3
Plecotus auritus
A5
Plecotus auritus
A6
Minutes after sunset
600
400
200
0
Apr 27
May 04
Date


Plecotus auritus
A7
Plecotus auritus
A8
Minutes after sunset
600
400
200
0
Apr 27
May 04
Apr 27
May 04
Date

Roost Emergence Time and Bat Observation

Based on: *Russ, Jon. 2012. British Bat Calls a Guide to species Identification. Pelagic Publishing.*

For more information see https://rbats-blog.updog.co/2018/05/29/bat-emergence/

Bat Passes Potentially Indicating Close Proximity to a Roost (Russ 2012) - Table

Table 12. Number of bat calls recorded before the upper time of the species-specific emergence time range, and which therefore may potentially indicate the presence of a nearby roost.

Table continues below

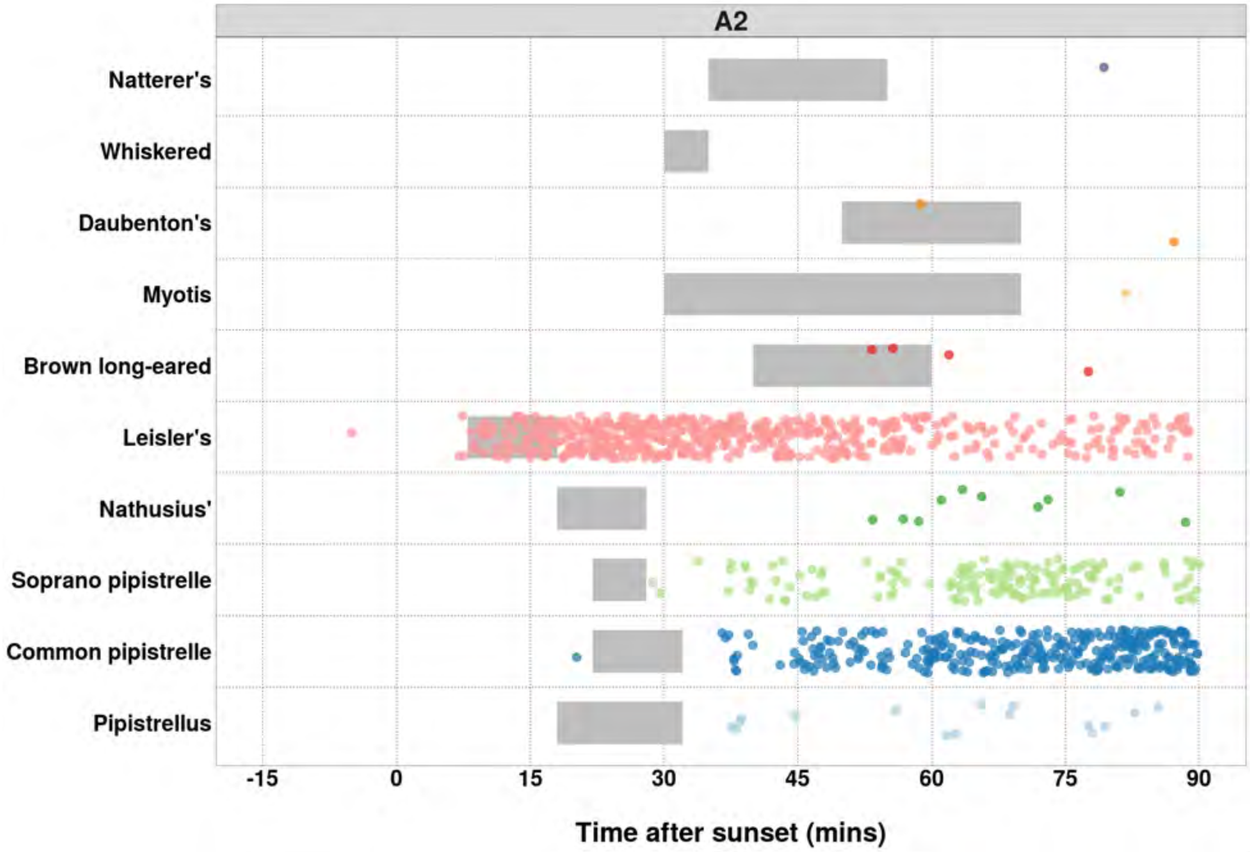
Species	Detector ID	2020-04-23	2020-04-24	2020-04-25	2020-04-26	2020-04-27
Pipistrellus	A3	0	0	0	0	0
Common pipistrelle	A2	0	0	0	1	0
Common pipistrelle	A3	2	1	0	0	0
Common pipistrelle	A5	1	0	0	0	0
Common pipistrelle	A6	0	1	0	0	0
Soprano pipistrelle	A3	0	3	0	0	0
Soprano pipistrelle	A5	0	0	0	2	0
Leisler’s	A2	6	1	3	5	0
Leisler’s	A3	31	58	39	13	5
Leisler’s	A5	3	0	0	2	0
Leisler’s	A6	1	9	4	2	0
Leisler’s	A7	1	5	1	0	0
Leisler’s	A8	18	8	9	0	10
Brown long-eared	A2	0	2	0	0	0
Daubenton’s	A2	0	0	0	0	0
Daubenton’s	A5	1	0	0	0	0

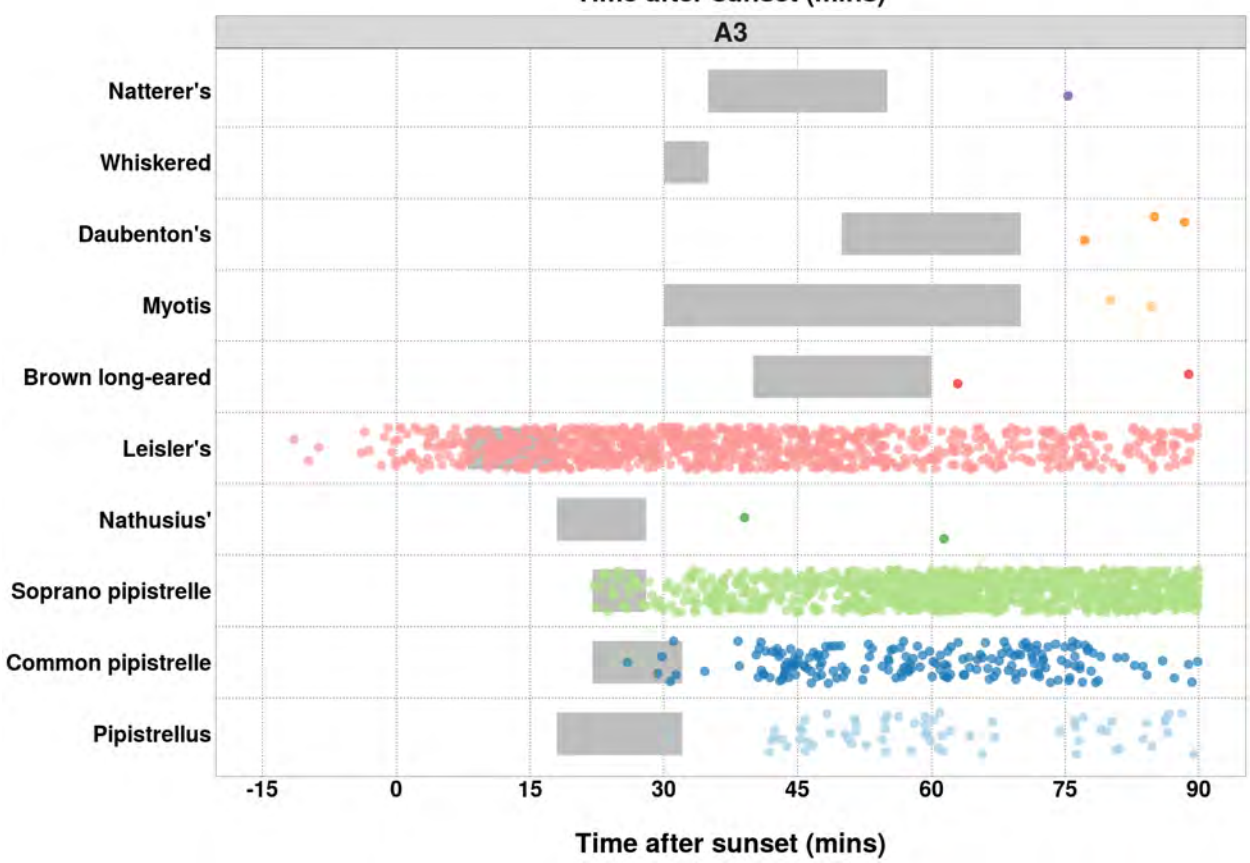
Daubenton’s	A6	0	0	0	0	0
Daubenton’s	A7	0	0	0	0	0

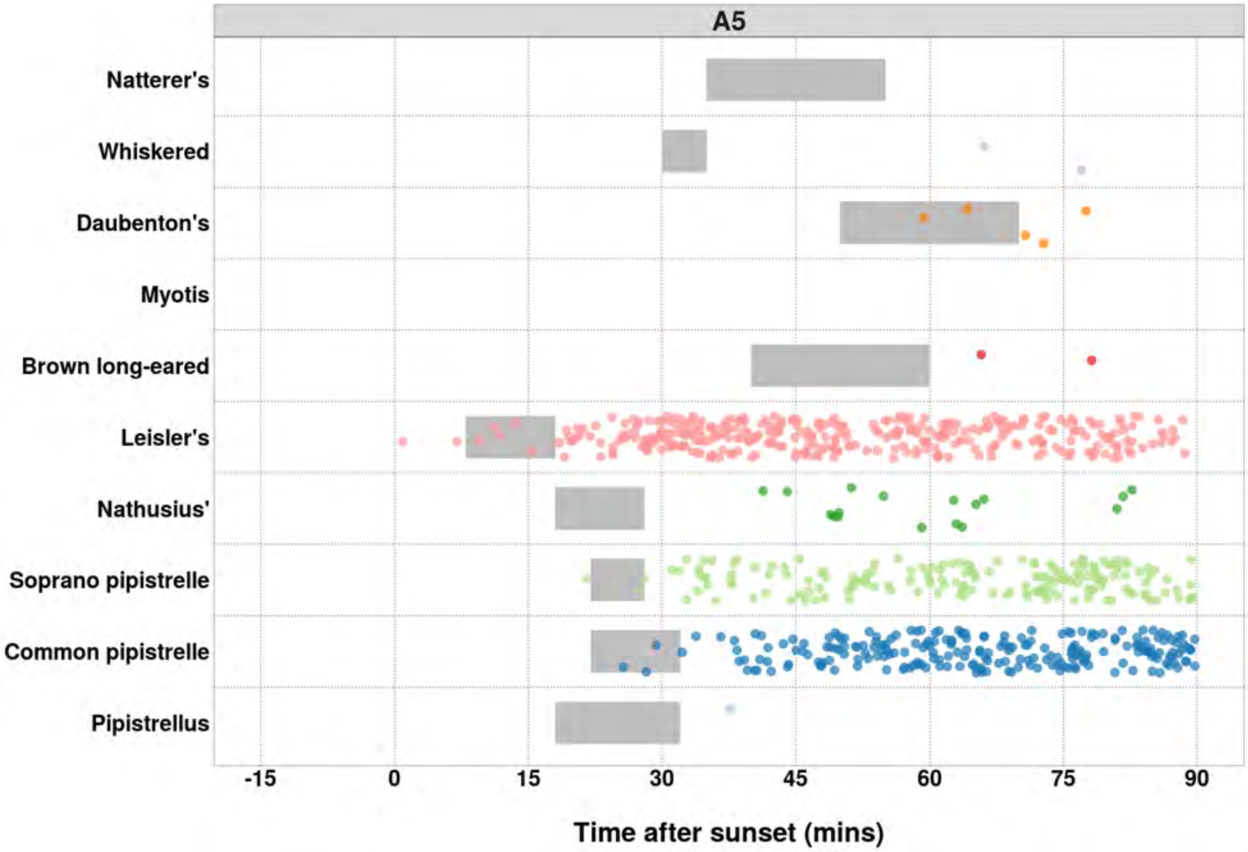
2020-04-28	2020-05-02	2020-05-03	2020-05-04
1	0	0	0
0	0	0	0
2	0	1	0
0	1	1	0
0	0	0	0
0	16	6	0
0	0	0	1
2	27	24	4
7	17	8	1
0	2	0	0
0	4	0	0
0	0	1	1
1	11	15	0
0	0	0	0
0	1	0	0
0	1	0	0
1	1	1	0
1	0	0	0

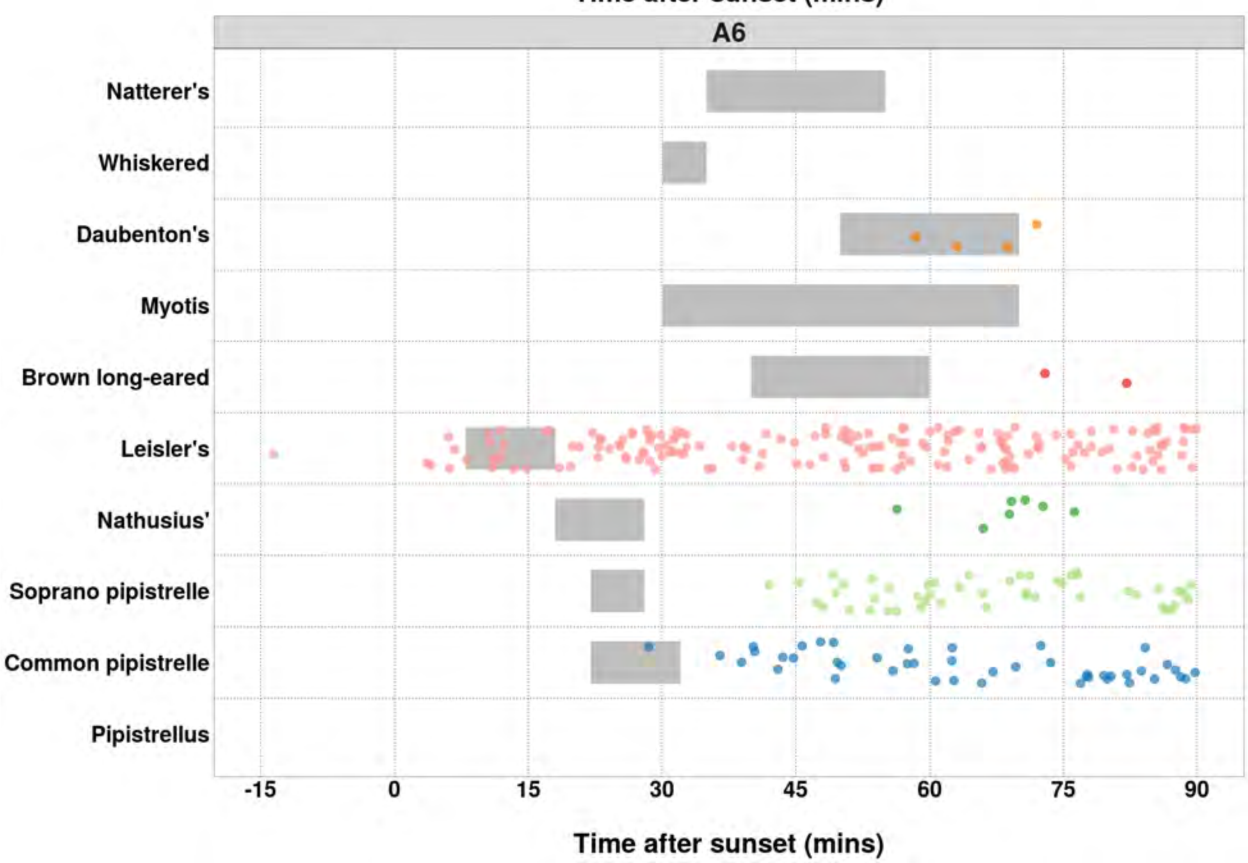
Bat Passes Potentially Indicating Close Proximity to a Roost (Russ 2012) - Figures

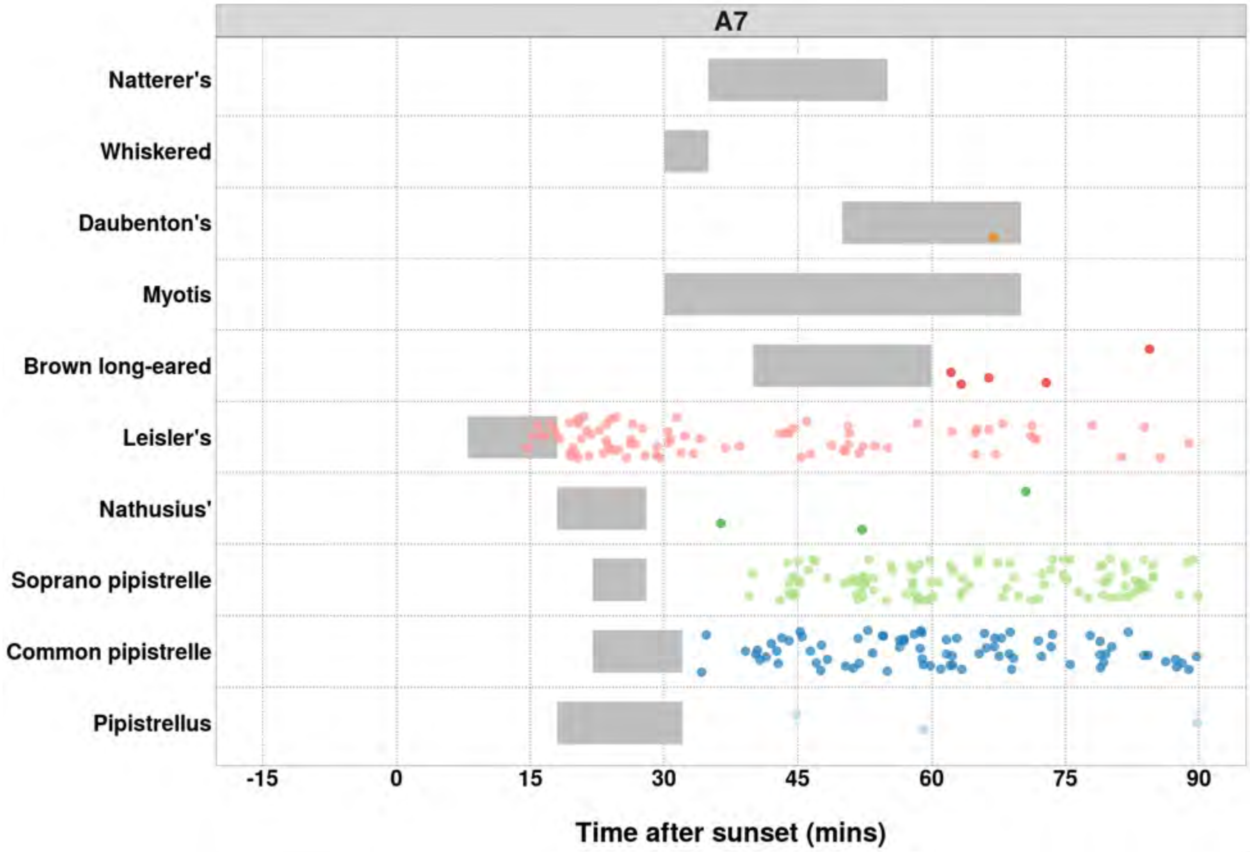
Figure 8. Time from 15 minutes before to 90 minutes after sunset. Species-specific emergence time ranges are shown as grey bars. Bat passes overlapping species-specific grey bars, or occuring earlier than this time range, may potentially indicate the presence of a nearby roost.

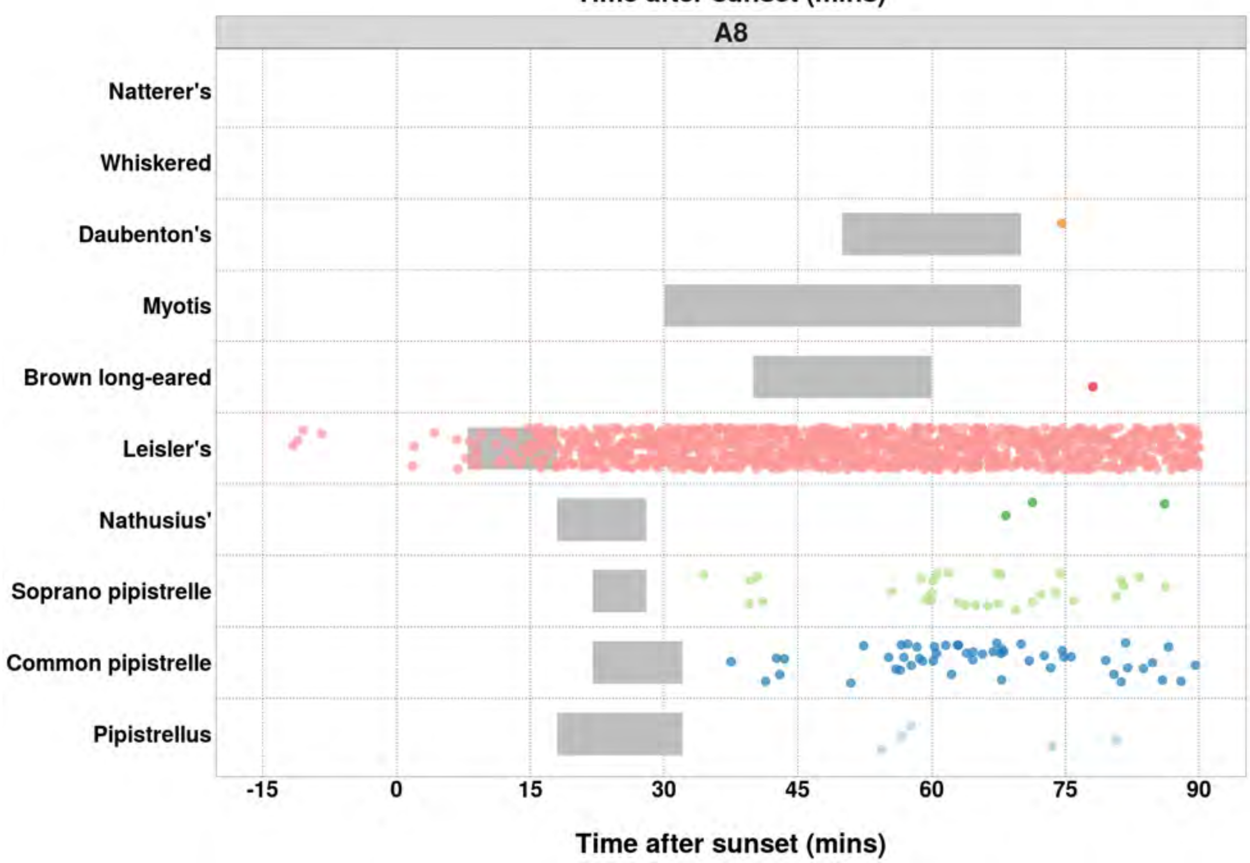

A2
Natterer's
Whiskered
Daubenton's
Myotis
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
Pipistrellus
-15
0
15
30
45
60
75
90
Time after sunset (mins)


A3
Natterer's
Whiskered
Daubenton's
Myotis
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
Pipistrellus
-15
0
15
30
45
60
75
90
Time after sunset (mins)


A5
Natterer's
Whiskered
Daubenton's
Myotis
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
Pipistrellus
-15
0
15
30
45
60
75
90
Time after sunset (mins)


A6
Natterer's
Whiskered
Daubenton's
Myotis
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
Pipistrellus
-15
0
15
30
45
60
75
90
Time after sunset (mins)


A7
Natterer's
Whiskered
Daubenton's
Myotis
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
Pipistrellus
-15
0
15
30
45
60
75
90
Time after sunset (mins)


A8
Natterer's
Whiskered
Daubenton's
Myotis
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
Pipistrellus
-15
0
15
30
45
60
75
90
Time after sunset (mins)

Counts of Bat Passes

All detectors

Table 14. The total number of passes recorded for each species across all of the detectors. The 'Total' percentage may not be exactly 100% due to rounding of the percentages per species.

Species	Passes (No.)	Percentage of total (%)
Pipistrellus	12233	32.7
Common pipistrelle	4603	12.3
Soprano pipistrelle	9146	24.5
Nathusius'	264	0.7
Leisler's	10461	28.0
Brown long-eared	109	0.3
Myotis	265	0.7
Daubenton's	164	0.4
Whiskered	25	0.1
Natterer's	91	0.2
Total	37361	99.9

Counts of Bat Passes

Per Detector

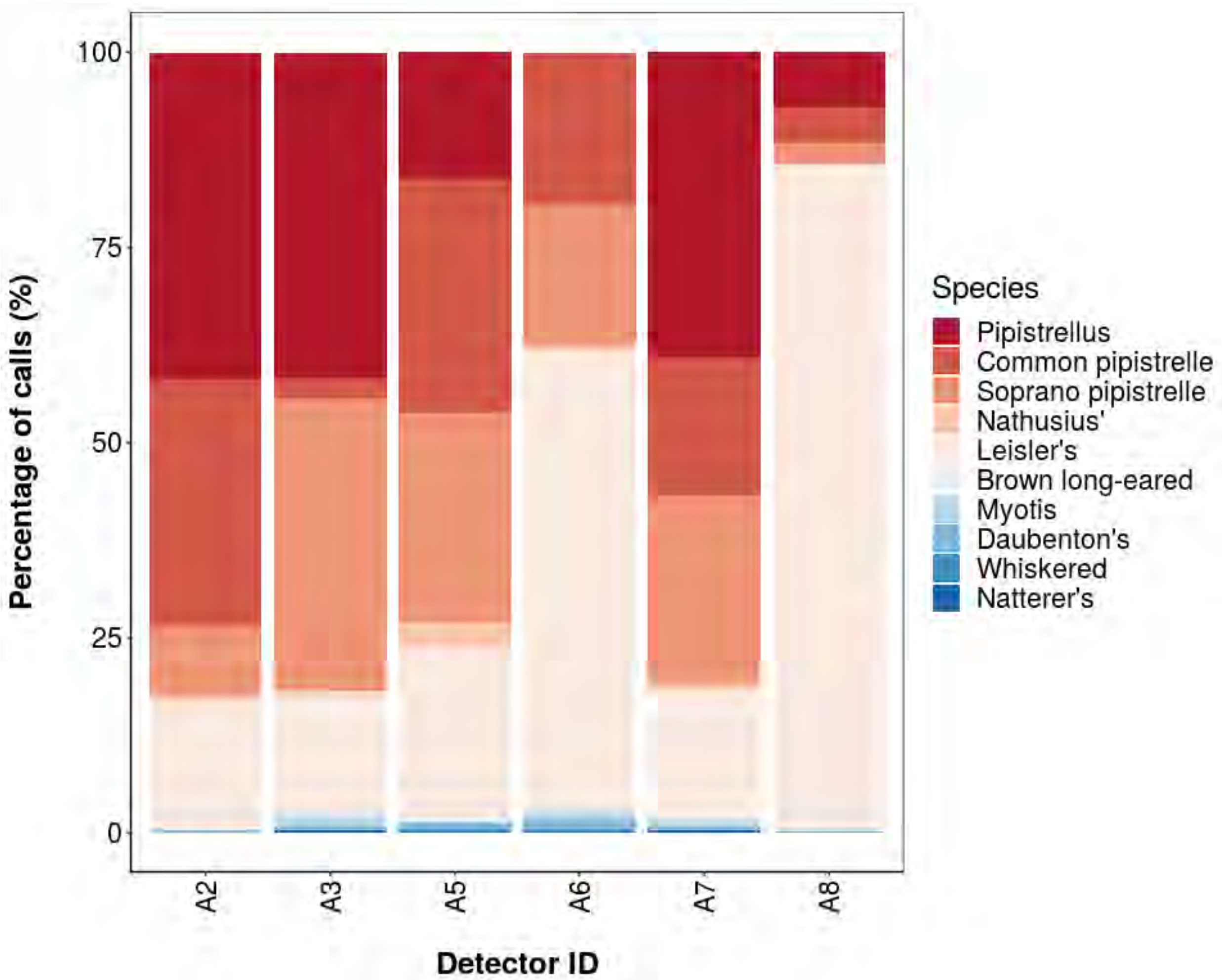
Table 15. The number of passes recorded for each species at each detector.

Species	Detector ID	Count (No)	Percentage by Detector (%)
Pipistrellus	A2	2952	41.8
Pipistrellus	A3	7478	41.7
Pipistrellus	A5	628	16.3
Pipistrellus	A7	768	39.1
Pipistrellus	A8	407	7.2
Common pipistrelle	A2	2234	31.6
Common pipistrelle	A3	441	2.5
Common pipistrelle	A5	1149	29.9
Common pipistrelle	A6	170	19.5
Common pipistrelle	A7	349	17.8
Common pipistrelle	A8	260	4.6
Soprano pipistrelle	A2	622	8.8
Soprano pipistrelle	A3	6729	37.5
Soprano pipistrelle	A5	1028	26.8
Soprano pipistrelle	A6	156	17.9
Soprano pipistrelle	A7	470	23.9
Soprano pipistrelle	A8	141	2.5
Nathusius’	A2	62	0.9
Nathusius’	A3	24	0.1
Nathusius’	A5	133	3.5
Nathusius’	A6	9	1.0
Nathusius’	A7	17	0.9
Nathusius’	A8	19	0.3
Leisler’s	A2	1157	16.4
Leisler’s	A3	2822	15.7
Leisler’s	A5	826	21.5
Leisler’s	A6	506	58.2
Leisler’s	A7	317	16.1
Leisler’s	A8	4833	85.1

Brown long-eared	A2	9	0.1
Brown long-eared	A3	51	0.3
Brown long-eared	A5	26	0.7
Brown long-eared	A6	5	0.6
Brown long-eared	A7	14	0.7
Brown long-eared	A8	4	0.1
Myotis	A2	2	0.0
Myotis	A3	237	1.3
Myotis	A6	7	0.8
Myotis	A7	12	0.6
Myotis	A8	7	0.1
Daubenton's	A2	21	0.3
Daubenton's	A3	79	0.4
Daubenton's	A5	29	0.8
Daubenton's	A6	14	1.6
Daubenton's	A7	10	0.5
Daubenton's	A8	11	0.2
Whiskered	A2	1	0.0
Whiskered	A3	5	0.0
Whiskered	A5	17	0.4
Whiskered	A6	1	0.1
Whiskered	A7	1	0.1
Natterer's	A2	2	0.0
Natterer's	A3	76	0.4
Natterer's	A5	5	0.1
Natterer's	A6	2	0.2
Natterer's	A7	6	0.3

Species Composition

Figure 10. Percentage species composition of passes at each detector.



PART 2a: Presence Only

THE NEXT SECTION OF THE REPORT FEATURES THE RAW DATA SUPPLIED TO ECOBAT AND ONLY TAKES INTO ACCOUNT THE PRESENCE, AND NOT THE ABSENCE, OF EACH BAT SPECIES. FOR EACH NIGHT, THERE IS NO 'ZERO DATA' FOR WHEN SPECIES WERE NOT DETECTED.

Nightly Bat Pass Rate (Bat passes per hour)

Median Per Detector

Table 16. The median Nightly Pass Rate (bat passes per hour, per night) of each species. If NA, then no bat passes.

Bat pass rates are often highly variable between nights, with some nights having few or no passes and other nights having high activity. In these circumstances, the median is likely to be a more useful summary of the 'average' activity than is the mean. For further information see: *Lintott, P. R., & Mathews, F. (2018). Basic mathematical errors may make ecological assessments unreliable. Biodiversity and Conservation, 27(1), 265-267.* https://doi.org/10.1007/s10531-017-1418-5

Species	Detector ID	Median Pass Rate
Pipistrellus	A2	31.9
Pipistrellus	A3	88.8
Pipistrellus	A5	66.0
Pipistrellus	A7	12.1
Pipistrellus	A8	5.6
Common pipistrelle	A2	22.1
Common pipistrelle	A3	5.3
Common pipistrelle	A5	7.1
Common pipistrelle	A6	1.9
Common pipistrelle	A7	3.7
Common pipistrelle	A8	1.2
Soprano pipistrelle	A2	4.2
Soprano pipistrelle	A3	78.2
Soprano pipistrelle	A5	7.8
Soprano pipistrelle	A6	2.0
Soprano pipistrelle	A7	5.4
Soprano pipistrelle	A8	0.8
Nathusius'	A2	0.4
Nathusius'	A3	0.2
Nathusius'	A5	0.6
Nathusius'	A6	0.2
Nathusius'	A7	0.2
Nathusius'	A8	0.2

Leisler’s	A2	11.2
Leisler’s	A3	26.5
Leisler’s	A5	6.7
Leisler’s	A6	4.3
Leisler’s	A7	3.5
Leisler’s	A8	33.1
Brown long-eared	A2	0.1
Brown long-eared	A3	0.4
Brown long-eared	A5	0.2
Brown long-eared	A6	0.1
Brown long-eared	A7	0.3
Brown long-eared	A8	0.1
Myotis	A2	0.1
Myotis	A3	2.5
Myotis	A6	0.3
Myotis	A7	0.3
Myotis	A8	0.2
Daubenton’s	A2	0.2
Daubenton’s	A3	0.5
Daubenton’s	A5	0.2
Daubenton’s	A6	0.2
Daubenton’s	A7	0.1
Daubenton’s	A8	0.3
Whiskered	A2	0.1
Whiskered	A3	0.1
Whiskered	A5	0.1
Whiskered	A6	0.1
Whiskered	A7	0.1
Natterer’s	A2	0.1
Natterer’s	A3	0.7
Natterer’s	A5	0.1
Natterer’s	A6	0.1
Natterer’s	A7	0.2

Nightly Bat Pass Rate (Bat passes per hour)

Mean per Detector

Table 17. The mean Nightly Pass Rate (bat passes per hour, per night) of each species at each detector. Values are given to 1 decimal place.

We recommend using the median values given above, for the reasons stated above, but provide the mean values in the table below.

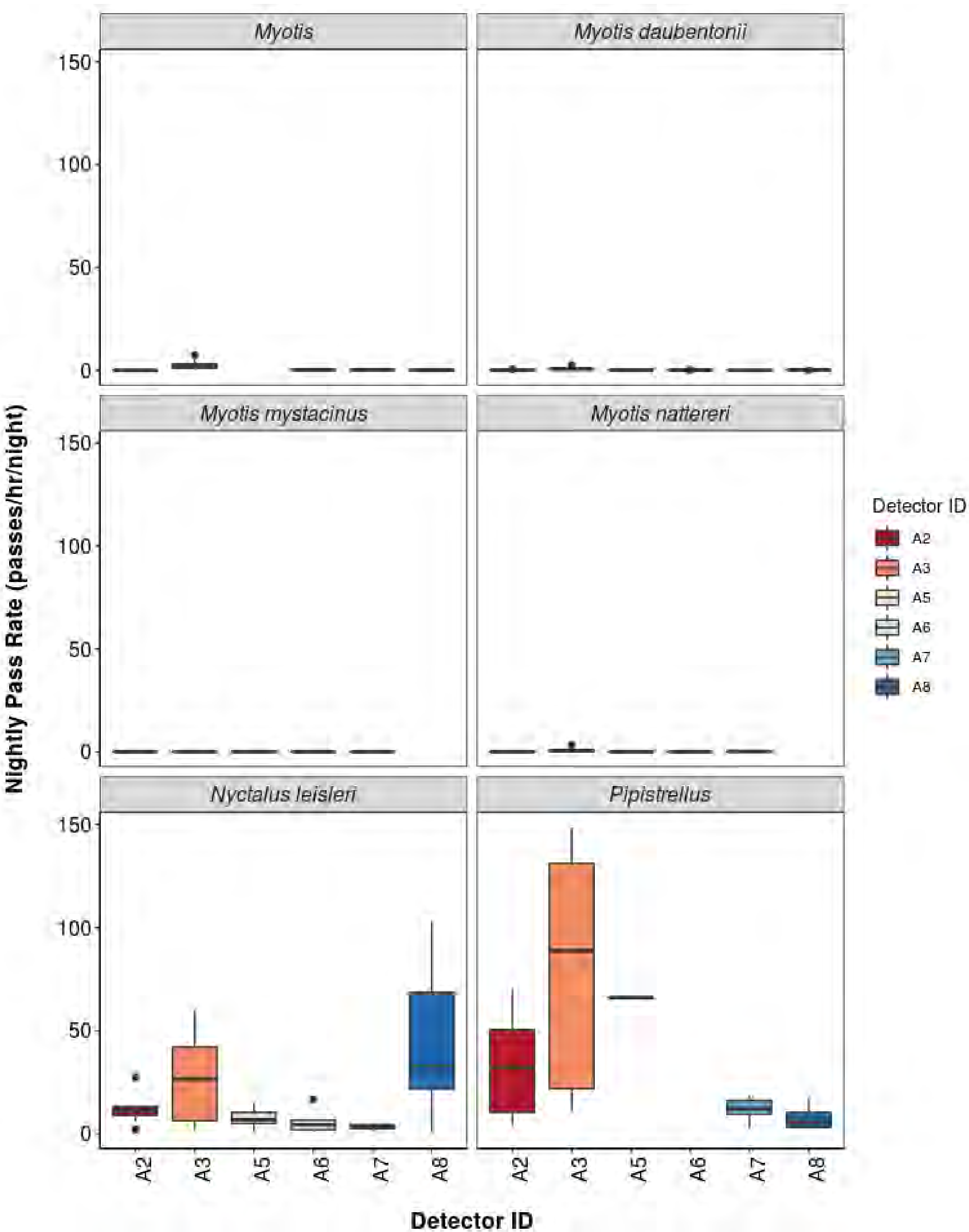
Species	Detector ID	Mean Pass Rate
Pipistrellus	A2	31.9
Pipistrellus	A3	80.7
Pipistrellus	A5	66.0
Pipistrellus	A7	12.0
Pipistrellus	A8	7.4
Common pipistrelle	A2	21.9
Common pipistrelle	A3	4.8
Common pipistrelle	A5	11.3
Common pipistrelle	A6	2.1
Common pipistrelle	A7	3.8
Common pipistrelle	A8	2.8
Soprano pipistrelle	A2	6.2
Soprano pipistrelle	A3	72.5
Soprano pipistrelle	A5	10.1
Soprano pipistrelle	A6	1.7
Soprano pipistrelle	A7	4.6
Soprano pipistrelle	A8	1.4
Nathusius’	A2	0.8
Nathusius’	A3	0.4
Nathusius’	A5	1.6
Nathusius’	A6	0.3
Nathusius’	A7	0.2
Nathusius’	A8	0.4
Leisler’s	A2	11.5
Leisler’s	A3	25.3
Leisler’s	A5	7.5

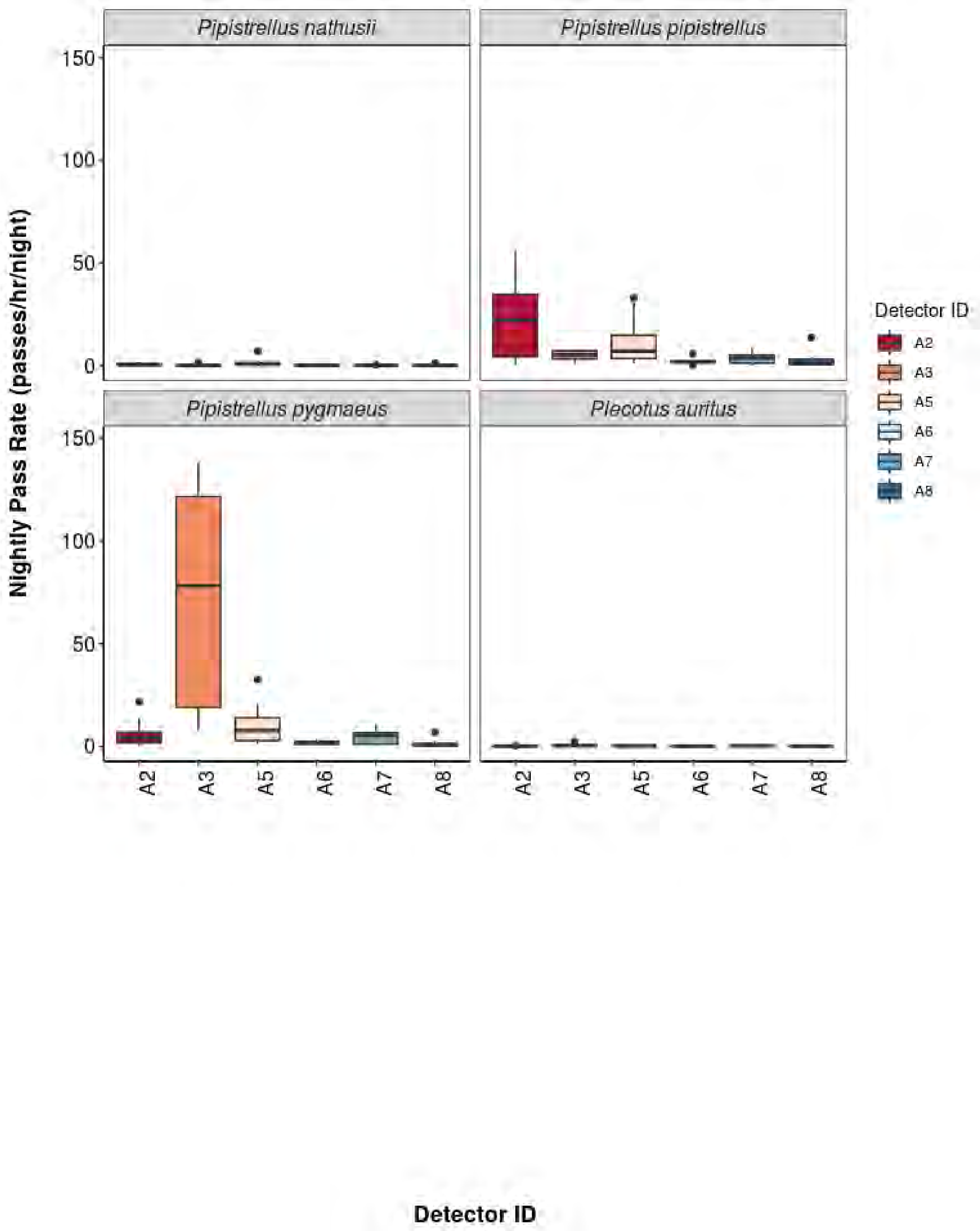
Leisler’s	A6	5.0
Leisler’s	A7	3.1
Leisler’s	A8	43.8
Brown long-eared	A2	0.2
Brown long-eared	A3	0.7
Brown long-eared	A5	0.3
Brown long-eared	A6	0.1
Brown long-eared	A7	0.3
Brown long-eared	A8	0.1
Myotis	A2	0.1
Myotis	A3	2.9
Myotis	A6	0.3
Myotis	A7	0.3
Myotis	A8	0.3
Daubenton’s	A2	0.3
Daubenton’s	A3	1.0
Daubenton’s	A5	0.3
Daubenton’s	A6	0.2
Daubenton’s	A7	0.2
Daubenton’s	A8	0.3
Whiskered	A2	0.1
Whiskered	A3	0.1
Whiskered	A5	0.2
Whiskered	A6	0.1
Whiskered	A7	0.1
Natterer’s	A2	0.1
Natterer’s	A3	0.9
Natterer’s	A5	0.2
Natterer’s	A6	0.1
Natterer’s	A7	0.2

Nightly Bat Passes (Bat passes per hour)

Per Detector - Figures

Figure 11. Boxplots for the number of bat passes per hour each night, for each detector. The ‘box’ shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The ‘whiskers’ extend from the box and represent the ranges for the bottom 25% and the top 25% of the data values, excluding outliers. An outlier is any extreme value that lies further away from the box than 1.5 times the interquartile range. Outliers are shown as dots. Where very few passes are recorded it is not possible to produce the box, so the data are shown as a line.


Myotis
Myotis daubentonii
Myotis mystacinus
Myotis nattereri
Nyctalus leisleri
Pipistrellus
Nightly Pass Rate (passes/hr/night)
0
50
100
150
A2
A3
A5
A6
A7
A8
Detector ID
Detector ID
A2
A3
A5
A6
A7
A8



Pipistrellus nathusii
Pipistrellus pipistrellus
Pipistrellus pygmaeus
Plecotus auritus
Nightly Pass Rate (passes/hr/night)
150
100
50
0
A2
A3
A5
A6
A7
A8
Detector ID
Detector ID

SPLIT BY MONTH

Total Bat Passes per Detector, each Month

Per Detector

Table 18. The total number of bat passes of each species in each month at each detector. This table simply tells you how many bats of each species were recorded passing each detector during each month. These numbers are not standardised by the night length, or how many nights each detector was active for during each month.

Species	Detector ID	Apr	May
Pipistrellus	A2	2107	845
Pipistrellus	A3	5513	1965
Pipistrellus	A5	628	0
Pipistrellus	A7	361	407
Pipistrellus	A8	217	190
Common pipistrelle	A2	1717	517
Common pipistrelle	A3	315	126
Common pipistrelle	A5	840	309
Common pipistrelle	A6	85	85
Common pipistrelle	A7	160	189
Common pipistrelle	A8	178	82
Soprano pipistrelle	A2	338	284
Soprano pipistrelle	A3	4980	1749
Soprano pipistrelle	A5	795	233
Soprano pipistrelle	A6	85	71
Soprano pipistrelle	A7	271	199
Soprano pipistrelle	A8	57	84
Nathusius’	A2	31	31
Nathusius’	A3	21	3
Nathusius’	A5	94	39
Nathusius’	A6	1	8
Nathusius’	A7	13	4
Nathusius’	A8	6	13
Leisler’s	A2	673	484

Leisler’s	A3	2276	546
Leisler’s	A5	585	241
Leisler’s	A6	242	264
Leisler’s	A7	198	119
Leisler’s	A8	3027	1806
Brown long-eared	A2	6	3
Brown long-eared	A3	49	2
Brown long-eared	A5	20	6
Brown long-eared	A6	3	2
Brown long-eared	A7	10	4
Brown long-eared	A8	3	1
Myotis	A2	0	2
Myotis	A3	189	48
Myotis	A6	4	3
Myotis	A7	12	0
Myotis	A8	5	2
Daubenton’s	A2	16	5
Daubenton’s	A3	58	21
Daubenton’s	A5	25	4
Daubenton’s	A6	9	5
Daubenton’s	A7	9	1
Daubenton’s	A8	10	1
Whiskered	A2	1	0
Whiskered	A3	4	1
Whiskered	A5	14	3
Whiskered	A6	1	0
Whiskered	A7	1	0
Natterer’s	A2	1	1
Natterer’s	A3	69	7
Natterer’s	A5	5	0
Natterer’s	A6	2	0
Natterer’s	A7	6	0

Survey Effort

Table 19. The number of survey nights per month per detector.

Month	Detector ID	No. of Survey Nights
Apr	A2	7
Apr	A3	8
Apr	A5	8
Apr	A6	7
Apr	A7	7
Apr	A8	8
May	A2	4
May	A3	4
May	A5	4
May	A6	4
May	A7	4
May	A8	4

Nightly Bat Pass Rate for each Month

Median Per Detector

Table 20. The median Nightly Pass Rate (bat passes per hour, per night) of each species throughout each month. If NA, then no bat passes.

Bat pass rates are often highly variable between nights, with some nights having few or no passes and other nights having high activity. In these circumstances, the median is likely to be a more useful summary of the 'average' activity than is the mean. For further information see: *Lintott, P. R., & Mathews, F. (2018). Basic mathematical errors may make ecological assessments unreliable. Biodiversity and Conservation, 27(1), 265-267.* https://doi.org/10.1007/s10531-017-1418-5

Species	Detector ID	Apr	May
Pipistrellus	A2	33.9	30.0
Pipistrellus	A3	100.5	77.1
Pipistrellus	A5	66.0	NA
Pipistrellus	A7	9.7	15.6
Pipistrellus	A8	3.8	7.5
Common pipistrelle	A2	26.5	15.0
Common pipistrelle	A3	4.9	5.7
Common pipistrelle	A5	7.1	6.6
Common pipistrelle	A6	1.7	1.9
Common pipistrelle	A7	2.4	8.4
Common pipistrelle	A8	0.5	3.6
Soprano pipistrelle	A2	4.2	4.9
Soprano pipistrelle	A3	88.8	67.6
Soprano pipistrelle	A5	7.8	5.9
Soprano pipistrelle	A6	1.7	2.4
Soprano pipistrelle	A7	3.3	6.5
Soprano pipistrelle	A8	0.7	1.2
Nathusius'	A2	0.3	1.2
Nathusius'	A3	0.1	0.3
Nathusius'	A5	0.6	1.6
Nathusius'	A6	0.1	0.4
Nathusius'	A7	0.2	0.1
Nathusius'	A8	0.1	0.7

Leisler’s	A2	11.2	12.4
Leisler’s	A3	28.2	9.3
Leisler’s	A5	8.6	4.6
Leisler’s	A6	3.4	6.4
Leisler’s	A7	3.5	3.4
Leisler’s	A8	33.1	49.4
Brown long-eared	A2	0.1	0.2
Brown long-eared	A3	0.4	0.2
Brown long-eared	A5	0.2	0.1
Brown long-eared	A6	0.1	0.1
Brown long-eared	A7	0.3	0.2
Brown long-eared	A8	0.1	0.1
Myotis	A2	NA	0.1
Myotis	A3	2.8	1.1
Myotis	A6	0.2	0.3
Myotis	A7	0.3	NA
Myotis	A8	0.3	0.2
Daubenton’s	A2	0.2	0.3
Daubenton’s	A3	0.5	0.7
Daubenton’s	A5	0.3	0.2
Daubenton’s	A6	0.2	0.3
Daubenton’s	A7	0.2	0.1
Daubenton’s	A8	0.3	0.1
Whiskered	A2	0.1	NA
Whiskered	A3	0.1	0.1
Whiskered	A5	0.3	0.1
Whiskered	A6	0.1	NA
Whiskered	A7	0.1	NA
Natterer’s	A2	0.1	0.1
Natterer’s	A3	0.8	0.4
Natterer’s	A5	0.1	NA
Natterer’s	A6	0.1	NA
Natterer’s	A7	0.2	NA

Nightly Bat Pass Rate for each Month

Mean per Detector

Table 21: The mean Nightly Pass Rate (bat passes per hour, per night) of each species throughout each month. Values are given to 1 decimal place.

We recommend using the median values given above, for the reasons stated above, but provide the mean values in the table below.

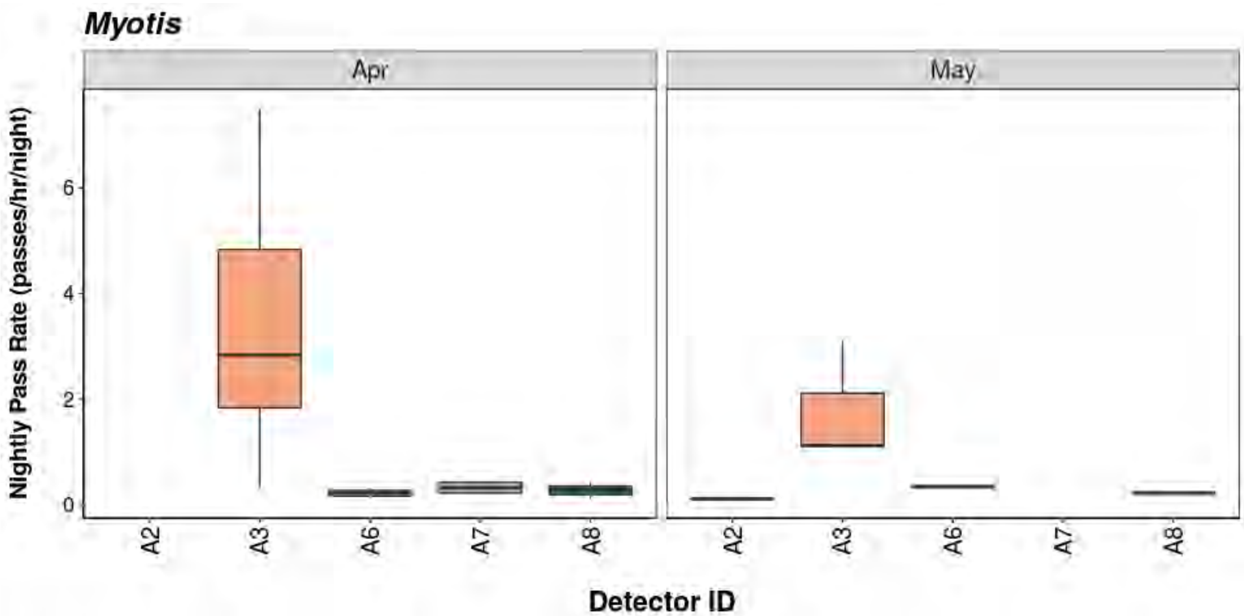
Species	Detector ID	Apr	May
Pipistrellus	A2	32.0	31.6
Pipistrellus	A3	83.8	73.3
Pipistrellus	A5	66.0	NA
Pipistrellus	A7	9.6	15.2
Pipistrellus	A8	7.7	7.1
Common pipistrelle	A2	26.1	14.5
Common pipistrelle	A3	4.8	4.7
Common pipistrelle	A5	12.8	8.7
Common pipistrelle	A6	1.5	3.2
Common pipistrelle	A7	2.4	7.1
Common pipistrelle	A8	2.7	3.1
Soprano pipistrelle	A2	5.2	7.9
Soprano pipistrelle	A3	75.7	65.3
Soprano pipistrelle	A5	12.1	6.5
Soprano pipistrelle	A6	1.3	2.7
Soprano pipistrelle	A7	4.1	5.6
Soprano pipistrelle	A8	0.9	2.4
Nathusius’	A2	0.6	1.2
Nathusius’	A3	0.5	0.3
Nathusius’	A5	1.7	1.5
Nathusius’	A6	0.1	0.4
Nathusius’	A7	0.3	0.2
Nathusius’	A8	0.2	0.7
Leisler’s	A2	10.3	13.6
Leisler’s	A3	30.4	15.3
Leisler’s	A5	7.8	6.7

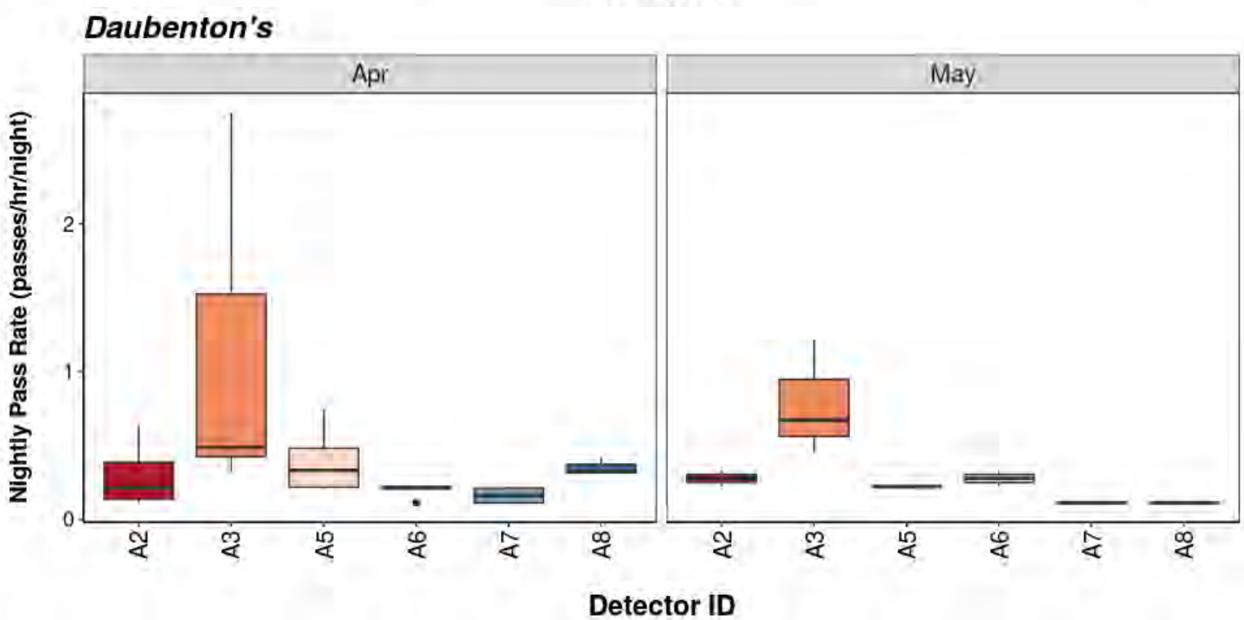
Leisler’s	A6	3.7	7.4
Leisler’s	A7	3.0	3.3
Leisler’s	A8	40.3	50.7
Brown long-eared	A2	0.2	0.2
Brown long-eared	A3	0.8	0.2
Brown long-eared	A5	0.3	0.2
Brown long-eared	A6	0.1	0.1
Brown long-eared	A7	0.3	0.2
Brown long-eared	A8	0.1	0.1
Myotis	A2	NA	0.1
Myotis	A3	3.4	1.8
Myotis	A6	0.2	0.3
Myotis	A7	0.3	NA
Myotis	A8	0.3	0.2
Daubenton’s	A2	0.3	0.3
Daubenton’s	A3	1.1	0.8
Daubenton’s	A5	0.4	0.2
Daubenton’s	A6	0.2	0.3
Daubenton’s	A7	0.2	0.1
Daubenton’s	A8	0.4	0.1
Whiskered	A2	0.1	NA
Whiskered	A3	0.1	0.1
Whiskered	A5	0.2	0.1
Whiskered	A6	0.1	NA
Whiskered	A7	0.1	NA
Natterer’s	A2	0.1	0.1
Natterer’s	A3	1.1	0.4
Natterer’s	A5	0.2	NA
Natterer’s	A6	0.1	NA
Natterer’s	A7	0.2	NA

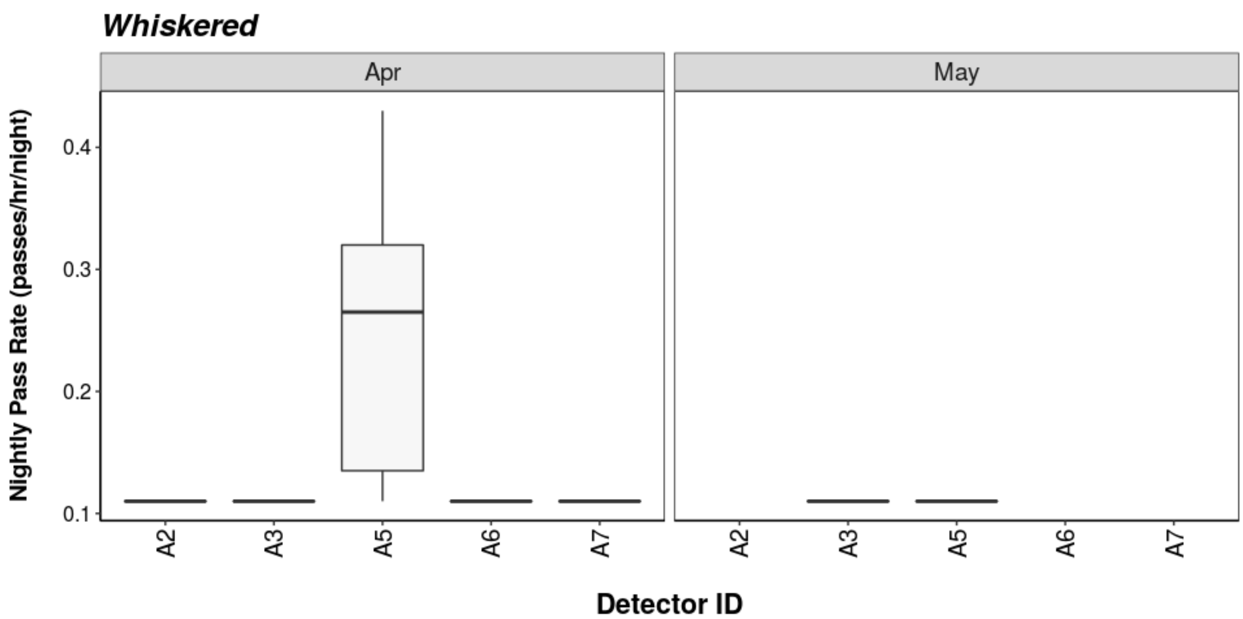
Nightly Bat Pass Rate for each Month

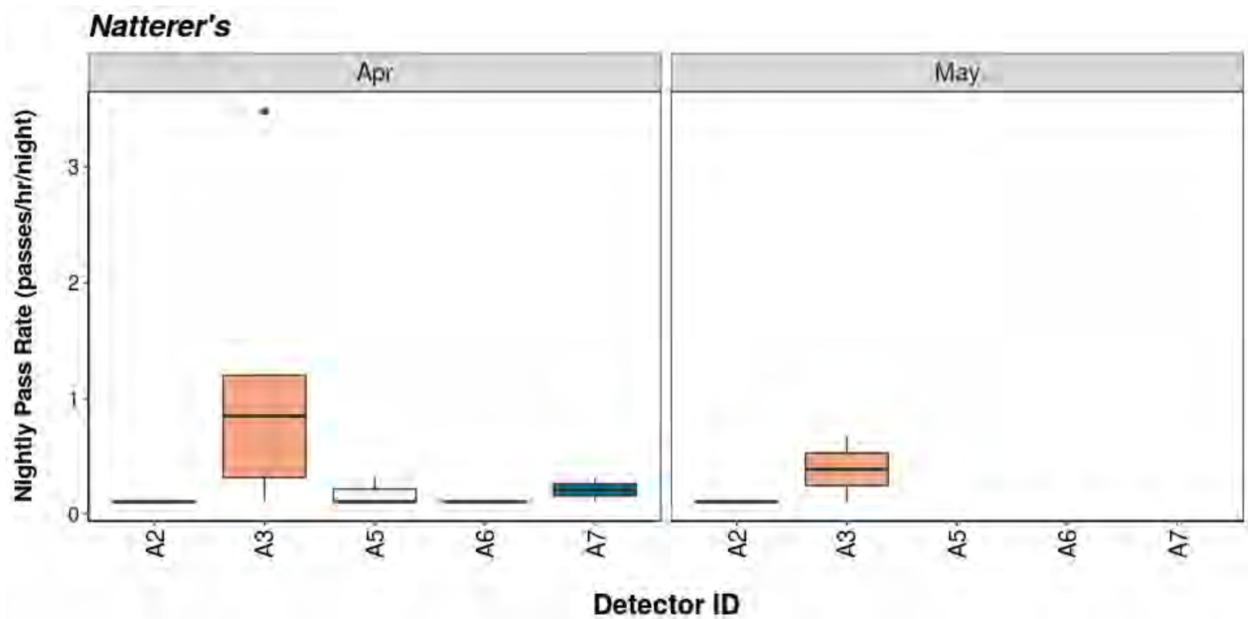
Per Detector - Figures

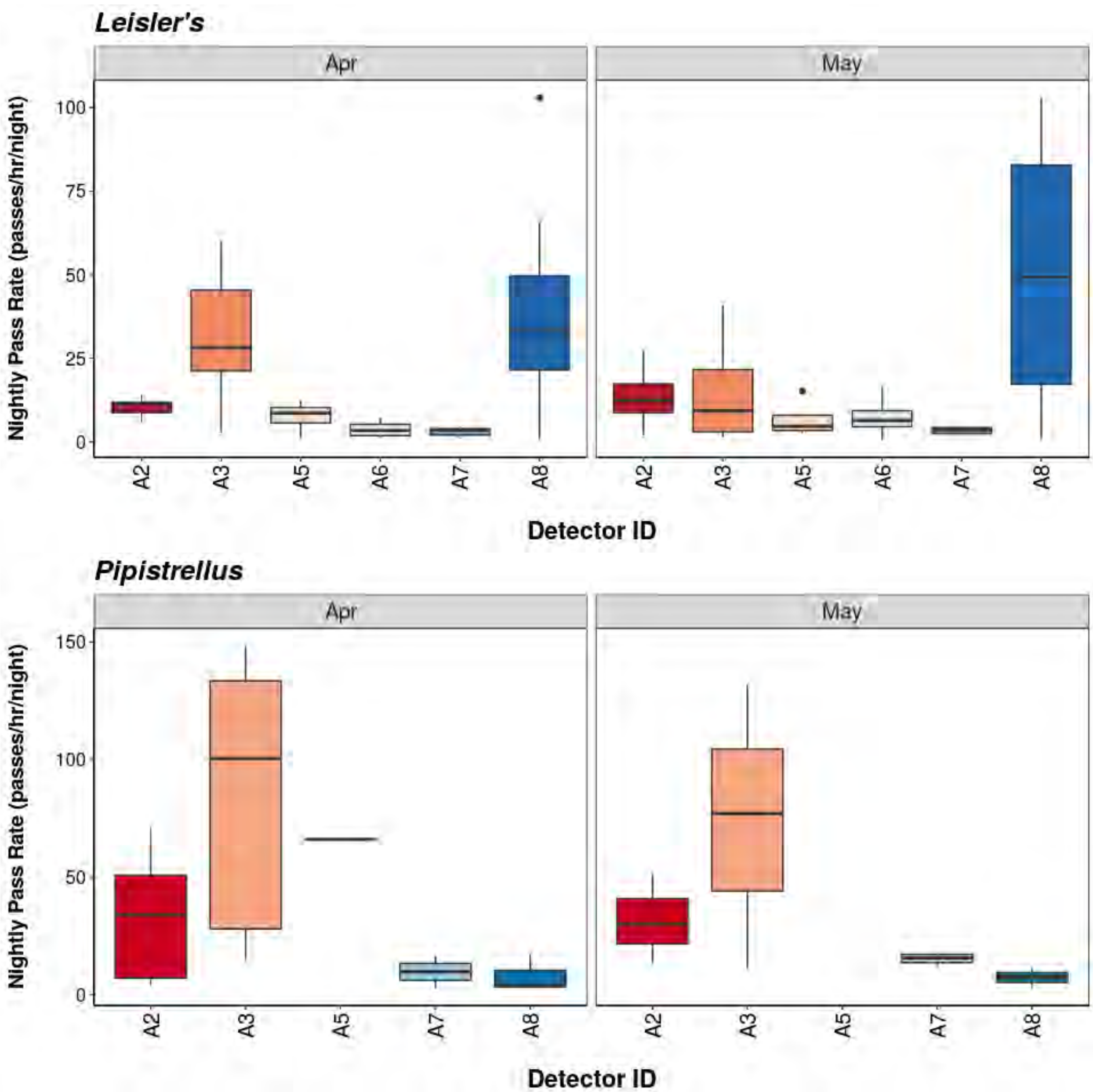
Figure 12. Figures show boxplots for the number of bat passes per hour by detector, for each month. The 'box' shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The 'whiskers' extend from the box and represent the ranges for the bottom 25% and the top 25% of the data values, excluding outliers. An outlier is any extreme value that lies further away from the box than 1.5 times the interquartile range. Outliers are shown as dots. Where very few passes are recorded it is not possible to produce the box, so the data are shown as a line.

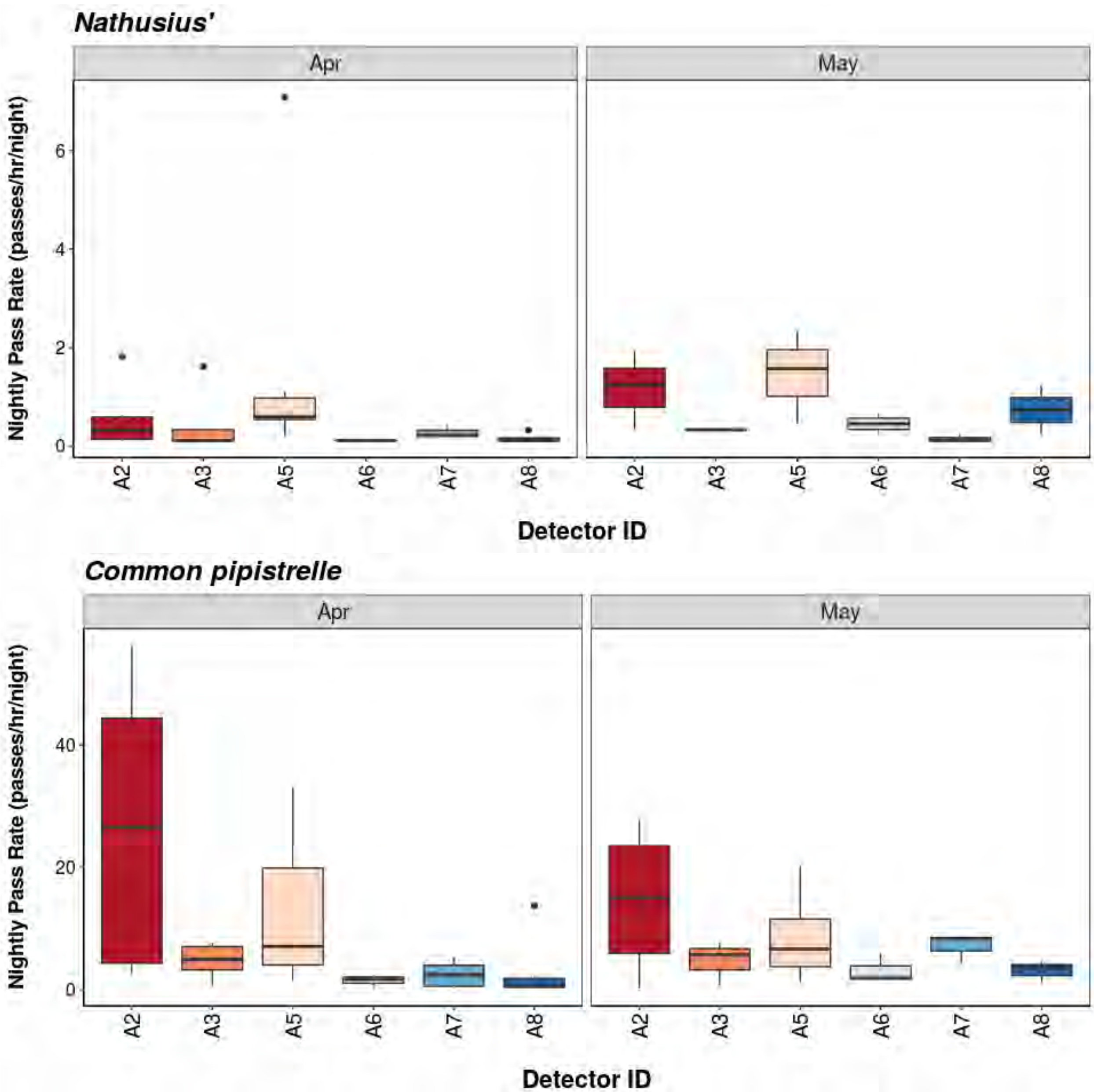


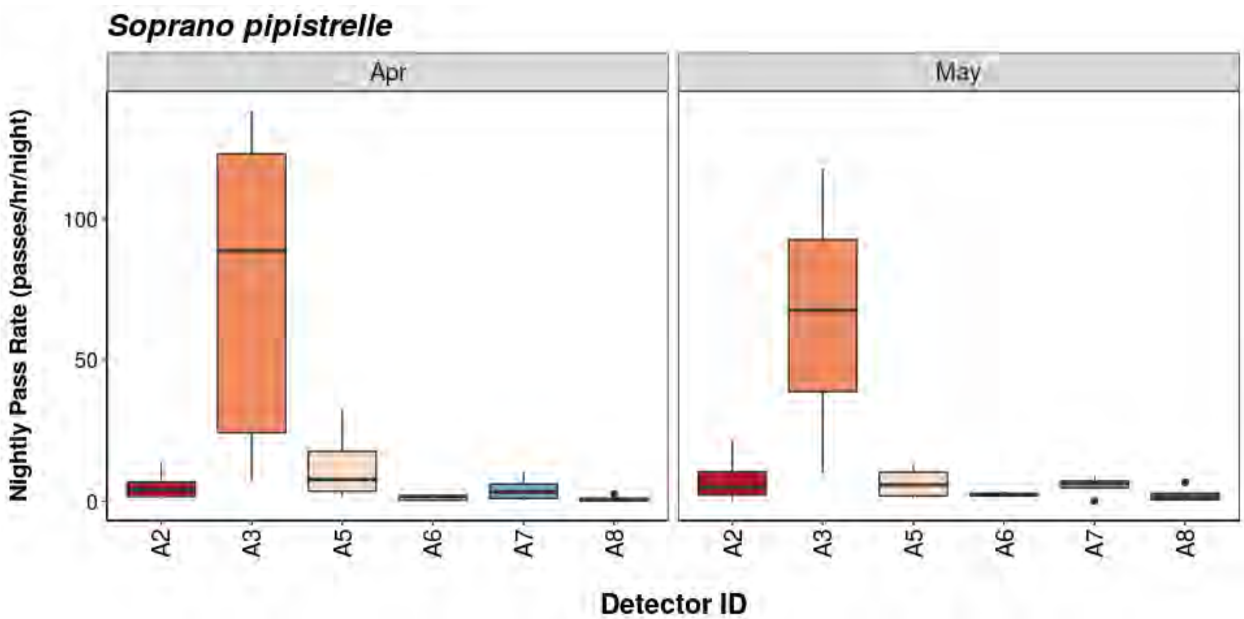


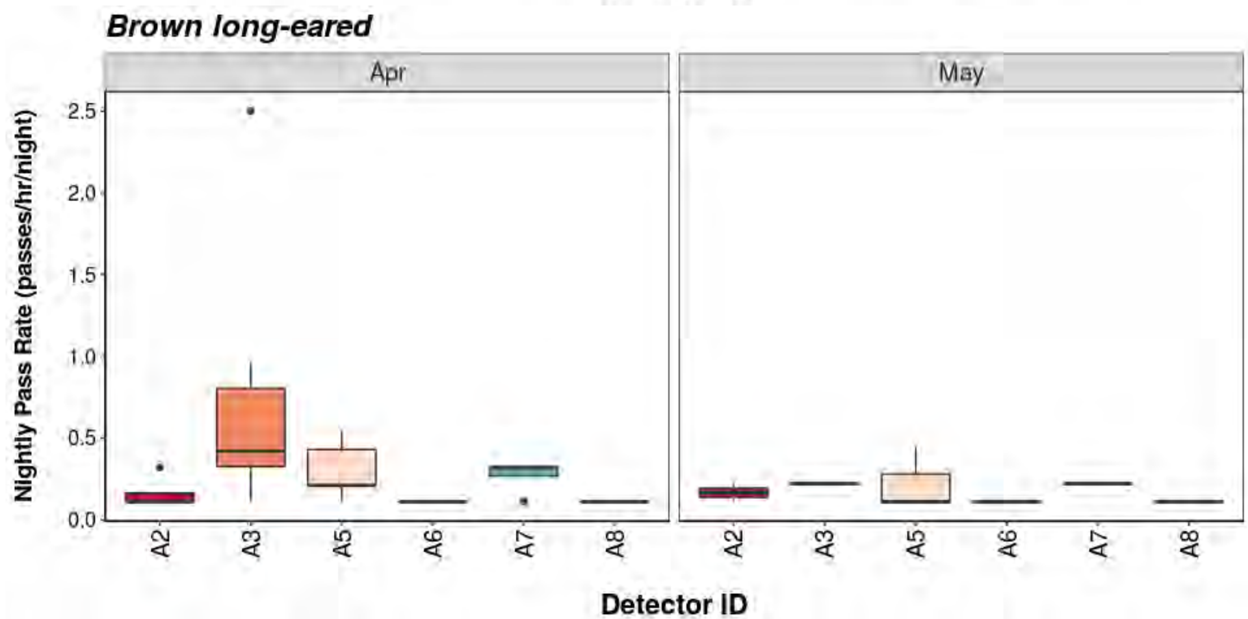

Whiskered
Apr
May
Nightly Pass Rate (passes/hr/night)
0.1
0.2
0.3
0.4
A2
A3
A5
A6
A7
Detector ID


Natterer's
Apr
May
Nightly Pass Rate (passes/hr/night)
0
1
2
3
A2
A3
A5
A6
A7
Detector ID


Leisler's
Apr
May
Nightly Pass Rate (passes/hr/night)
100
75
50
25
0
A2
A3
A5
A6
A7
A8
Detector ID
Pipistrellus
Apr
May
Nightly Pass Rate (passes/hr/night)
150
100
50
0
A2
A3
A5
A7
A8
Detector ID


Nathusius'
Apr
May
Nightly Pass Rate (passes/hr/night)
Detector ID
Common pipistrelle
Apr
May
Nightly Pass Rate (passes/hr/night)
Detector ID


Soprano pipistrelle
Apr
May
Nightly Pass Rate (passes/hr/night)
0
50
100
A2
A3
A5
A6
A7
A8
Detector ID


Brown long-eared
Apr
May
Nightly Pass Rate (passes/hr/night)
0.0
0.5
1.0
1.5
2.0
2.5
A2
A3
A5
A6
A7
A8
Detector ID

Bat Activity per Detector Location

Figure 13. Detector ID reference:

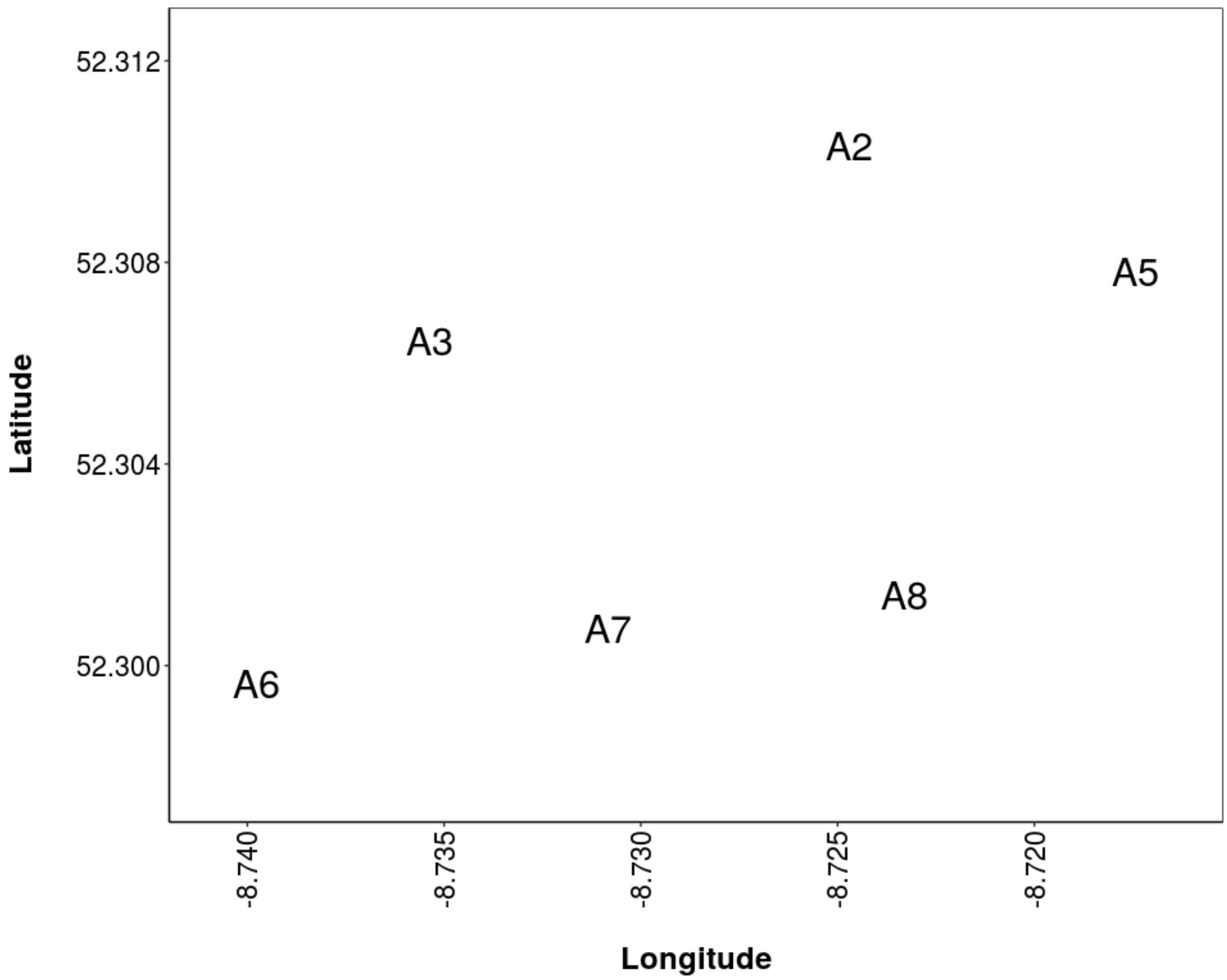
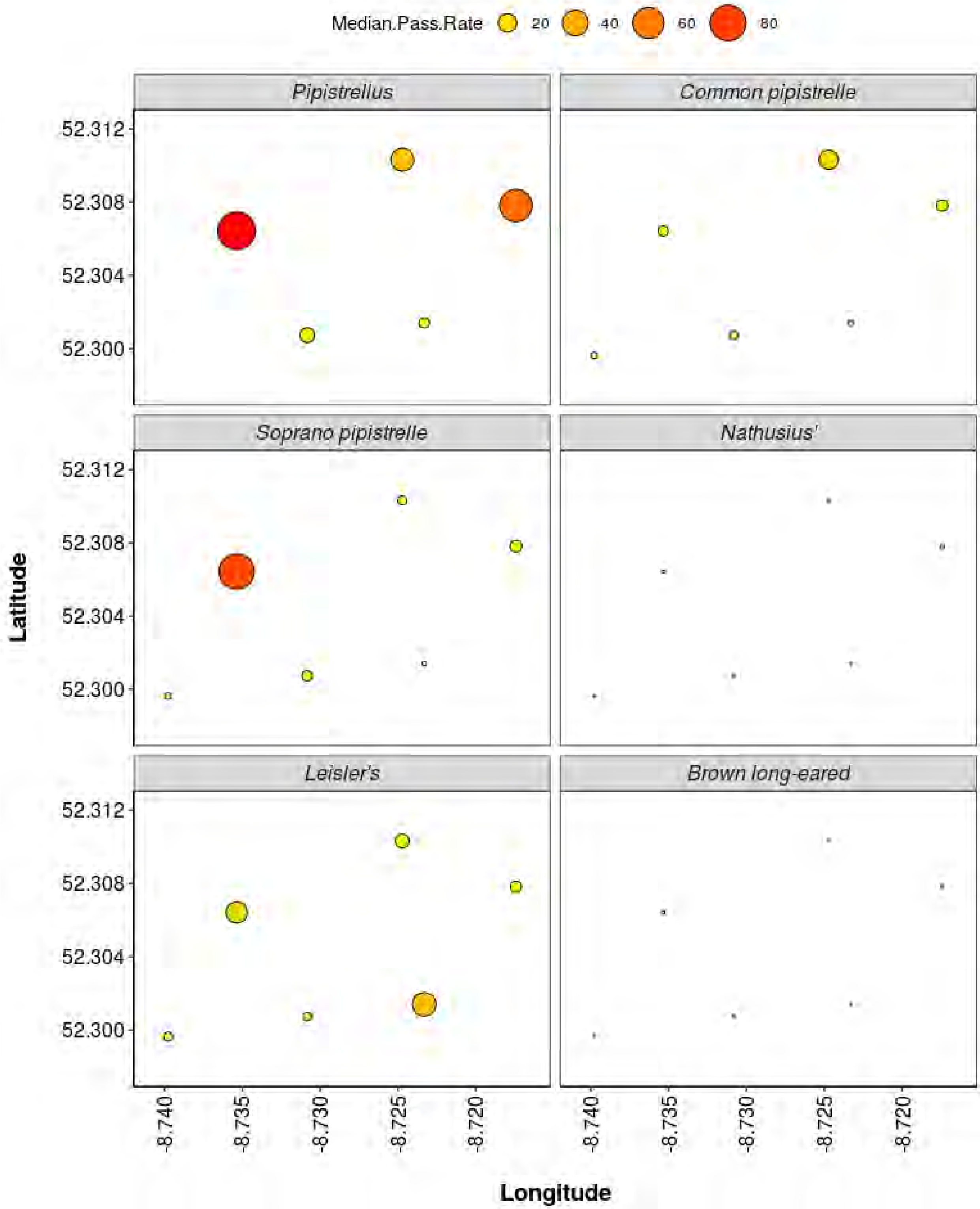
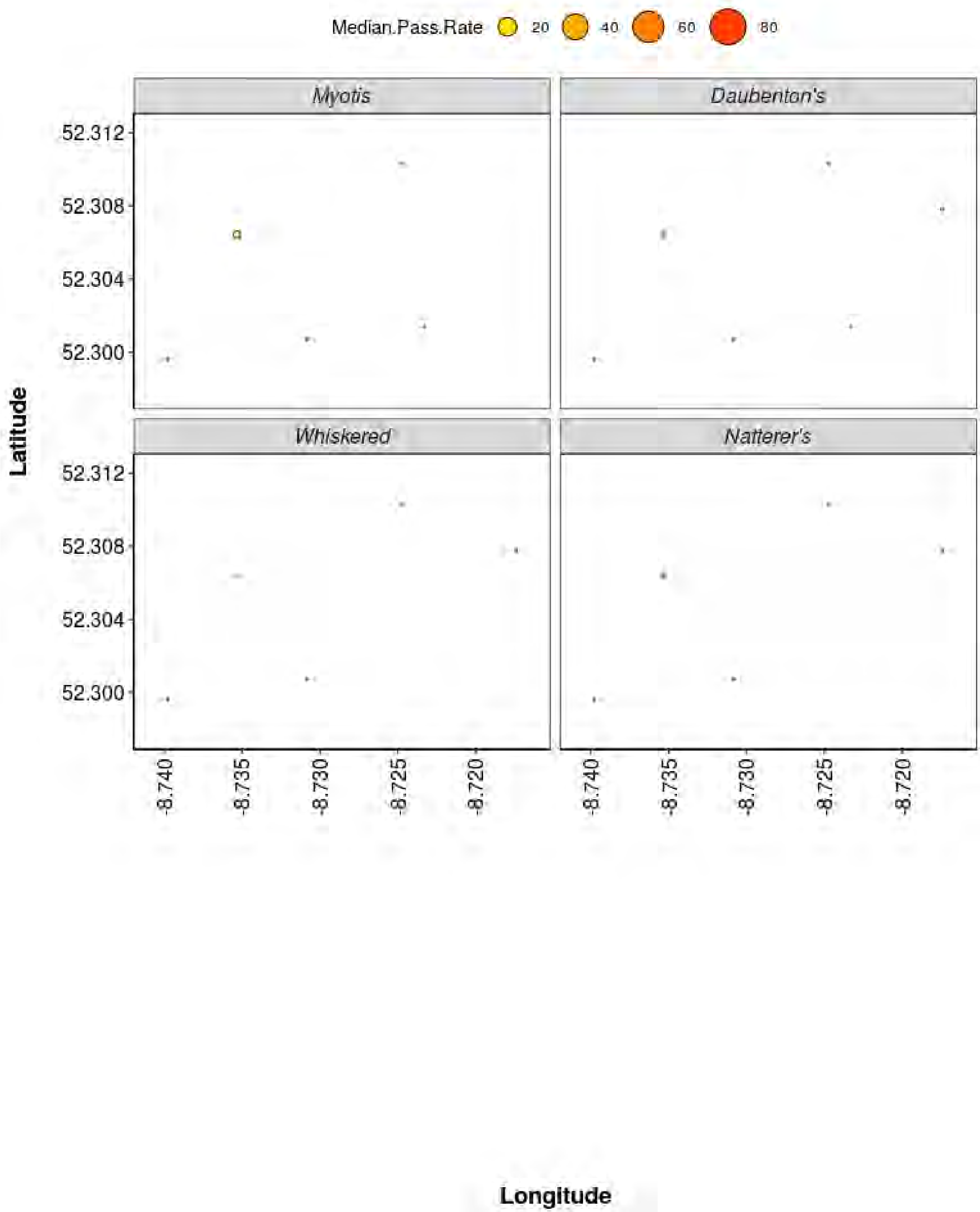


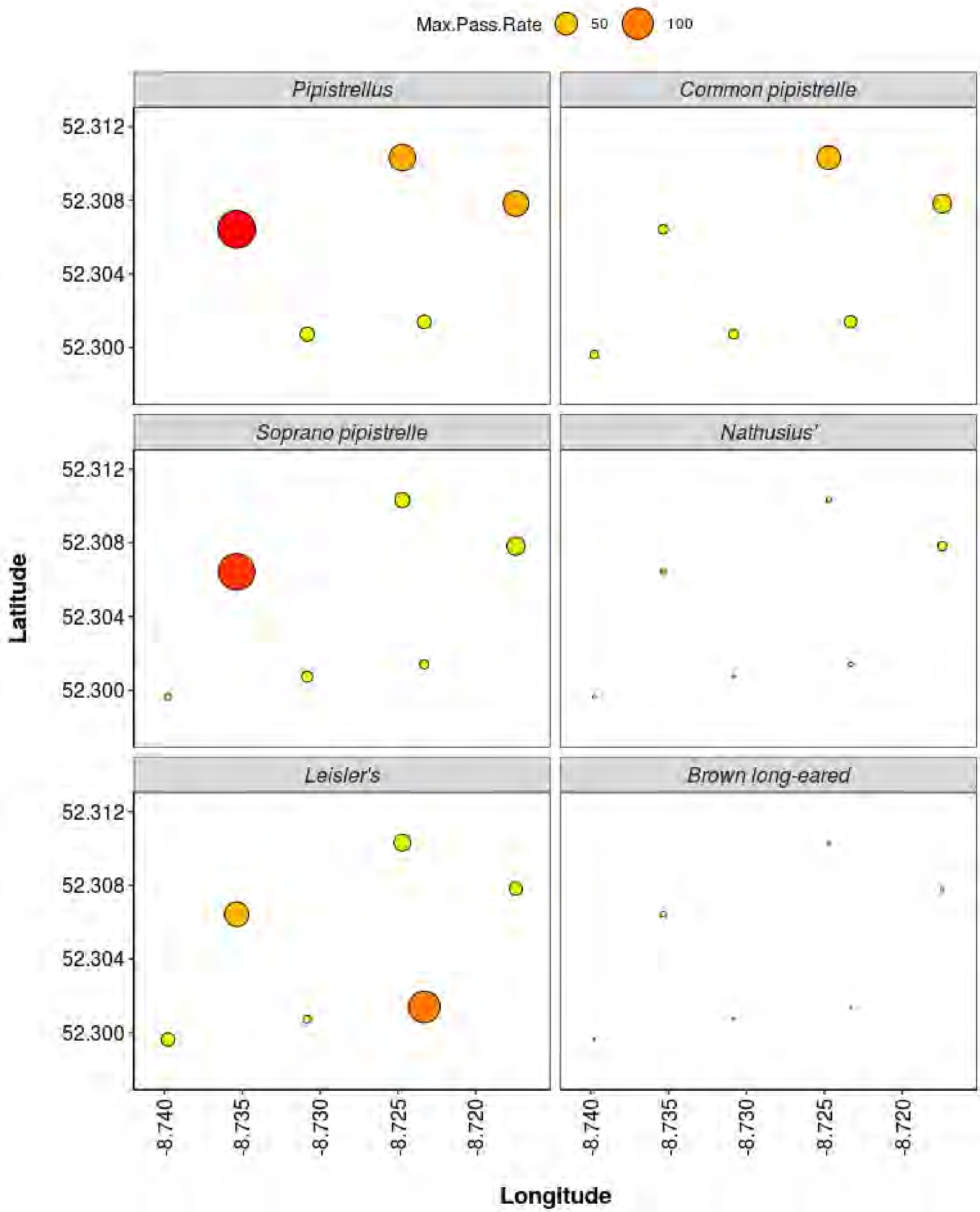
Figure 14. Median Nightly Pass Rate (bat passes/hr/night) throughout the survey period - represented by the size and colour of the point at each detector location.


Median.Pass.Rate
20
40
60
80
Pipistrellus
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Brown long-eared
52.312
52.308
52.304
52.300
-8.740
-8.735
-8.730
-8.725
-8.720
Latitude
Longitude

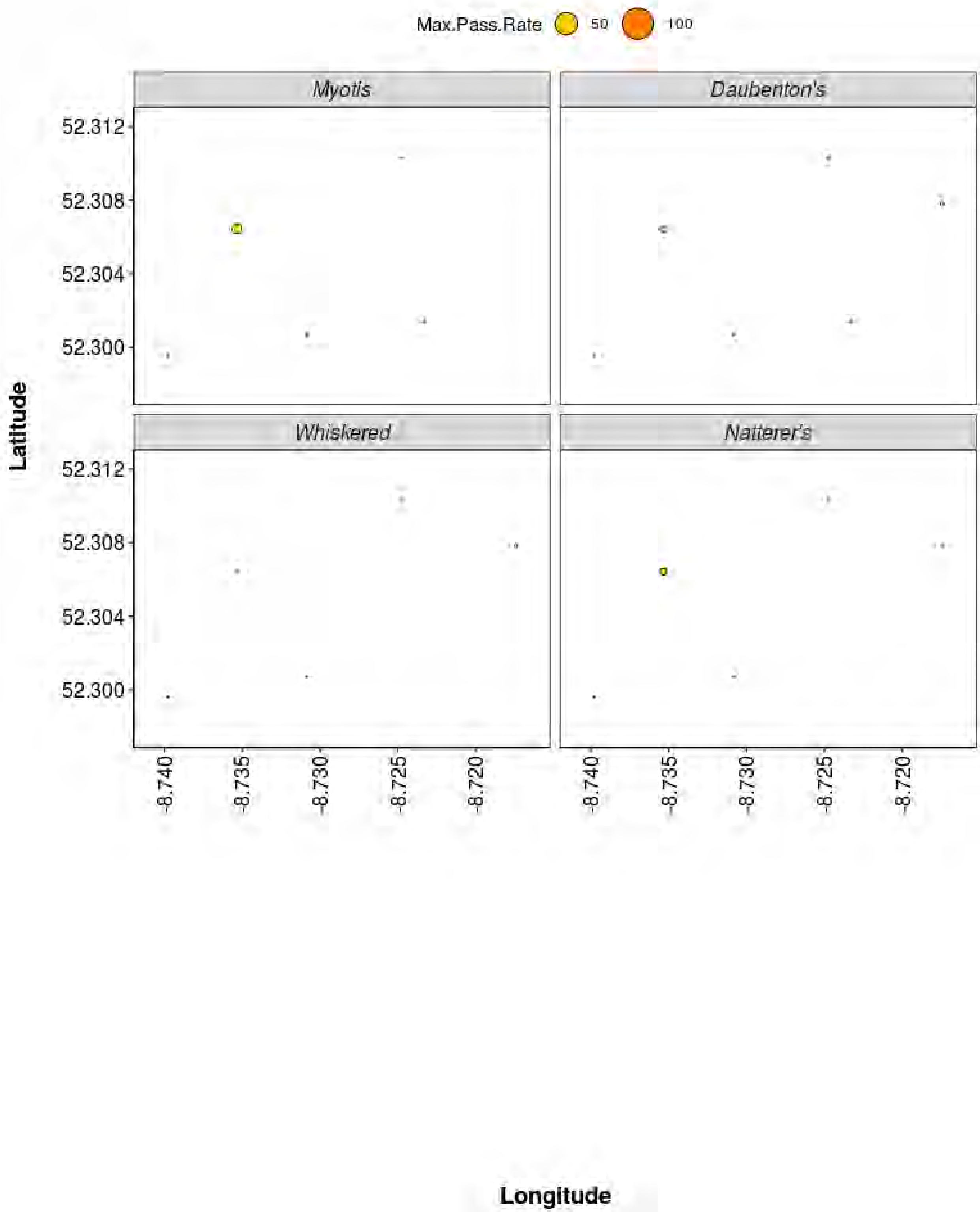


Median.Pass.Rate
20
40
60
80
Myotis
Daubenton's
Whiskered
Natterer's
Latitude
52.312
52.308
52.304
52.300
-8.740
-8.735
-8.730
-8.725
-8.720
Longitude

Figure 15. Maximum Nightly Pass Rate (bat passes/hr/night) recorded in a single night throughout the survey period - represented by the size and colour of the point at each detector location.



Max.Pass.Rate
50
100
Pipistrellus
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Brown long-eared
Latitude
52.312
52.308
52.304
52.300
Longitude
-8.740
-8.735
-8.730
-8.725
-8.720



Max.Pass.Rate
50
100
Myotis
Daubenton's
Whiskered
Natterer's
52.312
52.308
52.304
52.300
Latitude
-8.740
-8.735
-8.730
-8.725
-8.720
Longitude

PART 2B: Includes absences

THE NEXT SECTION OF THE REPORT FEATURES THE DATA SUPPLIED TO ECOBAT BUT TAKES INTO ACCOUNT SPECIES ABSENCES, AND THEREFORE INCLUDES 'ZERO DATA' FOR WHEN SPECIES WERE NOT DETECTED AT EACH DETECTOR ON A NIGHT. THIS DRAMATICALLY LOWERS THE MEANS AND MEDIANS OF THE DATA PRESENTED.

Nightly Bat Pass Rate (Bat passes per hour)

Median Per Detector

Table 22. The median Nightly Pass Rate (bat passes per hour, per night) of each species. If NA, then no bat passes.

Bat pass rates are often highly variable between nights, with some nights having few or no passes and other nights having high activity. In these circumstances, the median is likely to be a more useful summary of the ‘average’ activity than is the mean. For further information see: *Lintott, P. R., & Mathews, F. (2018). Basic mathematical errors may make ecological assessments unreliable. Biodiversity and Conservation, 27(1), 265-267.* https://doi.org/10.1007/s10531-017-1418-5

Species	Detector ID	Median Pass Rate
Brown long-eared	A2	0.1
Brown long-eared	A3	0.3
Brown long-eared	A5	0.2
Brown long-eared	A6	0.0
Brown long-eared	A7	0.1
Brown long-eared	A8	0.0
Common pipistrelle	A2	22.1
Common pipistrelle	A3	4.2
Common pipistrelle	A5	6.4
Common pipistrelle	A6	1.8
Common pipistrelle	A7	3.2
Common pipistrelle	A8	0.8
Daubenton’s	A2	0.2
Daubenton’s	A3	0.4
Daubenton’s	A5	0.2
Daubenton’s	A6	0.2
Daubenton’s	A7	0.1
Daubenton’s	A8	0.0
Leisler’s	A2	11.2
Leisler’s	A3	26.5
Leisler’s	A5	6.7
Leisler’s	A6	4.3
Leisler’s	A7	3.5

Leisler’s	A8	33.1
Myotis	A2	0.0
Myotis	A3	1.4
Myotis	A5	0.0
Myotis	A6	0.0
Myotis	A7	0.0
Myotis	A8	0.0
Nathusius’	A2	0.3
Nathusius’	A3	0.1
Nathusius’	A5	0.5
Nathusius’	A6	0.0
Nathusius’	A7	0.2
Nathusius’	A8	0.1
Natterer’s	A2	0.0
Natterer’s	A3	0.3
Natterer’s	A5	0.0
Natterer’s	A6	0.0
Natterer’s	A7	0.0
Natterer’s	A8	0.0
Pipistrellus	A2	30.0
Pipistrellus	A3	58.8
Pipistrellus	A5	0.0
Pipistrellus	A6	0.0
Pipistrellus	A7	7.2
Pipistrellus	A8	1.3
Soprano pipistrelle	A2	4.2
Soprano pipistrelle	A3	51.4
Soprano pipistrelle	A5	5.9
Soprano pipistrelle	A6	2.0
Soprano pipistrelle	A7	5.4
Soprano pipistrelle	A8	0.7
Whiskered	A2	0.0
Whiskered	A3	0.0
Whiskered	A5	0.1
Whiskered	A6	0.0
Whiskered	A7	0.0

Whiskered	A8	0.0

Nightly Bat Pass Rate (Bat passes per hour)

Mean per Detector

Table 23. The mean Nightly Pass Rate (bat passes per hour, per night) of each species at each detector. Values are given to 1 decimal place.

We recommend using the median values given above, for the reasons stated above, but provide the mean values in the table below.

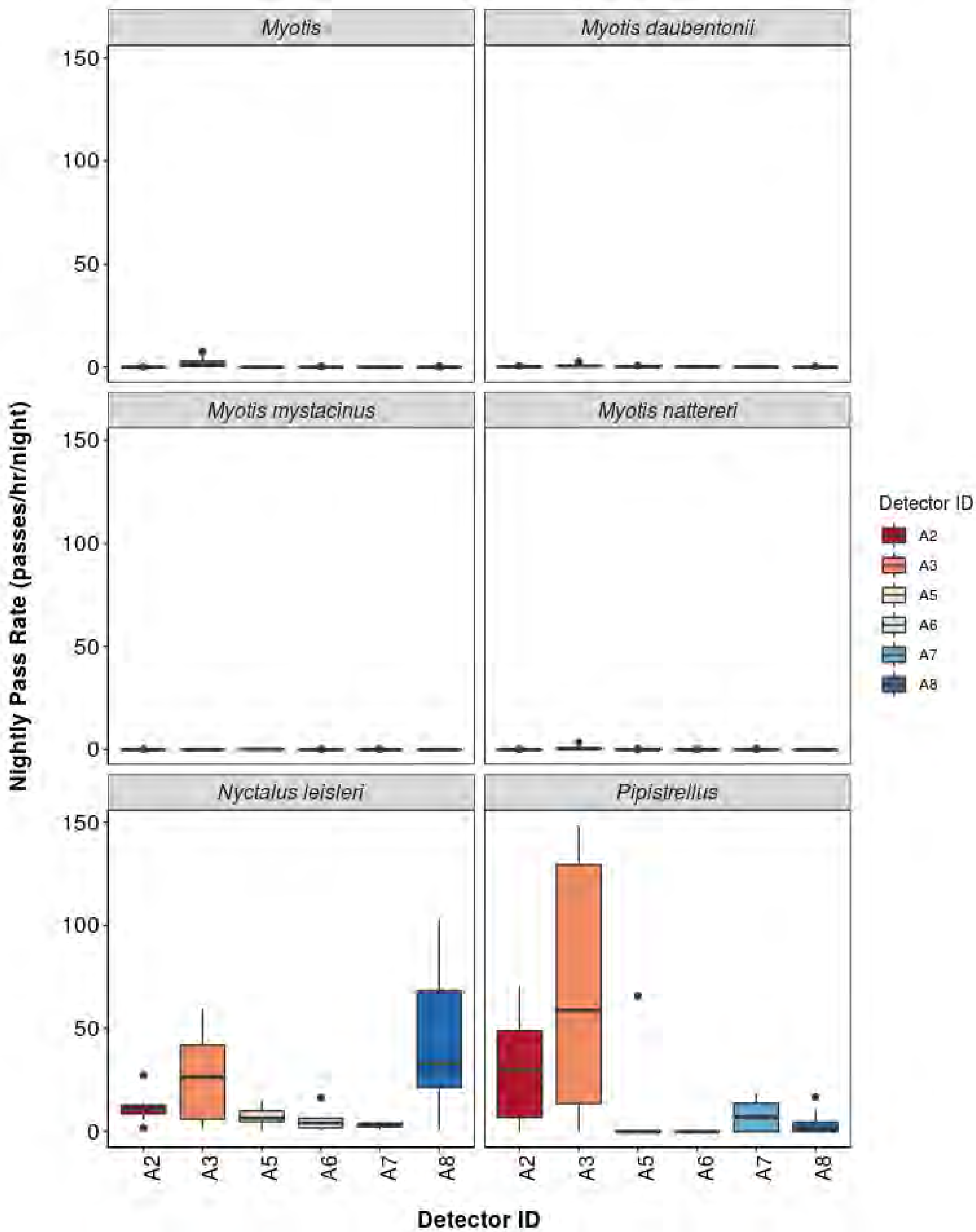
Species	Detector ID	Mean Pass Rate
Brown long-eared	A2	0.1
Brown long-eared	A3	0.5
Brown long-eared	A5	0.2
Brown long-eared	A6	0.0
Brown long-eared	A7	0.1
Brown long-eared	A8	0.0
Common pipistrelle	A2	21.9
Common pipistrelle	A3	4.0
Common pipistrelle	A5	10.3
Common pipistrelle	A6	1.7
Common pipistrelle	A7	3.5
Common pipistrelle	A8	2.4
Daubenton’s	A2	0.2
Daubenton’s	A3	0.7
Daubenton’s	A5	0.3
Daubenton’s	A6	0.1
Daubenton’s	A7	0.1
Daubenton’s	A8	0.1
Leisler’s	A2	11.5
Leisler’s	A3	25.3
Leisler’s	A5	7.5
Leisler’s	A6	5.0
Leisler’s	A7	3.1
Leisler’s	A8	43.8
Myotis	A2	0.0
Myotis	A3	2.2

Myotis	A5	0.0
Myotis	A6	0.1
Myotis	A7	0.1
Myotis	A8	0.1
Nathusius’	A2	0.6
Nathusius’	A3	0.2
Nathusius’	A5	1.2
Nathusius’	A6	0.1
Nathusius’	A7	0.2
Nathusius’	A8	0.2
Natterer’s	A2	0.0
Natterer’s	A3	0.7
Natterer’s	A5	0.0
Natterer’s	A6	0.0
Natterer’s	A7	0.1
Natterer’s	A8	0.0
Pipistrellus	A2	29.0
Pipistrellus	A3	67.2
Pipistrellus	A5	5.5
Pipistrellus	A6	0.0
Pipistrellus	A7	7.6
Pipistrellus	A8	3.7
Soprano pipistrelle	A2	6.2
Soprano pipistrelle	A3	60.5
Soprano pipistrelle	A5	9.2
Soprano pipistrelle	A6	1.5
Soprano pipistrelle	A7	4.6
Soprano pipistrelle	A8	1.3
Whiskered	A2	0.0
Whiskered	A3	0.0
Whiskered	A5	0.2
Whiskered	A6	0.0
Whiskered	A7	0.0
Whiskered	A8	0.0

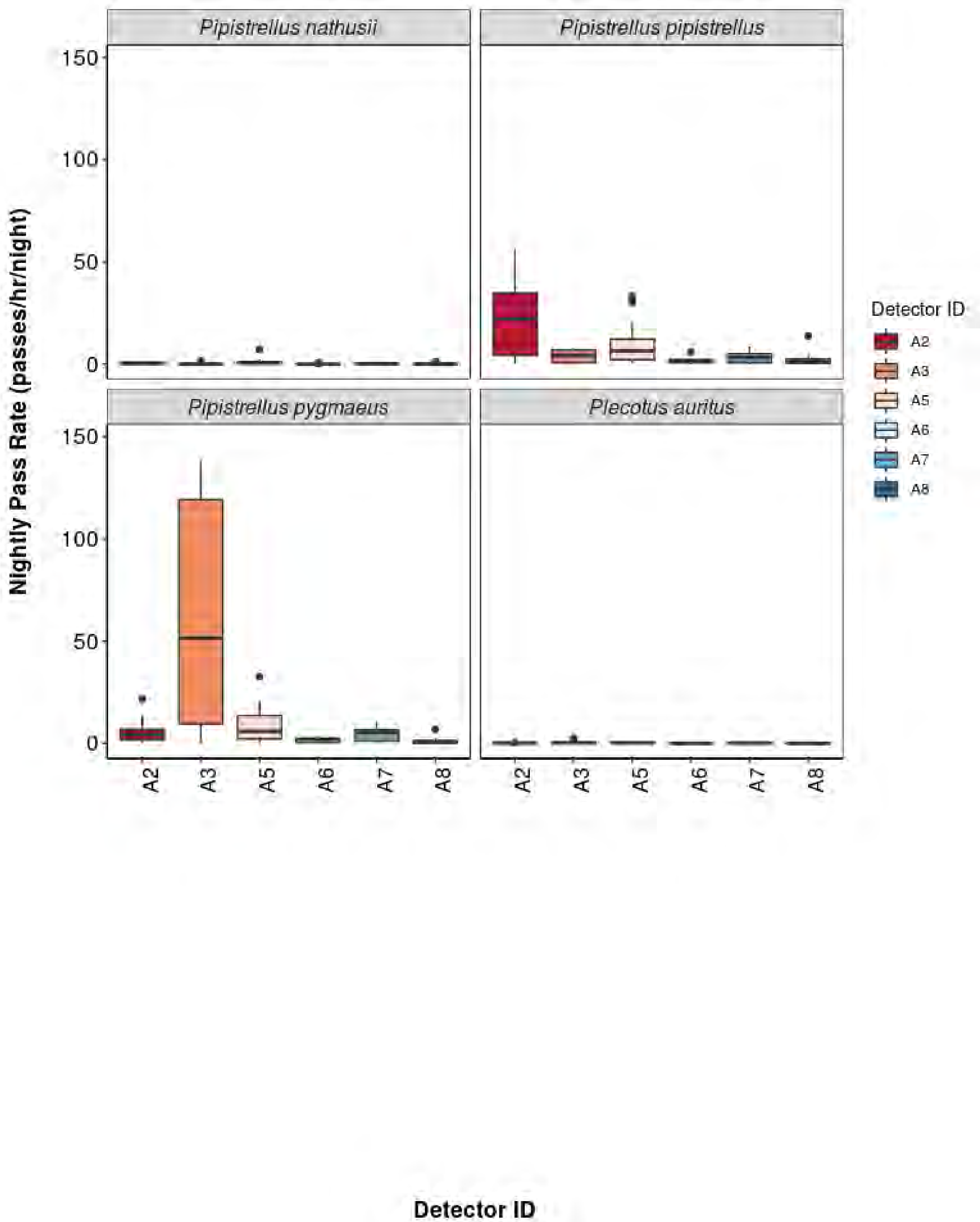
Nightly Bat Passes (Bat passes per hour)

Per Detector - Figures

Figure 16. Figures show boxplots for the number of bat passes per hour each night, for each detector. The 'box' shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The 'whiskers' extend from the box and represent the ranges for the bottom 25% and the top 25% of the data values, excluding outliers. An outlier is any extreme value that lies further away from the box than 1.5 times the interquartile range. Outliers are shown as dots. Where very few passes are recorded it is not possible to produce the box, so the data are shown as a line.



Myotis
Myotis daubentonii
Myotis mystacinus
Myotis nattereri
Nyctalus leisleri
Pipistrellus
Nightly Pass Rate (passes/hr/night)
0
50
100
150
A2
A3
A5
A6
A7
A8
Detector ID
Detector ID
A2
A3
A5
A6
A7
A8



Pipistrellus nathusii
Pipistrellus pipistrellus
Pipistrellus pygmaeus
Plecotus auritus
Nightly Pass Rate (passes/hr/night)
150
100
50
0
A2
A3
A5
A6
A7
A8
Detector ID
Detector ID

Survey Effort

Table 24. The number of nights bats were detected per month per detector.

Month	Detector ID	No of Survey Nights
Apr	A2	7
Apr	A3	8
Apr	A5	8
Apr	A6	7
Apr	A7	7
Apr	A8	8
May	A2	4
May	A3	4
May	A5	4
May	A6	4
May	A7	4
May	A8	4

Nightly Bat Pass Rate for each Month

Median Per Detector

Table 25. The median Nightly Pass Rate (bat passes per hour, per night) of each species throughout each month. If NA, then no bat passes.

Bat pass rates are often highly variable between nights, with some nights having few or no passes and other nights having high activity. In these circumstances, the median is likely to be a more useful summary of the 'average' activity than is the mean. For further information see: *Lintott, P. R., & Mathews, F. (2018). Basic mathematical errors may make ecological assessments unreliable. Biodiversity and Conservation, 27(1), 265-267.* https://doi.org/10.1007/s10531-017-1418-5

Species	Detector ID	Apr	May
Brown long-eared	A2	0.1	0.1
Brown long-eared	A3	0.4	0.0
Brown long-eared	A5	0.2	0.1
Brown long-eared	A6	0.0	0.1
Brown long-eared	A7	0.1	0.1
Brown long-eared	A8	0.0	0.0
Common pipistrelle	A2	26.5	15.0
Common pipistrelle	A3	4.2	3.2
Common pipistrelle	A5	6.4	6.6
Common pipistrelle	A6	1.5	1.8
Common pipistrelle	A7	2.4	6.3
Common pipistrelle	A8	0.5	2.3
Daubenton's	A2	0.2	0.1
Daubenton's	A3	0.4	0.6
Daubenton's	A5	0.3	0.1
Daubenton's	A6	0.2	0.1
Daubenton's	A7	0.1	0.0
Daubenton's	A8	0.0	0.0
Leisler's	A2	11.2	12.4
Leisler's	A3	28.2	9.3
Leisler's	A5	8.6	4.6
Leisler's	A6	3.4	6.4
Leisler's	A7	3.5	3.4

Leisler’s	A8	33.1	49.4
Myotis	A2	0.0	0.1
Myotis	A3	2.1	1.1
Myotis	A5	0.0	0.0
Myotis	A6	0.0	0.0
Myotis	A7	0.2	0.0
Myotis	A8	0.0	0.0
Nathusius’	A2	0.2	0.8
Nathusius’	A3	0.1	0.0
Nathusius’	A5	0.5	1.0
Nathusius’	A6	0.0	0.1
Nathusius’	A7	0.2	0.1
Nathusius’	A8	0.1	0.1
Natterer’s	A2	0.0	0.0
Natterer’s	A3	0.6	0.1
Natterer’s	A5	0.0	0.0
Natterer’s	A6	0.0	0.0
Natterer’s	A7	0.0	0.0
Natterer’s	A8	0.0	0.0
Pipistrellus	A2	33.9	21.6
Pipistrellus	A3	70.5	44.0
Pipistrellus	A5	0.0	0.0
Pipistrellus	A6	0.0	0.0
Pipistrellus	A7	2.5	13.6
Pipistrellus	A8	0.0	5.1
Soprano pipistrelle	A2	4.2	4.9
Soprano pipistrelle	A3	62.0	38.9
Soprano pipistrelle	A5	5.9	5.9
Soprano pipistrelle	A6	1.7	2.2
Soprano pipistrelle	A7	3.3	6.5
Soprano pipistrelle	A8	0.6	1.2
Whiskered	A2	0.0	0.0
Whiskered	A3	0.1	0.0
Whiskered	A5	0.2	0.1
Whiskered	A6	0.0	0.0
Whiskered	A7	0.0	0.0

Whiskered	A8	0.0	0.0

Nightly Bat Pass Rate for each Month

Mean per Detector

Table 26. The mean Nightly Pass Rate (bat passes per hour, per night) of each species throughout each month. Values are given to 1 decimal place.

We recommend using the median values given above, for the reasons stated above, but provide the mean values in the table below.

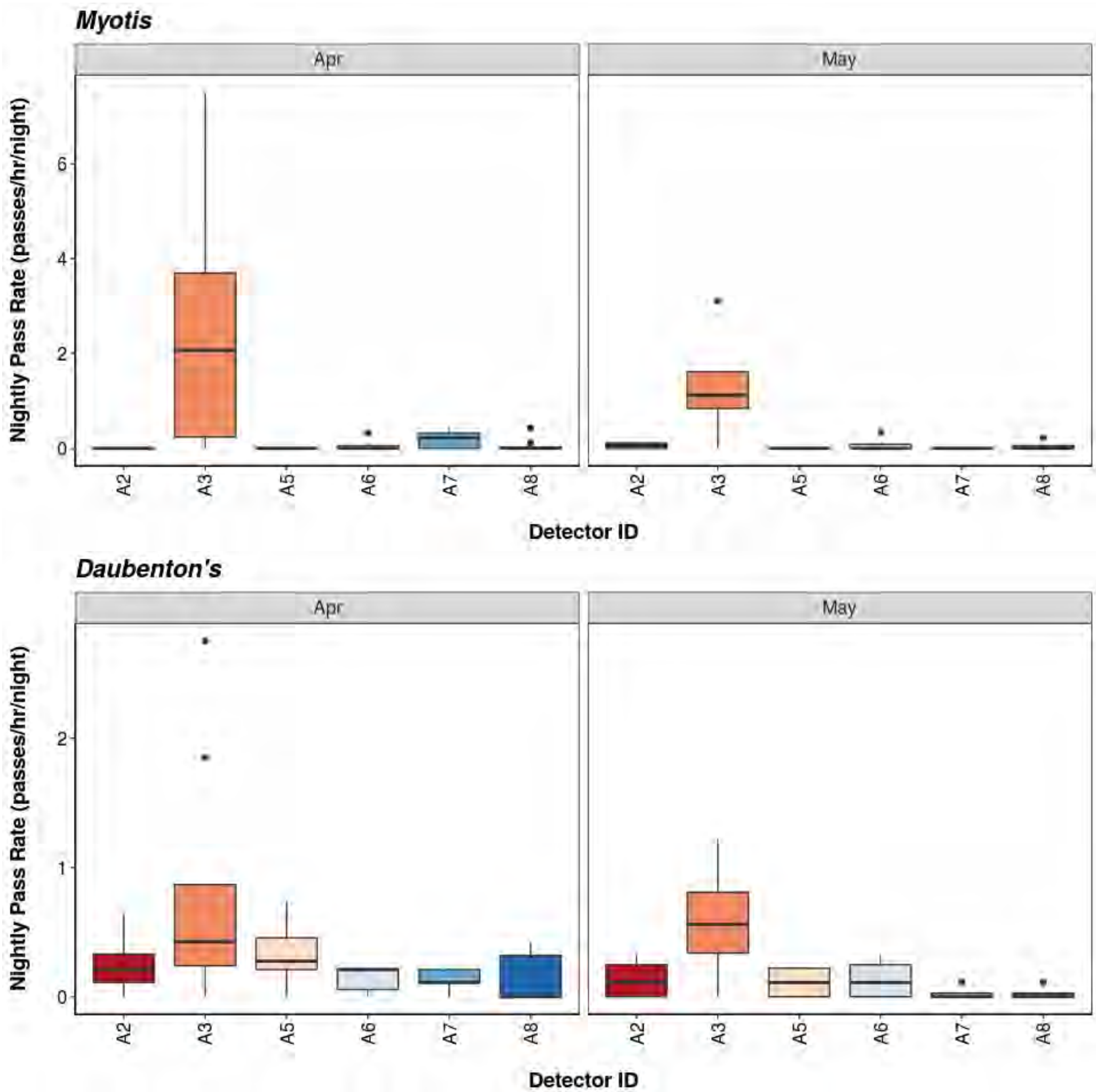
Species	Detector ID	Apr	May
Brown long-eared	A2	0.1	0.1
Brown long-eared	A3	0.7	0.1
Brown long-eared	A5	0.3	0.2
Brown long-eared	A6	0.0	0.1
Brown long-eared	A7	0.2	0.1
Brown long-eared	A8	0.0	0.0
Common pipistrelle	A2	26.1	14.5
Common pipistrelle	A3	4.2	3.5
Common pipistrelle	A5	11.2	8.7
Common pipistrelle	A6	1.3	2.4
Common pipistrelle	A7	2.4	5.3
Common pipistrelle	A8	2.4	2.3
Daubenton’s	A2	0.2	0.1
Daubenton’s	A3	0.8	0.6
Daubenton’s	A5	0.3	0.1
Daubenton’s	A6	0.1	0.1
Daubenton’s	A7	0.1	0.0
Daubenton’s	A8	0.1	0.0
Leisler’s	A2	10.3	13.6
Leisler’s	A3	30.4	15.3
Leisler’s	A5	7.8	6.7
Leisler’s	A6	3.7	7.4
Leisler’s	A7	3.0	3.3
Leisler’s	A8	40.3	50.7
Myotis	A2	0.0	0.1
Myotis	A3	2.6	1.3

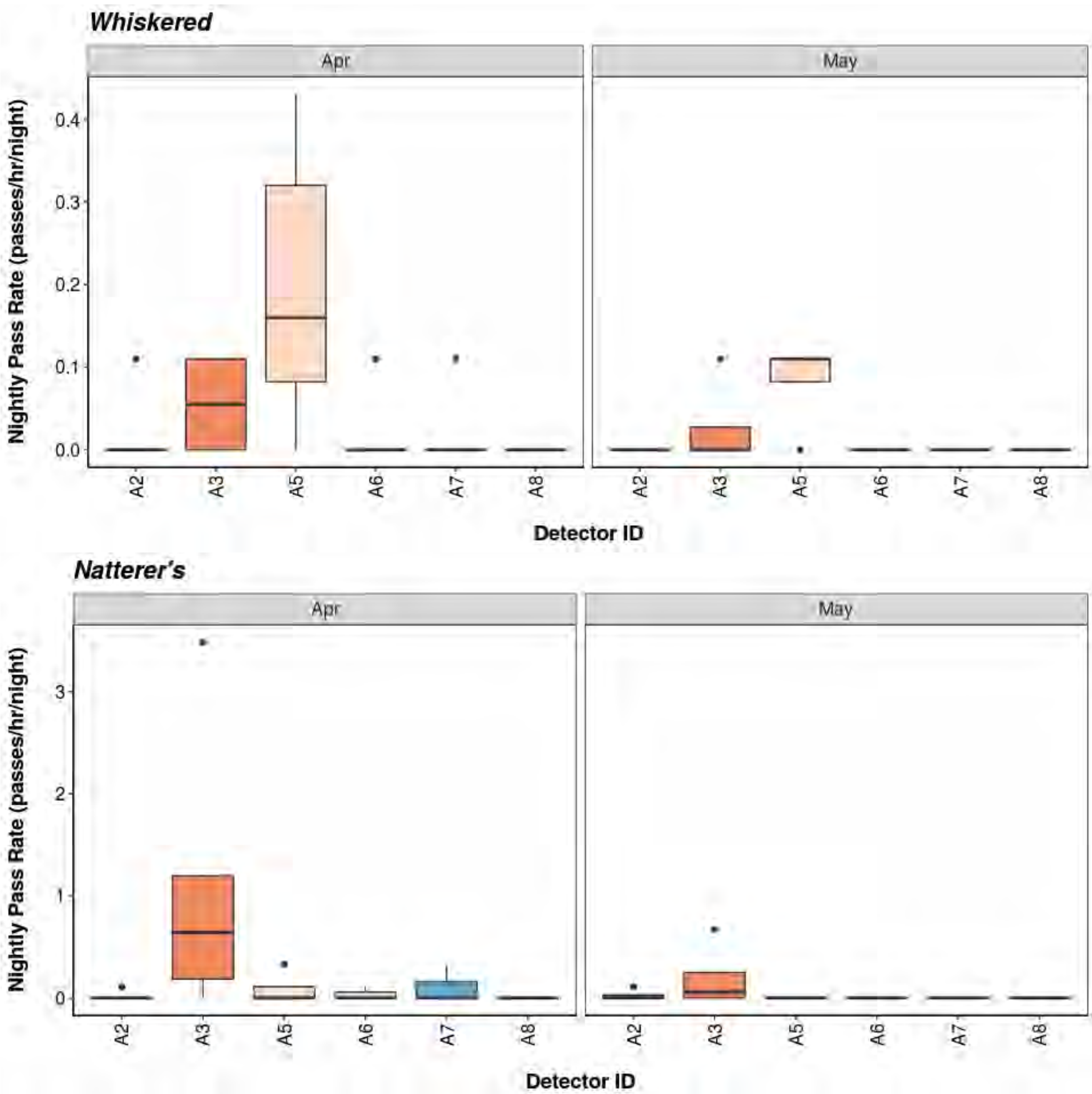
Myotis	A5	0.0	0.0
Myotis	A6	0.1	0.1
Myotis	A7	0.2	0.0
Myotis	A8	0.1	0.1
Nathusius'	A2	0.5	0.9
Nathusius'	A3	0.3	0.1
Nathusius'	A5	1.3	1.1
Nathusius'	A6	0.0	0.2
Nathusius'	A7	0.2	0.1
Nathusius'	A8	0.1	0.4
Natterer's	A2	0.0	0.0
Natterer's	A3	0.9	0.2
Natterer's	A5	0.1	0.0
Natterer's	A6	0.0	0.0
Natterer's	A7	0.1	0.0
Natterer's	A8	0.0	0.0
Pipistrellus	A2	32.0	23.7
Pipistrellus	A3	73.3	55.0
Pipistrellus	A5	8.3	0.0
Pipistrellus	A6	0.0	0.0
Pipistrellus	A7	5.5	11.4
Pipistrellus	A8	2.9	5.3
Soprano pipistrelle	A2	5.2	7.9
Soprano pipistrelle	A3	66.2	48.9
Soprano pipistrelle	A5	10.6	6.5
Soprano pipistrelle	A6	1.3	2.0
Soprano pipistrelle	A7	4.1	5.6
Soprano pipistrelle	A8	0.8	2.4
Whiskered	A2	0.0	0.0
Whiskered	A3	0.1	0.0
Whiskered	A5	0.2	0.1
Whiskered	A6	0.0	0.0
Whiskered	A7	0.0	0.0
Whiskered	A8	0.0	0.0

Nightly Bat Pass Rate for each Month

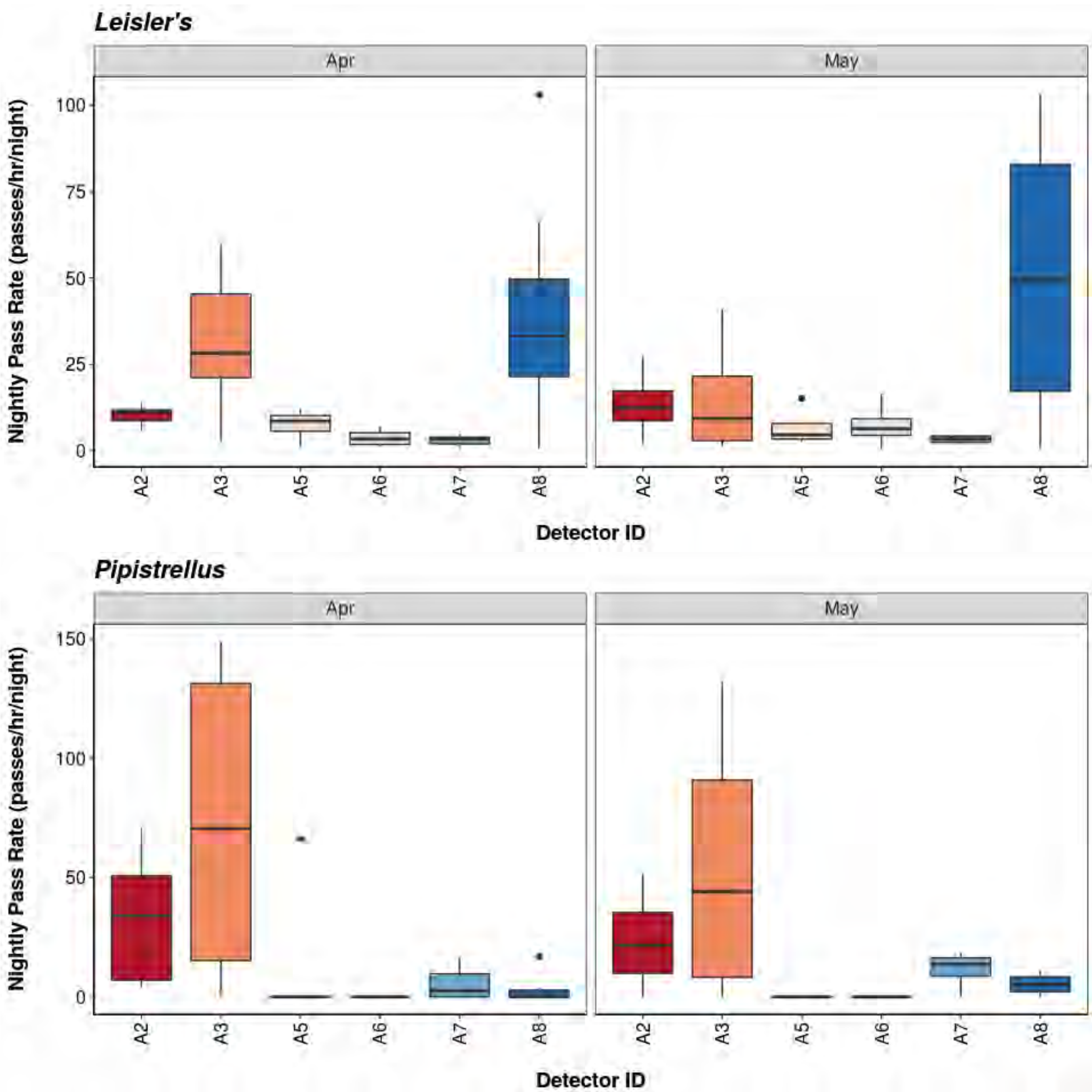
Per Detector - Figures

Figure 17. Figures show boxplots for the number of bat passes per hour by detector, for each month. The 'box' shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The 'whiskers' extend from the box and represent the ranges for the bottom 25% and the top 25% of the data values, excluding outliers. An outlier is any extreme value that lies further away from the box than 1.5 times the interquartile range. Outliers are shown as dots. Where very few passes are recorded it is not possible to produce the box, so the data are shown as a line.

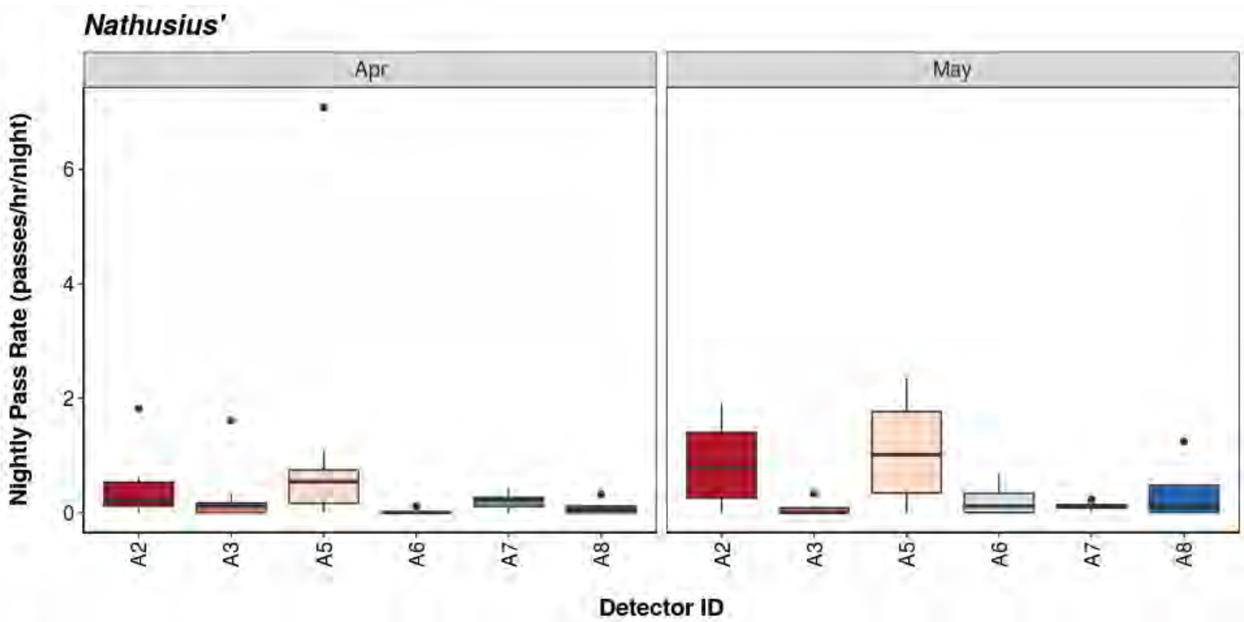


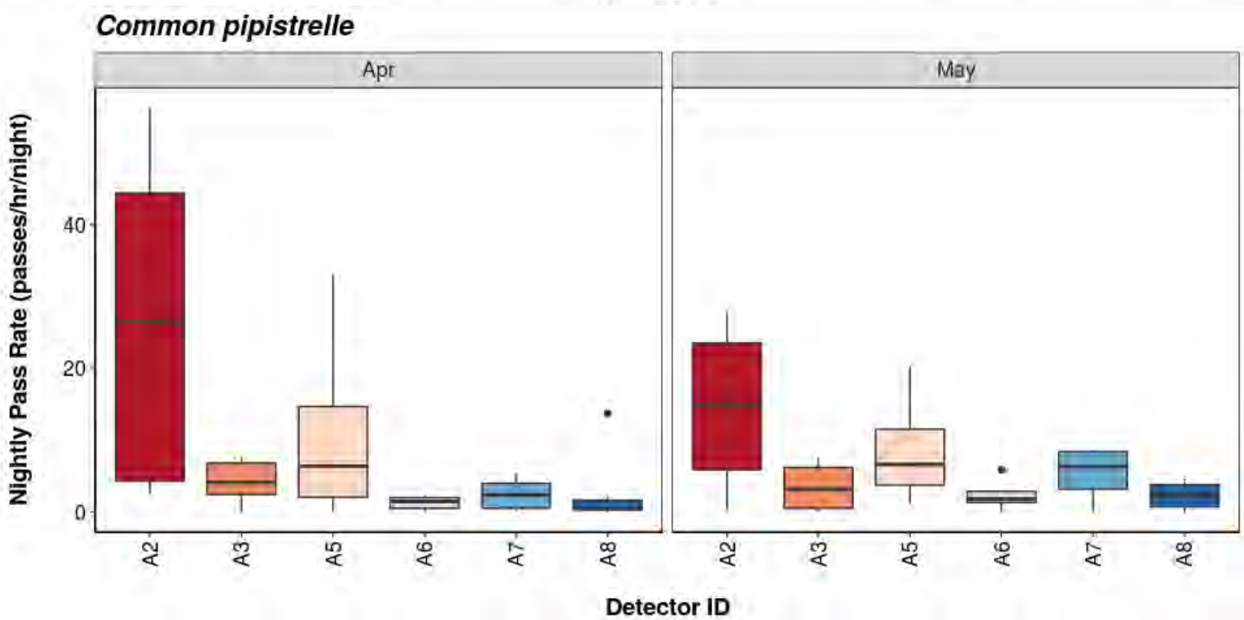


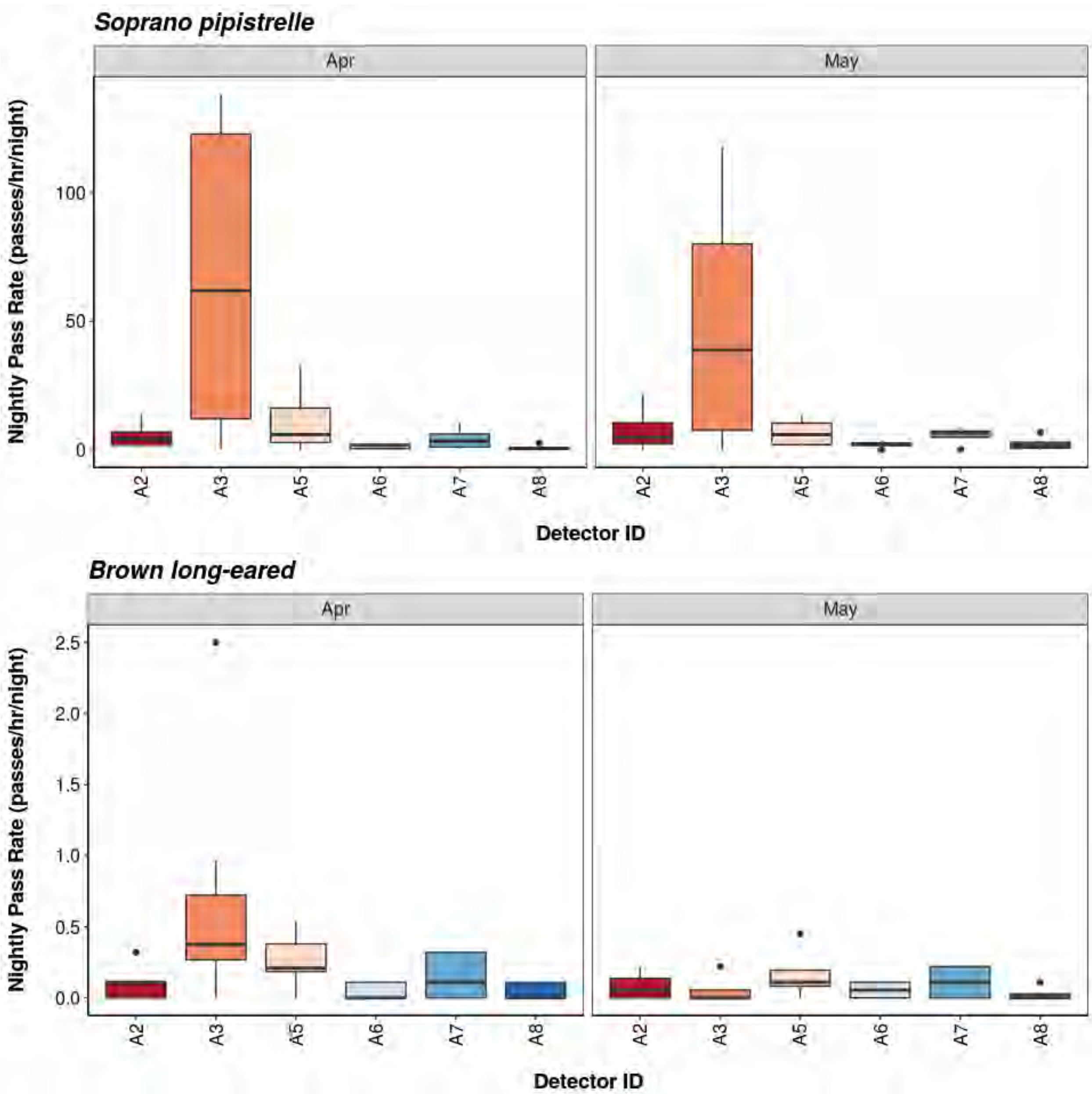
Whiskered
Apr
May
Nightly Pass Rate (passes/hr/night)
0.0
0.1
0.2
0.3
0.4
A2
A3
A5
A6
A7
A8
Detector ID
Natterer's
Apr
May
Nightly Pass Rate (passes/hr/night)
0
1
2
3
A2
A3
A5
A6
A7
A8
Detector ID



Leisler's
Apr
May
Nightly Pass Rate (passes/hr/night)
100
75
50
25
0
A2
A3
A5
A6
A7
A8
Detector ID
Pipistrellus
150
100
50
0


Nathusius'
Apr
May
Nightly Pass Rate (passes/hr/night)
0
2
4
6
A2
A3
A5
A6
A7
A8
Detector ID


Common pipistrelle
Apr
May
Nightly Pass Rate (passes/hr/night)
0
20
40
A2
A3
A5
A6
A7
A8
Detector ID



Soprano pipistrelle
Apr
May
Nightly Pass Rate (passes/hr/night)
0
50
100
A2
A3
A5
A6
A7
A8
Detector ID
Brown long-eared
Apr
May
Nightly Pass Rate (passes/hr/night)
0.0
0.5
1.0
1.5
2.0
2.5
A2
A3
A5
A6
A7
A8
Detector ID

Bat Activity per Detector Location

Figure 18. Detector ID reference:

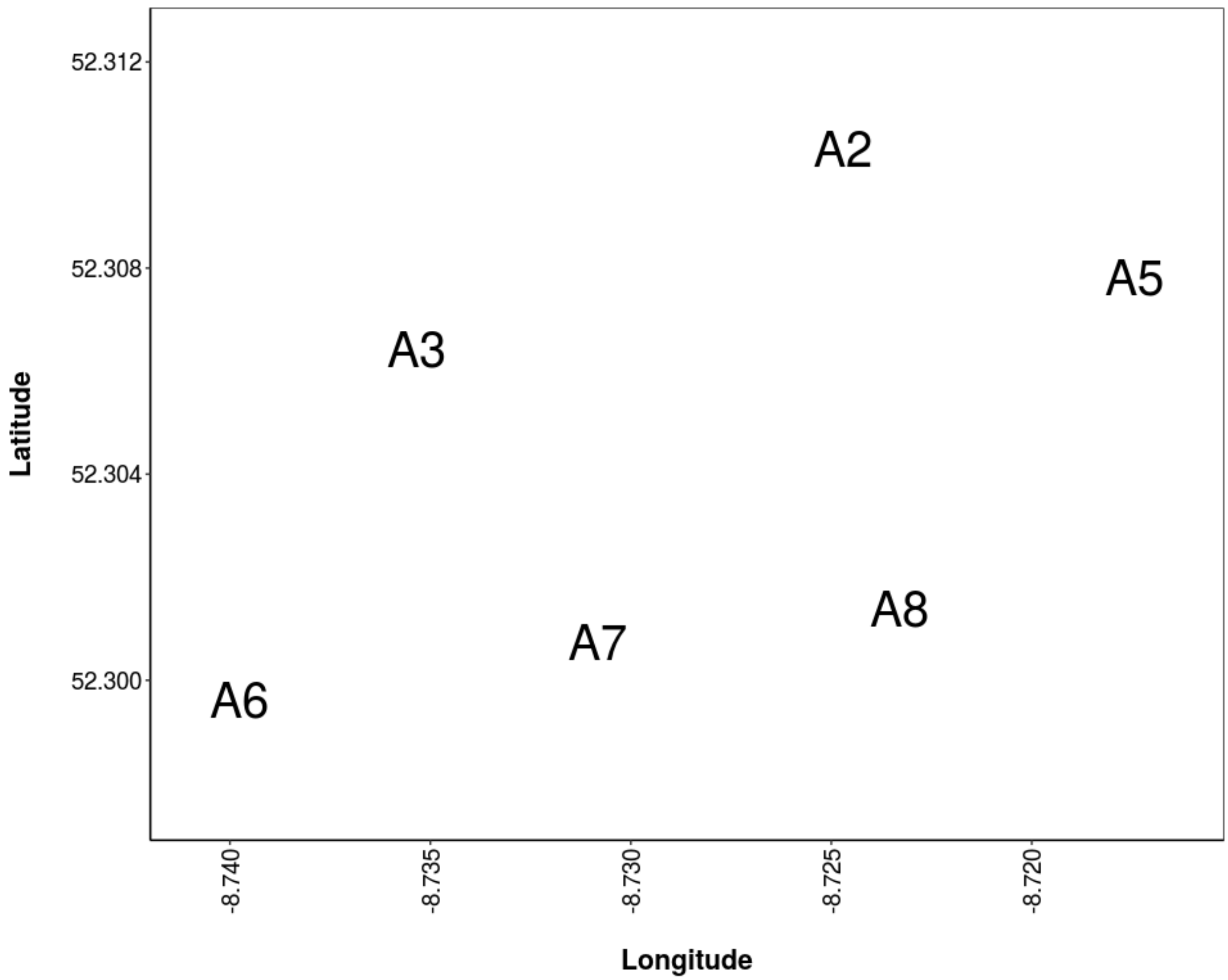
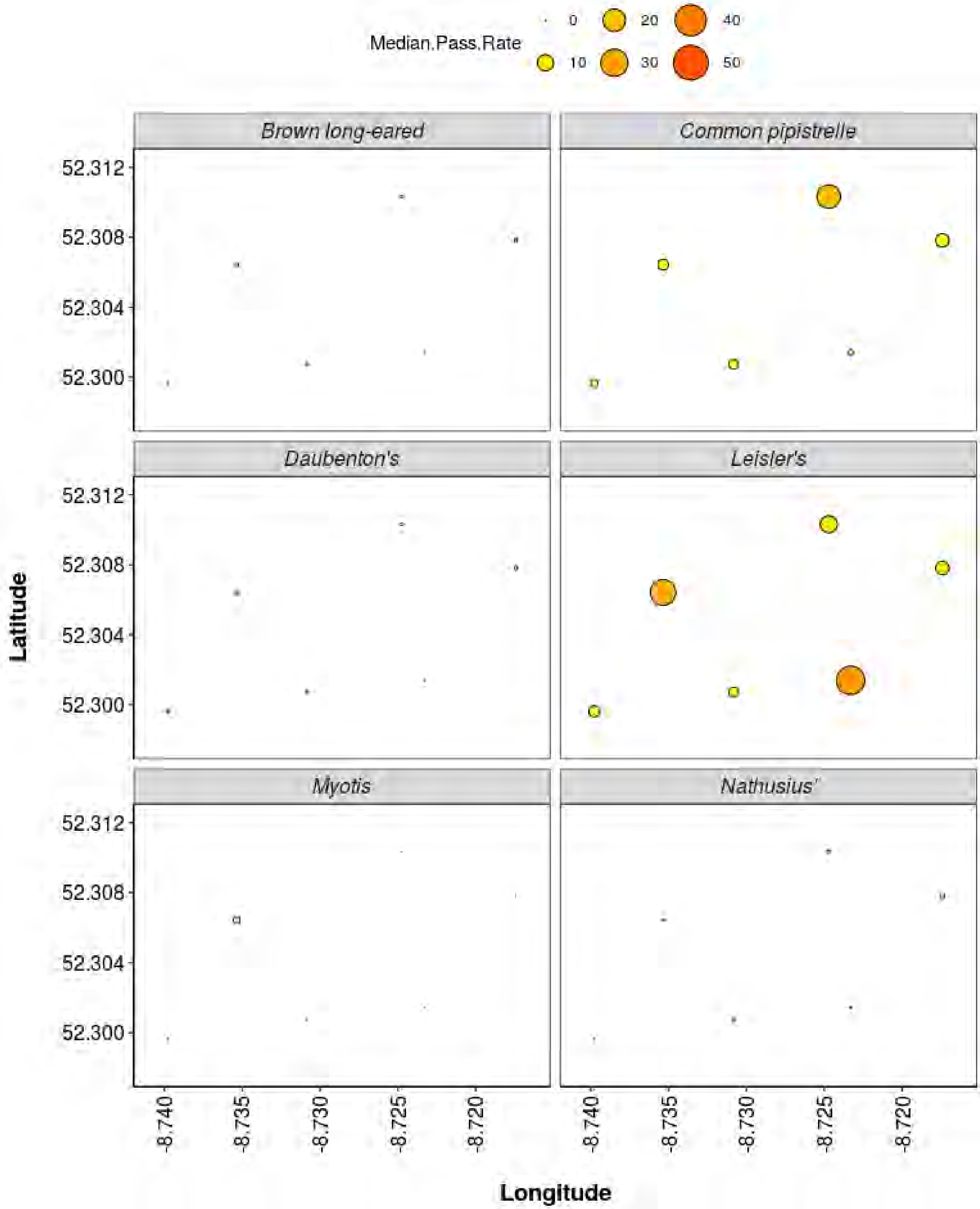
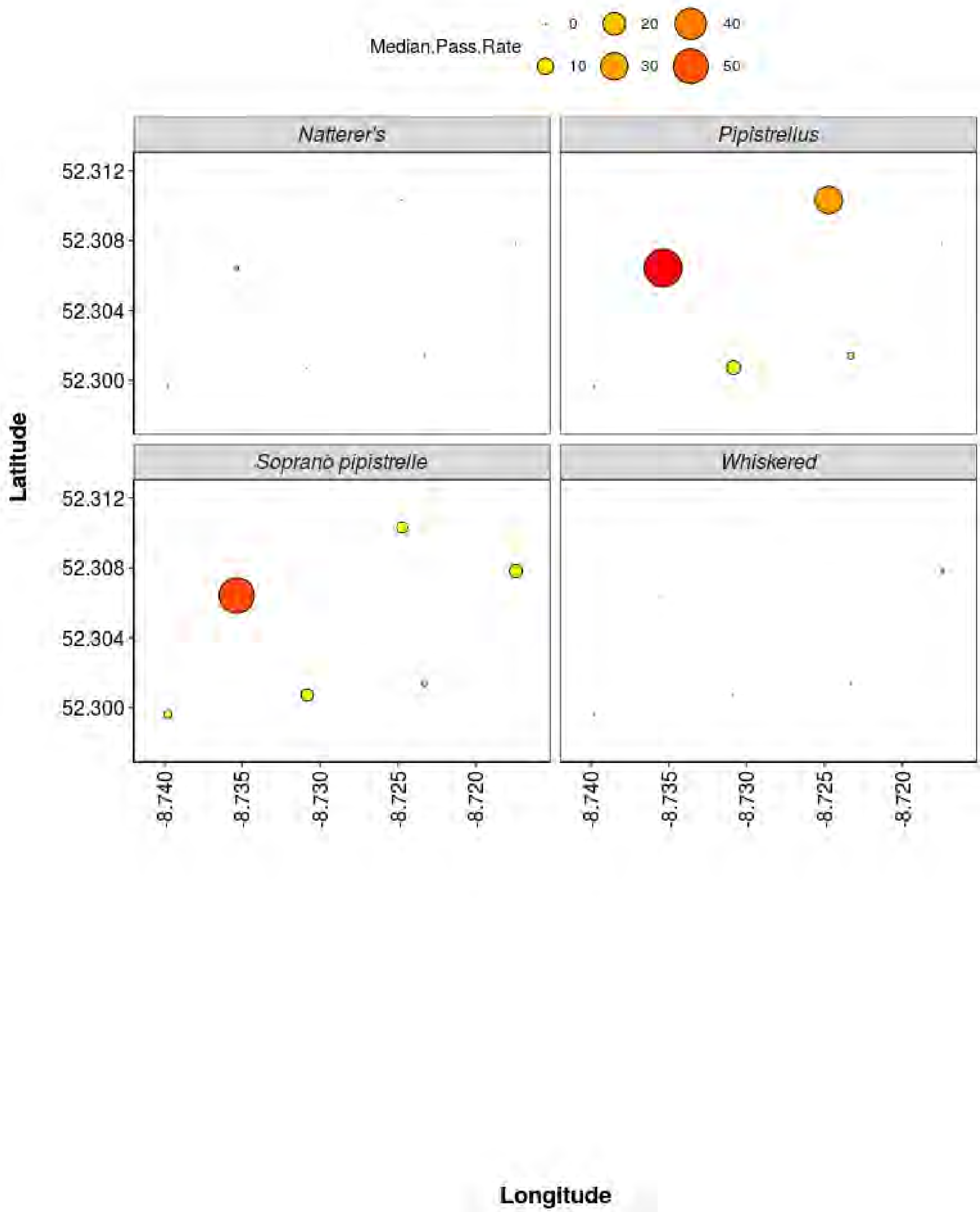


Figure 19. Median Nightly Pass Rate (bat passes/hr/night) throughout the survey period - represented by the size and colour of the point at each detector location.

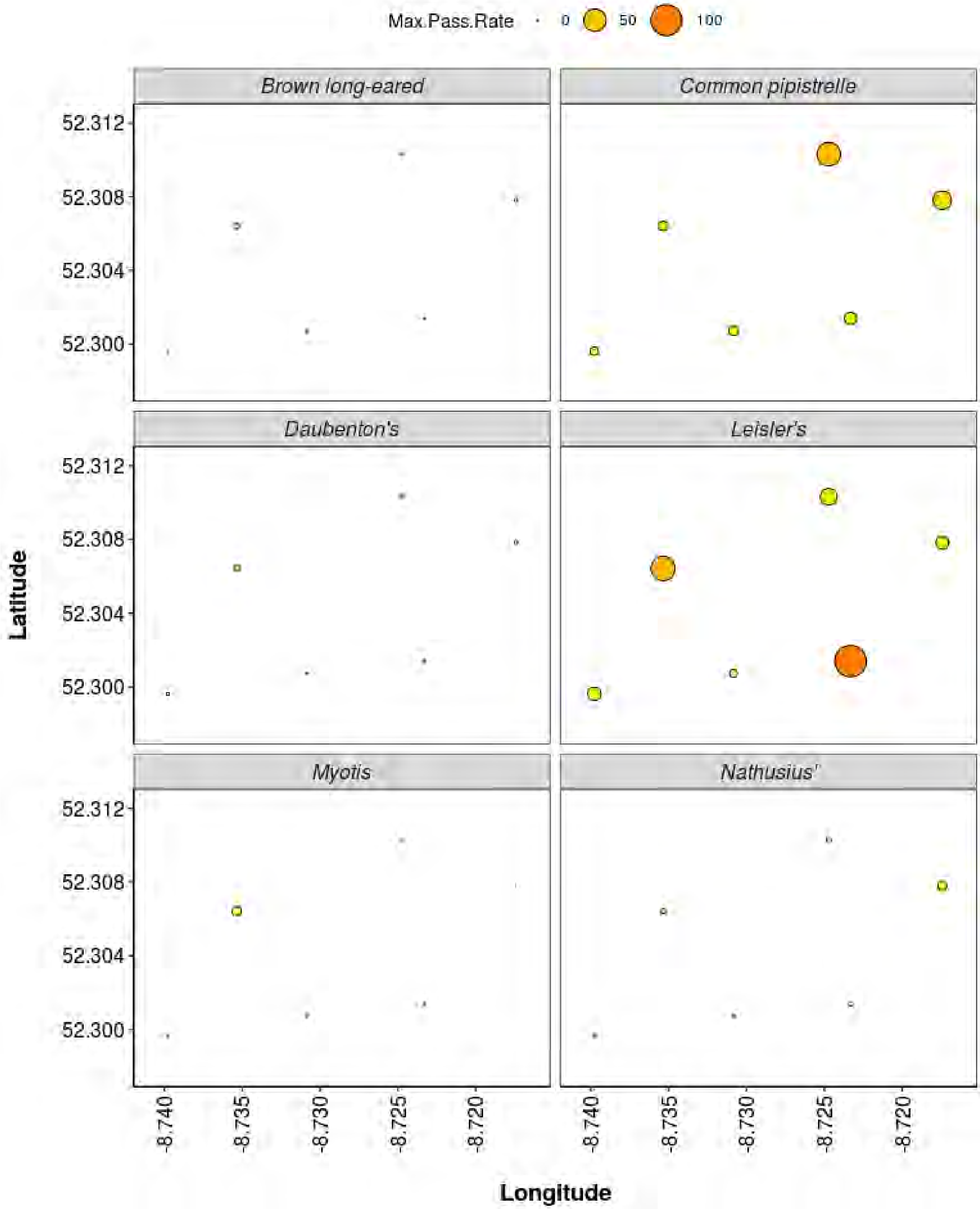


Median.Pass.Rate
0
10
20
30
40
50
Brown long-eared
Common pipistrelle
Daubenton's
Leisler's
Myotis
Nathusius'
Latitude
52.312
52.308
52.304
52.300
Longitude
-8.740
-8.735
-8.730
-8.725
-8.720

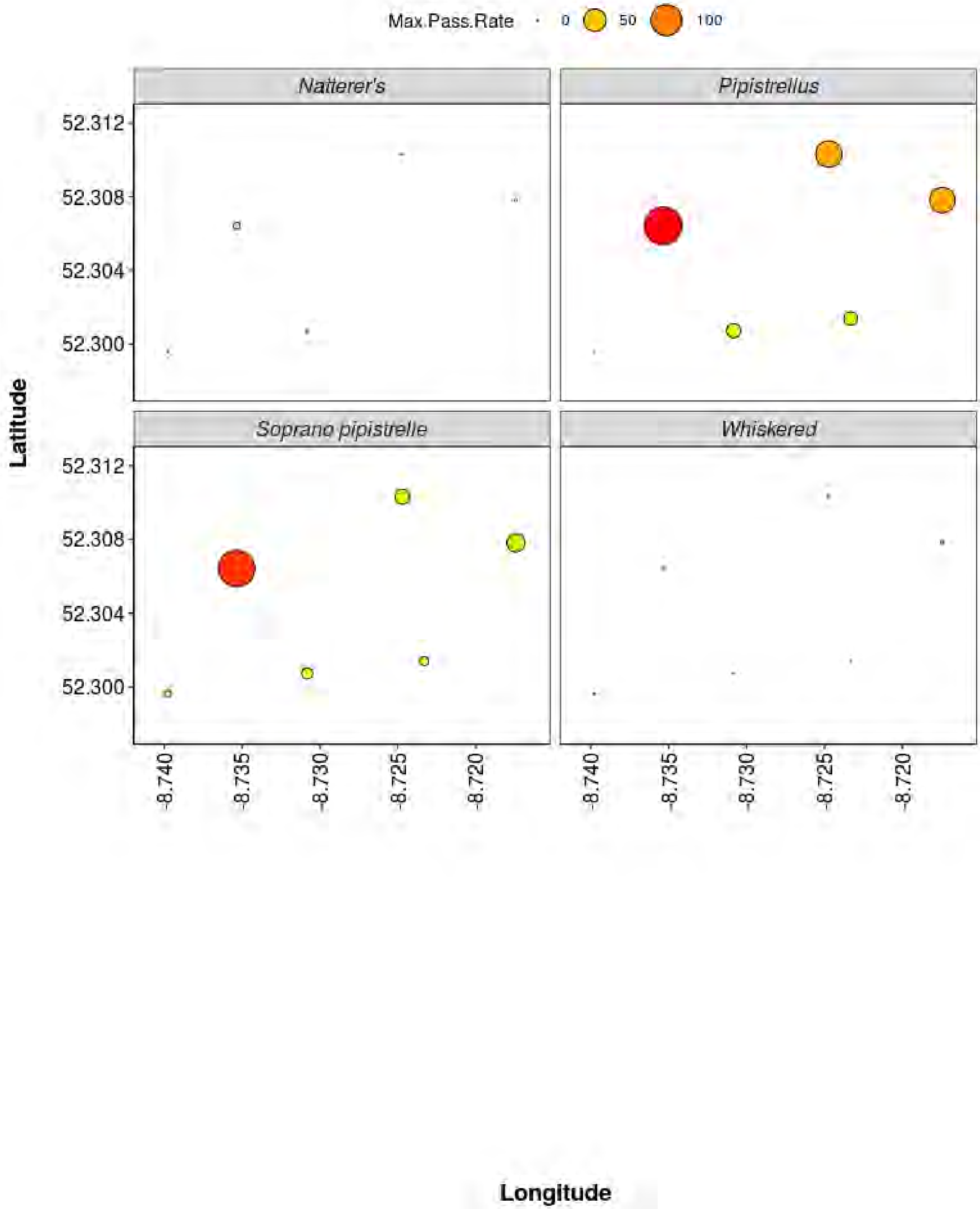


Median.Pass.Rate
0
10
20
30
40
50
Natterer's
Pipistrellus
Soprano pipistrelle
Whiskered
Latitude
52.312
52.308
52.304
52.300
-8.740
-8.735
-8.730
-8.725
-8.720
Longitude

Figure 20. Maximum Nightly Pass Rate (bat passes/hr/night) recorded in a single night throughout the survey period - represented by the size and colour of the point at each detector location.



Max.Pass.Rate
0
50
100
Brown long-eared
Common pipistrelle
Daubenton's
Leisler's
Myotis
Nathusius'
Latitude
52.312
52.308
52.304
52.300
-8.740
-8.735
-8.730
-8.725
-8.720
Longitude



Thank you for using Ecobat! If you have any questions please email info@themammalsociety.org.uk

This report was produced free of charge by the Mammal Society to support evidence-based conservation of bats.

The following analyses are based on data supplied by the user to the Mammal Society's Ecobat website. The outputs are designed to assist decision-making, but do not replace expert interpretation by the user. The creation of the Ecobat tool was supported by the Natural Environment Research Council (NERC).

Bat Activity Analysis

Site Name: Annagh

Author: Fehily Timoney

31/05/2021

Summary

Bats were detected on **10** nights between **2020-07-21** and **2020-07-30**, using **6** static bat detectors. Throughout this period **10** species were recorded. **Table 1.** Detectors were placed at the following locations:

Detector ID	Latitude	Longitude
A7	52.30073	-8.730829
A3	52.30642	-8.735358
A5	52.30781	-8.717422
A6	52.29963	-8.739770
A2	52.31032	-8.724717
A8	52.30140	-8.723312

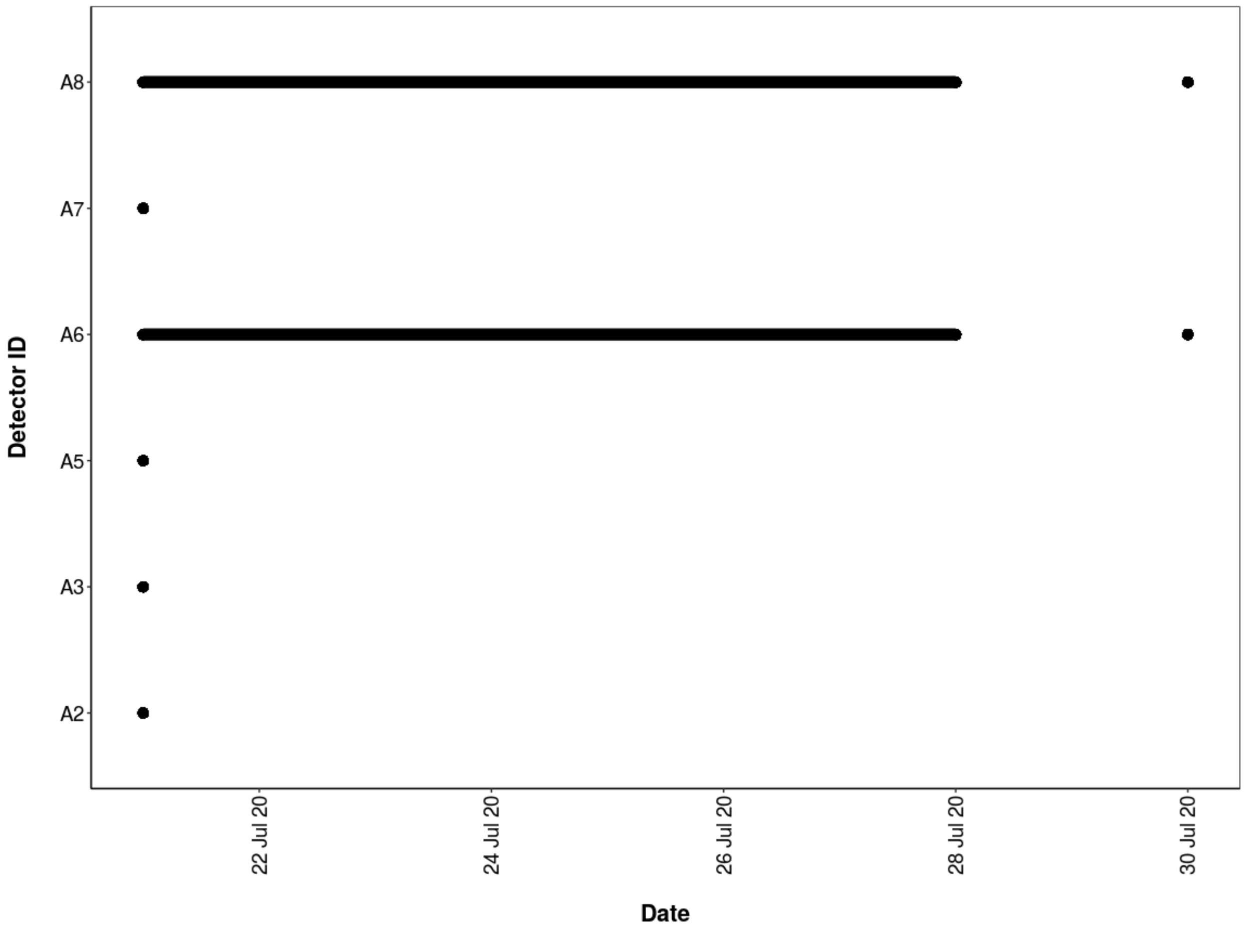
Survey Nights

Table 2. The number of nights that bats were detected on each recorder. This is not the same as the number of nights that detectors were active if there were nights when no bats were detected.

Detector ID	No. of nights
A2	10
A3	10
A5	10
A6	9
A7	10
A8	9

Survey Nights

Figure 1. Horizontal bars show nights when acoustic detectors recorded bats.



PART 1: Percentiles Analysis

This first part of the analysis looks at the relative activity levels of the bats you recorded. We take your value for the total bat passes each night for each species, and compare this to the values in our reference database. We tell you what percentile your data falls at, and therefore what the relative activity level is. For example, if the reference database has values of 5, 10, 15, 20 and you submit a value of 18, this will be the 80th percentile, and be classed as high activity.

The reference range dataset was stratified to include:

- Only records from within 30 days of the survey date.
- Only records from within 100km radius of the survey location.
- Records using any make of bat detector.

PER DETECTOR

Table 3. Summary table showing the number of nights recorded bat activity fell into each activity band for each species.

Detector ID	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
A2	*Myotis*	0	0	1	2	0
A2	*Myotis daubentonii*	0	0	0	2	3
A2	*Myotis mystacinus*	0	0	0	1	5
A2	*Myotis nattereri*	0	0	0	1	5
A2	*Nyctalus leisleri*	1	5	2	2	0
A2	*Pipistrellus*	7	1	0	0	0
A2	*Pipistrellus nathusii*	0	0	0	0	4
A2	*Pipistrellus pipistrellus*	1	3	6	0	0
A2	*Pipistrellus pygmaeus*	4	5	1	0	0
A2	*Plecotus auritus*	0	0	2	4	3
A3	*Myotis*	0	0	2	3	1
A3	*Myotis daubentonii*	0	0	0	4	3
A3	*Myotis mystacinus*	0	0	1	3	2
A3	*Myotis nattereri*	0	0	0	0	6
A3	*Nyctalus leisleri*	0	4	6	0	0
A3	*Pipistrellus*	7	0	0	0	0
A3	*Pipistrellus nathusii*	0	0	0	0	2
A3	*Pipistrellus pipistrellus*	2	6	1	0	1
A3	*Pipistrellus pygmaeus*	8	1	1	0	0
A3	*Plecotus auritus*	0	0	1	2	4

A5	*Myotis*	0	0	3	2	1
A5	*Myotis daubentonii*	0	0	0	4	3
A5	*Myotis mystacinus*	0	0	1	3	2
A5	*Myotis nattereri*	0	0	0	0	8
A5	*Nyctalus leisleri*	0	4	6	0	0
A5	*Pipistrellus*	7	0	0	0	0
A5	*Pipistrellus pipistrellus*	2	6	1	0	1
A5	*Pipistrellus pygmaeus*	8	1	1	0	0
A5	*Plecotus auritus*	0	0	1	2	4
A6	*Myotis*	0	0	2	0	1
A6	*Myotis daubentonii*	0	0	1	2	4
A6	*Myotis mystacinus*	0	0	0	0	2
A6	*Myotis nattereri*	0	0	0	1	4
A6	*Nyctalus leisleri*	0	1	7	0	1
A6	*Pipistrellus*	2	1	0	0	0
A6	*Pipistrellus pipistrellus*	1	1	5	0	2
A6	*Pipistrellus pygmaeus*	1	6	2	0	0
A6	*Plecotus auritus*	0	0	0	2	4
A7	*Myotis*	0	0	1	0	0
A7	*Myotis daubentonii*	0	0	0	5	3
A7	*Myotis mystacinus*	0	0	0	0	3
A7	*Myotis nattereri*	0	0	0	0	2
A7	*Nyctalus leisleri*	6	2	0	2	0
A7	*Pipistrellus*	5	0	0	0	0
A7	*Pipistrellus nathusii*	0	0	1	0	3
A7	*Pipistrellus pipistrellus*	0	4	3	1	0

A7	*Pipistrellus pygmaeus*	5	3	0	1	0
A7	*Plecotus auritus*	0	0	0	2	4
A8	*Nyctalus leisleri*	0	2	4	3	0
A8	*Pipistrellus pipistrellus*	0	0	4	1	2
A8	*Pipistrellus pygmaeus*	1	4	1	0	2

Table 4. Summary table showing key metrics for each species recorded. The reference range is the number of nights for each species that your data were compared to. We recommend a Reference Range of 200+ to be confident in the relative activity level.

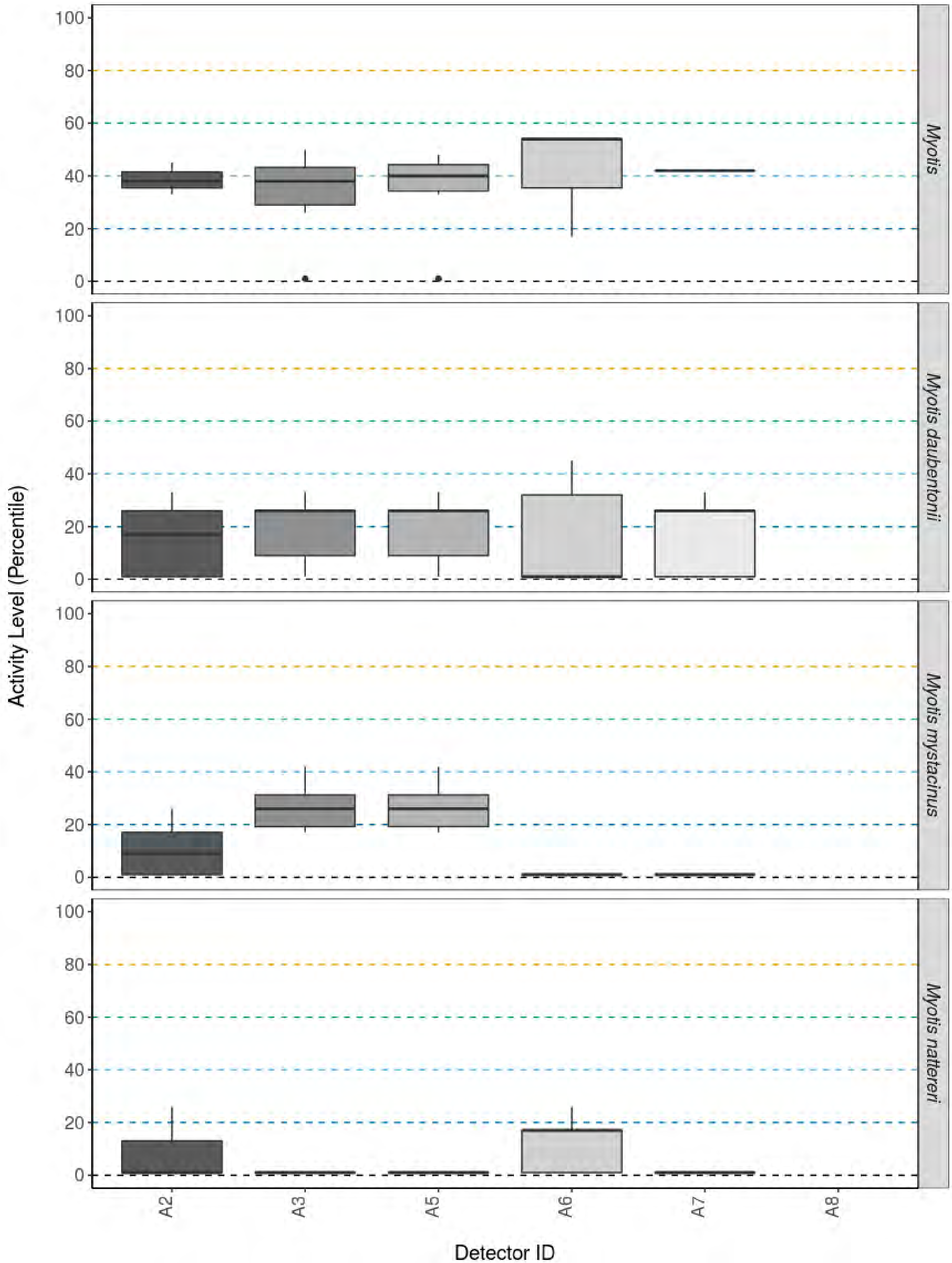
Detector ID	Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded	Reference Range
A2	*Myotis*	38	33 - 45	45	3	1359
A2	*Myotis daubentonii*	17	1 - 26	33	5	73
A2	*Myotis mystacinus*	9	1 - 17	26	6	34
A2	*Myotis nattereri*	1	1 - 13.5	26	6	68
A2	*Nyctalus leisleri*	62	44 - 71	83	10	1553
A2	*Pipistrellus*	84	75 - 93	100	8	2166
A2	*Pipistrellus nathusii*	17	17 - 17	17	4	120
A2	*Pipistrellus pipistrellus*	59	58.5 - 79	99	10	1983
A2	*Pipistrellus pygmaeus*	77	62 - 87	98	10	1838
A2	*Plecotus auritus*	33	17 - 45	58	9	915
A3	*Myotis*	38	19.5 - 45	50	6	1359
A3	*Myotis daubentonii*	26	9 - 29.5	33	7	73
A3	*Myotis mystacinus*	26	17 - 34	42	6	34
A3	*Myotis nattereri*	1	1 - 1	1	6	68
A3	*Nyctalus leisleri*	59	54.5 - 68	77	10	1553
A3	*Pipistrellus*	97	94 - 97.5	98	7	2166
A3	*Pipistrellus nathusii*	1	1 - 1	1	2	120

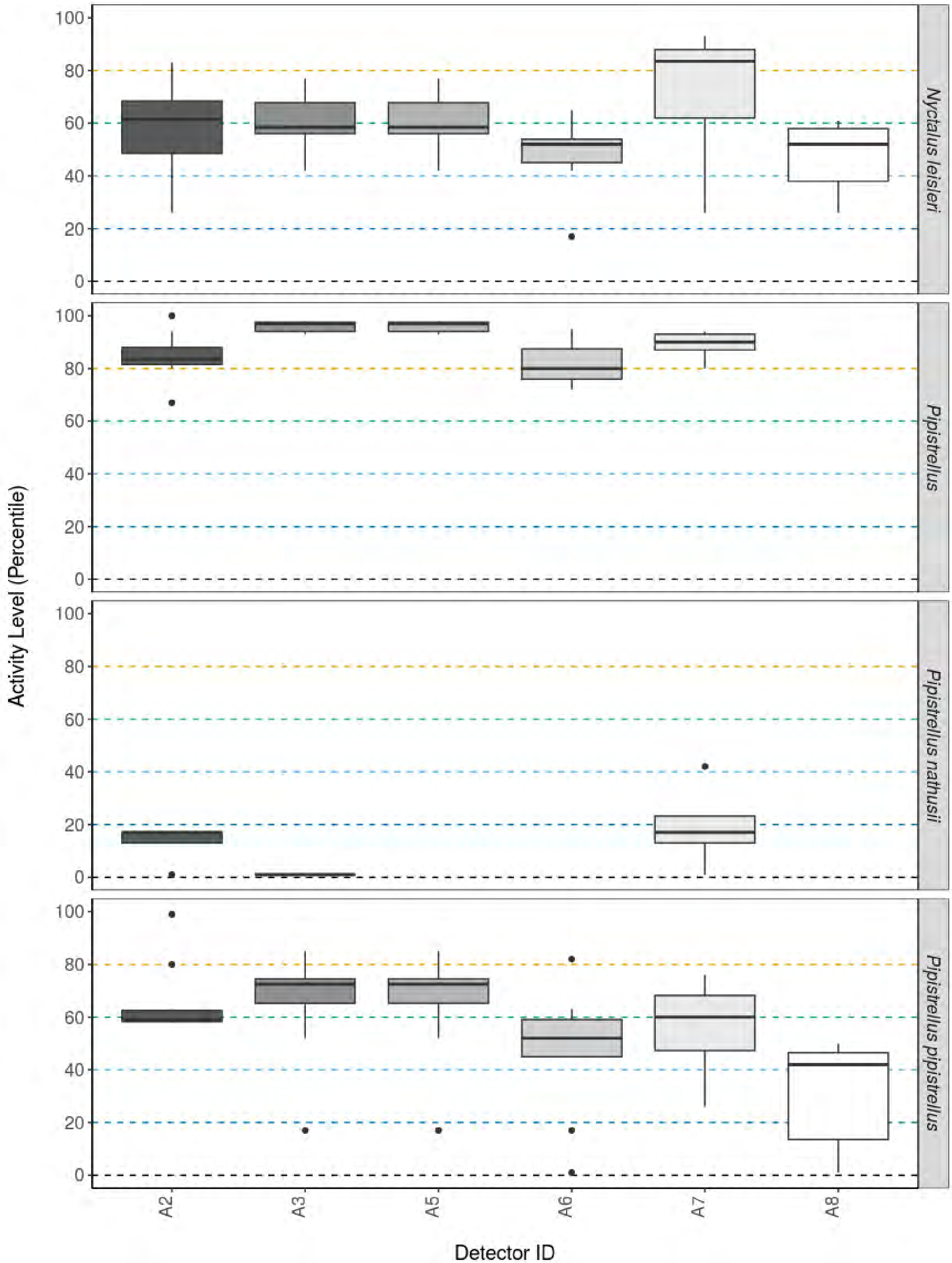
A3	*Pipistrellus pipistrellus*	73	46 - 78	85	10	1983
A3	*Pipistrellus pygmaeus*	93	72 - 96	98	10	1838
A3	*Plecotus auritus*	17	9 - 29.5	42	7	915
A5	*Myotis*	40	19.5 - 45	48	6	1359
A5	*Myotis daubentonii*	26	9 - 29.5	33	7	73
A5	*Myotis mystacinus*	26	17 - 34	42	6	34
A5	*Myotis nattereri*	1	1 - 1	1	8	68
A5	*Nyctalus leisleri*	59	54.5 - 68	77	10	1553
A5	*Pipistrellus*	97	94 - 97.5	98	7	2166
A5	*Pipistrellus pipistrellus*	73	46 - 78	85	10	1983
A5	*Pipistrellus pygmaeus*	93	72 - 96	98	10	1838
A5	*Plecotus auritus*	17	9 - 29.5	42	7	915
A6	*Myotis*	54	54 - 54	54	3	1359
A6	*Myotis daubentonii*	1	1 - 23	45	7	73
A6	*Myotis mystacinus*	1	1 - 1	1	2	34
A6	*Myotis nattereri*	17	1 - 21.5	26	5	68
A6	*Nyctalus leisleri*	52	35.5 - 58.5	65	9	1553
A6	*Pipistrellus*	80	72 - 95	95	3	2166
A6	*Pipistrellus pipistrellus*	52	26.5 - 65	82	9	1983
A6	*Pipistrellus pygmaeus*	72	60.5 - 79	93	9	1838

A6	*Plecotus auritus*	9	1 - 21.5	26	6	915
A7	*Myotis*	42	0	42	1	1359
A7	*Myotis daubentonii*	26	1 - 29.5	33	8	73
A7	*Myotis mystacinus*	1	1 - 1	1	3	34
A7	*Myotis nattereri*	1	1 - 1	1	2	68
A7	*Nyctalus leisleri*	84	54 - 89	93	10	1553
A7	*Pipistrellus*	90	85 - 93	94	5	2166
A7	*Pipistrellus nathusii*	17	9 - 29.5	42	4	120
A7	*Pipistrellus pipistrellus*	60	40 - 71.5	76	8	1983
A7	*Pipistrellus pygmaeus*	83	58 - 87.5	92	9	1838
A7	*Plecotus auritus*	17	1 - 26	26	6	915
A8	*Nyctalus leisleri*	52	37 - 58	61	9	1553
A8	*Pipistrellus pipistrellus*	42	13.5 - 47.5	50	7	1983
A8	*Pipistrellus pygmaeus*	69	30 - 80.5	88	8	1838

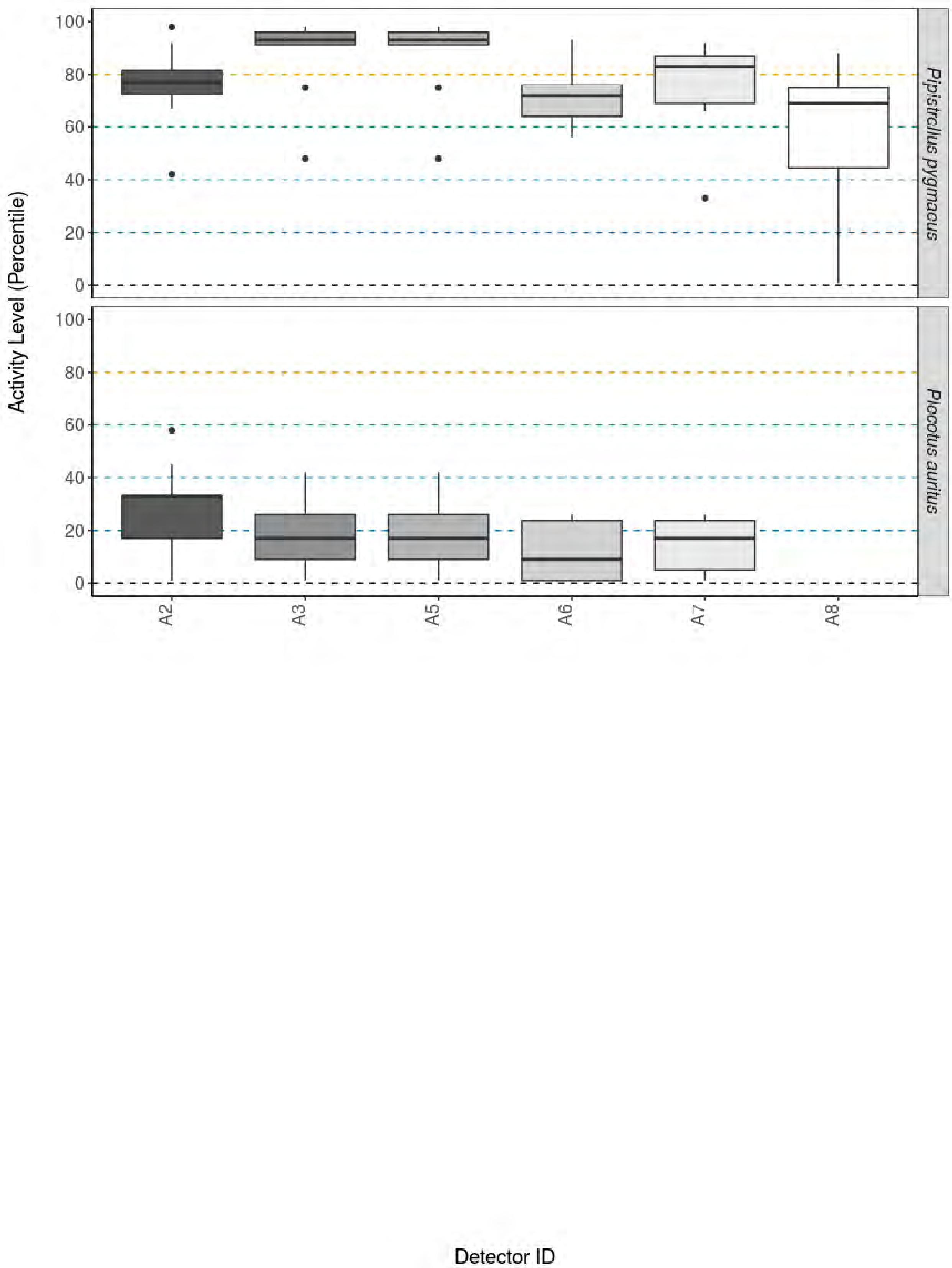
###Figures

Figure 2. The recorded activity of bats during the survey. The centre line indicates the median activity level whereas the box represents the interquartile range (the spread of the middle 50% of nights of activity)


Activity Level (Percentile)
Detector ID
Myotis
Myotis daubentonii
Myotis mystacinus
Myotis nattereri
0
20
40
60
80
100
A2
A3
A5
A6
A7
A8

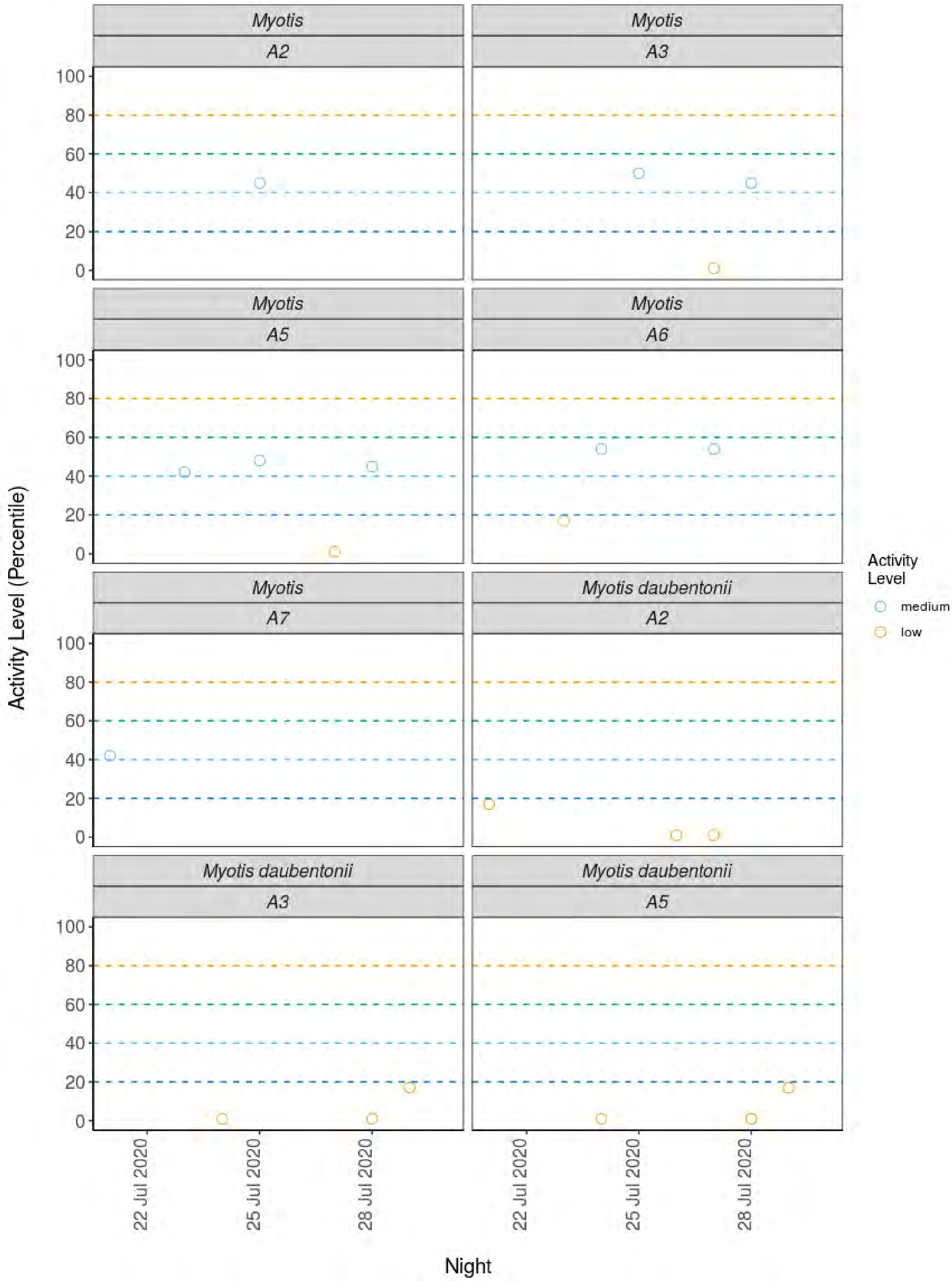


Activity Level (Percentile)
Nyctalus leisleri
Pipistrellus
Pipistrellus nathusii
Pipistrellus pipistrellus
100
80
60
40
20
0
A2
A3
A5
A6
A7
A8
Detector ID

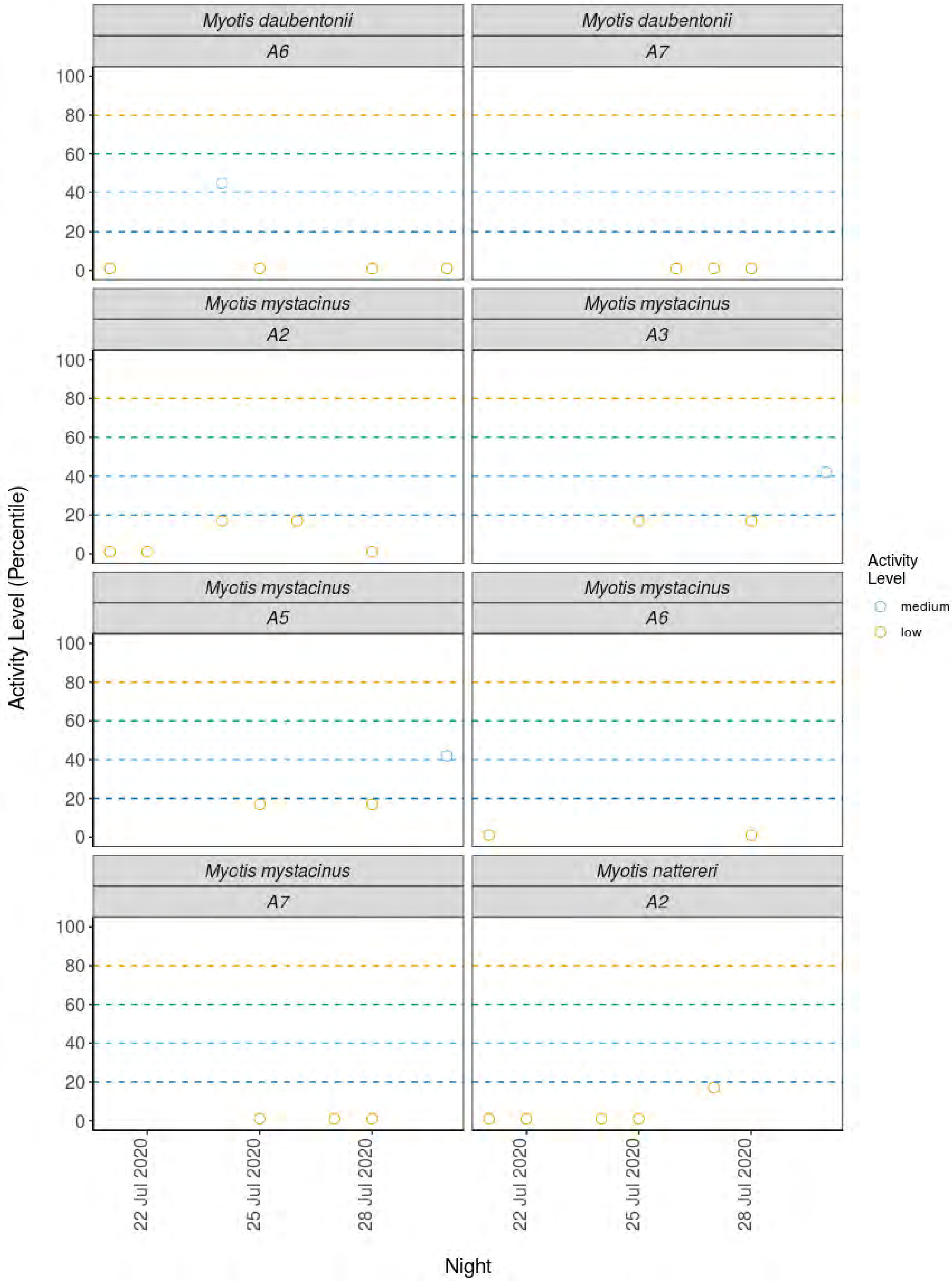


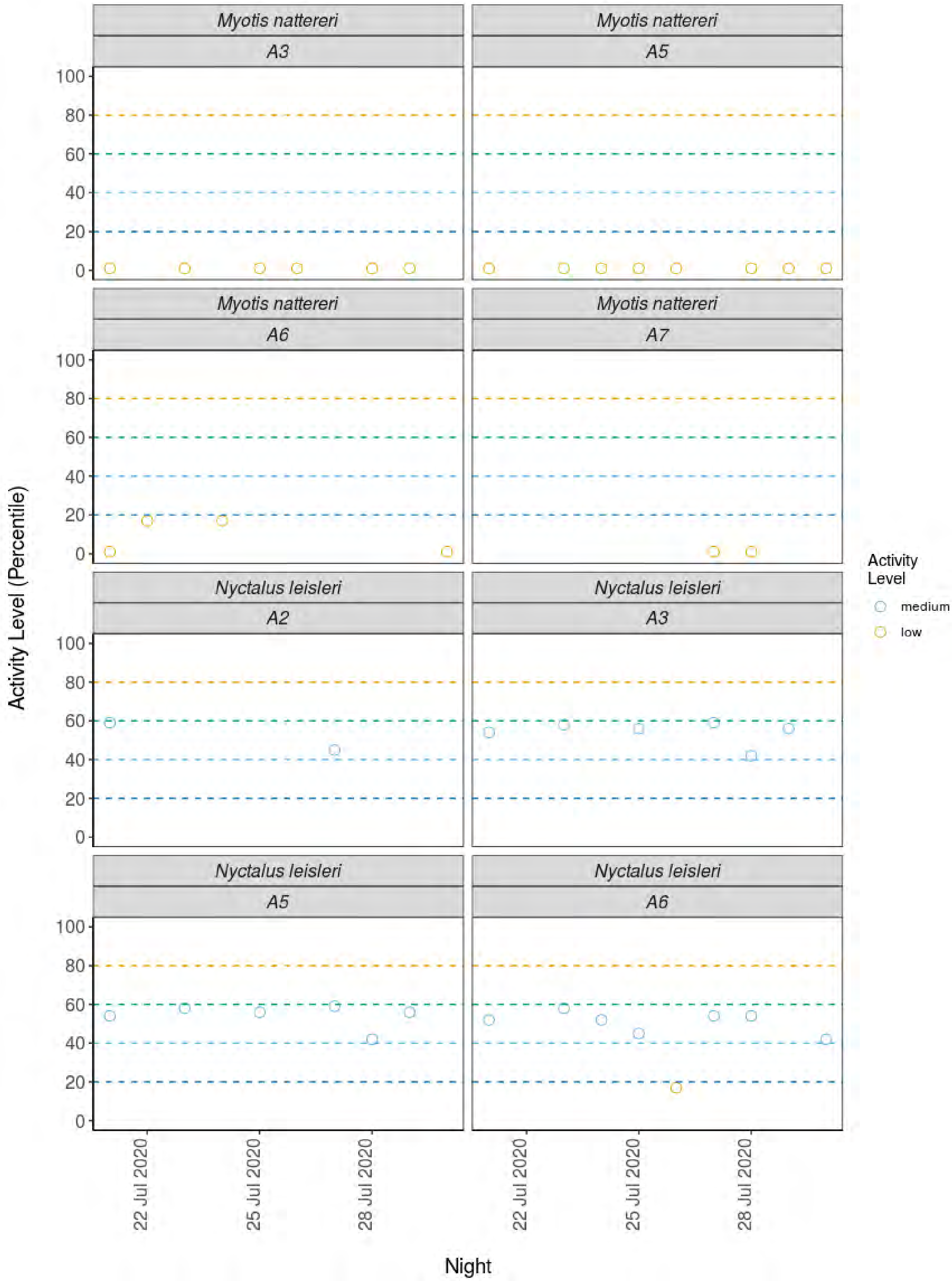
Activity Level (Percentile)
100
80
60
40
20
0
Pipistrellus pygmaeus
Plecotus auritus
A2
A3
A5
A6
A7
A8
Detector ID

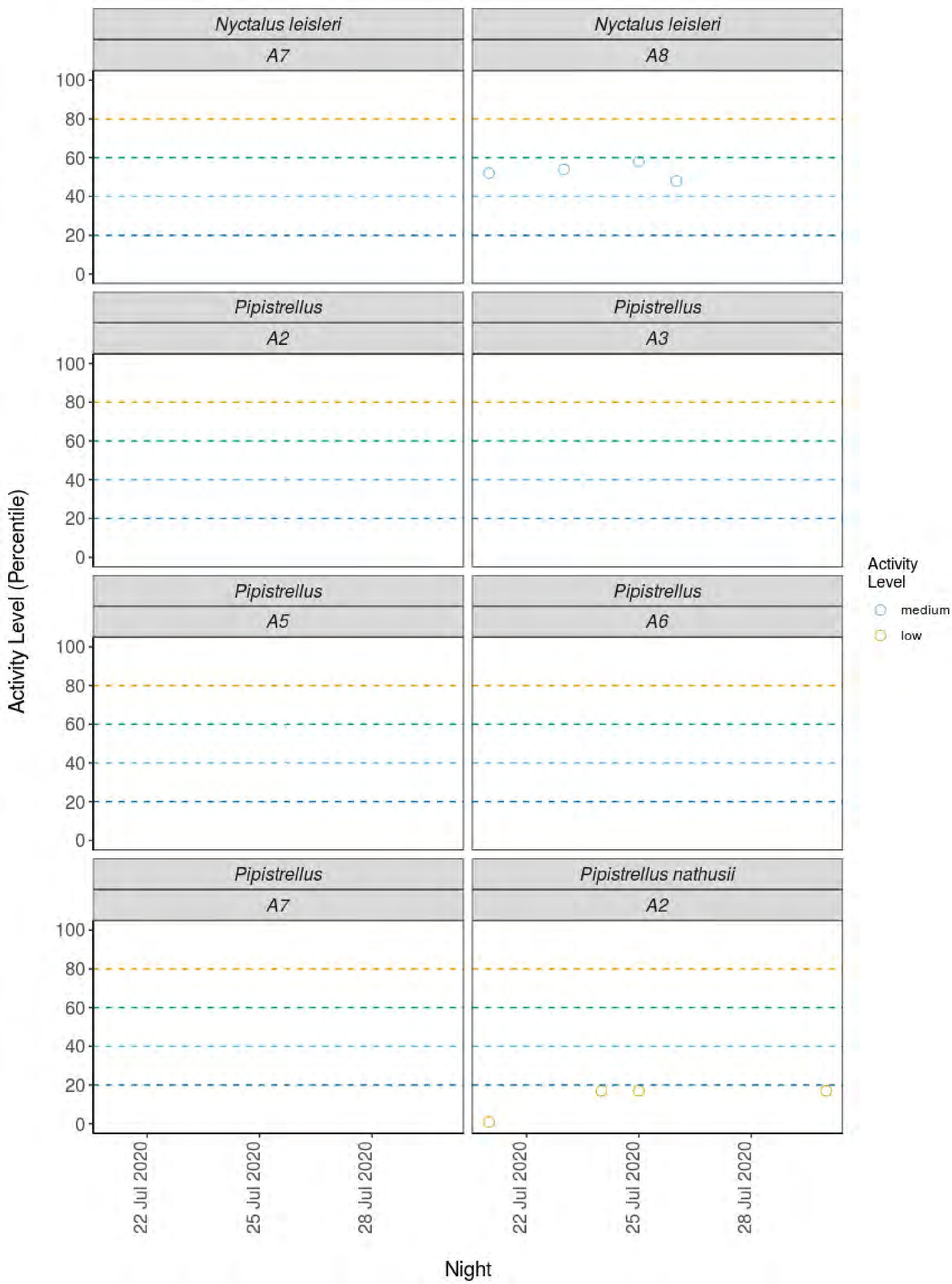
Figure 3. The activity level (percentile) of bats recorded across each night of the bat survey.



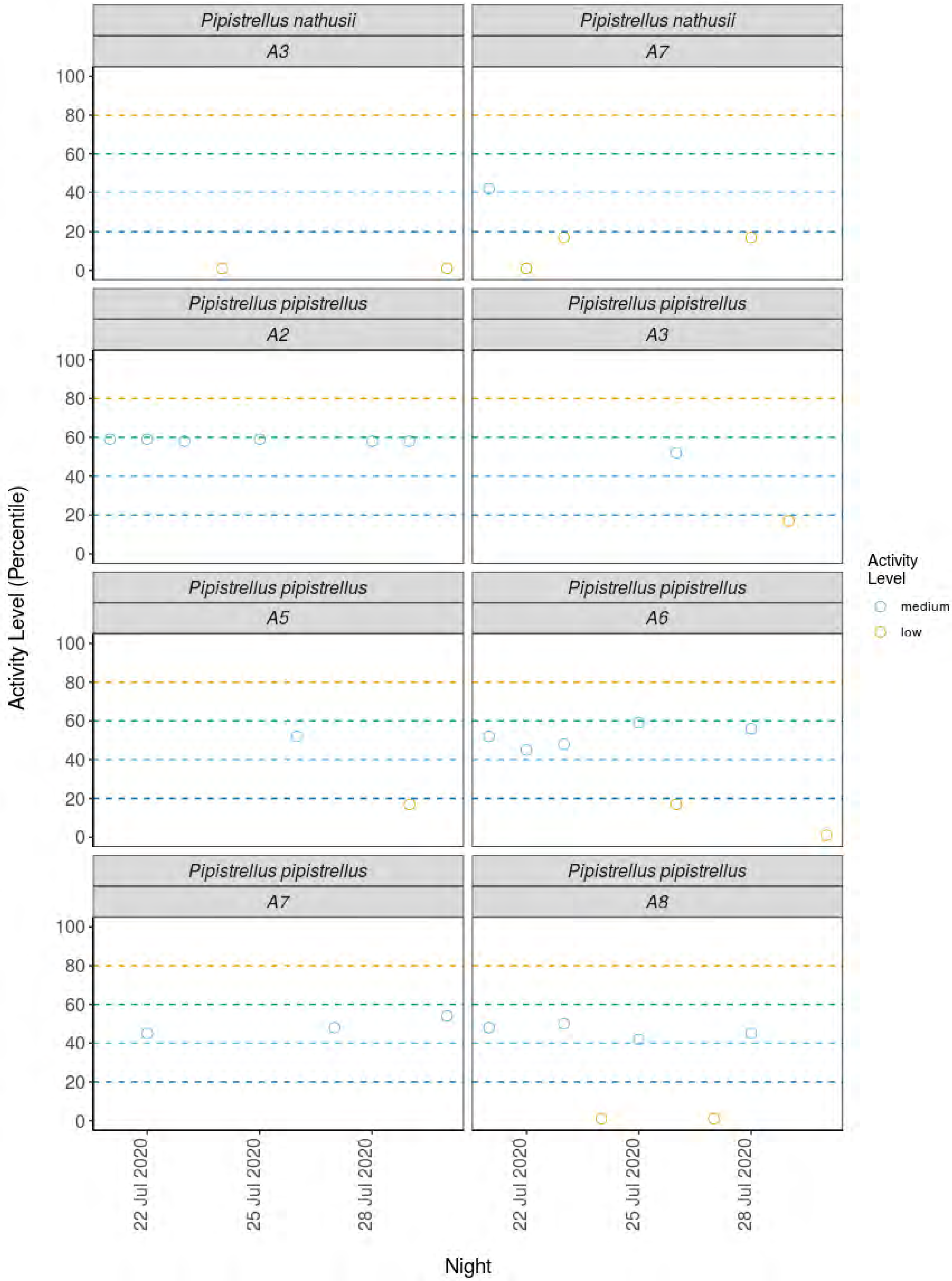
Myotis
A2
Myotis
A3
Myotis
A5
Myotis
A6
Myotis
A7
Myotis daubentonii
A2
Myotis daubentonii
A3
Myotis daubentonii
A5
100
80
60
40
20
0
Activity Level (Percentile)
22 Jul 2020
25 Jul 2020
28 Jul 2020
Night
Activity
Level
medium
low


Myotis daubentonii
A6
Myotis daubentonii
A7
Myotis mystacinus
A2
Myotis mystacinus
A3
Myotis mystacinus
A5
Myotis mystacinus
A6
Myotis mystacinus
A7
Myotis nattereri
A2
100
80
60
40
20
0
Activity Level (Percentile)
22 Jul 2020
25 Jul 2020
28 Jul 2020
Night
Activity Level
medium
low

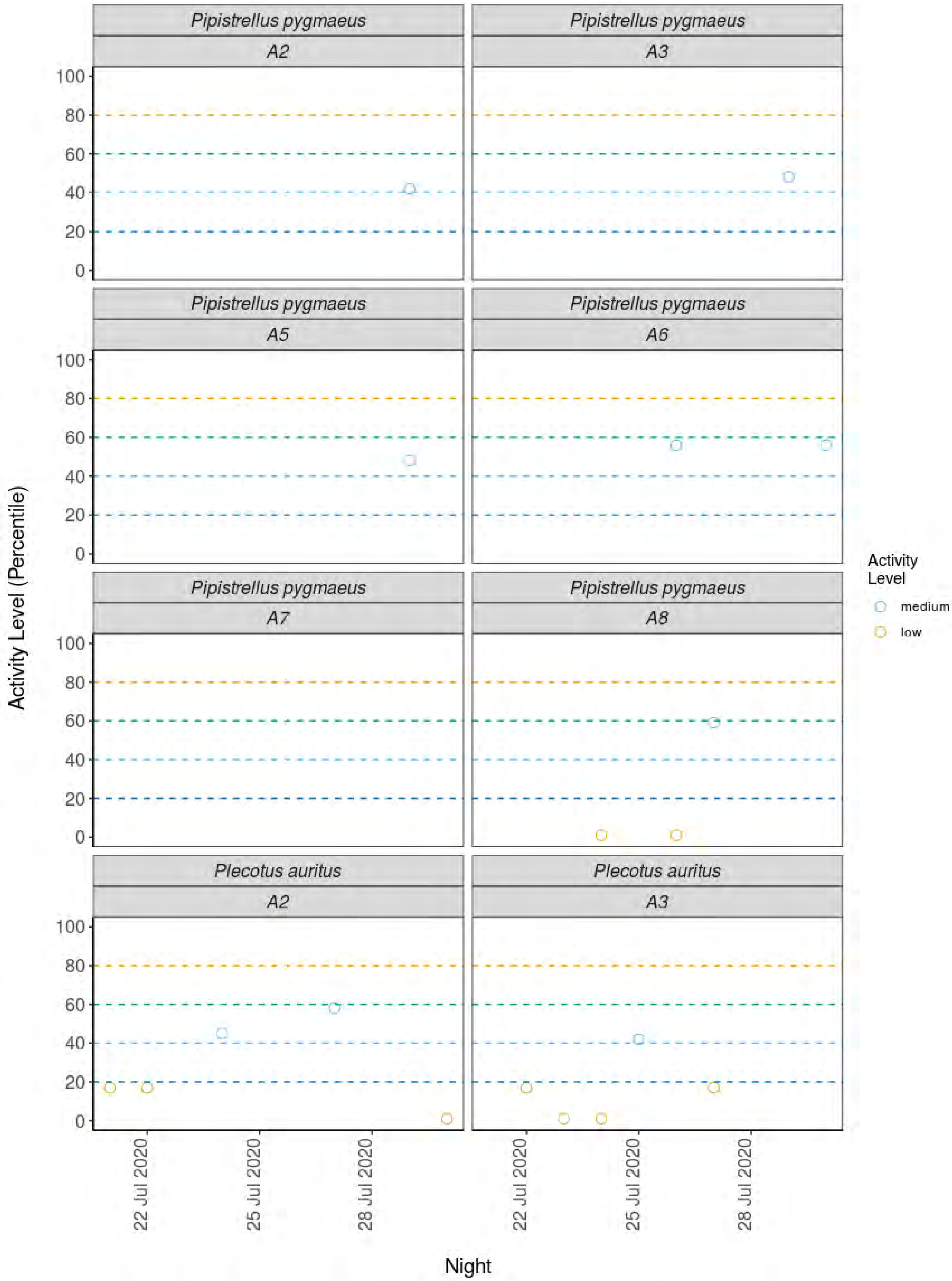

Myotis nattereri
A3
Myotis nattereri
A5
Myotis nattereri
A6
Myotis nattereri
A7
Nyctalus leisleri
A2
Nyctalus leisleri
A3
Nyctalus leisleri
A5
Nyctalus leisleri
A6
Activity Level (Percentile)
100
80
60
40
20
0
22 Jul 2020
25 Jul 2020
28 Jul 2020
Night
Activity Level
medium
low



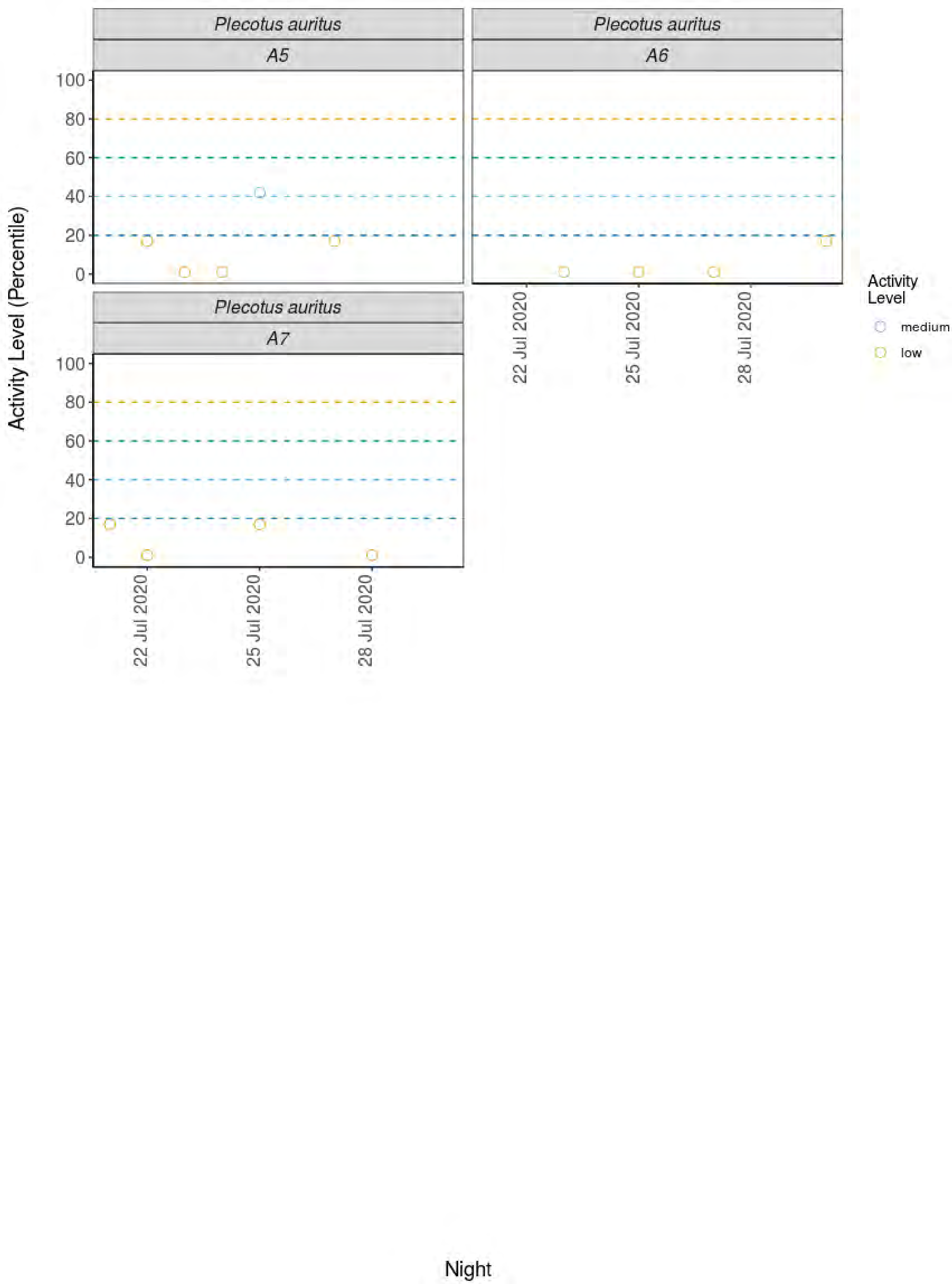
Nyctalus leisleri
A7
Nyctalus leisleri
A8
Pipistrellus
A2
Pipistrellus
A3
Pipistrellus
A5
Pipistrellus
A6
Pipistrellus
A7
Pipistrellus nathusii
A2
Activity Level (Percentile)
100
80
60
40
20
0
22 Jul 2020
25 Jul 2020
28 Jul 2020
Night
Activity Level
medium
low



Pipistrellus nathusii
A3
Pipistrellus nathusii
A7
Pipistrellus pipistrellus
A2
Pipistrellus pipistrellus
A3
Pipistrellus pipistrellus
A5
Pipistrellus pipistrellus
A6
Pipistrellus pipistrellus
A7
Pipistrellus pipistrellus
A8
Activity Level (Percentile)
100
80
60
40
20
0
22 Jul 2020
25 Jul 2020
28 Jul 2020
Night
Activity Level
medium
low



Pipistrellus pygmaeus
A2
Pipistrellus pygmaeus
A3
Pipistrellus pygmaeus
A5
Pipistrellus pygmaeus
A6
Pipistrellus pygmaeus
A7
Pipistrellus pygmaeus
A8
Plecotus auritus
A2
Plecotus auritus
A3
100
80
60
40
20
0
Activity Level (Percentile)
22 Jul 2020
25 Jul 2020
28 Jul 2020
Night
Activity Level
medium
low


Plecotus auritus
A5
Plecotus auritus
A6
Plecotus auritus
A7
Activity Level (Percentile)
100
80
60
40
20
0
22 Jul 2020
25 Jul 2020
28 Jul 2020
Activity Level
medium
low
Night

PER DETECTOR, PER MONTH

Table 5. Summary table showing the number of nights recorded bat activity fell into each activity band for each species at each detector during each month.

Detector ID	Species/Species Group	Month	Nights of High Activity	Nights of Moderate / High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity
A2	*Myotis*	Jul	0	0	1	2	0
A2	*Myotis daubentonii*	Jul	0	0	0	2	3
A2	*Myotis mystacinus*	Jul	0	0	0	1	5
A2	*Myotis nattereri*	Jul	0	0	0	1	5
A2	*Nyctalus leisleri*	Jul	1	5	2	2	0
A2	*Pipistrellus*	Jul	7	1	0	0	0
A2	*Pipistrellus nathusii*	Jul	0	0	0	0	4
A2	*Pipistrellus pipistrellus*	Jul	1	3	6	0	0
A2	*Pipistrellus pygmaeus*	Jul	4	5	1	0	0
A2	*Plecotus auritus*	Jul	0	0	2	4	3
A3	*Myotis*	Jul	0	0	2	3	1
A3	*Myotis daubentonii*	Jul	0	0	0	4	3
A3	*Myotis mystacinus*	Jul	0	0	1	3	2
A3	*Myotis nattereri*	Jul	0	0	0	0	6
A3	*Nyctalus leisleri*	Jul	0	4	6	0	0
A3	*Pipistrellus*	Jul	7	0	0	0	0
A3	*Pipistrellus nathusii*	Jul	0	0	0	0	2
A3	*Pipistrellus pipistrellus*	Jul	2	6	1	0	1

A3	*Pipistrellus pygmaeus*	Jul	8	1	1	0	0
A3	*Plecotus auritus*	Jul	0	0	1	2	4
A5	*Myotis*	Jul	0	0	3	2	1
A5	*Myotis daubentonii*	Jul	0	0	0	4	3
A5	*Myotis mystacinus*	Jul	0	0	1	3	2
A5	*Myotis nattereri*	Jul	0	0	0	0	8
A5	*Nyctalus leisleri*	Jul	0	4	6	0	0
A5	*Pipistrellus*	Jul	7	0	0	0	0
A5	*Pipistrellus pipistrellus*	Jul	2	6	1	0	1
A5	*Pipistrellus pygmaeus*	Jul	8	1	1	0	0
A5	*Plecotus auritus*	Jul	0	0	1	2	4
A6	*Myotis*	Jul	0	0	2	0	1
A6	*Myotis daubentonii*	Jul	0	0	1	2	4
A6	*Myotis mystacinus*	Jul	0	0	0	0	2
A6	*Myotis nattereri*	Jul	0	0	0	1	4
A6	*Nyctalus leisleri*	Jul	0	1	7	0	1
A6	*Pipistrellus*	Jul	2	1	0	0	0
A6	*Pipistrellus pipistrellus*	Jul	1	1	5	0	2
A6	*Pipistrellus pygmaeus*	Jul	1	6	2	0	0
A6	*Plecotus auritus*	Jul	0	0	0	2	4
A7	*Myotis*	Jul	0	0	1	0	0
A7	*Myotis daubentonii*	Jul	0	0	0	5	3
A7	*Myotis mystacinus*	Jul	0	0	0	0	3

A7	*Myotis nattereri*	Jul	0	0	0	0	2
A7	*Nyctalus leisleri*	Jul	6	2	0	2	0
A7	*Pipistrellus*	Jul	5	0	0	0	0
A7	*Pipistrellus nathusii*	Jul	0	0	1	0	3
A7	*Pipistrellus pipistrellus*	Jul	0	4	3	1	0
A7	*Pipistrellus pygmaeus*	Jul	5	3	0	1	0
A7	*Plecotus auritus*	Jul	0	0	0	2	4
A8	*Nyctalus leisleri*	Jul	0	2	4	3	0
A8	*Pipistrellus pipistrellus*	Jul	0	0	4	1	2
A8	*Pipistrellus pygmaeus*	Jul	1	4	1	0	2

Table 6. Summary table showing key metrics for each species recorded per month. Please note that we cannot split the reference range by month, hence this column is not shown in this table.

Detector ID	Species/Species Group	Month	Median Percentile	95% CIs	Max Percentile	Nights Recorded
A2	*Myotis*	Jul	38	33 - 45	45	3
A2	*Myotis daubentonii*	Jul	17	1 - 26	33	5
A2	*Myotis mystacinus*	Jul	9	1 - 17	26	6
A2	*Myotis nattereri*	Jul	1	1 - 13.5	26	6
A2	*Nyctalus leisleri*	Jul	62	44 - 71	83	10
A2	*Pipistrellus*	Jul	84	75 - 93	100	8
A2	*Pipistrellus nathusii*	Jul	17	17 - 17	17	4
A2	*Pipistrellus pipistrellus*	Jul	59	58.5 - 79	99	10
A2	*Pipistrellus pygmaeus*	Jul	77	62 - 87	98	10
A2	*Plecotus auritus*	Jul	33	17 - 45	58	9
A3	*Myotis*	Jul	38	19.5 - 45	50	6
A3	*Myotis daubentonii*	Jul	26	9 - 29.5	33	7
A3	*Myotis mystacinus*	Jul	26	17 - 34	42	6
A3	*Myotis nattereri*	Jul	1	1 - 1	1	6
A3	*Nyctalus leisleri*	Jul	59	54.5 - 68	77	10
A3	*Pipistrellus*	Jul	97	94 - 97.5	98	7
A3	*Pipistrellus nathusii*	Jul	1	1 - 1	1	2
A3	*Pipistrellus pipistrellus*	Jul	73	46 - 78	85	10

A3	*Pipistrellus pygmaeus*	Jul	93	72 - 96	98	10
A3	*Plecotus auritus*	Jul	17	9 - 29.5	42	7
A5	*Myotis*	Jul	40	19.5 - 45	48	6
A5	*Myotis daubentonii*	Jul	26	9 - 29.5	33	7
A5	*Myotis mystacinus*	Jul	26	17 - 34	42	6
A5	*Myotis nattereri*	Jul	1	1 - 1	1	8
A5	*Nyctalus leisleri*	Jul	59	54.5 - 68	77	10
A5	*Pipistrellus*	Jul	97	94 - 97.5	98	7
A5	*Pipistrellus pipistrellus*	Jul	73	46 - 78	85	10
A5	*Pipistrellus pygmaeus*	Jul	93	72 - 96	98	10
A5	*Plecotus auritus*	Jul	17	9 - 29.5	42	7
A6	*Myotis*	Jul	54	54 - 54	54	3
A6	*Myotis daubentonii*	Jul	1	1 - 23	45	7
A6	*Myotis mystacinus*	Jul	1	1 - 1	1	2
A6	*Myotis nattereri*	Jul	17	1 - 21.5	26	5
A6	*Nyctalus leisleri*	Jul	52	35.5 - 58.5	65	9
A6	*Pipistrellus*	Jul	80	72 - 95	95	3
A6	*Pipistrellus pipistrellus*	Jul	52	26.5 - 65	82	9
A6	*Pipistrellus pygmaeus*	Jul	72	60.5 - 79	93	9
A6	*Plecotus auritus*	Jul	9	1 - 21.5	26	6
A7	*Myotis*	Jul	42	0	42	1

A7	*Myotis daubentonii*	Jul	26	1 - 29.5	33	8
A7	*Myotis mystacinus*	Jul	1	1 - 1	1	3
A7	*Myotis nattereri*	Jul	1	1 - 1	1	2
A7	*Nyctalus leisleri*	Jul	84	54 - 89	93	10
A7	*Pipistrellus*	Jul	90	85 - 93	94	5
A7	*Pipistrellus nathusii*	Jul	17	9 - 29.5	42	4
A7	*Pipistrellus pipistrellus*	Jul	60	40 - 71.5	76	8
A7	*Pipistrellus pygmaeus*	Jul	83	58 - 87.5	92	9
A7	*Plecotus auritus*	Jul	17	1 - 26	26	6
A8	*Nyctalus leisleri*	Jul	52	37 - 58	61	9
A8	*Pipistrellus pipistrellus*	Jul	42	13.5 - 47.5	50	7
A8	*Pipistrellus pygmaeus*	Jul	69	30 - 80.5	88	8

PER SITE

In this 'Per Site' section of the analysis, all values are taken from across all of the detectors to provide site-wide averages/medians.

Table 7. Summary table showing the number of nights recorded bat activity fell into each activity band for each species.

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
Myotis	0	0	9	7	3
Myotis daubentonii	0	0	1	17	16
Myotis mystacinus	0	0	2	7	14
Myotis nattereri	0	0	0	2	25
Nyctalus leisleri	7	18	25	7	1
Pipistrellus	28	2	0	0	0
Pipistrellus nathusii	0	0	1	0	9
Pipistrellus pipistrellus	6	20	20	2	6
Pipistrellus pygmaeus	27	20	6	1	2
Plecotus auritus	0	0	4	12	19

Table 8. Summary table showing key metrics for each species recorded.

Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded
Myotis	38	54 - 54	54	19
Myotis daubentonii	26	9 - 29.5	45	34
Myotis mystacinus	17	17 - 34	42	23
Myotis nattereri	1	1 - 21.5	26	27
Nyctalus leisleri	58	54.5 - 68	93	58
Pipistrellus	94	94 - 97.5	100	30
Pipistrellus nathusii	17	9 - 29.5	42	10
Pipistrellus pipistrellus	59	58.5 - 79	99	54
Pipistrellus pygmaeus	78	72 - 96	98	56
Plecotus auritus	17	9 - 29.5	58	35

###Figures

Figure 4. The activity level (percentile) of bats recorded across each night of the bat survey for the **entire site**.

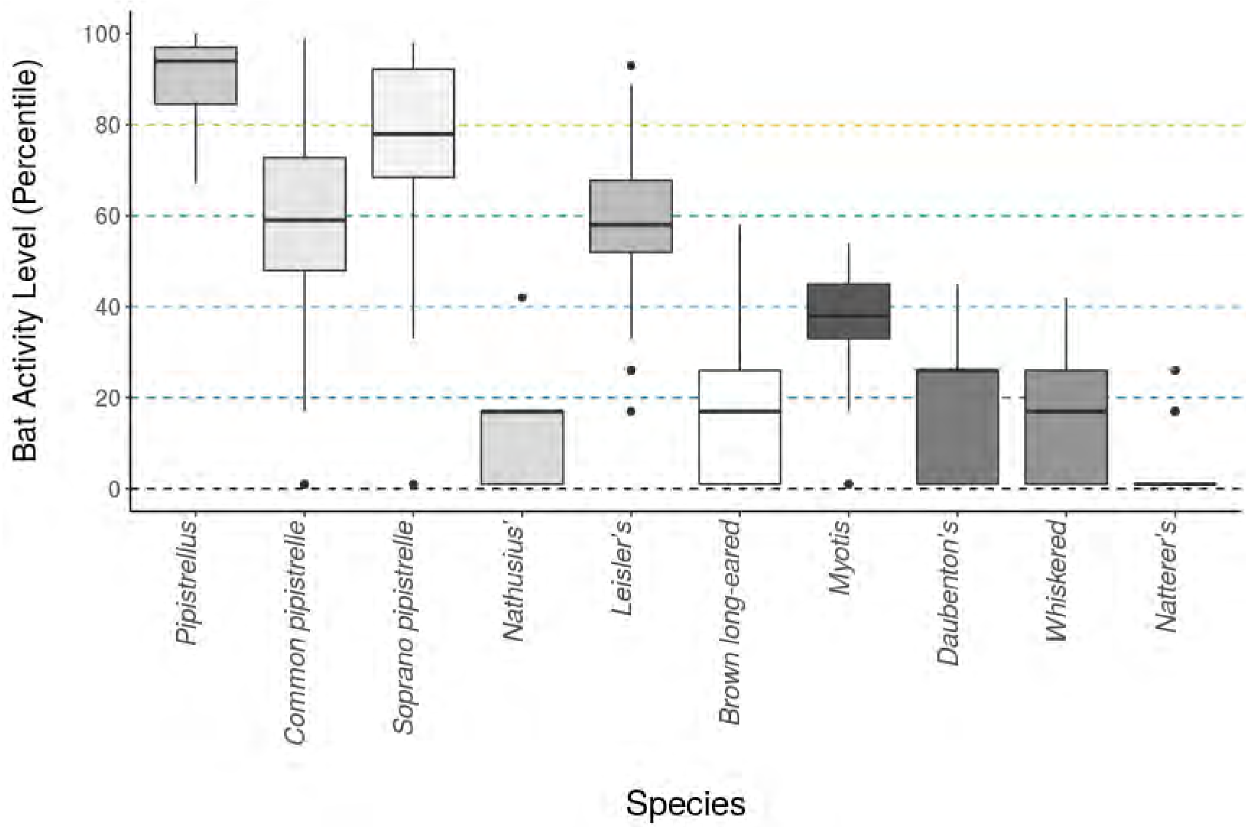
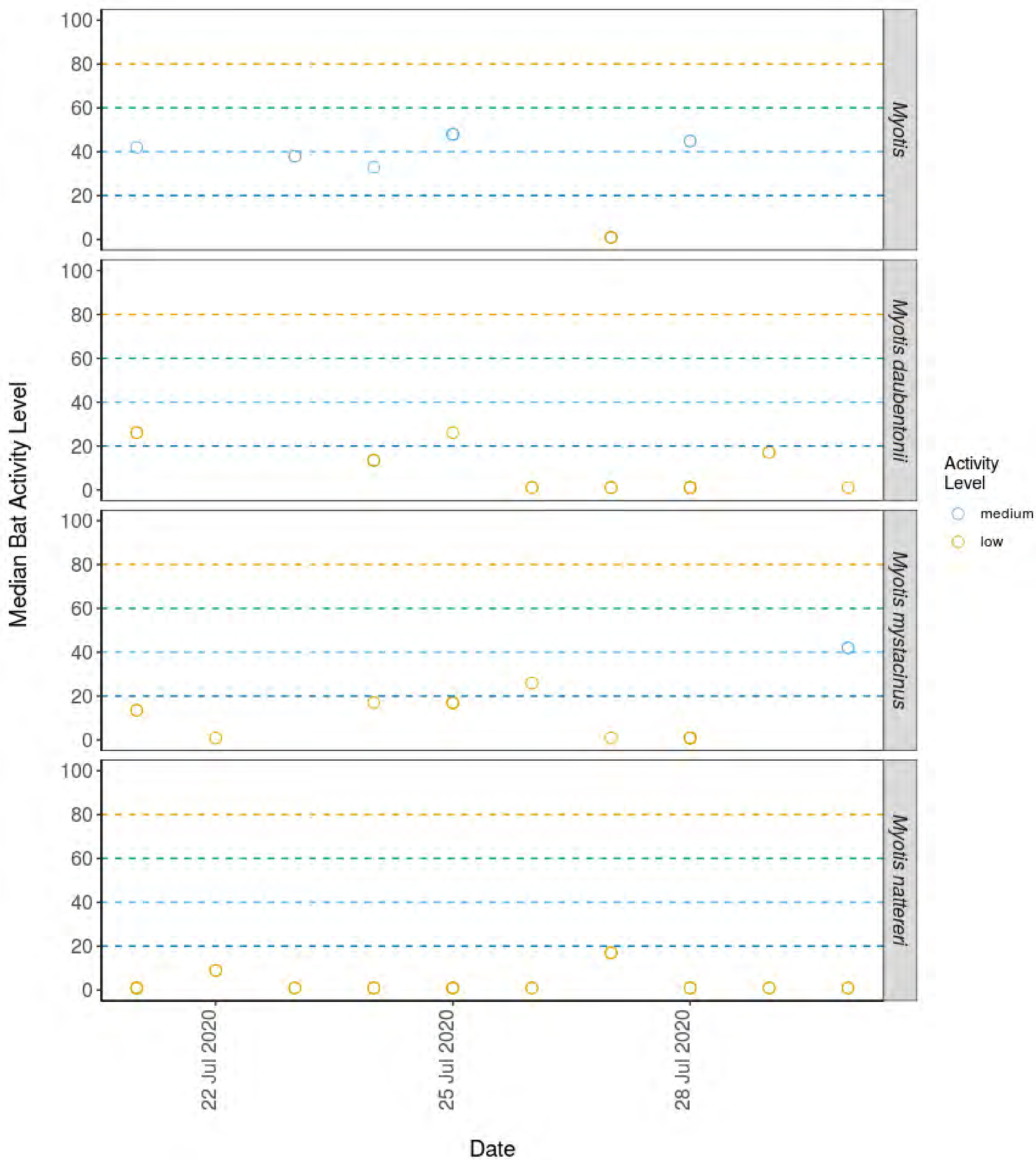
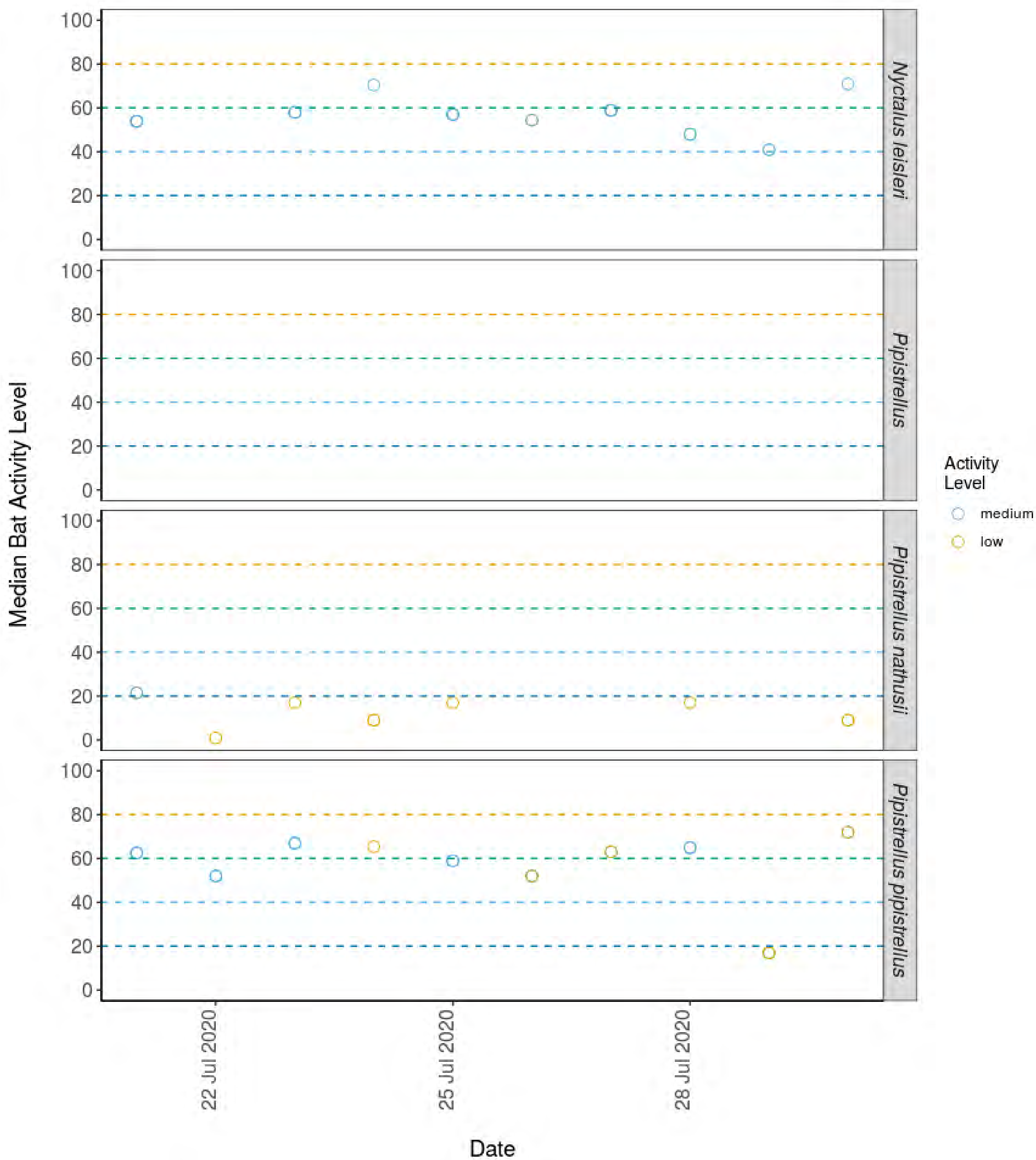


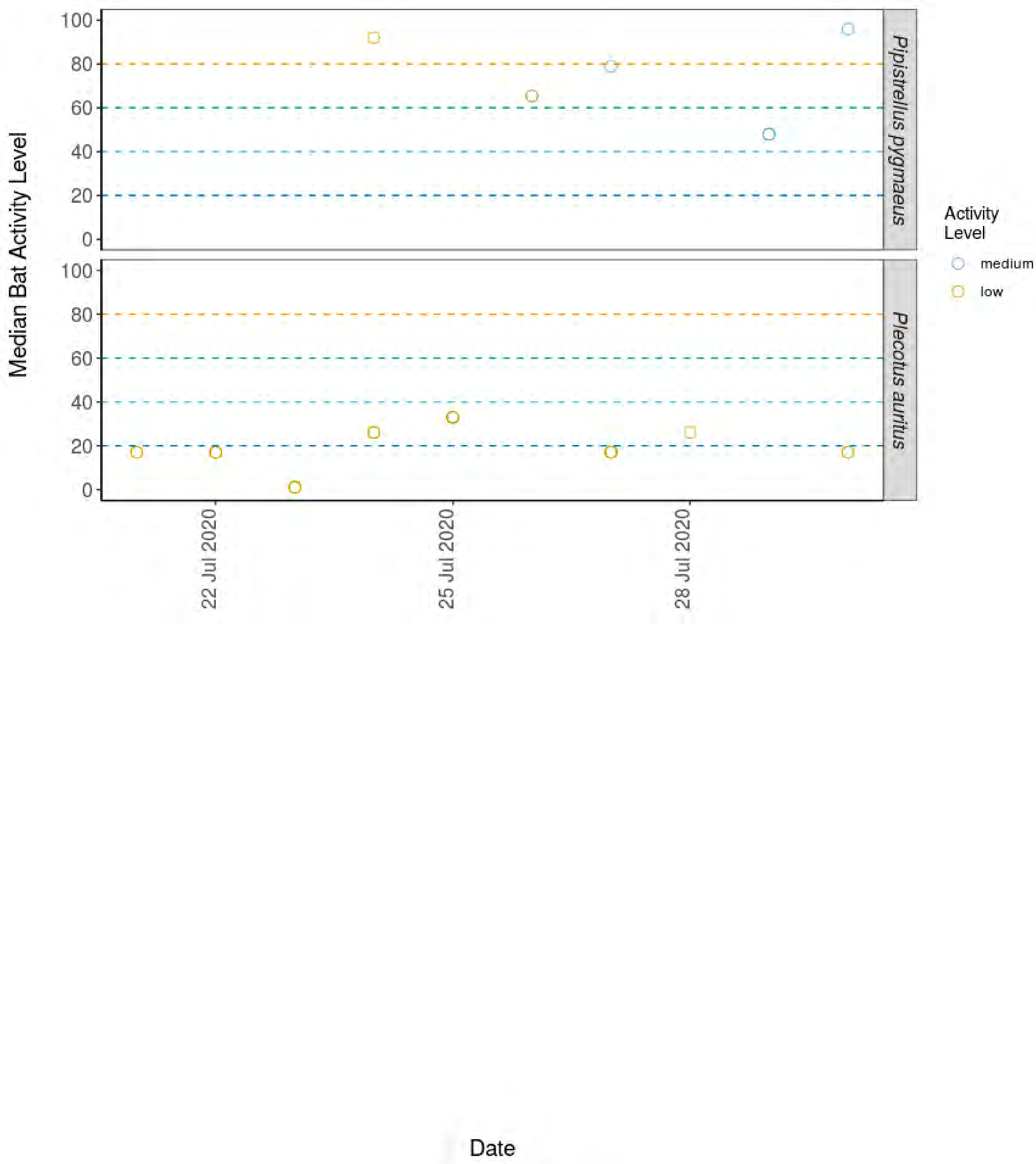
Figure 5. The median activity levels of bats recorded across all detectors each night.



Median Bat Activity Level
100
80
60
40
20
0
Myotis
Myotis daubentonii
Myotis mystacinus
Myotis nattereri
22 Jul 2020
25 Jul 2020
28 Jul 2020
Date
Activity Level
medium
low



Median Bat Activity Level
100
80
60
40
20
0
Nyctalus leisleri
Pipistrellus
Pipistrellus nathusii
Pipistrellus pipistrellus
22 Jul 2020
25 Jul 2020
28 Jul 2020
Date
Activity Level
medium
low



Median Bat Activity Level
100
80
60
40
20
0
Pipistrellus pygmaeus
Plecotus auritus
22 Jul 2020
25 Jul 2020
28 Jul 2020
Activity Level
medium
low
Date

PER SITE, PER MONTH

Table 9. Summary table showing the number of nights recorded bat activity fell into each activity band for each species during each month.

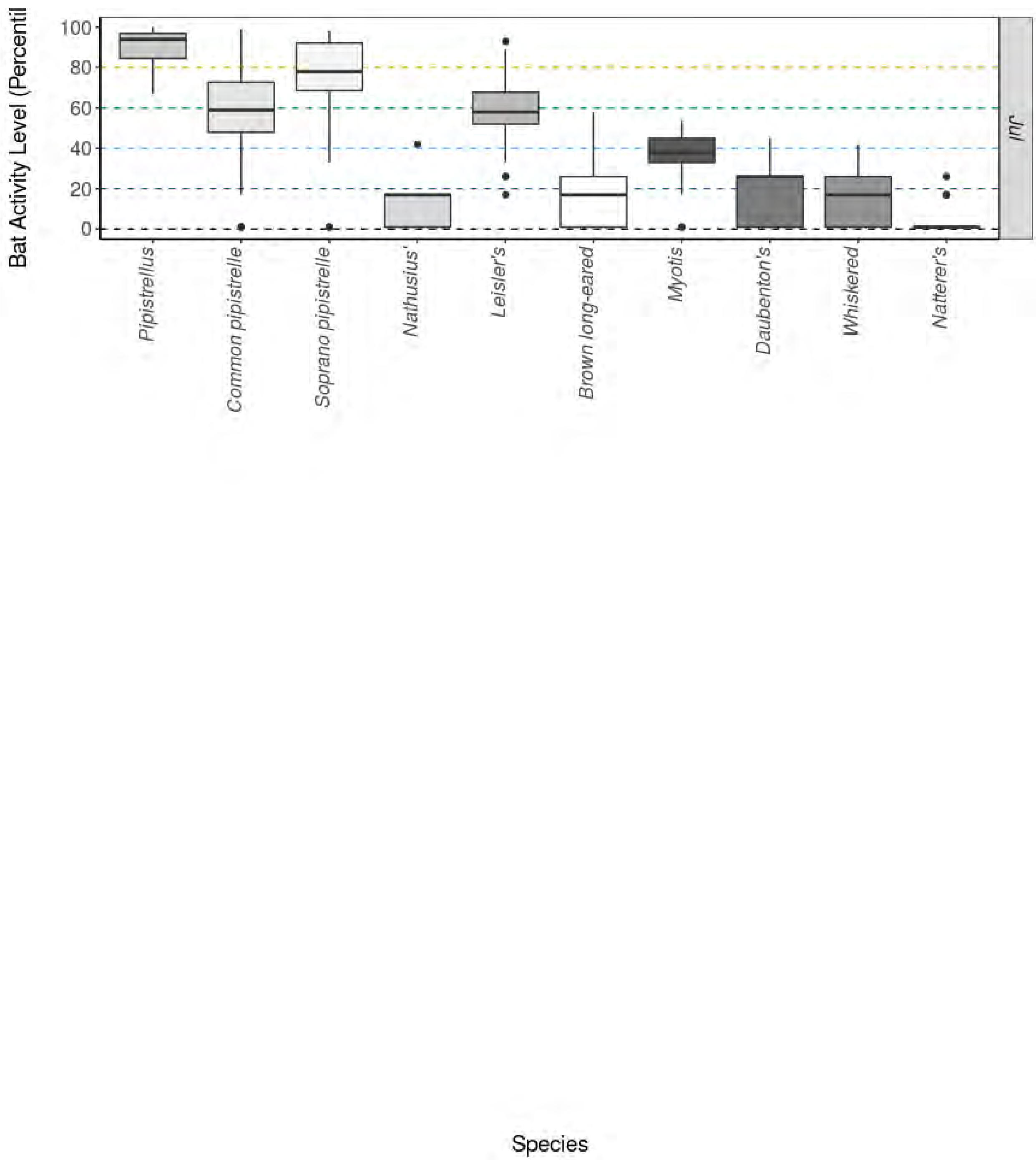
Species/Species Group	Month	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity
Myotis	Jul	0	0	9	7	3
Myotis daubentonii	Jul	0	0	1	17	16
Myotis mystacinus	Jul	0	0	2	7	14
Myotis nattereri	Jul	0	0	0	2	25
Nyctalus leisleri	Jul	7	18	25	7	1
Pipistrellus	Jul	28	2	0	0	0
Pipistrellus nathusii	Jul	0	0	1	0	9
Pipistrellus pipistrellus	Jul	6	20	20	2	6
Pipistrellus pygmaeus	Jul	27	20	6	1	2
Plecotus auritus	Jul	0	0	4	12	19

Table 10. Summary table showing key metrics for each species recorded per month.

Species/Species Group	Month	Median Percentile	95% CIs	Max Percentile	Nights Recorded
Myotis	Jul	38	54 - 54	54	19
Myotis daubentonii	Jul	26	9 - 29.5	45	34
Myotis mystacinus	Jul	17	17 - 34	42	23
Myotis nattereri	Jul	1	1 - 21.5	26	27
Nyctalus leisleri	Jul	58	54.5 - 68	93	58
Pipistrellus	Jul	94	94 - 97.5	100	30
Pipistrellus nathusii	Jul	17	9 - 29.5	42	10
Pipistrellus pipistrellus	Jul	59	58.5 - 79	99	54
Pipistrellus pygmaeus	Jul	78	72 - 96	98	56
Plecotus auritus	Jul	17	9 - 29.5	58	35

###Figures

Figure 6. The activity level (percentile) of bats recorded across each night of the bat survey for the entire site, split between months.



PART 2: Nightly Analysis

ENTIRE SURVEY PERIOD

Sunrise and Sunset Times

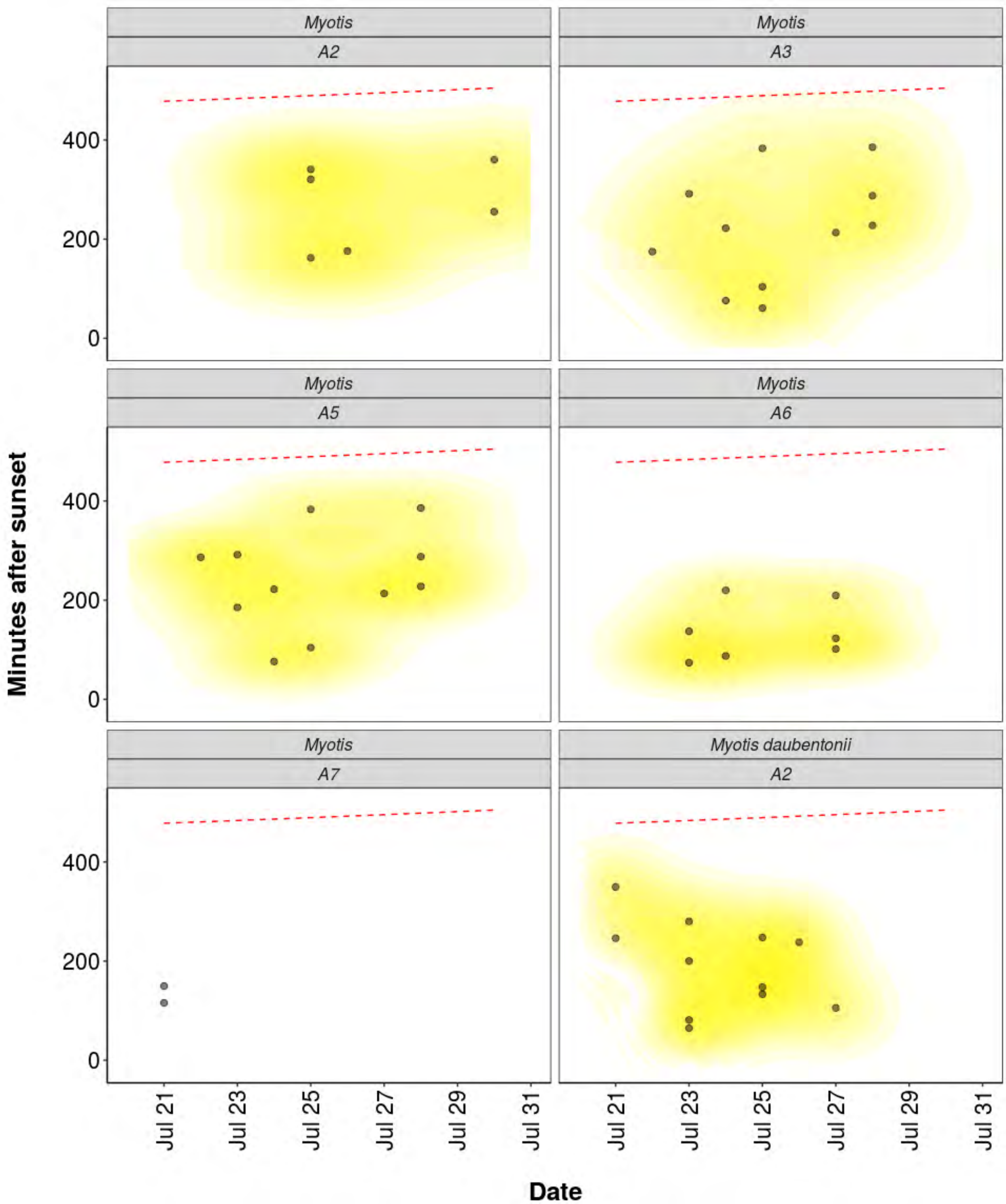
Table 11. The times of sunset and sunrise the following morning for surveys beginning on the date shown.

Night (y-m-d)	Sunset (hh:mm)	Sunrise (hh:mm)	Night Length (hours)
2020-07-21	21:44	05:42	8.0
2020-07-22	21:42	05:43	8.0
2020-07-23	21:41	05:45	8.1
2020-07-24	21:40	05:46	8.1
2020-07-25	21:38	05:47	8.2
2020-07-26	21:37	05:49	8.2
2020-07-27	21:35	05:50	8.3
2020-07-28	21:34	05:52	8.3
2020-07-29	21:32	05:54	8.4
2020-07-30	21:30	05:55	8.4

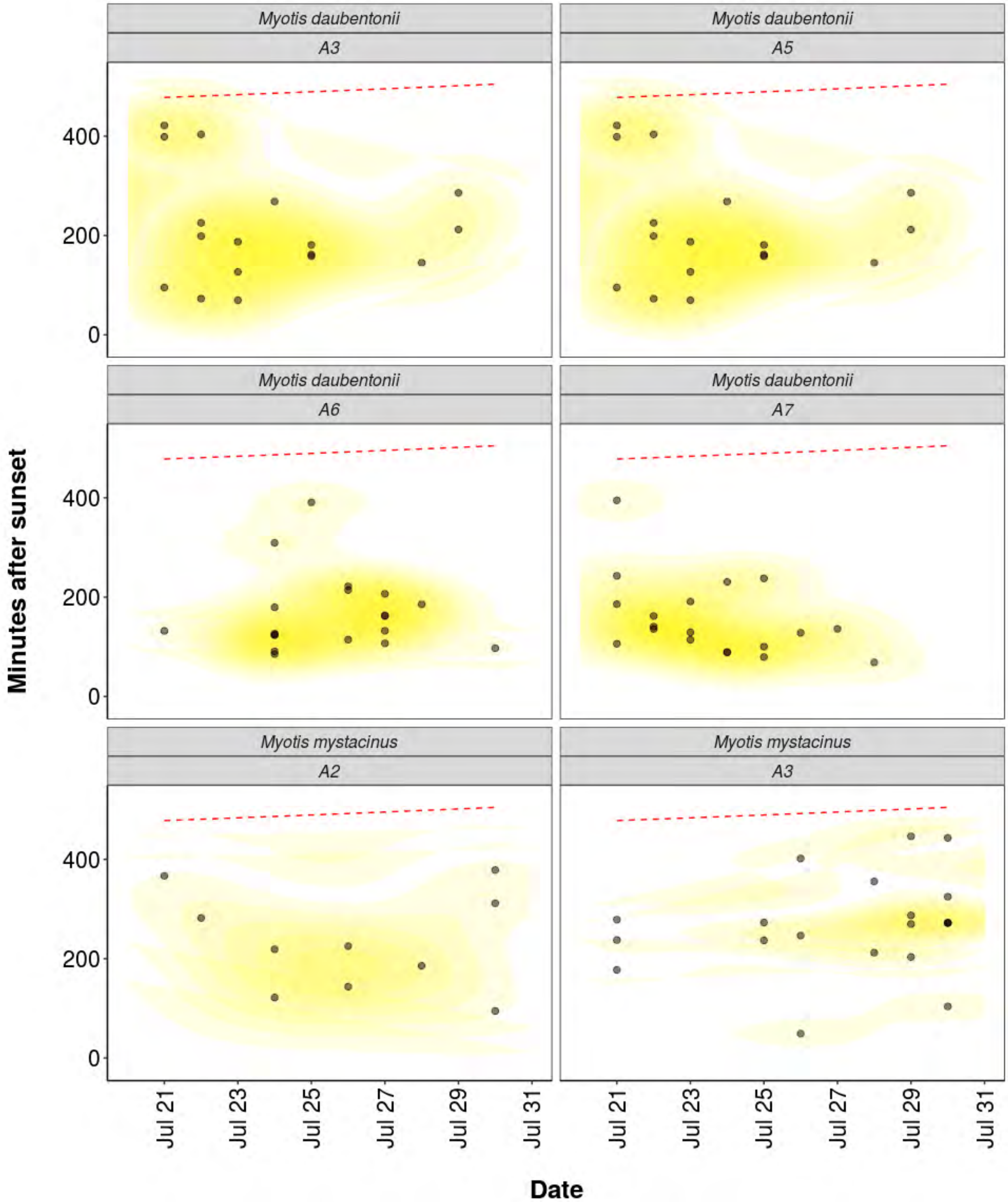
Distribution of Bat Activity Across the Night through Time

Per Detector

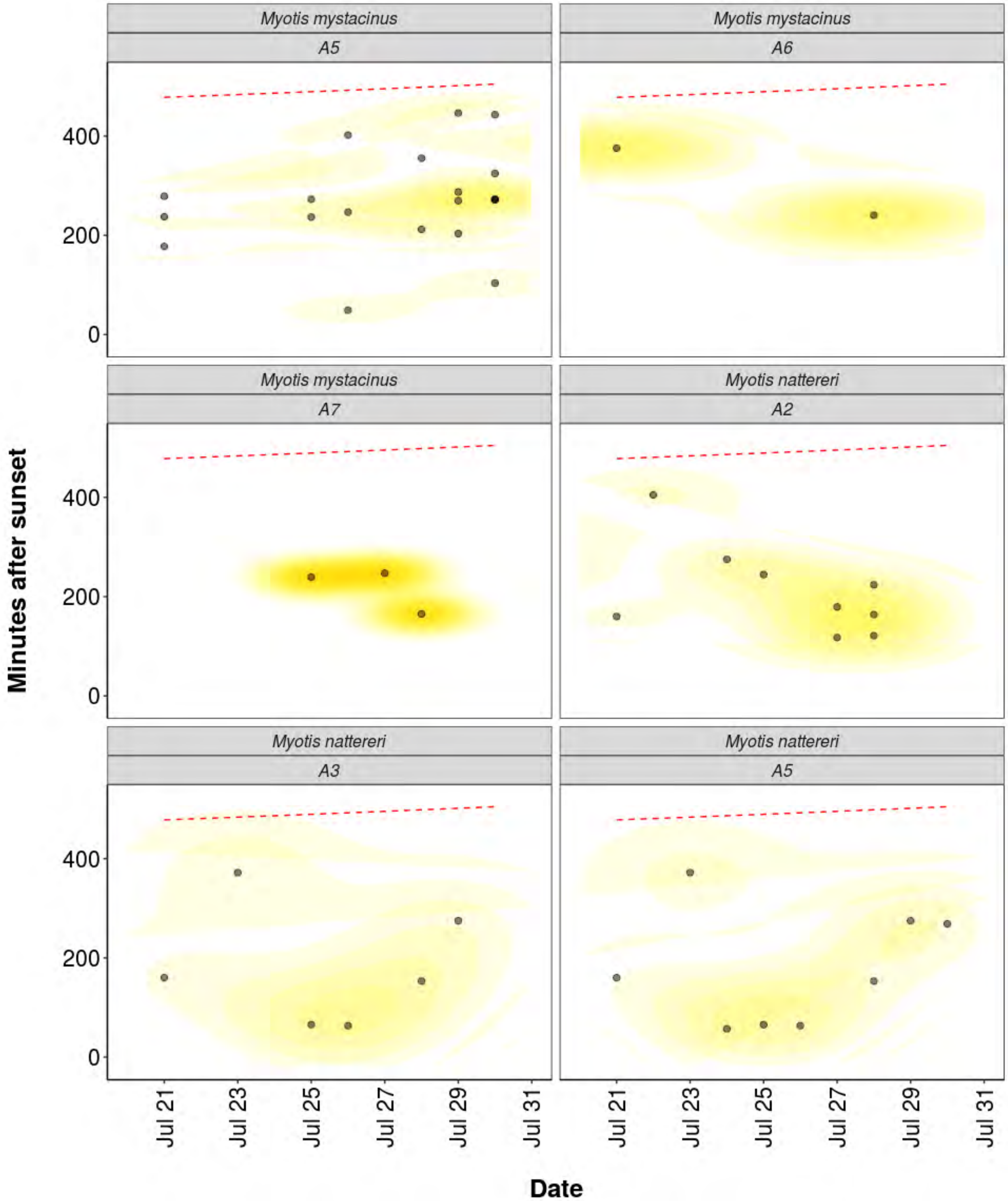
Figure 7. Timing of bat calls plotted as minutes before/after sunset, whereby 0 on the y axis represents sunset. Sunrise throughout the survey period is depicted as the red dashed line. Colours indicate kernel densities, with darkest colours showing peaks of activity. These colours are comparative only within each plot, and do not account for overall activity.



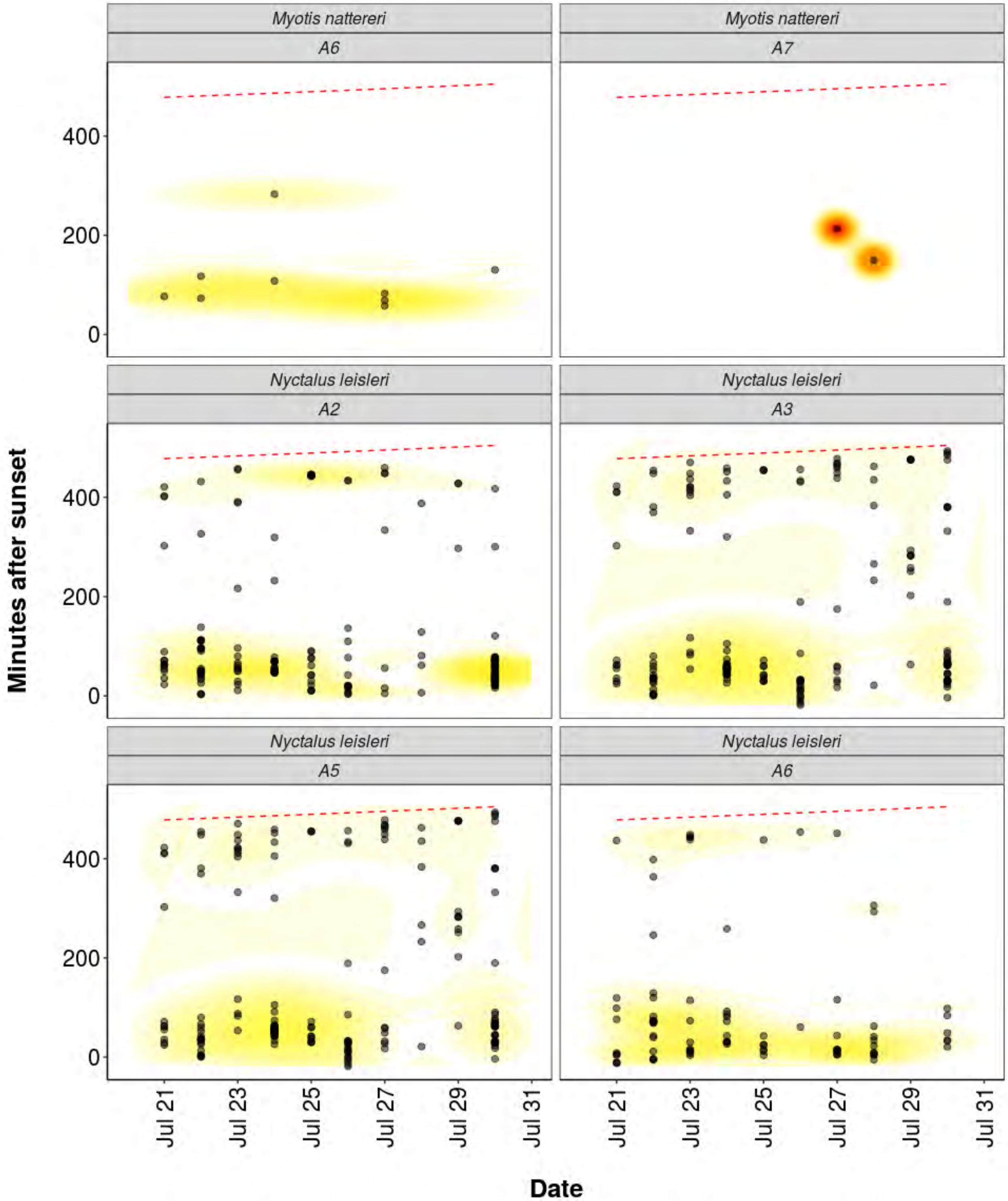
Myotis
A2
Myotis
A3
Myotis
A5
Myotis
A6
Myotis
A7
Myotis daubentonii
A2
Minutes after sunset
0
200
400
Jul 21
Jul 23
Jul 25
Jul 27
Jul 29
Jul 31
Date



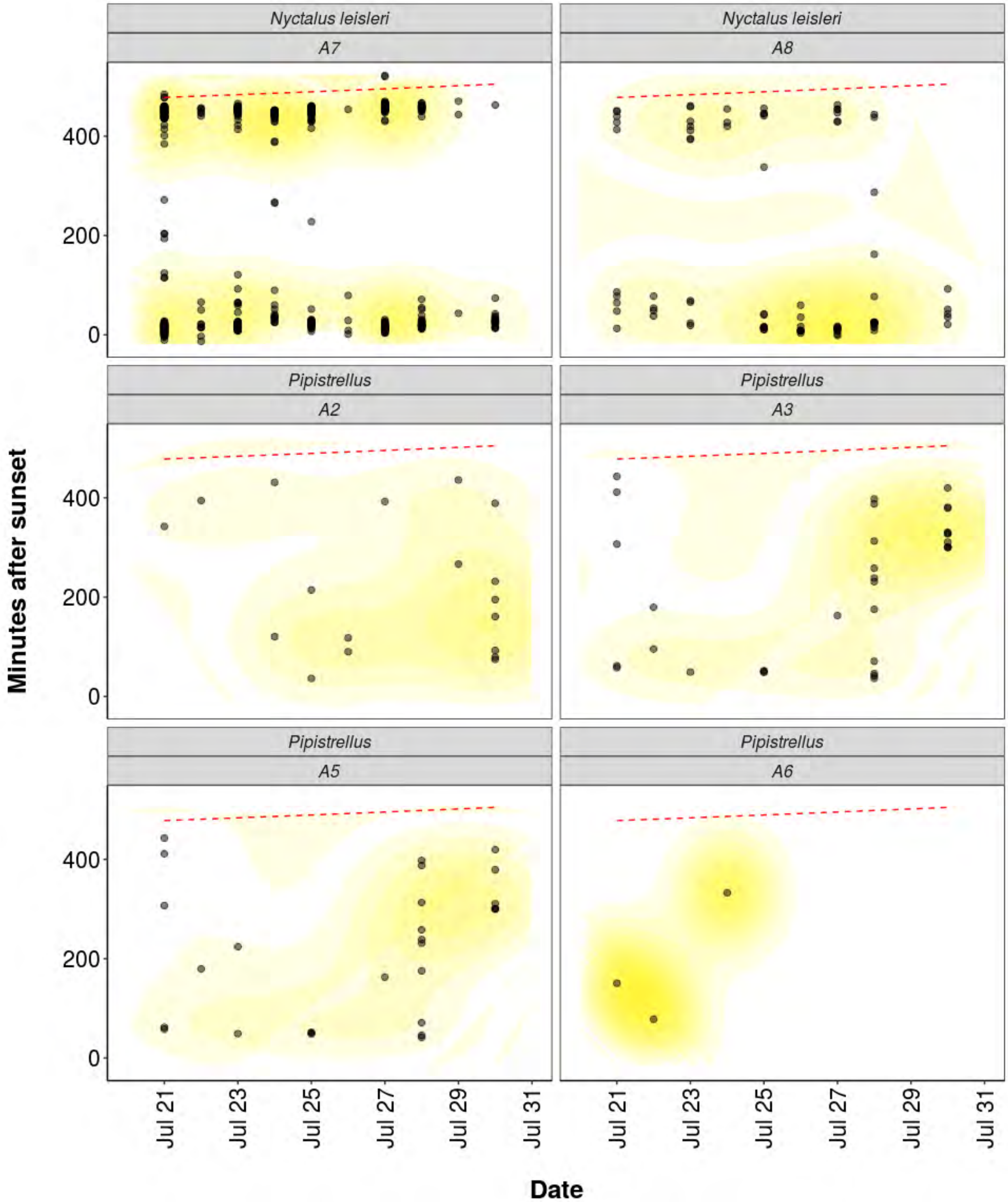
Myotis daubentonii
A3
Myotis daubentonii
A5
Myotis daubentonii
A6
Myotis daubentonii
A7
Myotis mystacinus
A2
Myotis mystacinus
A3
Minutes after sunset
0
200
400
Jul 21
Jul 23
Jul 25
Jul 27
Jul 29
Jul 31
Date



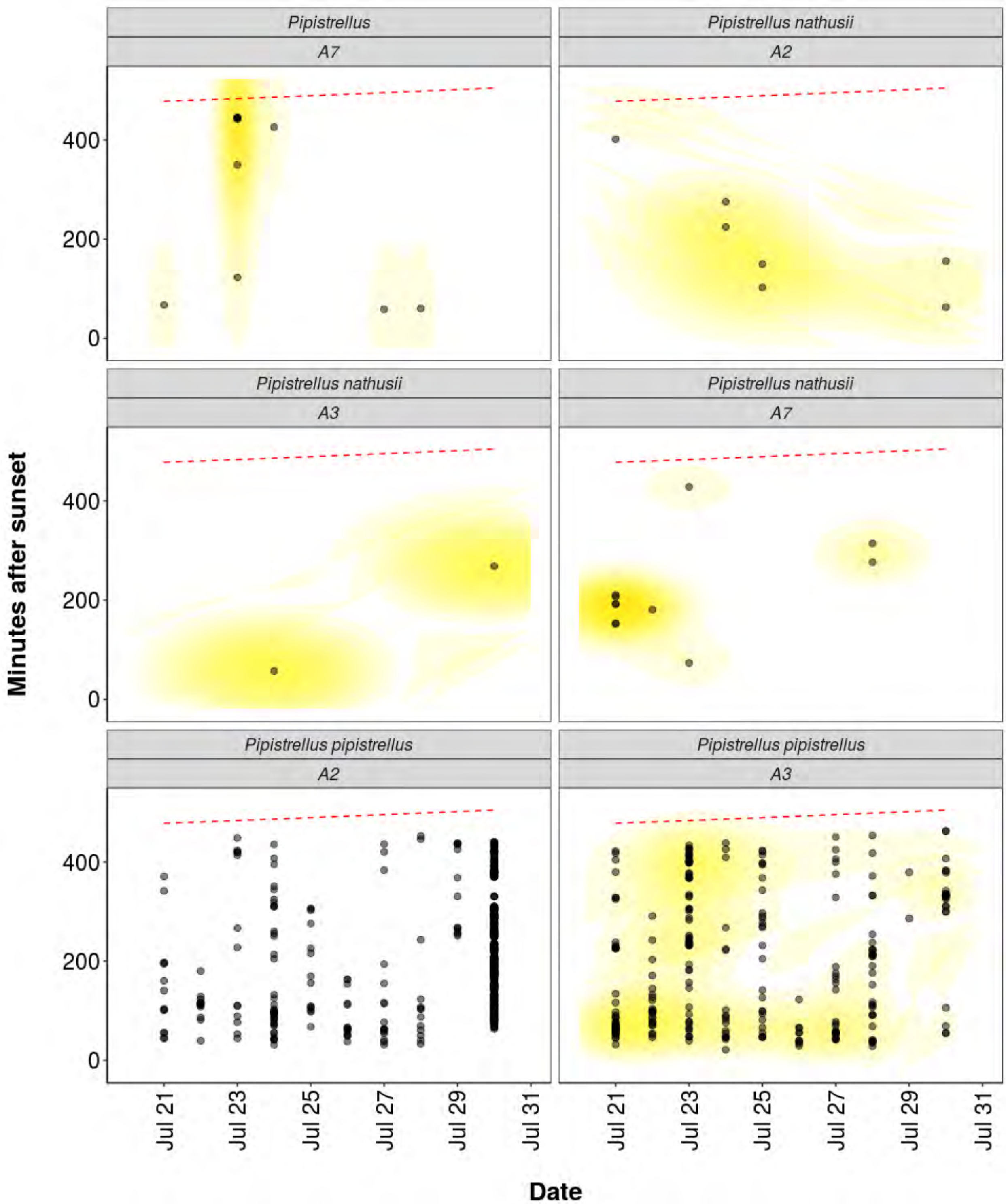
Myotis mystacinus
A5
Myotis mystacinus
A6
Myotis mystacinus
A7
Myotis nattereri
A2
Myotis nattereri
A3
Myotis nattereri
A5
Minutes after sunset
0
200
400
Jul 21
Jul 23
Jul 25
Jul 27
Jul 29
Jul 31
Date



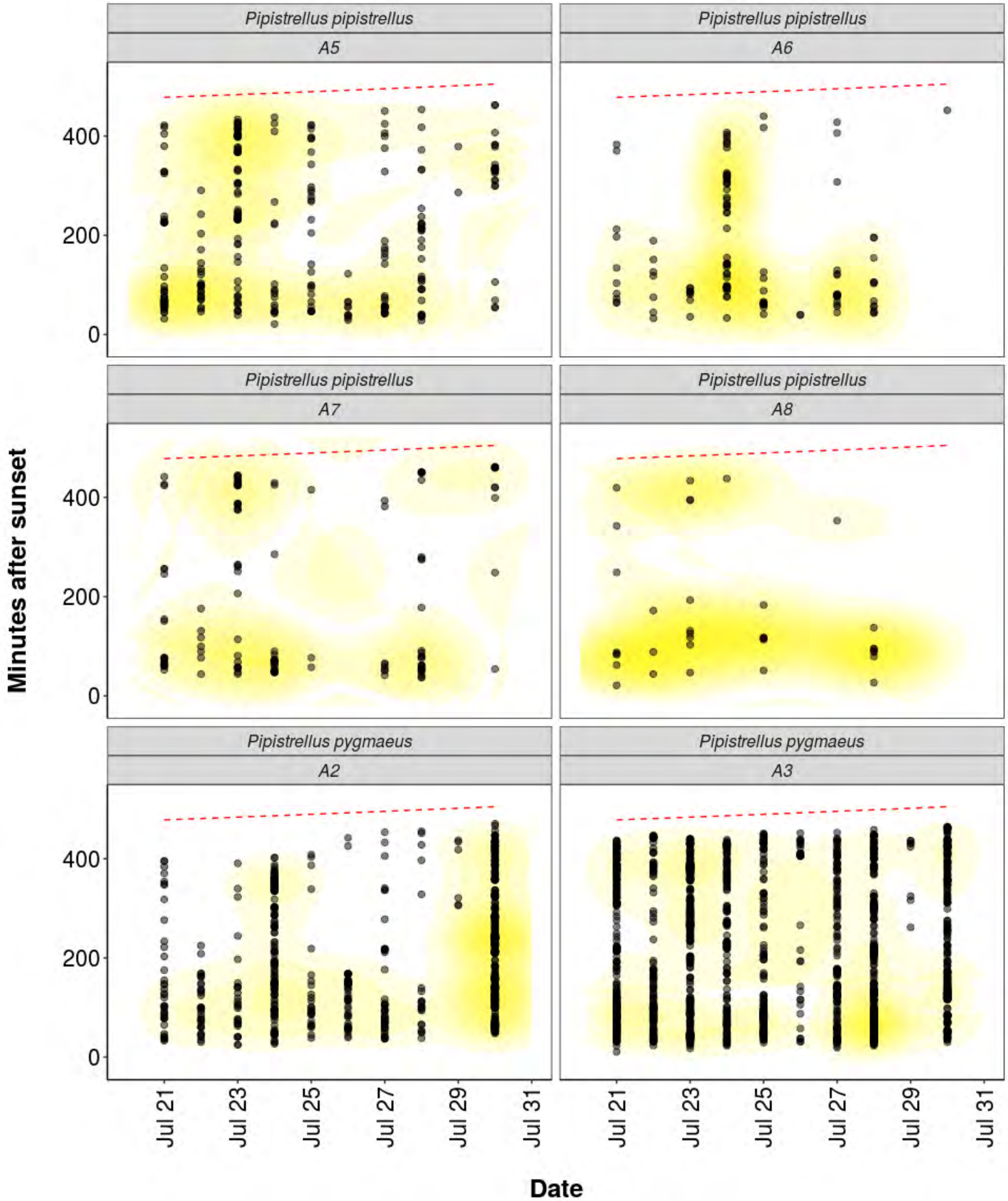
Myotis nattereri
A6
Myotis nattereri
A7
Nyctalus leisleri
A2
Nyctalus leisleri
A3
Nyctalus leisleri
A5
Nyctalus leisleri
A6
Minutes after sunset
0
200
400
Jul 21
Jul 23
Jul 25
Jul 27
Jul 29
Jul 31
Date



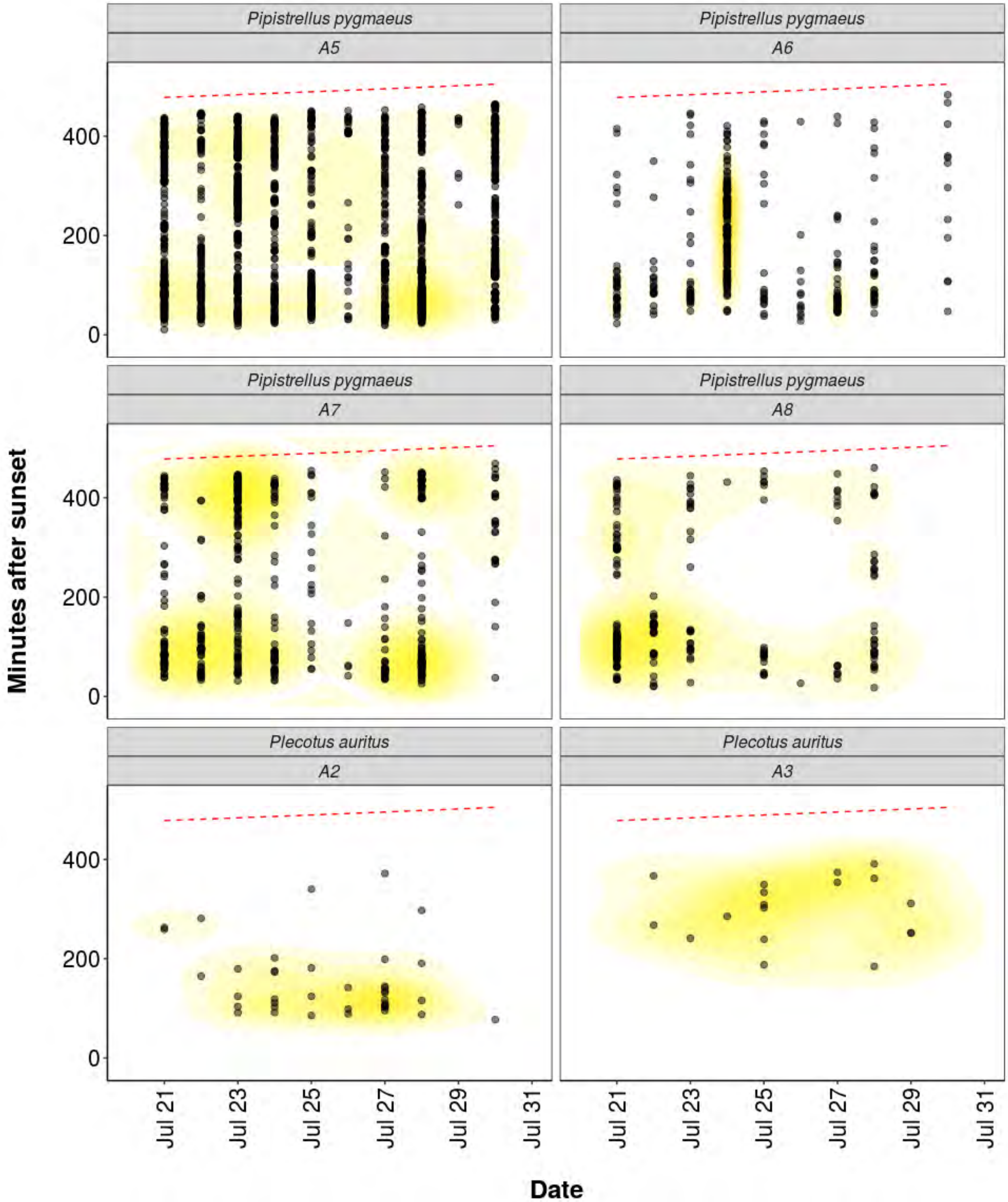
Nyctalus leisleri
A7
Nyctalus leisleri
A8
Pipistrellus
A2
Pipistrellus
A3
Pipistrellus
A5
Pipistrellus
A6
Minutes after sunset
0
200
400
Jul 21
Jul 23
Jul 25
Jul 27
Jul 29
Jul 31
Date



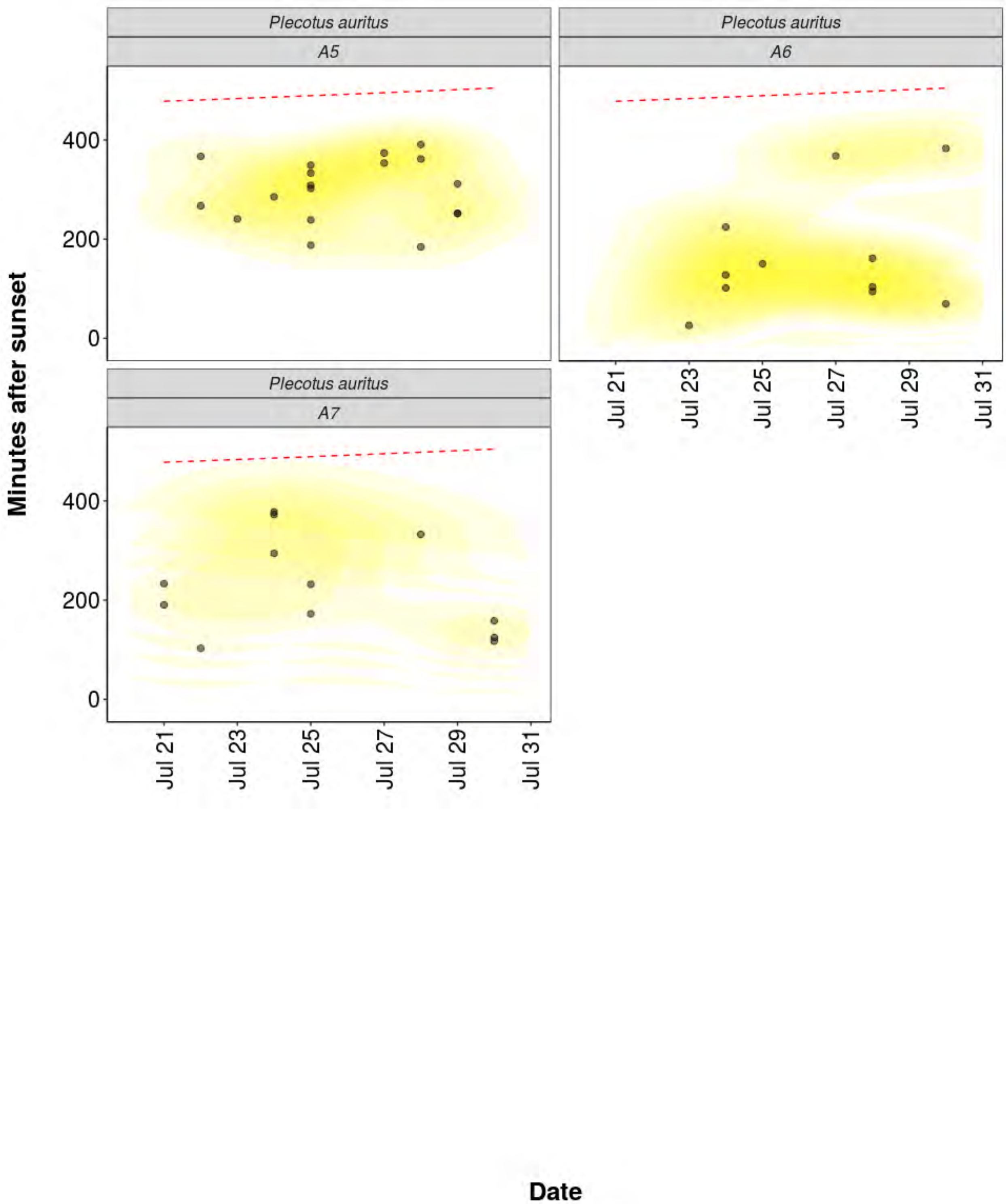
Pipistrellus
A7
Pipistrellus nathusii
A2
Pipistrellus nathusii
A3
Pipistrellus nathusii
A7
Pipistrellus pipistrellus
A2
Pipistrellus pipistrellus
A3
Minutes after sunset
0
200
400
Jul 21
Jul 23
Jul 25
Jul 27
Jul 29
Jul 31
Date



Pipistrellus pipistrellus
A5
Pipistrellus pipistrellus
A6
Pipistrellus pipistrellus
A7
Pipistrellus pipistrellus
A8
Pipistrellus pygmaeus
A2
Pipistrellus pygmaeus
A3
Minutes after sunset
0
200
400
Jul 21
Jul 23
Jul 25
Jul 27
Jul 29
Jul 31
Date



Pipistrellus pygmaeus
A5
Pipistrellus pygmaeus
A6
Pipistrellus pygmaeus
A7
Pipistrellus pygmaeus
A8
Plecotus auritus
A2
Plecotus auritus
A3
Minutes after sunset
0
200
400
Jul 21
Jul 23
Jul 25
Jul 27
Jul 29
Jul 31
Date



Plecotus auritus
A5
Plecotus auritus
A6
Plecotus auritus
A7
Minutes after sunset
400
200
0
Jul 21
Jul 23
Jul 25
Jul 27
Jul 29
Jul 31
Date

Roost Emergence Time and Bat Observation

Based on: *Russ, Jon. 2012. British Bat Calls a Guide to species Identification. Pelagic Publishing.*

For more information see https://rbats-blog.updog.co/2018/05/29/bat-emergence/

Bat Passes Potentially Indicating Close Proximity to a Roost (Russ 2012) - Table

Table 12. Number of bat calls recorded before the upper time of the species-specific emergence time range, and which therefore may potentially indicate the presence of a nearby roost.

Table continues below

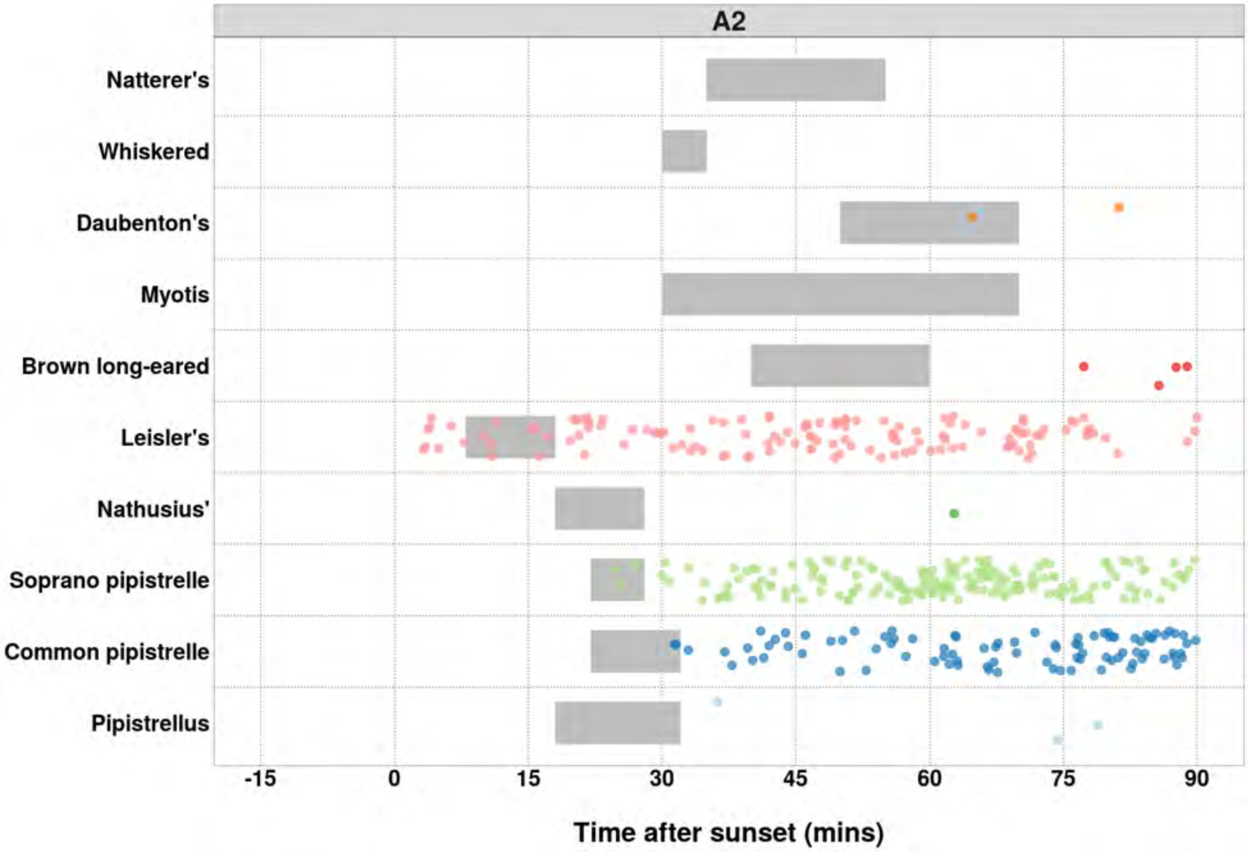
Species	Detector ID	2020-07-21	2020-07-22	2020-07-23	2020-07-24	2020-07-25
Common pipistrelle	A2	0	0	0	1	0
Common pipistrelle	A3	1	0	0	1	0
Common pipistrelle	A5	1	0	0	1	0
Common pipistrelle	A8	1	0	0	0	0
Soprano pipistrelle	A2	0	0	2	1	0
Soprano pipistrelle	A3	2	1	3	3	0
Soprano pipistrelle	A5	2	1	3	3	0
Soprano pipistrelle	A6	1	0	0	0	0
Soprano pipistrelle	A7	0	0	0	0	0
Soprano pipistrelle	A8	0	3	0	0	0
Leisler’s	A2	0	3	1	0	3
Leisler’s	A3	0	5	0	0	0
Leisler’s	A5	0	5	0	0	0

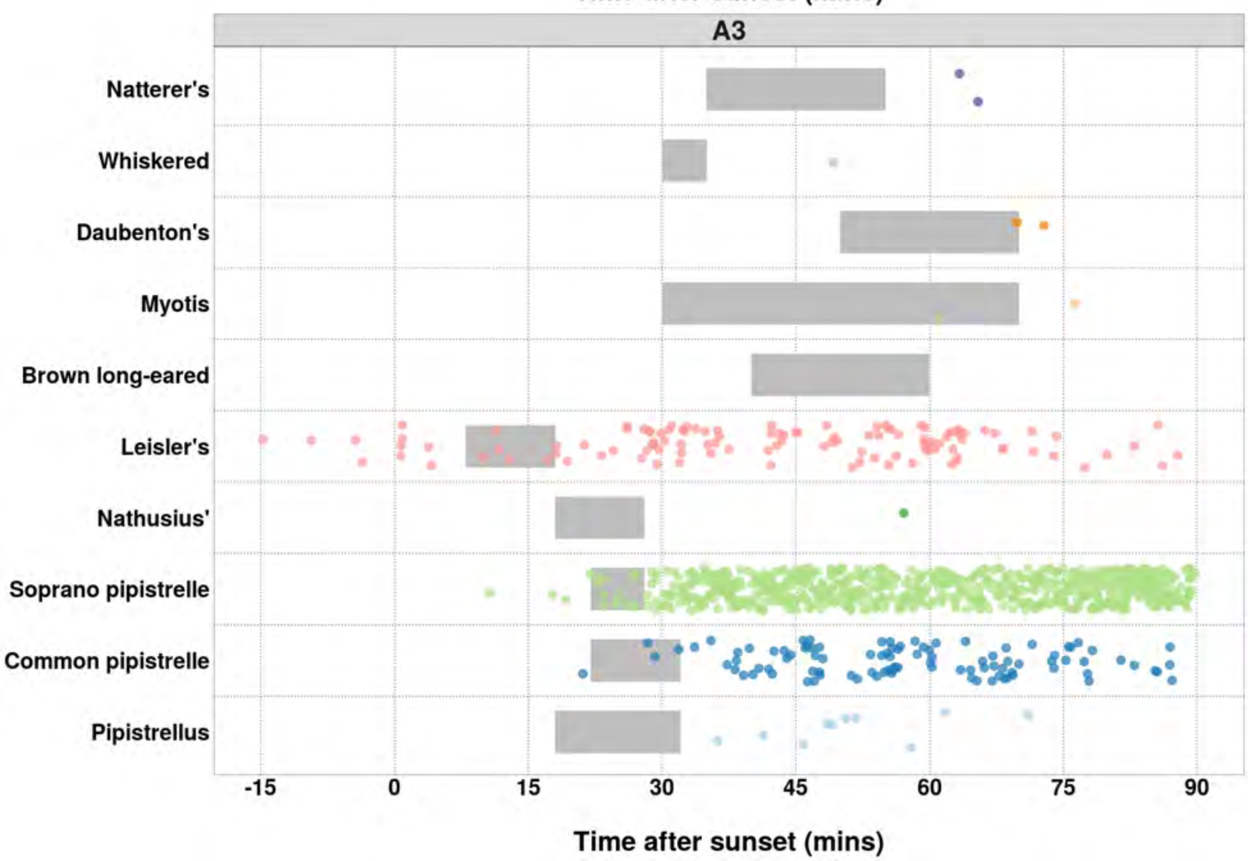
Leisler’s	A6	6	4	6	0	3
Leisler’s	A7	51	5	31	0	6
Leisler’s	A8	1	0	0	0	6
Brown long-eared	A6	0	0	1	0	0
Myotis	A3	0	0	0	0	1
Daubenton’s	A2	0	0	1	0	0
Daubenton’s	A3	0	0	1	0	0
Daubenton’s	A5	0	0	1	0	0
Daubenton’s	A7	0	0	0	0	0

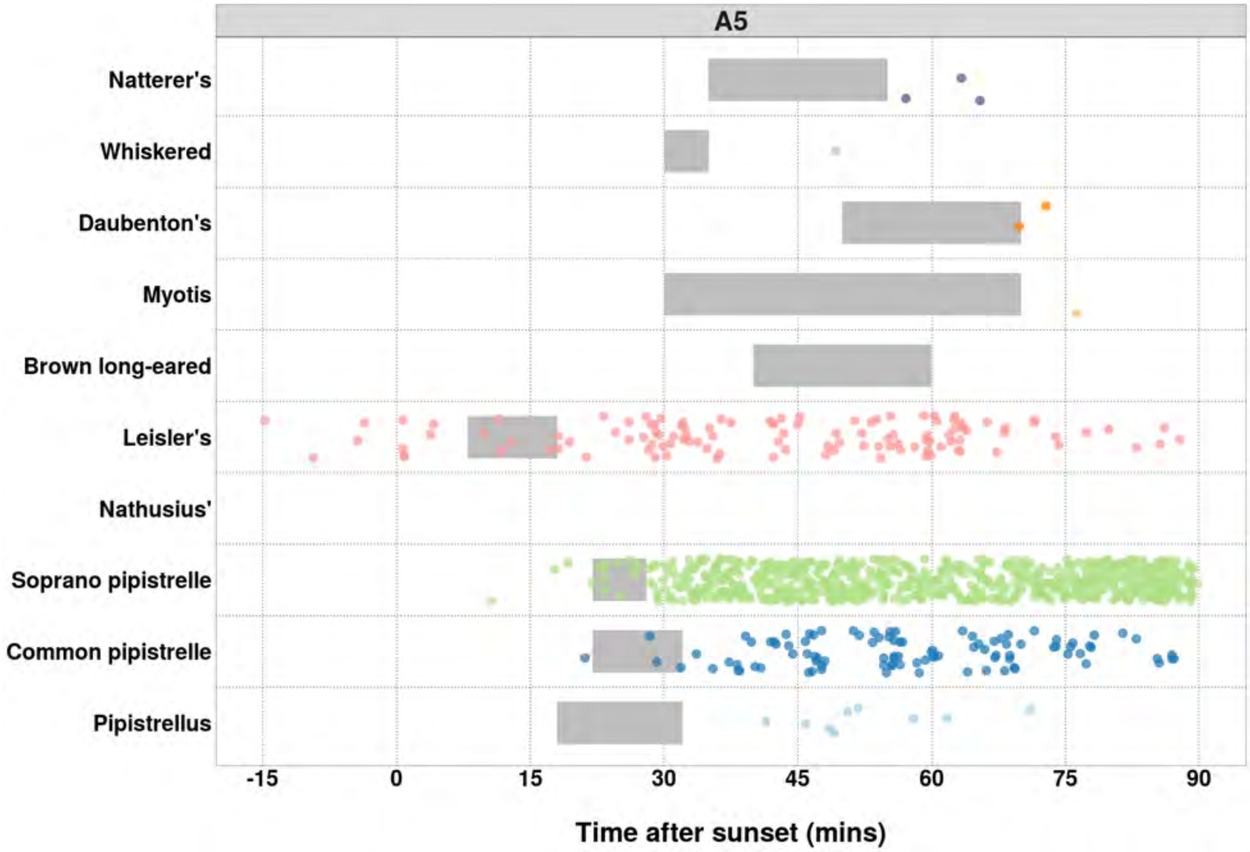
2020-07-26	2020-07-27	2020-07-28	2020-07-30
0	1	0	0
1	0	1	0
1	0	1	0
0	0	1	0
0	0	0	0
0	2	4	0
0	2	4	0
0	0	0	0
0	0	1	0
1	0	1	0
5	2	1	1
9	1	0	1
9	1	0	1
0	8	5	0
2	40	9	3
6	9	3	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	1	0

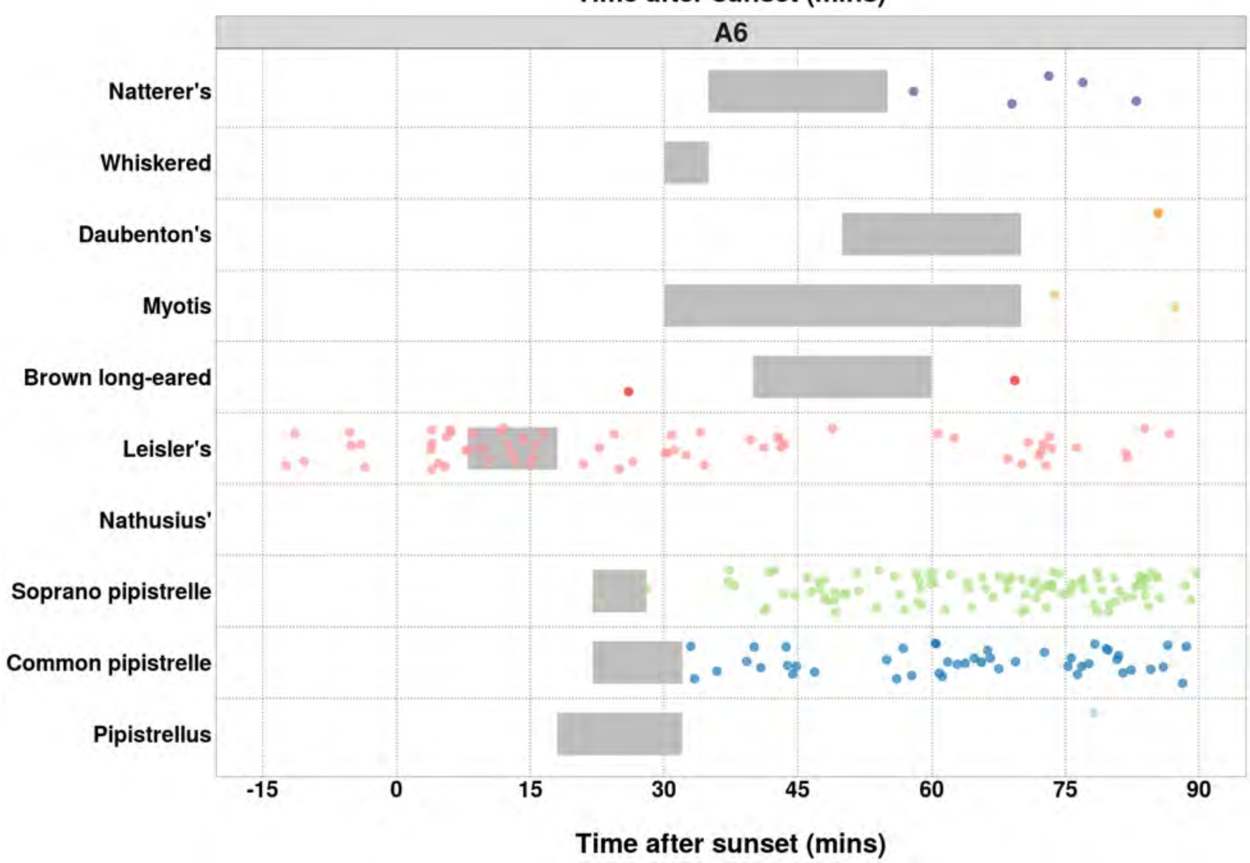
Bat Passes Potentially Indicating Close Proximity to a Roost (Russ 2012) - Figures

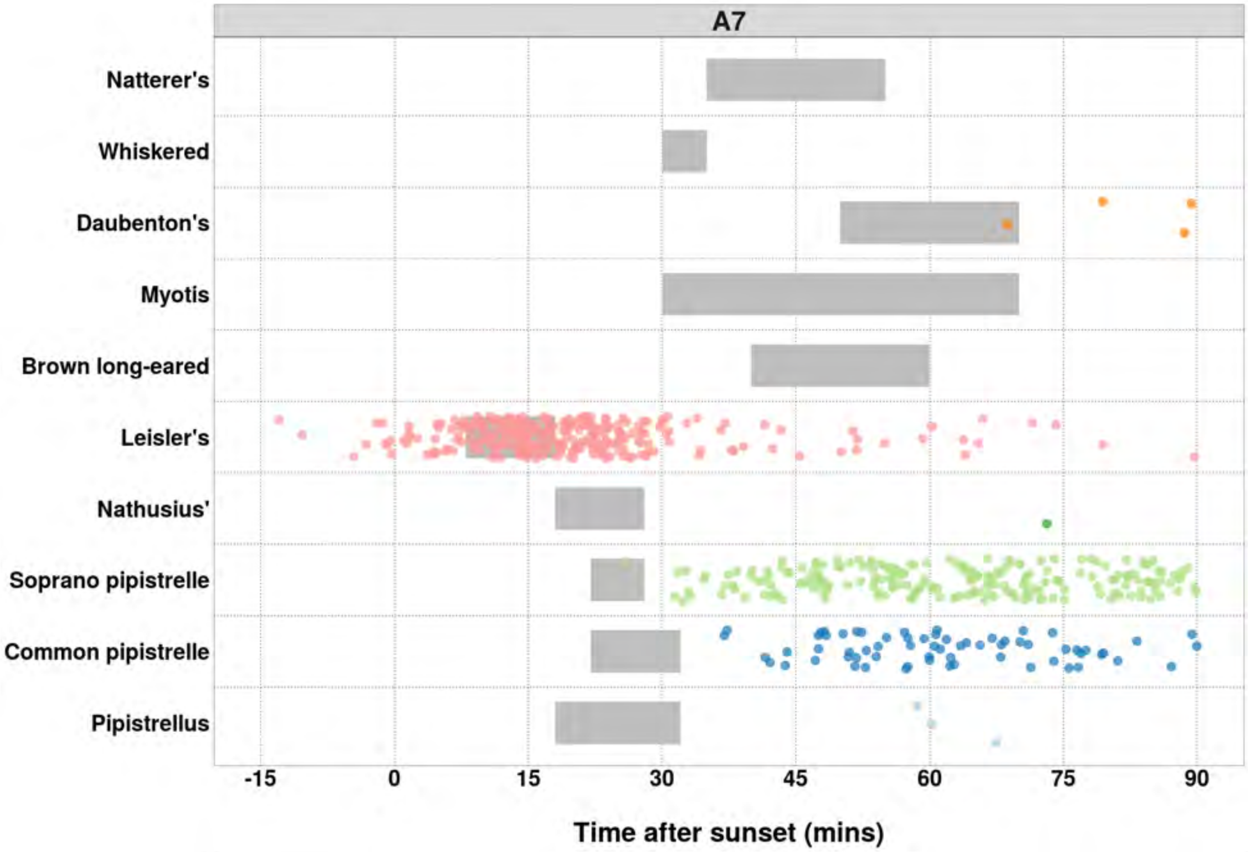
Figure 8. Time from 15 minutes before to 90 minutes after sunset. Species-specific emergence time ranges are shown as grey bars. Bat passes overlapping species-specific grey bars, or occuring earlier than this time range, may potentially indicate the presence of a nearby roost.

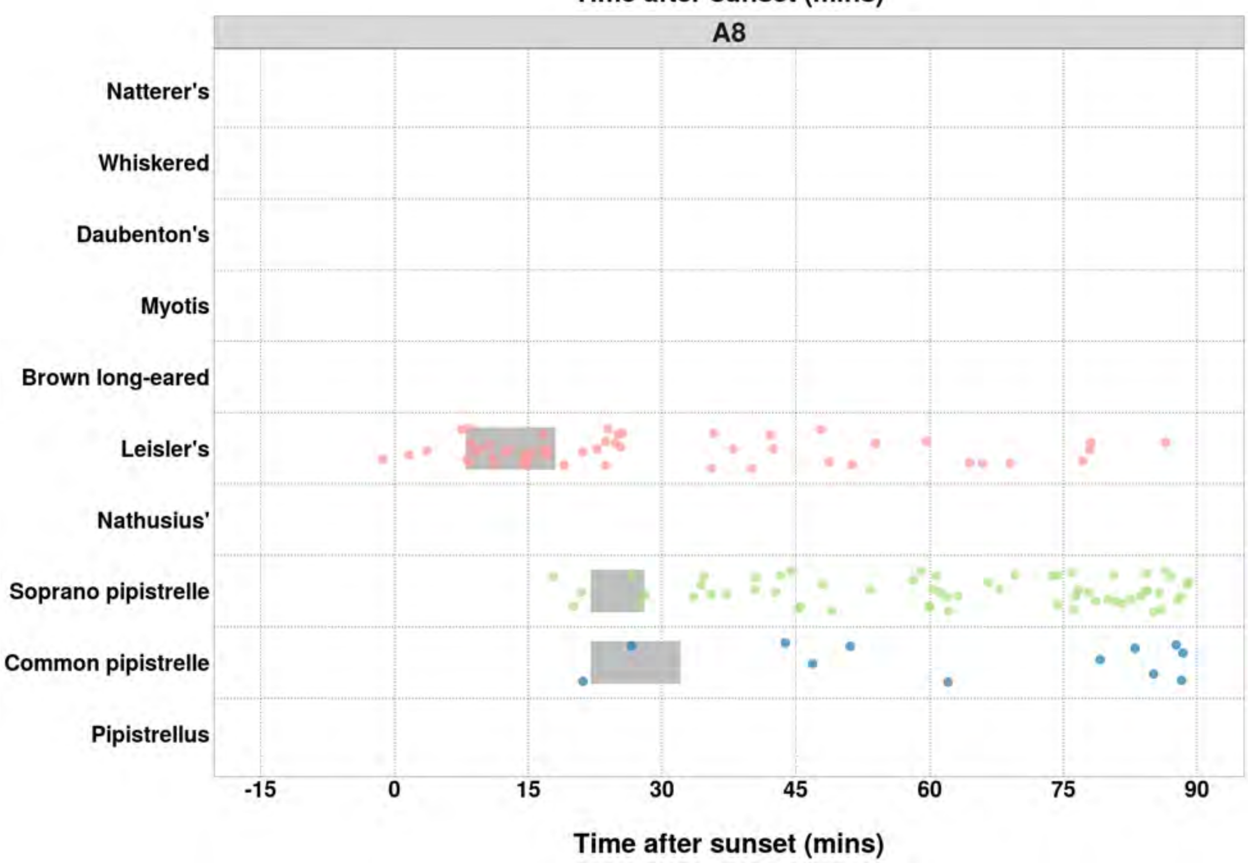

A2
Natterer's
Whiskered
Daubenton's
Myotis
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
Pipistrellus
-15
0
15
30
45
60
75
90
Time after sunset (mins)


A3
Natterer's
Whiskered
Daubenton's
Myotis
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
Pipistrellus
-15
0
15
30
45
60
75
90
Time after sunset (mins)


A5
Natterer's
Whiskered
Daubenton's
Myotis
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
Pipistrellus
-15
0
15
30
45
60
75
90
Time after sunset (mins)


A6
Natterer's
Whiskered
Daubenton's
Myotis
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
Pipistrellus
-15
0
15
30
45
60
75
90
Time after sunset (mins)


A7
Natterer's
Whiskered
Daubenton's
Myotis
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
Pipistrellus
-15
0
15
30
45
60
75
90
Time after sunset (mins)


A8
Natterer's
Whiskered
Daubenton's
Myotis
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
Pipistrellus
-15
0
15
30
45
60
75
90
Time after sunset (mins)

Counts of Bat Passes

All detectors

Table 14. The total number of passes recorded for each species across all of the detectors. The 'Total' percentage may not be exactly 100% due to rounding of the percentages per species.

Species	Passes (No.)	Percentage of total (%)
Pipistrellus	6898	41.9
Common pipistrelle	1660	10.1
Soprano pipistrelle	6216	37.7
Nathusius'	20	0.1
Leisler's	1307	7.9
Brown long-eared	99	0.6
Myotis	107	0.6
Daubenton's	83	0.5
Whiskered	55	0.3
Natterer's	34	0.2
Total	16479	99.9

Counts of Bat Passes

Per Detector

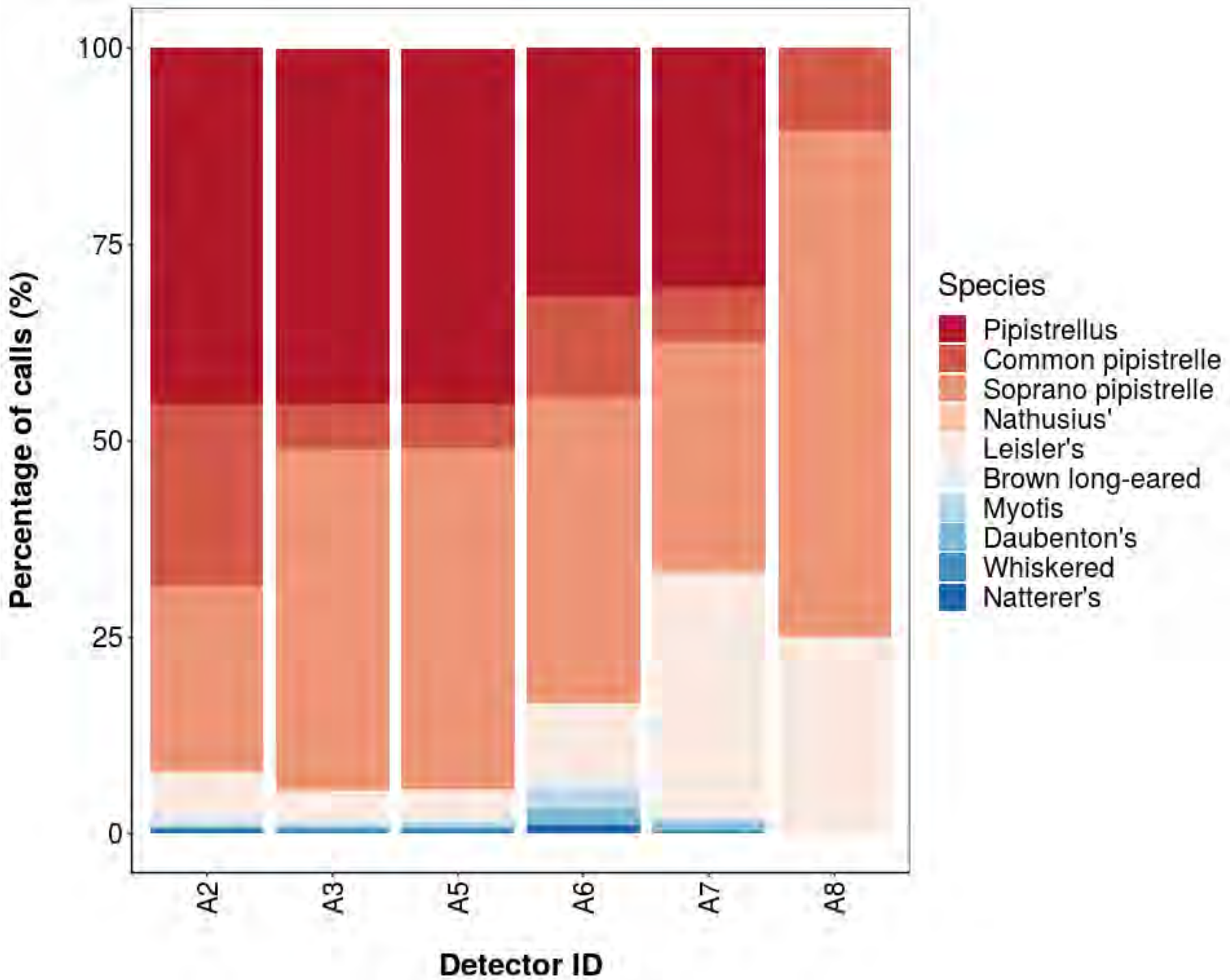
Table 15. The number of passes recorded for each species at each detector.

Species	Detector ID	Count (No)	Percentage by Detector (%)
Pipistrellus	A2	1596	45.4
Pipistrellus	A3	2218	45.3
Pipistrellus	A5	2212	45.2
Pipistrellus	A6	293	31.5
Pipistrellus	A7	579	30.5
Common pipistrelle	A2	812	23.1
Common pipistrelle	A3	281	5.7
Common pipistrelle	A5	281	5.7
Common pipistrelle	A6	121	13.0
Common pipistrelle	A7	130	6.8
Common pipistrelle	A8	35	10.4
Soprano pipistrelle	A2	834	23.7
Soprano pipistrelle	A3	2125	43.4
Soprano pipistrelle	A5	2125	43.4
Soprano pipistrelle	A6	362	38.9
Soprano pipistrelle	A7	553	29.1
Soprano pipistrelle	A8	217	64.6
Nathusius’	A2	7	0.2
Nathusius’	A3	2	0.0
Nathusius’	A7	11	0.6
Leisler’s	A2	183	5.2
Leisler’s	A3	183	3.7
Leisler’s	A5	183	3.7
Leisler’s	A6	89	9.6
Leisler’s	A7	585	30.8
Leisler’s	A8	84	25.0
Brown long-eared	A2	40	1.1
Brown long-eared	A3	18	0.4
Brown long-eared	A5	18	0.4

Brown long-eared	A6	11	1.2
Brown long-eared	A7	12	0.6
Myotis	A2	16	0.5
Myotis	A3	30	0.6
Myotis	A5	31	0.6
Myotis	A6	24	2.6
Myotis	A7	6	0.3
Daubenton’s	A2	11	0.3
Daubenton’s	A3	17	0.3
Daubenton’s	A5	17	0.3
Daubenton’s	A6	19	2.0
Daubenton’s	A7	19	1.0
Whiskered	A2	10	0.3
Whiskered	A3	20	0.4
Whiskered	A5	20	0.4
Whiskered	A6	2	0.2
Whiskered	A7	3	0.2
Natterer’s	A2	9	0.3
Natterer’s	A3	6	0.1
Natterer’s	A5	8	0.2
Natterer’s	A6	9	1.0
Natterer’s	A7	2	0.1

Species Composition

Figure 10. Percentage species composition of passes at each detector.



PART 2a: Presence Only

THE NEXT SECTION OF THE REPORT FEATURES THE RAW DATA SUPPLIED TO ECOBAT AND ONLY TAKES INTO ACCOUNT THE PRESENCE, AND NOT THE ABSENCE, OF EACH BAT SPECIES. FOR EACH NIGHT, THERE IS NO 'ZERO DATA' FOR WHEN SPECIES WERE NOT DETECTED.

Nightly Bat Pass Rate (Bat passes per hour)

Median Per Detector

Table 16. The median Nightly Pass Rate (bat passes per hour, per night) of each species. If NA, then no bat passes.

Bat pass rates are often highly variable between nights, with some nights having few or no passes and other nights having high activity. In these circumstances, the median is likely to be a more useful summary of the 'average' activity than is the mean. For further information see: *Lintott, P. R., & Mathews, F. (2018). Basic mathematical errors may make ecological assessments unreliable. Biodiversity and Conservation, 27(1), 265-267.* https://doi.org/10.1007/s10531-017-1418-5

Species	Detector ID	Median Pass Rate
Pipistrellus	A2	7.1
Pipistrellus	A3	41.6
Pipistrellus	A5	41.0
Pipistrellus	A6	5.5
Pipistrellus	A7	13.9
Common pipistrelle	A2	1.8
Common pipistrelle	A3	3.2
Common pipistrelle	A5	3.2
Common pipistrelle	A6	1.3
Common pipistrelle	A7	1.9
Common pipistrelle	A8	0.7
Soprano pipistrelle	A2	4.5
Soprano pipistrelle	A3	20.7
Soprano pipistrelle	A5	20.7
Soprano pipistrelle	A6	3.1
Soprano pipistrelle	A7	7.0
Soprano pipistrelle	A8	2.9
Nathusius'	A2	0.2
Nathusius'	A3	0.1
Nathusius'	A7	0.2
Leisler's	A2	1.9
Leisler's	A3	1.7
Leisler's	A5	1.7

Leisler’s	A6	1.3
Leisler’s	A7	6.9
Leisler’s	A8	1.3
Brown long-eared	A2	0.5
Brown long-eared	A3	0.2
Brown long-eared	A5	0.2
Brown long-eared	A6	0.2
Brown long-eared	A7	0.2
Myotis	A2	0.6
Myotis	A3	0.6
Myotis	A5	0.7
Myotis	A6	1.3
Myotis	A7	0.8
Daubenton’s	A2	0.2
Daubenton’s	A3	0.4
Daubenton’s	A5	0.4
Daubenton’s	A6	0.1
Daubenton’s	A7	0.4
Whiskered	A2	0.2
Whiskered	A3	0.4
Whiskered	A5	0.4
Whiskered	A6	0.1
Whiskered	A7	0.1
Natterer’s	A2	0.1
Natterer’s	A3	0.1
Natterer’s	A5	0.1
Natterer’s	A6	0.2
Natterer’s	A7	0.1

Nightly Bat Pass Rate (Bat passes per hour)

Mean per Detector

Table 17. The mean Nightly Pass Rate (bat passes per hour, per night) of each species at each detector. Values are given to 1 decimal place.

We recommend using the median values given above, for the reasons stated above, but provide the mean values in the table below.

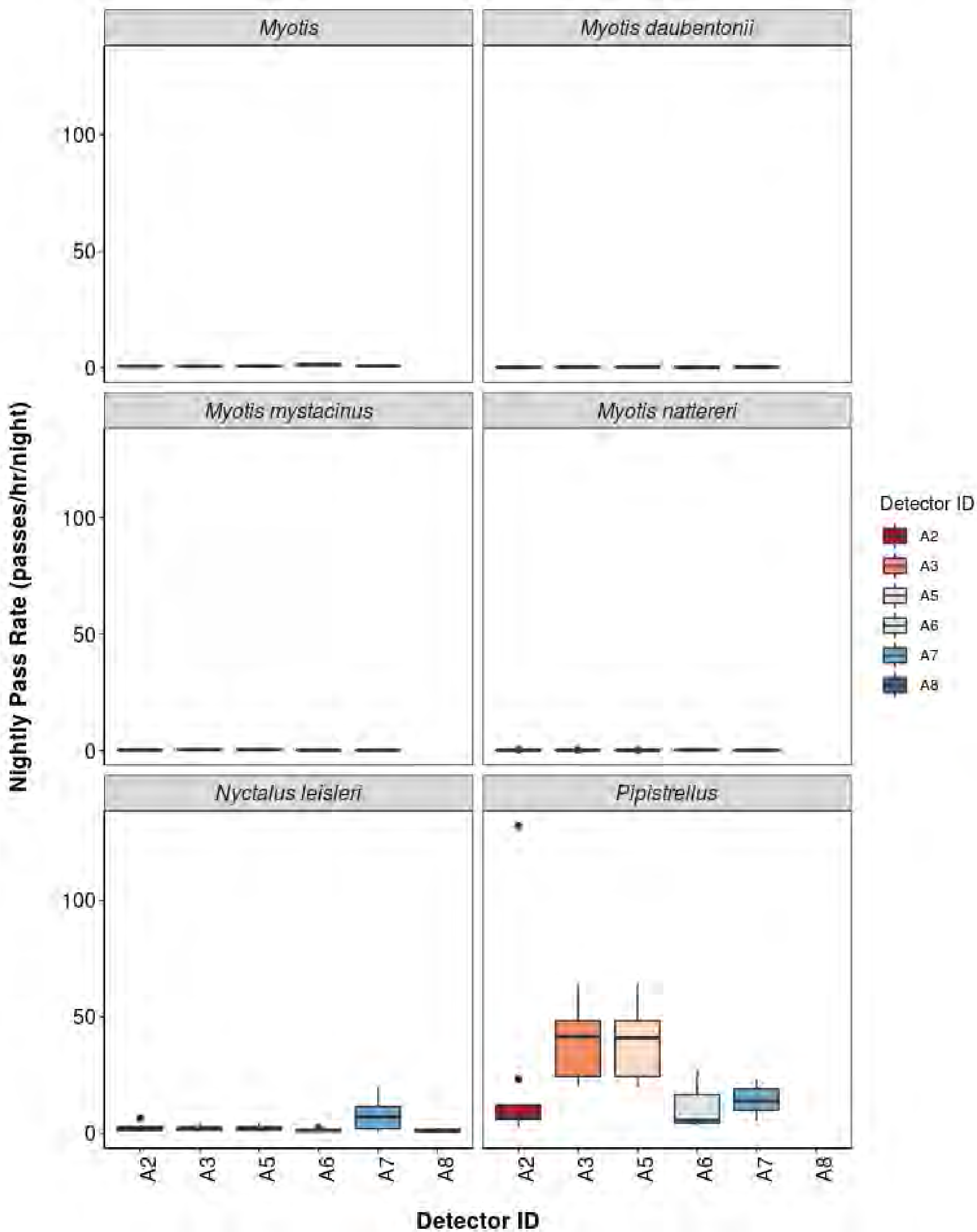
Species	Detector ID	Mean Pass Rate
Pipistrellus	A2	24.0
Pipistrellus	A3	38.7
Pipistrellus	A5	38.6
Pipistrellus	A6	12.1
Pipistrellus	A7	14.2
Common pipistrelle	A2	9.7
Common pipistrelle	A3	3.5
Common pipistrelle	A5	3.5
Common pipistrelle	A6	1.7
Common pipistrelle	A7	2.0
Common pipistrelle	A8	0.6
Soprano pipistrelle	A2	10.1
Soprano pipistrelle	A3	26.0
Soprano pipistrelle	A5	26.0
Soprano pipistrelle	A6	4.9
Soprano pipistrelle	A7	7.6
Soprano pipistrelle	A8	3.4
Nathusius’	A2	0.2
Nathusius’	A3	0.1
Nathusius’	A7	0.3
Leisler’s	A2	2.2
Leisler’s	A3	2.2
Leisler’s	A5	2.2
Leisler’s	A6	1.2
Leisler’s	A7	7.2
Leisler’s	A8	1.1

Brown long-eared	A2	0.5
Brown long-eared	A3	0.3
Brown long-eared	A5	0.3
Brown long-eared	A6	0.2
Brown long-eared	A7	0.2
Myotis	A2	0.6
Myotis	A3	0.6
Myotis	A5	0.6
Myotis	A6	1.0
Myotis	A7	0.8
Daubenton’s	A2	0.3
Daubenton’s	A3	0.3
Daubenton’s	A5	0.3
Daubenton’s	A6	0.3
Daubenton’s	A7	0.3
Whiskered	A2	0.2
Whiskered	A3	0.4
Whiskered	A5	0.4
Whiskered	A6	0.1
Whiskered	A7	0.1
Natterer’s	A2	0.2
Natterer’s	A3	0.1
Natterer’s	A5	0.1
Natterer’s	A6	0.2
Natterer’s	A7	0.1

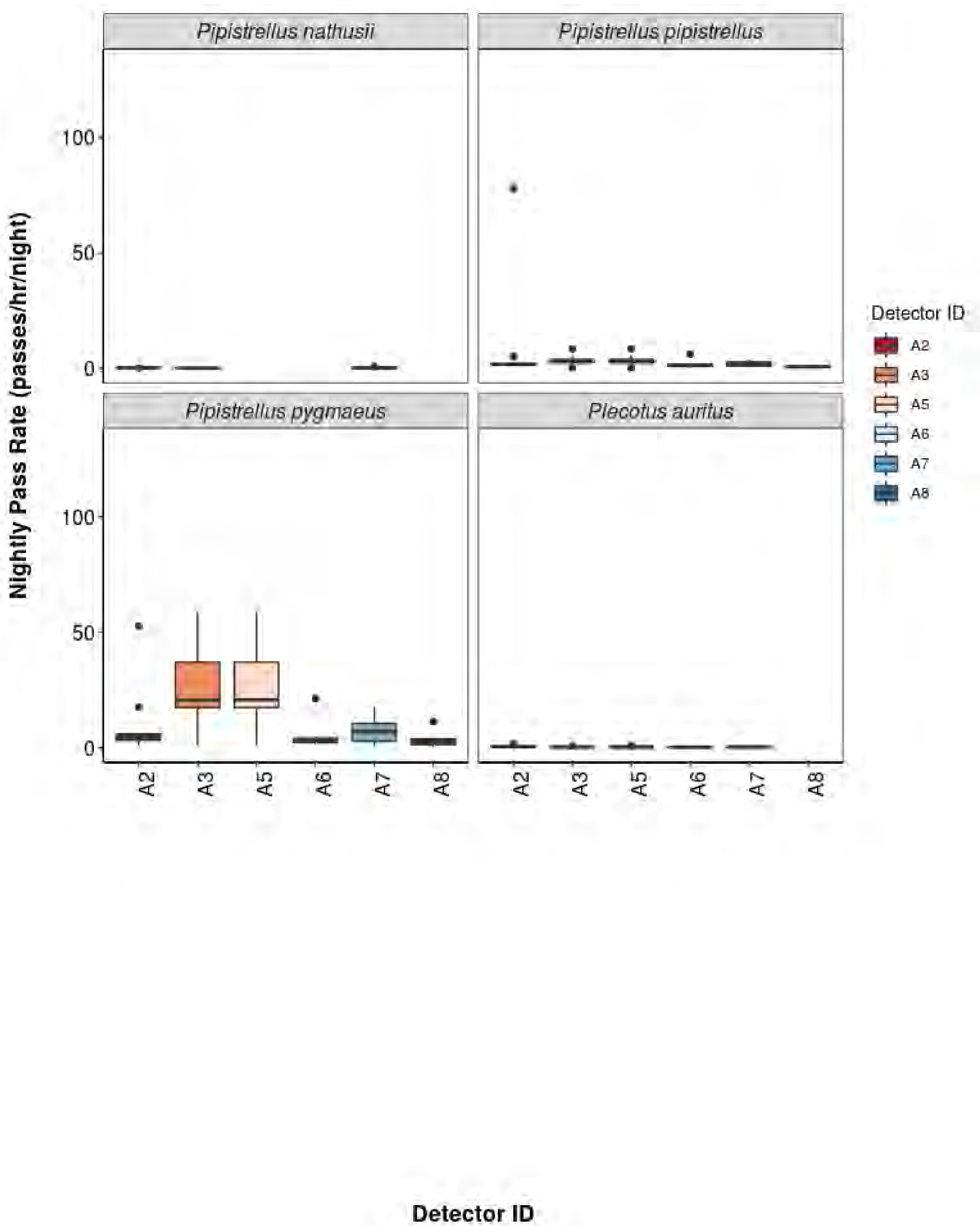
Nightly Bat Passes (Bat passes per hour)

Per Detector - Figures

Figure 11. Boxplots for the number of bat passes per hour each night, for each detector. The 'box' shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The 'whiskers' extend from the box and represent the ranges for the bottom 25% and the top 25% of the data values, excluding outliers. An outlier is any extreme value that lies further away from the box than 1.5 times the interquartile range. Outliers are shown as dots. Where very few passes are recorded it is not possible to produce the box, so the data are shown as a line.



Myotis
Myotis daubentonii
Myotis mystacinus
Myotis nattereri
Nyctalus leisleri
Pipistrellus
Nightly Pass Rate (passes/hr/night)
0
50
100
A2
A3
A5
A6
A7
A8
Detector ID
Detector ID
A2
A3
A5
A6
A7
A8



Pipistrellus nathusii
Pipistrellus pipistrellus
Pipistrellus pygmaeus
Plecotus auritus
Nightly Pass Rate (passes/hr/night)
100
50
0
A2
A3
A5
A6
A7
A8
Detector ID

SPLIT BY MONTH

Total Bat Passes per Detector, each Month

Per Detector

Table 18. The total number of bat passes of each species in each month at each detector. This table simply tells you how many bats of each species were recorded passing each detector during each month. These numbers are not standardised by the night length, or how many nights each detector was active for during each month.

Species	Detector ID	Jul
Pipistrellus	A2	1596
Pipistrellus	A3	2218
Pipistrellus	A5	2212
Pipistrellus	A6	293
Pipistrellus	A7	579
Common pipistrelle	A2	812
Common pipistrelle	A3	281
Common pipistrelle	A5	281
Common pipistrelle	A6	121
Common pipistrelle	A7	130
Common pipistrelle	A8	35
Soprano pipistrelle	A2	834
Soprano pipistrelle	A3	2125
Soprano pipistrelle	A5	2125
Soprano pipistrelle	A6	362
Soprano pipistrelle	A7	553
Soprano pipistrelle	A8	217
Nathusius’	A2	7
Nathusius’	A3	2
Nathusius’	A7	11
Leisler’s	A2	183
Leisler’s	A3	183
Leisler’s	A5	183
Leisler’s	A6	89

Leisler’s	A7	585
Leisler’s	A8	84
Brown long-eared	A2	40
Brown long-eared	A3	18
Brown long-eared	A5	18
Brown long-eared	A6	11
Brown long-eared	A7	12
Myotis	A2	16
Myotis	A3	30
Myotis	A5	31
Myotis	A6	24
Myotis	A7	6
Daubenton’s	A2	11
Daubenton’s	A3	17
Daubenton’s	A5	17
Daubenton’s	A6	19
Daubenton’s	A7	19
Whiskered	A2	10
Whiskered	A3	20
Whiskered	A5	20
Whiskered	A6	2
Whiskered	A7	3
Natterer’s	A2	9
Natterer’s	A3	6
Natterer’s	A5	8
Natterer’s	A6	9
Natterer’s	A7	2

Survey Effort

Table 19. The number of survey nights per month per detector.

Month	Detector ID	No. of Survey Nights
Jul	A2	10
Jul	A3	10
Jul	A5	10
Jul	A6	9
Jul	A7	10
Jul	A8	9

Nightly Bat Pass Rate for each Month

Median Per Detector

Table 20. The median Nightly Pass Rate (bat passes per hour, per night) of each species throughout each month. If NA, then no bat passes.

Bat pass rates are often highly variable between nights, with some nights having few or no passes and other nights having high activity. In these circumstances, the median is likely to be a more useful summary of the ‘average’ activity than is the mean. For further information see: *Lintott, P. R., & Mathews, F. (2018). Basic mathematical errors may make ecological assessments unreliable. Biodiversity and Conservation, 27(1), 265-267.* https://doi.org/10.1007/s10531-017-1418-5

Species	Detector ID	Jul
Pipistrellus	A2	7.1
Pipistrellus	A3	41.6
Pipistrellus	A5	41.0
Pipistrellus	A6	5.5
Pipistrellus	A7	13.9
Common pipistrelle	A2	1.8
Common pipistrelle	A3	3.2
Common pipistrelle	A5	3.2
Common pipistrelle	A6	1.3
Common pipistrelle	A7	1.9
Common pipistrelle	A8	0.7
Soprano pipistrelle	A2	4.5
Soprano pipistrelle	A3	20.7
Soprano pipistrelle	A5	20.7
Soprano pipistrelle	A6	3.1
Soprano pipistrelle	A7	7.0
Soprano pipistrelle	A8	2.9
Nathusius’	A2	0.2
Nathusius’	A3	0.1
Nathusius’	A7	0.2
Leisler’s	A2	1.9
Leisler’s	A3	1.7
Leisler’s	A5	1.7

Leisler’s	A6	1.3
Leisler’s	A7	6.9
Leisler’s	A8	1.3
Brown long-eared	A2	0.5
Brown long-eared	A3	0.2
Brown long-eared	A5	0.2
Brown long-eared	A6	0.2
Brown long-eared	A7	0.2
Myotis	A2	0.6
Myotis	A3	0.6
Myotis	A5	0.7
Myotis	A6	1.3
Myotis	A7	0.8
Daubenton’s	A2	0.2
Daubenton’s	A3	0.4
Daubenton’s	A5	0.4
Daubenton’s	A6	0.1
Daubenton’s	A7	0.4
Whiskered	A2	0.2
Whiskered	A3	0.4
Whiskered	A5	0.4
Whiskered	A6	0.1
Whiskered	A7	0.1
Natterer’s	A2	0.1
Natterer’s	A3	0.1
Natterer’s	A5	0.1
Natterer’s	A6	0.2
Natterer’s	A7	0.1

Nightly Bat Pass Rate for each Month

Mean per Detector

Table 21: The mean Nightly Pass Rate (bat passes per hour, per night) of each species throughout each month. Values are given to 1 decimal place.

We recommend using the median values given above, for the reasons stated above, but provide the mean values in the table below.

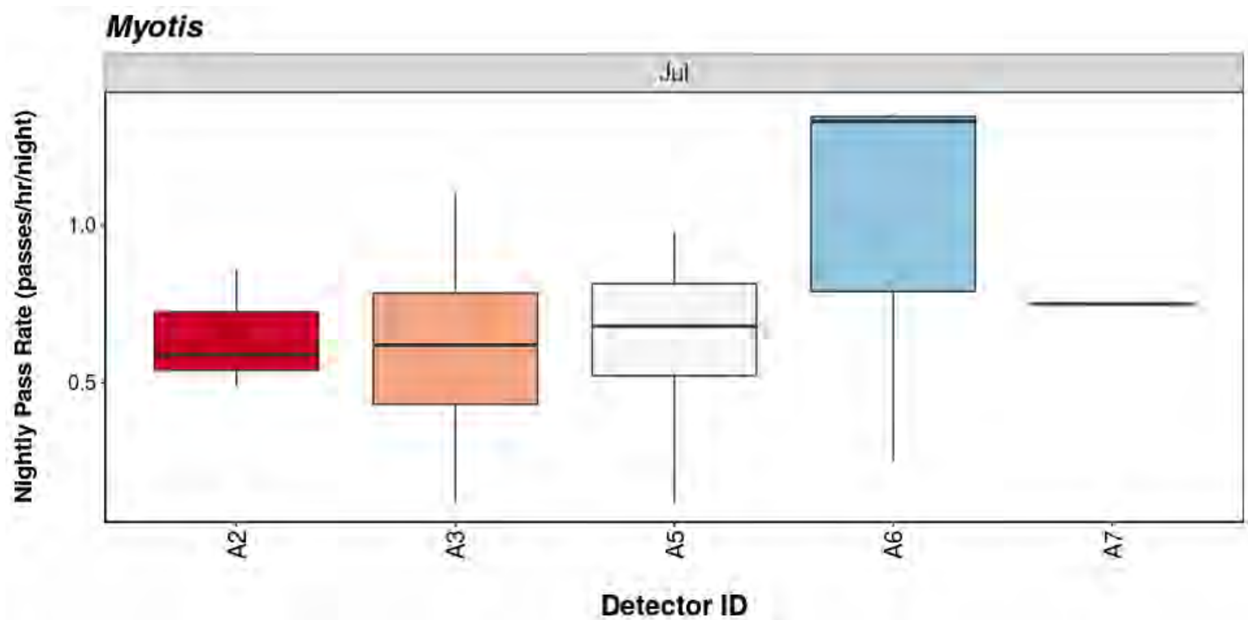
Species	Detector ID	Jul
Pipistrellus	A2	24.0
Pipistrellus	A3	38.7
Pipistrellus	A5	38.6
Pipistrellus	A6	12.1
Pipistrellus	A7	14.2
Common pipistrelle	A2	9.7
Common pipistrelle	A3	3.5
Common pipistrelle	A5	3.5
Common pipistrelle	A6	1.7
Common pipistrelle	A7	2.0
Common pipistrelle	A8	0.6
Soprano pipistrelle	A2	10.1
Soprano pipistrelle	A3	26.0
Soprano pipistrelle	A5	26.0
Soprano pipistrelle	A6	4.9
Soprano pipistrelle	A7	7.6
Soprano pipistrelle	A8	3.4
Nathusius’	A2	0.2
Nathusius’	A3	0.1
Nathusius’	A7	0.3
Leisler’s	A2	2.2
Leisler’s	A3	2.2
Leisler’s	A5	2.2
Leisler’s	A6	1.2
Leisler’s	A7	7.2
Leisler’s	A8	1.1

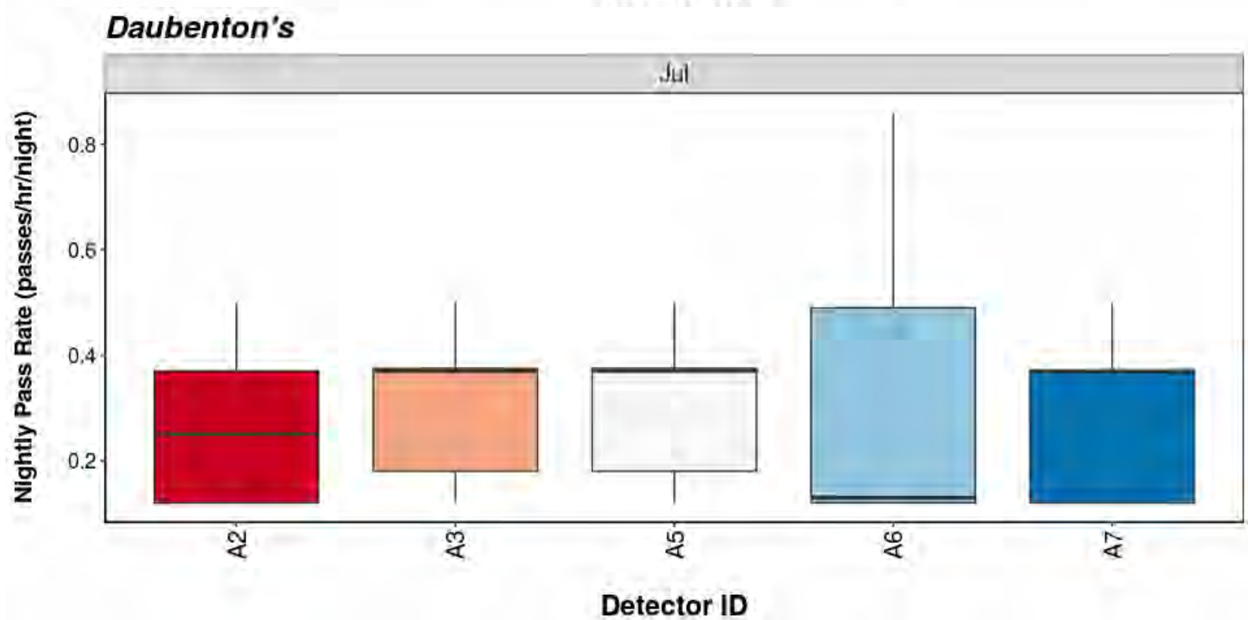
Brown long-eared	A2	0.5
Brown long-eared	A3	0.3
Brown long-eared	A5	0.3
Brown long-eared	A6	0.2
Brown long-eared	A7	0.2
Myotis	A2	0.6
Myotis	A3	0.6
Myotis	A5	0.6
Myotis	A6	1.0
Myotis	A7	0.8
Daubenton’s	A2	0.3
Daubenton’s	A3	0.3
Daubenton’s	A5	0.3
Daubenton’s	A6	0.3
Daubenton’s	A7	0.3
Whiskered	A2	0.2
Whiskered	A3	0.4
Whiskered	A5	0.4
Whiskered	A6	0.1
Whiskered	A7	0.1
Natterer’s	A2	0.2
Natterer’s	A3	0.1
Natterer’s	A5	0.1
Natterer’s	A6	0.2
Natterer’s	A7	0.1

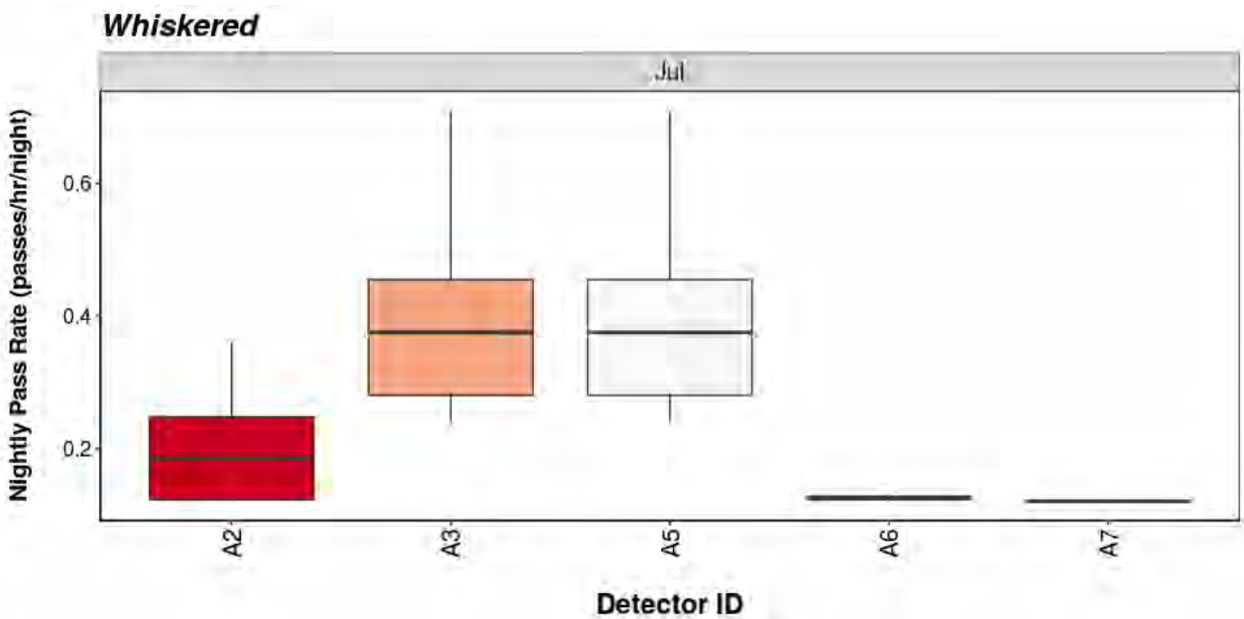
Nightly Bat Pass Rate for each Month

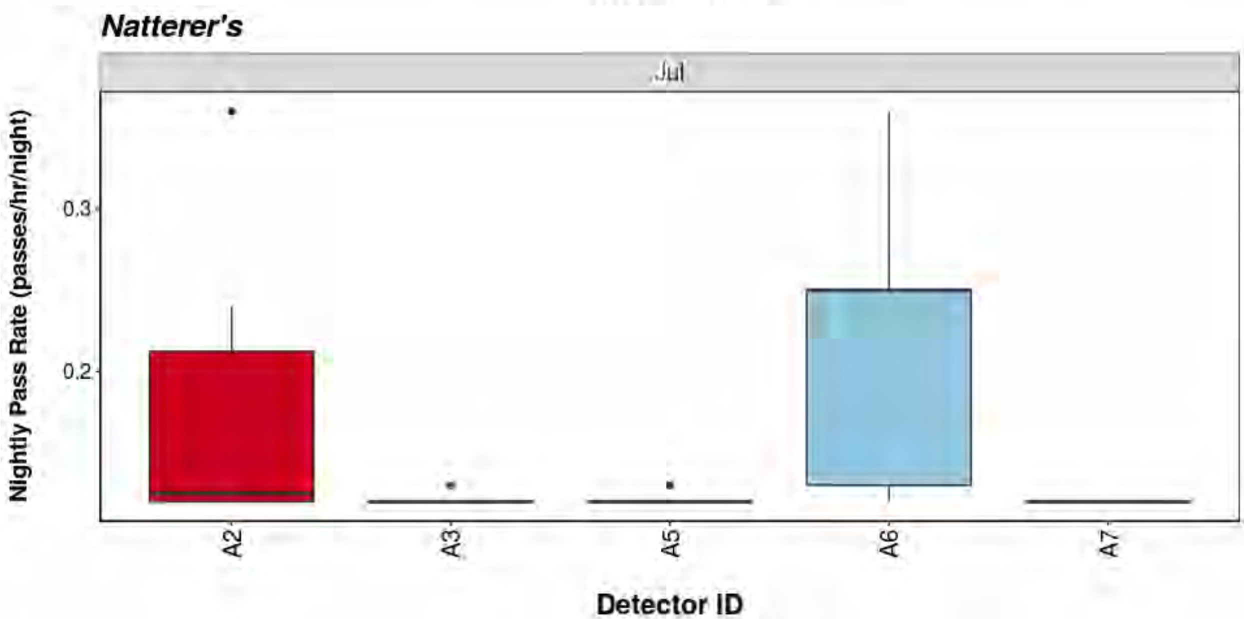
Per Detector - Figures

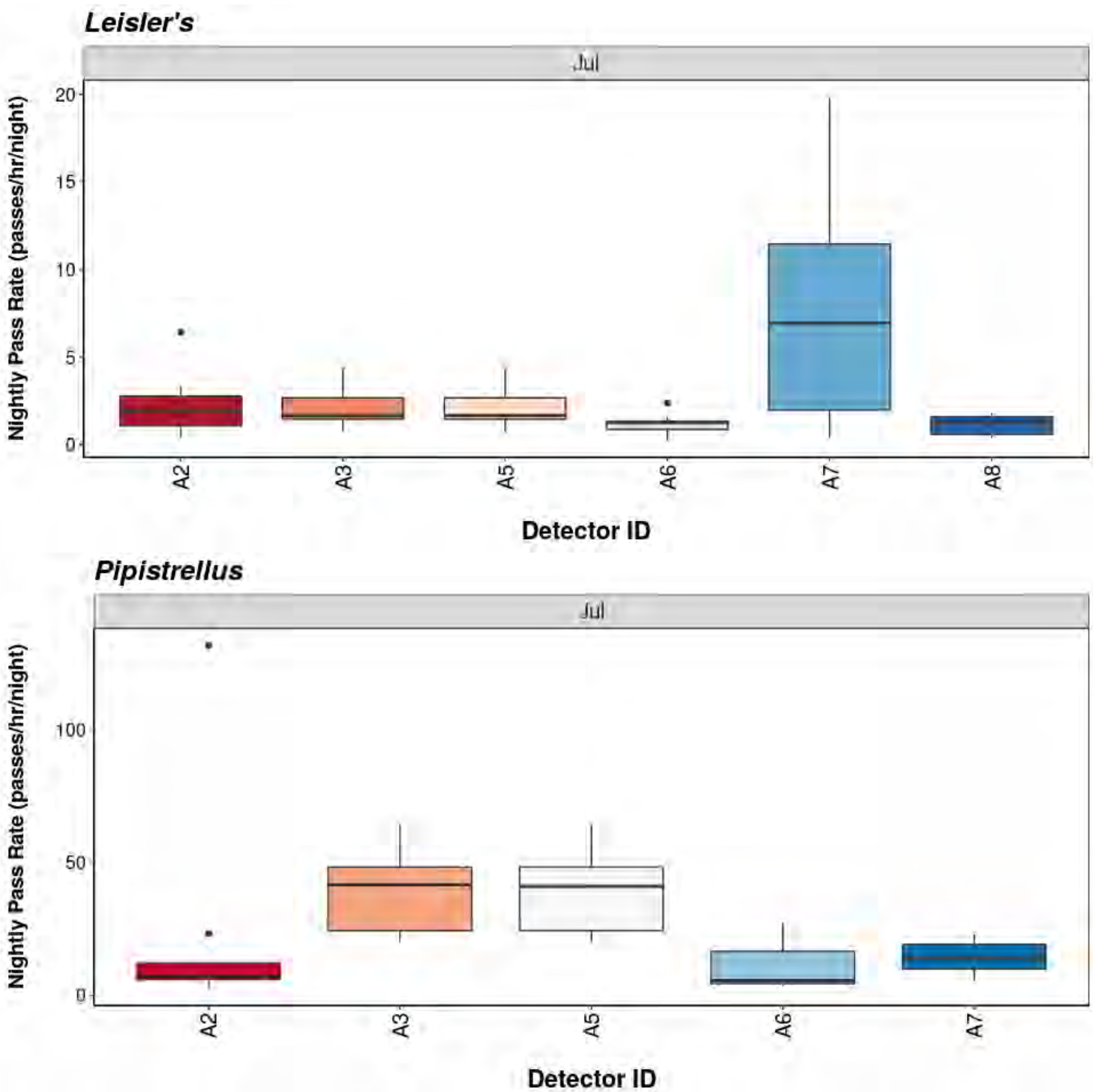
Figure 12. Figures show boxplots for the number of bat passes per hour by detector, for each month. The 'box' shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The 'whiskers' extend from the box and represent the ranges for the bottom 25% and the top 25% of the data values, excluding outliers. An outlier is any extreme value that lies further away from the box than 1.5 times the interquartile range. Outliers are shown as dots. Where very few passes are recorded it is not possible to produce the box, so the data are shown as a line.



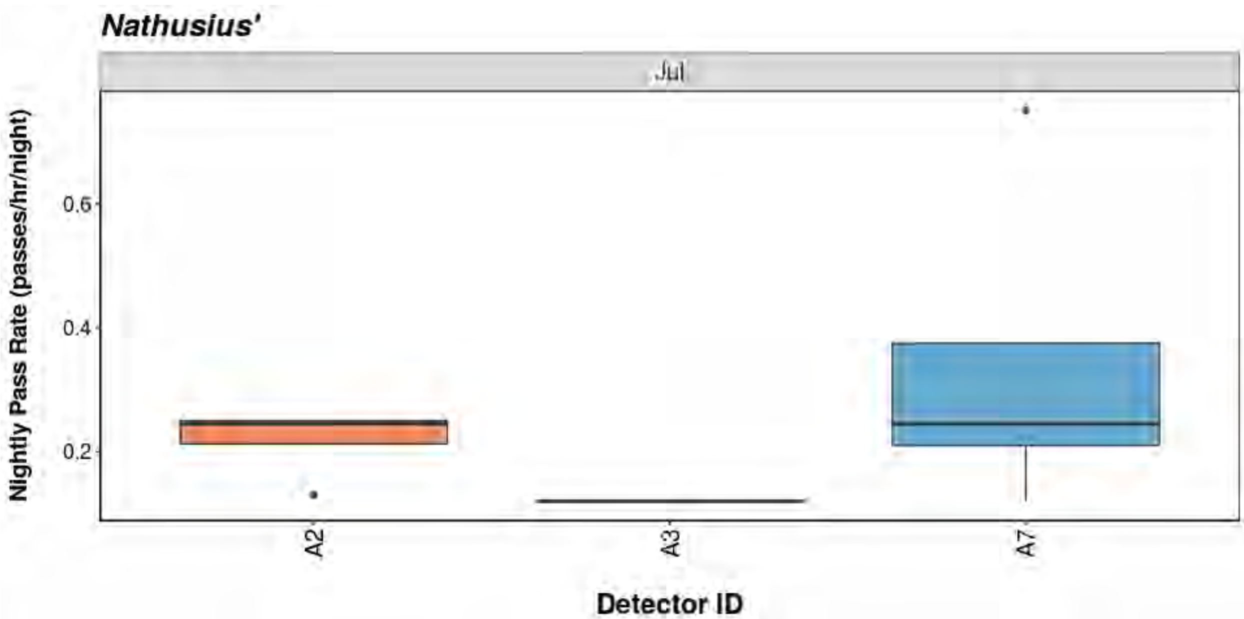


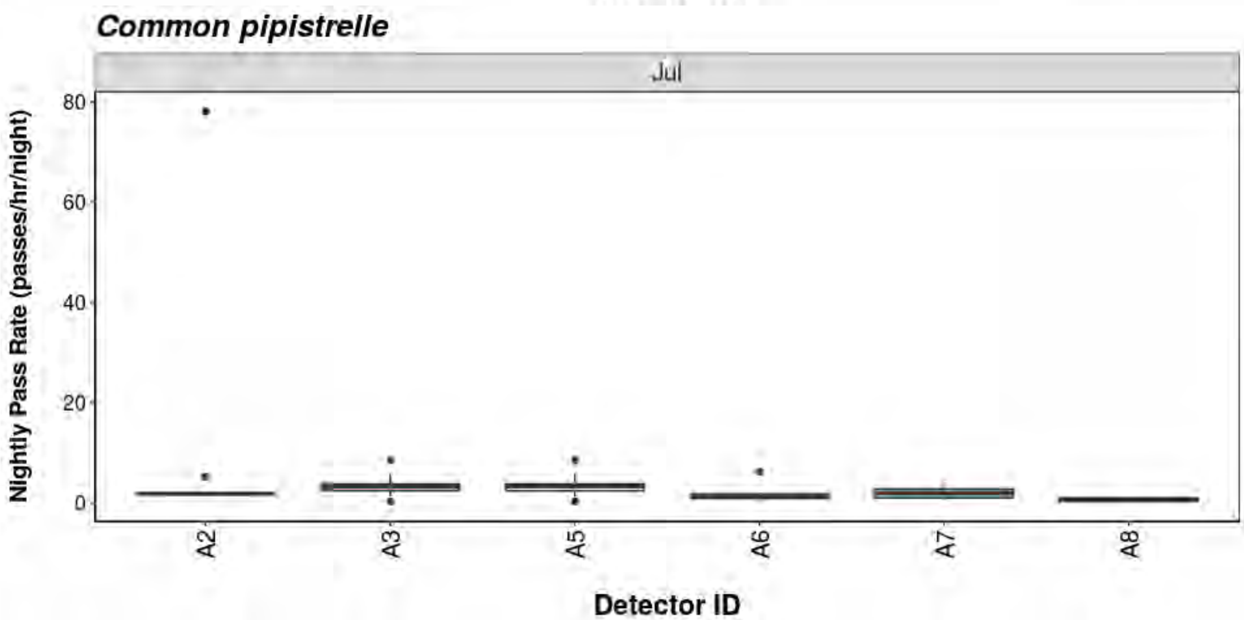

Whiskered
Jul
Nightly Pass Rate (passes/hr/night)
0.6
0.4
0.2
A2
A3
A5
A6
A7
Detector ID

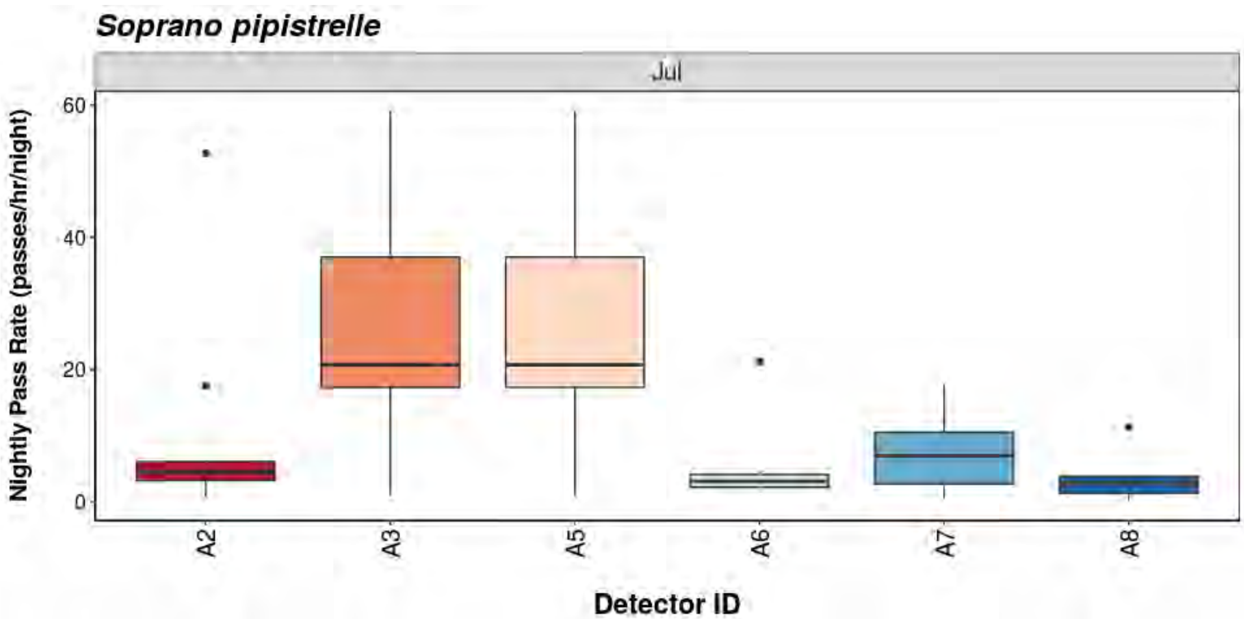

Natterer's
Jul
Nightly Pass Rate (passes/hr/night)
0.3
0.2
A2
A3
A5
A6
A7
Detector ID



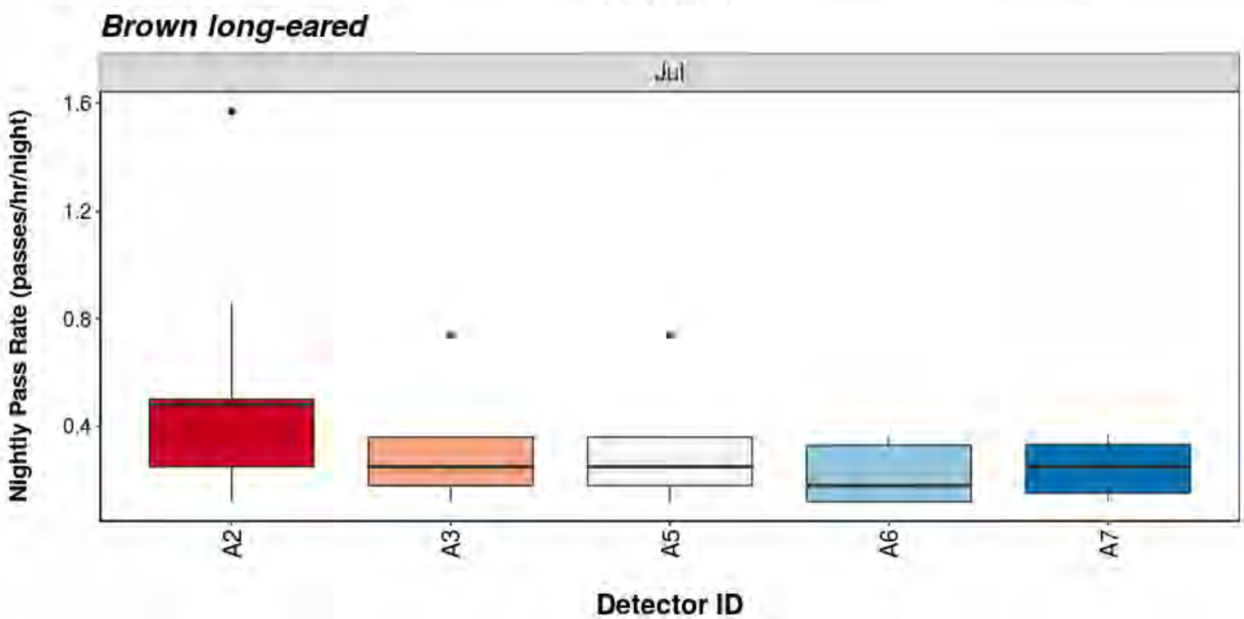
Leisler's
Jul
Nightly Pass Rate (passes/hr/night)
0
5
10
15
20
A2
A3
A5
A6
A7
A8
Detector ID
Pipistrellus
Jul
Nightly Pass Rate (passes/hr/night)
0
50
100
A2
A3
A5
A6
A7
Detector ID


Nathusius'
Jul
Nightly Pass Rate (passes/hr/night)
0.6
0.4
0.2
A2
A3
A7
Detector ID


Common pipistrelle
Jul
Nightly Pass Rate (passes/hr/night)
80
60
40
20
0
A2
A3
A5
A6
A7
A8
Detector ID



Soprano pipistrelle
Jul
Nightly Pass Rate (passes/hr/night)
60
40
20
0
A2
A3
A5
A6
A7
A8
Detector ID



Brown long-eared
Jul
Nightly Pass Rate (passes/hr/night)
1.6
1.2
0.8
0.4
A2
A3
A5
A6
A7
Detector ID

Bat Activity per Detector Location

Figure 13. Detector ID reference:

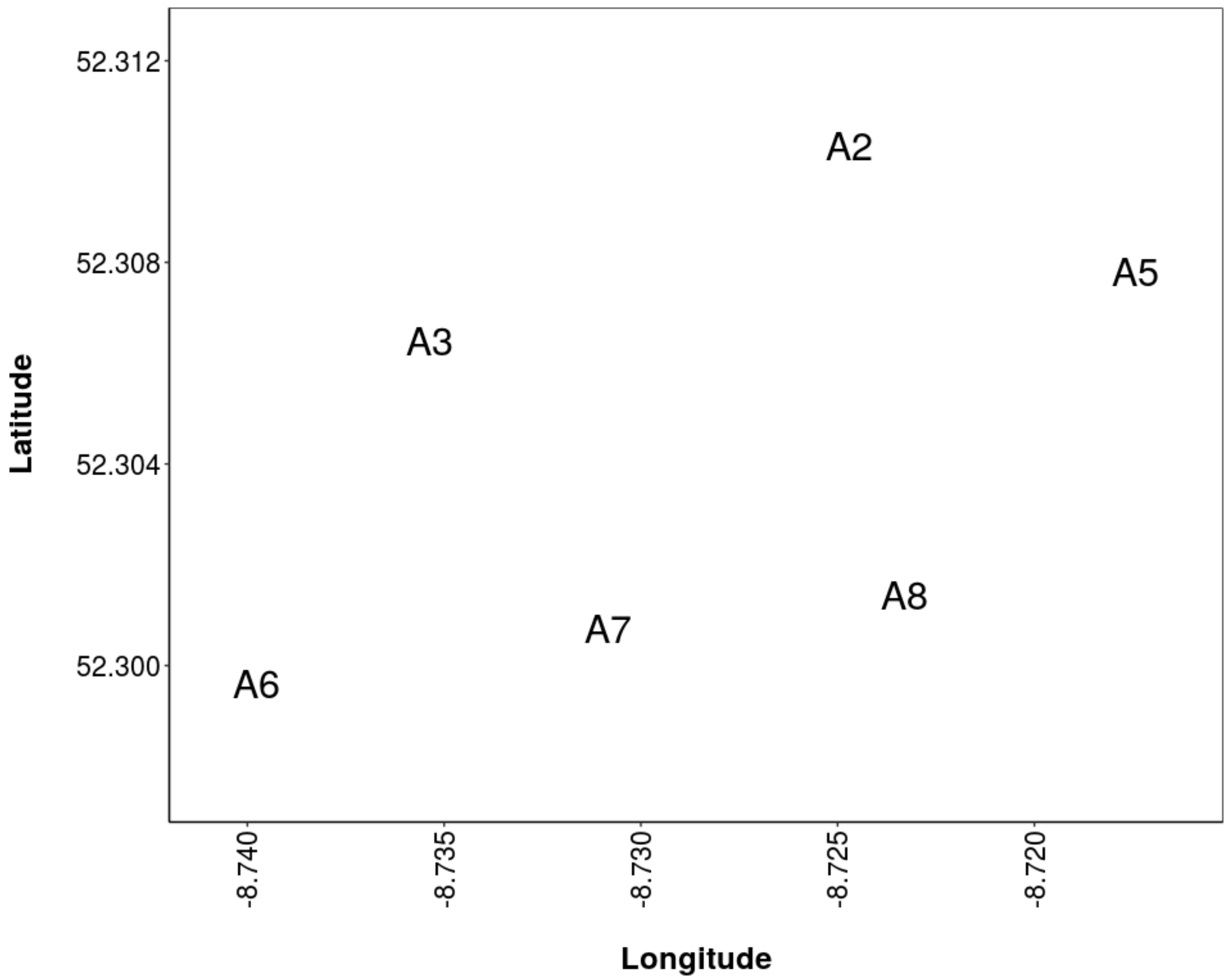
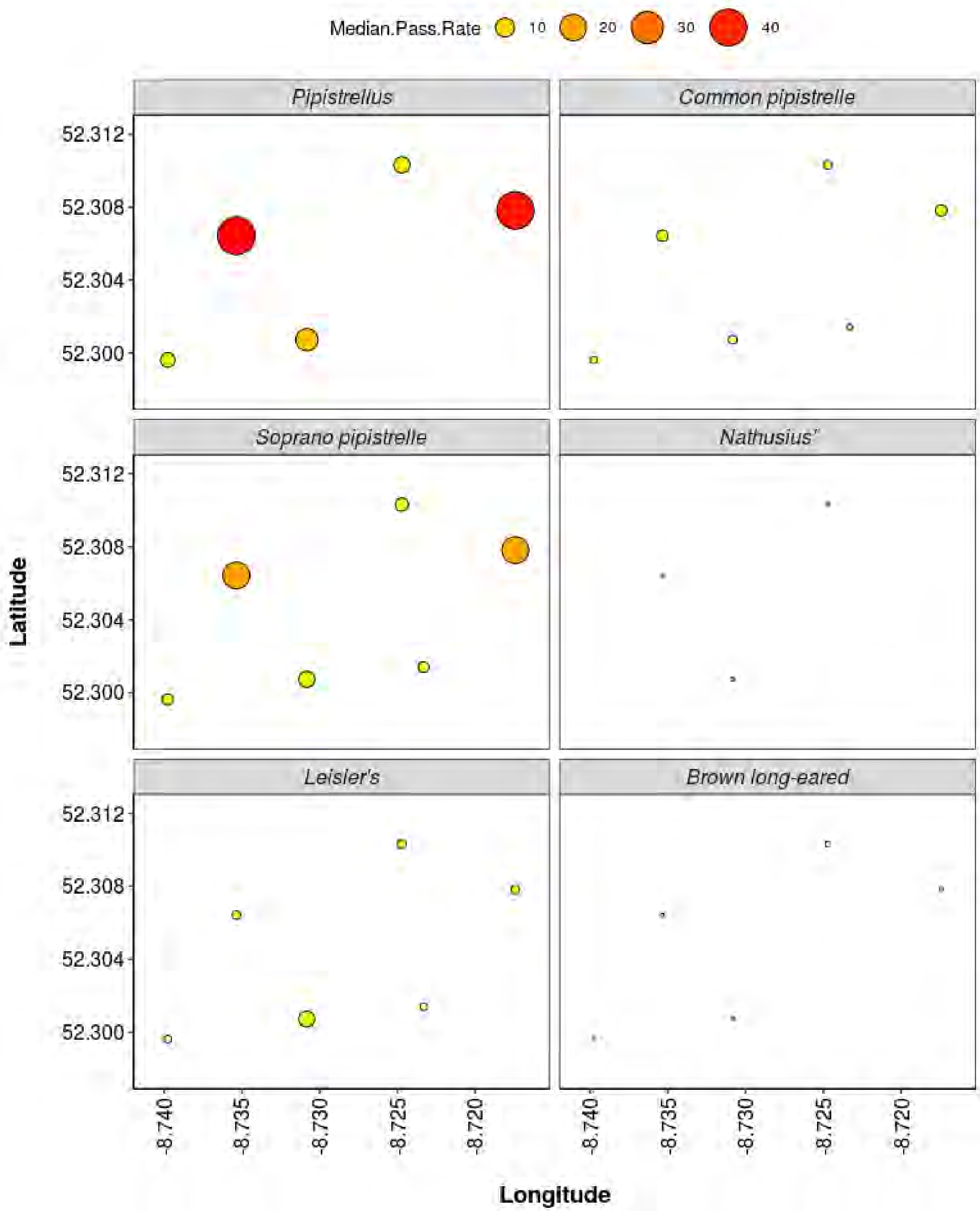
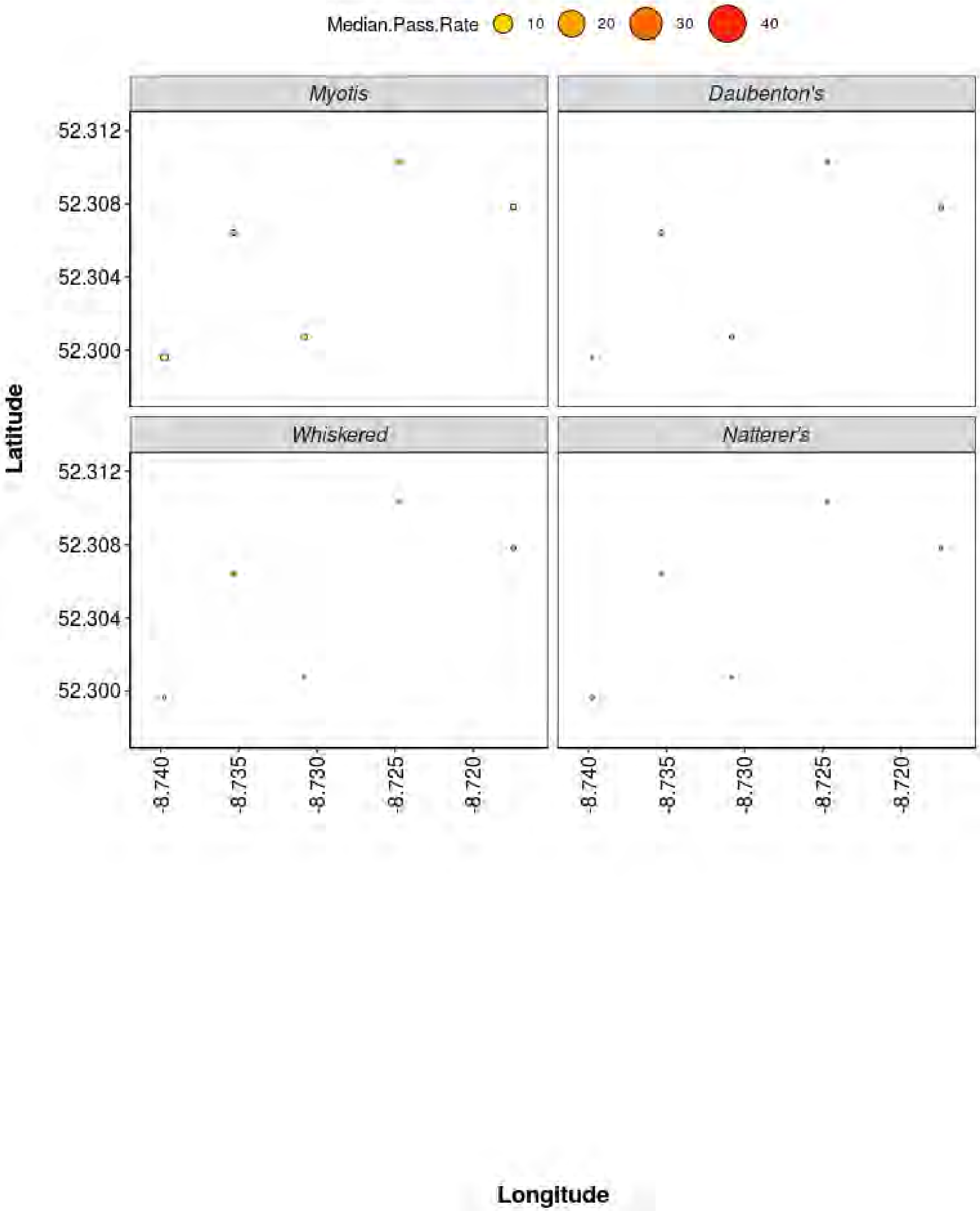


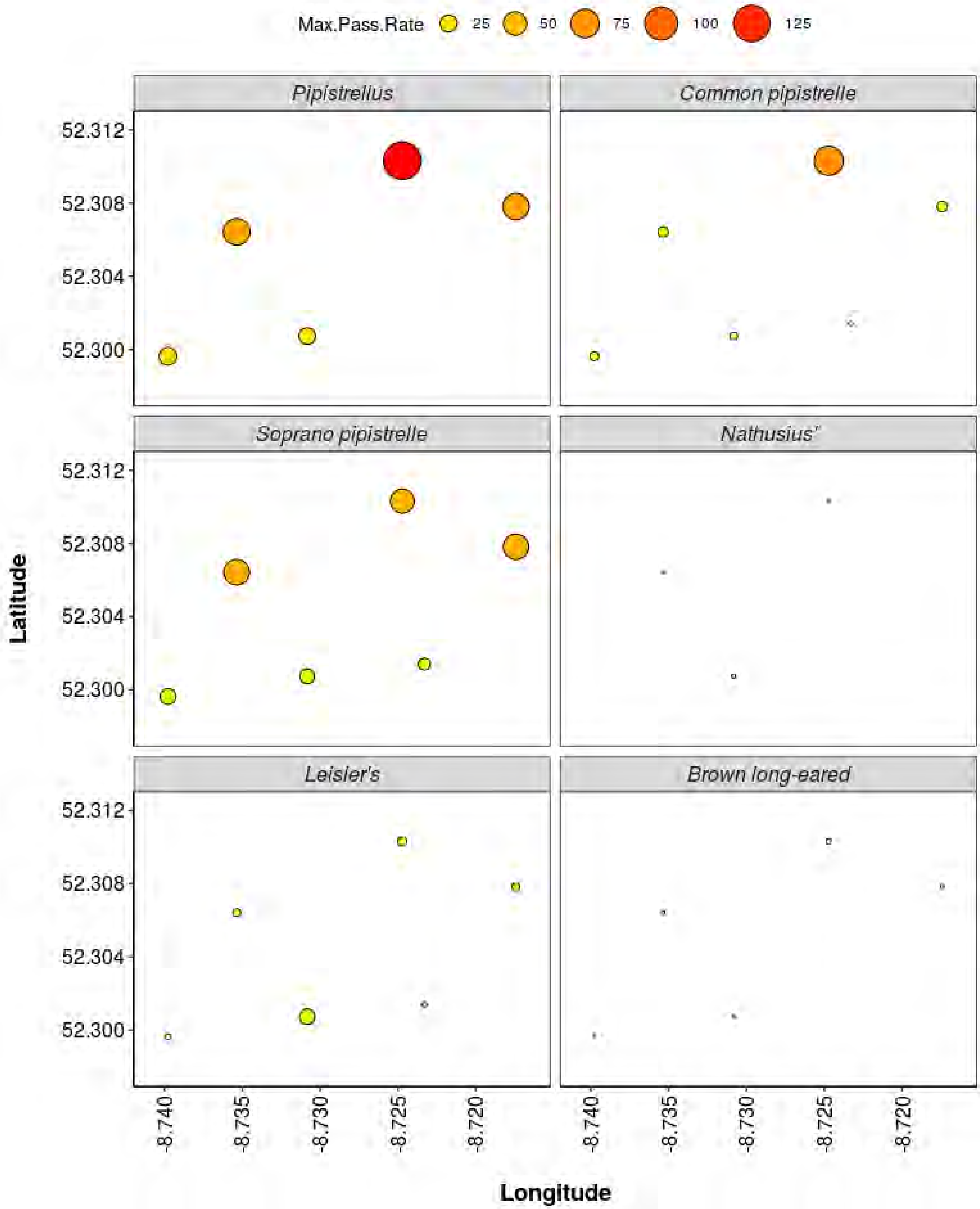
Figure 14. Median Nightly Pass Rate (bat passes/hr/night) throughout the survey period - represented by the size and colour of the point at each detector location.

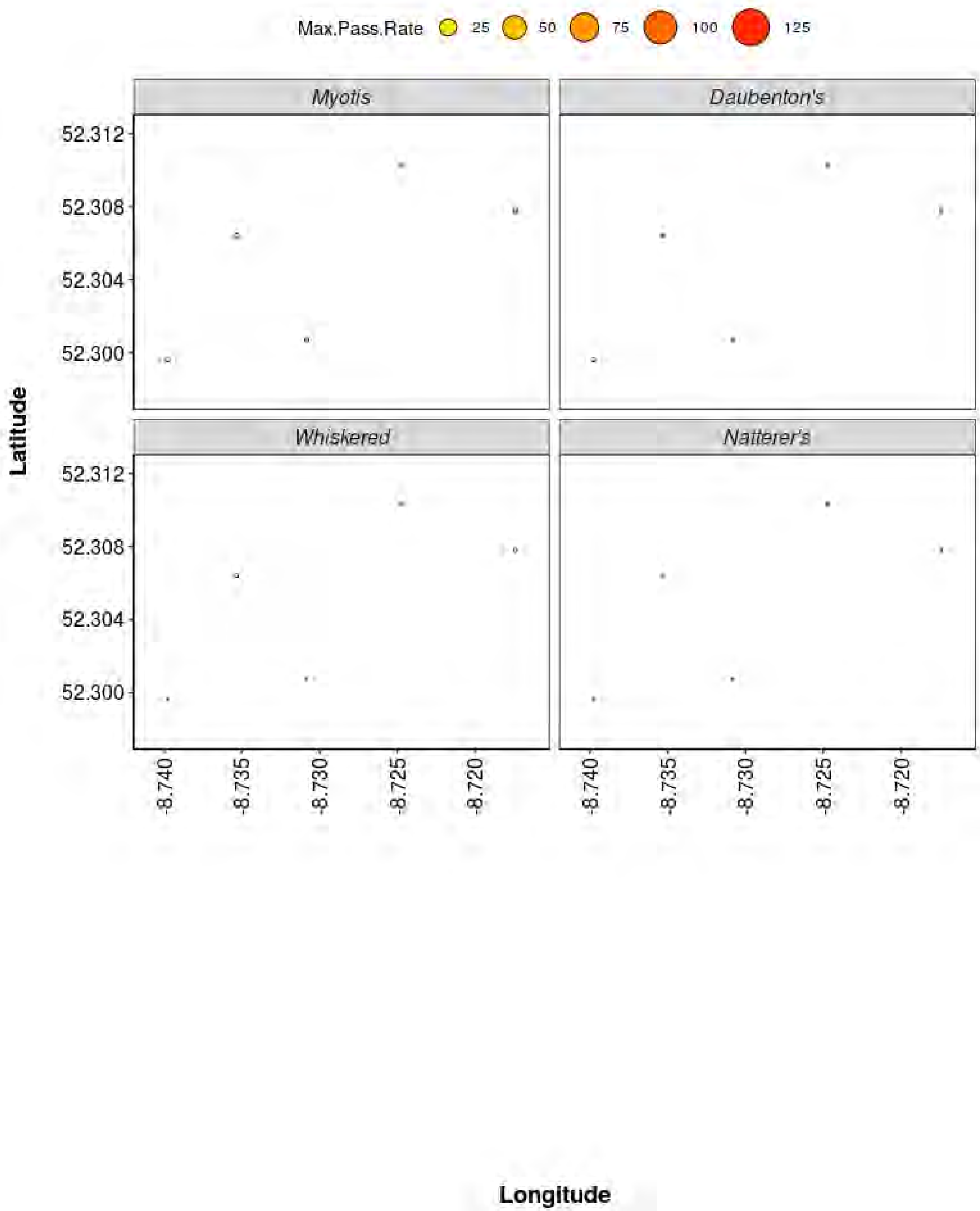

Median.Pass.Rate 10 20 30 40
Pipistrellus
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Brown long-eared
Latitude
52.312
52.308
52.304
52.300
-8.740
-8.735
-8.730
-8.725
-8.720
Longitude



Median.Pass.Rate
10
20
30
40
Myotis
Daubenton's
Whiskered
Natterer's
Latitude
52.312
52.308
52.304
52.300
-8.740
-8.735
-8.730
-8.725
-8.720
Longitude

Figure 15. Maximum Nightly Pass Rate (bat passes/hr/night) recorded in a single night throughout the survey period - represented by the size and colour of the point at each detector location.


Max.Pass.Rate
25
50
75
100
125
Pipistrellus
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Brown long-eared
52.312
52.308
52.304
52.300
Latitude
-8.740
-8.735
-8.730
-8.725
-8.720
Longitude


Max.Pass.Rate
25
50
75
100
125
Myotis
Daubenton's
Whiskered
Natterer's
52.312
52.308
52.304
52.300
Latitude
-8.740
-8.735
-8.730
-8.725
-8.720
Longitude

PART 2B: Includes absences

THE NEXT SECTION OF THE REPORT FEATURES THE DATA SUPPLIED TO ECOBAT BUT TAKES INTO ACCOUNT SPECIES ABSENCES, AND THEREFORE INCLUDES 'ZERO DATA' FOR WHEN SPECIES WERE NOT DETECTED AT EACH DETECTOR ON A NIGHT. THIS DRAMATICALLY LOWERS THE MEANS AND MEDIANS OF THE DATA PRESENTED.

Nightly Bat Pass Rate (Bat passes per hour)

Median Per Detector

Table 22. The median Nightly Pass Rate (bat passes per hour, per night) of each species. If NA, then no bat passes.

Bat pass rates are often highly variable between nights, with some nights having few or no passes and other nights having high activity. In these circumstances, the median is likely to be a more useful summary of the 'average' activity than is the mean. For further information see: *Lintott, P. R., & Mathews, F. (2018). Basic mathematical errors may make ecological assessments unreliable. Biodiversity and Conservation, 27(1), 265-267.* https://doi.org/10.1007/s10531-017-1418-5

Species	Detector ID	Median Pass Rate
Brown long-eared	A2	0.4
Brown long-eared	A3	0.2
Brown long-eared	A5	0.2
Brown long-eared	A6	0.1
Brown long-eared	A7	0.1
Brown long-eared	A8	0.0
Common pipistrelle	A2	1.8
Common pipistrelle	A3	3.2
Common pipistrelle	A5	3.2
Common pipistrelle	A6	1.3
Common pipistrelle	A7	1.1
Common pipistrelle	A8	0.4
Daubenton's	A2	0.1
Daubenton's	A3	0.2
Daubenton's	A5	0.2
Daubenton's	A6	0.1
Daubenton's	A7	0.2
Daubenton's	A8	0.0
Leisler's	A2	1.9
Leisler's	A3	1.7
Leisler's	A5	1.7
Leisler's	A6	1.3
Leisler's	A7	6.9

Leisler's	A8	1.3
Myotis	A2	0.0
Myotis	A3	0.2
Myotis	A5	0.3
Myotis	A6	0.0
Myotis	A7	0.0
Myotis	A8	0.0
Nathusius'	A2	0.0
Nathusius'	A3	0.0
Nathusius'	A5	0.0
Nathusius'	A6	0.0
Nathusius'	A7	0.0
Nathusius'	A8	0.0
Natterer's	A2	0.1
Natterer's	A3	0.1
Natterer's	A5	0.1
Natterer's	A6	0.1
Natterer's	A7	0.0
Natterer's	A8	0.0
Pipistrellus	A2	6.5
Pipistrellus	A3	24.4
Pipistrellus	A5	24.4
Pipistrellus	A6	0.0
Pipistrellus	A7	2.7
Pipistrellus	A8	0.0
Soprano pipistrelle	A2	4.5
Soprano pipistrelle	A3	20.7
Soprano pipistrelle	A5	20.7
Soprano pipistrelle	A6	3.1
Soprano pipistrelle	A7	5.6
Soprano pipistrelle	A8	2.3
Whiskered	A2	0.1
Whiskered	A3	0.2
Whiskered	A5	0.2
Whiskered	A6	0.0
Whiskered	A7	0.0

Whiskered	A8	0.0

Nightly Bat Pass Rate (Bat passes per hour)

Mean per Detector

Table 23. The mean Nightly Pass Rate (bat passes per hour, per night) of each species at each detector. Values are given to 1 decimal place.

We recommend using the median values given above, for the reasons stated above, but provide the mean values in the table below.

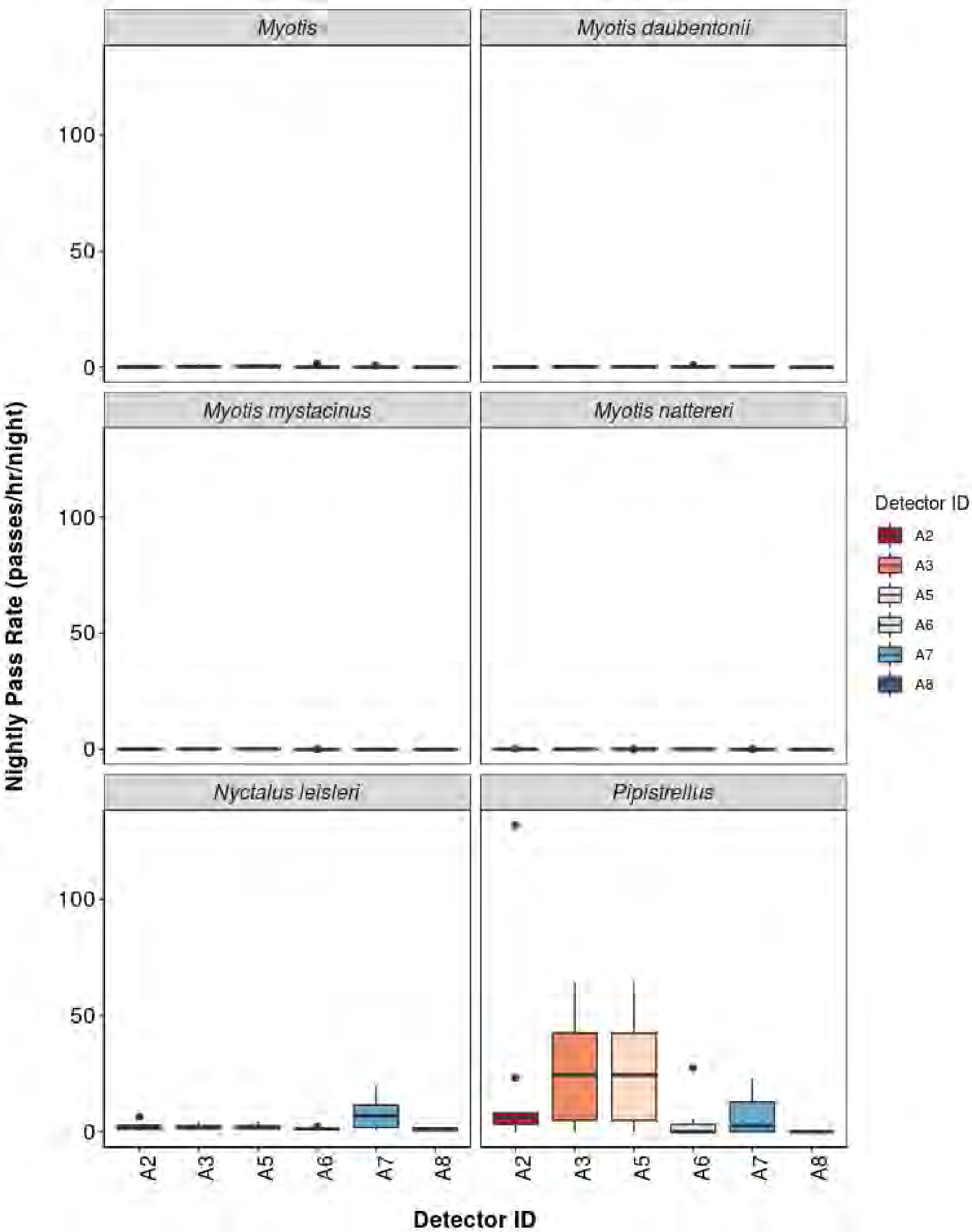
Species	Detector ID	Mean Pass Rate
Brown long-eared	A2	0.5
Brown long-eared	A3	0.2
Brown long-eared	A5	0.2
Brown long-eared	A6	0.1
Brown long-eared	A7	0.1
Brown long-eared	A8	0.0
Common pipistrelle	A2	9.7
Common pipistrelle	A3	3.5
Common pipistrelle	A5	3.5
Common pipistrelle	A6	1.7
Common pipistrelle	A7	1.6
Common pipistrelle	A8	0.5
Daubenton’s	A2	0.1
Daubenton’s	A3	0.2
Daubenton’s	A5	0.2
Daubenton’s	A6	0.3
Daubenton’s	A7	0.2
Daubenton’s	A8	0.0
Leisler’s	A2	2.2
Leisler’s	A3	2.2
Leisler’s	A5	2.2
Leisler’s	A6	1.2
Leisler’s	A7	7.2
Leisler’s	A8	1.1
Myotis	A2	0.2
Myotis	A3	0.4

Myotis	A5	0.4
Myotis	A6	0.3
Myotis	A7	0.1
Myotis	A8	0.0
Nathusius’	A2	0.1
Nathusius’	A3	0.0
Nathusius’	A5	0.0
Nathusius’	A6	0.0
Nathusius’	A7	0.1
Nathusius’	A8	0.0
Natterer’s	A2	0.1
Natterer’s	A3	0.1
Natterer’s	A5	0.1
Natterer’s	A6	0.1
Natterer’s	A7	0.0
Natterer’s	A8	0.0
Pipistrellus	A2	19.2
Pipistrellus	A3	27.1
Pipistrellus	A5	27.0
Pipistrellus	A6	4.0
Pipistrellus	A7	7.1
Pipistrellus	A8	0.0
Soprano pipistrelle	A2	10.1
Soprano pipistrelle	A3	26.0
Soprano pipistrelle	A5	26.0
Soprano pipistrelle	A6	4.9
Soprano pipistrelle	A7	6.8
Soprano pipistrelle	A8	3.0
Whiskered	A2	0.1
Whiskered	A3	0.2
Whiskered	A5	0.2
Whiskered	A6	0.0
Whiskered	A7	0.0
Whiskered	A8	0.0

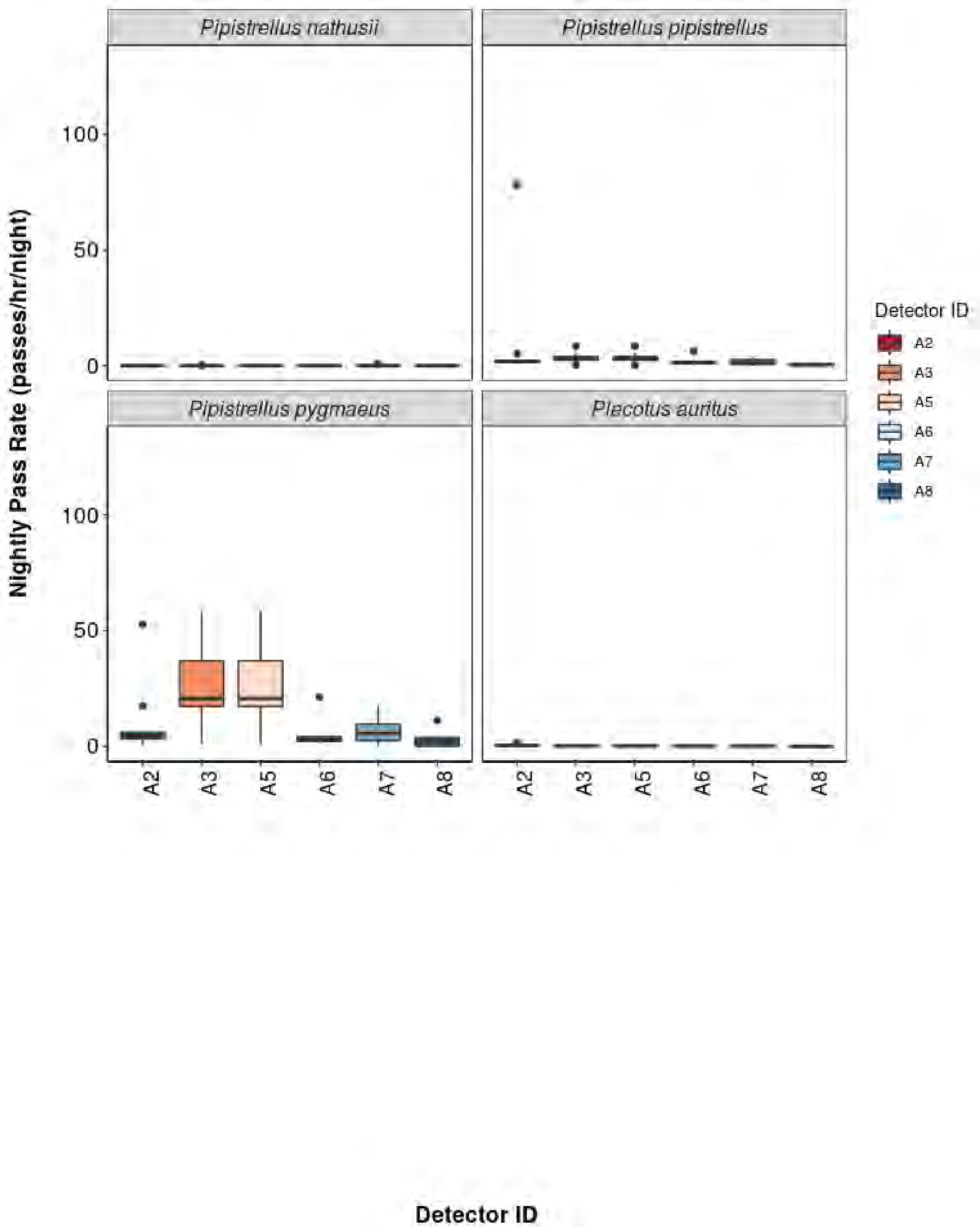
Nightly Bat Passes (Bat passes per hour)

Per Detector - Figures

Figure 16. Figures show boxplots for the number of bat passes per hour each night, for each detector. The 'box' shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The 'whiskers' extend from the box and represent the ranges for the bottom 25% and the top 25% of the data values, excluding outliers. An outlier is any extreme value that lies further away from the box than 1.5 times the interquartile range. Outliers are shown as dots. Where very few passes are recorded it is not possible to produce the box, so the data are shown as a line.



Myotis
Myotis daubentonii
Myotis mystacinus
Myotis nattereri
Nyctalus leisleri
Pipistrellus
Nightly Pass Rate (passes/hr/night)
0
50
100
A2
A3
A5
A6
A7
A8
Detector ID
Detector ID
A2
A3
A5
A6
A7
A8



Pipistrellus nathusii
Pipistrellus pipistrellus
Pipistrellus pygmaeus
Plecotus auritus
Nightly Pass Rate (passes/hr/night)
100
50
0
A2
A3
A5
A6
A7
A8
Detector ID

Survey Effort

Table 24. The number of nights bats were detected per month per detector.

Month	Detector ID	No of Survey Nights
Jul	A2	10
Jul	A3	10
Jul	A5	10
Jul	A6	9
Jul	A7	10
Jul	A8	9

Nightly Bat Pass Rate for each Month

Median Per Detector

Table 25. The median Nightly Pass Rate (bat passes per hour, per night) of each species throughout each month. If NA, then no bat passes.

Bat pass rates are often highly variable between nights, with some nights having few or no passes and other nights having high activity. In these circumstances, the median is likely to be a more useful summary of the 'average' activity than is the mean. For further information see: *Lintott, P. R., & Mathews, F. (2018). Basic mathematical errors may make ecological assessments unreliable. Biodiversity and Conservation, 27(1), 265-267.* https://doi.org/10.1007/s10531-017-1418-5

Species	Detector ID	Jul
Brown long-eared	A2	0.4
Brown long-eared	A3	0.2
Brown long-eared	A5	0.2
Brown long-eared	A6	0.1
Brown long-eared	A7	0.1
Brown long-eared	A8	0.0
Common pipistrelle	A2	1.8
Common pipistrelle	A3	3.2
Common pipistrelle	A5	3.2
Common pipistrelle	A6	1.3
Common pipistrelle	A7	1.1
Common pipistrelle	A8	0.4
Daubenton's	A2	0.1
Daubenton's	A3	0.2
Daubenton's	A5	0.2
Daubenton's	A6	0.1
Daubenton's	A7	0.2
Daubenton's	A8	0.0
Leisler's	A2	1.9
Leisler's	A3	1.7
Leisler's	A5	1.7
Leisler's	A6	1.3
Leisler's	A7	6.9

Leisler’s	A8	1.3
Myotis	A2	0.0
Myotis	A3	0.2
Myotis	A5	0.3
Myotis	A6	0.0
Myotis	A7	0.0
Myotis	A8	0.0
Nathusius’	A2	0.0
Nathusius’	A3	0.0
Nathusius’	A5	0.0
Nathusius’	A6	0.0
Nathusius’	A7	0.0
Nathusius’	A8	0.0
Natterer’s	A2	0.1
Natterer’s	A3	0.1
Natterer’s	A5	0.1
Natterer’s	A6	0.1
Natterer’s	A7	0.0
Natterer’s	A8	0.0
Pipistrellus	A2	6.5
Pipistrellus	A3	24.4
Pipistrellus	A5	24.4
Pipistrellus	A6	0.0
Pipistrellus	A7	2.7
Pipistrellus	A8	0.0
Soprano pipistrelle	A2	4.5
Soprano pipistrelle	A3	20.7
Soprano pipistrelle	A5	20.7
Soprano pipistrelle	A6	3.1
Soprano pipistrelle	A7	5.6
Soprano pipistrelle	A8	2.3
Whiskered	A2	0.1
Whiskered	A3	0.2
Whiskered	A5	0.2
Whiskered	A6	0.0
Whiskered	A7	0.0

Whiskered	A8	0.0

Nightly Bat Pass Rate for each Month

Mean per Detector

Table 26. The mean Nightly Pass Rate (bat passes per hour, per night) of each species throughout each month. Values are given to 1 decimal place.

We recommend using the median values given above, for the reasons stated above, but provide the mean values in the table below.

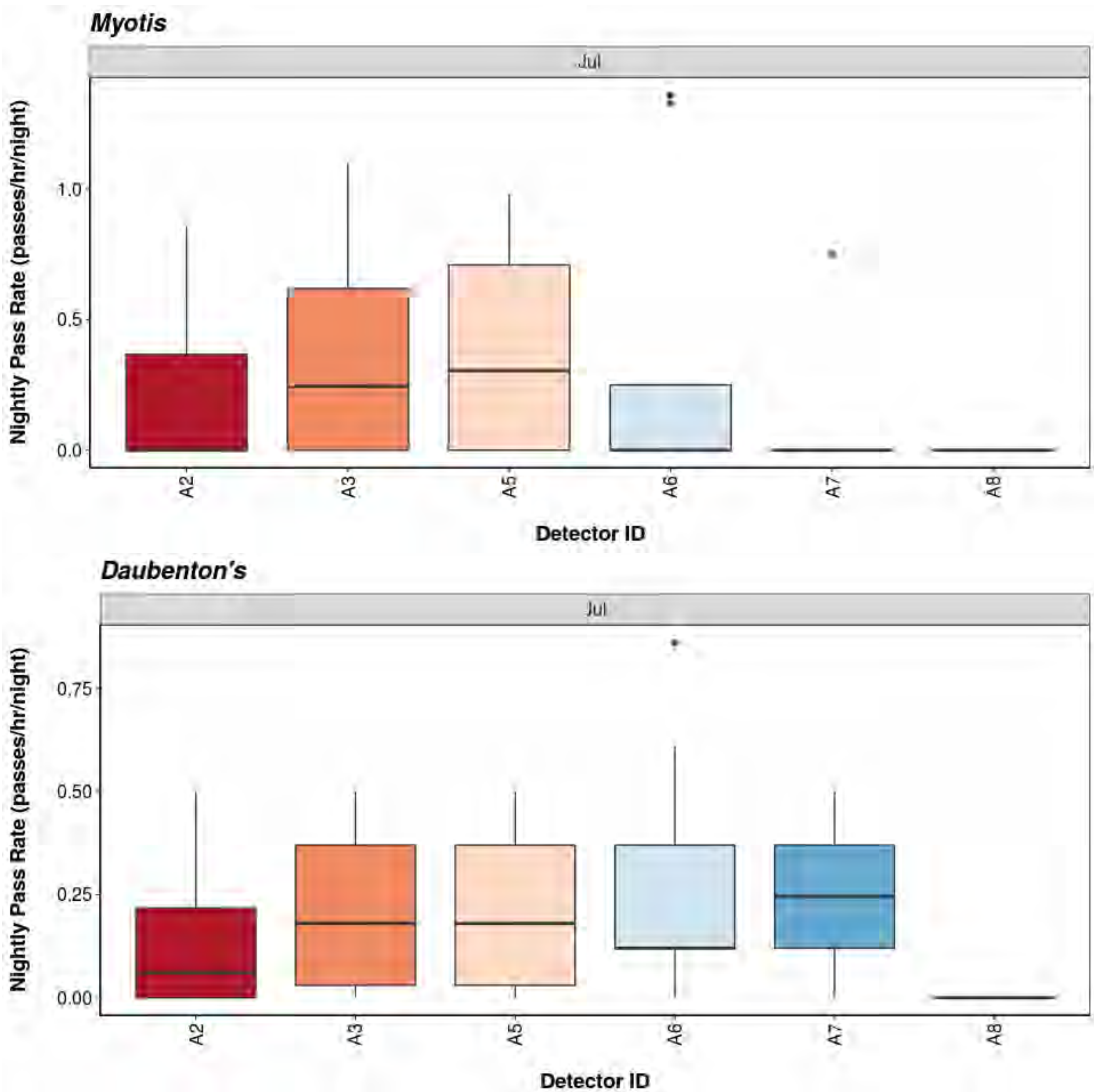
Species	Detector ID	Jul
Brown long-eared	A2	0.5
Brown long-eared	A3	0.2
Brown long-eared	A5	0.2
Brown long-eared	A6	0.1
Brown long-eared	A7	0.1
Brown long-eared	A8	0.0
Common pipistrelle	A2	9.7
Common pipistrelle	A3	3.5
Common pipistrelle	A5	3.5
Common pipistrelle	A6	1.7
Common pipistrelle	A7	1.6
Common pipistrelle	A8	0.5
Daubenton’s	A2	0.1
Daubenton’s	A3	0.2
Daubenton’s	A5	0.2
Daubenton’s	A6	0.3
Daubenton’s	A7	0.2
Daubenton’s	A8	0.0
Leisler’s	A2	2.2
Leisler’s	A3	2.2
Leisler’s	A5	2.2
Leisler’s	A6	1.2
Leisler’s	A7	7.2
Leisler’s	A8	1.1
Myotis	A2	0.2
Myotis	A3	0.4

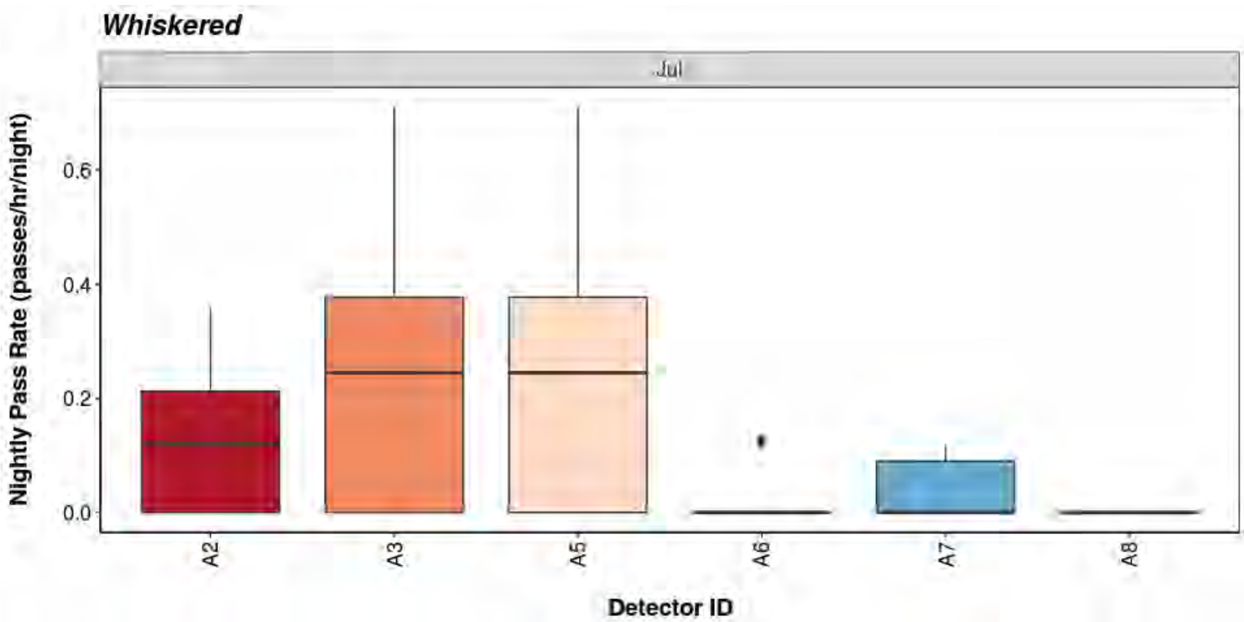
Myotis	A5	0.4
Myotis	A6	0.3
Myotis	A7	0.1
Myotis	A8	0.0
Nathusius’	A2	0.1
Nathusius’	A3	0.0
Nathusius’	A5	0.0
Nathusius’	A6	0.0
Nathusius’	A7	0.1
Nathusius’	A8	0.0
Natterer’s	A2	0.1
Natterer’s	A3	0.1
Natterer’s	A5	0.1
Natterer’s	A6	0.1
Natterer’s	A7	0.0
Natterer’s	A8	0.0
Pipistrellus	A2	19.2
Pipistrellus	A3	27.1
Pipistrellus	A5	27.0
Pipistrellus	A6	4.0
Pipistrellus	A7	7.1
Pipistrellus	A8	0.0
Soprano pipistrelle	A2	10.1
Soprano pipistrelle	A3	26.0
Soprano pipistrelle	A5	26.0
Soprano pipistrelle	A6	4.9
Soprano pipistrelle	A7	6.8
Soprano pipistrelle	A8	3.0
Whiskered	A2	0.1
Whiskered	A3	0.2
Whiskered	A5	0.2
Whiskered	A6	0.0
Whiskered	A7	0.0
Whiskered	A8	0.0

Nightly Bat Pass Rate for each Month

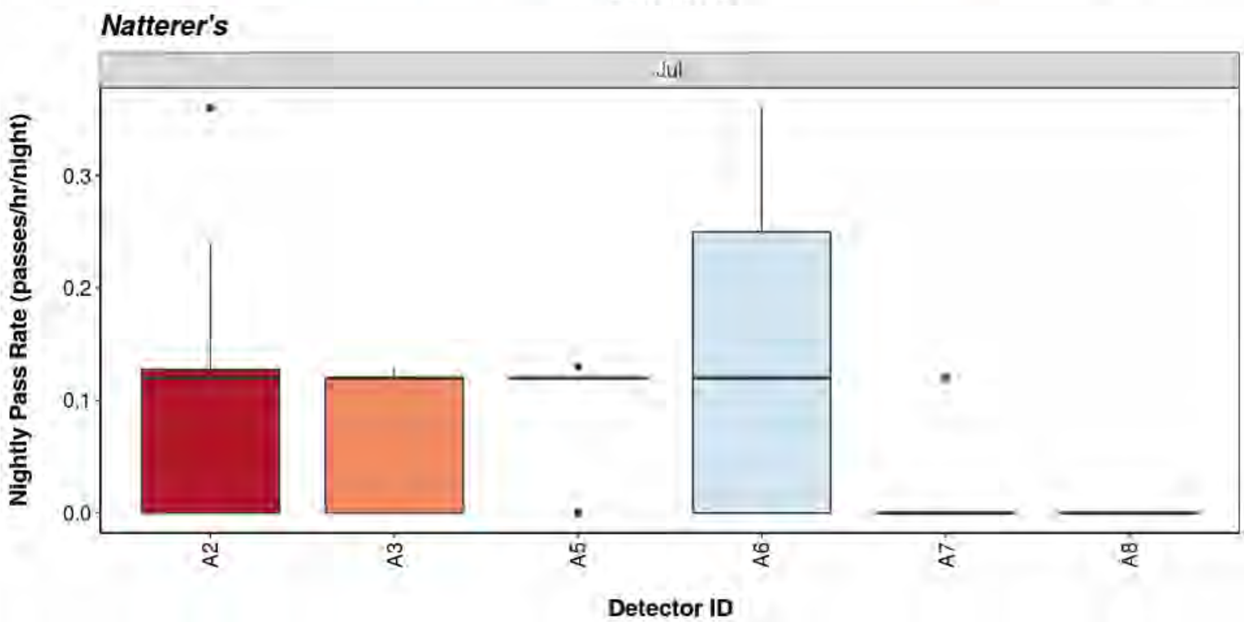
Per Detector - Figures

Figure 17. Figures show boxplots for the number of bat passes per hour by detector, for each month. The 'box' shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The 'whiskers' extend from the box and represent the ranges for the bottom 25% and the top 25% of the data values, excluding outliers. An outlier is any extreme value that lies further away from the box than 1.5 times the interquartile range. Outliers are shown as dots. Where very few passes are recorded it is not possible to produce the box, so the data are shown as a line.

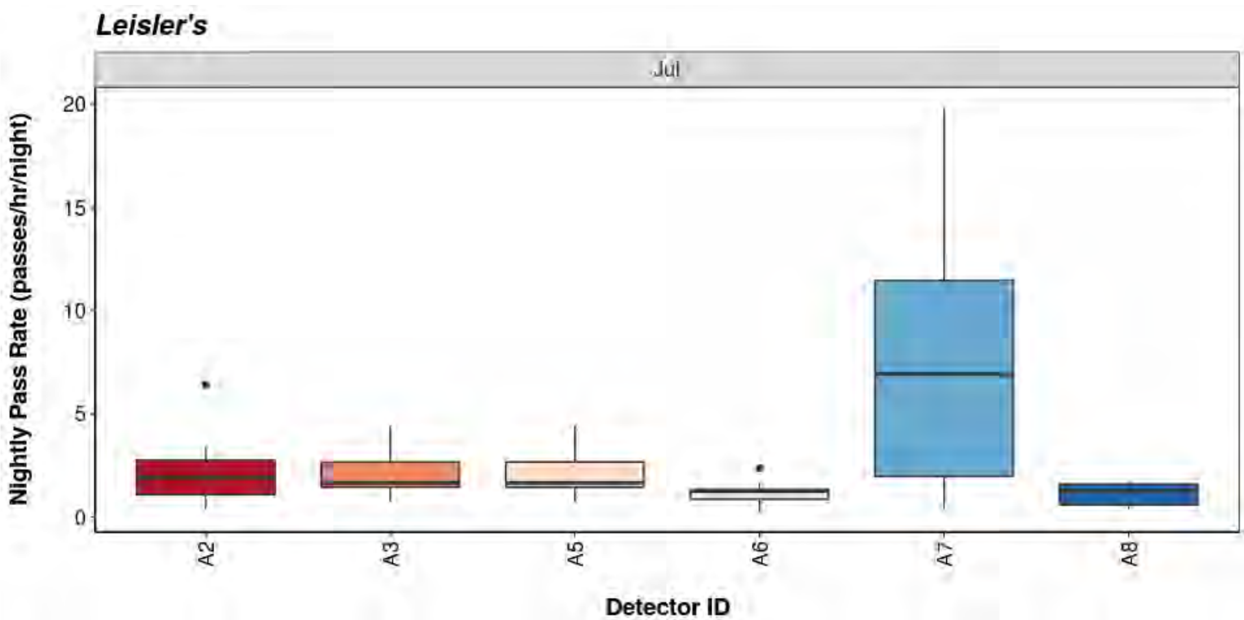


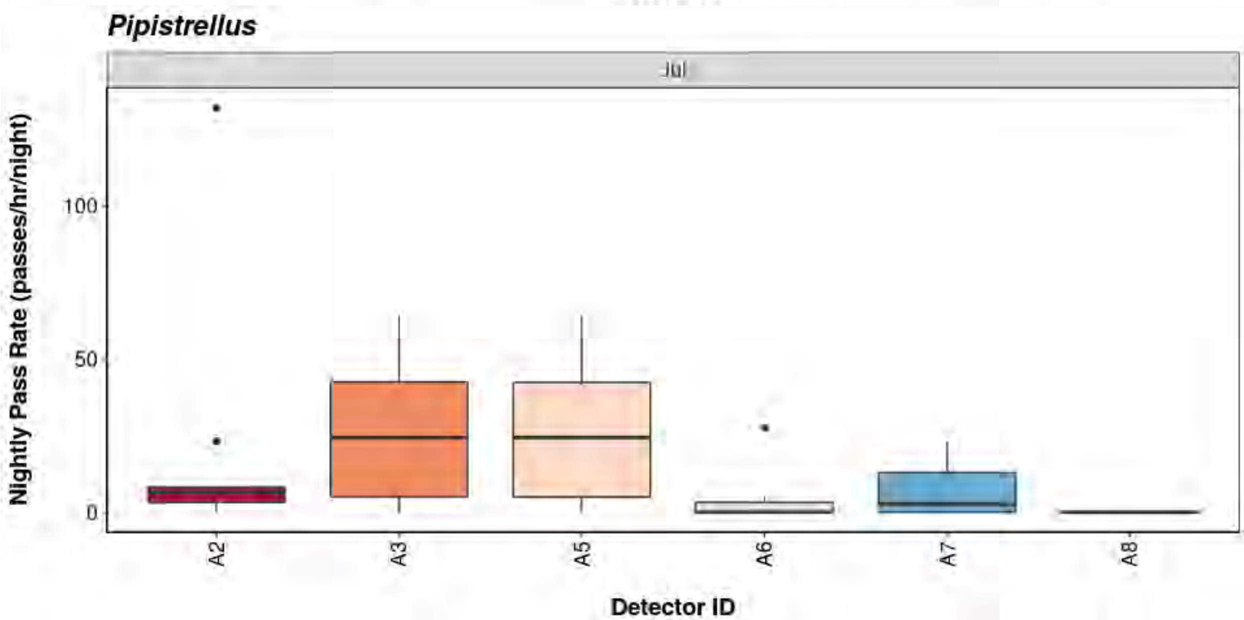


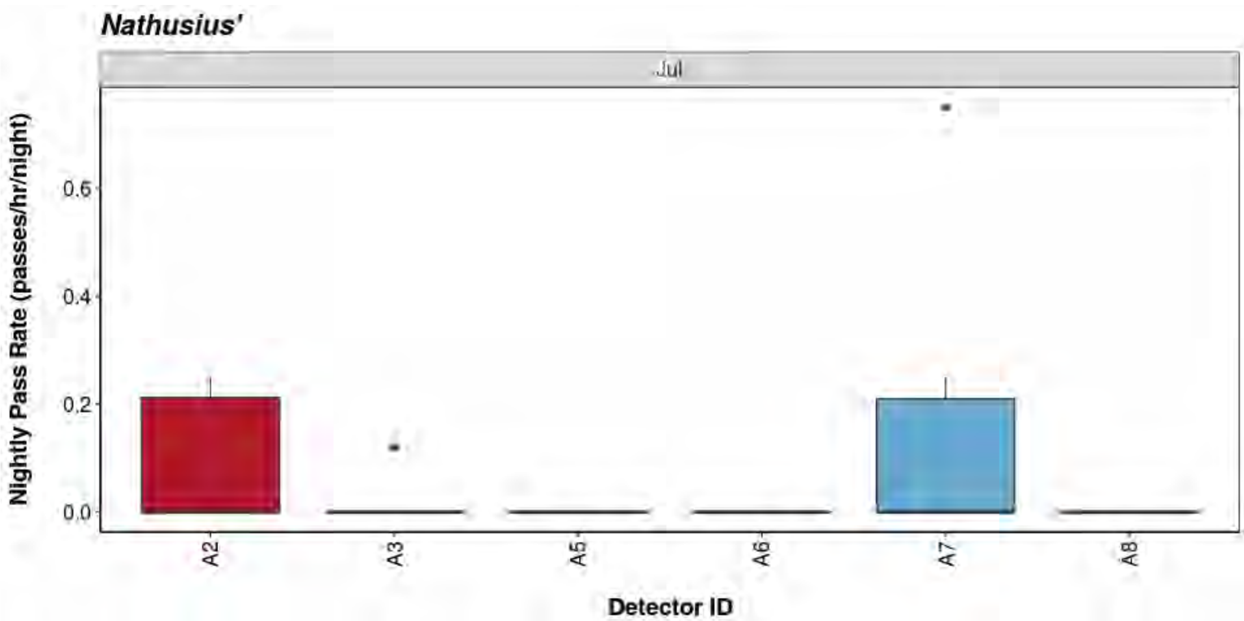
Whiskered
Jul
Nightly Pass Rate (passes/hr/night)
0.6
0.4
0.2
0.0
A2
A3
A5
A6
A7
A8
Detector ID



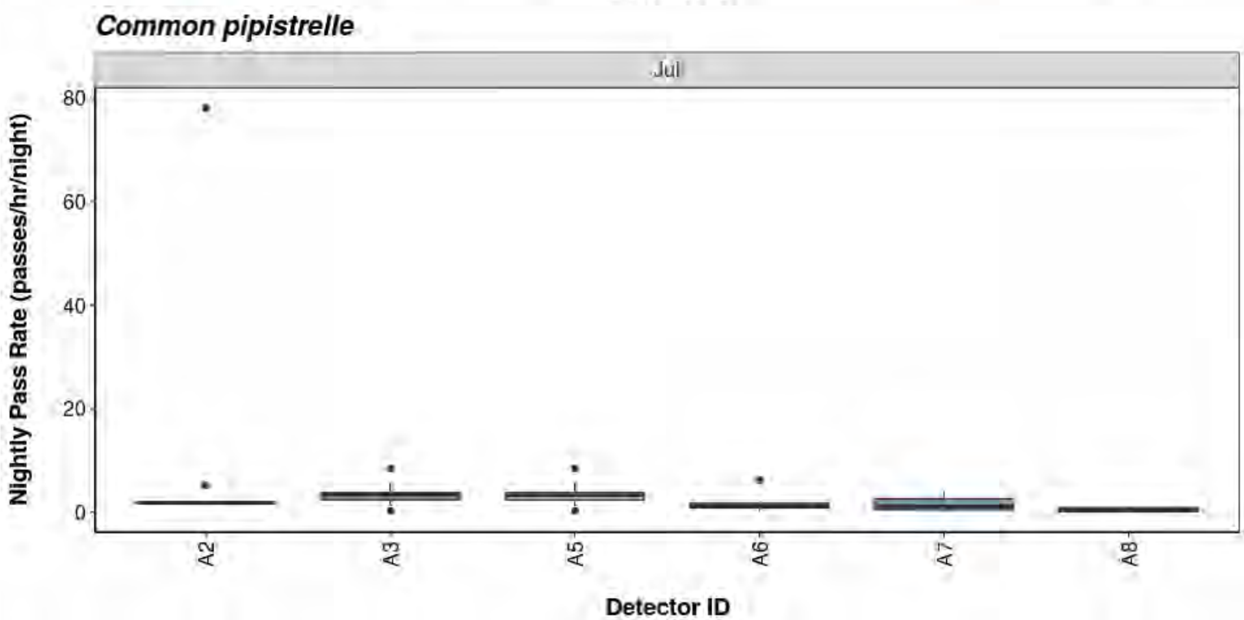
Natterer's
Jul
Nightly Pass Rate (passes/hr/night)
0.3
0.2
0.1
0.0
A2
A3
A5
A6
A7
A8
Detector ID


Leisler's
Jul
Nightly Pass Rate (passes/hr/night)
20
15
10
5
0
A2
A3
A5
A6
A7
A8
Detector ID

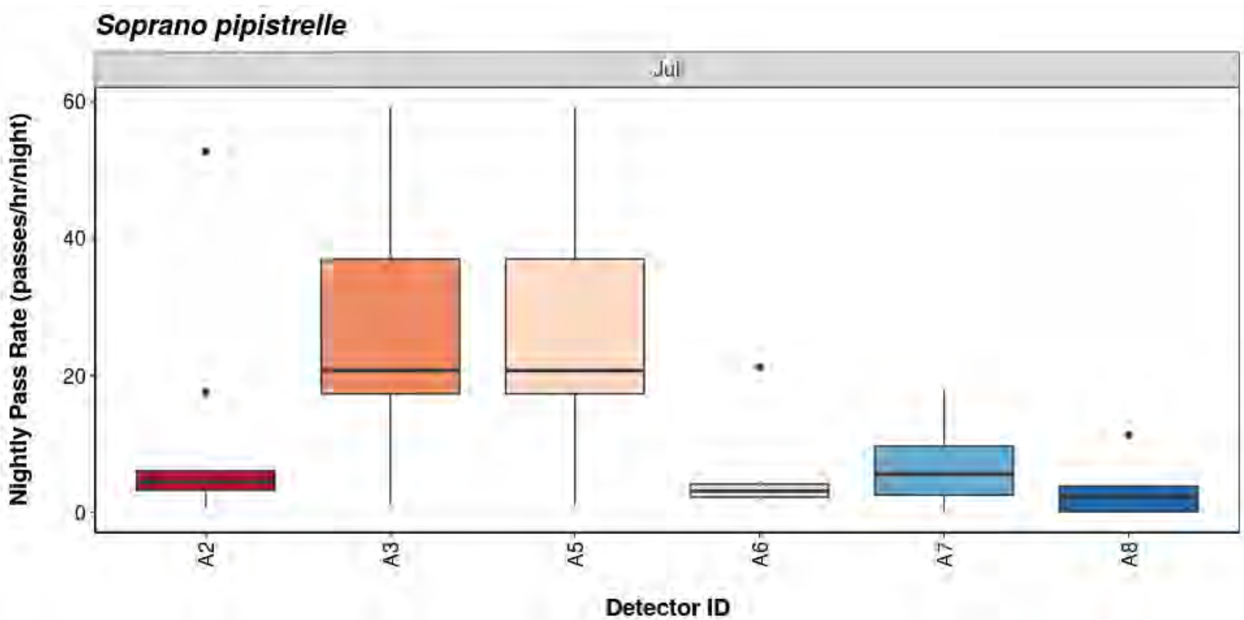

Pipistrellus
Jul
Nightly Pass Rate (passes/hr/night)
100
50
0
A2
A3
A5
A6
A7
A8
Detector ID

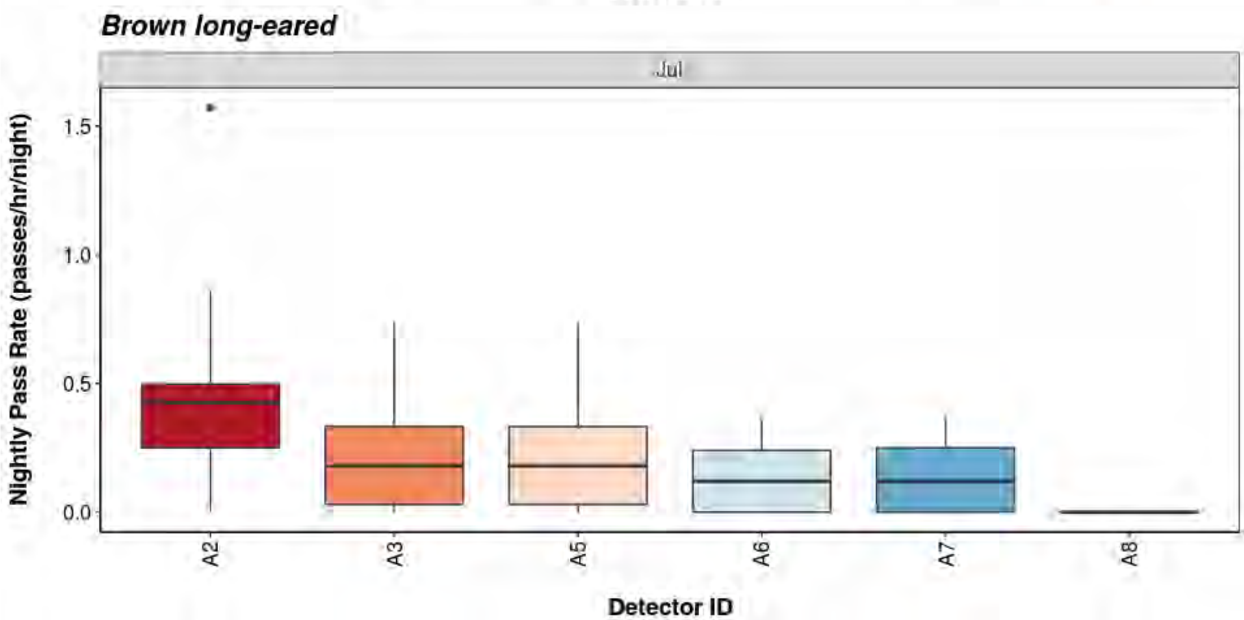


Nathusius'
Jul
Nightly Pass Rate (passes/hr/night)
0.0
0.2
0.4
0.6
A2
A3
A5
A6
A7
A8
Detector ID



Common pipistrelle
Jul
Nightly Pass Rate (passes/hr/night)
0
20
40
60
80
A2
A3
A5
A6
A7
A8
Detector ID


Soprano pipistrelle
Jul
Nightly Pass Rate (passes/hr/night)
60
40
20
0
A2
A3
A5
A6
A7
A8
Detector ID


Brown long-eared
Jul
Nightly Pass Rate (passes/hr/night)
1.5
1.0
0.5
0.0
A2
A3
A5
A6
A7
A8
Detector ID

Bat Activity per Detector Location

Figure 18. Detector ID reference:

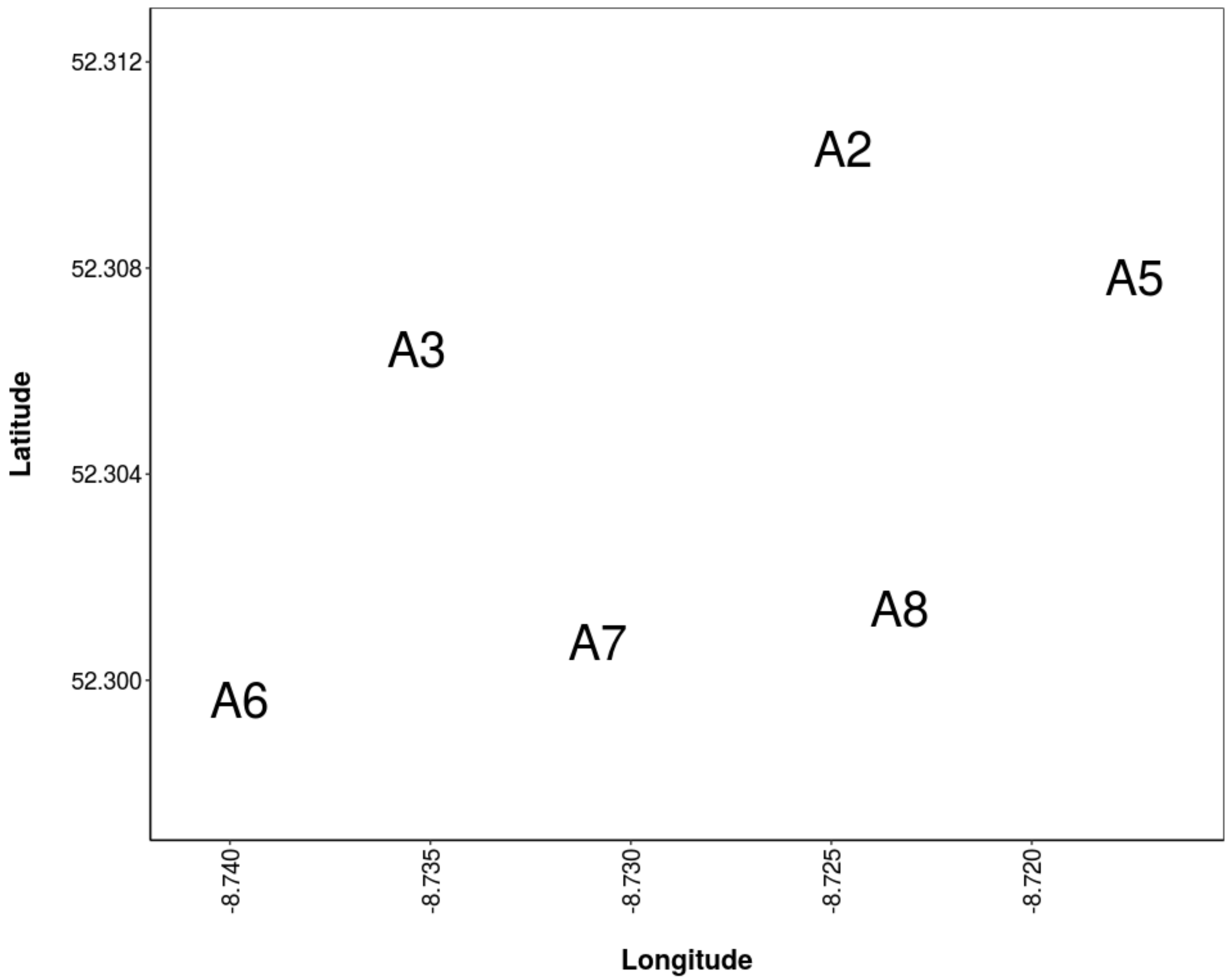
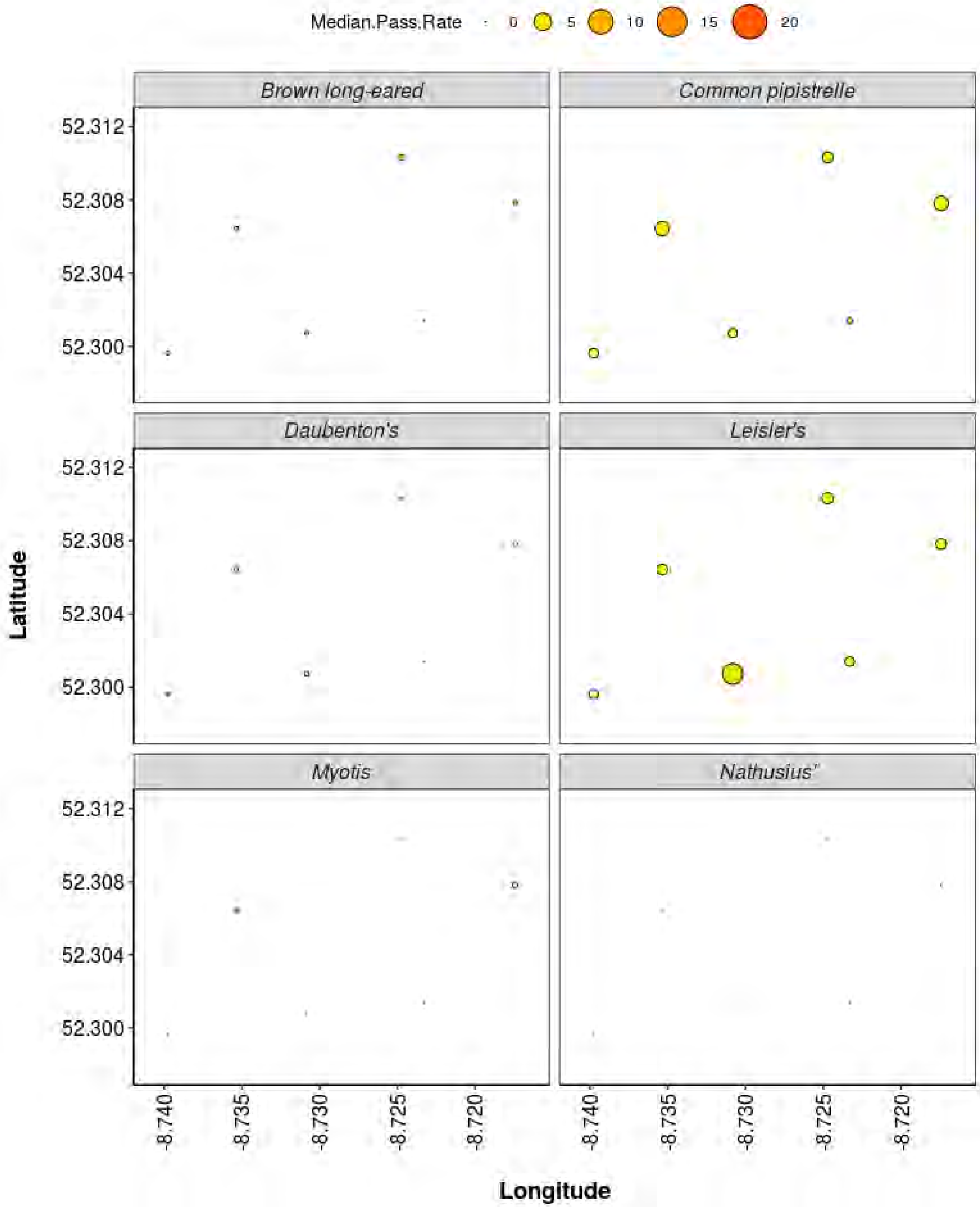
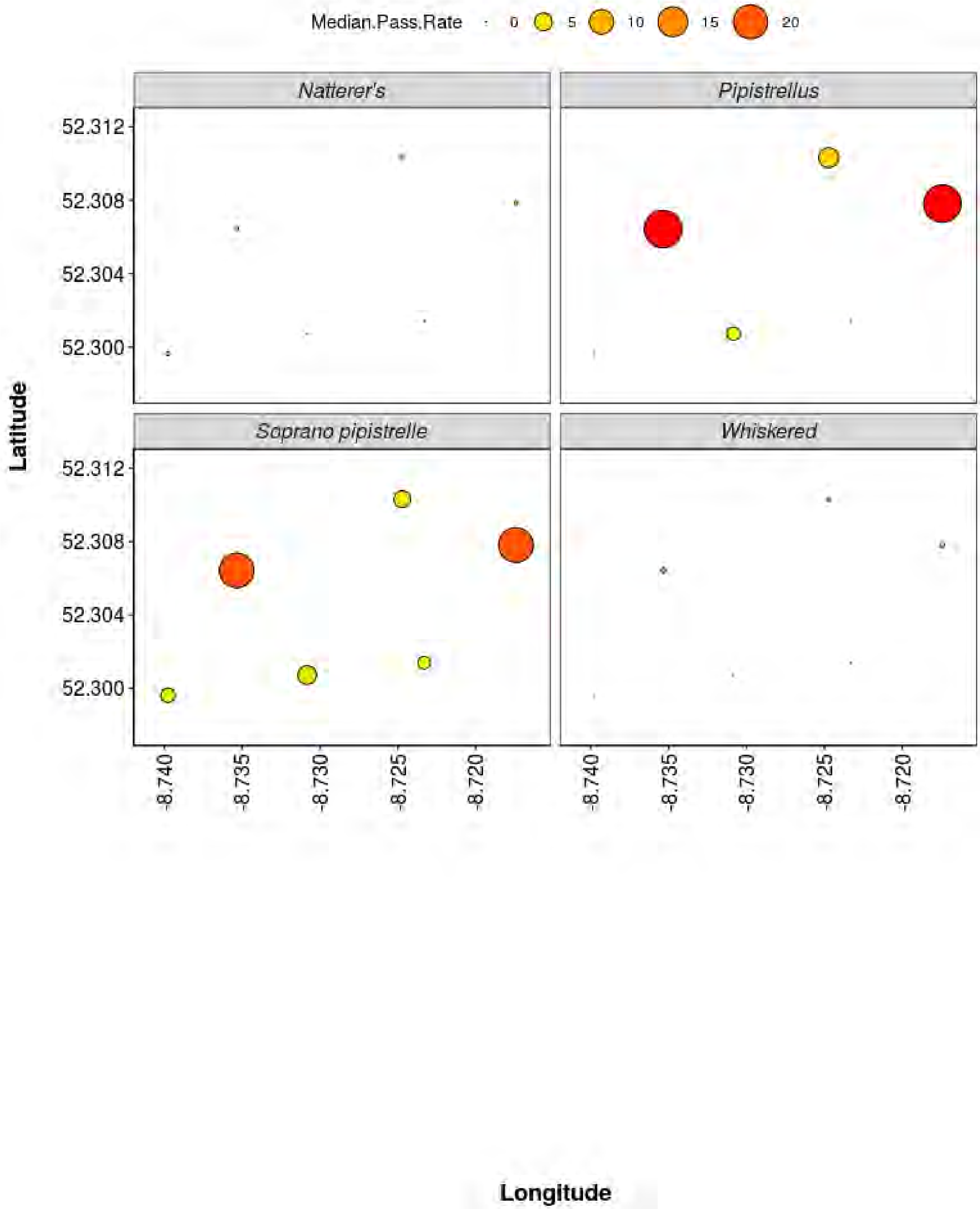


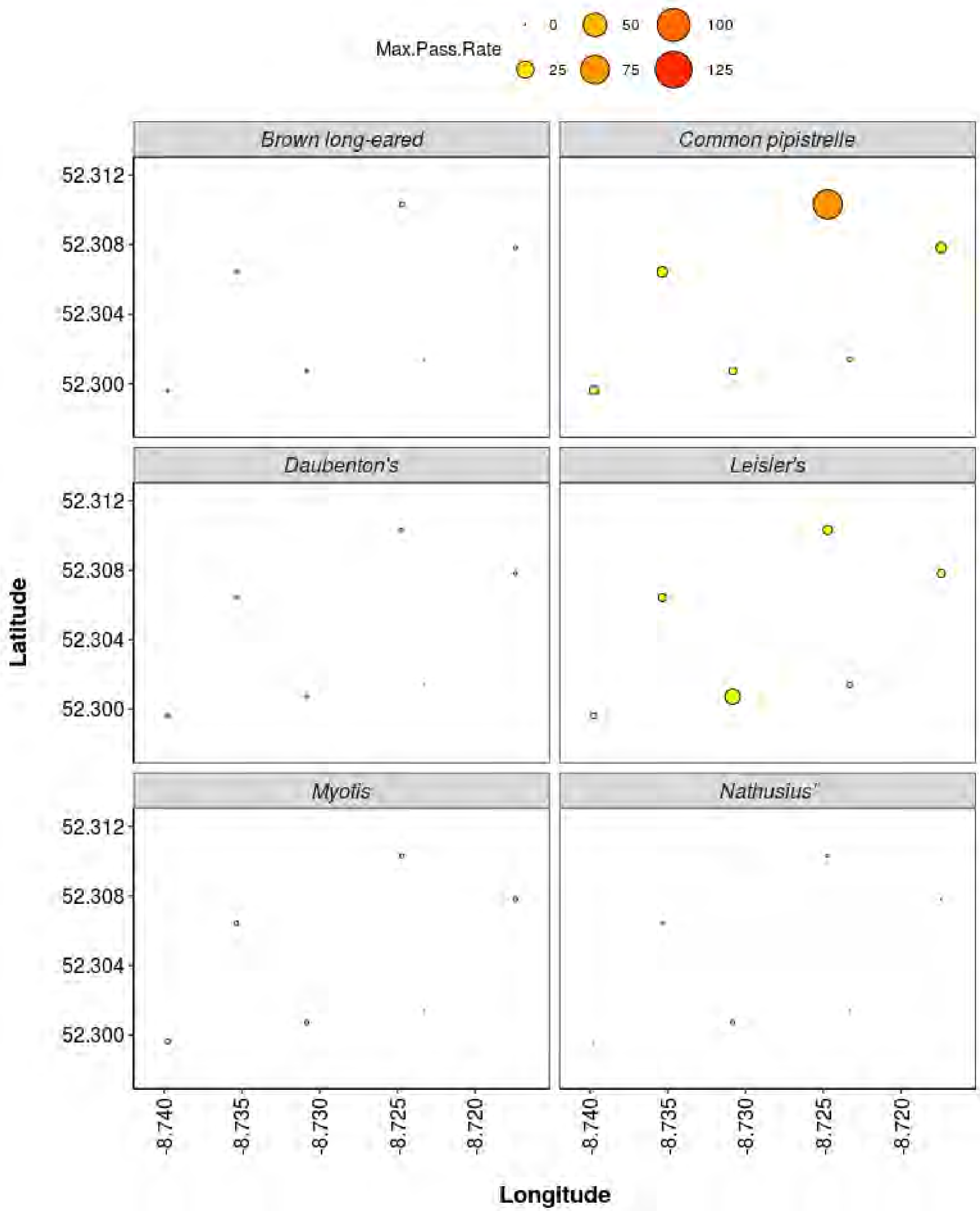
Figure 19. Median Nightly Pass Rate (bat passes/hr/night) throughout the survey period - represented by the size and colour of the point at each detector location.

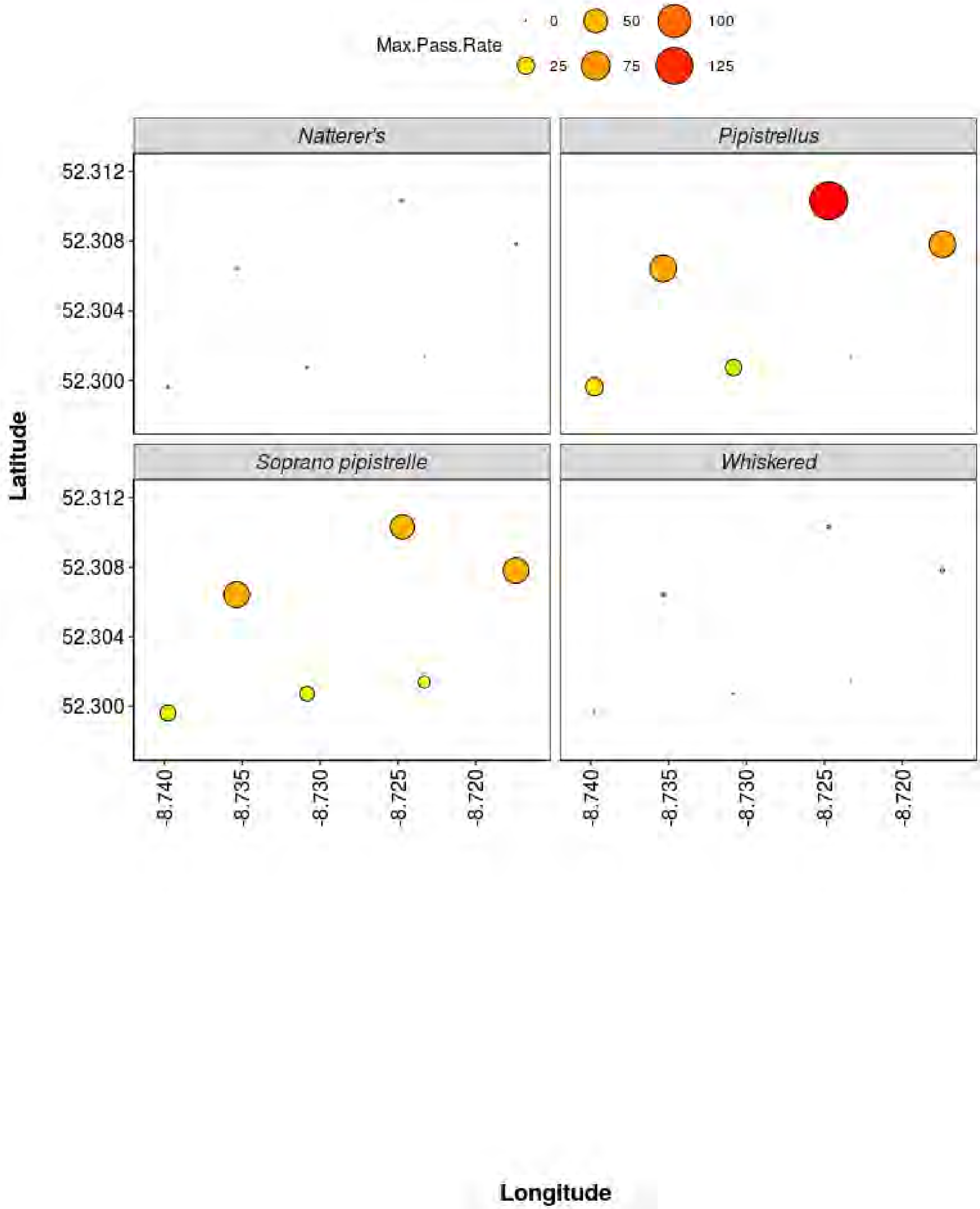

Median.Pass.Rate
0
5
10
15
20
Brown long-eared
Common pipistrelle
Daubenton's
Leisler's
Myotis
Nathusius'
Latitude
52.312
52.308
52.304
52.300
Longitude
-8.740
-8.735
-8.730
-8.725
-8.720



Median.Pass.Rate
0
5
10
15
20
Natterer's
Pipistrellus
Soprano pipistrelle
Whiskered
52.312
52.308
52.304
52.300
Latitude
-8.740
-8.735
-8.730
-8.725
-8.720
Longitude

Figure 20. Maximum Nightly Pass Rate (bat passes/hr/night) recorded in a single night throughout the survey period - represented by the size and colour of the point at each detector location.


Max.Pass.Rate
0
25
50
75
100
125
Brown long-eared
Common pipistrelle
Daubenton's
Leisler's
Myotis
Nathusius'
Latitude
52.312
52.308
52.304
52.300
-8.740
-8.735
-8.730
-8.725
-8.720
Longitude



Thank you for using Ecobat! If you have any questions please email
info@themammalsociety.org.uk

This report was produced free of charge by the Mammal Society to support evidence-based conservation of bats.

The following analyses are based on data supplied by the user to the Mammal Society's Ecobat website. The outputs are designed to assist decision-making, but do not replace expert interpretation by the user. The creation of the Ecobat tool was supported by the Natural Environment Research Council (NERC).

Bat Activity Analysis

Site Name: Annagh

Author: Fehily Timoney

31/05/2021

Summary

Bats were detected on **17** nights between **2020-09-15** and **2020-10-01**, using **6** static bat detectors. Throughout this period **10** species were recorded. **Table 1.** Detectors were placed at the following locations:

Detector ID	Latitude	Longitude
A2	52.31032	-8.724717
A3	52.30642	-8.735358
A6	52.29963	-8.739770
A7	52.30073	-8.730829
A8	52.30140	-8.723312
A5	52.30781	-8.717422

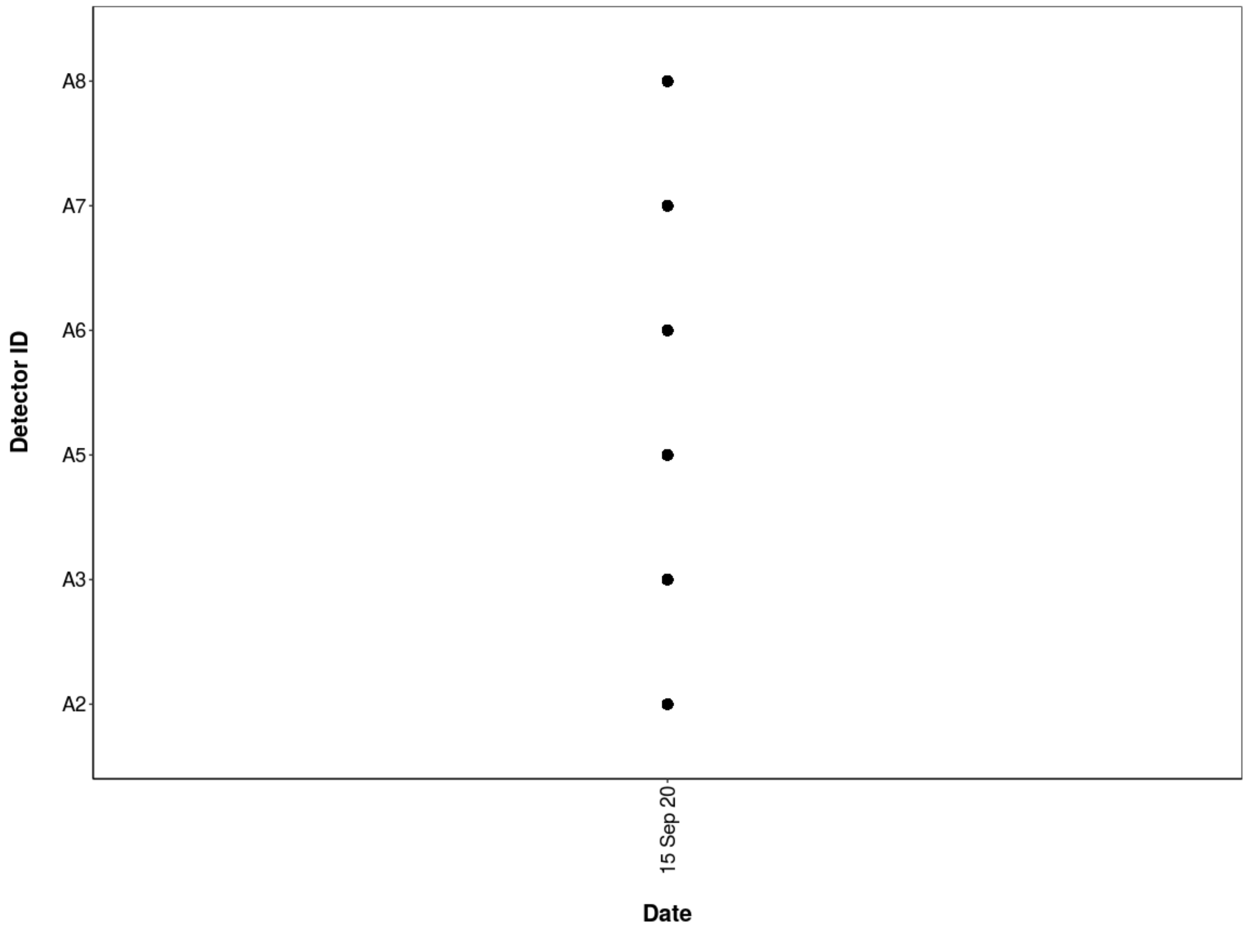
Survey Nights

Table 2. The number of nights that bats were detected on each recorder. This is not the same as the number of nights that detectors were active if there were nights when no bats were detected.

Detector ID	No. of nights
A2	17
A3	16
A5	17
A6	9
A7	9
A8	9

Survey Nights

Figure 1. Horizontal bars show nights when acoustic detectors recorded bats.



PART 1: Percentiles Analysis

This first part of the analysis looks at the relative activity levels of the bats you recorded. We take your value for the total bat passes each night for each species, and compare this to the values in our reference database. We tell you what percentile your data falls at, and therefore what the relative activity level is. For example, if the reference database has values of 5, 10, 15, 20 and you submit a value of 18, this will be the 80th percentile, and be classed as high activity.

The reference range dataset was stratified to include:

- Only records from within 30 days of the survey date.
- Only records from within 100km radius of the survey location.
- Records using any make of bat detector.

PER DETECTOR

Table 3. Summary table showing the number of nights recorded bat activity fell into each activity band for each species.

Detector ID	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
A2	*Myotis*	0	1	4	3	1
A2	*Myotis daubentonii*	0	0	2	6	4
A2	*Myotis mystacinus*	0	0	0	2	4
A2	*Myotis nattereri*	0	0	0	2	4
A2	*Nyctalus leisleri*	2	1	4	3	2
A2	*Pipistrellus*	9	2	0	0	0
A2	*Pipistrellus nathusii*	0	2	1	2	1
A2	*Pipistrellus pipistrellus*	11	0	2	0	1
A2	*Pipistrellus pygmaeus*	9	3	2	1	1
A2	*Plecotus auritus*	1	1	4	5	3
A3	*Myotis*	0	4	2	0	2
A3	*Myotis daubentonii*	0	0	2	5	4
A3	*Myotis mystacinus*	0	3	1	1	3
A3	*Myotis nattereri*	0	0	1	5	3
A3	*Nyctalus leisleri*	0	2	2	6	2
A3	*Pipistrellus*	6	1	0	0	0
A3	*Pipistrellus nathusii*	0	0	1	1	4
A3	*Pipistrellus pipistrellus*	7	2	2	2	1
A3	*Pipistrellus pygmaeus*	10	4	1	0	1
A3	*Plecotus auritus*	2	5	3	3	1

A5	*Myotis*	0	3	5	3	1
A5	*Myotis daubentonii*	0	0	0	4	6
A5	*Myotis mystacinus*	0	1	3	4	4
A5	*Myotis nattereri*	0	0	1	1	7
A5	*Nyctalus leisleri*	3	3	3	3	1
A5	*Pipistrellus*	9	0	0	0	0
A5	*Pipistrellus nathusii*	3	1	1	1	1
A5	*Pipistrellus pipistrellus*	13	1	1	1	1
A5	*Pipistrellus pygmaeus*	14	2	0	0	0
A5	*Plecotus auritus*	4	2	3	4	2
A6	*Myotis*	0	1	4	2	0
A6	*Myotis daubentonii*	0	0	2	0	2
A6	*Myotis mystacinus*	0	0	2	1	3
A6	*Myotis nattereri*	0	0	0	3	3
A6	*Nyctalus leisleri*	0	0	2	2	5
A6	*Pipistrellus*	3	1	0	0	0
A6	*Pipistrellus nathusii*	0	0	0	0	2
A6	*Pipistrellus pipistrellus*	3	2	3	1	0
A6	*Pipistrellus pygmaeus*	5	3	0	0	1
A6	*Plecotus auritus*	0	0	4	2	2
A7	*Myotis*	0	0	4	2	1
A7	*Myotis daubentonii*	0	0	1	3	3
A7	*Myotis mystacinus*	0	0	0	0	1
A7	*Myotis nattereri*	0	0	1	0	2
A7	*Nyctalus leisleri*	0	0	1	1	3
A7	*Pipistrellus*	3	0	0	0	0

A7	*Pipistrellus nathusii*	0	0	1	1	1
A7	*Pipistrellus pipistrellus*	2	1	3	0	2
A7	*Pipistrellus pygmaeus*	3	2	2	1	1
A7	*Plecotus auritus*	0	0	2	4	1
A8	*Myotis*	0	4	2	0	0
A8	*Myotis daubentonii*	0	0	1	4	2
A8	*Myotis mystacinus*	0	1	4	0	3
A8	*Myotis nattereri*	0	0	0	3	2
A8	*Nyctalus leisleri*	0	1	0	2	2
A8	*Pipistrellus*	7	0	0	0	0
A8	*Pipistrellus pipistrellus*	4	1	2	1	1
A8	*Pipistrellus pygmaeus*	9	0	0	0	0
A8	*Plecotus auritus*	0	2	3	3	1

Table 4. Summary table showing key metrics for each species recorded. The reference range is the number of nights for each species that your data were compared to. We recommend a Reference Range of 200+ to be confident in the relative activity level.

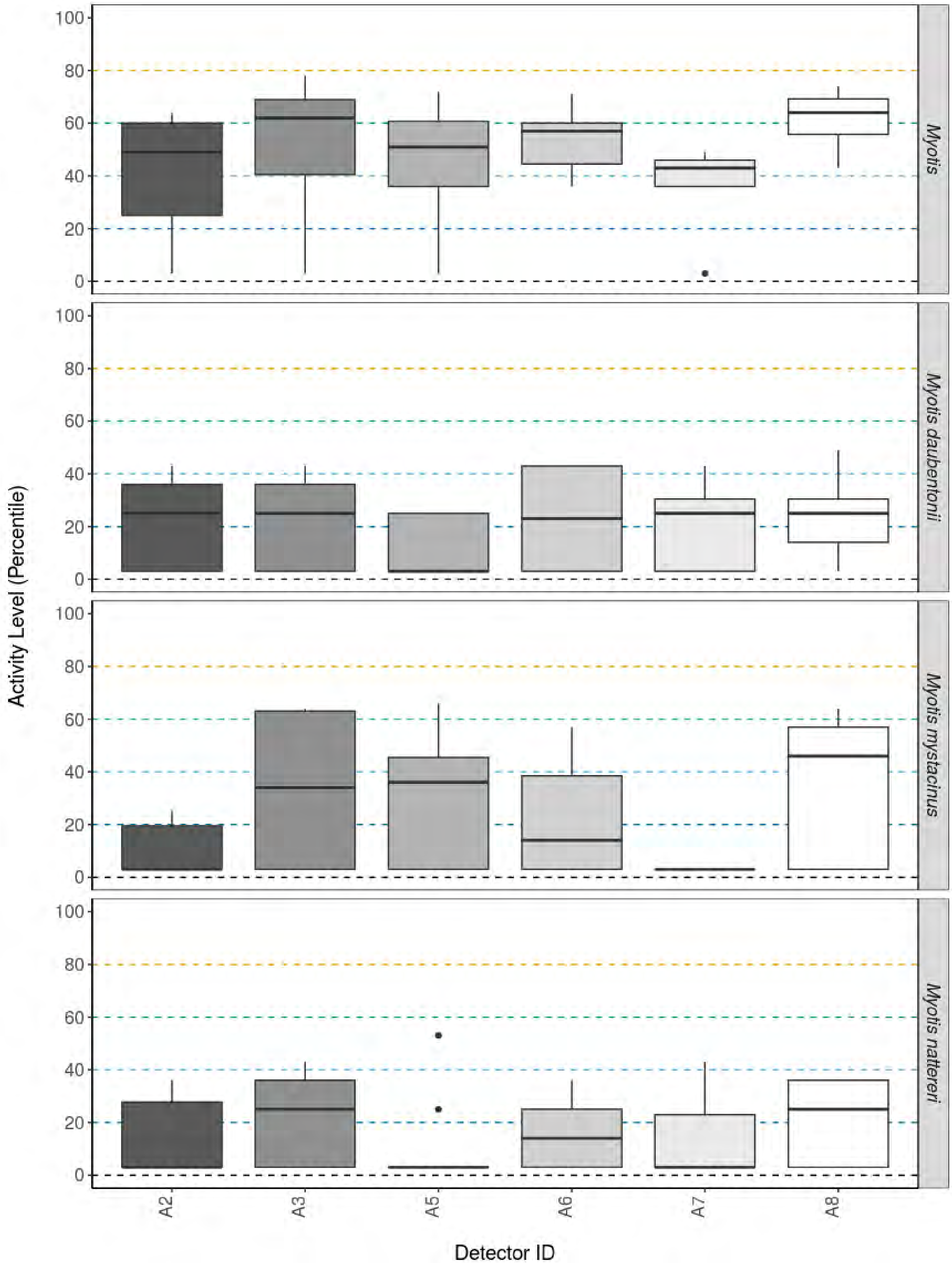
Detector ID	Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded	Reference Range
A2	*Myotis*	49	25 - 60	64	9	1232
A2	*Myotis daubentonii*	25	14 - 36	43	12	82
A2	*Myotis mystacinus*	3	3 - 14	25	6	58
A2	*Myotis nattereri*	3	3 - 19.5	36	6	84
A2	*Nyctalus leisleri*	43	25 - 62.5	88	12	1028
A2	*Pipistrellus*	96	81.5 - 98.5	100	11	1766
A2	*Pipistrellus nathusii*	47	19.5 - 64	64	6	88
A2	*Pipistrellus pipistrellus*	93	66 - 95.5	99	14	1669
A2	*Pipistrellus pygmaeus*	84	60 - 91	100	16	1485
A2	*Plecotus auritus*	36	19.5 - 51	90	14	842
A3	*Myotis*	62	28 - 72	78	8	1232
A3	*Myotis daubentonii*	25	14 - 34	43	11	82
A3	*Myotis mystacinus*	34	3 - 63	64	8	58
A3	*Myotis nattereri*	25	3 - 36	43	9	84
A3	*Nyctalus leisleri*	31	19.5 - 50	66	12	1028
A3	*Pipistrellus*	96	86.5 - 98.5	99	7	1766
A3	*Pipistrellus nathusii*	3	3 - 25	49	6	88

A3	*Pipistrellus pipistrellus*	78	48.5 - 88	98	14	1669
A3	*Pipistrellus pygmaeus*	89	70 - 91.5	98	16	1485
A3	*Plecotus auritus*	62	39 - 71	81	14	842
A5	*Myotis*	51	36 - 60.5	72	12	1232
A5	*Myotis daubentonii*	3	3 - 14	25	10	82
A5	*Myotis mystacinus*	36	19.5 - 44.5	66	12	58
A5	*Myotis nattereri*	3	3 - 14	53	9	84
A5	*Nyctalus leisleri*	53	37 - 74	88	13	1028
A5	*Pipistrellus*	98	95 - 99.5	100	9	1766
A5	*Pipistrellus nathusii*	78	19.5 - 89	93	7	88
A5	*Pipistrellus pipistrellus*	92	62.5 - 95.5	100	17	1669
A5	*Pipistrellus pygmaeus*	94	84.5 - 95	97	16	1485
A5	*Plecotus auritus*	43	26 - 67	96	15	842
A6	*Myotis*	57	44.5 - 64	71	7	1232
A6	*Myotis daubentonii*	23	3 - 43	43	4	82
A6	*Myotis mystacinus*	14	3 - 41	57	6	58
A6	*Myotis nattereri*	14	3 - 25	36	6	84
A6	*Nyctalus leisleri*	3	3 - 31.5	60	9	1028
A6	*Pipistrellus*	97	80 - 99	99	4	1766
A6	*Pipistrellus nathusii*	3	3 - 3	3	2	88
A6	*Pipistrellus pipistrellus*	70	53 - 86	96	9	1669

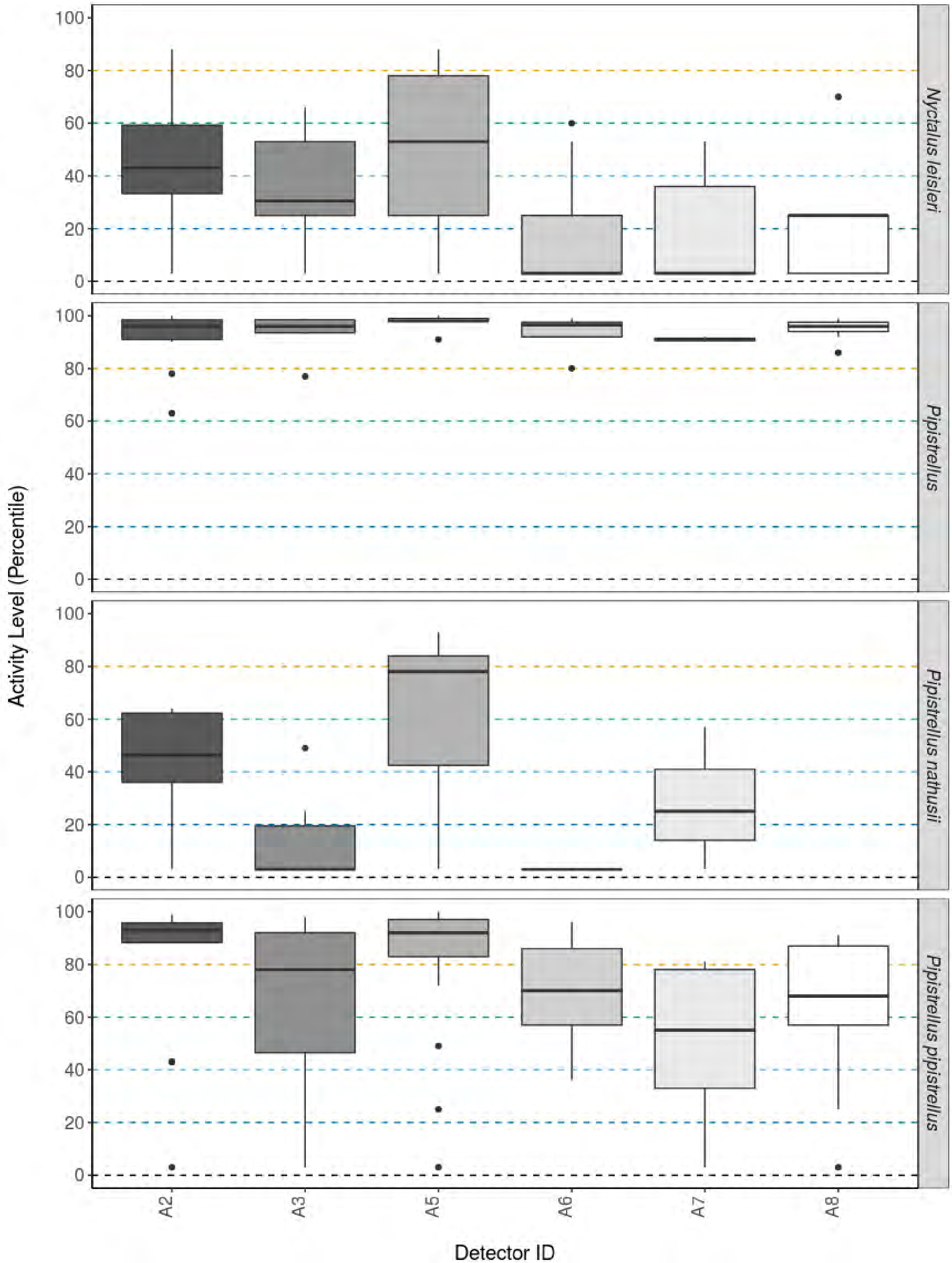
A6	*Pipistrellus pygmaeus*	84	43.5 - 92	98	9	1485
A6	*Plecotus auritus*	40	14 - 48	53	8	842
A7	*Myotis*	43	23 - 46	49	7	1232
A7	*Myotis daubentonii*	25	3 - 34	43	7	82
A7	*Myotis mystacinus*	3	0	3	1	58
A7	*Myotis nattereri*	3	3 - 3	43	3	84
A7	*Nyctalus leisleri*	3	3 - 28	53	5	1028
A7	*Pipistrellus*	91	90 - 92	92	3	1766
A7	*Pipistrellus nathusii*	25	3 - 57	57	3	88
A7	*Pipistrellus pipistrellus*	55	23 - 79	81	8	1669
A7	*Pipistrellus pygmaeus*	64	36 - 86	89	9	1485
A7	*Plecotus auritus*	36	19.5 - 43	49	7	842
A8	*Myotis*	64	53 - 71	74	6	1232
A8	*Myotis daubentonii*	25	14 - 37	49	7	82
A8	*Myotis mystacinus*	46	3 - 57	64	8	58
A8	*Myotis nattereri*	25	3 - 36	36	5	84
A8	*Nyctalus leisleri*	25	3 - 47.5	70	5	1028
A8	*Pipistrellus*	96	89 - 98.5	99	7	1766
A8	*Pipistrellus pipistrellus*	68	35.5 - 87.5	91	9	1669
A8	*Pipistrellus pygmaeus*	93	88 - 97	99	9	1485
A8	*Plecotus auritus*	43	23 - 53.5	64	9	842

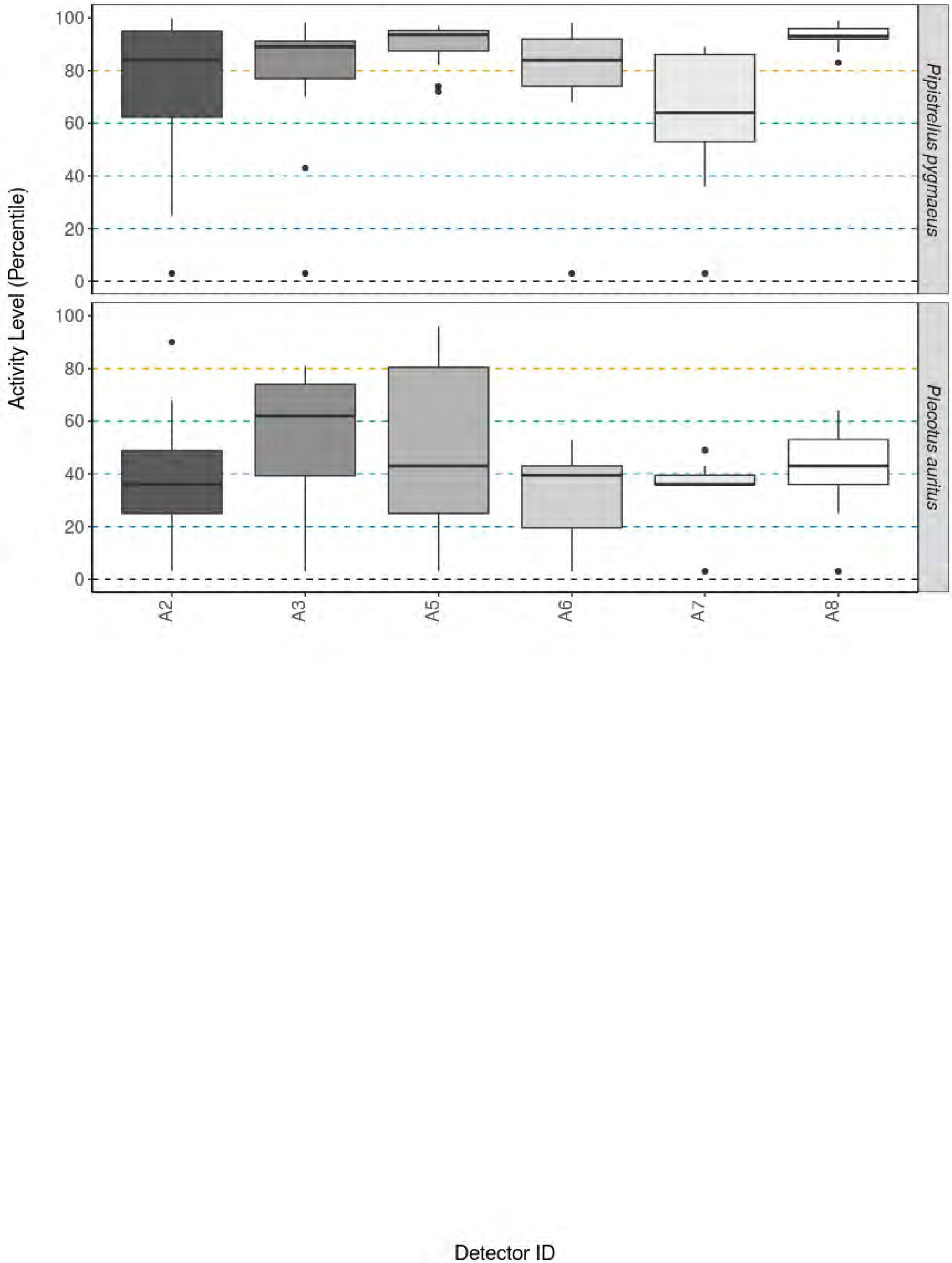
###Figures

Figure 2. The recorded activity of bats during the survey. The centre line indicates the median activity level whereas the box represents the interquartile range (the spread of the middle 50% of nights of activity)



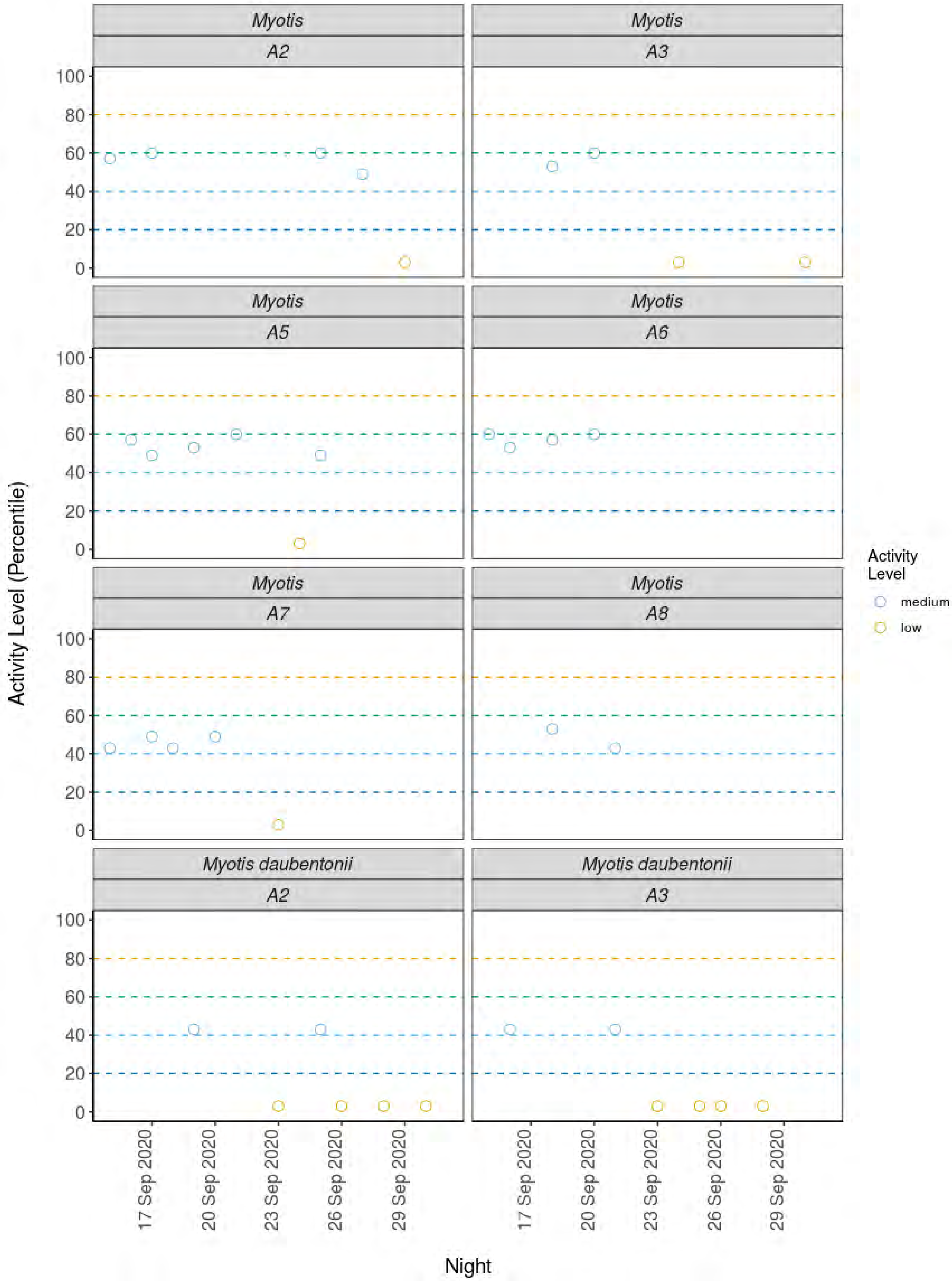
Activity Level (Percentile)
100
80
60
40
20
0
Myotis
Myotis daubentonii
Myotis mystacinus
Myotis nattereri
A2
A3
A5
A6
A7
A8
Detector ID

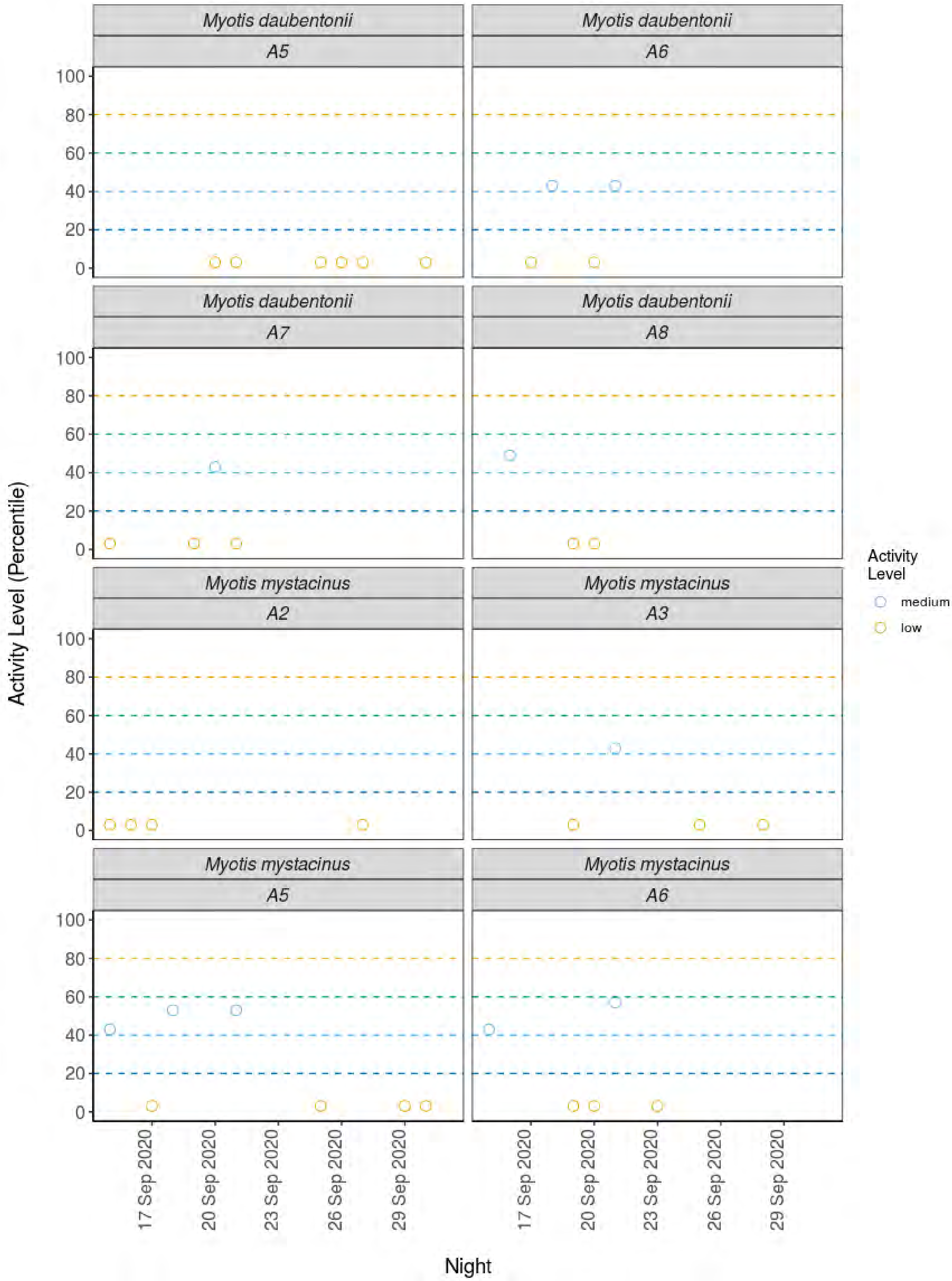

Activity Level (Percentile)
0
20
40
60
80
100
Nyctalus leisleri
Pipistrellus
Pipistrellus nathusii
Pipistrellus pipistrellus
A2
A3
A5
A6
A7
A8
Detector ID



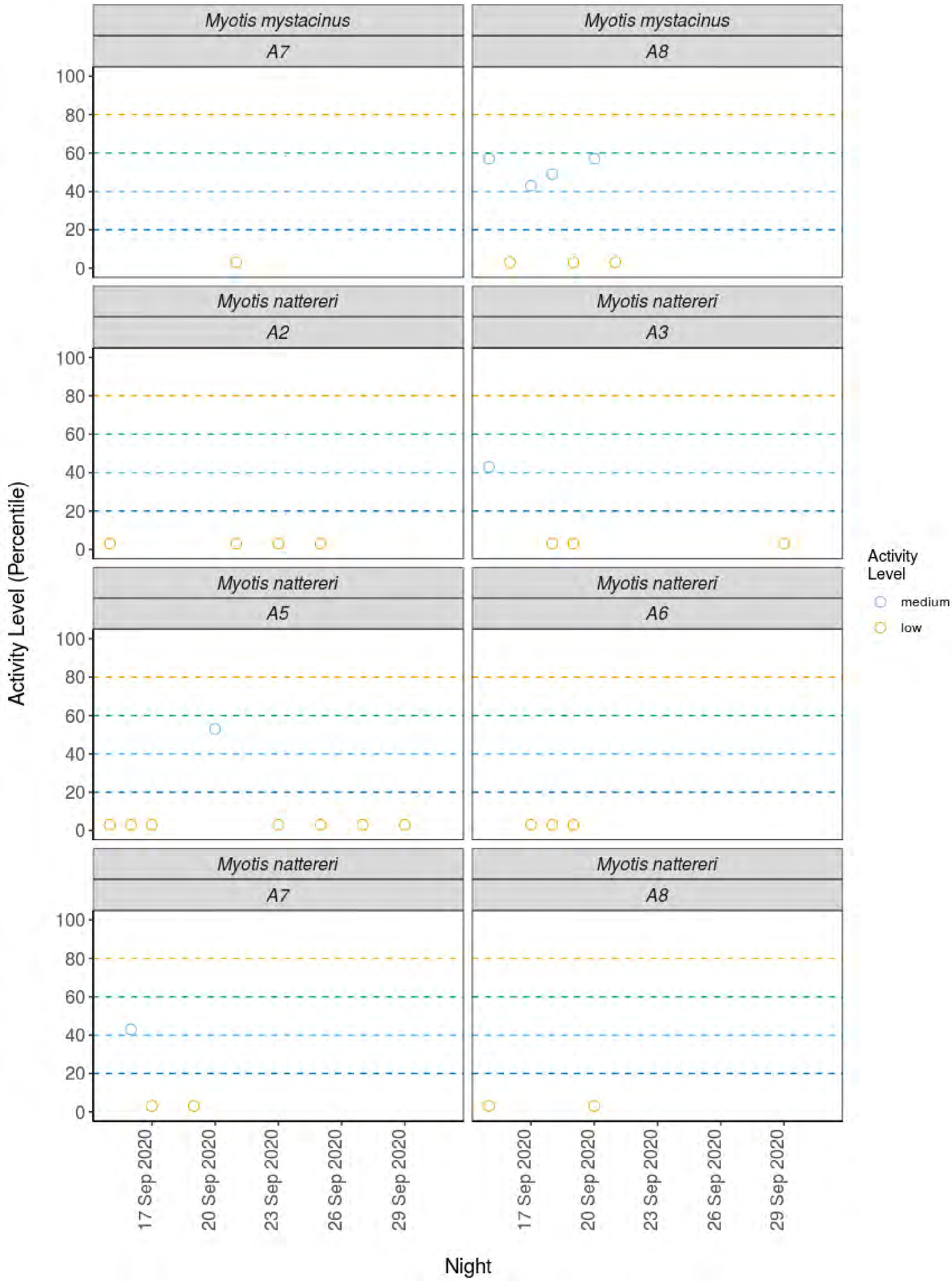
Activity Level (Percentile)
100
80
60
40
20
0
Pipistrellus pygmaeus
Plecotus auritus
A2
A3
A5
A6
A7
A8
Detector ID

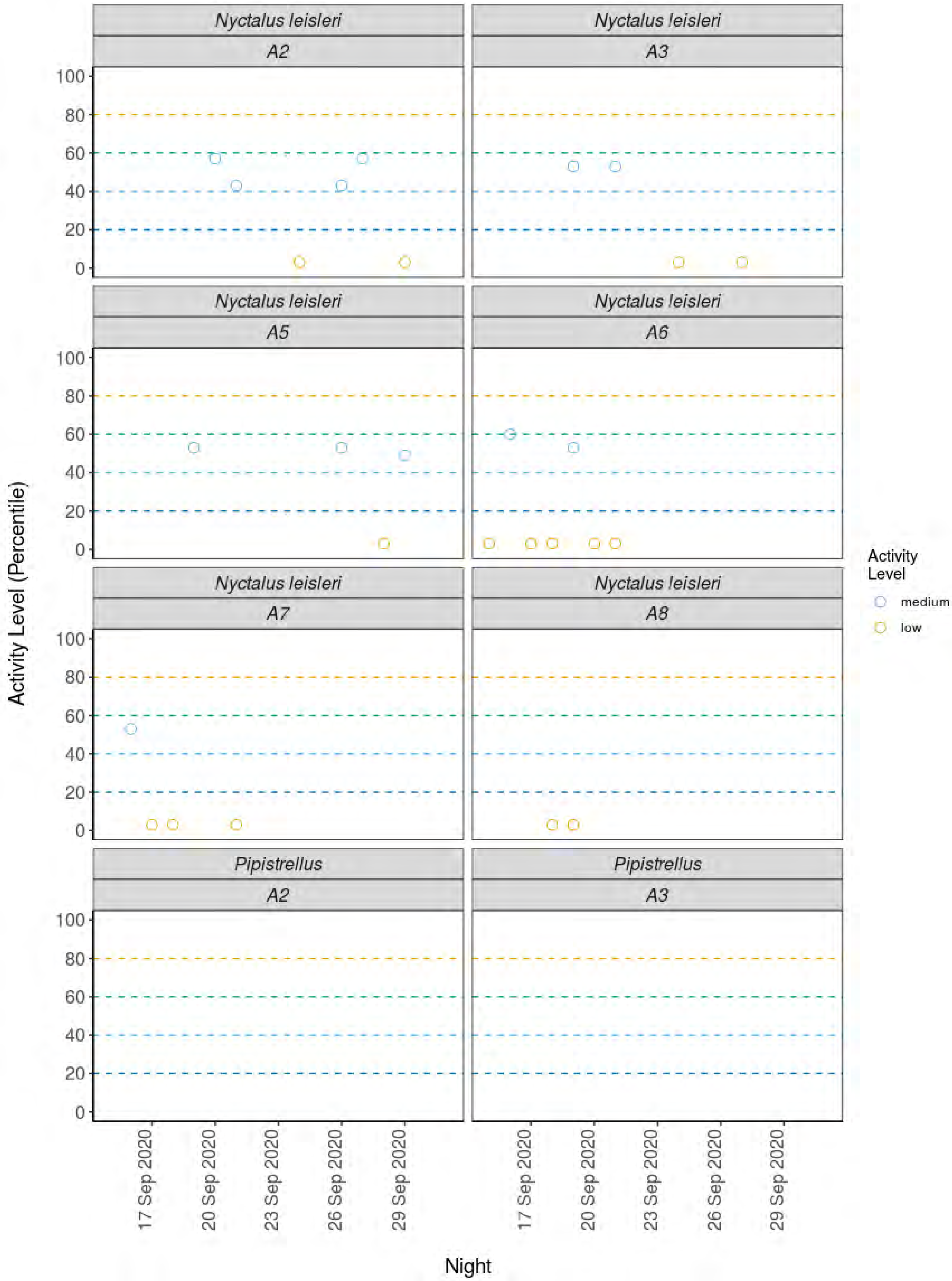
Figure 3. The activity level (percentile) of bats recorded across each night of the bat survey.

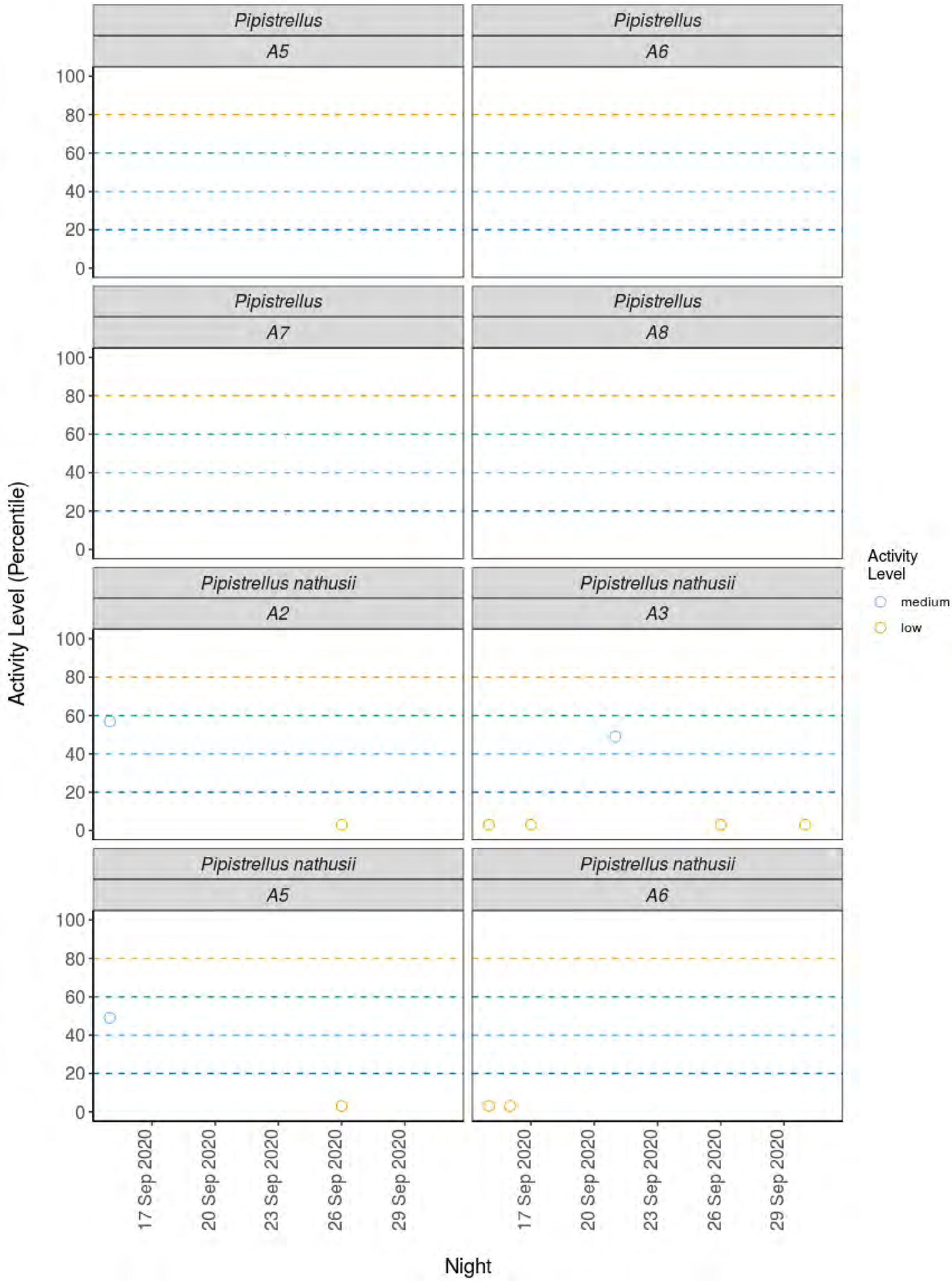

Myotis
A2
Myotis
A3
Myotis
A5
Myotis
A6
Myotis
A7
Myotis
A8
Myotis daubentonii
A2
Myotis daubentonii
A3
Activity Level (Percentile)
100
80
60
40
20
0
17 Sep 2020
20 Sep 2020
23 Sep 2020
26 Sep 2020
29 Sep 2020
Night
Activity Level
medium
low

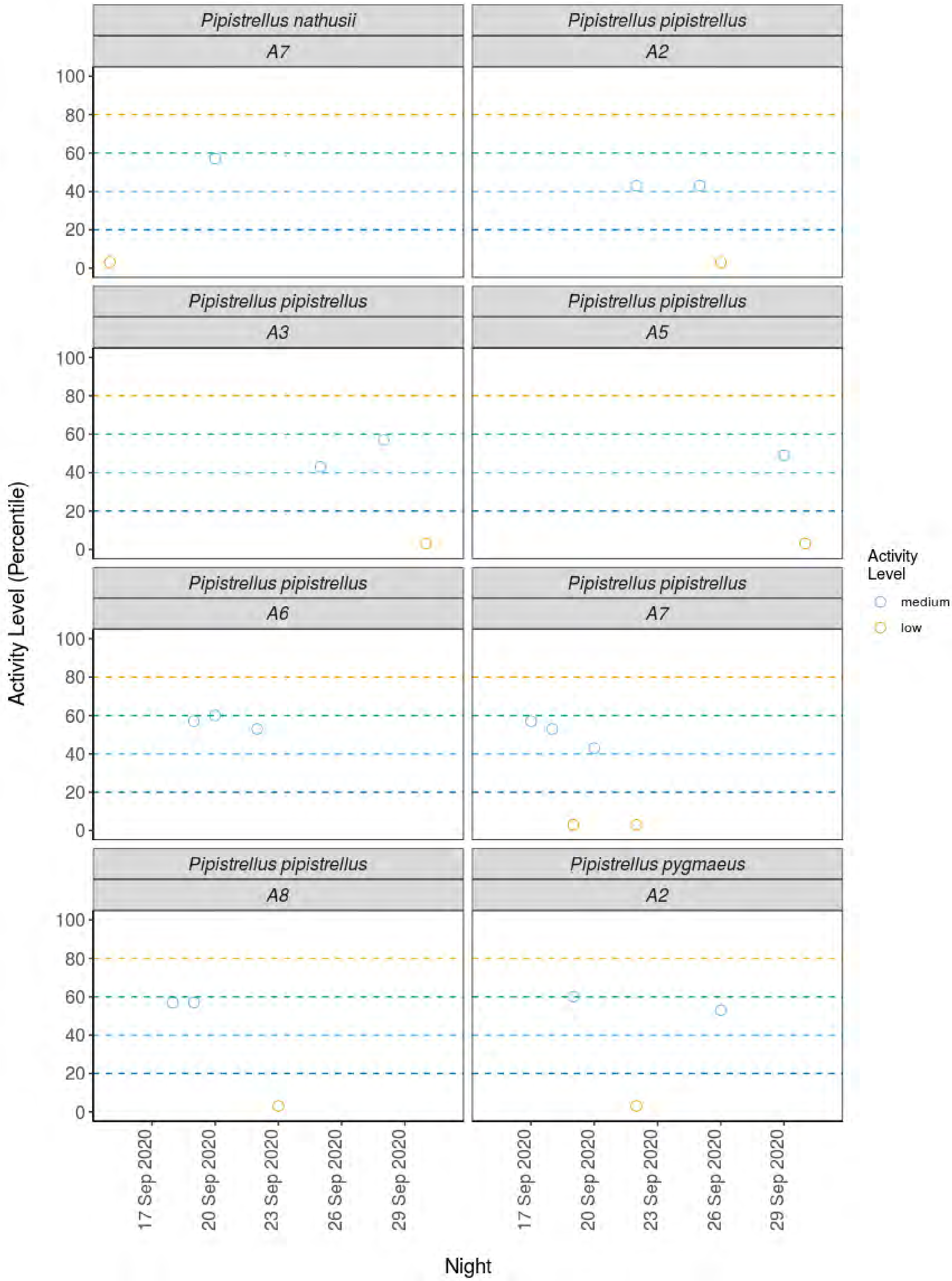


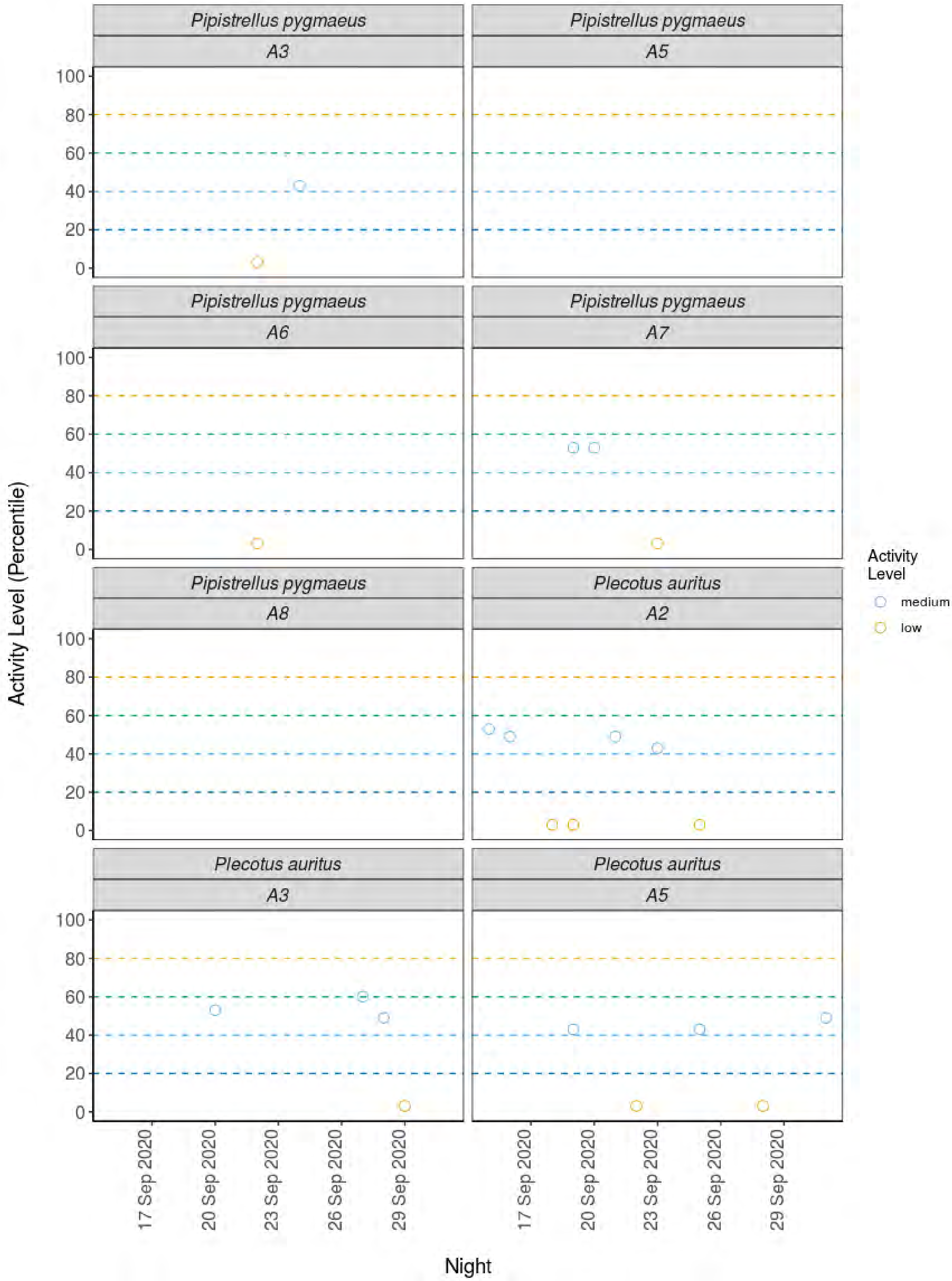
Myotis daubentonii
A5
Myotis daubentonii
A6
Myotis daubentonii
A7
Myotis daubentonii
A8
Myotis mystacinus
A2
Myotis mystacinus
A3
Myotis mystacinus
A5
Myotis mystacinus
A6
Activity Level (Percentile)
100
80
60
40
20
0
17 Sep 2020
20 Sep 2020
23 Sep 2020
26 Sep 2020
29 Sep 2020
Night
Activity Level
medium
low

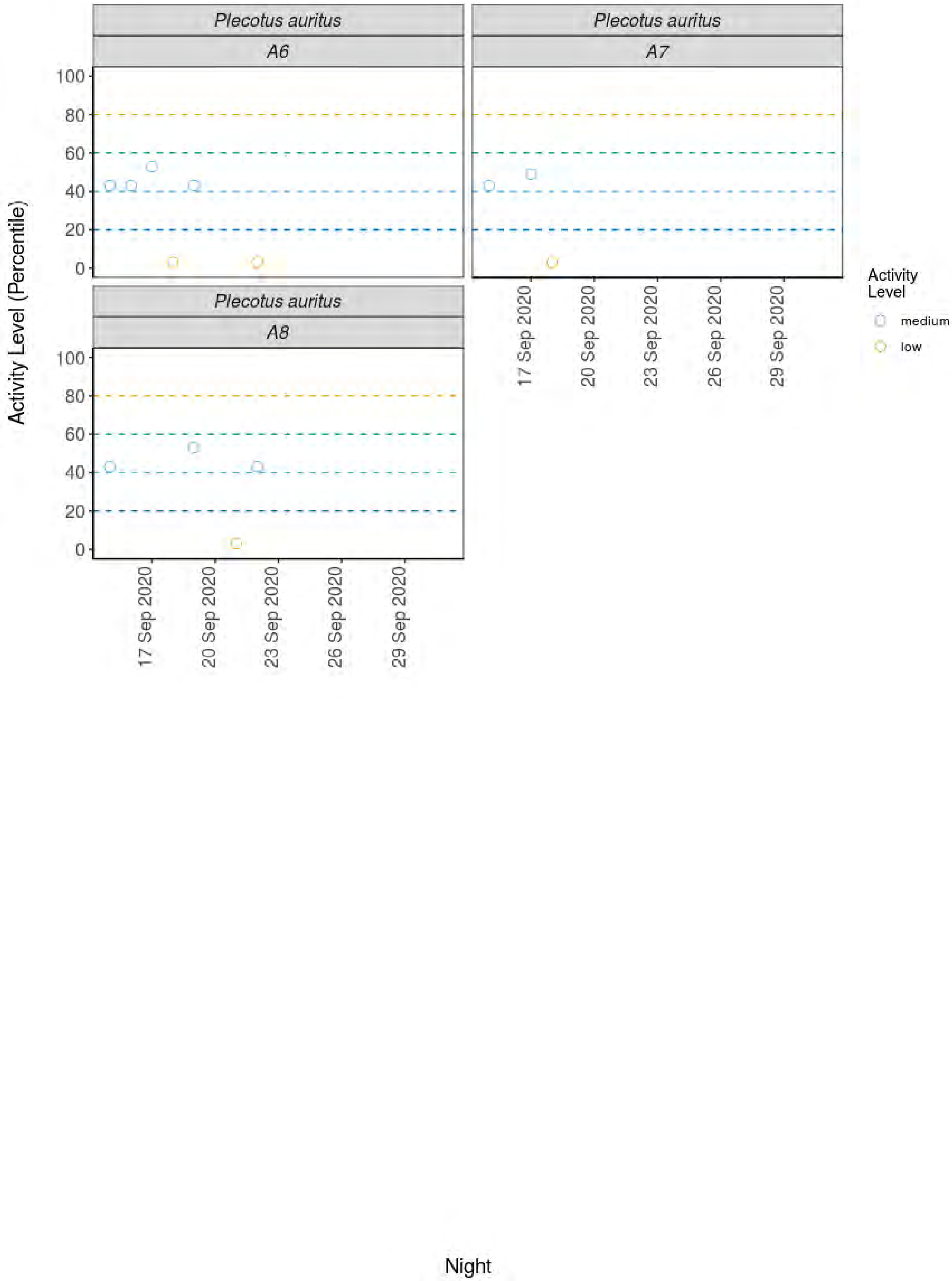

Myotis mystacinus
A7
Myotis mystacinus
A8
Myotis nattereri
A2
Myotis nattereri
A3
Myotis nattereri
A5
Myotis nattereri
A6
Myotis nattereri
A7
Myotis nattereri
A8
Activity Level (Percentile)
100
80
60
40
20
0
17 Sep 2020
20 Sep 2020
23 Sep 2020
26 Sep 2020
29 Sep 2020
Night
Activity Level
medium
low


Nyctalus leisleri
A2
Nyctalus leisleri
A3
Nyctalus leisleri
A5
Nyctalus leisleri
A6
Nyctalus leisleri
A7
Nyctalus leisleri
A8
Pipistrellus
A2
Pipistrellus
A3
Activity Level (Percentile)
100
80
60
40
20
0
17 Sep 2020
20 Sep 2020
23 Sep 2020
26 Sep 2020
29 Sep 2020
Night
Activity Level
medium
low


Pipistrellus
A5
Pipistrellus
A6
Pipistrellus
A7
Pipistrellus
A8
Pipistrellus nathusii
A2
Pipistrellus nathusii
A3
Pipistrellus nathusii
A5
Pipistrellus nathusii
A6
Activity Level (Percentile)
100
80
60
40
20
0
17 Sep 2020
20 Sep 2020
23 Sep 2020
26 Sep 2020
29 Sep 2020
Night
Activity Level
medium
low


Pipistrellus nathusii
A7
Pipistrellus pipistrellus
A2
Pipistrellus pipistrellus
A3
Pipistrellus pipistrellus
A5
Pipistrellus pipistrellus
A6
Pipistrellus pipistrellus
A7
Pipistrellus pipistrellus
A8
Pipistrellus pygmaeus
A2
Activity Level (Percentile)
0
20
40
60
80
100
17 Sep 2020
20 Sep 2020
23 Sep 2020
26 Sep 2020
29 Sep 2020
Night
Activity Level
medium
low


Pipistrellus pygmaeus
A3
Pipistrellus pygmaeus
A5
Pipistrellus pygmaeus
A6
Pipistrellus pygmaeus
A7
Pipistrellus pygmaeus
A8
Plecotus auritus
A2
Plecotus auritus
A3
Plecotus auritus
A5
100
80
60
40
20
0
Activity Level (Percentile)
17 Sep 2020
20 Sep 2020
23 Sep 2020
26 Sep 2020
29 Sep 2020
Night
Activity Level
medium
low



Plecotus auritus
A6
Plecotus auritus
A7
Plecotus auritus
A8
Activity Level (Percentile)
100
80
60
40
20
0
17 Sep 2020
20 Sep 2020
23 Sep 2020
26 Sep 2020
29 Sep 2020
Activity Level
medium
low
Night

PER DETECTOR, PER MONTH

Table 5. Summary table showing the number of nights recorded bat activity fell into each activity band for each species at each detector during each month.

Detector ID	Species/Species Group	Month	Nights of High Activity	Nights of Moderate / High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity
A2	*Myotis*	Sep	0	1	4	3	1
A2	*Myotis daubentonii*	Sep	0	0	2	6	4
A2	*Myotis mystacinus*	Sep	0	0	0	2	4
A2	*Myotis nattereri*	Sep	0	0	0	2	4
A2	*Nyctalus leisleri*	Sep	2	1	4	3	2
A2	*Pipistrellus*	Sep	9	2	0	0	0
A2	*Pipistrellus nathusii*	Sep	0	2	1	2	1
A2	*Pipistrellus pipistrellus*	Sep	11	0	2	0	1
A2	*Pipistrellus pygmaeus*	Sep	9	3	2	0	1
A2	*Pipistrellus pygmaeus*	Oct	0	0	0	1	0
A2	*Plecotus auritus*	Sep	1	1	4	5	3
A3	*Myotis*	Sep	0	4	2	0	2
A3	*Myotis daubentonii*	Sep	0	0	2	5	4
A3	*Myotis mystacinus*	Sep	0	3	1	1	3
A3	*Myotis nattereri*	Sep	0	0	1	5	3
A3	*Nyctalus leisleri*	Sep	0	2	2	6	2
A3	*Pipistrellus*	Sep	6	1	0	0	0
A3	*Pipistrellus nathusii*	Sep	0	0	1	1	4

A3	*Pipistrellus pipistrellus*	Sep	7	2	2	2	1
A3	*Pipistrellus pygmaeus*	Sep	10	4	1	0	1
A3	*Plecotus auritus*	Sep	2	5	3	3	1
A5	*Myotis*	Sep	0	3	5	3	1
A5	*Myotis daubentonii*	Sep	0	0	0	4	6
A5	*Myotis mystacinus*	Sep	0	1	3	4	4
A5	*Myotis nattereri*	Sep	0	0	1	1	7
A5	*Nyctalus leisleri*	Sep	3	3	3	3	1
A5	*Pipistrellus*	Sep	9	0	0	0	0
A5	*Pipistrellus nathusii*	Sep	3	1	1	1	1
A5	*Pipistrellus pipistrellus*	Sep	13	0	1	1	1
A5	*Pipistrellus pipistrellus*	Oct	0	1	0	0	0
A5	*Pipistrellus pygmaeus*	Sep	14	1	0	0	0
A5	*Pipistrellus pygmaeus*	Oct	0	1	0	0	0
A5	*Plecotus auritus*	Sep	4	2	2	4	2
A5	*Plecotus auritus*	Oct	0	0	1	0	0
A6	*Myotis*	Sep	0	1	4	2	0
A6	*Myotis daubentonii*	Sep	0	0	2	0	2
A6	*Myotis mystacinus*	Sep	0	0	2	1	3
A6	*Myotis nattereri*	Sep	0	0	0	3	3
A6	*Nyctalus leisleri*	Sep	0	0	2	2	5
A6	*Pipistrellus*	Sep	3	1	0	0	0
A6	*Pipistrellus nathusii*	Sep	0	0	0	0	2

A6	*Pipistrellus pipistrellus*	Sep	3	2	3	1	0
A6	*Pipistrellus pygmaeus*	Sep	5	3	0	0	1
A6	*Plecotus auritus*	Sep	0	0	4	2	2
A7	*Myotis*	Sep	0	0	4	2	1
A7	*Myotis daubentonii*	Sep	0	0	1	3	3
A7	*Myotis mystacinus*	Sep	0	0	0	0	1
A7	*Myotis nattereri*	Sep	0	0	1	0	2
A7	*Nyctalus leisleri*	Sep	0	0	1	1	3
A7	*Pipistrellus*	Sep	3	0	0	0	0
A7	*Pipistrellus nathusii*	Sep	0	0	1	1	1
A7	*Pipistrellus pipistrellus*	Sep	2	1	3	0	2
A7	*Pipistrellus pygmaeus*	Sep	3	2	2	1	1
A7	*Plecotus auritus*	Sep	0	0	2	4	1
A8	*Myotis*	Sep	0	4	2	0	0
A8	*Myotis daubentonii*	Sep	0	0	1	4	2
A8	*Myotis mystacinus*	Sep	0	1	4	0	3
A8	*Myotis nattereri*	Sep	0	0	0	3	2
A8	*Nyctalus leisleri*	Sep	0	1	0	2	2
A8	*Pipistrellus*	Sep	7	0	0	0	0
A8	*Pipistrellus pipistrellus*	Sep	4	1	2	1	1
A8	*Pipistrellus pygmaeus*	Sep	9	0	0	0	0
A8	*Plecotus auritus*	Sep	0	2	3	3	1

Table 6. Summary table showing key metrics for each species recorded per month. Please note that we cannot split the reference range by month, hence this column is not shown in this table.

Detector ID	Species/Species Group	Month	Median Percentile	95% CIs	Max Percentile	Nights Recorded
A2	*Myotis*	Sep	49	25 - 60	64	9
A2	*Myotis daubentonii*	Sep	25	14 - 36	43	12
A2	*Myotis mystacinus*	Sep	3	3 - 14	25	6
A2	*Myotis nattereri*	Sep	3	3 - 19.5	36	6
A2	*Nyctalus leisleri*	Sep	43	25 - 62.5	88	12
A2	*Pipistrellus*	Sep	96	81.5 - 98.5	100	11
A2	*Pipistrellus nathusii*	Sep	47	19.5 - 64	64	6
A2	*Pipistrellus pipistrellus*	Sep	93	66 - 95.5	99	14
A2	*Pipistrellus pygmaeus*	Sep	86	60 - 91	100	15
A2	*Pipistrellus pygmaeus*	Oct	25	60 - 91	25	1
A2	*Plecotus auritus*	Sep	36	19.5 - 51	90	14
A3	*Myotis*	Sep	62	28 - 72	78	8
A3	*Myotis daubentonii*	Sep	25	14 - 34	43	11
A3	*Myotis mystacinus*	Sep	34	3 - 63	64	8
A3	*Myotis nattereri*	Sep	25	3 - 36	43	9
A3	*Nyctalus leisleri*	Sep	31	19.5 - 50	66	12
A3	*Pipistrellus*	Sep	96	86.5 - 98.5	99	7
A3	*Pipistrellus nathusii*	Sep	3	3 - 25	49	6

A3	*Pipistrellus pipistrellus*	Sep	78	48.5 - 88	98	14
A3	*Pipistrellus pygmaeus*	Sep	89	70 - 91.5	98	16
A3	*Plecotus auritus*	Sep	62	39 - 71	81	14
A5	*Myotis*	Sep	51	36 - 60.5	72	12
A5	*Myotis daubentonii*	Sep	3	3 - 14	25	10
A5	*Myotis mystacinus*	Sep	36	19.5 - 44.5	66	12
A5	*Myotis nattereri*	Sep	3	3 - 14	53	9
A5	*Nyctalus leisleri*	Sep	53	37 - 74	88	13
A5	*Pipistrellus*	Sep	98	95 - 99.5	100	9
A5	*Pipistrellus nathusii*	Sep	78	19.5 - 89	93	7
A5	*Pipistrellus pipistrellus*	Sep	93	62.5 - 95.5	100	16
A5	*Pipistrellus pipistrellus*	Oct	72	62.5 - 95.5	72	1
A5	*Pipistrellus pygmaeus*	Sep	94	84.5 - 95	97	15
A5	*Pipistrellus pygmaeus*	Oct	72	84.5 - 95	72	1
A5	*Plecotus auritus*	Sep	43	26 - 67	96	14
A5	*Plecotus auritus*	Oct	49	26 - 67	49	1
A6	*Myotis*	Sep	57	44.5 - 64	71	7
A6	*Myotis daubentonii*	Sep	23	3 - 43	43	4
A6	*Myotis mystacinus*	Sep	14	3 - 41	57	6
A6	*Myotis nattereri*	Sep	14	3 - 25	36	6
A6	*Nyctalus leisleri*	Sep	3	3 - 31.5	60	9

A6	*Pipistrellus*	Sep	97	80 - 99	99	4
A6	*Pipistrellus nathusii*	Sep	3	3 - 3	3	2
A6	*Pipistrellus pipistrellus*	Sep	70	53 - 86	96	9
A6	*Pipistrellus pygmaeus*	Sep	84	43.5 - 92	98	9
A6	*Plecotus auritus*	Sep	40	14 - 48	53	8
A7	*Myotis*	Sep	43	23 - 46	49	7
A7	*Myotis daubentonii*	Sep	25	3 - 34	43	7
A7	*Myotis mystacinus*	Sep	3	0	3	1
A7	*Myotis nattereri*	Sep	3	3 - 3	43	3
A7	*Nyctalus leisleri*	Sep	3	3 - 28	53	5
A7	*Pipistrellus*	Sep	91	90 - 92	92	3
A7	*Pipistrellus nathusii*	Sep	25	3 - 57	57	3
A7	*Pipistrellus pipistrellus*	Sep	55	23 - 79	81	8
A7	*Pipistrellus pygmaeus*	Sep	64	36 - 86	89	9
A7	*Plecotus auritus*	Sep	36	19.5 - 43	49	7
A8	*Myotis*	Sep	64	53 - 71	74	6
A8	*Myotis daubentonii*	Sep	25	14 - 37	49	7
A8	*Myotis mystacinus*	Sep	46	3 - 57	64	8
A8	*Myotis nattereri*	Sep	25	3 - 36	36	5
A8	*Nyctalus leisleri*	Sep	25	3 - 47.5	70	5
A8	*Pipistrellus*	Sep	96	89 - 98.5	99	7
A8	*Pipistrellus pipistrellus*	Sep	68	35.5 - 87.5	91	9

A8	*Pipistrellus pygmaeus*	Sep	93	88 - 97	99	9
A8	*Plecotus auritus*	Sep	43	23 - 53.5	64	9

PER SITE

In this 'Per Site' section of the analysis, all values are taken from across all of the detectors to provide site-wide averages/medians.

Table 7. Summary table showing the number of nights recorded bat activity fell into each activity band for each species.

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
Myotis	0	13	21	10	5
Myotis daubentonii	0	0	8	22	21
Myotis mystacinus	0	5	10	8	18
Myotis nattereri	0	0	3	14	21
Nyctalus leisleri	5	7	12	17	15
Pipistrellus	37	4	0	0	0
Pipistrellus nathusii	3	3	4	5	9
Pipistrellus pipistrellus	40	7	13	5	6
Pipistrellus pygmaeus	50	14	5	2	4
Plecotus auritus	7	10	19	21	10

Table 8. Summary table showing key metrics for each species recorded.

Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded
Myotis	53	53 - 71	78	49
Myotis daubentonii	25	3 - 43	49	51
Myotis mystacinus	25	3 - 63	66	41
Myotis nattereri	3	3 - 36	53	38
Nyctalus leisleri	36	37 - 74	88	56
Pipistrellus	97	95 - 99.5	100	41
Pipistrellus nathusii	36	3 - 57	93	24
Pipistrellus pipistrellus	84	66 - 95.5	100	71
Pipistrellus pygmaeus	89	88 - 97	100	75
Plecotus auritus	43	39 - 71	96	67

###Figures

Figure 4. The activity level (percentile) of bats recorded across each night of the bat survey for the **entire site**.

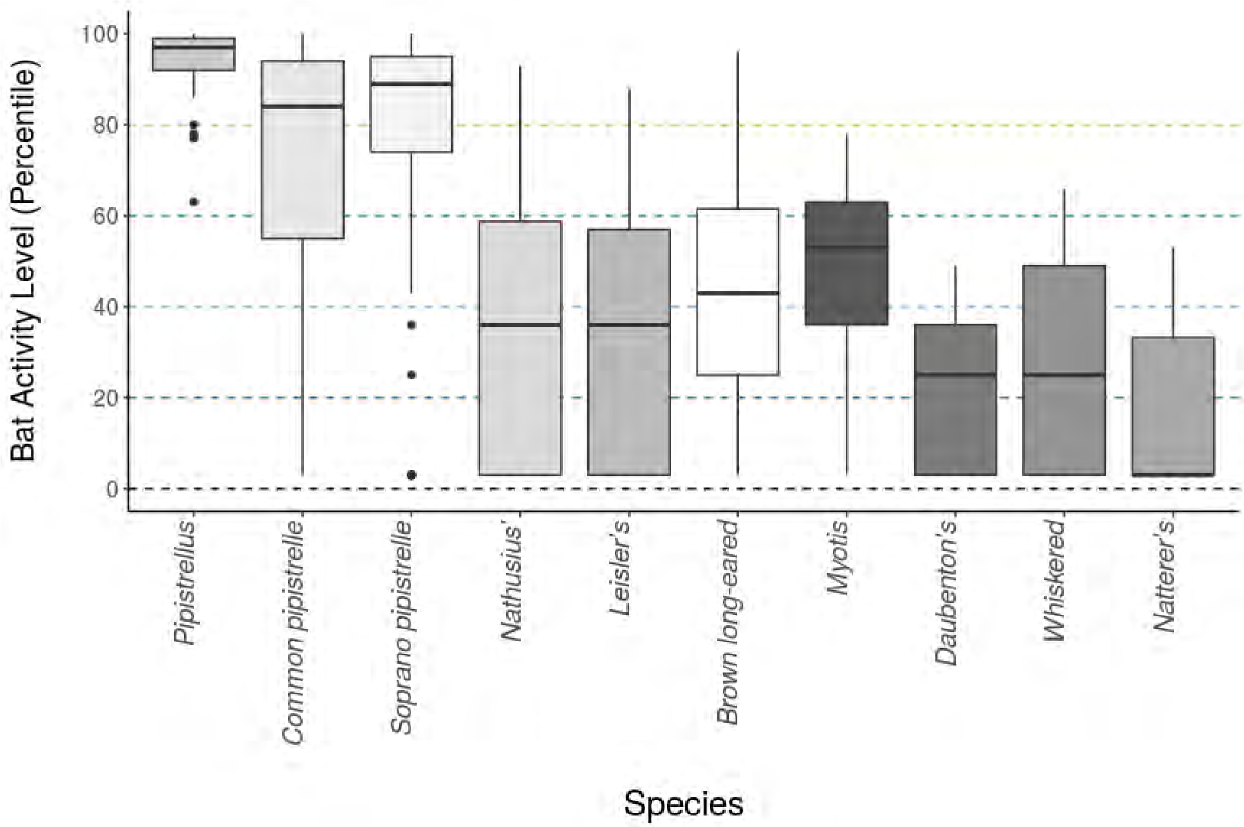
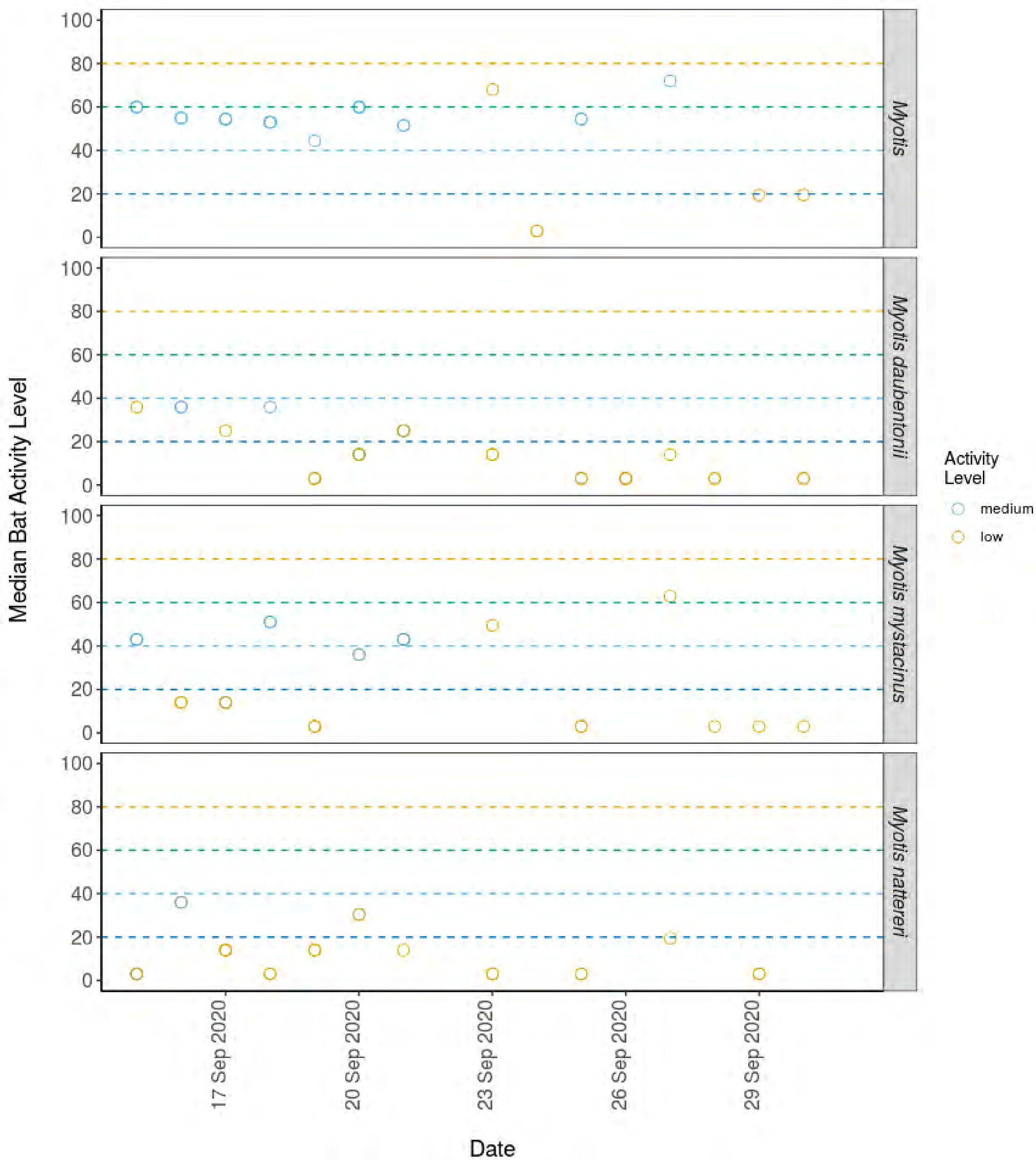
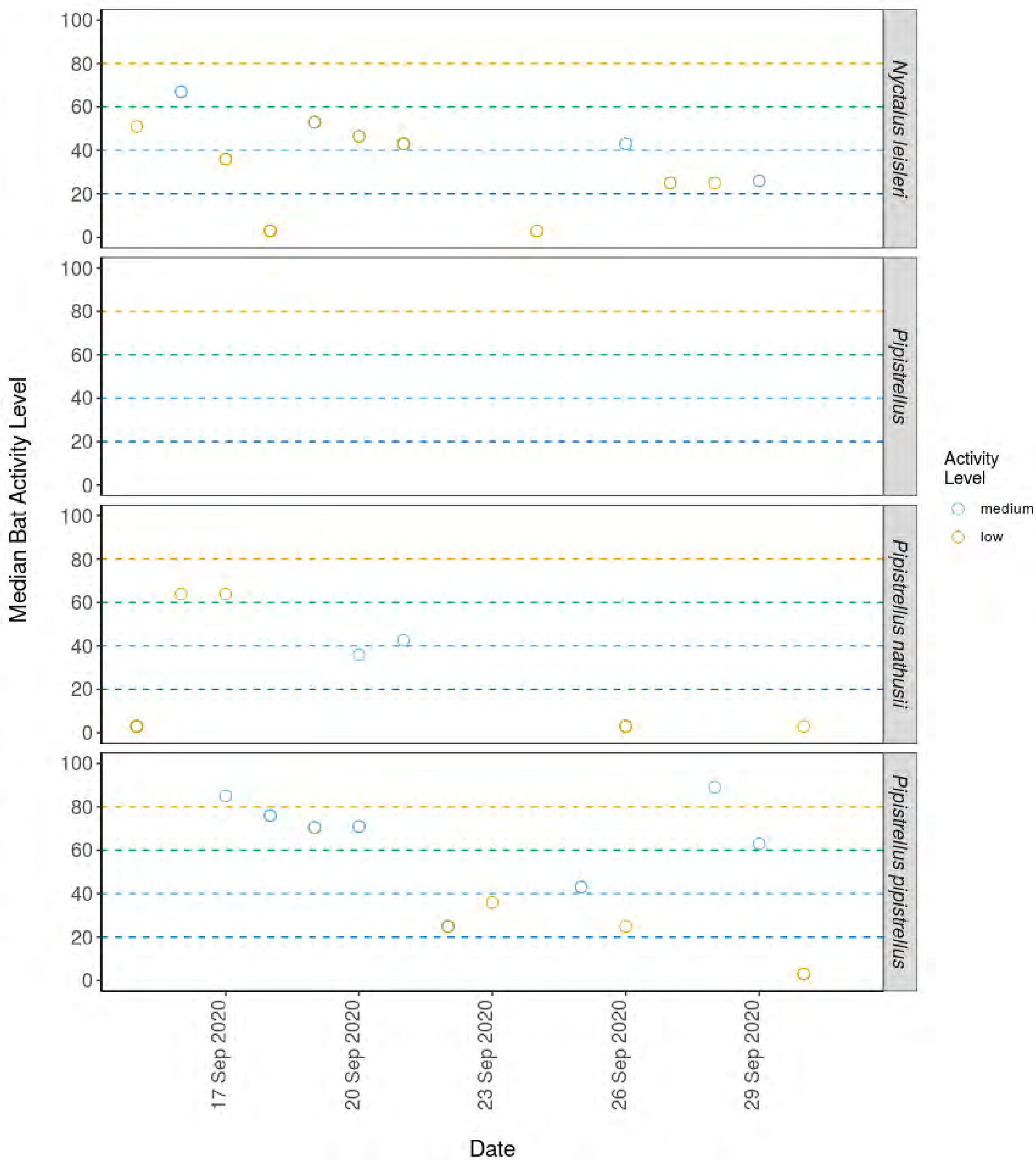


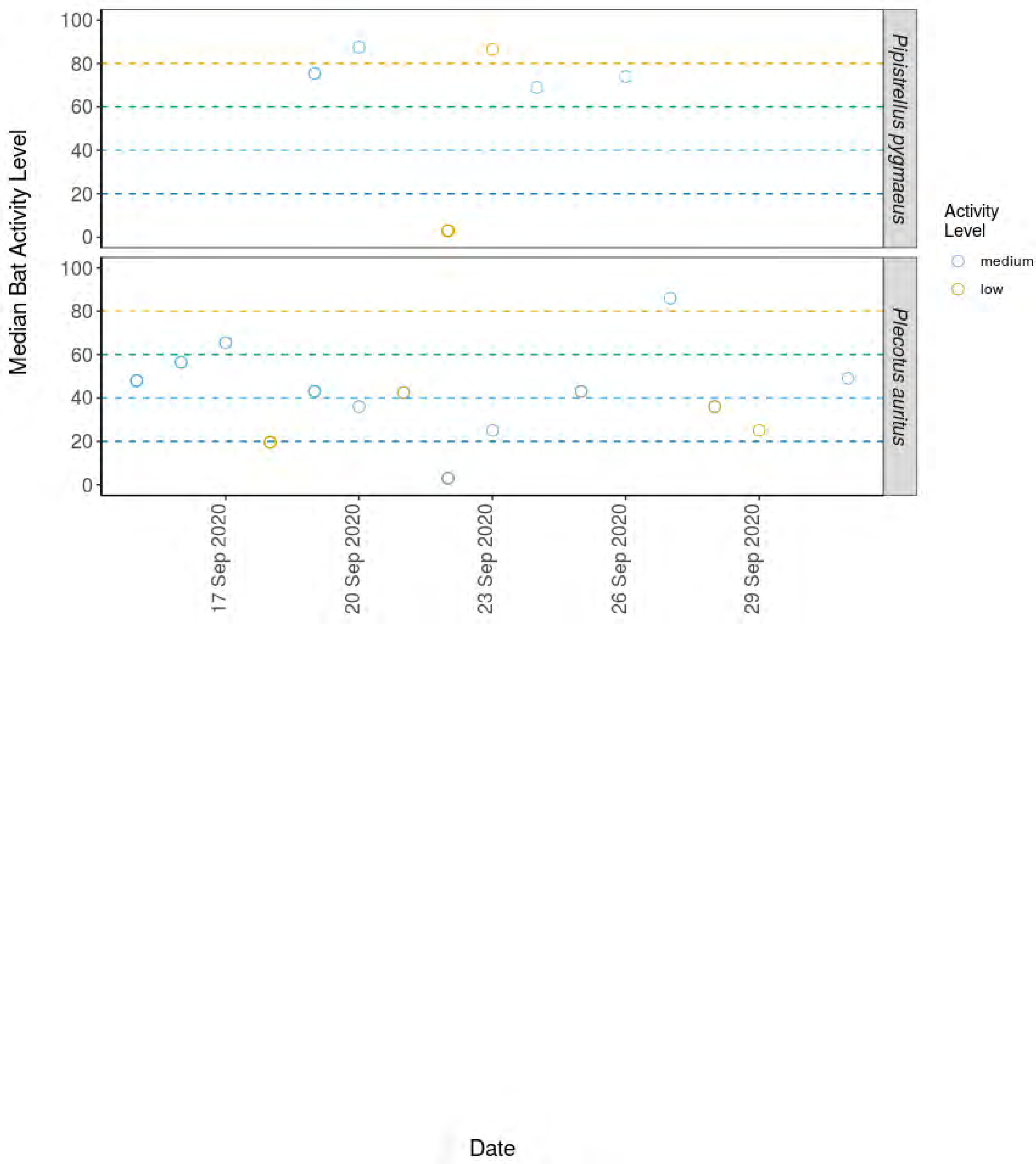
Figure 5. The median activity levels of bats recorded across all detectors each night.



Median Bat Activity Level
Myotis
Myotis daubentonii
Myotis mystacinus
Myotis nattereri
100
80
60
40
20
0
17 Sep 2020
20 Sep 2020
23 Sep 2020
26 Sep 2020
29 Sep 2020
Date
Activity Level
medium
low



Median Bat Activity Level
100
80
60
40
20
0
Nyctalus leisleri
Pipistrellus
Pipistrellus nathusii
Pipistrellus pipistrellus
17 Sep 2020
20 Sep 2020
23 Sep 2020
26 Sep 2020
29 Sep 2020
Date
Activity Level
medium
low



Median Bat Activity Level
100
80
60
40
20
0
Pipistrellus pygmaeus
Plecotus auritus
17 Sep 2020
20 Sep 2020
23 Sep 2020
26 Sep 2020
29 Sep 2020
Activity Level
medium
low
Date

PER SITE, PER MONTH

Table 9. Summary table showing the number of nights recorded bat activity fell into each activity band for each species during each month.

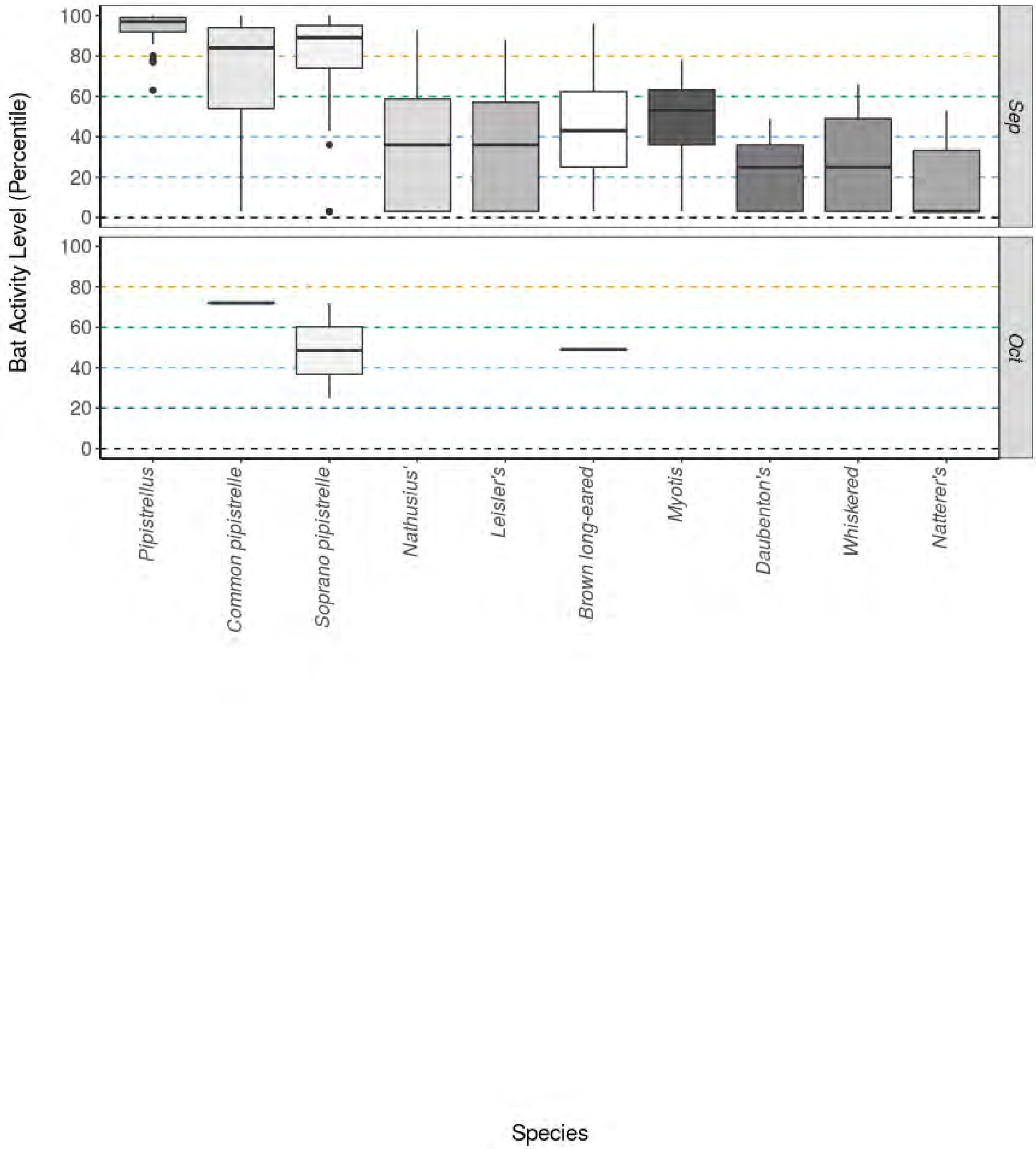
Species/Species Group	Month	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity
Myotis	Sep	0	13	21	10	5
Myotis daubentonii	Sep	0	0	8	22	21
Myotis mystacinus	Sep	0	5	10	8	18
Myotis nattereri	Sep	0	0	3	14	21
Nyctalus leisleri	Sep	5	7	12	17	15
Pipistrellus	Sep	37	4	0	0	0
Pipistrellus nathusii	Sep	3	3	4	5	9
Pipistrellus pipistrellus	Sep	40	6	13	5	6
Pipistrellus pipistrellus	Oct	0	1	0	0	0
Pipistrellus pygmaeus	Sep	50	13	5	1	4
Pipistrellus pygmaeus	Oct	0	1	0	1	0
Plecotus auritus	Sep	7	10	18	21	10
Plecotus auritus	Oct	0	0	1	0	0

Table 10. Summary table showing key metrics for each species recorded per month.

Species/Species Group	Month	Median Percentile	95% CIs	Max Percentile	Nights Recorded
Myotis	Sep	53	53 - 71	78	49
Myotis daubentonii	Sep	25	3 - 43	49	51
Myotis mystacinus	Sep	25	3 - 63	66	41
Myotis nattereri	Sep	3	3 - 36	53	38
Nyctalus leisleri	Sep	36	37 - 74	88	56
Pipistrellus	Sep	97	95 - 99.5	100	41
Pipistrellus nathusii	Sep	36	3 - 57	93	24
Pipistrellus pipistrellus	Sep	84	66 - 95.5	100	70
Pipistrellus pipistrellus	Oct	72	62.5 - 95.5	72	1
Pipistrellus pygmaeus	Sep	89	88 - 97	100	73
Pipistrellus pygmaeus	Oct	49	84.5 - 95	72	2
Plecotus auritus	Sep	43	39 - 71	96	66
Plecotus auritus	Oct	49	26 - 67	49	1

###Figures

Figure 6. The activity level (percentile) of bats recorded across each night of the bat survey for the entire site, split between months.



PART 2: Nightly Analysis

ENTIRE SURVEY PERIOD

Sunrise and Sunset Times

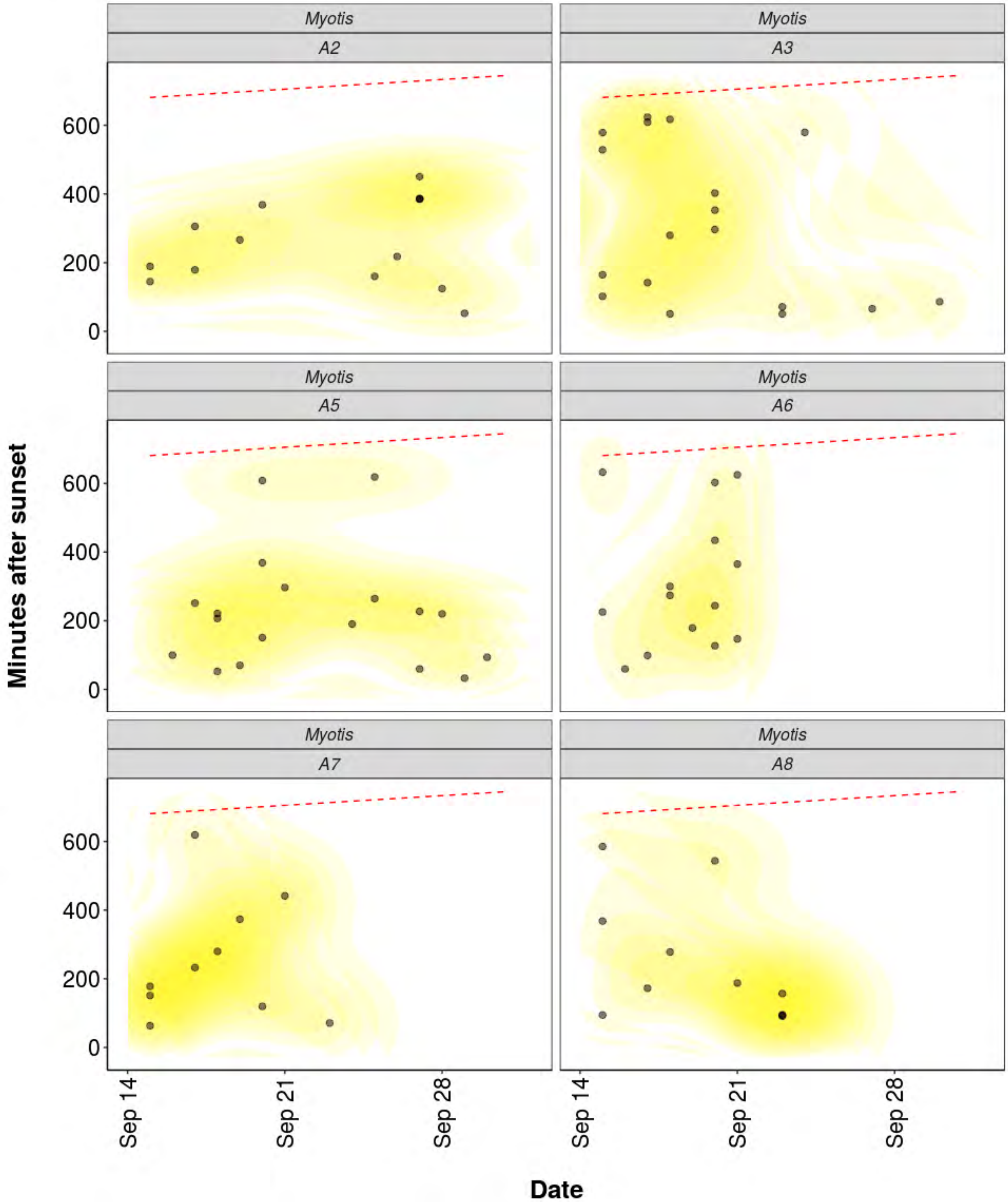
Table 11. The times of sunset and sunrise the following morning for surveys beginning on the date shown.

Night (y-m-d)	Sunset (hh:mm)	Sunrise (hh:mm)	Night Length (hours)
2020-09-15	19:51	07:12	11.3
2020-09-16	19:49	07:14	11.4
2020-09-17	19:46	07:16	11.5
2020-09-18	19:44	07:17	11.6
2020-09-19	19:42	07:19	11.6
2020-09-20	19:39	07:20	11.7
2020-09-21	19:37	07:22	11.8
2020-09-22	19:35	07:24	11.8
2020-09-23	19:32	07:25	11.9
2020-09-24	19:30	07:27	12.0
2020-09-25	19:27	07:29	12.0
2020-09-26	19:25	07:30	12.1
2020-09-27	19:23	07:32	12.2
2020-09-28	19:20	07:34	12.2
2020-09-29	19:18	07:35	12.3
2020-09-30	19:16	07:37	12.4
2020-10-01	19:13	07:39	12.4

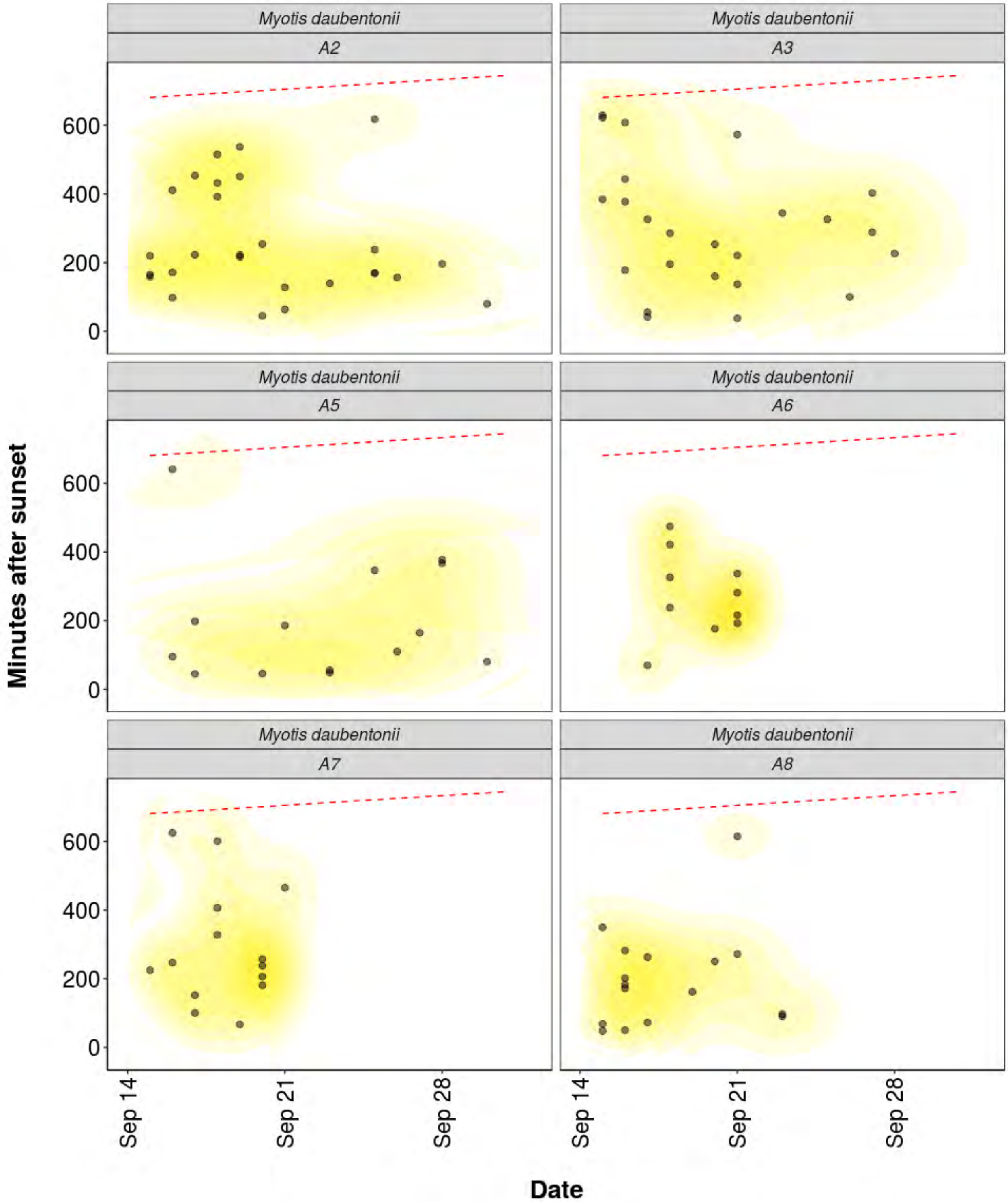
Distribution of Bat Activity Across the Night through Time

Per Detector

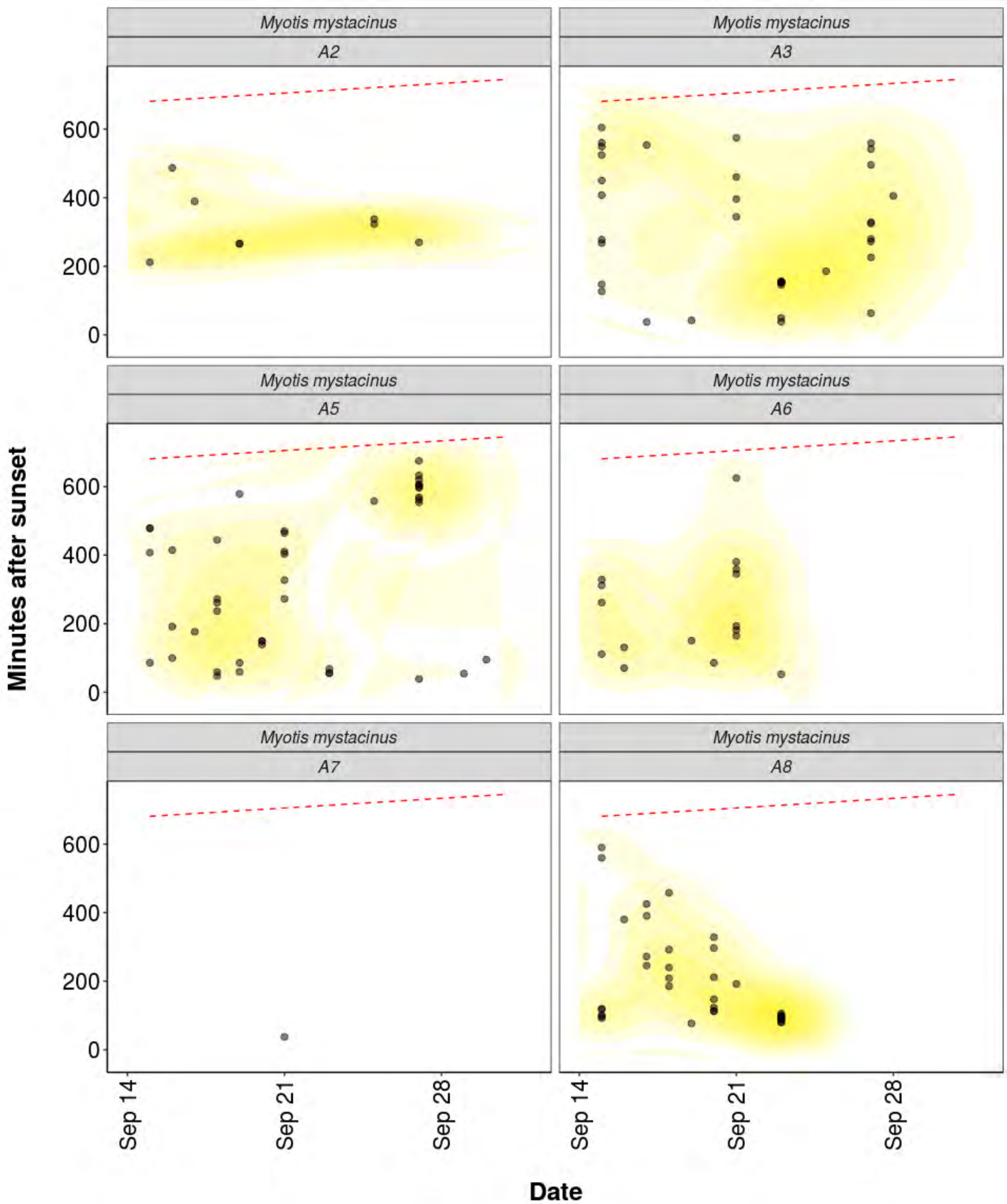
Figure 7. Timing of bat calls plotted as minutes before/after sunset, whereby 0 on the y axis represents sunset. Sunrise throughout the survey period is depicted as the red dashed line. Colours indicate kernel densities, with darkest colours showing peaks of activity. These colours are comparative only within each plot, and do not account for overall activity.



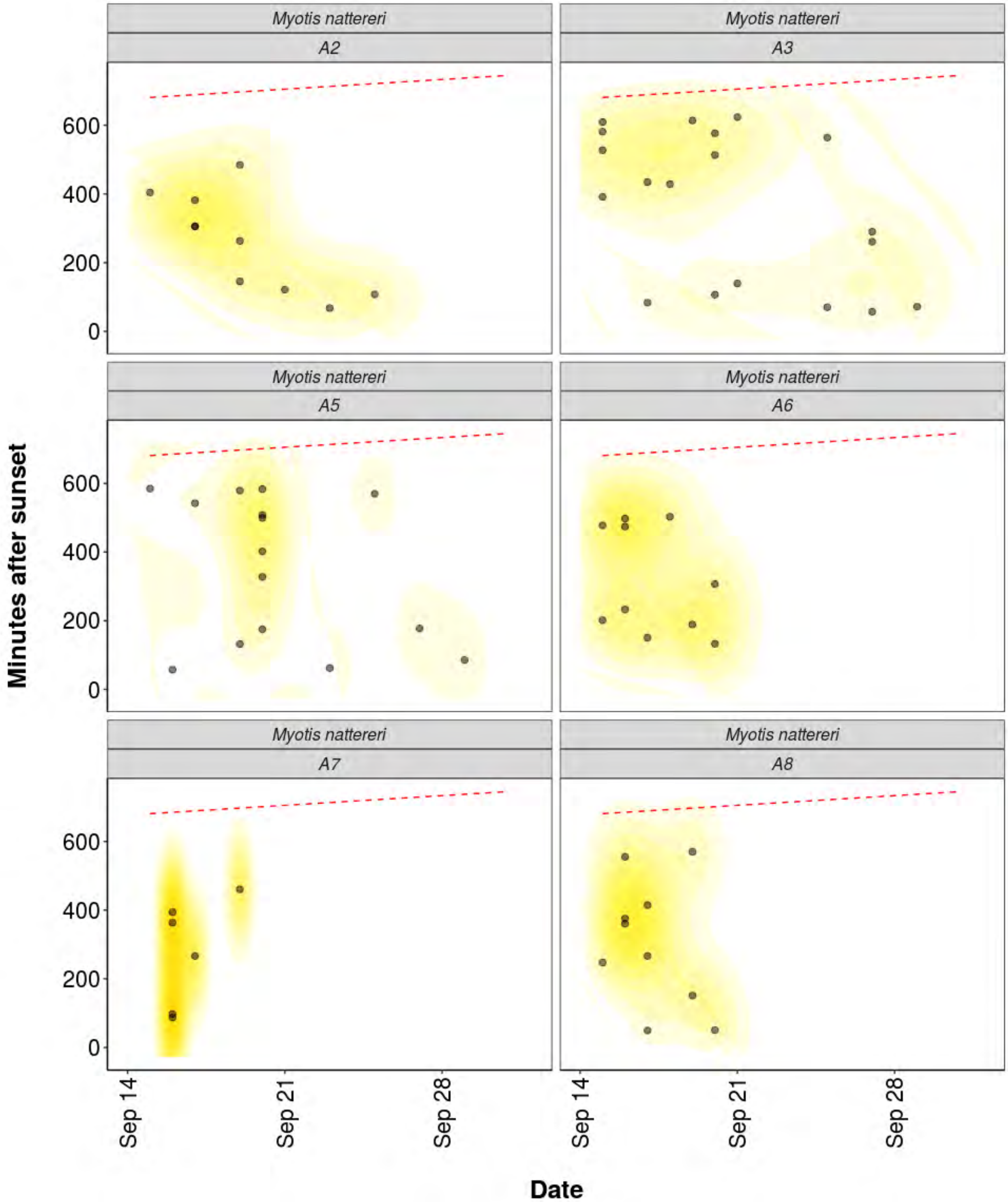
Myotis
A2
Myotis
A3
Myotis
A5
Myotis
A6
Myotis
A7
Myotis
A8
Minutes after sunset
0
200
400
600
Sep 14
Sep 21
Sep 28
Date

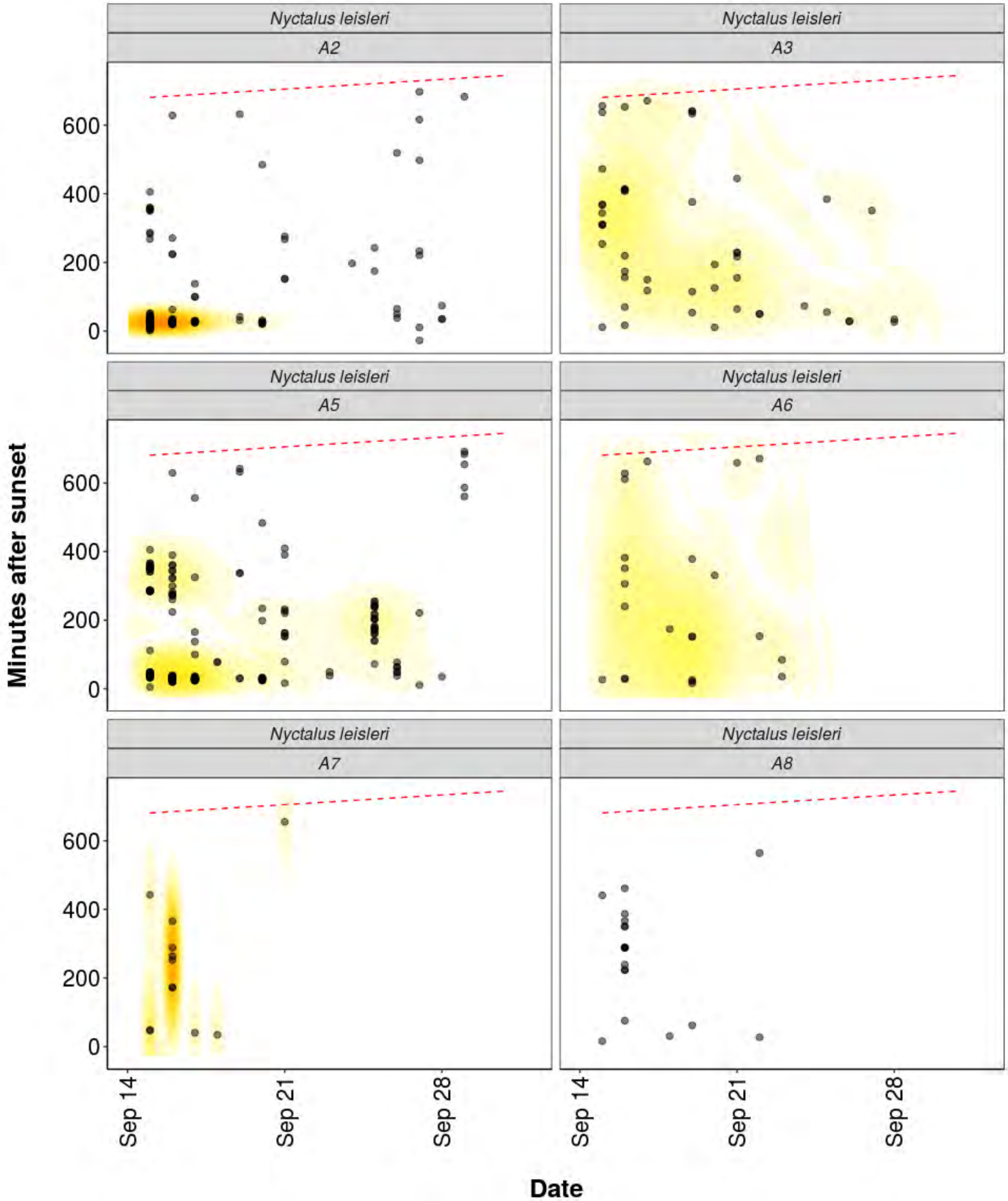


Myotis daubentonii
A2
Myotis daubentonii
A3
Myotis daubentonii
A5
Myotis daubentonii
A6
Myotis daubentonii
A7
Myotis daubentonii
A8
Minutes after sunset
600
400
200
0
Sep 14
Sep 21
Sep 28
Date

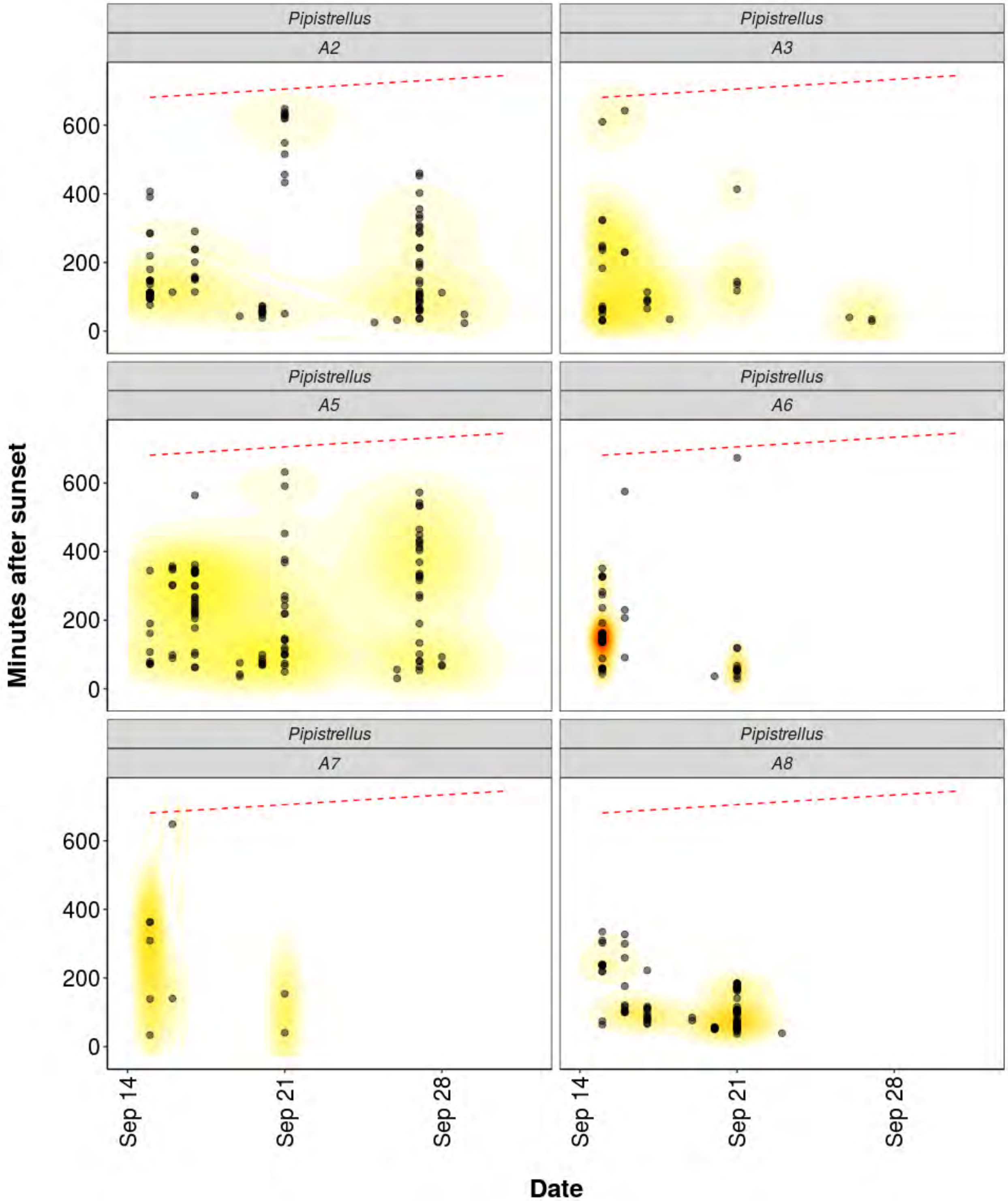


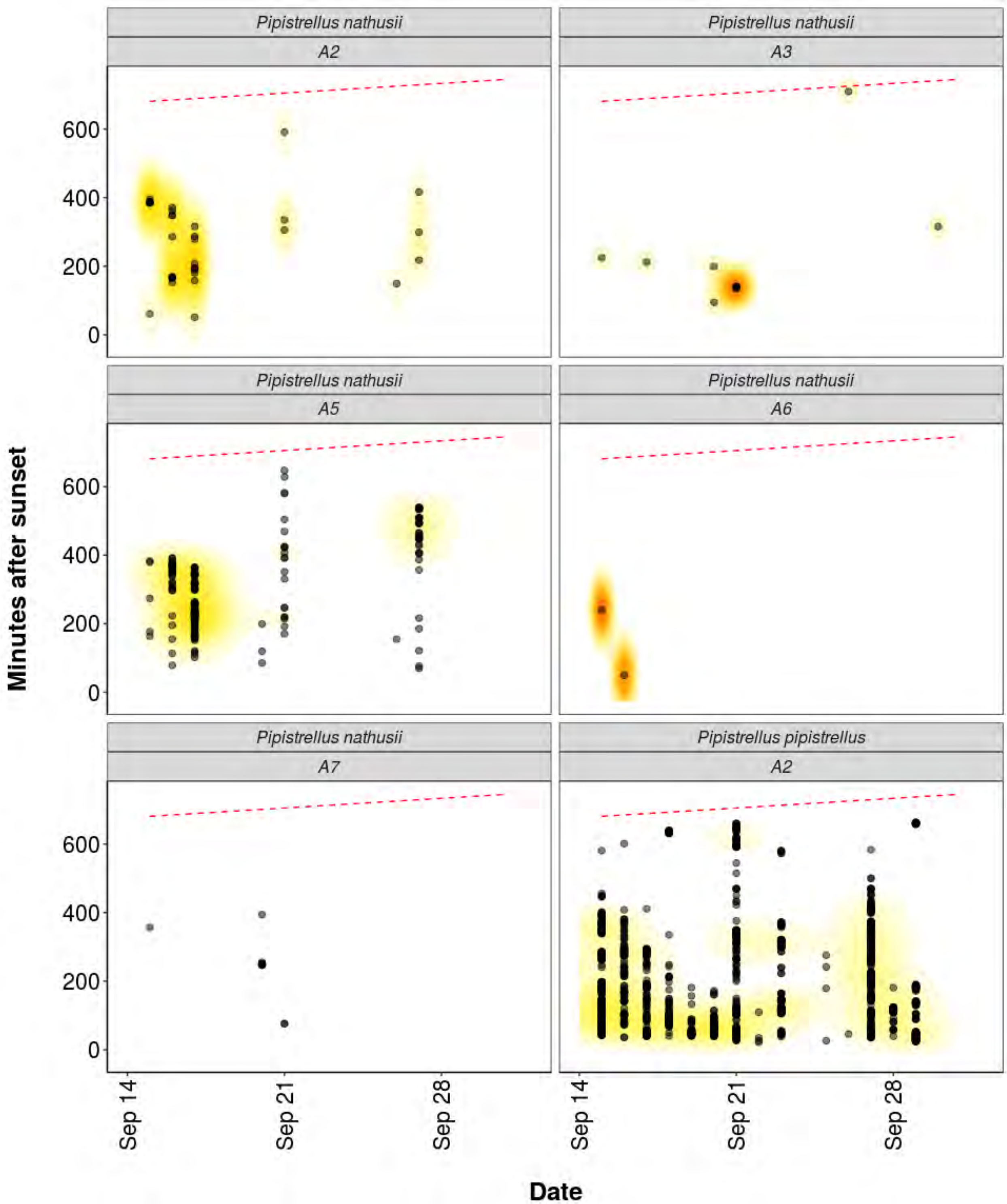
Myotis mystacinus
A2
Myotis mystacinus
A3
Myotis mystacinus
A5
Myotis mystacinus
A6
Myotis mystacinus
A7
Myotis mystacinus
A8
Minutes after sunset
0
200
400
600
Sep 14
Sep 21
Sep 28
Date


Myotis nattereri
A2
Myotis nattereri
A3
Myotis nattereri
A5
Myotis nattereri
A6
Myotis nattereri
A7
Myotis nattereri
A8
Minutes after sunset
0
200
400
600
Sep 14
Sep 21
Sep 28
Date

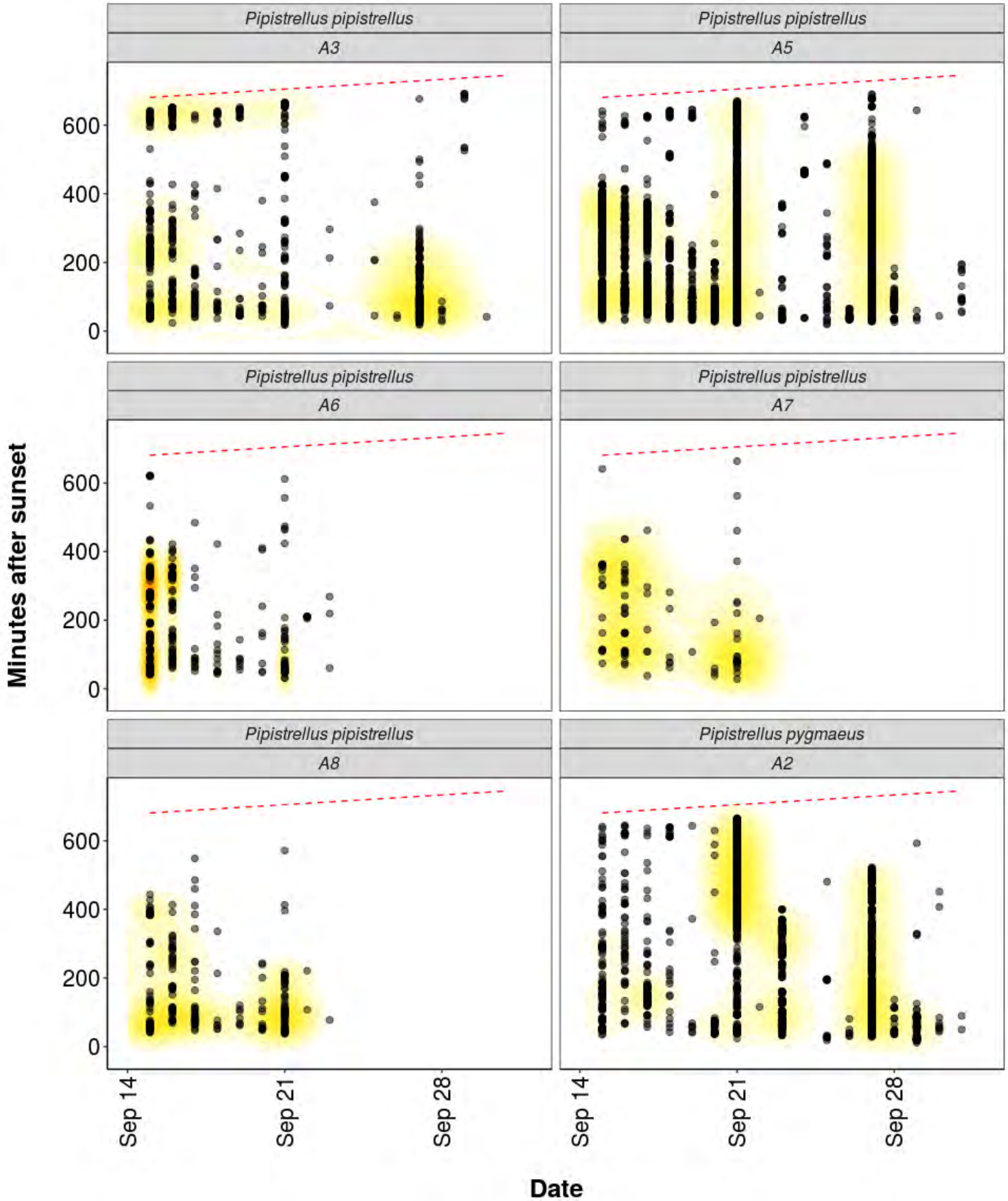


Nyctalus leisleri
A2
Nyctalus leisleri
A3
Nyctalus leisleri
A5
Nyctalus leisleri
A6
Nyctalus leisleri
A7
Nyctalus leisleri
A8
Minutes after sunset
0
200
400
600
Sep 14
Sep 21
Sep 28
Date

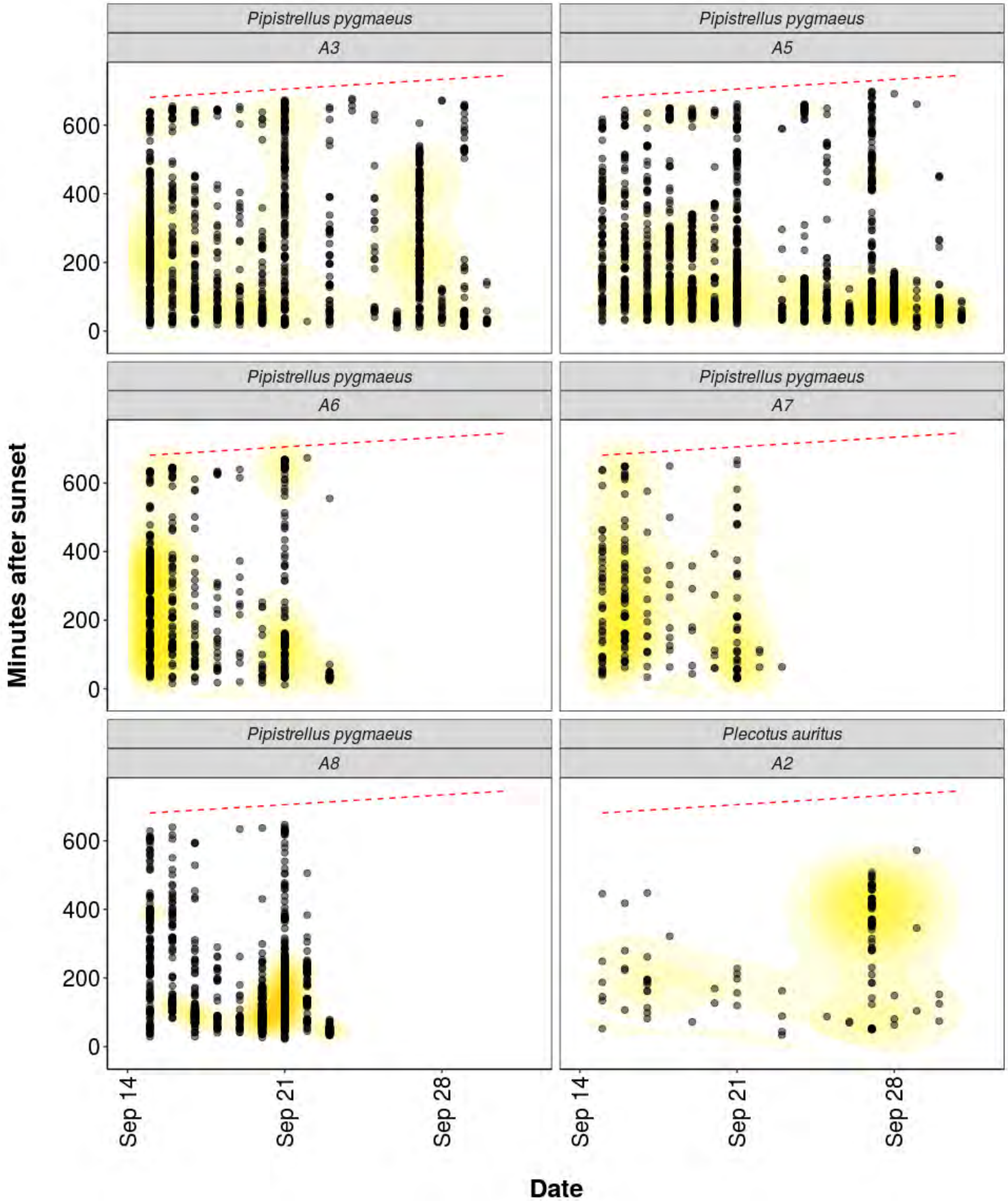

Pipistrellus
A2
Pipistrellus
A3
Pipistrellus
A5
Pipistrellus
A6
Pipistrellus
A7
Pipistrellus
A8
Minutes after sunset
0
200
400
600
Sep 14
Sep 21
Sep 28
Date



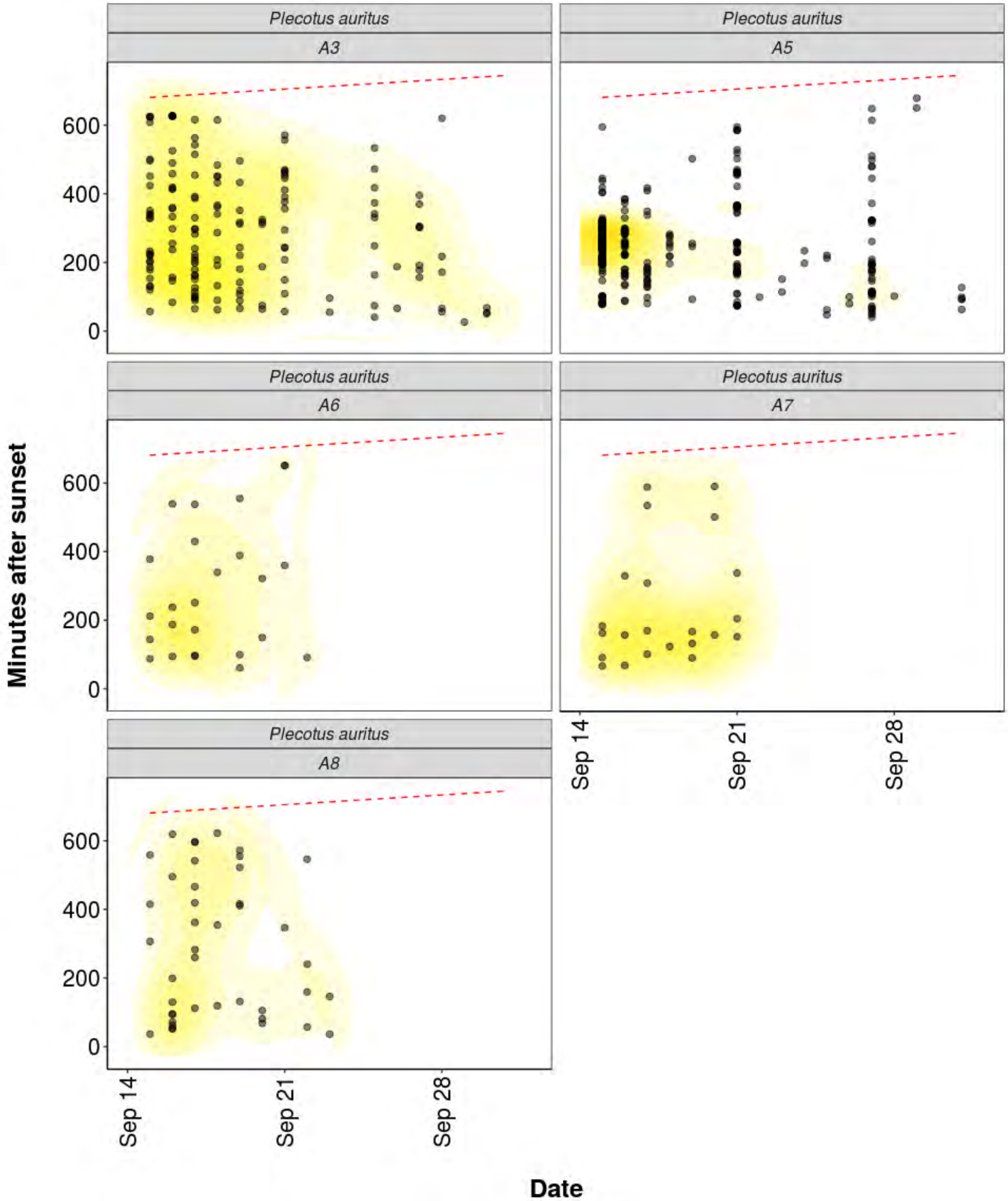
Pipistrellus nathusii
A2
Pipistrellus nathusii
A3
Pipistrellus nathusii
A5
Pipistrellus nathusii
A6
Pipistrellus nathusii
A7
Pipistrellus pipistrellus
A2
Minutes after sunset
0
200
400
600
Sep 14
Sep 21
Sep 28
Date



Pipistrellus pipistrellus
A3
Pipistrellus pipistrellus
A5
Pipistrellus pipistrellus
A6
Pipistrellus pipistrellus
A7
Pipistrellus pipistrellus
A8
Pipistrellus pygmaeus
A2
Minutes after sunset
0
200
400
600
Sep 14
Sep 21
Sep 28
Date



Pipistrellus pygmaeus
A3
Pipistrellus pygmaeus
A5
Pipistrellus pygmaeus
A6
Pipistrellus pygmaeus
A7
Pipistrellus pygmaeus
A8
Plecotus auritus
A2
Minutes after sunset
0
200
400
600
Sep 14
Sep 21
Sep 28
Date



Plecotus auritus
A3
Plecotus auritus
A5
Plecotus auritus
A6
Plecotus auritus
A7
Plecotus auritus
A8
Minutes after sunset
0
200
400
600
Sep 14
Sep 21
Sep 28
Date

Roost Emergence Time and Bat Observation

Based on: *Russ, Jon. 2012. British Bat Calls a Guide to species Identification. Pelagic Publishing.*

For more information see https://rbats-blog.updog.co/2018/05/29/bat-emergence/

Bat Passes Potentially Indicating Close Proximity to a Roost (Russ 2012) - Table

Table 12. Number of bat calls recorded before the upper time of the species-specific emergence time range, and which therefore may potentially indicate the presence of a nearby roost.

Table continues below

Species	Detector ID	2020-09-15	2020-09-16	2020-09-17	2020-09-18	2020-09-19
Pipistrellus	A2	0	0	0	0	0
Pipistrellus	A3	3	0	0	0	0
Pipistrellus	A5	0	0	0	0	0
Pipistrellus	A6	0	0	0	0	0
Common pipistrelle	A2	0	0	0	0	0
Common pipistrelle	A3	0	1	0	0	0
Common pipistrelle	A5	0	1	0	0	2
Common pipistrelle	A6	0	0	0	0	0
Common pipistrelle	A7	0	0	0	0	0
Soprano pipistrelle	A2	0	0	0	0	0
Soprano pipistrelle	A3	7	5	4	1	2
Soprano pipistrelle	A5	1	0	0	1	0
Soprano pipistrelle	A6	0	1	1	1	1

Soprano pipistrelle	A8	0	0	0	0	0
Leisler’s	A2	17	0	0	0	0
Leisler’s	A3	1	1	0	0	0
Leisler’s	A5	1	0	0	0	0
Leisler’s	A6	0	0	0	0	1
Leisler’s	A8	1	0	0	0	0
Brown long-eared	A2	1	0	0	0	0
Brown long-eared	A3	1	0	0	0	0
Brown long-eared	A5	0	0	0	0	0
Brown long-eared	A8	1	2	0	0	0
Myotis	A2	0	0	0	0	0
Myotis	A3	0	0	0	1	0
Myotis	A5	0	0	0	1	0
Myotis	A6	0	1	0	0	0
Myotis	A7	1	0	0	0	0
Daubenton’s	A2	0	0	0	0	0
Daubenton’s	A3	0	0	2	0	0
Daubenton’s	A5	0	0	1	0	0
Daubenton’s	A7	0	0	0	0	1
Daubenton’s	A8	2	1	0	0	0
Natterer’s	A8	0	0	1	0	0

Table continues below

2020-09-20	2020-09-21	2020-09-22	2020-09-23	2020-09-24	2020-09-25	2020-09-26
0	0	0	0	0	1	0
0	0	0	0	0	0	0
0	0	0	0	0	0	1
0	1	0	0	0	0	0
0	4	2	0	0	1	0
0	7	0	0	0	0	0
3	17	0	1	0	3	0
0	1	0	0	0	0	0

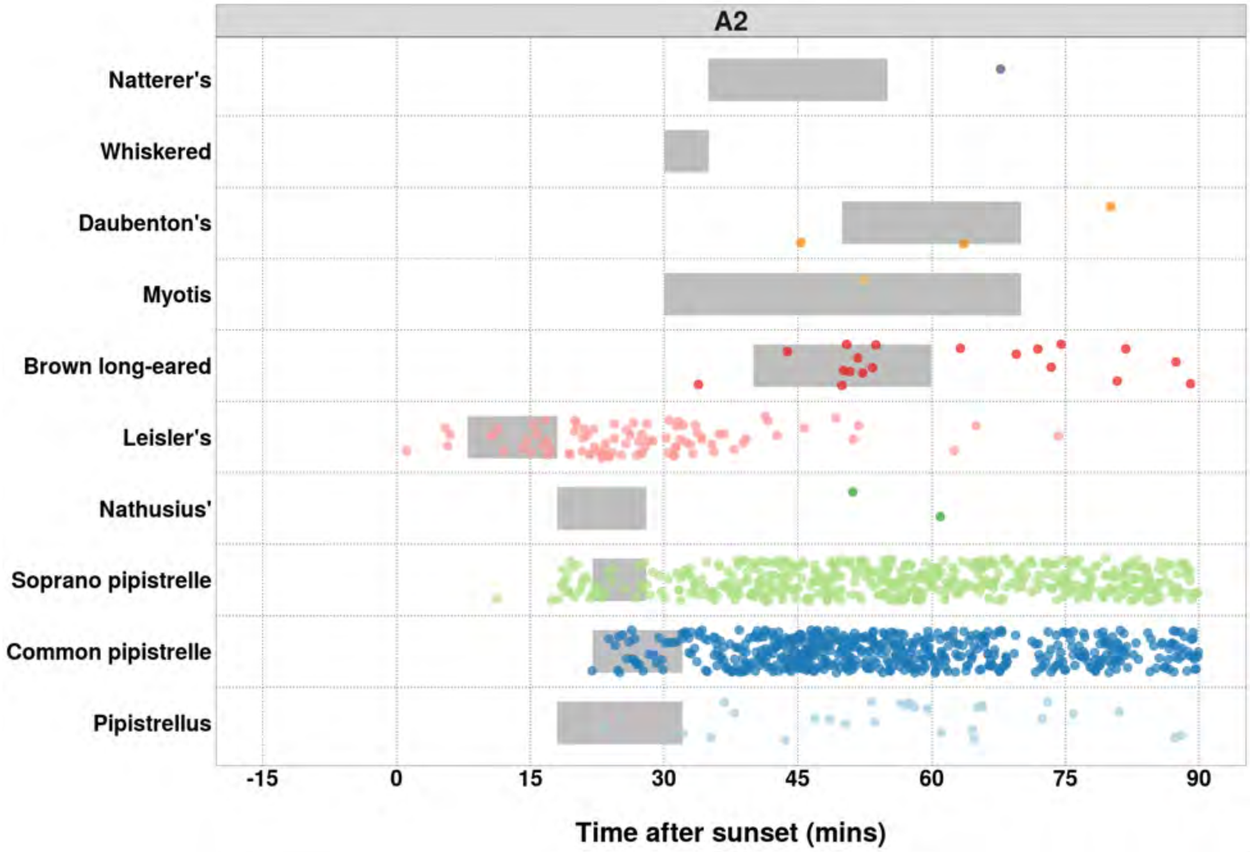
0	1	0	0	0	0	0
0	1	0	0	0	4	0
5	10	1	2	0	0	7
0	2	0	0	2	0	1
2	1	0	1	0	0	0
1	4	0	0	0	0	0
0	0	0	0	0	0	0
1	0	0	0	0	0	0
0	1	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	2	0	0	0
0	1	0	1	0	1	0
0	0	0	0	0	1	0
0	0	1	1	0	0	0
0	0	0	0	0	0	0
0	0	0	1	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
1	1	0	0	0	0	0
0	1	0	0	0	0	0
1	0	0	2	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
1	0	0	0	0	0	0

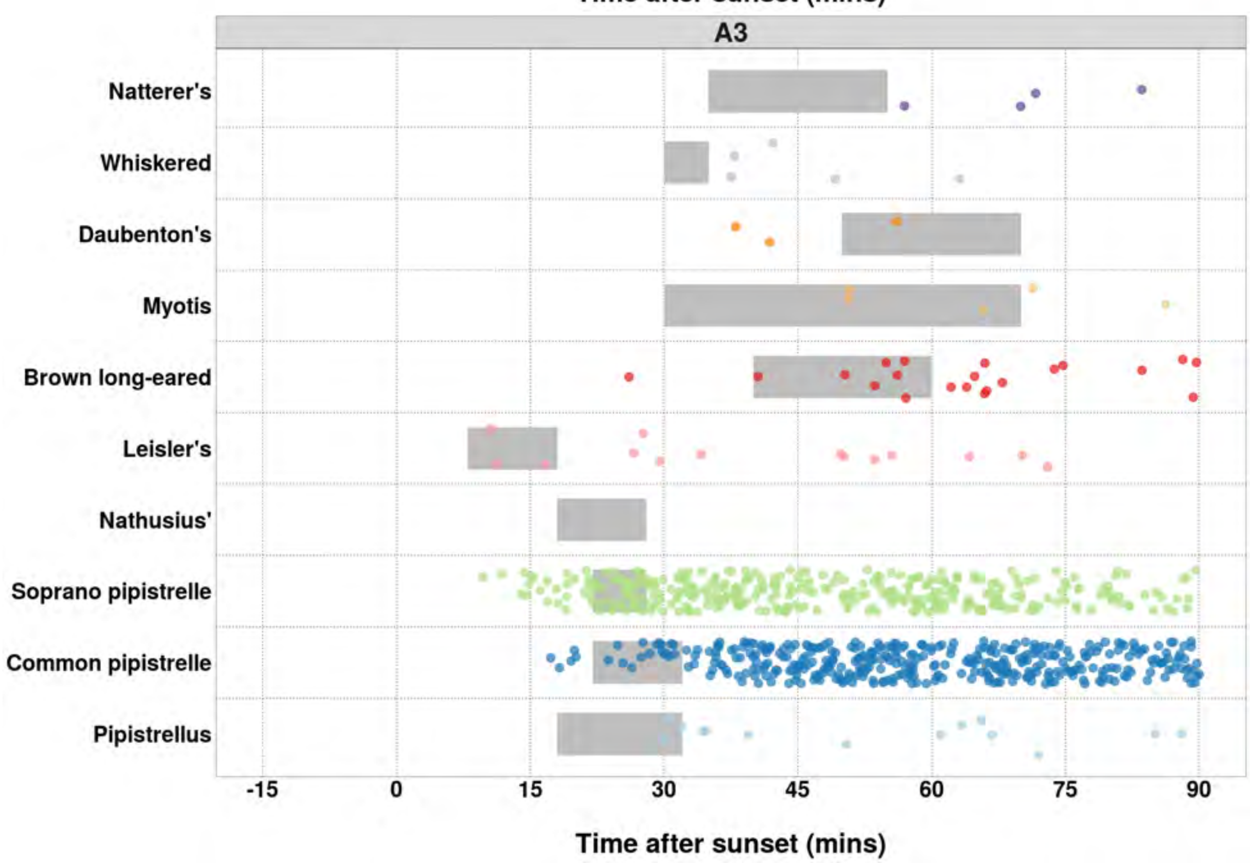
2020-09-27	2020-09-28	2020-09-29	2020-09-30
0	0	1	0
1	0	0	0
0	0	0	0
0	0	0	0
0	0	21	0
13	1	0	0
6	1	1	0
0	0	0	0

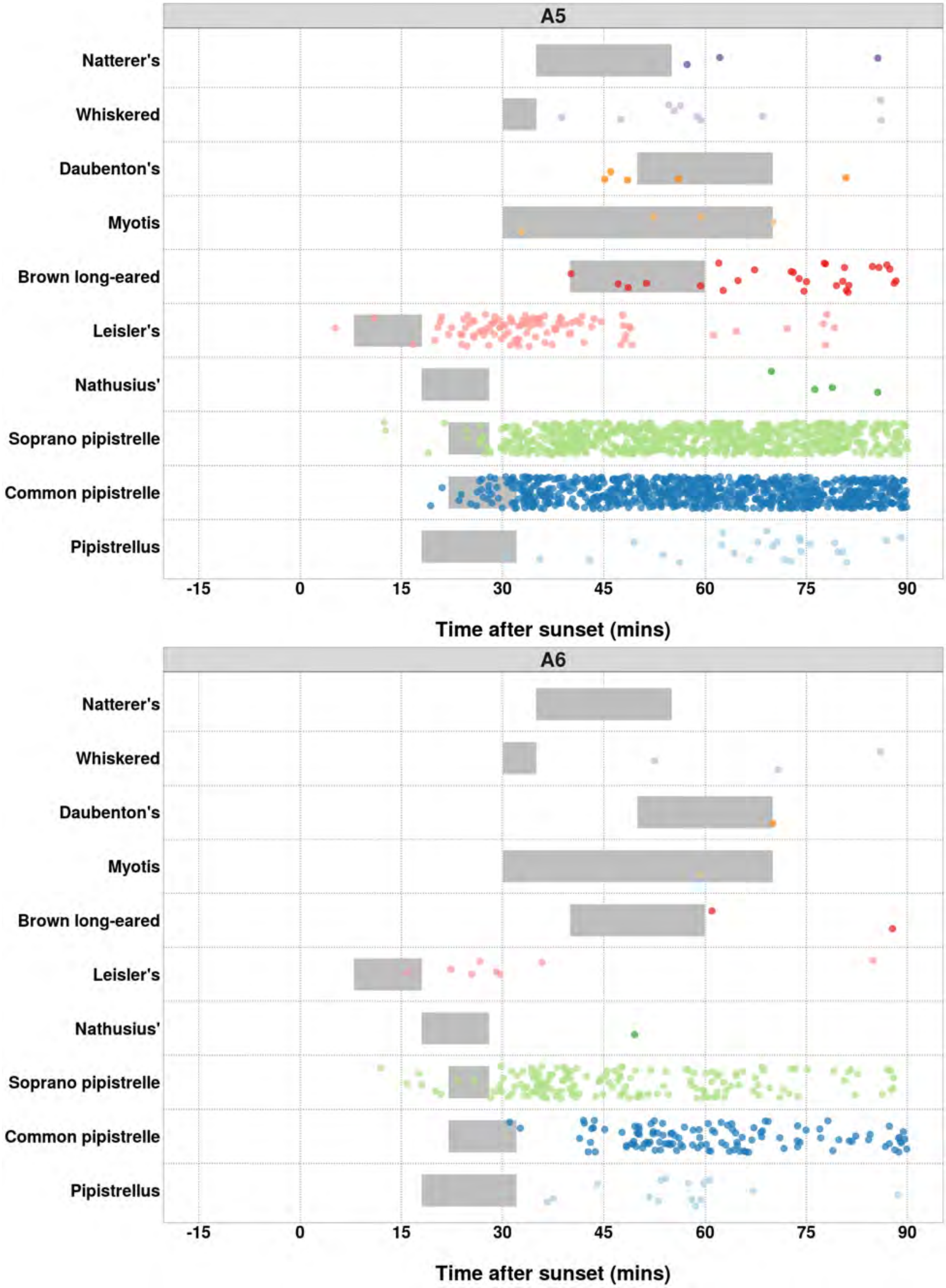
0	0	0	0
1	0	30	0
4	1	10	5
1	1	3	1
0	0	0	0
0	0	0	0
2	0	0	0
0	0	0	0
1	0	0	0
0	0	0	0
0	0	0	0
7	0	0	0
0	1	1	2
4	0	0	0
0	0	0	0
0	0	1	0
1	0	0	0
1	0	1	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

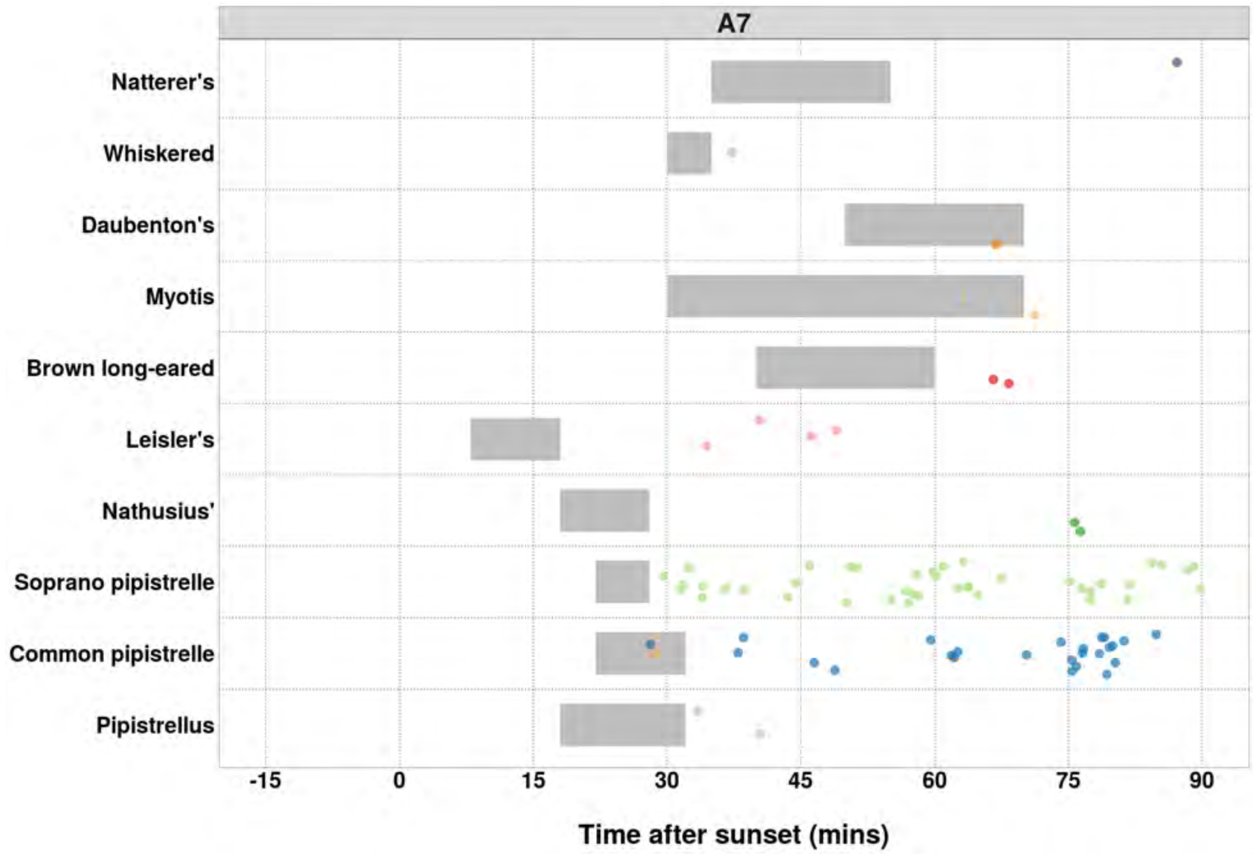
Bat Passes Potentially Indicating Close Proximity to a Roost (Russ 2012) - Figures

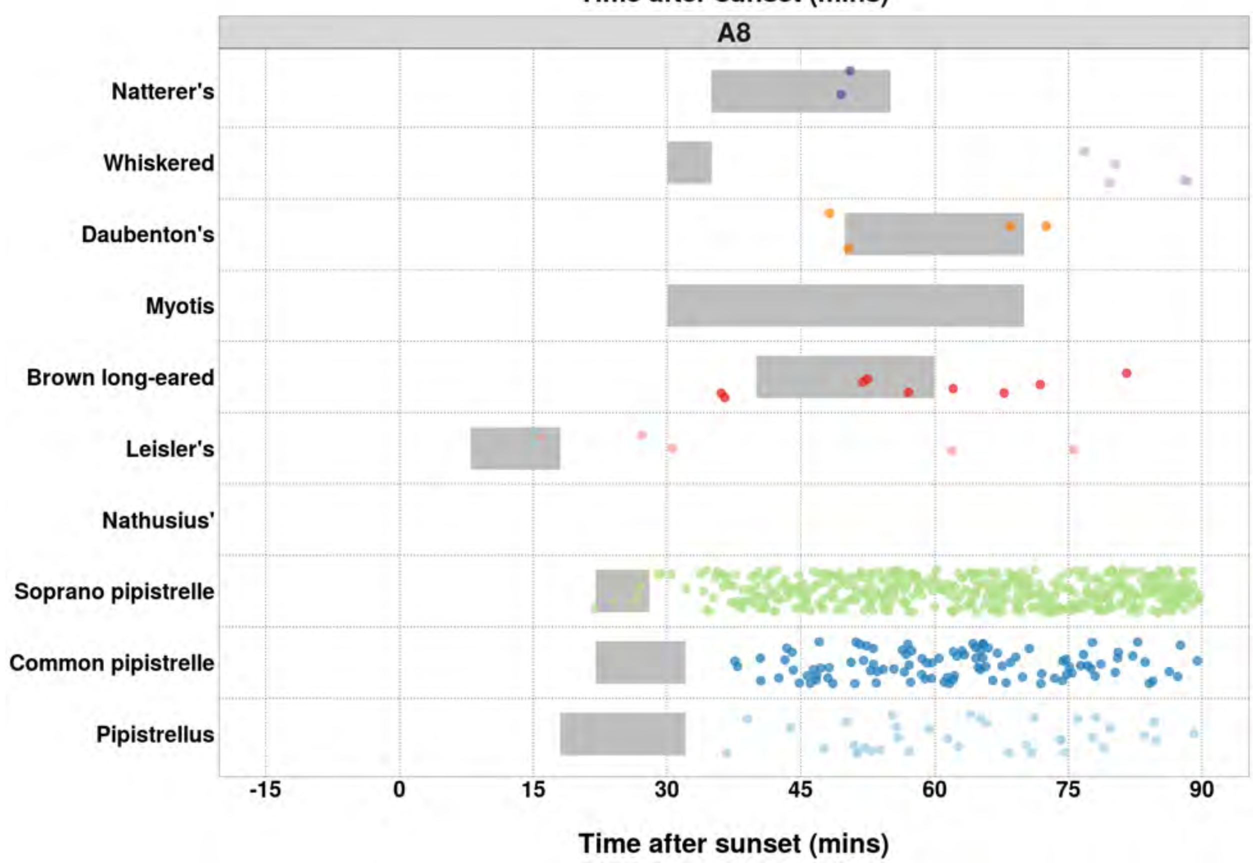
Figure 8. Time from 15 minutes before to 90 minutes after sunset. Species-specific emergence time ranges are shown as grey bars. Bat passes overlapping species-specific grey bars, or occuring earlier than this time range, may potentially indicate the presence of a nearby roost.


A2
Natterer's
Whiskered
Daubenton's
Myotis
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
Pipistrellus
-15
0
15
30
45
60
75
90
Time after sunset (mins)


A3
Natterer's
Whiskered
Daubenton's
Myotis
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
Pipistrellus
-15
0
15
30
45
60
75
90
Time after sunset (mins)


A5
Natterer's
Whiskered
Daubenton's
Myotis
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
Pipistrellus
-15
0
15
30
45
60
75
90
Time after sunset (mins)
A6
Natterer's
Whiskered
Daubenton's
Myotis
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
Pipistrellus
-15
0
15
30
45
60
75
90
Time after sunset (mins)


A7
Natterer's
Whiskered
Daubenton's
Myotis
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
Pipistrellus
-15
0
15
30
45
60
75
90
Time after sunset (mins)


A8
Natterer's
Whiskered
Daubenton's
Myotis
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
Pipistrellus
-15
0
15
30
45
60
75
90
Time after sunset (mins)

Counts of Bat Passes

All detectors

Table 14. The total number of passes recorded for each species across all of the detectors. The 'Total' percentage may not be exactly 100% due to rounding of the percentages per species.

Species	Passes (No.)	Percentage of total (%)
Pipistrellus	14926	44.4
Common pipistrelle	8200	24.4
Soprano pipistrelle	8428	25.1
Nathusius'	255	0.8
Leisler's	422	1.3
Brown long-eared	718	2.1
Myotis	332	1.0
Daubenton's	105	0.3
Whiskered	141	0.4
Natterer's	70	0.2
Total	33597	100.0

Counts of Bat Passes

Per Detector

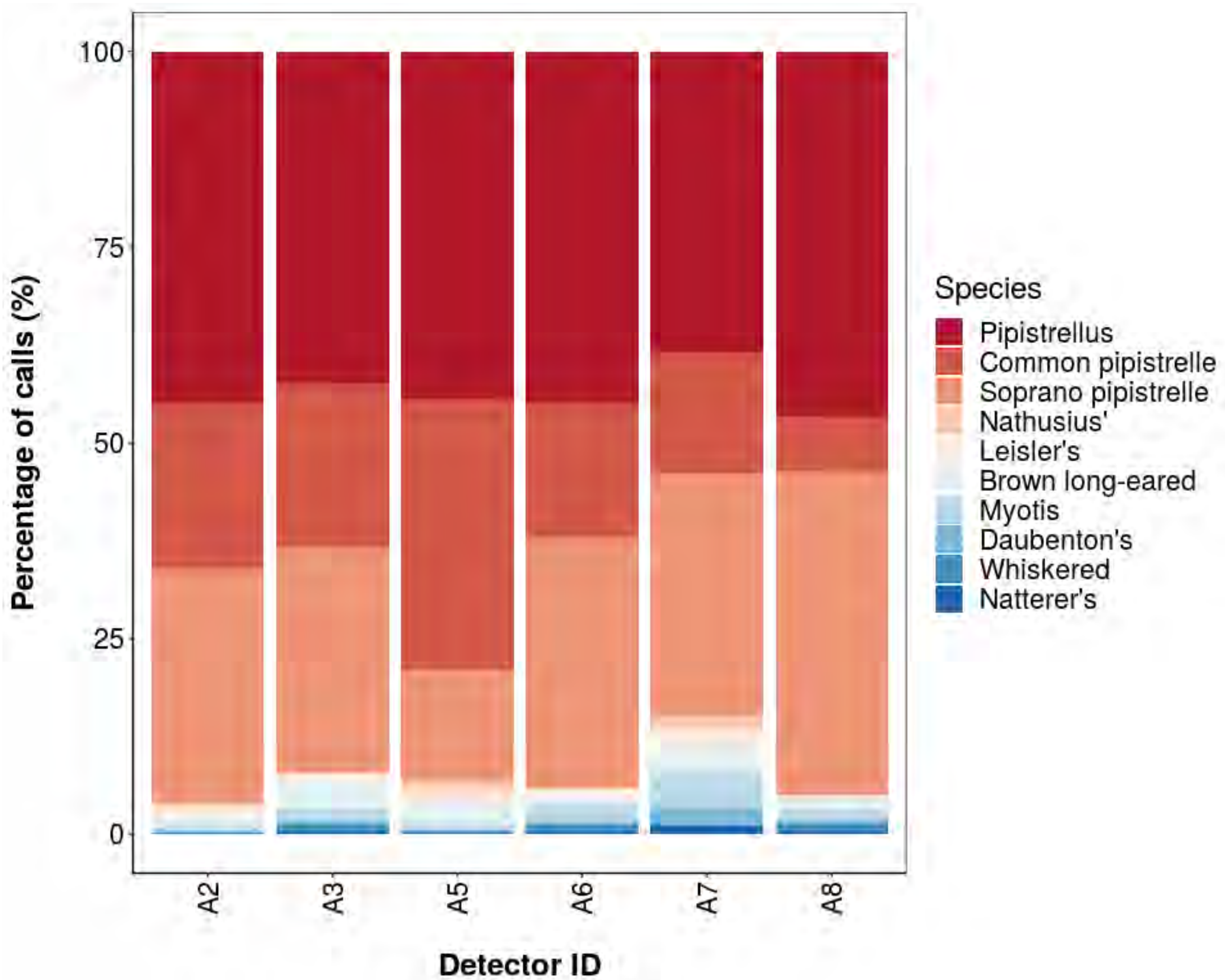
Table 15. The number of passes recorded for each species at each detector.

Species	Detector ID	Count (No)	Percentage by Detector (%)
Pipistrellus	A2	4151	44.9
Pipistrellus	A3	1969	42.5
Pipistrellus	A5	5827	44.4
Pipistrellus	A6	1017	44.9
Pipistrellus	A7	230	38.5
Pipistrellus	A8	1732	46.6
Common pipistrelle	A2	1962	21.2
Common pipistrelle	A3	964	20.8
Common pipistrelle	A5	4530	34.5
Common pipistrelle	A6	390	17.2
Common pipistrelle	A7	92	15.4
Common pipistrelle	A8	262	7.1
Soprano pipistrelle	A2	2780	30.0
Soprano pipistrelle	A3	1335	28.8
Soprano pipistrelle	A5	1865	14.2
Soprano pipistrelle	A6	724	32.0
Soprano pipistrelle	A7	185	31.0
Soprano pipistrelle	A8	1539	41.4
Nathusius’	A2	34	0.4
Nathusius’	A3	11	0.2
Nathusius’	A5	198	1.5
Nathusius’	A6	2	0.1
Nathusius’	A7	10	1.7
Leisler’s	A2	124	1.3
Leisler’s	A3	49	1.1
Leisler’s	A5	195	1.5
Leisler’s	A6	23	1.0
Leisler’s	A7	12	2.0
Leisler’s	A8	19	0.5

Brown long-eared	A2	113	1.2
Brown long-eared	A3	155	3.3
Brown long-eared	A5	361	2.8
Brown long-eared	A6	25	1.1
Brown long-eared	A7	22	3.7
Brown long-eared	A8	42	1.1
Myotis	A2	46	0.5
Myotis	A3	74	1.6
Myotis	A5	78	0.6
Myotis	A6	49	2.2
Myotis	A7	25	4.2
Myotis	A8	60	1.6
Daubenton’s	A2	27	0.3
Daubenton’s	A3	24	0.5
Daubenton’s	A5	14	0.1
Daubenton’s	A6	10	0.4
Daubenton’s	A7	14	2.3
Daubenton’s	A8	16	0.4
Whiskered	A2	8	0.1
Whiskered	A3	37	0.8
Whiskered	A5	43	0.3
Whiskered	A6	16	0.7
Whiskered	A7	1	0.2
Whiskered	A8	36	1.0
Natterer’s	A2	10	0.1
Natterer’s	A3	19	0.4
Natterer’s	A5	15	0.1
Natterer’s	A6	10	0.4
Natterer’s	A7	6	1.0
Natterer’s	A8	10	0.3

Species Composition

Figure 10. Percentage species composition of passes at each detector.



PART 2a: Presence Only

THE NEXT SECTION OF THE REPORT FEATURES THE RAW DATA SUPPLIED TO ECOBAT AND ONLY TAKES INTO ACCOUNT THE PRESENCE, AND NOT THE ABSENCE, OF EACH BAT SPECIES. FOR EACH NIGHT, THERE IS NO 'ZERO DATA' FOR WHEN SPECIES WERE NOT DETECTED.

Nightly Bat Pass Rate (Bat passes per hour)

Median Per Detector

Table 16. The median Nightly Pass Rate (bat passes per hour, per night) of each species. If NA, then no bat passes.

Bat pass rates are often highly variable between nights, with some nights having few or no passes and other nights having high activity. In these circumstances, the median is likely to be a more useful summary of the 'average' activity than is the mean. For further information see: *Lintott, P. R., & Mathews, F. (2018). Basic mathematical errors may make ecological assessments unreliable. Biodiversity and Conservation, 27(1), 265-267.* https://doi.org/10.1007/s10531-017-1418-5

Species	Detector ID	Median Pass Rate
Pipistrellus	A2	15.1
Pipistrellus	A3	17.5
Pipistrellus	A5	35.8
Pipistrellus	A6	16.8
Pipistrellus	A7	6.1
Pipistrellus	A8	16.0
Common pipistrelle	A2	9.4
Common pipistrelle	A3	1.9
Common pipistrelle	A5	6.7
Common pipistrelle	A6	1.1
Common pipistrelle	A7	0.6
Common pipistrelle	A8	1.0
Soprano pipistrelle	A2	3.1
Soprano pipistrelle	A3	4.7
Soprano pipistrelle	A5	9.6
Soprano pipistrelle	A6	2.9
Soprano pipistrelle	A7	0.9
Soprano pipistrelle	A8	9.4
Nathusius'	A2	0.4
Nathusius'	A3	0.1
Nathusius'	A5	1.8
Nathusius'	A6	0.1
Nathusius'	A7	0.2

Leisler’s	A2	0.3
Leisler’s	A3	0.2
Leisler’s	A5	0.5
Leisler’s	A6	0.1
Leisler’s	A7	0.1
Leisler’s	A8	0.2
Brown long-eared	A2	0.2
Brown long-eared	A3	0.7
Brown long-eared	A5	0.3
Brown long-eared	A6	0.3
Brown long-eared	A7	0.3
Brown long-eared	A8	0.3
Myotis	A2	0.4
Myotis	A3	0.8
Myotis	A5	0.5
Myotis	A6	0.6
Myotis	A7	0.4
Myotis	A8	0.9
Daubenton’s	A2	0.2
Daubenton’s	A3	0.2
Daubenton’s	A5	0.1
Daubenton’s	A6	0.2
Daubenton’s	A7	0.2
Daubenton’s	A8	0.2
Whiskered	A2	0.1
Whiskered	A3	0.3
Whiskered	A5	0.3
Whiskered	A6	0.1
Whiskered	A7	0.1
Whiskered	A8	0.4
Natterer’s	A2	0.1
Natterer’s	A3	0.2
Natterer’s	A5	0.1
Natterer’s	A6	0.1
Natterer’s	A7	0.1
Natterer’s	A8	0.2

Nightly Bat Pass Rate (Bat passes per hour)

Mean per Detector

Table 17. The mean Nightly Pass Rate (bat passes per hour, per night) of each species at each detector. Values are given to 1 decimal place.

We recommend using the median values given above, for the reasons stated above, but provide the mean values in the table below.

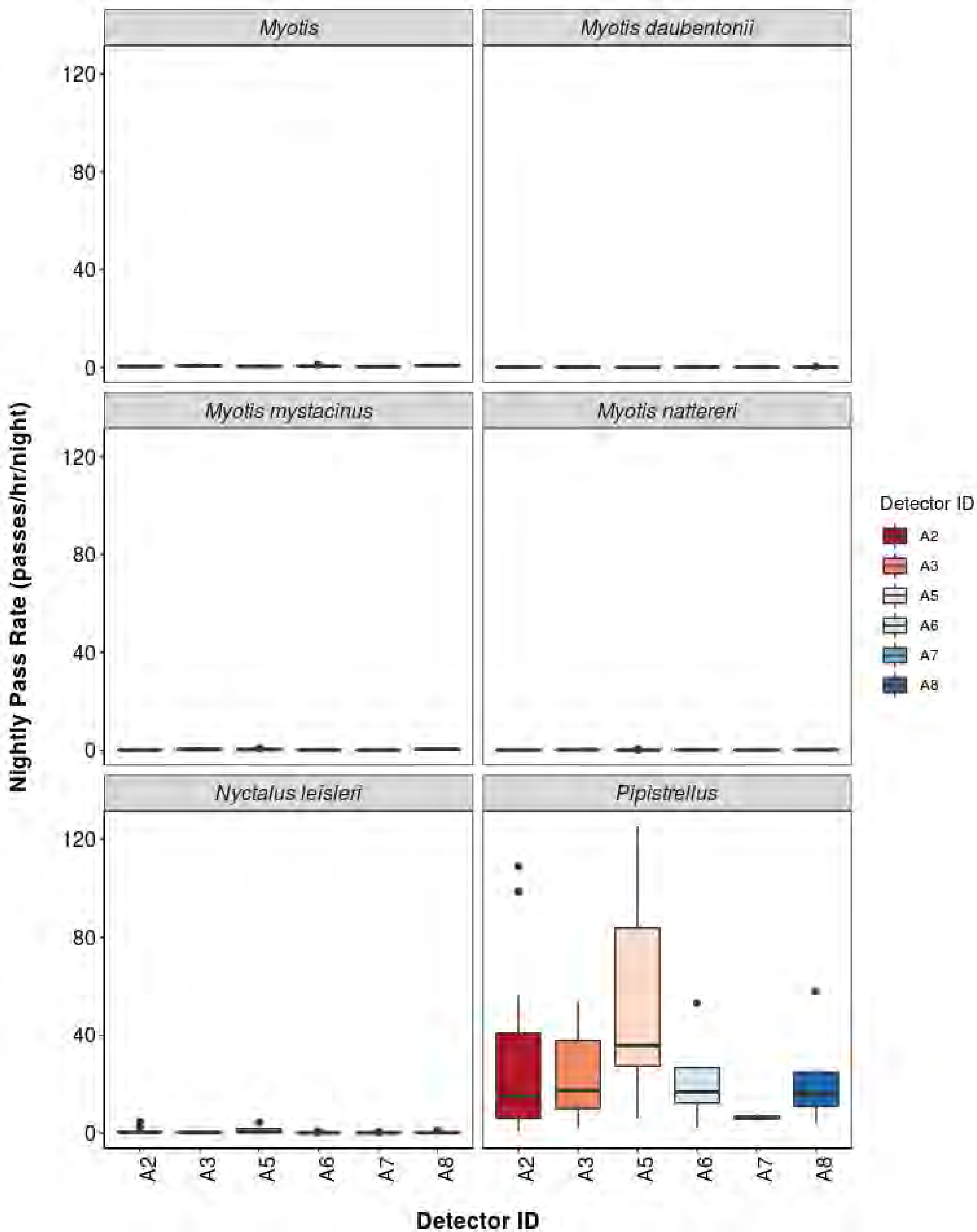
Species	Detector ID	Mean Pass Rate
Pipistrellus	A2	32.0
Pipistrellus	A3	24.1
Pipistrellus	A5	55.1
Pipistrellus	A6	22.2
Pipistrellus	A7	6.7
Pipistrellus	A8	21.3
Common pipistrelle	A2	11.9
Common pipistrelle	A3	5.9
Common pipistrelle	A5	22.7
Common pipistrelle	A6	3.8
Common pipistrelle	A7	1.0
Common pipistrelle	A8	2.5
Soprano pipistrelle	A2	14.6
Soprano pipistrelle	A3	7.1
Soprano pipistrelle	A5	9.8
Soprano pipistrelle	A6	7.0
Soprano pipistrelle	A7	1.8
Soprano pipistrelle	A8	14.7
Nathusius’	A2	0.5
Nathusius’	A3	0.2
Nathusius’	A5	2.4
Nathusius’	A6	0.1
Nathusius’	A7	0.3
Leisler’s	A2	0.9
Leisler’s	A3	0.4
Leisler’s	A5	1.3

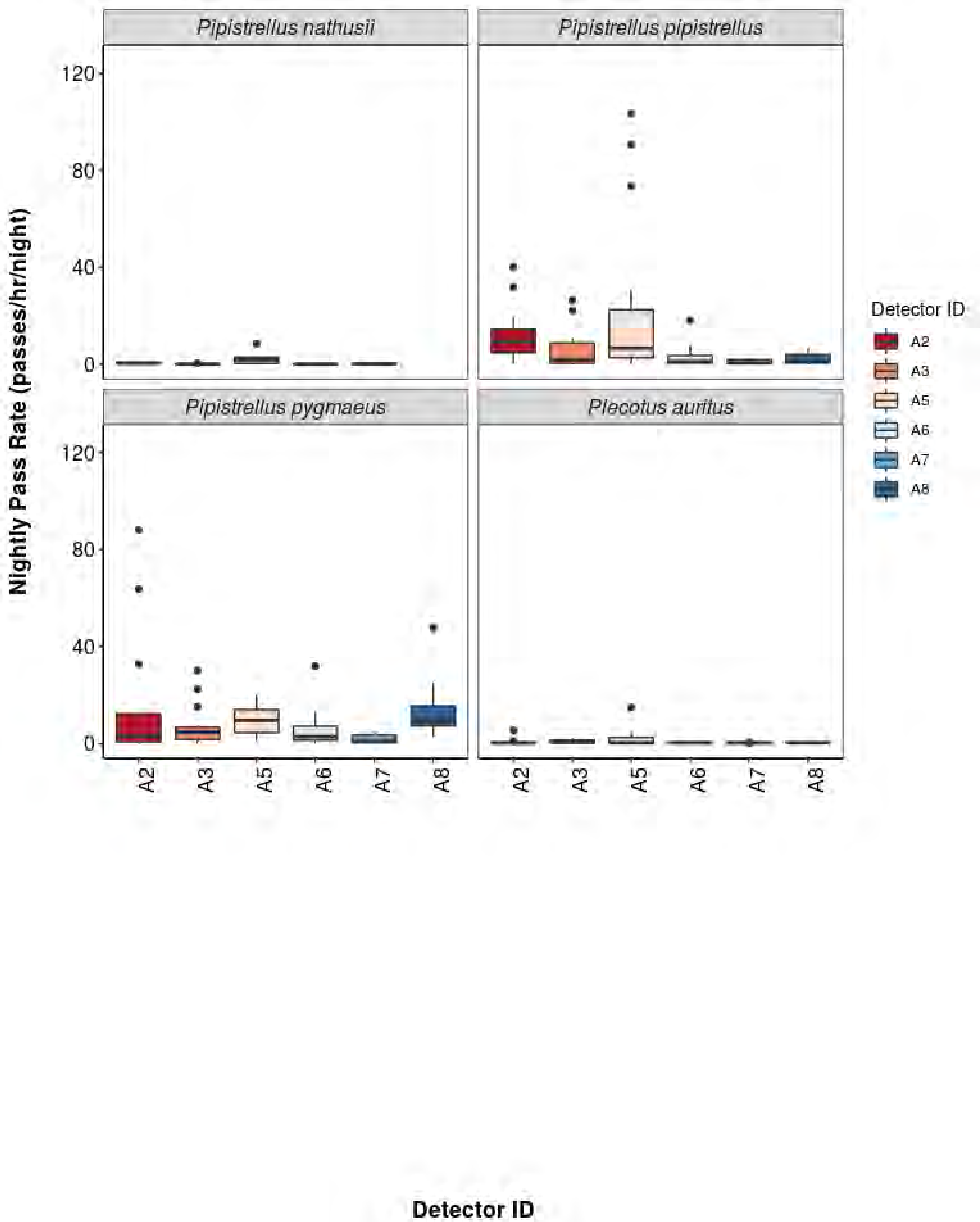
Leisler’s	A6	0.2
Leisler’s	A7	0.2
Leisler’s	A8	0.3
Brown long-eared	A2	0.7
Brown long-eared	A3	1.0
Brown long-eared	A5	2.1
Brown long-eared	A6	0.3
Brown long-eared	A7	0.3
Brown long-eared	A8	0.4
Myotis	A2	0.4
Myotis	A3	0.8
Myotis	A5	0.6
Myotis	A6	0.6
Myotis	A7	0.3
Myotis	A8	0.9
Daubenton’s	A2	0.2
Daubenton’s	A3	0.2
Daubenton’s	A5	0.1
Daubenton’s	A6	0.2
Daubenton’s	A7	0.2
Daubenton’s	A8	0.2
Whiskered	A2	0.1
Whiskered	A3	0.4
Whiskered	A5	0.3
Whiskered	A6	0.2
Whiskered	A7	0.1
Whiskered	A8	0.4
Natterer’s	A2	0.1
Natterer’s	A3	0.2
Natterer’s	A5	0.1
Natterer’s	A6	0.1
Natterer’s	A7	0.2
Natterer’s	A8	0.2

Nightly Bat Passes (Bat passes per hour)

Per Detector - Figures

Figure 11. Boxplots for the number of bat passes per hour each night, for each detector. The 'box' shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The 'whiskers' extend from the box and represent the ranges for the bottom 25% and the top 25% of the data values, excluding outliers. An outlier is any extreme value that lies further away from the box than 1.5 times the interquartile range. Outliers are shown as dots. Where very few passes are recorded it is not possible to produce the box, so the data are shown as a line.


Myotis
Myotis daubentonii
Myotis mystacinus
Myotis nattereri
Nyctalus leisleri
Pipistrellus
Nightly Pass Rate (passes/hr/night)
0
40
80
120
A2
A3
A5
A6
A7
A8
Detector ID
Detector ID
A2
A3
A5
A6
A7
A8


Pipistrellus nathusii
Pipistrellus pipistrellus
Pipistrellus pygmaeus
Plecotus auritus
Nightly Pass Rate (passes/hr/night)
0
40
80
120
A2
A3
A5
A6
A7
A8
Detector ID
Detector ID
A2
A3
A5
A6
A7
A8

SPLIT BY MONTH

Total Bat Passes per Detector, each Month

Per Detector

Table 18. The total number of bat passes of each species in each month at each detector. This table simply tells you how many bats of each species were recorded passing each detector during each month. These numbers are not standardised by the night length, or how many nights each detector was active for during each month.

Species	Detector ID	Sep	Oct
Pipistrellus	A2	4151	0
Pipistrellus	A3	1969	0
Pipistrellus	A5	5827	0
Pipistrellus	A6	1017	0
Pipistrellus	A7	230	0
Pipistrellus	A8	1732	0
Common pipistrelle	A2	1962	0
Common pipistrelle	A3	964	0
Common pipistrelle	A5	4515	15
Common pipistrelle	A6	390	0
Common pipistrelle	A7	92	0
Common pipistrelle	A8	262	0
Soprano pipistrelle	A2	2778	2
Soprano pipistrelle	A3	1335	0
Soprano pipistrelle	A5	1850	15
Soprano pipistrelle	A6	724	0
Soprano pipistrelle	A7	185	0
Soprano pipistrelle	A8	1539	0
Nathusius’	A2	34	0
Nathusius’	A3	11	0
Nathusius’	A5	198	0
Nathusius’	A6	2	0
Nathusius’	A7	10	0
Leisler’s	A2	124	0

Leisler’s	A3	49	0
Leisler’s	A5	195	0
Leisler’s	A6	23	0
Leisler’s	A7	12	0
Leisler’s	A8	19	0
Brown long-eared	A2	113	0
Brown long-eared	A3	155	0
Brown long-eared	A5	356	5
Brown long-eared	A6	25	0
Brown long-eared	A7	22	0
Brown long-eared	A8	42	0
Myotis	A2	46	0
Myotis	A3	74	0
Myotis	A5	78	0
Myotis	A6	49	0
Myotis	A7	25	0
Myotis	A8	60	0
Daubenton’s	A2	27	0
Daubenton’s	A3	24	0
Daubenton’s	A5	14	0
Daubenton’s	A6	10	0
Daubenton’s	A7	14	0
Daubenton’s	A8	16	0
Whiskered	A2	8	0
Whiskered	A3	37	0
Whiskered	A5	43	0
Whiskered	A6	16	0
Whiskered	A7	1	0
Whiskered	A8	36	0
Natterer’s	A2	10	0
Natterer’s	A3	19	0
Natterer’s	A5	15	0
Natterer’s	A6	10	0
Natterer’s	A7	6	0
Natterer’s	A8	10	0

Survey Effort

Table 19. The number of survey nights per month per detector.

Month	Detector ID	No. of Survey Nights
Sep	A2	16
Sep	A3	16
Sep	A5	16
Sep	A6	9
Sep	A7	9
Sep	A8	9
Oct	A2	1
Oct	A5	1

Nightly Bat Pass Rate for each Month

Median Per Detector

Table 20. The median Nightly Pass Rate (bat passes per hour, per night) of each species throughout each month. If NA, then no bat passes.

Bat pass rates are often highly variable between nights, with some nights having few or no passes and other nights having high activity. In these circumstances, the median is likely to be a more useful summary of the 'average' activity than is the mean. For further information see: *Lintott, P. R., & Mathews, F. (2018). Basic mathematical errors may make ecological assessments unreliable. Biodiversity and Conservation, 27(1), 265-267.* https://doi.org/10.1007/s10531-017-1418-5

Species	Detector ID	Sep	Oct
Pipistrellus	A2	15.1	NA
Pipistrellus	A3	17.5	NA
Pipistrellus	A5	35.8	NA
Pipistrellus	A6	16.8	NA
Pipistrellus	A7	6.1	NA
Pipistrellus	A8	16.0	NA
Common pipistrelle	A2	9.4	NA
Common pipistrelle	A3	1.9	NA
Common pipistrelle	A5	8.3	1.2
Common pipistrelle	A6	1.1	NA
Common pipistrelle	A7	0.6	NA
Common pipistrelle	A8	1.0	NA
Soprano pipistrelle	A2	3.7	0.2
Soprano pipistrelle	A3	4.7	NA
Soprano pipistrelle	A5	9.9	1.2
Soprano pipistrelle	A6	2.9	NA
Soprano pipistrelle	A7	0.9	NA
Soprano pipistrelle	A8	9.4	NA
Nathusius'	A2	0.4	NA
Nathusius'	A3	0.1	NA
Nathusius'	A5	1.8	NA
Nathusius'	A6	0.1	NA
Nathusius'	A7	0.2	NA

Leisler’s	A2	0.3	NA
Leisler’s	A3	0.2	NA
Leisler’s	A5	0.5	NA
Leisler’s	A6	0.1	NA
Leisler’s	A7	0.1	NA
Leisler’s	A8	0.2	NA
Brown long-eared	A2	0.2	NA
Brown long-eared	A3	0.7	NA
Brown long-eared	A5	0.3	0.4
Brown long-eared	A6	0.3	NA
Brown long-eared	A7	0.3	NA
Brown long-eared	A8	0.3	NA
Myotis	A2	0.4	NA
Myotis	A3	0.8	NA
Myotis	A5	0.5	NA
Myotis	A6	0.6	NA
Myotis	A7	0.4	NA
Myotis	A8	0.9	NA
Daubenton’s	A2	0.2	NA
Daubenton’s	A3	0.2	NA
Daubenton’s	A5	0.1	NA
Daubenton’s	A6	0.2	NA
Daubenton’s	A7	0.2	NA
Daubenton’s	A8	0.2	NA
Whiskered	A2	0.1	NA
Whiskered	A3	0.3	NA
Whiskered	A5	0.3	NA
Whiskered	A6	0.1	NA
Whiskered	A7	0.1	NA
Whiskered	A8	0.4	NA
Natterer’s	A2	0.1	NA
Natterer’s	A3	0.2	NA
Natterer’s	A5	0.1	NA
Natterer’s	A6	0.1	NA
Natterer’s	A7	0.1	NA
Natterer’s	A8	0.2	NA

Nightly Bat Pass Rate for each Month

Mean per Detector

Table 21: The mean Nightly Pass Rate (bat passes per hour, per night) of each species throughout each month. Values are given to 1 decimal place.

We recommend using the median values given above, for the reasons stated above, but provide the mean values in the table below.

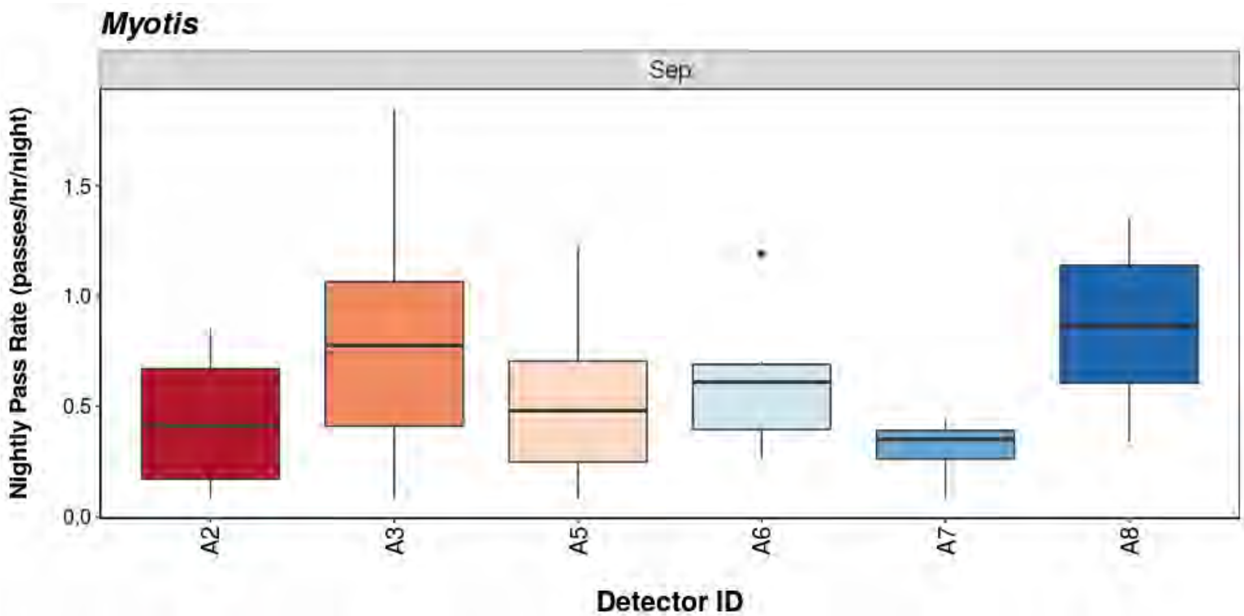
Species	Detector ID	Sep	Oct
Pipistrellus	A2	32.0	NA
Pipistrellus	A3	24.1	NA
Pipistrellus	A5	55.1	NA
Pipistrellus	A6	22.2	NA
Pipistrellus	A7	6.7	NA
Pipistrellus	A8	21.3	NA
Common pipistrelle	A2	11.9	NA
Common pipistrelle	A3	5.9	NA
Common pipistrelle	A5	24.0	1.2
Common pipistrelle	A6	3.8	NA
Common pipistrelle	A7	1.0	NA
Common pipistrelle	A8	2.5	NA
Soprano pipistrelle	A2	15.6	0.2
Soprano pipistrelle	A3	7.1	NA
Soprano pipistrelle	A5	10.4	1.2
Soprano pipistrelle	A6	7.0	NA
Soprano pipistrelle	A7	1.8	NA
Soprano pipistrelle	A8	14.7	NA
Nathusius’	A2	0.5	NA
Nathusius’	A3	0.2	NA
Nathusius’	A5	2.4	NA
Nathusius’	A6	0.1	NA
Nathusius’	A7	0.3	NA
Leisler’s	A2	0.9	NA
Leisler’s	A3	0.4	NA
Leisler’s	A5	1.3	NA

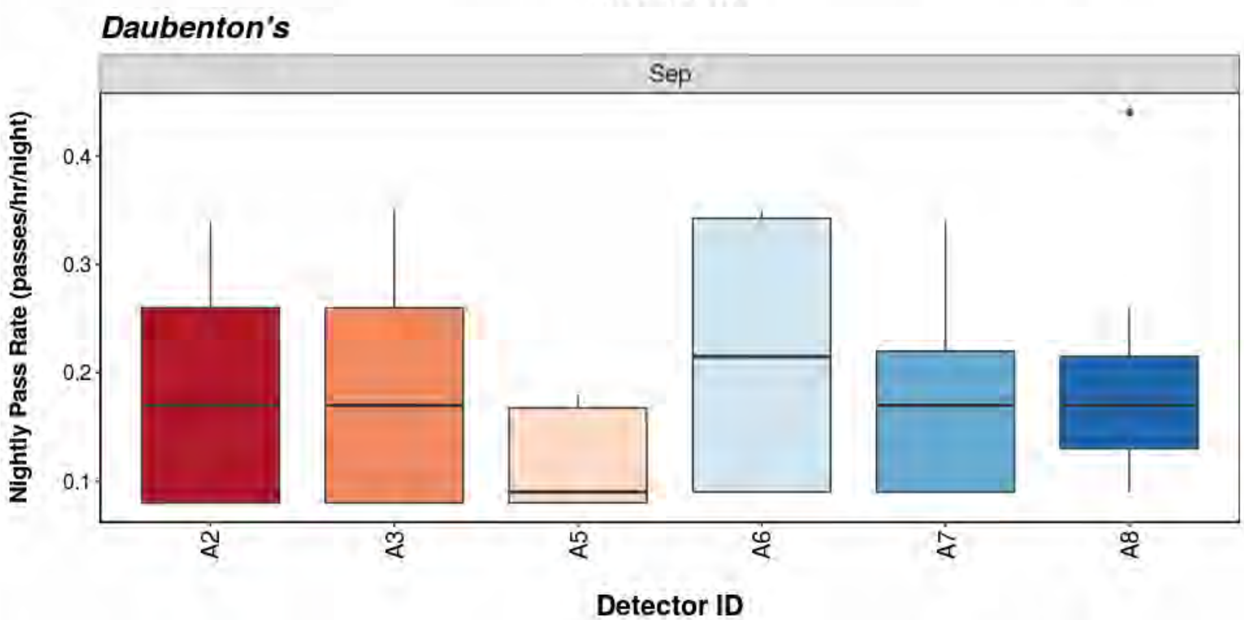
Leisler’s	A6	0.2	NA
Leisler’s	A7	0.2	NA
Leisler’s	A8	0.3	NA
Brown long-eared	A2	0.7	NA
Brown long-eared	A3	1.0	NA
Brown long-eared	A5	2.2	0.4
Brown long-eared	A6	0.3	NA
Brown long-eared	A7	0.3	NA
Brown long-eared	A8	0.4	NA
Myotis	A2	0.4	NA
Myotis	A3	0.8	NA
Myotis	A5	0.6	NA
Myotis	A6	0.6	NA
Myotis	A7	0.3	NA
Myotis	A8	0.9	NA
Daubenton’s	A2	0.2	NA
Daubenton’s	A3	0.2	NA
Daubenton’s	A5	0.1	NA
Daubenton’s	A6	0.2	NA
Daubenton’s	A7	0.2	NA
Daubenton’s	A8	0.2	NA
Whiskered	A2	0.1	NA
Whiskered	A3	0.4	NA
Whiskered	A5	0.3	NA
Whiskered	A6	0.2	NA
Whiskered	A7	0.1	NA
Whiskered	A8	0.4	NA
Natterer’s	A2	0.1	NA
Natterer’s	A3	0.2	NA
Natterer’s	A5	0.1	NA
Natterer’s	A6	0.1	NA
Natterer’s	A7	0.2	NA
Natterer’s	A8	0.2	NA

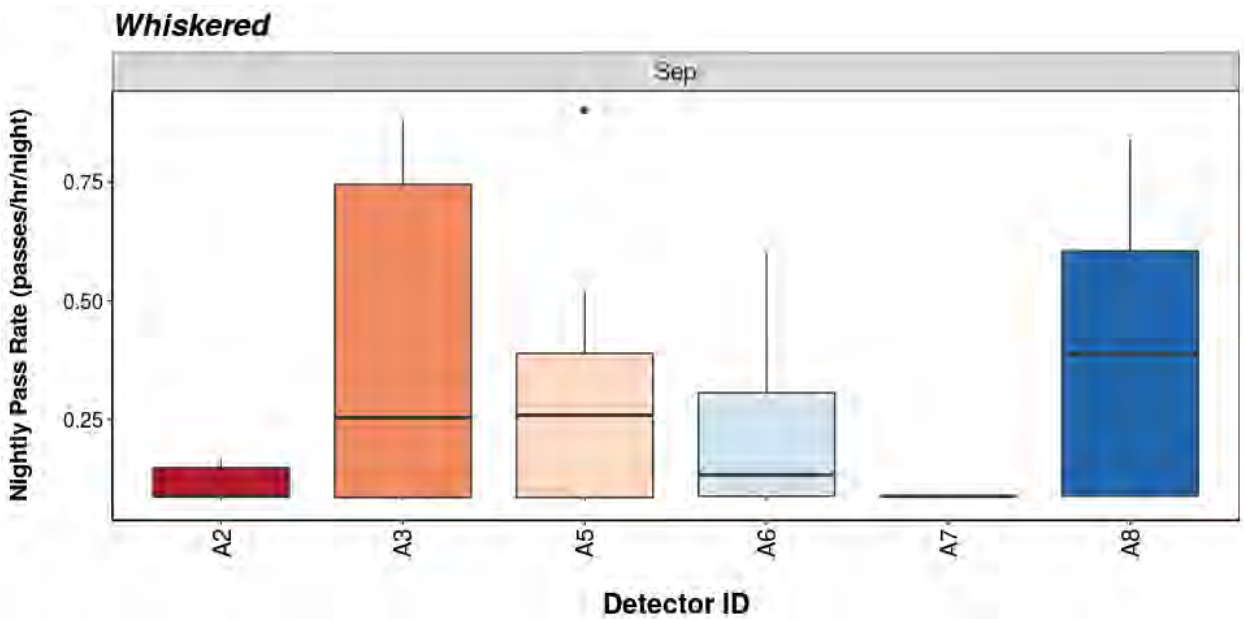
Nightly Bat Pass Rate for each Month

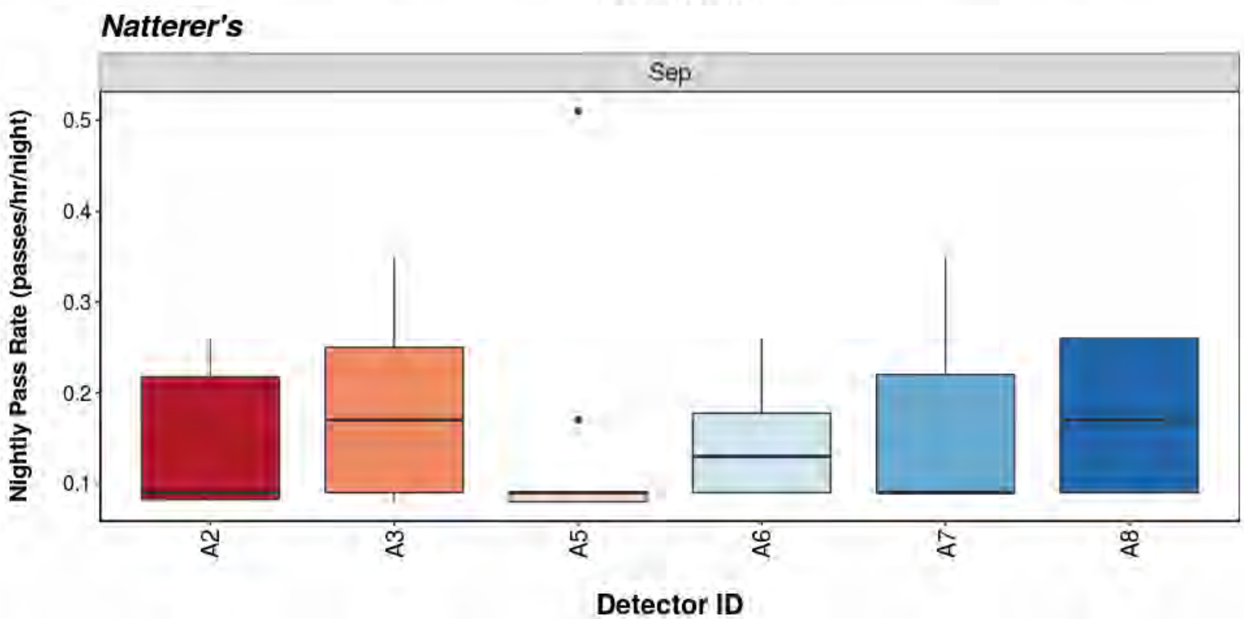
Per Detector - Figures

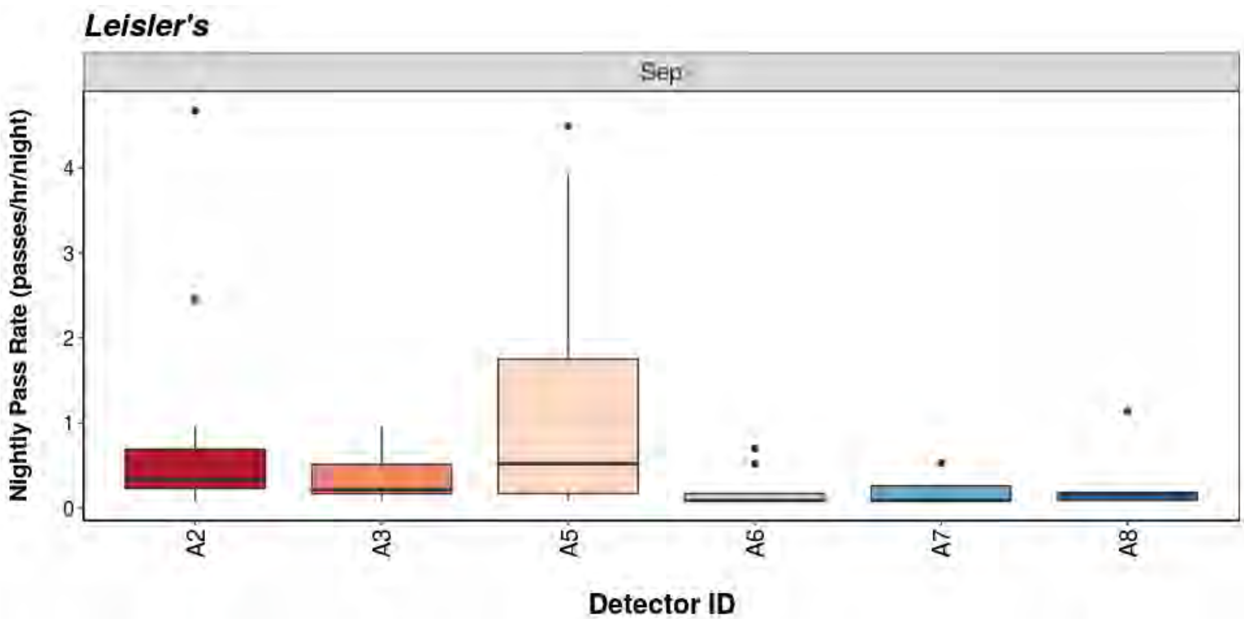
Figure 12. Figures show boxplots for the number of bat passes per hour by detector, for each month. The 'box' shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The 'whiskers' extend from the box and represent the ranges for the bottom 25% and the top 25% of the data values, excluding outliers. An outlier is any extreme value that lies further away from the box than 1.5 times the interquartile range. Outliers are shown as dots. Where very few passes are recorded it is not possible to produce the box, so the data are shown as a line.



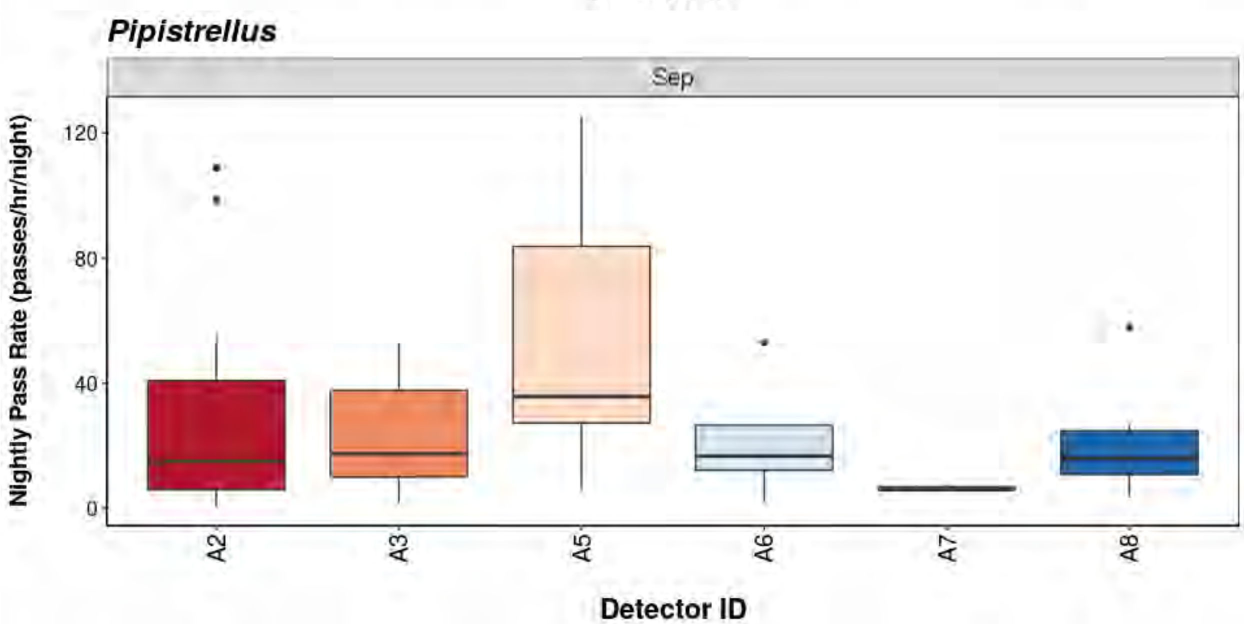



Whiskered
Sep
Nightly Pass Rate (passes/hr/night)
0.25
0.50
0.75
A2
A3
A5
A6
A7
A8
Detector ID

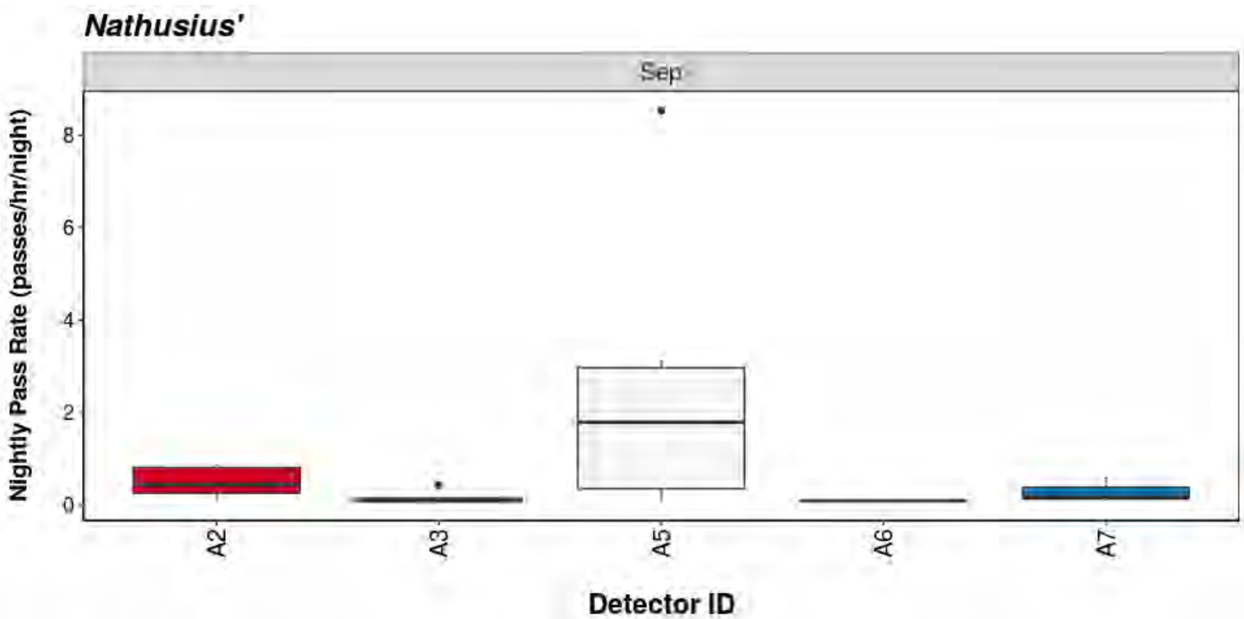

Natterer's
Sep
Nightly Pass Rate (passes/hr/night)
0.1
0.2
0.3
0.4
0.5
A2
A3
A5
A6
A7
A8
Detector ID

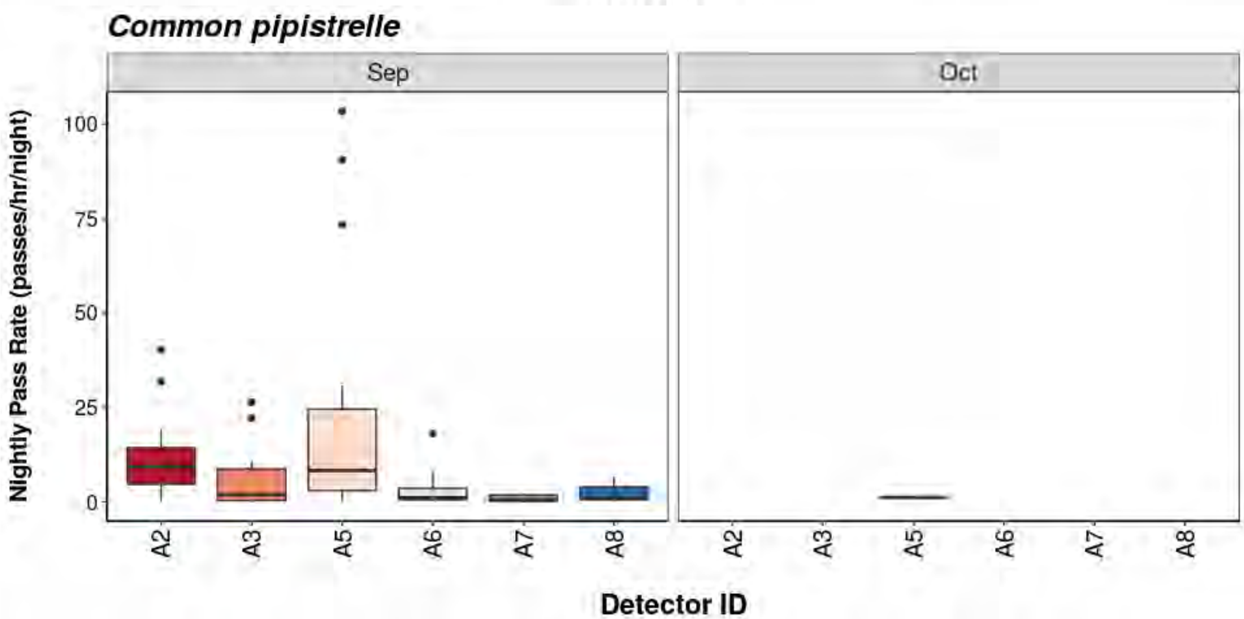


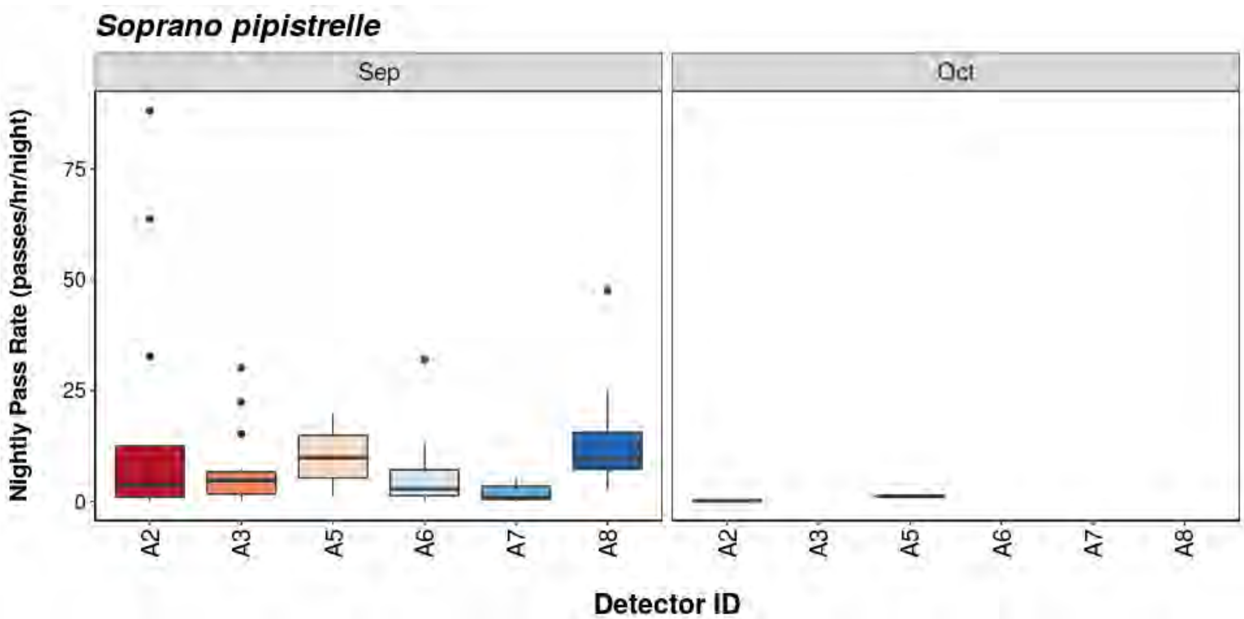
Leisler's
Sep
Nightly Pass Rate (passes/hr/night)
0
1
2
3
4
A2
A3
A5
A6
A7
A8
Detector ID



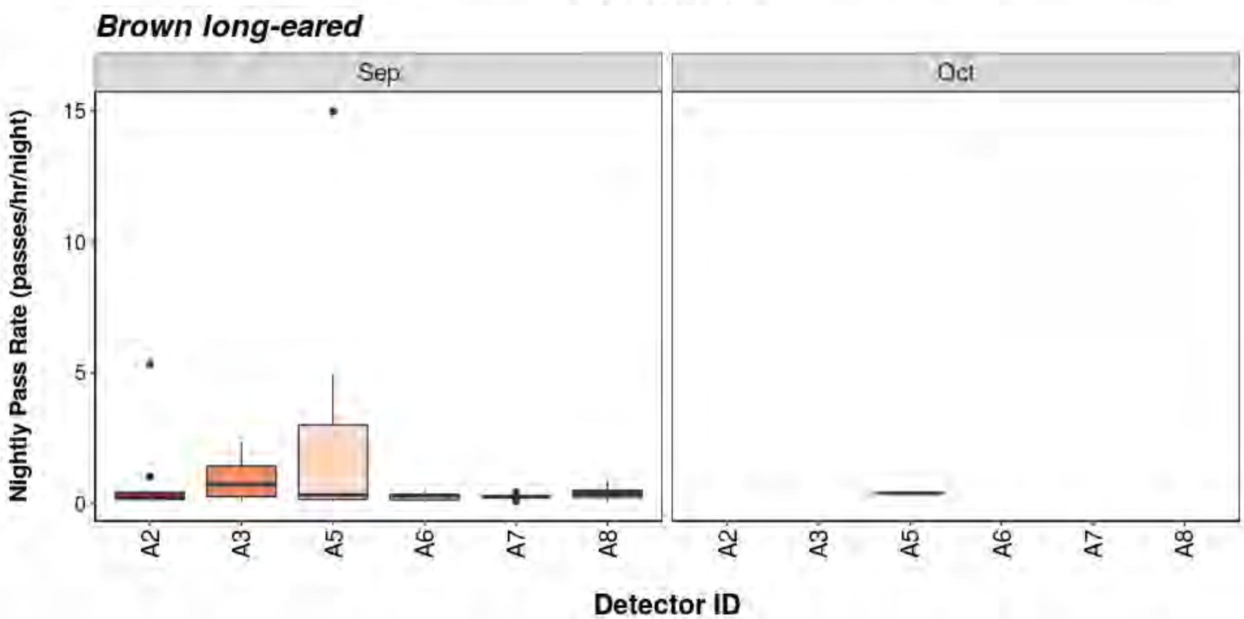
Pipistrellus
Sep
Nightly Pass Rate (passes/hr/night)
0
40
80
120
A2
A3
A5
A6
A7
A8
Detector ID


Nathusius'
Sep
Nightly Pass Rate (passes/hr/night)
8
6
4
2
0
A2
A3
A5
A6
A7
Detector ID


Common pipistrelle
Sep
Oct
Nightly Pass Rate (passes/hr/night)
100
75
50
25
0
A2
A3
A5
A6
A7
A8
Detector ID



Soprano pipistrelle
Sep
Oct
Nightly Pass Rate (passes/hr/night)
0
25
50
75
A2
A3
A5
A6
A7
A8
Detector ID



Brown long-eared
Sep
Oct
Nightly Pass Rate (passes/hr/night)
0
5
10
15
A2
A3
A5
A6
A7
A8
Detector ID

Bat Activity per Detector Location

Figure 13. Detector ID reference:

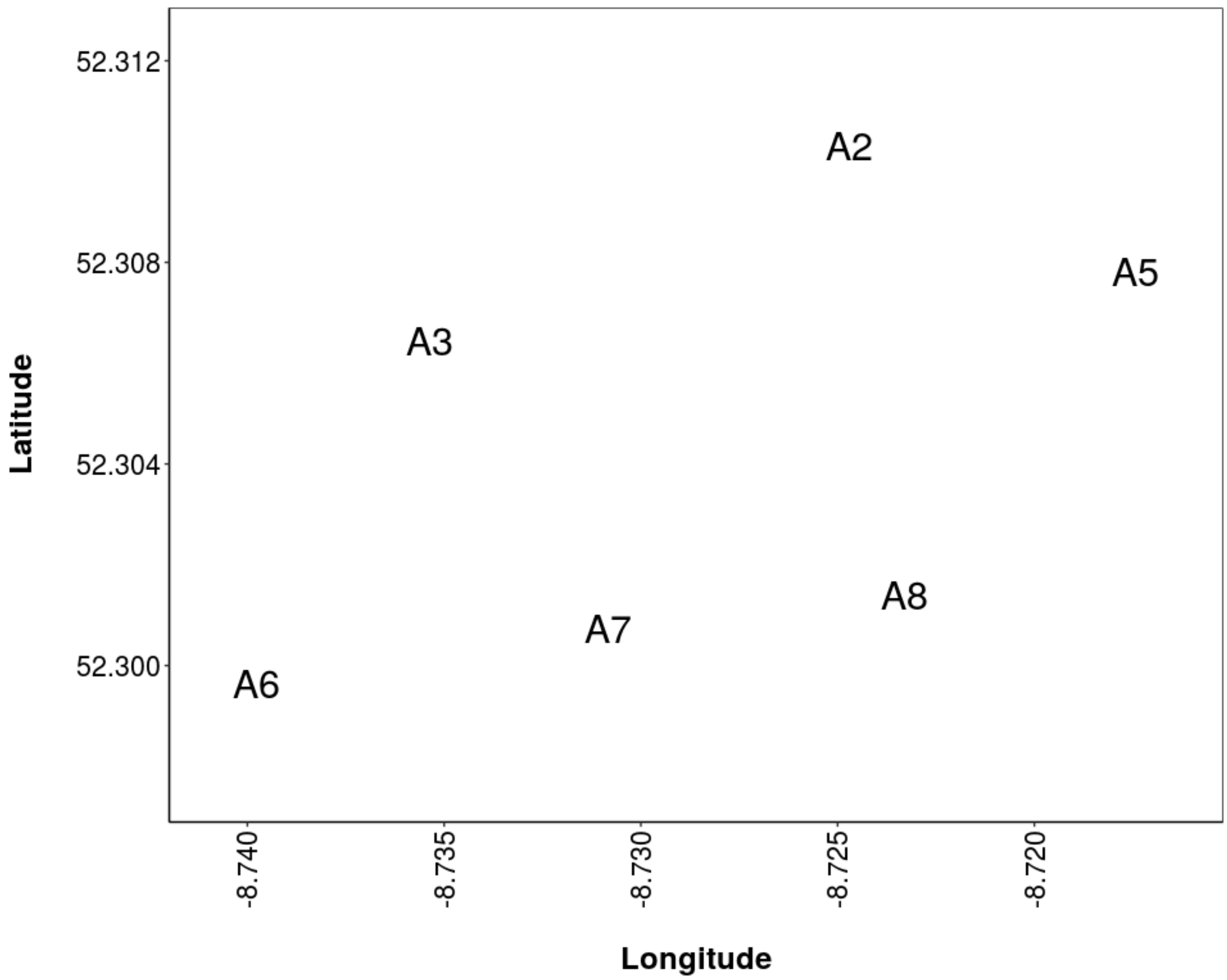
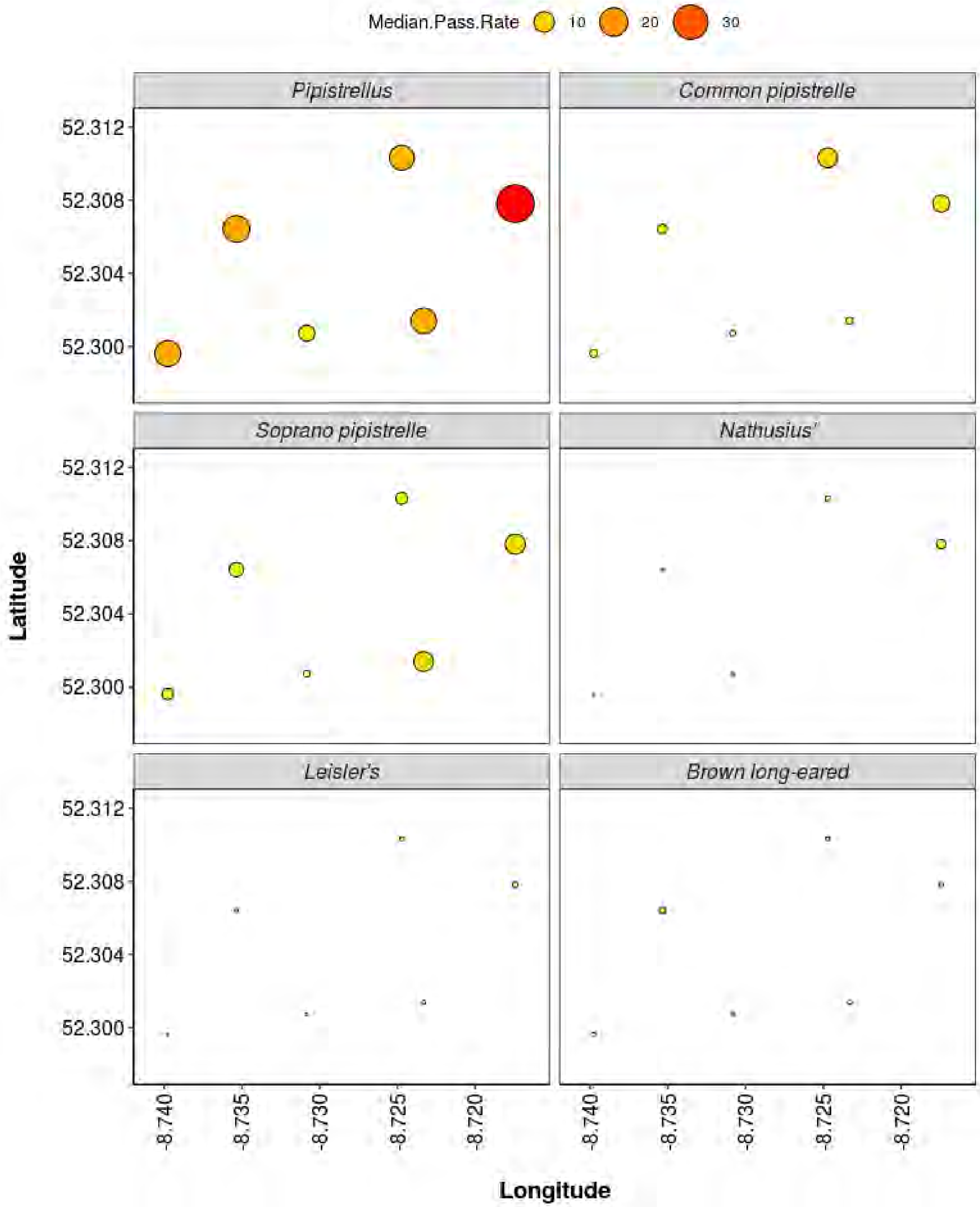
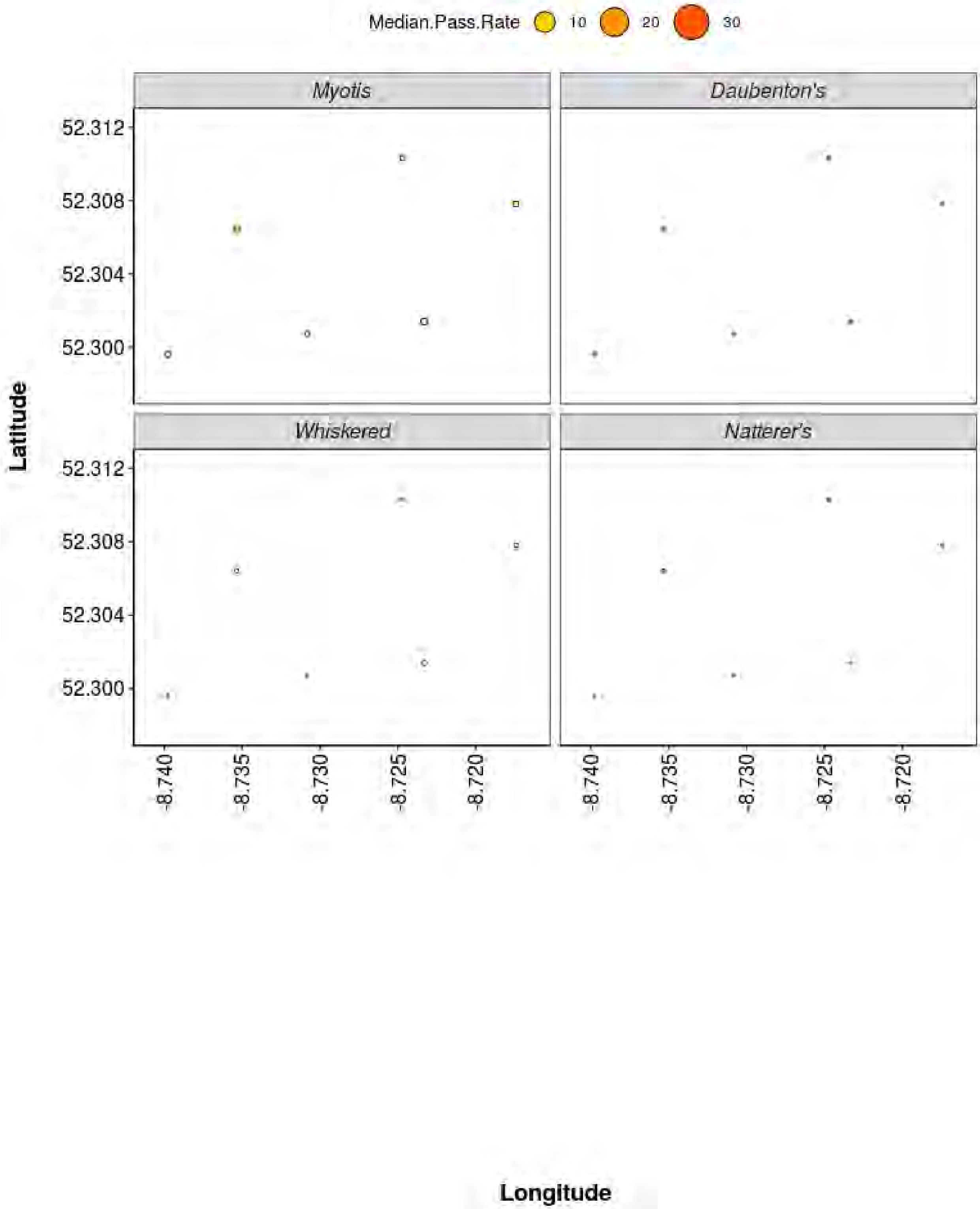


Figure 14. Median Nightly Pass Rate (bat passes/hr/night) throughout the survey period - represented by the size and colour of the point at each detector location.

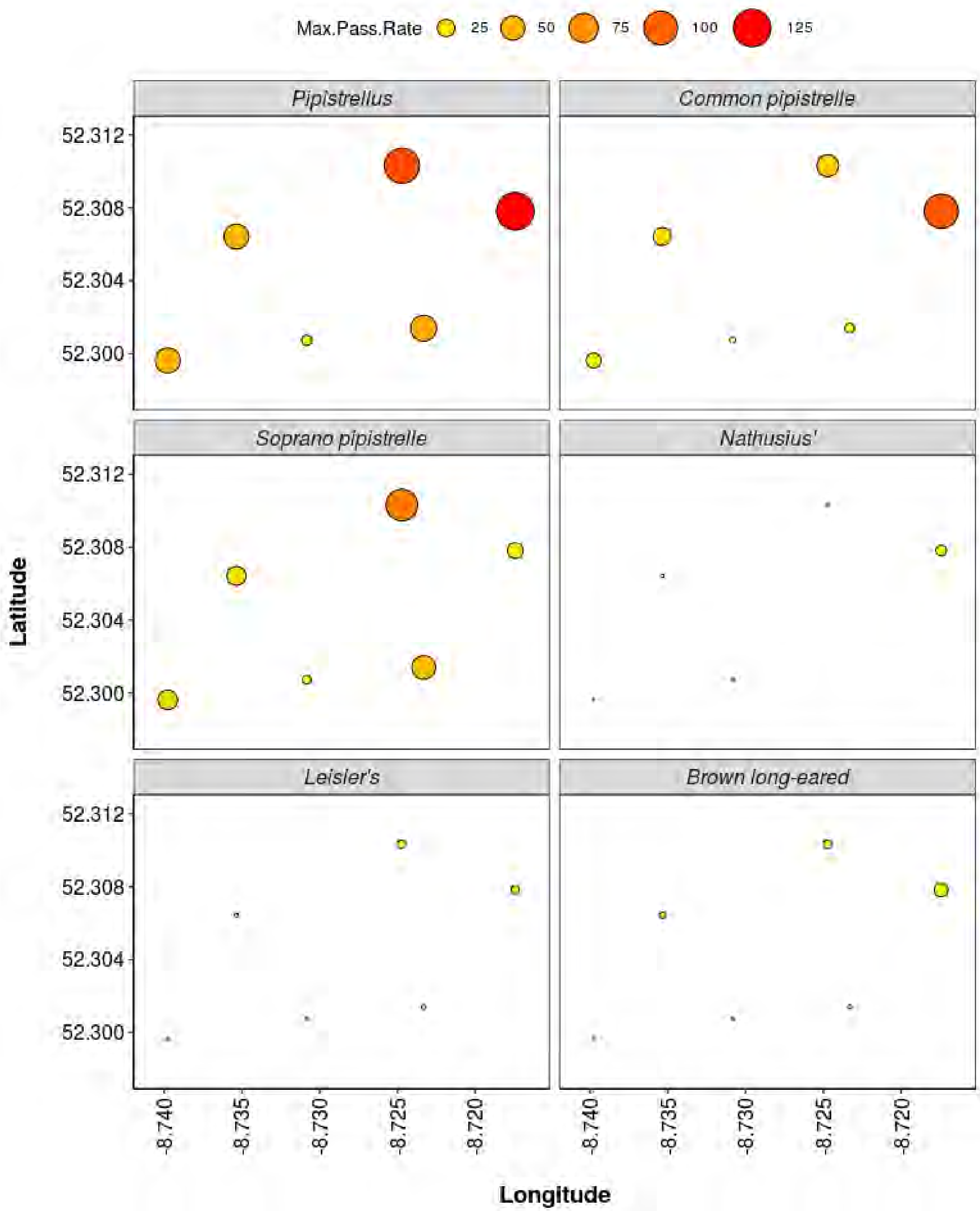


Median.Pass.Rate
10
20
30
Pipistrellus
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Brown long-eared
52.312
52.308
52.304
52.300
Latitude
-8.740
-8.735
-8.730
-8.725
-8.720
Longitude

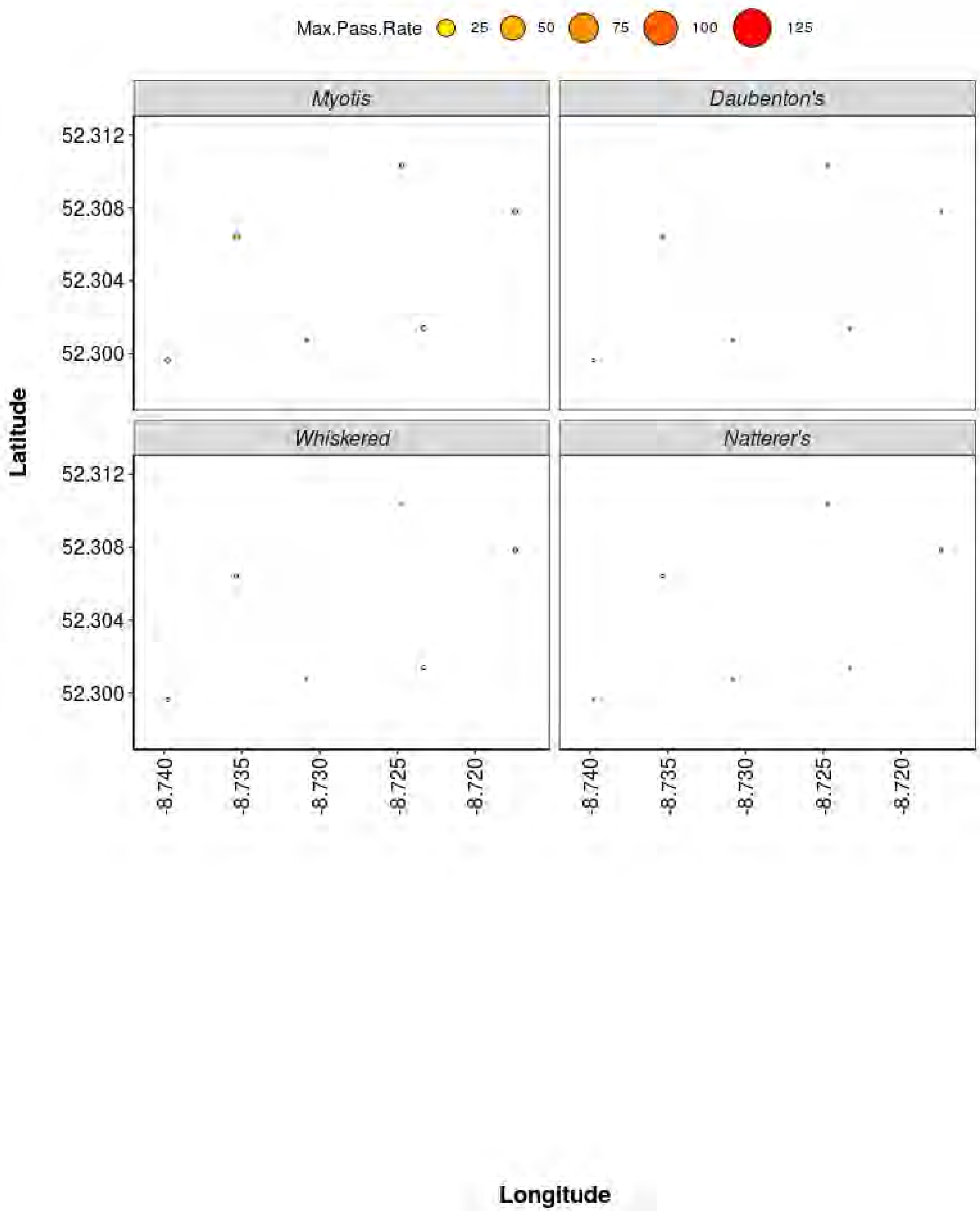


Median.Pass.Rate
10
20
30
Myotis
Daubenton's
Whiskered
Natterer's
52.312
52.308
52.304
52.300
-8.740
-8.735
-8.730
-8.725
-8.720
Latitude
Longitude

Figure 15. Maximum Nightly Pass Rate (bat passes/hr/night) recorded in a single night throughout the survey period - represented by the size and colour of the point at each detector location.



Max.Pass.Rate
25
50
75
100
125
Pipistrellus
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Brown long-eared
52.312
52.308
52.304
52.300
Latitude
-8.740
-8.735
-8.730
-8.725
-8.720
Longitude



Max.Pass.Rate
25
50
75
100
125
Myotis
Daubenton's
Whiskered
Natterer's
Latitude
52.312
52.308
52.304
52.300
-8.740
-8.735
-8.730
-8.725
-8.720
Longitude

PART 2B: Includes absences

THE NEXT SECTION OF THE REPORT FEATURES THE DATA SUPPLIED TO ECOBAT BUT TAKES INTO ACCOUNT SPECIES ABSENCES, AND THEREFORE INCLUDES 'ZERO DATA' FOR WHEN SPECIES WERE NOT DETECTED AT EACH DETECTOR ON A NIGHT. THIS DRAMATICALLY LOWERS THE MEANS AND MEDIANS OF THE DATA PRESENTED.

Nightly Bat Pass Rate (Bat passes per hour)

Median Per Detector

Table 22. The median Nightly Pass Rate (bat passes per hour, per night) of each species. If NA, then no bat passes.

Bat pass rates are often highly variable between nights, with some nights having few or no passes and other nights having high activity. In these circumstances, the median is likely to be a more useful summary of the 'average' activity than is the mean. For further information see: *Lintott, P. R., & Mathews, F. (2018). Basic mathematical errors may make ecological assessments unreliable. Biodiversity and Conservation, 27(1), 265-267.* https://doi.org/10.1007/s10531-017-1418-5

Species	Detector ID	Median Pass Rate
Brown long-eared	A2	0.2
Brown long-eared	A3	0.6
Brown long-eared	A5	0.3
Brown long-eared	A6	0.3
Brown long-eared	A7	0.3
Brown long-eared	A8	0.3
Common pipistrelle	A2	8.0
Common pipistrelle	A3	1.1
Common pipistrelle	A5	6.7
Common pipistrelle	A6	1.1
Common pipistrelle	A7	0.5
Common pipistrelle	A8	1.0
Daubenton's	A2	0.1
Daubenton's	A3	0.1
Daubenton's	A5	0.1
Daubenton's	A6	0.0
Daubenton's	A7	0.1
Daubenton's	A8	0.2
Leisler's	A2	0.2
Leisler's	A3	0.2
Leisler's	A5	0.4
Leisler's	A6	0.1
Leisler's	A7	0.1

Leisler’s	A8	0.1
Myotis	A2	0.1
Myotis	A3	0.0
Myotis	A5	0.2
Myotis	A6	0.5
Myotis	A7	0.3
Myotis	A8	0.5
Nathusius’	A2	0.0
Nathusius’	A3	0.0
Nathusius’	A5	0.0
Nathusius’	A6	0.0
Nathusius’	A7	0.0
Nathusius’	A8	0.0
Natterer’s	A2	0.0
Natterer’s	A3	0.1
Natterer’s	A5	0.1
Natterer’s	A6	0.1
Natterer’s	A7	0.0
Natterer’s	A8	0.1
Pipistrellus	A2	5.4
Pipistrellus	A3	0.0
Pipistrellus	A5	6.0
Pipistrellus	A6	0.0
Pipistrellus	A7	0.0
Pipistrellus	A8	14.4
Soprano pipistrelle	A2	2.6
Soprano pipistrelle	A3	4.7
Soprano pipistrelle	A5	9.2
Soprano pipistrelle	A6	2.9
Soprano pipistrelle	A7	0.9
Soprano pipistrelle	A8	9.4
Whiskered	A2	0.0
Whiskered	A3	0.0
Whiskered	A5	0.1
Whiskered	A6	0.1
Whiskered	A7	0.0

Whiskered	A8	0.4

Nightly Bat Pass Rate (Bat passes per hour)

Mean per Detector

Table 23. The mean Nightly Pass Rate (bat passes per hour, per night) of each species at each detector. Values are given to 1 decimal place.

We recommend using the median values given above, for the reasons stated above, but provide the mean values in the table below.

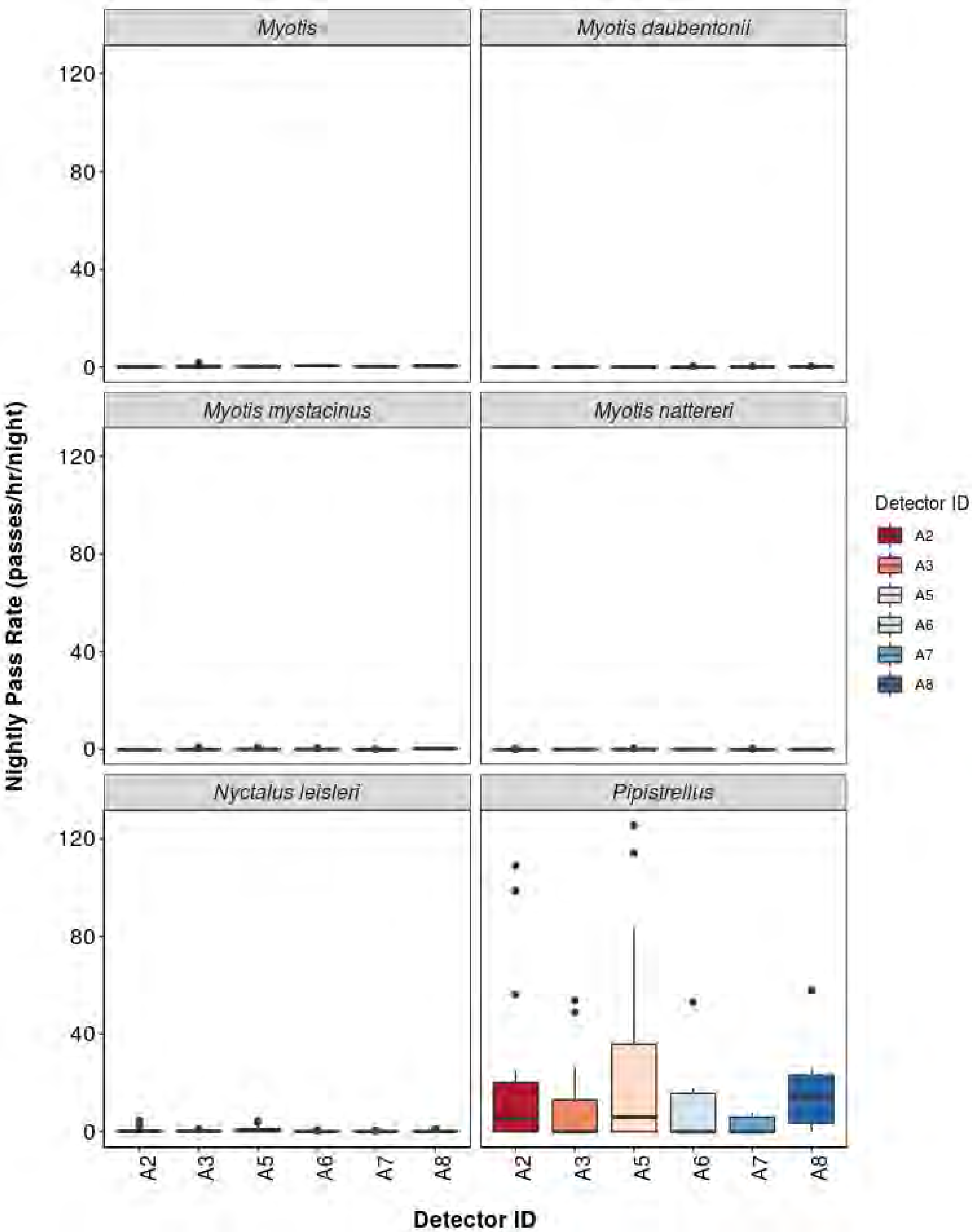
Species	Detector ID	Mean Pass Rate
Brown long-eared	A2	0.6
Brown long-eared	A3	0.8
Brown long-eared	A5	1.8
Brown long-eared	A6	0.2
Brown long-eared	A7	0.2
Brown long-eared	A8	0.4
Common pipistrelle	A2	9.8
Common pipistrelle	A3	5.1
Common pipistrelle	A5	22.7
Common pipistrelle	A6	3.8
Common pipistrelle	A7	0.9
Common pipistrelle	A8	2.5
Daubenton’s	A2	0.1
Daubenton’s	A3	0.1
Daubenton’s	A5	0.1
Daubenton’s	A6	0.1
Daubenton’s	A7	0.1
Daubenton’s	A8	0.2
Leisler’s	A2	0.6
Leisler’s	A3	0.3
Leisler’s	A5	1.0
Leisler’s	A6	0.2
Leisler’s	A7	0.1
Leisler’s	A8	0.2
Myotis	A2	0.2
Myotis	A3	0.4

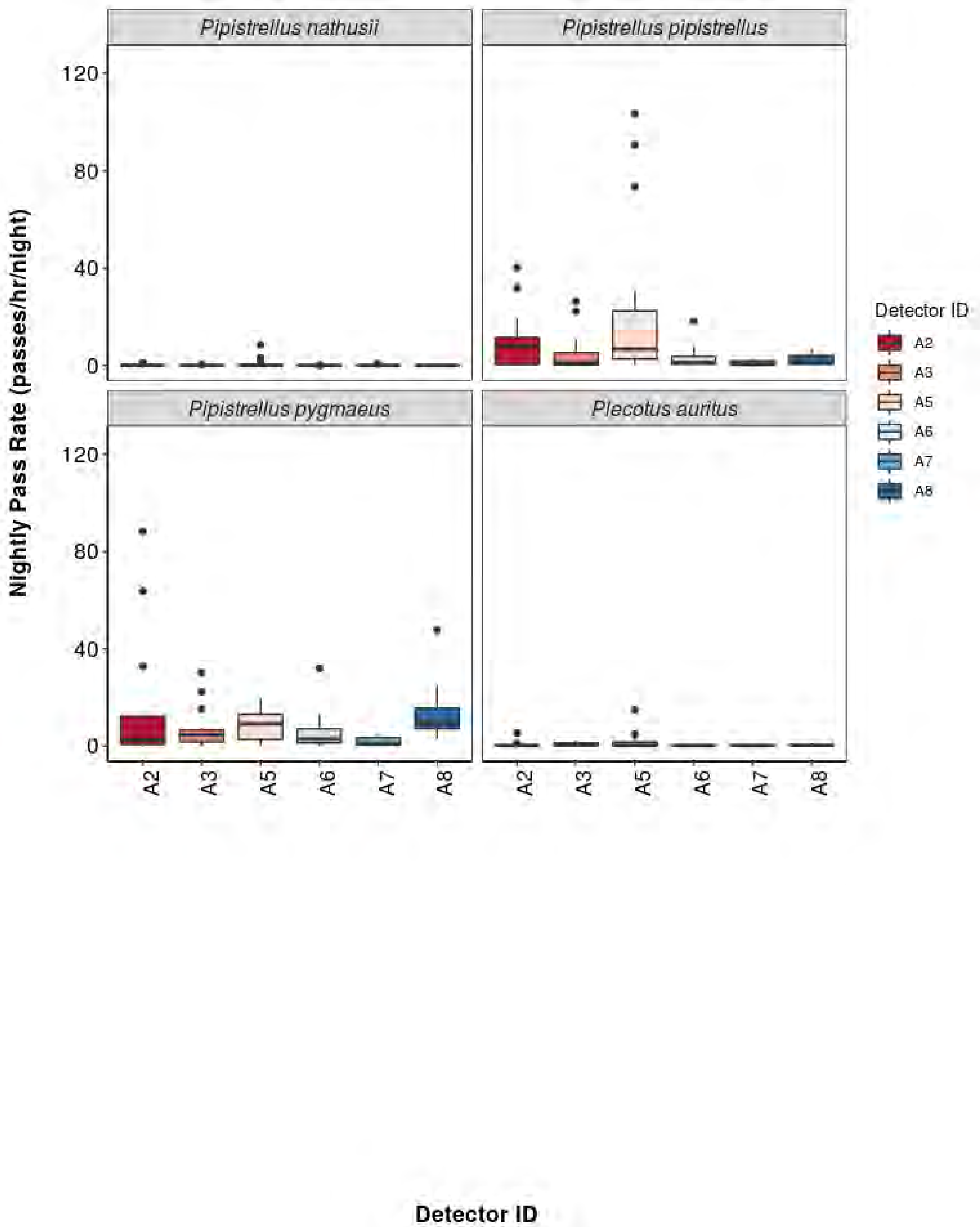
Myotis	A5	0.4
Myotis	A6	0.5
Myotis	A7	0.2
Myotis	A8	0.6
Nathusius’	A2	0.2
Nathusius’	A3	0.1
Nathusius’	A5	1.0
Nathusius’	A6	0.0
Nathusius’	A7	0.1
Nathusius’	A8	0.0
Natterer’s	A2	0.1
Natterer’s	A3	0.1
Natterer’s	A5	0.1
Natterer’s	A6	0.1
Natterer’s	A7	0.1
Natterer’s	A8	0.1
Pipistrellus	A2	20.7
Pipistrellus	A3	10.5
Pipistrellus	A5	29.2
Pipistrellus	A6	9.9
Pipistrellus	A7	2.2
Pipistrellus	A8	16.6
Soprano pipistrelle	A2	13.8
Soprano pipistrelle	A3	7.1
Soprano pipistrelle	A5	9.3
Soprano pipistrelle	A6	7.0
Soprano pipistrelle	A7	1.8
Soprano pipistrelle	A8	14.7
Whiskered	A2	0.0
Whiskered	A3	0.2
Whiskered	A5	0.2
Whiskered	A6	0.2
Whiskered	A7	0.0
Whiskered	A8	0.3

Nightly Bat Passes (Bat passes per hour)

Per Detector - Figures

Figure 16. Figures show boxplots for the number of bat passes per hour each night, for each detector. The ‘box’ shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The ‘whiskers’ extend from the box and represent the ranges for the bottom 25% and the top 25% of the data values, excluding outliers. An outlier is any extreme value that lies further away from the box than 1.5 times the interquartile range. Outliers are shown as dots. Where very few passes are recorded it is not possible to produce the box, so the data are shown as a line.


Myotis
Myotis daubentonii
Myotis mystacinus
Myotis nattereri
Nyctalus leisleri
Pipistrellus
120
80
40
0
A2
A3
A5
A6
A7
A8
Nightly Pass Rate (passes/hr/night)
Detector ID
Detector ID
A2
A3
A5
A6
A7
A8


Pipistrellus nathusii
Pipistrellus pipistrellus
Pipistrellus pygmaeus
Plecotus auritus
Nightly Pass Rate (passes/hr/night)
0
40
80
120
A2
A3
A5
A6
A7
A8
Detector ID
Detector ID

Survey Effort

Table 24. The number of nights bats were detected per month per detector.

Month	Detector ID	No of Survey Nights
Sep	A2	16
Sep	A3	16
Sep	A5	16
Sep	A6	9
Sep	A7	9
Sep	A8	9
Oct	A2	1
Oct	A5	1

Nightly Bat Pass Rate for each Month

Median Per Detector

Table 25. The median Nightly Pass Rate (bat passes per hour, per night) of each species throughout each month. If NA, then no bat passes.

Bat pass rates are often highly variable between nights, with some nights having few or no passes and other nights having high activity. In these circumstances, the median is likely to be a more useful summary of the 'average' activity than is the mean. For further information see: *Lintott, P. R., & Mathews, F. (2018). Basic mathematical errors may make ecological assessments unreliable. Biodiversity and Conservation, 27(1), 265-267.* https://doi.org/10.1007/s10531-017-1418-5

Species	Detector ID	Oct	Sep
Brown long-eared	A2	0.0	0.2
Brown long-eared	A3	NA	0.6
Brown long-eared	A5	0.4	0.2
Brown long-eared	A6	NA	0.3
Brown long-eared	A7	NA	0.3
Brown long-eared	A8	NA	0.3
Common pipistrelle	A2	0.0	8.6
Common pipistrelle	A3	NA	1.1
Common pipistrelle	A5	1.2	8.3
Common pipistrelle	A6	NA	1.1
Common pipistrelle	A7	NA	0.5
Common pipistrelle	A8	NA	1.0
Daubenton's	A2	0.0	0.1
Daubenton's	A3	NA	0.1
Daubenton's	A5	0.0	0.1
Daubenton's	A6	NA	0.0
Daubenton's	A7	NA	0.1
Daubenton's	A8	NA	0.2
Leisler's	A2	0.0	0.3
Leisler's	A3	NA	0.2
Leisler's	A5	0.0	0.5
Leisler's	A6	NA	0.1
Leisler's	A7	NA	0.1

Leisler’s	A8	NA	0.1
Myotis	A2	0.0	0.1
Myotis	A3	NA	0.0
Myotis	A5	0.0	0.3
Myotis	A6	NA	0.5
Myotis	A7	NA	0.3
Myotis	A8	NA	0.5
Nathusius’	A2	0.0	0.0
Nathusius’	A3	NA	0.0
Nathusius’	A5	0.0	0.0
Nathusius’	A6	NA	0.0
Nathusius’	A7	NA	0.0
Nathusius’	A8	NA	0.0
Natterer’s	A2	0.0	0.0
Natterer’s	A3	NA	0.1
Natterer’s	A5	0.0	0.1
Natterer’s	A6	NA	0.1
Natterer’s	A7	NA	0.0
Natterer’s	A8	NA	0.1
Pipistrellus	A2	0.0	6.1
Pipistrellus	A3	NA	0.0
Pipistrellus	A5	0.0	15.8
Pipistrellus	A6	NA	0.0
Pipistrellus	A7	NA	0.0
Pipistrellus	A8	NA	14.4
Soprano pipistrelle	A2	0.2	3.1
Soprano pipistrelle	A3	NA	4.7
Soprano pipistrelle	A5	1.2	9.6
Soprano pipistrelle	A6	NA	2.9
Soprano pipistrelle	A7	NA	0.9
Soprano pipistrelle	A8	NA	9.4
Whiskered	A2	0.0	0.0
Whiskered	A3	NA	0.0
Whiskered	A5	0.0	0.2
Whiskered	A6	NA	0.1
Whiskered	A7	NA	0.0

Whiskered	A8	NA	0.4

Nightly Bat Pass Rate for each Month

Mean per Detector

Table 26. The mean Nightly Pass Rate (bat passes per hour, per night) of each species throughout each month. Values are given to 1 decimal place.

We recommend using the median values given above, for the reasons stated above, but provide the mean values in the table below.

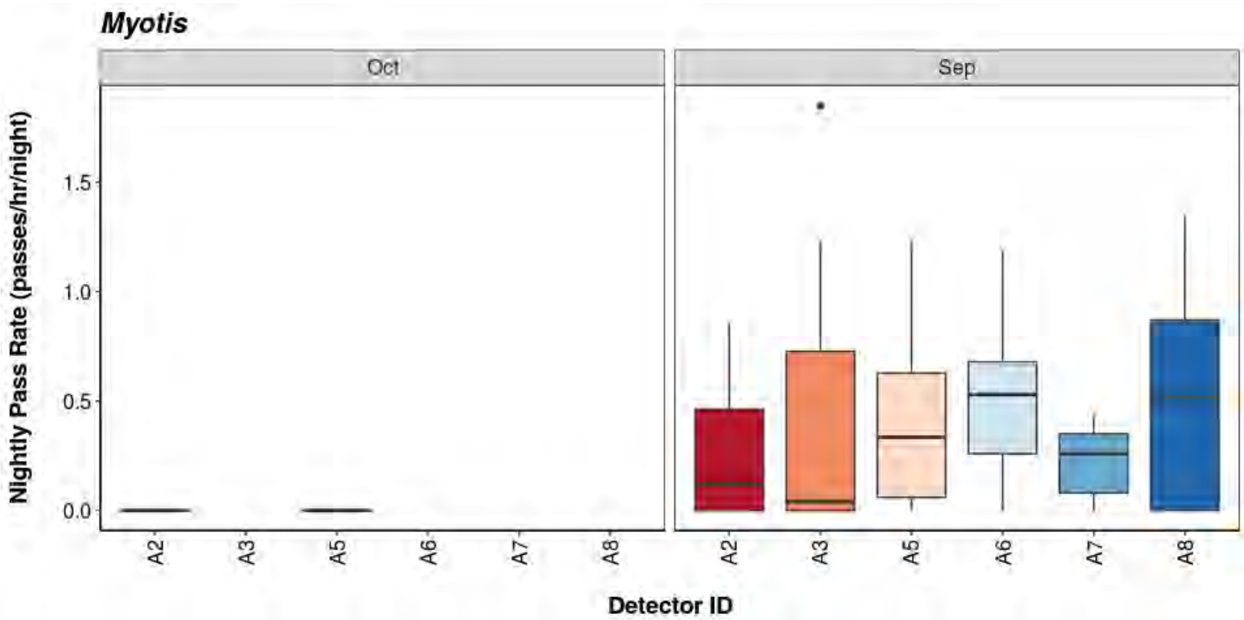
Species	Detector ID	Oct	Sep
Brown long-eared	A2	0.0	0.6
Brown long-eared	A3	NA	0.8
Brown long-eared	A5	0.4	1.9
Brown long-eared	A6	NA	0.2
Brown long-eared	A7	NA	0.2
Brown long-eared	A8	NA	0.4
Common pipistrelle	A2	0.0	10.4
Common pipistrelle	A3	NA	5.1
Common pipistrelle	A5	1.2	24.0
Common pipistrelle	A6	NA	3.8
Common pipistrelle	A7	NA	0.9
Common pipistrelle	A8	NA	2.5
Daubenton’s	A2	0.0	0.1
Daubenton’s	A3	NA	0.1
Daubenton’s	A5	0.0	0.1
Daubenton’s	A6	NA	0.1
Daubenton’s	A7	NA	0.1
Daubenton’s	A8	NA	0.2
Leisler’s	A2	0.0	0.7
Leisler’s	A3	NA	0.3
Leisler’s	A5	0.0	1.1
Leisler’s	A6	NA	0.2
Leisler’s	A7	NA	0.1
Leisler’s	A8	NA	0.2
Myotis	A2	0.0	0.2
Myotis	A3	NA	0.4

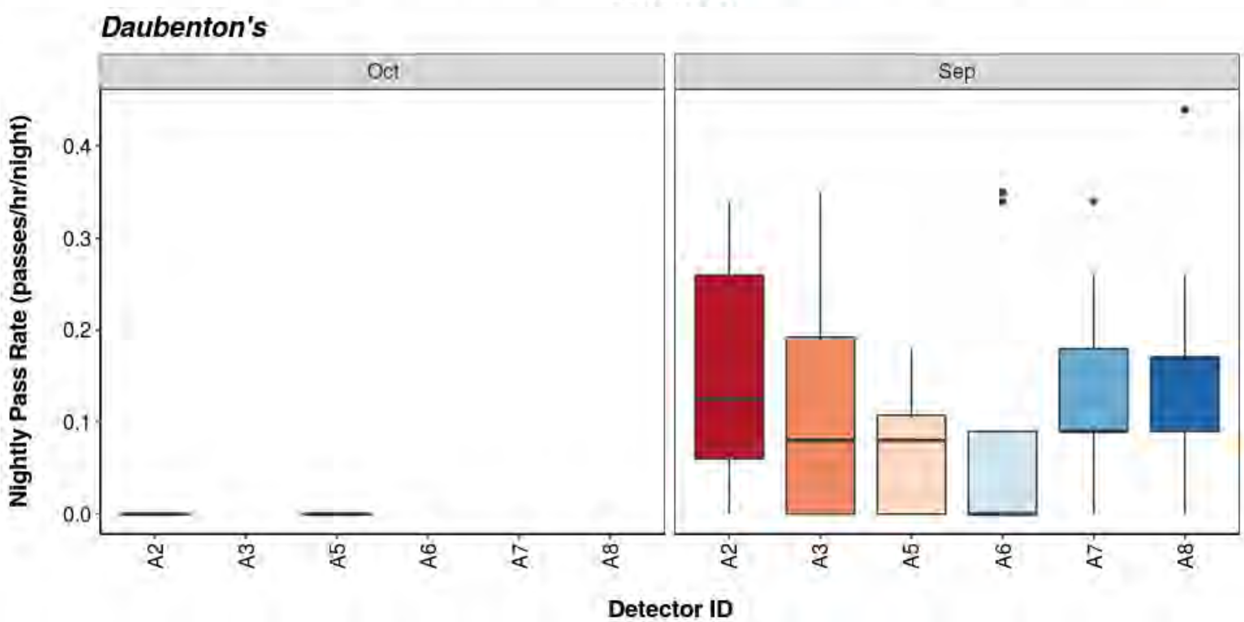
Myotis	A5	0.0	0.4
Myotis	A6	NA	0.5
Myotis	A7	NA	0.2
Myotis	A8	NA	0.6
Nathusius’	A2	0.0	0.2
Nathusius’	A3	NA	0.1
Nathusius’	A5	0.0	1.1
Nathusius’	A6	NA	0.0
Nathusius’	A7	NA	0.1
Nathusius’	A8	NA	0.0
Natterer’s	A2	0.0	0.1
Natterer’s	A3	NA	0.1
Natterer’s	A5	0.0	0.1
Natterer’s	A6	NA	0.1
Natterer’s	A7	NA	0.1
Natterer’s	A8	NA	0.1
Pipistrellus	A2	0.0	22.0
Pipistrellus	A3	NA	10.5
Pipistrellus	A5	0.0	31.0
Pipistrellus	A6	NA	9.9
Pipistrellus	A7	NA	2.2
Pipistrellus	A8	NA	16.6
Soprano pipistrelle	A2	0.2	14.6
Soprano pipistrelle	A3	NA	7.1
Soprano pipistrelle	A5	1.2	9.8
Soprano pipistrelle	A6	NA	7.0
Soprano pipistrelle	A7	NA	1.8
Soprano pipistrelle	A8	NA	14.7
Whiskered	A2	0.0	0.0
Whiskered	A3	NA	0.2
Whiskered	A5	0.0	0.2
Whiskered	A6	NA	0.2
Whiskered	A7	NA	0.0
Whiskered	A8	NA	0.3

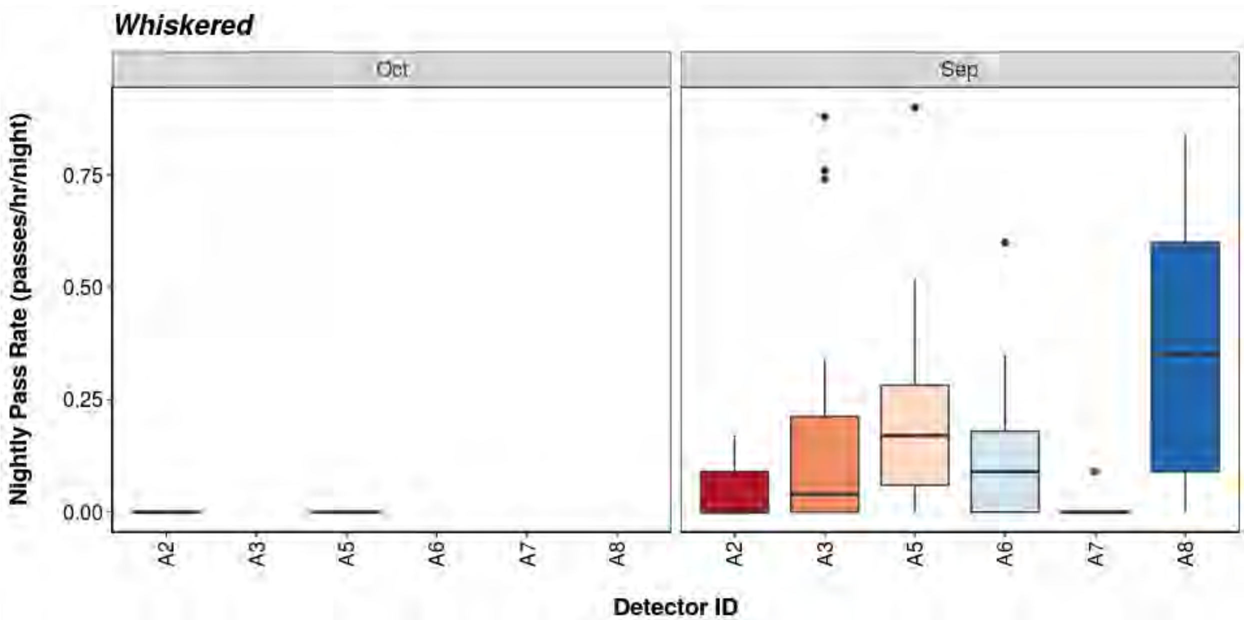
Nightly Bat Pass Rate for each Month

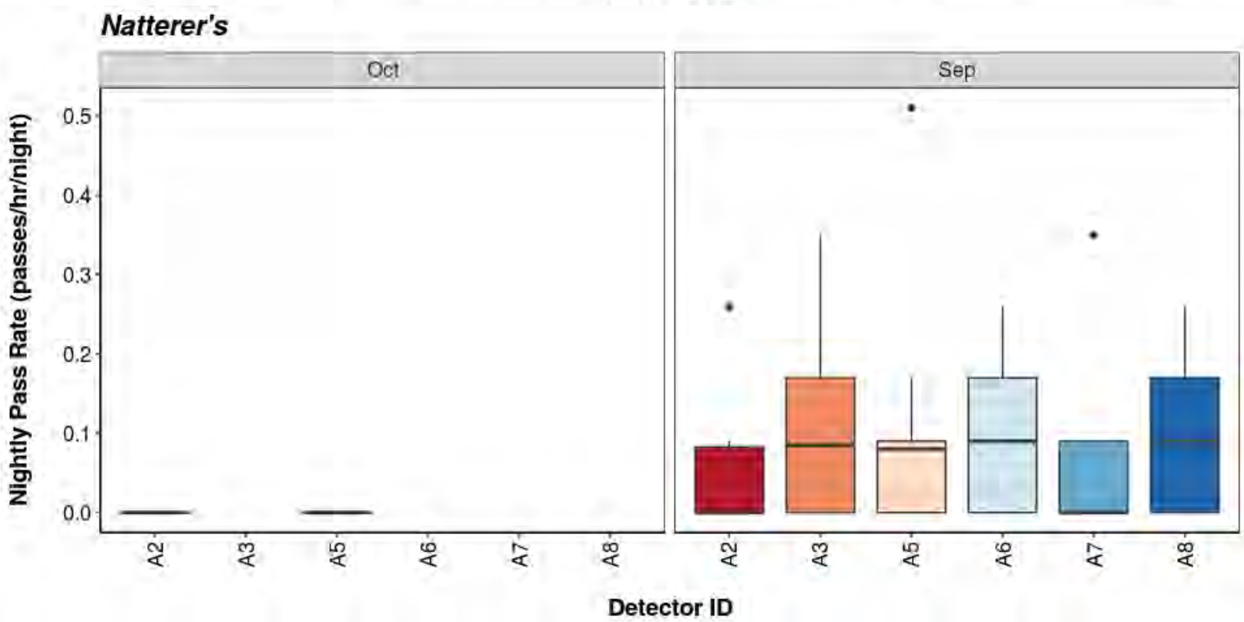
Per Detector - Figures

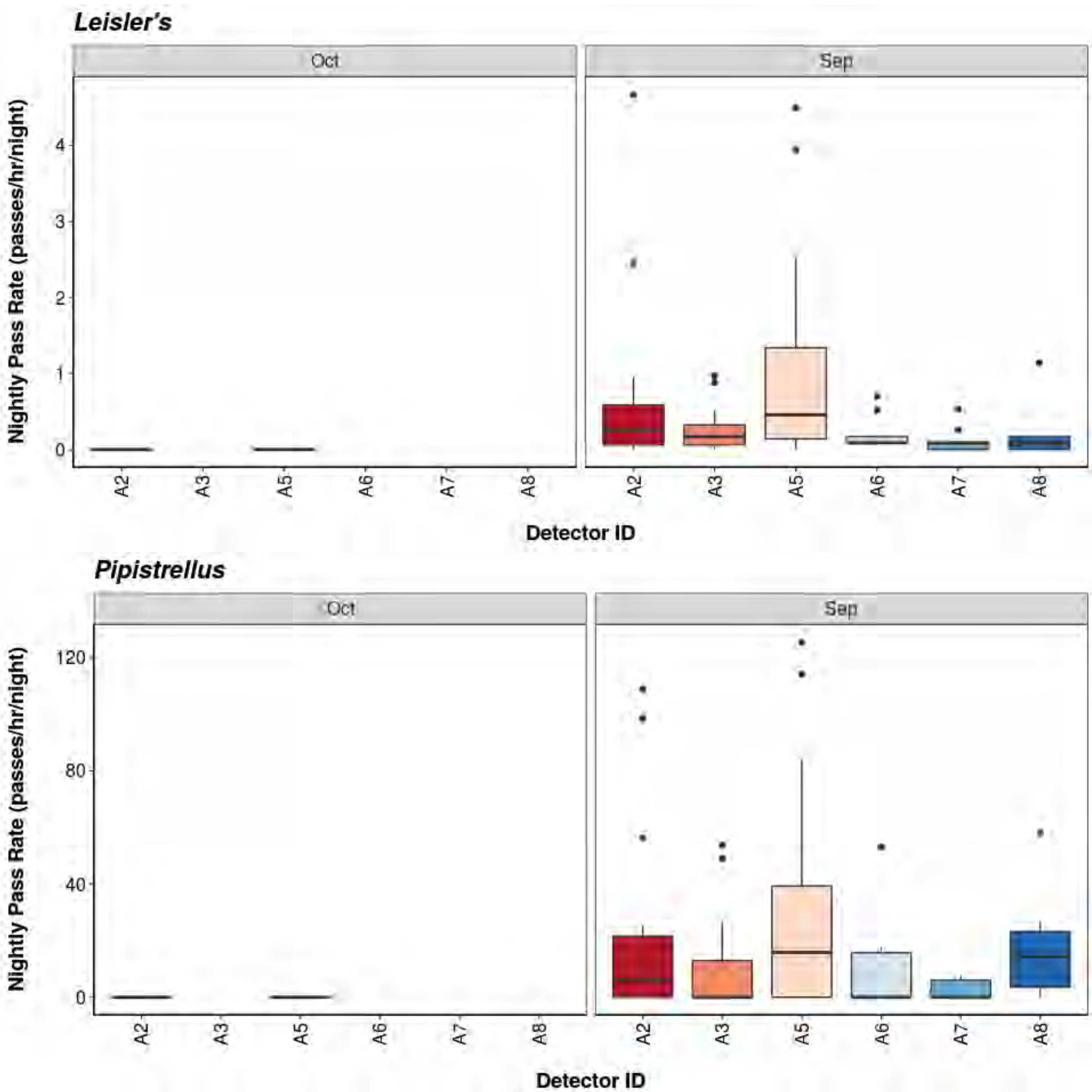
Figure 17. Figures show boxplots for the number of bat passes per hour by detector, for each month. The 'box' shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The 'whiskers' extend from the box and represent the ranges for the bottom 25% and the top 25% of the data values, excluding outliers. An outlier is any extreme value that lies further away from the box than 1.5 times the interquartile range. Outliers are shown as dots. Where very few passes are recorded it is not possible to produce the box, so the data are shown as a line.



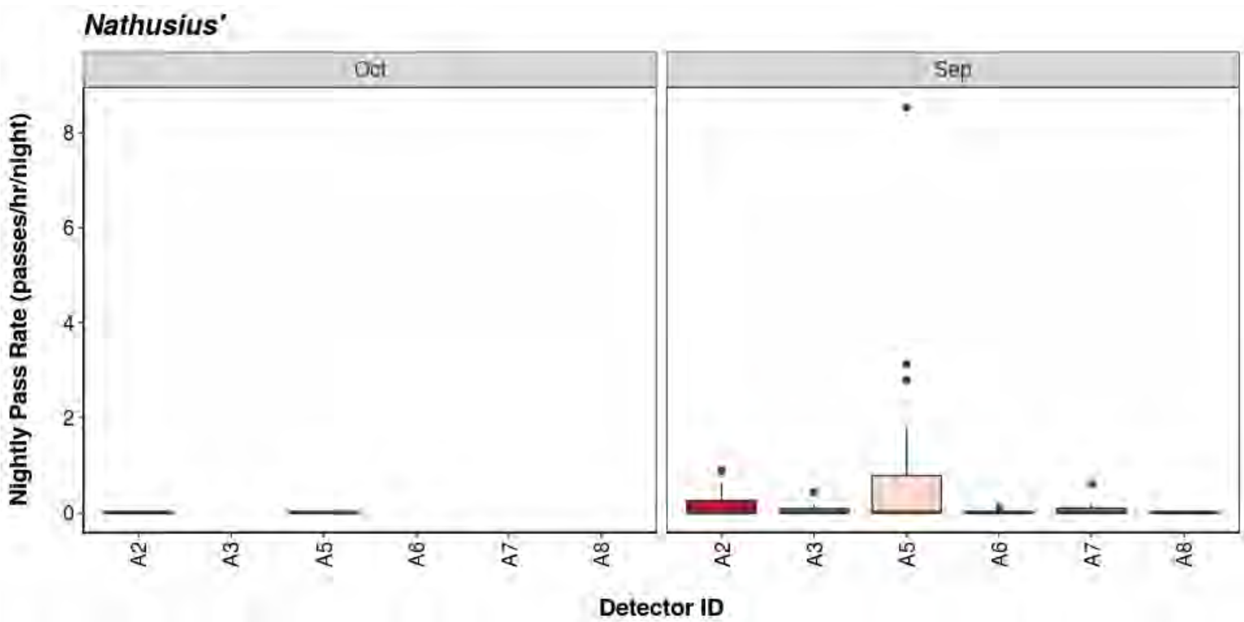


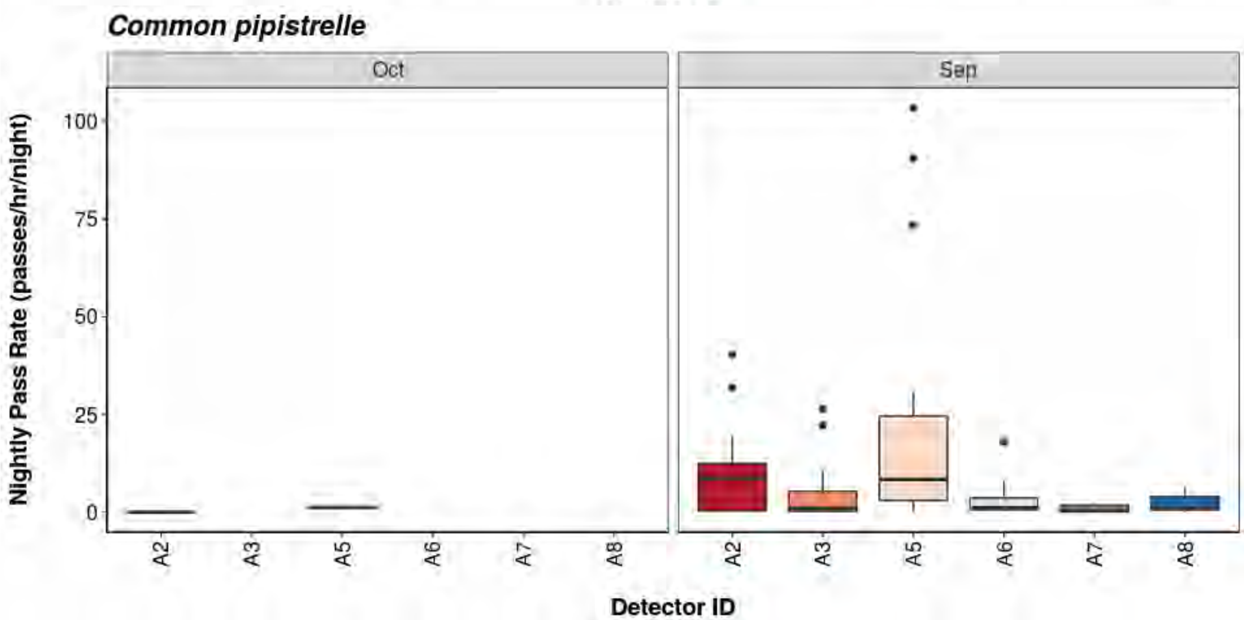

Whiskered
Oct
Sep
Nightly Pass Rate (passes/hr/night)
0.00
0.25
0.50
0.75
A2
A3
A5
A6
A7
A8
Detector ID

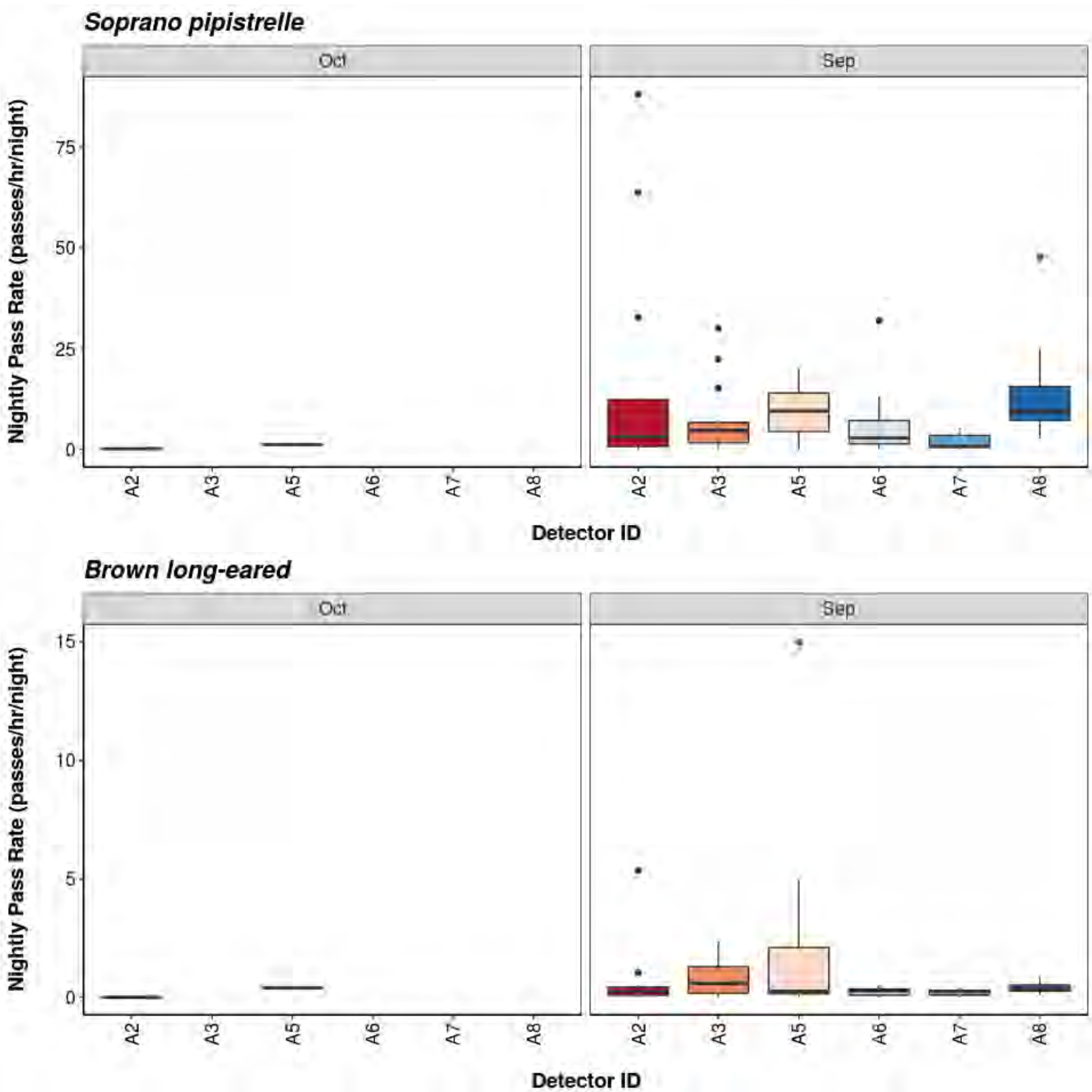

Natterer's
Oct
Sep
Nightly Pass Rate (passes/hr/night)
0.0
0.1
0.2
0.3
0.4
0.5
A2
A3
A5
A6
A7
A8
Detector ID



Leisler's
Oct
Sep
Nightly Pass Rate (passes/hr/night)
0
1
2
3
4
A2
A3
A5
A6
A7
A8
Detector ID
Pipistrellus
Oct
Sep
Nightly Pass Rate (passes/hr/night)
0
40
80
120
A2
A3
A5
A6
A7
A8
Detector ID


Nathusius'
Oct
Sep
Nightly Pass Rate (passes/hr/night)
0
2
4
6
8
A2
A3
A5
A6
A7
A8
Detector ID


Common pipistrelle
Oct
Sep
Nightly Pass Rate (passes/hr/night)
0
25
50
75
100
A2
A3
A5
A6
A7
A8
Detector ID



Soprano pipistrelle
Oct
Sep
Nightly Pass Rate (passes/hr/night)
0
25
50
75
A2
A3
A5
A6
A7
A8
Detector ID
Brown long-eared
Oct
Sep
Nightly Pass Rate (passes/hr/night)
0
5
10
15
A2
A3
A5
A6
A7
A8
Detector ID

Bat Activity per Detector Location

Figure 18. Detector ID reference:

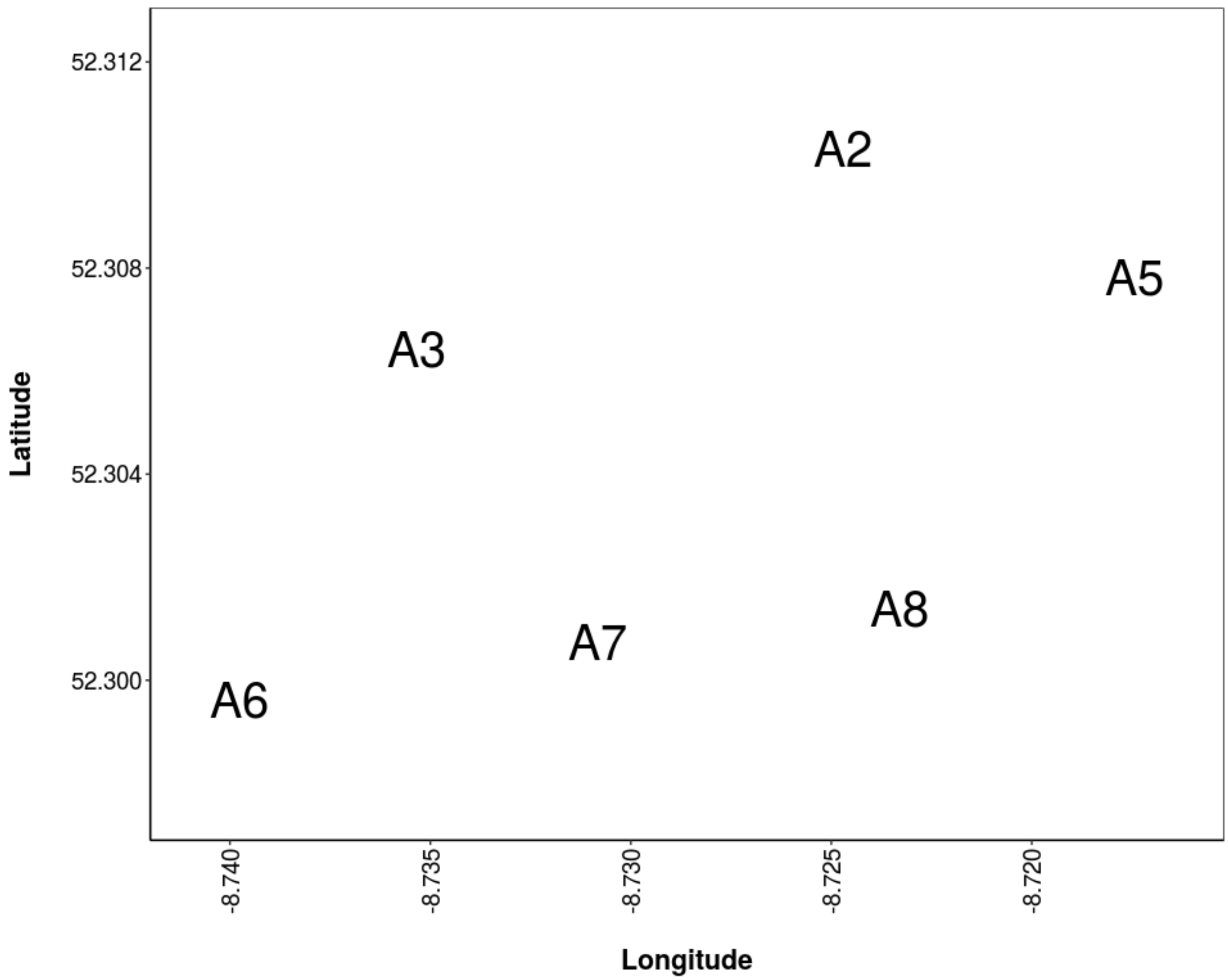
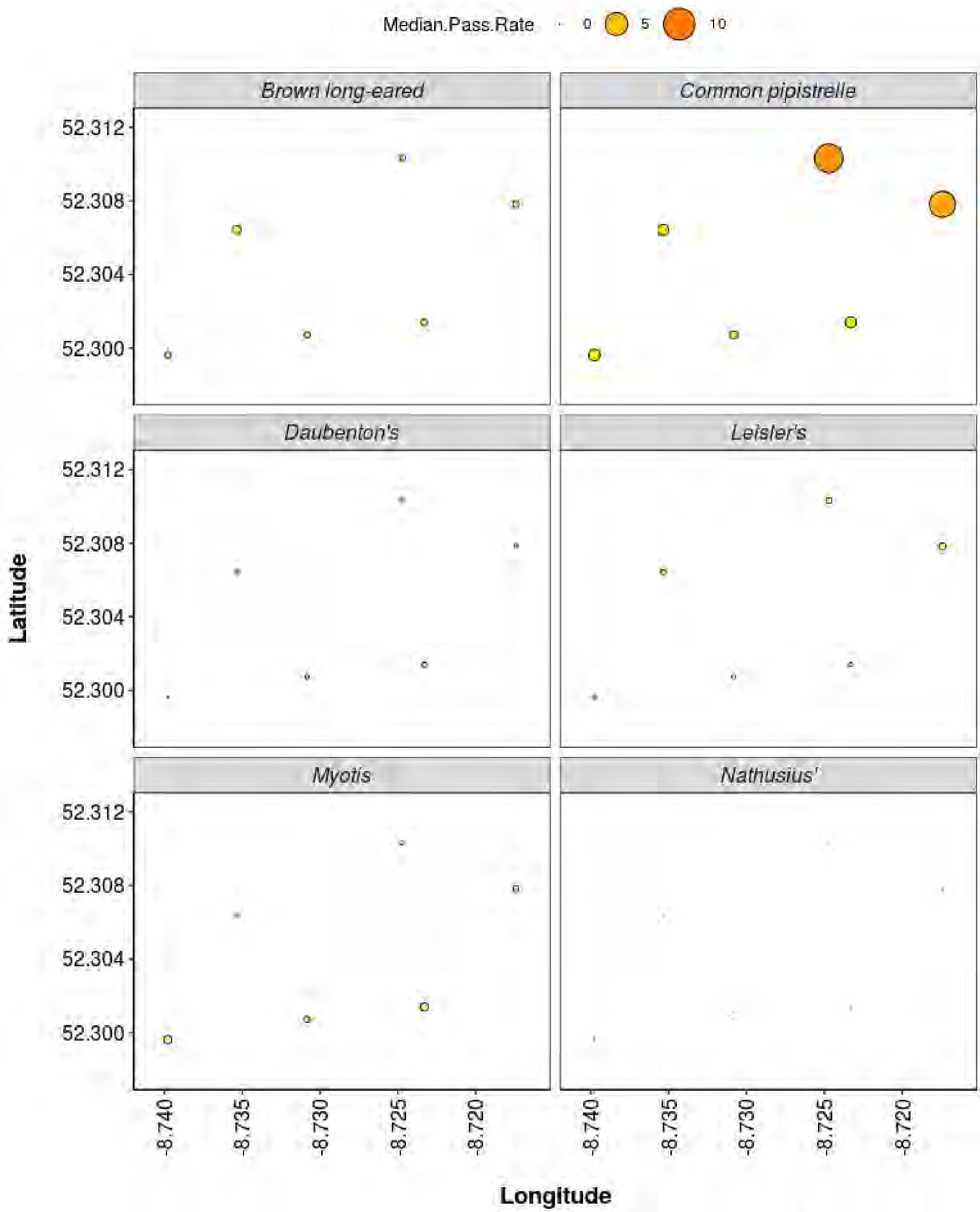


Figure 19. Median Nightly Pass Rate (bat passes/hr/night) throughout the survey period - represented by the size and colour of the point at each detector location.


Median.Pass.Rate
0
5
10
Brown long-eared
Common pipistrelle
Daubenton's
Leisler's
Myotis
Nathusius'
52.312
52.308
52.304
52.300
-8.740
-8.735
-8.730
-8.725
-8.720
Latitude
Longitude

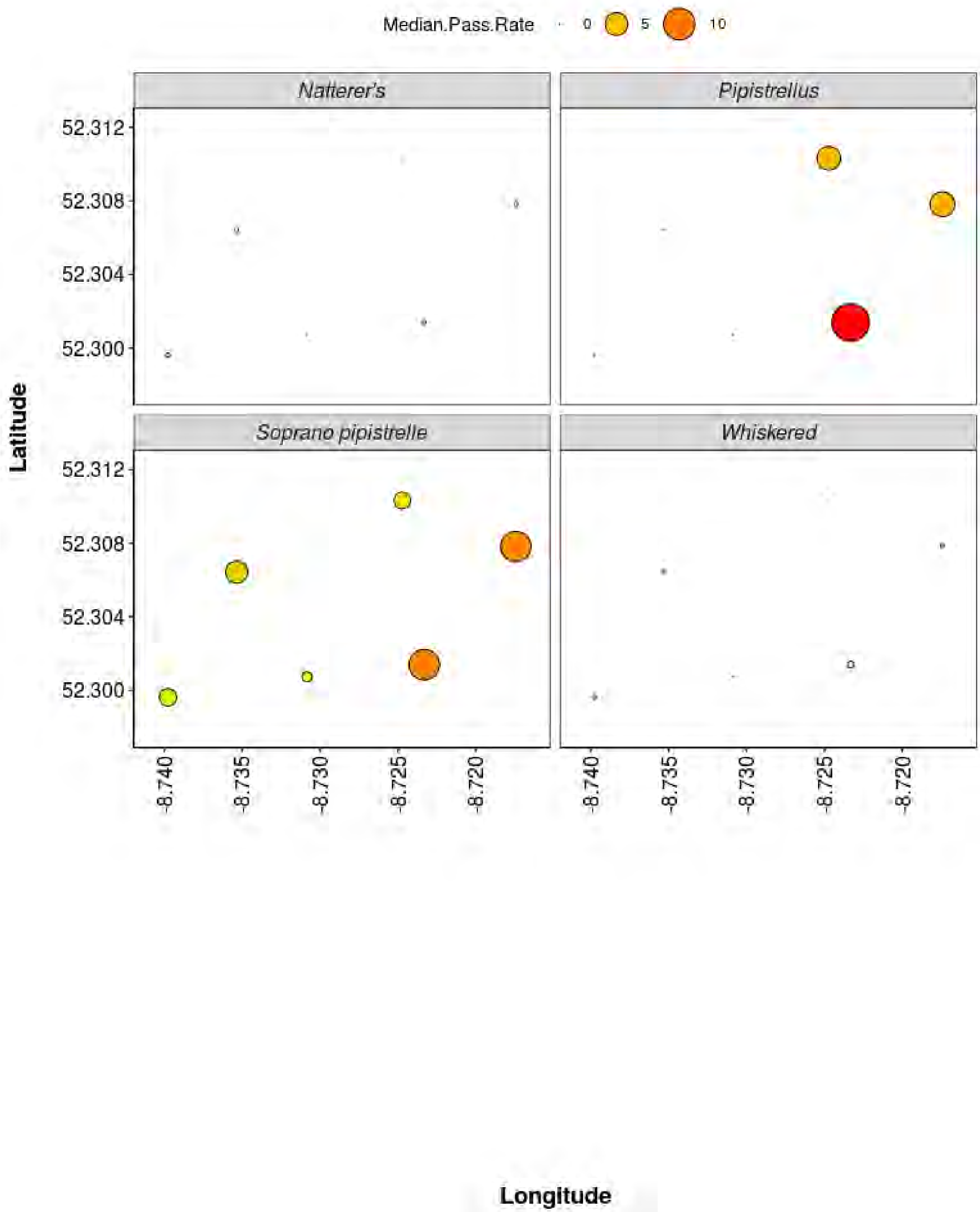
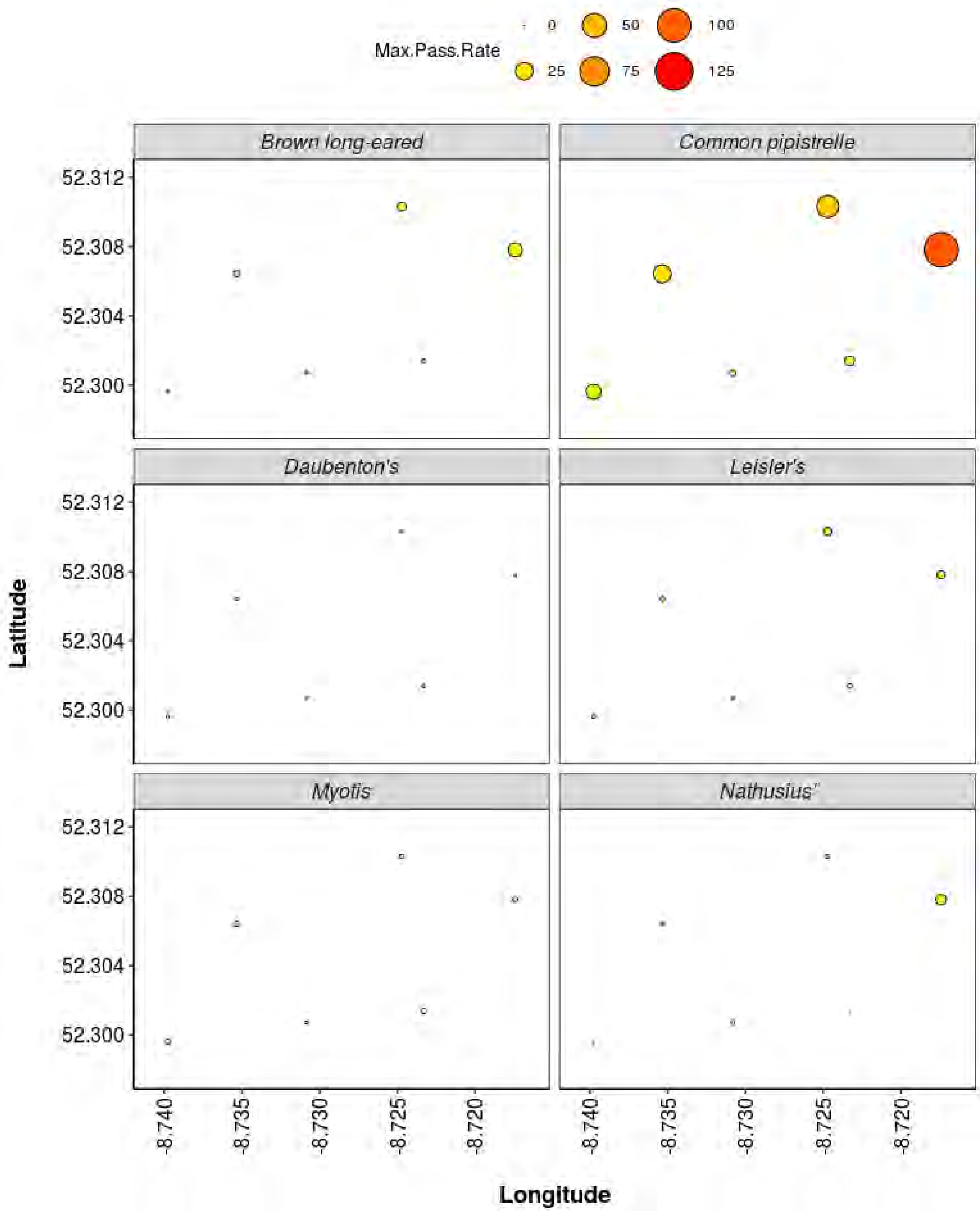
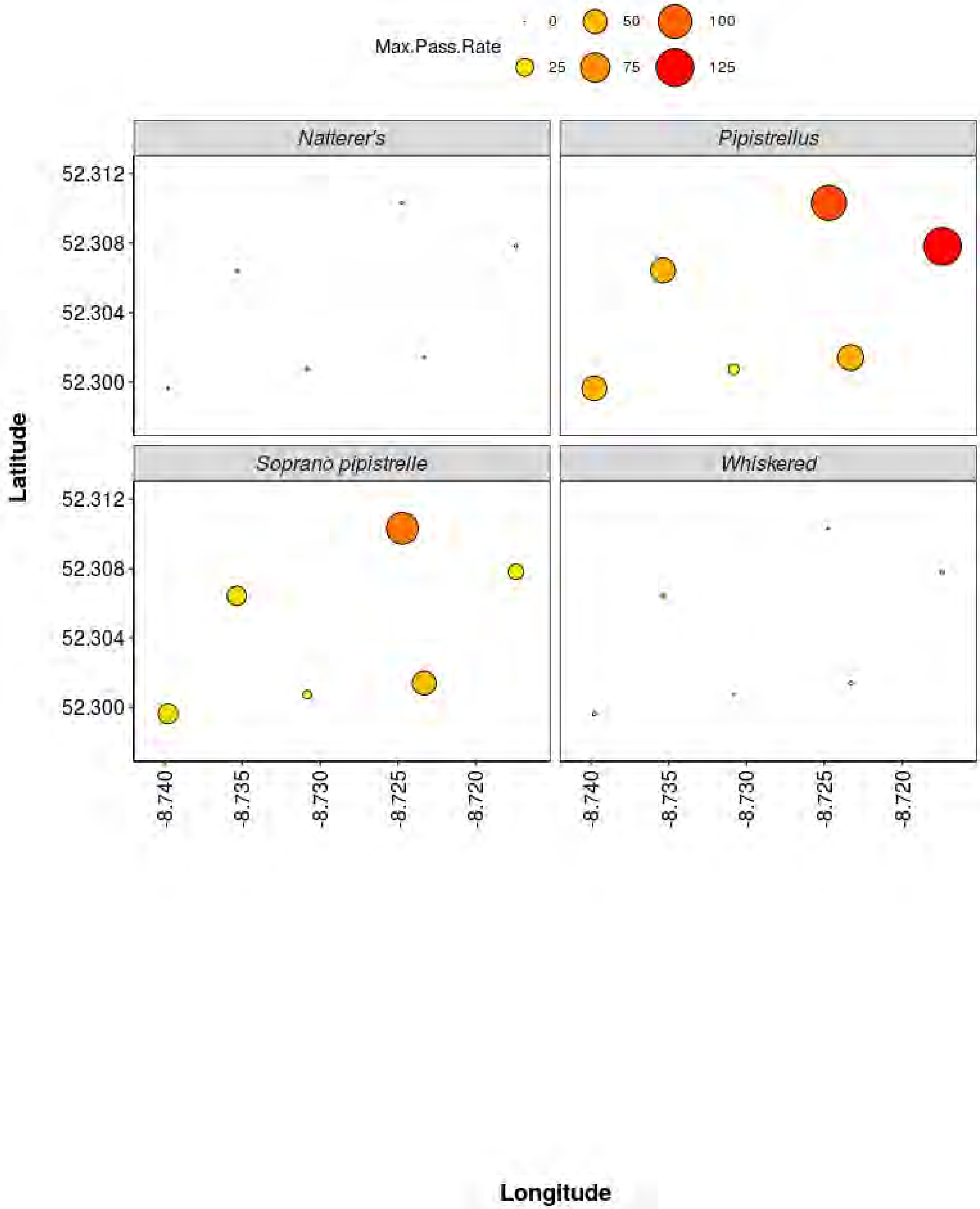

Median.Pass.Rate
0
5
10
Natterer's
Pipistrellus
Soprano pipistrelle
Whiskered
Latitude
52.312
52.308
52.304
52.300
-8.740
-8.735
-8.730
-8.725
-8.720
Longitude

Figure 20. Maximum Nightly Pass Rate (bat passes/hr/night) recorded in a single night throughout the survey period - represented by the size and colour of the point at each detector location.



Max.Pass.Rate
0
25
50
75
100
125
Brown long-eared
Common pipistrelle
Daubenton's
Leisler's
Myotis
Nathusius'
52.312
52.308
52.304
52.300
-8.740
-8.735
-8.730
-8.725
-8.720
Latitude
Longitude



Thank you for using Ecobat! If you have any questions please email info@themammalsociety.org.uk

FEHILY TIMONEY

CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

APPENDIX E

Ecobat Analysis Reports for Periods 2 & 3 2021

This report was produced free of charge by the Mammal Society to support evidence-based conservation of bats.

The following analyses are based on data supplied by the user to the Mammal Society's Ecobat website. The outputs are designed to assist decision-making, but do not replace expert interpretation by the user. The creation of the Ecobat tool was supported by the Natural Environment Research Council (NERC).

Bat Activity Analysis

Site Name: Annagh

Author: Fehily Timoney

08/11/2021

Summary

Bats were detected on **35** nights between **2021-07-21** and **2021-08-24**, using **5** static bat detectors. Throughout this period **8** species were recorded. **Table 1.** Detectors were placed at the following locations:

Detector ID	Latitude	Longitude
AT1	52.31205	-8.722680
AT3	52.30627	-8.721922
AT6	52.30382	-8.720163
AT2	52.30940	-8.730150
AT5	52.30215	-8.732132

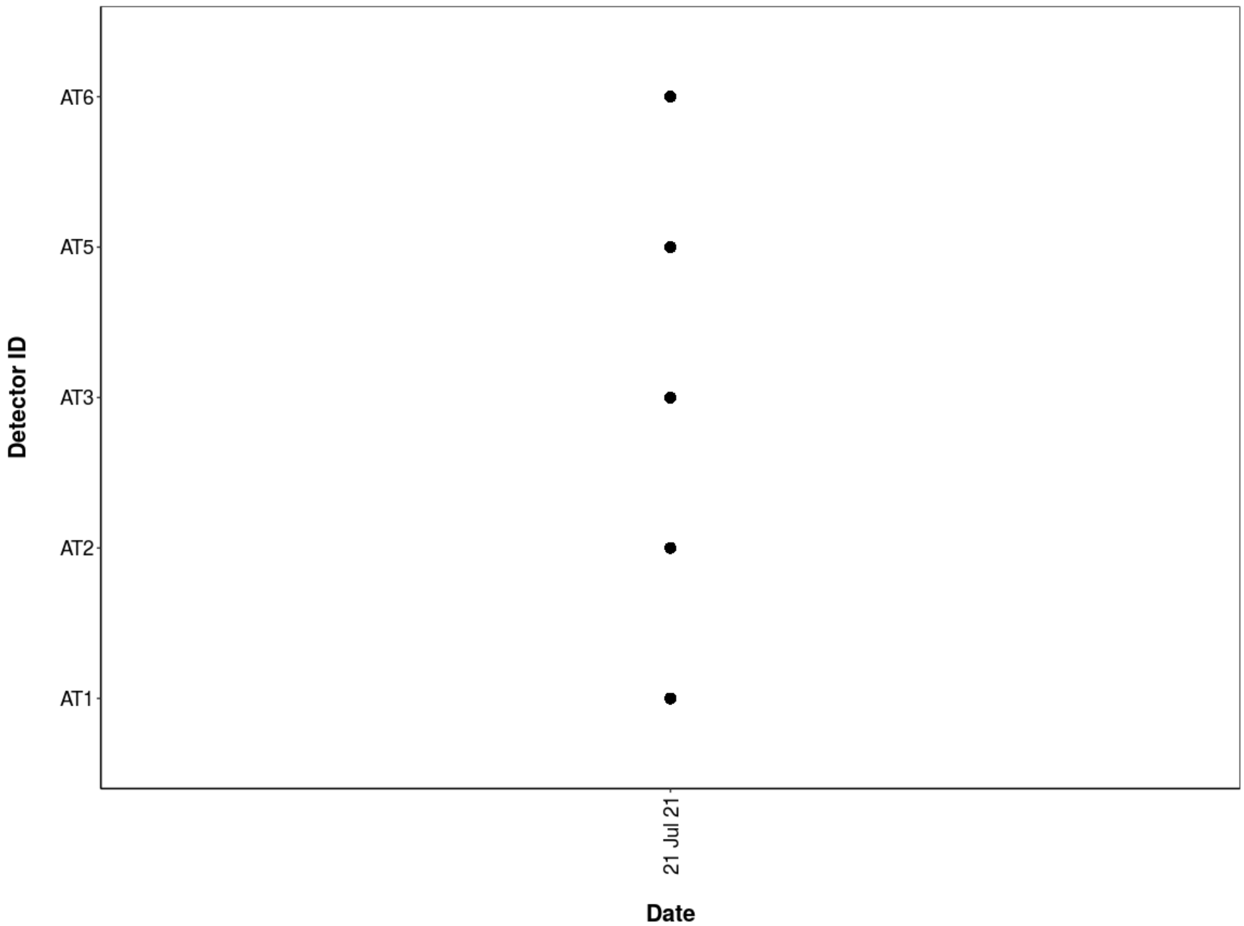
Survey Nights

Table 2. The number of nights that bats were detected on each recorder. This is not the same as the number of nights that detectors were active if there were nights when no bats were detected.

Detector ID	No. of nights
AT1	35
AT2	35
AT3	13
AT5	13
AT6	13

Survey Nights

Figure 1. Horizontal bars show nights when acoustic detectors recorded bats.



PART 1: Percentiles Analysis

This first part of the analysis looks at the relative activity levels of the bats you recorded. We take your value for the total bat passes each night for each species, and compare this to the values in our reference database. We tell you what percentile your data falls at, and therefore what the relative activity level is. For example, if the reference database has values of 5, 10, 15, 20 and you submit a value of 18, this will be the 80th percentile, and be classed as high activity.

The reference range dataset was stratified to include:

- Only records from within 30 days of the survey date.
- Only records from within 100km radius of the survey location.
- Records using any make of bat detector.

PER DETECTOR

Table 3. Summary table showing the number of nights recorded bat activity fell into each activity band for each species.

Detector ID	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
AT1	*Myotis daubentonii*	0	0	0	7	14
AT1	*Myotis mystacinus*	0	0	0	1	6
AT1	*Myotis nattereri*	0	0	1	10	13
AT1	*Nyctalus leisleri*	2	10	15	8	0
AT1	*Pipistrellus nathusii*	0	0	1	1	1
AT1	*Pipistrellus pipistrellus*	5	27	2	0	1
AT1	*Pipistrellus pygmaeus*	28	5	1	1	0
AT1	*Plecotus auritus*	0	0	6	14	7
AT2	*Myotis daubentonii*	0	0	1	13	10
AT2	*Myotis mystacinus*	0	0	2	3	13
AT2	*Myotis nattereri*	0	0	2	5	12
AT2	*Nyctalus leisleri*	0	15	16	2	1
AT2	*Pipistrellus nathusii*	0	0	1	3	3
AT2	*Pipistrellus pipistrellus*	22	10	0	2	1
AT2	*Pipistrellus pygmaeus*	32	2	0	0	1
AT2	*Plecotus auritus*	0	0	0	14	15
AT3	*Myotis daubentonii*	0	5	3	2	3
AT3	*Myotis mystacinus*	0	0	2	4	5
AT3	*Myotis nattereri*	0	0	2	3	4

AT3	*Nyctalus leisleri*	0	9	1	2	1
AT3	*Pipistrellus nathusii*	0	0	1	0	2
AT3	*Pipistrellus pipistrellus*	6	3	1	1	1
AT3	*Pipistrellus pygmaeus*	6	4	0	2	1
AT3	*Plecotus auritus*	0	0	4	6	2
AT5	*Myotis daubentonii*	0	0	0	0	6
AT5	*Myotis mystacinus*	0	0	0	0	4
AT5	*Myotis nattereri*	0	0	0	0	2
AT5	*Nyctalus leisleri*	0	2	8	1	2
AT5	*Pipistrellus nathusii*	0	0	0	0	1
AT5	*Pipistrellus pipistrellus*	3	7	3	0	0
AT5	*Pipistrellus pygmaeus*	11	2	0	0	0
AT5	*Plecotus auritus*	0	0	0	1	5
AT6	*Myotis daubentonii*	0	1	5	3	2
AT6	*Myotis mystacinus*	0	0	0	5	4
AT6	*Myotis nattereri*	0	1	5	3	4
AT6	*Nyctalus leisleri*	0	9	4	0	0
AT6	*Pipistrellus nathusii*	0	1	2	0	3
AT6	*Pipistrellus pipistrellus*	12	0	1	0	0
AT6	*Pipistrellus pygmaeus*	13	0	0	0	0
AT6	*Plecotus auritus*	0	2	8	3	0

Table 4. Summary table showing key metrics for each species recorded. The reference range is the number of nights for each species that your data were compared to. We recommend a Reference Range of 200+ to be confident in the relative activity level.

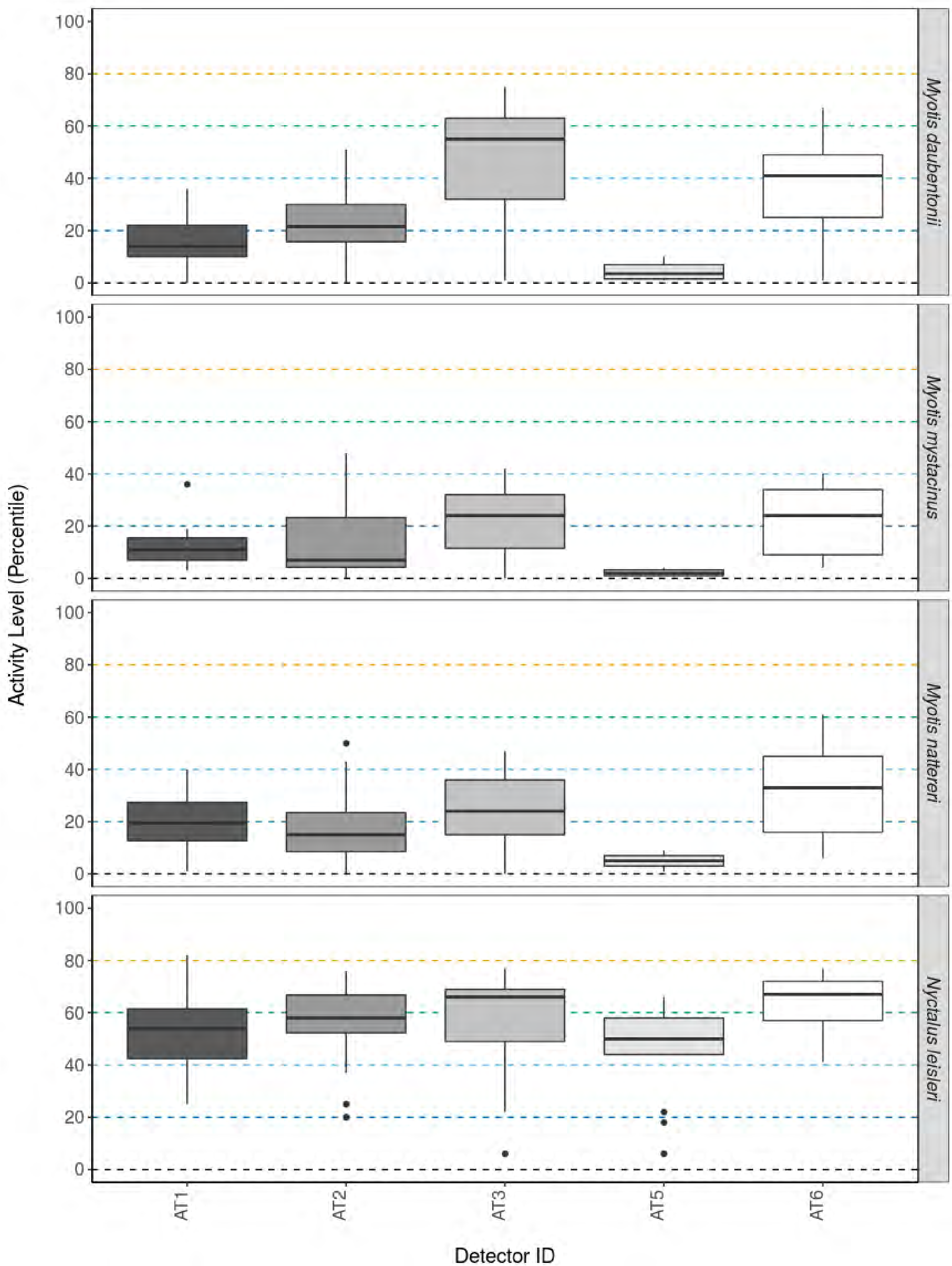
Detector ID	Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded	Reference Range
AT1	*Myotis daubentonii*	14	12 - 21.5	36	21	75
AT1	*Myotis mystacinus*	11	3.5 - 27.5	36	7	49
AT1	*Myotis nattereri*	20	14.5 - 24.5	40	24	67
AT1	*Nyctalus leisleri*	54	47.5 - 57.5	82	35	108
AT1	*Pipistrellus nathusii*	35	19 - 46	46	3	20
AT1	*Pipistrellus pipistrellus*	77	75 - 78	83	35	108
AT1	*Pipistrellus pygmaeus*	85	82 - 86.5	96	35	109
AT1	*Plecotus auritus*	31	25 - 35	57	27	119
AT2	*Myotis daubentonii*	22	17.5 - 28.5	51	24	75
AT2	*Myotis mystacinus*	7	6 - 25	48	18	49
AT2	*Myotis nattereri*	15	11 - 26	50	19	67
AT2	*Nyctalus leisleri*	58	54 - 62.5	76	34	108
AT2	*Pipistrellus nathusii*	27	14 - 43	59	7	20
AT2	*Pipistrellus pipistrellus*	82	79 - 85	95	35	108
AT2	*Pipistrellus pygmaeus*	94	91 - 95.5	99	35	109
AT2	*Plecotus auritus*	18	16 - 22.5	37	29	119
AT3	*Myotis daubentonii*	55	30 - 62.5	75	13	75

AT3	*Myotis mystacinus*	24	13 - 35.5	42	11	49
AT3	*Myotis nattereri*	24	15.5 - 41.5	47	9	67
AT3	*Nyctalus leisleri*	66	41.5 - 70.5	77	13	108
AT3	*Pipistrellus nathusii*	20	18 - 47	47	3	20
AT3	*Pipistrellus pipistrellus*	82	46 - 84	86	12	108
AT3	*Pipistrellus pygmaeus*	80	50.5 - 84	89	13	109
AT3	*Plecotus auritus*	36	21.5 - 42.5	51	12	119
AT5	*Myotis daubentonii*	4	2 - 7	10	6	75
AT5	*Myotis mystacinus*	2	1 - 3	4	4	49
AT5	*Myotis nattereri*	5	5 - 5	9	2	67
AT5	*Nyctalus leisleri*	50	33 - 55.5	66	13	108
AT5	*Pipistrellus nathusii*	18	0	18	1	20
AT5	*Pipistrellus pipistrellus*	75	62 - 78	82	13	108
AT5	*Pipistrellus pygmaeus*	90	82 - 91	97	13	109
AT5	*Plecotus auritus*	14	8 - 22	29	6	119
AT6	*Myotis daubentonii*	41	22 - 49	67	11	75
AT6	*Myotis mystacinus*	24	9 - 35	40	9	49
AT6	*Myotis nattereri*	33	20.5 - 46.5	61	13	67
AT6	*Nyctalus leisleri*	67	56.5 - 70.5	77	13	108
AT6	*Pipistrellus nathusii*	33	5 - 57	68	6	20
AT6	*Pipistrellus pipistrellus*	92	83 - 95	97	13	108

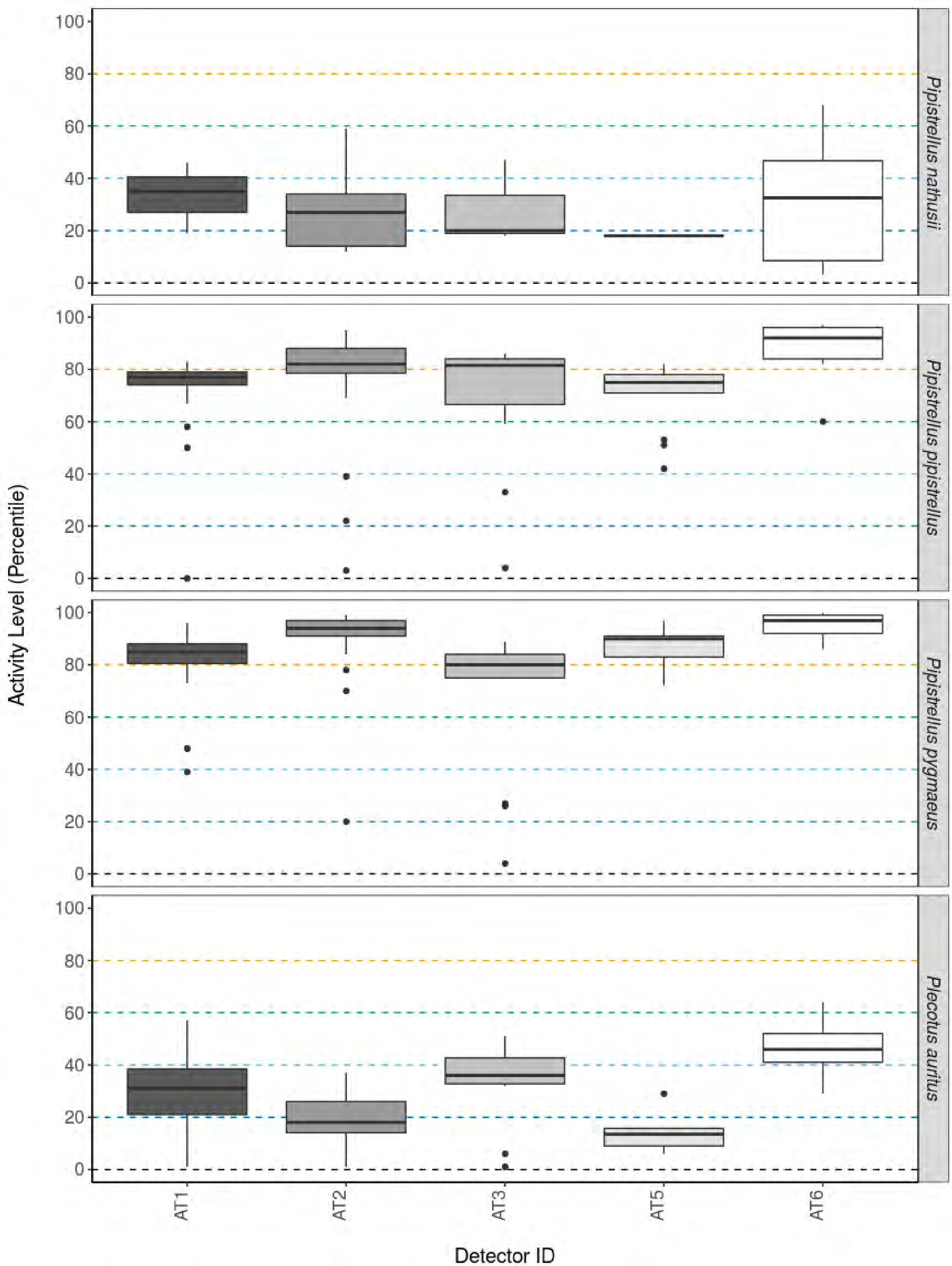
AT6	*Pipistrellus pygmaeus*	97	92 - 98.5	100	13	109
AT6	*Plecotus auritus*	46	40 - 53.5	64	13	119

###Figures

Figure 2. The recorded activity of bats during the survey. The centre line indicates the median activity level whereas the box represents the interquartile range (the spread of the middle 50% of nights of activity)

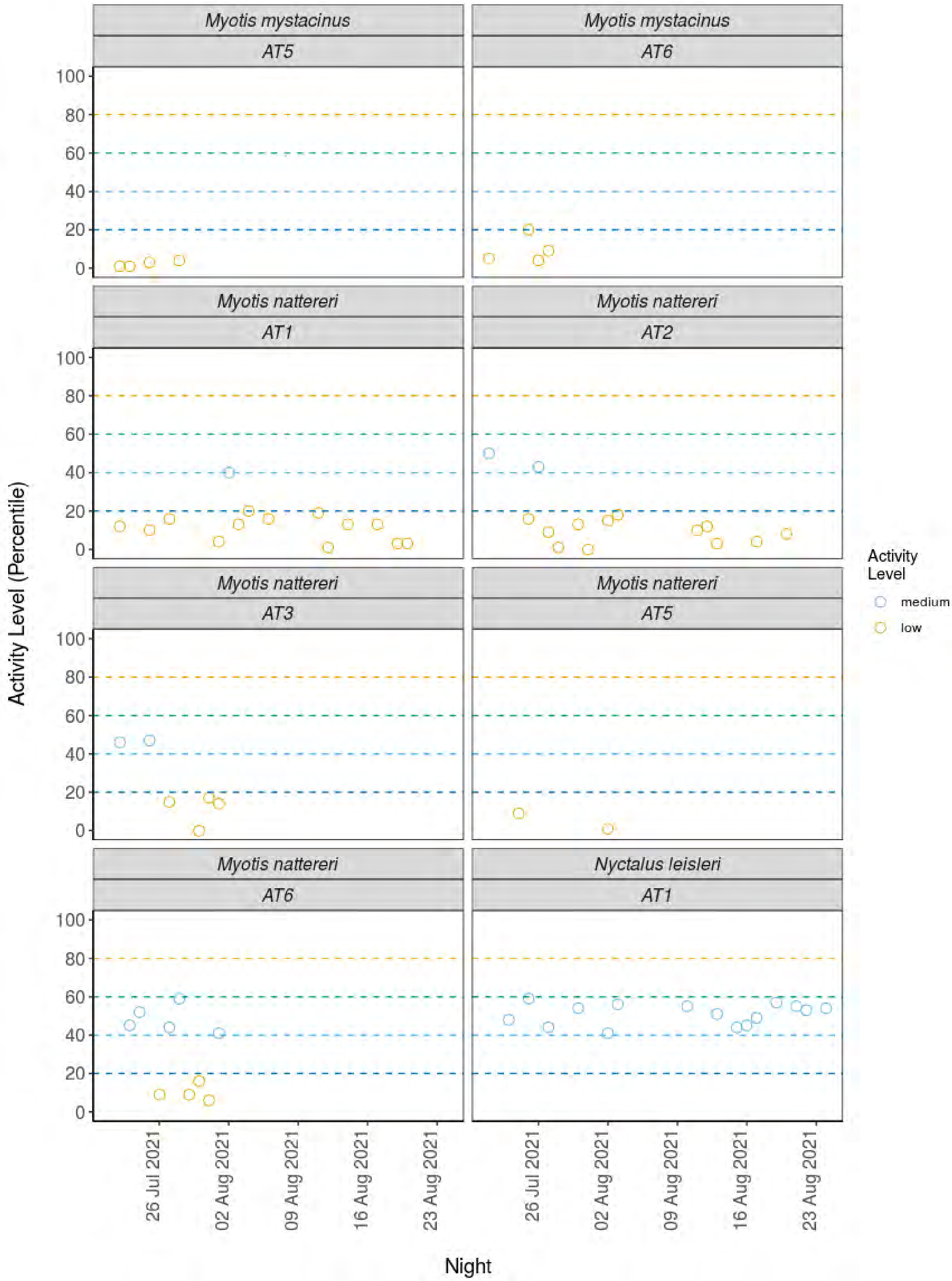


Activity Level (Percentile)
100
80
60
40
20
0
Myotis daubentonii
Myotis mystacinus
Myotis nattereri
Nyctalus leisleri
AT1
AT2
AT3
AT5
AT6
Detector ID

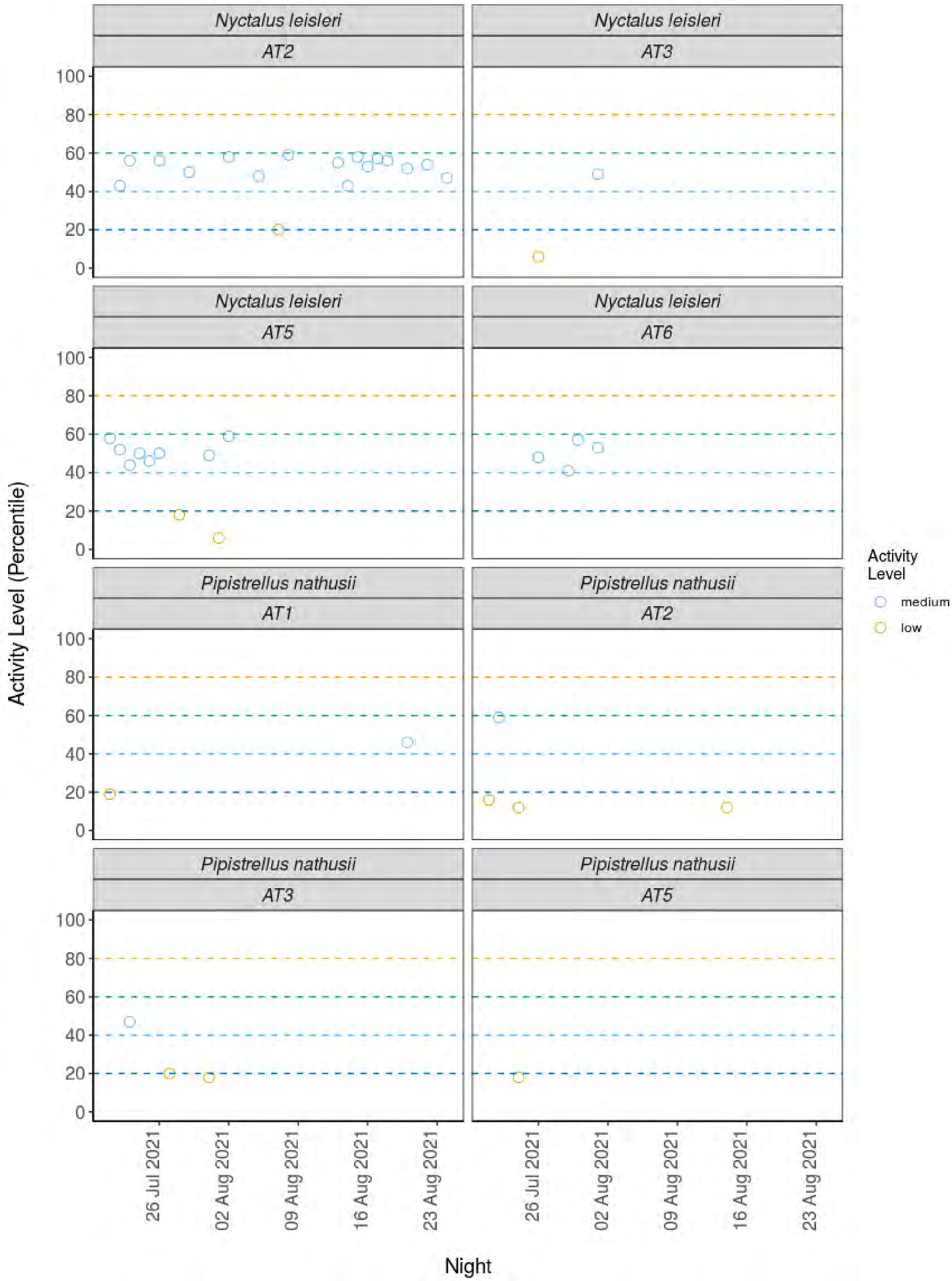


Activity Level (Percentile)
Pipistrellus nathusii
Pipistrellus pipistrellus
Pipistrellus pygmaeus
Plecotus auritus
AT1
AT2
AT3
AT5
AT6
Detector ID

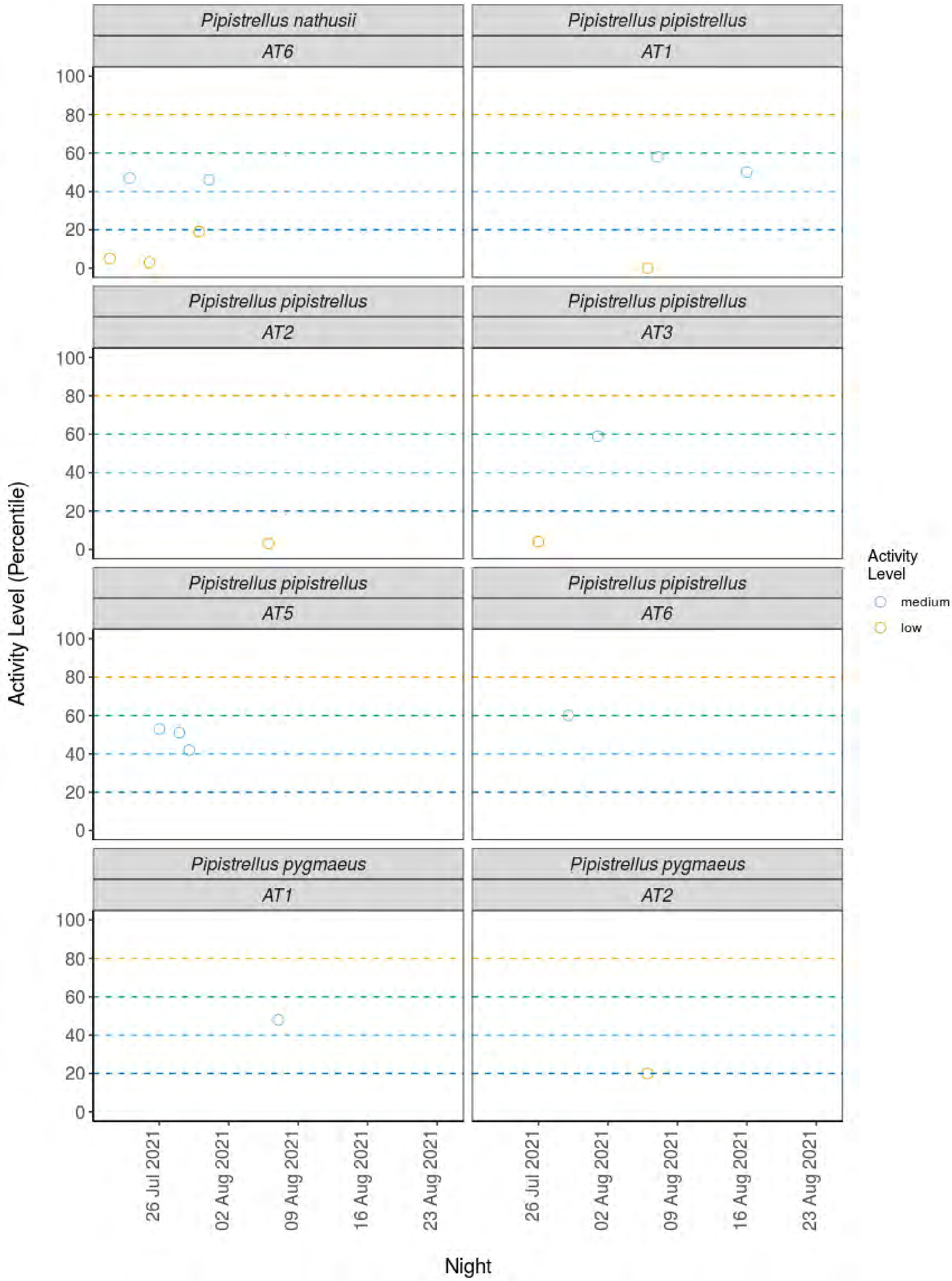
Figure 3. The activity level (percentile) of bats recorded across each night of the bat survey.

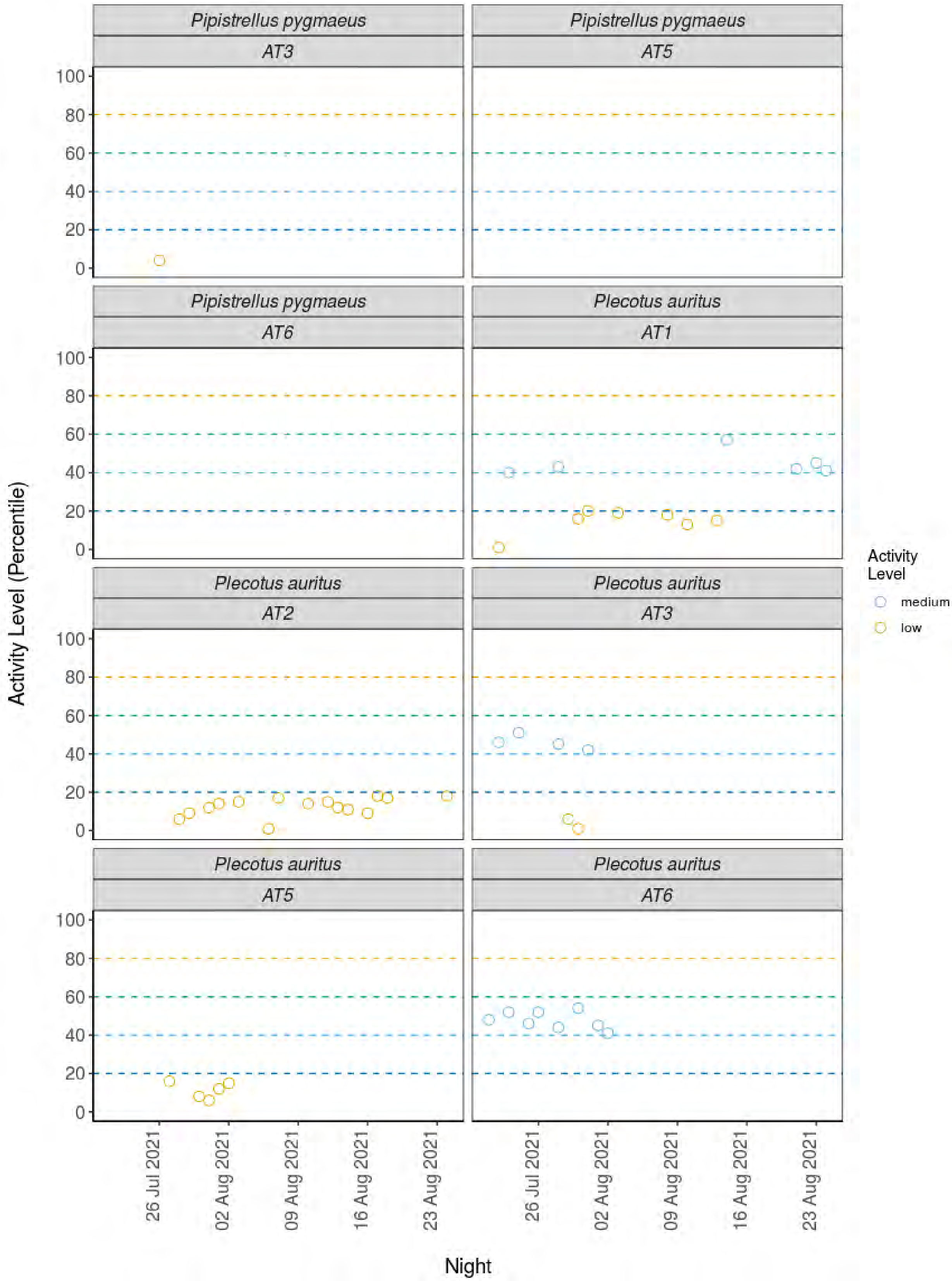


Myotis mystacinus
AT5
Myotis mystacinus
AT6
Myotis nattereri
AT1
Myotis nattereri
AT2
Myotis nattereri
AT3
Myotis nattereri
AT5
Myotis nattereri
AT6
Nyctalus leisleri
AT1
Activity Level (Percentile)
0
20
40
60
80
100
26 Jul 2021
02 Aug 2021
09 Aug 2021
16 Aug 2021
23 Aug 2021
Night
Activity Level
medium
low



Nyctalus leisleri
AT2
Nyctalus leisleri
AT3
Nyctalus leisleri
AT5
Nyctalus leisleri
AT6
Pipistrellus nathusii
AT1
Pipistrellus nathusii
AT2
Pipistrellus nathusii
AT3
Pipistrellus nathusii
AT5
Activity Level (Percentile)
0
20
40
60
80
100
26 Jul 2021
02 Aug 2021
09 Aug 2021
16 Aug 2021
23 Aug 2021
Night
Activity Level
medium
low


Pipistrellus nathusii
AT6
Pipistrellus pipistrellus
AT1
Pipistrellus pipistrellus
AT2
Pipistrellus pipistrellus
AT3
Pipistrellus pipistrellus
AT5
Pipistrellus pipistrellus
AT6
Pipistrellus pygmaeus
AT1
Pipistrellus pygmaeus
AT2
Activity Level (Percentile)
0
20
40
60
80
100
26 Jul 2021
02 Aug 2021
09 Aug 2021
16 Aug 2021
23 Aug 2021
Night
Activity Level
medium
low



Pipistrellus pygmaeus
AT3
Pipistrellus pygmaeus
AT5
Pipistrellus pygmaeus
AT6
Plecotus auritus
AT1
Plecotus auritus
AT2
Plecotus auritus
AT3
Plecotus auritus
AT5
Plecotus auritus
AT6
Activity Level (Percentile)
0
20
40
60
80
100
26 Jul 2021
02 Aug 2021
09 Aug 2021
16 Aug 2021
23 Aug 2021
Night
Activity Level
medium
low

PER DETECTOR, PER MONTH

Table 5. Summary table showing the number of nights recorded bat activity fell into each activity band for each species at each detector during each month.

Detector ID	Species/Species Group	Month	Nights of High Activity	Nights of Moderate / High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity
AT1	*Myotis daubentonii*	Jul	0	0	0	0	6
AT1	*Myotis daubentonii*	Aug	0	0	0	7	8
AT1	*Myotis mystacinus*	Jul	0	0	0	0	1
AT1	*Myotis mystacinus*	Aug	0	0	0	1	5
AT1	*Myotis nattereri*	Jul	0	0	0	5	3
AT1	*Myotis nattereri*	Aug	0	0	1	5	10
AT1	*Nyctalus leisleri*	Jul	0	3	4	4	0
AT1	*Nyctalus leisleri*	Aug	2	7	11	4	0
AT1	*Pipistrellus nathusii*	Jul	0	0	0	1	1
AT1	*Pipistrellus nathusii*	Aug	0	0	1	0	0
AT1	*Pipistrellus pipistrellus*	Jul	3	8	0	0	0
AT1	*Pipistrellus pipistrellus*	Aug	2	19	2	0	1
AT1	*Pipistrellus pygmaeus*	Jul	9	2	0	0	0
AT1	*Pipistrellus pygmaeus*	Aug	19	3	1	1	0
AT1	*Plecotus auritus*	Jul	0	0	2	3	3
AT1	*Plecotus auritus*	Aug	0	0	4	11	4

AT2	*Myotis daubentonii*	Jul	0	0	0	3	2
AT2	*Myotis daubentonii*	Aug	0	0	1	10	8
AT2	*Myotis mystacinus*	Jul	0	0	2	2	3
AT2	*Myotis mystacinus*	Aug	0	0	0	1	10
AT2	*Myotis nattereri*	Jul	0	0	2	4	5
AT2	*Myotis nattereri*	Aug	0	0	0	1	7
AT2	*Nyctalus leisleri*	Jul	0	7	4	0	0
AT2	*Nyctalus leisleri*	Aug	0	8	12	2	1
AT2	*Pipistrellus nathusii*	Jul	0	0	1	1	2
AT2	*Pipistrellus nathusii*	Aug	0	0	0	2	1
AT2	*Pipistrellus pipistrellus*	Jul	9	2	0	0	0
AT2	*Pipistrellus pipistrellus*	Aug	13	8	0	2	1
AT2	*Pipistrellus pygmaeus*	Jul	11	0	0	0	0
AT2	*Pipistrellus pygmaeus*	Aug	21	2	0	0	1
AT2	*Plecotus auritus*	Jul	0	0	0	5	3
AT2	*Plecotus auritus*	Aug	0	0	0	9	12
AT3	*Myotis daubentonii*	Jul	0	5	1	2	3
AT3	*Myotis daubentonii*	Aug	0	0	2	0	0
AT3	*Myotis mystacinus*	Jul	0	0	1	3	5
AT3	*Myotis mystacinus*	Aug	0	0	1	1	0
AT3	*Myotis nattereri*	Jul	0	0	2	3	3

AT3	*Myotis nattereri*	Aug	0	0	0	0	1
AT3	*Nyctalus leisleri*	Jul	0	8	0	2	1
AT3	*Nyctalus leisleri*	Aug	0	1	1	0	0
AT3	*Pipistrellus nathusii*	Jul	0	0	1	0	2
AT3	*Pipistrellus pipistrellus*	Jul	6	2	0	1	1
AT3	*Pipistrellus pipistrellus*	Aug	0	1	1	0	0
AT3	*Pipistrellus pygmaeus*	Jul	6	2	0	2	1
AT3	*Pipistrellus pygmaeus*	Aug	0	2	0	0	0
AT3	*Plecotus auritus*	Jul	0	0	4	4	2
AT3	*Plecotus auritus*	Aug	0	0	0	2	0
AT5	*Myotis daubentonii*	Jul	0	0	0	0	4
AT5	*Myotis daubentonii*	Aug	0	0	0	0	2
AT5	*Myotis mystacinus*	Jul	0	0	0	0	4
AT5	*Myotis nattereri*	Jul	0	0	0	0	1
AT5	*Myotis nattereri*	Aug	0	0	0	0	1
AT5	*Nyctalus leisleri*	Jul	0	2	7	1	1
AT5	*Nyctalus leisleri*	Aug	0	0	1	0	1
AT5	*Pipistrellus nathusii*	Jul	0	0	0	0	1
AT5	*Pipistrellus pipistrellus*	Jul	3	5	3	0	0
AT5	*Pipistrellus pipistrellus*	Aug	0	2	0	0	0
AT5	*Pipistrellus pygmaeus*	Jul	9	2	0	0	0
AT5	*Pipistrellus pygmaeus*	Aug	2	0	0	0	0

AT5	*Plecotus auritus*	Jul	0	0	0	1	3
AT5	*Plecotus auritus*	Aug	0	0	0	0	2
AT6	*Myotis daubentonii*	Jul	0	1	4	2	2
AT6	*Myotis daubentonii*	Aug	0	0	1	1	0
AT6	*Myotis mystacinus*	Jul	0	0	0	3	4
AT6	*Myotis mystacinus*	Aug	0	0	0	2	0
AT6	*Myotis nattereri*	Jul	0	0	4	3	4
AT6	*Myotis nattereri*	Aug	0	1	1	0	0
AT6	*Nyctalus leisleri*	Jul	0	8	3	0	0
AT6	*Nyctalus leisleri*	Aug	0	1	1	0	0
AT6	*Pipistrellus nathusii*	Jul	0	1	2	0	3
AT6	*Pipistrellus pipistrellus*	Jul	10	0	1	0	0
AT6	*Pipistrellus pipistrellus*	Aug	2	0	0	0	0
AT6	*Pipistrellus pygmaeus*	Jul	11	0	0	0	0
AT6	*Pipistrellus pygmaeus*	Aug	2	0	0	0	0
AT6	*Plecotus auritus*	Jul	0	2	6	3	0
AT6	*Plecotus auritus*	Aug	0	0	2	0	0

Table 6. Summary table showing key metrics for each species recorded per month. Please note that we cannot split the reference range by month, hence this column is not shown in this table.

Detector ID	Species/Species Group	Month	Median Percentile	95% CIs	Max Percentile	Nights Recorded
AT1	*Myotis daubentonii*	Jul	14	12 - 21.5	18	6
AT1	*Myotis daubentonii*	Aug	14	12 - 21.5	36	15
AT1	*Myotis mystacinus*	Jul	10	3.5 - 27.5	10	1
AT1	*Myotis mystacinus*	Aug	12	3.5 - 27.5	36	6
AT1	*Myotis nattereri*	Jul	28	14.5 - 24.5	36	8
AT1	*Myotis nattereri*	Aug	18	14.5 - 24.5	40	16
AT1	*Nyctalus leisleri*	Jul	48	47.5 - 57.5	69	11
AT1	*Nyctalus leisleri*	Aug	55	47.5 - 57.5	82	24
AT1	*Pipistrellus nathusii*	Jul	27	19 - 46	35	2
AT1	*Pipistrellus nathusii*	Aug	46	19 - 46	46	1
AT1	*Pipistrellus pipistrellus*	Jul	77	75 - 78	82	11
AT1	*Pipistrellus pipistrellus*	Aug	76	75 - 78	83	24
AT1	*Pipistrellus pygmaeus*	Jul	88	82 - 86.5	96	11
AT1	*Pipistrellus pygmaeus*	Aug	85	82 - 86.5	92	24
AT1	*Plecotus auritus*	Jul	30	25 - 35	43	8
AT1	*Plecotus auritus*	Aug	32	25 - 35	57	19
AT2	*Myotis daubentonii*	Jul	21	17.5 - 28.5	38	5

AT2	*Myotis daubentonii*	Aug	22	17.5 - 28.5	51	19
AT2	*Myotis mystacinus*	Jul	27	6 - 25	48	7
AT2	*Myotis mystacinus*	Aug	6	6 - 25	25	11
AT2	*Myotis nattereri*	Jul	21	11 - 26	50	11
AT2	*Myotis nattereri*	Aug	11	11 - 26	25	8
AT2	*Nyctalus leisleri*	Jul	64	54 - 62.5	76	11
AT2	*Nyctalus leisleri*	Aug	57	54 - 62.5	75	23
AT2	*Pipistrellus nathusii*	Jul	24	14 - 43	59	4
AT2	*Pipistrellus nathusii*	Aug	27	14 - 43	37	3
AT2	*Pipistrellus pipistrellus*	Jul	87	79 - 85	95	11
AT2	*Pipistrellus pipistrellus*	Aug	82	79 - 85	93	24
AT2	*Pipistrellus pygmaeus*	Jul	94	91 - 95.5	98	11
AT2	*Pipistrellus pygmaeus*	Aug	95	91 - 95.5	99	24
AT2	*Plecotus auritus*	Jul	23	16 - 22.5	31	8
AT2	*Plecotus auritus*	Aug	18	16 - 22.5	37	21
AT3	*Myotis daubentonii*	Jul	59	30 - 62.5	75	11
AT3	*Myotis daubentonii*	Aug	49	30 - 62.5	55	2
AT3	*Myotis mystacinus*	Jul	17	13 - 35.5	41	9
AT3	*Myotis mystacinus*	Aug	36	13 - 35.5	42	2
AT3	*Myotis nattereri*	Jul	27	15.5 - 41.5	47	8
AT3	*Myotis nattereri*	Aug	14	15.5 - 41.5	14	1

AT3	*Nyctalus leisleri*	Jul	67	41.5 - 70.5	77	11
AT3	*Nyctalus leisleri*	Aug	57	41.5 - 70.5	65	2
AT3	*Pipistrellus nathusii*	Jul	20	18 - 47	47	3
AT3	*Pipistrellus pipistrellus*	Jul	84	46 - 84	86	10
AT3	*Pipistrellus pipistrellus*	Aug	64	46 - 84	69	2
AT3	*Pipistrellus pygmaeus*	Jul	82	50.5 - 84	89	11
AT3	*Pipistrellus pygmaeus*	Aug	77	50.5 - 84	78	2
AT3	*Plecotus auritus*	Jul	36	21.5 - 42.5	51	10
AT3	*Plecotus auritus*	Aug	37	21.5 - 42.5	40	2
AT5	*Myotis daubentonii*	Jul	6	2 - 7	10	4
AT5	*Myotis daubentonii*	Aug	3	2 - 7	4	2
AT5	*Myotis mystacinus*	Jul	2	1 - 3	4	4
AT5	*Myotis nattereri*	Jul	9	5 - 5	9	1
AT5	*Myotis nattereri*	Aug	1	5 - 5	1	1
AT5	*Nyctalus leisleri*	Jul	50	33 - 55.5	66	11
AT5	*Nyctalus leisleri*	Aug	33	33 - 55.5	59	2
AT5	*Pipistrellus nathusii*	Jul	18	0	18	1
AT5	*Pipistrellus pipistrellus*	Jul	75	62 - 78	82	11
AT5	*Pipistrellus pipistrellus*	Aug	75	62 - 78	78	2
AT5	*Pipistrellus pygmaeus*	Jul	90	82 - 91	97	11
AT5	*Pipistrellus pygmaeus*	Aug	86	82 - 91	90	2
AT5	*Plecotus auritus*	Jul	12	8 - 22	29	4

AT5	*Plecotus auritus*	Aug	14	8 - 22	15	2
AT6	*Myotis daubentonii*	Jul	43	22 - 49	67	9
AT6	*Myotis daubentonii*	Aug	33	22 - 49	41	2
AT6	*Myotis mystacinus*	Jul	20	9 - 35	40	7
AT6	*Myotis mystacinus*	Aug	29	9 - 35	34	2
AT6	*Myotis nattereri*	Jul	32	20.5 - 46.5	59	11
AT6	*Myotis nattereri*	Aug	51	20.5 - 46.5	61	2
AT6	*Nyctalus leisleri*	Jul	67	56.5 - 70.5	77	11
AT6	*Nyctalus leisleri*	Aug	63	56.5 - 70.5	72	2
AT6	*Pipistrellus nathusii*	Jul	33	5 - 57	68	6
AT6	*Pipistrellus pipistrellus*	Jul	93	83 - 95	97	11
AT6	*Pipistrellus pipistrellus*	Aug	85	83 - 95	85	2
AT6	*Pipistrellus pygmaeus*	Jul	98	92 - 98.5	100	11
AT6	*Pipistrellus pygmaeus*	Aug	94	92 - 98.5	95	2
AT6	*Plecotus auritus*	Jul	48	40 - 53.5	64	11
AT6	*Plecotus auritus*	Aug	43	40 - 53.5	45	2

PER SITE

In this 'Per Site' section of the analysis, all values are taken from across all of the detectors to provide site-wide averages/medians.

Table 7. Summary table showing the number of nights recorded bat activity fell into each activity band for each species.

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
Myotis daubentonii	0	6	9	25	35
Myotis mystacinus	0	0	4	13	32
Myotis nattereri	0	1	10	21	35
Nyctalus leisleri	2	45	44	13	4
Pipistrellus nathusii	0	1	5	4	10
Pipistrellus pipistrellus	48	47	7	3	3
Pipistrellus pygmaeus	90	13	1	3	2
Plecotus auritus	0	2	18	38	29

Table 8. Summary table showing key metrics for each species recorded.

Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded
Myotis daubentonii	21	30 - 62.5	75	75
Myotis mystacinus	11	9 - 35	48	49
Myotis nattereri	19	5 - 5	61	67
Nyctalus leisleri	57	56.5 - 70.5	82	108
Pipistrellus nathusii	24	5 - 57	68	20
Pipistrellus pipistrellus	79	83 - 95	97	108
Pipistrellus pygmaeus	88	92 - 98.5	100	109
Plecotus auritus	28	8 - 22	64	87

###Figures

Figure 4. The activity level (percentile) of bats recorded across each night of the bat survey for the **entire site**.

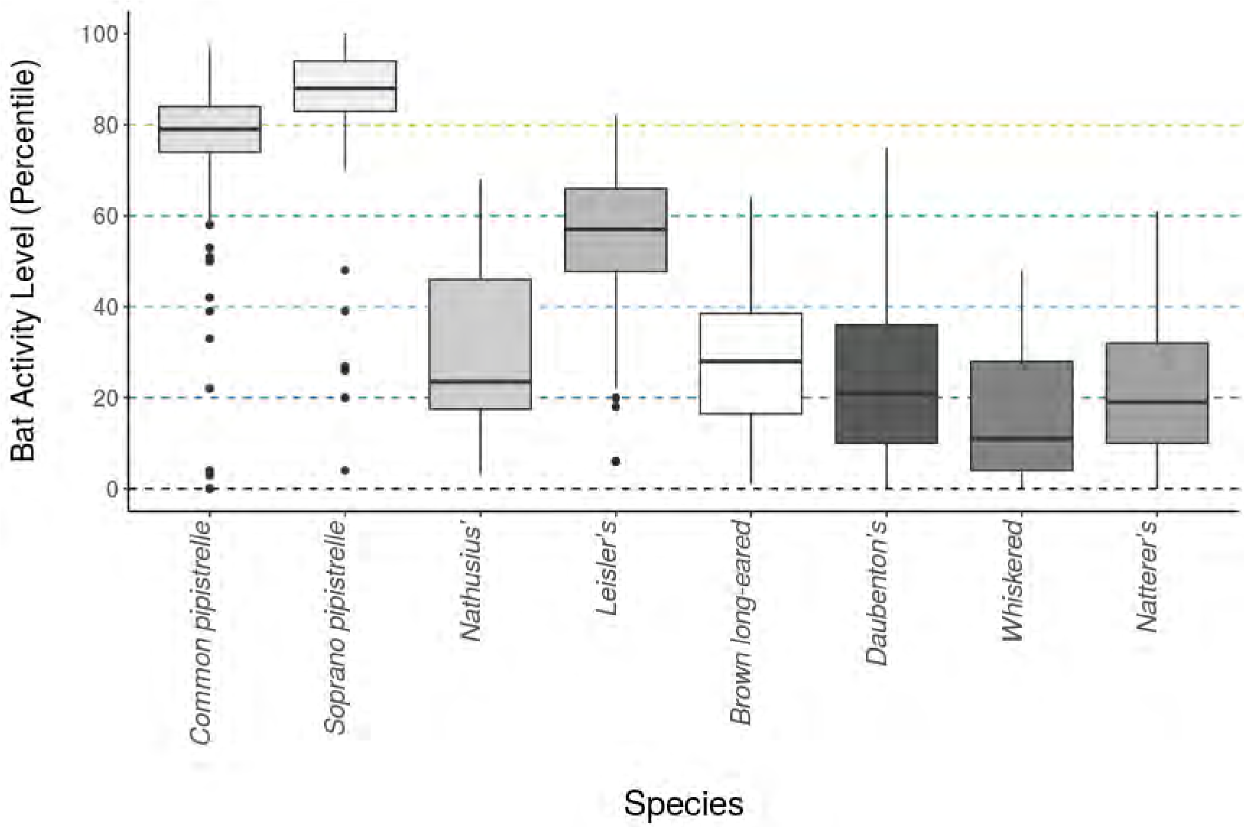
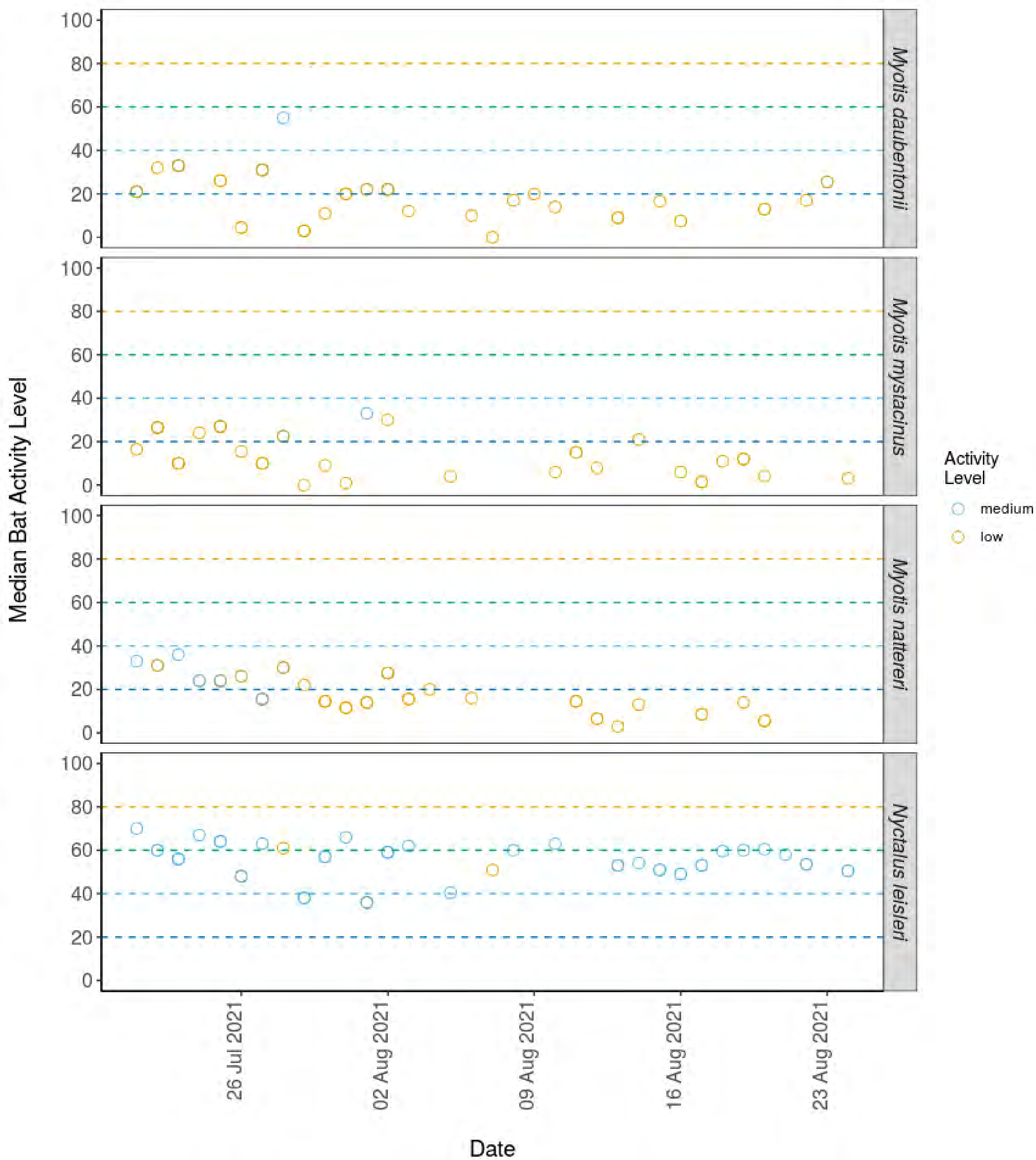
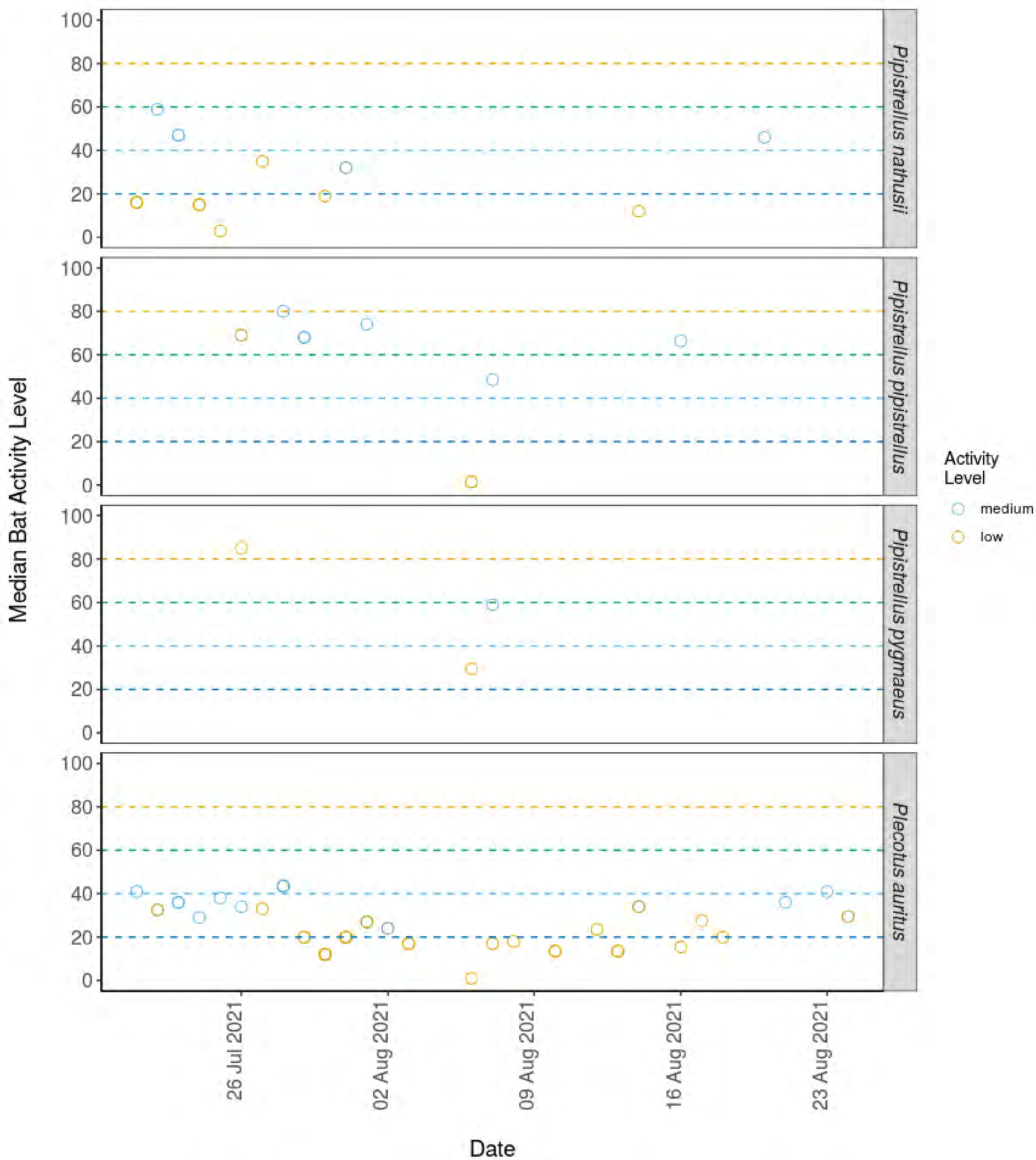


Figure 5. The median activity levels of bats recorded across all detectors each night.



Median Bat Activity Level
100
80
60
40
20
0
Myotis daubentonii
Myotis mystacinus
Myotis nattereri
Nyctalus leisleri
26 Jul 2021
02 Aug 2021
09 Aug 2021
16 Aug 2021
23 Aug 2021
Date
Activity Level
medium
low



Median Bat Activity Level
Pipistrellus nathusii
Pipistrellus pipistrellus
Pipistrellus pygmaeus
Plecotus auritus
Activity Level
medium
low
100
80
60
40
20
0
26 Jul 2021
02 Aug 2021
09 Aug 2021
16 Aug 2021
23 Aug 2021
Date

PER SITE, PER MONTH

Table 9. Summary table showing the number of nights recorded bat activity fell into each activity band for each species during each month.

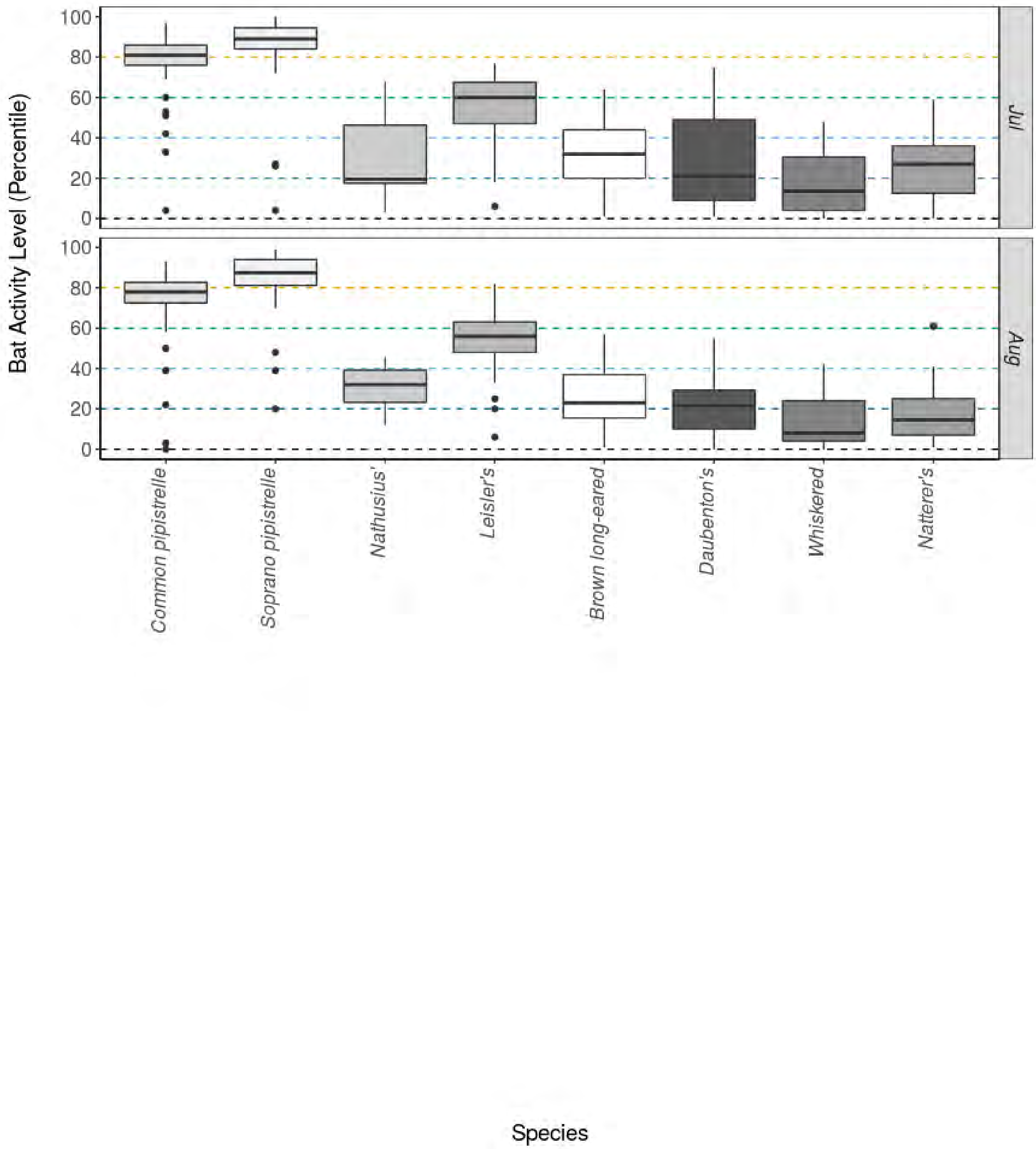
Species/Species Group	Month	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity
Myotis daubentonii	Jul	0	6	5	7	17
Myotis daubentonii	Aug	0	0	4	18	18
Myotis mystacinus	Jul	0	0	3	8	17
Myotis mystacinus	Aug	0	0	1	5	15
Myotis nattereri	Jul	0	0	8	15	16
Myotis nattereri	Aug	0	1	2	6	19
Nyctalus leisleri	Jul	0	28	18	7	2
Nyctalus leisleri	Aug	2	17	26	6	2
Pipistrellus nathusii	Jul	0	1	4	2	9
Pipistrellus nathusii	Aug	0	0	1	2	1
Pipistrellus pipistrellus	Jul	31	17	4	1	1
Pipistrellus pipistrellus	Aug	17	30	3	2	2
Pipistrellus pygmaeus	Jul	46	6	0	2	1
Pipistrellus pygmaeus	Aug	44	7	1	1	1
Plecotus auritus	Jul	0	2	12	16	11
Plecotus auritus	Aug	0	0	6	22	18

Table 10. Summary table showing key metrics for each species recorded per month.

Species/Species Group	Month	Median Percentile	95% CIs	Max Percentile	Nights Recorded
Myotis daubentonii	Jul	21	30 - 62.5	75	35
Myotis daubentonii	Aug	22	30 - 62.5	55	40
Myotis mystacinus	Jul	14	9 - 35	48	28
Myotis mystacinus	Aug	8	9 - 35	42	21
Myotis nattereri	Jul	27	5 - 5	59	39
Myotis nattereri	Aug	15	5 - 5	61	28
Nyctalus leisleri	Jul	60	56.5 - 70.5	77	55
Nyctalus leisleri	Aug	56	56.5 - 70.5	82	53
Pipistrellus nathusii	Jul	20	5 - 57	68	16
Pipistrellus nathusii	Aug	32	19 - 46	46	4
Pipistrellus pipistrellus	Jul	81	83 - 95	97	54
Pipistrellus pipistrellus	Aug	78	83 - 95	93	54
Pipistrellus pygmaeus	Jul	89	92 - 98.5	100	55
Pipistrellus pygmaeus	Aug	88	92 - 98.5	99	54
Plecotus auritus	Jul	32	8 - 22	64	41
Plecotus auritus	Aug	23	8 - 22	57	46

###Figures

Figure 6. The activity level (percentile) of bats recorded across each night of the bat survey for the entire site, split between months.



PART 2: Nightly Analysis

ENTIRE SURVEY PERIOD

Sunrise and Sunset Times

Table 11. The times of sunset and sunrise the following morning for surveys beginning on the date shown.

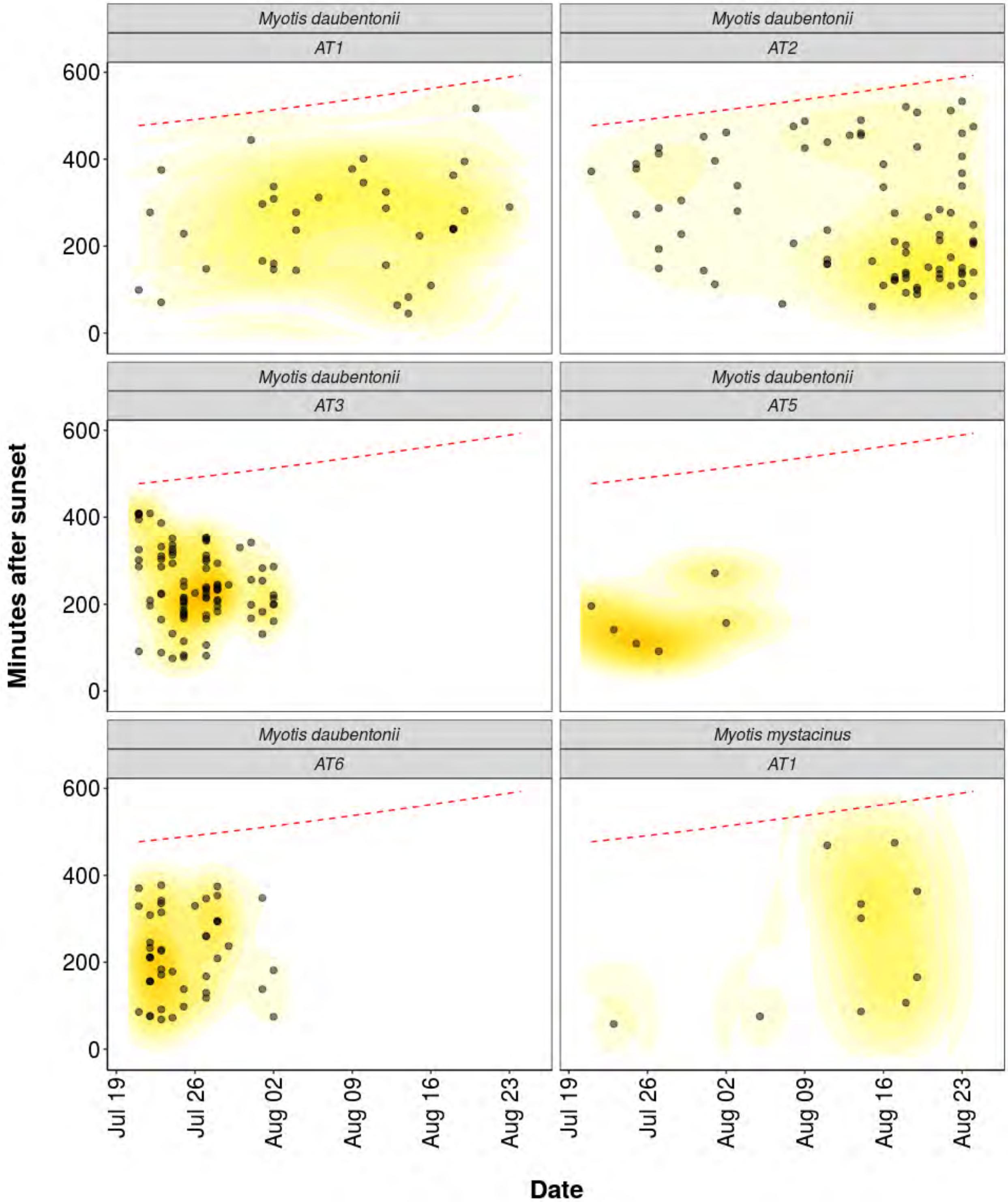
Night (y-m-d)	Sunset (hh:mm)	Sunrise (hh:mm)	Night Length (hours)
2021-07-21	21:44	05:41	8.0
2021-07-22	21:43	05:43	8.0
2021-07-23	21:41	05:44	8.0
2021-07-24	21:40	05:46	8.1
2021-07-25	21:39	05:47	8.1
2021-07-26	21:37	05:49	8.2
2021-07-27	21:36	05:50	8.2
2021-07-28	21:34	05:52	8.3
2021-07-29	21:32	05:53	8.3
2021-07-30	21:31	05:55	8.4
2021-07-31	21:29	05:56	8.4
2021-08-01	21:28	05:58	8.5
2021-08-02	21:26	05:59	8.6
2021-08-03	21:24	06:01	8.6
2021-08-04	21:22	06:03	8.7
2021-08-05	21:21	06:04	8.7
2021-08-06	21:19	06:06	8.8
2021-08-07	21:17	06:08	8.8
2021-08-08	21:15	06:09	8.9
2021-08-09	21:13	06:11	9.0
2021-08-10	21:11	06:12	9.0
2021-08-11	21:09	06:14	9.1
2021-08-12	21:08	06:16	9.1
2021-08-13	21:06	06:17	9.2
2021-08-14	21:04	06:19	9.3
2021-08-15	21:02	06:21	9.3
2021-08-16	21:00	06:22	9.4

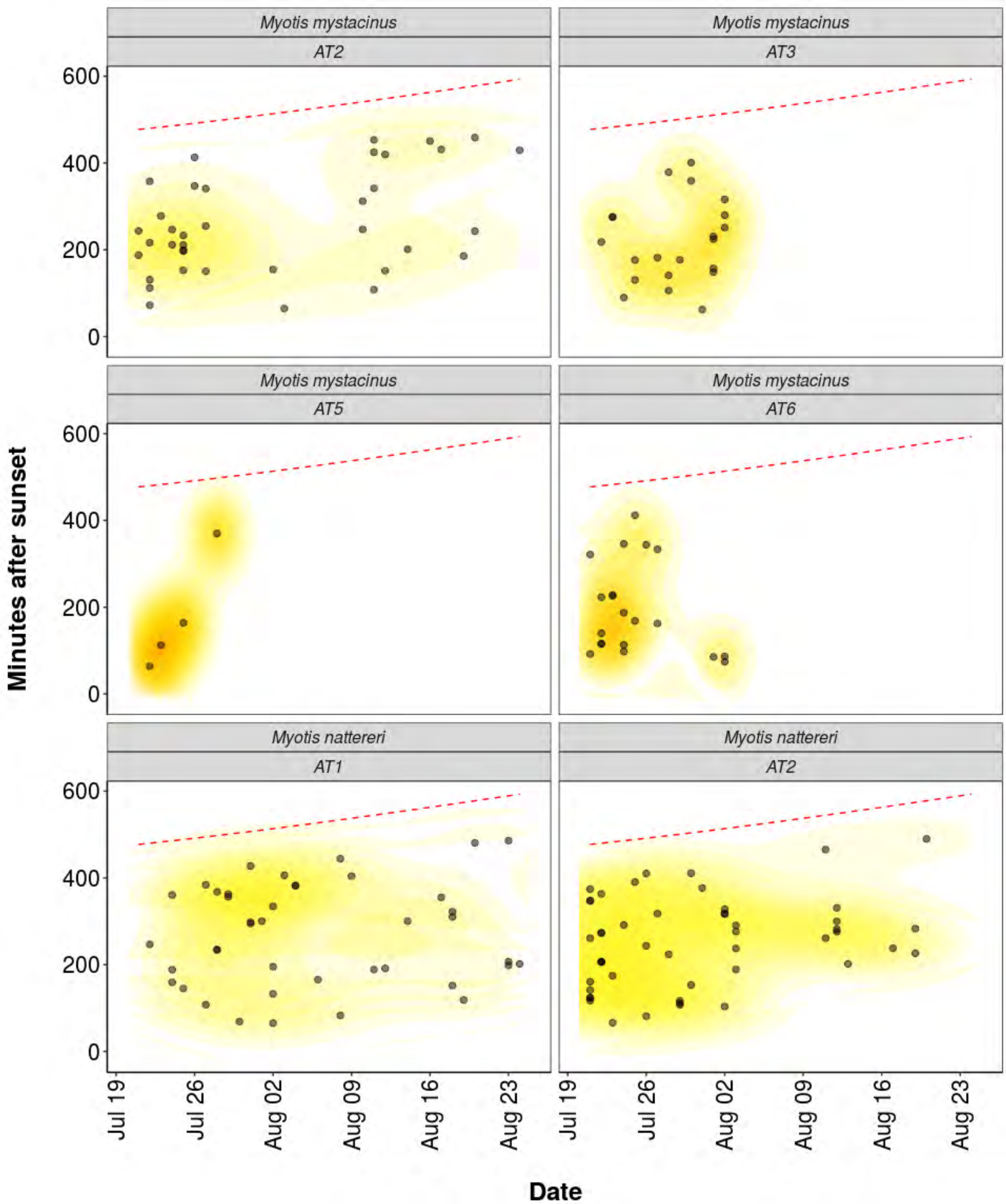
2021-08-17	20:57	06:24	9.4
2021-08-18	20:55	06:26	9.5
2021-08-19	20:53	06:27	9.6
2021-08-20	20:51	06:29	9.6
2021-08-21	20:49	06:31	9.7
2021-08-22	20:47	06:32	9.8
2021-08-23	20:45	06:34	9.8
2021-08-24	20:43	06:36	9.9

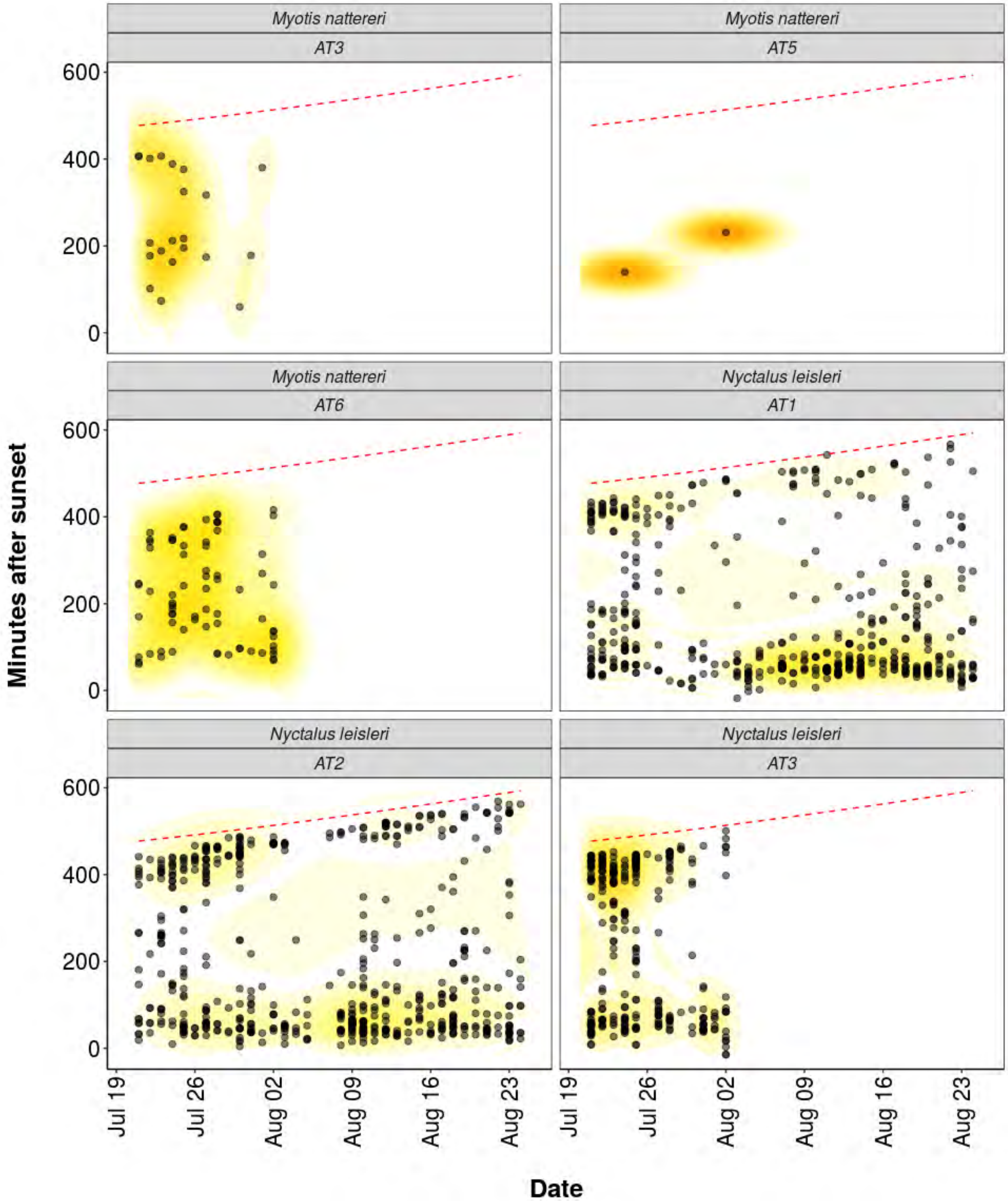
Distribution of Bat Activity Across the Night through Time

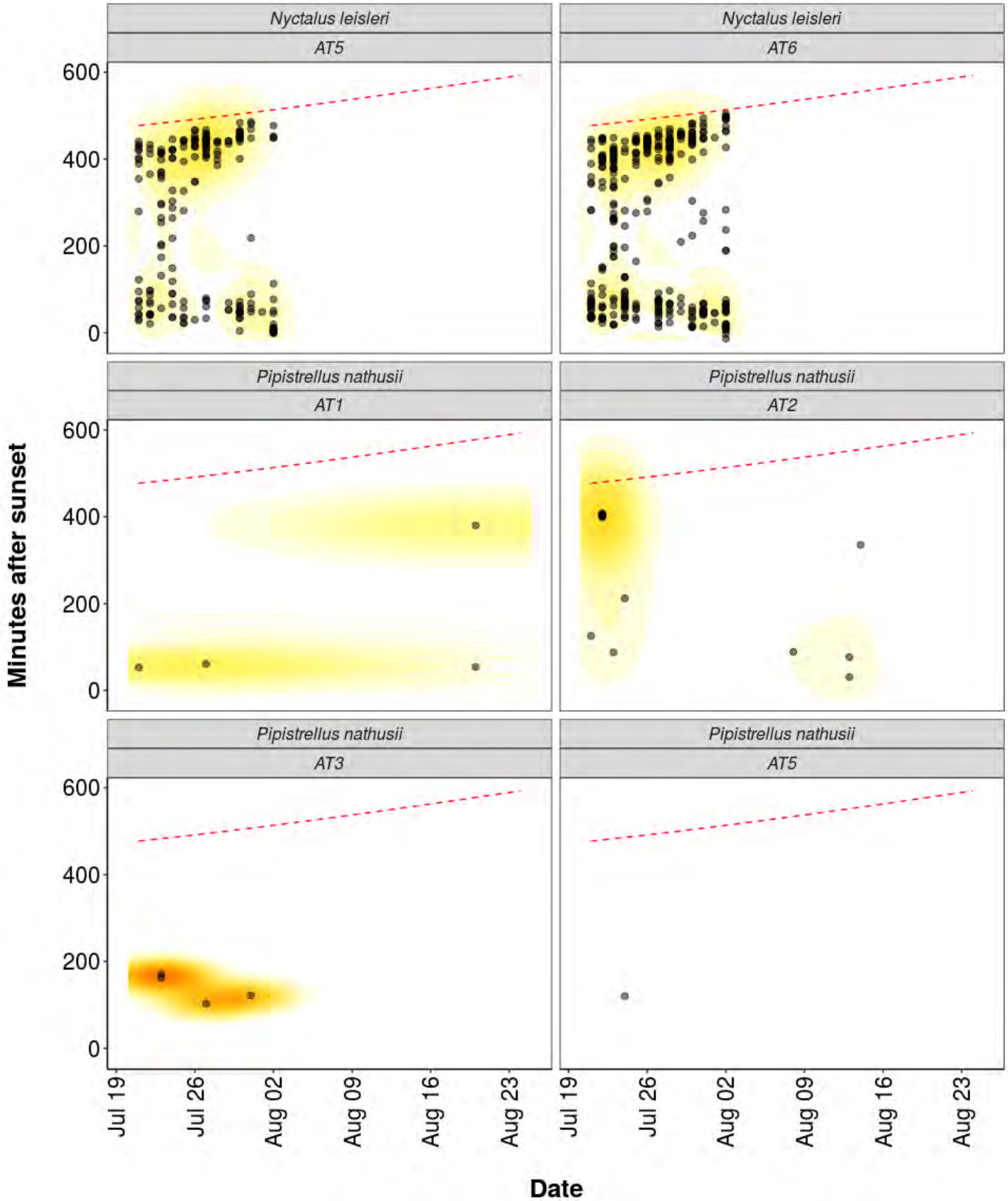
Per Detector

Figure 7. Timing of bat calls plotted as minutes before/after sunset, whereby 0 on the y axis represents sunset. Sunrise throughout the survey period is depicted as the red dashed line. Colours indicate kernel densities, with darkest colours showing peaks of activity. These colours are comparative only within each plot, and do not account for overall activity.

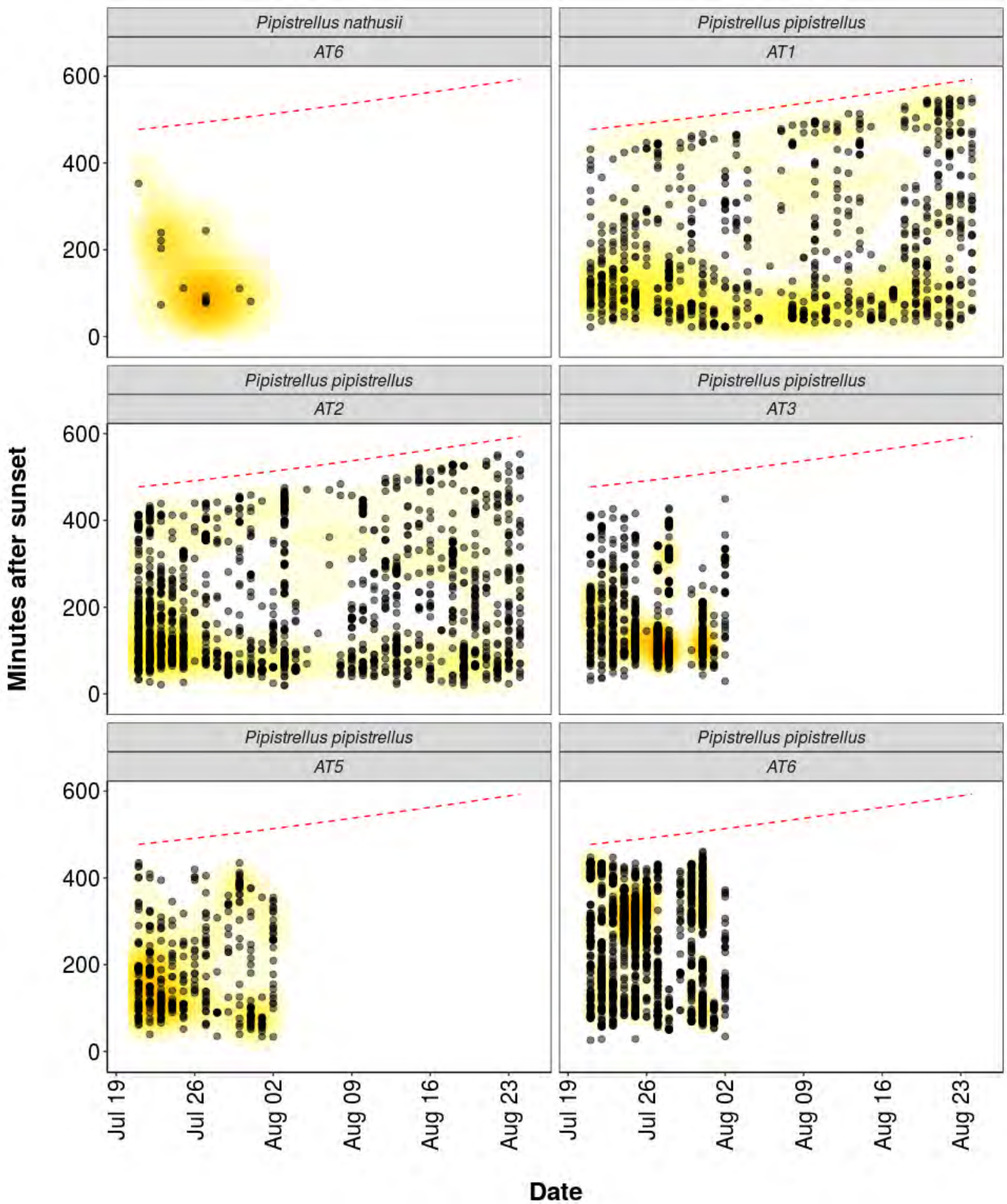

Myotis daubentonii
AT1
Myotis daubentonii
AT2
Myotis daubentonii
AT3
Myotis daubentonii
AT5
Myotis daubentonii
AT6
Myotis mystacinus
AT1
0
200
400
600
Minutes after sunset
Jul 19
Jul 26
Aug 02
Aug 09
Aug 16
Aug 23
Date


Myotis mystacinus
AT2
Myotis mystacinus
AT3
Myotis mystacinus
AT5
Myotis mystacinus
AT6
Myotis nattereri
AT1
Myotis nattereri
AT2
Minutes after sunset
0
200
400
600
Jul 19
Jul 26
Aug 02
Aug 09
Aug 16
Aug 23
Date

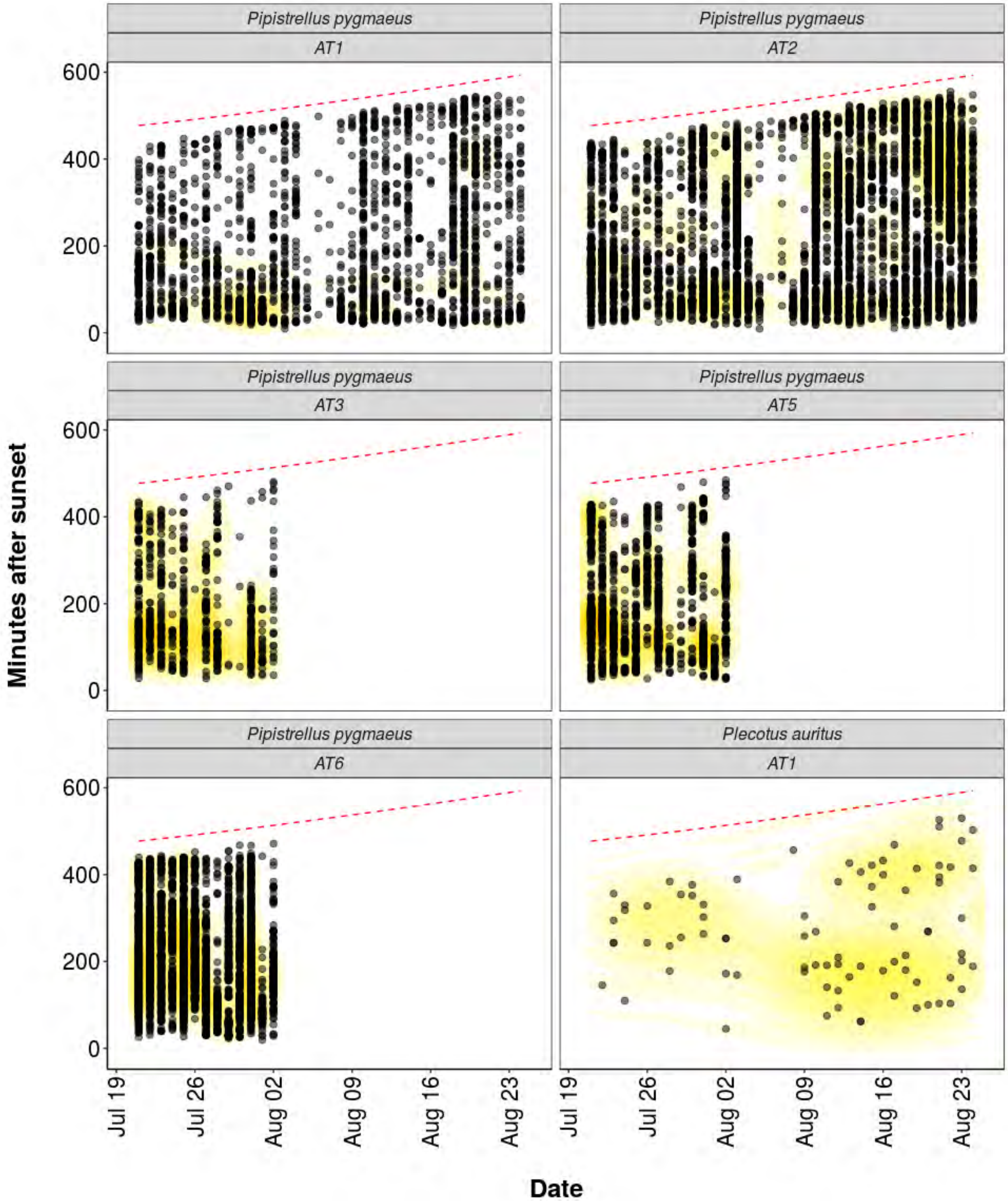

Myotis nattereri
AT3
Myotis nattereri
AT5
Myotis nattereri
AT6
Nyctalus leisleri
AT1
Nyctalus leisleri
AT2
Nyctalus leisleri
AT3
600
400
200
0
Minutes after sunset
Jul 19
Jul 26
Aug 02
Aug 09
Aug 16
Aug 23
Date

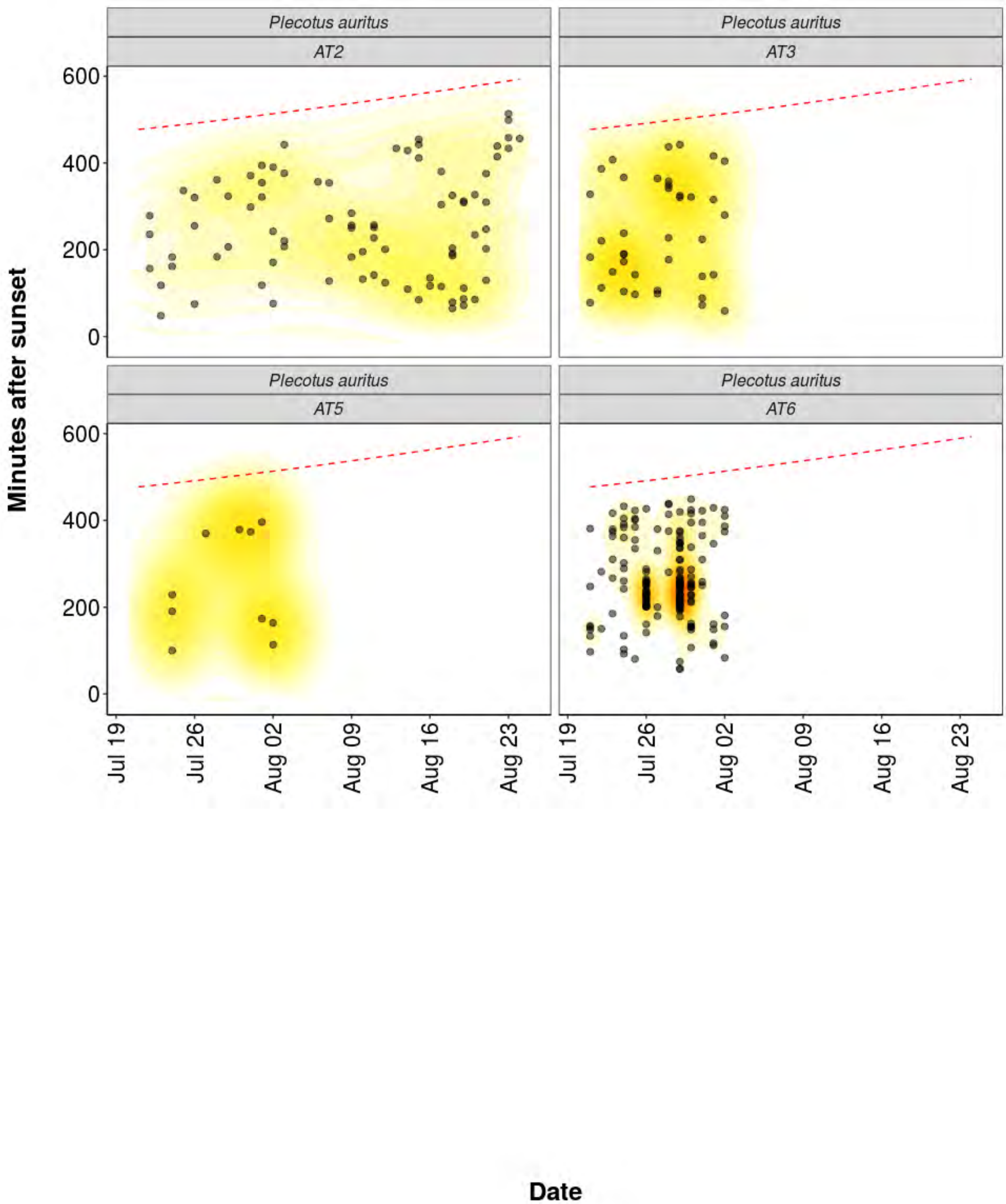


Nyctalus leisleri
AT5
Nyctalus leisleri
AT6
Pipistrellus nathusii
AT1
Pipistrellus nathusii
AT2
Pipistrellus nathusii
AT3
Pipistrellus nathusii
AT5
Minutes after sunset
0
200
400
600
Jul 19
Jul 26
Aug 02
Aug 09
Aug 16
Aug 23
Date



Pipistrellus nathusii
AT6
Pipistrellus pipistrellus
AT1
Pipistrellus pipistrellus
AT2
Pipistrellus pipistrellus
AT3
Pipistrellus pipistrellus
AT5
Pipistrellus pipistrellus
AT6
Minutes after sunset
0
200
400
600
Jul 19
Jul 26
Aug 02
Aug 09
Aug 16
Aug 23
Date


Pipistrellus pygmaeus
AT1
Pipistrellus pygmaeus
AT2
Pipistrellus pygmaeus
AT3
Pipistrellus pygmaeus
AT5
Pipistrellus pygmaeus
AT6
Plecotus auritus
AT1
Minutes after sunset
600
400
200
0
Jul 19
Jul 26
Aug 02
Aug 09
Aug 16
Aug 23
Date


Plecotus auritus
AT2
Plecotus auritus
AT3
Plecotus auritus
AT5
Plecotus auritus
AT6
Minutes after sunset
0
200
400
600
Jul 19
Jul 26
Aug 02
Aug 09
Aug 16
Aug 23
Date

Roost Emergence Time and Bat Observation

Based on: *Russ, Jon. 2012. British Bat Calls a Guide to species Identification. Pelagic Publishing.*

For more information see https://rbats-blog.updog.co/2018/05/29/bat-emergence/

Bat Passes Potentially Indicating Close Proximity to a Roost (Russ 2012) - Table

Table 12. Number of bat calls recorded before the upper time of the species-specific emergence time range, and which therefore may potentially indicate the presence of a nearby roost.

Table continues below

Species	Detector ID	2021-07-21	2021-07-22	2021-07-23	2021-07-24	2021-07-25
Common pipistrelle	AT1	1	0	0	0	0
Common pipistrelle	AT2	0	1	1	0	1
Common pipistrelle	AT3	1	0	0	0	0
Common pipistrelle	AT6	1	1	0	0	1
Soprano pipistrelle	AT1	1	0	0	0	0
Soprano pipistrelle	AT2	5	1	1	2	0
Soprano pipistrelle	AT3	0	0	0	0	0
Soprano pipistrelle	AT5	2	0	0	0	0
Soprano pipistrelle	AT6	1	0	0	0	1
Leisler’s	AT1	0	0	0	0	0
Leisler’s	AT2	0	0	0	1	0
Leisler’s	AT3	2	0	0	0	2
Leisler’s	AT5	0	0	0	0	0
Leisler’s	AT6	0	0	0	0	0

Brown long-eared	AT1	0	0	0	0	0
Brown long-eared	AT2	0	0	1	0	0
Brown long-eared	AT3	0	0	0	0	0
Brown long-eared	AT6	0	0	0	0	0
Daubenton’s	AT1	0	0	0	0	0
Daubenton’s	AT2	0	0	0	0	0
Daubenton’s	AT6	0	0	1	0	0

Table continues below

2021-07-26	2021-07-27	2021-07-29	2021-07-30	2021-07-31	2021-08-01	2021-08-02
0	0	0	1	3	9	5
0	0	0	0	0	0	1
0	0	0	0	0	0	1
0	0	0	0	0	0	0
0	0	1	1	10	10	8
0	1	0	2	0	2	1
0	1	0	0	0	0	0
1	0	0	0	0	0	2
0	0	6	5	0	1	0
0	0	2	2	0	0	0
0	0	0	2	0	1	0
0	0	0	0	0	0	5
0	0	0	1	0	0	10
0	1	0	4	1	0	8
0	0	0	0	0	0	1
0	0	0	0	0	0	0
0	0	0	0	0	0	1
0	0	2	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0

Table continues below

2021-08-03	2021-08-04	2021-08-05	2021-08-07	2021-08-08	2021-08-09	2021-08-10
1	1	0	0	0	0	1
2	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
6	6	0	0	0	3	10
3	2	2	0	1	2	4
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
1	2	1	0	1	0	1
1	0	0	0	1	1	1
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	1	0	0	0
0	0	0	0	0	0	0

Table continues below

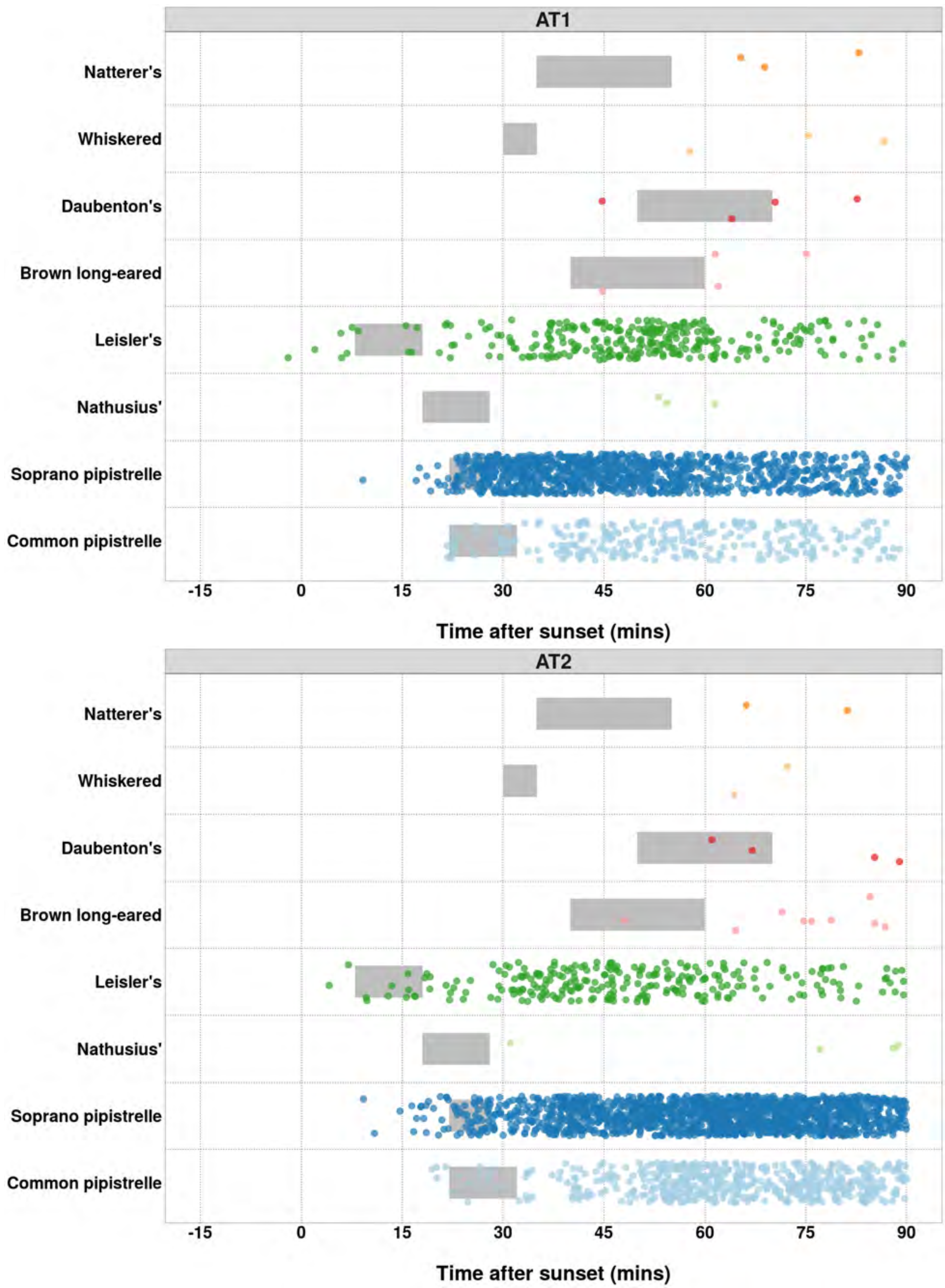
2021-08-11	2021-08-12	2021-08-13	2021-08-14	2021-08-15	2021-08-17	2021-08-18
0	1	1	0	0	0	0
0	0	2	0	0	1	1
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	2	6	0	0	5	3
0	1	6	2	0	2	8
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0

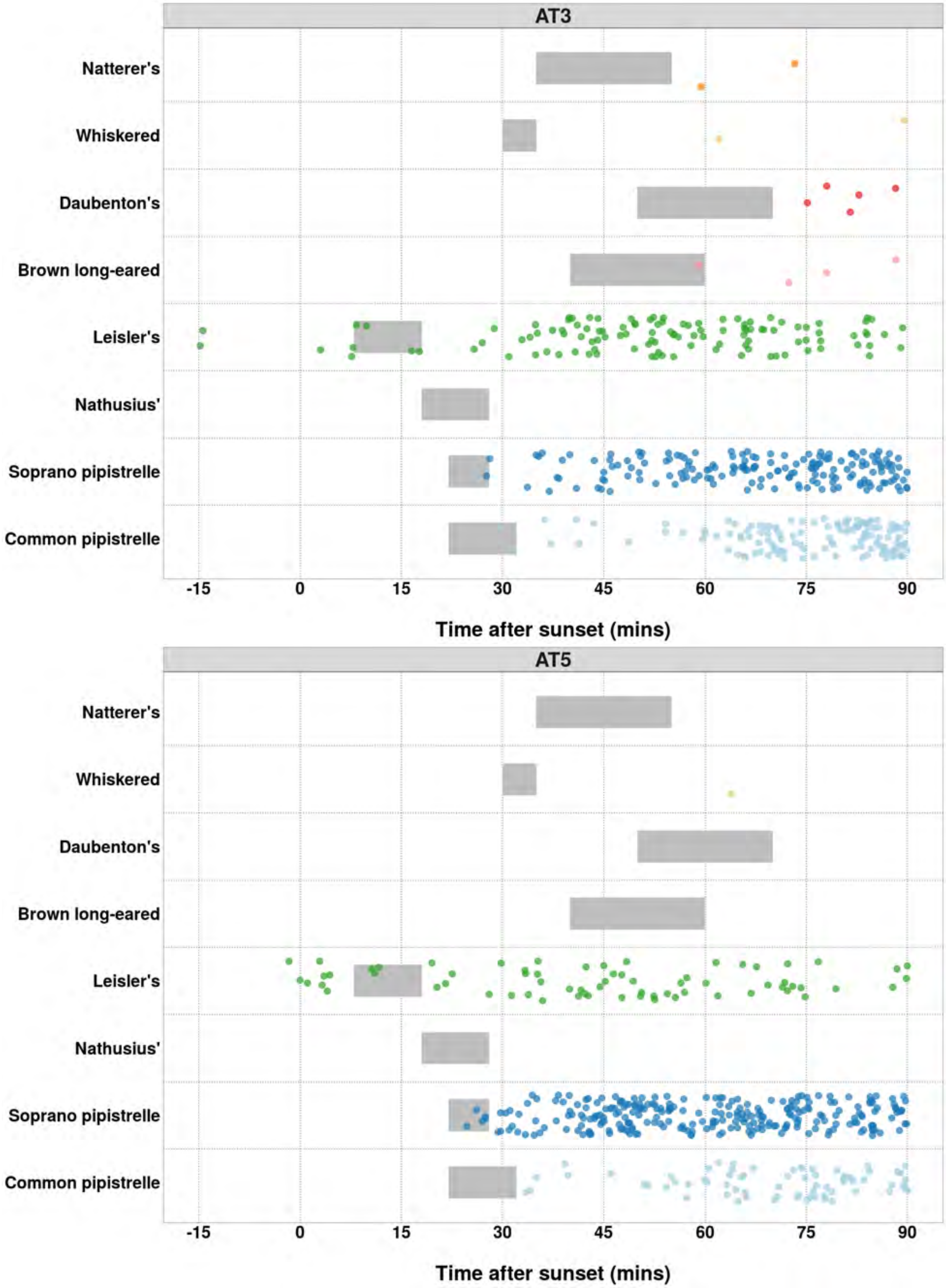
0	0	0	0	0	0	0
1	0	0	1	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	1	1	0	0	0
0	0	0	0	1	0	0
0	0	0	0	0	0	0

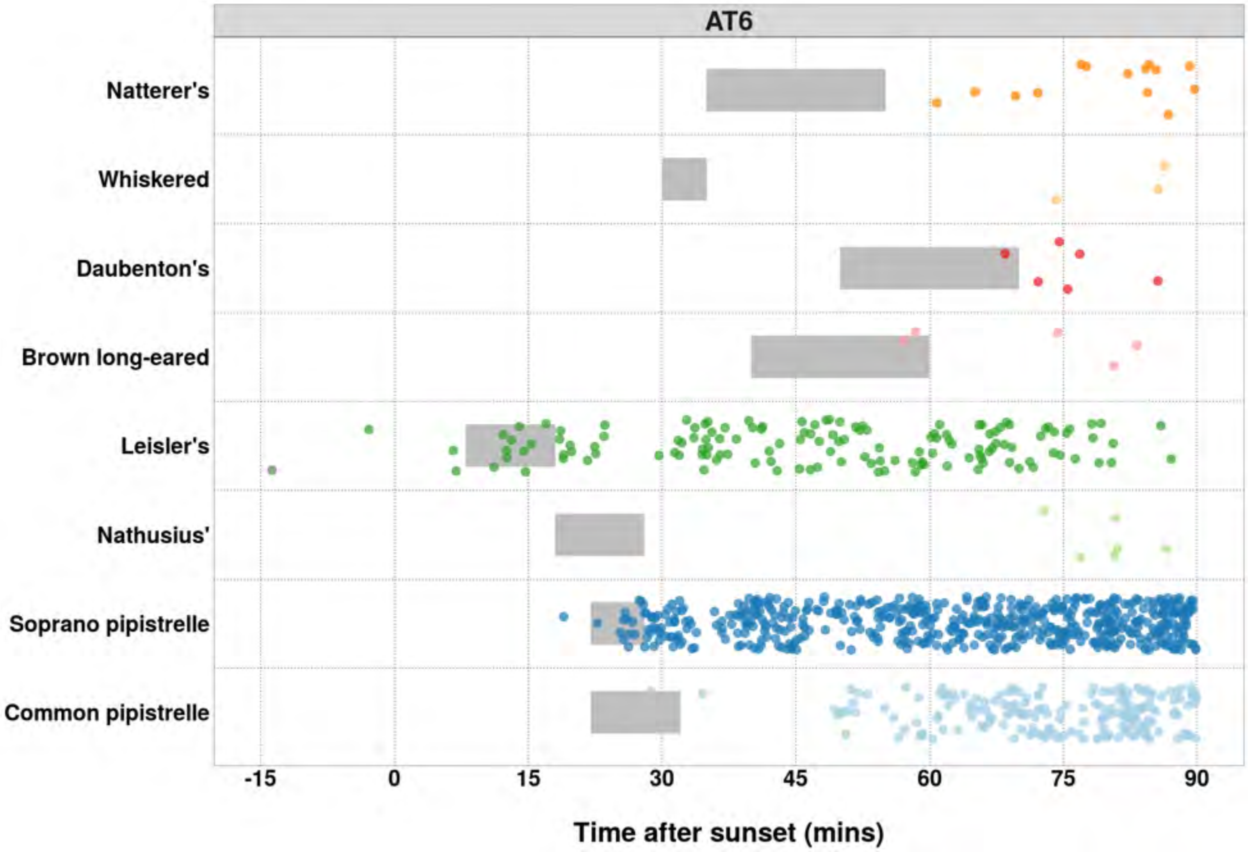
2021-08-19	2021-08-20	2021-08-21	2021-08-22	2021-08-23
0	0	1	3	0
2	0	0	0	1
0	0	0	0	0
0	0	0	0	0
7	2	2	5	2
7	2	0	5	2
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	2
0	0	0	0	1
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

Bat Passes Potentially Indicating Close Proximity to a Roost (Russ 2012) - Figures

Figure 8. Time from 15 minutes before to 90 minutes after sunset. Species-specific emergence time ranges are shown as grey bars. Bat passes overlapping species-specific grey bars, or occuring earlier than this time range, may potentially indicate the presence of a nearby roost.


AT1
Natterer's
Whiskered
Daubenton's
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
-15
0
15
30
45
60
75
90
Time after sunset (mins)
AT2
Natterer's
Whiskered
Daubenton's
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
-15
0
15
30
45
60
75
90
Time after sunset (mins)


AT3
Natterer's
Whiskered
Daubenton's
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
-15
0
15
30
45
60
75
90
Time after sunset (mins)
AT5
Natterer's
Whiskered
Daubenton's
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
-15
0
15
30
45
60
75
90
Time after sunset (mins)



AT6
Natterer's
Whiskered
Daubenton's
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
-15
0
15
30
45
60
75
90
Time after sunset (mins)

Counts of Bat Passes

All detectors

Table 14. The total number of passes recorded for each species across all of the detectors. The 'Total' percentage may not be exactly 100% due to rounding of the percentages per species.

Species	Passes (No.)	Percentage of total (%)
Common pipistrelle	185071	20.4
Soprano pipistrelle	688904	75.8
Nathusius'	1165	0.1
Leisler's	22625	2.5
Brown long-eared	3962	0.4
Daubenton's	3934	0.4
Whiskered	1074	0.1
Natterer's	2272	0.2
Total	909007	99.9

Counts of Bat Passes

Per Detector

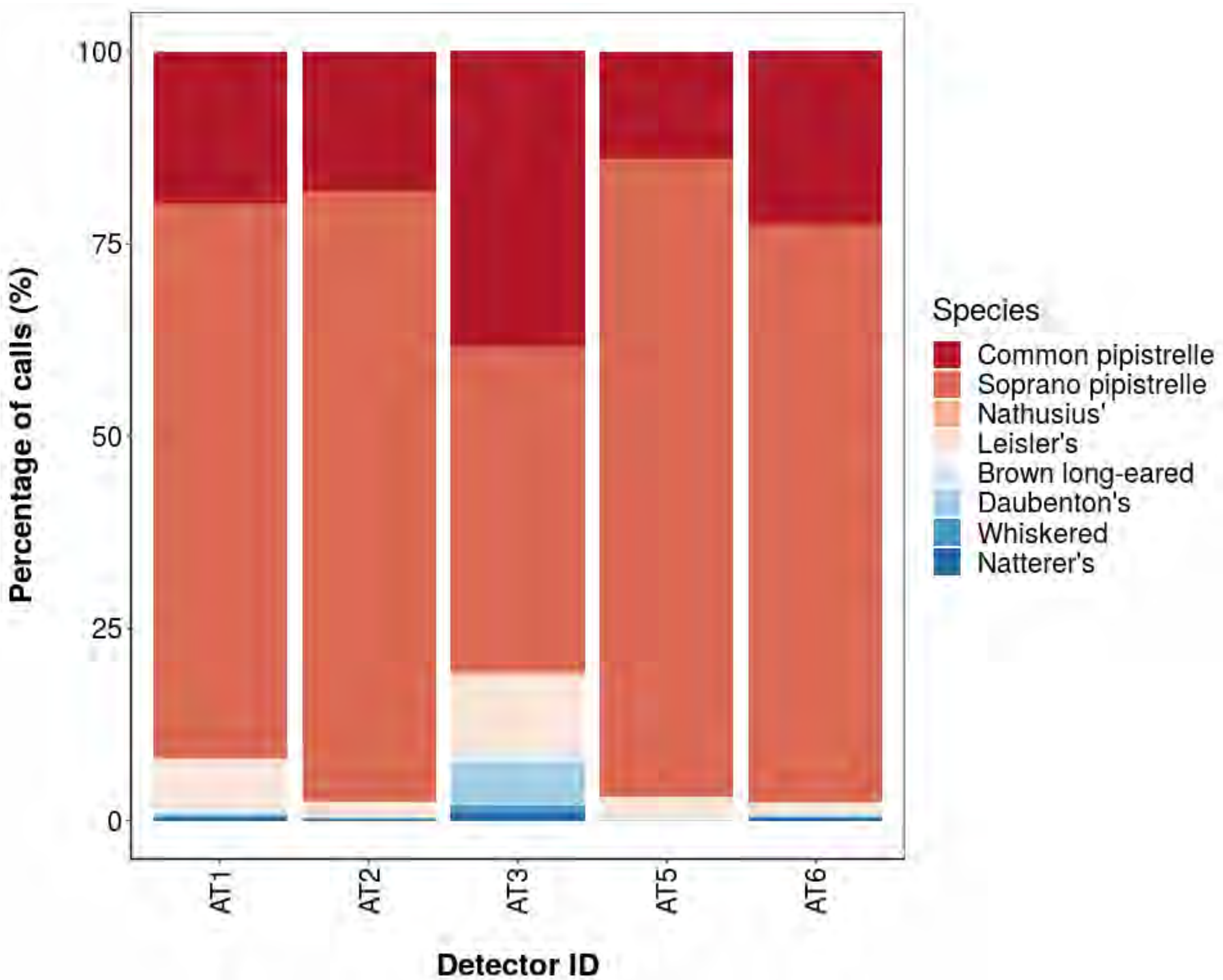
Table 15. The number of passes recorded for each species at each detector.

Species	Detector ID	Count (No)	Percentage by Detector (%)
Common pipistrelle	AT1	22544	19.8
Common pipistrelle	AT2	71224	18.1
Common pipistrelle	AT3	13502	38.4
Common pipistrelle	AT5	7389	13.9
Common pipistrelle	AT6	70412	22.5
Soprano pipistrelle	AT1	82277	72.1
Soprano pipistrelle	AT2	312048	79.4
Soprano pipistrelle	AT3	14881	42.4
Soprano pipistrelle	AT5	44118	83.0
Soprano pipistrelle	AT6	235580	75.1
Nathusius’	AT1	160	0.1
Nathusius’	AT2	336	0.1
Nathusius’	AT3	138	0.4
Nathusius’	AT5	19	0.0
Nathusius’	AT6	512	0.2
Leisler’s	AT1	6951	6.1
Leisler’s	AT2	7167	1.8
Leisler’s	AT3	3332	9.5
Leisler’s	AT5	1513	2.8
Leisler’s	AT6	3662	1.2
Brown long-eared	AT1	1179	1.0
Brown long-eared	AT2	630	0.2
Brown long-eared	AT3	652	1.9
Brown long-eared	AT5	90	0.2
Brown long-eared	AT6	1411	0.4
Daubenton’s	AT1	377	0.3
Daubenton’s	AT2	698	0.2
Daubenton’s	AT3	1956	5.6
Daubenton’s	AT5	27	0.1

Daubenton’s	AT6	876	0.3
Whiskered	AT1	107	0.1
Whiskered	AT2	383	0.1
Whiskered	AT3	318	0.9
Whiskered	AT5	11	0.0
Whiskered	AT6	255	0.1
Natterer’s	AT1	544	0.5
Natterer’s	AT2	467	0.1
Natterer’s	AT3	349	1.0
Natterer’s	AT5	10	0.0
Natterer’s	AT6	902	0.3

Species Composition

Figure 10. Percentage species composition of passes at each detector.



PART 2a: Presence Only

THE NEXT SECTION OF THE REPORT FEATURES THE RAW DATA SUPPLIED TO ECOBAT AND ONLY TAKES INTO ACCOUNT THE PRESENCE, AND NOT THE ABSENCE, OF EACH BAT SPECIES. FOR EACH NIGHT, THERE IS NO 'ZERO DATA' FOR WHEN SPECIES WERE NOT DETECTED.

Nightly Bat Pass Rate (Bat passes per hour)

Median Per Detector

Table 16. The median Nightly Pass Rate (bat passes per hour, per night) of each species. If NA, then no bat passes.

Bat pass rates are often highly variable between nights, with some nights having few or no passes and other nights having high activity. In these circumstances, the median is likely to be a more useful summary of the 'average' activity than is the mean. For further information see: *Lintott, P. R., & Mathews, F. (2018). Basic mathematical errors may make ecological assessments unreliable. Biodiversity and Conservation, 27(1), 265-267.* https://doi.org/10.1007/s10531-017-1418-5

Species	Detector ID	Median Pass Rate
Common pipistrelle	AT1	68.7
Common pipistrelle	AT2	143.2
Common pipistrelle	AT3	150.8
Common pipistrelle	AT5	57.6
Common pipistrelle	AT6	592.7
Soprano pipistrelle	AT1	215.1
Soprano pipistrelle	AT2	735.6
Soprano pipistrelle	AT3	111.9
Soprano pipistrelle	AT5	394.2
Soprano pipistrelle	AT6	1686.6
Nathusius'	AT1	5.6
Nathusius'	AT2	3.6
Nathusius'	AT3	2.7
Nathusius'	AT5	2.4
Nathusius'	AT6	6.8
Leisler's	AT1	15.0
Leisler's	AT2	19.6
Leisler's	AT3	30.6
Leisler's	AT5	14.4
Leisler's	AT6	35.5
Brown long-eared	AT1	4.2
Brown long-eared	AT2	2.1
Brown long-eared	AT3	6.1

Brown long-eared	AT5	1.6
Brown long-eared	AT6	11.7
Daubenton’s	AT1	1.7
Daubenton’s	AT2	3.0
Daubenton’s	AT3	17.1
Daubenton’s	AT5	0.4
Daubenton’s	AT6	7.6
Whiskered	AT1	1.1
Whiskered	AT2	0.7
Whiskered	AT3	3.5
Whiskered	AT5	0.3
Whiskered	AT6	3.3
Natterer’s	AT1	2.4
Natterer’s	AT2	1.8
Natterer’s	AT3	3.5
Natterer’s	AT5	0.6
Natterer’s	AT6	4.9

Nightly Bat Pass Rate (Bat passes per hour)

Mean per Detector

Table 17. The mean Nightly Pass Rate (bat passes per hour, per night) of each species at each detector. Values are given to 1 decimal place.

We recommend using the median values given above, for the reasons stated above, but provide the mean values in the table below.

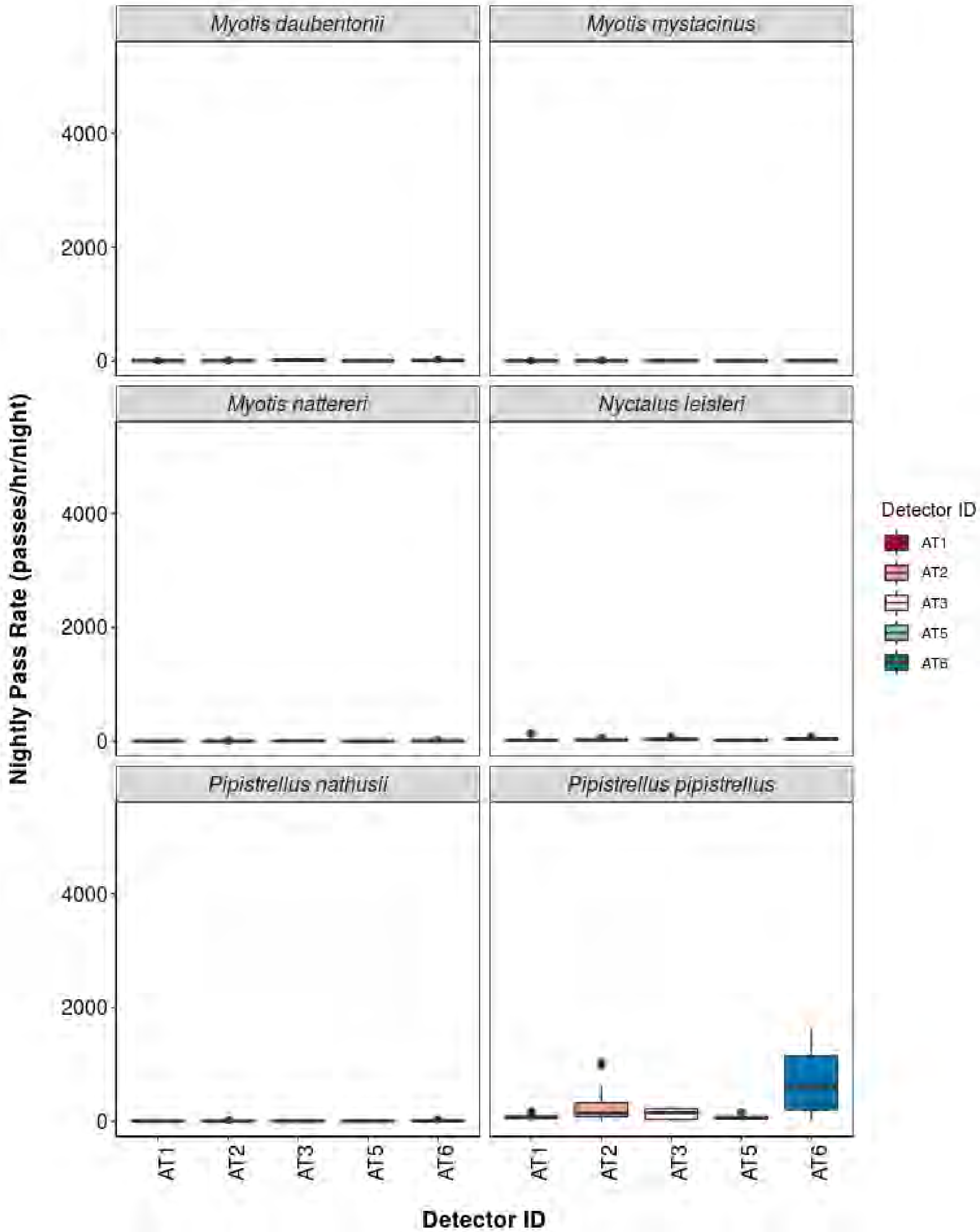
Species	Detector ID	Mean Pass Rate
Common pipistrelle	AT1	73.1
Common pipistrelle	AT2	235.8
Common pipistrelle	AT3	137.5
Common pipistrelle	AT5	69.5
Common pipistrelle	AT6	664.3
Soprano pipistrelle	AT1	269.5
Soprano pipistrelle	AT2	989.4
Soprano pipistrelle	AT3	140.5
Soprano pipistrelle	AT5	415.8
Soprano pipistrelle	AT6	2216.5
Nathusius’	AT1	6.0
Nathusius’	AT2	5.8
Nathusius’	AT3	5.7
Nathusius’	AT5	2.4
Nathusius’	AT6	10.4
Leisler’s	AT1	22.3
Leisler’s	AT2	24.0
Leisler’s	AT3	31.4
Leisler’s	AT5	14.1
Leisler’s	AT6	34.3
Brown long-eared	AT1	4.8
Brown long-eared	AT2	2.4
Brown long-eared	AT3	6.6
Brown long-eared	AT5	1.8
Brown long-eared	AT6	13.2
Daubenton’s	AT1	2.0

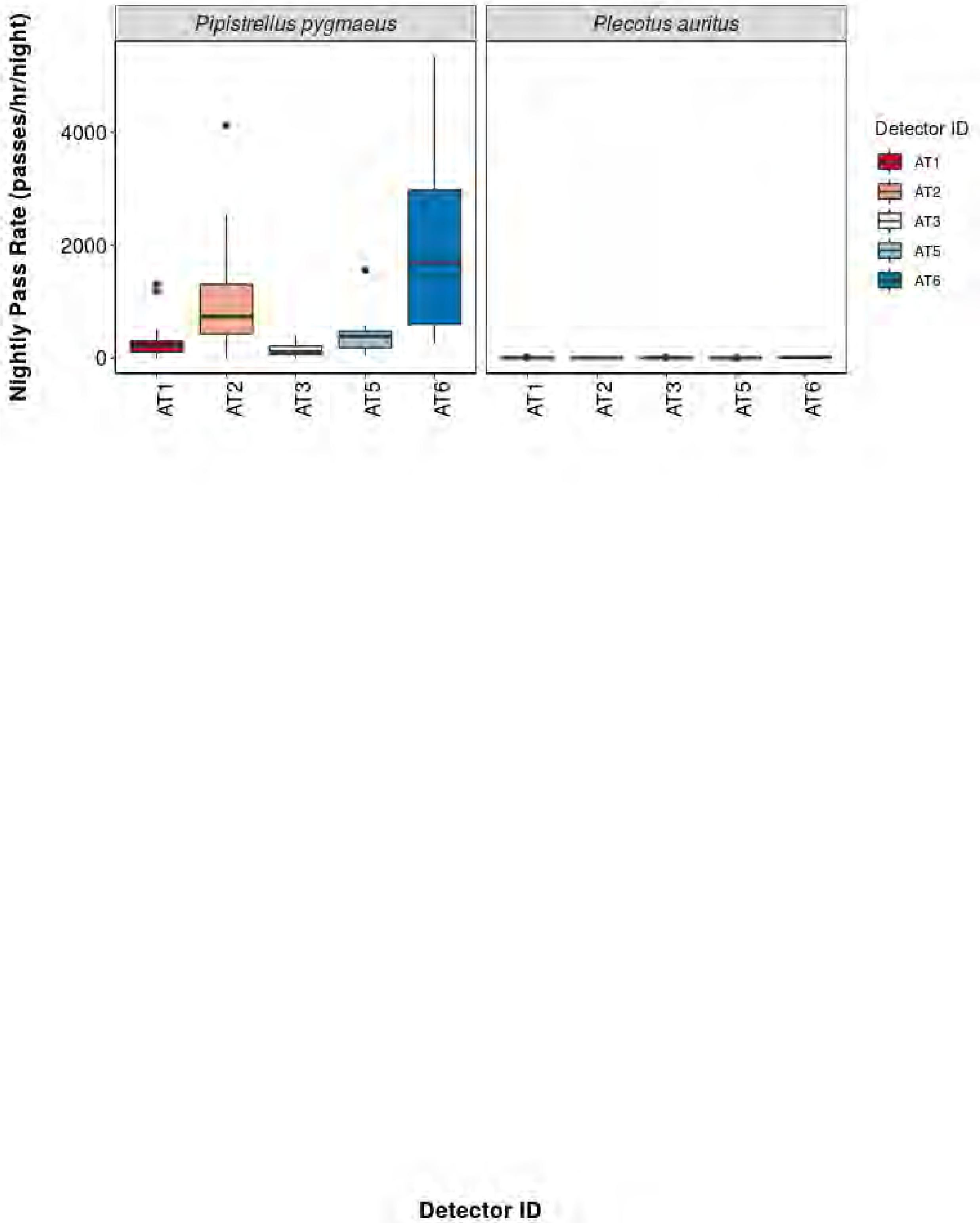
Daubenton’s	AT2	3.2
Daubenton’s	AT3	18.4
Daubenton’s	AT5	0.5
Daubenton’s	AT6	9.8
Whiskered	AT1	1.7
Whiskered	AT2	2.6
Whiskered	AT3	3.5
Whiskered	AT5	0.3
Whiskered	AT6	3.5
Natterer’s	AT1	2.6
Natterer’s	AT2	3.0
Natterer’s	AT3	4.8
Natterer’s	AT5	0.6
Natterer’s	AT6	8.4

Nightly Bat Passes (Bat passes per hour)

Per Detector - Figures

Figure 11. Boxplots for the number of bat passes per hour each night, for each detector. The 'box' shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The 'whiskers' extend from the box and represent the ranges for the bottom 25% and the top 25% of the data values, excluding outliers. An outlier is any extreme value that lies further away from the box than 1.5 times the interquartile range. Outliers are shown as dots. Where very few passes are recorded it is not possible to produce the box, so the data are shown as a line.


Myotis daubentonii
Myotis mystacinus
Myotis nattereri
Nyctalus leisleri
Pipistrellus nathusii
Pipistrellus pipistrellus
Nightly Pass Rate (passes/hr/night)
4000
2000
0
AT1
AT2
AT3
AT5
AT6
Detector ID
Detector ID
AT1
AT2
AT3
AT5
AT6



Pipistrellus pygmaeus
Plecotus auritus
Nightly Pass Rate (passes/hr/night)
4000
2000
0
AT1
AT2
AT3
AT5
AT6
Detector ID
AT1
AT2
AT3
AT5
AT6
Detector ID

SPLIT BY MONTH

Total Bat Passes per Detector, each Month

Per Detector

Table 18. The total number of bat passes of each species in each month at each detector. This table simply tells you how many bats of each species were recorded passing each detector during each month. These numbers are not standardised by the night length, or how many nights each detector was active for during each month.

Species	Detector ID	Jul	Aug
Common pipistrelle	AT1	8140	14404
Common pipistrelle	AT2	35024	36200
Common pipistrelle	AT3	13005	497
Common pipistrelle	AT5	6345	1044
Common pipistrelle	AT6	66674	3738
Soprano pipistrelle	AT1	39038	43239
Soprano pipistrelle	AT2	78252	233796
Soprano pipistrelle	AT3	13605	1276
Soprano pipistrelle	AT5	39629	4489
Soprano pipistrelle	AT6	221571	14009
Nathusius’	AT1	67	93
Nathusius’	AT2	241	95
Nathusius’	AT3	138	0
Nathusius’	AT5	19	0
Nathusius’	AT6	512	0
Leisler’s	AT1	1421	5530
Leisler’s	AT2	2767	4400
Leisler’s	AT3	2974	358
Leisler’s	AT5	1324	189
Leisler’s	AT6	3154	508
Brown long-eared	AT1	286	893
Brown long-eared	AT2	177	453
Brown long-eared	AT3	550	102
Brown long-eared	AT5	63	27

Brown long-eared	AT6	1258	153
Daubenton’s	AT1	82	295
Daubenton’s	AT2	140	558
Daubenton’s	AT3	1738	218
Daubenton’s	AT5	21	6
Daubenton’s	AT6	783	93
Whiskered	AT1	9	98
Whiskered	AT2	292	91
Whiskered	AT3	212	106
Whiskered	AT5	11	0
Whiskered	AT6	183	72
Natterer’s	AT1	220	324
Natterer’s	AT2	367	100
Natterer’s	AT3	335	14
Natterer’s	AT5	8	2
Natterer’s	AT6	621	281

Survey Effort

Table 19. The number of survey nights per month per detector.

Month	Detector ID	No. of Survey Nights
Jul	AT1	11
Jul	AT2	11
Jul	AT3	11
Jul	AT5	11
Jul	AT6	11
Aug	AT1	24
Aug	AT2	24
Aug	AT3	2
Aug	AT5	2
Aug	AT6	2

Nightly Bat Pass Rate for each Month

Median Per Detector

Table 20. The median Nightly Pass Rate (bat passes per hour, per night) of each species throughout each month. If NA, then no bat passes.

Bat pass rates are often highly variable between nights, with some nights having few or no passes and other nights having high activity. In these circumstances, the median is likely to be a more useful summary of the 'average' activity than is the mean. For further information see: *Lintott, P. R., & Mathews, F. (2018). Basic mathematical errors may make ecological assessments unreliable. Biodiversity and Conservation, 27(1), 265-267.* https://doi.org/10.1007/s10531-017-1418-5

Species	Detector ID	Jul	Aug
Common pipistrelle	AT1	85.2	63.5
Common pipistrelle	AT2	318.7	133.2
Common pipistrelle	AT3	199.4	29.1
Common pipistrelle	AT5	57.6	61.1
Common pipistrelle	AT6	658.8	219.1
Soprano pipistrelle	AT1	322.4	185.3
Soprano pipistrelle	AT2	712.8	763.0
Soprano pipistrelle	AT3	148.1	74.8
Soprano pipistrelle	AT5	419.5	262.7
Soprano pipistrelle	AT6	2248.1	820.2
Nathusius'	AT1	4.1	9.7
Nathusius'	AT2	3.2	3.6
Nathusius'	AT3	2.7	NA
Nathusius'	AT5	2.4	NA
Nathusius'	AT6	6.8	NA
Leisler's	AT1	12.7	15.4
Leisler's	AT2	29.2	17.1
Leisler's	AT3	33.5	21.0
Leisler's	AT5	14.4	11.0
Leisler's	AT6	35.5	29.7
Brown long-eared	AT1	4.3	4.0
Brown long-eared	AT2	3.2	2.0
Brown long-eared	AT3	6.1	6.0

Brown long-eared	AT5	1.4	1.6
Brown long-eared	AT6	13.7	9.0
Daubenton’s	AT1	1.7	1.6
Daubenton’s	AT2	3.0	3.0
Daubenton’s	AT3	22.6	12.8
Daubenton’s	AT5	0.6	0.4
Daubenton’s	AT6	9.1	5.4
Whiskered	AT1	1.1	1.1
Whiskered	AT2	3.9	0.6
Whiskered	AT3	2.2	6.2
Whiskered	AT5	0.3	NA
Whiskered	AT6	2.7	4.2
Natterer’s	AT1	4.0	2.1
Natterer’s	AT2	3.0	1.1
Natterer’s	AT3	3.9	1.6
Natterer’s	AT5	1.0	0.2
Natterer’s	AT6	4.7	16.4

Nightly Bat Pass Rate for each Month

Mean per Detector

Table 21: The mean Nightly Pass Rate (bat passes per hour, per night) of each species throughout each month. Values are given to 1 decimal place.

We recommend using the median values given above, for the reasons stated above, but provide the mean values in the table below.

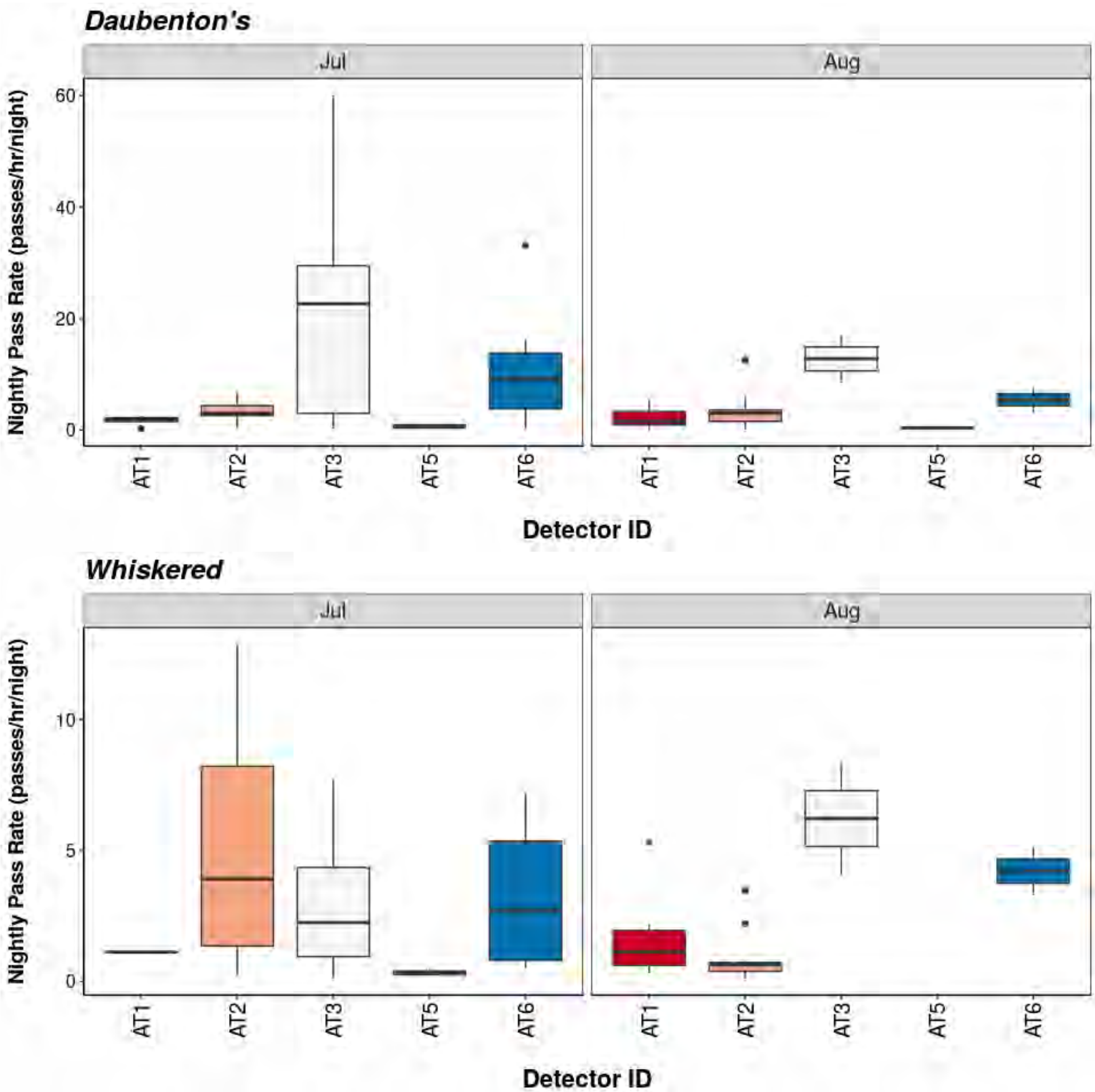
Species	Detector ID	Jul	Aug
Common pipistrelle	AT1	90.4	65.2
Common pipistrelle	AT2	393.7	163.4
Common pipistrelle	AT3	159.2	29.1
Common pipistrelle	AT5	71.1	61.1
Common pipistrelle	AT6	745.2	219.1
Soprano pipistrelle	AT1	428.6	196.6
Soprano pipistrelle	AT2	871.5	1043.4
Soprano pipistrelle	AT3	152.4	74.8
Soprano pipistrelle	AT5	443.6	262.7
Soprano pipistrelle	AT6	2470.4	820.2
Nathusius’	AT1	4.1	9.7
Nathusius’	AT2	7.5	3.5
Nathusius’	AT3	5.7	NA
Nathusius’	AT5	2.4	NA
Nathusius’	AT6	10.4	NA
Leisler’s	AT1	15.9	25.2
Leisler’s	AT2	30.6	20.8
Leisler’s	AT3	33.3	21.0
Leisler’s	AT5	14.7	11.0
Leisler’s	AT6	35.2	29.7
Brown long-eared	AT1	4.3	5.0
Brown long-eared	AT2	2.7	2.3
Brown long-eared	AT3	6.7	6.0
Brown long-eared	AT5	1.9	1.6
Brown long-eared	AT6	14.0	9.0
Daubenton’s	AT1	1.7	2.2

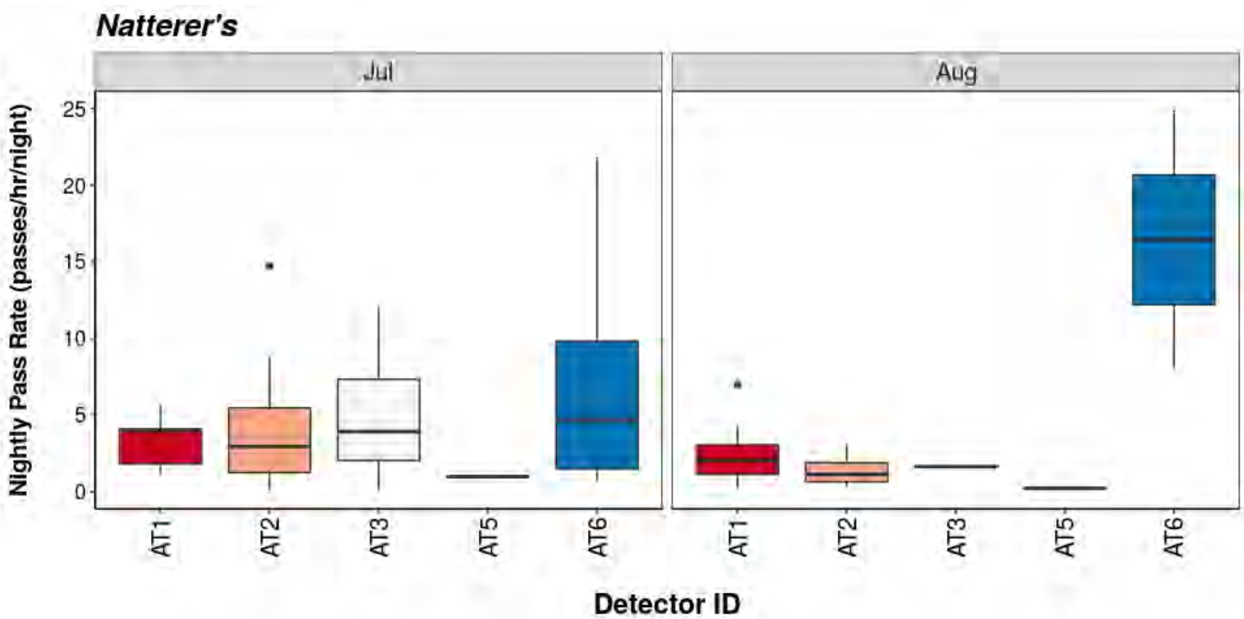
Daubenton’s	AT2	3.4	3.1
Daubenton’s	AT3	19.4	12.8
Daubenton’s	AT5	0.6	0.4
Daubenton’s	AT6	10.7	5.4
Whiskered	AT1	1.1	1.8
Whiskered	AT2	5.2	0.9
Whiskered	AT3	2.9	6.2
Whiskered	AT5	0.3	NA
Whiskered	AT6	3.2	4.2
Natterer’s	AT1	3.3	2.2
Natterer’s	AT2	4.1	1.4
Natterer’s	AT3	5.2	1.6
Natterer’s	AT5	1.0	0.2
Natterer’s	AT6	6.9	16.4

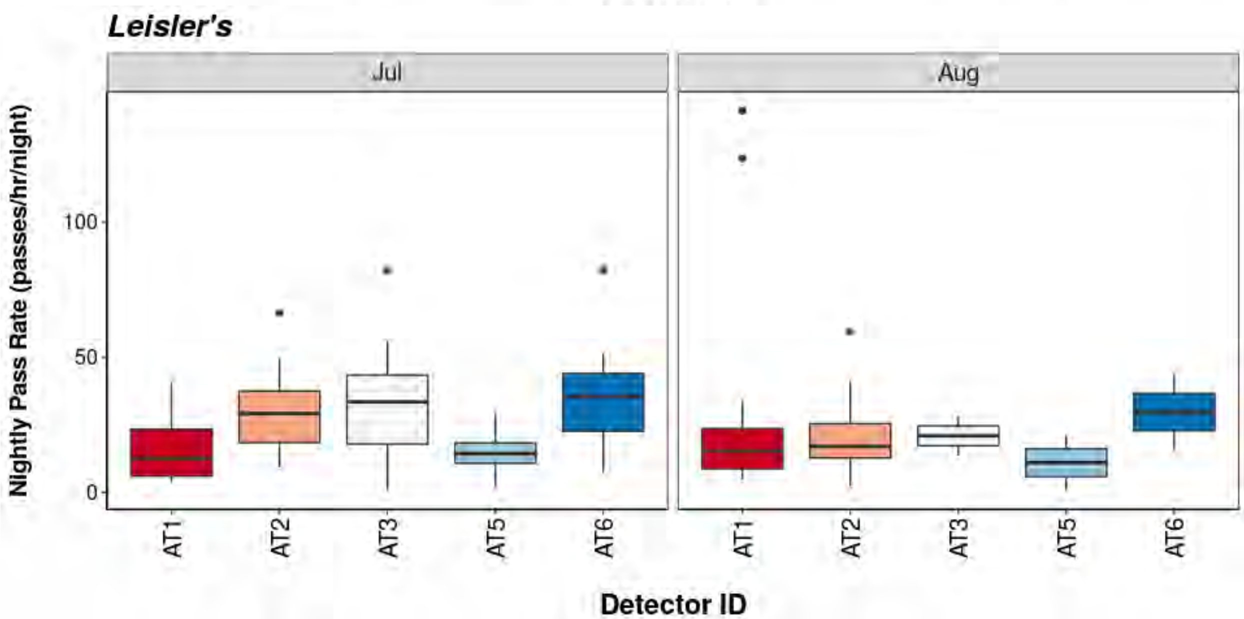
Nightly Bat Pass Rate for each Month

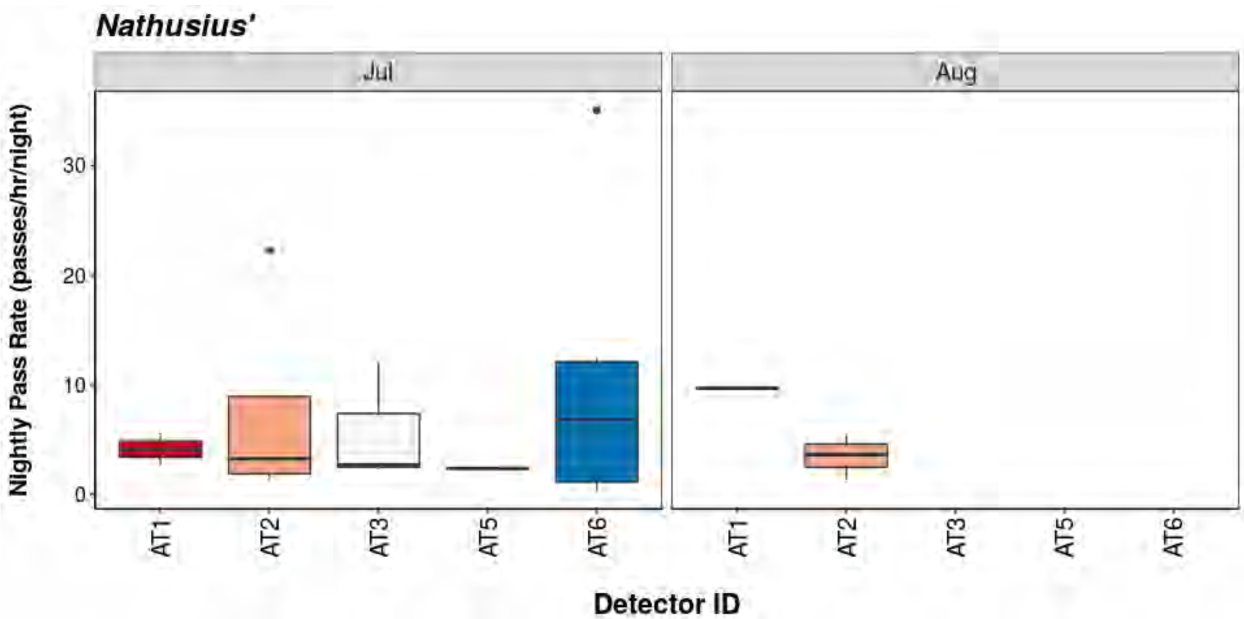
Per Detector - Figures

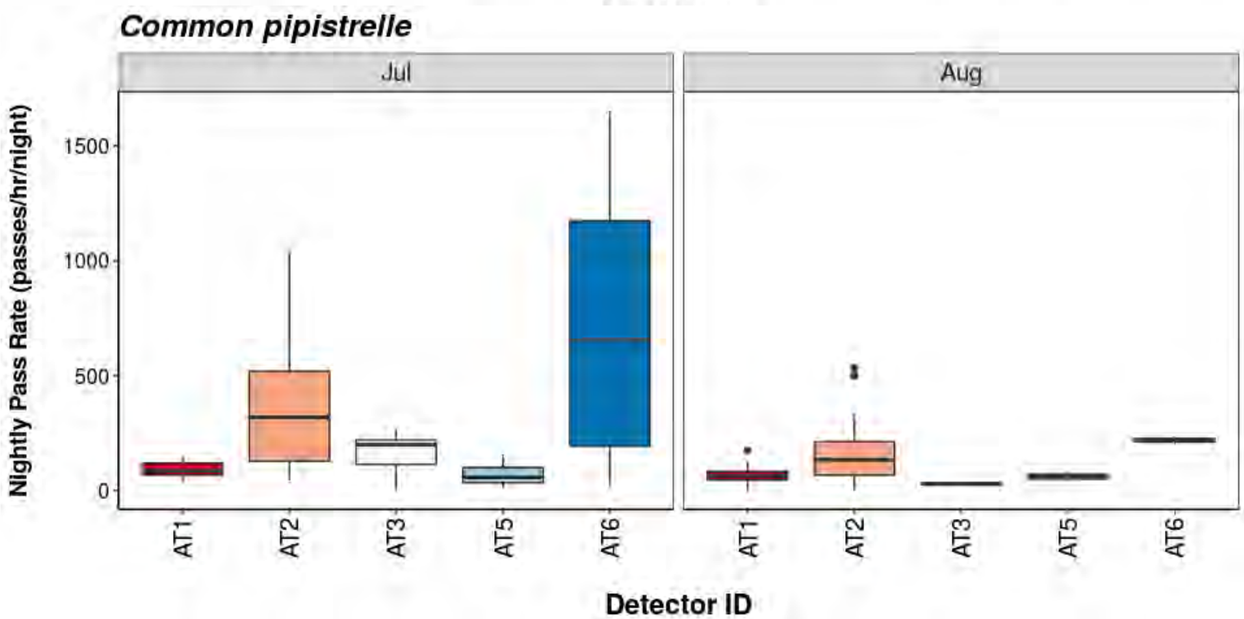
Figure 12. Figures show boxplots for the number of bat passes per hour by detector, for each month. The 'box' shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The 'whiskers' extend from the box and represent the ranges for the bottom 25% and the top 25% of the data values, excluding outliers. An outlier is any extreme value that lies further away from the box than 1.5 times the interquartile range. Outliers are shown as dots. Where very few passes are recorded it is not possible to produce the box, so the data are shown as a line.

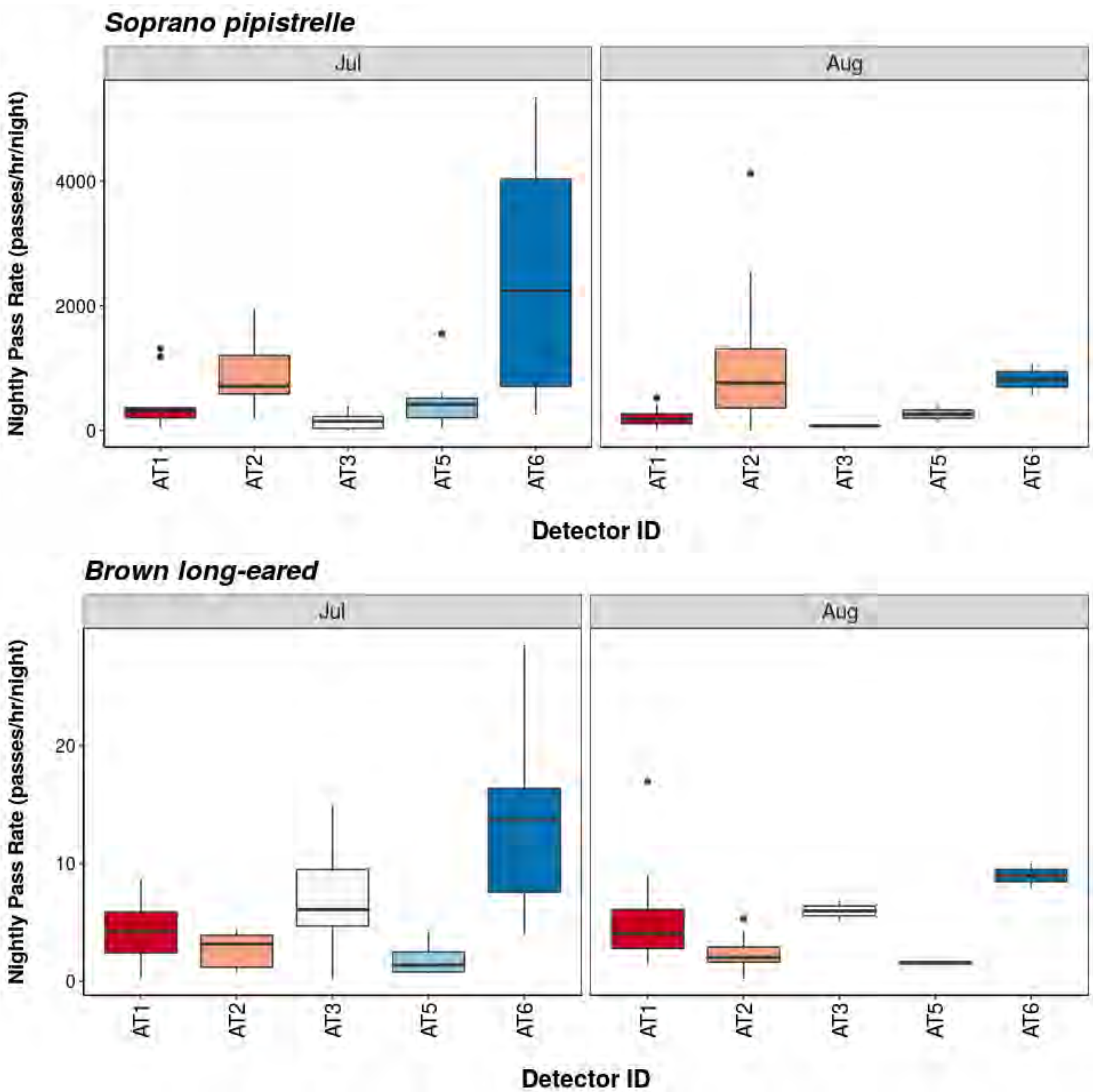



Natterer's
Jul
Aug
Nightly Pass Rate (passes/hr/night)
25
20
15
10
5
0
AT1
AT2
AT3
AT5
AT6
Detector ID


Leisler's
Jul
Aug
Nightly Pass Rate (passes/hr/night)
100
50
0
AT1
AT2
AT3
AT5
AT6
Detector ID


Nathusius'
Jul
Aug
Nightly Pass Rate (passes/hr/night)
0
10
20
30
AT1
AT2
AT3
AT5
AT6
Detector ID


Common pipistrelle
Jul
Aug
Nightly Pass Rate (passes/hr/night)
0
500
1000
1500
AT1
AT2
AT3
AT5
AT6
Detector ID


Soprano pipistrelle
Jul
Aug
Nightly Pass Rate (passes/hr/night)
4000
2000
0
AT1
AT2
AT3
AT5
AT6
Detector ID
Brown long-eared
Jul
Aug
Nightly Pass Rate (passes/hr/night)
20
10
0
AT1
AT2
AT3
AT5
AT6
Detector ID

Bat Activity per Detector Location

Figure 13. Detector ID reference:

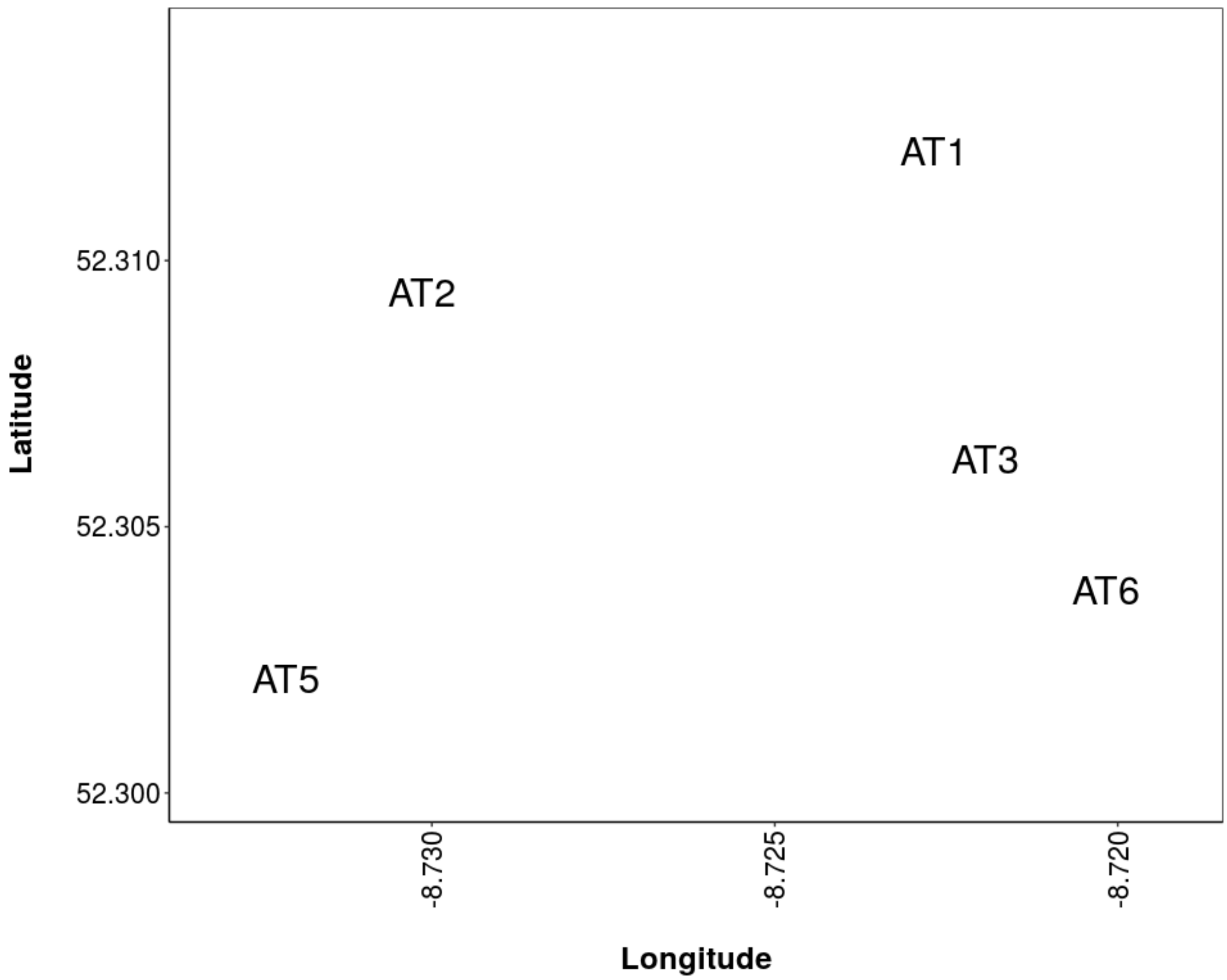
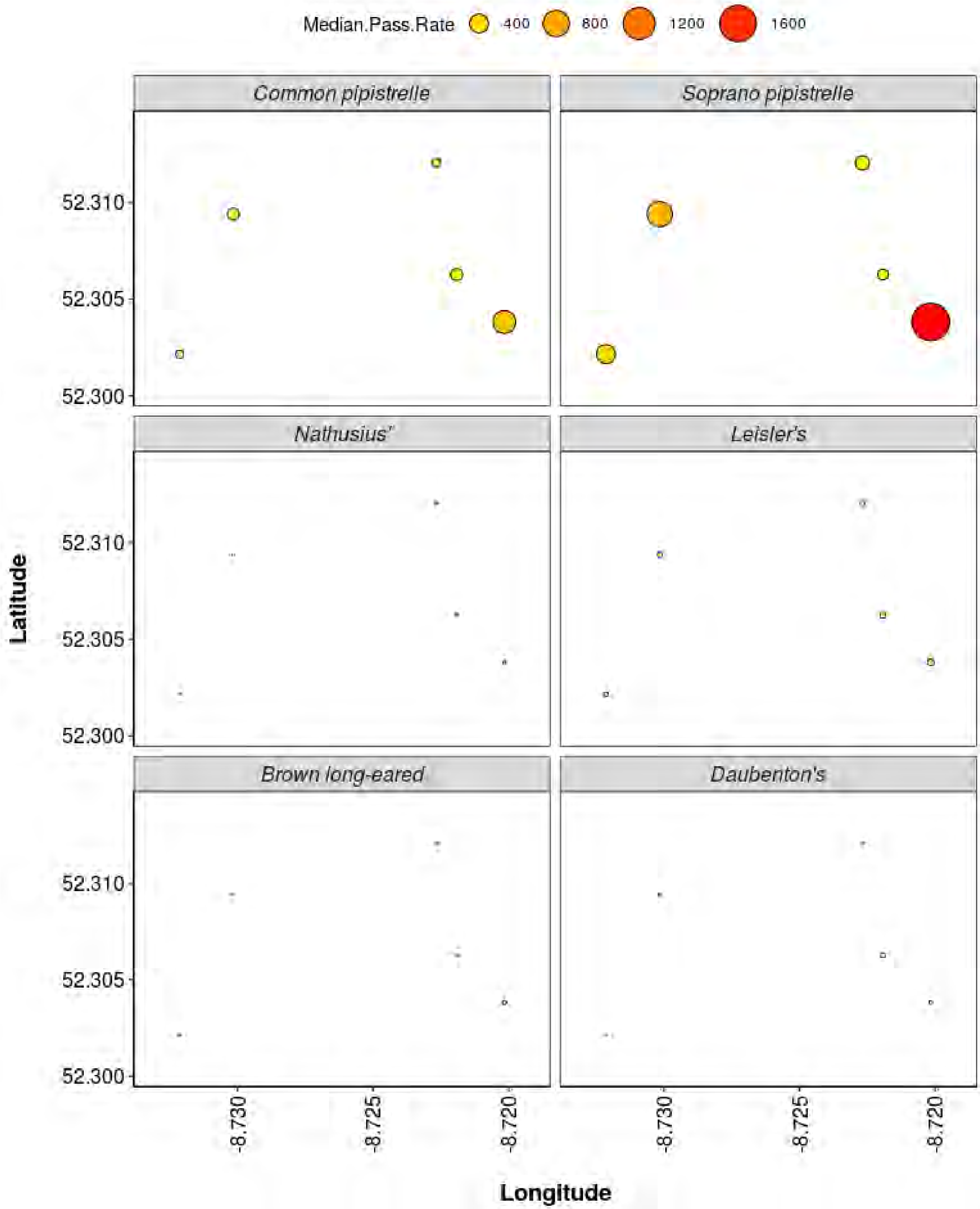


Figure 14. Median Nightly Pass Rate (bat passes/hr/night) throughout the survey period - represented by the size and colour of the point at each detector location.


Median.Pass.Rate
400
800
1200
1600
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Brown long-eared
Daubenton's
Latitude
52.310
52.305
52.300
-8.730
-8.725
-8.720
Longitude

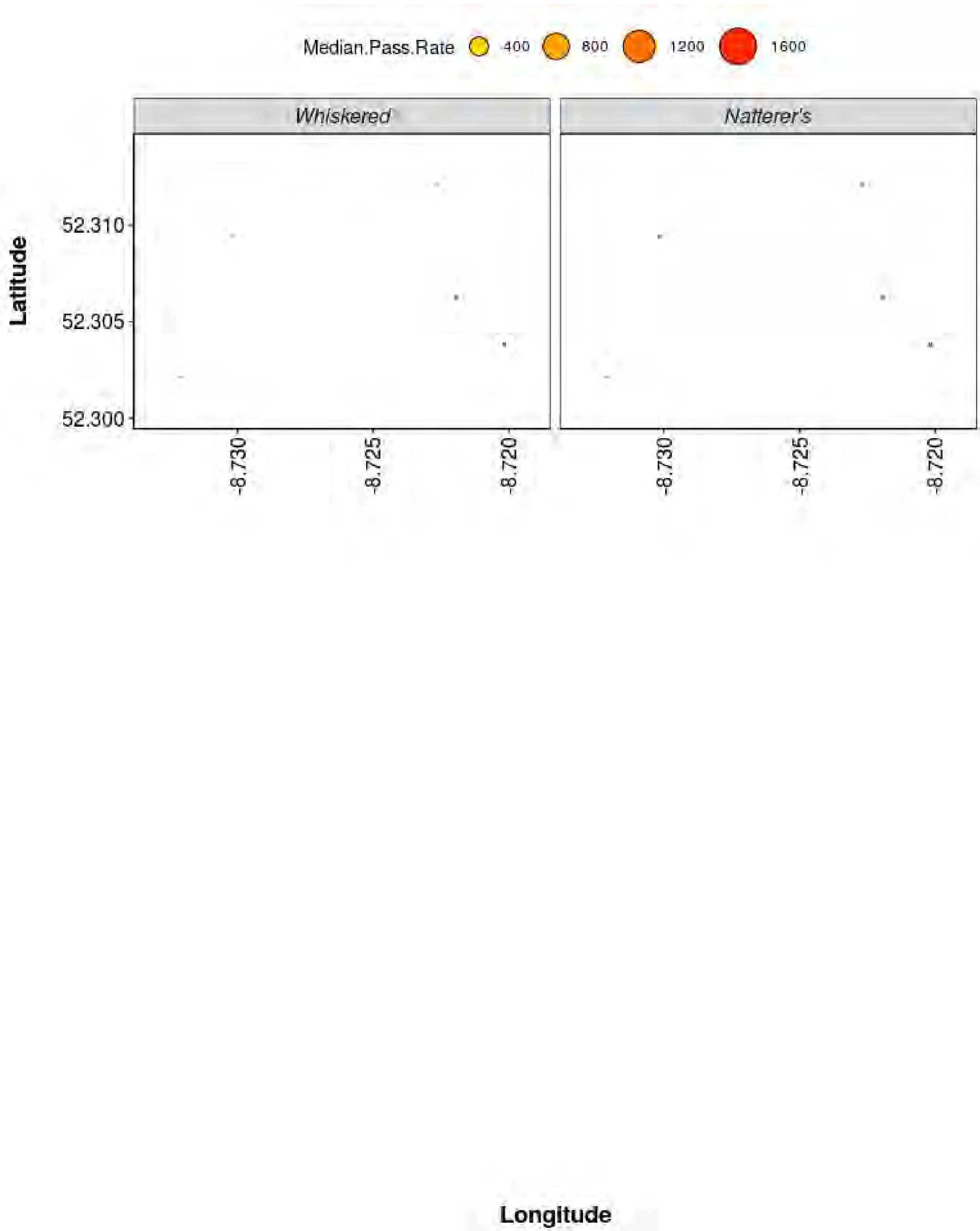
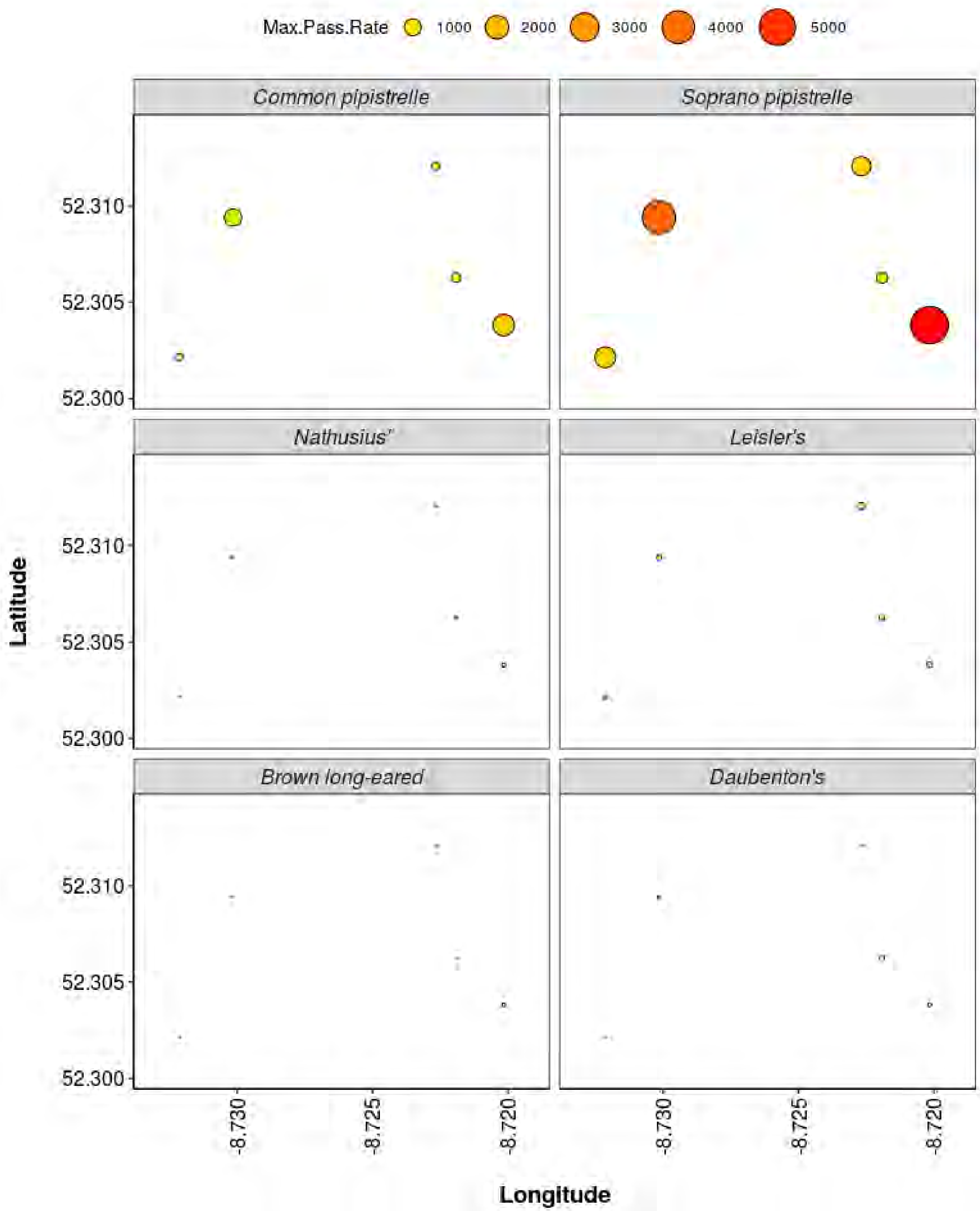
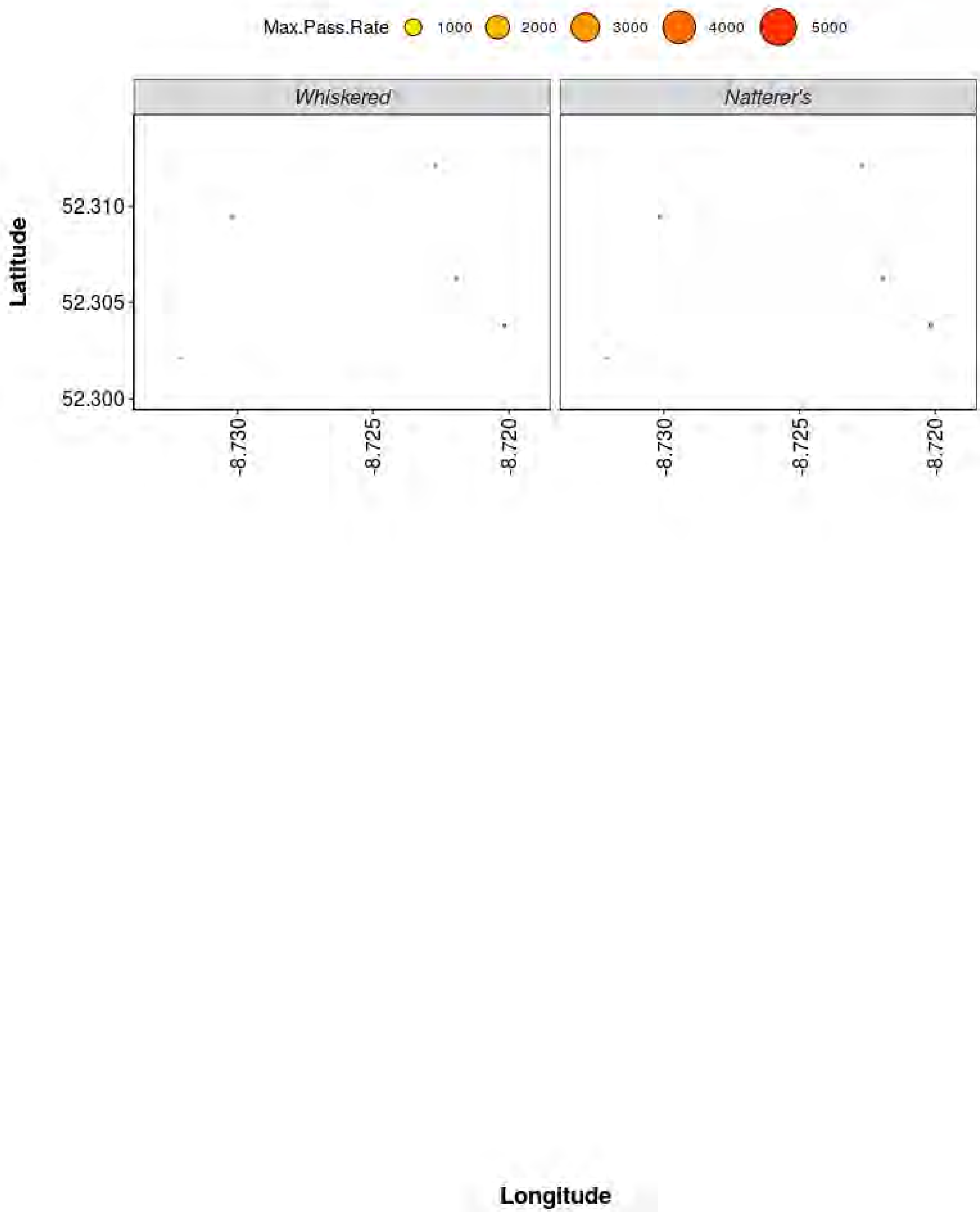

Median.Pass.Rate
400
800
1200
1600
Whiskered
Natterer's
Latitude
52.310
52.305
52.300
-8.730
-8.725
-8.720
Longitude

Figure 15. Maximum Nightly Pass Rate (bat passes/hr/night) recorded in a single night throughout the survey period - represented by the size and colour of the point at each detector location.


Max.Pass.Rate
1000
2000
3000
4000
5000
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Brown long-eared
Daubenton's
Latitude
52.310
52.305
52.300
Longitude
-8.730
-8.725
-8.720



Max.Pass.Rate
1000
2000
3000
4000
5000
Whiskered
Natterer's
Latitude
52.310
52.305
52.300
-8.730
-8.725
-8.720
Longitude

PART 2B: Includes absences

THE NEXT SECTION OF THE REPORT FEATURES THE DATA SUPPLIED TO ECOBAT BUT TAKES INTO ACCOUNT SPECIES ABSENCES, AND THEREFORE INCLUDES 'ZERO DATA' FOR WHEN SPECIES WERE NOT DETECTED AT EACH DETECTOR ON A NIGHT. THIS DRAMATICALLY LOWERS THE MEANS AND MEDIANS OF THE DATA PRESENTED.

Nightly Bat Pass Rate (Bat passes per hour)

Median Per Detector

Table 22. The median Nightly Pass Rate (bat passes per hour, per night) of each species. If NA, then no bat passes.

Bat pass rates are often highly variable between nights, with some nights having few or no passes and other nights having high activity. In these circumstances, the median is likely to be a more useful summary of the 'average' activity than is the mean. For further information see: *Lintott, P. R., & Mathews, F. (2018). Basic mathematical errors may make ecological assessments unreliable. Biodiversity and Conservation, 27(1), 265-267.* https://doi.org/10.1007/s10531-017-1418-5

Species	Detector ID	Median Pass Rate
Brown long-eared	AT1	2.9
Brown long-eared	AT2	1.9
Brown long-eared	AT3	5.5
Brown long-eared	AT5	0.0
Brown long-eared	AT6	11.7
Common pipistrelle	AT1	68.7
Common pipistrelle	AT2	143.2
Common pipistrelle	AT3	115.0
Common pipistrelle	AT5	57.6
Common pipistrelle	AT6	592.7
Daubenton's	AT1	0.7
Daubenton's	AT2	1.8
Daubenton's	AT3	17.1
Daubenton's	AT5	0.0
Daubenton's	AT6	6.0
Leisler's	AT1	15.0
Leisler's	AT2	18.9
Leisler's	AT3	30.6
Leisler's	AT5	14.4
Leisler's	AT6	35.5
Nathusius'	AT1	0.0
Nathusius'	AT2	0.0
Nathusius'	AT3	0.0

Nathusius’	AT5	0.0
Nathusius’	AT6	0.0
Natterer’s	AT1	1.4
Natterer’s	AT2	0.2
Natterer’s	AT3	1.8
Natterer’s	AT5	0.0
Natterer’s	AT6	4.9
Soprano pipistrelle	AT1	215.1
Soprano pipistrelle	AT2	735.6
Soprano pipistrelle	AT3	111.9
Soprano pipistrelle	AT5	394.2
Soprano pipistrelle	AT6	1686.6
Whiskered	AT1	0.0
Whiskered	AT2	0.1
Whiskered	AT3	2.2
Whiskered	AT5	0.0
Whiskered	AT6	1.0

Nightly Bat Pass Rate (Bat passes per hour)

Mean per Detector

Table 23. The mean Nightly Pass Rate (bat passes per hour, per night) of each species at each detector. Values are given to 1 decimal place.

We recommend using the median values given above, for the reasons stated above, but provide the mean values in the table below.

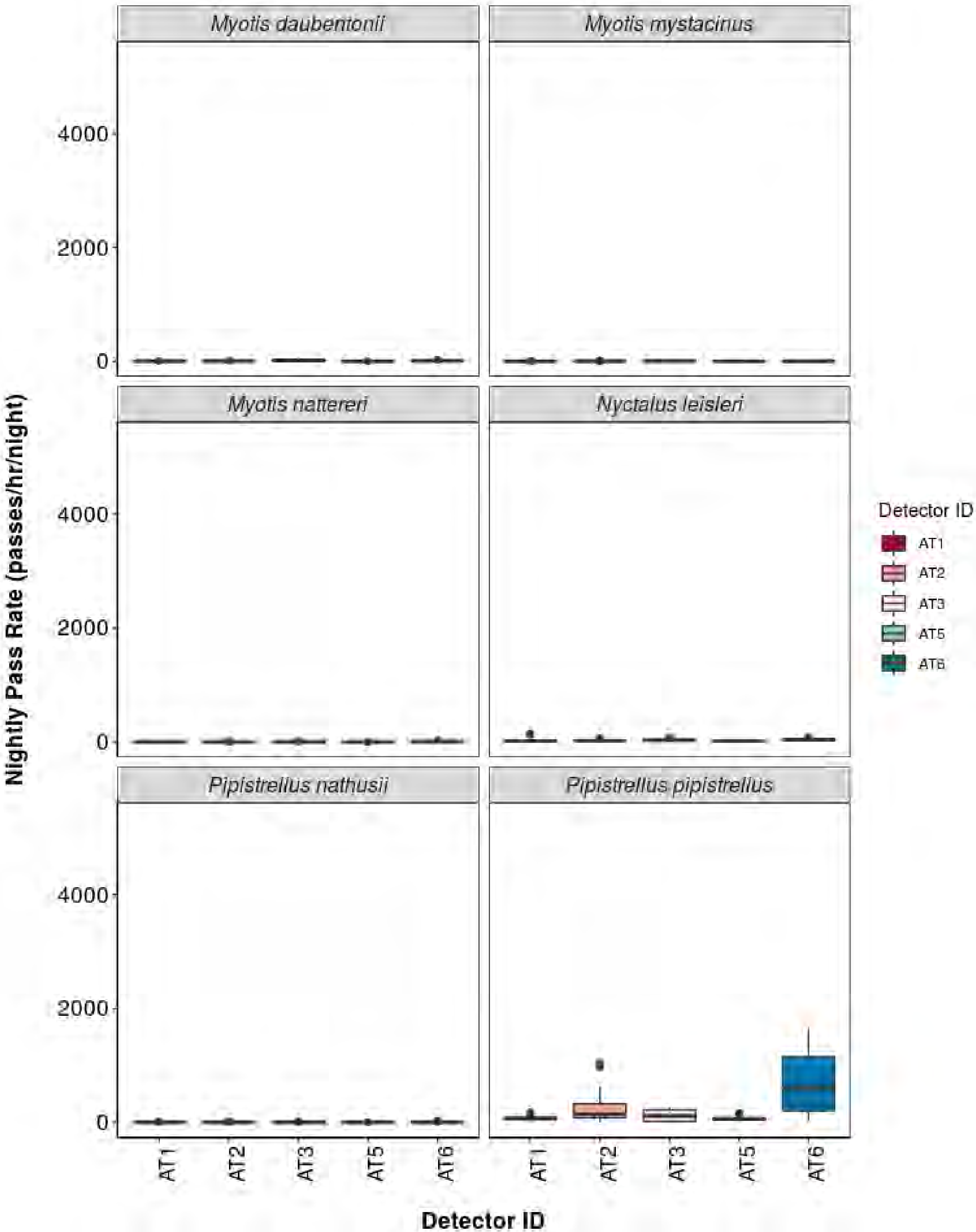
Species	Detector ID	Mean Pass Rate
Brown long-eared	AT1	3.7
Brown long-eared	AT2	2.0
Brown long-eared	AT3	6.1
Brown long-eared	AT5	0.8
Brown long-eared	AT6	13.2
Common pipistrelle	AT1	73.1
Common pipistrelle	AT2	235.8
Common pipistrelle	AT3	127.0
Common pipistrelle	AT5	69.5
Common pipistrelle	AT6	664.3
Daubenton’s	AT1	1.2
Daubenton’s	AT2	2.2
Daubenton’s	AT3	18.4
Daubenton’s	AT5	0.3
Daubenton’s	AT6	8.3
Leisler’s	AT1	22.3
Leisler’s	AT2	23.3
Leisler’s	AT3	31.4
Leisler’s	AT5	14.1
Leisler’s	AT6	34.3
Nathusius’	AT1	0.5
Nathusius’	AT2	1.2
Nathusius’	AT3	1.3
Nathusius’	AT5	0.2
Nathusius’	AT6	4.8
Natterer’s	AT1	1.8

Natterer’s	AT2	1.6
Natterer’s	AT3	3.3
Natterer’s	AT5	0.1
Natterer’s	AT6	8.4
Soprano pipistrelle	AT1	269.5
Soprano pipistrelle	AT2	989.4
Soprano pipistrelle	AT3	140.5
Soprano pipistrelle	AT5	415.8
Soprano pipistrelle	AT6	2216.5
Whiskered	AT1	0.3
Whiskered	AT2	1.3
Whiskered	AT3	3.0
Whiskered	AT5	0.1
Whiskered	AT6	2.4

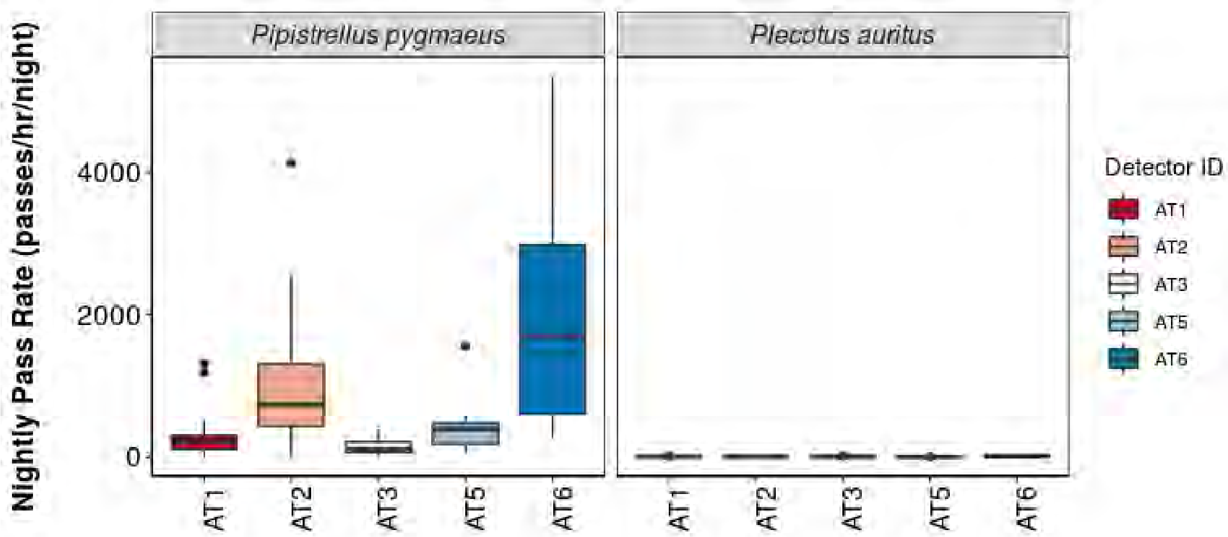
Nightly Bat Passes (Bat passes per hour)

Per Detector - Figures

Figure 16. Figures show boxplots for the number of bat passes per hour each night, for each detector. The 'box' shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The 'whiskers' extend from the box and represent the ranges for the bottom 25% and the top 25% of the data values, excluding outliers. An outlier is any extreme value that lies further away from the box than 1.5 times the interquartile range. Outliers are shown as dots. Where very few passes are recorded it is not possible to produce the box, so the data are shown as a line.



Myotis daubentonii
Myotis mystacinus
Myotis nattereri
Nyctalus leisleri
Pipistrellus nathusii
Pipistrellus pipistrellus
Nightly Pass Rate (passes/hr/night)
4000
2000
0
AT1
AT2
AT3
AT5
AT6
Detector ID



Pipistrellus pygmaeus
Plecotus auritus
Nightly Pass Rate (passes/hr/night)
4000
2000
0
AT1
AT2
AT3
AT5
AT6
Detector ID
AT1
AT2
AT3
AT5
AT6

Detector ID

Survey Effort

Table 24. The number of nights bats were detected per month per detector.

Month	Detector ID	No of Survey Nights
Jul	AT1	11
Jul	AT2	11
Jul	AT3	11
Jul	AT5	11
Jul	AT6	11
Aug	AT1	24
Aug	AT2	24
Aug	AT3	2
Aug	AT5	2
Aug	AT6	2

Nightly Bat Pass Rate for each Month

Median Per Detector

Table 25. The median Nightly Pass Rate (bat passes per hour, per night) of each species throughout each month. If NA, then no bat passes.

Bat pass rates are often highly variable between nights, with some nights having few or no passes and other nights having high activity. In these circumstances, the median is likely to be a more useful summary of the 'average' activity than is the mean. For further information see: *Lintott, P. R., & Mathews, F. (2018). Basic mathematical errors may make ecological assessments unreliable. Biodiversity and Conservation, 27(1), 265-267.* https://doi.org/10.1007/s10531-017-1418-5

Species	Detector ID	Aug	Jul
Brown long-eared	AT1	3.1	2.6
Brown long-eared	AT2	1.9	1.3
Brown long-eared	AT3	6.0	5.5
Brown long-eared	AT5	1.6	0.0
Brown long-eared	AT6	9.0	13.7
Common pipistrelle	AT1	63.5	85.2
Common pipistrelle	AT2	133.2	318.7
Common pipistrelle	AT3	29.1	186.6
Common pipistrelle	AT5	61.1	57.6
Common pipistrelle	AT6	219.1	658.8
Daubenton's	AT1	0.8	0.2
Daubenton's	AT2	2.0	0.0
Daubenton's	AT3	12.8	22.6
Daubenton's	AT5	0.4	0.0
Daubenton's	AT6	5.4	6.0
Leisler's	AT1	15.4	12.7
Leisler's	AT2	16.5	29.2
Leisler's	AT3	21.0	33.5
Leisler's	AT5	11.0	14.4
Leisler's	AT6	29.7	35.5
Nathusius'	AT1	0.0	0.0
Nathusius'	AT2	0.0	0.0
Nathusius'	AT3	0.0	0.0

Nathusius’	AT5	0.0	0.0
Nathusius’	AT6	0.0	0.4
Natterer’s	AT1	0.9	1.9
Natterer’s	AT2	0.0	3.0
Natterer’s	AT3	0.8	2.1
Natterer’s	AT5	0.1	0.0
Natterer’s	AT6	16.4	4.7
Soprano pipistrelle	AT1	185.3	322.4
Soprano pipistrelle	AT2	763.0	712.8
Soprano pipistrelle	AT3	74.8	148.1
Soprano pipistrelle	AT5	262.7	419.5
Soprano pipistrelle	AT6	820.2	2248.1
Whiskered	AT1	0.0	0.0
Whiskered	AT2	0.0	1.1
Whiskered	AT3	6.2	1.7
Whiskered	AT5	0.0	0.0
Whiskered	AT6	4.2	0.6

Nightly Bat Pass Rate for each Month

Mean per Detector

Table 26. The mean Nightly Pass Rate (bat passes per hour, per night) of each species throughout each month. Values are given to 1 decimal place.

We recommend using the median values given above, for the reasons stated above, but provide the mean values in the table below.

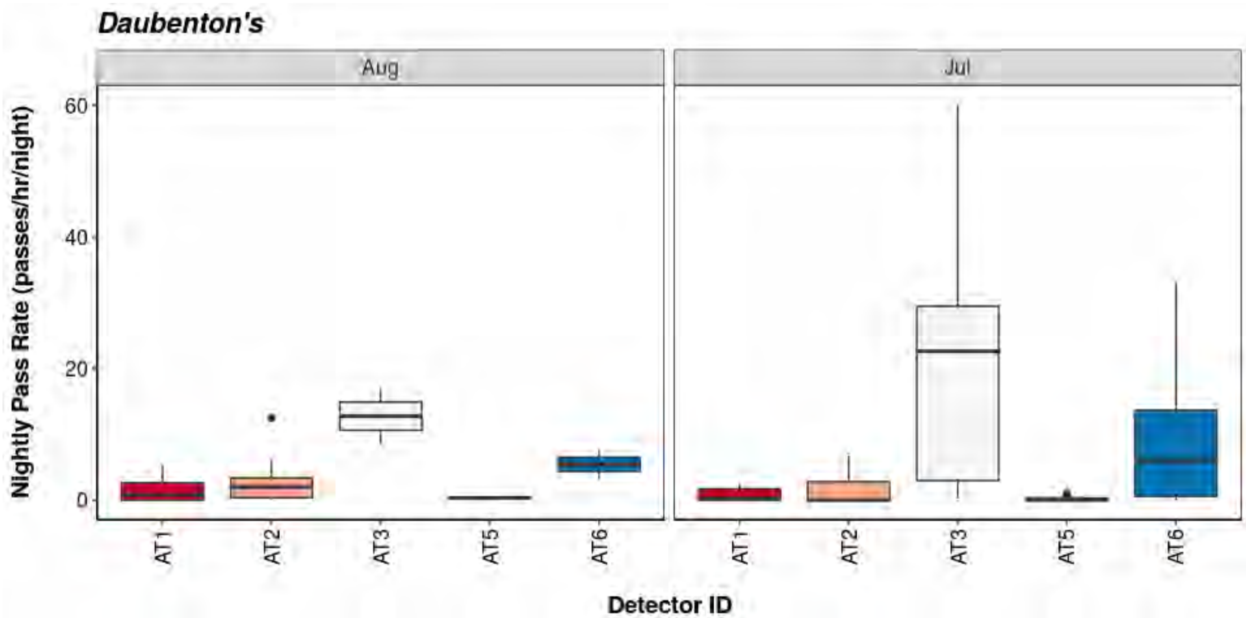
Species	Detector ID	Aug	Jul
Brown long-eared	AT1	4.0	3.2
Brown long-eared	AT2	2.0	2.0
Brown long-eared	AT3	6.0	6.1
Brown long-eared	AT5	1.6	0.7
Brown long-eared	AT6	9.0	14.0
Common pipistrelle	AT1	65.2	90.4
Common pipistrelle	AT2	163.4	393.7
Common pipistrelle	AT3	29.1	144.8
Common pipistrelle	AT5	61.1	71.1
Common pipistrelle	AT6	219.1	745.2
Daubenton’s	AT1	1.4	0.9
Daubenton’s	AT2	2.5	1.6
Daubenton’s	AT3	12.8	19.4
Daubenton’s	AT5	0.4	0.2
Daubenton’s	AT6	5.4	8.8
Leisler’s	AT1	25.2	15.9
Leisler’s	AT2	19.9	30.6
Leisler’s	AT3	21.0	33.3
Leisler’s	AT5	11.0	14.7
Leisler’s	AT6	29.7	35.2
Nathusius’	AT1	0.4	0.7
Nathusius’	AT2	0.4	2.7
Nathusius’	AT3	0.0	1.5
Nathusius’	AT5	0.0	0.2
Nathusius’	AT6	0.0	5.6
Natterer’s	AT1	1.5	2.4

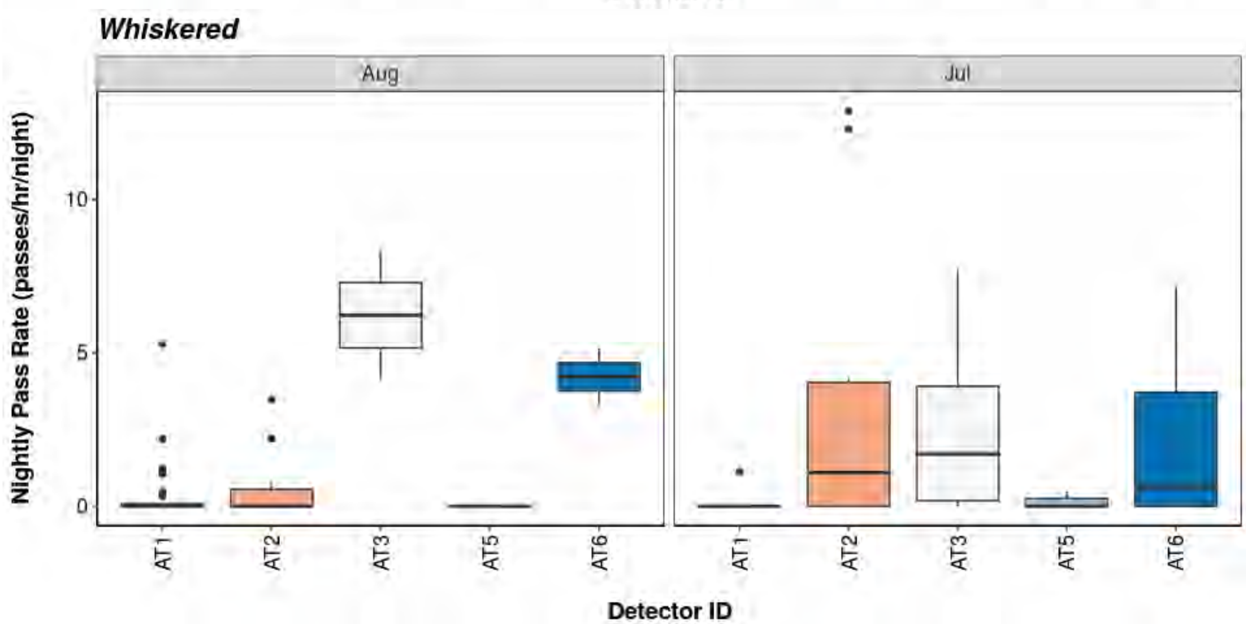
Natterer’s	AT2	0.5	4.1
Natterer’s	AT3	0.8	3.8
Natterer’s	AT5	0.1	0.1
Natterer’s	AT6	16.4	6.9
Soprano pipistrelle	AT1	196.6	428.6
Soprano pipistrelle	AT2	1043.4	871.5
Soprano pipistrelle	AT3	74.8	152.4
Soprano pipistrelle	AT5	262.7	443.6
Soprano pipistrelle	AT6	820.2	2470.4
Whiskered	AT1	0.4	0.1
Whiskered	AT2	0.4	3.3
Whiskered	AT3	6.2	2.4
Whiskered	AT5	0.0	0.1
Whiskered	AT6	4.2	2.1

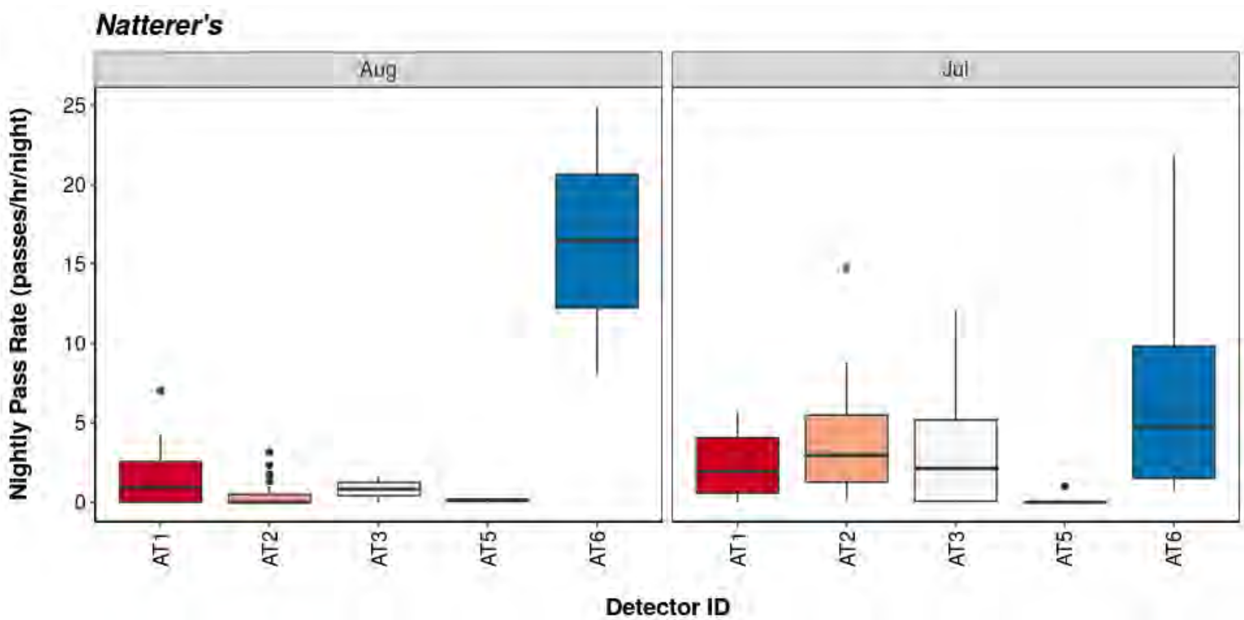
Nightly Bat Pass Rate for each Month

Per Detector - Figures

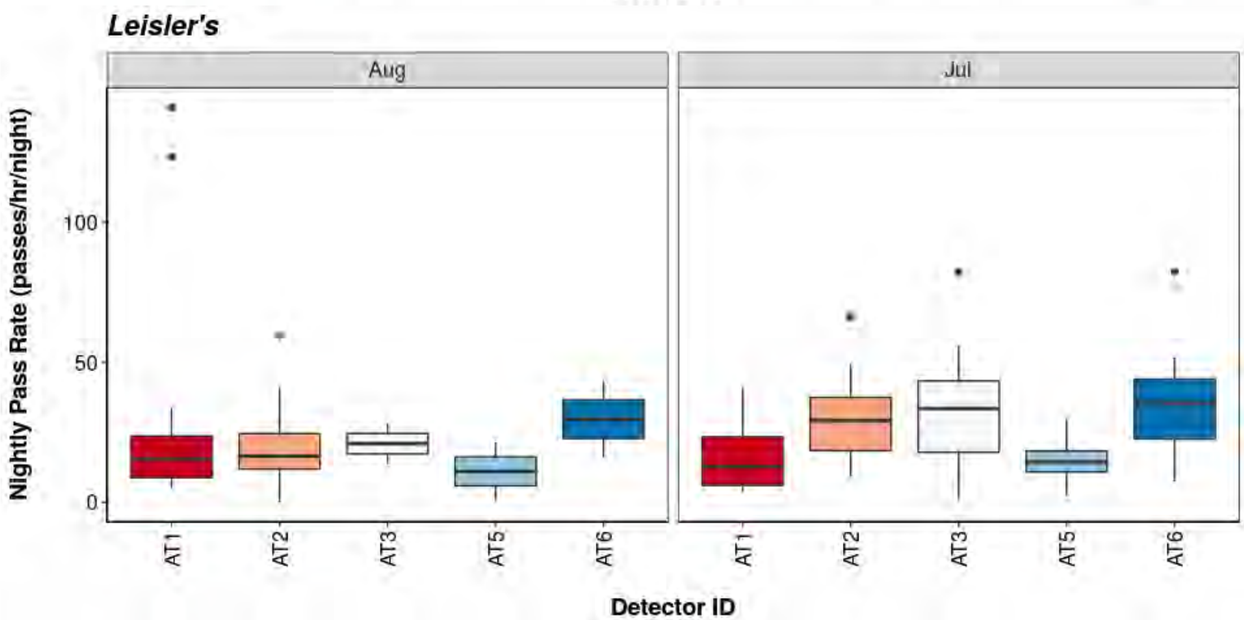
Figure 17. Figures show boxplots for the number of bat passes per hour by detector, for each month. The 'box' shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The 'whiskers' extend from the box and represent the ranges for the bottom 25% and the top 25% of the data values, excluding outliers. An outlier is any extreme value that lies further away from the box than 1.5 times the interquartile range. Outliers are shown as dots. Where very few passes are recorded it is not possible to produce the box, so the data are shown as a line.



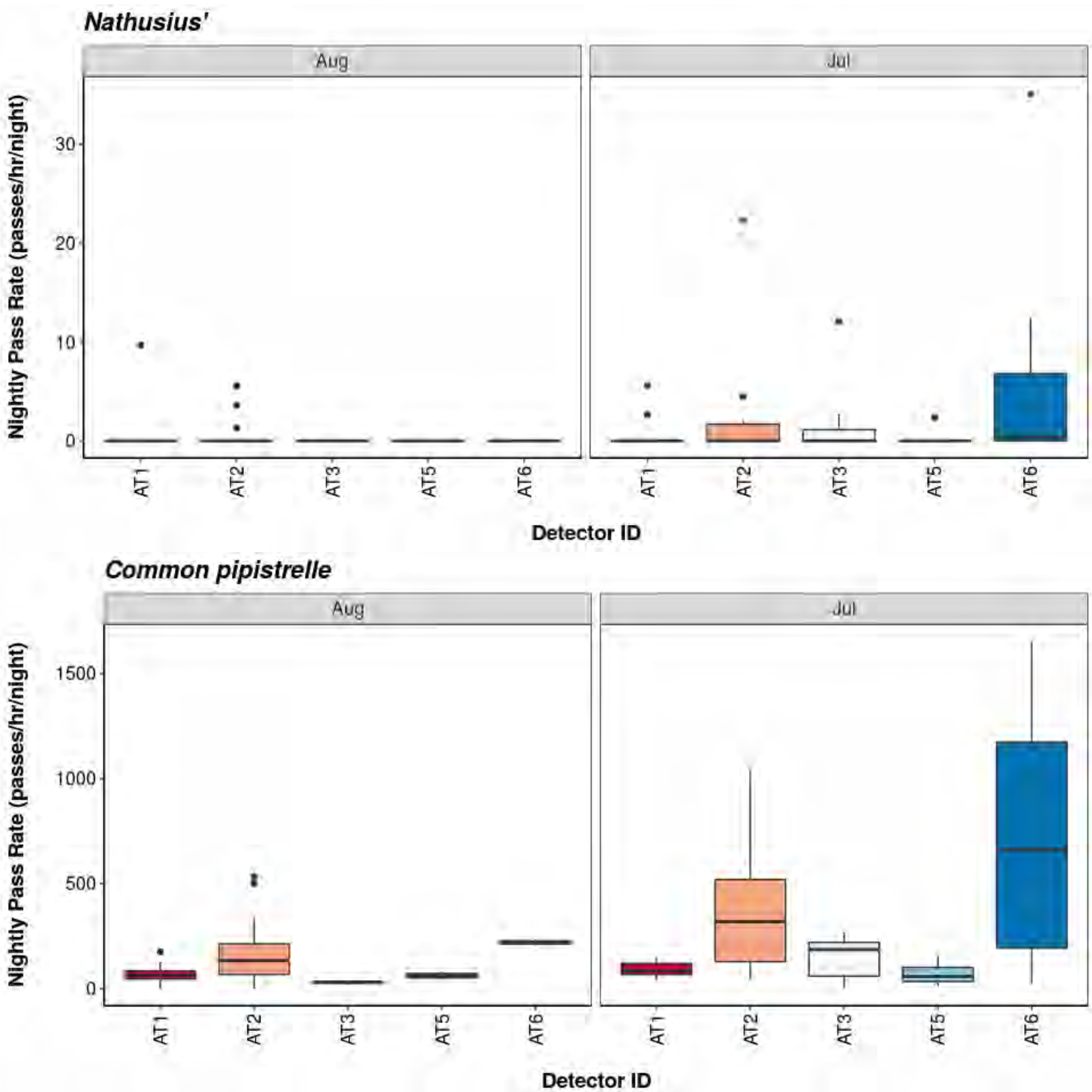


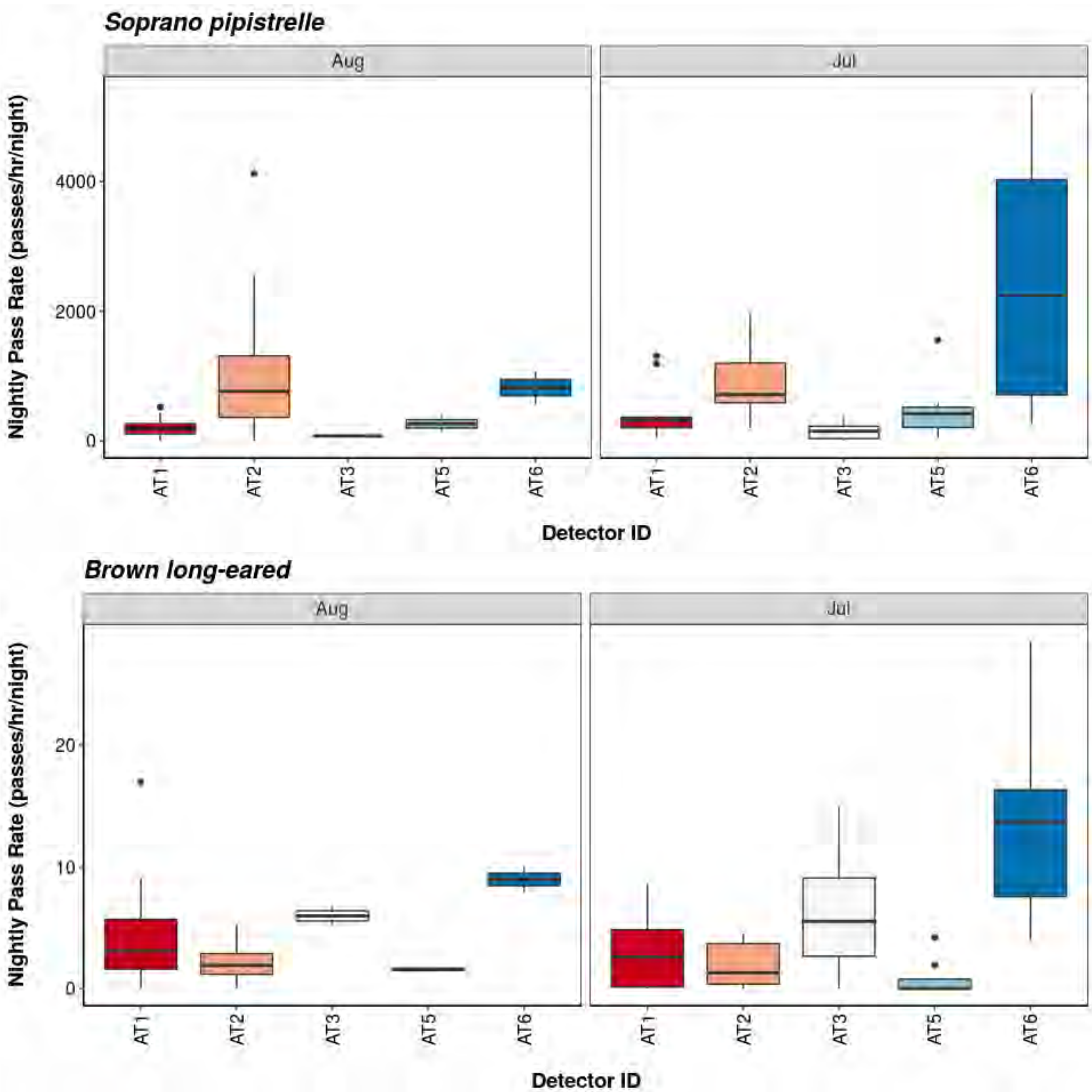


Natterer's
Aug
Jul
Nightly Pass Rate (passes/hr/night)
25
20
15
10
5
0
AT1
AT2
AT3
AT5
AT6
Detector ID



Leisler's
Aug
Jul
Nightly Pass Rate (passes/hr/night)
100
50
0
AT1
AT2
AT3
AT5
AT6
Detector ID


Nathusius'
Aug
Jul
Nightly Pass Rate (passes/hr/night)
0
10
20
30
AT1
AT2
AT3
AT5
AT6
Detector ID
Common pipistrelle
Aug
Jul
Nightly Pass Rate (passes/hr/night)
0
500
1000
1500
AT1
AT2
AT3
AT5
AT6
Detector ID



Soprano pipistrelle
Aug
Jul
Nightly Pass Rate (passes/hr/night)
4000
2000
0
AT1
AT2
AT3
AT5
AT6
Detector ID
Brown long-eared
Aug
Jul
Nightly Pass Rate (passes/hr/night)
20
10
0
AT1
AT2
AT3
AT5
AT6
Detector ID

Bat Activity per Detector Location

Figure 18. Detector ID reference:

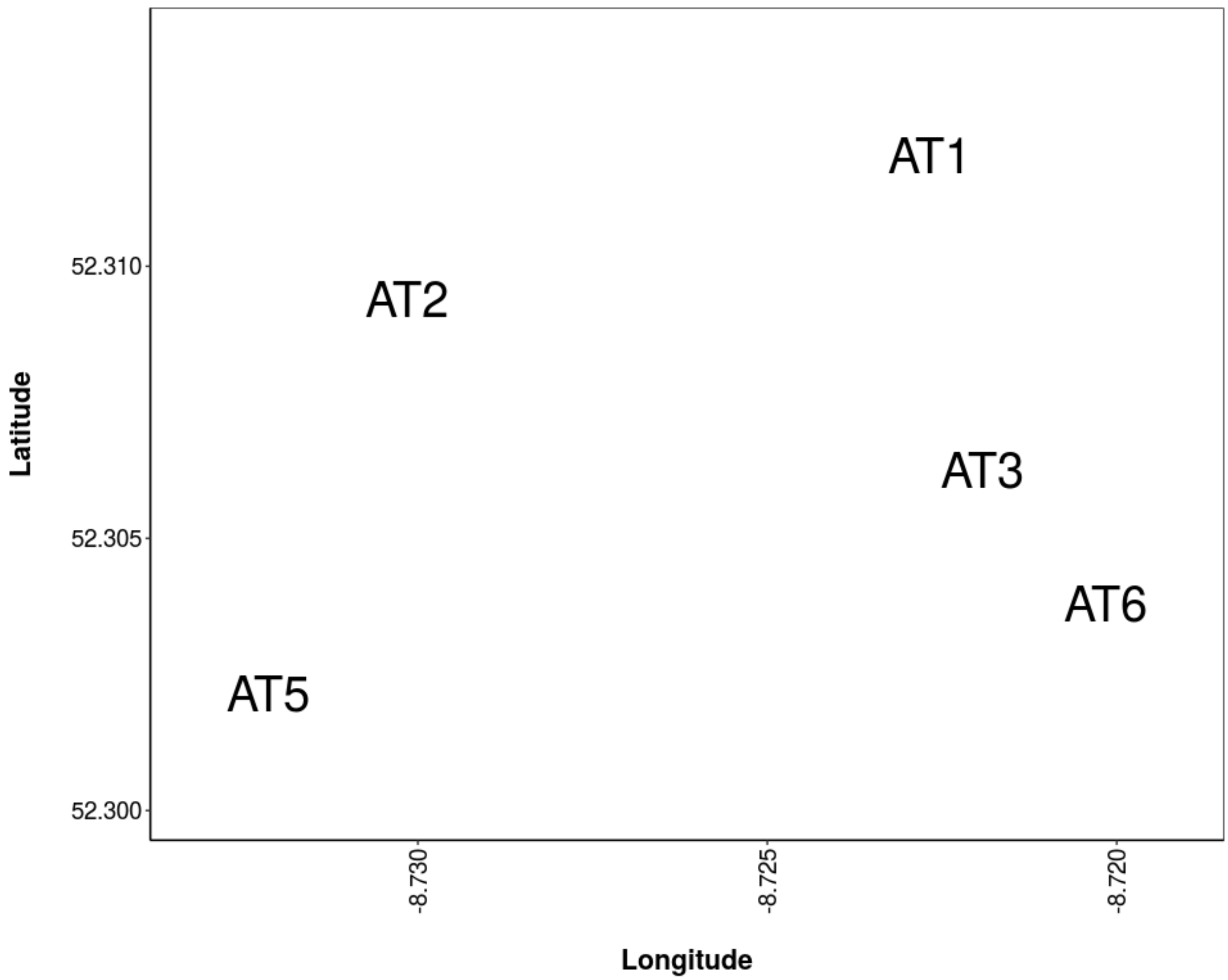
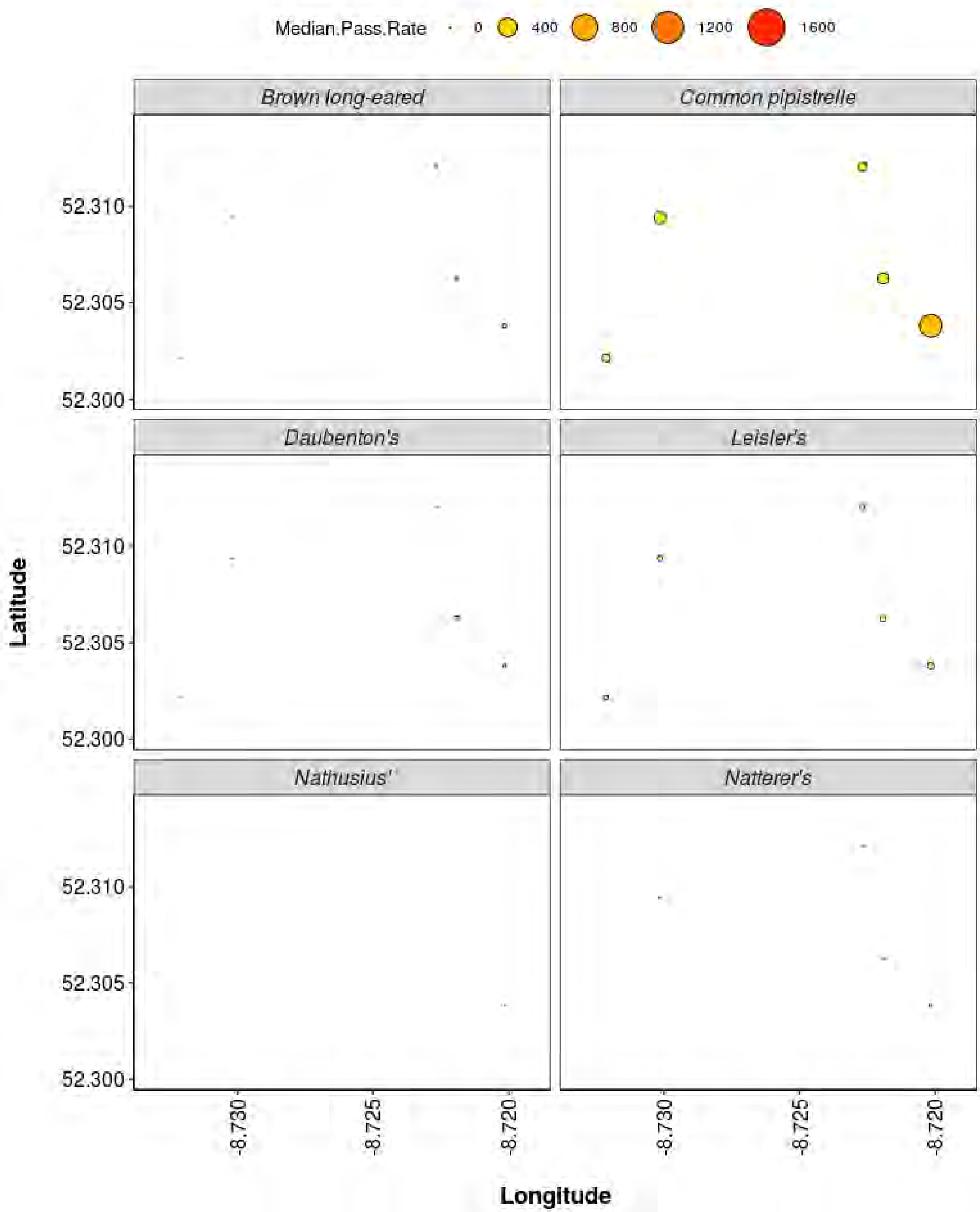
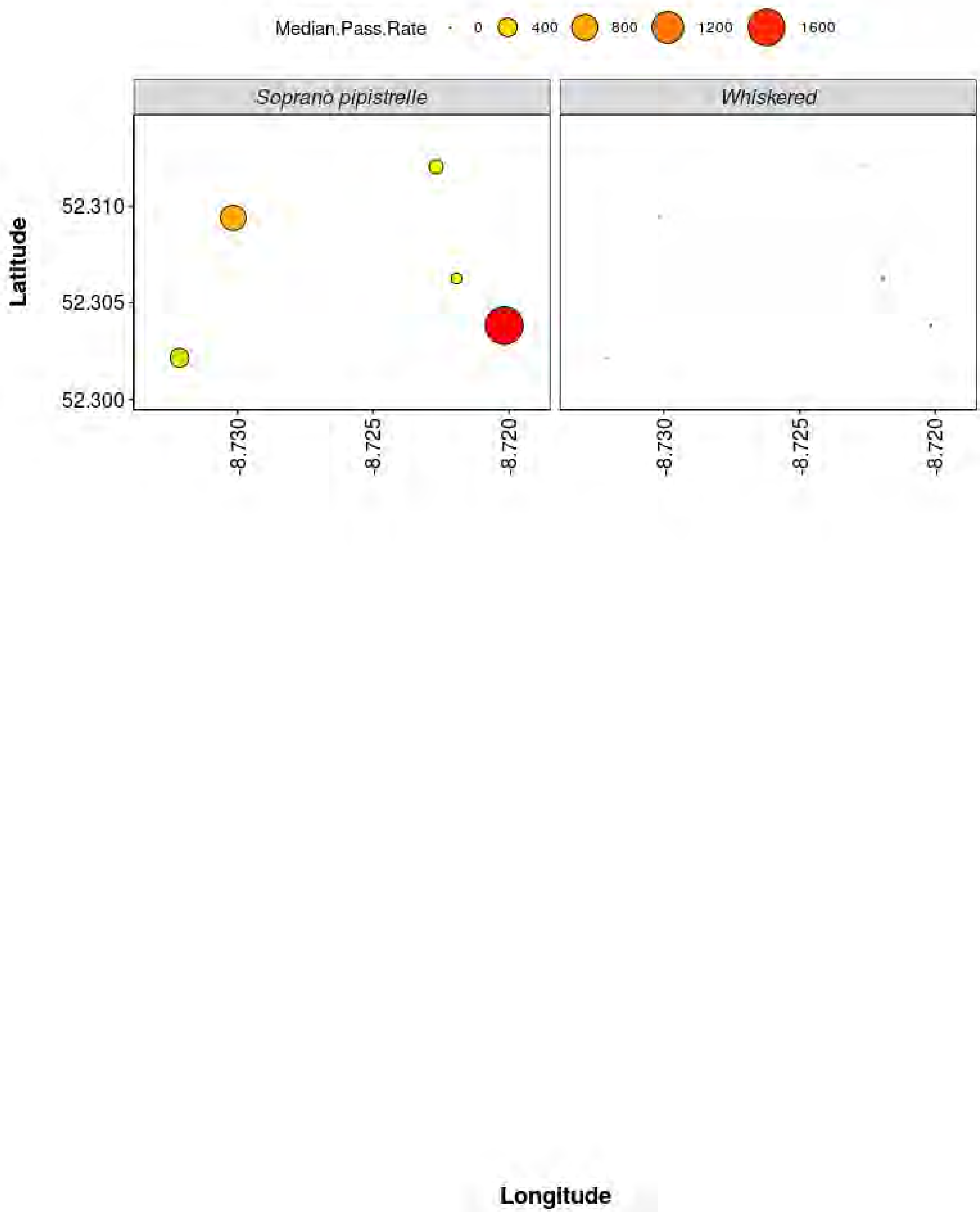


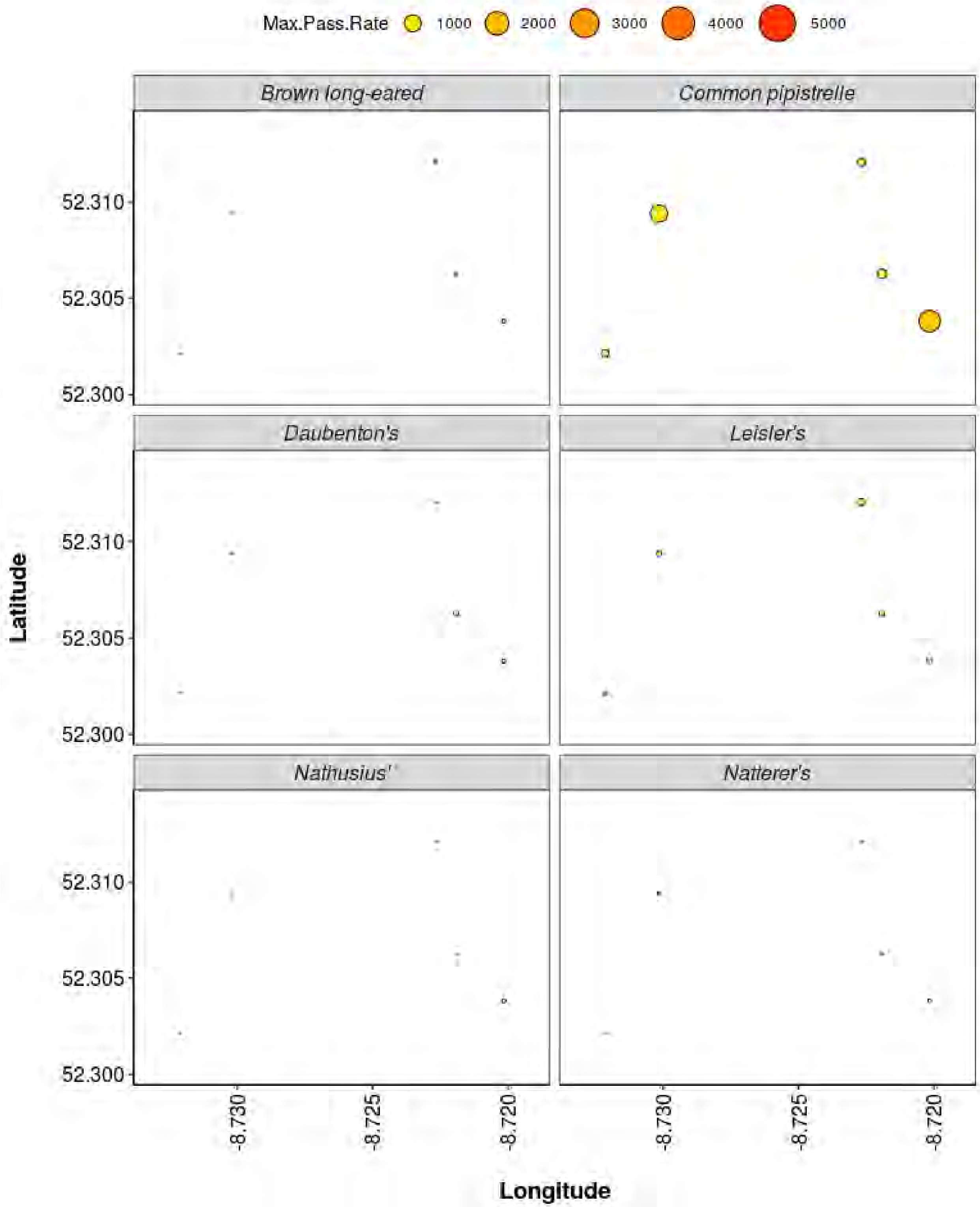
Figure 19. Median Nightly Pass Rate (bat passes/hr/night) throughout the survey period - represented by the size and colour of the point at each detector location.


Median.Pass.Rate
0
400
800
1200
1600
Brown long-eared
Common pipistrelle
Daubenton's
Leisler's
Nathusius'
Natterer's
Latitude
52.310
52.305
52.300
Longitude
-8.730
-8.725
-8.720

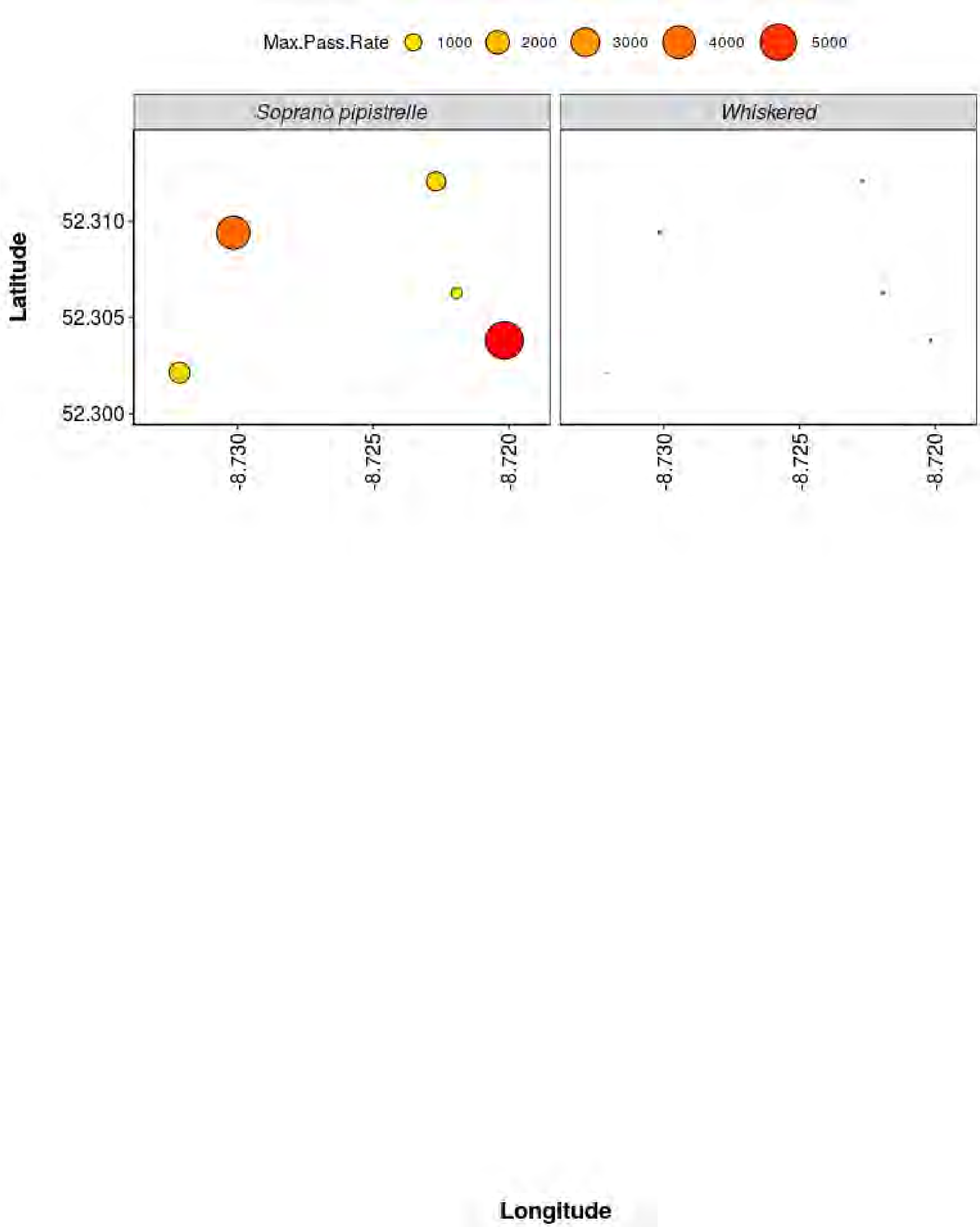


Median.Pass.Rate
0
400
800
1200
1600
Soprano pipistrelle
Whiskered
Latitude
52.310
52.305
52.300
-8.730
-8.725
-8.720
Longitude

Figure 20. Maximum Nightly Pass Rate (bat passes/hr/night) recorded in a single night throughout the survey period - represented by the size and colour of the point at each detector location.



Max.Pass.Rate
1000
2000
3000
4000
5000
Brown long-eared
Common pipistrelle
Daubenton's
Leisler's
Nathusius'
Natterer's
52.310
52.305
52.300
-8.730
-8.725
-8.720
Latitude
Longitude



Thank you for using Ecobat! If you have any questions please email info@themammalsociety.org.uk

This report was produced free of charge by the Mammal Society to support evidence-based conservation of bats.

The following analyses are based on data supplied by the user to the Mammal Society's Ecobat website. The outputs are designed to assist decision-making, but do not replace expert interpretation by the user. The creation of the Ecobat tool was supported by the Natural Environment Research Council (NERC).

Bat Activity Analysis

Site Name: Annagh

Author: Fehily Timoney

17/11/2021

Summary

Bats were detected on **25** nights between **2021-09-13** and **2021-10-07**, using **5** static bat detectors. Throughout this period **8** species were recorded. **Table 1.** Detectors were placed at the following locations:

Detector ID	Latitude	Longitude
AT6	52.30382	-8.720163
AT2	52.30940	-8.730150
AT3	52.30627	-8.721922
AT5	52.30215	-8.732132
AT4	52.30246	-8.736060

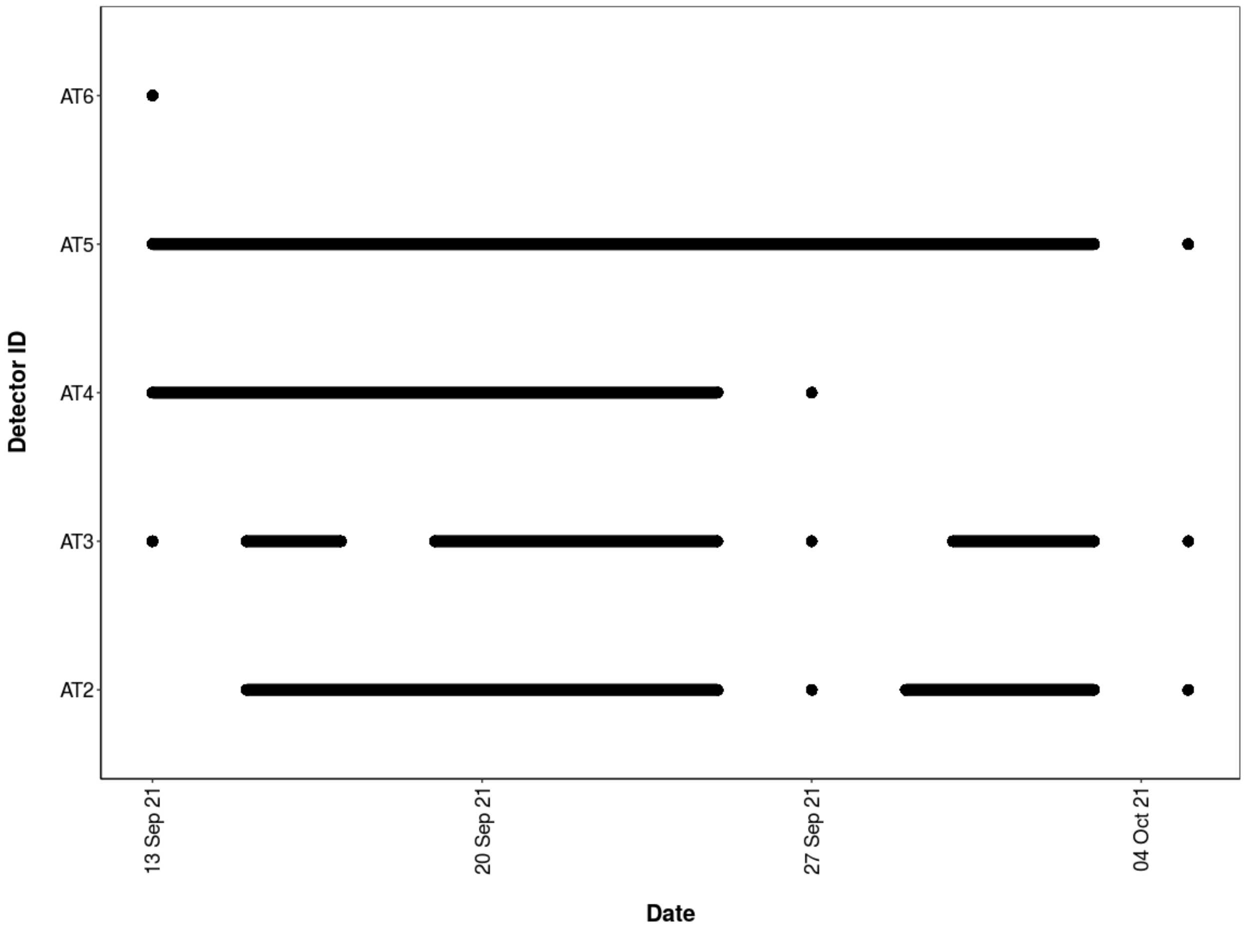
Survey Nights

Table 2. The number of nights that bats were detected on each recorder. This is not the same as the number of nights that detectors were active if there were nights when no bats were detected.

Detector ID	No. of nights
AT2	18
AT3	18
AT4	24
AT5	23
AT6	18

Survey Nights

Figure 1. Horizontal bars show nights when acoustic detectors recorded bats.



PART 1: Percentiles Analysis

This first part of the analysis looks at the relative activity levels of the bats you recorded. We take your value for the total bat passes each night for each species, and compare this to the values in our reference database. We tell you what percentile your data falls at, and therefore what the relative activity level is. For example, if the reference database has values of 5, 10, 15, 20 and you submit a value of 18, this will be the 80th percentile, and be classed as high activity.

The reference range dataset was stratified to include:

- Only records from within 30 days of the survey date.
- Only records from within 100km radius of the survey location.
- Records using any make of bat detector.

PER DETECTOR

Table 3. Summary table showing the number of nights recorded bat activity fell into each activity band for each species.

Detector ID	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
AT2	*Myotis daubentonii*	0	0	0	2	5
AT2	*Myotis mystacinus*	0	0	1	2	4
AT2	*Myotis nattereri*	0	0	0	0	2
AT2	*Nyctalus leisleri*	0	0	0	1	3
AT2	*Pipistrellus nathusii*	0	0	0	0	2
AT2	*Pipistrellus pipistrellus*	4	6	2	1	2
AT2	*Pipistrellus pygmaeus*	8	4	1	1	4
AT2	*Plecotus auritus*	0	0	0	0	3
AT3	*Myotis daubentonii*	0	0	1	1	9
AT3	*Myotis mystacinus*	0	0	0	5	3
AT3	*Nyctalus leisleri*	1	1	0	4	6
AT3	*Pipistrellus nathusii*	0	0	3	2	3
AT3	*Pipistrellus pipistrellus*	10	5	0	0	1
AT3	*Pipistrellus pygmaeus*	4	7	2	5	0
AT3	*Plecotus auritus*	0	0	1	1	5
AT4	*Myotis daubentonii*	0	0	0	4	5
AT4	*Myotis nattereri*	0	0	0	1	2
AT4	*Nyctalus leisleri*	0	2	4	5	8
AT4	*Pipistrellus nathusii*	0	0	0	2	2

AT4	*Pipistrellus pipistrellus*	5	5	6	0	3
AT4	*Pipistrellus pygmaeus*	11	2	5	4	2
AT4	*Plecotus auritus*	0	0	1	6	5
AT5	*Myotis daubentonii*	0	0	2	3	4
AT5	*Myotis nattereri*	0	0	4	1	3
AT5	*Nyctalus leisleri*	0	1	2	8	4
AT5	*Pipistrellus nathusii*	0	0	0	0	2
AT5	*Pipistrellus pipistrellus*	2	3	6	2	3
AT5	*Pipistrellus pygmaeus*	2	5	4	4	3
AT5	*Plecotus auritus*	0	0	1	8	8
AT6	*Myotis daubentonii*	1	5	6	0	0
AT6	*Myotis mystacinus*	4	4	5	1	0
AT6	*Myotis nattereri*	0	0	5	4	3
AT6	*Nyctalus leisleri*	0	1	7	6	3
AT6	*Pipistrellus nathusii*	1	1	2	2	1
AT6	*Pipistrellus pipistrellus*	9	2	3	2	1
AT6	*Pipistrellus pygmaeus*	13	2	1	1	0
AT6	*Plecotus auritus*	10	5	1	0	1

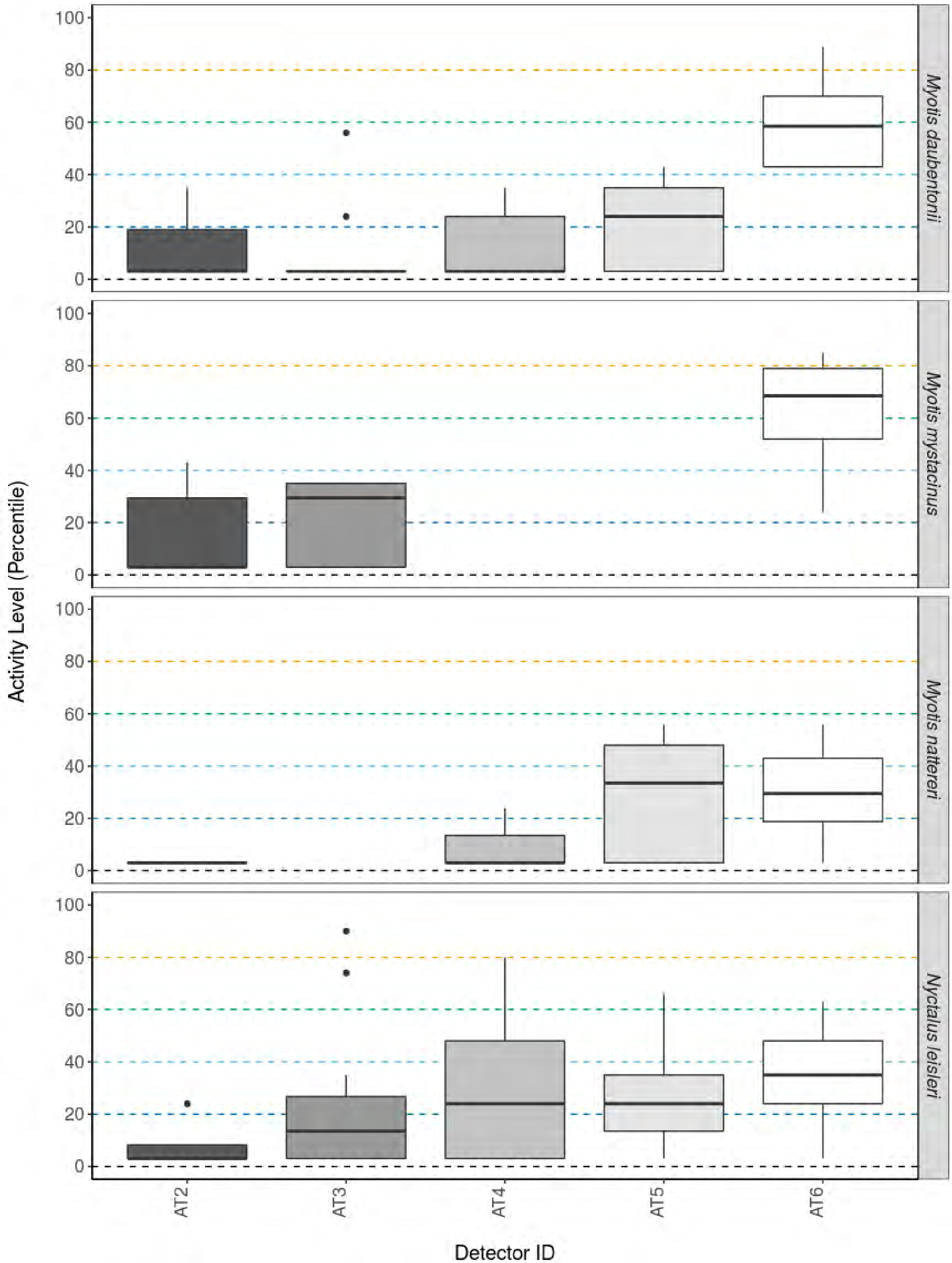
Table 4. Summary table showing key metrics for each species recorded. The reference range is the number of nights for each species that your data were compared to. We recommend a Reference Range of 200+ to be confident in the relative activity level.

Detector ID	Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded	Reference Range
AT2	*Myotis daubentonii*	3	3 - 19	35	7	302
AT2	*Myotis mystacinus*	3	3 - 23	43	7	185
AT2	*Myotis nattereri*	3	3 - 3	3	2	334
AT2	*Nyctalus leisleri*	3	3 - 3	24	4	1517
AT2	*Pipistrellus nathusii*	3	3 - 3	3	2	266
AT2	*Pipistrellus pipistrellus*	69	42 - 79	93	15	2224
AT2	*Pipistrellus pygmaeus*	78	44.5 - 85	93	18	2030
AT2	*Plecotus auritus*	3	3 - 3	3	3	1247
AT3	*Myotis daubentonii*	3	3 - 3	56	11	302
AT3	*Myotis mystacinus*	30	3 - 35	35	8	185
AT3	*Nyctalus leisleri*	14	3 - 46.5	90	12	1517
AT3	*Pipistrellus nathusii*	30	3 - 43	52	8	266
AT3	*Pipistrellus pipistrellus*	89	76 - 93	98	16	2224
AT3	*Pipistrellus pygmaeus*	72	49.5 - 76.5	86	18	2030
AT3	*Plecotus auritus*	3	3 - 13.5	52	7	1247
AT4	*Myotis daubentonii*	3	3 - 24	35	9	302
AT4	*Myotis nattereri*	3	3 - 3	24	3	334
AT4	*Nyctalus leisleri*	24	13.5 - 41.5	80	19	1517
AT4	*Pipistrellus nathusii*	14	3 - 24	24	4	266

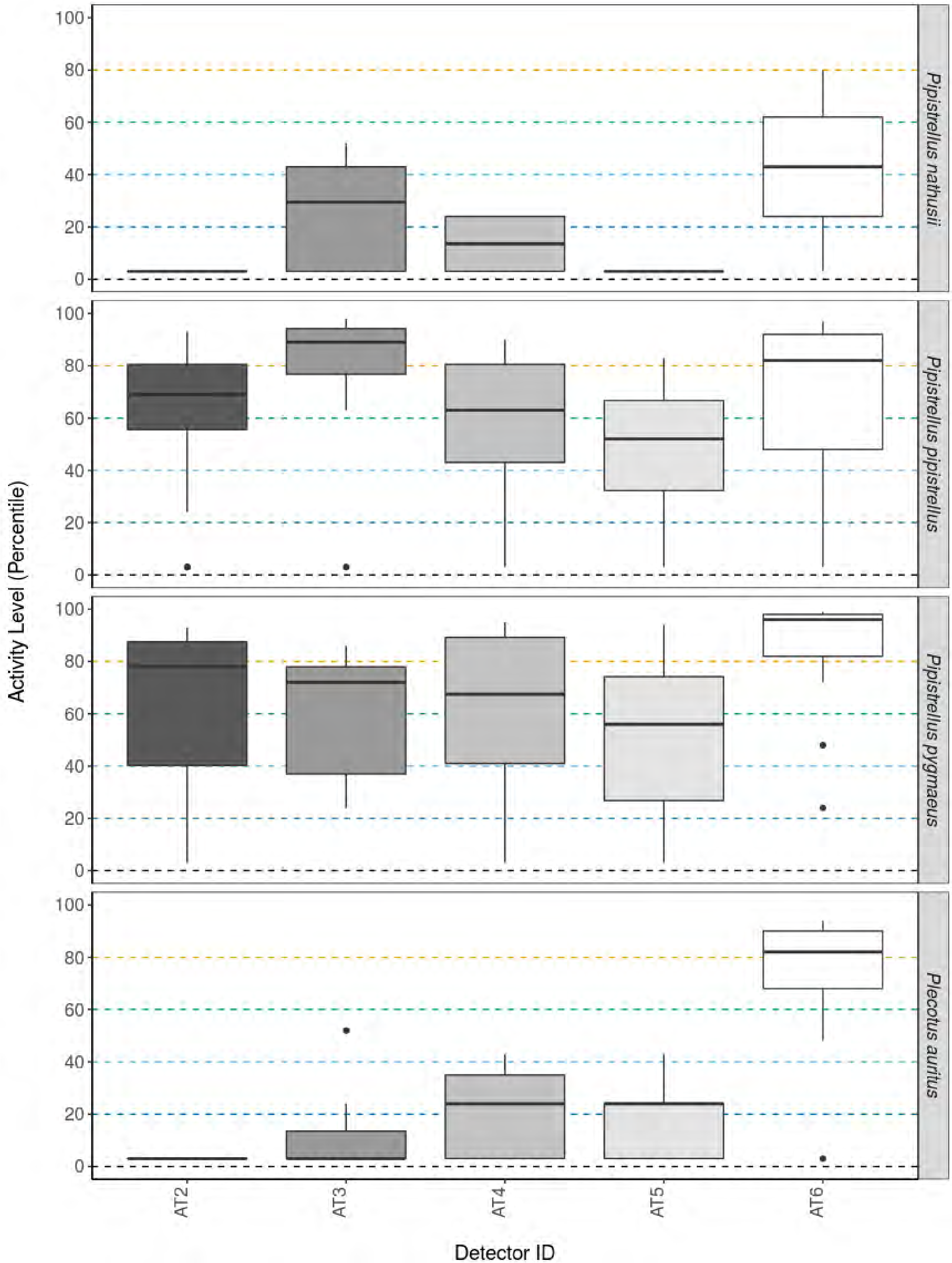
AT4	*Pipistrellus pipistrellus*	63	43 - 73.5	90	19	2224
AT4	*Pipistrellus pygmaeus*	68	49 - 77.5	95	24	2030
AT4	*Plecotus auritus*	24	3 - 29.5	43	12	1247
AT5	*Myotis daubentonii*	24	3 - 33.5	43	9	302
AT5	*Myotis nattereri*	34	3 - 48	56	8	334
AT5	*Nyctalus leisleri*	24	13.5 - 41.5	66	15	1517
AT5	*Pipistrellus nathusii*	3	3 - 3	3	2	266
AT5	*Pipistrellus pipistrellus*	52	31 - 63	83	16	2224
AT5	*Pipistrellus pygmaeus*	56	35 - 65.5	94	18	2030
AT5	*Plecotus auritus*	24	3 - 24	43	17	1247
AT6	*Myotis daubentonii*	59	43 - 70.5	89	12	302
AT6	*Myotis mystacinus*	69	52 - 77.5	85	14	185
AT6	*Myotis nattereri*	30	13.5 - 43	56	12	334
AT6	*Nyctalus leisleri*	35	24 - 43.5	63	17	1517
AT6	*Pipistrellus nathusii*	43	13.5 - 78	80	7	266
AT6	*Pipistrellus pipistrellus*	82	51.5 - 87	97	17	2224
AT6	*Pipistrellus pygmaeus*	96	73.5 - 98	99	17	2030
AT6	*Plecotus auritus*	82	68.5 - 87	94	17	1247

###Figures

Figure 2. The recorded activity of bats during the survey. The centre line indicates the median activity level whereas the box represents the interquartile range (the spread of the middle 50% of nights of activity)

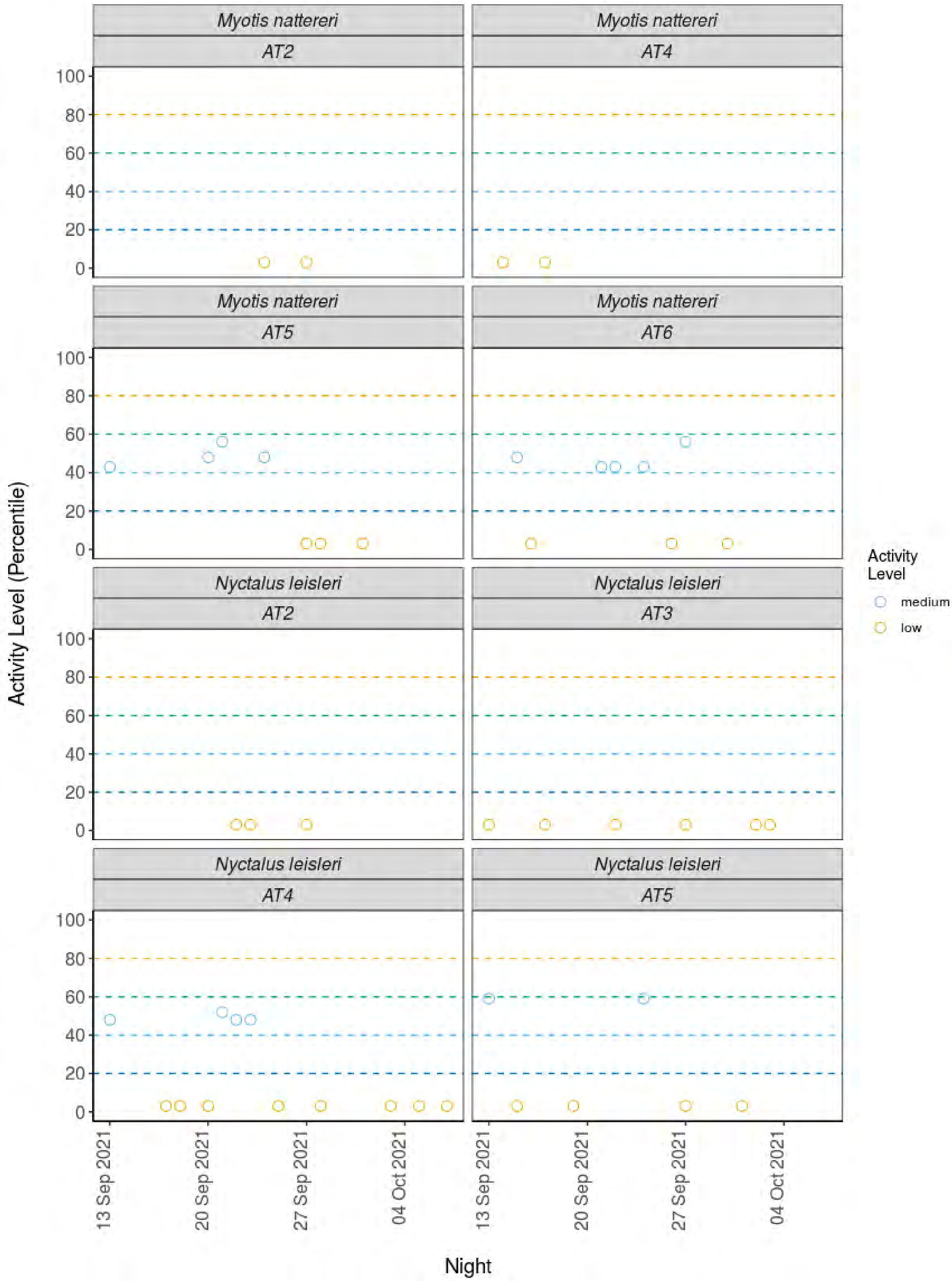


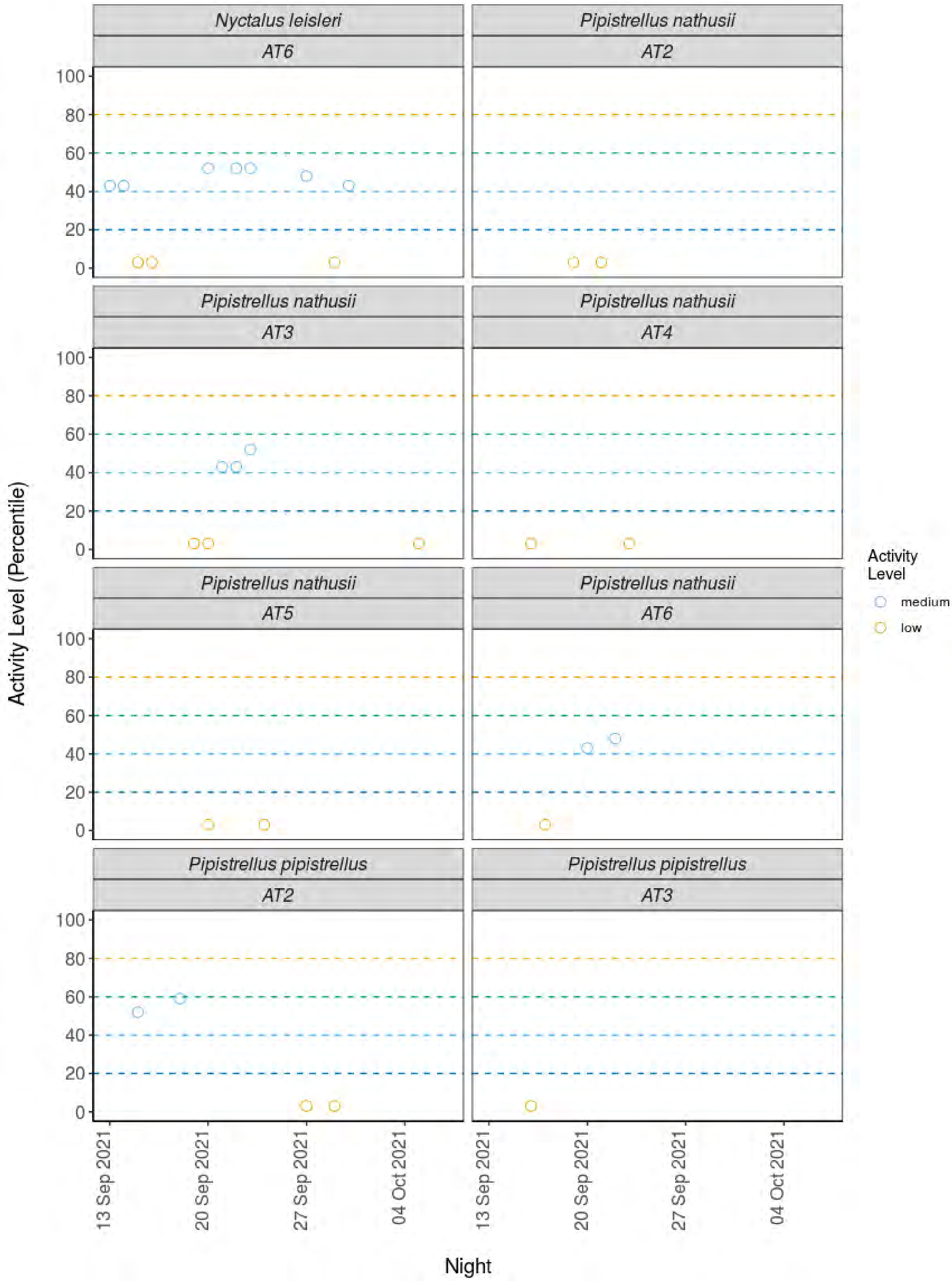
Activity Level (Percentile)
Myotis daubentonii
Myotis mystacinus
Myotis nattereri
Nyctalus leisleri
0
20
40
60
80
100
AT2
AT3
AT4
AT5
AT6
Detector ID

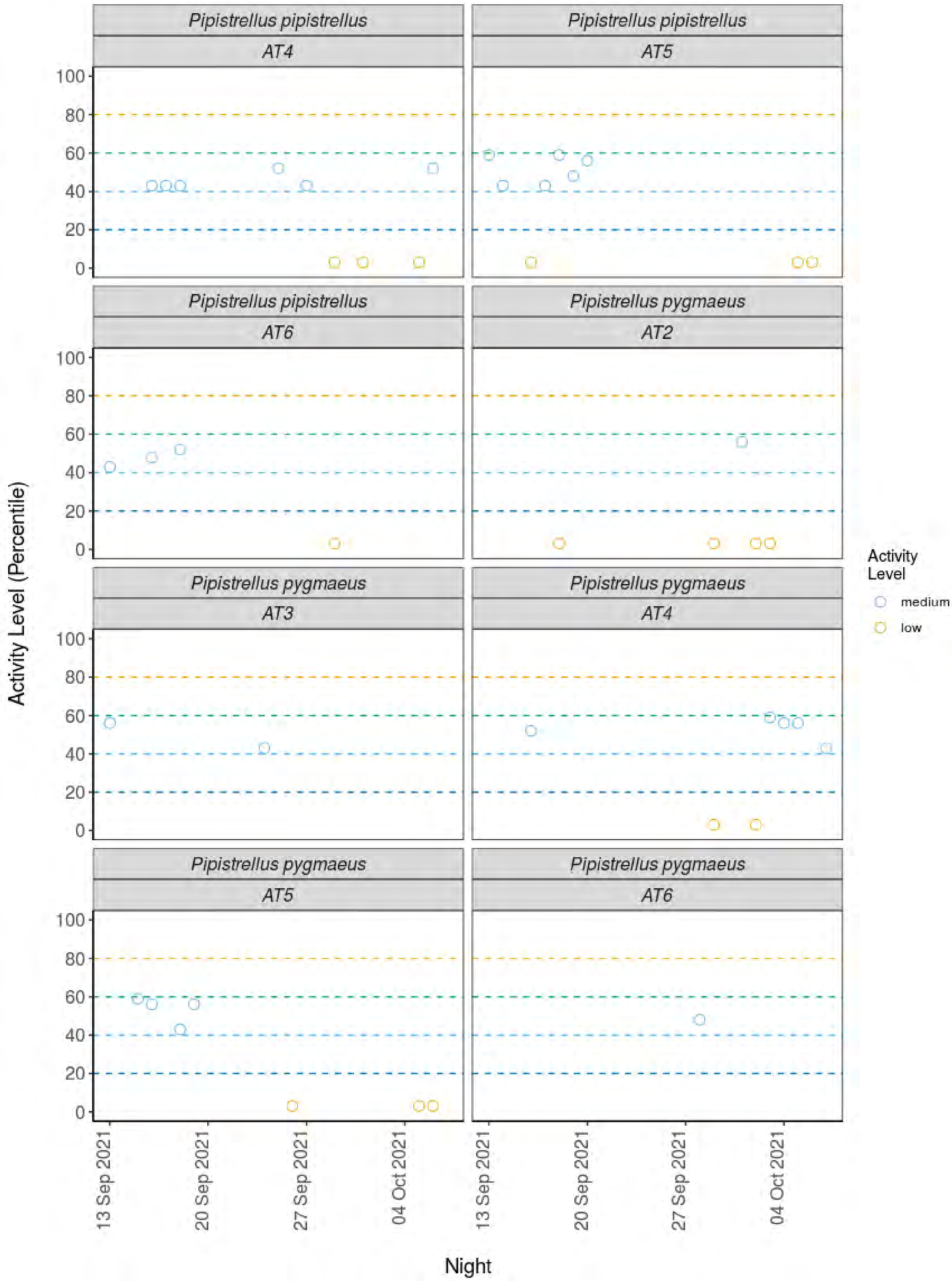


Activity Level (Percentile)
Detector ID
AT2
AT3
AT4
AT5
AT6
0
20
40
60
80
100
Pipistrellus nathusii
Pipistrellus pipistrellus
Pipistrellus pygmaeus
Plecotus auritus

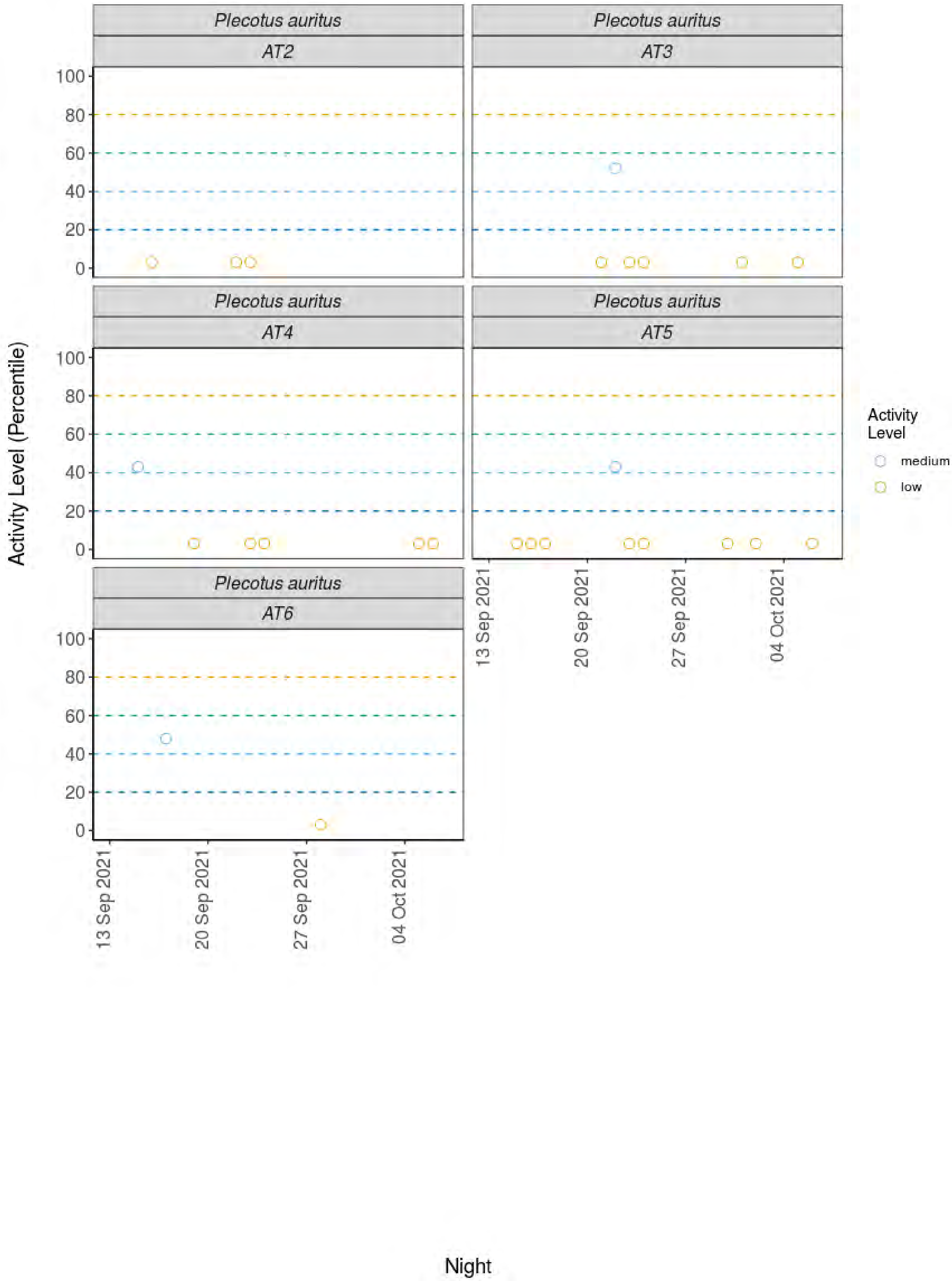
Figure 3. The activity level (percentile) of bats recorded across each night of the bat survey.


Myotis nattereri
AT2
Myotis nattereri
AT4
Myotis nattereri
AT5
Myotis nattereri
AT6
Nyctalus leisleri
AT2
Nyctalus leisleri
AT3
Nyctalus leisleri
AT4
Nyctalus leisleri
AT5
Activity Level (Percentile)
100
80
60
40
20
0
13 Sep 2021
20 Sep 2021
27 Sep 2021
04 Oct 2021
Night
Activity Level
medium
low


Nyctalus leisleri
AT6
Pipistrellus nathusii
AT2
Pipistrellus nathusii
AT3
Pipistrellus nathusii
AT4
Pipistrellus nathusii
AT5
Pipistrellus nathusii
AT6
Pipistrellus pipistrellus
AT2
Pipistrellus pipistrellus
AT3
Activity Level (Percentile)
100
80
60
40
20
0
13 Sep 2021
20 Sep 2021
27 Sep 2021
04 Oct 2021
Night
Activity Level
medium
low



Pipistrellus pipistrellus
AT4
Pipistrellus pipistrellus
AT5
Pipistrellus pipistrellus
AT6
Pipistrellus pygmaeus
AT2
Pipistrellus pygmaeus
AT3
Pipistrellus pygmaeus
AT4
Pipistrellus pygmaeus
AT5
Pipistrellus pygmaeus
AT6
Activity Level (Percentile)
100
80
60
40
20
0
13 Sep 2021
20 Sep 2021
27 Sep 2021
04 Oct 2021
Night
Activity Level
medium
low



Plecotus auritus
AT2
Plecotus auritus
AT3
Plecotus auritus
AT4
Plecotus auritus
AT5
Plecotus auritus
AT6
Activity Level (Percentile)
100
80
60
40
20
0
13 Sep 2021
20 Sep 2021
27 Sep 2021
04 Oct 2021
Activity Level
medium
low
Night

PER DETECTOR, PER MONTH

Table 5. Summary table showing the number of nights recorded bat activity fell into each activity band for each species at each detector during each month.

Detector ID	Species/Species Group	Month	Nights of High Activity	Nights of Moderate / High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity
AT2	*Myotis daubentonii*	Sep	0	0	0	2	4
AT2	*Myotis daubentonii*	Oct	0	0	0	0	1
AT2	*Myotis mystacinus*	Sep	0	0	1	2	4
AT2	*Myotis nattereri*	Sep	0	0	0	0	2
AT2	*Nyctalus leisleri*	Sep	0	0	0	1	3
AT2	*Pipistrellus nathusii*	Sep	0	0	0	0	2
AT2	*Pipistrellus pipistrellus*	Sep	4	6	2	0	2
AT2	*Pipistrellus pipistrellus*	Oct	0	0	0	1	0
AT2	*Pipistrellus pygmaeus*	Sep	8	4	0	0	2
AT2	*Pipistrellus pygmaeus*	Oct	0	0	1	1	2
AT2	*Plecotus auritus*	Sep	0	0	0	0	3
AT3	*Myotis daubentonii*	Sep	0	0	1	1	6
AT3	*Myotis daubentonii*	Oct	0	0	0	0	3
AT3	*Myotis mystacinus*	Sep	0	0	0	5	2
AT3	*Myotis mystacinus*	Oct	0	0	0	0	1
AT3	*Nyctalus leisleri*	Sep	1	0	0	3	4
AT3	*Nyctalus leisleri*	Oct	0	1	0	1	2

AT3	*Pipistrellus nathusii*	Sep	0	0	3	2	2
AT3	*Pipistrellus nathusii*	Oct	0	0	0	0	1
AT3	*Pipistrellus pipistrellus*	Sep	9	3	0	0	1
AT3	*Pipistrellus pipistrellus*	Oct	1	2	0	0	0
AT3	*Pipistrellus pygmaeus*	Sep	4	5	2	2	0
AT3	*Pipistrellus pygmaeus*	Oct	0	2	0	3	0
AT3	*Plecotus auritus*	Sep	0	0	1	1	3
AT3	*Plecotus auritus*	Oct	0	0	0	0	2
AT4	*Myotis daubentonii*	Sep	0	0	0	3	3
AT4	*Myotis daubentonii*	Oct	0	0	0	1	2
AT4	*Myotis nattereri*	Sep	0	0	0	1	2
AT4	*Nyctalus leisleri*	Sep	0	2	4	3	5
AT4	*Nyctalus leisleri*	Oct	0	0	0	2	3
AT4	*Pipistrellus nathusii*	Sep	0	0	0	2	2
AT4	*Pipistrellus pipistrellus*	Sep	5	5	5	0	1
AT4	*Pipistrellus pipistrellus*	Oct	0	0	1	0	2
AT4	*Pipistrellus pygmaeus*	Sep	11	2	1	2	1
AT4	*Pipistrellus pygmaeus*	Oct	0	0	4	2	1
AT4	*Plecotus auritus*	Sep	0	0	1	6	3
AT4	*Plecotus auritus*	Oct	0	0	0	0	2
AT5	*Myotis daubentonii*	Sep	0	0	2	2	4

AT5	*Myotis daubentonii*	Oct	0	0	0	1	0
AT5	*Myotis nattereri*	Sep	0	0	4	1	2
AT5	*Myotis nattereri*	Oct	0	0	0	0	1
AT5	*Nyctalus leisleri*	Sep	0	1	2	6	3
AT5	*Nyctalus leisleri*	Oct	0	0	0	2	1
AT5	*Pipistrellus nathusii*	Sep	0	0	0	0	2
AT5	*Pipistrellus pipistrellus*	Sep	2	3	6	2	1
AT5	*Pipistrellus pipistrellus*	Oct	0	0	0	0	2
AT5	*Pipistrellus pygmaeus*	Sep	2	5	4	3	1
AT5	*Pipistrellus pygmaeus*	Oct	0	0	0	1	2
AT5	*Plecotus auritus*	Sep	0	0	1	5	6
AT5	*Plecotus auritus*	Oct	0	0	0	3	2
AT6	*Myotis daubentonii*	Sep	1	5	6	0	0
AT6	*Myotis mystacinus*	Sep	4	4	5	1	0
AT6	*Myotis nattereri*	Sep	0	0	5	4	3
AT6	*Nyctalus leisleri*	Sep	0	1	7	6	3
AT6	*Pipistrellus nathusii*	Sep	1	1	2	2	1
AT6	*Pipistrellus pipistrellus*	Sep	9	2	3	2	1
AT6	*Pipistrellus pygmaeus*	Sep	13	2	1	1	0
AT6	*Plecotus auritus*	Sep	10	5	1	0	1

Table 6. Summary table showing key metrics for each species recorded per month. Please note that we cannot split the reference range by month, hence this column is not shown in this table.

Detector ID	Species/Species Group	Month	Median Percentile	95% CIs	Max Percentile	Nights Recorded
AT2	*Myotis daubentonii*	Sep	3	3 - 19	35	6
AT2	*Myotis daubentonii*	Oct	3	3 - 19	3	1
AT2	*Myotis mystacinus*	Sep	3	3 - 23	43	7
AT2	*Myotis nattereri*	Sep	3	3 - 3	3	2
AT2	*Nyctalus leisleri*	Sep	3	3 - 3	24	4
AT2	*Pipistrellus nathusii*	Sep	3	3 - 3	3	2
AT2	*Pipistrellus pipistrellus*	Sep	73	42 - 79	93	14
AT2	*Pipistrellus pipistrellus*	Oct	24	42 - 79	24	1
AT2	*Pipistrellus pygmaeus*	Sep	85	44.5 - 85	93	14
AT2	*Pipistrellus pygmaeus*	Oct	19	44.5 - 85	56	4
AT2	*Plecotus auritus*	Sep	3	3 - 3	3	3
AT3	*Myotis daubentonii*	Sep	3	3 - 3	56	8
AT3	*Myotis daubentonii*	Oct	3	3 - 3	3	3
AT3	*Myotis mystacinus*	Sep	35	3 - 35	35	7
AT3	*Myotis mystacinus*	Oct	3	3 - 35	3	1
AT3	*Nyctalus leisleri*	Sep	14	3 - 46.5	90	8
AT3	*Nyctalus leisleri*	Oct	14	3 - 46.5	74	4
AT3	*Pipistrellus nathusii*	Sep	35	3 - 43	52	7
AT3	*Pipistrellus nathusii*	Oct	3	3 - 43	3	1
AT3	*Pipistrellus pipistrellus*	Sep	92	76 - 93	98	13

AT3	*Pipistrellus pipistrellus*	Oct	76	76 - 93	88	3
AT3	*Pipistrellus pygmaeus*	Sep	78	49.5 - 76.5	86	13
AT3	*Pipistrellus pygmaeus*	Oct	35	49.5 - 76.5	73	5
AT3	*Plecotus auritus*	Sep	3	3 - 13.5	52	5
AT3	*Plecotus auritus*	Oct	3	3 - 13.5	3	2
AT4	*Myotis daubentonii*	Sep	14	3 - 24	35	6
AT4	*Myotis daubentonii*	Oct	3	3 - 24	24	3
AT4	*Myotis nattereri*	Sep	3	3 - 3	24	3
AT4	*Nyctalus leisleri*	Sep	35	13.5 - 41.5	80	14
AT4	*Nyctalus leisleri*	Oct	3	13.5 - 41.5	24	5
AT4	*Pipistrellus nathusii*	Sep	14	3 - 24	24	4
AT4	*Pipistrellus pipistrellus*	Sep	74	43 - 73.5	90	16
AT4	*Pipistrellus pipistrellus*	Oct	3	43 - 73.5	52	3
AT4	*Pipistrellus pygmaeus*	Sep	85	49 - 77.5	95	17
AT4	*Pipistrellus pygmaeus*	Oct	43	49 - 77.5	59	7
AT4	*Plecotus auritus*	Sep	24	3 - 29.5	43	10
AT4	*Plecotus auritus*	Oct	3	3 - 29.5	3	2
AT5	*Myotis daubentonii*	Sep	14	3 - 33.5	43	8
AT5	*Myotis daubentonii*	Oct	24	3 - 33.5	24	1
AT5	*Myotis nattereri*	Sep	43	3 - 48	56	7
AT5	*Myotis nattereri*	Oct	3	3 - 48	3	1

AT5	*Nyctalus leisleri*	Sep	24	13.5 - 41.5	66	12
AT5	*Nyctalus leisleri*	Oct	35	13.5 - 41.5	35	3
AT5	*Pipistrellus nathusii*	Sep	3	3 - 3	3	2
AT5	*Pipistrellus pipistrellus*	Sep	58	31 - 63	83	14
AT5	*Pipistrellus pipistrellus*	Oct	3	31 - 63	3	2
AT5	*Pipistrellus pygmaeus*	Sep	59	35 - 65.5	94	15
AT5	*Pipistrellus pygmaeus*	Oct	3	35 - 65.5	24	3
AT5	*Plecotus auritus*	Sep	14	3 - 24	43	12
AT5	*Plecotus auritus*	Oct	24	3 - 24	35	5
AT6	*Myotis daubentonii*	Sep	59	43 - 70.5	89	12
AT6	*Myotis mystacinus*	Sep	69	52 - 77.5	85	14
AT6	*Myotis nattereri*	Sep	30	13.5 - 43	56	12
AT6	*Nyctalus leisleri*	Sep	35	24 - 43.5	63	17
AT6	*Pipistrellus nathusii*	Sep	43	13.5 - 78	80	7
AT6	*Pipistrellus pipistrellus*	Sep	82	51.5 - 87	97	17
AT6	*Pipistrellus pygmaeus*	Sep	96	73.5 - 98	99	17
AT6	*Plecotus auritus*	Sep	82	68.5 - 87	94	17

PER SITE

In this 'Per Site' section of the analysis, all values are taken from across all of the detectors to provide site-wide averages/medians.

Table 7. Summary table showing the number of nights recorded bat activity fell into each activity band for each species.

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
Myotis daubentonii	1	5	9	10	23
Myotis mystacinus	4	4	6	8	7
Myotis nattereri	0	0	9	6	10
Nyctalus leisleri	1	5	13	24	24
Pipistrellus nathusii	1	1	5	6	10
Pipistrellus pipistrellus	30	21	17	5	10
Pipistrellus pygmaeus	38	20	13	15	9
Plecotus auritus	10	5	4	15	22

Table 8. Summary table showing key metrics for each species recorded.

Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded
Myotis daubentonii	24	43 - 70.5	89	48
Myotis mystacinus	35	52 - 77.5	85	29
Myotis nattereri	24	3 - 48	56	25
Nyctalus leisleri	24	3 - 46.5	90	67
Pipistrellus nathusii	24	3 - 43	80	23
Pipistrellus pipistrellus	71	76 - 93	98	83
Pipistrellus pygmaeus	75	73.5 - 98	99	95
Plecotus auritus	24	68.5 - 87	94	56

###Figures

Figure 4. The activity level (percentile) of bats recorded across each night of the bat survey for the **entire site**.

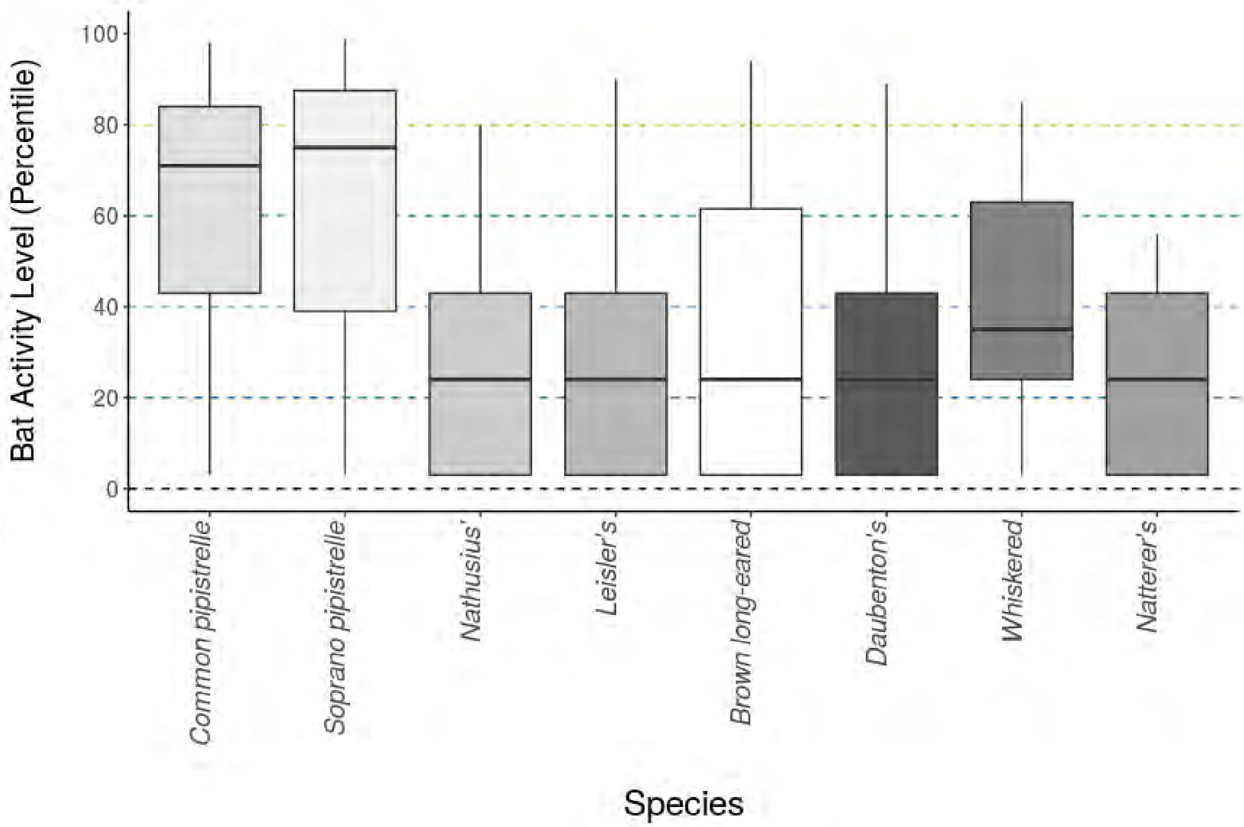
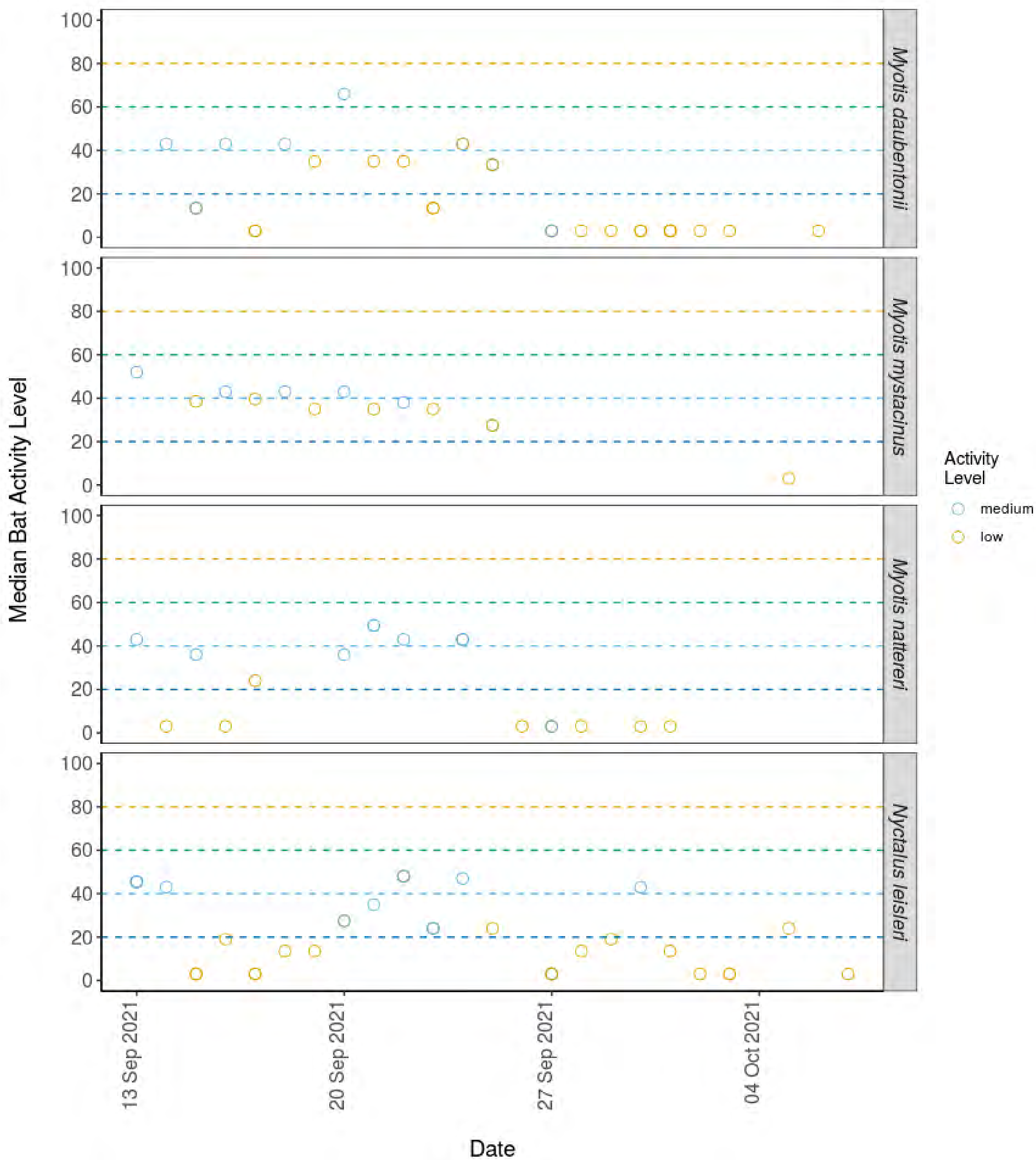
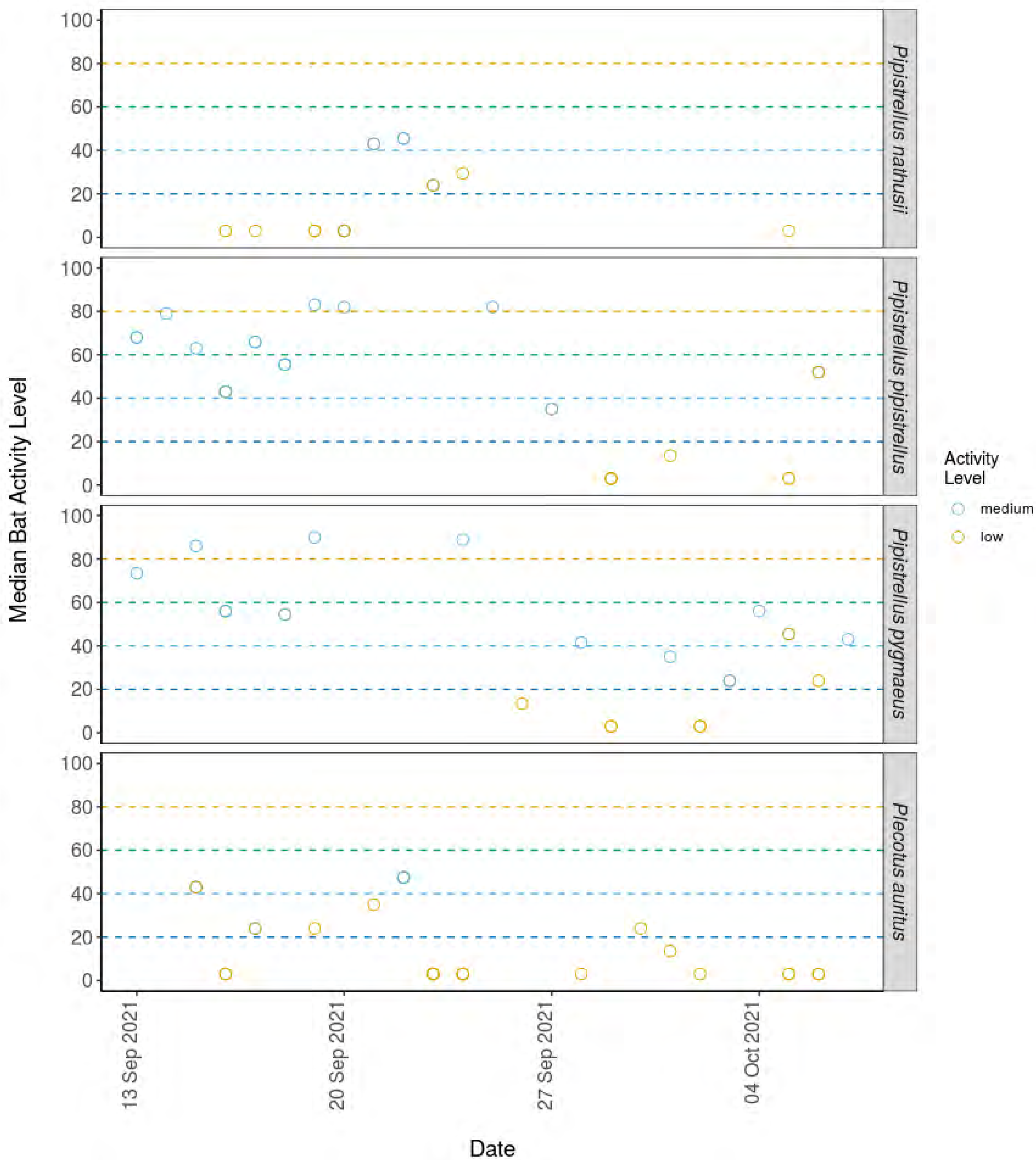


Figure 5. The median activity levels of bats recorded across all detectors each night.



Median Bat Activity Level
Myotis daubentonii
Myotis mystacinus
Myotis nattereri
Nyctalus leisleri
100
80
60
40
20
0
13 Sep 2021
20 Sep 2021
27 Sep 2021
04 Oct 2021
Date
Activity Level
medium
low



Median Bat Activity Level
Pipistrellus nathusii
Pipistrellus pipistrellus
Pipistrellus pygmaeus
Plecotus auritus
0
20
40
60
80
100
13 Sep 2021
20 Sep 2021
27 Sep 2021
04 Oct 2021
Date
Activity Level
medium
low

PER SITE, PER MONTH

Table 9. Summary table showing the number of nights recorded bat activity fell into each activity band for each species during each month.

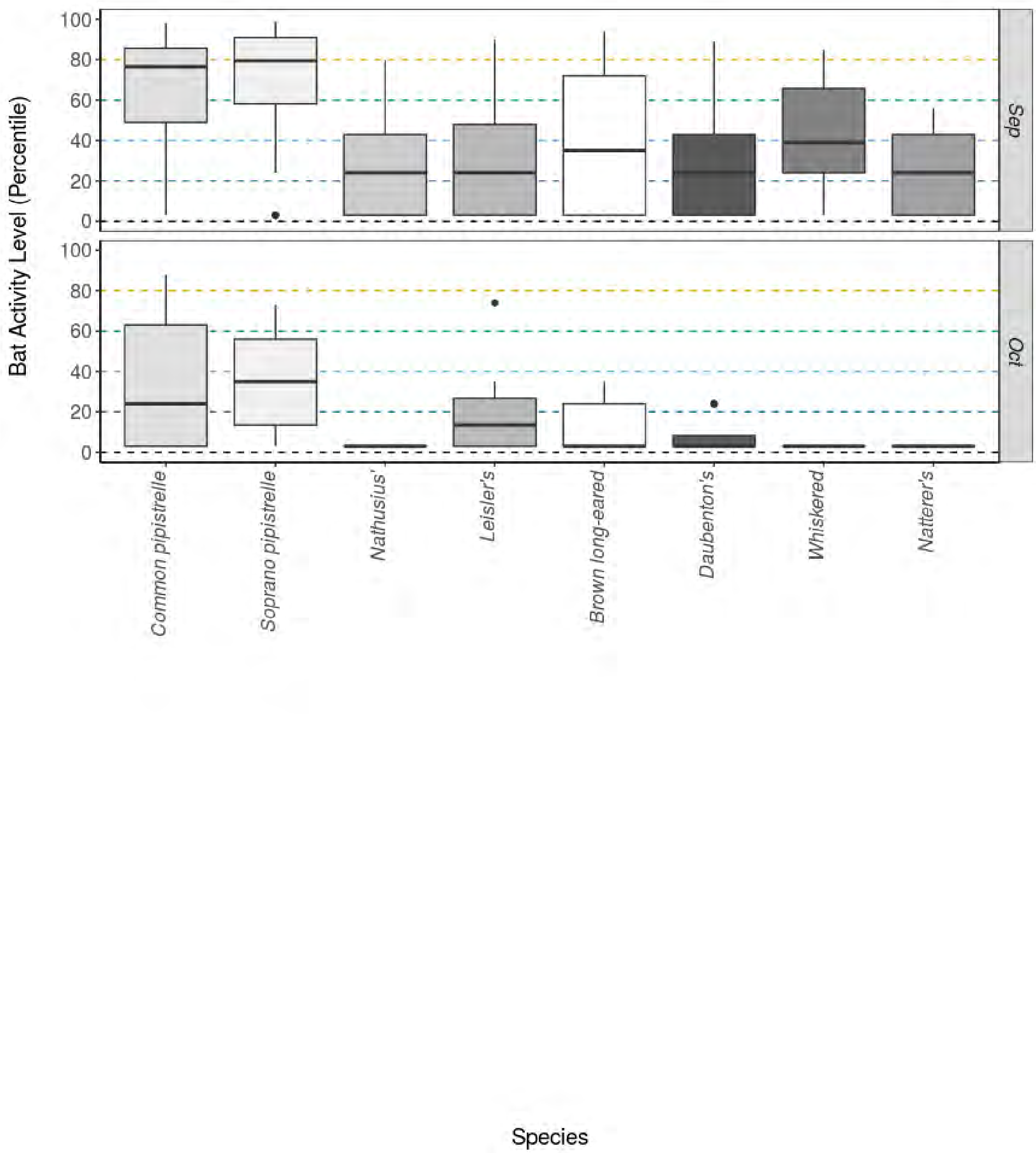
Species/Species Group	Month	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity
Myotis daubentonii	Sep	1	5	9	8	17
Myotis daubentonii	Oct	0	0	0	2	6
Myotis mystacinus	Sep	4	4	6	8	6
Myotis mystacinus	Oct	0	0	0	0	1
Myotis nattereri	Sep	0	0	9	6	9
Myotis nattereri	Oct	0	0	0	0	1
Nyctalus leisleri	Sep	1	4	13	19	18
Nyctalus leisleri	Oct	0	1	0	5	6
Pipistrellus nathusii	Sep	1	1	5	6	9
Pipistrellus nathusii	Oct	0	0	0	0	1
Pipistrellus pipistrellus	Sep	29	19	16	4	6
Pipistrellus pipistrellus	Oct	1	2	1	1	4
Pipistrellus pygmaeus	Sep	38	18	8	8	4
Pipistrellus pygmaeus	Oct	0	2	5	7	5
Plecotus auritus	Sep	10	5	4	12	16
Plecotus auritus	Oct	0	0	0	3	6

Table 10. Summary table showing key metrics for each species recorded per month.

Species/Species Group	Month	Median Percentile	95% CIs	Max Percentile	Nights Recorded
Myotis daubentonii	Sep	24	43 - 70.5	89	40
Myotis daubentonii	Oct	3	3 - 33.5	24	8
Myotis mystacinus	Sep	39	52 - 77.5	85	28
Myotis mystacinus	Oct	3	3 - 35	3	1
Myotis nattereri	Sep	24	3 - 48	56	24
Myotis nattereri	Oct	3	3 - 48	3	1
Nyctalus leisleri	Sep	24	3 - 46.5	90	55
Nyctalus leisleri	Oct	14	3 - 46.5	74	12
Pipistrellus nathusii	Sep	24	3 - 43	80	22
Pipistrellus nathusii	Oct	3	3 - 43	3	1
Pipistrellus pipistrellus	Sep	77	76 - 93	98	74
Pipistrellus pipistrellus	Oct	24	76 - 93	88	9
Pipistrellus pygmaeus	Sep	80	73.5 - 98	99	76
Pipistrellus pygmaeus	Oct	35	49.5 - 76.5	73	19
Plecotus auritus	Sep	35	68.5 - 87	94	47
Plecotus auritus	Oct	3	3 - 29.5	35	9

###Figures

Figure 6. The activity level (percentile) of bats recorded across each night of the bat survey for the entire site, split between months.



PART 2: Nightly Analysis

ENTIRE SURVEY PERIOD

Sunrise and Sunset Times

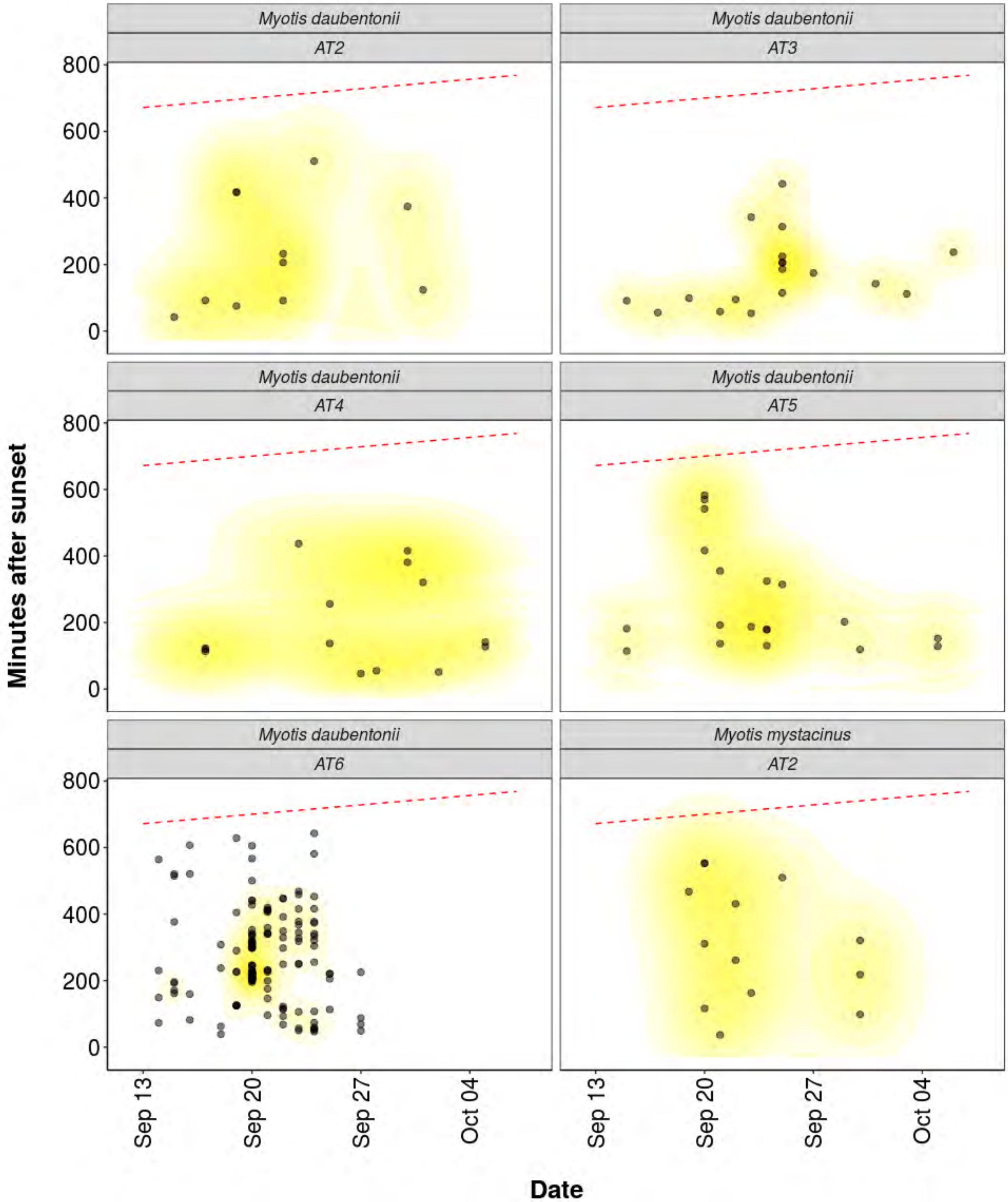
Table 11. The times of sunset and sunrise the following morning for surveys beginning on the date shown.

Night (y-m-d)	Sunset (hh:mm)	Sunrise (hh:mm)	Night Length (hours)
2021-09-13	19:57	07:09	11.2
2021-09-14	19:54	07:10	11.3
2021-09-15	19:52	07:12	11.3
2021-09-16	19:49	07:13	11.4
2021-09-17	19:47	07:15	11.5
2021-09-18	19:45	07:17	11.5
2021-09-19	19:42	07:18	11.6
2021-09-20	19:40	07:20	11.7
2021-09-21	19:38	07:22	11.7
2021-09-22	19:35	07:23	11.8
2021-09-23	19:33	07:25	11.9
2021-09-24	19:30	07:27	11.9
2021-09-25	19:28	07:28	12.0
2021-09-26	19:26	07:30	12.1
2021-09-27	19:23	07:32	12.1
2021-09-28	19:21	07:33	12.2
2021-09-29	19:19	07:35	12.3
2021-09-30	19:16	07:37	12.3
2021-10-01	19:14	07:38	12.4
2021-10-02	19:12	07:40	12.5
2021-10-03	19:09	07:42	12.5
2021-10-04	19:07	07:43	12.6
2021-10-05	19:05	07:45	12.7
2021-10-06	19:02	07:47	12.7
2021-10-07	19:00	07:49	12.8

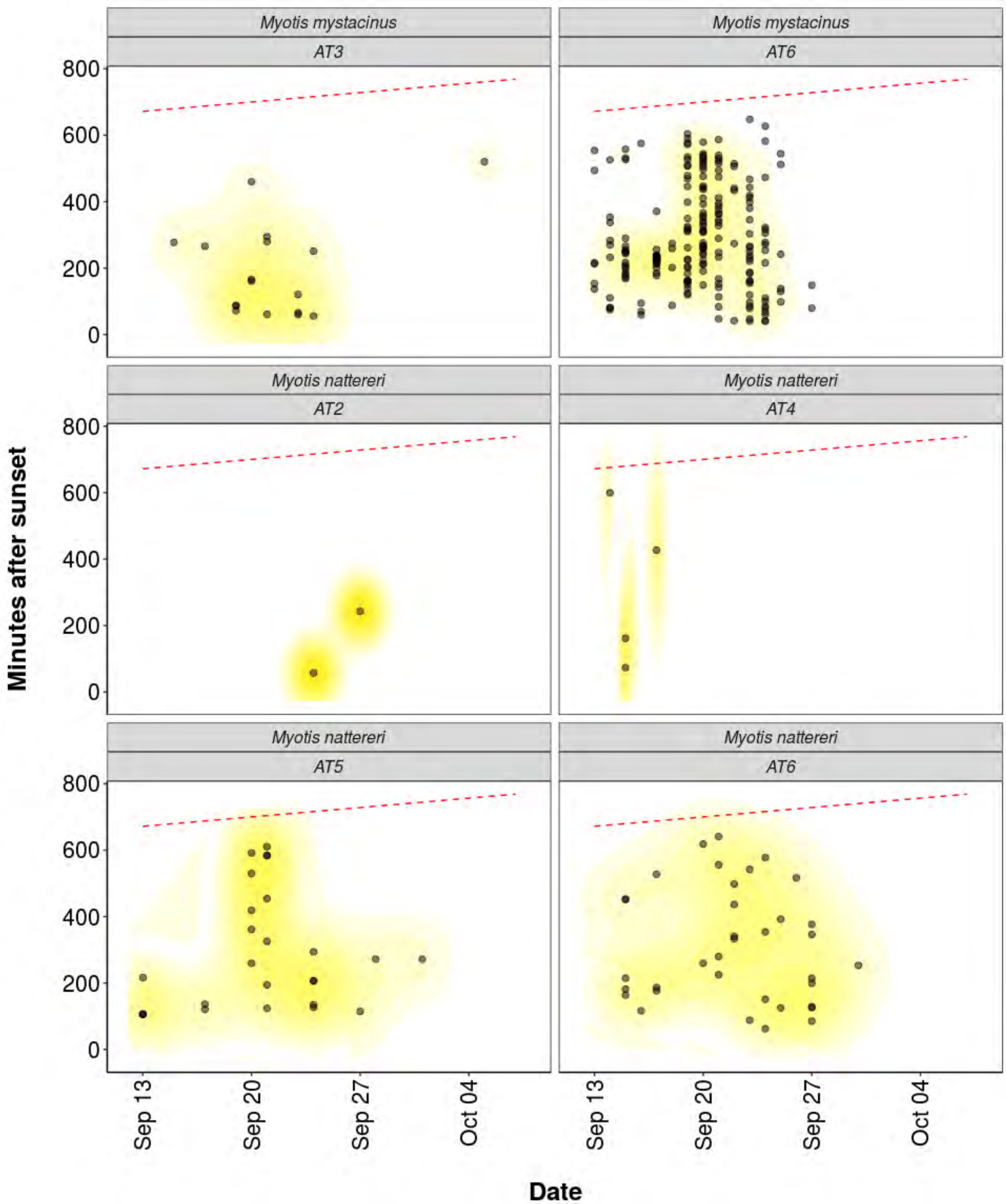
Distribution of Bat Activity Across the Night through Time

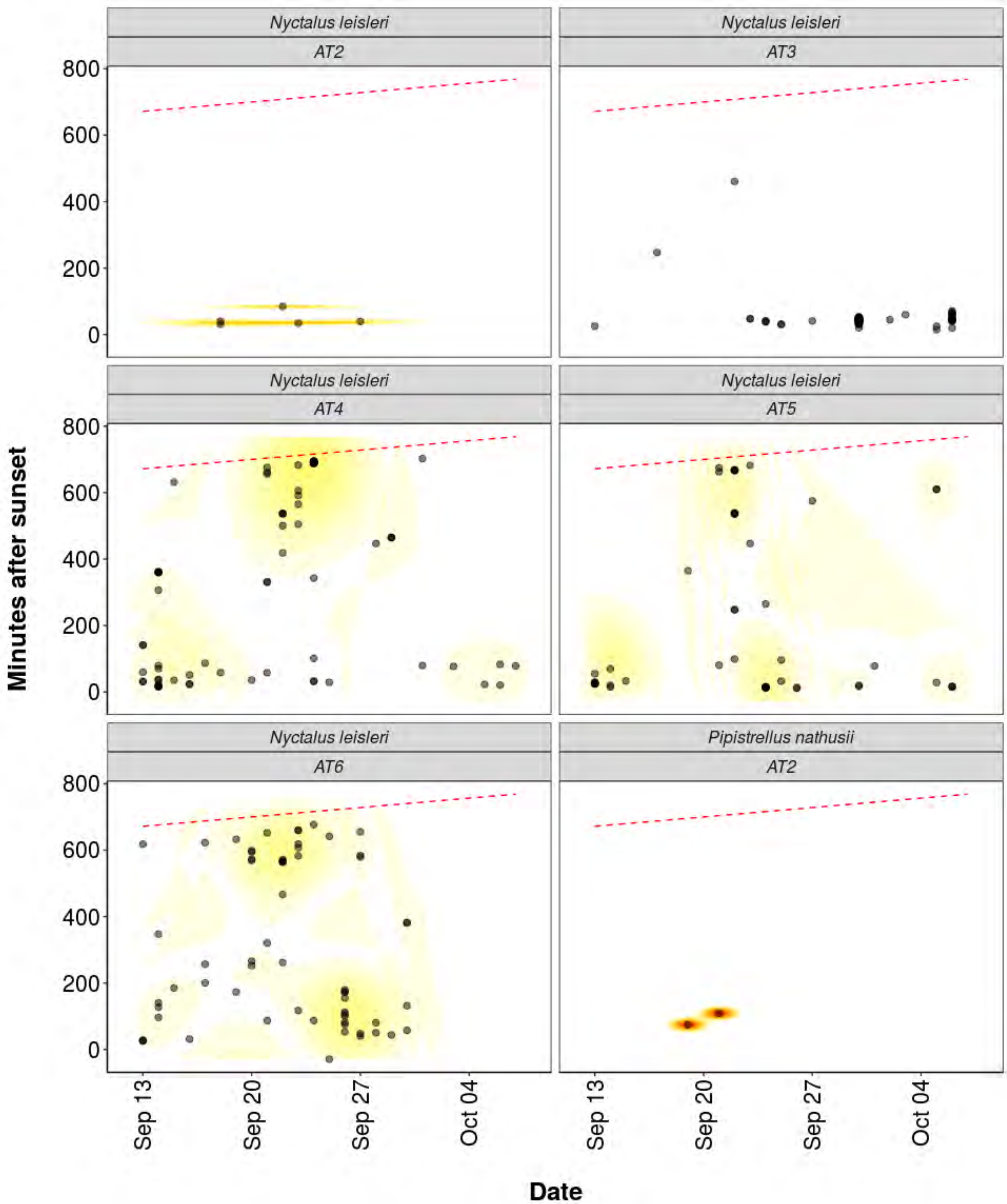
Per Detector

Figure 7. Timing of bat calls plotted as minutes before/after sunset, whereby 0 on the y axis represents sunset. Sunrise throughout the survey period is depicted as the red dashed line. Colours indicate kernel densities, with darkest colours showing peaks of activity. These colours are comparative only within each plot, and do not account for overall activity.

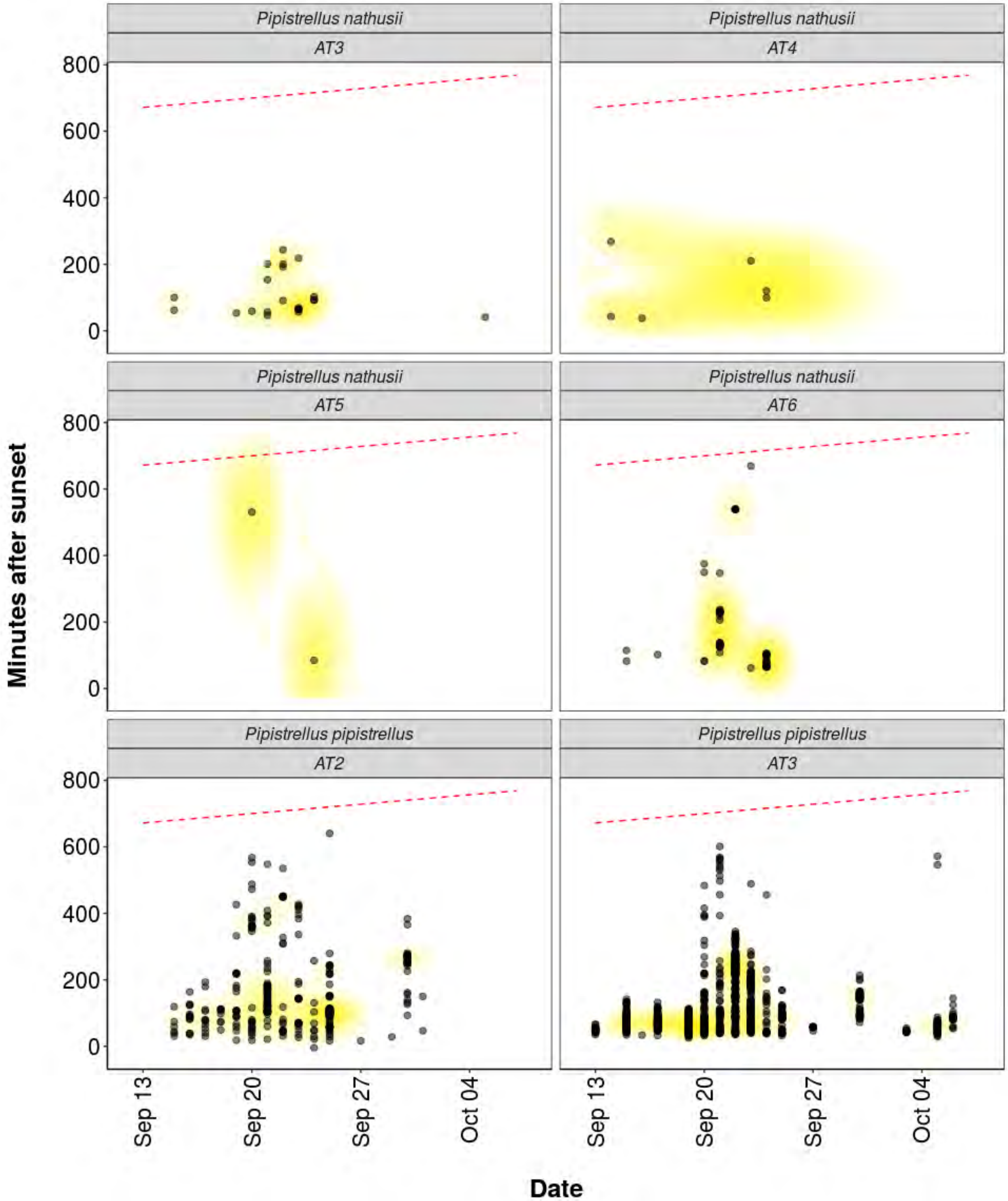


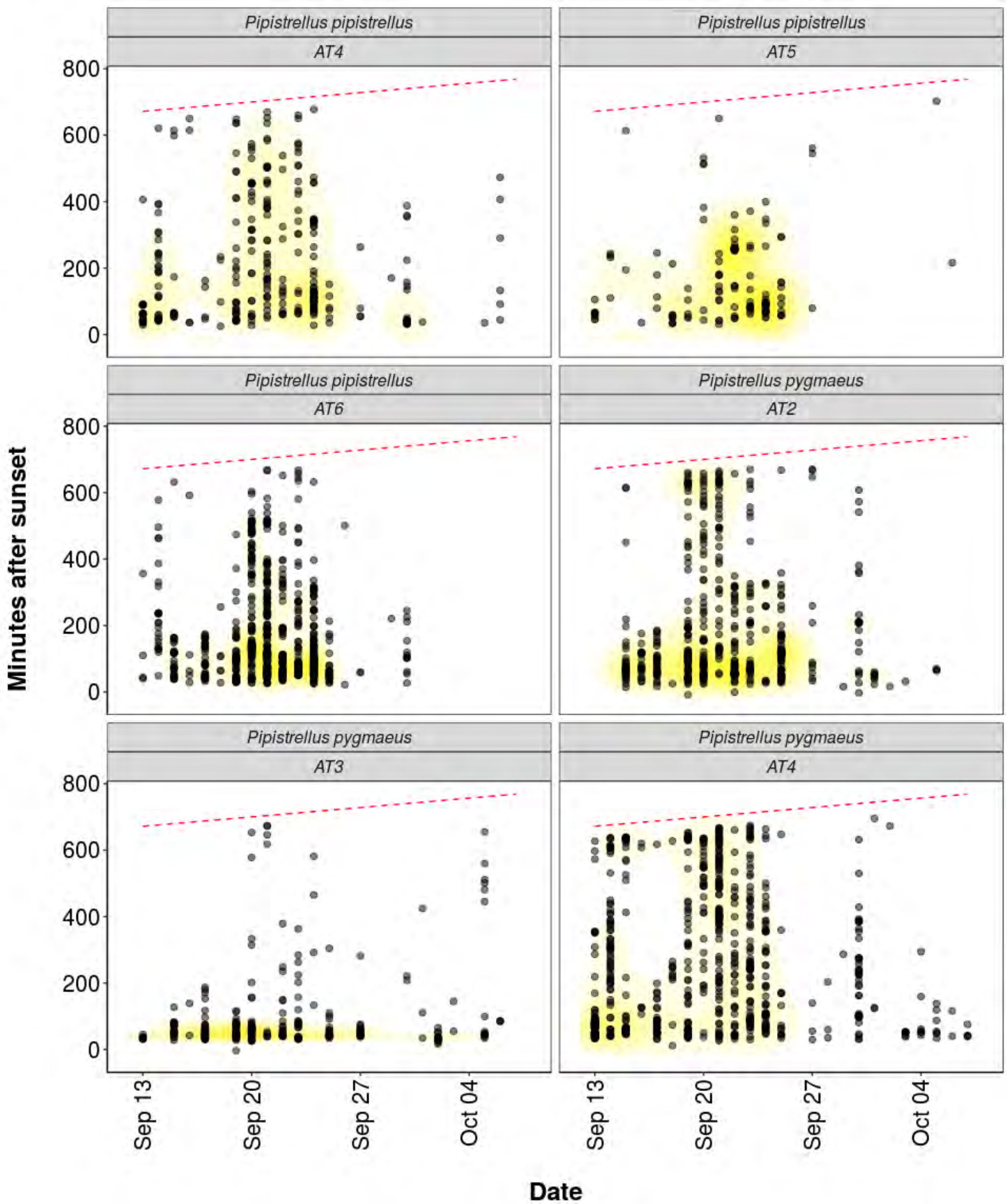
Myotis daubentonii
AT2
Myotis daubentonii
AT3
Myotis daubentonii
AT4
Myotis daubentonii
AT5
Myotis daubentonii
AT6
Myotis mystacinus
AT2
Minutes after sunset
0
200
400
600
800
Sep 13
Sep 20
Sep 27
Oct 04
Date


Myotis mystacinus
AT3
Myotis mystacinus
AT6
Myotis nattereri
AT2
Myotis nattereri
AT4
Myotis nattereri
AT5
Myotis nattereri
AT6
Minutes after sunset
0
200
400
600
800
Sep 13
Sep 20
Sep 27
Oct 04
Date

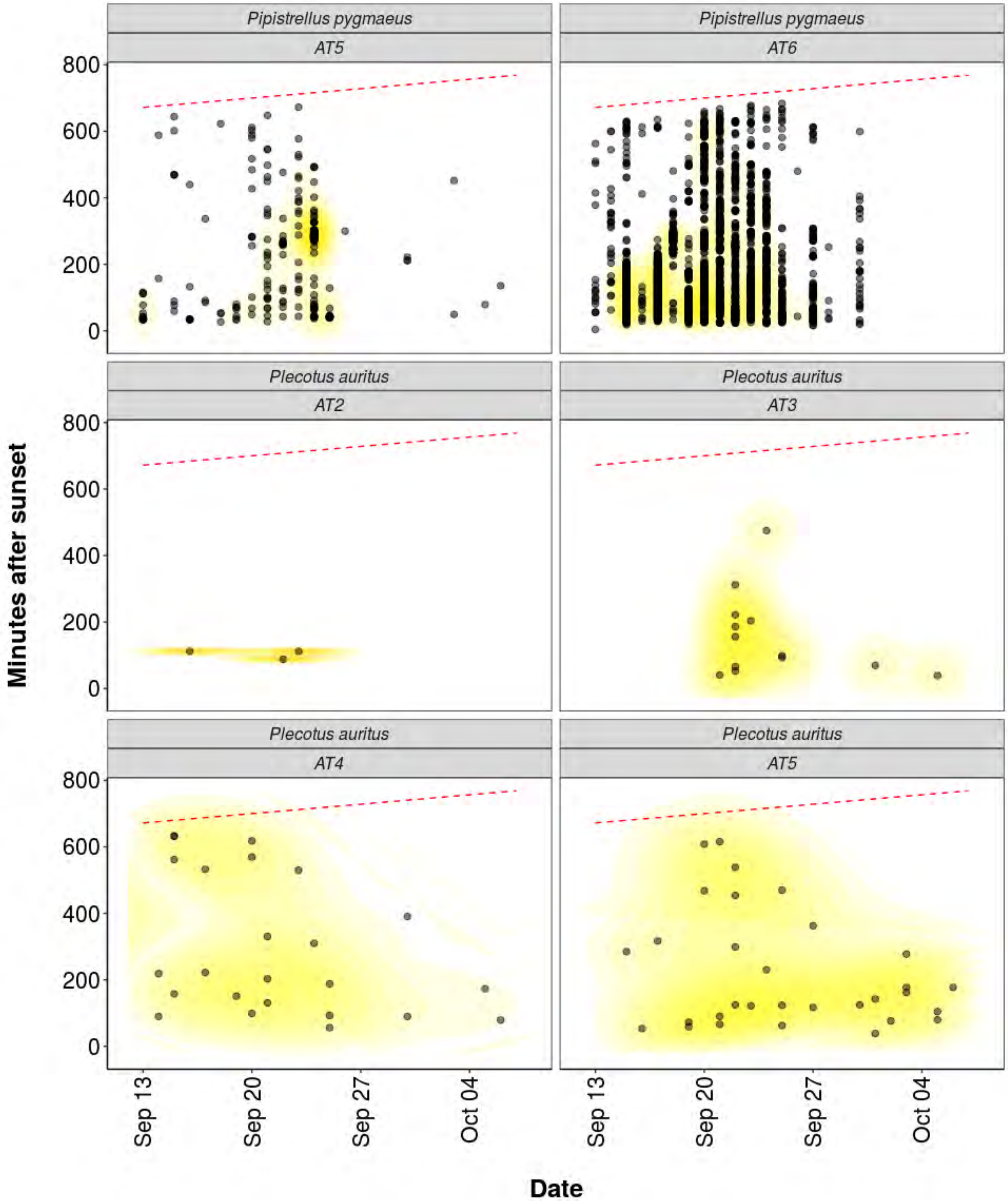


Nyctalus leisleri
AT2
Nyctalus leisleri
AT3
Nyctalus leisleri
AT4
Nyctalus leisleri
AT5
Nyctalus leisleri
AT6
Pipistrellus nathusii
AT2
Minutes after sunset
800
600
400
200
0
Sep 13
Sep 20
Sep 27
Oct 04
Date

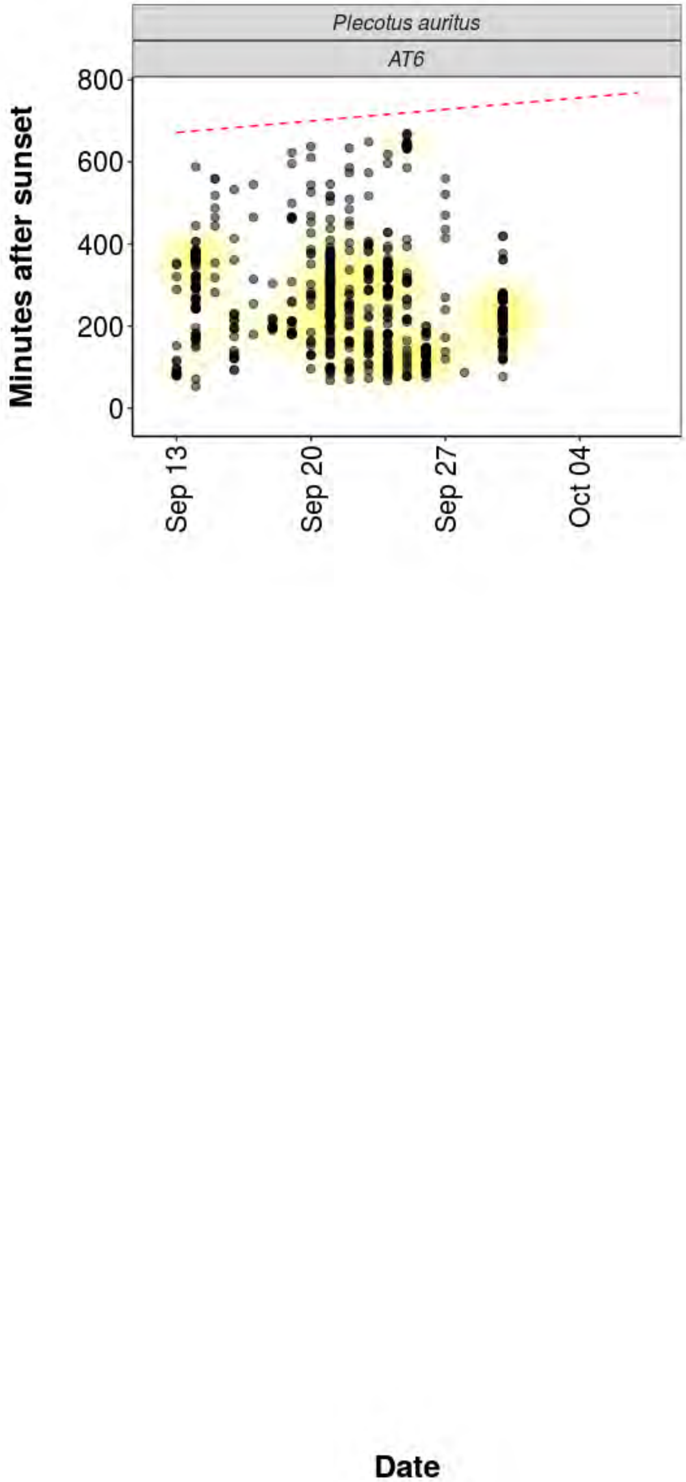

Pipistrellus nathusii
AT3
Pipistrellus nathusii
AT4
Pipistrellus nathusii
AT5
Pipistrellus nathusii
AT6
Pipistrellus pipistrellus
AT2
Pipistrellus pipistrellus
AT3
Minutes after sunset
0
200
400
600
800
Sep 13
Sep 20
Sep 27
Oct 04
Date



Pipistrellus pipistrellus
AT4
Pipistrellus pipistrellus
AT5
Pipistrellus pipistrellus
AT6
Pipistrellus pygmaeus
AT2
Pipistrellus pygmaeus
AT3
Pipistrellus pygmaeus
AT4
Minutes after sunset
800
600
400
200
0
Sep 13
Sep 20
Sep 27
Oct 04
Date



Pipistrellus pygmaeus
AT5
Pipistrellus pygmaeus
AT6
Plecotus auritus
AT2
Plecotus auritus
AT3
Plecotus auritus
AT4
Plecotus auritus
AT5
Minutes after sunset
0
200
400
600
800
Sep 13
Sep 20
Sep 27
Oct 04
Date


Plecotus auritus
AT6
Minutes after sunset
800
600
400
200
0
Sep 13
Sep 20
Sep 27
Oct 04
Date

Roost Emergence Time and Bat Observation

Based on: *Russ, Jon. 2012. British Bat Calls a Guide to species Identification. Pelagic Publishing.*

For more information see https://rbats-blog.updog.co/2018/05/29/bat-emergence/

Bat Passes Potentially Indicating Close Proximity to a Roost (Russ 2012) - Table

Table 12. Number of bat calls recorded before the upper time of the species-specific emergence time range, and which therefore may potentially indicate the presence of a nearby roost.

Table continues below

Species	Detector ID	2021-09-13	2021-09-14	2021-09-15	2021-09-16	2021-09-17
Common pipistrelle	AT2	0	0	1	0	1
Common pipistrelle	AT3	0	0	0	0	0
Common pipistrelle	AT4	1	0	0	0	0
Common pipistrelle	AT5	0	0	0	0	0
Common pipistrelle	AT6	0	0	0	1	0
Soprano pipistrelle	AT2	0	0	2	0	2
Soprano pipistrelle	AT3	0	0	1	0	0
Soprano pipistrelle	AT4	0	0	0	0	0
Soprano pipistrelle	AT5	0	0	0	0	0
Soprano pipistrelle	AT6	1	0	8	0	1
Leisler’s	AT3	0	0	0	0	0
Leisler’s	AT4	0	4	0	0	0
Leisler’s	AT5	0	1	0	0	0

Leisler’s	AT6	0	0	0	0	0
Brown long-eared	AT3	0	0	0	0	0
Brown long-eared	AT4	0	0	0	0	0
Brown long-eared	AT5	0	0	0	1	0
Brown long-eared	AT6	0	1	0	0	0
Daubenton’s	AT2	0	0	1	0	0
Daubenton’s	AT3	0	0	0	0	1
Daubenton’s	AT4	0	0	0	0	0
Daubenton’s	AT6	0	0	0	0	0

Table continues below

2021-09-18	2021-09-19	2021-09-20	2021-09-21	2021-09-22	2021-09-23	2021-09-24
0	1	1	1	1	1	3
0	4	1	0	0	0	0
1	0	1	0	0	0	1
0	0	0	1	0	0	0
1	6	2	4	0	0	3
1	3	1	0	1	1	1
0	1	3	0	0	0	0
1	0	0	1	0	0	0
1	0	0	1	0	0	0
0	9	9	14	5	1	12
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	7
0	0	0	0	0	0	0
0	0	0	1	1	0	0
0	0	0	0	0	0	0
0	1	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	1	0	1	0
0	0	0	0	0	0	0

2	0	0	0	1	2	4

Table continues below

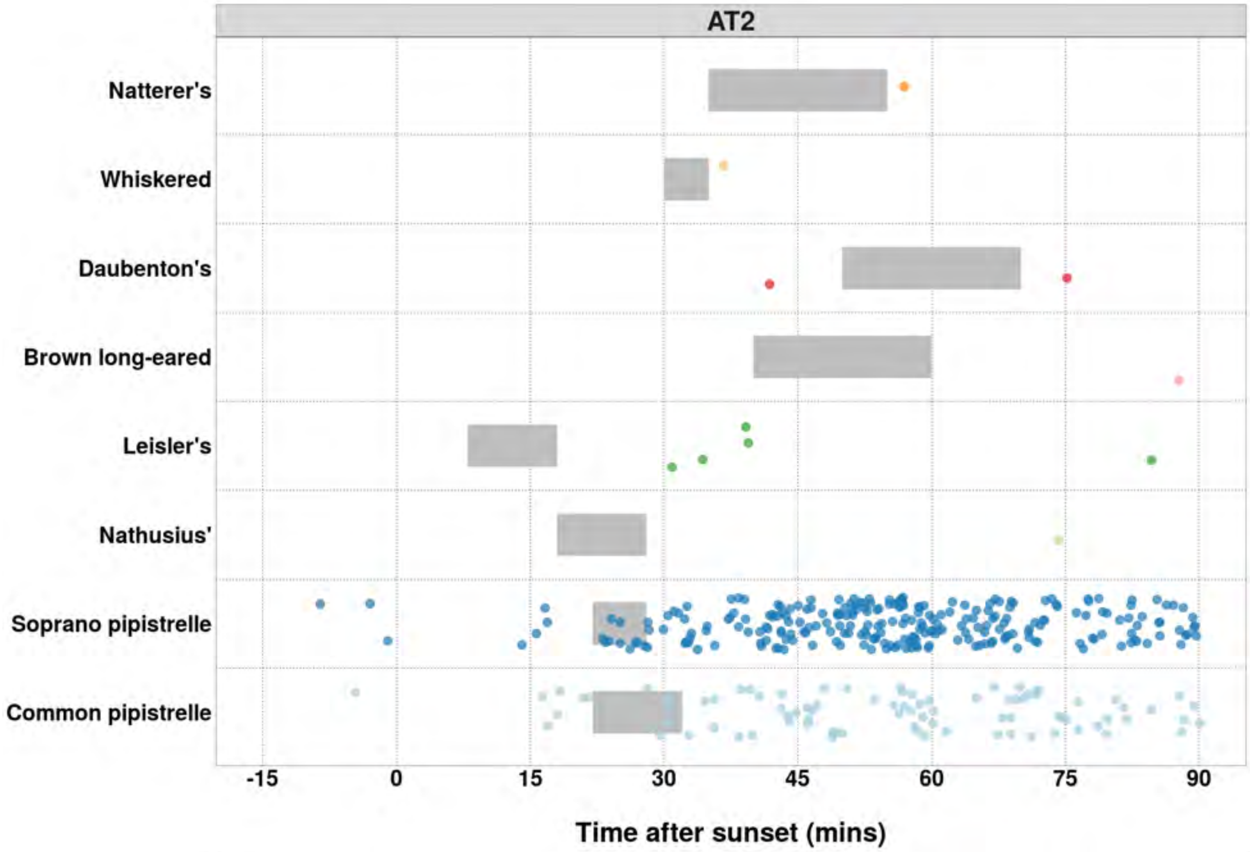
2021-09-25	2021-09-26	2021-09-27	2021-09-28	2021-09-29	2021-09-30	2021-10-01
2	0	1	0	1	0	0
1	0	0	0	0	0	0
0	0	0	0	0	3	0
0	0	0	0	0	0	0
2	1	0	0	0	1	0
1	0	0	0	1	1	1
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
5	0	3	0	0	2	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	2	0	0	0	1	0
1	0	0	0	0	0	0
0	0	0	0	0	0	0
1	0	0	0	0	0	0
0	0	0	0	0	0	1
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	1	1	0	0	0
0	0	2	0	0	0	0

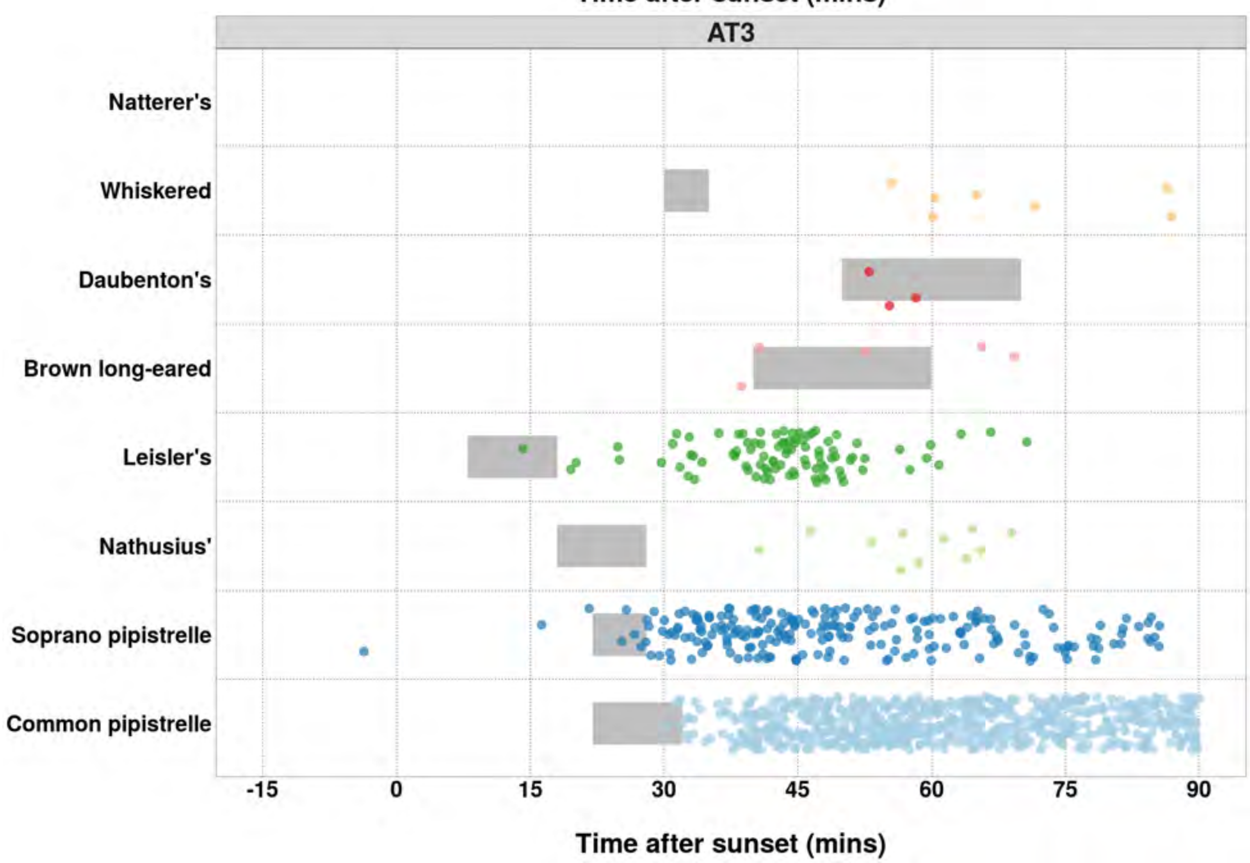
2021-10-02	2021-10-05	2021-10-06
0	0	0
0	1	0
0	0	0
0	0	0
0	0	0
1	0	0
3	0	0
0	0	0

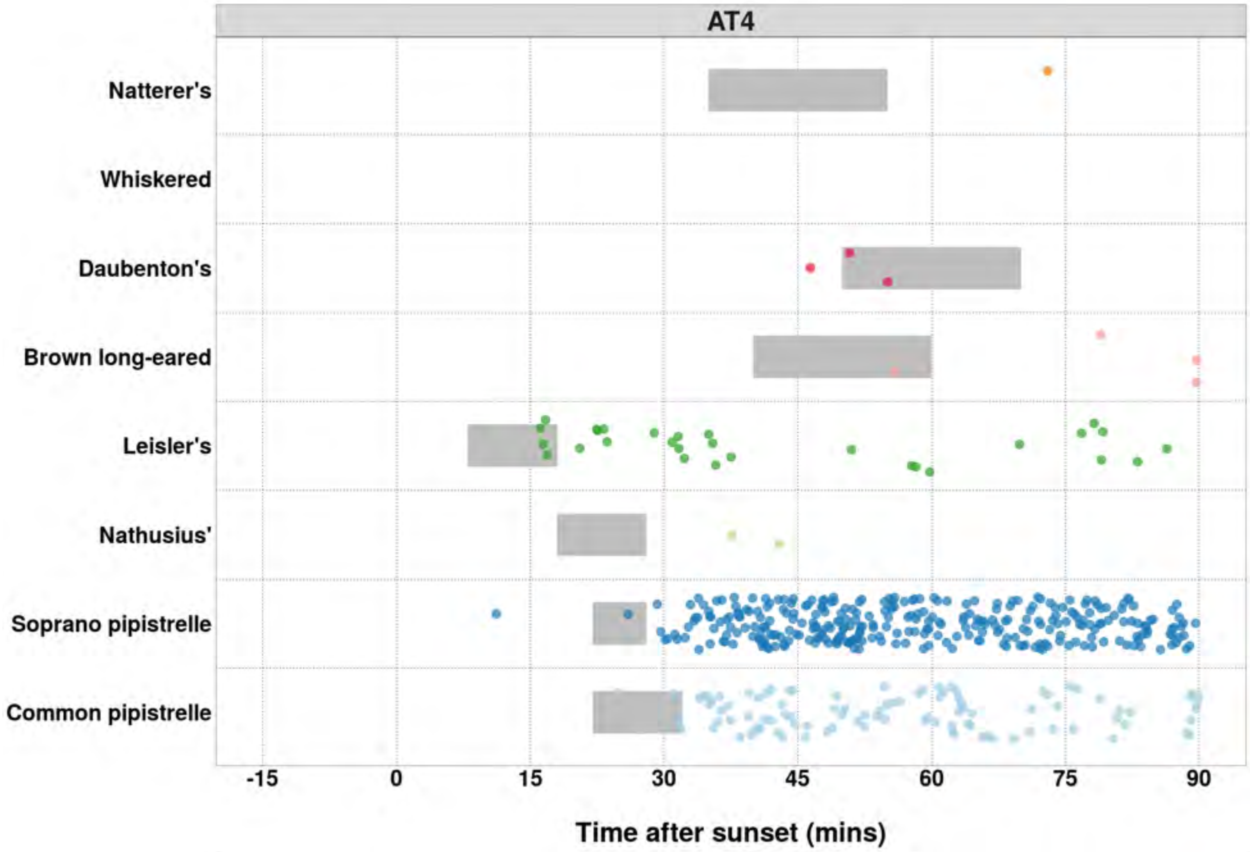
0	0	0
0	0	0
0	1	0
0	0	0
0	0	3
0	0	0
0	1	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
1	0	0
0	0	0

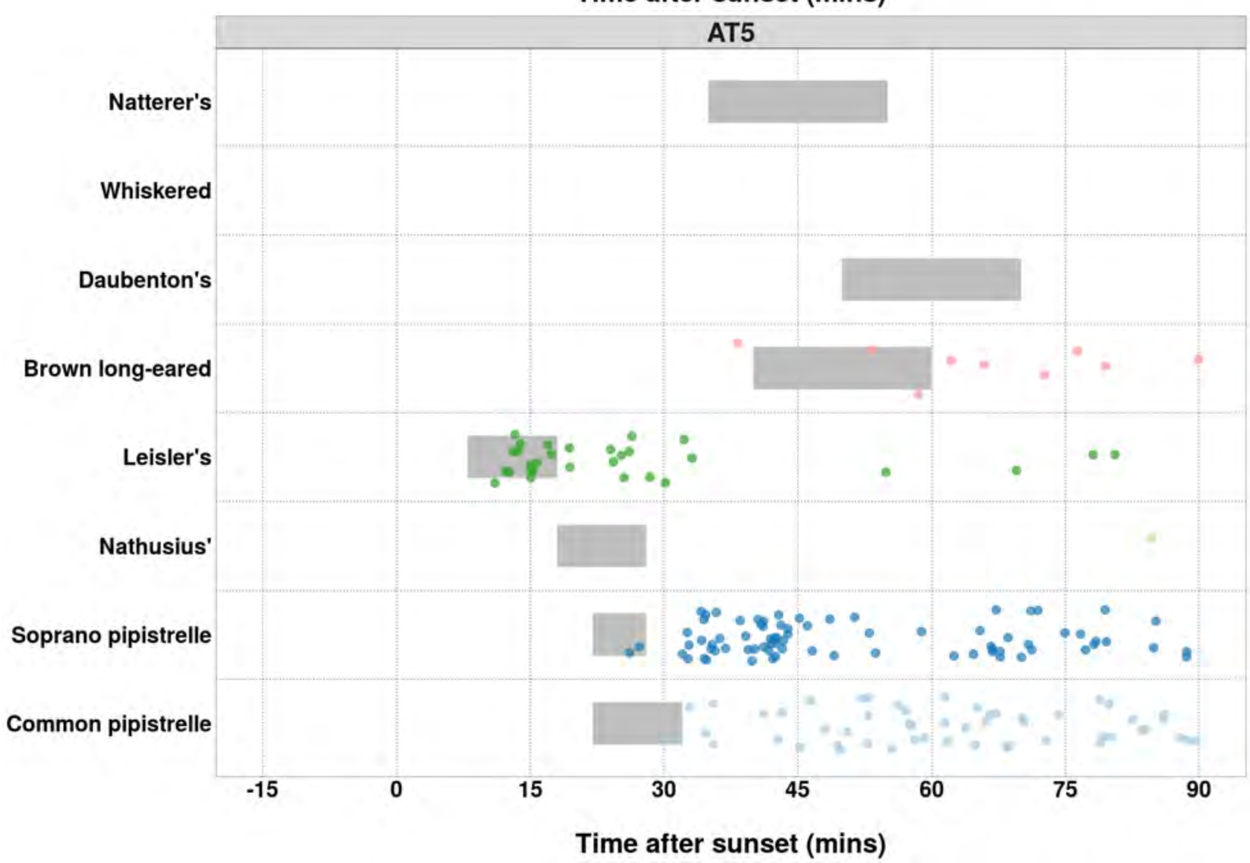
Bat Passes Potentially Indicating Close Proximity to a Roost (Russ 2012) - Figures

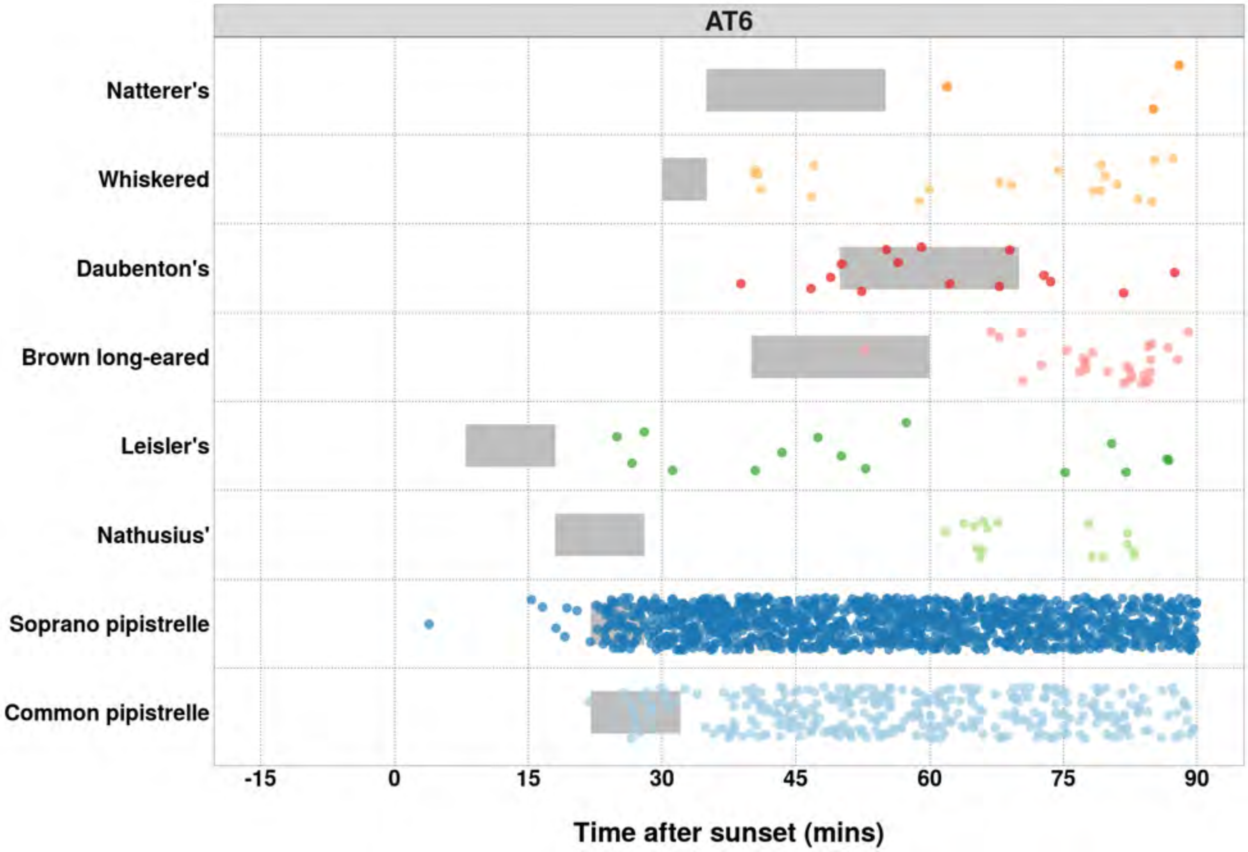
Figure 8. Time from 15 minutes before to 90 minutes after sunset. Species-specific emergence time ranges are shown as grey bars. Bat passes overlapping species-specific grey bars, or occuring earlier than this time range, may potentially indicate the presence of a nearby roost.


AT2
Natterer's
Whiskered
Daubenton's
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
-15
0
15
30
45
60
75
90
Time after sunset (mins)


AT3
Natterer's
Whiskered
Daubenton's
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
-15
0
15
30
45
60
75
90
Time after sunset (mins)


AT4
Natterer's
Whiskered
Daubenton's
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
-15
0
15
30
45
60
75
90
Time after sunset (mins)


AT5
Natterer's
Whiskered
Daubenton's
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
-15
0
15
30
45
60
75
90
Time after sunset (mins)



AT6
Natterer's
Whiskered
Daubenton's
Brown long-eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
-15
0
15
30
45
60
75
90
Time after sunset (mins)

Counts of Bat Passes

All detectors

Table 14. The total number of passes recorded for each species across all of the detectors. The 'Total' percentage may not be exactly 100% due to rounding of the percentages per species.

Species	Passes (No.)	Percentage of total (%)
Common pipistrelle	2926	27.8
Soprano pipistrelle	5876	55.9
Nathusius'	90	0.9
Leisler's	292	2.8
Brown long-eared	809	7.7
Daubenton's	207	2.0
Whiskered	240	2.3
Natterer's	68	0.6
Total	10508	100.0

Counts of Bat Passes

Per Detector

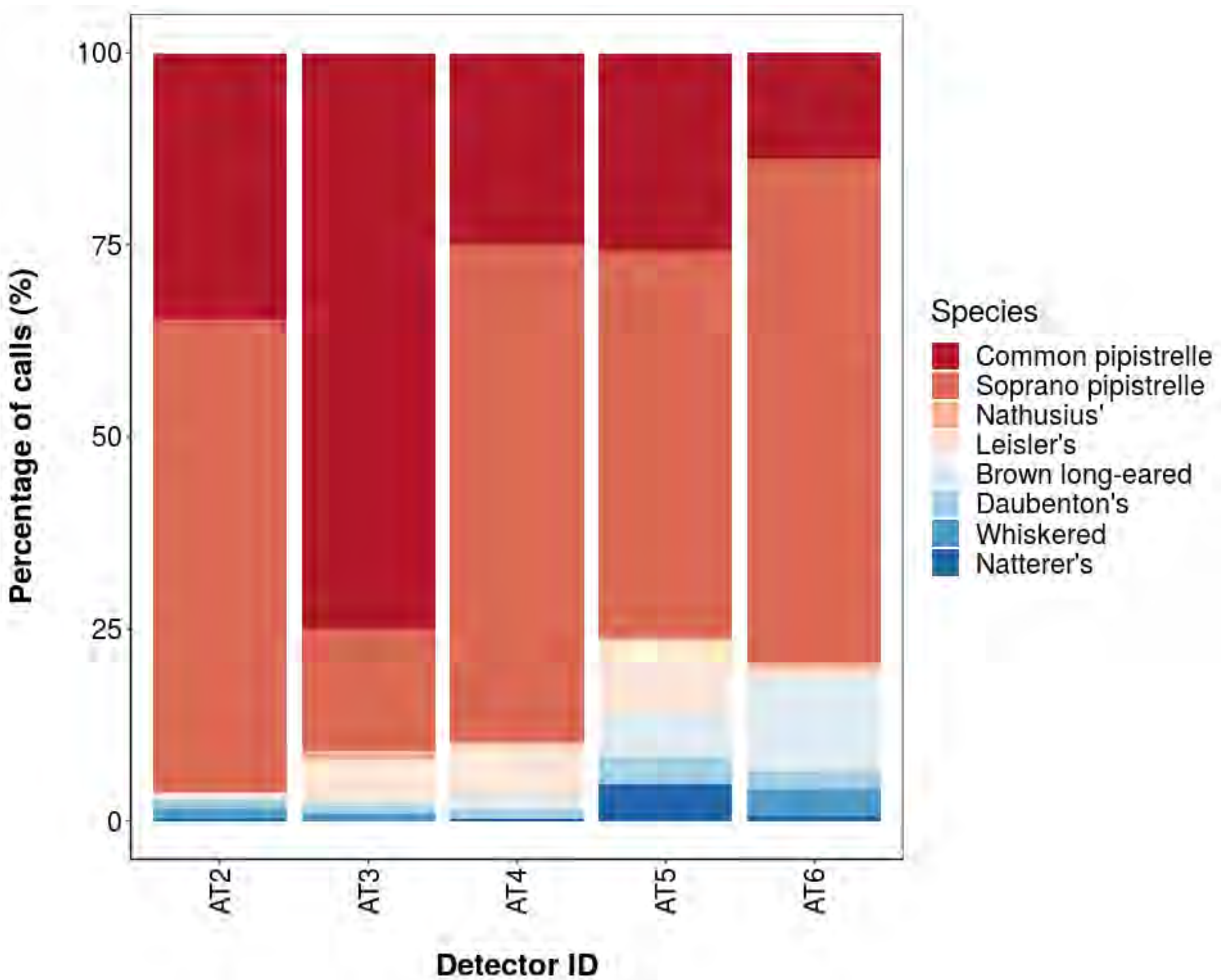
Table 15. The number of passes recorded for each species at each detector.

Species	Detector ID	Count (No)	Percentage by Detector (%)
Common pipistrelle	AT2	327	34.6
Common pipistrelle	AT3	1322	74.9
Common pipistrelle	AT4	307	24.9
Common pipistrelle	AT5	139	25.7
Common pipistrelle	AT6	831	13.8
Soprano pipistrelle	AT2	581	61.5
Soprano pipistrelle	AT3	279	15.8
Soprano pipistrelle	AT4	797	64.7
Soprano pipistrelle	AT5	272	50.4
Soprano pipistrelle	AT6	3947	65.5
Nathusius’	AT2	2	0.2
Nathusius’	AT3	22	1.2
Nathusius’	AT4	6	0.5
Nathusius’	AT5	2	0.4
Nathusius’	AT6	58	1.0
Leisler’s	AT2	5	0.5
Leisler’s	AT3	94	5.3
Leisler’s	AT4	80	6.5
Leisler’s	AT5	51	9.4
Leisler’s	AT6	62	1.0
Brown long-eared	AT2	3	0.3
Brown long-eared	AT3	13	0.7
Brown long-eared	AT4	24	1.9
Brown long-eared	AT5	31	5.7
Brown long-eared	AT6	738	12.2
Daubenton’s	AT2	11	1.2
Daubenton’s	AT3	18	1.0
Daubenton’s	AT4	14	1.1
Daubenton’s	AT5	19	3.5

Daubenton’s	AT6	145	2.4
Whiskered	AT2	13	1.4
Whiskered	AT3	17	1.0
Whiskered	AT6	210	3.5
Natterer’s	AT2	2	0.2
Natterer’s	AT4	4	0.3
Natterer’s	AT5	26	4.8
Natterer’s	AT6	36	0.6

Species Composition

Figure 10. Percentage species composition of passes at each detector.



PART 2a: Presence Only

THE NEXT SECTION OF THE REPORT FEATURES THE RAW DATA SUPPLIED TO ECOBAT AND ONLY TAKES INTO ACCOUNT THE PRESENCE, AND NOT THE ABSENCE, OF EACH BAT SPECIES. FOR EACH NIGHT, THERE IS NO 'ZERO DATA' FOR WHEN SPECIES WERE NOT DETECTED.

Nightly Bat Pass Rate (Bat passes per hour)

Median Per Detector

Table 16. The median Nightly Pass Rate (bat passes per hour, per night) of each species. If NA, then no bat passes.

Bat pass rates are often highly variable between nights, with some nights having few or no passes and other nights having high activity. In these circumstances, the median is likely to be a more useful summary of the 'average' activity than is the mean. For further information see: *Lintott, P. R., & Mathews, F. (2018). Basic mathematical errors may make ecological assessments unreliable. Biodiversity and Conservation, 27(1), 265-267.* https://doi.org/10.1007/s10531-017-1418-5

Species	Detector ID	Median Pass Rate
Common pipistrelle	AT2	1.1
Common pipistrelle	AT3	4.6
Common pipistrelle	AT4	0.9
Common pipistrelle	AT5	0.5
Common pipistrelle	AT6	2.4
Soprano pipistrelle	AT2	1.8
Soprano pipistrelle	AT3	1.2
Soprano pipistrelle	AT4	1.0
Soprano pipistrelle	AT5	0.6
Soprano pipistrelle	AT6	16.5
Nathusius'	AT2	0.1
Nathusius'	AT3	0.2
Nathusius'	AT4	0.1
Nathusius'	AT5	0.1
Nathusius'	AT6	0.3
Leisler's	AT2	0.1
Leisler's	AT3	0.1
Leisler's	AT4	0.2
Leisler's	AT5	0.2
Leisler's	AT6	0.3
Brown long-eared	AT2	0.1
Brown long-eared	AT3	0.1
Brown long-eared	AT4	0.2

Brown long-eared	AT5	0.2
Brown long-eared	AT6	2.5
Daubenton’s	AT2	0.1
Daubenton’s	AT3	0.1
Daubenton’s	AT4	0.1
Daubenton’s	AT5	0.2
Daubenton’s	AT6	0.7
Whiskered	AT2	0.1
Whiskered	AT3	0.2
Whiskered	AT6	1.2
Natterer’s	AT2	0.1
Natterer’s	AT4	0.1
Natterer’s	AT5	0.3
Natterer’s	AT6	0.2

Nightly Bat Pass Rate (Bat passes per hour)

Mean per Detector

Table 17. The mean Nightly Pass Rate (bat passes per hour, per night) of each species at each detector. Values are given to 1 decimal place.

We recommend using the median values given above, for the reasons stated above, but provide the mean values in the table below.

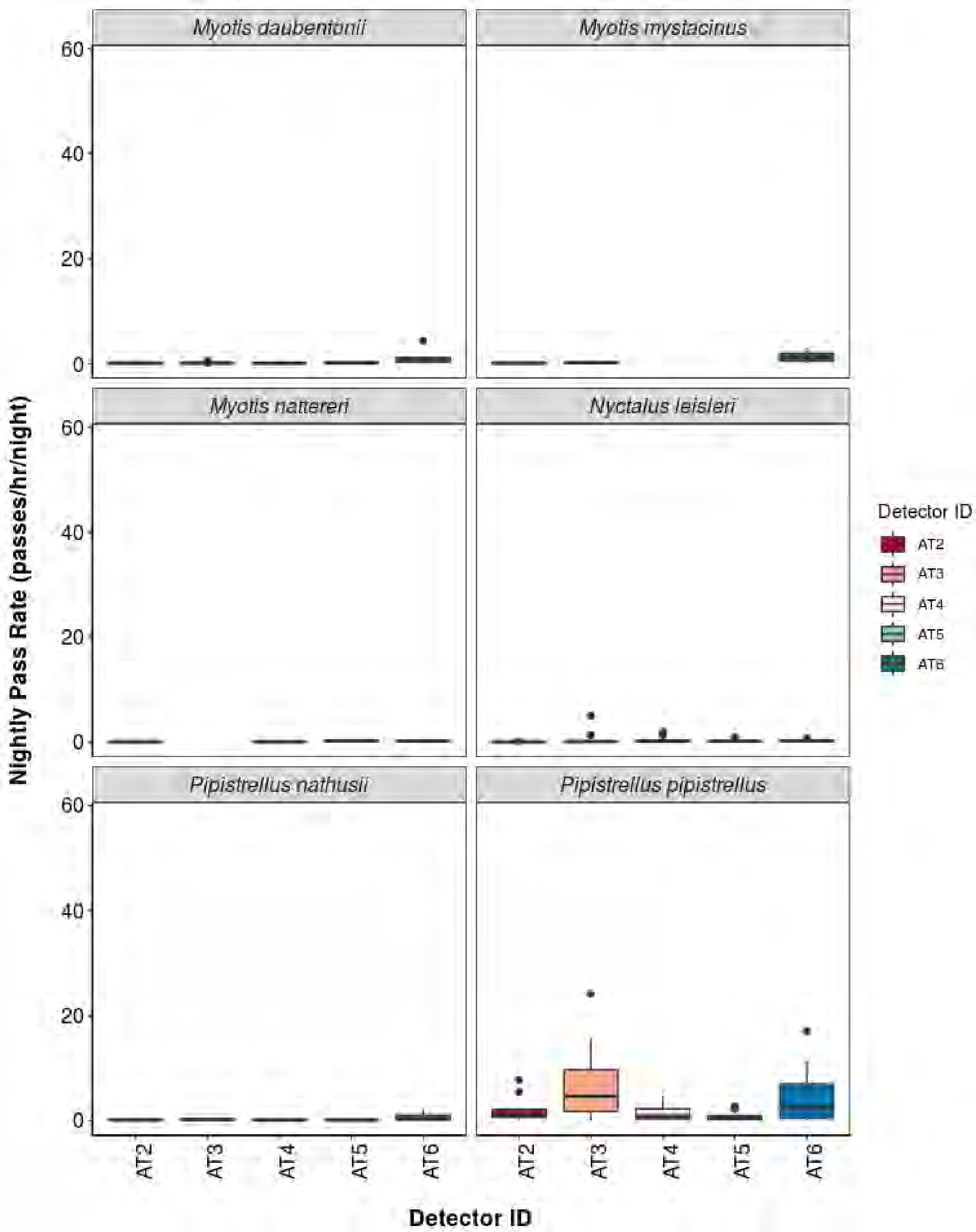
Species	Detector ID	Mean Pass Rate
Common pipistrelle	AT2	1.8
Common pipistrelle	AT3	7.0
Common pipistrelle	AT4	1.4
Common pipistrelle	AT5	0.7
Common pipistrelle	AT6	4.2
Soprano pipistrelle	AT2	2.7
Soprano pipistrelle	AT3	1.3
Soprano pipistrelle	AT4	2.9
Soprano pipistrelle	AT5	1.3
Soprano pipistrelle	AT6	19.9
Nathusius’	AT2	0.1
Nathusius’	AT3	0.2
Nathusius’	AT4	0.1
Nathusius’	AT5	0.1
Nathusius’	AT6	0.7
Leisler’s	AT2	0.1
Leisler’s	AT3	0.6
Leisler’s	AT4	0.4
Leisler’s	AT5	0.3
Leisler’s	AT6	0.3
Brown long-eared	AT2	0.1
Brown long-eared	AT3	0.2
Brown long-eared	AT4	0.2
Brown long-eared	AT5	0.2
Brown long-eared	AT6	3.7
Daubenton’s	AT2	0.1

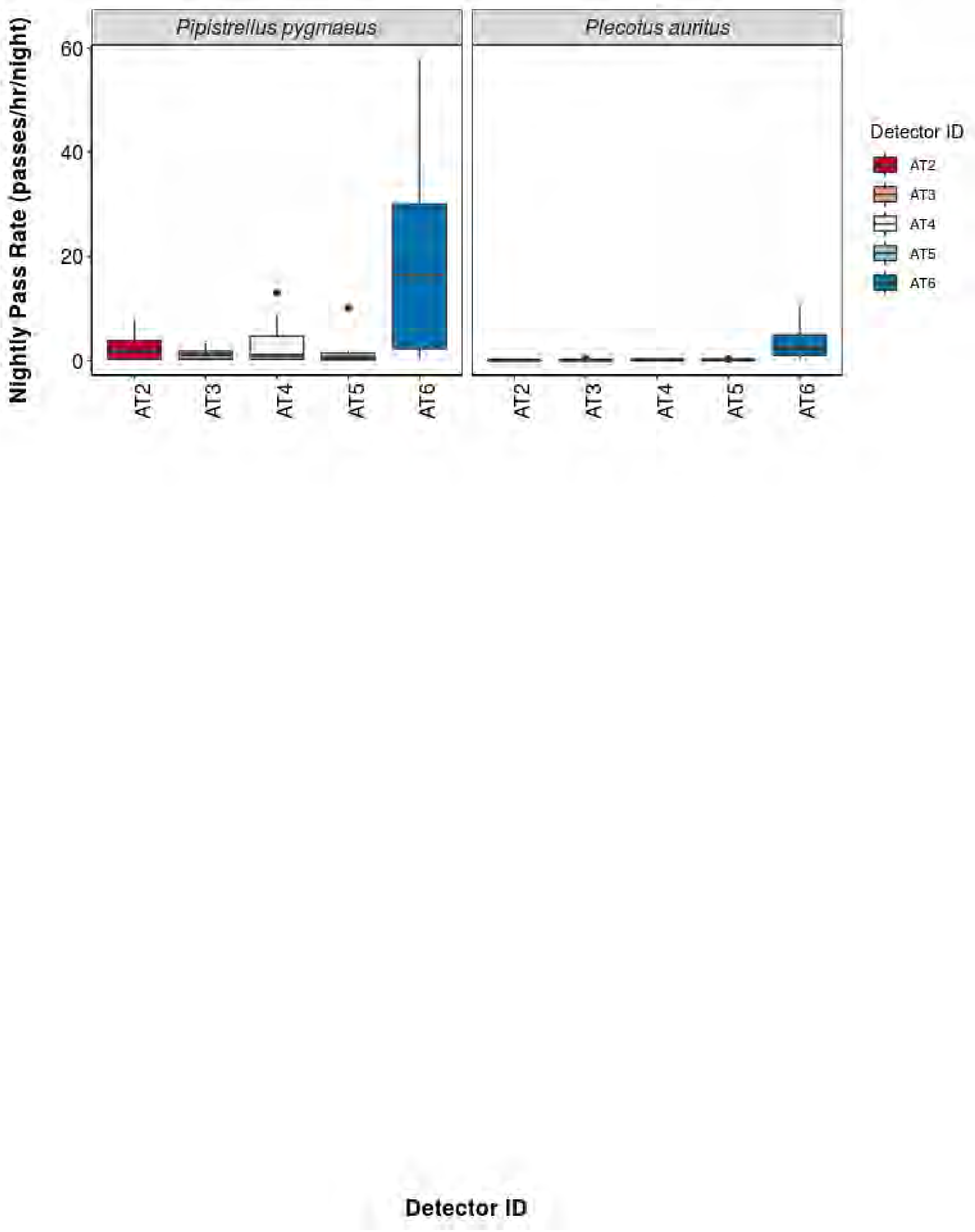
Daubenton’s	AT3	0.1
Daubenton’s	AT4	0.1
Daubenton’s	AT5	0.2
Daubenton’s	AT6	1.0
Whiskered	AT2	0.2
Whiskered	AT3	0.2
Whiskered	AT6	1.3
Natterer’s	AT2	0.1
Natterer’s	AT4	0.1
Natterer’s	AT5	0.3
Natterer’s	AT6	0.3

Nightly Bat Passes (Bat passes per hour)

Per Detector - Figures

Figure 11. Boxplots for the number of bat passes per hour each night, for each detector. The ‘box’ shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The ‘whiskers’ extend from the box and represent the ranges for the bottom 25% and the top 25% of the data values, excluding outliers. An outlier is any extreme value that lies further away from the box than 1.5 times the interquartile range. Outliers are shown as dots. Where very few passes are recorded it is not possible to produce the box, so the data are shown as a line.


Myotis daubentonii
Myotis mystacinus
Myotis nattereri
Nyctalus leisleri
Pipistrellus nathusii
Pipistrellus pipistrellus
Nightly Pass Rate (passes/hr/night)
Detector ID
0
20
40
60
AT2
AT3
AT4
AT5
AT6
Detector ID
AT2
AT3
AT4
AT5
AT6


Pipistrellus pygmaeus
Plecotus auritus
Nightly Pass Rate (passes/hr/night)
60
40
20
0
AT2
AT3
AT4
AT5
AT6
Detector ID
AT2
AT3
AT4
AT5
AT6
Detector ID

SPLIT BY MONTH

Total Bat Passes per Detector, each Month

Per Detector

Table 18. The total number of bat passes of each species in each month at each detector. This table simply tells you how many bats of each species were recorded passing each detector during each month. These numbers are not standardised by the night length, or how many nights each detector was active for during each month.

Species	Detector ID	Sep	Oct
Common pipistrelle	AT2	325	2
Common pipistrelle	AT3	1243	79
Common pipistrelle	AT4	299	8
Common pipistrelle	AT5	137	2
Common pipistrelle	AT6	831	0
Soprano pipistrelle	AT2	569	12
Soprano pipistrelle	AT3	241	38
Soprano pipistrelle	AT4	765	32
Soprano pipistrelle	AT5	268	4
Soprano pipistrelle	AT6	3947	0
Nathusius’	AT2	2	0
Nathusius’	AT3	21	1
Nathusius’	AT4	6	0
Nathusius’	AT5	2	0
Nathusius’	AT6	58	0
Leisler’s	AT2	5	0
Leisler’s	AT3	73	21
Leisler’s	AT4	73	7
Leisler’s	AT5	44	7
Leisler’s	AT6	62	0
Brown long-eared	AT2	3	0
Brown long-eared	AT3	11	2
Brown long-eared	AT4	22	2
Brown long-eared	AT5	22	9

Brown long-eared	AT6	738	0
Daubenton’s	AT2	10	1
Daubenton’s	AT3	15	3
Daubenton’s	AT4	10	4
Daubenton’s	AT5	17	2
Daubenton’s	AT6	145	0
Whiskered	AT2	13	0
Whiskered	AT3	16	1
Whiskered	AT6	210	0
Natterer’s	AT2	2	0
Natterer’s	AT4	4	0
Natterer’s	AT5	25	1
Natterer’s	AT6	36	0

Survey Effort

Table 19. The number of survey nights per month per detector.

Month	Detector ID	No. of Survey Nights
Sep	AT2	14
Sep	AT3	13
Sep	AT4	17
Sep	AT5	18
Sep	AT6	18
Oct	AT2	4
Oct	AT3	5
Oct	AT4	7
Oct	AT5	5

Nightly Bat Pass Rate for each Month

Median Per Detector

Table 20. The median Nightly Pass Rate (bat passes per hour, per night) of each species throughout each month. If NA, then no bat passes.

Bat pass rates are often highly variable between nights, with some nights having few or no passes and other nights having high activity. In these circumstances, the median is likely to be a more useful summary of the 'average' activity than is the mean. For further information see: *Lintott, P. R., & Mathews, F. (2018). Basic mathematical errors may make ecological assessments unreliable. Biodiversity and Conservation, 27(1), 265-267.* https://doi.org/10.1007/s10531-017-1418-5

Species	Detector ID	Sep	Oct
Common pipistrelle	AT2	1.4	0.2
Common pipistrelle	AT3	7.2	1.5
Common pipistrelle	AT4	1.4	0.1
Common pipistrelle	AT5	0.6	0.1
Common pipistrelle	AT6	2.4	NA
Soprano pipistrelle	AT2	3.1	0.2
Soprano pipistrelle	AT3	1.8	0.2
Soprano pipistrelle	AT4	3.2	0.3
Soprano pipistrelle	AT5	0.7	0.1
Soprano pipistrelle	AT6	16.5	NA
Nathusius'	AT2	0.1	NA
Nathusius'	AT3	0.2	0.1
Nathusius'	AT4	0.1	NA
Nathusius'	AT5	0.1	NA
Nathusius'	AT6	0.3	NA
Leisler's	AT2	0.1	NA
Leisler's	AT3	0.1	0.1
Leisler's	AT4	0.2	0.1
Leisler's	AT5	0.2	0.2
Leisler's	AT6	0.3	NA
Brown long-eared	AT2	0.1	NA
Brown long-eared	AT3	0.1	0.1
Brown long-eared	AT4	0.2	0.1

Brown long-eared	AT5	0.1	0.2
Brown long-eared	AT6	2.5	NA
Daubenton’s	AT2	0.1	0.1
Daubenton’s	AT3	0.1	0.1
Daubenton’s	AT4	0.1	0.1
Daubenton’s	AT5	0.1	0.2
Daubenton’s	AT6	0.7	NA
Whiskered	AT2	0.1	NA
Whiskered	AT3	0.2	0.1
Whiskered	AT6	1.2	NA
Natterer’s	AT2	0.1	NA
Natterer’s	AT4	0.1	NA
Natterer’s	AT5	0.4	0.1
Natterer’s	AT6	0.2	NA

Nightly Bat Pass Rate for each Month

Mean per Detector

Table 21: The mean Nightly Pass Rate (bat passes per hour, per night) of each species throughout each month. Values are given to 1 decimal place.

We recommend using the median values given above, for the reasons stated above, but provide the mean values in the table below.

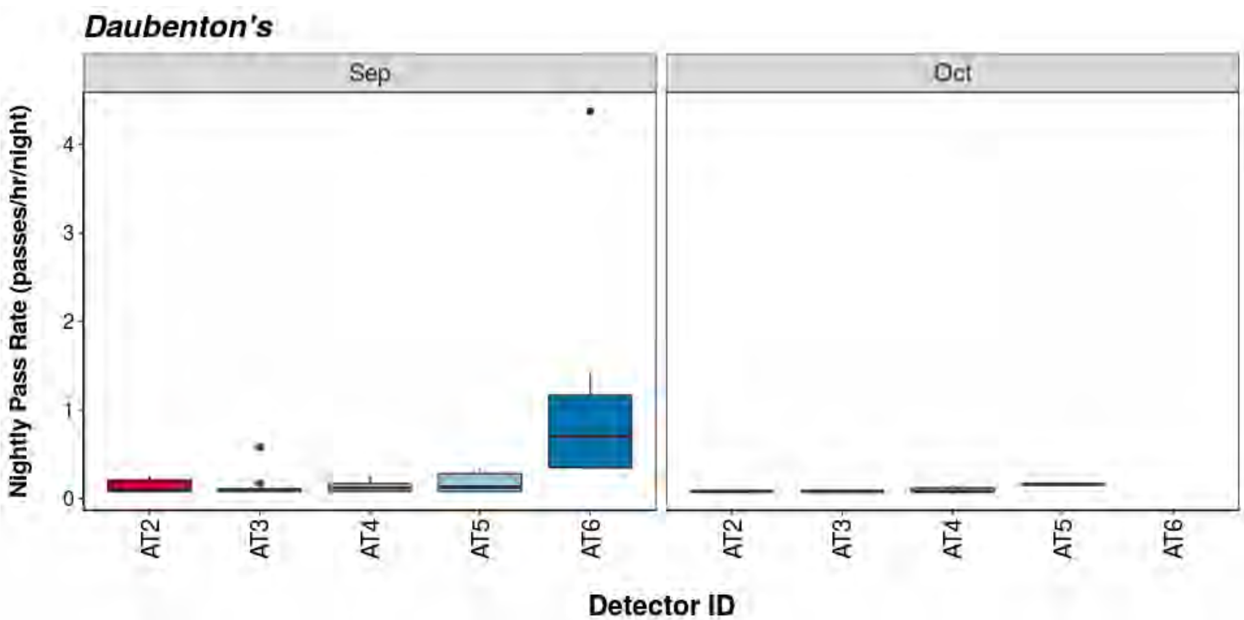
Species	Detector ID	Sep	Oct
Common pipistrelle	AT2	2.0	0.2
Common pipistrelle	AT3	8.2	2.1
Common pipistrelle	AT4	1.6	0.2
Common pipistrelle	AT5	0.8	0.1
Common pipistrelle	AT6	4.2	NA
Soprano pipistrelle	AT2	3.5	0.2
Soprano pipistrelle	AT3	1.6	0.6
Soprano pipistrelle	AT4	3.9	0.4
Soprano pipistrelle	AT5	1.5	0.1
Soprano pipistrelle	AT6	19.9	NA
Nathusius’	AT2	0.1	NA
Nathusius’	AT3	0.3	0.1
Nathusius’	AT4	0.1	NA
Nathusius’	AT5	0.1	NA
Nathusius’	AT6	0.7	NA
Leisler’s	AT2	0.1	NA
Leisler’s	AT3	0.7	0.4
Leisler’s	AT4	0.4	0.1
Leisler’s	AT5	0.3	0.2
Leisler’s	AT6	0.3	NA
Brown long-eared	AT2	0.1	NA
Brown long-eared	AT3	0.2	0.1
Brown long-eared	AT4	0.2	0.1
Brown long-eared	AT5	0.2	0.1
Brown long-eared	AT6	3.7	NA
Daubenton’s	AT2	0.1	0.1

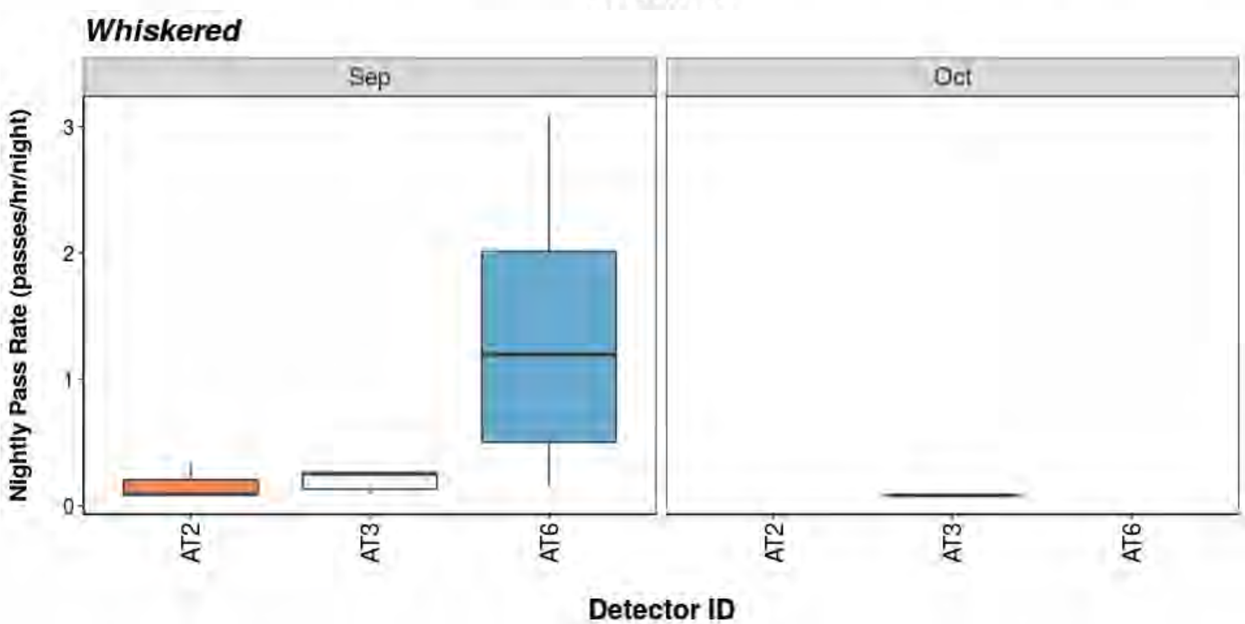
Daubenton’s	AT3	0.2	0.1
Daubenton’s	AT4	0.1	0.1
Daubenton’s	AT5	0.2	0.2
Daubenton’s	AT6	1.0	NA
Whiskered	AT2	0.2	NA
Whiskered	AT3	0.2	0.1
Whiskered	AT6	1.3	NA
Natterer’s	AT2	0.1	NA
Natterer’s	AT4	0.1	NA
Natterer’s	AT5	0.3	0.1
Natterer’s	AT6	0.3	NA

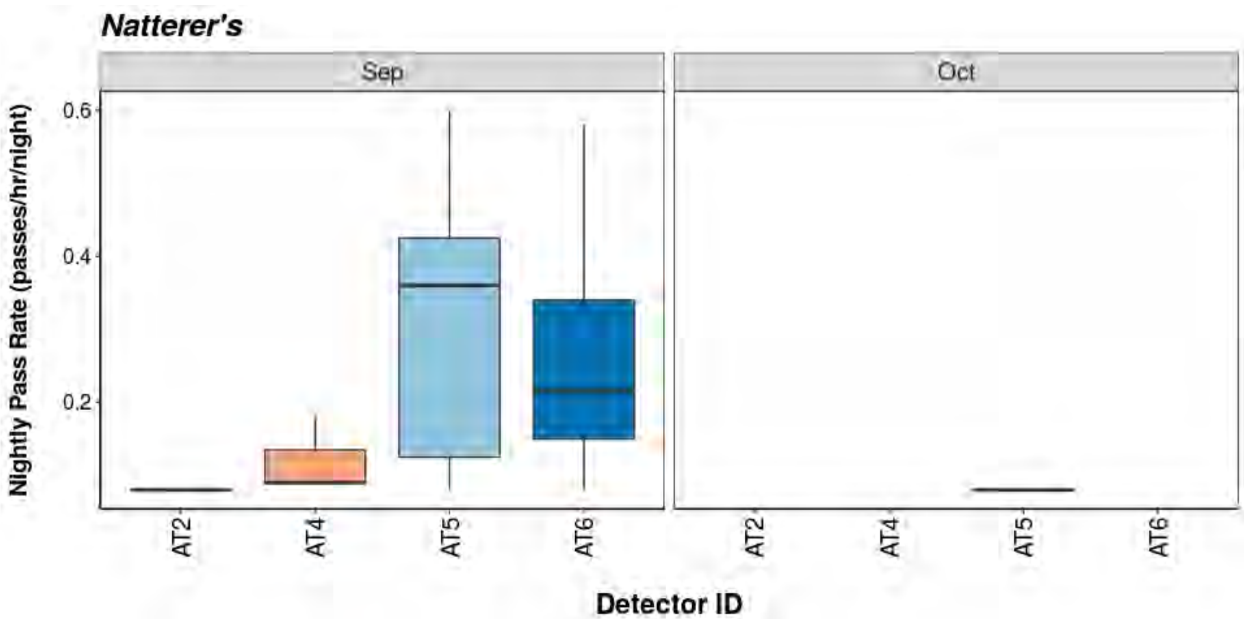
Nightly Bat Pass Rate for each Month

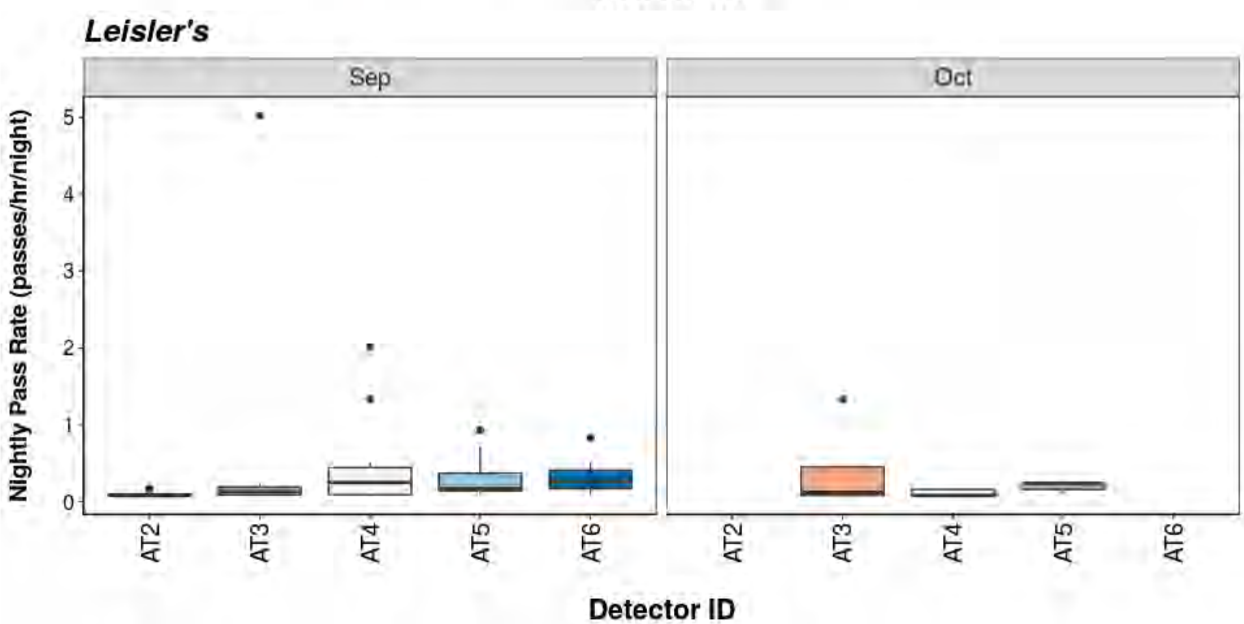
Per Detector - Figures

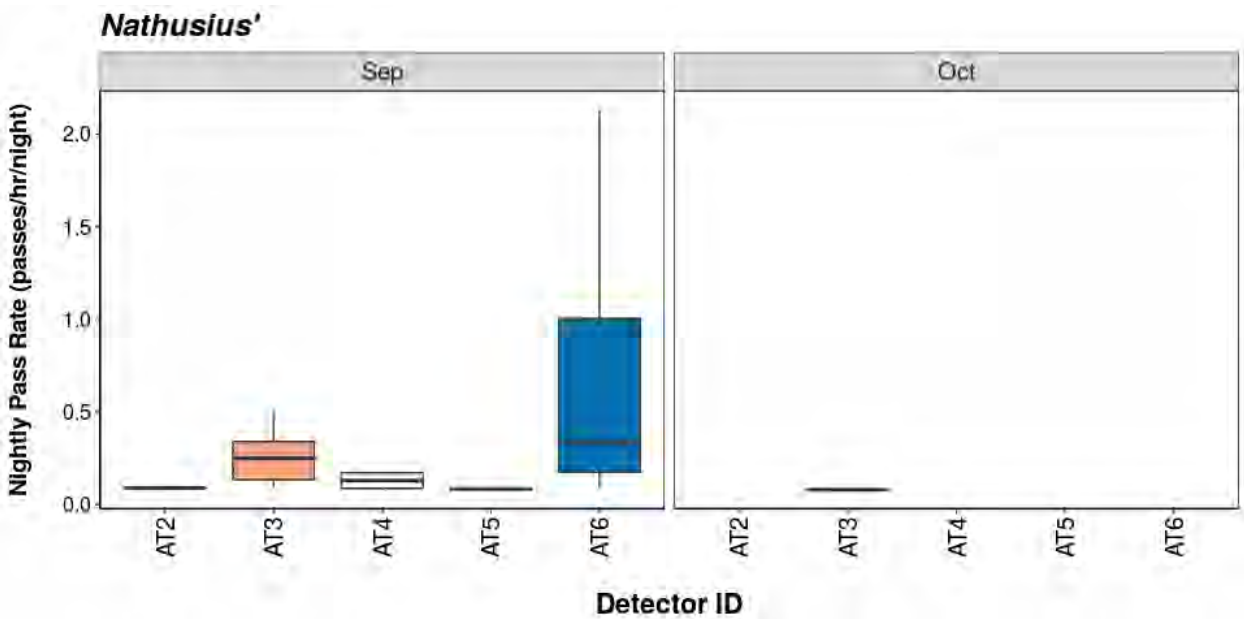
Figure 12. Figures show boxplots for the number of bat passes per hour by detector, for each month. The 'box' shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The 'whiskers' extend from the box and represent the ranges for the bottom 25% and the top 25% of the data values, excluding outliers. An outlier is any extreme value that lies further away from the box than 1.5 times the interquartile range. Outliers are shown as dots. Where very few passes are recorded it is not possible to produce the box, so the data are shown as a line.



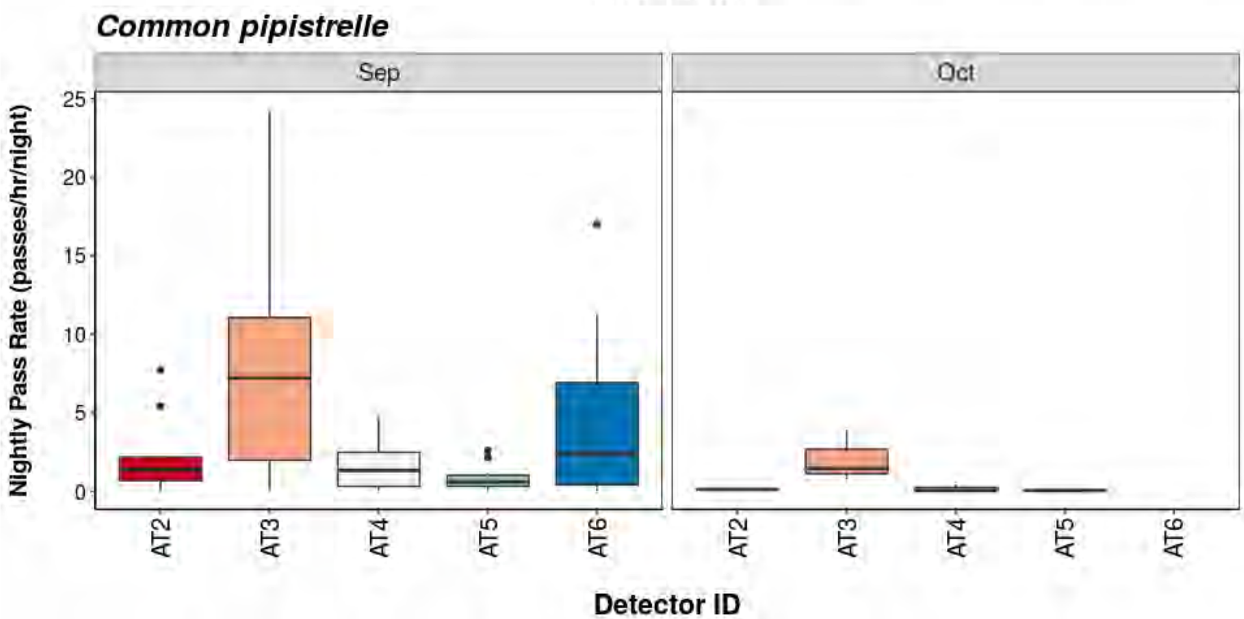



Natterer's
Sep
Oct
Nightly Pass Rate (passes/hr/night)
0.6
0.4
0.2
AT2
AT4
AT5
AT6
Detector ID

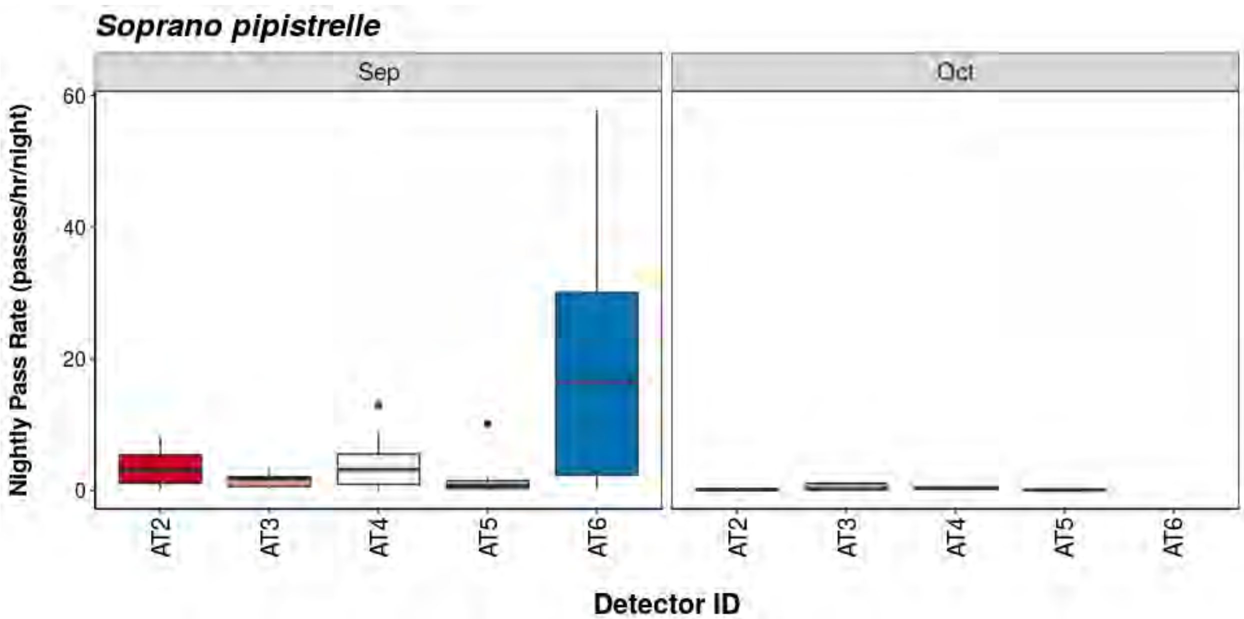

Leisler's
Sep
Oct
Nightly Pass Rate (passes/hr/night)
5
4
3
2
1
0
AT2
AT3
AT4
AT5
AT6
Detector ID



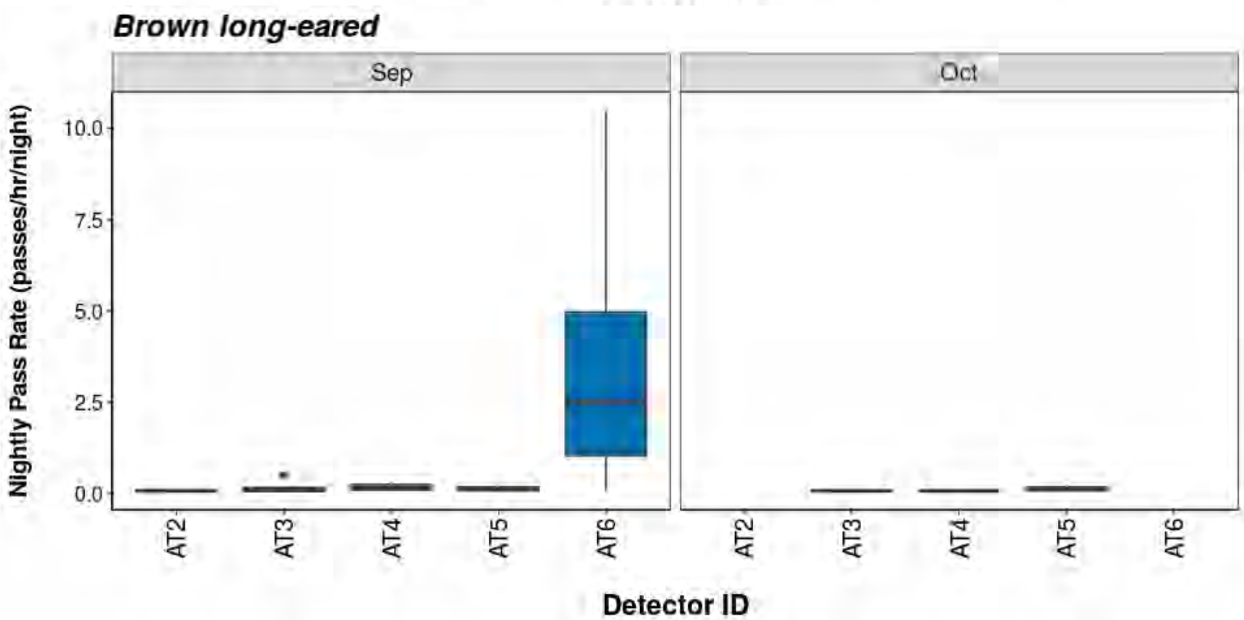
Nathusius'
Sep
Oct
Nightly Pass Rate (passes/hr/night)
2.0
1.5
1.0
0.5
0.0
AT2
AT3
AT4
AT5
AT6
Detector ID



Common pipistrelle
Sep
Oct
Nightly Pass Rate (passes/hr/night)
25
20
15
10
5
0
AT2
AT3
AT4
AT5
AT6
Detector ID



Soprano pipistrelle
Sep
Oct
Nightly Pass Rate (passes/hr/night)
60
40
20
0
AT2
AT3
AT4
AT5
AT6
Detector ID



Brown long-eared
Sep
Oct
Nightly Pass Rate (passes/hr/night)
10.0
7.5
5.0
2.5
0.0
AT2
AT3
AT4
AT5
AT6
Detector ID

Bat Activity per Detector Location

Figure 13. Detector ID reference:

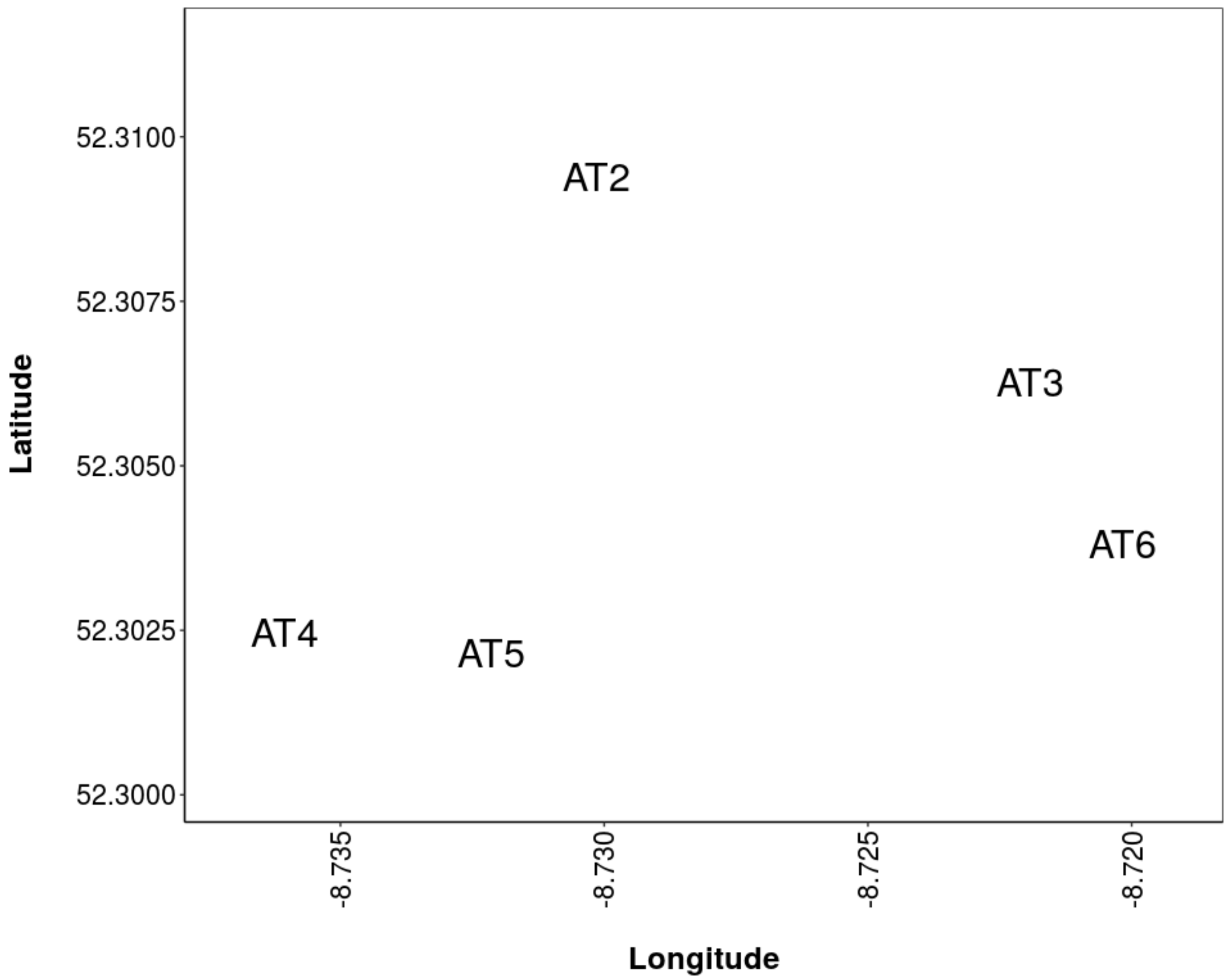
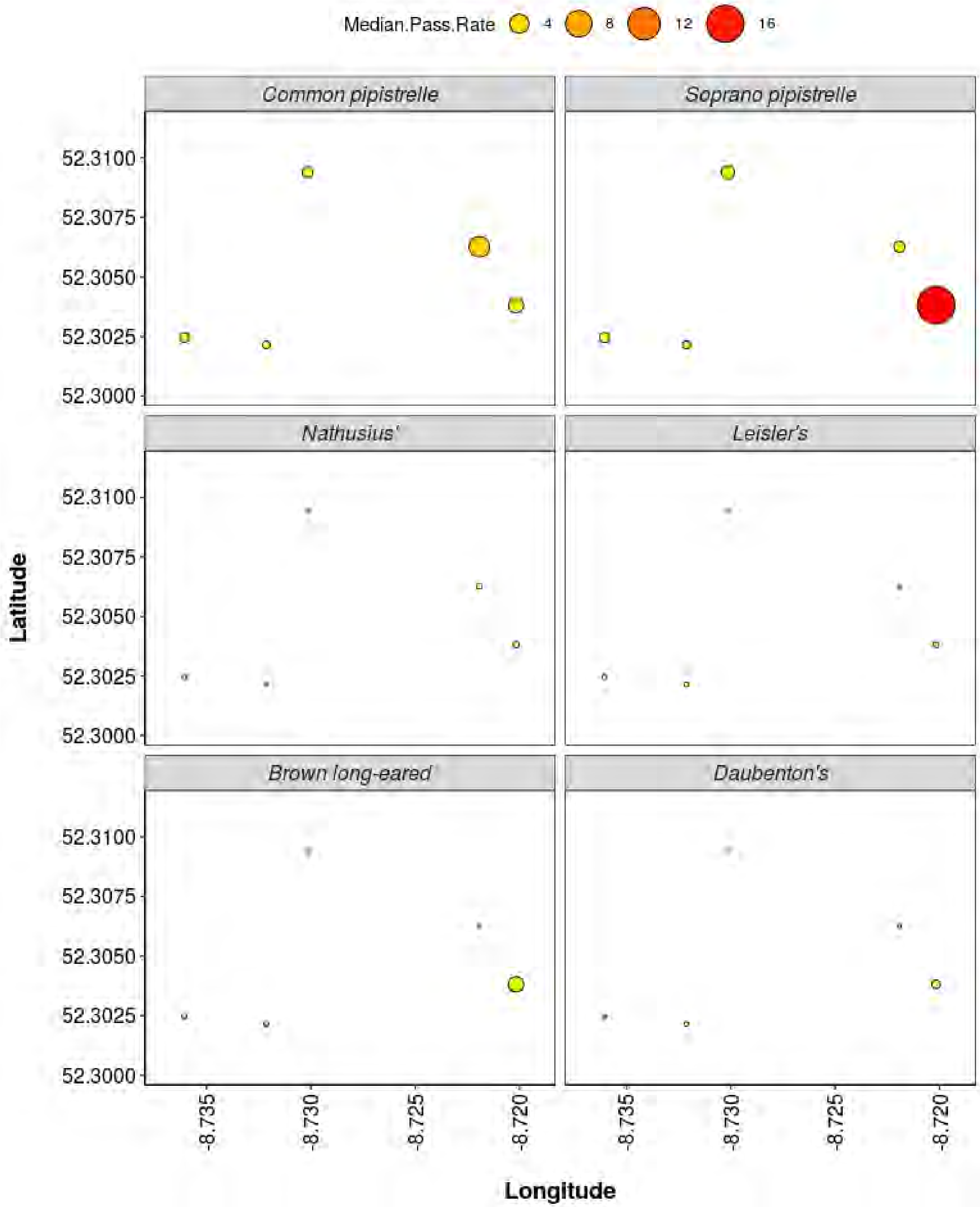


Figure 14. Median Nightly Pass Rate (bat passes/hr/night) throughout the survey period - represented by the size and colour of the point at each detector location.



Median.Pass.Rate
4
8
12
16
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Brown long-eared
Daubenton's
Latitude
52.3100
52.3075
52.3050
52.3025
52.3000
Longitude
-8.735
-8.730
-8.725
-8.720

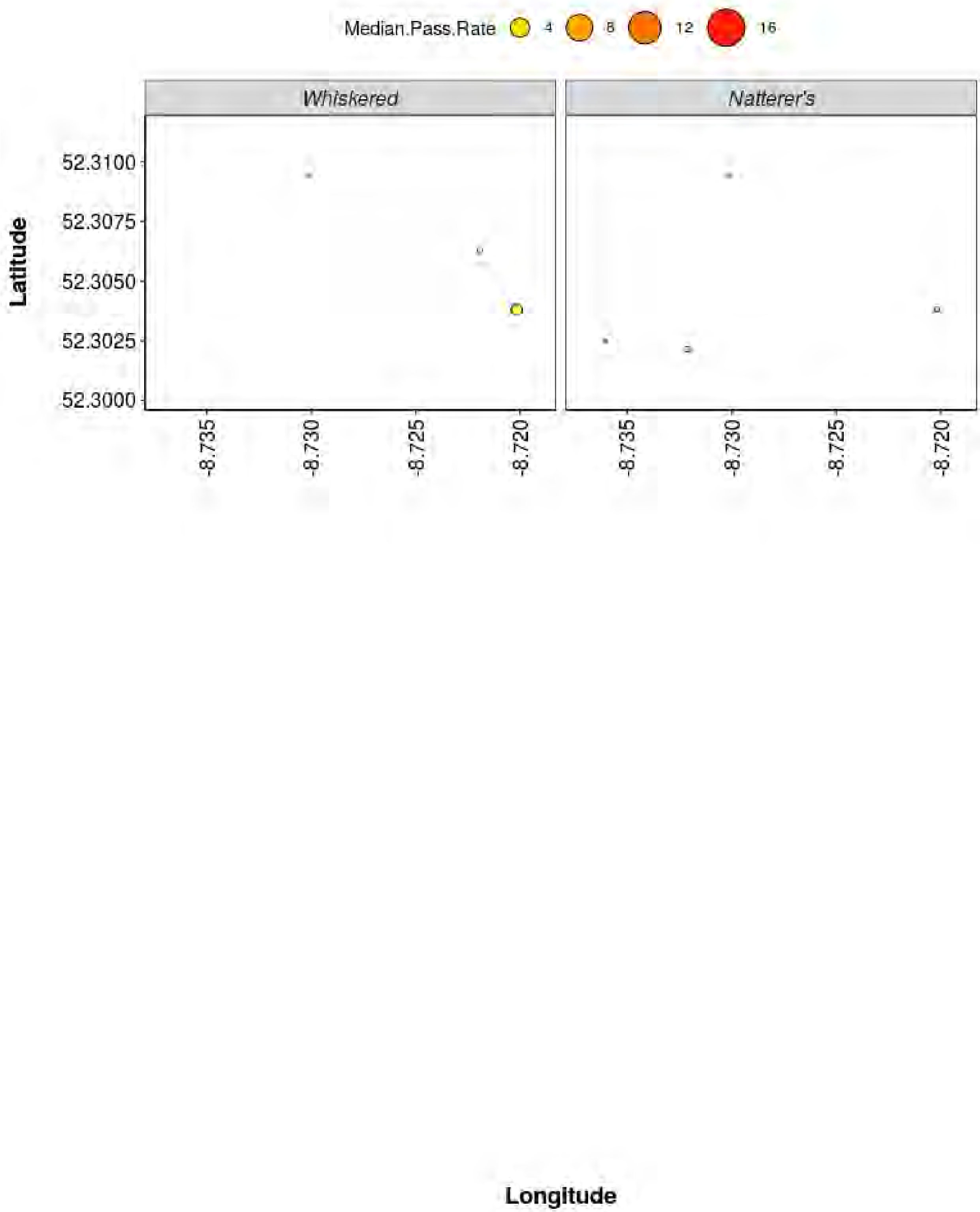
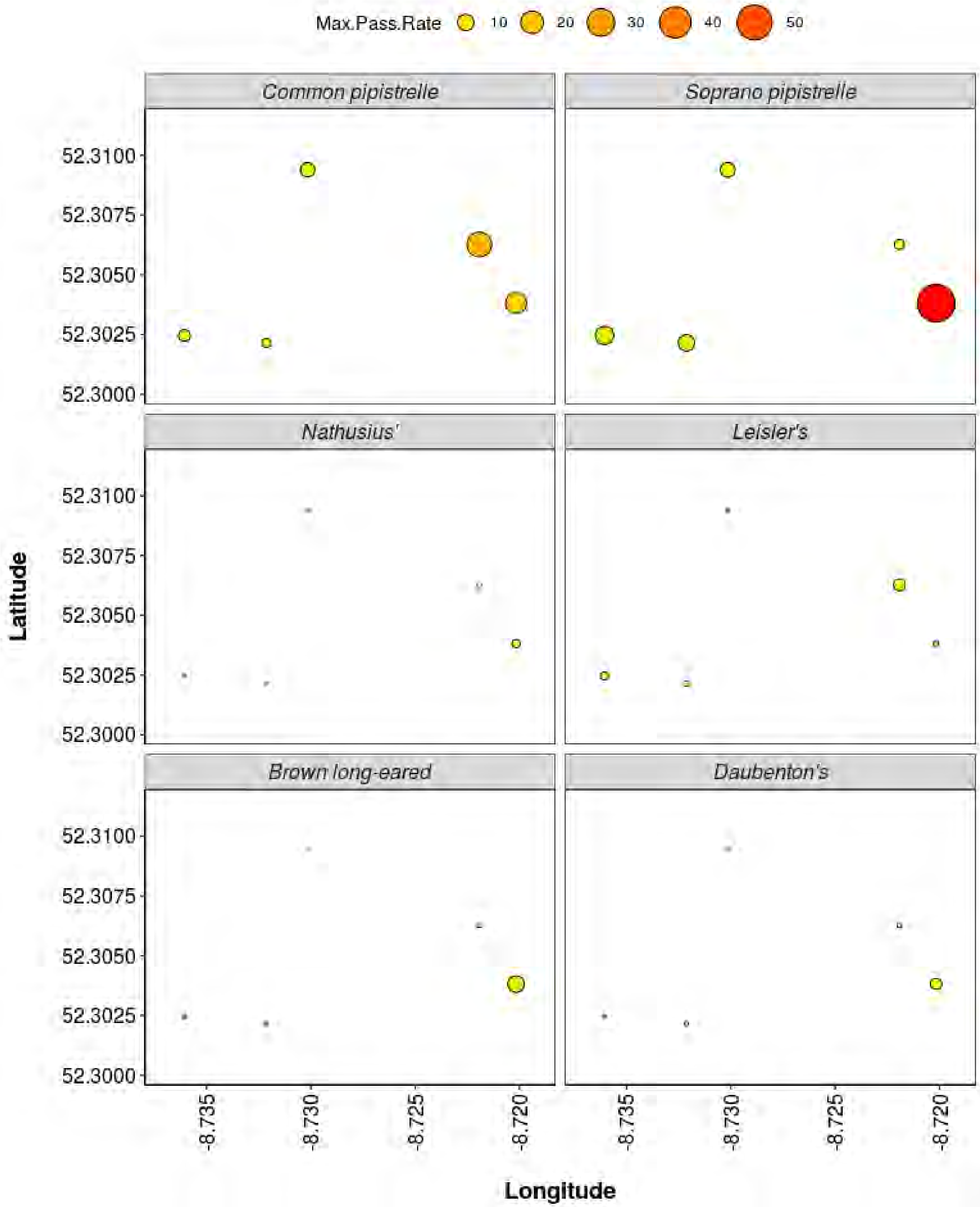
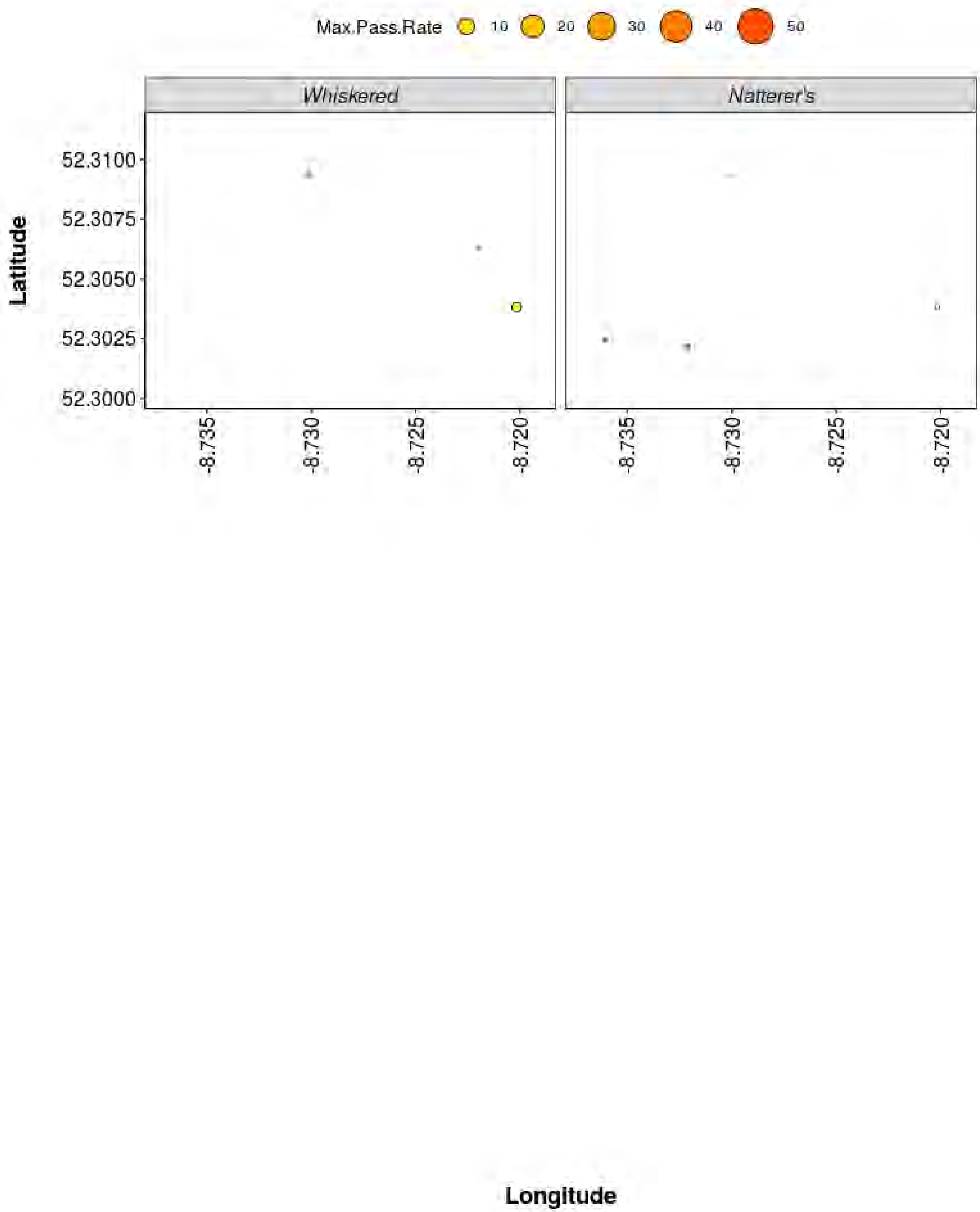

Median.Pass.Rate
4
8
12
16
Whiskered
Natterer's
Latitude
52.3100
52.3075
52.3050
52.3025
52.3000
-8.735
-8.730
-8.725
-8.720
Longitude

Figure 15. Maximum Nightly Pass Rate (bat passes/hr/night) recorded in a single night throughout the survey period - represented by the size and colour of the point at each detector location.



Max.Pass.Rate
10
20
30
40
50
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Brown long-eared
Daubenton's
Latitude
52.3100
52.3075
52.3050
52.3025
52.3000
Longitude
-8.735
-8.730
-8.725
-8.720


Max.Pass.Rate
10
20
30
40
50
Whiskered
Natterer's
Latitude
52.3100
52.3075
52.3050
52.3025
52.3000
-8.735
-8.730
-8.725
-8.720
Longitude

PART 2B: Includes absences

THE NEXT SECTION OF THE REPORT FEATURES THE DATA SUPPLIED TO ECOBAT BUT TAKES INTO ACCOUNT SPECIES ABSENCES, AND THEREFORE INCLUDES 'ZERO DATA' FOR WHEN SPECIES WERE NOT DETECTED AT EACH DETECTOR ON A NIGHT. THIS DRAMATICALLY LOWERS THE MEANS AND MEDIANS OF THE DATA PRESENTED.

Nightly Bat Pass Rate (Bat passes per hour)

Median Per Detector

Table 22. The median Nightly Pass Rate (bat passes per hour, per night) of each species. If NA, then no bat passes.

Bat pass rates are often highly variable between nights, with some nights having few or no passes and other nights having high activity. In these circumstances, the median is likely to be a more useful summary of the 'average' activity than is the mean. For further information see: *Lintott, P. R., & Mathews, F. (2018). Basic mathematical errors may make ecological assessments unreliable. Biodiversity and Conservation, 27(1), 265-267.* https://doi.org/10.1007/s10531-017-1418-5

Species	Detector ID	Median Pass Rate
Brown long-eared	AT2	0.0
Brown long-eared	AT3	0.0
Brown long-eared	AT4	0.0
Brown long-eared	AT5	0.1
Brown long-eared	AT6	2.3
Common pipistrelle	AT2	0.9
Common pipistrelle	AT3	4.0
Common pipistrelle	AT4	0.4
Common pipistrelle	AT5	0.2
Common pipistrelle	AT6	2.2
Daubenton's	AT2	0.0
Daubenton's	AT3	0.1
Daubenton's	AT4	0.0
Daubenton's	AT5	0.0
Daubenton's	AT6	0.4
Leisler's	AT2	0.0
Leisler's	AT3	0.1
Leisler's	AT4	0.1
Leisler's	AT5	0.1
Leisler's	AT6	0.3
Nathusius'	AT2	0.0
Nathusius'	AT3	0.0
Nathusius'	AT4	0.0

Nathusius’	AT5	0.0
Nathusius’	AT6	0.0
Natterer’s	AT2	0.0
Natterer’s	AT3	0.0
Natterer’s	AT4	0.0
Natterer’s	AT5	0.0
Natterer’s	AT6	0.1
Soprano pipistrelle	AT2	1.8
Soprano pipistrelle	AT3	1.2
Soprano pipistrelle	AT4	1.0
Soprano pipistrelle	AT5	0.3
Soprano pipistrelle	AT6	12.8
Whiskered	AT2	0.0
Whiskered	AT3	0.0
Whiskered	AT4	0.0
Whiskered	AT5	0.0
Whiskered	AT6	0.5

Nightly Bat Pass Rate (Bat passes per hour)

Mean per Detector

Table 23. The mean Nightly Pass Rate (bat passes per hour, per night) of each species at each detector. Values are given to 1 decimal place.

We recommend using the median values given above, for the reasons stated above, but provide the mean values in the table below.

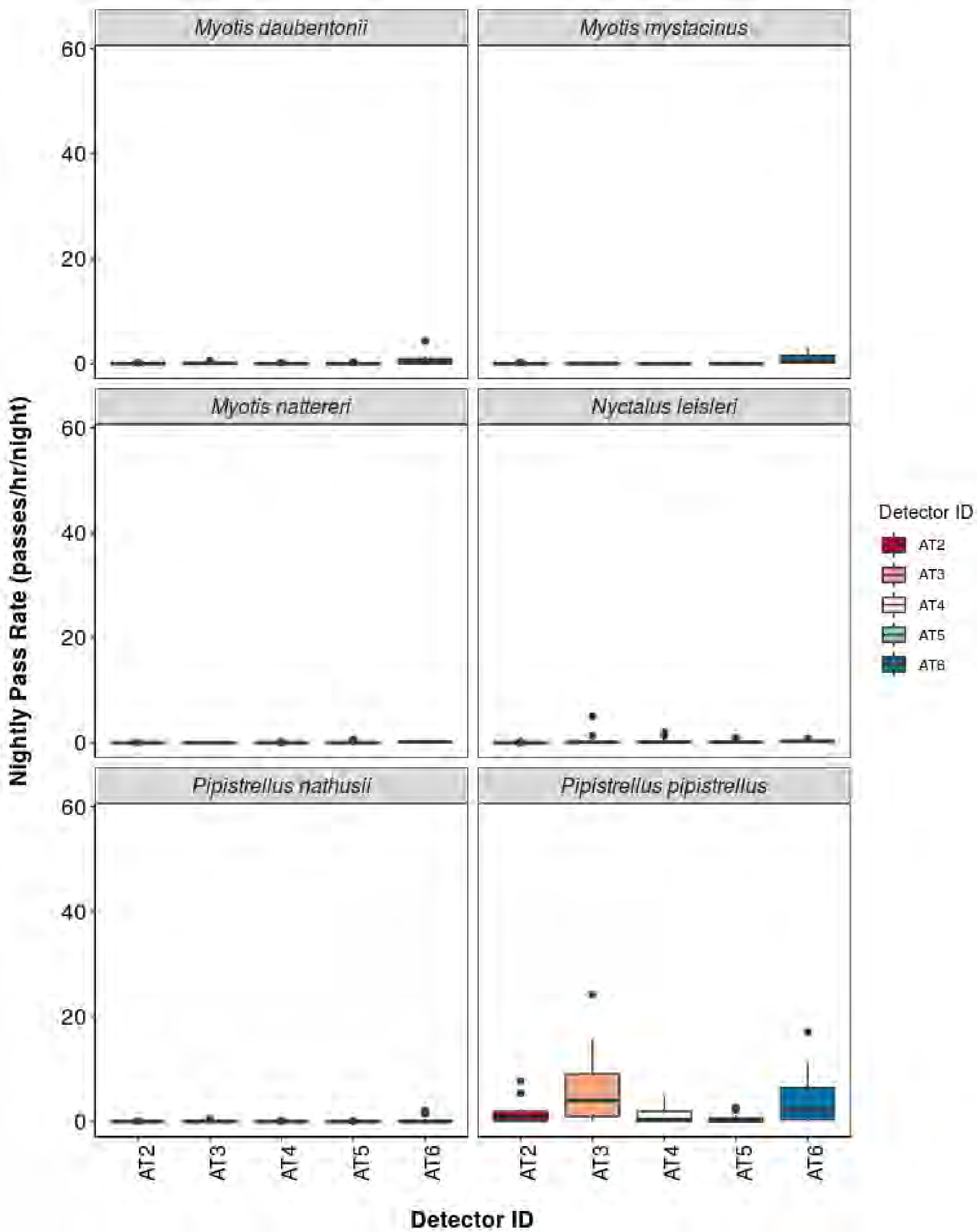
Species	Detector ID	Mean Pass Rate
Brown long-eared	AT2	0.0
Brown long-eared	AT3	0.1
Brown long-eared	AT4	0.1
Brown long-eared	AT5	0.1
Brown long-eared	AT6	3.5
Common pipistrelle	AT2	1.5
Common pipistrelle	AT3	6.2
Common pipistrelle	AT4	1.1
Common pipistrelle	AT5	0.5
Common pipistrelle	AT6	3.9
Daubenton’s	AT2	0.1
Daubenton’s	AT3	0.1
Daubenton’s	AT4	0.0
Daubenton’s	AT5	0.1
Daubenton’s	AT6	0.7
Leisler’s	AT2	0.0
Leisler’s	AT3	0.4
Leisler’s	AT4	0.3
Leisler’s	AT5	0.2
Leisler’s	AT6	0.3
Nathusius’	AT2	0.0
Nathusius’	AT3	0.1
Nathusius’	AT4	0.0
Nathusius’	AT5	0.0
Nathusius’	AT6	0.3
Natterer’s	AT2	0.0

Natterer’s	AT3	0.0
Natterer’s	AT4	0.0
Natterer’s	AT5	0.1
Natterer’s	AT6	0.2
Soprano pipistrelle	AT2	2.7
Soprano pipistrelle	AT3	1.3
Soprano pipistrelle	AT4	2.9
Soprano pipistrelle	AT5	1.0
Soprano pipistrelle	AT6	18.8
Whiskered	AT2	0.1
Whiskered	AT3	0.1
Whiskered	AT4	0.0
Whiskered	AT5	0.0
Whiskered	AT6	1.0

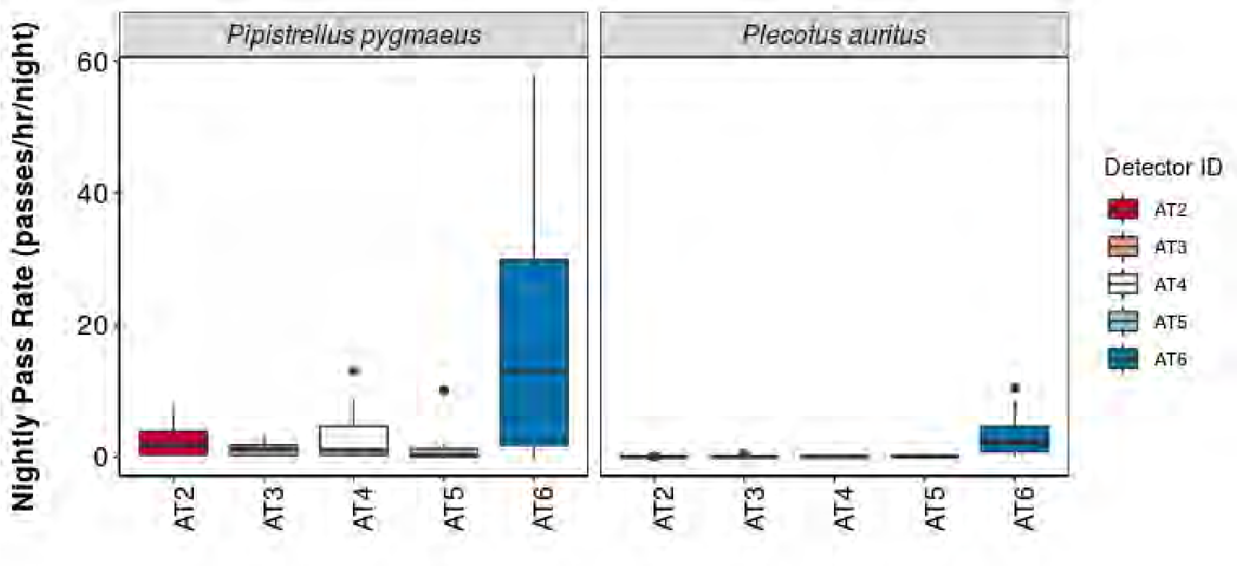
Nightly Bat Passes (Bat passes per hour)

Per Detector - Figures

Figure 16. Figures show boxplots for the number of bat passes per hour each night, for each detector. The 'box' shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The 'whiskers' extend from the box and represent the ranges for the bottom 25% and the top 25% of the data values, excluding outliers. An outlier is any extreme value that lies further away from the box than 1.5 times the interquartile range. Outliers are shown as dots. Where very few passes are recorded it is not possible to produce the box, so the data are shown as a line.



Myotis daubentonii
Myotis mystacinus
Myotis nattereri
Nyctalus leisleri
Pipistrellus nathusii
Pipistrellus pipistrellus
Nightly Pass Rate (passes/hr/night)
60
40
20
0
AT2
AT3
AT4
AT5
AT6
Detector ID
Detector ID
AT2
AT3
AT4
AT5
AT6


Pipistrellus pygmaeus
Plecotus auritus
Nightly Pass Rate (passes/hr/night)
60
40
20
0
AT2
AT3
AT4
AT5
AT6
Detector ID
AT2
AT3
AT4
AT5
AT6

Detector ID

Survey Effort

Table 24. The number of nights bats were detected per month per detector.

Month	Detector ID	No of Survey Nights
Sep	AT2	14
Sep	AT3	13
Sep	AT4	17
Sep	AT5	18
Sep	AT6	18
Oct	AT2	4
Oct	AT3	5
Oct	AT4	7
Oct	AT5	5

Nightly Bat Pass Rate for each Month

Median Per Detector

Table 25. The median Nightly Pass Rate (bat passes per hour, per night) of each species throughout each month. If NA, then no bat passes.

Bat pass rates are often highly variable between nights, with some nights having few or no passes and other nights having high activity. In these circumstances, the median is likely to be a more useful summary of the 'average' activity than is the mean. For further information see: *Lintott, P. R., & Mathews, F. (2018). Basic mathematical errors may make ecological assessments unreliable. Biodiversity and Conservation, 27(1), 265-267.* https://doi.org/10.1007/s10531-017-1418-5

Species	Detector ID	Oct	Sep
Brown long-eared	AT2	0.0	0.0
Brown long-eared	AT3	0.0	0.0
Brown long-eared	AT4	0.0	0.1
Brown long-eared	AT5	0.2	0.1
Brown long-eared	AT6	NA	2.3
Common pipistrelle	AT2	0.0	1.4
Common pipistrelle	AT3	0.8	7.2
Common pipistrelle	AT4	0.0	1.2
Common pipistrelle	AT5	0.0	0.4
Common pipistrelle	AT6	NA	2.2
Daubenton's	AT2	0.0	0.0
Daubenton's	AT3	0.1	0.1
Daubenton's	AT4	0.0	0.0
Daubenton's	AT5	0.0	0.0
Daubenton's	AT6	NA	0.4
Leisler's	AT2	0.0	0.0
Leisler's	AT3	0.1	0.1
Leisler's	AT4	0.1	0.2
Leisler's	AT5	0.1	0.1
Leisler's	AT6	NA	0.3
Nathusius'	AT2	0.0	0.0
Nathusius'	AT3	0.0	0.1
Nathusius'	AT4	0.0	0.0

Nathusius’	AT5	0.0	0.0
Nathusius’	AT6	NA	0.0
Natterer’s	AT2	0.0	0.0
Natterer’s	AT3	0.0	0.0
Natterer’s	AT4	0.0	0.0
Natterer’s	AT5	0.0	0.0
Natterer’s	AT6	NA	0.1
Soprano pipistrelle	AT2	0.2	3.1
Soprano pipistrelle	AT3	0.2	1.8
Soprano pipistrelle	AT4	0.3	3.2
Soprano pipistrelle	AT5	0.1	0.6
Soprano pipistrelle	AT6	NA	12.8
Whiskered	AT2	0.0	0.0
Whiskered	AT3	0.0	0.1
Whiskered	AT4	0.0	0.0
Whiskered	AT5	0.0	0.0
Whiskered	AT6	NA	0.5

Nightly Bat Pass Rate for each Month

Mean per Detector

Table 26. The mean Nightly Pass Rate (bat passes per hour, per night) of each species throughout each month. Values are given to 1 decimal place.

We recommend using the median values given above, for the reasons stated above, but provide the mean values in the table below.

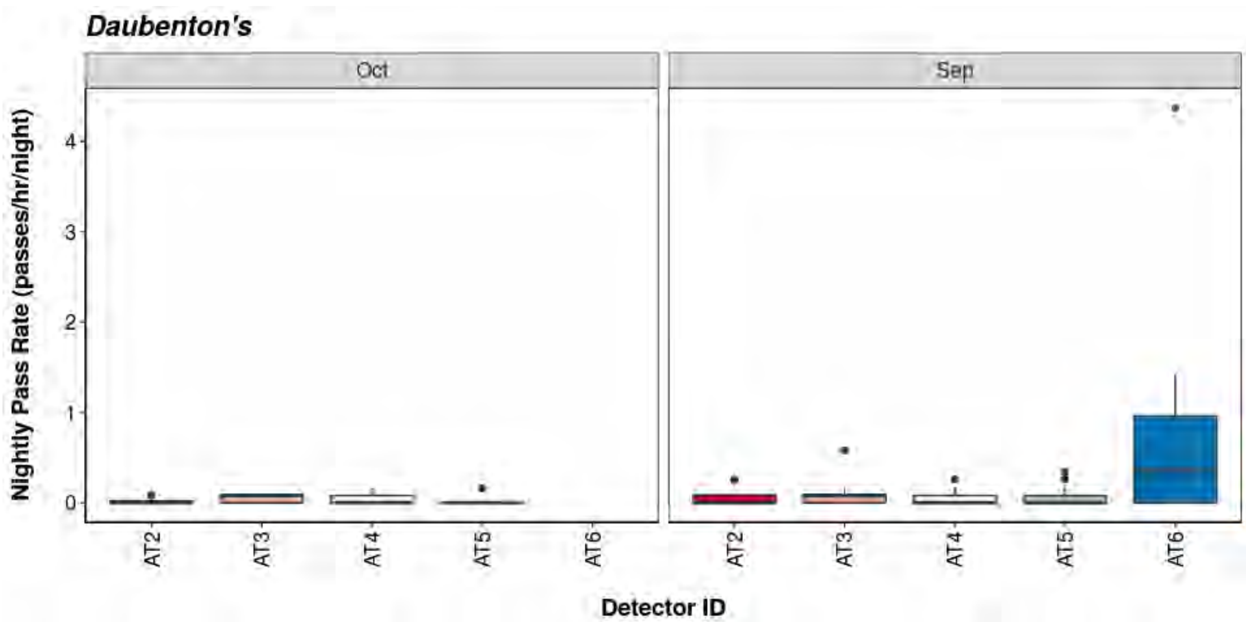
Species	Detector ID	Oct	Sep
Brown long-eared	AT2	0.0	0.0
Brown long-eared	AT3	0.0	0.1
Brown long-eared	AT4	0.0	0.1
Brown long-eared	AT5	0.1	0.1
Brown long-eared	AT6	NA	3.5
Common pipistrelle	AT2	0.0	2.0
Common pipistrelle	AT3	1.2	8.2
Common pipistrelle	AT4	0.1	1.5
Common pipistrelle	AT5	0.0	0.6
Common pipistrelle	AT6	NA	3.9
Daubenton’s	AT2	0.0	0.1
Daubenton’s	AT3	0.0	0.1
Daubenton’s	AT4	0.0	0.0
Daubenton’s	AT5	0.0	0.1
Daubenton’s	AT6	NA	0.7
Leisler’s	AT2	0.0	0.0
Leisler’s	AT3	0.3	0.5
Leisler’s	AT4	0.1	0.4
Leisler’s	AT5	0.1	0.2
Leisler’s	AT6	NA	0.3
Nathusius’	AT2	0.0	0.0
Nathusius’	AT3	0.0	0.1
Nathusius’	AT4	0.0	0.0
Nathusius’	AT5	0.0	0.0
Nathusius’	AT6	NA	0.3
Natterer’s	AT2	0.0	0.0

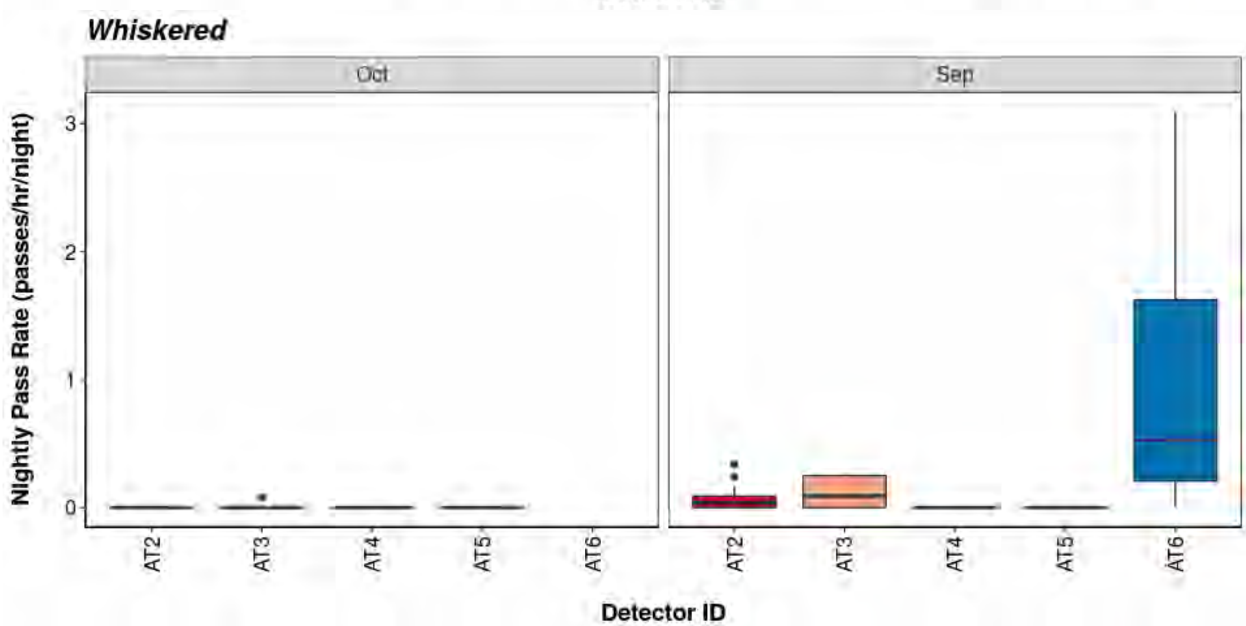
Natterer's	AT3	0.0	0.0
Natterer's	AT4	0.0	0.0
Natterer's	AT5	0.0	0.1
Natterer's	AT6	NA	0.2
Soprano pipistrelle	AT2	0.2	3.5
Soprano pipistrelle	AT3	0.6	1.6
Soprano pipistrelle	AT4	0.4	3.9
Soprano pipistrelle	AT5	0.1	1.3
Soprano pipistrelle	AT6	NA	18.8
Whiskered	AT2	0.0	0.1
Whiskered	AT3	0.0	0.1
Whiskered	AT4	0.0	0.0
Whiskered	AT5	0.0	0.0
Whiskered	AT6	NA	1.0

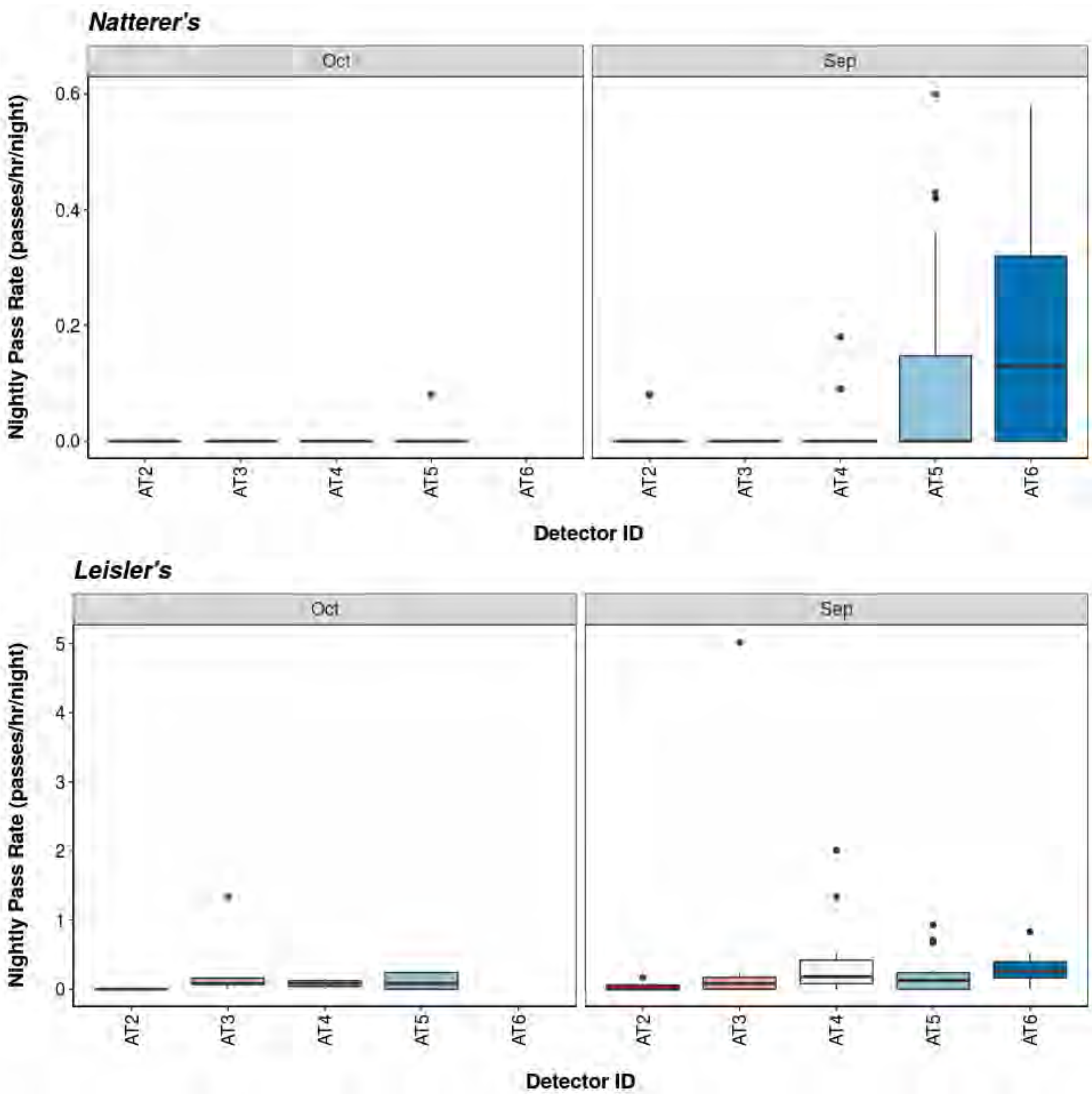
Nightly Bat Pass Rate for each Month

Per Detector - Figures

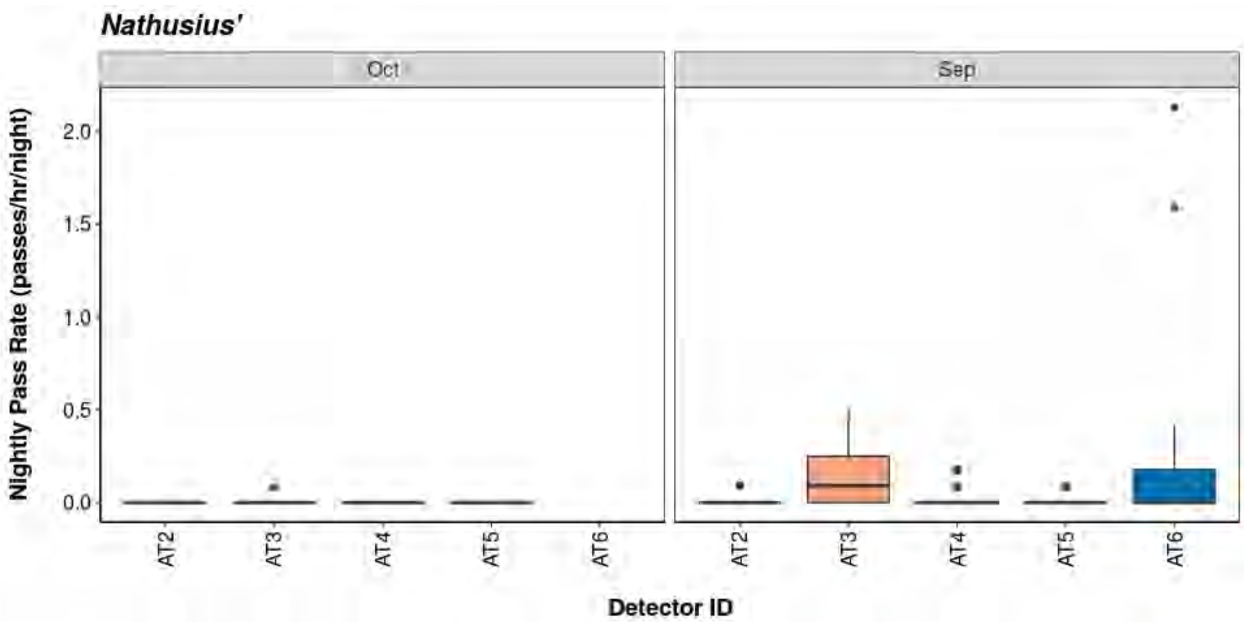
Figure 17. Figures show boxplots for the number of bat passes per hour by detector, for each month. The 'box' shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The 'whiskers' extend from the box and represent the ranges for the bottom 25% and the top 25% of the data values, excluding outliers. An outlier is any extreme value that lies further away from the box than 1.5 times the interquartile range. Outliers are shown as dots. Where very few passes are recorded it is not possible to produce the box, so the data are shown as a line.

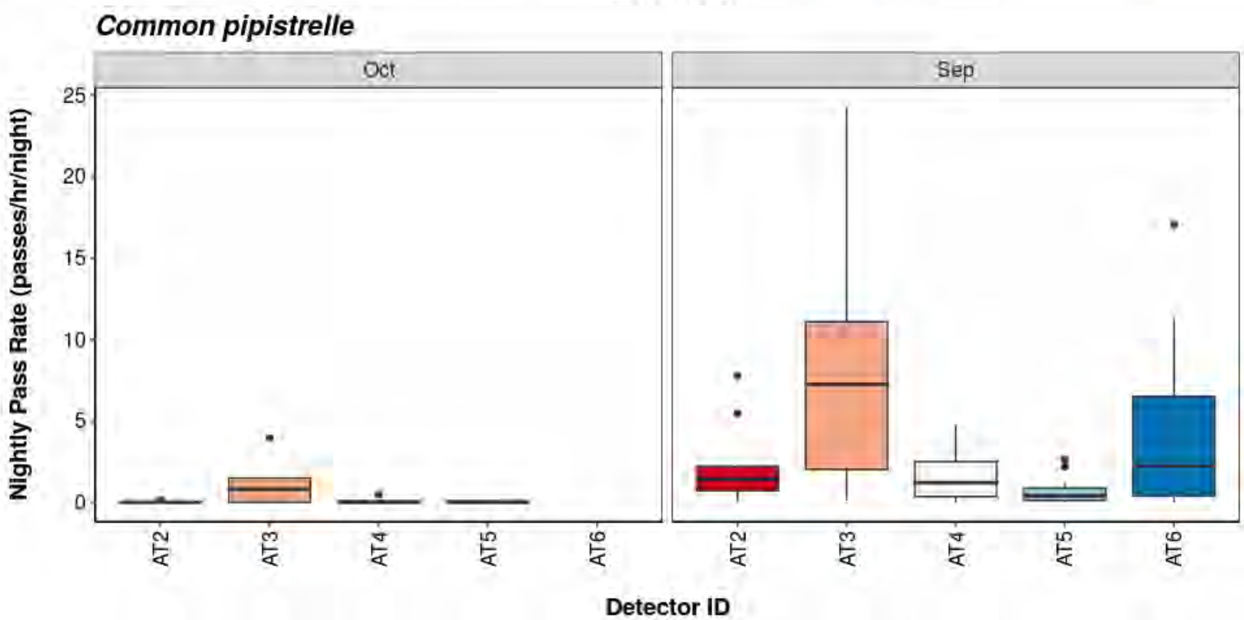


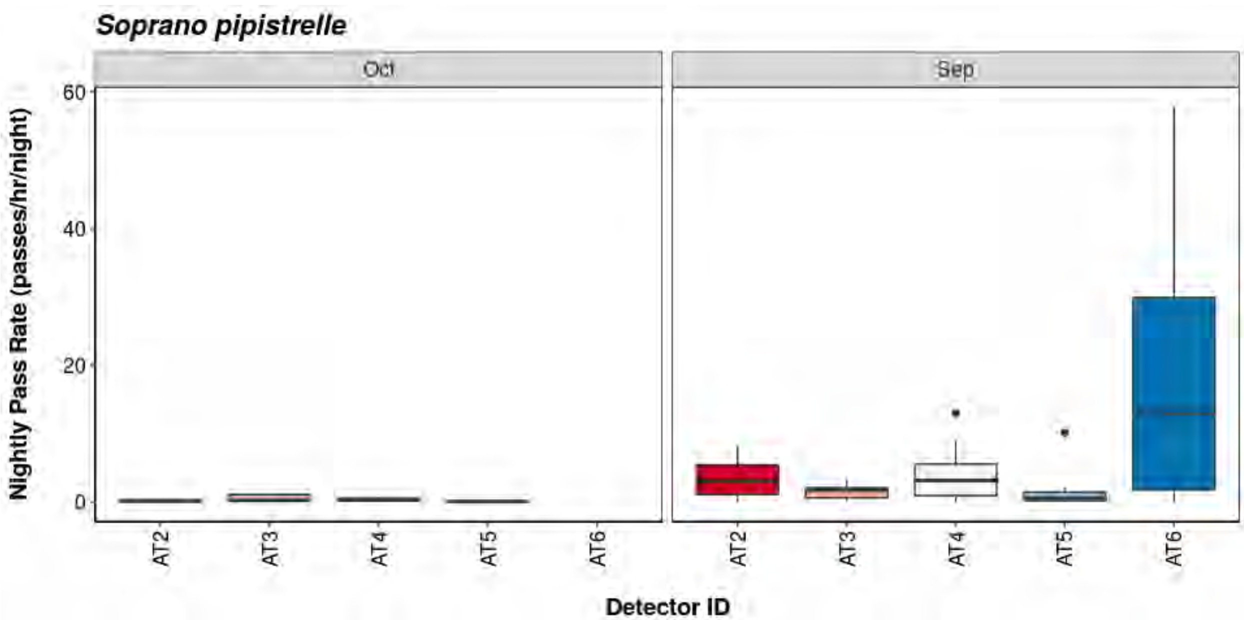




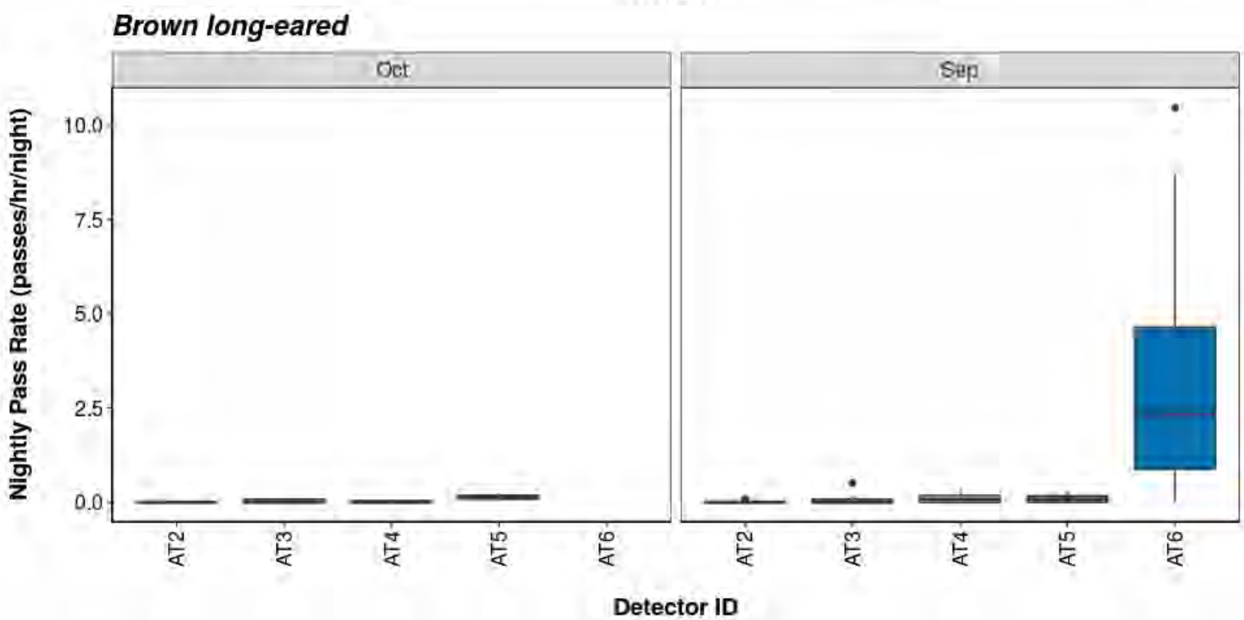
Natterer's
Oct
Sep
Nightly Pass Rate (passes/hr/night)
0.0
0.2
0.4
0.6
AT2
AT3
AT4
AT5
AT6
Detector ID
Leisler's
Oct
Sep
Nightly Pass Rate (passes/hr/night)
0
1
2
3
4
5
AT2
AT3
AT4
AT5
AT6
Detector ID


Nathusius'
Oct
Sep
Nightly Pass Rate (passes/hr/night)
2.0
1.5
1.0
0.5
0.0
AT2
AT3
AT4
AT5
AT6
Detector ID


Common pipistrelle
Oct
Sep
Nightly Pass Rate (passes/hr/night)
25
20
15
10
5
0
AT2
AT3
AT4
AT5
AT6
Detector ID



Soprano pipistrelle
Oct
Sep
Nightly Pass Rate (passes/hr/night)
60
40
20
0
AT2
AT3
AT4
AT5
AT6
Detector ID



Brown long-eared
Oct
Sep
Nightly Pass Rate (passes/hr/night)
10.0
7.5
5.0
2.5
0.0
AT2
AT3
AT4
AT5
AT6
Detector ID

Bat Activity per Detector Location

Figure 18. Detector ID reference:

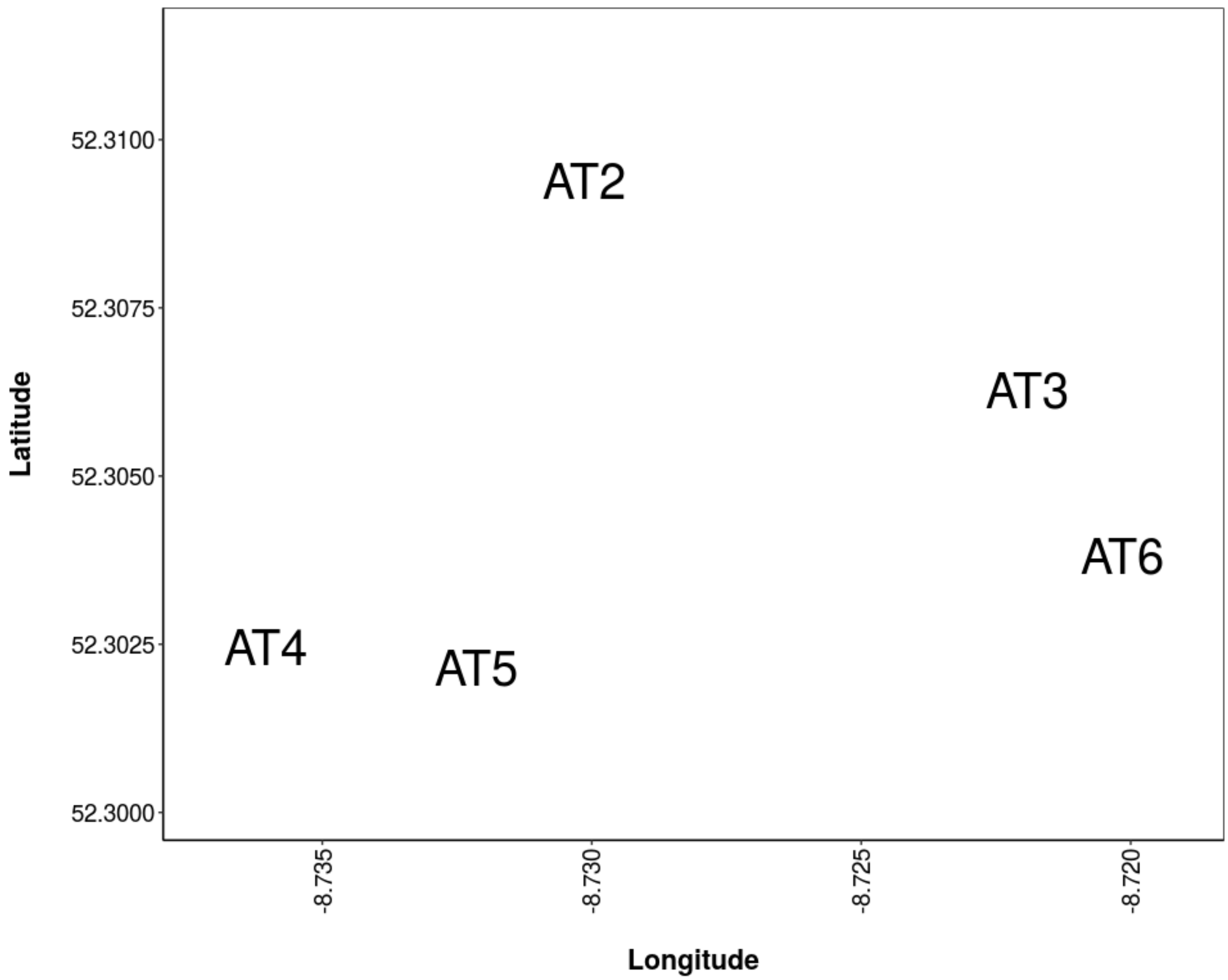
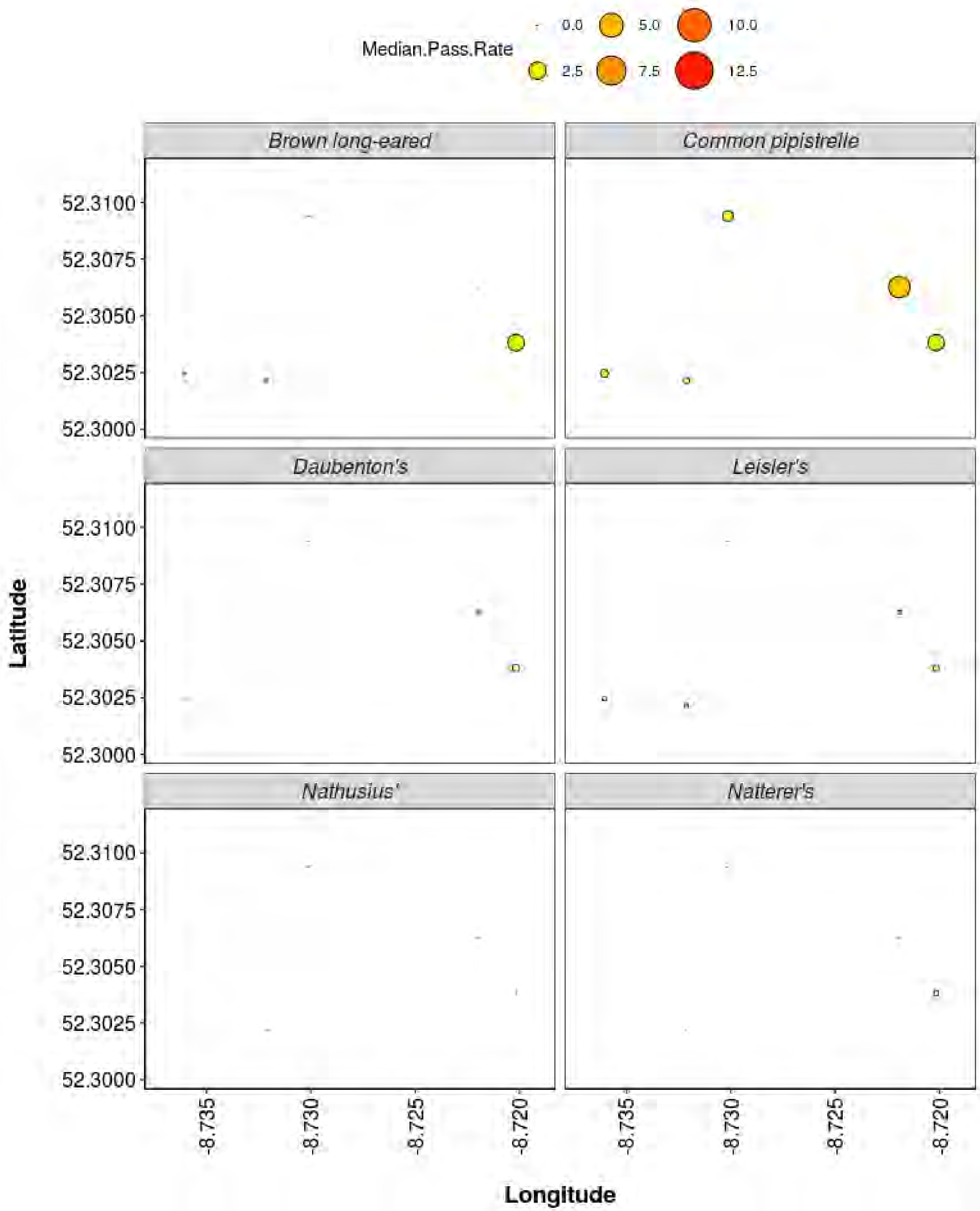


Figure 19. Median Nightly Pass Rate (bat passes/hr/night) throughout the survey period - represented by the size and colour of the point at each detector location.



Median.Pass.Rate
0.0
2.5
5.0
7.5
10.0
12.5
Brown long-eared
Common pipistrelle
Daubenton's
Leisler's
Nathusius'
Natterer's
52.3100
52.3075
52.3050
52.3025
52.3000
-8.735
-8.730
-8.725
-8.720
Latitude
Longitude

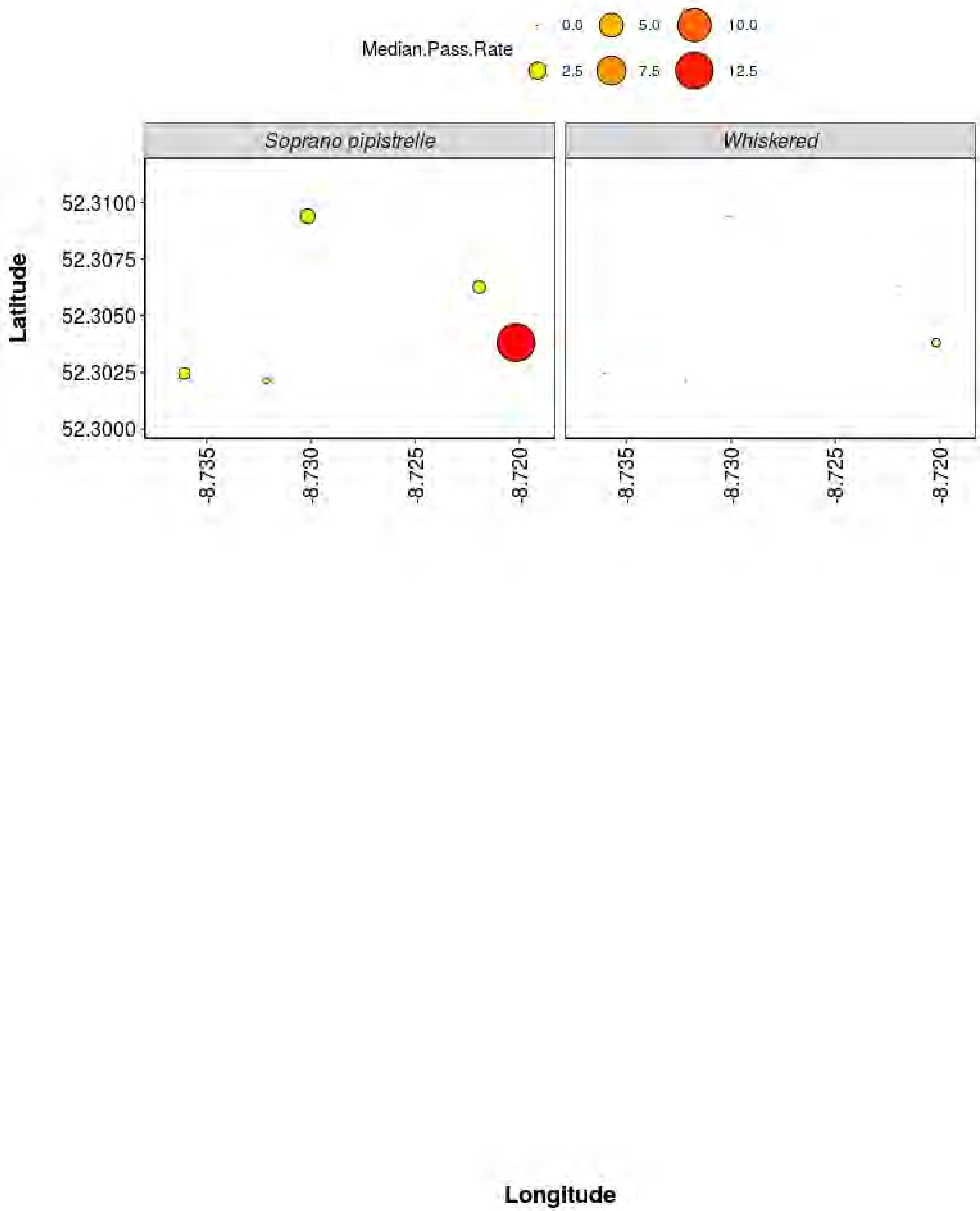
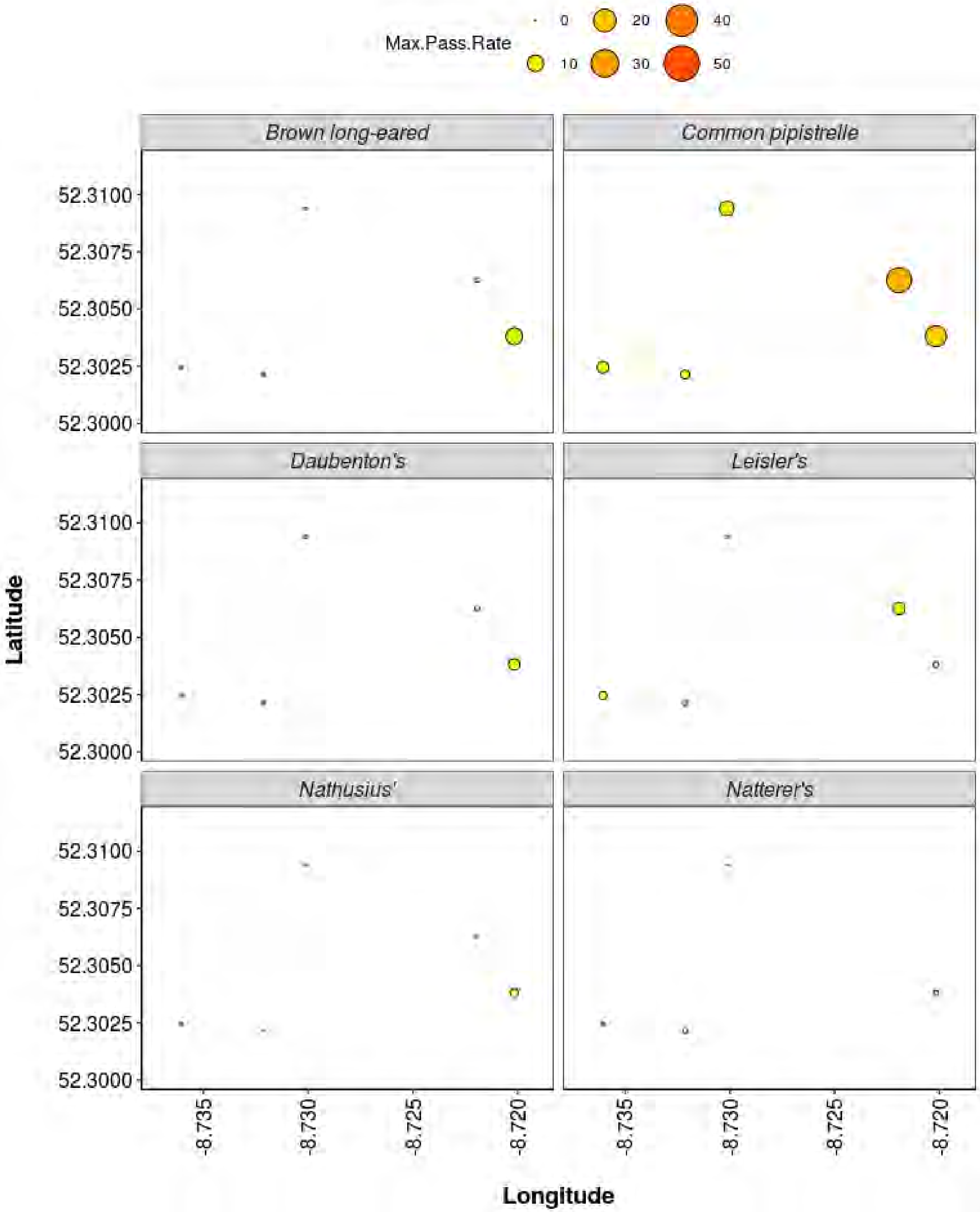
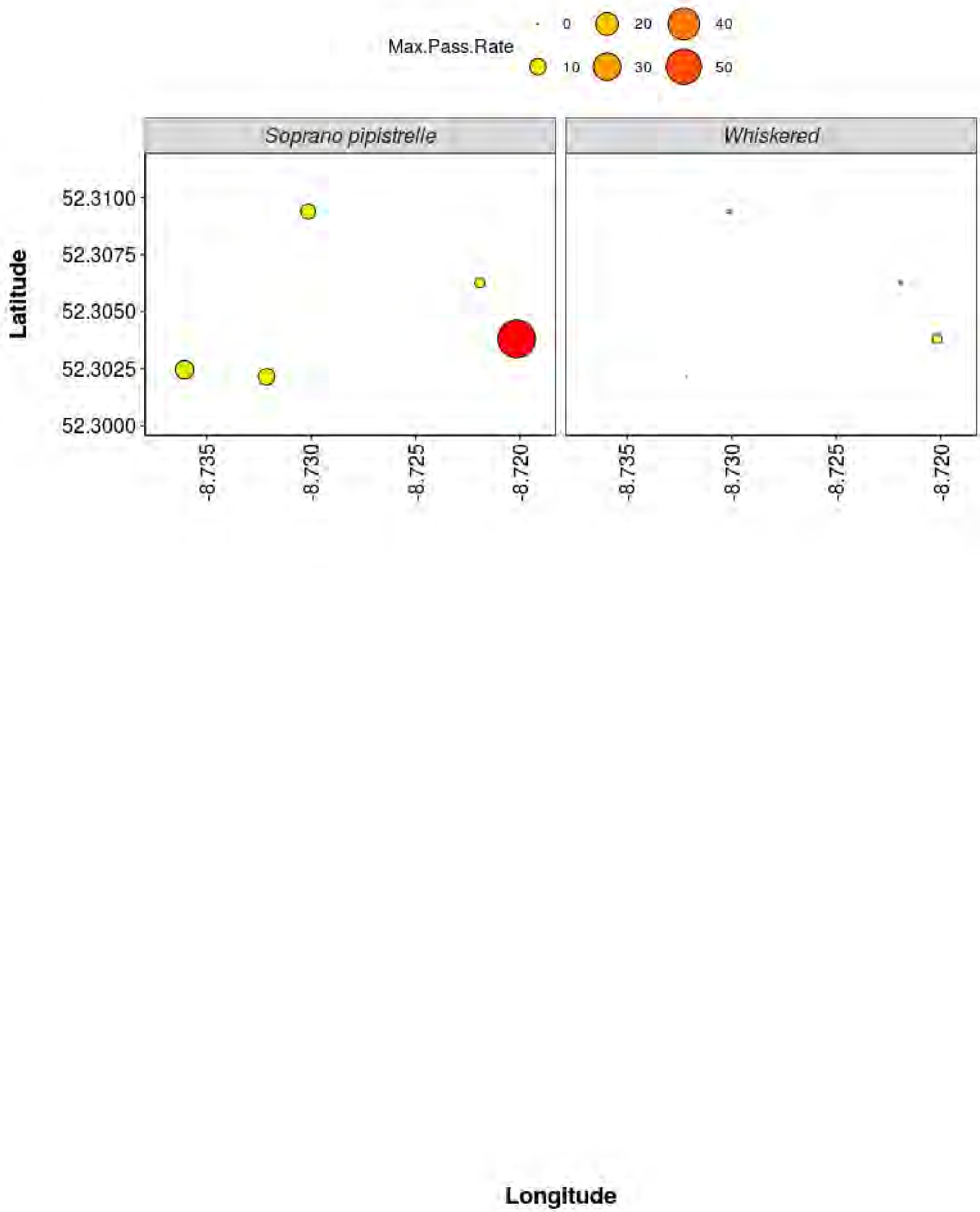

Median.Pass.Rate
0.0
2.5
5.0
7.5
10.0
12.5
Soprano pipistrelle
Whiskered
Latitude
52.3100
52.3075
52.3050
52.3025
52.3000
-8.735
-8.730
-8.725
-8.720
Longitude

Figure 20. Maximum Nightly Pass Rate (bat passes/hr/night) recorded in a single night throughout the survey period - represented by the size and colour of the point at each detector location.



Max.Pass.Rate
0
10
20
30
40
50
Brown long-eared
Common pipistrelle
Daubenton's
Leisler's
Nathusius'
Natterer's
52.3100
52.3075
52.3050
52.3025
52.3000
-8.735
-8.730
-8.725
-8.720
Latitude
Longitude



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PLANNING

APPENDIX F

Habitat Management Measures Map

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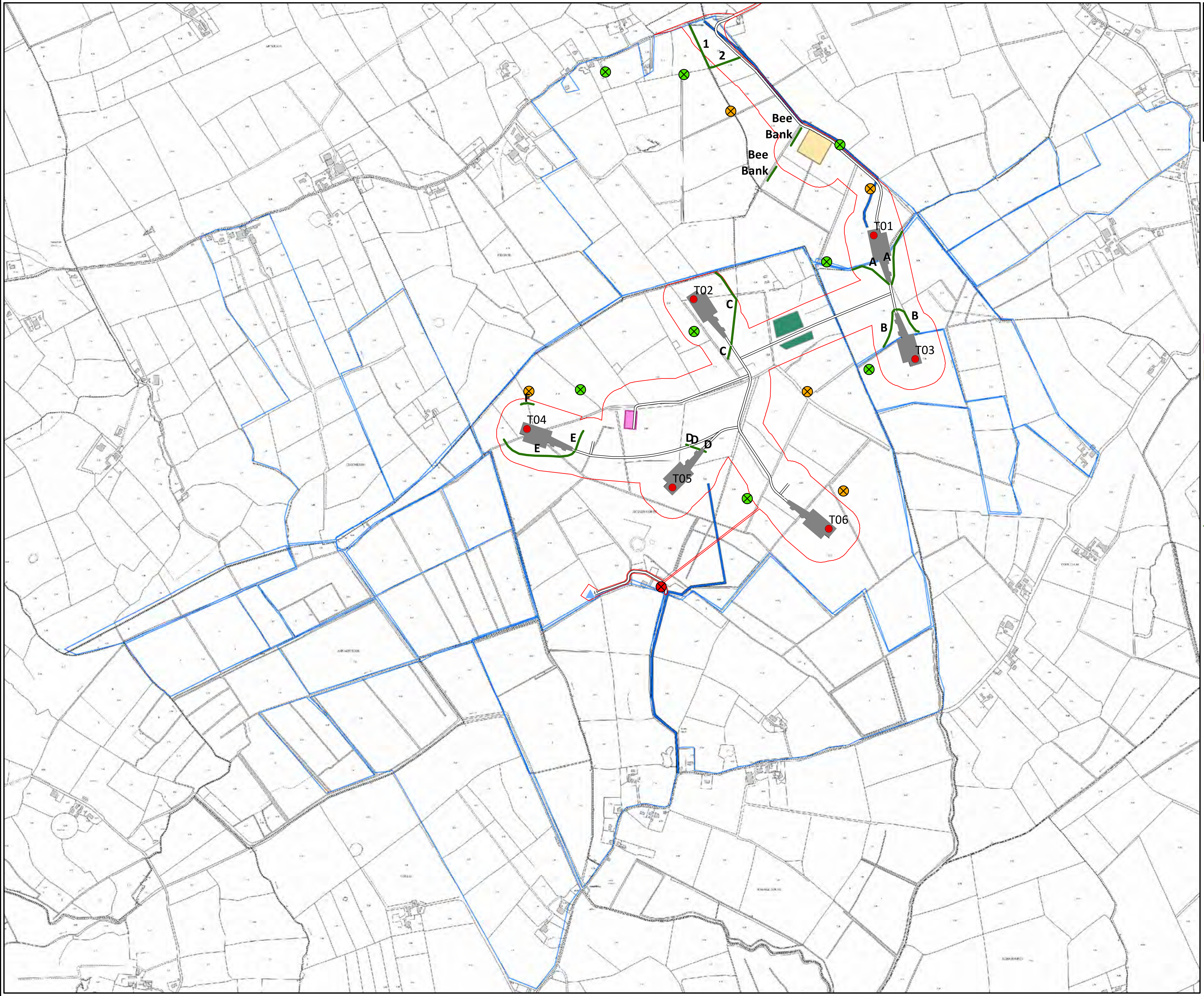

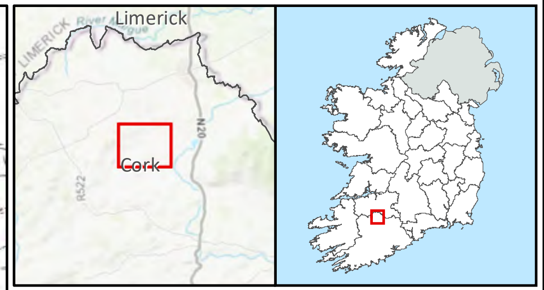

Legend

- Site Boundary
- Turbine Layout
- Met Mast
- Internal Access Track
- Construction Access
- Turbine Hardstanding Area
- Substation
- Construction Compound
- Landowners

Landscape Management:

- Barn Owl Nest Box
- Log Pile
- Refugia Pile
- Landscape Management (lines)
- Wet Grassland Receptor Site
- Wildflower Meadow (at Construction Compound)

TITLE: Habitat Management Measures			
PROJECT: Annagh Wind Farm, Co. Cork			
FIGURE NO:	8.13		
CLIENT:	EMPower		
SCALE:	1:13000	**REVISION:**	0
DATE:	20/10/2021	**PAGE SIZE:**	A3

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APPENDIX 8.4

Ornithology Reports

CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

ANNAGH WIND FARM ORNITHOLOGICAL SURVEYS

BASELINE ORNITHOLOGICAL SURVEYS – ANNAGH WIND FARM: SUMMER 2019 AND WINTER 2019/20

Prepared for: EMPower

Date: November 2021

Core House, Pouladuff Road, Cork, T12 D773, Ireland

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EXECUTIVE SUMMARY

Ornithological surveys for Annagh Wind farm searched for and recorded all bird species, focusing primarily on the wind farm site but also taking in the surrounding region. Surveys extended throughout the year, covering both the breeding and non-breeding seasons.

The methodology for the 2019/2020 vantage point surveys at Annagh Wind farm adhered to Scottish Natural Heritage guidance (SNH, 2017) for assessing the impact of proposed wind farm on the breeding and wintering populations of birds within the site and in the greater area. Two timed watches of three hours duration were carried out from each VP every month from April to September 2019 and October 2019 to April 2020 inclusive, totalling 72 hours (36 hours per season) of observation time at each VP over the survey period. Breeding & winter bird transect surveys, hinterland surveys and wader surveys were also undertaken during this period.

During vantage point surveys a total of 56 species of bird were recorded across the surveyed summer and winter periods of 2019/20. One additional target species, namely Hen Harrier (Amber-listed; Annex 1) was noted during winter transect surveys only.

During hinterland surveys surrounding the proposed site a total of 47 species were noted.

During breeding wader surveys evidence was noted for 2 species: common Snipe and Woodcock. A total of 4 occupied territories, 3 potential territories and 2 confirmed breeding attempts were noted for common Snipe. A single potential territory was noted for woodcock.

During breeding transects a total of 42 species were detected; four of these were Red-listed: Kestrel, Meadow pipit, Snipe and Woodcock. A total of eight Amber-listed species were recorded during breeding transects.

A total of 28 species were detected during wintering bird transects. One Annex 1 species was recorded, namely Hen Harrier. A total of four Red-listed species (Kestrel, Meadow Pipit, Redwing and Snipe) were recorded during winter transects. Two Amber-listed species were recorded.

1. INTRODUCTION

Fehily Timoney & Company (FT) was appointed by EMPower to undertake ornithological surveys at the proposed Annagh wind farm from 2019-2020. This report presents the results of the first year of ornithological surveys and summarises the activity of specific target bird species during survey periods in 2019 and 2020. The study area of Annagh wind farm is near Charleville, Co, Cork.

This avian assessment for surveys completed over the first year in summer 2019 and winter 2019/20 includes the assessment of bird species potentially occurring within the proposed site boundary, and surveys of surrounding habitats of value to birds. Surveys adhered to Scottish Natural Heritage guidance (SNH, 2017). The following surveys were carried out:

- Vantage Point survey (breeding and non-breeding season);
- Hinterland survey;
- Breeding Wader survey;
- Breeding bird transect survey; and
- Winter bird transect survey.

The monthly assessment of bird species during the breeding and winter season within the site was completed using vantage point survey watches. Surveys took place at 2 vantage point (VP) locations from April to September 2019 (inclusive) and October 2019 to March 2020 (inclusive). Each VP was subject to 2 watches per month, each consisting of 3 hours in length (6 hours surveyed per VP per month).

Hinterland surveys were completed in potential favourable bird habitats within a 10 km radius of the proposed wind farm development. This survey method was used to assess species populations surrounding the proposed development site. Breeding bird surveys were completed along transects within the site. This survey technique was also used to assess the presence of breeding waders.

1.1 Study Area

The proposed Annagh wind farm is located c. 7.3 km south west of Charleville, Co. Cork near the Co. Cork/Co. Limerick border. The study area encompasses parts of the townlands of Cooliney, Fiddane, Annagh North, Cullig and Coolcaum. The VP surveys study area was the VP viewsheds and 500m turbine buffers. Breeding bird, breeding wader and wintering bird transects were surveyed within the land ownership boundary. Surrounding habitats and land uses are described by Corine 2018[1] as: Pastures (code 231), land principally occupied by agriculture with significant areas of natural vegetation (code 243), Broad-leaved forests (code 311) and Coniferous forests (code 312). Figure 2-1 displays the site location and vantage points within the study area.

During site surveys, habitats such as wet grassland (GS4), conifer plantation (WD4), hedgerows (WL1), treelines (WL2) and improved agricultural grasslands (GA1) were recorded (Fossitt, 2000). At Annagh, (mixed) broadleaved woodland (WD1), improved agricultural grassland (GA1) and wet grassland (GS4) are the dominant habitat types.

[1] https://gis.epa.ie/EPAMaps/. Accessed 24/11/21.

The protected European sites within 15 km of the proposed wind farm are:

- Blackwater River (Cork/Waterford) SAC (002170)
- Ballyhoura Mountains SAC (002036)
- Kilcolman Bog SPA (004095)

The protected national sites within 15 km of the proposed wind farm are:

- Eagle Lough pNHA (site code 001049)
- Kilcolman Bog pNHA (side code 000092)
- Ballyhoura Mountains pNHA (site code 002036)
- Ballinvonear Pond pNHA (Site code 000012)
- Mountrussel Wood pNHA (Site code 002088)
- Awbeg Valley (Above Doneraile) pNHA (Site code 000075)
- Ballintlea Wood pNHA (Site code 002086)
- Castleoliver wood pNHA (Site code 002090)

Path: R:\Map Production\2020\P2359\Workspace\CEMP\P2359_GIS_Fig1-1_SiteLocation_A3.mxd

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
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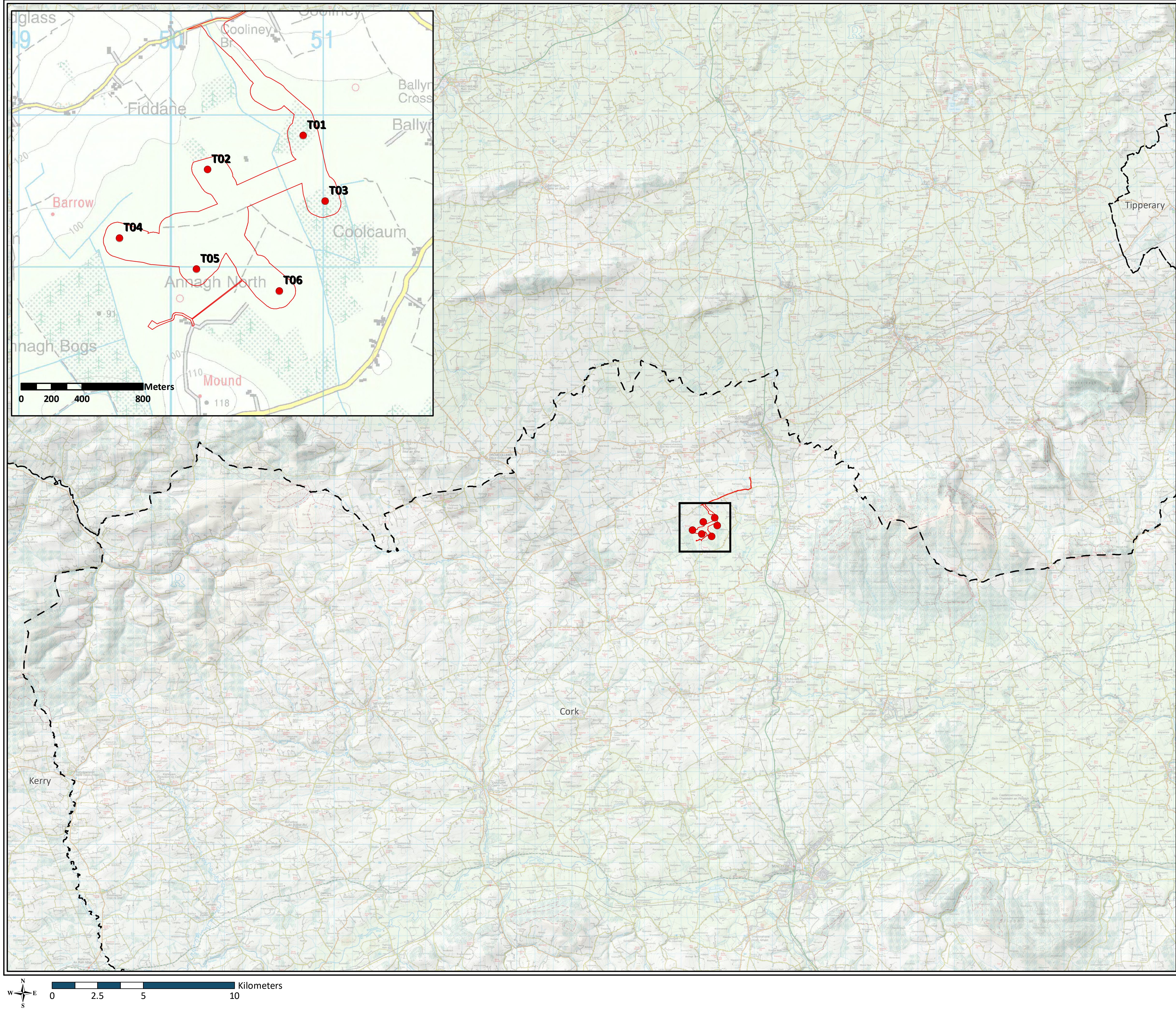

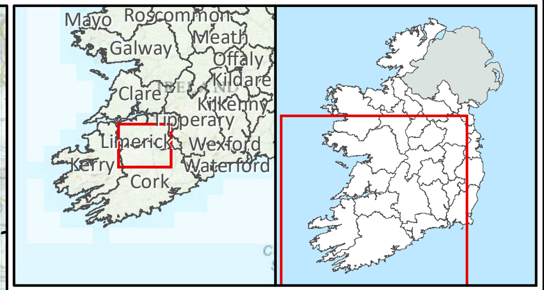

Legend

- County Boundaries
- Proposed Site Boundary
- Proposed Turbine Layout

TITLE:	Site Location
PROJECT:	Annagh Wind Farm, Co. Cork
FIGURE NO:	1.1
CLIENT:	EMPower
SCALE: 1:200000	**REVISION:** 0
DATE: 14/10/2021	**PAGE SIZE:** A3

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2. SURVEY METHODOLOGY

The following surveys were carried out:

- Vantage Point survey (breeding and non-breeding season);
- Hinterland survey;
- Breeding Wader survey;
- Breeding bird transect survey; and
- Winter bird transect survey.

Vantage point surveys carried out at the proposed Wind Farm adhered to Scottish Natural Heritage guidance (SNH, 2017). Hinterland surveys were completed in potentially favourable bird habitats within a c. 10km radius of the proposed Bilboa Wind Farm site, the surveys were undertaken following methodology by Hardey *et al.* (2013) and O' Donoghue, (2012). Breeding bird transects method utilised is based on the existing British Trust for Ornithology (BTO) Breeding Bird Survey (BBS or CBS). Winter bird transect surveys were conducted following a modified wintering bird transect survey method based on Brown and Shepherd (1993) and recommended in published guidance from Scottish Natural Heritage (2017).

2.1 Vantage Point Surveys

Vantage Point (VP) surveys were carried out at the proposed Annagh Wind Farm site from April 2019 to March 2020 (inclusive) during the non-breeding (winter) and breeding seasons, in accordance with the Scottish Natural Heritage Methodology for onshore wind farms (SNH, 2017). These surveys were divided into summer (April – September 2019) and winter (October 2019 – March 2020) seasons. Two fixed VP locations (Annagh VP1 and VP2) overlooking the study area were used during the VP surveys (Table 2-1). Table 2-2 gives the VP locations. Vantage points were chosen to cover a specific viewshed of the proposed development site. Each was chosen specifically to encompass the view of all the proposed turbines. Figure 2-1 displays the site location and vantage points within the study area.

The main purposes of vantage point survey watches are to collect data on *target species* that will enable estimates to be made of:

a. The time spent flying over the defined survey area;
b. The relative use of different parts of the defined survey area; and
c. The proportion of flying time spent within the upper and lower height limits as determined by the rotor diameter and rotor hub height.

The specific vantage points and turbines within their viewsheds can be seen in Table 2-1 below:

Table 2-1: Vantage point viewshed and turbines encompassed

Site	Vantage Point	Turbine number(s) covered in viewshed
Annagh	VP 1	1-6
	VP 2	1-6

Vantage point locations were based on observations from walkover/reconnaissance surveys, viewshed analysis (using GIS) and collated information on known feeding and roosting sites from both desktop review and consultation. The number and location of vantage points was selected in order to achieve visibility of the entire study area and important features for birds in close proximity to the site (e.g., lakes, wetlands).

In line with recommended best practice (SNH, 2017 and Band *et al*. 2007), viewshed analysis was undertaken using ARCMAP 10.4.1, to calculate a theoretical zone of visibility from each vantage point. Visibility is calculated from each vantage point along an invisible layer suspended at the predicted lowermost height passed through by the rotor blade tips, using an observer height of 1.5 m. We note the following from SNH guidance in respect of priority areas for viewshed analysis (emphasis added):

> *"Where the key purpose is to estimate the risk of collision with turbines, **it is the visibility of the airspace to be occupied by the turbine rotors (the collision risk volume) that is of prime importance**. Therefore, it is recommended that visibility be calculated using the least visible part of this airspace, i.e. an imaginary layer suspended at the lowermost height passed through by the rotor blade tips (typically about 20-30m above ground level). Predicting visibility at this level is a simple task using GIS, however it should be noted that the baseline should take account of any forestry or other features that will potentially obstruct the view. For example, forestry may be 10-30m high and if viewshed height is taken as 20-30m ground level the visible area could be overestimated if there is forestry within the viewshed. Being able to view all or most of the site to ground level can be helpful in gauging overall bird activity and usage of the site but is not as important as being able to view the collision risk volume"*

Following SNH guidance (2017), watches were conducted to sample diurnal and crepuscular activity of target species and *exceeding* the required effort from SNH.

Data recorded included flight activity of target species (flight height, duration, directionality) in addition to metrics such as flock size (per recorded transit) and time of observation relative. Detailed notes of each observation of a target bird species was recorded including behaviour, gender (where possible), numbers, flight height, associated habitat and the period of time spent within the study area. Successful foraging events were also noted if they arose. Other bird species seen or heard during the VP surveys were also recorded and were considered separately in the analysis as additional species. Flight activity was annotated onto field maps. Total numbers of birds present both on arrival at the vantage point and on departure is noted. Details of each flight-path observation are provided in Section 3. Binoculars are used to scan for target species. Dictaphones are utilised to dictate bird heights whilst tracking flight events.

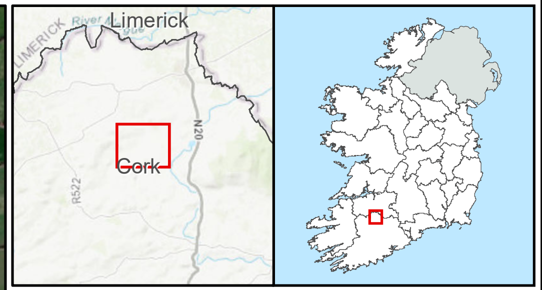
Flight heights are estimated visually as allowed for in SNH (2017) guidance. Flight height estimation using a clinometer or rangefinder is accepted as an *alternative* means of determining flight height however this is often not practicable (equipment may be clumsy and birds may be lost from view whilst trying to focus additional equipment on a target species rapidly moving out of sight); it should be noted that in practice many flocks of swans do not fly close enough to a surveyor for a rangefinder to be used, resulting in most flights heights being estimated in any case. As is often the case an experienced observer will be able to record accurate observations at a higher frequency.

As previously mentioned, VP surveys were carried out at the site from April 2019 to March 2020 inclusive and involved carrying out 2 x 3-hour VPs at each VP every month. As per SNH guidance (2017), 36 hours of vantage point effort was carried out at each vantage point during the breeding period, and 36 hours during wintering period). The proportion of survey time that activity was recorded inside and outside the wind farm site boundary was used as part of the overall analysis and assessment of target species usage of the study area. Vantage point locations can be found in Table 2-2, below. All surveys were conducted during suitable weather conditions.

Table 2-2: Grid References for VP locations at Annagh Wind Farm

Site	Vantage Point	Easting, Northing (ITM)
Annagh WF	VP 1	550115, 616205
	VP 2	550037, 616468

Path: R:\Map Production\2020\P2359\Workspace\Information\P2359_GIS_ViewshedAnalysis_A3.mxd



Legend

- Turbine Layout
- Turbine Layout 500m Buffer
- Vantage Point Locations

2km Viewsheds

- VP1 Viewshed
- VP2 Viewshed

TITLE:	Viewshed Analysis (based on a target height of 30m and observer height of 1.5m)
PROJECT:	Annagh Wind Farm
FIGURE NO:	2.1
CLIENT:	EMP Group
SCALE: 1:12800	**REVISION:** 0
DATE: 15/10/2021	**PAGE SIZE:** A3

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N W E S
0 0.25 0.5 1 Kilometers

2.2 Hinterland Surveys

The methodology used for wetland sites during the hinterland surveys followed I-WeBS (Irish Wetland Bird Survey) methodology (Lewis *et al*, 2019), whereby each location was surveyed for the duration necessary to identify and obtain a count for all target species present. The same approach was adapted for non-wetland sites. A hinterland survey for raptors was conducted in accordance with Raptors: a field guide to survey and monitoring (Hardey *et al*. 2013) to assess Hen Harrier and other raptor activity over the winter and breeding periods in the greater surroundings. Surveys for Hen Harrier breeding and roosting sites were also carried out within 10km of the proposed Wind Farm, fulfilling and exceeding the requirement set out in SNH Guidance (2017).

The surveys were carried out in suitable woodland and wetland habitats in the area surrounding the proposed wind farm site. This comprised 13 sites within 10 km from the proposed wind farm site. These sites were chosen as they had suitable habitat for the following target species and groups: raptors, waders, waterfowl, swans and barn owl. Surveys were carried out between April and September in the summer of 2019 and October to March in the winter of 2019/20. The following sites were checked regularly across this period: West Plantation (Aughrim), River Blackwater SAC/Annagh Bridge, River Awbeg, River Blackwater SAC/Buttevant Bridge , Eagle Lough pNHA, Glanmore Flats, Kilcolman Bog SPA, Ballinvonear Ponds pNHA, Ballyhoura Mountain pNHA, Castle Lake (Milltown), Small Quarry Lake (Ballyroe), and Large Quarry Lake (Ballinadrideen). Two opportunistic visits were made to flooded fields, also listed below (Table 2-3). Table 2-3 indicates where within the 10 km area around the proposed Wind Farm hinterland surveys were carried out.

Table 2-3: Hinterland survey locations

Location	Easting, Northing (ITM)	Distance to site (km)	Dates visited
West Plantation (Aughrim)	543767, 616842,	5.76	02/05/2019 27/05/2019 23/06/2019 01/08/2019 27/08/2019 06/11/2019 28/11/2019 17/12/2019 28/01/2020 25/02/2020
River Blackwater SAC/Annagh Bridge	549814, 615638	1.01	02/05/2019 27/05/2019 23/06/2019 01/08/2019 27/08/2019 06/11/2019 28/11/2019 17/12/2019 28/01/2020

Location	Easting, Northing (ITM)	Distance to site (km)	Dates visited
			25/02/2020 27/04/2020
River Awbeg	552564, 614751	2.76	02/05/2019 27/05/2019 23/06/2019 01/08/2019 27/08/2019 06/11/2019 28/11/2019 17/12/2019 28/01/2020 25/02/2020
River Blackwater SAC/ Buttevant	554265, 609841	7.84	02/05/2019 27/05/2019 23/06/2019 01/08/2019 01/08/2019 27/08/2019 06/11/2019 28/11/2019 17/12/2019 28/01/2020 25/02/2020
Eagle Lough pNHA	556064, 610328	8.60	02/05/2019 27/05/2019 23/06/2019 01/08/2019 27/08/2019 08/11/2019 28/11/2019 17/12/2019 28/01/2020 25/02/2020
Glanmore Flats	554616, 612847	5.55	02/05/2019 27/05/2019 23/06/2019 01/08/2019 27/08/2019 06/11/2019 28/11/2019

Location	Easting, Northing (ITM)	Distance to site (km)	Dates visited
			17/12/2019 28/01/2020 25/02/2020
Kilcolman Bog SPA	558072, 610856	9.49	02/05/2019 27/05/2019 23/06/2019 01/08/2019 27/08/2019 06/11/2019 28/11/2019 17/12/2019 28/01/2020 25/02/2020 27/04/2020
Ballinvonear Ponds pNHA	556797, 613057	7.13	02/05/2019 27/05/2019 23/06/2019 01/08/2019 27/08/2019 06/11/2019 28/11/2019 17/12/2019 28/01/2020 25/02/2020
Ballyhoura Mountain pNHA	557289, 614688	6.60	02/05/2019 27/05/2019 28/11/2019 20/12/2019 28/01/2020 25/02/2020 27/04/2020
Castle Lake (Milltown)	550153, 619611	0.90	02/05/2019 27/05/2019 23/06/2019 01/08/2019 27/08/2019 08/11/2019 28/11/2019 17/12/2019 28/01/2020

Location	Easting, Northing (ITM)	Distance to site (km)	Dates visited
			25/02/2020
Small Quarry Lake (Ballyroe)	552833, 616762	1.89	02/05/2019 27/05/2019 23/06/2019 01/08/2019 27/08/2019 08/11/2019 28/11/2019 20/12/2019 28/01/2020 25/02/2020
Large Quarry Lake (Ballinadrideen)	553853, 617143	2.60	02/05/2019 27/05/2019 23/06/2019 01/08/2019 27/08/2019 08/11/2019 28/11/2019 17/12/2019 28/01/2020 25/02/2020
Flooded Field near Corbett Court	554293, 618683	3.50	17/12/2019
Fields close to Glanmore Flats	554495, 612863	5.60	28/11/2019