FEHILY TIMONEY

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

APPENDIX 6

Biodiversity

Appendix 6.1 - Biodiversity Enhancement & Management Plan

Appendix 6.2 - Aquatic Ecology Baseline Report

Appendix 6.3 - Littleton Wind Farm Bat Report

Appendix 6.4 - Invasive Species Management Plan

APPENDIX 6.1

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LITTLETON WIND FARM

Biodiversity Enhancement & Management Plan

Prepared for:

Littleton Wind Farm DAC

Date: **April 2026**

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BIODIVERSITY ENHANCEMENT & MANAGEMENT PLAN

REVISION CONTROL TABLE, CLIENT, KEYWORDS AND ABSTRACT

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Abstract: This report details the Biodiversity Enhancement & Management Plan for the proposed Littleton Wind Farm, Co Tipperary.

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1. INTRODUCTION

This Biodiversity Enhancement and Management Plan (BEMP) sets out the implementation of biodiversity enhancement features at the proposed wind farm site. The plan includes both mitigation and enhancement measures relating to habitat creation and management, which are clearly differentiated. Additionally, maintenance measures are detailed. All mitigation, enhancement and maintenance measures included in this BEMP will be implemented in full.

The measures contained in this BEMP include those designed to protect and enhance existing habitats. Higher value habitats will be actively managed to maintain and improve their value and lower value habitats will see specific interventions designed to improve their attractiveness for a range of species. Appropriate planting will increase the available feeding, roosting and nesting cover for wildlife.

The BEMP includes the following:

- Details of all measures to be taken to protect and enhance habitats of local biodiversity value occurring at the site and the species which utilise the same within the vicinity;
- A description of target habitats and range of species appropriate to the site;
- Appropriate strategies for maintaining existing and targeted habitats and species;
- Timelines for new planting and habitat creation;
- Details of ecological oversight and monitoring;
- A map identifying the areas to be managed.

1.1 Study Area

The proposed wind farm is located in Littleton Bog and Lanespark Bog, Co Tipperary. The relevant TDR point of interest is located at R693 / R639 Roundabout.

The geographic scope of the BEMP is confined to the Land ownership boundary (optioned lands) for the proposed wind farm, and R693 / R639 Roundabout TDR Node.

1.2 Habitats

The following habitats are located within the study area, as classified by Fossitt (2000):

FL1 - Dystrophic lakes	PB1 - Raised bog
FL2 - Acid oligotrophic lakes	PB4 - Cutover bog
FL8 - Other artificial lakes and ponds	WD2 - Mixed broadleaved/conifer woodland
FS1 - Reed and large sedge swamps	WD3 - (Mixed) conifer woodland
FW4 - Drainage ditches	WD4 - Conifer plantation
GA1 - Improved agricultural grassland	WL1 - Hedgerows
GS1 - Dry calcareous and neutral grassland	WL2 - Treelines
GS2 - Dry meadows and grassy verges	WN1 - Oak-birch-holly woodland
GS4 - Wet grassland	WN7 - Bog woodland
HD1 - Dense bracken	WS1 - Scrub
HD1/WS1 Dense bracken/Scrub Mosaic	WS2 - Immature woodland

1.2.1 Target Habitats

Within the habitats listed above, a number are targeted by the measures proposed in this management plan. These habitats and the applicable measures are summarised in Table 1-1, and described in detail below:

Table 1-1: Target Habitats

Habitat	Proposed Measures
GS1 - Dry calcareous and neutral grassland	Translocate soil and seedbank from northern access track footprint to adjacent drainage buffers.
WL1 - Hedgerows	Re-plant hedgerows removed from borrow pit footprint and associated access track footprint.
Oak-Ash-Hazel Woodland (WN2)	Retain/replant as required along northern verge of proposed amenity trail to maintain linear field boundary.
WS2 - Immature woodland/ WS1 - Scrub	Remove non-native eucalyptus trees & restore native scrub within eucalyptus plantation footprint.
PB1 - Raised bog	Drain Blocking
PB4 - Cutover bog	Drain Blocking; Ponds/Scrapes
FL1 - Dystrophic lakes	The large lake which has established on cutover bog in the BEMP area will be retained, and current water levels will be maintained to provide continuity of the existing habitat resource for waders and waterbirds.

1.3 Target Species and Groups

Following extensive desk studies and field studies a range of key ecological receptors were identified at the site. These are detailed within EIAR Chapter 6: Biodiversity. The enhancement and mitigation measures detailed here will protect these species, in addition to improving the biodiversity value of the site generally.

1.3.1 Bats

A total of eight bat species have been recorded as present within the study area during bat surveys. The measures that will be implemented to protect bats are:

Bat Buffer Maintenance, Hedgerow/Treeline Re-planting, and Woodland/Treeline Planting.

1.3.2 Marsh Fritillary

Areas of suitable marsh fritillary habitat within the BEMP area will be monitored and maintained through periodic scrub clearance as required.

Areas of suitable marsh fritillary habitat within the proposed wind farm footprint will be translocated to suitable locations in adjacent areas.

1.3.3 Insects (general)

A range of insect species will benefit from measures which create and enhance semi-natural habitats at the site. These include the creation of pollinator-friendly habitats described above, drain blocking and creation of ponds/scrapes in addition to the creation of log piles which will provide insect habitats.

1.3.4 Badger

A range of measures including seasonal restrictions, buffer zones, restrictions on machinery use and vegetation clearance, and monitoring are proposed to ensure badgers are not negatively impacted by the proposed development, including measures proposed within the BEMP.

1.3.5 Small Mammals

Small mammals such as wood mouse and pygmy shrew will benefit from woodland and hedgerow planting. These features will provide increased cover and food for these animals.

The abovementioned species, in addition to other small mammals such as hedgehog, will also benefit from the installation of Hibernacula which will provide shelter.

1.3.6 Amphibians

Smooth newt and common frog will benefit from the conversion of settlement ponds within the BEMP area to permanent amphibian habitats following construction.

1.3.7 Raptors

Barn owl and kestrel will benefit from installation of nest boxes within the BEMP area, while raptors as a general grouping will benefit from nature-friendly management of the proposed development and maintenance of the existing habitat mosaic away from proposed turbine locations.

1.3.8 Waders/Water Birds

The large lake which has established on cutover bog in the BEMP area will be retained, and current water levels will be maintained to provide continuity of the existing habitat resource for waders and waterbirds.

2. ECOLOGICAL ENHANCEMENT

2.1 Biodiversity Enhancement and Management Plan (BEMP) Area

2.1.1 Tree Planting

Planting of native tree species is proposed at a number of locations across the BEMP area (see Appendix IV Figure 6-15). The proposed planting is restricted to drier areas and the margins of existing woodland and avoids areas of open peat which are likely to revert to semi-natural peatland and wetland habitats. Planting of trees on the two smaller peat deposition areas (PDAs) where they are overlapped by the BEMP area is also proposed. Planting of both polygons and lines of trees is proposed, as shown in Appendix IV Figure 6-15.

A planting mix which encompasses species recorded onsite, in addition to species which are likely to establish in the direr disturbed peat habitats is proposed, as detailed below.

Table 2-1: Planting Mix

Species	Percentage of Planting Mix
Hawthorn	15%
Blackthorn	15%
Rowan	10%
Pedunculate Oak	15%
Sessile Oak	15%
Hazel	10%
Holly	15%
Spindle	5%

These presence of these species will accelerate woodland succession in drier areas and provide a seedbank which will increase diversity in future woodland successional stages as the existing immature woodlands dominated by birch.

Planting is proposed to consist of native whips, with planting targeted in open areas where reduced competition will increase the likelihood of successful establishment. Tree protection will be provided to protect trees from grazing animals during the establishment phase.

Descriptions of the individual tree planting locations shown in Appendix IV Figure 6-15 are included in Table 2-2 below.

Table 2-2: Tree Planting Descriptions

ID	Shape	Description
1	Polygon	Tree planting on raised bank between existing trees on margins
2	Polygon	Tree planting on raised bank between existing trees on margins
3	Line	Treeline Planting on Cutover Bog Margin
4	Polygon	Tree planting on elevated section of cutover bog
5	Line	Treeline planting on margin of immature woodland
6	Line	Treeline planting on margin of immature woodland
7	Line	Treeline planting on margin of scrub
8	Polygon	Tree planting on PDA
9	Polygon	Tree planting on PDA
10	Polygon	Tree planting in clearing (cutover bog)

2.1.2 Drain Blocking

Targeted drain blocking using coir plugs or other suitable biodegradable material installed by hand will be undertaken in the marginal drain on the eastern side of the intact raised bog in the south-west of the BEMP area. Drain blocking using the same approach will also be carried out in cutover bog in the western part of the BEMP area. See Appendix IV Figure 6-15 for proposed drain blocking locations.

The proposed drain blocking measures have been assessed within the FRA, which did not identify any risk of flooding to neighbouring properties or proposed wind farm infrastructure. The effects of drain blocking will be localised within the enhancement areas where this is being implemented.

2.1.3 Wetland Retention & Level Monitoring

The large lake which has established on cutover bog in the BEMP area will be retained, and current water levels will be maintained to provide continuity of the existing habitat resource for waders and waterbirds. This will be achieved through maintaining the existing drainage system and outfall, which support the stable water levels which currently exist.

The wetland retention (maintenance of existing baseline drainage) has been assessed within the FRA.

2.1.4 Ponds/Scrapes

Creation of ponds/scrapes is proposed for areas of bare peat within the cutover bog south of the main peat deposition area (PDA). These will accelerate re-wetting of the bog in this area and create habitats of value to local fauna including invertebrates and wildfowl. See Appendix IV Figure 6-15 for location of measure.

This measure has been considered fully within the FRA, which did not identify any risk of flooding to neighbouring properties or proposed wind farm infrastructure.

2.1.5 Eucalyptus Removal

A plantation of immature non-native eucalyptus trees is present in the eastern part of the BEMP area. The central portion of the eucalyptus plantation (equivalent to approximately half the extent of the plantation) will be removed to facilitate the main PDA.

It is proposed to remove the remaining eucalyptus trees to the north and south of the PDA to allow native scrub to establish in these areas.

See Appendix IV Figure 6-15 for location of measure.

2.1.6 Heath/Marsh Fritillary Habitat on main PDA

Once completed, the PDA will provide a suitable substrate for establishment of grassland and dry heath-type vegetation. Once complete, the PDA will be planted with native grass seed to accelerate revegetation and establishment of grassland/heath type habitats.

In addition, devils bit scabious seed will be collected from across the site and planted in suitably prepared areas distributed across the PDA in order to encourage the establishment of marsh fritillary larval habitat.

It is acknowledged that scrub encroachment may occur in this area. In the event that scrub begins to establish in this PDA, periodic monitoring and management to ensure that scrub does not dominate the PDA will be undertaken. As such, on a precautionary basis, the highest level of scrub cover which will be allowed to establish in this area is 40%, resulting in maintenance of a mosaic of open scrub and grassland/heath-type vegetation.

See Appendix IV Figure 6-15 for location of measure.

2.1.7 Establishment of Calcareous Grassland on Main Site Compound

The main temporary compound in the north of the proposed wind farm will be surfaced with limestone. Following construction, the limestone shall be left in situ to provide a calcareous and free draining substrate, and covered with a shallow layer of neutral/calcareous soil to provide suitable conditions for the establishment of neutral/calcareous flora, leading to the eventual establishment of Neutral/Calcareous grassland.

See Appendix IV Figure 6-15 for location of measure.

2.1.8 Management of Marsh Fritillary Habitat

Areas of existing and translocated marsh fritillary habitat within the BEMP area will be managed to prevent scrub encroachment during the operational phase. This will be achieved through periodic monitoring undertaken according to the main ecological monitoring schedule (Years 1, 2, 3, 5, 10, 15, 20 and 30) triggering removal of trees and shrubs from these areas as required. A combination of mechanical and manual methods will be used for scrub/tree control as required based on the characteristics of individual areas. Periodic mowing of vegetation will also be undertaken to ensure swards to not become too tall, to create a mosaic of varying heights and to ensure swards do not become overly dense. Optimal habitat structure for marsh fritillary is an uneven patchwork of short and tall vegetation ranging from 5 cm to 25 cm in height.

2.1.9 Nest Boxes

One barn owl nest box and one kestrel nest box will be installed on suitable trees in the north-eastern part of the BEMP area under ecological supervision. These can be installed on poles if suitable trees are not available.

These nest boxes will be maintained and replaced as required during the lifespan of the wind farm. Any maintenance work may only be carried out from October to February inclusive under the supervision of a qualified ecologist to ensure nesting season is avoided.

Nest boxes for these species are commercially available or can alternatively be constructed onsite. Plans for barn owl and kestrel boxes are included in Appendix 1.

2.1.10 Log Piles

A proportion of the timber being removed will be salvaged by cutting into logs to create log stacks/piles distributed across the BEMP area (see Figure 6-15 in Appendix VI for BEMP area) as specified by the project ecologist. These piles will be used by insects as the timber decays. Logs of different sizes can be stacked on top of each-other or positioned vertically in a pile. It is important to ensure that the logs remain damp and do not dry out by part-burying (some) logs and placing in a partly shaded location within the site.

2.1.11 Refugia/Hibernacula

Refugia piles and hibernacula will be created. These provide sheltering locations for a wide range of wildlife, including reptiles, amphibians, small mammals and invertebrates. Refugia piles are produced by piling natural materials such as logs, sticks and leaves; that can be supported by additional materials such as rubble and bricks to form a structure with many cracks and crevices for sheltering. Hibernacula are produced in a similar way, but often require setting into the ground in a shallow pit and topping with soil to enclose the structure and creating a more stable microclimate suitable for hibernating species. These structures will be installed in areas of woodland within the BEMP area, where they are less likely to be disturbed. Refugia/hibernacula will be distributed across the BEMP area as specified by the project ecologist



Plate 2-1: Example of hibernaculum

3. MITIGATION MEASURES

3.1 Translocation of Calcareous/Neutral Soil

Soil excavated from the northern access track footprint will be translocated to adjacent areas i.e. areas bordering drains to retain these soils and associated seed banks in the same area.

3.2 Translocation of Marsh Fritillary Habitat

Preconstruction surveys for marsh fritillary will be undertaken to reconfirm the findings of the EIAR.

Areas of suitable marsh fritillary habitat within the proposed wind farm footprint will be translocated to suitable locations in adjacent areas. These areas are identified in EIAR Figure 6-13, and any changes to the baseline will inform the translocation effort. Receptor areas will be prepared as required to ensure the successful establishment of translocated turves. Translocation will be achieved through the excavation and relocation of turves with vegetation comprising suitable larval habitat.

If larval webs are present in any of the areas selected for translocation, translocation of turves and larval webs to suitable receptor areas outside the footprint will be undertaken. This will be achieved by marking the location of pupae/larvae, and carefully excavating the surrounding sod under ecological supervision. If required, translocation will be carried out immediately following the survey during September to ensure pupae/larvae can be relocated at the time of translocation.

3.3 Maintenance of Bat Buffers

The areas surrounding turbines will be actively managed to discourage foraging by bats. The buffer extent around each turbine has been calculated based on proposed turbine dimension options and the height of surrounding trees (see EIAR Chapter 6: Biodiversity). Where buffers overlap both woodland and open habitats, the full circular buffer will be applied to both the wooded area and adjacent open habitat as the area to be managed to discourage bat foraging. The buffer size for all proposed turbines is 76m from the turbine base. Where no woodland is present, conservative buffers matching those for adjacent wooded areas has been applied within which habitats will be managed as required to discourage foraging bats.

Tree-free buffers will be maintained around all turbines to reduce risks to bats. These bat felling buffers will be maintained by keeping vegetation short, which will minimise insect abundance. This will be achieved by mechanical means only, and pesticides and toxic substances shall not be utilised. The buffers shall be cut twice per year, in spring and summer as required. All areas of the buffer with vegetation shall be mowed according to this schedule.

3.4 Amphibian Ponds

Following construction, the settlement ponds within the BEMP area will be adapted to provide permanent ponds to provide suitable breeding habitat for amphibians.

Existing scrub around ponds will be retained where possible, in order to provide suitable supporting habitat and connectivity for smooth newt.

Following construction, one side of each pond will be excavated to form a shallow-angled slope providing variable water depth. The ponds will be fenced to prevent disturbance. Access will be provided via gates.

The locations of settlement ponds are shown on Proposed Drainage Layout drawings P1617-1-0226-A1-D101 to P1617-1-0226-A1-D112 prepared by Hydro Environmental Services witch have been submitted with planning application drawings as part of the Littleton Wind Farm planning application.

3.5 Hedgerow Re-planting at Borrow Pit

A total of 548m of hedgerow along three existing field boundaries will be lost within the proposed borrow pit footprint. In addition to this, a section of hedgerow 21m in length will be lost where the proposed borrow pit access track breaks through hedgerow upon leaving Littleton Bog.

Upon reinstatement of the borrow pit, these hedgerows will be replanted along their current alignments, using the same native tree and shrub species currently present: hazel (*Corylus avellana*), elder (*Sambucus nigra*), hawthorn (*Crataegus monogyna*), blackthorn (*Prunus spinosa*), wych elm (*Ulmus glabra*), downy birch (*Betula pendula*), bramble (*Rubus fruticosus* agg.), wild privet (*Ligustrum vulgare*) and dog rose (*Rosa canina* agg.).

3.6 Treeline Re-planting at R693 / R639 Roundabout

Following construction, the section of treeline required to be removed at the R693 / R639 Roundabout will be replanted with the same species as currently present (excepting ash). These species are hawthorn, Scots pine (*Pinus sylvestris*), birch and hazel.

3.7 Woodland Re-planting at Substation Compound

Following construction, the area of immature woodland removed from the substation compound footprint will be replanted with downy birch whips. In addition, a line of downy birch or other suitable native trees of standard size will be planted along the western margin bordering the existing rail line/proposed access track to restore connectivity for bats in advance of the re-planted woodland re-establishing. Tree protection will be provided to protect trees from grazing animals during the establishment phase.

3.8 Translocation of Vegetation from T05 Compound & Reinstatement

Prior to construction, areas of vegetation and the associated peat and seedbank within the compound north-east of T05 will be translocated to adjacent areas of bare peat and cordoned off.

Following construction, this compound will be reinstated using stockpiled peat from other areas of the site.

3.9 Maintain Linear Field Boundary at Amenity Trail Entrance

The trees bordering the northern side of the proposed amenity trail traversing the area of WN1 - Oak-birch-holly woodland at the western edge of the site will be retained where possible, and if removed shall be replanted with the same species as currently present (hawthorn, hazel, holly and spindle).

3.10 Reinstatement of Temporary Compounds

Excepting the main site compound, substation compound and T05 for which specific measures are detailed above in Sections 2.1.7 and 3.7, the remaining temporary compounds will be reinstated and restored to a state similar to their pre-construction condition. i.e. bare peat, recolonising bare ground and drains as applicable.

4. MAINTENANCE/ESTABLISHMENT

4.1 Tree Care

4.1.1 Establishment of Whips

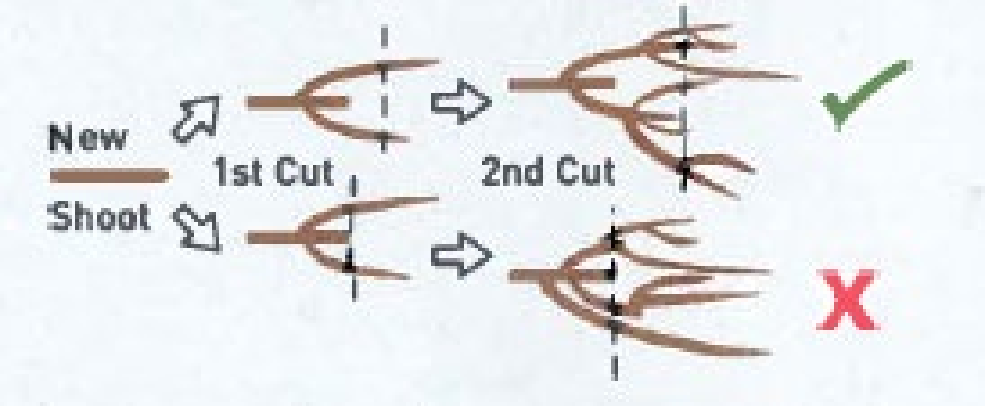
The whips planted will require monitoring during the first years after planting to ensure successful establishment, maintenance of tree protection, localised vegetation clearance (using mechanical means only) if trees are being outcompeted by surrounding vegetation, and to identify any areas where supplementary planting may be required to replace dead whips.

4.1.2 Semi-mature Trees

Larger trees such as the standards proposed to be planted along the western edge of the substation compound can be slower to establish following transplantation and need help until established. These trees may require watering and provisions should be made for this. While establishing, the trees will not require pruning, except where dead branches form or branches are damaged by winds. These branches should be carefully removed to prevent the introduction of disease.

4.1.3 Tree Trimming/Hedgerow Maintenance

Tightly cut hedgerows with flat tops provide little benefit to wildlife, taller and bulky hedgerows are recommended as this provides more shelter for wildlife. When the hedgerows are maintained, stems will be cut a little above the last cut (see Plate 4-1) 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 4-1: 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 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 may disturb breeding; this is in keeping with the Wildlife Act 1976 (as amended).

4.2 Drain Blocking

Drain blocking will be monitored to ensure successful establishment and functionality of blacking measures. If required, supplementary blocking will be carried out.

4.3 Maintenance of Wetland

Water levels at the wetland will be monitored during the operational phase. If required, levels will be adjusted at the control point.

4.4 Vegetation Clearance

4.4.1 Eucalyptus Clearance

The areas cleared of eucalyptus will be monitored during the initial stages of operation, and any regrowth of eucalyptus will be removed. If removal is required on the PDA, this will be carried out manually since it will not be safe access the PDA with wheeled or tracked machinery.

4.4.2 Marsh Fritillary

The areas of marsh fritillary habitat within the BEMP area will be monitored throughout the operational phase, and tree/scrub removal will be carried out as required to maintain suitable marsh fritillary habitat in these areas.

4.4.3 Bat Buffers

The bat buffers shall be cut twice per year during every year of operation, in spring and summer as required. All areas of the buffer with vegetation shall be mowed according to this schedule.

4.5 Vegetation Establishment

4.5.1 Peat Deposition Area

The establishment of vegetation on the main PDA will be monitored during the early operational phase, and supplementary planting of native grass seed and devil's bit scabious will be carried out as required to achieve a minimum of 50% vegetation coverage by year 5 of operation.

4.5.2 Amphibian Ponds

Establishment of vegetation within and around ponds will be monitored during the early operational phase, and if required, supplementary native planting to achieve vegetative cover around ponds and provision of suitable vegetation for egg deposition within ponds will be undertaken.

4.5.3 General Monitoring

The development of vegetation and associated habitats will be monitored for all enhancement and mitigation measures throughout the operational phase of the proposed development in order to document and track the outcome of these measures.

4.6 Nest Boxes

The nest boxes will be maintained and replaced as required during the lifespan of the wind farm. Any maintenance work may only be carried out from October to February inclusive under the supervision of a qualified ecologist to ensure nesting season is avoided.

5. MONITORING & MAINTENANCE SCHEDULE

5.1 General Monitoring of Management Measures

Commencing in year 1 of operation the status of the habitat enhancement and mitigation measures will be checked as per Table 5-1 below. Monitoring will be undertaken by a qualified ecologist appointed by the developer/operator of the wind farm. The timing of monitoring is provided in Table 5-1 below. This will follow implementation of the plan to confirm whether habitats have successfully established and to identify any issues that need to be addressed. Following these monitoring visits, a short status report will be prepared. This will identify any necessary actions to ensure the success of the BEMP, which will be implemented on foot of the report findings.

A final assessment of the condition and success of the various biodiversity management and enhancement prescriptions will also be undertaken in Year 35.

Table 5-1: Summary of Biodiversity Enhancement & Management Measures

Measure	Target Species/Habitat	Implementation Timeline	Monitoring	Ongoing management
Enhancement				
Tree Planting	Woodland	From project initiation; ongoing management through establishment phase	Years 1, 2, 3, 5, 10, 15, 20, 30, 35	Supplementary planting, localised vegetation clearance, maintain tree protection (Years 1-3, year 5)
Drain Blocking	Bog	From project initiation; ongoing management through establishment phase	Years 1, 2, 3, 5, 10, 15, 20, 30, 35	Supplementary blocking (Years 1-3, year 5)
Wetland Retention	Lake & Associated Wetland/Waterbird Habitats	From project initiation; ongoing management through establishment phase	Years 1, 2, 3, 5, 10, 15, 20, 30, 35	Maintain existing level (Years 1, 2, 3, 5, 10, 15, 20, 30, 35)
Ponds/Scrapes	Wetland/Recolonising Cutover Bog	From project initiation; ongoing management through establishment phase	Years 1, 2, 3, 5, 10, 15, 20, 30, 35	None; monitoring only
Eucalyptus Removal	Native scrub & associated habitats	From project initiation; ongoing management through establishment phase	Years 1, 2, 3, 5, 10, 15, 20, 30, 35	Clearance of any eucalyptus regrowth (Years 1-3, year 5)
Peat Deposition Area	Grassland/heath/marsh fritillary habitat	From project initiation; ongoing management through establishment phase	Years 1, 2, 3, 5, 10, 15, 20, 30, 35	Supplementary planting to achieve min. 50% vegetation cover by year 5. (Years 1-3, year 5)
Amphibian Ponds	Amphibian Breeding Habitat	From project initiation; ongoing management through establishment phase	Years 1, 2, 3, 5, 10, 15, 20, 30, 35	Supplementary planting to encourage establishment of marginal cover and aquatic vegetation. (Years 1-3, year 5)

Measure	Target Species/Habitat	Implementation Timeline	Monitoring	Ongoing management
Calcareous grassland substrate at site compound	Neutral/calcareous grassland	From project initiation; ongoing management through establishment phase	Years 1, 2, 3, 5, 10, 15, 20, 30, 35	None; monitoring only
Maintenance of marsh fritillary habitat	Marsh fritillary	From project initiation; ongoing management through establishment phase	Years 1, 2, 3, 5, 10, 15, 20, 30, 35	Remove trees/scrub where encroachment occurs. (Years 1, 2, 3, 5, 10, 15, 20, 30, 35)
Nest boxes	Kestrel, Barn Owl	From project initiation; ongoing management through establishment phase	Years 1, 2, 3, 5, 10, 15, 20, 30, 35	Maintain or replace nest boxes as required. (Years 1, 2, 3, 5, 10, 15, 20, 30, 35)
Mitigation				
Bat Buffer Maintenance	All bat species occurring onsite	Buffers to be cleared prior to turbine installation. Clearance will take place outside the bird breeding season (March-August inclusive)	Annual monitoring throughout lifespan of wind farm (mid- late summer)	Ensure vegetation is kept low
Translocation of Calcareous/Neutral Soil	Neutral/calcareous grassland	To be carried out concurrently with construction of access track.	Years 1, 2, 3, 5, 10, 15, 20, 30, 35	None; monitoring only
Translocation of Marsh Fritillary Habitat	Marsh fritillary	To be carried out prior to vegetation clearance.	Years 1, 2, 3, 5, 10, 15, 20, 30, 35	Supplementary planting of devil's bit scabious if required (Years 1-3, year 5)
Hedgerow/Treeline Reinstatement (TDR)	Hedgerows/Treelines Associated bird, bat & insect species	To be planted at the earliest suitable time immediately following delivery of turbine components	Years 1, 2, 3, 5, 15 following replanting	Ensure establishment
Hedgerow Reinstatement (Borrow Pit)	Hedgerows Associated bird, bat & insect species	To be planted at the earliest suitable time following borrow pit reinstatement	Years 1, 2, 3, 5, 15 following borrow pit reinstatement	Ensure establishment of hedgerows with equal or greater height and width versus existing hedgerows.

Measure	Target Species/Habitat	Implementation Timeline	Monitoring	Ongoing management
Woodland Re-planting at Substation Compound	Woodland	To be implemented at the earliest suitable time following reinstatement of the substation compound; ongoing management through establishment phase	Years 1, 2, 3, 5, 10, 15, 20, 30, 35	Supplementary planting, watering of standard trees where required, localised vegetation clearance, maintain tree protection (Years 1-3, year 5)
Translocation of Vegetation from T05 Compound & Reinstatement	Revegetating Cutover Bog	Translocation to be carried out concurrently with compound establishment. Reinstatement following removal of compound.	Years 1, 2, 3, 5, 10, 15, 20, 30, 35	None; monitoring only
Maintain Linear Field Boundary at Amenity Trail Entrance	Linear wooded feature	Trees along boundary to be retained at vegetation clearance stage, or replanted at the earliest suitable time following construction	Years 1, 2, 3, 5, 10, 15, 20, 30, 35	If replanting is required: supplementary planting, localised vegetation clearance, maintain tree protection (Years 1-3, year 5)
Reinstatement of Temporary Compounds	Revegetating Cutover Bog	Reinstatement following removal of compound.	Years 1, 2, 3, 5, 10, 15, 20, 30, 35	None; monitoring only

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FEHILY TIMONEY

DESIGNING AND DELIVERING
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APPENDIX 1

Nest Box Plans

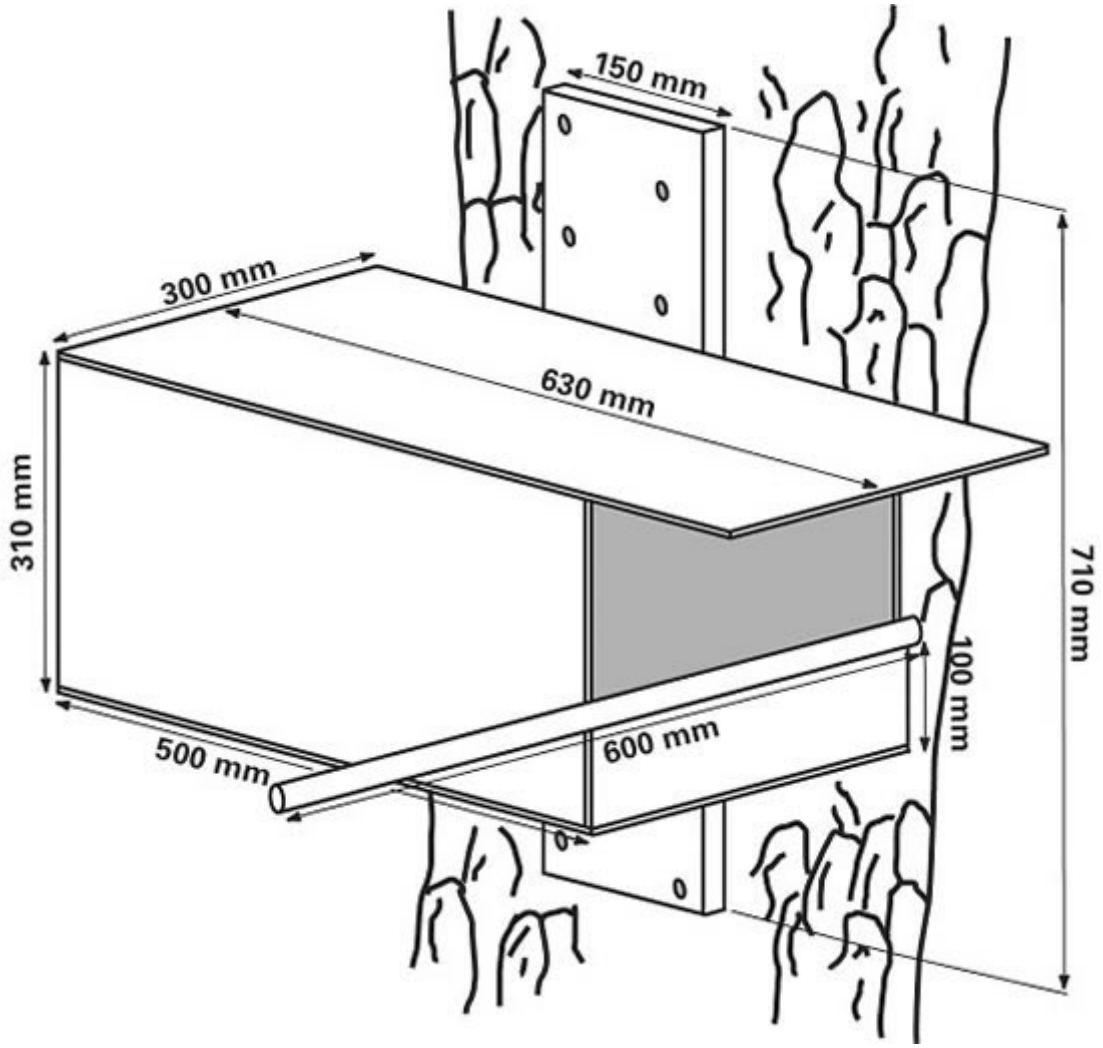


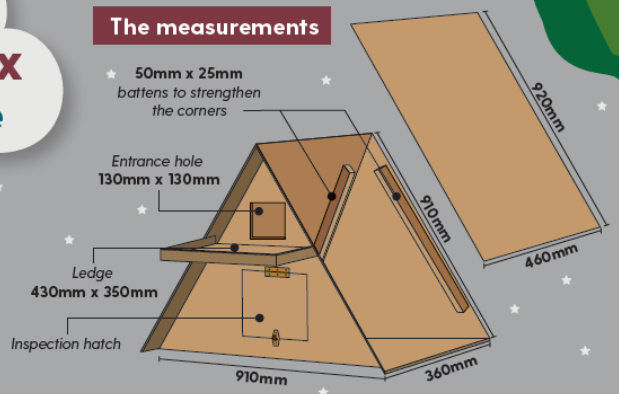
Plate 1: Kestrel Nest Box Dimensions

BirdWatchIreland

Making a Barn Owl box

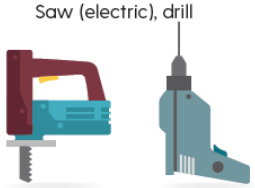
A how-to guide

The measurements



The tools

Saw (electric), drill



tape measure and pencil



The materials

- Exterior grade (11mm) marine plywood x 1 sheet
- Batten timber (50mm x 25mm)
- Silicone sealant
- Roofing felt
- Stainless steel screws
- Small butt hinge x 1
- Small door latch lock x 1

Step 1 Using the diagram, measure and mark out the plywood. Labelling the sections can come in handy later.

Step 2 Cut all panels, entrance hole and inspection hatch (retaining cut out) .

Step 3 Assemble the box by screwing all but final sloped panel together. Use battens as illustrated to strengthen internally.

Step 4 Use batten timber to put a rim around the external ledge and secure to box using more batten material. Use hinge and latch to fit inspection hatch door.

Step 5 Use the silicone sealant to fill in any small gaps in the joints to weather-proof the box.

Step 6 Fit final sloped panel and finish with roof felt.

The installation

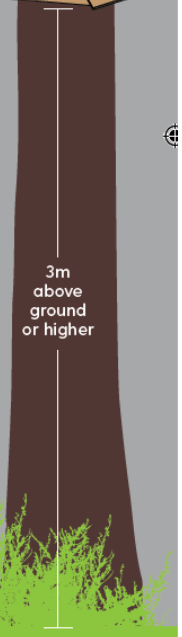
Pick a suitable location in a mature isolated tree or in a large tree on the edge of a wood or in a hedgerow.

Position the box 3 metres or higher in the tree, making sure it faces away from prevailing wind and out over suitable foraging habitats.

Do not hide the box in tree foliage. Make sure an owl can see the nest box from a distance and has a clear flight path to the box. Bear this in mind if installing the box during the winter months.

The design illustrated is for outdoor use, alternative designs are used for indoor situations such as in barns.





IMPORTANT: Do not install Barn Owl boxes near busy roads, as the owls are vulnerable to being hit by cars. Choose sites at least 200m away from large busy roads.

Heritage Officer Programme | An Chomhairle Oidhreachta The Heritage Council

www.birdwatchireland.ie

Plate 2: Barn Owl Nest Box Plans

FEHILY TIMONEY

DESIGNING AND DELIVERING
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APPENDIX 6.2

Aquatic Ecology Baseline Reports

Aquatic baseline report for Littleton wind farm, Co. Tipperary (2025)

Triturus

Prepared by Triturus Environmental Ltd. for Fehily Timoney

November 2025

Please cite as:

Triturus (2025). Aquatic baseline report for Littleton wind farm, Co. Tipperary (2025). Report prepared by Triturus Environmental Ltd. for Fehily Timoney. November 2025.

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1. Introduction

1.1 Background

Triturus Environmental Ltd. were commissioned by Fehily Timoney to undertake baseline aquatic surveys to inform EIAR preparation for the proposed Littleton wind farm project, located near Littleton, Co. Tipperary (**Figure 2.1**).

Undertaken on a catchment-wide scale, this report provides a baseline assessment of the aquatic ecology, including fisheries and biological water quality as well as protected species and habitats in the vicinity of the proposed project, inclusive of the proposed grid cable route (GCR). The surveys would serve to update previous surveys of the site (by Triturus in 2021 and 2023) whilst also accounting for any changes in proposed infrastructure and site layout in the interim period. Aquatic surveys were undertaken in September 2025.

1.2 Project description

A full description of the proposed project will be provided in any Environmental Impact Assessment Report (EIAR) used to support consenting applications.

2. Methodology

2.1 Selection of watercourses for assessment

All freshwater watercourses which could be affected directly or indirectly by the proposed wind farm project and associated infrastructure were considered as part of the current baseline. This included sites in the vicinity of the proposed turbine array, in addition to watercourse crossings of the proposed grid cable route (GCR). Thus, a total of 35 no. individual sites were selected for detailed aquatic assessment (see **Table 2.1, Figure 2.1** below). The courses and nomenclature for the watercourses surveyed followed Environmental Protection Agency (EPA) mapping.

Riverine survey sites survey sites were present on the Clover River (EPA code: 16C04), Drish River (16D02), River Suir (16S02), Black River (16B01), North Glengoole River (16N28), Breegagh River (16B03), River Goul (15G02), Ardreagh River (15A03), Borrisbeg River (15B18), Clomantagh Lower Stream (15C91), Gorteenahilla River (15G08), Lismaine Stream (15L16), Lisdowney Stream (15L02), River Nore (15N01) and several unnamed watercourses (**Table 2.1**). Additionally, a total of 4 no. lakes/wetlands located at Littleton Bog were also surveyed in September 2025 (**Table 2.1; Figure 2.3**). The aquatic survey sites were located within the Suir_SC_040, Goul_SC_010 and Nore_SC_070 river sub-catchments. The proposed wind farm site did not overlap with any European sites. However, there was potential downstream hydrological connectivity between the proposed project and the Lower River Suir SAC (002137), a site designated for a range of aquatic qualifying interests. A single GCR watercourse crossing of the River Nore (at site G11) traversed the River Barrow and River Nore SAC (002162) and River Nore SPA (004233).

Please note that this aquatic report should be read in conjunction with the final Environmental Impact Assessment Report (EIAR) prepared for the proposed project.

2.2 Aquatic site surveys

Aquatic surveys of the watercourses within the vicinity of the proposed wind farm project were conducted on the 2nd , 3rd, 4th and 19th September 2025. Survey effort focused on both instream and riparian habitats at each aquatic sampling location and included a fisheries habitat appraisal, white-clawed crayfish survey, otter survey (within 150m of the survey site), macrophyte and aquatic bryophyte survey and biological water quality (Q-sampling at riverine sites) or invertebrate sweep sampling (lacustrine sites). This holistic approach informed the overall aquatic ecological evaluation of each site in the context of the proposed project and ensured that any habitats and species of high conservation value would be detected to best inform mitigation.

In addition to the ecological characteristics of the site, a broad aquatic and riparian habitat assessment was conducted utilising elements of the methodology given in the Environment Agency's 'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003' (EA, 2003) and the Irish Heritage Council's 'A Guide to Habitats in Ireland' (Fossitt, 2000). This broad characterisation helped define the watercourses' conformity or departure from naturalness. All sites were assessed in terms of:

- Physical watercourse/waterbody characteristics (i.e. width, depth, channel form), including associated evidence of historical drainage

- Substrate type, listing substrate fractions in order of dominance (i.e. bedrock, boulder, cobble, gravel, sand, silt, etc.)
- Flow type by proportion of riffle, glide and pool in the sampling area
- An appraisal of the macrophyte and aquatic bryophyte community at each site
- Riparian vegetation composition and bordering land use practices

Table 2.1 Summary of *n*=20 riverine survey sites in the vicinity of the proposed Littleton wind farm

2023 site no.	2025 site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
A4	A1	Unnamed stream	n/a	Noard	621499	656663
A5	A2	Clover River	16C04	Noard	621241	655973
A6	A3	Clover River	16C04	R639 road crossing, Leigh	621356	657637
A3	A4	Unnamed stream	n/a	R639 road crossing, Leigh	622188	658445
A7	A5	Clover River	16C04	Noard	619601	659306
B1	B1	Drish River	16D02	Longfordpass South	624723	657212
n/a	B2	Unnamed stream	n/a	Longfordpass South	623872	658080
B2	B3	Drish River	16D02	Bridge 100m u/s Longfordpass Bridge	624889	660463
B3	B4	Drish River	16D02	Castletown Bridge	621680	663563
B5	B5	Drish River	16D02	Drish Bridge	614891	658369
n/a	B6	River Suir	16S02	Thurles Bridge	613217	656936
C1	C1	Black River	16B01	Clonoura	623707	654329
C2	C2	Black River	16B01	Derryvella	621096	652818
n/a	C3	Unnamed stream	n/a	Lanespark	621774	650932
C3	C4	North Glengoole River	16N28	Derryvella	620969	652602
C4	C5	Black River	16B01	Derryhogan	619908	653512
C5	C6	Black River	16B01	N75 crossing, Two Mile Borris	619148	657810
D1	D1	Breegagh River	16B03	Kileen	621369	650304
D2	D2	Breegagh River	16B03	Ballymurreen Bridge	617399	653051
D3	D3	Breegagh River	16B03	Archerstown Bridge	613950	656841

Table 2.2 Summary of *n*=11 watercourse crossings along the proposed grid cable route (GCR)

2023 site no.	2025 site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
B2	G1	Drish River	16D02	Bridge 100m u/s Longfordpass Bridge	624889	660463
n/a	G2	River Goul	15G02	Urlingford	627557	662814
n/a	G3	Ardreagh River	15A03	Urlingford	628129	663283
n/a	G4	Borrisbeg River	15B18	R693 road crossing, Borrismore	630026	663573
n/a	G5	Borrisbeg River	15B18	R693 road crossing, Borrismore	631586	663278

2023 site no.	2025 site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
n/a	G6	Clomantagh Lower Stream	15C91	R693 road crossing, Clomantagh Lower	635291	663867
n/a	G7	Gorteenahilla River	15G08	R693 road crossing, Freshford	640307	664969
n/a	G8	Unmapped stream	n/a	R694 road crossing	640626	665400
E8	G9	Lismaine Stream	15L16	L694 road crossing	642120	667578
E9	G10	Lisdowney Stream	15L02	Grange Bridge	643572	668666
n/a	G11	River Nore	15N01	Moatpark	643930	671951

Table 2.3 Summary of *n*=4 lake/wetland survey sites in the vicinity of the proposed Littleton wind farm (sites not previously covered in 2023 surveys)

2023 site no.	2025 site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
n/a	L18	Lake/wetland	n/a	Bawnreagh	623852	656260
n/a	L19	Lake/wetland	n/a	Clonoura	623732	655408
n/a	L20	Lake/wetland	n/a	Clonoura	623482	655235
n/a	L21	Lake/wetland	n/a	Clonoura	623580	655191

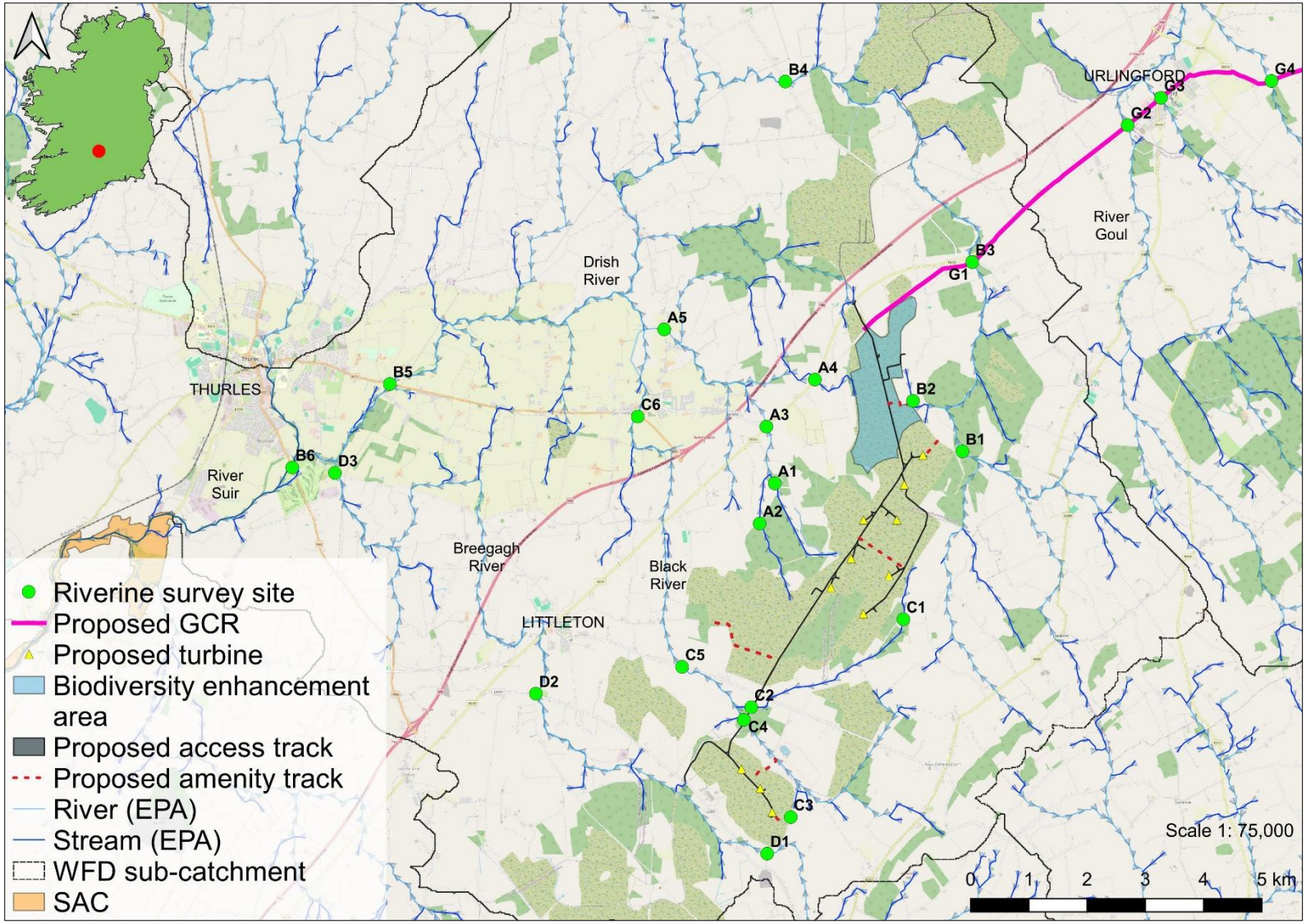


Figure 2.1 Overview of the riverine survey sites in the vicinity of the proposed Littleton wind farm, 2025

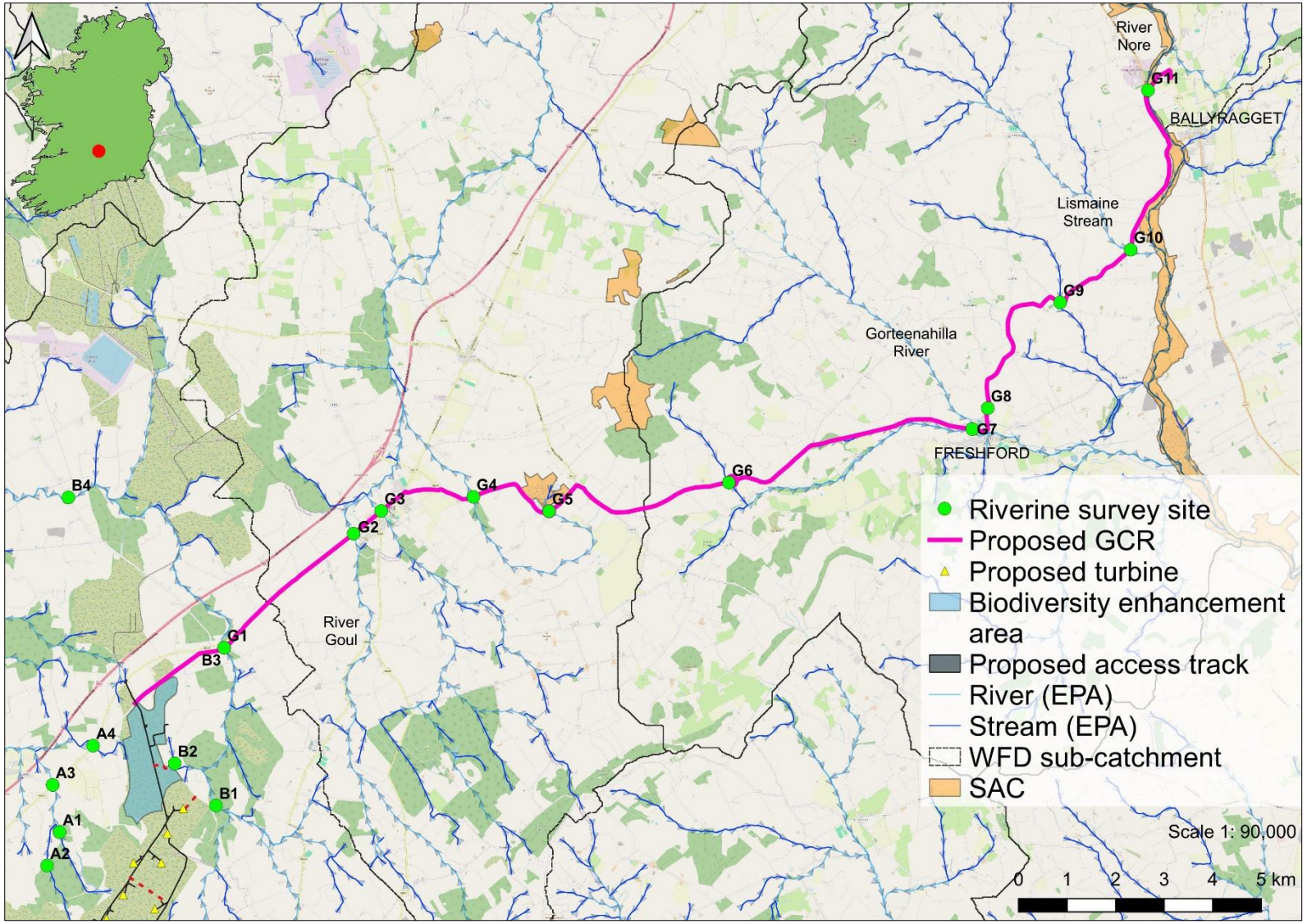


Figure 2.2 Overview of the GCR survey sites (watercourse crossings), 2025

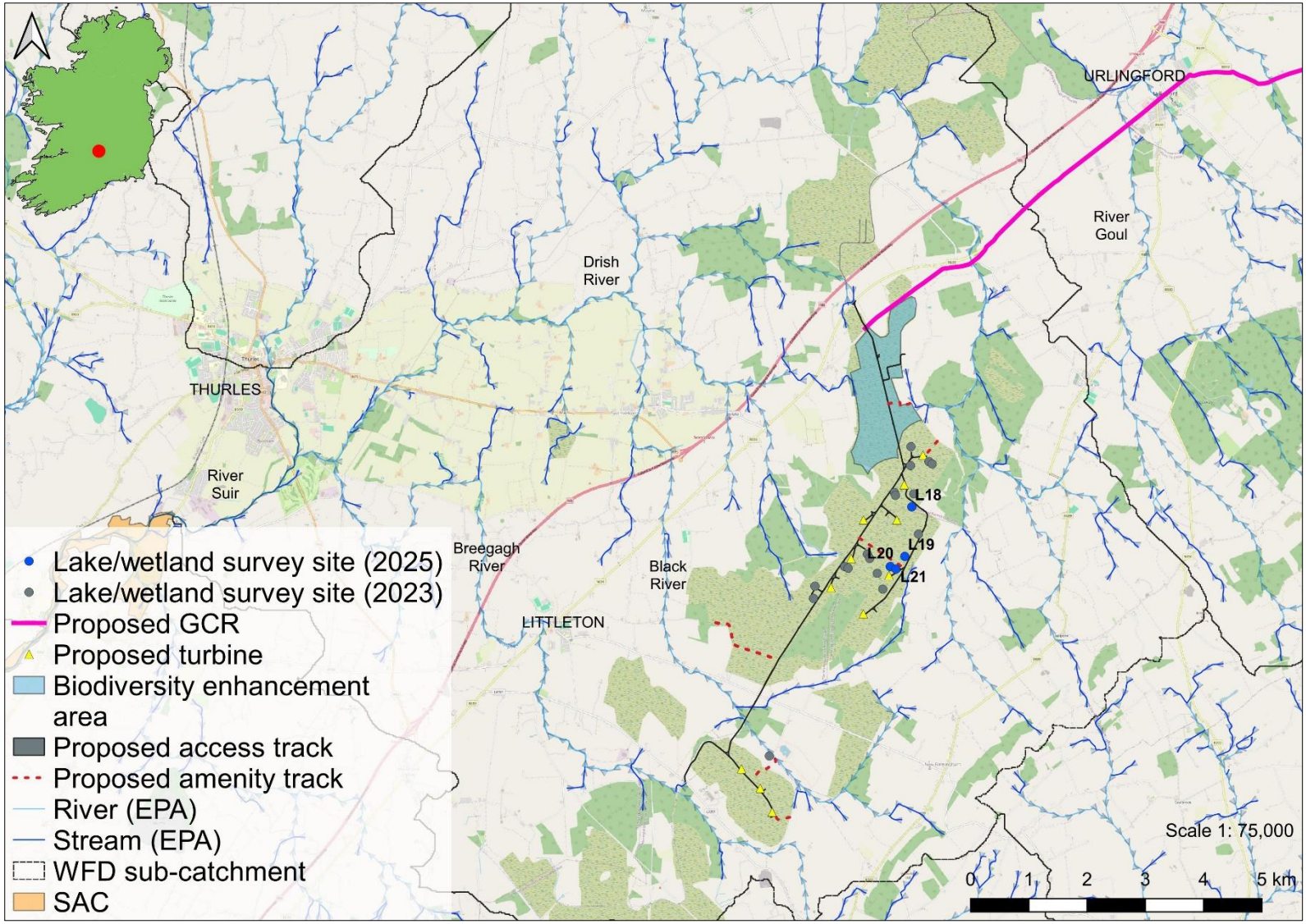


Figure 2.3 Overview of the lacustrine survey sites in the vicinity of Littleton wind farm, 2025

2.3 Fisheries habitat appraisal

A fisheries habitat appraisal of the 34 no. individual riverine and lacustrine sites was undertaken to establish their importance for salmonid, lamprey, European eel and other fish species in terms of spawning, nursery and or holding habitat. The appraisals of salmonids and lamprey were cognisant of species-specific habitat requirements and preferences as outlined in O'Grady (2006), Hendry et al. (2003), Armstrong et al. (2003), Harvey & Cowx (2003), Maitland (2003) and Hendry & Cragg-Hine (1997). River habitat surveys and fisheries assessments were also carried out utilising elements of the approaches in the River Habitat Survey Methodology (EA, 2003) and Fishery Assessment Methodology (O'Grady, 2006) to broadly characterise the channel (i.e. profile, substrata etc.).

2.4 White-clawed crayfish survey

White-clawed crayfish (*Austropotamobius pallipes*) surveys were undertaken at the aquatic survey sites in September 2025 under a National Parks and Wildlife (NPWS) open national licence (no. C164/2025), as prescribed by Sections 9, 23 and 34 of the Wildlife Act (1976-2023), to capture and release crayfish to their site of capture. As per Inland Fisheries Ireland aquatic biosecurity recommendations, the crayfish sampling started at the uppermost site(s) of the wind farm catchment/sub-catchments in the survey area to minimise the risk of transferring invasive propagules (including crayfish plague) in an upstream direction.

Hand-searching of instream refugia and sweep netting was undertaken according to Reynolds et al. (2010). An appraisal of white-clawed crayfish habitat at each site was conducted based on physical habitat attributes (Gammell et al., 2021; Peay, 2003), water chemistry and incidental records in mustelid spraint. Additionally, a desktop review of crayfish records within the wider survey area was completed.

2.5 Biological water quality (Q-sampling)

A total of 30 no. individual riverine survey sites were assessed for biological water quality through Q-sampling in September 2025 (**Table 2.1, 2.2**). All samples were taken with a standard kick sampling hand net (250mm width, 500µm mesh size) from areas of riffle/glide utilising a 2-minute kick sample, as per Environmental Protection Authority (EPA) methodology (Feeley et al., 2020). Large cobble was also washed at each site for 1 minute (where present) to collect attached macro-invertebrates (as per Feeley et al., 2020). Samples were elutriated and fixed in 70% ethanol for subsequent laboratory identification. Samples were converted to Q-ratings as per Toner et al. (2005) and assigned to WFD status classes (**Table 2.4**). Any rare invertebrate species were identified from the NPWS Red List publications for beetles (Foster et al., 2009), mayflies (Kelly-Quinn & Regan, 2012), stoneflies (Feeley et al., 2020) and other relevant taxa (i.e. Byrne et al., 2009; Nelson et al., 2011).

Table 2.4 Reference categories for EPA Q-ratings (Q1 to Q5)

Q value	WFD status	Pollution status	Condition
Q5 or Q4-5	High status	Unpolluted	Satisfactory
Q4	Good status	Unpolluted	Satisfactory
Q3-4	Moderate status	Slightly polluted	Unsatisfactory
Q3 or Q2-3	Poor status	Moderately polluted	Unsatisfactory
Q2, Q1-2 or Q1	Bad status	Seriously polluted	Unsatisfactory

2.6 Lacustrine macro-invertebrate communities

The 4 no. lake/wetland sites were sampled for macro-invertebrates via sweep netting in September 2025. A standard lake net (250mm width, mesh size 500µm) was used to sweep macrophytes to capture macro-invertebrates. The net was also moved along the lake/lake bed to collect epibenthic and epiphytic invertebrates from the substratum (as per Cheal et al., 1993). A 3-minute sampling period was employed. To ensure appropriate habitat coverage, the sampling period was also divided amongst the range of meso-habitats present at the survey site to get a representative sample for sub-habitats.

2.7 Macrophytes and aquatic bryophytes

Surveys of the macrophyte and aquatic bryophyte community were conducted by instream wading at each of the survey sites, with specimens collected (by hand or via grapnel) for on-site identification. An assessment of the aquatic vegetation community helped to identify any rare macrophyte species listed under the Flora (Protection) Order, 2022, Irish Red list for vascular plants (Wyse-Jackson et al., 2016) and or aquatic bryophytes (Lockhart et al., 2012), or habitats corresponding to Annex I habitats, such as floating river vegetation (3260) or hydrophilous tall herb (6430).

2.8 Otter signs

The presence of otter (*Lutra lutra*) was determined through the recording of otter signs within 150m radius of each survey site. Notes on the age and location of signs (ITM coordinates) were made, in addition to the quantity and visible constituents of spraint (i.e. remains of fish, crustaceans, molluscs etc.).

2.9 Aquatic ecological evaluation

The evaluation of aquatic ecological receptors contained within this report uses the geographic scale and criteria defined in the 'Guidelines for Assessment of Ecological Impacts of National Road Schemes' (NRA, 2009).

2.10 Biosecurity

A strict biosecurity protocol following IFI (2010) and the Check-Clean-Dry approach was adhered to during surveys for all equipment and PPE used. Disinfection of all equipment and PPE before and after use with Virkon™ was conducted to prevent the transfer of pathogens or invasive propagules between survey sites. Surveys were undertaken at sites in a downstream order to minimise the risk of upstream propagule mobilisation. Care was given towards preventing the spread or introduction of highly virulent crayfish plague (*Aphanomyces astaci*). Any aquatic invasive species or pathogens recorded within or adjoining the survey areas were geo-referenced. All Triturus staff are certified in 'Good fieldwork practice: slowing the spread of invasive non-native species' by the University of Leeds.

3. Desktop review

3.1 Survey area description

The proposed Littleton wind farm is located in an extensive area of cutover bog within the townlands of Noard, Kileen, Derryhogan, Lanespark, Derryvella, Leigh, Clonoura, Longfordpass South, Two Mile Borris, Ballymurreen, Archerstown, Urlingford, Borrismore, Clomantagh Lower, Freshford and Moatpark (**Figure 2.1**). The proposed wind farm site is within the South Eastern River Basin District and within hydrometric areas 15 (Nore) and 16 (Suir). The watercourses and aquatic surveys sites in the vicinity of Littleton wind farm are typically small, historically modified lowland depositing channels (FW2; Fossitt, 2000) which flow over areas of Tournaisian and Visean limestone and calcareous shale (Geological Survey of Ireland data). Land use practices in the wider survey area comprise peat bogs (CORINE 412), transitional woodland scrub (324) with localised coniferous forests (312), adjoining pastures (231) and built land (BL3).

3.2 Fisheries

The Drish River, a tributary of the River Suir, is known to support *Lampetra* sp. (O'Connor, 2007; Kurz & Costello, 1999) as well as Atlantic salmon (*Salmo salar*), brown trout (*Salmo trutta*), European eel (*Anguilla anguilla*), pike (*Esox lucius*), stone loach (*Barbatula barbatula*), minnow (*Phoxinus phoxinus*) and three-spined stickleback (*Gasterosteus aculeatus*) (Triturus 2023 data). The trout and pike in the Drish were found to be fast-growing and similar to those in comparable rivers in the Irish midlands (CFB data referenced in AECOM, 2020). The river suffered significant pollution from a zinc and lead mine at Lisheen until the recent past (AECOM, 2020; O'Connor, 2007).

The Clover River, a tributary of the Drish River, is known to support brown trout, lamprey (*Lampetra* sp.), three-spined stickleback, pike, perch (*Perca fluviatilis*) and stone loach (Triturus 2021 & 2023 data). The Breegagh River, another Drish River tributary, also supports Atlantic salmon, brown trout, lamprey (*Lampetra* sp.), European eel, minnow, stone loach and three-spined stickleback (Triturus 2021 & 2023 data). The Black River (Two Mile Borris) is known to support Atlantic salmon, brown trout, lamprey (*Lampetra* sp.), European eel and stone loach (Triturus 2021 & 2023 data; O'Connor, 2007). The North Glengoole River, a Black River tributary, supports Atlantic salmon, brown trout, European eel and three-spined stickleback (Triturus 2021 & 2023 data).

In terms of the proposed GCR option, the route crosses the River Nore, Drish River, River Goul, Borrisbeg River, Gorteenahilla River, Lisdowney Stream and the Ardreagh River, which are known to support Atlantic salmon, brown trout, stone loach and three-spined stickleback (Triturus 2021 & 2023 data; IFI 2021 data). The Gorteenahilla River, a tributary of the Nuenna River, supports Atlantic salmon, brown trout, *Lampetra* sp. and three-spined stickleback (Triturus 2021-2023 data). The Clomantagh Lower Stream and the Lismaine Stream frequently run dry and provide poor-quality fisheries habitat, often only supporting

three-spined stickleback (Triturus data). The Lisdowney Stream, a River Nore tributary, supports Atlantic salmon, brown trout, European eel and three-spined stickleback (Triturus 2021 & 2023 data; IFI 2021 data). The River Nore in the vicinity of Ballyragget supports a range of fish species, including Atlantic salmon, brown trout, *Lampetra* sp., European eel, minnow (*Phoxinus phoxinus*), stone loach and rudd (*Scardinius erythropthalmus*) (Triturus 2021 & 2023 data).

Fisheries data for the lake/wetland waterbodies surveyed was not available prior to this survey.

3.3 Protected & rare aquatic species

A comprehensive desktop review of available data from the National Parks and Wildlife Service (NPWS), National Biodiversity Data Centre (NBDC), Inland Fisheries Ireland (IFI), Botanical Society of Britain and Ireland (BSBI), National Crayfish Plague Surveillance Programme (NCPSP), Environmental Protection Agency (EPA) and Triturus databases for the 10km grid squares containing and adjoining the project (i.e. S15, S16, S25, S26, S36, S46 & S47) identified records for a low number of rare and or protected aquatic species within the vicinity of the proposed wind farm.

A high number of contemporary white-clawed crayfish (*Austropotamobius pallipes*) records (>75) were available for the respective grid squares in the 2005-2023 period (**Figure 3.1**), with a further c.50 historical records (pre-2005). A low number of records were available for the Drish River, Clover River (single record), Black River, River Goul, and the River Nore (**Figure 3.1**). The previous 2023 surveys (Triturus, 2024) did not record live crayfish although crayfish remains were identified in otter spraint on the Ardreagh River at the currently proposed GCR crossing.

A low number of contemporary otter (*Lutra lutra*) records (2005-2023) were available for the relevant grid squares, with records from the Black River, Drish River and River Nore (**Figure 3.1**). Otter signs were recorded during the 2023 surveys at sites on the Clover River and unnamed tributary, Breegagh River, Ardreagh River, Gorteenahilla River and the Lisdowney Stream (Triturus, 2024).

A low number of records were available for freshwater pearl mussel (M*argaritifera margaritifera*) for the River Nore located between the River Erkina confluence and Ballyragget in the 1993 to 2007 period (i.e. downstream of the proposed project). However, no live mussel have been recorded in this area of the River Nore since 2007 (Pascal Sweeney pers. comm.), including during a survey completed in May 2023 (Triturus data).

A low number of records for lamprey (*Lampetra* sp.) (reported as brook lamprey) were available for the River Nore downstream of Durrow (data not shown). *Lampetra* sp. are also known from the Nuenna River (Gordon et al., 2021; Matson et al., 2018) and several survey watercourses (see section 3.2 above).Historical records (1968 & 1972) for spawning sea lamprey (*Petromyzon marinus*) were available for the River Nore in the vicinity of Ballyragget (data not shown).

Two records for Flora (Protection) Order 2022 macrophyte species opposite-leaved pondweed (*Groenlandia densa*), were available from a former pond in the vicinity of Urlingford, but these were historical only (i.e. pre-1900, data not shown). No contemporary NPWS records for macrophytes or aquatic bryophytes protected under the Flora (Protection) Order, 2022 were available for the respective grid squares.

A single record for smooth newt (*Lissotriton vulgaris*) was available for bog habitat at Derryvella, adjacent to the North Glengoole River from 2010 (data not shown).

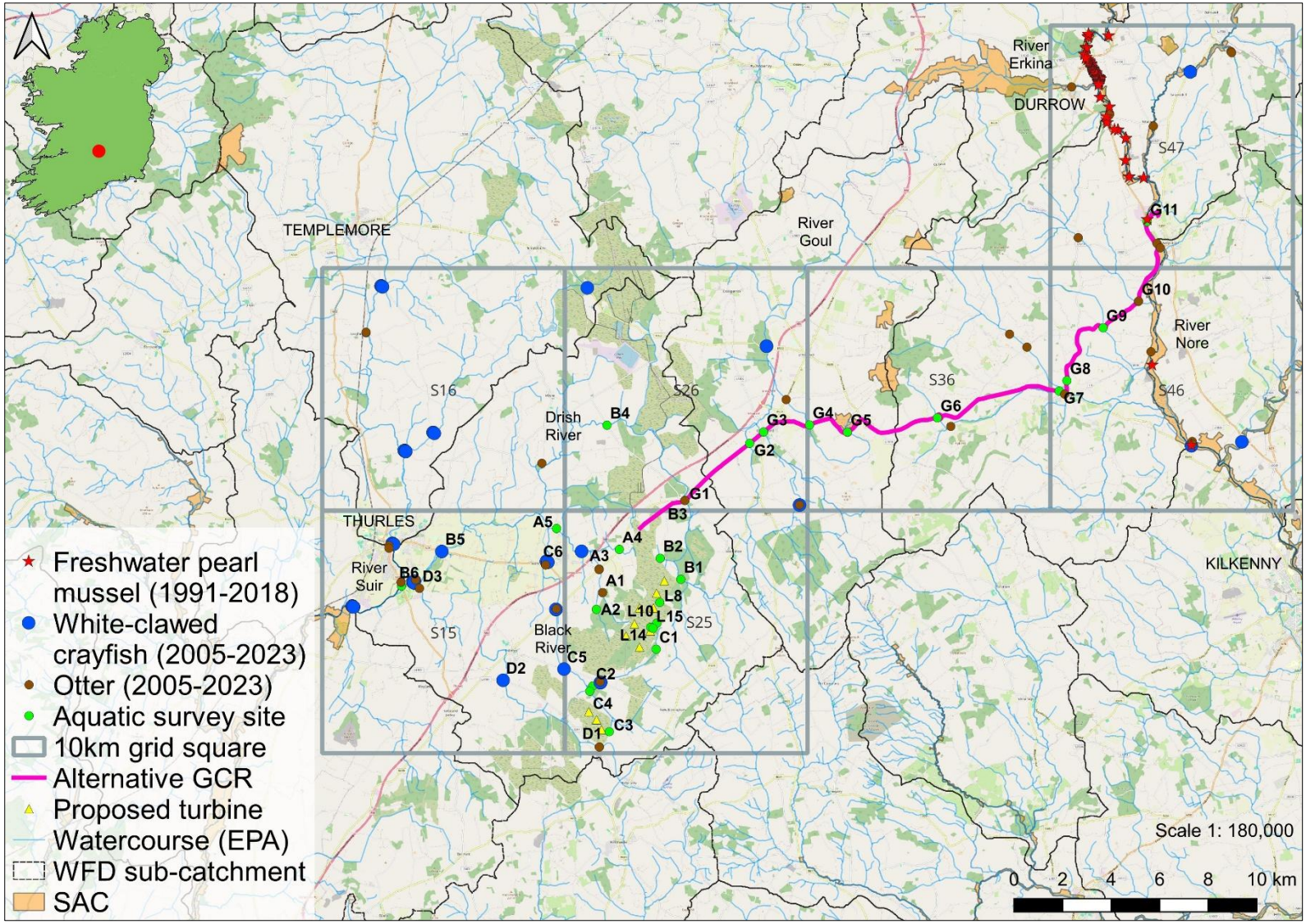


Figure 3.1 Distribution of selected protected species records in the vicinity of the proposed Littleton wind farm (source: NPWS, EPA, NBDC & Triturus data)

4. Results of aquatic surveys

The following section summarises each of the 30 no. riverine and 4 no. lake/wetland survey sites in terms of aquatic habitats, physical characteristics and overall value for fish, white-clawed crayfish, otter and macrophyte/aquatic bryophyte communities. Biological water quality (Q-sample) and macro-invertebrate sweep sample results are summarised for each site and provided in full in **Appendix A**. A summary of the aquatic species and habitats of high conservation concern recorded during the surveys is provided in **Table 4.2**. An evaluation of the aquatic ecological importance of each survey site based on these aquatic surveys is provided and summarised in **Table 4.3**.Habitat codes are according to Fossitt (2000). Scientific names are provided at first mention only. Sites were surveyed in September 2025. Where relevant, survey site numbers from the 2023 survey have been provided for context and are also outlined in **Tables 2.1-2.3** above.

4.1 Riverine survey site results

4.1.1 Site A1 – unnamed stream, Noard

Site A1 (2023 site code: A4) was located on an unnamed tributary of the Clover River (no EPA code) near the proposed turbine array. The lowland depositing channel (FW2) had been extensively straightened and deepened throughout, resulting in a deep trapezoidal channel with 2-3m high banks and poor hydromorphology. The stream was 3-4m wide and 0.4-0.6m deep with a profile of deep, slow-flowing glide with occasional pool. Riffle was absent. The substrata were dominated by deep peat/silt and sands with scattered boulder. Cobble was present but highly localised and bedded in silt. Peat staining was present at the time of the survey. Macrophyte cover was high with frequent branched bur-reed (*Sparganium erectum*) and lesser pondweed (*Potamogeton pusillus*). Localised stands of bulrush (*Typha latifolia*), broad-leaved pondweed (*Potamogeton natans*) and common reed (*Phragmites australis*) were present with frequent encroachment of floating sweet-grass (*Glyceria fluitans*) along the margins. Aquatic bryophytes were absent. The steep banks supported abundant bramble (*Rubus fruticosus* agg.) scrub and intermittent treelines of grey willow (*Salix cinerea* subsp. *oleifolia*), dog rose (*Rosa canina*), hawthorn (*Crataegus monogyna*) and ash (*Fraxinus excelsior*). The site was bordered by coniferous afforestation (WD4), scrub (WS1), reclaimed wet grassland (GS4) and improved pasture (GA1).

In the previous 2023 survey (2023 site code: A4) a low density of adult brown trout (*Salmo trutta*) were recorded via electro-fishing (Triturus, 2024). Spawning habitat was absent, given very significant siltation, with slow-flowing glide resulting in poor quality nursery habitat. Despite abundant soft sediment accumulations, the site was unsuitable for lamprey, given the flocculent, humic nature of the sediment and absence of suitable spawning gravels. The site was also of poor suitability for European eel and white-clawed crayfish, with no crayfish recorded. No otter signs were recorded in vicinity of the site although the species is known to utilise the area for sprainting (Triturus, 2024).

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). However, it should be noted that this is a tentative rating given poor flows and lack of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value

greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the known presence of salmonids and utilisation by otter, the aquatic ecological evaluation of site A1 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.1 Representative image of site A1 on an unnamed Clover River tributary, September 2025

4.1.2 Site A2 – Clover River, Noard

Site A2 (2023 site code: A5) was located on the upper reaches of the Clover River (16C04) near the proposed turbine array. The small lowland channel (FW2) had been extensively straightened and deepened, resulting in a trapezoidal channel with very poor hydromorphology. The 2m wide channel was dry at the time of survey with a base of argillaceous mud on top of compacted gravels. The ephemeral channel supported scattered water mint (*Mentha aquatica*) blue water speedwell (*Veronica anagallis-aquatica*), bottle sedge (*Carex rostrata*) and watercress (*Nasturtium officinale*). The banks had been historically cleared and were fenced to the bank top with only rank grass vegetation. The site was bordered by improved pasture (GA1) with coniferous afforestation (WD4) upstream.

The site was not of fisheries value at this location, given its ephemeral nature in addition to siltation and enrichment pressures, very poor hydromorphology (maintained channel and intermittent connectivity with downstream habitats (instream blockages). There was no suitability for white-clawed crayfish. No otter signs were recorded in the vicinity of the site.

It was not possible to collect a biological water quality sample due to the dry nature of the channel.

Given the absence of aquatic species or habitats of higher conservation value, the aquatic ecological evaluation of site A2 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.2 Representative image of site A2 on the upper reaches of the Clover River, September 2025 (ephemeral channel)

4.1.3 Site A3 – Clover River, Leigh

Site A3 (2023 site code: A6) was located on the Clover River (16C04) at the R639 crossing, c. 1.7km downstream of site A2. The lowland depositing river (FW2) at this location had been historically straightened and extensively deepened, with steep bank of 5-6m in height. The river was 6-8m wide (narrower upstream of bridge) and 0.3-0.7m deep and suffered from low summer flows at the time of survey. Upstream of the bridge, shallower riffles and glide was present (0.1-0.2m deep). The profile was of slow-flowing, deep, homogenous glide with riffle and shallower glide present only upstream. The substrata were dominated by cobble and mixed gravels with scattered boulder. These were heavily silted (exacerbated by low flows). Large woody debris (LWD) dams were frequent, improving habitat heterogeneity. Riparian shading was high, with macrophytes restricted to more open areas of channel. Unbranched bur-reed (*Sparganium emersum*) was occasional, with frequent marginal stands of fool's watercress (*Helosciadium nodiflorum*), localised lesser water parsnip (*Berula erecta*), blue water speedwell and common water starwort (*Callitriche stagnalis*). Common duckweed (*Lemna minor*) was also frequent. Aquatic bryophytes were rare and limited to occasional *Leptodictyum riparium* on larger substrata. The channel was lined by mature treelines of sycamore (*Acer psuedoplatanus*), ash and elder (*Sambucus nigra*) with scrubby understories. The site was bordered by buildings and artificial surfaces (BL3) and improved pasture (GA1).

The previous survey recorded brown trout, stone loach (*Barbatula barbatula*) and three-spined stickleback (*Gasterosteus aculeatus*) via electro-fishing (Triturus, 2024). Despite significant siltation

pressures, the site was of value for salmonids. However, due to significant siltation pressures, salmonid spawning habitat was highly localised but nonetheless present. Although suitable lamprey spawning areas were located upstream of the bridge, no suitable nursery habitat was identified. There as some moderate suitability for European eel with ample instream refugia. Despite some suitability for white-clawed crayfish none were recorded although remains of the species have been identified at this site previously (Triturus 2021 data). No otter signs were recorded in vicinity of the site although the species is known to utilise the area for sprainting (Triturus, 2024).

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the known presence of salmonids and utilisation by otter, the aquatic ecological evaluation of site A3 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.3 Representative image of site A3 on the Clover River, September 2025

4.1.4 Site A4 – unnamed stream, Leigh

Site A4 (2023 site code: A3) was located on an unnamed Clover River tributary (no EPA code) draining to the north-west of the proposed turbine array. The small lowland channel (FW2) had been historically straightened and deepened along field boundaries and was dry at the time of survey (as per 2023 survey). The stream passed under the local road via a pipe culvert. The channel featured a base of cobble and mixed gravels bedded in silt/mud. Leaf litter and woody debris was abundant on the bed. No aquatic vegetation was present in the ephemeral channel, which was very heavily shaded by mature treelines and hedgerows supporting bramble, ivy (*Hedera helix*), ash and elder. Non-native snowberry (*Symphoricarpos albus*) was frequent along the banks near the culvert. The site was bordered by heavily improved pasture (GA1).

The site was not of fisheries value, given its dry, ephemeral nature and poor quality aquatic habitats with no flows. There was no suitability for white-clawed crayfish. No otter signs were recorded in the vicinity of the site.

It was not possible to collect a biological water quality sample due to the dry nature of the channel.

Given the absence of aquatic species or habitats of higher conservation value, the aquatic ecological evaluation of site A4 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.4 Representative image of site A4 on an unnamed Clover River tributary, September 2025 (dry, ephemeral channel)

4.1.5 Site A5 – Clover River, Noard

Site A5 (2023 site code: A7) was located on the lower reaches of the Clover River (16C04) at a local road crossing c. 2.8km downstream of site A3. The lowland river (FW2) had been historically straightened and, although some good instream recovery was evident. The river was 3-4m wide and 0.2-0.4m deep, with very localised deeper areas to 0.75m. The profile comprised peat-stained slow-flowing glide with localised riffle and pool. Woody debris dams were frequent instream.. The substrata were dominated by mixed gravels and sands with localised boulder and cobble only. Soft sediment accumulations were present but shallow and flocculent. Siltation was high overall (peat-derived). Given high shading, macrophyte growth was sparse with localised fool's watercress (and ivy-leaved duckweed (*Lemna trisulca*) along channel margins. Small stands of branched bur-reed were present locally. Bittersweet (*Solanum dulcamara*) and reed canary grass (*Phalaris arundinacea*) were locally abundant in open areas of the channel. Aquatic bryophyte coverage was low, with rare *Fontinalis antipyretica* and *Leptodictyum riparium*. The river was well shaded by dense grey willow and ash with abundant bramble scrub on the steep banks. The site was bordered by a residential property (BL3,

GA2) and improved pasture (GA1).

Atlantic salmon (*Salmo salar*), brown trout, stone loach, lamprey (*Lampetra* sp.) and pike (*Esox lucius*) were recorded via electro-fishing at site A5 (2023 site code: A7) during the previous survey (Triturus, 2024). The site was of moderate value for salmonids given evident siltation pressures which impacted the quality of spawning habitat. The generally shallow nature of the site also reduced the value as a nursery habitat. Some moderate quality holding habitat was present locally due to undercut banks, overhanging vegetation and pools associated with debris dams. Whilst a low density of *Lampetra* sp. ammocoetes were recorded in a previous survey (Triturus, 2024), the site was considered sub-optimal due to the flocculent and humic nature of the soft sediment deposits. The site offered some good suitability for European eel and white-clawed crayfish. However, no crayfish were recorded via hand-searching and sweep netting. No otter signs were recorded in vicinity of the site although the species is known to utilise the area (Triturus, 2024).

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the known presence of salmonids (including Atlantic salmon) and lamprey (*Lampetra* sp.), in addition to utilisation by otter, the aquatic ecological evaluation of site A5 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.5 Representative image of site A5 on the lower reaches of the Clover River, September 2025

4.1.6 Site B1 – Drish River, Longfordpass South

Site B1 (2023 site code: B1) was located on the upper reaches of the Drish River (16D02). The lowland river (FW2) had been extensively straightened and deepened throughout, resulting in a homogenous trapezoidal channel with very poor hydromorphology and low summer flows. The channelised river was 3-4m wide and 0.5-0.8m deep, with locally deeper glide to >1m. The profile was of stagnant glide and pool at the time of survey. The substrata were dominated by sand and heavily silted mixed gravels. Cobble and small boulder were scattered. The site was very heavily vegetated with near total cover of macrophytes. Fool's watercress and branched bur-reed was abundant with frequent common duckweed, ivy-leaved duckweed and lesser water parsnip (*Berula erecta*). Spiked water milfoil (*Myriophyllum spicatum*), blue water speedwell and water mint were occasional. River water dropwort (*Oenanthe fluviatilis*) Semi-floating mats of reed canary grass were abundant along the channel margins and sloping banks. The banks had been cleared historically and supported scattered grey willow, alder (*Alnus glutinosa*), blackthorn (*Prunus spinosa*) and downy birch (*Betula pubescens*). The site was bordered by dry meadow habitat (GS2) and scrub (WS1) with intermittent treelines of ash, grey willow and alder.

Three-spined stickleback was the only fish species recorded via electro-fishing at site B1 during the previous survey (Triturus, 2024). The river at this location was of very poor value for salmonids, given heavy siltation, poor hydromorphology, poor flows and noxious macrophyte cover. The site exhibited some good suitability for European eel with scattered boulder and abundant macrophyte refugia. There was some low suitability for white-clawed crayfish, although none were recorded. No otter signs were recorded in vicinity of the site (although there were few marking opportunities).

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). However, it should be noted that this is a tentative rating given poor flows and lack of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site B1 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.6 Representative image of site B1 on the Drish River, September 2025

4.1.7 Site B2 – Unnamed stream, Longfordpass South

Site B2 (not surveyed in 2023) was located on the uppermost reaches of an unnamed Drish River tributary adjacent to the proposed biodiversity enhancement area. The heavily modified, lowland depositing stream (FW2 was dry at the time of survey, with a mud base covered in leaf litter. The channel was broadly U-shaped and was 1.5-2m wide with bank heights of 1-2m. The channel was heavily scrubbed over with dense scrub vegetation (WS1), which included grey willow bramble and gorse (*Ulex europaeus*). The site was bordered by a broad-leaved plantation (WS2) with cutover bog (PB4) to the west and improved pasture (GA1) to the north.

Site B2 was not of fisheries value given its dry, ephemeral nature and absence of aquatic habitats. No otter signs were recorded in the vicinity of the site.

It was not possible to collect a biological water quality sample due to the dry nature of the channel.

Given the absence of aquatic species or habitats of higher conservation value, the aquatic ecological evaluation of site B2 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.7 Representative image of site B2 on an unnamed stream, September 2025 (dry, ephemeral channel)

4.1.8 Site B3/G1 – Drish River, Longfordpass North

Site B3/G1 (2023 site code: B2) was located on the Drish River (16D02) at a local road and proposed GCR crossing upstream of Longfordpass Bridge. The lowland depositing river (FW2) had been extensively straightened and deepened historically, resulting in very poor hydromorphology. The river suffered from low water levels at the time of survey (typical of this location, pers. obs.), with an imperceptible flow and ponding of water between macrophyte beds. The channel was a homogenous 10-12m wide and 0.1-0.4m deep with deep silt deposits of >0.3m locally. Boulder and cobble with mixed gravels were present near the bridge but absent elsewhere. The site was very heavily vegetated (near 100% cover), with open ponding areas very localised. These supported a diverse range of macrophytes, including abundant spiked water milfoil, branched bur-reed, lesser water parsnip, fool's watercress and both common and ivy-leaved duckweed. Blue water speedwell and yellow water lily (*Nuphar lutea*) were locally frequent, with more occasional lesser pondweed, river water dropwort (*Oenanthe fluviatilis*) and water-forget-me-not (*Myosotis scorpioides*). The moss *Cinclidotus fontinaloides* was abundant on instream boulder and the dry bridge apron. The mosses *Fontinalis antipyretica*, *Leptodictyum riparium* and *Hygroamblystegium* sp. were present but rare. The channel was lined and encroached by reed canary grass with frequent bittersweet, purple loosestrife (*Lythrum salicaria*), hedge bindweed (*Calystegia sepium*) and willowherbs (*Epilobium* spp.). Given the presence of numerous indicator species (EC, 2013; Devaney et al., 2013), the littoral herb community downstream of the crossing was representative of the Annex I hydrophilous tall herb (6430) habitat. The site was bordered by amenity grassland (GA2) and improved pasture (GA1) with narrow buffers.

Atlantic salmon, European eel and three-spined stickleback were recorded via electro-fishing at site B3/G1 (2023 site code: B2) during the previous survey (Triturus, 2024). The site was of poor salmonid value given known flow issues in addition to poor hydromorphology and poor connectivity with downstream habitats (i.e. the site is typically stagnant in the summer months). Boulder-dominated areas in vicinity of the bridge apron provided good suitability for European eel. There was some low suitability for white-clawed crayfish, although none were recorded. No otter signs were recorded in vicinity of the site (although the species is known to utilise the site, Triturus data).

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). However, it should be noted that this is a tentative rating given poor flows and lack of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of Annex I hydrophilous tall herb habitat (6430), the aquatic ecological evaluation of site B3/G1 was of **county importance** (**Table 4.3**).



Plate 4.8 Representative image of site B3/G1 on the Drish River facing upstream, September 2025

4.1.9 Site B4 – Drish River, Castletown Bridge

Site B4 (2023 site code: B3) was located on the Drish River (16D02) at Castletown Bridge, c. 6km downstream of site B3. The lowland alkaline river (FW2) at this location had been deepened historically but retained some good semi-natural features. Recent clearance of adjoining drains has occurred upstream of the bridge. The river was 5-6m wide in a heavily vegetated channel up to 8-10m wide. The depth ranged 0.5-1m with deeper pool areas to 1.5m locally. The profile was of slow-flowing glide, with localised faster runs between macrophyte beds exposing gravel substrata. The substrata were dominated by cobble and mixed gravels with scattered boulder. However, these were bedded

in silt and moderately calcified (compacted). The compacted bed was also moderately silted with soft sediment deposits frequent. The site was very heavily vegetated (>90% cover) with abundant heterophyllous common clubrush (*Schoenoplectus lacustris*), common duckweed, ivy-leaved duckweed and fool's watercress. Yellow lily, various-leaved water starwort (*Callitriche platycarpa*), river dropwort, branched bur-reed, lesser water parsnip and broad-leaved pondweed were occasional with localised common reed and mare's-tail (*Hippuris vulgaris*). The moss *Rhynchostegium riparium* was occasional. Filamentous algae was present locally. Adjoining the river margins was a sparse herbaceous community supporting reed canary grass, bittersweet, marsh willowherb (*Epilobium palustre*), great willowherb (*Epilobium hirsutum*), water mint and water-forget-me-not. The site was bordered by improved pasture (GA1) and, downstream, an intermittent treeline (WL2) of ash, hawthorn and sycamore (*Acer pseudoplatanus*).

Brown trout, lamprey (*Lampetra* sp.), pike, stone loach and three-spined stickleback were recorded via electro-fishing at site B4 (2023 site code: B3) during the previous survey (Triturus, 2024). Salmonid nursery and spawning habitat quality was poor with evident water quality pressures. Some very limited salmonid and lamprey spawning habitat was present (but sub-optimal). Deeper glide areas provided some good suitability as holding habitat for adult salmonids. Soft sediment deposits were shallow and provided poor quality lamprey nursery habitat (although a low density were recorded in the previous survey (Triturus, 2024)). The site provided good suitability for European eel (i.e. glide, pool and scattered boulder). Despite some good suitability, no white-clawed crayfish were recorded, although the value of the site was reduced given compaction of substrata and poorly accessible boulder refugia. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the known presence of salmonids and lamprey (*Lampetra* sp.), the aquatic ecological evaluation of site B4 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.9 Representative image of site B3 on the Drish River at Castletown Bridge, September 2025

4.1.10 Site B5 – Drish River, Drish Bridge

Site B5 (2023 site code: B5) was located on the Drish River (16D02) at Drish Bridge (N75), c.12km downstream of site B4. The swift-flowing lowland depositing river (FW2) had been locally straightened historically with some local bank works, but good instream recovery was evident. The river was 6-8m wide (channel up to 10m) and 0.3-0.8m deep, with locally deeper areas to 1.5m. The profile comprised swift, deep glide and pool with only very localised riffle upstream of the bridge. The substrata were dominated by relatively clean, mobile coarse gravels and cobble, with frequent boulder. Sands and finer gravels were also present locally in pool slacks and along channel margins. Soft sediment accumulations were sand-dominated where present (rare overall). Siltation was low to moderate. Macrophyte cover was relatively high with locally abundant common clubrush, water crowfoot (*Ranunculus* sp.) and ivy-leaved duckweed. The margins also supported occasional fool's watercress, blue water speedwell and water mint with scattered iris (*Iris pseudacorus*) and branched bur-reed. The sloping margins supported abundant reed canary grass. Aquatic bryophyte coverage was locally high with *Fontinalis antipyretica* and *Fissidens* sp. on larger boulder. However, given the fragmented nature of the aquatic vegetation community, the site *did not* represent Annex I floating river vegetation (3260). Filamentous algae was present, indicating eutrophication pressures. The historically modified and grazed banks supported abundant reed canary grass with scattered bramble scrub, grey willow, osier (*Salix viminalis*) and immature oak (*Quercus* sp.). The site was bordered by semi-improved pasture (GA1).

Atlantic salmon, brown trout, European eel, lamprey (*Lampetra* sp.), minnow and stone loach were recorded via electro-fishing at site B5 (2023 site code: B5) during the previous survey (Triturus, 2024). The site was of very high value for salmonids with excellent quality nursery habitat present (especially

for Atlantic salmon), given an abundance of refugia. The site also provided excellent quality holding habitat for salmonids by way of deeper pool (e.g. under bridge) and overhanging marginal vegetation. Such areas, in addition to frequent large boulder, were also of high suitability for European eel. Although localised, good quality salmonid and lamprey spawning habitat was present upstream of the bridge. The site was also of value as a lamprey nursery with soft sediment deposits (sand-dominated) associated with macrophyte beds, providing some suitability (although sub-optimal). Despite some good suitability for white-clawed crayfish, none were recorded. No otter signs were recorded in vicinity of the site, although marking opportunities were poor.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the known presence of salmonids (including Atlantic salmon), *Lampetra* sp. and Red-listed European eel,, the aquatic ecological evaluation of site B5 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.10 Representative image of site B5 on the Drish River upstream of Drish Bridge, September 2025

4.1.11 Site B6 – River Suir, Thurles Bridge

Site B6 (not surveyed in 2023) was located on the River Suir (16S02) at Thurles Bridge, downstream of the Drish River confluence. The swift-flowing lowland depositing river (FW2) was semi-natural in character. The river was 10m-12m wide, 0.3-0.6m deep, with banks ranging from 0.3m to 2m high on the southern bank. The flow profile was of fast-flowing glide with localised pool. Siltation was low. The substrata comprised occasional partially bedded boulder and frequent cobble with mixed gravels and

sand. Finer sandy deposits were also occasional in the margins. Siltation was low overall but present. Common club-rush and branched bur-reed was occasional. Depositing margins supported rare yellow water lily. The moss *Fontinalis antipyretica* was frequent on boulder and cobble,. The banks supported reed canary grass, with the southern bank also supporting gorse, bramble, nettle (*Urtica dioica*), snowberry and dog rose. Treeline on both banks supported willow species (*Salix* spp.), ash, horse chestnut (*Aesculus hippocastanum*) and beech (*Betula* sp.).

Site B6 was a moderate-quality salmonid spawning habitat with mixed gravels offering some spawning opportunities (though quality reduced by siltation). The site was a good quality salmonid nursery habitat with boulder and cobble providing refugia for juveniles. Deeper glide and pool areas were limited but of value as holding habitat for adult salmonids. Physical suitability was present for white-clawed crayfish, but was compromised by the partially bedded nature of larger substrata. The site had some suitability for European eel; however, as with crayfish, the presence of bedded larger substrata reduced the overall suitability. Marginal sand deposits provided some sub-optimal nursery habitat for lamprey ammocoetes. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the importance of the River Suir as an ecological corridor in a regional context, the aquatic ecological evaluation of site B6 was of **county importance** (**Table 4.3**).



Plate 4.11 Representative image of site B6 on the River Suir upstream of Thurles Bridge, September 2025

4.1.12 Site C1 – Black River, Clonoura

Site C1 (2023 site code: C1) was located on the uppermost reaches of the Black River (16B01) that drained to the south of the proposed wind farm site. As per previous surveys, the river was dry at this location at the time of survey, with no pools of standing water and a dry mud base in a remnant channel. The channel had been straightened and deepened historically and was 1.5-2m wide with bank heights of 1-2m. Evidently, the channel was ephemeral, likely only conveying water during wetter periods. The channel was heavily scrubbed over with high levels of terrestrial plant encroachment and willow scrub. The site was bordered by a broad-leaved plantation (WS2) with arable crops (BC1) to the east.

Site C1 was not of fisheries value given its dry, ephemeral nature and absence of aquatic habitats. No otter signs were recorded in the vicinity of the site.

It was not possible to collect a biological water quality sample due to the dry nature of the channel.

Given the absence of aquatic species or habitats of higher conservation value, the aquatic ecological evaluation of site C1 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.12 Representative image of site C1 on the Black River, September 2025 (dry, ephemeral channel)

4.1.13 Site C2 – Black River, Derryvella

Site C2 (2023 site code: C2) was located on the upper reaches of the Black River (16B01) within Derryvella Bog, c. 3km downstream from site C1. The lowland depositing river (FW2) had been straightened and deepened historically but showed some instream recovery. The river was 2-2.5m

wide and 0.1-0.5m deep with a profile of slow-flowing glide and riffle with occasional pool. The stream was culverted underneath a Bord na Móna rail line via a large corrugated pipe culvert. The substrata were dominated by humic silt deposits (peat) with scattered heavily-silted small cobble and mixed gravels with occasional small boulder. The river was very heavily shaded by willow and bramble scrub. As a result, macrophytes were limited to water mint and fool's watercress, in addition to localised iris and common reed. Some *Pellia* sp. liverwort grew on sections of muddy bank. The site was bordered by an area of cutover bog (PB4) and semi-improved pasture (GA1) with abundant scrub (WS1).

Brown trout and three-spined stickleback were recorded via electro-fishing at site C2 (2023 site code: C2) during previous surveys (Triturus, 2024). Atlantic salmon were also recorded in the 2021 survey (Triturus, 2021). Despite historical modifications, poor flows and siltation pressures (peat escapement), the site was of some moderate value as a salmonid nursery. The quality of salmonid spawning habitat was significantly reduced by siltation, but the value likely improved during higher flows. Submerged tree roots and bank scours provided valuable holding areas for adult salmonids. Whilst some limited lamprey spawning habitat was present, ammocoete habitat was unsuitable given the humic, flocculent nature of the silt. The site offered some suitability for European eel and white-clawed crayfish. However, no crayfish were recorded via hand searching and sweep netting (limited refugia). No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the known presence of salmonids, the aquatic ecological evaluation of site C2 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.13 Representative image of site C2 on the Black River, September 2025

4.1.14 Site C3 – Unnamed Stream, Lanespark

Site C3 (not surveyed in 2023) was located on a heavily modified tributary of the Glengoole North River adjacent to the proposed turbine array. The small lowland depositing stream (FW2) was <1m wide and broadly U-shaped with 2-3m high banks. The channel was dry at the time of survey, with a mud base covered with leaf litter. The instream vegetation comprised occasional common reed and wild angelica (*Angelica sylvestris*). The riparian areas supported dense scrub vegetation (WS1). This included abundant grey willow, bramble, gorse , and bracken (*Pteridium aquilinum*). The site was bordered by improved pasture (GA1) and cutover bog (PB4).

The site was not of fisheries value, given its dry, ephemeral nature and absence of aquatic habitats. There was no suitability for white-clawed crayfish. No otter signs were recorded in the vicinity of the site.

It was not possible to collect biological water quality due to the dry nature of the channel.

Given the absence of aquatic species or habitats of higher conservation value, the aquatic ecological evaluation of site C3 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.14 Representative image of site C3 on an unnamed stream, September 2025 (dry, ephemeral channel)

4.1.15 Site C4 – North Glengoole River, Derryvella

Site C4 (2023 site code: C3) was located on the North Glengoole River (16N28) at a Bord na Móna rail crossing (culvert), 250m upstream of the Black River confluence. The lowland depositing river (FW2) had been historically straightened and deepened with trapezoidal banks of up to 4m in height and old embankments evident along the channel. The river was 2-2.5m wide and 0.1-0.4m deep,. Shallow glide predominated with only localised riffle and pool. In shallower areas near the culvert, the substrata comprised mixed gravels and small cobble with occasional boulder. However, outside of this area, depositional silt dominated (up to 0.2m deep). Hard substrata were exposed to moderate siltation and partial bedding. Cover of macrophytes was locally high in open areas of channel with abundant fool's watercress, frequent water mint and brooklime (*Veronica beccabunga*) and localised bulrush (*Typha latifolia*). Aquatic bryophytes were not present. The river channel became heavily shaded downstream of the culvert with grey willow, hawthorn and gorse. The site was bordered by dry meadows habitat (GS2) and improved pasture (GA1) in a wider landscape of cutover bog (PB4).

Brown trout and three-spined stickleback were recorded via electro-fishing at site C4 (2023 site code: C3) in the previous survey (Triturus, 2024). Atlantic salmon were also recorded in the 2021 survey (Triturus, 2021). The site was of moderate value only for salmonids due to significant siltation pressures. The shallow stream provided some suitable spawning habitat (exposed gravels), although these were heavily silted. Localised small pools associated with the culvert, bank scours and macrophyte stands provided some holding habitat for adult salmonids. Soft sediment accumulations whilst widespread were humic in nature and poorly suited for lamprey ammocoetes. The site provided some suitability for European eel with occasional boulder, bank sours and pool providing refugia. Despite some suitability for white-clawed crayfish, none were recorded. No otter sign were recorded in vicinity of the site (few marking opportunities).

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the known presence of salmonids, the aquatic ecological evaluation of site C4 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.16 Representative image of site C4 on the North Glengoole River, September 2025

4.1.16 Site C5 – Black River, Derryhogan

Site C5 (2023 site code: C4) was located on the Black River (16B01) at a local road crossing, c. 1.5km downstream of site C2. The river had been extensively straightened and deepened historically, resulting in a characteristic trapezoidal channel with steep banks of up to 5m in height. The river flowed under the local road via a corrugated pipe culvert (fish passable). The homogenous river section was 3-4m wide and 0.2m to 0.5m deep, with occasional pool areas to 1m. The profile was of deep, slow-flowing glide with riffle restricted to upstream of the culvert. The substrata comprised compacted and heavily silted mixed gravels and cobble, with occasional boulder (near culvert only). Bank erosion was frequent (exposed clay) and contributed to the silt loading. Siltation was high overall (largely peat-derived) with deep silt-sand deposits present along channel margins (up to 0.2m deep). The site was heavily shaded by mature treelines of ash, elder, hawthorn and cypress (*Cupressaceae* family). As a result, macrophytes were absent. Aquatic bryophytes were not recorded, with the liverworts *Pellia endiviifolia* and *Conocephalum conicum* on muddy banks. The site was bordered by improved pasture (GA1).

Brown trout and stone loach were recorded via electro-fishing at site C5 (2023 site code: C3) during previous surveys (Triturus, 2021, 2024). Due to significant siltation and hydromorphological pressures, the site was of moderate value only for salmonids. However, some good quality holding areas for adult salmonids were present in deeper glide and pool. Soft sediment accumulations were largely humic or argillaceous in nature and were sub-optimal for lamprey ammocoetes. Some very limited superficial spawning gravels suitable for lamprey were present in the vicinity of the culvert, although spawning habitat improved upstream, where riffles were more frequent. Aside from submerged tree root

systems, suitability for European eel and white-clawed crayfish was relatively poor, given limited accessible instream refugia (no crayfish recorded). No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3-4 (moderate status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the known presence of salmonids, the aquatic ecological evaluation of site C4 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.16 Representative image of site C5 on the Black River (downstream of culvert), September 2025

4.1.17 Site C6 – Black River, Two Mile Borris

Site C6 (2023 site code: C5) was located on the Black River (16B01) at the N75 road crossing, c. 5km downstream of site C5. The lowland river (FW2) had been extensively straightened and deepened historically with only very localised instream recovery. The river flowed in a steep, 5-8m high trapezoidal channel. The river was 6-8m wide and 0.2-0.6m deep, with locally deeper areas to 1m. The river suffered from low summer flows at the time of survey. Slow-flowing glide predominated, with localised riffles near the road bridge and occasional pools. The substrata were dominated by cobble with frequent boulder and small interstitial patches of mixed gravels. Siltation was moderate overall (peat) but soft sediment accumulations were localised. The substrata were relatively mobile. The site supported frequent lesser water parsnip and occasional common water starwort, water mint, water crowfoot (*Ranunculus* sp.) and watercress. Curled pondweed (*Potamogeton crispus*) was present but rare. Common duckweed and ivy-leaved duckweed were both frequent. Coverage of aquatic bryophytes was high, with abundant *Fontinalis antipyretica* on larger cobble/boulder. Filamentous

algae was present, despite shading. Riparian shading was relatively high given the presence of maturing alder plantations (WS2) along the channel (both banks). The site was bordered by improved pasture (GA1) and grassy verges (GS2).

Atlantic salmon, brown trout, European eel, lamprey (*Lampetra* sp.) and stone loach were recorded via electro-fishing at site C6 (2023 site code: C5) during the previous survey (Triturus, 2024). Despite evident impacts and low summer flows, the site was of good value as a salmonid nursery, with slow-flowing glide and riffle providing suitable habitat for Atlantic salmon parr and juvenile brown trout. Deeper glide with frequent bank scours and submerged tree roots provided valuable holding areas for adult trout in the typically homogenous channel. Salmonid and lamprey spawning substrata were sparse and impacted by siltation pressures. The site was of high value for European eel, with abundant boulder and cobble offering good refuge potential. Soft sediment accumulations were largely confined to the road culvert and provided some suitability as lamprey nursery habitat. Despite some good suitability, no white-clawed crayfish were recorded, though the species is known from the wider river system (Triturus data). A spraint site and abundant otter prints were recorded under the bridge (ITM 619156, 657813).

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the utilisation by otter and the known presence of salmonids, lamprey (*Lampetra* sp.) and Red-listed European eel, the aquatic ecological evaluation of site C6 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.17 Representative image of site C6 on the Black River, September 2025

4.1.18 Site D1 – Breegagh River, Killeen

Site D1 (2023 site code: D1) was located on the Breegagh River (16B03) at a local road crossing, where the river flowed through a stacked three-bore box culvert. The small lowland river (FW2) had been straightened and deepened historically, resulting in a homogenous channel with poor hydromorphology and little instream recovery. Boulder revetments were present in the vicinity of the culvert. The river was 2.5-3m wide and 0.3-0.8m deep in deep, slow-flowing glide. Pool was occasional. Riffles were limited to the vicinity of the culvert. The substrata were dominated by compacted cobble with occasional boulder and limited interstitial mixed gravels. The site suffered from heavy siltation, although deposits were flocculent, with only very localised, shallow accumulations. Woody debris was frequent instream, which improved habitat heterogeneity. The river flowed through a maturing broad-leaved plantation, and shading was high. As a result, macrophytes were limited to occasional fool's watercress, water mint and lesser water parsnip along channel margins in more open areas. Reed canary grass was abundant along channel margins. Aquatic bryophytes were limited to localised *Rhynchostegium riparioides* on exposed boulder near the culvert. The site was bordered by a broad-leaved plantation of sycamore, wych elm (*Ulmus glabra*) and alder (WD1), with dense bramble scrub (WS1) and improved pasture (GA1).

Atlantic salmon and brown trout were recorded via electro-fishing at site D1 (2023 site code: D1) during the previous survey (Triturus, 2024). Despite impacts, the site was of good value for salmonids especially as a holding habitat for adult trout, with frequent scoured banks and instream woody debris providing valuable refugia. The site was of poor quality as a salmonid or lamprey spawning habitat given significant siltation pressures. The site was of some suitability for European eel with occasional boulder and scoured banks providing refugia. Despite some suitability, no white-clawed crayfish were recorded. A regular otter spraint site (with fish remains) was recorded under the box culvert (ITM 621364,650303).

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). However, it should be noted that this is a tentative rating given poor flows and lack of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the utilisation by otter and the known presence of salmonids (including Atlantic salmon) , the aquatic ecological evaluation of site D1 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.18 Representative image of site D1 on the Breegagh River, September 2025

4.1.19 Site D2 – Breegagh River, Ballymurreen Bridge

Site D2 (2023 site code: D2) was located on the Breegagh River (16B03) at Ballymurreen Bridge, c.5km downstream of site D1. The lowland river (FW2) had been straightened historically but not deepened and retained many good semi-natural characteristics. However, livestock poaching pressures have significantly impacted the quality of aquatic habitats since previous surveys of the site (September 2021 & September 2023; Plate 4.19). The river was 4-5m wide (channel up to 7m wide in places) and 0.2-0.4m deep. Locally deeper glide and pool to 0.8m was present. The profile comprised slow-flowing glide with occasional riffles near the bridge, with pool becoming more frequent downstream. The substrata were dominated by silt with only localised areas of exposed mixed gravels and cobbles (in contrast to 2021, when gravels were widespread). Sand accumulations were also present. The site supported sparse growth of macrophytes with scattered water crowfoot (*Ranunculus* sp.), lesser water parsnip, water forget-me-not, watercress and branched bur-reed. Filamentous algae were present, indicating eutrophication. Aquatic bryophytes were limited to very occasional *Rhynchostegium riparioides* and *Leptodictyum riparium* on larger substrata.. The river was bordered on the east bank by a mature treeline of blackthorn, hawthorn, ash, elder, sycamore and bramble, with improved pasture (GA1) on the west.

Atlantic salmon, brown trout, lamprey (*Lampetra* sp.),stone loach and three-spined stickleback were recorded via electro-fishing at site D2 (2023 site code: D2) during the previous surveys (Triturus, 2021, 2024). Despite evident declines in habitat quality due to livestock poaching and siltation, the site remained of moderate value for salmonids with swift glide and riffle areas providing moderate quality nursery areas. The shallow site was of relatively poor value as a holding habitat for adult salmonids, although some areas were present in bank scours and under overhanging trees. Lamprey ammocoete

habitat was widespread, although much of the soft sediment accumulations were argillaceous in nature and thus sub-optimal. Lamprey spawning habitat by way of finer gravels was present but highly localised (and much reduced over previous surveys). The site was of poor value for European eel, given a paucity of accessible instream refugia and the shallow nature. Despite some suitability for white-clawed crayfish, none were recorded (although positive eDNA recorded at the site in 2021). No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the known presence of salmonids (including Atlantic salmon) and lamprey (*Lampetra* sp.), the aquatic ecological evaluation of site D2 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.19 Representative image of site D2 on the Breegagh River at Ballymurreen Bridge, September 2023 (top) and September 2025 (bottom), showing evident deterioration in water quality and aquatic habitats due to livestock poaching

4.1.20 Site D3 – Breegagh River, Archerstown Bridge

Site D3 (2023 site code: D3) was located on the lower reaches of the Breegagh River (16B03) at Archerstown Bridge, c.9km downstream of site D2. The lowland depositing river (FW2) was semi-natural in vicinity of the bridge, with some local bank modifications but an otherwise largely natural channel. The river suffered from low summer flows at the time of survey and was 2-3m wide in a 4-5m channel upstream, with braiding around a small island downstream of the bridge (river also wider). The river was 0.2-0.5m deep with locally deeper areas to 1.5m. The profile comprised riffle and deep glide with occasional pool. The substrata of the calcareous river were dominated by cobble and clean, mobile mixed gravels with frequent boulder. Beds of sand were present locally with flocculent soft sediment in slacks and along channel margins. Siltation was low overall.. The site was heavily vegetated with frequent water crowfoot (*Ranunculus* sp.) and lesser water parsnip. Fool's watercress was also frequent with occasional water mint, ivy-leaved duckweed and rare branched bur-reed. Cover of aquatic bryophytes was high with locally abundant *Fontinalis antipyretica*, *Chiloscyphus polyanthos* and *Leptodictyum riparium*. Larger boulders supported *Rhynchostegium riparioides*. Cover of filamentous algae was high (c.10%), indicating enrichment. The channel margins were dominated by reed canary grass with abundant bittersweet. The mature riparian zones supported treelines of sycamore, willow species and ash with abundant bramble and nettle. The site was bordered by residential properties (BL3/GA2) and improved pasture (GA1) with mature buffers.

Atlantic salmon, brown trout, European eel, minnow and stone loach were recorded via electro-fishing at site D3 (2023 site code: D3) during the previous survey (Triturus, 2024). Despite low summer flows (site normally of higher energy), the site was of high value for salmonids with good quality nursery habitat present (especially for Atlantic salmon), given an abundance of macrophyte beds in swift glide. The site also provided high quality holding habitat by way of deeper pool (e.g. downstream of bridge), extensive macrophyte beds and overhanging marginal vegetation. Such areas, in addition to frequent large boulder, were also of high suitability for European eel and white-clawed crayfish (the latter of which was not recorded). Some good quality spawning habitat for both salmonids and lamprey was present upstream and downstream of the bridge. However, there was a paucity of suitable lamprey nursery habitat with soft sediment accumulations, shallow and flocculent in nature. No otter signs were recorded in vicinity of the site although the species is known to utilise the area for sprainting (Triturus, 2024).

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the known presence of salmonids (including Atlantic salmon) and Red-listed eel, in addition to utilisation by otter, the aquatic ecological evaluation of site D3 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.20 Representative image of site D3 on the Breegagh River at Archerstown Bridge, September 2025

4.1.21 Site G2 – River Goul, Urlingford

Site G2 (not surveyed in 2023) was located on the River Goul (15G02) at the R639 road and proposed GCR crossing (double pipe culverts with rendered apron). The lowland depositing river (FW2) had been deepened but not straightened historically The river was 1-1.5m wide and 0.5-0.6m deep, with bank heights of 2-3m. The profile was composed exclusively of deeper, slow-flowing glide. The substrata were dominated by heavily silted and compacted mixed gravels. The site featured a low coverage of macrophytes comprising occasional fool's watercress, *common* water starwort and common duckweed. Aquatic bryophytes were absent. The steep banks supported abundant common reed, with occasional reed canary grass, great willowherb, nettle and bramble.. The site was bordered by improved pasture (GA1) and wet grassland (GS4).

The site was of poor value for salmonids given extensive modifications and poor flows. However, deep glide habitat was of some value as holding areas for adult salmonids. However, a concrete apron at the downstream side of the culvert created a barrier to upstream fish passage at low flows. The site supported high numbers of three-spined stickleback (recorded during sweep netting). Suitability for lamprey was also poor with an absence of suitable nursery areas. There was no suitability for white-clawed crayfish given the absence of suitable refugia. No otter signs were recorded in the vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). However, it should be noted that this is a tentative rating given poor flows and lack of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site G2 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.21 Representative image of site G2 on the River Goul, September 2025

4.1.22 Site G3 – Ardreagh River, Urlingford

Site G3 (not surveyed in 2023) was located on the Ardreagh River (15A01) at the R639 road and proposed GCR crossing (double box culvert) in Urlingford. The lowland channel (FW2) was highly modified (held between retaining walls) and had been straightened historically. The river flowed over a low gradient and was 4-5m wide and 0.2-0.5m deep. The profile comprised predominantly shallow slow slow-flowing glide with occasional riffle and pool. The substrata comprised frequent mixed gravels with occasional small to medium boulder. Larger boulder were also present directly upstream of the road crossing. Siltation was moderate to high, with significant flocculent accumulations covering instream vegetation. Filamentous algae cover was considerable in open water areas, indicating eutrophication. Directly upstream of the crossing, the site featured a relatively high coverage of macrophytes, which included abundant curled pondweed, water forget-me-not, fool's watercress, water mint, common water starwort and common duckweed. Reed canary grass and branched burr-reed were present between larger instream boulders. Aquatic bryophytes were limited to *Leptodictyum riparium* on larger instream boulder and retaining walls, with *Cratoneuron filicinum* also present in the splash zone.. Further upstream, the river comprised predominantly deeper glide (c. 0.5m deep) which was heavily shaded by overhanging sycamore, ash, alder, hawthorn and non-native Himalayan honeysuckle (*Leycesteria formosa*). The site was immediately bordered by sub-urban areas and buildings (BL3).

Despite evident impacts, the site was of some value for salmonids with mixed gravels offering moderate-quality salmonid spawning habitat (but impacted by siltation).. The site was of moderate

quality as a salmonid nursery habitat, with instream vegetation and occasional boulders providing some refugia. The upstream shaded section offered some holding habitat for larger salmonids, but its nursery value was reduced by the presence of only very limited refugia (occasional small boulders). This shaded section also offered some suitability for European eel. The silted margins directly upstream of the road crossing provided some nursery suitability for lamprey ammocoetes. White-clawed crayfish suitability was low due to limited available refugia; however, a single crayfish was recorded. No otter signs were recorded in the vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of white-clawed crayfish, the aquatic ecological evaluation of site G3 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.22 Representative image of site G3 on the Ardreagh River, facing downstream, September 2025



Plate 4.23 Representative image of the upstream section of site G3 on the Ardreagh River, facing upstream, September 2025

4.1.23 Site G4 – Borrisbeg River, Borrismore

Site G4 (not surveyed in 2023) was located on the Borrisbeg River (15B18) at the R693 road and proposed GCR crossing. The upland eroding channel (FW1), which had been straightened historically, was 2.5-3m wide and 0.1m-0.2m deep, with deeper pool (0.5m deep) located directly below the road crossing. Bank heights were 1-1.5m. The profile was of slow-flowing, shallow riffle and glide with deeper localised pool. The substrata comprised partially bedded small boulder and cobble with frequent sand accumulations along the littorals and in pools. Some calcification of the bed was evident. Siltation was low. Macrophytes were confined to the pool area where abundant fools watercress, common duckweed and ivy-leaved duckweed were present along with water mint in the margins. Aquatic bryophytes were absent. The watercourse was heavily shaded by bordering trees and scrubby vegetation, which included sycamore, holly (*Ilex aquifolium*), hawthorn, ash, bramble and grey willow. The site was bordered by improved pasture (GA1).

The site was a lower-quality salmonid spawning habitat, given the bedded nature of the substrata and lack of suitable gravels (sand only). Salmonid nursery habitat was of moderate quality with shallow glide and deeper pool with macrophytes providing some refugia. Adult salmonid holding habitat was limited, being confined to the deeper pool downstream of the road crossing. This deeper pool also provided some suitability for European eel, with larger boulder providing refugia. The sand accumulations were of some value as lamprey ammocoete habitat. Suitability for white-clawed crayfish was moderate although none were recorded. No otter signs were recorded in the vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of suitable salmonid and lamprey habitat, the aquatic ecological evaluation of site G4 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.24 Representative image of site G4 on the Borrisbeg River, September 2025

4.1.24 Site G5 - Borrisbeg River, Borrismore

Site G5 (not surveyed in 2023) was located on the uppermost reaches of the Borrisbeg River (15B18) at the R693 road and proposed GCR crossing immediately south of the Loughans SAC (000407), a large turlough. The lowland channel had been extensively straightened and deepened historically and was dry at the time of the survey (as per previous surveys). Contained in a deep U-shaped channel, the dry river was a homogenous 3m wide with bank heights of up to 2m. The bed comprised damp mud with scattered boulder. This and the presence of *Fontinalis antipyretica* on larger substrata indicated occasional water flows (e.g. winter months). The channel was heavily shaded by mature ash, willow and sycamore treelines. The site was bordered by improved pasture (GA1).

Site G5 was not of fisheries value given its dry, ephemeral nature and absence of aquatic habitats. Under wetted conditions, the river would still provide poor (if any) suitability for fish species or white-clawed crayfish. No otter signs were recorded in the vicinity of the site.

It was not possible to collect a biological water quality sample due to the dry nature of the channel.

Given the absence of aquatic species or habitats of higher conservation value, the aquatic ecological evaluation of site G5 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.25 Representative image of site G5 on the Borrisbeg River, September 2025 (dry channel)

4.1.25 Site G6 – Clomantagh Lower Stream, Clomantagh Lower

Site G6 (not surveyed in 2023) was located on the Clomantagh Lower Stream (15C91) at a local road and proposed GCR crossing. In contrast to EPA mapping, the stream had evidently been historically realigned and, despite extensive searching, no trace of a watercourse could be identified (likely culverted underground). The mapped course of the stream was located in heavily improved pasture (GA1) with hedgerows dominated by bramble and hawthorn.

Site G6 was not of fisheries value given its dry nature and absence of aquatic habitats. No otter signs were recorded in the vicinity of the site.

It was not possible to collect a biological water quality sample due to the dry nature of the channel.

Given the absence of aquatic species or habitats of higher conservation value, the aquatic ecological evaluation of site G6 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.26 Representative image of site G6 on the Clomantagh Lower Stream, September 2025 (no watercourse identified)

4.1.26 Site G7 – Gorteenahilla River, Freshford

Site G7 (not surveyed in 2023) was located on the lowermost reaches of the Gorteenahilla River (15G08) at the R693 road and proposed GCR crossing immediately upstream of the Nuenna River confluence. The river was dry at this location at the time of survey. The lower reaches of the karstic river frequently flow underground in the summer months (pers. obs.). No remnant pools were present and natural gradients prevented water entering the dry channel from the connecting Nuenna River. The semi-natural upland eroding river (FW1) was 4-6m wide with steep banks of up to 3m in vicinity of the road crossing (a perched cobbled apron). Typical of a spate channel, the substrata were dominated by cobble with frequent small boulder and localised coarse gravels. Sand-dominated sediment accumulations were evident on meanders and adjoining putative pool areas. Macrophytes and aquatic bryophytes were not present. The river was lined by mature treelines dominated by ash and sycamore. The site was bordered by improved pasture (GA1) and the peri-urban area of Freshford (BL3).

Site G7 was not of fisheries value given its dry, ephemeral nature and absence of aquatic habitats. No otter signs were recorded in the vicinity of the site.

It was not possible to collect a biological water quality sample due to the dry nature of the channel.

Given the absence of aquatic species or habitats of higher conservation value, the aquatic ecological evaluation of site G7 was of **local importance (lower value)** (**Table 4.3**).

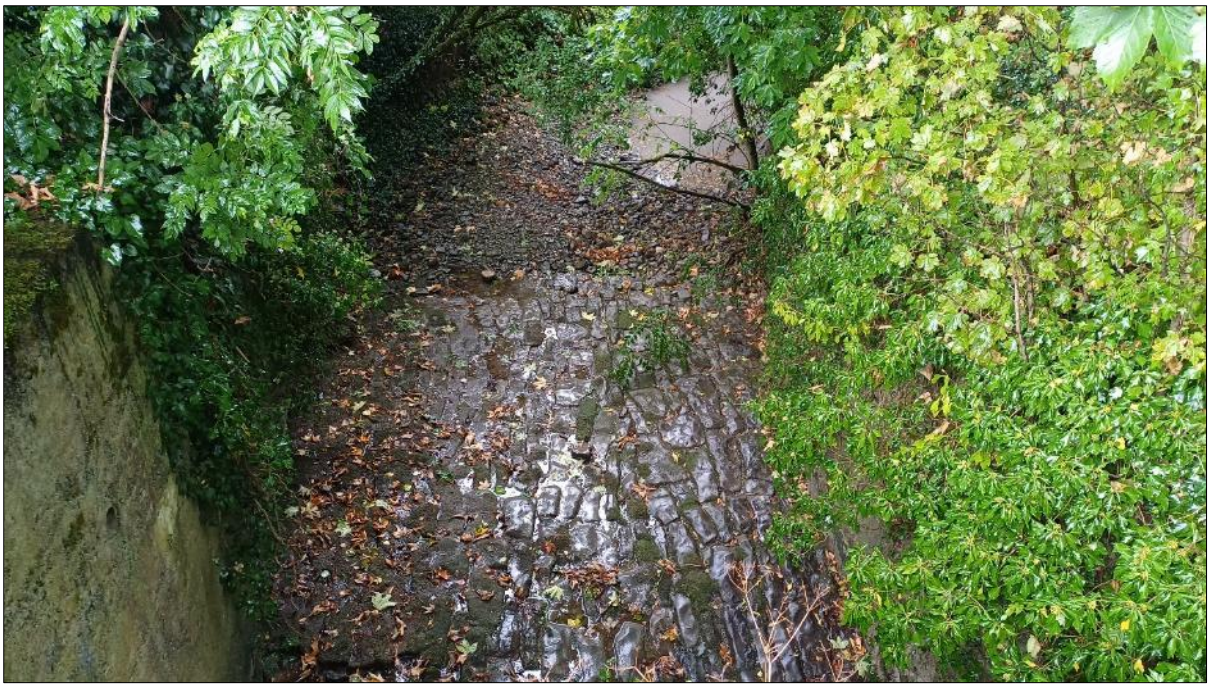


Plate 4.28 Representative image of site G7 on the Gorteenahilla River, September 2025

4.1.27 Site G8 - unmapped stream, R694 road crossing

Site G8 (not surveyed in 2023) was located on an unmapped stream at the R694 road and proposed GCR crossing north of Freshford. The highly modified seasonal channel was dry at the time of survey. The channel was 2m wide with bank heights of 1.5m and was historically straightened. The bed comprised small boulder and cobble, with mixed gravels. The dry bed was strewn with twigs and leaves from bordering trees and did not support any macrophytes. The semi-aquatic bryophyte *Leptodictyum riparium* was present on larger cobble and boulders, with *Pellia* sp. present on embankments. The channel was extensively tunnelled by bordering trees, which included beech (*Betula* sp.), hawthorn, ash and cypress (*Cupressus* sp.). The site was bordered by pasture (GA1), grazed by sheep and built land (BL3).

The highly modified seasonal channel did not contain any water at the time of survey and therefore, was not of fisheries value. Additionally, there was no suitability for species such as otter and white-clawed crayfish.

It was not possible to collect a biological water quality sample due to the dry nature of the channel.

Given the absence of aquatic species or habitats of higher conservation value, the aquatic ecological evaluation of site G8 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.29 Representative image of site G8, September 2025 (dry, ephemeral channel)

4.1.28 Site G9 – Lismaine Stream, Clone

Site G9 (2023 site code: E8) was located on the Lismaine Stream (15L16), a tributary of the River Nore, at a local road and proposed GCR crossing. The stream (FW1) crossed under the road via a box culvert (rendered bed) and was dry at the time of survey. The small stream had been extensively straightened and deepened historically, with poor recovery evident in the steep-sided trapezoidal channel. The stream was 2m wide. The banks were typically undercut/scoured, indicating spate tendencies of the modified channel. The substrata were dominated by mixed gravels and cobble, with scattered boulder. Given high shading, macrophytes were not present. Aquatic bryophyte coverage was also low, with only very occasional *Rhynchostegium riparioides* and *Pellia epiphylla*. The liverwort *Conocephalum conicum* was locally frequent on muddy banks. The stream was lined by mature treelines of sycamore and ash with hawthorn and blackthorn. The site was bordered by improved pasture (GA1).

The site was not of fisheries value at the time of survey given its dry, ephemeral nature . However, there was some physical suitability for salmonids (known further downstream - Triturus 2021 data) and the site (2023 site code: E8) was found to support three-spined stickleback during the previous survey when it supported flowing water (Triturus, 2024). The site was unsuitable for white-clawed crayfish. No otter signs were recorded in vicinity of the site.

It was not possible to collect a biological water quality sample due to the dry nature of the channel.

Given the absence of aquatic species or habitats of higher conservation value, the aquatic ecological evaluation of site G9 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.30 Representative image of site G9 on the Lismaine Stream, September 2025 (dry, ephemeral channel)

4.1.29 Site G10 – Lisdowney Stream, Grange Bridge

Site G10 (2023 site code: E9) was located on the Lisdowney Stream (15L02), a tributary of the River Nore at Grange Bridge, a proposed GCR crossing. The lowland depositing river (FW2) had been historically straightened and deepened, with bank modifications in vicinity of the bridge, but demonstrated some good instream recovery. The river was 6-8m wide and 0.2-0.4m deep, with localised deeper areas to >1m. The stream suffered from very low summer flows at the time of survey with a profile of very slow-flowing glide (i.e. imperceptible flow). A small weir was present under the bridge with a larger weir (1.5m fall) located 50m downstream of the bridge. The substrata were dominated by compacted and calcified cobble and boulder with more localised mixed gravels. Larger boulder were scattered. Bed calcification was widespread. and resulted in low coverage of aquatic vegetation. Macrophytes were limited to occasional marginal stands of fool's watercress. Aquatic bryophyte coverage was low, with only very occasional *Leptodictyum riparium* and *Rhynchostegium riparioides*. The river was shaded by mature mixed woodland and treelines supporting hawthorn, sycamore, ash, beech and holly. The site was bordered by improved pasture (GA1) and a residential property upstream (BL3).

Atlantic salmon, brown trout, European eel and three-spined stickleback were recorded via electro-fishing at site G10 (2023 site code: E9) during the previous survey (Triturus, 2024). Despite low summer flows, the site was of good value for salmonids. The site was of highest value as a salmonid nursery (being more evident in normal flows when swift glide habitat predominates). However, the paucity of instream refugia reduced the value overall. Localised pool and deep glide/undercuts provided some valuable holding habitat for adult salmonids (especially downstream of the large fish passable weir). The site was of some value for spawning salmonids and lamprey, but high calcification/compaction

rates reduced the potential of the site. The compacted bed with limited soft sediment deposition created unsuitable lamprey nursery conditions (none known from site). European eel suitability was locally good in deep pools/glide. Despite some moderate suitability, no white-clawed crayfish were recorded. A regular otter spraint site was recorded under the bridge (ITM 643578, 668668).

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). However, it should be noted that this is a tentative rating given poor flows and lack of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given utilisation by otter, in addition to the known presence of salmonids (including Atlantic salmon) and Red-listed European eel, the aquatic ecological evaluation of site G10 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.31 Representative image of site G10 on the Lisdowney Stream, September 2025 during low summer flows

4.1.30 Site G11 – River Nore, Moatpark

Site G11 (not surveyed in 2023) was located on the River Nore (15N01) at a proposed GCR crossing upstream of Ballyragget. The large lowland river (FW2) had been historically deepened and was 0.4-1.5m deep with 3m high banks. Although short riffle sections were present immediately downstream of a river island, the 12-15m wide river soon graded into homogenous deep glide and pool with depositing margins. The substrata comprised compacted boulder and cobble with localised areas of sand and silt. Extensive areas of mobile gravels and cobbles were present upstream near the island. Significant eutrophication and siltation was evident. Macrophyte cover was low with only scattered water mint, blue water speedwell and branched bur-reed. Water crowfoot (*Ranunculus* sp.) was rare.

Larger substrata supported occasional *Fontinalis antipyretica*. The riparian areas supported intermittent and narrow treelines of mature crack willow (*Salix fragilis*), grey willow, ash and alder with abundant bramble and reed canary grass. The site was bordered by heavily improved pasture (GA1) and dry meadow areas (GS2).

The River Nore at this location was of good value for salmonids with the riffle and shallow glide areas at the island upstream of the proposed crossing representing a highly valuable salmonid and lamprey spawning area (rare in the wider survey area). However, deep glide downstream (surveyed in 2023, site code: E10) was not of value as a spawning habitat and was a poor quality salmonid nursery. Such habitat was, though, of good value as a holding area for adult salmonids, in addition to coarse fish species and European eel. Soft sediment accumulations along the margins, although often sand dominated, were of some value to lamprey ammocoetes. There was moderate potential for white-clawed crayfish, although bed compaction and modifications reduced suitability – none were recorded. No otter signs were recorded in vicinity of the site although foraging suitability was high.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix A**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the location of the site within the River Barrow and River Nore SAC (002162) and the River Nore SPA (004233), the aquatic ecological evaluation of site G11 was of **international importance** (**Table 4.4**).



Plate 4.32 Representative image of site G11 on the River Nore, August 2025

4.2 Lacustrine survey site results

4.2.1 Site L18- lake/wetland, Bawnreagh

Site L18 was an oligotrophic cutover peatland bog lake. The lake was c. 0.8 hectares in size and between 0.3-1m deep. The lake had a fibrous peat base. It supported abundant bog cotton (*Eriophorum angustifolium*) and bottle sedge in the littorals with locally frequent broad-leaved pondweed and bog pondweed (*Potamogeton polygonifolius*). Fen pondweed (*Potamogeton coloratus*) was rare. Bulbous rush (*Juncus bulbosus*) was also locally frequent in the littorals with bog pimpernel (*Lysimachia tenella*). Pockets of *Sphagnum cuspidatum* were also present, submerged in the littorals. *Sphagnum tenellum* and *Sphagnum papillosum* were present on wet hummocks with marsh pennywort (*Hydrocotyle vulgaris*) and extensive bog cotton bordering the littorals. The survey area was bordered by cutover bog (PB4) and heath.

The site was typically too shallow to support significant fish populations apart from likely three spined stickleback. Geographic isolation and a lack of connectivity from other fisheries habitats would further reduce the fisheries potential of the site. No smooth newt (*Lissotriton vulgaris*) were recorded during the survey.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix A**).

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site L18 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.33 Representative image of site L18, September 2025

4.2.2 Site L19 - lake/wetland, Clonoura

Site L19 comprised a mosaic of small interconnected lakes in historical cutover peatland. The wetland complex was c. 0.08 hectares in size and between 0.1 to 0.3m deep. The site had a bed composed exclusively of fibrous peat. The oligotrophic ponds within the wetland complex supported a moderate diversity of macrophytes, including broad-leaved pondweed in open water with expansive bog cotton in the littorals. Shallow pockets of open water also supported occasional *Chara vulgaris* and small pondweed (*Potamogeton berchtoldii*). Common duckweed was locally frequent in standing water. Pockets of bulrush were scattered throughout. The wetland supported scattered downy birch and grey willow in the margins with exposed tracts of bare peat. Immature native woodland (WS2) was present on the escarpments of higher ground.

The site was too shallow to support fish. Geographic isolation and a lack of connectivity from other fisheries habitats would further reduce the fisheries potential of the site. While it had high suitability for smooth newt and frog, none were recorded.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix A**).

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site L19 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.34 Representative image of site L19, September 2025

4.2.3 Site L20 - lake/wetland, Clonoura

Site L20 comprised a large area of open water c. 0.5hectares in size with bordering wetland in a historical peatland cutover hollow between exposed peat. The oligotrophic lake basin was between

0.1m and 0.6m deep. It had a bed composed exclusively of fibrous peat. The lake supported a low diversity of macrophytes characteristic of lowland cutover bog (PB4). This included open water supporting occasional broadleaved pondweed and bog pondweed. The littorals supported expansive bog cotton with tracts of bottle sedge and water horsetail on deeper littorals fronting bog cotton. The lake also supported pockets of emergent bulrush reed swamp (FS1). It was bordered by bare peat with revegetating cutover bog (PB4) with immature native woodland (WS2) on higher ground.

The site was too shallow and silted to support salmonids, but three spined stickleback were recorded via sweep sampling. While it had high suitability for smooth newt and frog, none were recorded.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix A**).

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site L20 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.35 Representative image of site L20, September 2025

4.2.4 Site L21 - lake/wetland, Clonoura

Site L21 comprised a small pocket of open water, c.0.1 hectares in size with bordering wetland in a historical peatland cutover hollow. Located adjacent to site L20, the oligotrophic lake was between 0.1m and 0.3m deep. It had a bed composed exclusively of fibrous peat. The lake supported a low diversity of macrophytes characteristic of lowland cutover bog (PB4). This included open water supporting broadleaved pondweed and bog pondweed. The littorals supported expansive bog cotton with locally frequent bottle sedge on softer peat. The lake also supported pockets of emergent bulrush reed swamp (FS1). It was bordered by bare peat tracks with revegetating cutover bog (PB4) with immature native woodland (WS2) on higher ground.

The pond was typically too shallow to support fish. Geographic isolation and a lack of connectivity from other fisheries habitats would further reduce the fisheries potential of the site. While it had high suitability for smooth newt and common frog none were observed.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix A**).

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site L21 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.36 Representative image of site L21, September 2025

4.3 White-clawed crayfish survey

White-clawed crayfish was recorded from site G3on the Ardreagh River, where a single adult was captured via hand searching. No other live crayfish were recorded in the surveys undertaken at 29 no. other riverine or 4 no. lacustrine sites in September 2025.

Furthermore, inspection of otter spraints at 3 no. sites on the Black River, Breegagh River and Lisdowney Stream did not reveal the presence of crayfish remains.



Plate 4.37 White-clawed crayfish captured during sweep netting at site G3 on the Ardreagh River, September 2025

4.4 Biological water quality (macro-invertebrates)

The whirligig beetle *Gyrinus urinator* was recorded from site C6 on the Black River (**Appendix A**). This species is listed as 'Near threatened' on the Irish Red list (Foster et al., 2009).

No other rare or protected macro-invertebrate species (according to national red lists) were recorded in the biological water quality samples collected from the 19 no. other wetted riverine sites in September 2025 (**Figure 4.1**, **Appendix A**).

None of the survey sites achieved **Q4 (good status)** water quality (**Figure 4.1**). This was due to the absence of EPA group A species and or their presence at <5% of the total sample abundance (**Appendix A**).

All of the sites, with exception of site C5, achieved **Q3 (poor status)** biological water quality. This was given an absence of EPA group A (the cleanest water indicators), low numbers of EPA group B and a dominance of EPA group C (moderate water quality indicators). The group B species recorded included the mayflies *Alainites muticus* and *Paraleptophlebia cincta* and the stonefly *Leuctra fusca*. The dominant group C species included the mayfly *Baetis rhodani*, the caseless caddis species *Polycentropus kingi* and freshwater shrimp (*Gammarus duebenii*).

A single site, C5 on the Black River, achieved **Q3-4 (moderate status)** water quality (**Figure 4.1**). Despite the presence of the EPA group A mayfly *Ecdyonurus dispar*, this was only recorded in low numbers (<5% of total sample) and thus did not meet the qualifying criteria for good status as set out by Toner et al. (2005).

It should be noted that it was not possible to collected biological water quality samples for sites A2, A4, B2, B3, C1, C3 and sites G5-G9 due to the dry nature of the channels at the time of survey. The Q-ratings for sites A1, B1, B4, B3/G1, D1, G2 and G10 were tentative due to low summer flows and or a lack of suitable riffle areas for sampling (as per Toner et al., 2005).

4.5 Lacustrine macro-invertebrates

No protected macro-invertebrate species were recorded in the sweep samples taken from the four no. lake/wetland sites in September 2025 (**Appendix A**). All species recorded were of least concern when cross-referenced against national red lists, where lists exist for each species group.

The shallow peat lakes and wetlands supported a wide diversity of species, supporting mayflies such as *Cloeon dipterum* and *Caenis horaria*, two species that are widespread in silty lake margins. No dragonflies were recorded. However, the ubiquitous damselfly genus *Coenagrion* was present. The pigmy backswimmer (*Plea minutissima*) has a sparse distribution in Ireland but is known to be spreading northwards in recent decades (Anderson, 2010). A single specimen was recorded at lake survey site L20 (**Appendix A**). A second species of note was the dytiscid (diving) beetle, *Hyphydrus ovatus,* that was recorded a site L18. This beetle species has a sparse distribution in Ireland (NBDC data), despite being of least concern on the national red list for water beetles (Foster et al. 2009).

4.6 Otter signs

Whilst a full otter survey was beyond the scope of this survey, signs were recorded within a 150m radius of the survey sites in September 2025.

A total of 3 no. otter signs were recorded across 34 no. individual survey sites during the course of aquatic surveys undertaken in September 2025. All were recorded from riverine sites. Spraint sites (all regular) were recorded at sites on the Black River (C6), Breegagh River (D1) and the Lisdowney Stream (G10).

No breeding (holts) or resting (couch) areas were identified in the vicinity of the survey sites in September 2025 or during the previous 2023 surveys (Triturus, 2024).

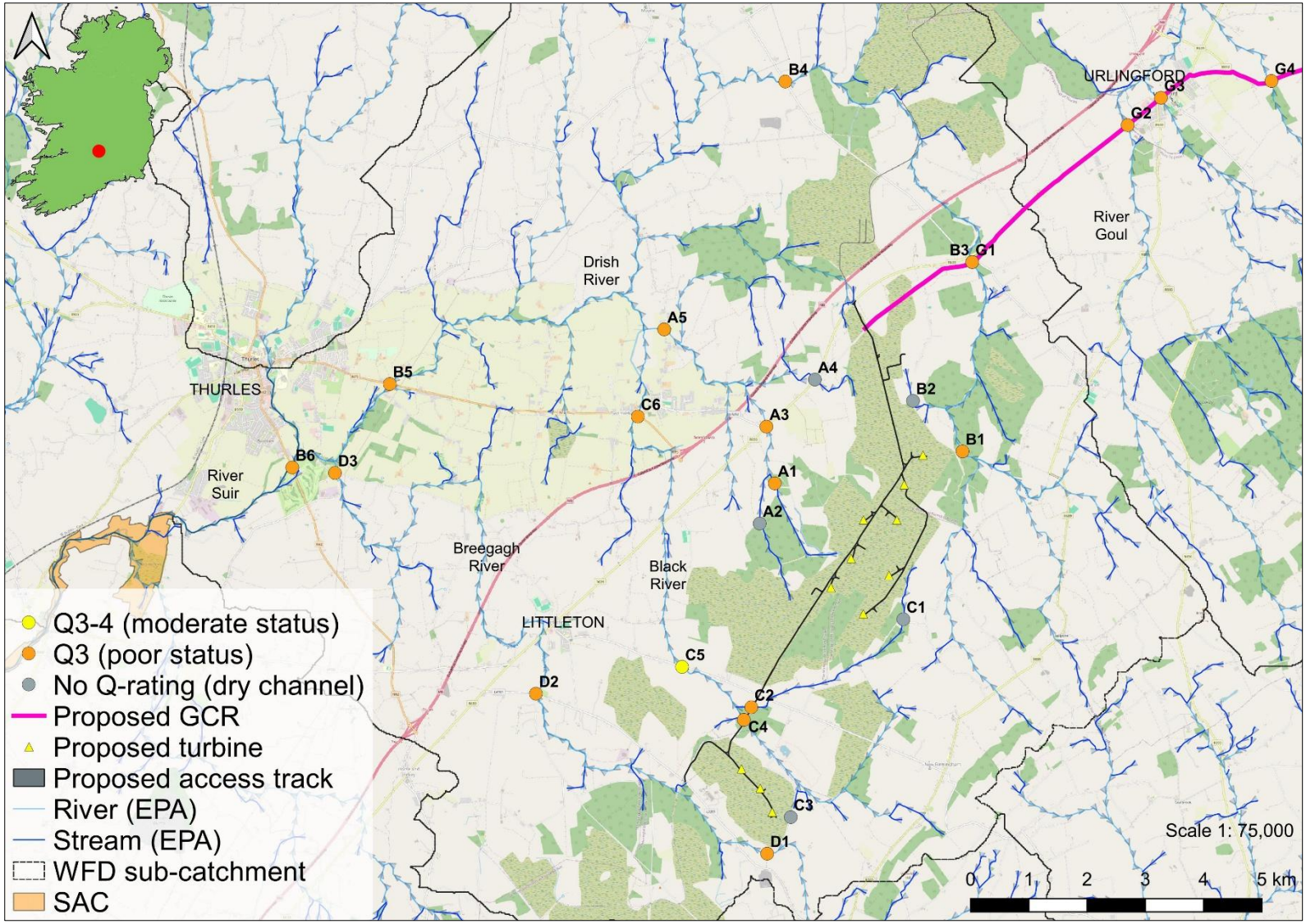


Figure 4.1 Overview of the biological water quality status in the vicinity of the proposed Littleton wind farm project, September 2025

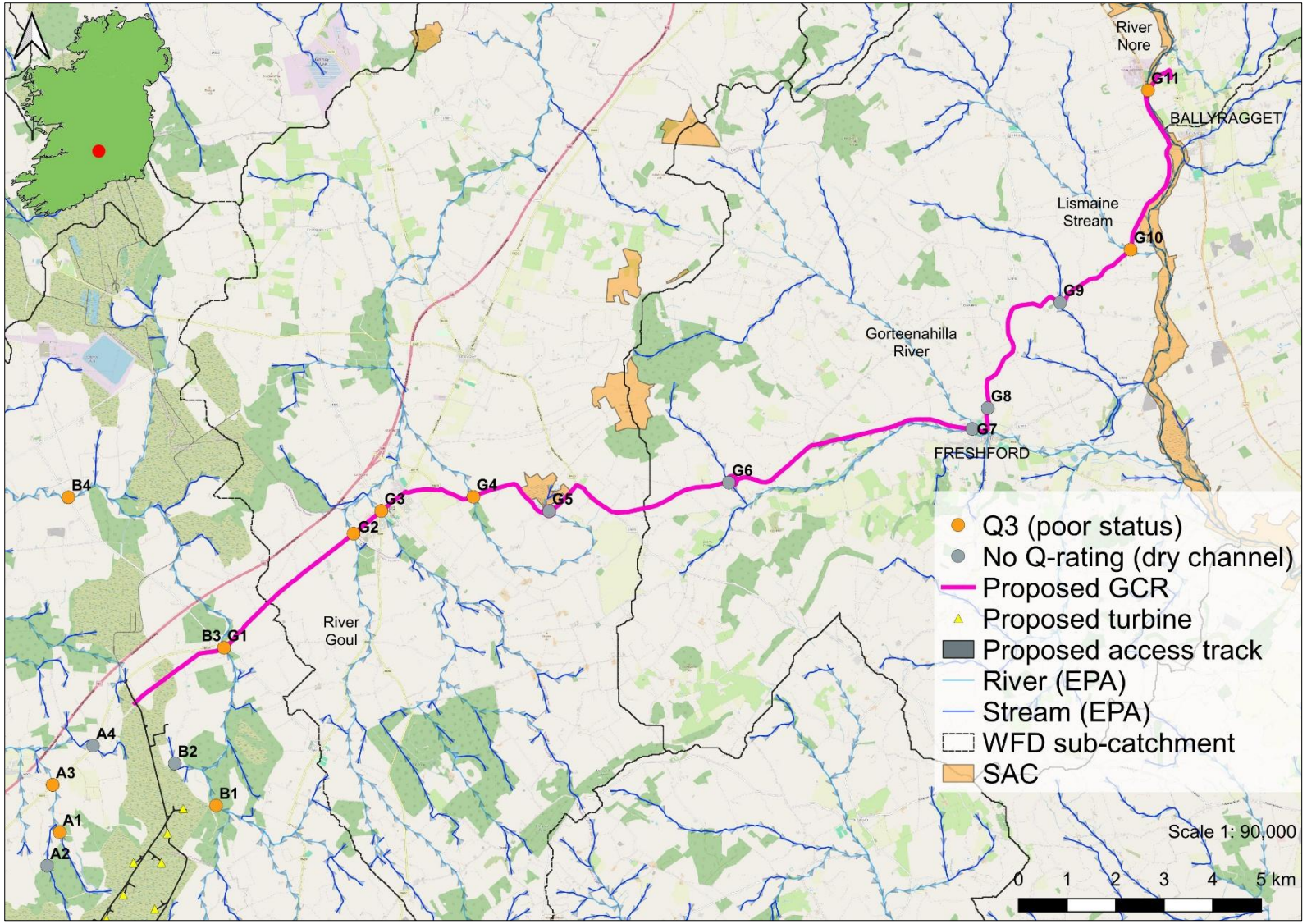


Figure 4.2 Overview of the biological water quality status in the vicinity of the proposed GCR crossings, September 2025

Table 4.1 Comparison of 2023 and 2025 biological water quality (Q-ratings) at sites in vicinity of Littleton wind farm

			September 2023		September 2025	
Site no.	Watercourse	EPA code	Q-rating	WFD status	Q-rating	WFD status
A1	Unnamed stream	n/a	Q3*	Poor	Q3*	Poor
A2	Clover River	16C04	Q3*	Poor	n/a - dry channel	
A3	Clover River	16C04	Q3	Poor	Q3	Poor
A4	Unnamed stream	n/a	Q2-3*	Poor	n/a - dry channel	
A5	Clover River	16C04	Q3-4	Mod.	Q3	Poor
B1	Drish River	16D02	Q3*	Poor	Q3*	Poor
B2	Unnamed stream	n/a	Not surveyed		n/a - dry channel	
B3/G1	Drish River	16D02	Q2-3	Poor	Q3*	Poor
B4	Drish River	16D02	Q2-3	Poor	Q3*	Poor
B5	Drish River	16D02	Q4	Good	Q3	Poor
B6	River Suir	16S02	Not surveyed		Q3	Poor
C1	Black River	16B01	n/a - dry channel		n/a - dry channel	
C2	Black River	16B01	Q3	Poor	Q3	Poor
C3	Unnamed stream	n/a	Not surveyed		n/a - dry channel	
C4	North Glengoole River	16N28	Q3	Poor	Q3*	Poor
C5	Black River	16B01	Q3	Poor	Q3-4	Mod.
C6	Black River	16B01	Q3	Poor	Q3	Poor
D1	Breegagh River	16B03	Q3-4	Mod.	Q3*	Poor
D2	Breegagh River	16B03	Q3	Poor	Q3*	Poor
D3	Breegagh River	16B03	Q3-4	Mod.	Q3	Poor
G2	River Goul	15G02	Not surveyed		Q3*	Poor
G3	Ardreagh River	15A03	Not surveyed		Q3	Poor
G4	Borrisbeg River	15B18	Not surveyed		Q3	Poor
G5	Borrisbeg River	15B18	Not surveyed		n/a – dry channel	
G6	Clomantagh Lower Stream	15C91	Not surveyed		n/a – dry channel	
G7	Gorteenahilla River	15G08	Not surveyed		n/a – dry channel	
G8	Unmapped stream	n/a	Not surveyed		n/a – dry channel	
G9	Lismaine Stream	15L16	Q3	Poor	n/a – dry channel	
G10	Lisdowney Stream	15L02	Q4	Good	Q3*	Poor
G11	River Nore	15N01	Not surveyed		Q3	Poor

* tentative rating given poor flows and the absence of suitable riffle areas for sampling (as per Toner et al., 2005)

Table 4.2 Summary of aquatic species & habitats of higher conservation value recorded in the vicinity of the proposed Littleton wind farm, September 2025

Site		White-clawed crayfish	Otter signs[4]	Annex I aquatic habitats	Rare or protected macrophytes/ aquatic bryophytes	Rare or protected macro-invertebrates	Other species/habitats of high conservation value
Riverine sites							
A1	Unnamed stream	None recorded	No signs	None recorded	None recorded	None recorded	None recorded
A2	Clover River	None recorded	No signs	None recorded	None recorded	None recorded	None recorded
A3	Clover River	None recorded	No signs	None recorded	None recorded	None recorded	None recorded
A4	Unnamed stream	None recorded	No signs	None recorded	None recorded	None recorded	None recorded
A5	Clover River	None recorded	No signs	None recorded	None recorded	None recorded	**Atlantic salmon & *Lampetra* sp. recorded in 2023**
B1	Drish River	None recorded	No signs	None recorded	None recorded	None recorded	None recorded
B2	Unnamed stream	None recorded	No signs	None recorded	None recorded	None recorded	None recorded
B3/G1	Drish River	None recorded	No signs	**Hydrophilous tall herb (6430)**	None recorded	None recorded	**Atlantic salmon & European eel recorded in 2023**
B4	Drish River	None recorded	No signs	None recorded	None recorded	None recorded	***Lampetra* sp. recorded in 2023**
B5	Drish River	None recorded	No signs	None recorded	None recorded	None recorded	**Atlantic salmon, *Lampetra* sp. & European eel recorded in 2023**
B6	River Suir	None recorded	No signs	None recorded	None recorded	None recorded	None recorded
C1	Black River	None recorded	No signs	None recorded	None recorded	None recorded	None recorded
C2	Black River	None recorded	No signs	None recorded	None recorded	None recorded	**Atlantic salmon recorded in 2023**
C3	Unnamed stream	None recorded	No signs	None recorded	None recorded	None recorded	None recorded
C4	North Glengoole River	None recorded	No signs	None recorded	None recorded	None recorded	None recorded

Site		White-clawed crayfish	Otter signs[4]	Annex I aquatic habitats	Rare or protected macrophytes/ aquatic bryophytes	Rare or protected macro-invertebrates	Other species/habitats of high conservation value
C5	Black River	None recorded	No signs	None recorded	None recorded	None recorded	None recorded
C6	Black River	None recorded	**Regular spraint site**	None recorded	None recorded	***Gyrinus urinator* (Near threatened; Foster et al., 2009)**	**Atlantic salmon, *Lampetra* sp. & European eel recorded in 2023**
D1	Breegagh River	None recorded	**Regular spraint site**	None recorded	None recorded	None recorded	**Atlantic salmon recorded in 2023**
D2	Breegagh River	None recorded	No signs	None recorded	None recorded	None recorded	**Atlantic salmon & *Lampetra* sp. recorded in 2023**
D3	Breegagh River	None recorded	No signs	None recorded	None recorded	None recorded	**Atlantic salmon & European eel recorded in 2023**
G2	River Goul	None recorded	No signs	None recorded	None recorded	None recorded	None recorded
G3	Ardreagh River	**Single crayfish captured**	No signs	None recorded	None recorded	None recorded	None recorded
G4	Borrisbeg River	None recorded	No signs	None recorded	None recorded	None recorded	None recorded
G5	Borrisbeg River	None recorded	No signs	None recorded	None recorded	None recorded	None recorded
G6	Clomantagh Lower Stream	None recorded	No signs	None recorded	None recorded	None recorded	None recorded
G7	Gorteenahilla River	None recorded	No signs	None recorded	None recorded	None recorded	None recorded
G8	Unmapped stream	None recorded	No signs	None recorded	None recorded	None recorded	None recorded
G9	Lismaine Stream	None recorded	No signs	None recorded	None recorded	None recorded	None recorded
G10	Lisdowney Stream	None recorded	**Regular spraint site**	None recorded	None recorded	None recorded	**Atlantic salmon & European eel recorded in 2023**
G11	River Nore	None recorded	No signs	None recorded	None recorded	None recorded	None recorded
Lacustrine sites							
L18	Lake/wetland	No signs	Not present	None recorded	None recorded	None recorded	None recorded
L19	Lake/wetland	No signs	Not present	None recorded	None recorded	None recorded	None recorded

Site		White-clawed crayfish	Otter signs[4]	Annex I aquatic habitats	Rare or protected macrophytes/ aquatic bryophytes	Rare or protected macro-invertebrates	Other species/habitats of high conservation value
L20	Lake/wetland	No signs	Not present	None recorded	None recorded	None recorded	None recorded
L21	Lake/wetland	No signs	Not present	None recorded	None recorded	None recorded	None recorded

Conservation value: White-clawed crayfish (*Austropotamobius pallipes*), Atlantic salmon (*Salmo salar*), brook lamprey (L*ampetra planeri*), river lamprey (*Lampetra fluviatilis*) and Eurasian otter (*Lutra lutra*) are listed under Annex II and Annex V of the Directive on the Conservation of Natural Habitats of Wild Fauna and Flora (92/43/EEC) ('EU Habitats Directive'). White-clawed crayfish and otter are also protected under the Irish Wildlife Acts 1976-2023. White-clawed crayfish (Füreder et al., 2010) are listed as 'Endangered' according to the IUCN Red List. European eel are 'critically endangered' according to most recent ICUN red list (Pike et al., 2020) and listed as 'critically engendered' in Ireland (King et al., 2011).

Table 4.3 Aquatic ecological evaluation summary of the Littleton wind farm survey sites according to NRA (2009) criteria

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
Riverine sites				
A1	Unnamed stream	n/a	**Local importance (higher value)**	Brown trout recorded in 2023; site utilised by otter
A2	Clover River	16C04	Local importance (lower value)	No aquatic species or habitats of high conservation value (dry, ephemeral channel)
A3	Clover River	16C04	**Local importance (higher value)**	Brown trout recorded in 2023; site utilised by otter
A4	Unnamed stream	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value (dry, ephemeral channel)
A5	Clover River	16C04	**Local importance (higher value)**	Atlantic salmon, brown trout & lamprey (*Lampetra* sp.) recorded 2023; site utilised by otter
B1	Drish River	16D02	Local importance (lower value)	No aquatic species or habitats of high conservation value
B2	Unnamed stream	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value (dry, ephemeral channel)
B3/G1	Drish River	16D02	**County importance**	Annex I hydrophilous tall herb (6430) habitat present
B4	Drish River	16D02	**Local importance (higher value)**	Brown trout & lamprey (*Lampetra* sp.) recorded in 2023
B5	Drish River	16D02	**Local importance (higher value)**	Atlantic salmon, brown trout, lamprey (*Lampetra* sp.) & Red-listed European eel recorded in 2023
B6	River Suir	16S02	**County importance**	Regionally important ecological corridor
C1	Black River	16B01	Local importance (lower value)	No aquatic species or habitats of high conservation value (dry, ephemeral channel)
C2	Black River	16B01	**Local importance (higher value)**	Atlantic salmon recorded in 2023
C3	Unnamed stream	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value (dry, ephemeral channel)
C4	North Glengoole River	16N28	**Local importance (higher value)**	Brown trout recorded in 2023
C5	Black River	16B01	**Local importance (higher value)**	Brown trout recorded in 2023

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
C6	Black River	16B01	**Local importance (higher value)**	Red-listed beetle *Gyrinus urinator* recorded (2025); Atlantic salmon, brown trout, European eel & lamprey (*Lampetra* sp.) recorded in 2023
D1	Breegagh River	16B03	**Local importance (higher value)**	Salmonids (including Atlantic salmon) recorded; site utilised by otter
D2	Breegagh River	16B03	**Local importance (higher value)**	Otter signs recorded (2025)
D3	Breegagh River	16B03	**Local importance (higher value)**	Atlantic salmon, European eel & otter signs recorded in 2023
G2	River Goul	15G02	Local importance (lower value)	No aquatic species or habitats of high conservation value
G3	Ardreagh River	15A01	**Local importance (higher value)**	White-clawed crayfish recorded (2025)
G4	Borrisbeg River	15B18	**Local importance (higher value)**	Suitable salmonid and lamprey habitat present
G5	Borrisbeg River	15B18	Local importance (lower value)	No aquatic species or habitats of high conservation value (dry, ephemeral channel)
G6	Clomantagh Lower Stream	15C91	Local importance (lower value)	Watercourse not present (possibly culverted underground)
G7	Gorteenahilla River	15G08	Local importance (lower value)	No aquatic species or habitats of high conservation value (dry, ephemeral channel)
G8	Unmapped stream	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value (dry, ephemeral channel)
G9	Lismaine Stream	15L16	Local importance (lower value)	No aquatic species or habitats of high conservation value (dry, ephemeral channel)
G10	Lisdowney Stream	15L02	**Local importance (higher value)**	Site utilised by otter (2025)
G11	River Nore	15N01	**International importance**	Site located in River Barrow and River Nore SAC (002162) and the River Nore SPA (004233)
Lacustrine sites				
L18	Lake/wetland	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value
L19	Lake/wetland	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value
L20	Lake/wetland	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
L21	Lake/wetland	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value

Conservation value: White-clawed crayfish (*Austropotamobius pallipes*), Atlantic salmon (*Salmo salar*), brook lamprey (L*ampetra planeri*), river lamprey (*Lampetra fluviatilis*) and Eurasian otter (*Lutra lutra*) are listed under Annex II and Annex V of the Directive on the Conservation of Natural Habitats of Wild Fauna and Flora (92/43/EEC) ('EU Habitats Directive'). White-clawed crayfish and otter are also protected under the Irish Wildlife Acts 1976-2023. White-clawed crayfish (Füreder et al., 2010) are listed as 'Endangered' according to the IUCN Red List. European eel are 'critically endangered' according to most recent ICUN red list (Pike et al., 2020) and listed as 'critically engendered' in Ireland (King et al., 2011). With the exception of the Inland Fisheries Acts 1959 to 2017, brown trout and coarse fish species have no legal protection in Ireland.

5. Discussion

The riverine watercourses in the vicinity of the proposed Littleton wind farm, inclusive of those crossed by the proposed GCR, were typically lowland channels which had been extensively straightened and or deepened historically as part of drainage and land reclamation works, resulting in poor hydromorphology and reduced habitat heterogeneity. Whilst some good instream recovery had occurred locally (e.g. Drish River, Black River, Breegagh River, Lisdowney Stream), significant siltation and hydromorphological pressures were evident throughout much of the survey area. Furthermore, low summer flows, characteristic of this part of Ireland, also impacted the aquatic ecology during the 2025 surveys. A total of 10 no. sites, inclusive of five GCR watercourse crossings, were dry at the time of survey and did not support aquatic habitats.

Nevertheless, the majority of the riverine survey sites were evaluated as at least **local importance (higher value)** in terms of their aquatic ecology due to the presence of or suitability for high conservation value fish species, Annex II white-clawed crayfish, Annex II otter, the Red-listed beetle *Gyrinus urinator* or Annex I habitats (**Table 4.3**). Site G11 on the River Nore (proposed GCR crossing) was evaluated as **international importance** given its location with both the River Barrow and River Nore SAC (002162) and River Nore SPA (004233). Site B3/G1 on the Drish River (proposed GCR crossing) was evaluated as **county importance** given the presence of Annex I hydrophilous tall herb habitat. Site B6 on the River Suir was of **county importance** given the river's regional importance as an ecological corridor.

The 4 no. lakes and wetlands located near the turbine array originate from historical cutover bog activities and as such were shallow, peat stained, poorly vegetated and of lower productivity, providing relatively poor habitat for many higher conservation value species or habitats. Nevertheless these sites supported a range of macro-invertebrate species and were of high suitability for amphibians[1]. None of the lake/wetland sites corresponded to Annex I lake habitats (e.g. natural dystrophic lakes and ponds, 3160) and were of **local importance (lower value)**.

In support of previous surveys, no rare or protected macrophytes/aquatic bryophytes, otter breeding/resting areas or aquatic invasive species were recorded during the current survey. Biological water quality had broadly declined relative to the previous 2023 surveys, driven primarily through lower water volumes and reduced flows in the 2025 survey period.

5.1 Fisheries

Electro-fishing was beyond the scope of the current survey. However, a fisheries appraisal at all survey sites generally supported available data and previous findings. In 2023 a typical diversity of fish species for Irish midland rivers, namely Atlantic salmon, brown trout, lamprey (*Lampetra* sp.), European eel, stone loach, minnow, pike, perch and three-spined stickleback, were recorded via electro-fishing (Triturus, 2024). Whilst some good instream recovery had occurred locally (e.g. Drish River, Black River, Breegagh River, Lisdowney Stream), significant siltation and hydromorphological pressures

[1] Many sites had high suitability for amphibians although a dedicated survey for smooth newt and common frog was beyond the scope of this survey. An environmental DNA approach would help to clarify the status of amphibians at these sites

were evident throughout the survey area. Historical straightening and deepening of watercourses damages habitat and flow heterogeneity, removes instream structure and refugia, encourages sediment deposition and invariably results in an irreparable reduction in fisheries potential, particularly for salmonids (O'Briain et al., 2019; O'Grady et al., 2017; Blann et al., 2009; O'Grady, 2006) but also European eel and lamprey species.

Despite often considerable water quality and hydromorphological pressures, salmonid populations are widespread in the survey area, with Atlantic salmon known to occur on the Clover River, Drish River, Black River, Breegagh River, Ardreagh River, Gorteenahilla River and the Lisdowney Stream, as well as the River Nore and River Suir. In context of the survey area, lamprey (*Lampetra* sp.) are known from the Clover River, Drish River, Black River, Breegagh River, River Goul, River Suir and River Nore, although densities are typically low given sub-optimal spawning and nursery habitats, often a result of siltation and historical instream modifications. These characteristics were again observed in the current survey, including at proposed GCR crossings not surveyed previously (i.e. G2-G8 inclusive). Red-listed (King et al., 2011) and critically endangered (Pike et al., 2020) European eel are also known to occupy a restricted distribution in the survey area but are known from the majority of the survey watercourses (Triturus, 2024). Current and previous findings suggest this is due to a combination of sub-optimal habitat and widespread migration barriers in the survey catchments.

The 4 no. lakes and wetlands located adjacent to the proposed turbine array originate from historical cutover bog activities and as such are shallow, highly turbid (peat stained), poorly vegetated, isolated from other aquatic habitats and of lower productivity. None were considered of significant fisheries value (stickleback only).

5.2 White-clawed crayfish

Despite suitability at numerous sites, only a single live white-clawed crayfish was recorded during targeted surveys in September 2025, with an adult captured via hand searching on the Ardreagh River, a tributary of the River Goul, at site G3 (proposed GCR crossing) (**Plate 4.37**). Indeed, crayfish remains (but no live crayfish) were recorded in otter spraint at this same location in September 2023 (Triturus, 2024). White-clawed crayfish are also known from the Drish River, Clover River, Black River, River Goul and the River Nore (**Figure 3.1**) although crayfish plague (*Aphanomyces astaci*) has likely impacted crayfish populations throughout the Suir and Nore catchments.

The 4 no. survey lakes/wetlands were inherently unsuitable for white-clawed crayfish given their unsuitable peat geologies, water chemistry (humic/acidic) and physical habitat attributes (Demers et al., 2005; Lucey & McGarrigle, 1987).

5.3 Otter

Despite widespread suitability, only a low number of otter signs (3 no.) were recorded across 34 no. individual survey sites. All were recorded from riverine sites with the lakes/wetlands surveyed providing poor otter habitat, primarily due to insufficient prey resources. Spraint sites (all regular) were recorded at sites on the Black River (C6), Breegagh River (D1) and the Lisdowney Stream (G10). Otter signs were recorded at 6 no. sites during the previous 2023 survey (Triturus, 2024).

In keeping with previous observations, the paucity of signs in the wider survey area was considered to mainly reflect the influence of historical instream modifications (straightening, deepening) and low summer flows on the health and distribution of fish populations, the key prey resource of otter (Krawczyk et al., 2016; Ruiz-Olmo & Jiménez, 2009). Otters are food-limited and prey availability is a crucial factor in determining mortality, breeding success and the status of local populations (Sittenthaler et al., 2019; Ruiz-Olmo et al., 2002). Furthermore, otter sign marking is routinely associated with prominent features such as large instream boulders and tree root systems (Almeida et al., 2012). Historical drainage, such as that carried out historically in the vicinity of the proposed project, significantly reduces instream habitat heterogeneity (O'Grady, 2017) and the availability or marking features which therefore results in the deposition and detection of fewer otter signs such as spraints, irrespective of watercourse utilisation (e.g. for foraging).

No breeding (holts) or resting (couch) areas were identified in the vicinity of the survey sites in September 2025 or during the previous 2023 surveys (Triturus, 2024).

5.4 Macrophytes and Annex I habitats

In keeping with previous data, no rare or protected macrophytes or aquatic bryophytes were recorded at the riverine or lacustrine survey sites in September 2025.

Based on the presence of several indicator species (EC, 2013; Devaney, 2013), including *Lythrum salicaria, Epilobium hirsutum, Solanum dulcamara*, *Calystegia sepium, Myosotis scorpioides, Mentha aquatica* and *Galium palustre,* the heavily modified Drish River at site B3/G1 supported the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels (6430)'. This habitat often forms along unmanaged margins of lowland rivers (Devaney et al., 2013) and was recorded at the same location in 2023 (Triturus, 2024).

Although Annex I floating river vegetation (3260) was recorded at sites on the Black River (C6) and Breegagh River (D3) in 2023 (Triturus, 2024), the aquatic vegetation communities at these locations, though still supporting indicator species (EC, 2013), were not considered representative of the habitat in the current survey. This was mainly due to lower summer flows and water levels compared with 2023 which resulted in fragmentation and reduced coverage of the habitats.

5.5 Macro-invertebrates & biological water quality

Site C6 on the Black River was found to support the IUCN-threatened whirligig beetle *Gyrinus urinator*. This species is listed as IUCN near-threatened and has a limited distribution in Ireland, being largely restricted to lowland, base-rich rivers and streams (Foster et al., 2009).

With the exception of *Gyrinus urinator* (site C6), no other rare or protected macro-invertebrate species (according to national red lists) were recorded in the biological water quality samples taken from 20 no. wetted riverine sites or 4 no. sweep samples from lake sites in September 2025 (**Appendix A**). Whilst not protected, the nationally uncommon dytiscid beetle *Hyphydrus ovatus* and the pigmy backswimmer (*Plea minutissima*) were recorded at sites L18 and L20 respectively.

None of the riverine sites achieved greater than **Q3-4 (moderate status)** water quality in the current survey and thus all sites failed to meet the target good status (≥Q4) requirements of the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 and the Water Framework Directive (2000/60/EC) (**Figure 4.1**). Two sites (B5 & G10) achieved Q4 status in 2023 but not in 2025, with a greater number of moderate status sites also in 2023 (**Table 4.1**). The reduction in water quality from the previous survey can be attributed to the low summer flows experienced during the September 2025 survey which evidently impacted macro-invertebrate populations and distribution. Site C5 on the Black River showed a slight improvement in water quality in September 2025, achieving **Q3–4 (moderate status)**, compared with **Q3 (poor status**) in 2023 (**Table 4.1**). Peat extraction (leading to siltation) and forestry are the significant threats to water quality in the survey area (EPA data). Furthermore, hydromorphological modifications also influenced biological water quality in September 2025.



Plate 5.1 Stock image of the IUCN near-threatened whirligig beetle *Gyrinus urinator*, recorded on the Black River at site C6 in September 2025

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7. Appendix A – Q-sample results (biological water quality) & lacustrine macroinvertebrates

Table 7.1 Macro-invertebrate Q-sampling results for riverine sites in the vicinity of Littleton wind farm, September 2025

Taxon	Family	Binomial name	A1	A3	A5	B1	B4	B5	B6	C2	C4	C5	C6	EPA Class
Ephemeroptera	Heptageniidae	*Ecdyonurus dispar*										2		**A**
Ephemeroptera	Baetidae	*Alainites muticus*	1		1			15		1		2		**B**
Ephemeroptera	Leptophlebiidae	*Paraleptophlebia cincta*					4							**B**
Odonata	Coenagrionidae	sp. indet.	1				1							**B**
Plecoptera	Leuctridae	*Leuctra fusca*			1			6	1	1			1	**B**
Trichoptera	Beraeidae	*Beraeodes minutus*									1			**B**
Trichoptera	Cased caddis pupa	sp. indet.		1									2	**B**
Trichoptera	Goeridae	*Silo pallipes*										2		**B**
Trichoptera	Hydroptilidae	*Hydroptila* sp.						1						**B**
Trichoptera	Leptoceridae	*Athripsodes aterrimus*							1					**B**
Trichoptera	Sericostomatidae	*Sericostoma personatum*		2	1	1		1		1				**B**
Trichoptera	Hydropsychidae	*Hydropsyche instabilis*		2	2			9	1	2		34		**C**
Trichoptera	Hydropsychidae	*Hydropsyche siltalai*						3						**C**
Trichoptera	Polycentropodidae	*Polycentropus kingi*	2		17		12	1	7				3	**C**
Trichoptera	Rhyacophilidae	*Rhyacophila dorsalis*						1				2		**C**
Ephemeroptera	Baetidae	*Baetis rhodani*			1			23		2		7		**C**
Ephemeroptera	Caenidae	*Caenis horaria*								1				**C**
Ephemeroptera	Caenidae	*Caenis luctuosa*				3			3					**C**
Ephemeroptera	Caenidae	sp. indet.						1						**C**
Ephemeroptera	Ephemerellidae	*Serratella ignita*							2			2		**C**
Coleoptera	Dytiscidae	Dytiscidae larva						2		2				**C**
Coleoptera	Dytiscidae	*Dytiscus semisulcatus*										1		**C**
Coleoptera	Dytiscidae	*Nebrioporus depressus*								4	2			**C**
Coleoptera	Elmidae	*Elmis aenea*		5	7	1	1	2	4			25	13	**C**
Coleoptera	Elmidae	*Limnius volckmari*			3			1		1		3		**C**

Taxon	Family	Binomial name	A1	A3	A5	B1	B4	B5	B6	C2	C4	C5	C6	EPA Class
Coleoptera	Gyrinidae	Gyrinidae larva					2							C
Coleoptera	Gyrinidae	*Gyrinus urinator* †											1	C
Coleoptera	Haliplidae	*Brychius elevatus*			1			3				1		C
Coleoptera	Hydrophilidae	*Laccobius minutus*							1					C
Gastropoda	Bithnyiidae	*Bithynia tentaculata*				2	39							C
Gastropoda	Lymnaeidae	*Lymnaea stagnalis*					2		1					C
Gastropoda	Planorbidae	*Bathyomphalus contortus*	1											C
Gastropoda	Planorbidae	*Gyraulus albus*							1					C
Gastropoda	Planorbidae	*Planorbis planorbis*		6		1	7		1					C
Arachnida	Hydrachnidiae	sp. indet.						3		1				C
Hemiptera	Gerridae	*Gerris* sp.		3			2			13	4	8		C
Hemiptera	Hydrometridae	*Hydrometra stagnorum*					1							C
Hirudinidae	Piscicolidae	Piscicola sp.										1	1	C
Crustacea	Gammaridae	*Gammarus duebeni*	10	45	8	5	11	47	19	27		65	8	C
Diptera	Chironomidae	Non-*Chironomus* spp.			1			1	10	4		1		C
Diptera	Culicidae	sp. indet.			1								1	C
Diptera	Pediciidae	*Dicranota* sp.		1								2	1	C
Diptera	Simuliidae	sp. indet.						1	1			9		C
Diptera	Tipuliidae	*Tipula* sp.							9					C
Gastropoda	Tateidae	*Potamopyrgus antipodarum*							4				2	C
Crustacea	Asellidae	*Asellus aquaticus*	3			2	29	3	4	1	3			D
Crustacea	Crangonyctidae	*Crangonyx* sp.						1	1					D
Gastropoda	Lymnaeidae	*Ampullacaena balthica*					2		8					D
Gastropoda	Physidae	*Physa fontinalis*				2	7	1	2					D
Hirudinidae	Glossiphoniidae	sp. indet.	1	1	2		1				2			D
Megaloptera	Sialidae	*Sialis lutaria*				2								D

Taxon	Family	Binomial name	A1	A3	A5	B1	B4	B5	B6	C2	C4	C5	C6	EPA Class
Mollusca	Sphaeriidae	sp. indet.					5	1					2	**D**
Diptera	Chironomidae	*Chironomus* spp.			14				9		4	2	1	**E**
Annelidae	Oligochaeta	sp. indet.						1				2		**n/a**
Abundance			**19**	**66**	**60**	**19**	**126**	**128**	**90**	**61**	**16**	**171**	**36**	
Q-rating			***Q3**	**Q3**	**Q3**	***Q3**	***Q3**	**Q3**	**Q3**	**Q3**	**Q3**	**Q3-4**	**Q3**	
WFD status			**Poor**	**Poor**	**Poor**	**Poor**	**Poor**	**Poor**	**Poor**	**Poor**	**Poor**	**Mod.**	**Poor**	

* tentative rating due to poor flows and or lack of suitable riffle areas for sampling (as per Toner et al., 2005)

† Listed as 'Near threatened' in Ireland (Foster et al., 2009)

Table 7.2 Macro-invertebrate Q-sampling results for riverine sites in the vicinity of Littleton wind farm, September 2025 (* tentative rating)

Taxon	Family	Binomial name	D1	D2	D3	B3/G1	G2	G3	G4	G10	G11	EPA Class
Ephemeroptera	Baetidae	*Alainites muticus*		1	2			3				**B**
Plecoptera	Leuctridae	*Leuctra fusca*	1		3						3	**B**
Trichoptera	Cased caddis pupa	sp. indet.		3								**B**
Trichoptera	Glossosomatidae	*Agapetus fuscipes*							10			**B**
Trichoptera	Glossosomatidae	sp. indet.		4	2						2	**B**
Trichoptera	Limnephilidae	*Drusus annulatus*								1		**B**
Trichoptera	Limnephilidae	*Potamophylax cingulatus*			5					7		**B**
Trichoptera	Odontoceridae	*Odontocerum albicorne*	1								7	**B**
Trichoptera	Sericostomatidae	*Sericostoma personatum*		1	1	1	2			8	2	**B**
Trichoptera	Hydropsychidae	*Hydropsyche instabilis*		18	6						2	**C**
Trichoptera	Polycentropodidae	*Plectrocnemia conspersa*	1									**C**
Trichoptera	Polycentropodidae	*Polycentropus kingi*	3		1			12				**C**
Trichoptera	Rhyacophilidae	*Rhyacophila dorsalis*			1							**C**
Ephemeroptera	Baetidae	*Baetis rhodani*	3		1			3	3		13	**C**
Ephemeroptera	Ephemerellidae	*Serratella ignita*			6			1			2	**C**
Coleoptera	Dytiscidae	Dytiscidae larva	1				2					**C**
Coleoptera	Dytiscidae	*Ilybius fuliginosus*					1					**C**
Coleoptera	Dytiscidae	*Nebrioporus depressus*		1						9		**C**
Coleoptera	Dytiscidae	*Oreodytes sanmarkii*		1								**C**
Coleoptera	Dytiscidae	*Oreodytes septentrionalis*		2								**C**
Coleoptera	Dytiscidae	*Stictotarsus duodecimpustulatus*					2			2		**C**
Coleoptera	Elmidae	*Elmis aenea*		18	1		2	6	26			**C**
Coleoptera	Elmidae	*Esolus parallelepipedus*					1					**C**
Coleoptera	Elmidae	*Limnius volckmari*		1				1				**C**
Coleoptera	Halipliidae	*Brychius elevatus*		3	4			3		1		**C**

Taxon	Family	Binomial name	D1	D2	D3	B3/G1	G2	G3	G4	G10	G11	EPA Class
Coleoptera	Halipliidae	*Haliplus ruficollis*					1					**C**
Coleoptera	Halipliidae	sp. indet.								1		**C**
Coleoptera	Hydraenidae	*Hydraena gracilis*							1			**C**
Coleoptera	Hydrophilidae	*Laccobius bipunctatus*					2					**C**
Gastropoda	Bithnyiidae	*Bithynia tentaculata*				28						**C**
Gastropoda	Planorbidae	*Bathyomphalus contortus*				7						**C**
Gastropoda	Planorbidae	*Planorbis planorbis*				3		2		1	2	**C**
Gastropoda	Valvatidae	*Valvata piscinalis*						7				**C**
Arachnida	Hydrachnidiae	sp. indet.		2	3							**C**
Hemiptera	Gerridae	*Gerris* sp.	14				2			2	4	**C**
Hemiptera	Veliidae	*Velia caprai*					3				1	**C**
Hirudinidae	Piscicolidae	*Piscicola* sp.			3			1				**C**
Diptera	Chironomidae	Non-*Chironomus* spp.	3	3	2			1	1	10		**C**
Diptera	Pediciidae	*Dicranota* sp.		2				3	14			**C**
Diptera	Ptychopteridae	sp. indet.							1			**C**
Diptera	Simuliidae	sp. indet.			1							**C**
Gastropoda	Tateidae	*Potamopyrgus antipodarum*	2	4							15	**C**
Crustacea	Gammaridae	*Gammarus duebeni*	27	109	32	15	4	42	27	1	10	**C**
Crustacea	Asellidae	*Asellus aquaticus*	1	19	8	26	2	1		31		**D**
Gastropoda	Lymnaeidae	*Ampullacaena balthica*		6			11			19	2	**D**
Gastropoda	Physidae	*Physa fontinalis*				8				10		**D**
Hirudinidae	Glossiphoniidae	sp. indet.				1	1			1	1	**D**
Diptera	Chironomidae	*Chironomus* spp.	9	5	2		3	2			1	**E**
Abundance			**66**	**203**	**84**	**89**	**39**	**88**	**83**	**104**	**67**	
Q-rating			***Q3**	***Q3**	**Q3**	***Q3**	***Q3**	**Q3**	**Q3**	***Q3**	**Q3**	
WFD status			**Poor**	**Poor**	**Poor**	**Poor**	**Poor**	**Poor**	**Poor**	**Poor**	**Poor**	

Table 7.3 Macro-invertebrate sweep sample results for lake/ wetland sites L8, L10, L12 & L14 in the vicinity of Littleton wind farm, September 2025

Taxon	Family	Binomial name	L8	L10	L14	L15
Ephemeroptera	Baetidae	*Cloeon simile*	2	9	11	
Ephemeroptera	Caenidae	*Caenis horaria*			7	
Trichoptera	Limnephilidae	*Limnephilus marmoratus*			3	
Trichoptera	Phryganeidae	*Agrypnia obsoleta*				1
Trichoptera	Polycentropodidae	*Plectrocnemia conspersa*	1			
Coleoptera	Dytiscidae	Dytiscidae larva	1			
Coleoptera	Dytiscidae	*Hyphydrus ovatus*	1		1	
Coleoptera	Dytiscidae	*Porhydrus lineatus*		1	3	
Coleoptera	Dytiscidae	*Stictonectes lepidus*			1	
Coleoptera	Gyrinidae	*Gyrinus marinus*	2			
Coleoptera	Haliplidae	*Haliplus ruficollis*	1			
Coleoptera	Haliplidae	*Haliplus* sp.			18	
Coleoptera	Hydrophilidae	*Laccobius bipunctatus*		1		
Coleoptera	Hydrophilidae	*Laccobius minutus*			1	
Coleoptera	Noteridae	*Noterus clavicornis*			1	
Gastropoda	Lymnaeidae	*Ampullacaena balthica*		7		2
Gastropoda	Physidae	*Physa fontinalis*			3	
Gastropoda	Planorbidae	*Gyraulus albus*				1
Gastropoda	Planorbidae	*Planorbis planorbis*		8	1	1
Gastropoda	Succineidae	sp. indet.		1	1	
Gastropoda	Tateidae	*Potamopyrgus antipodarum*			24	1
Hemiptera	Corixidae	*Callicorixa praeusta*				3
Hemiptera	Corixidae	*Corixa panzeri*	4	2		13
Hemiptera	Corixidae	Corixidae nymph				11
Hemiptera	Corixidae	*Hesperocorixa linnaei*	7	6		5

Taxon	Family	Binomial name	L8	L10	L14	L15
Hemiptera	Corixidae	*Hesperocorixa sahlbergi*		4		
Hemiptera	Corixidae	sp. indet.			3	
Hemiptera	Gerridae	*Gerris* sp.	1			
Hemiptera	Notonectidae	*Notonecta viridis*		2		1
Hemiptera	Pleidae	*Plea minutissima*			1	
Hirudinidae	Erpobdellidae	sp. indet.	2			
Hirudinidae	Glossiphoniidae	sp. indet.			1	
Mollusca	Sphaeriidae	sp. indet.				4
Odonata	Coenagrionidae	sp. indet.	18	16	7	
Crustacea	Asellidae	*Asellus aquaticus*	13	7	29	6
Crustacea	Gammaridae	*Gammarus duebeni*				2
Arachnida	Hydrachnidiae	sp. indet.	1			
Diptera	Chaoboridae	sp. indet.	8			
Diptera	Chironomidae	*Chironomus* spp.		1		
Diptera	Chironomidae	Non-*Chironomus* spp.	1			1
Diptera	Culicidae	sp. indet.		1		
Diptera	Limoniidae	sp. indet.			1	
Species richness (*n*)			**15**	**14**	**19**	**14**
Abundance			**63**	**66**	**117**	**52**



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Aquatic baseline report for Littleton wind farm, Co. Tipperary

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1. Introduction

1.1 Background

Triturus Environmental Ltd. were commissioned by Fehily Timoney to conduct baseline aquatic and fisheries surveys to inform EIAR preparation for the proposed Littleton wind farm project, located near Littleton, Co. Tipperary (**Figure 2.1**). Undertaken on a sub-catchment-wide scale, this report provides a baseline assessment of the aquatic ecology including fisheries, biological water quality, protected species and habitats in the vicinity of the proposed project, inclusive of the proposed grid cable route (GCR). The surveys would serve to update previous surveys of the site (by Triturus in 2021) whilst also accounting for any changes in proposed infrastructure and site layout in the interim period. Aquatic surveys were undertaken in September and October 2023.

1.2 Project description

A full description of the proposed project will be provided in any Environmental Impact Assessment Report (EIAR) used to support consenting applications.

2. Methodology

2.1 Selection of watercourses for assessment

All freshwater watercourses which could be affected directly or indirectly by the proposed wind farm project were considered as part of the current baseline. This included sites in vicinity of the proposed site boundary in addition to watercourse crossings of the proposed grid cable route (GCR) options. A total of 30 no. riverine sites were selected for detailed aquatic assessment (see **Table 2.1, Figure 2.1** below). The flow paths and nomenclature for the watercourses surveyed followed Environmental Protection Agency (EPA) mapping.

Riverine survey sites survey sites were present on the Clover River (EPA code: 16C04), Drish River (16D02), Black River (16B01), North Glengoole River (16N28), Breegagh River (16B03), River Goul (15G02), Ardreagh River (15A03), Lisduff Stream (15L08), Tincashel River (15T05), Clomantanagh Lower Stream (15C91), Gorteenahilla River (15G08), Lismaine Stream (15L16), Lisdowney Stream (15L02), River Nore (15N01) and several unnamed watercourses (**Table 2.1**). Additionally, a total of 17 no. lakes/wetlands located within the proposed site boundary at Littleton Bog were also surveyed in September-October 2023 (**Table 2.1; Figure 2.2**). The aquatic survey sites were located within the Suir_SC_040, Goul_SC_010 and Nore_SC_070 river sub-catchments. The proposed wind farm site boundary did not overlap with any European sites. However, there was potential downstream hydrological connectivity between the proposed project and the Lower River Suir SAC (002137), a site designated for a range of aquatic qualifying interests (NPWS, 2017a). A single GCR watercourse crossing of the River Nore (at site E9) traversed the River Barrow And River Nore SAC (2162) and River Nore SPA (4233).

Please note this aquatic report should be read in conjunction with the final Environmental Impact Assessment Report (EIAR) prepared for the proposed project. More specific aquatic methodology is outlined below and in the appendices of this report.

2.2 Aquatic site surveys

Aquatic surveys of the watercourses within the vicinity of the proposed wind farm project were conducted on the 5th, 6th, 7th and 21st September and 12th-13th October 2023. Survey effort focused on both instream and riparian habitats at each aquatic sampling location. Surveys at each of these sites included a fisheries assessment (electro-fishing and or fisheries habitat appraisal), white-clawed crayfish survey, otter survey (within 150m of the survey site), macrophyte and aquatic bryophyte survey and biological water quality (Q-sampling at riverine sites) or invertebrate sweep sampling (lacustrine sites) (**Figure 2.1**). This holistic approach informed the overall aquatic ecological evaluation of each site in context of the proposed project and ensured that any habitats and species of high conservation value would be detected to best inform mitigation.

In addition to the ecological characteristics of the site, a broad aquatic and riparian habitat assessment was conducted utilising elements of the methodology given in the Environment Agency's 'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003' (EA, 2003) and the Irish Heritage Council's 'A Guide to Habitats in Ireland' (Fossitt, 2000). This broad characterisation helped

define the watercourses' conformity or departure from naturalness. All sites were assessed in terms of:

- Physical watercourse/waterbody characteristics (i.e. width, depth etc.) including associated evidence of historical drainage
- Substrate type, listing substrate fractions in order of dominance (i.e. bedrock, boulder, cobble, gravel, sand, silt etc.)
- Flow type by proportion of riffle, glide and pool in the sampling area
- An appraisal of the macrophyte and aquatic bryophyte community at each site
- Riparian vegetation composition

Table 2.1 Location of 47 no. aquatic survey sites in the vicinity of Littleton wind farm, Co. Tipperary

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)	GCR crossing
Riverine sites						
A1	Unnamed stream	n/a	Longfordpass North	622135	660772	
A2	Unnamed stream	n/a	Clooncleagh	619285	660881	
A3	Unnamed stream	n/a	R639 road crossing, Leigh	622188	658445	
A4	Unnamed stream	n/a	Noard	621555	656463	
A5	Clover River	16C04	Noard	621241	655973	
A6	Clover River	16C04	R639 road crossing, Leigh	621356	657637	
A7	Clover River	16C04	Noard	619601	659306	
B1	Drish River	16D02	Longfordpass South	624723	657212	
B2	Drish River	16D02	Bridge 100m u/s Longfordpass Bridge	624889	660463	Yes
B3	Drish River	16D02	Castletown Bridge	621680	663563	
B4	Drish River	16D02	Ballyduff Bridge	618961	661310	
B5	Drish River	16D02	Drish Bridge	614891	658369	
C1	Black River	16B01	Clonoura	623707	654329	
C2	Black River	16B01	Derryvella	621096	652818	
C3	North Glengoole River	16N28	Derryvella	620969	652602	
C4	Black River	16B01	Derryhogan	619908	653512	
C5	Black River	16B01	N75 crossing, Two Mile Borris	619120	657824	
D1	Breegagh River	16B03	Kileen	621369	650304	
D2	Breegagh River	16B03	Ballymurreen Bridge	617399	653051	
D3	Breegagh River	16B03	Archerstown Bridge	613950	656841	
E1	River Goul	15G02	R689 road crossing, Fennor	627891	660586	Yes
E2	Ardreagh River	15A03	Lisduff	629611	660275	Yes
E3	Lisduff Stream	15L08	Lisduff	630069	660402	Yes
E4	Tincashel River	15T05	Lisduff	630645	660666	Yes
E5	Clomantanagh Lower Stream	15C91	Clomantagh Lower	635617	663477	Yes

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)	GCR crossing
E6	Unnamed stream	n/a	Kilrush	637410	665322	Yes
E7	Gorteenahilla River	15G08	Ballyguider Bridge	638977	666778	Yes
E8	Lismaine Stream	15L16	Clone	642128	667587	Yes
E9	Lisdowney Stream	15L02	Grange Bridge	643580	668665	Yes
E10	River Nore	15N01	Parksgrove	644041	671505	Yes
Lacustrine sites						
L1	Lake/wetland	n/a	Longfordpass South	623838	657293	
L2	Lake/wetland	n/a	Bawnreagh	624148	657036	
L3	Lake/wetland	n/a	Bawnreagh	624203	656996	
L4	Lake/wetland	n/a	Bawnreagh	623830	656968	
L5	Lake/wetland	n/a	Bawnreagh	623886	656483	
L6	Lake/wetland	n/a	Leigh	623554	656506	
L7	Lake/wetland	n/a	Leigh	623573	656457	
L8	Lake/wetland	n/a	Clonoura	623966	655791	
L9	Lake/wetland	n/a	Clonoura	623089	655449	
L10	Lake/wetland	n/a	Clonoura	623128	655375	
L11	Lake/wetland	n/a	Clonoura	623259	655119	
L12	Lake/wetland	n/a	Clonoura	623355	654846	
L13	Lake/wetland	n/a	Noard	622700	655234	
L14	Lake/wetland	n/a	Noard	622759	655206	
L15	Lake/wetland	n/a	Noard	622190	654897	
L16	Lake/wetland	n/a	Lanespark	622163	654688	
L17	Lake/wetland	n/a	Noard	621406	651982	

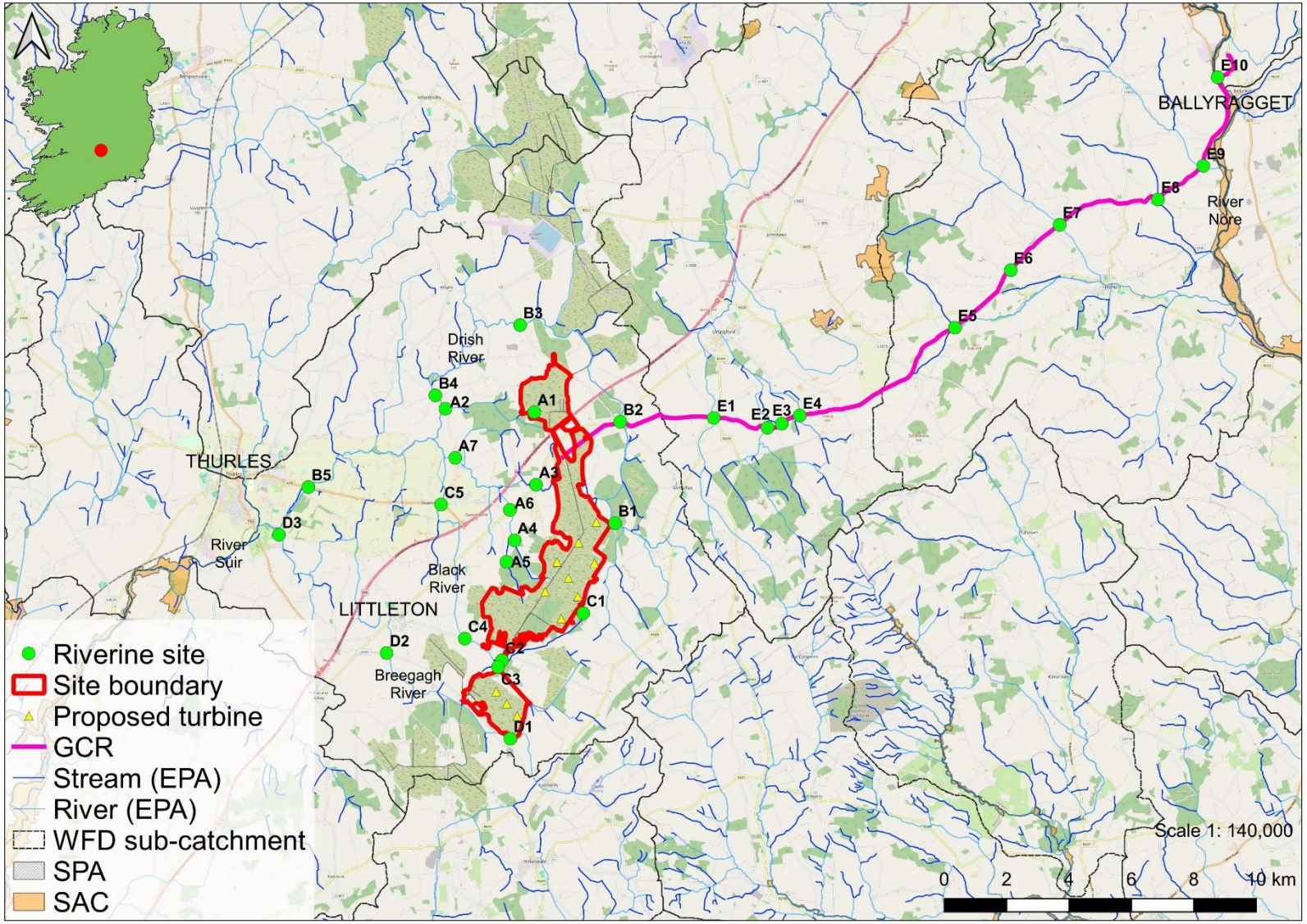


Figure 2.1 Overview of the 30 no. riverine survey sites in vicinity of the proposed Littleton wind farm project, Co. Tipperary

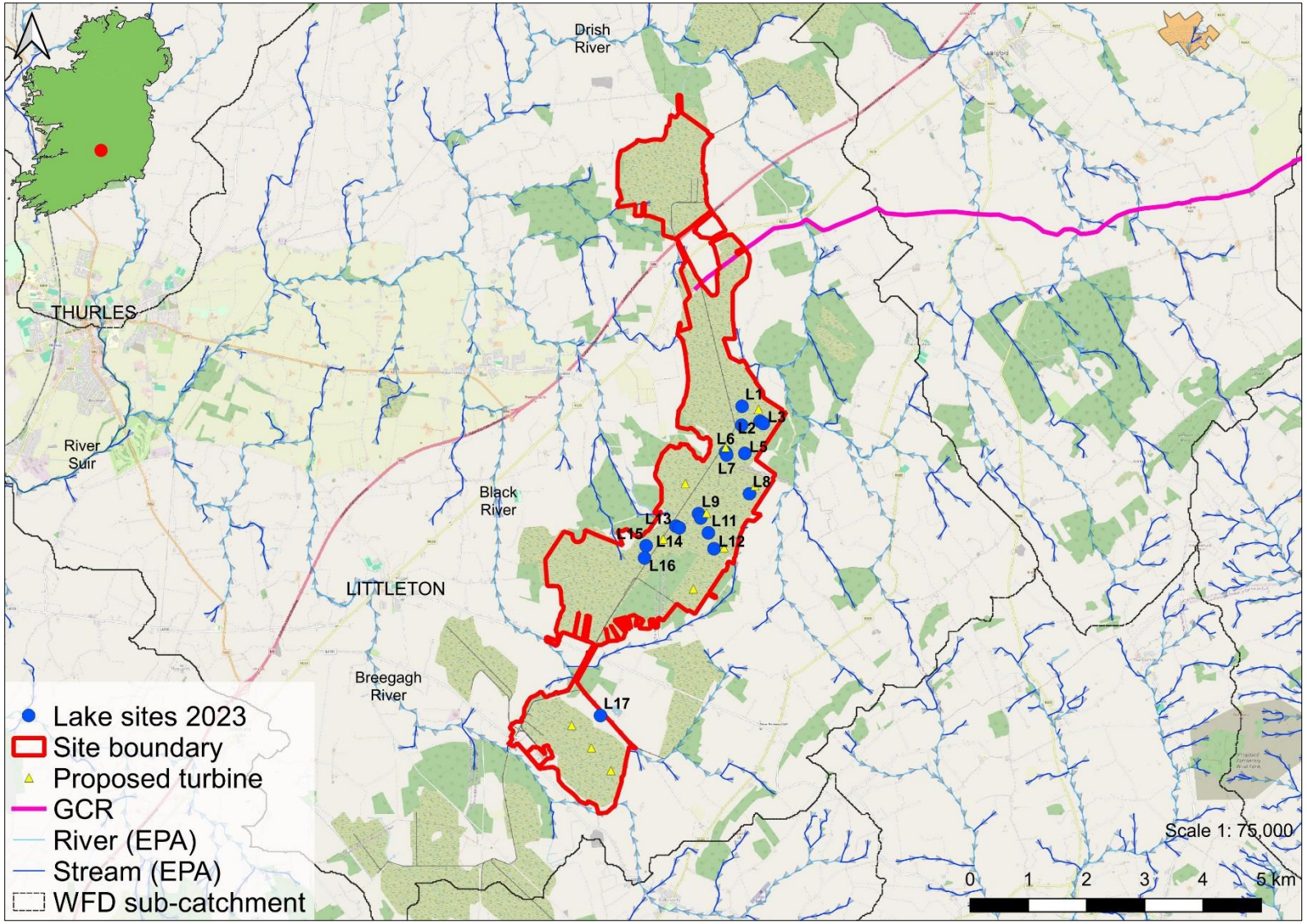


Figure 2.2 Overview of the 17 no. lacustrine survey sites in vicinity of the proposed Littleton wind farm project, Co. Tipperary

2.3 Fisheries assessment (electro-fishing) & appraisal

A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish sites on riverine watercourses in the vicinity of the proposed Littleton wind farm in September 2023 (**Table 2.1, Figure 2.1; Appendix A**), following notification to Inland Fisheries Ireland, under the conditions of a Department of the Environment, Climate and Communications (DECC) licence. The survey was undertaken in accordance with best practice (CFB, 2008; CEN, 2003) and Section 14 licencing requirements.

Furthermore, a fisheries habitat appraisal of all aquatic survey sites, including 17 no. lake/wetland habitats (**Table 2.1**), was undertaken to establish their importance for salmonid, lamprey, European eel and other fish species. The baseline assessment also considered the quality of spawning, nursery and holding habitat for salmonids and lamprey within the vicinity of the survey sites. For detailed survey methodology, please refer to accompanying fisheries assessment report in **Appendix A.**

2.4 White-clawed crayfish survey

White-clawed crayfish (*Austropotamobius pallipes*) surveys were undertaken at the aquatic survey sites in September-October 2023 under a National Parks and Wildlife (NPWS) open national licence (no. C24/2023), as prescribed by Sections 9, 23 and 34 of the Wildlife Act (1976 to 2023), to capture and release crayfish to their site of capture. As per Inland Fisheries Ireland aquatic biosecurity recommendations, the crayfish sampling started at the uppermost site(s) of the wind farm catchment/sub-catchments in the survey area to minimise the risk of transfer invasive propagules (including crayfish plague) in an upstream direction. Hand-searching of instream refugia and sweep netting was undertaken according to Reynolds et al. (2010). An appraisal of white-clawed crayfish habitat at each site was conducted based on physical habitat attributes, water chemistry and incidental records in mustelid spraint. Additionally, a desktop review of crayfish records within the wider survey area was completed.

2.5 Biological water quality (Q-sampling)

A total of 30 no. riverine survey sites were assessed for biological water quality through Q-sampling in September 2023. All samples were taken with a standard kick sampling hand net (250mm width, 500µm mesh size) from areas of riffle/glide utilising a 2-minute kick sample, as per Environmental Protection Authority (EPA) methodology (Feeley et al., 2020). Large cobble was also washed at each site for 1-minute (where present) to collect attached macro-invertebrates (as per Feeley et al., 2020). Samples were elutriated and fixed in 70% ethanol for subsequent laboratory identification. Samples were converted to Q-ratings as per Toner et al. (2005) and assigned to WFD status classes (**Table 2.2**). Any rare invertebrate species were identified from the NPWS Red List publications for beetles (Foster et al., 2009), mayflies (Kelly-Quinn & Regan, 2012), stoneflies (Feeley et al., 2020) and other relevant taxa (i.e. Byrne et al., 2009; Nelson et al., 2011).

Table 2.2 Reference categories for EPA Q-ratings (Q1 to Q5)

Q value	WFD status	Pollution status	Condition
Q5 or Q4-5	High status	Unpolluted	Satisfactory
Q4	Good status	Unpolluted	Satisfactory
Q3-4	Moderate status	Slightly polluted	Unsatisfactory
Q3 or Q2-3	Poor status	Moderately polluted	Unsatisfactory
Q2, Q1-2 or Q1	Bad status	Seriously polluted	Unsatisfactory

2.6 Lacustrine macro-invertebrate communities

A subset of 17 no. lake/wetland sites were sampled for macro-invertebrates via sweep netting in September-October 2023. A standard lake net (250mm width, mesh size 500µm) was used to sweep macrophytes to capture macro-invertebrates. The net was also moved along the lake/lake bed to collect epibenthic and epiphytic invertebrates from the substratum (as per Cheal et al., 1993). A 3-minute sampling period was employed. To ensure appropriate habitat coverage, the sampling period was also divided amongst the range of meso-habitats present at the survey site to get a representative sample for sub-habitats.

2.7 Macrophytes and aquatic bryophytes

Surveys of the macrophyte and aquatic bryophyte community were conducted by instream wading at each of the wetted aquatic survey sites, with specimens collected (by hand, sweep nets or via grapnel) for on-site identification. An assessment of the aquatic vegetation community helped to identify any rare macrophyte species (Flora Protection Order or Wyse-Jackson et al., 2016) or habitats corresponding to the Annex I habitats, e.g., 'Water courses of plain to montane levels, with submerged or floating vegetation of the *Ranunculion fluitantis* and *Callitricho-Batrachion* (low water level during summer) or aquatic mosses [3260]' (more commonly referred to as 'floating river vegetation').

2.8 Otter signs

The presence of otter (*Lutra lutra*) at each aquatic survey site was determined through the recording of otter signs within 150m of each survey site. Notes on the age and location (ITM coordinates) were made for each otter sign recorded, in addition to the quantity and visible constituents of spraint (i.e. remains of fish, crustaceans, molluscs etc.).

2.9 Aquatic ecological evaluation

The evaluation of aquatic ecological receptors contained within this report uses the geographic scale and criteria defined in the 'Guidelines for Assessment of Ecological Impacts of National Road Schemes' (NRA, 2009).

2.10 Biosecurity

A strict biosecurity protocol following IFI (2010) and the Check-Clean-Dry approach was adhered to during surveys for all equipment and PPE used. Disinfection of all equipment and PPE before and after use with Virkon™ was conducted to prevent the transfer of pathogens or invasive propagules between survey sites. Surveys were undertaken at sites in a downstream order to minimise the risk of upstream propagule mobilisation. Care was given towards preventing the spread or introduction of highly virulent crayfish plague (*Aphanomyces astaci*). Furthermore, staff did not undertake any work in a known crayfish plague catchment for a period of <72hrs in advance of the survey. Where feasible, equipment was also thoroughly dried (through UV exposure) between survey areas. Any aquatic invasive species or pathogens recorded within or adjoining the survey areas were geo-referenced. All Triturus staff are certified in 'Good fieldwork practice: slowing the spread of invasive non-native species' by the University of Leeds.

3. Desktop review

3.1 Survey area description

The proposed Littleton wind farm is located in an extensive area of cutover bog within the townlands of Noard, Ballybeg, Kileen, Newhill, Derryhogna, Kilmakill, Lansespark, Derryvella, Leigh, Clonoura, Longfordpass North, Longfordpass South and Bawnreagh approximately 2.5km west of Littleton, County Tipperary (**Figure 2.1**). The proposed wind farm site is within the South Eastern River Basin District and within hydrometric areas 15 (Nore) and 16 (Suir). The watercourses and aquatic surveys sites in the vicinity of Littleton wind farm are typically small, historically modified lowland depositing channels (FW2; Fossitt, 2000) which flow over areas of Tournaisian and Visean limestone and calcareous shale (Geological Survey of Ireland data). Land use practices in the wider survey area comprise peat bogs (CORINE 412), transitional woodland scrub (324) with localised coniferous forests (312) and adjoining pastures (231).

3.2 Fisheries

The Drish River, a tributary of the River Suir, is known to support *Lampetra* sp. (O'Connor, 2007; Kurz & Costello, 1999) as well as Atlantic salmon (*Salmo salar*), brown trout (*Salmo trutta*) and pike (*Esox lucius*) (1993 data presented in AECOM, 2020). The trout and pike in the Drish were found to be fast growing and similar to those in comparable rivers in the Irish midlands (CFB data referenced in AECOM, 2020). The river suffered significant pollution from a zinc and lead mine at Lisheen until the recent past (AECOM, 2020; O'Connor, 2007).

The Clover River, a tributary of the Drish River, is known to support brown trout, three-spined stickleback (*Gasterosteus aculeatus*), perch (*Perca fluviatilis*) and stone loach (*Barbatula barbatula*) (Triturus 2021 data). The Breegagh River, another Drish River tributary, also supports brown trout, stone loach and three-spined stickleback in addition to Atlantic salmon and *Lampetra* sp. (Triturus 2021 data). The Black River (Two Mile Borris) is known to support Atlantic salmon, brown trout, European eel and stone loach (Triturus 2021 data) in addition to lamprey *Lampetra* sp. (O'Connor, 2007). The North Glengoole River, a Black River tributary, supports Atlantic salmon, brown trout, European eel and three-spined stickleback (Triturus 2021 data).

In terms of the proposed GCR option, the route crosses the River Goul and several tributaries (Ardreagh River, Lisduff Stream & Tincashel River) which are known to support Atlantic salmon, brown trout, stone loach and three-spined stickleback (IFI 2021 data). The Gorteenahilla River, a tributary of the Nuenna River, supports Atlantic salmon, brown trout, *Lampetra* sp. and three-spined stickleback (Triturus 2021-2022 data). The Lismaine Stream frequently runs dry and provides poor quality fisheries habitat (Triturus data). The Lisdowney Stream, a River Nore tributary, supports Atlantic salmon, brown trout, European eel and three-spined stickleback (Triturus 2021 data; IFI 2021 data). The River Nore in the vicinity of Ballyragget supports a range of fish species including Atlantic salmon, brown trout, *Lampetra* sp., European eel, minnow (*Phoxinus phoxinus*), stone loach and rudd (*Scardinius erythropthalmus*) (Triturus 2021 data).

Fisheries data for the other watercourses surveyed was not available at the time of survey.

3.3 Protected aquatic species data

A comprehensive desktop review of available data from the National Parks and Wildlife Service (NPWS), National Biodiversity Data Centre (NBDC), Inland Fisheries Ireland (IFI), Botanical Society of Britain and Ireland (BSBI), National Crayfish Plague Surveillance Programme (NCPSP), Environmental Protection Agency (EPA) and Triturus databases for the 10km grid squares containing and adjoining the project (i.e. S15, S16, S25, S26, S36, S46 & S47) identified records for a low number of rare and or protected aquatic species within the vicinity of the proposed wind farm.

A high number of contemporary white-clawed crayfish (*Austropotamobius pallipes*) records (>100) were available for the respective grid squares in the 1996-2014 period (**Figure 3.1**), with a further 50 approx. historical records. A low number of records were available for the Drish River, Clover River (single record), Black River, River Goul, River Nore and Lough Doire Bhile (near lake site L17) (**Figure 3.1**).

A low number of contemporary otter (*lutra lutra*) records (2005-2022) were available for the relevant grid squares, with records from the Black River, Drish River and River Nore (**Figure 3.1**). Otter signs were recorded during previous surveys for the project on the Clover River, Black River and Drish River (Triturus 2021 data).

A low number of records were available for freshwater pearl mussel (M*argaritifera margaritifera*) for the River Nore located between the River Erkina confluence and Ballyragget in the 1993 to 2007 period (i.e. downstream of the proposed project). However, no live mussel have been recorded in this area of the River Nore since 2007 (Pascal Sweeney pers. comm.), including during a survey completed in May 2023 (Triturus data).

A low number of records for lamprey (*Lampetra* sp.) (reported as brook lamprey) were available for the River Nore downstream of Durrow (data not shown). *Lampetra* sp. are also known from the Nuenna River (Gordon et al., 2021; Matson et al., 2018) and several survey watercourses (see section 3.2 above).

Historical records (1968 & 1972) for spawning sea lamprey (*Petromyzon marinus*) were available for the River Nore in the vicinity of Ballyragget (data not shown).

Two records for Flora (Protection) Order 2022 macrophyte species opposite-leaved pondweed (*Groenlandia densa*) were available from a former pond in the vicinity of Urlingford but these were historical only (i.e. pre-1900, data not shown).

A single record for smooth newt (*Lissotriton vulgaris*) was available for bog habitat at Derryvella adjacent to the North Glengoole River at survey site C3 from 2010 (data not shown).

3.4 EPA water quality data (existing data)

The following outlines the available water quality data for the watercourses in context of the proposed wind farm site boundary. Only recent water quality is summarised below. Contemporary EPA biological monitoring data was available for the Drish, Clover and Black Rivers only. Please note that biological water quality analysis was undertaken as part of this study, with the results presented in the **section 4** and **Appendix B** of this report.

3.4.1 Drish River

The Drish River (EPA code: 16D02) drains north and then south-west of the proposed wind farm site boundary before joining the River Suir downstream of Thurles. There was a total of 4 no. contemporary EPA biological monitoring stations on the river in the vicinity of the proposed project. The Drish River achieved Q3 (poor status) at the two uppermost stations (RS16D020040 (site B2), RS16D020070 (site B3)), **Q3-4 (moderate status)** at station RS16D020100 and **Q4 (good status)** at station RS16D020200 in 2023.

The Drish_010, _020, _040 & _050 river waterbodies were all of poor status in the 2016-2021 period and were considered 'at risk' of failing to achieve good status (WFD Risk 3rd cycle). The lower reaches (Drish_060) achieved moderate status in the same period but were also considered 'at risk'. Peat extraction, forestry and agriculture are the primary threats to water quality in these waterbodies (EPA, 2019).

3.4.2 Clover River

There were 2 no. contemporary EPA biological monitoring stations on the Clover River (16C04), a tributary of the Black River. The Clover achieved **Q3 (poor status)** at station RS16C040100 (survey site A3) in 2023 but this elevated to **Q3-4 (moderate status)** in the lower reaches at station RS16C040300 (also in 2023).

The upper reaches of the Clover River (Clover_010 waterbody) were of poor status in the 2016-2021 period, whilst the lower reaches (Clover_020 waterbody) were of moderate status. Both waterbodies were considered 'at risk' of not achieving good status. Peat extraction and forestry are the significant threats to water quality in these waterbodies (EPA, 2019).

3.4.3 Black River

There were 2 no. contemporary EPA biological monitoring stations on the Black River (16B01), a tributary of the Drish River. At Black River Bridge (station RS16B010030) and station RS16B010100 the river achieved **Q3 (poor status)** in 2023.

The Black (Twomileborris)_010 waterbody (encompassing most of the river) was of moderate WFD status in the 2016-2021 period and was considered 'at risk' of achieving good status. The lower reaches of the Black River are part of the Drish_050 waterbody which was of poor status in the same period and also 'at risk'. (as outlined above). Peat extraction is the primary threat to water quality in these waterbodies (EPA, 2019).

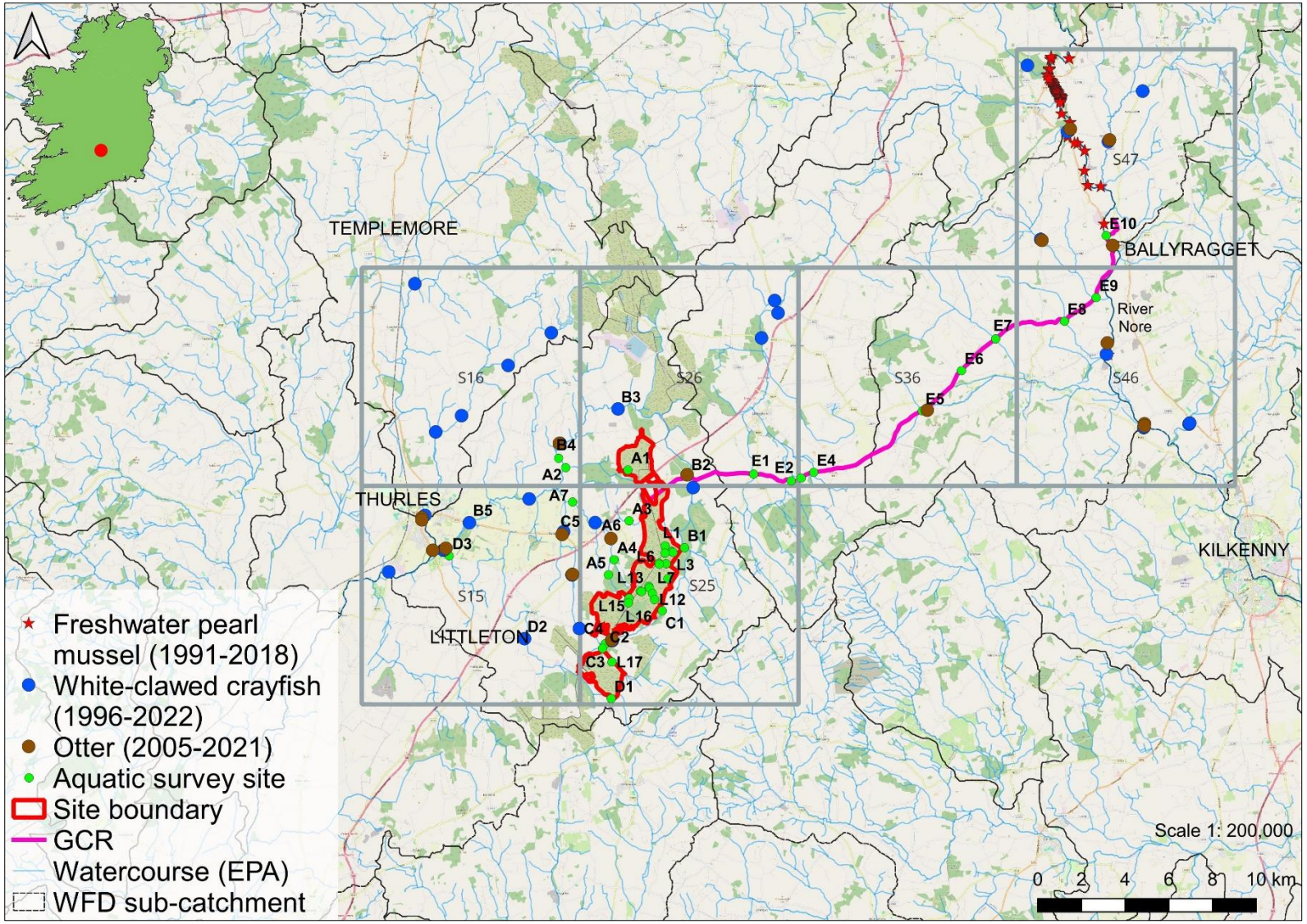


Figure 3.1 Distribution of selected protected species records in the vicinity of the proposed Littleton wind farm (source: NPWS, EPA, NBDC & Triturus data)

4. Results of aquatic surveys

The following section summarises each of the 30 no. riverine and 17 no. lake/wetland survey sites in terms of aquatic habitats, physical characteristics and overall value for fish, macro-invertebrates and macrophyte/aquatic bryophyte communities. Biological water quality (Q-sample) and macro-invertebrate sweep sample results are summarised for each site and provided in full in **Appendix B**. Habitat codes are according to Fossitt (2000). Scientific names are provided at first mention only. Sites were surveyed in September-October 2023. Please refer to **Appendix A** (fisheries assessment report) for more detailed fisheries results. A summary of the fish species recorded at each survey site is provided in **Table 4.1**. A summary of the aquatic species and habitats of high conservation concern recorded during the surveys is provided in **Table 4.2**. An evaluation of the aquatic ecological importance of each survey site based on these aquatic surveys is provided and summarised in **Table 4.3**.

4.1 Riverine survey site results

4.1.1 Site A1 – unnamed stream, Longfordpass North

Site A1 was located on the uppermost reaches of an unnamed Drish River tributary (no EPA code) within the proposed site boundary. Situated in an extensive area of cutover bog (PB4), the Drish River tributary had been extensively straightened and deepened, with V-shaped banks to 4-5m in height. The homogenous channel was 1-1.5m wide and <0.1m deep with imperceptible flows at the time of survey (near stagnant glide and pool). The channel had been excavated with a gravel-dominated base. Occasional cobble and bolder was also present. However, these were heavily silted (flocculent deposits from peat escapement). The stream was considered likely ephemeral (seasonal) at this location. Given the low flows and high riparian shading, macrophytes were absent with the exception of very localised water horsetail (*Equisetum fluviatile*) and common reed (*Phragmites australis*) along channel margins. No aquatic bryophytes were recorded. The channel was heavily scrubbed over with high levels of terrestrial encroachment from willow (*Salix* sp.), downy birch (*Betula pubescens*) and bramble (*Rubus fruticosus* agg.). The site was bordered by dry meadow habitat (GS2) and cutover bog (PB4) habitat in the wider area.

Three-spined stickleback (*Gasterosteus aculeatus*) was the only fish species recorded via electro-fishing at site A1 (**Appendix A**). With the exception of low densities of this species, the site was of very poor fisheries value at the time of survey given observed low seasonal flows (stagnant), very shallow nature, heavy siltation and historical modifications. There was no suitability for white-clawed crayfish given very shallow water. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). However, it should be noted that this is a tentative rating given poor flows and lack of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site A1 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.2 Representative image of site A1 on an unnamed Drish River tributary, September 2023

4.1.2 Site A2 – unnamed stream, Clooncleagh

Site A2 was located on the lower reaches of an unnamed Drish River tributary at a local road crossing, approximately 3.2km downstream of site A1. The stream (FW2) had been straightened and deepened throughout, resulting in a V-shaped channel with 2-3m high banks and very poor hydromorphology. The stream was culverted under the local road almost as far as the Drish confluence. Where open at the road crossing, the stream was <1.5m wide and was semi-dry at the time of survey, with only remnant, shallow pools of stagnant water (no flows). The channel featured a base of cobble and mixed gravels bedded in mud. No aquatic vegetation was present and the ephemeral channel likely only conveys water after heavy rainfall events or during floods. The stream was very heavily tunnelled by nitrophilous vegetation dominated by nettle (*Urtica dioica*) and bramble, with a dense stock-proof hawthorn (*Crataegus monogyna*) hedgerow along the south bank. The site was bordered by the Ballybeg Farm Co-op (BL3) and heavily improved pasture (GA1).

Site A2 was not of fisheries value given its dry, ephemeral nature and absence of aquatic habitats. No otter signs were recorded in the vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q2-3 (poor status)** (**Appendix B**). However, it should be noted that this is a tentative rating given poor flows and lack of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site A2 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.2 Representative image of site A2 on an unnamed Drish River tributary, September 2023 (semi-dry, ephemeral channel)

4.1.3 Site A3 – unnamed stream, Leigh

Site A3 was located on an unnamed stream (no EPA code) draining to the west of the proposed site boundary. The Clover River tributary (FW2) had been historically straightened and deepened along field boundaries and was semi-dry at the time of survey, with only localised ponding of 0.1m deep stagnant water between debris dams and no flows. The stream passed under the local road via a pipe culvert that was dry at the time of survey. The channel featured a base of cobble and mixed gravels bedded in silt/mud. Leaf litter and woody debris was abundant on the bed. No aquatic vegetation was present in the ephemeral channel, which was very heavily shaded by mature treelines and hedgerows supporting bramble, ivy (Hedera helix), ash (*Fraxinus excelsior*) and elder (*Sambucus nigra*). Non-native snowberry (*Symphoricarpos albus*) was recorded at the road crossing. The site was bordered by heavily improved pasture (GA1).

No fish were recorded via electro-fishing at site A3. The site was not of fisheries value given its semi-dry, ephemeral nature and poor quality aquatic habitats with no flows. There was no suitability for white-clawed crayfish. No otter signs were recorded in the vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q2-3 (poor status)** (**Appendix B**). However, it should be noted that this is a tentative rating given poor flows and lack of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site A3 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.3 Representative image of site A3 on an unnamed Clover River tributary, September 2023

4.1.4 Site A4 – unnamed stream, Noard

Site A4 was located on an unnamed tributary of the Clover River. The lowland depositing channel (FW2) had been extensively straightened and deepened throughout, resulting in a deep trapezoidal channel with 2-3m high banks and poor hydromorphology. The stream was 3-4m wide and 0.4-0.6m deep with a profile dominated by deep, slow-flowing glide with occasional pool. Riffle was absent. The substrata were dominated by deep peat/silt and sands with scattered boulder. Cobble was present but highly localised and bedded in silt. Peat staining was very high at the time of survey. Macrophyte cover was high with frequent branched bur-reed (*Sparganium erectum*) and lesser pondweed (Potamogeton pusillus). Localised stands of bulrush (*Typha latifolia*), broad-leaved pondweed (*Potamogeton natans*) and common reed were present with frequent bent grass (*Agrostis* sp.) encroachment of the margins. Aquatic bryophytes were not recorded. The steep banks supported abundant bramble scrub and intermittent treelines of grey willow (*Salix cinerea*), dog rose (*Rosa canina*), hawthorn and ash. The site was bordered by coniferous afforestation (WD4), scrub (WS1), reclaimed wet grassland (GS4) and improved pasture (GA1).

Brown trout (*Salmo trutta*), stone loach (*Barbatula barbatula*), three-spined stickleback (*Gasterosteus aculeatus*) and perch (*Perca fluviatilis*) were recorded via electro-fishing at site A4 (**Appendix A**). The site was of poor value for salmonids, supporting only a low density of adult trout present in deeper holding pools. Spawning habitat was absent given very significant siltation, with slow-flowing glide resulting in poor quality nursery habitat. Despite abundant soft sediment accumulations, the site was unsuitable for lamprey given the flocculent, humic nature of the sediment and absence of suitable

spawning gravels. The site was also of poor suitability for European eel and white-clawed crayfish with none recorded. A regular otter spraint site (containing fish remains) was recorded on a marginal cobble bar (ITM 621499, 656663).

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). However, it should be noted that this is a tentative rating given poor flows and lack of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids and utilisation by otter, the aquatic ecological evaluation of site A4 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.4 Representative image of site A4 on an unnamed Clover River tributary, September 2023

4.1.5 Site A5 – Clover River, Noard

Site A5 was located on the upper reaches of the Clover River (16C04). The small lowland channel (FW2) had been straightened and deepened throughout, resulting in a trapezoidal channel with very poor hydromorphology and low flows. The river had been excavated in the recent past and was 2m wide and 0.3-0.4m deep with a bed comprised of soft silt (often up to 0.2m deep) underlain by compacted gravels and clay. The narrow channel was heavily vegetated with a relatively high diversity of vegetation including abundant common duckweed (*Lemna minor*), locally frequent common reed and broad-leaved pondweed, water mint (*Mentha aquatica*) and lesser pondweed. Blue water speedwell (*Veronica anagallis-aquatica*), bottle sedge (*Carex rostrata*) and watercress (*Nasturtium officinale*) were also present locally. The liverwort *Riccia fluitans* was abundant on the sloping clay banks and instream as floating mats. The banks had been historically cleared and were fenced to the banktop with only rank grass vegetation. The site was bordered by improved pasture (GA1) with coniferous

afforestation (and alder borders) present upstream.

No fish were recorded via electro-fishing at site A5. The river was not of fisheries value at this location given siltation and enrichment pressures, very poor hydromorphology (maintained channel), poor flows and intermittent connectivity with downstream habitats (instream blockages). White-clawed crayfish habitat was poor overall (given heavy siltation) and none were recorded. No otter signs were recorded in the vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). However, it should be noted that this is a tentative rating given poor flows and lack of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site A5 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.5 Representative image of site A5 on the upper reaches of the Clover River, September 2023

4.1.6 Site A6 – Clover River, Leigh

Site A6 was located on the Clover River (16C04) at the R639 crossing, approx. 1.7km downstream of site A5. The lowland depositing river (FW2) at this location had been historically straightened and extensively deepened, with V-shaped bank heights of 5-6m. The river was 6-8m wide (narrower upstream of bridge) and 0.4-0.8m deep. Upstream of the bridge, shallower riffles and glide was present (0.1-0.3m deep). The profile was of slow-flowing, deep homogenous glide with riffle and shallower glide present only upstream. Peat-staining was high at the time of survey. The cobble and mixed gravel substrata were very heavily silted. Boulder was occasional, with large woody debris

(LWD) frequent downstream of the bridge adding some valuable habitat heterogeneity. Riparian shading was high, with macrophytes confined to upstream of the bridge in a more open section of channel (historical tree clearance). Here, unbranched bur-reed (*Sparganium emersum*) was occasional instream, with frequent marginal stands of fool's watercress (*Apium nodiflorum*), localised lesser water parsnip (*Berula erecta*), blue water speedwell and water starwort (*Callitriche* sp.). Common duckweed was also frequent. Aquatic bryophytes were rare and limited to occasional *Leptodictyum riparium* on larger cobble and boulder. The channel was lined by mature treelines of sycamore (*Acer psuedoplatanus*), ash and elder with scrubby understories. The site was bordered by buildings and artificial surfaces (BL3) and improved pasture (GA1).

Brown trout, stone loach and three-spined stickleback were recorded via electro-fishing at site A6 (**Appendix A**). Despite significant siltation pressures, the site was evidently of good value as an adult trout habitat. However, due to significant siltation pressures salmonid spawning habitat was limited to a small, faster-flowing area upstream of the bridge. This also offered some moderate value for spawning lamprey but ammocoete habitat was sub-optimal (largely flocculent, humic deposits) and none were recorded. Despite some good suitability for European eel, none were recorded. No white-clawed crayfish were recorded (moderate suitability) although the remains of predated crayfish were recorded at this site previously (Triturus 2021 data). An otter spraint site was recorded on marginal boulders upstream of the bridge (ITM 621353, 657617).

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids and utilisation by otter, the aquatic ecological evaluation of site A6 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.6 Representative image of site A6 on the Clover River, September 2023

4.1.7 Site A7 – Clover River, Noard

Site A7 was located on the lower reaches of the Clover River (16C04) at a local road crossing approximately 2.8km downstream of site A6. The lowland river (FW2) had been deepened and locally straightened although some good hydromorphological recovery was evident. The river averaged 3-4m wide and 0.2-0.4m deep, with very localised deeper areas to 0.6m. The profile comprised peat-stained slow-flowing glide with localised riffle and pool. Large woody debris (LWD) was abundant instream and contributed to habitat heterogeneity. The substrata were dominated by mixed gravels and sands with localised boulder and cobble only. Soft sediment accumulations were present but shallow and flocculent. Siltation was high overall (peat-derived). Given high shading, macrophyte growth was sparse with localised fool's watercress and ivy-leaved duckweed (*Lemna trisulca*) along channel margins. Bittersweet (*Solanum dulcamara*) and reed canary grass (*Phalaris arundinacea*) were locally abundant in open areas of channel. Small stands of branched bur-reed were present locally. Aquatic bryophyte coverage was low with rare *Fontinalis antipyretica* and *Leptodictyum riparium*. The river was typically well shaded by dense grey willow and ash with abundant bramble scrub on the steep banks. The site was bordered by residential property and improved pasture (GA1).

Atlantic salmon, brown trout, stone loach, lamprey (*Lampetra* sp.) and pike (*Esox lucius*) were recorded via electro-fishing at site A7 (**Appendix A**). The site was a moderate quality salmonid habitat only given evident siltation pressures which impacted the spawning potential of the river at this location. The generally shallow nature of the site also reduced the value as a nursery habitat. Some moderate quality holding habitat was present locally due to undercut banks, overhanging vegetation and pools associated with LWD. Whilst a low density of *Lampetra* sp. ammocoetes were recorded, the site was considered sub-optimal due to the flocculent and humic nature of the soft sediment deposits. Despite some good suitability for European eel and white-clawed crayfish, none were recorded. Recent otter prints were recorded in marginal sand/mud under the dry bridge arch (ITM 619607, 659303).

Biological water quality, based on Q-sampling, was calculated as **Q3-4 (moderate status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids (including Atlantic salmon) and lamprey (*Lampetra* sp.), in addition to utilisation by otter, the aquatic ecological evaluation of site A7 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.7 Representative image of site A7 on the Clover River, September 2023

4.1.8 Site B1 – Drish River, Longfordpass South

Site B1 was located on the upper reaches of the Drish River (16D02). The lowland river (FW2) had been extensively straightened and deepened throughout, resulting in a homogenous trapezoidal channel with very poor hydromorphology and low summer flows. The channelized river was 3-4m wide and 0.5-0.8m deep, with locally deeper glide to >1.2m. The profile was of stagnant glide at the time of survey. The substrata were dominated by sand and heavily silted mixed gravels. Cobble and small boulder were scattered. The site was very heavily vegetated with near total cover of macrophytes. Fool's watercress was abundant with frequent common duckweed, ivy-leaved duckweed and lesser water parsnip. Blue water speedwell and water mint were occasional. Submerged macrophytes were dominated by river water dropwort (*Oenanthe fluviatilis*) with occasional spiked water milfoil (*Myriophyllum spicatum*). Localised stands of branched bur-reed were present with sparse growth of common reed. Semi-floating mats of reed canary grass were abundant along the channel margins and sloping banks. The banks had been cleared historically and supported scattered grey willow, blackthorn (*Prunus spinosa*) and downy birch. The site was bordered by dry meadow habitat (GS2) with intermittent treelines of ash, grey willow and Scot's pine (*Pinus sylvestris*).

Three-spined stickleback was the only fish species recorded via electro-fishing at site B1 (**Appendix A**). The river at this location was of very poor value for salmonids given heavy siltation, poor hydromorphology, poor flows and heavy macrophyte cover. Despite some good suitability for European eel, none were recorded (although the species was present downstream). There was some low suitability for white-clawed crayfish although none were recorded. No otter signs were recorded in vicinity of the site (although there were few marking opportunities).

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). However, it should be noted that this is a tentative rating given poor flows and lack of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site B1 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.7 Representative image of site B1 on the Drish River, September 2023

4.1.9 Site B2 – Drish River, Longfordpass North

Site B2 was located on the Drish River (16D02) at a local road crossing upstream of Longfordpass Bridge. The lowland depositing river (FW2) had been extensively straightened and deepened historically, resulting in very poor hydromorphology. The river suffered from low water levels at the time of survey with slight flows and ponding of water between macrophyte beds. However, downstream of the bridge strong flows emanated from a pipe culvert which diverts flow from upstream of the bridge (i.e. navigates the perched, dry apron). The channel was a homogenous 10-12m wide and 0.1-0.3m deep with deep silt deposits of >0.3m locally. Near the upstream local road bridge, hard substrata were present (boulder and cobble with mixed gravels). However, elsewhere deep silt dominated. The site was very heavily vegetated (near 100% cover), with open ponding areas very localised. These supported a diverse range of macrophytes including abundant spiked water milfoil, branched bur-reed, lesser water parsnip, fool's watercress and both common and ivy-leaved duckweed. Blue water speedwell and yellow water lily were locally frequent with more occasional lesser pondweed, river water dropwort and water-forget-me-not (*Myosotis scorpioides*). *Cinclidotus fontinaloides* was abundant on instream boulder and the dry bridge apron. The mosses *Fontinalis antipyretica*, *Leptodictyum riparium* and *Hygroamblystegium* sp. were present but rare. The channel

was lined and encroached by reed canary grass with frequent bittersweet, purple loosestrife (*Lythrum salicaria*), hedge bindweed (*Calystegia sepium*) and willowherbs (*Epilobium* spp.). Given the presence of numerous indicator species (EC, 2013; Devaney et al., 2013), the herb community was representative of the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]'. The site was bordered by improved pasture (GA1) with narrow buffers.

Atlantic salmon (*Salmo salar*), European eel (*Anguilla anguilla*) and three-spined stickleback were recorded via electro-fishing at site B2 (**Appendix A**). The site was of poor salmonid value given known flow issues in addition to poor hydromorphology and poor connectivity with downstream habitats (i.e. the site is typically stagnant pond-like glide). However, a single Atlantic salmon parr was recorded in fast glide of an inflowing channel downstream of the bridge. Boulder dominated areas in vicinity of the bridge apron provided good suitability for European eel and supported a low density. There was some low suitability for white-clawed crayfish although none were recorded. No otter signs were recorded in vicinity of the site (although the species is known to utilise the site).

Biological water quality, based on Q-sampling, was calculated as **Q2-3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of Annex I hydrophilous tall herb habitat [6430], the aquatic ecological evaluation of site B2 was of **county importance** (**Table 4.3**).



Plate 4.9 Representative image of site B2 on the Drish River facing downstream to Longfordpass Bridge, September 2023

4.1.10 Site B3 – Drish River, Castletown Bridge

Site B3 was located on the Drish River (16D02) at Castletown Bridge, approximately 6km downstream of site B2. The lowland alkaline river (FW2) at this location had been deepened historically but retained some good semi-natural features. Recent clearance of adjoining drains has occurred upstream of the bridge. The river was 5-6m wide in a heavily-vegetated channel up to 8-10m wide. The depth ranged 0.5-1m with deeper pool areas to 1.5m locally. The profile was of slow-flowing glide, with localised faster runs between macrophyte beds exposing gravel substrata. The substrata were dominated by cobble and mixed gravels with scattered boulder. However, these were bedded in silt and moderately calcified (compacted). The compacted bed was also moderately silted with soft sediment deposits frequent. The site was very heavily vegetated (>90% cover) with abundant heterophyllous common clubrush (*Schoenoplectus lacustris*), common duckweed, ivy-leaved duckweed and fool's watercress. Yellow lily, river dropwort, branched bur-reed, lesser water parsnip and broad-leaved pondweed were occasional with localised common reed and mare's-tail (*Hippuris vulgaris*). The moss *Rhynchostegium riparium* was occasional. Filamentous algae was present, locally. Adjoining the river margins was a sparse herbaceous community supporting reed canary grass, bittersweet, marsh willowherb (*Epilobium palustre*), great willowherb (*Epilobium hirsutum*), water mint and water-forget-me-not. The site was bordered by improved pasture (GA1) and, downstream, an intermittent treeline (WL2) of ash, hawthorn and sycamore.

Brown Trout, Lamprey (*Lampetra* sp.), stone loach, three-spined stickleback and pike were recorded via electro-fishing at site B3 (**Appendix A**). The quality of salmonid nursery and spawning habitat was poor with evident water quality pressures. Some very limited salmonid and lamprey spawning habitat was present (but sup-optimal). Deeper glide areas provided some good suitability as adult holding habitat. Soft sediment deposits were shallow and provided poor quality lamprey nursery habitat although a low density were recorded. Despite some good suitability, no European eel or white-clawed crayfish were recorded, although the value of the site was reduced given compaction of substrata and poorly accessible boulder refugia. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q2-3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of lamprey (*Lampetra* sp.), the aquatic ecological evaluation of site B3 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.10 Representative image of site B3 on the Drish River at Castletown Bridge, September 2023 (facing upstream)

4.1.11 Site B4 – Drish River, Ballyduff Bridge

Site B4 was located on the Drish River (16D02) at Ballyduff Bridge approximately 5.7km downstream of site B3. The swift-flowing, lowland alkaline river (FW2) was largely natural at this location and was 10-12m wide and 0.2-0.5m deep. Localised deeper pool to 0.8m was present downstream of the bridge. The site was typified by swift, shallow glide and occasional riffle and pool. The substrata were dominated by heavily compacted and calcified cobble with occasional interstitial gravels and frequent boulder. Siltation was low overall and no soft sediment deposits were present, even in association with macrophyte beds or pool slacks (i.e., high-energy site). Heterophyllous fool's watercress was locally abundant in open areas with sparse stands of water crowfoot (*Ranunculus* sp.) and marginal beds of watercress and water mint. A single stand of iris (*Iris psuedacorus*) was present on a mid-channel island downstream of the bridge. Ivy-leaved duckweed was present but rare. Aquatic bryophytes dominated the site with abundant Leptodictyum riparium and Fontinalis antipyretica, and more occasional *Ricardia chamedryfolia*, *Pellia endiviifolia* and *Rhynchostegium riparium*. Filamentous algae was present (<1% cover). Reed canary grass with bittersweet, nettle and hedge bindweed lined the channel. The site was bordered by mature treelines of sycamore and ash with occasional willow and elder.

Atlantic salmon, brown trout and stone loach were recorded via electro-fishing at site B4 (**Appendix A**). The site was an excellent quality salmonid nursery, with abundant fast-flowing bryophyte-rich glide supporting a high density of juvenile Atlantic salmon and, less so, brown trout. Good quality spawning habitat (especially for Atlantic salmon) was widespread with abundant mixed gravels and cobbles (including upstream of bridge). Overhanging marginal vegetation and trees in addition to larger

boulder and bank scours provided valuable thermal refugia for adult salmonids. Despite some good suitability, no European eel or white-clawed crayfish were recorded. The high energy site was unsuitable for lamprey ammocoetes although some localised spawning habitat was present. No otter signs were recorded in vicinity of the site (although a regular spraint site is known upstream of the bridge; Triturus data).

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids (including Atlantic salmon), the aquatic ecological evaluation of site B4 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.11 Representative image of site B4 on the Drish River at Ballyduff Bridge, September 2023

4.1.12 Site B5 – Drish River, Drish Bridge

Site B5 was located on the Drish River at Drish Bridge (N75) approximately 6.7km downstream of site B4. The swift-flowing lowland depositing river (FW2) had been locally straightened historically with some local bank works but good instream recovery was evident. The river was 6-8m wide (channel up to 10m) and 0.3-0.7m deep, with locally deeper areas to 1.5m. The profile comprised swift deep glide and pool with only very localised riffle upstream of the bridge crossing. The substrata were dominated by clean, mobile carse gravels and cobble, with frequent boulder. Sands and finer gravels were also present locally in pool slacks and along channel margins. Soft sediment accumulations were sand-dominated where present (rare overall). Siltation was low overall. Macrophyte cover was relatively high with locally abundant common clubrush, water crowfoot (*Ranunculus* sp.) and ivy-leaved duckweed. The deep margins also supported occasional heterophyllus fool's watercress, blue water

speedwell, water mint and scattered iris and branched bur-reed. The sloping margins supported abundant reed canary grass which typically overhung the margins (providing valuable refugia for fish). Aquatic bryophyte coverage was locally high with *Fontinalis antipyretica* and *Fissidens* sp. on larger boulder. However, given the fragmented nature of the aquatic vegetation community, the site *did not* represent Annex I floating river vegetation [3260]. Filamentous algae was present, further indicating enrichment. The historically modified and or grazed banks supported abundant reed canary grass with scattered bramble scrub, grey willow and immature oak (*Quercus* sp.). The site was bordered by semi-improved pasture (GA1).

Atlantic salmon, brown trout, European eel, lamprey (*Lampetra* sp.), minnow (*Phoxinus phoxinus*) and stone loach were recorded via electro-fishing at site B5 (**Appendix A**). The site was of very high value for salmonids with excellent quality nursery habitat present (especially for Atlantic salmon) given an abundance of macrophyte beds in swift glide. The site also provided excellent quality holding habitat by way of deeper pool (e.g. under bridge) and overhanging marginal vegetation. Such areas, in addition to frequent large boulder, were also of high suitability for European eel. Although localised, high quality salmonid and lamprey spawning habitat was present upstream of the bridge. The site was also of value for *Lampetra* sp. with a low density recorded in sub-optimal (sand-dominated) soft sediment deposits associated with macrophyte beds. Despite some good suitability for white-clawed crayfish, none were recorded. No otter signs were recorded in vicinity of the site although marking opportunities were poor.

Biological water quality, based on Q-sampling, was calculated as **Q4 (good status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids (including Atlantic salmon), *Lampetra* sp. and Red-listed European eel, in addition to Q4 (good status) water quality, the aquatic ecological evaluation of site B5 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.12 Representative image of site B5 on the Drish River upstream of Drish Bridge, September 2023

4.1.13 Site C1 – Black River, Clonoura

Site C1 was located on the uppermost reaches of the Black River (16B01) that drained to the south of the proposed wind farm site. The site was dry at the time of survey, with no pools of standing water and a dry mud base in a remnant channel. The river channel had been straightened and deepened historically and was 1.5-2m wide with bank heights of 1-2m. Evidently, the channel was ephemeral, likely only conveying water during wetter periods. The channel was heavily scrubbed over with high levels of terrestrial encroachment and willow scrub. The site was bordered by a broad-leaved plantation (WS2) with arable crops (BC1) to the east.

Site C1 was not of fisheries value given its dry, ephemeral nature and absence of aquatic habitats. No otter signs were recorded in the vicinity of the site.

Given the dry, ephemeral nature of the site, it was not possible to collected a biological water quality sample at the time of survey.

Given the absence of aquatic habitats, the aquatic ecological evaluation of site C1 was of **lower importance (lower value)** (**Table 4.3**).



Plate 4.13 Representative image of site C1 on the Black River, September 2023 (dry, ephemeral channel)

4.1.14 Site C2 – Black River, Derryvella

Site C2 was located on the upper reaches of the Black River (16B01) within Derryvella Bog, approximately 3.2km downstream from site C1. The lowland depositing river (FW2) had been straightened and deepened historically, with some recovery evident. The river was 2-2.5m wide and 0.1-0.2m deep, with locally deeper pool to 0.3-0.5m. The stream was culverted underneath a Bord na Móna rail line via a large corrugated pipe culvert. Upstream, flows were low and the channel was heavily scrubbed. Downstream of the culvert, shallow slow-flowing glide and localised riffle was present with occasional pool, grading to slow-flowing glide downstream. The substrata were dominated by humic silt deposits (peat) with scattered heavily-silted small cobble and mixed gravels with occasional small boulder. The river was very heavily shaded by willow and bramble scrub. As a result, macrophytes were limited to water mint and fool's watercress, in addition to localised iris and common reed. Some *Pellia* sp. liverwort grew on muddy banks. The site was bordered by an area of cutover bog (PB4) and semi-improved pasture (GA1) with abundant scrub (WS1).

Brown trout and three-spined stickleback were the only fish species recorded via electro-fishing at site C2 (**Appendix A**). Although recorded previously at the site (Triturus 2021 data), no Atlantic salmon were captured. Despite historical modifications, poor flows and siltation pressures (peat escapement), the site was of some moderate value as a salmonid nursery, at least in vicinity of the culvert where riffle habitat was present. The salmonid spawning value was compromised by siltation but the value likely improved during higher flows. Submerged tree roots and bank scours provided valuable holding areas for adult salmonids. Whilst some limited lamprey spawning habitat was present, ammocoete habitat was unsuitable given the flocculent nature of the silt (peat-dominated). Despite some

suitability for European eel and white-clawed crayfish none were recorded (limited refugia). No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids, the aquatic ecological evaluation of site C2 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.14 Representative image of site C2 on the Black River, September 2023

4.1.15 Site C3 – North Glengoole River, Derryvella

Site C3 was located on the North Glengoole River (16N28) at a Bord na Móna rail crossing (culvert), some 0.25km upstream of the Black River confluence. The lowland depositing river (FW2) had been historically straightened and deepened with V-shaped banks of up to 4m in height and old embankments evident along the channel. The river was 2-2.5m wide and 0.1-0.2m deep, with locally deeper pool to 0.4m. Shallow glide predominated, with only localised riffle associated with macrophyte beds and rare pool. In shallower areas near the culvert the substrata comprised mixed gravels and small cobble with occasional boulder. However, outside of this area, depositional silt dominated (up to 0.2m deep). Hard substrata were exposed to moderate siltation and partial bedding. Cover of macrophytes was high (>75%) with abundant fool's watercress, frequent water mint and brooklime (*Veronica beccabunga*) and localised bulrush. Aquatic bryophytes were not recorded. The river channel became heavily shaded downstream of the culvert with grey willow, hawthorn and gorse (*Ulex europaeus*). A narrow and fragmented herbaceous layer supporting purple loosestrife, hedge bindweed, willowherbs (*Epilobium* spp.), hogweed (*Heracleum sphondylium*), reed canary grass and

rank grasses was present along the channel margins. The site was bordered by dry meadows habitat (GS2) and improved pasture (GA1) in a wider landscape of cutover bog (PB4).

Brown trout and three-spined stickleback were the only fish species recorded via electro-fishing at site C3 (**Appendix A**). Although recorded previously (Triturus 2021 data), no Atlantic salmon were captured. The site was of moderate value for salmonids only, supporting a low density of mixed cohort brown trout, given significant siltation pressures. The shallow stream provided some suitable spawning habitat (exposed gravels) although these were heavily silted. Localised small pools associated with the culvert, bank scours and macrophyte stands provided some holding habitat for adult salmonids. Despite some suitability for European eel and white-clawed crayfish, none were recorded. No otter sign were recorded in vicinity of the site (few marking opportunities).

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids, the aquatic ecological evaluation of site C3 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.16 Representative image of site C3 on the North Glengoole River, September 2023

4.1.16 Site C4 – Black River, Derryhogan

Site C4 was located on the Black River (16B01) at a local road bridge, approx. 1.5km downstream of site C2. The river had been extensively straightened and deepened, with very steep (near vertical) trapezoidal banks of 4-5m in height. The river flowed under the local road via a corrugated pipe culvert (fish passable). The homogenous river section was 3-4m in a channel up to 5-6m wide. The depth

varied from 0.2 to 0.5m, with occasional pool areas to 1m. Deep slow-flowing glide dominated the site, with occasional pool. Riffle was present upstream of the road culvert. The substrata comprised compacted and heavily silted mixed gravels and cobble, with occasional boulder (near culvert only). Bank erosion was frequent (exposed clay) and contributed to the silt loading. Siltation was high overall (largely peat-derived) with deep silt-sand deposits present along channel margins (up to 0.2m deep). The site was heavily shaded by mature treelines of ash, elder, hawthorn and cypress (Cupressaceae family). As a result, macrophytes were absent. Aquatic bryophytes were not recorded, with the liverworts *Pellia endiviifolia* and *Conocephalum conicum* on muddy banks. The site was bordered by improved pasture (GA1).

Brown trout and stone loach were the only two fish species recorded via electro-fishing at site C4 (**Appendix A**). Adult trout dominated, with only low numbers of juveniles present. The site was a moderate quality salmonid spawning and nursery habitat. Holding habitat, by way of deeper pools, bank undercuts and submerged tree root systems, was of good quality. Despite high siltation, soft sediment accumulations did not support lamprey ammocoetes (largely humic or clay-based in nature). Some very limited superficial spawning gravels suitable for lamprey were present in the vicinity of the culvert although spawning habitat improved upstream, where riffles were more commonplace. Aside from submerged tree root systems, suitability for European eel and white-clawed crayfish was relatively poor given limited accessible instream refugia (neither species recorded). No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids, the aquatic ecological evaluation of site C4 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.16 Representative image of site C4 on the Black River, September 2023 (downstream of culvert)

4.1.17 Site C5 – Black River, Two Mile Borris

Site C5 was located on the Black River (16B01) at the N75 road crossing, approx. 5km downstream of site C4. As per upstream, the lowland river (FW2) at this location had been straightened and deepened historically, flowing in a steep, 5-8m high trapezoidal channel. The river was 6-8m wide and 0.2-0.6m deep, with locally deeper areas to 1m. Slow-flowing glide predominated, with localised riffles near the road bridge and occasional pools. The substrata were dominated by cobble with frequent boulder and small interstitial patches of mixed gravels. Siltation was moderate overall (peat) but soft sediment accumulations were localised. The substrata were relatively mobile. The site supported a diverse range of macrophytes, with frequent lesser water parsnip and occasional water starwort (*Callitriche* sp.), water mint, water crowfoot (*Ranunculus* sp.) and watercress. Curled pondweed (*Potamogeton crispus*) was present but rare. Common duckweed and ivy-leaved duckweed were both frequent. Coverage of aquatic bryophytes was high, with abundant *Fontinalis antipyretica* on larger cobble/boulder. Filamentous algae was present (1% cover). Given the presence of several indicator species (EC, 2013) and the high coverage of bryophytes, the aquatic plant community was considered representative of the Annex I habitat 'Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* (low water level during summer) or aquatic mosses [3260]'. Riparian shading was relatively high given the presence of maturing alder plantations along the channel (both banks). The site was bordered by improved pasture (GA1) and grassy verges habitat (GS2).

Atlantic salmon, brown trout, European eel, lamprey (*Lampetra* sp.) and stone loach were recorded via electro-fishing at site C5 (**Appendix A**). The site was of highest value as a salmonid nursery, with

boulder-rich glide and riffle supporting a moderate density of Atlantic salmon parr and a lower number of juvenile brown trout. Deeper glide with frequent bank scours and submerged tree roots provided valuable holding areas for adult trout. Spawning substrata was sparse and impacted by siltation pressures (but nonetheless present). The site was also of high value for European eel with abundant boulder and cobble supporting a moderate density of juveniles and small adults. Soft sediment accumulations were largely confined to the road culvert and these humic areas supported a low density of small *Lampetra* sp. ammocoetes. Despite some good suitability, no white-clawed crayfish were recorded (but known from the river, Triturus 2021 data). Abundant otter prints were recorded in marginal mud under the bridge (ITM 619139, 657812).

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of Annex I floating river vegetation [3260], the aquatic ecological evaluation of site C5 was of **county importance** (**Table 4.3**).



Plate 4.17 Representative image of site C5 on the Black River, September 2023

4.1.18 Site D1 – Breegagh River, Killeen

Site D1 was located on the Breegagh River (16B03) at a local road crossing, where the river flowed through a stacked three-bore box culvert. The small lowland river (FW2) had been straightened and deepened historically, resulting in a homogenous channel with poor hydromorphology. Boulder revetments were present in the vicinity of the culvert. The river was 2.5-3m wide and 0.3-0.7m deep in deep, slow-flowing glide. Pool was occasional. Riffles were limited to the vicinity of the culvert. The substrata were dominated by compacted cobble with occasional boulder and limited interstitial mixed

gravels. The site suffered from heavy siltation, although deposits were flocculent, with only very localised, shallow accumulations. Large woody debris (LWD) was frequent instream which improved habitat heterogeneity of the straightened channel. The river flowed through a maturing broad-leaved plantation and shading was high. As a result, macrophytes were limited to occasional fool's watercress, water mint and lesser water parsnip along channel margins in more open areas. Reed canary grass was abundant along channel margins and created overhangs of high value for salmonids. Aquatic bryophytes were limited to localised *Brachythecium rivulare* on exposed boulder near the culvert. The site was bordered by a broad-leaved plantation of sycamore, wych elm (*Ulmus glabra*) and alder (*Alnus glutinosa*) (WD1), with dense bramble scrub (WS1) and improved pasture (GA1).

Atlantic salmon and brown trout were the only fish species recorded via electro-fishing at site D1 (**Appendix A**). The site was of good value as a salmonid nursery, supporting a moderate density of Atlantic salmon parr and juvenile trout. The site was of highest value as a holding habitat for adult trout, with frequent scoured banks and instream LWD providing valuable deeper glide and pool areas in an otherwise shallow river section. The site was of poor quality as a spawning habitat given significant siltation pressures. Despite some suitability, no European eel or white-clawed crayfish were recorded. A regular otter spraint site (with fish remains) was recorded on marginal mud in the box culvert (ITM 621359, 650301).

Biological water quality, based on Q-sampling, was calculated as **Q3-4 (moderate status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids (including Atlantic salmon) and utilisation by otter, the aquatic ecological evaluation of site D1 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.18 Representative image of site D1 on the Breegagh River, September 2023

4.1.19 Site D2 – Breegagh River, Ballymurreen Bridge

Site D2 was located on the Breegagh River (16B03) at Ballymurreen Bridge, approx. 4.8km downstream of site D1. The lowland river (FW2) had been straightened historically but not deepened and retained many good semi-natural characteristics. However, livestock poaching pressures has significantly impacted the quality of aquatic habitats since previous surveys of the site (September 2021). The river was 4-5m wide (channel up to 7m wide in places) and 0.2-0.4m deep. Locally deeper glide and pool to 0.8m was present. The profile comprised slow-flowing glide with occasional riffles near the bridge, and pool becoming more frequent downstream. The substrata were dominated by soft sediment deposits with only localised areas of exposed mixed gravels and cobbles (in contrast to 2021 when gravels were widespread). Sand patches were also present. The site supported sparse growth of macrophytes with scattered water crowfoot (*Ranunculus* sp.), lesser water parsnip, water forget-me-not, watercress and branched bur-reed. Filamentous algae were present, indicating enrichment. Aquatic bryophytes were limited to very occasional *Brachythecium rivulare* on larger, more stable boulder. The river was flanked on the east bank by a mature treeline of blackthorn, hawthorn, ash, elder, sycamore and bramble, with the west bank featuring improved grassland (GA1).

Atlantic salmon, brown trout, lamprey (*Lampetra* sp.) and stone loach were recorded via electro-fishing at site D2 (**Appendix A**). The site was a moderate quality salmonid nursery, with the value reduced in recent years due to evident siltation pressures which reduced the distribution of gravel and cobble areas. The shallow site was of relatively poor value as a holding habitat for adult salmonids although some scoured areas and overhanging vegetation provided valuable areas. Whilst some good quality nursery areas were present in association with *Ranunculus* beds, the site was poor overall given widespread siltation and low macrophyte cover. Lamprey ammocoete habitat was widespread although much of the soft sediment accumulations were clay-dominated and thus sub-optimal for *Lampetra* sp. Lamprey spawning habitat by way of finer gravels was present but highly localised. The site was of poor value for European eel given a paucity of accessible instream refugia and the shallow nature. Despite some suitability for white-clawed crayfish, none were recorded (although positive eDNA at the site in 2021). No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids (including Atlantic salmon) and lamprey (*Lampetra* sp.), the aquatic ecological evaluation of site D2 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.19 Representative image of site D2 on the Breegagh River at Ballymurreen Bridge, September 2021 (top) and September 2023 (bottom) showing evident deterioration in water quality and aquatic habitats due to livestock poaching

4.1.20 Site D3 – Breegagh River, Archerstown Bridge

Site D3 was located on the lower reaches of the Breegagh River (16B03) at Archerstown Bridge, approximately 9.6km downstream of site B2. The swift flowing lowland depositing river (FW2) was semi-natural in vicinity of the bridge, with some local bank modifications but an otherwise largely

natural channel. The river was 2-3m wide in a 4-5m channel upstream with braiding around a small island downstream of the bridge (river also wider). The river averaged 0.3-0.6m deep with locally deeper areas to 1.6m. The profile comprised riffle and swift deep glid with occasional pool. The substrata of the calcareous river were dominated by cobble and clean, mobile mixed gravels with frequent boulder. Beds of sand were present locally with flocculent soft sediment in slacks and along channel margins. Siltation was low overall given high flow rates and macrophyte cover. The site was heavily vegetated with abundant water crowfoot (*Ranunculus* sp.) and frequent heterophyllus lesser water parsnip. Fool's watercress was also frequent with occasional water mint, ivy-leaved duckweed and rare branched bur-reed. Cover of aquatic bryophytes was high with locally abundant *Fontinalis antipyretica*, *Chiloscyphus polyanthos* and *Leptodictyum riparium*. Larger boulders supported *Rhynchostegium riparioides*. The aquatic vegetation community was considered representative of the Annex I habitat floating river vegetation [3260]. Cover of filamentous algae was high (10%), despite high flow rates, indicating enrichment. The channel margins were dominated by reed canary grass with abundant bittersweet. The mature riparian zones supported treelines of sycamore, willow species and ash with abundant bramble and nettle. The site was bordered by residential properties (BL3/GA2) and improved pasture (GA1) with mature buffers.

Atlantic salmon, brown trout, European eel, minnow and stone loach were recorded via electro-fishing at site D3 (**Appendix A**). The site was of very high value for salmonids with excellent quality nursery habitat present (especially for Atlantic salmon) given an abundance of macrophyte beds in swift glide. The site also provided excellent quality holding habitat by way of deeper pool (e.g. downstream of bridge), extensive macrophyte beds and overhanging marginal vegetation. Such areas, in addition to frequent large boulder, were also of high suitability for European eel and white-clawed crayfish (the latter of which was not recorded). High quality spawning habitat for both salmonids and lamprey was present upstream and downstream of the bridge. However, there was a paucity of suitable lamprey nursery habitat with soft sediment accumulations shallow and flocculent in nature. An otter spraint site was recorded on a marginal boulder immediately downstream of the easternmost arch (ITM 613956, 656844).

Biological water quality, based on Q-sampling, was calculated as **Q3-4 (moderate status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than ‘least concern’, according to national red lists, were recorded via Q-sampling.

Given the presence of Annex I floating river vegetation [3260], the aquatic ecological evaluation of site D3 was of **county importance** (**Table 4.3**).



Plate 4.20 Representative image of site D3 on the Breegagh River at Archerstown Bridge, September 2023

4.1.21 Site E1 – River Goul, Fennor

Site E1 was located on the upper reaches of the River Goul (15G02) at a local road and proposed GCR crossing. The narrow lowland depositing river (FW2) had been extensively straightened and deepened (embankments & spoil heaps evident), resulting in a typically homogenous trapezoidal channel with poor hydromorphology, especially upstream of the bridge. The heavily modified river flowed under the road via 3 x pipe culverts (fish passable). The profile comprised slow-flowing glide and pool although faster glide was located downstream of the culverts. The substrata were dominated by clay-dominated soft sediment up to 0.2m in depth with scattered angular boulder and discarded house bricks. The littorals supported silted mixed gravels and cobble but were typically exposed clay/mud. Given high riparian shading, macrophytes were limited to fool's watercress, blue water speedwell and brooklime in open areas. Aquatic bryophyte coverage was low with localised *Leptodictyum riparium* on larger substrata. Large woody debris and trash was frequent instream and resulted in a number of blockages to flow (although this increased habitat heterogeneity). The site was heavily shaded by mature grey willow, elder and hawthorn treelines with nettle, great willowherb, bindweed and bramble-dominated scrub. The site was bordered by improved pasture (GA1) and a residential property.

Brown trout, stone loach and lamprey (*Lampetra* sp.) were recorded via electro-fishing at site E1 (**Appendix A**). The site was a moderate quality salmonid habitat, at best, supporting a low density of brown trout only, given significant siltation pressures and poor hydromorphology. The quality of salmonid nursery habitat was poor with an absence of suitable spawning habitat (due to siltation). The narrow channel featured frequently undercut clay banks and these coupled with LWD and occasional

pools provided some holding habitat for small adult salmonids. European eel habitat was moderate overall although none were recorded. Whilst soft sediment accumulations were dominant, these supported only a low density of lamprey ammocoetes due to the clay nature of the sediment. Despite some low suitability for white-clawed crayfish, none were recorded and no evidence of the species (e.g. burrows in clay banks) were noted. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids and lamprey (*Lampetra* sp.), the aquatic ecological evaluation of site E1 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.21 Representative image of site E1 on the River Goul, September 2023

4.1.22 Site E2 – Ardreagh River, Lisduff

Site E2 was located on the Ardreagh River (15A03) at a local road and proposed GCR crossing. The small swift-flowing lowland river (FW2) had been locally straightened and deepened upstream of the bridge but retained some semi-natural features downstream (e.g. meanders). The small calcareous stream was 1-2m wide and 0.1-0.2m deep, with a paucity of deeper areas. The profile comprised swift glide and riffle with only localised, small pools. The substrata were dominated by calcified cobble and coarser gravels with scattered boulder. Soft sediment accumulations were present but these were shallow and flocculent. Siltation was higher than expected for the river type. Linear stands of fool's watercress and water mint were frequent along channel margins, with occasional watercress and lesser water parsnip. Common duckweed was also present locally in slacks. Aquatic bryophyte coverage as low although some *Pellia endiviifolia* and *Chiloscyphus polyanthos* were present on larger

substrata. Downstream of the bridge the river was heavily shaded by mature treelines of hawthorn, alder and grey willow, with the banks cleared historically upstream. The site was bordered by improved pasture (GA1) with wet grassland (GS4) upstream of the bridge on the west bank.

Atlantic salmon, brown trout, European eel and three-spined stickleback were recorded via electro-fishing at site E2 (**Appendix A**). The site was a moderate quality salmonid nursery and spawning habitat due to evident siltation pressures. A low density of juvenile trout and salmon were present. Holding opportunities were typically absent given the shallow nature of the site. The site was of moderate value for European eel. Although some limited lamprey spawning habitat was present, calcification of the bed and siltation pressures and the predominance of larger substrata reduced the value overall. Suitable ammocoete habitat was absent. Despite some suitability, no white-clawed crayfish were recorded. However, a regular otter spraint site was recorded on a boulder underneath the bridge arch that contained recent crayfish remains (ITM 629612, 660282).

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids (including Atlantic salmon) and European eel, utilisation by otter and the likely presence of white-clawed crayfish, the aquatic ecological evaluation of site E2 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.22 Representative image of site E2 on the Ardreagh River, September 2023

4.1.23 Site E3 – Lisduff Stream, Lisduff

Site E3 was located on the Lisduff Stream (15L08), a tributary of the Ardreagh River, at a local road and proposed GCR crossing. The small calcareous lowland stream (FW2) crossed under the road via a pipe culvert and had been straightened and deepened historically, resulting in a trapezoidal channel with poor hydromorphology and steep banks of >2m in height. The stream was 1-1.5m wide and 0.05-0.1m deep and suffered from low summer flows at the time of survey. The profile comprised slow-flowing riffle and glide with an absence of pool. The substrata were dominated by heavily calcified mixed gravels and cobble with scattered small boulder. Flocculent soft sediment beds were associated with instream macrophytes. With the exception of a small area at the culvert, the stream was very heavily vegetated with near 100% cover of fool's watercress and watercress. Terrestrial encroachment of the very shallow channel was high with herbaceous vegetation also growing from the bed. Aquatic bryophytes were limited to occasional *Leptodictyum riparium* and *Pellia endiviifolia*. The stream was lined by a stockproof hedgerow of hawthorn with an open banktop to the east. The site was bordered by improved pasture (GA1).

No fish were recorded via electro-fishing at site E3. The site was not of fisheries value at the time of survey given its very shallow (possibly ephemeral) nature, historical modifications and poor quality aquatic habitats. There was no suitability for white-clawed crayfish. No otter signs were recorded in the vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site E3 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.23 Representative image of site E3 on the Lisduff Stream, September 2023

4.1.24 Site E4 – Tincashel River, Lisduff

Site E4 was located on the Tincashel Stream (15T05) at a local road and proposed GCR crossing. The small swift-flowing lowland stream (FW2) had been straightened and deepened throughout (especially upstream of road culvert), although some good instream recovery had occurred. The stream flowed in a trapezoidal channel and was 2-2.5m wide and 0.1-0.2m deep, with a paucity of deeper areas. The profile comprised swift shallow glide and riffle with only occasional small pool, typically associated with macrophyte beds or instream trash/debris. The substrata were dominated by calcified cobble and coarse gravels although fine to medium gravel patches were present locally. Small boulders were locally frequent. Soft sediment accumulations were present but were shallow and flocculent. Siltation was light overall. Linear stands of fool's watercress were frequent along the stream margins with frequent water mint and occasional brooklime and watercress. Cover of aquatic bryophytes was locally high with *Pellia endiviifolia* and *Leptodictyum riparium* on larger substrata and calcified areas of bed. Whilst the east bank had been historically cleared (along a farm access track), the west bank supported a mature treeline dominated by hawthorn, elder and sycamore. The site was bordered by improved pasture (GA1).

Brown trout was the only fish species recorded via electro-fishing at site E4 (**Appendix A**). The site was a good quality salmonid nursery, despite its generally shallow and historically modified nature. Natural bed calcification reduced the capacity of the site as a salmonid/lamprey spawning habitat although some good quality substrata were present locally. The shallow site was also of poor value as a salmonid holding habitat. Good quality lamprey spawning habitat (fine gravels) was present locally although suitable ammocoete habitat was absent in vicinity of the survey site. Despite some moderate

suitability, no European eel or white-clawed crayfish were recorded. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids, the aquatic ecological evaluation of site E4 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.24 Representative image of site E4 on the Tincashel River, September 2023

4.1.25 Site E5 – Clomantanagh Lower Stream, Clomantanagh Lower

Site E5 was located on the Clomantagh Lower Stream (15C91) at a local road and proposed GCR crossing. In contrast to EPA mapping, the stream had been extensively realigned along field boundaries and was culverted under the local road before grading into a large, shallow drainage channel of 3m width and <0.1m depth which ran parallel to the road. Flowing water was absent (i.e. stagnant). The substrata comprised exclusively of deep, anoxic soft sediment (up to 0.3m in depth) with sands, scattered boulder and abundant woody debris. The channel supported locally frequent fool's watercress and watercress in open areas, with scattered iris. Aquatic bryophytes were absent. The channel was very heavily shaded by mature treelines dominated by alder and sycamore. The site was bordered by improved pasture (GA1).

No fish were recorded via electro-fishing at site E5. The site was not of fisheries value given its very heavily silted and modified nature, an absence of flows and poor connectivity with downstream

habitats. There was no suitability for white-clawed crayfish. No otter signs were recorded in the vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q2 (bad status)** (**Appendix B**). However, it should be noted that this is a tentative rating given poor flows and lack of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site E5 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.25 Representative image of site E5 on the Clomantanagh River, September 2023

4.1.26 Site E6 – unnamed stream, Kilrush

Site E6 was located on an unnamed, unmapped tributary of the Nuenna River at a local road and proposed GCR crossing. The upland eroding watercourse (FW1) had been locally deepened and straightened along field boundaries but retained many semi-natural characteristics in vicinity of the single arch masonry bridge. The stream flowed over a moderate gradient in a trapezoidal channel with bank heights of up to 3m. The stream was 1.5-2.5m wide and 0.1-0.15m deep. The profile comprised riffle and cascades with frequent small pool. The substrata were dominated by angular boulder and cobble with frequent interstitial sands and fine gravels. Despite eroding conditions, siltation was high overall (high clay fraction) although soft sediment accumulations were absent. Given high shading and mobile substrata, macrophytes and aquatic bryophytes were absent. The stream was heavily shaded with dense scrub of grey willow, bramble, hazel (*Corylus avellana*) and ferns. The site was bordered by improved pasture (GA1).

No fish were recorded via electro-fishing at site E6. The site was of poor fisheries value given its heavily silted and shallow nature and poor connectivity with downstream habitats. The stream showed some ephemeral characteristics and may run dry, seasonally. There was no suitability for white-clawed crayfish. No otter signs were recorded in the vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (good status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site E6 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.26 Representative image of site E6 on an unmapped Nuenna River tributary, September 2023

4.1.27 Site E7 – Gorteenahilla River, Ballyguider Bridge

Site E7 was located on the Gorteenahilla River (15G08) at Ballyguider Bridge, a proposed GCR crossing. The upland eroding river (FW1) had been straightened and deepened locally in vicinity of the twin arch masonry bridge (cobbled apron, perched, <0.1m) but retained some good semi-natural characteristics. The river was 4-5m wide and 0.1-0.3m deep, with occasional deeper areas to 1.2m. The profile comprised a series of riffles, deep slow-flowing glides and occasional pools. A deep pool was located immediately downstream of the bridge apron. The substrata were dominated by angular cobble and boulder with frequent mixed gravels (though no extensive areas). Patches of sand and fine gravels were present but rare overall. Soft sediment accumulations were not present given high energy characteristics although siltation was moderate and higher than expected for river type. Cover of floc[1] was high (30%). The site was well shaded and macrophyte cover was sparse with only

[1] floc is defined as an aggregation of (mostly dead) organic material, mainly from algae and diatoms, but also with potential origins from decaying macrophytes and associated decomposers (bacteria and fungi) (Moorkens & Killeen, 2020)

occasional fool's watercress present. Aquatic bryophyte coverage was also low with occasional *Fontinalis antipyretica*, *Rhynchostegium riparioides* and Fissidens sp. The red algae *Hildenbrandia* sp. was present locally on boulder. The river was lined by mature treelines of horse chestnut (*Aesculus hippocastanum*), sycamore with abundant blackthorn and bramble. The site was bordered by a residential property and improved pasture with narrow borders (GA1).

Atlantic salmon and brown trout were the only fish species recorded via electro-fishing at site E7 (**Appendix A**). The site was of very high value as a salmonid nursery, with abundant Atlantic salmon parr and a low density of brown trout. The site also provided some localised good quality holding areas for adult salmonids (e.g. pool downstream of apron). However, the site was of moderate value only as a spawning habitat given the predominance of larger substrata in addition to siltation and enrichment pressures (i.e. floc cover). The high energy site was unsuitable for lamprey. Despite some good suitability, no European eel or white-clawed crayfish were recorded. An otter spraint site was recorded on a ledge under the eastern bridge arch (ITM 638980, 666779).

Biological water quality, based on Q-sampling, was calculated as **Q4 (good status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids (including Atlantic salmon) and utilisation by otter, in addition to Q4 (good status) water quality, the aquatic ecological evaluation of site E7 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.27 Representative image of site E7 on the Gorteenahilla River, September 2023

4.1.28 Site E8 – Lismaine Stream, Clone

Site E8 was located on the Lismaine Stream (15L16), a tributary of the River Nore, at a local road and proposed GCR crossing. The stream (FW1) crossed under the road via a box culvert (rendered bed) and suffered from low flows at the time of survey. The small stream had been extensively straightened and deepened historically with poor recovery evident in the steep-sided trapezoidal channel. The stream was 2m wide and 0.05-0.1m deep. The profile comprised very slow flowing glide and riffle with occasional near stagnant pool. The banks were typically undercut/scoured, indicating spate tendencies of the modified channel. The substrata were dominated by mixed gravels and cobble which were heavily silted. Boulder was scattered throughout. Siltation was high overall (depositional habitat at time of survey). Livestock poaching was present upstream. Given high shading and poor flows, macrophytes were not present. Aquatic bryophyte coverage was also low with only very occasional *Rhynchostegium riparioides* and *Pellia epiphylla*. The liverwort *Conocephalum conicum* was locally frequent on muddy banks. The stream was lined by mature treelines of sycamore and ash with hawthorn and blackthorn. The site was bordered by improved pasture (GA1).

Three-spined stickleback were the only fish recorded via electro-fishing at site E8 (**Appendix A**). With the exception of low densities of this species, the site was not of fisheries value at the time of survey given very poor flows in addition to the shallow nature of the site and siltation pressures. However, there was some physical suitability for small salmonids (known further downstream - Triturus 2021 data). The site was unsuitable for white-clawed crayfish. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids (including Atlantic salmon) and utilisation by otter, the aquatic ecological evaluation of site E8 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.20 Representative image of site E8 on the Lismaine Stream, September 2023

4.1.29 Site E9 – Lisdowney Stream, Grange Bridge

Site E9 was located on the Lisdowney Stream (15L02), a tributary of the River Nore at Grange Bridge, a proposed GCR crossing. The high energy lowland river (FW1) had been historically straightened and deepened, with bank modifications in vicinity of the bridge, but demonstrated some good instream recovery. The river was 6-8m wide and 0.3-0.5m deep, with localised deeper areas to >1m. The profile comprised swift glide and pool. A small weir was present under the bridge with a larger weir (1.5m fall) located 50m downstream of the bridge. Given high energy conditions, the substrata were dominated by compacted and calcified cobble and boulder with more localised mixed gravels. Larger boulder were scattered. Cyanobacterial deposits were widespread on larger substrata. This resulted in low coverage of aquatic vegetation. Macrophytes were limited to occasional marginal stands of fool's watercress. Aquatic bryophyte coverage was low with only very occasional *Leptodictyum riparium* and *Rhynchostegium riparioides*. The river was shaded by mature mixed woodland and treelines supporting hawthorn, sycamore, ash, beech (*Fagus sylvatica*) and holly (*Ilex aquifolium*). The site was bordered by improved pasture (GA1) and a residential property upstream.

Atlantic salmon, brown trout, European eel and three-spined stickleback were recorded via electro-fishing at site E9 (**Appendix A**). The site was of good value for salmonids supporting moderate densities of Atlantic salmon and brown trout. The site was of highest value as a salmonid nursery with frequent swift glide although the paucity of instream refugia reduced the value overall. Localised pool and deep glide/undercuts provided some valuable holding habitat for adult salmonids (especially downstream of the large weir). The site was of some value for spawning salmonids and lamprey but high calcification/compaction rates reduced the capacity of the site. The high energy site was unsuitable as a lamprey nursery habitat. European eel suitability was locally good in deep pools/glide

with a low density recorded. Despite some suitability, no white-clawed crayfish were recorded. A regular otter spraint site was recorded on boulder revetment under the bridge (ITM643579, 668675).

Biological water quality, based on Q-sampling, was calculated as **Q4 (good status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids (including Atlantic salmon) and European eel, in addition to utilisation by otter and Q4 (good status) water quality, the aquatic ecological evaluation of site E9 was of **local importance (higher value)** (**Table 4.3**).



Plate 4.29 Representative image of site E9 on the Lisdowney Stream, September 2023

4.1.30 Site E10 – River Nore, Parksgrove

Site E10 was located on the River Nore (15N01) at a proposed GCR crossing approximately 0.7km upstream of Ballyragget Bridge. The large lowland depositing river (FW2) had been historically modified and was 15-20m wide and >1.5m deep, with a profile dominated by deep glide with associated pool (no riffles). The substrata comprised abundant compacted sands with scattered, bedded boulder and cobble. Small patches of mixed gravels were present along the steep margins of the channel, alongside some depositional soft sediment areas. Siltation was high. Given the high average depth, macrophyte coverage was low with intermittent linear stands of branched bur-reed and rare common clubrush. Aquatic bryophytes were limited to rare *Fontinalis antipyretica* and *Rhynchostegium riparioides*. Cover of filamentous algae (*Cladophora* sp.) was high, indicating significant enrichment. The steep, near vertical margins were lined by abundant reed canary grass with only scattered grey willow and hawthorn. The site was bordered by dry meadow habitat on the

west bank (GS2) with heavily improved pasture (GA1) on the east.

Electro-fishing was not undertaken at site E10 due to prohibitive depths and water volumes. However, the river in the vicinity of Ballyragget is known to support Atlantic salmon, brown trout, *Lampetra* sp., European eel, minnow, stone loach and rudd (*Scardinius erythropthalmus*) (Triturus 2021 data). The deep glide at the proposed crossing was of value only as a salmonid holding habitat, with little suitability as spawning or nursery areas. Lamprey spawning habitat was also largely absent although marginal soft sediment deposits provided some moderate quality nursery areas. Suitability for white-clawed crayfish was low. Whilst of value as an occasional foraging habitat, no otter signs were recorded in vicinity of the site (few marking opportunities).

Biological water quality, based on Q-sampling, was calculated as **Q3 (good status)** (**Appendix B**). However, it should be noted that this is a tentative rating given poor flows and lack of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the location of the site within the River Barrow and River Nore SAC (002162) and River Nore SPA (004233), the aquatic ecological evaluation of site E10 was of **international importance** (**Table 4.3**).



Plate 4.30 Representative image of site E10 on the River Nore, September 2023

4.2 Lacustrine survey site results

4.2.1 Site L1 – lake/wetland, Longfordpass South

Site L1 was a small, interconnected twin-basin lake of c.1ha located in the vicinity of proposed turbine T1 in Littleton Bog. The small heavily peat-stained lake was shallow, averaging <0.5m deep with very

shallow sloping margins and a base comprised exclusively of peat (often deep, >0.2m). The open waterbody, which evidently reduced in area and depth during dry periods, supported sparse macrophyte growth with scattered bottle sedge and bulrush, rare bog pondweed (*Potamogeton polygonifolius*) and a single stand (in north basin) of common reed. Small stands of bent grass (*Agrostis* sp.) were frequent around the margins and extended into the basins. The exposed peat littorals supported abundant spike-rush (*Eleocharis palustris*), bog cotton (*Eriophorum angustifolium*) and deer grass (*Trichophorum cespitosum*) with scattered rushes (*Juncus* spp.) and stunted downy birch, lodgepole pine (*Pinus contorta*) and willow (*Salix* sp.). The lake was bordered by extensive, heavily degraded cutover bog (PB4) with multiple (maintained) drainage channels adjoining the lake.

With the exception of three-spined stickleback (recorded via sweep sampling), site L1 was of poor fisheries value given its shallow, fluctuating and peat nature. However, there was high suitability for amphibians (albeit none were recorded). No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**). The water stick insect *Ranatra linearis*, a recent discovery in Ireland (Nelson, 2018), was recorded in the sample (**Plate 4.49**).

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site L1 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.31 Representative image of site L1, October 2023

4.2.2 Site L2 – lake/wetland, Bawnreagh

Site L2 was located within an extensive area of cutover bog (Littleton Bog), within the proposed site boundary. The large, shallow linear cutover lake covered an area of c.1ha and ranged from 0.2-0.5m deep. The bed was comprised entirely of bare soft silt (peat). Peat staining was high at the time of

survey. Macrophyte coverage was low with scattered stands of bog pondweed, broad-leaved pondweed, bulbous rush (*Juncus bulbosus*). Stonewort (*Chara* sp.), *Sphagnum* sp. mosses and bladderwort (*Utricularia* sp.) were present along the margins but rare overall. Cottongrass and bottle sedge were abundant in the peaty littorals. The southern part of the lake was more of a wetland habitat (likely dries out, on occasion) and supported abundant *Sphagnum cuspidatum*, broad-leaved and bog pondweed, cotton grass and frequent bottle sedge. The lake was situated in cutover bog (PB4) with heath and scattered pre-thicket lodgepole pine.

With the exception of three-spined stickleback (considered likely present), site L2 was of poor fisheries value given its very shallow, peat nature and lack of connectivity to superior fisheries habitats (e.g. flowing watercourses). However, the site was of high suitability for amphibians, although none were recorded during the site visit. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site L2 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.32 Representative image of site L2, October 2023

4.2.3 Site L3 – lake/wetland, Bawnreagh

Site L3 was located within an extensive area of cutover bog (Littleton Bog), within the proposed site boundary and adjacent to site L2. The shallow linear cutover lake covered an area of c.0.5ha and ranged from 0.2-0.6m deep. The bed was comprised entirely of bare soft silt (peat). Peat staining was high at the time of survey. Given the typically flocculent bed, macrophyte growth was sparse with very scattered stands of bog pondweed and broad-leaved pondweed and rare bulbous rush. Cottongrass,

Sphagnum cuspidatum and bottle sedge were abundant in the exposed peaty littorals. The shallow sloping, bare peat littorals, supported sparse but widespread bladderwort (*Utricularia* sp.) and more localised stonewort (*Nitella* sp.). The lake was bordered by (locally regenerating) cutover bog (PB4) with abundant lodgepole pine, downy birch, purple moor grass (*Molinia caerulea*) and heather (*Calluna vulgaris*).

With the exception of three-spined stickleback (considered likely present), site L3 was of poor fisheries value given its very shallow, peat nature and lack of connectivity to superior fisheries habitats (e.g. flowing watercourses). However, the site was of high suitability for amphibians, although none were recorded during the site visit. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site L3 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.33 Representative image of site L3, October 2023

4.2.4 Site L4 – lake/wetland, Bawnreagh

Site L4 was a small lake located between proposed turbines T1 & T2. The 1.3ha heavily peat-stained lake was shallow, averaging <0.5m deep with shallow sloping margins and a base comprised exclusively of peat (often compacted but locally deep, >0.2m). The waterbody was somewhat sheltered from prevailing winds but supported sparse macrophyte growth with scattered small stands of common reed, bulrush, broad-leaved pondweed and bog pondweed, typically in marginal areas, with abundant bog cotton in the inundated littorals. These areas also supported occasional

bladderwort (*Utricularia* sp.). The lake was bordered by cutover bog (PB4) supporting abundant heather and stunted lodgepole pine with frequent downy birch and scattered gorse.

With the exception of three-spined stickleback (considered likely present), site L4 was of poor fisheries value given its very shallow, peat nature and lack of connectivity to superior fisheries habitats (e.g. flowing watercourses). However, there was high suitability for amphibians, although none were recorded during the site visit. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site L4 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.34 Representative image of site L4, October 2023

4.2.5 Site L5 – lake/wetland, Bawnreagh

Site L5 was a small, irregularly shaped cutover lake located in the vicinity of proposed turbine T2. The 1.4ha heavily peat-stained lake was shallow, averaging 0.5-1m deep with quickly shelving margins and a base comprised exclusively of peat (often compacted but locally deep, >0.3m). The largely open waterbody supported sparse macrophyte growth with scattered small stands of broad-leaved pondweed and common reed throughout the lake. Bog pondweed was rare. The northern shoreline supported a large bed of water horsetail (*Equisetum fluviatile*) with bottle sedge frequent along all margins. The shallow bare peat littorals supported frequent stonewort (*Chara* sp.) with rare bladderwort (*Utricularia* sp.). Bottle sedge and cotton grass were locally abundant along the lake margins with occasional marsh pennywort (*Hydrocotyle vulgaris*). The lake was bordered by cutover

bog (PB4) supporting abundant heather, stunted lodgepole pine and downy birch with abundant purple moor grass.

With the exception of three-spined stickleback (recorded in sweep sample), site L5 was of poor fisheries value given its shallow, peat nature and lack of connectivity to superior fisheries habitats (e.g. flowing watercourses). However, there was some low suitability for European eel and the site was of high suitability for amphibians, although none were recorded during the site visit. No otter signs were recorded in vicinity of the site. Mute swan (*Cygnus olor*) were present on the lake.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site L5 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.35 Representative image of site L5, October 2023

4.2.6 Site L6 – lake/wetland, Bawnreagh

Site L6 was a large wetland complex with a small central ponding area. Although the pond held water at the time of survey, the depth was <0.05m with a bed comprised entirely of flocculent peat (up to 0.3m in depth). The depth was often greater in the surrounding wetland (although this too was shallow, <0.1m). The ephemeral pond featured sparse macrophyte growth with scattered bulrush and water mint with rare bladderwort (*Utricularia* sp.) on the exposed peat bed. The wetland was dominated by bottle sedge and was fringed by abundant cotton grass and purple moor grass with scattered downy birch, willow and heather.

The site was not of fisheries value given its very shallow, peat nature, lack of connectivity to superior fisheries habitats (e.g. flowing watercourses) and likely ephemeral nature. However, there was some good suitability in the wider wetland for amphibians (although none were recorded). No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site L6 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.36 Representative image of site L6, October 2023

4.2.7 Site L7 – lake/wetland, Bawnreagh

Site L7 was a small pond located adjacent to site L6. The small 200m^2 pond was situated in a larger wetland area. The depth averaged <0.1m (wetland was often deeper) with a bed comprised entirely of soft, often flocculent peat up to a depth of 0.5m. The pond basin supported frequent bog pondweed, occasional bulrush and dominant bottle sedge. Bladderwort (*Utricularia* sp.) was locally abundant in the shallow littorals of the pond and wetland, with occasional water mint and marsh pennywort and rare stonewort (*Nitella* sp.). The wetland was dominated by bottle sedge with abundant cotton grass and was bordered by wet areas of purple moor grass with localised tussock sedge (*Carex* sp.), downy birch and grey willow.

The site was not of fisheries value given its very shallow, peat nature, lack of connectivity to superior fisheries habitats (e.g. flowing watercourses) and likely ephemeral nature. However, there was some good suitability in the wider wetland for amphibians (although none were recorded). No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site L7 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.37 Representative image of site L7, October 2023

4.2.8 Site L8 – lake/wetland, Lanespark

Site L8 was a small pond and wetland complex located approximately 150m south of proposed turbine T3. A small pond of c. 40m^2 was situated in a larger (0.2ha) seasonally flooded wetland area. The pond was 0.2-0.3m deep with a bed of compacted peat (as per the adjoining wetland). The pond supported sparse growth of broad-leaved pondweed with rare bog pondweed and bladderwort (*Utricularia* sp.). Filamentous algal and floc cover was very high (>70% of the bed). The surrounding wetland was dominated by bottle sedge with scattered small stands of bulrush. Common duckweed was present locally in the flooded wetland. The pond and wetland adjoined wet areas supporting abundant lodgepole pine and downy birch with scattered willow (*Salix* sp.). The site was bordered by cutover bog (PB4), some of which was regenerating locally.

Given the small, shallow size of the pond and seasonal nature of the supporting wetland area, site L8 was not of fisheries value. However, the site was of high suitability for amphibians, although none were recorded during the site visit. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site L8 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.38 Representative image of site L8, October 2023

4.2.9 Site L9 – lake/wetland, Clonoura

Site L9 was a small seasonal cutover peatland pool c. 120m^2 with a small pocket of open water 0.1-0.2m deep. Located adjacent to proposed turbine T5, the oligotrophic pool had an exposed peat base with no *Sphagnum* mosses or macrophytes. It was bordered exclusively by bog cotton that formed extensive swards in the historical cutover recess. The bordering areas of pest embankments supported scattered downy birch and lodgepole pine.

Given the small, shallow size of the pond and seasonal nature of the supporting wetland area, site L9 was not of fisheries value. However, the site was of high suitability for amphibians, although none were recorded during the site visit. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site L9 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.39 Representative image of site L9, October 2023

4.2.10 Site L10 – lake/wetland, Clonoura

Site L10 was located adjacent to proposed turbine T5. The small lake covered c. 0.1ha and ranged from 0.2m to 0.5m in depth with a bed comprised entirely of soft silt (peat). The cutover peatland basin had shallow sloping margins and a peat base supporting occasional bulrush with abundant bog cotton and occasional *Juncus* species. The peat embankments and margins supported scattered downy birch and lodgepole pine.

The site was not of fisheries value given its shallow, peat nature and lack of connectivity to superior fisheries habitats (e.g. flowing watercourses. As the pond supported no submerged macrophytes it had poor suitability for smooth newt. However it had good suitability for common frog (none recorded) given the species breeds in a broad range of wetlands. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site L10 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.40 Representative image of site L10, October 2023

4.2.11 Site L11 – lake/wetland, Clonoura

Site L11 was located within the proposed site boundary, 250m south of site proposed turbine T5. The large, shallow cutover lake covered an area of c.3.5ha and ranged from 0.2m to 1m in depth with a bed comprised entirely of soft silt (peat). The eastern margin was steeper and deeper than the western and northern margins which had more gradual sloping shorelines. Peat staining was high at the time of survey, exacerbated by significant wind fetch. Macrophyte coverage was low with only occasional bog pondweed in open water. Stands of bottle sedge and bulrush were scattered around the lake margins. Abundant cotton grass was present on the peaty littorals The lake was situated in cutover bog (PB4) with localised bog woodland (WN7) support downy birch and willow (*Salix* sp.).

The cutover peat lake was of poor fisheries value given its heavily silted, generally shallow nature and isolation from other aquatic habitats. The site was of high value for amphibians although none were recorded during the site visit. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site L11 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.41 Representative image of site L11

4.2.12 Site L12 – lake/wetland, Noard

Site L12 was located within the proposed site boundary 175m west of proposed turbine T6. The small, shallow cutover lake covered an area of c.0.4ha and averaged 0.2-0.3m deep. The bed was comprised entirely of bare soft silt (peat). Peat staining was high at the time of survey. Macrophyte coverage was low with only occasional bog pondweed and water horsetail in open water. Frequent stands of bottle sedge and bulrush were present in the margins with abundant cotton grass on the peaty littorals. The lake was situated in cutover bog (PB4) with downy birch and willow (*Salix* sp.) growing along the low gradient and cutover shorelines.

The cutover peat lake was not considered of fisheries value given its heavily silted, shallow nature and isolation from other aquatic habitats. The site was of high value for amphibians although none were recorded during the site visit. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site L12 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.42 Representative image of site L12

4.2.13 Site L13 – lake/wetland, Noard

Site L13 was located within the proposed site boundary <300m north of proposed turbine T7. The small, shallow cutover lake covered an area of c.0.2ha and was 0.1-0.3m deep. The bed was comprised entirely of bare soft silt (peat). Peat staining was high at the time of survey. Macrophyte coverage was low with only occasional bog pondweed. The peaty littorals (including exposed lakebed) supported abundant cotton grass in addition to rushes (*Juncus* spp.). The lake was situated in cutover bog (PB4) with immature downy birch and willow (*Salix* sp.) growing along the shoreline.

The cutover peat lake was considered of poor fisheries value given its heavily silted, shallow nature and isolation from other aquatic habitats. However, there was some low potential for European eel given the presence of the species in the nearby tributary of the Clover River (recorded in 2021). The site was of high value for amphibians although none were recorded during the site visit. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site L13 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.43 Representative image of site L13

4.2.14 Site L14 – lake/wetland, Noard

Site L14 was located within the proposed site boundary and immediately west of site L13. The small, shallow elliptical cutover lake covered an area of c.0.3ha and was 0.1-0.3m deep. The bed was comprised entirely of bare soft silt (peat). Peat staining was high at the time of survey. Macrophyte coverage was low with only occasional bog pondweed. The peaty littorals (including exposed lakebed) supported abundant cotton grass in addition to rushes (*Juncus* spp.). The lake was situated in cutover bog (PB4) with immature downy birch and willow (*Salix* sp.) growing along the shoreline.

The cutover peat lake was considered of poor fisheries value given its heavily silted, shallow nature and isolation from other aquatic habitats. However, there was some low potential for European eel given the presence of the species in the nearby tributary of the Clover River (recorded in 2021). The site was of high value for amphibians although none were recorded during the site visit. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site L14 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.44 Representative image of site L14

4.2.15 Site L15 – lake/wetland, Noard

Site L15 was a small 200m^2 cutover peat basin waterbody located 300m south-west of proposed turbine T7. The lake was a homogenous 0.3 to 0.4m deep with shallow sloping margins. The site was bordered by abundant bog cotton and bottle sedge but supported no submerged macrophytes apart from bulbosus rush due to the heavily peat stained water. Small pockets of *Sphagnum cuspidatum* were present in the margins. The pond was bordered by extensive bog cotton on exposed peat with immature birch woodland on the peatland escarpments.

The cutover lake was of poor fisheries value given its heavily silted, shallow nature and isolation from other aquatic habitats. The site was of high value for common frog but not smooth newt due to sparse macrophyte cover. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site L15 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.45 Representative image of site L15, October 2023

4.2.16 Site L16 – lake/wetland, Derryhogan

Site L16 was located within the proposed site boundary approximately 300m south of turbine T7. The shallow linear cutover lake and wetland covered an area of c.1.4ha and ranged from 0.1-0.3m deep. The bed was comprised entirely of bare soft silt (peat). Turbidity was low at the time of survey (i.e. low peat staining). The site was heavily vegetated with abundant water mint, bulrush, marsh horsetail (*Equisetum palustre*) in wetland areas and occasional bog pondweed in open water sections. Water starwort (*Callitriche* sp.) was also occasional. Spike rush, rushes (*Juncus* spp.) and bottle sedge were present along the margins. Abundant cotton grass was present on the peaty littorals. The lake was situated in cutover bog (PB4) with downy birch, willow (*Salix* sp.) and lodgepole pine growing along the low gradient shorelines.

The site was not considered of fisheries value given its heavily silted, shallow nature and isolation from other aquatic habitats. However, the site was of high value for amphibians although none were recorded during the site visit. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site L16 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.46 Representative image of site L16

4.2.17 Site L17 – lake/wetland, Lanespark

Site L17 was located at the southern extent of the proposed site boundary near Lanespark Bog, adjacent to Loch Doire Bhile and the North Glengoole Stream, and approximately 500m from both proposed turbine T9 and T10. As with Loch Doire Bhile, the site had been excavated as part of habitat creation on cutover bog. The shallow, clear-water lake covered an area of c.0.7ha and ranged from 0.2m to 1m deep. The substrata comprised gravels and clay. The lake was fringed by common reed with occasional stands of broad-leaved pondweed. Stonewort (*Chara* sp.) was abundant on the lakebed. The open, gravelly banks supported scattered willow (*Salix* sp.) with coniferous afforestation (WD4) present to the north of the site.

The artificial lake was not considered of fisheries value given its shallow nature, isolation from other aquatic habitats and absence of fish stocking history (in contrast to the nearby Loch Doire Bhile which supports stocked brown and rainbow trout). Whilst there was some good suitability for white-clawed crayfish, none were recorded. The species is known from the adjoining Loch Doire Bhile. The site was of high value for amphibians although none were recorded during the site visit. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site L17 was of **local importance (lower value)** (**Table 4.3**).



Plate 4.47 Representative image of site L17

4.3 White-clawed crayfish survey

No live white-clawed crayfish were recorded via hand-searching and sweep netting of instream refugia during the surveys undertaken at 30 no. riverine and 17 no. lacustrine sites in September and October 2023, respectively.

However, recent crayfish remains were recorded in otter spraint at site E2 on the Ardreagh River (proposed GCR crossing) (**Plate 4.48**).



Plate 4.48 White-clawed crayfish remains identified in otter spraint site at site E2 on the Ardreagh River, September 2023

4.4 Otter signs

A total of 7 no. otter signs were recorded across 47 no. survey sites during the course of aquatic surveys undertaken in September-October 2023. All were recorded from riverine sites. Spraint sites (mostly regular) were recorded at sites on the Clover River (A6) and unnamed tributary (A4), Breegagh River (D1 & D3), Ardreagh River (E2), Gorteenahilla River (E7) and the Lisdowney Stream (E9).

No breeding (holts) or resting (couch) areas were identified in the vicinity of the survey sites in September and October 2023.

4.5 Invasive aquatic species

No aquatic invasive species were recorded in vicinity of the survey sites in September and October 2023.

4.6 Biological water quality (macro-invertebrates)

No rare or protected macro-invertebrate species (according to national red lists) were recorded in the biological water quality samples taken from a total of 28 no. wetted riverine sites in September 2023 (**Figure 4.1, Appendix B**).

Sites B5 on the Drish River, E7 on the Gorteenahilla River and E9 on the Lisdowney Stream achieved **Q4 (good status)** water quality and thus met the target good status (≥Q4) requirements of the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 and the Water Framework Directive (2000/60/EC) (**Figure 4.1**). This was given the presence of one group A

taxa in fair numbers (5% of total abundance), namely the mayflies *Ecdyonurus dispar* or *Heptagenia sulphurea* (**Appendix B**).

Sites A7 on the Clover River, D1 on the Drish River, D3 on the Breegagh River and E10 on the River Nore achieved **Q3-4 (moderate status)** water quality (**Figure 4.1**). This was given the low numbers (<5%) of group A species mayflies *Ecdyonurus dispar* or *Heptagenia sulphurea* (**Appendix B**).

A total of 21 no. sites on the Clover River (A5 & A6) and unnamed tributaries (A1, A2, A3 & A4), Drish River (B1, B2, B3 & B4), Black River (C2, C4 & C5), North Glengoole River (C3), Breegagh River (D2), Goul River (E1), Ardreagh River (E2), Lisduff River (E3), Tincashel River (E4), unnamed Nuenna River tributary (E6) and the Lismaine Stream (E8) achieved **Q2-3 or Q3 (poor status)** based on an absence of group A species, low numbers or an absence of group B species and a dominance of group C species such as the mayfly *Baetis rhodani*, freshwater shrimp (*Gammarus duebeni*), New Zealand mud snail (*Potamopyrgus antipodarum*) and blackfly larvae (Simuliidae) (**Appendix B**).

Site E5 on the historically realigned Clomantanagh Lower Stream achieved Q2 (bad status) given the dominance of pollution tolerant group D and E taxa such as *Asellus aquaticus* and *Chironomus* sp. (**Appendix B**).

It should be noted that the ratings for sites A1, A2, A3, A4, A5, B1, E5 and E10 were tentative due to low flows and or a lack of suitable riffle areas for sampling (Toner et al., 2005).

4.7 Lacustrine macro-invertebrates

No rare or protected macro-invertebrate species were recorded in the sweep samples taken from 17 no. lake/wetland sites in October 2023 (**Appendix B**). However, whilst not protected, the nationally uncommon water stick insect *Ranatra linearis*, a recent discovery in Ireland (Nelson, 2018), was recorded at site L1 (**Plate 4.49**).

The shallow, peat lakes and wetlands supported a varied diversity of species, typically dominated by mayflies (*Cloeon* sp.), bluet damselflies (Coenagrionidae), water boatmen (*Hesperocorixa* spp.) and freshwater hoglouse (*Asellus aquaticus*) and a low diversity of Sphaeriidae and Planorbidae molluscan species (**Appendix B**).

4.8 Macrophytes and aquatic bryophytes

No rare or protected macrophytes or aquatic bryophytes were recorded at the 47 no. riverine and lacustrine survey sites in September-October 2023.

The Annex I habitat 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation or aquatic mosses [3260]' (aka floating river vegetation) was recorded on the Black River at site C5 and the Breegagh River at site D3. Several indicator species (EC, 2013) were present, such as water crowfoot (*Ranunculus* sp.) with a particularly high coverage of aquatic bryophytes, including abundant *Fontinalis antipyretica*, *Chiloscyphus polyanthos* and or *Leptodictyum riparium*.



Plate 4.49 The water stick insect (*Ranatra linearis*) recorded from lake site L1, October 2023



Plate 4.50 A darter dragonfly (*Sympetrum* sp.) ovipositing at site L2, October 2023

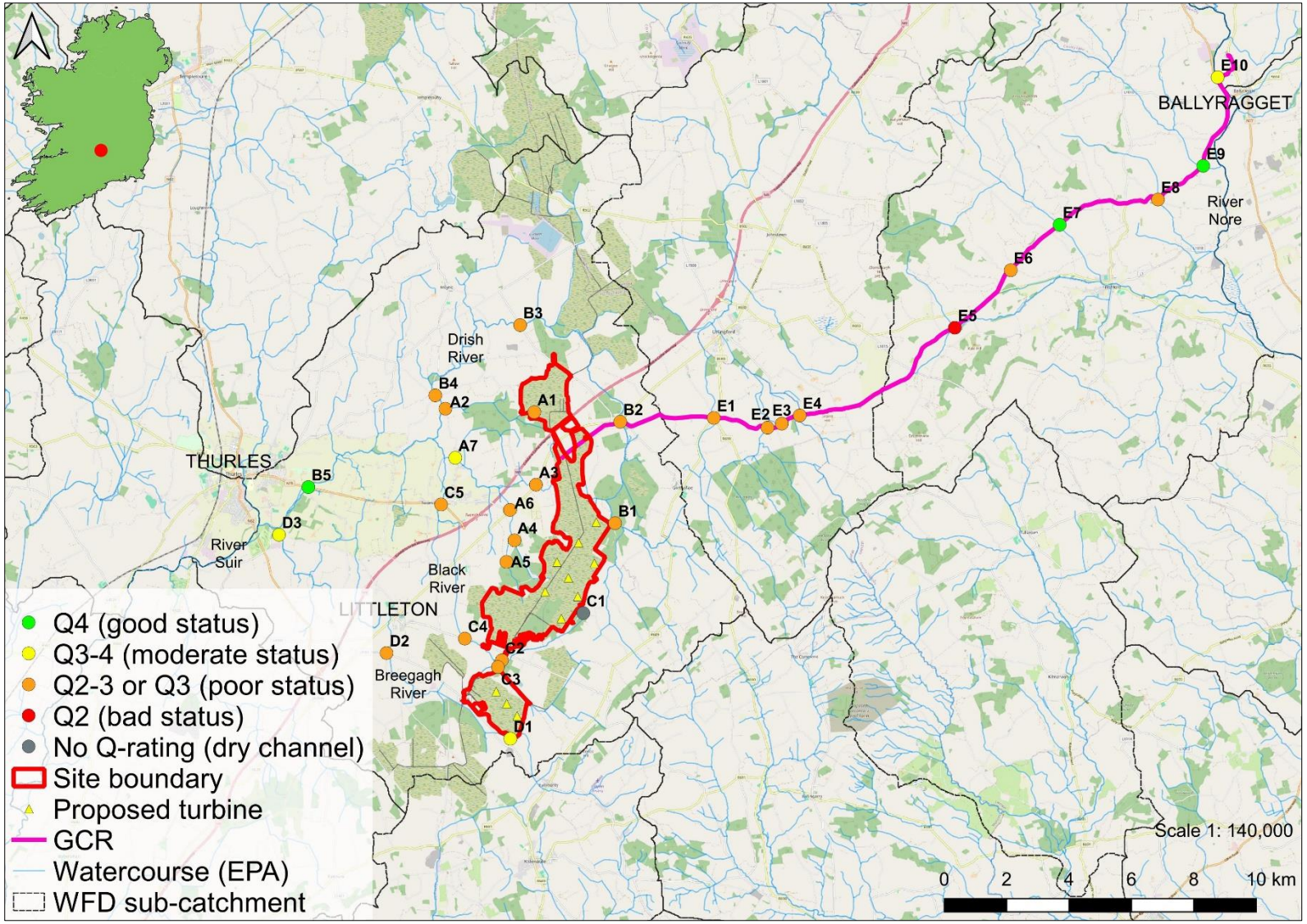


Figure 4.1 Overview of the biological water quality status in the vicinity of the proposed Littleton wind farm project, September 2023

4.9 Aquatic ecological evaluation

An aquatic ecological evaluation of each survey site was based on the results of fisheries surveys, white-clawed crayfish surveys, otter surveys, macrophyte and aquatic bryophyte surveys, macroinvertebrate surveys and biological water quality (**Table 4.3**).

Site E10 on the River Nore (proposed GCR crossing) was evaluated as **international importance** given its location with both the River Barrow and River Nore SAC (002162) and River Nore SPA (004233), sites designated for a range of aquatic species and habitats (NPWS, 2022, 2011).

Sites B2 on the Drish River, C5 on the Black River and D3 on the Breegagh River were evaluated as **county importance** given the presence of the Annex I habitats 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]' (site B2) and 'Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* (low water level during summer) or aquatic mosses [3260]' (sites C5 & D3).

A total of 17 no. sites on the Clover River (A6 & A7) and unnamed tributary (A4), Drish River (B3, B4 & B5), Black River (C2 & C4), North Glengoole River (C3), Breegagh River (D1 & D2), River Goul (E1), Ardreagh River (E2), Tincashel River (E4), Gorteenahilla River (E7), Lismaine Stream (E8) and Lisdowney Stream (E9) were evaluated as **local importance (higher value)** in terms of their aquatic ecology due to the presence of species of higher conservation value (**Table 4.3**).

The remaining 9 no. riverine sites (i.e. sites A1, A2, A3, A5, B1, C1, E3, E5 & E6) as well as all 18 no. lake/wetland sites were evaluated as **local importance (lower value)** given the absence of aquatic species or habitats of high conservation value (**Table 4.3**).

Table 4.1 Summary of fish species of higher conservation value and relative abundances (low, medium, high & very high) recorded via **electro-fishing** per riverine survey site in the vicinity of the proposed Littleton wind farm, September 2023

Site	Watercourse	Relative abundance				Other species
		Atlantic salmon	Brown trout	*Lampetra* sp.	European eel	
A1	Unnamed stream	No fish recorded				
A2	Unnamed stream	No fish recorded				
A3	Unnamed stream	No fish recorded				
A4	Unnamed stream		Low			Perch, stone loach, three-spined stickleback
A5	Clover River					Three-spined stickleback
A6	Clover River		Medium			Perch, stone loach, three-spined stickleback
A7	Clover River	Low	Medium	Low		Pike, stone loach
B1	Drish River					Three-spined stickleback
B2	Drish River	Low			Low	Three-spined stickleback
B3	Drish River		Low	Low		Pike, stone loach, three-spined stickleback
B4	Drish River	Very high	High			Stone loach
B5	Drish River	High	Low	Medium	Low	Minnow, stone loach
C1	Black River	No fish recorded – dry channel				
C2	Black River		Low			Three-spined stickleback
C3	North Glengoole River		Low			Three-spined stickleback
C4	Black River		Low			Stone loach
C5	Black River	Medium	Medium	Medium	Medium	Stone loach
D1	Breegagh River	Medium	High			
D2	Breegagh River	Medium	Medium	Medium		Stone loach
D3	Breegagh River	High	Very high		Low	Minnow, stone loach
E1	River Goul		Low	Low		Stone loach
E2	Ardreagh River	Low	Low		Low	Three-spined stickleback
E3	Lisduff Stream	No fish recorded				
E4	Tincashel River		Medium			
E5	Clomantanagh Lower Stream	No fish recorded				
E6	Unnamed stream	No fish recorded				

Site	Watercourse	Relative abundance				Other species
		Atlantic salmon	Brown trout	*Lampetra* sp.	European eel	
E7	Gorteenahilla River	Very high	Medium			
E8	Lismaine Stream					Three-spined stickleback
E9	Lisdowney Stream	High	Medium		Low	Three-spined stickleback
E10	River Nore	Fisheries appraisal only				

Conservation value: Atlantic salmon (*Salmo salar*), brook lamprey (L*ampetra planeri*) and river lamprey (*Lampetra fluviatilis*) are listed under Annex II of the Habitats Directive [92/42/EEC]. Atlantic salmon and river lamprey are also listed under Annex V of the Habitats Directive [92/42/EEC]. European eel are 'critically endangered' according to most recent ICUN red list (Pike et al., 2020) and listed as 'critically engendered' in Ireland (King et al., 2011). With the exception of the Inland Fisheries Acts 1959 to 2017, brown trout and coarse fish species have no legal protection in Ireland.

Table 4.2 Summary of aquatic species & habitats of higher conservation value recorded in the vicinity of the proposed Laurclavagh wind farm, July 2022

Site	Watercourse	White-clawed crayfish	Otter signs[4]	Annex I aquatic habitats	Rare or protected macrophytes/ aquatic bryophytes	Rare or protected macro-invertebrates	Other species/habitats of high conservation value
Riverine sites							
A1	Unnamed stream	None recorded	No signs	Not present	None recorded	None recorded	None recorded
A2	Unnamed stream	None recorded	No signs	Not present	None recorded	None recorded	None recorded
A3	Unnamed stream	None recorded	No signs	Not present	None recorded	None recorded	None recorded
A4	Unnamed stream	None recorded	**Regular spraint site**	Not present	None recorded	None recorded	None recorded
A5	Clover River	None recorded	No signs	Not present	None recorded	None recorded	None recorded
A6	Clover River	None recorded	**Regular spraint site**	Not present	None recorded	None recorded	None recorded
A7	Clover River	None recorded	No signs	Not present	None recorded	None recorded	**Atlantic salmon, lamprey (*Lampetra* sp.)**
B1	Drish River	None recorded	No signs	Not present	None recorded	None recorded	None recorded
B2	Drish River	None recorded	No signs	Not present	None recorded	None recorded	**Atlantic salmon, European eel**
B3	Drish River	None recorded	No signs	Not present	None recorded	None recorded	**Lamprey (*Lampetra* sp.)**
B4	Drish River	None recorded	No signs	Not present	None recorded	None recorded	**Atlantic salmon**
B5	Drish River	None recorded	No signs	Not present	None recorded	None recorded	**Atlantic salmon, lamprey (*Lampetra* sp.), European eel**
C1	Black River	None recorded	No signs	Not present	None recorded	None recorded	None recorded
C2	Black River	None recorded	No signs	Not present	None recorded	None recorded	None recorded
C3	North Glengoole River	None recorded	No signs	Not present	None recorded	None recorded	None recorded
C4	Black River	None recorded	No signs	Not present	None recorded	None recorded	None recorded

Site	Watercourse	White-clawed crayfish	Otter signs[4]	Annex I aquatic habitats	Rare or protected macrophytes/ aquatic bryophytes	Rare or protected macro-invertebrates	Other species/habitats of high conservation value
C5	Black River	None recorded	No signs	**Floating river vegetation [3260]**	None recorded	None recorded	**Atlantic salmon, lamprey (*Lampetra* sp.), European eel**
D1	Breegagh River	None recorded	**Regular spraint site**	Not present	None recorded	None recorded	**Atlantic salmon**
D2	Breegagh River	None recorded	No signs	Not present	None recorded	None recorded	**Atlantic salmon, lamprey (*Lampetra* sp.)**
D3	Breegagh River	None recorded	**Regular spraint site**	**Floating river vegetation [3260]**	None recorded	None recorded	**Atlantic salmon, European eel**
E1	River Goul	None recorded	No signs	Not present	None recorded	None recorded	**Lamprey (*Lampetra* sp.)**
E2	Ardreagh River	**None recorded but crayfish remains in otter spraint**	**Regular spraint site**	Not present	None recorded	None recorded	**Atlantic salmon, European eel**
E3	Lisduff Stream	None recorded	No signs	Not present	None recorded	None recorded	None recorded
E4	Tincashel River	None recorded	No signs	Not present	None recorded	None recorded	None recorded
E5	Clomantanagh Lower Stream	None recorded	No signs	Not present	None recorded	None recorded	None recorded
E6	Unnamed stream	None recorded	No signs	Not present	None recorded	None recorded	None recorded
E7	Gorteenahilla River	None recorded	**Regular spraint site**	Not present	None recorded	None recorded	**Atlantic salmon**
E8	Lismaine Stream	None recorded	No signs	Not present	None recorded	None recorded	None recorded
E9	Lisdowney Stream	None recorded	**Regular spraint site**	Not present	None recorded	None recorded	**Atlantic salmon, European eel**
E10	River Nore	None recorded	No signs	Not present	None recorded	None recorded	None recorded but Atlantic salmon, *Lampetra* sp. & European eel known
Lacustrine sites							
L1	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L2	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded

Site	Watercourse	White-clawed crayfish	Otter signs[4]	Annex I aquatic habitats	Rare or protected macrophytes/ aquatic bryophytes	Rare or protected macro-invertebrates	Other species/habitats of high conservation value
L3	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L4	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L5	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L6	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L7	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L8	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L9	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L10	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L11	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L12	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L13	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L14	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L15	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L16	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L17	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded

Conservation value: White-clawed crayfish (*Austropotamobius pallipes*), Atlantic salmon (*Salmo salar*), brook lamprey (L*ampetra planeri*), river lamprey (*Lampetra fluviatilis*) and Eurasian otter (*Lutra lutra*) are listed under Annex II and Annex V of the Directive on the Conservation of Natural Habitats of Wild Fauna and Flora (92/43/EEC) ('EU Habitats Directive'). White-clawed crayfish and otter are also protected under the Irish Wildlife Acts 1976-2023. White-clawed crayfish (Füreder et al., 2010) are listed as 'Endangered' according to the IUCN Red List. European eel are 'critically endangered' according to most recent ICUN red list (Pike et al., 2020) and listed as 'critically engendered' in Ireland (King et al., 2011). With the exception of the Inland Fisheries Acts 1959 to 2017, brown trout and coarse fish species have no legal protection in Ireland.

[4] Otter signs within 150m of the survey site

Table 4.3 Aquatic ecological evaluation summary of the Littleton wind farm survey sites according to NRA (2009) criteria

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
Riverine sites				
A1	Unnamed stream	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q3 (poor status) water quality (tentative)
A2	Unnamed stream	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q2-3 (poor status) water quality (tentative)
A3	Unnamed stream	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q2-3 (poor status) water quality (tentative)
A4	Unnamed stream	n/a	**Local importance (higher value)**	Salmonids recorded; site utilised by otter
A5	Clover River	16C04	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q3 (poor status) water quality (tentative)
A6	Clover River	16C04	**Local importance (higher value)**	Salmonids recorded; site utilised by otter
A7	Clover River	16C04	**Local importance (higher value)**	Salmonids (including Atlantic salmon) & lamprey (*Lampetra* sp.) recorded; site utilised by otter
B1	Drish River	16D02	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q3 (poor status) water quality (tentative)
B2	Drish River	16D02	**County importance**	Annex I hydrophilous tall herb [6430] present
B3	Drish River	16D02	**Local importance (higher value)**	Salmonids & lamprey (Lampetra sp.) recorded
B4	Drish River	16D02	**Local importance (higher value)**	Salmonids (including Atlantic salmon) recorded
B5	Drish River	16D02	**Local importance (higher value)**	Salmonids (including Atlantic salmon), lamprey (*Lampetra* sp.) & Red-listed European eel recorded; site utilised by otter; Q4 (good status) water quality
C1	Black River	16B01	Local importance (lower value)	No aquatic species or habitats of high conservation value (dry ephemeral site)
C2	Black River	16B01	**Local importance (higher value)**	Salmonids recorded
C3	North Glengoole River	16N28	**Local importance (higher value)**	Salmonids recorded

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
C4	Black River	16B01	**Local importance (higher value)**	Salmonids recorded
C5	Black River	16B01	**County importance**	Annex I floating river vegetation [3260] present
D1	Breegagh River	16B03	**Local importance (higher value)**	Salmonids (including Atlantic salmon) recorded; site utilised by otter
D2	Breegagh River	16B03	**Local importance (higher value)**	Salmonids (including Atlantic salmon) & lamprey (*Lampetra* sp.) recorded
D3	Breegagh River	16B03	**County importance**	Annex I floating river vegetation [3260] recorded
E1	River Goul	15G02	**Local importance (higher value)**	Salmonids (including Atlantic salmon) & lamprey (*Lampetra* sp.) recorded
E2	Ardreagh River	15A03	**Local importance (higher value)**	Salmonids (including Atlantic salmon) & Red-listed European eel recorded; site utilised by otter; white-clawed crayfish likely present (based on inclusion in otter spraint)
E3	Lisduff Stream	15L08	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q3 (poor status) water quality
E4	Tincashel River	15T05	**Local importance (higher value)**	Salmonids recorded
E5	Clomantanagh Lower Stream	15C91	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q2 (bad status) water quality (tentative)
E6	Unnamed stream	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value; Q3 (poor status) water quality

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
E7	Gorteenahilla River	15G08	**Local importance (higher value)**	Salmonids (including Atlantic salmon) recorded; site utilised by otter; Q4 (good status) water quality
E8	Lismaine Stream	15L16	**Local importance (higher value)**	Salmonids (including Atlantic salmon) recorded; site utilised by otter
E9	Lisdowney Stream	15L02	**Local importance (higher value)**	Salmonids (including Atlantic salmon) & Red-listed European eel recorded; site utilised by otter; Q4 (good status) water quality
E10	River Nore	15N01	**International importance**	Located within the River Barrow and River Nore SAC (002162) and River Nore SPA (004233)
Lacustrine sites				
L1	Lake/wetland	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value
L2	Lake/wetland	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value
L3	Lake/wetland	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value
L4	Lake/wetland	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value
L5	Lake/wetland	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value
L6	Lake/wetland	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value
L7	Lake/wetland	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value
L8	Lake/wetland	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value
L9	Lake/wetland	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value
L10	Lake/wetland	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
L11	Lake/wetland	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value
L12	Lake/wetland	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value
L13	Lake/wetland	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value
L14	Lake/wetland	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value
L15	Lake/wetland	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value
L16	Lake/wetland	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value
L17	Lake/wetland	n/a	Local importance (lower value)	No aquatic species or habitats of high conservation value

Conservation value: White-clawed crayfish (*Austropotamobius pallipes*), Atlantic salmon (*Salmo salar*), brook lamprey (L*ampetra planeri*), river lamprey (*Lampetra fluviatilis*) and Eurasian otter (*Lutra lutra*) are listed under Annex II and Annex V of the Directive on the Conservation of Natural Habitats of Wild Fauna and Flora (92/43/EEC) ('EU Habitats Directive'). White-clawed crayfish and otter are also protected under the Irish Wildlife Acts 1976-2023. White-clawed crayfish (Füreder et al., 2010) are listed as 'Endangered' according to the IUCN Red List. European eel are 'critically endangered' according to most recent ICUN red list (Pike et al., 2020) and listed as 'critically engendered' in Ireland (King et al., 2011). With the exception of the Inland Fisheries Acts 1959 to 2017, brown trout and coarse fish species have no legal protection in Ireland.

5. Discussion

The riverine watercourses in the vicinity of the proposed Littleton wind farm, inclusive of those crossed by the proposed GCR, were typically lowland channels which had been extensively straightened and or deepened historically as part of arterial drainage and land reclamation works, resulting in poor hydromorphology and reduced habitat heterogeneity. Whilst some good instream recovery had occurred locally (e.g. Drish River, Black River, Breegagh River, Lisdowney Stream), significant siltation and hydromorphological pressures were evident throughout the survey area. Nevertheless, the majority of the riverine survey sites were evaluated as at least **local importance (higher value)** in terms of their aquatic ecology due to the presence of high conservation value species (including Atlantic salmon, lamprey (*Lampetra* sp.), European eel and otter) or habitats (i.e. sites B2, C5 & D3) (**Table 4.2**). Site E10 on the River Nore (proposed GCR crossing) was evaluated as **international importance** given its location with both the River Barrow and River Nore SAC (002162) and River Nore SPA (004233).

The lakes and wetlands located within the proposed site boundary typically originate from historical cutover bog activities and as such are shallow, highly turbid (peat stained), poorly vegetated and of lower productivity, providing relatively poor habitat for many higher conservation value species or habitats. Nevertheless these sites supported a range of macroinvertebrate species and many were of high suitability for amphibians[2]. None of these lake/wetland sites corresponded to Annex I lake habitats (e.g. natural dystrophic lakes and ponds, 3160). All 18 no. lacustrine sites were of **local importance (lower value)** given the absence of aquatic species or habitats of high conservation value[2].

5.1 Fisheries

A typical diversity of fish species for Irish midland rivers – namely Atlantic salmon, brown trout, lamprey (*Lampetra* sp.), European eel, stone loach, minnow, pike, perch and three-spined stickleback – were recorded during the electro-fishing survey (**Table 4.1; Appendix A**). The recorded assemblages were in keeping with previous surveys of the area (Triturus, 2023).

Salmonid populations were widespread with the survey area, being present at 19 no. riverine sites. Atlantic salmon were recorded from a total of 11 no. sites[3] on the Clover River (A7), Drish River (B2, B4, B5), Black River (C5), Breegagh River (D1, D2, D3), Ardreagh River (E2), Gorteenahilla River (E7) and the Lisdowney Stream (E9). The quality of salmonid habitat was typically poor due to significant hydromorphological pressures resulting from arterial drainage (i.e. extensive straightening & deepening). However, particularly high densities of juvenile salmonids were recorded at sites B4, D3 and E7 (excellent quality salmonid nurseries) (**Appendix A**).

Lamprey ammocoetes (*Lampetra* sp.) were recorded from 6 no. sites on the Clover River (A7), Drish River (B3 & B5), Black River (C5), Breegagh River (D2) and River Goul (E1) during targeted electro-fishing (low to medium densities only). An early stage *Lampetra* sp. transformer were also recorded

[2] Many sites had high suitability for amphibians although a dedicated survey for smooth newt and common frog was beyond the scope of this survey. An environmental DNA approach would help to clarify the status of amphibians in these sites

[3] Atlantic salmon are also known from the River Nore in the vicinity of Ballyragget but electro-fishing was not feasible at site E10 due to prohibitive depths

at site A7. The restricted distribution of lamprey reflected the paucity of suitable nursery and or spawning habitat, primarily due to significant arterial drainage pressures (**Appendix A**).

Red-listed European eel were recorded in low densities at a total of 6 no. sites on the Drish River (B2 & B5), Black River (C5), Breegagh River (D3), Ardreagh River (E2) and the Lisdowney Stream (E9) (**Table 4.1; Appendix A**). The paucity of eel recorded during the electro-fishing surveys was considered to reflect a combination sub-optimal habitat and widespread migration barriers in the survey catchments (**Appendix A**).

Whilst some of the more mature cutover lake/wetland survey sites had inherently more aquatic value, none were considered of significant fisheries value (stickleback only) due to their generally very shallow nature, peat substrata, lower pH and poor connectivity or isolation from other aquatic habitats supporting fish populations. There was some low European eel potential in those lakes situated in close proximity to the riverine watercourses found to or known to support the species (e.g. sites L13, L14, L17).

5.2 Otter

Despite widespread suitability, only a low number of otter signs (7 no.) were recorded across 47 no. survey sites. All were recorded from riverine sites with the lakes surveyed providing poor otter habitat, primarily due to insufficient prey resources. Spraint sites (mostly regular) were recorded at sites on the Clover River (A6) and unnamed tributary (A4), Breegagh River (D1 & D3), Ardreagh River (E2), Gorteenahilla River (E7) and the Lisdowney Stream (E9).

This paucity of signs was considered to mainly reflect the influence of historical instream modifications (straightening, deepening) on the health and distribution of fish populations, the key prey resource of otter (Krawczyk et al., 2016; Ruiz-Olmo & Jiménez, 2009). Otters are food-limited and prey availability is a crucial factor in determining mortality, breeding success and the status of local populations (Sittenthaler et al., 2019; Ruiz-Olmo et al., 2002). Furthermore, otter sign marking is routinely associated with prominent features such as large instream boulders and tree root systems (Almeida et al., 2012). Historical drainage, such as that carried out historically in the vicinity of the proposed project, significantly reduces instream habitat heterogeneity (O'Grady, 2017) and the availability or marking areas (outposts), which therefore results in the deposition and detection of fewer otter signs such as spraints, irrespective of watercourse utilisation (e.g. for foraging).

No breeding (holt) or couch (resting) areas were identified in the vicinity of the survey sites in September-October 2023.

5.3 White-clawed crayfish

Despite suitability at numerous sites, no live white-clawed crayfish were recorded during targeted surveys in September-October 2023. However, recent crayfish remains were identified in otter spraint at site E2 on the Ardreagh River, a tributary of the River Goul (**Plate 4.48**). This would indicate the presence of crayfish in the vicinity of the site. Indeed, contemporary and historic records are available for the downstream-connecting River Goul, including the capture of a juvenile crayfish downstream of Urlingford in 2022 (Triturus data) (**Figure 3.1**). Incidentally, white-clawed crayfish eDNA was

detected at sites on the Clover River, Black River, Drish River and Breegagh River in 2021 (Triturus, 2023).

Most of the 17 no. survey lakes/wetlands were inherently unsuitable for the white-clawed crayfish given their unsuitable peat geologies, water chemistry (humic/acidic) and physical habitat attributes (Demers et al., 2005; Lucey & McGarrigle, 1987). However, there was good suitability at site L17, a small artificial alkaline lake adjacent to Loch Doire Bhile, a site known to support crayfish (NPWS data). No crayfish were recorded from site L17 via hand searching or sweep netting in the current survey.

5.4 Macrophytes and Annex I habitats

No rare or protected macrophytes or aquatic bryophytes were recorded at the riverine or lacustrine survey sites in September-October 2023.

Sites C5 on the Black River and D3 on the Breegagh River supported the Annex I habitat 'Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* (low water level during summer) or aquatic mosses [3260]' (aka floating river vegetation, FRV). This was based on the presence of several key indicator species including water crowfoot (*Ranunculus* sp.), water starwort (*Callitriche* sp.) and a high coverage of aquatic bryophytes such as *Fontinalis antipyretica* and *Chiloscyphus polyanthos.* Numerous studies have shown that both *Ranunculus*-dominated and bryophyte-rich areas provide particularly valuable habitat for juvenile salmonids (e.g. Marsh et al., 2020) and this was observed at this site during the survey.

Based on the presence of several indicator species (EC, 2013; Devaney, 2013), including *Lythrum salicaria, Epilobium hirsutum, Solanum dulcamara*, *Calystegia sepium, Myosotis scorpioides, Mentha aquatica* and *Galium palustre,* the heavily modified Drish River at site B2 supported the Annex I habitat 'Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]'. This habitat often forms along unmanaged margins of lowland rivers (Devaney et al., 2013).

The presence of these Annex I habitats resulted in the evaluation of these sites as **county importance** (as per NRA, 2009).

5.5 Macroinvertebrates & biological water quality

No rare or protected macro-invertebrate species (according to national red lists) were recorded in the biological water quality samples taken from 28 no. wetted riverine sites in September 2023 or 17 no. sweep samples from lake sites in October 2023 (**Appendix B**). Whilst not protected, the nationally uncommon water stick insect *Ranatra linearis*, a recent discovery in Ireland (Nelson, 2018), was recorded at site L1 (**Plate 4.49**).

A total of 3 no. sites on the Drish River (B5), Gorteenahilla River (E7) and Lisdowney Stream (E9) achieved **Q4 (good status)** water quality and thus met the target good status (≥Q4) requirements of the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 and the Water Framework Directive (2000/60/EC) (**Figure 4.1**). The remaining 25 no. riverine sample sites achieved **Q3-4 (moderate status)** (sites A7, D1, D3 & E10), **Q2-3 or Q3 (poor status)** (sites A1, A2, A3,

A4, A5, A6, B1, B2, B3, B4, C2, C3, C4, C5, D2, E1, E2, E3, E4, E6 &E8) or Q2 (bad status) (site E5) in September 2023.

With the exception of sites B5, E7 and E9, the biological water quality in the vicinity of the proposed project was unsatisfactory and was not meeting good status targets. Peat extraction (leading to siltation) and forestry are the significant threats to water quality in the survey area (EPA, 2019). Furthermore, low summer flows and widespread hydromorphological modifications also influenced biological water quality in September 2023.

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7. Appendix A – fisheries assessment report

Please see accompanying fisheries assessment report

8. Appendix B – Q-sample results (biological water quality) & lacustrine macroinvertebrates

Table 8.1 Macro-invertebrate Q-sampling results for riverine sites A1-A7 & B1-B5 in the vicinity of Littleton wind farm, September 2023

Group	Family	Species	A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	EPA group
Ephemeroptera	Heptageniidae	*Heptagenia sulphurea*							2					14	**A**
Ephemeroptera	Baetidae	*Alainites muticus*							2				5	10	**B**
Plecoptera	Leuctridae	*Leuctra fusca*						2	8					12	**B**
Trichoptera	Cased caddis pupa	sp. indet.	1						2						**B**
Trichoptera	Glossosomatidae	*Agapetus fuscipes*											22	1	**B**
Trichoptera	Goeridae	*Silo pallipes*							1				1		**B**
Trichoptera	Lepidostomatidae	*Lepidostoma hirtum*											13		**B**
Trichoptera	Limnephilidae	*Halesus radiatus*							1						**B**
Trichoptera	Limnephilidae	*Limnephilus marmoratus*	2				6								**B**
Trichoptera	Limnephilidae	*Potamophylax cingulatus*						5	18	1	1				**B**
Trichoptera	Phryganeidae	*Agrypnia obsoleta*								2	1				**B**
Trichoptera	Sericostomatidae	*Sericostoma personatum*						22					5	10	**B**
Odonata	Calopterygidae	*Calopteryx splendens*				3									**B**
Odonata	Coenagrionidae	sp. indet.	5			6	8			4	2				**B**
Odonata	Libellulidae	*Orthetrum cancellatum*								3	1				**B**
Ephemeroptera	Baetidae	*Baetis rhodani*		3				16	7				62	79	**C**
Ephemeroptera	Ephemerellidae	*Serratella ignita*						6	1				18	1	**C**
Trichoptera	Hydropsychidae	*Hydropsyche instabilis*						13	11				8		**C**
Trichoptera	Polycentropodidae	*Polycentropus flavomaculatus*							6					1	**C**
Trichoptera	Polycentropodidae	*Polycentropus kingi*							6						**C**
Trichoptera	Rhyacophilidae	*Rhyacophila dorsalis*											1	1	**C**
Crustacea	Gammaridae	*Gammarus duebeni*	6			26		55	14	102	181	77	82	76	**C**
Coleoptera	Dytiscidae	*Colymbetes fuscus*					1								**C**
Coleoptera	Dytiscidae	Dytiscidae larva	1			1					3				**C**
Coleoptera	Dytiscidae	*Hyphydrus ovatus*									1				**C**

Group	Family	Species	A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	EPA group
Coleoptera	Dytiscidae	*Ilybius fuliginosus*								1	1				**C**
Coleoptera	Dytiscidae	*Stictotarsus duodecimpustulatus*				1									C
Coleoptera	Elmidae	*Brychius elevatus*									2		24		C
Coleoptera	Elmidae	*Elmis aenea*							8				10	4	**C**
Coleoptera	Elmidae	*Limnius volckmari*							5				9	18	C
Coleoptera	Gyrinidae	Gyrinidae larva		1		2			2						C
Coleoptera	Gyrinidae	*Gyrinus substriatus*	2	2		5					1				C
Coleoptera	Haliplidae	*Haliplus ruficollis* group				9	2								**C**
Coleoptera	Hydrophilidae	*Helophorus grandis*					1								C
Diptera	Chironomidae	Non-*Chironomus* spp.	1	2	4	14			6					1	C
Diptera	Dixidae	sp. indet.			8		1								C
Diptera	Tipulidae	*Tipula* sp.	1	3											C
Diptera	Simuliidae	sp. indet.			16				37					5	C
Hemiptera	Corixidae	Corixidae nymph				1									C
Hemiptera	Corixidae	*Hesperocorixa linnaei*	3			9									C
Hemiptera	Gerridae	*Gerris* sp.	3	3		1			1	6				1	C
Hemiptera	Gerridae	Gerridae nymph		1						1			1		C
Hemiptera	Hydrometridae	*Hydrometra stagnorum*					1								C
Hemiptera	Nepidae	*Nepa cinerea*				2	3								C
Hemiptera	Notonectidae	*Notonecta viridis*									12				C
Gastropoda	Lymnaeidae	*Stagnicola fuscus*				6				1					C
Gastropoda	Lymnaeidae	*Lymnaea stagnalis*									4	2			C
Gastropoda	Planorbidae	*Bathyomphalus contortus*				1									C
Gastropoda	Planorbidae	*Planorbis planorbis*	1			15	31			41	11	5			C
Gastropoda	Planorbidae	*Ancylus fluviatilis*											8	3	C
Gastropoda	Tateidae	*Potamopyrgus antipodarum*				16		34	87		1	2	12	10	C
Platyhelminthes	Tricladida	sp. indet.		1								142	1		C

Group	Family	Species	A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	EPA group
Arachnida	Hydrachnidiae	sp. indet.	5			1	1								**C**
Crustacea	Asellidae	*Asellus aquaticus*	1	17	25	7	22		6		84	103	1		**D**
Mollusca	Lymnaeidae	*Ampullacaena balthica*				18	6	4					3	6	**D**
Mollusca	Physidae	*Physa fontinalis*								64	54	32			**D**
Mollusca	Sphaeriidae	sp. indet.	3	2				12	5		1	21			**D**
Hirudinidae	Glossiphoniidae	*Glossiphonia complanata*					1	4			2				**D**
Hirudinidae	Glossiphoniidae	sp. indet.		1					1						**D**
Megaloptera	Sialidae	*Sialis lutaria*									3				**D**
Diptera	Chironomidae	*Chironomus* spp.			8	5						2			**E**
Annelidae	Oligochaeta	sp. indet.			2								10	7	**n/a**
Abundance			**35**	**36**	**63**	**149**	**84**	**173**	**237**	**226**	**366**	**386**	**296**	**260**	
Q-rating			*Q3	*Q2-3	*Q2-3	*Q3	*Q3	Q3	Q3-4	*Q3	Q2-3	Q2-3	Q3	Q4	
WFD status			Poor	Poor	Poor	Poor	Poor	Poor	Mod	Poor	Poor	Poor	Poor	Good	

* tentative rating due to poor flows and or lack of suitable riffle areas for sampling (as per Toner et al., 2005)

Table 8.2 Macro-invertebrate Q-sampling results for riverine sites C2-C5, D1-D3 & E1-E5 in the vicinity of Littleton wind farm, September 2023

Group	Family	Species	C2	C3	C4	C5	D1	D2	D3	E1	E2	E3	E4	E5	EPA group
Ephemeroptera	Heptageniidae	*Ecdyonurus dispar*					4		1						**A**
Ephemeroptera	Baetidae	*Alainites muticus*				2	6	6	6				5		**B**
Plecoptera	Leuctridae	*Leuctra fusca*					4								**B**
Trichoptera	Cased caddis pupa	sp. indet.						1					1		**B**
Trichoptera	Glossosomatidae	*Agapetus fuscipes*					16	39	46	32			12		**B**
Trichoptera	Goeridae	*Silo pallipes*					1	3	2	1			23		**B**
Trichoptera	Lepidostomatidae	*Lepidostoma hirtum*									1				**B**
Trichoptera	Limnephilidae	*Drusus annulatus*					4					1			**B**
Trichoptera	Limnephilidae	*Halesus radiatus*				2									**B**
Trichoptera	Limnephilidae	*Limnephilus marmoratus*							1						**B**
Trichoptera	Limnephilidae	*Potamophylax cingulatus*	6	1	3	1				1	1				**B**
Trichoptera	Limnephilidae	*Stenophylax permistus*											11		**B**
Trichoptera	Sericostomatidae	*Sericostoma personatum*	5	13	1			5	9	9	5				**B**
Ephemeroptera	Baetidae	*Baetis rhodani*		66	21	32	59	39	81	18	12	8	55		**C**
Ephemeroptera	Ephemerellidae	*Serratella ignita*					12	1	14	5			6		**C**
Trichoptera	Hydropsychidae	*Hydropsyche instabilis*	7	2	2	6	11	8							**C**
Trichoptera	Polycentropodidae	*Plectrocnemia conspersa*				2									**C**
Trichoptera	Polycentropodidae	*Polycentropus kingi*				1			1						**C**
Trichoptera	Rhyacophilidae	*Rhyacophila dorsalis*		4					1		3		2		**C**
Crustacea	Gammaridae	*Gammarus duebeni*	24	31	23	42	25	92	42	16	48	3	35		**C**
Coleoptera	Dytiscidae	Dytiscidae larva			1										**C**
Coleoptera	Dytiscidae	*Ilybius fuliginosus*									1				**C**
Coleoptera	Elmidae	*Brychius elevatus*							2						**C**
Coleoptera	Elmidae	*Elmis aenea*		9	2	12	20	12	4		10		14		**C**
Coleoptera	Elmidae	*Limnius volckmari*						5	1		2		12		**C**

Group	Family	Species	C2	C3	C4	C5	D1	D2	D3	E1	E2	E3	E4	E5	EPA group
Coleoptera	Gyrinidae	Gyrinidae larva			1	2									C
Diptera	Chironomidae	Non-*Chironomus* spp.			2			3	2			4	1	1	C
Diptera	Dixidae	sp. indet.										1		2	C
Diptera	Tipulidae	*Tipula* sp.									1	1			C
Diptera	Limoniidae	*Antocha sp.*		3							4				C
Diptera	Pediciidae	*Dicranota sp.*					5	1					1		C
Diptera	Simuliidae	sp. indet.	10		14	223	5	48	29	13	18	14	2		C
Hemiptera	Gerridae	*Gerris* sp.				2			10	4				2	C
Hemiptera	Gerridae	Gerridae nymph								1					C
Gastropoda	Planorbidae	*Planorbis planorbis*			1										C
Gastropoda	Planorbidae	*Ancylus fluviatilis*	2								3				C
Gastropoda	Tateidae	*Potamopyrgus antipodarum*	44	41	12	65	5	21	26		11	6	10		C
Platyhelminthes	Tricladida	sp. indet.			1										C
Arachnida	Hydrachnidiae	sp. indet.			2	4		5		3					C
Crustacea	Asellidae	*Asellus aquaticus*			2	4		1		15		23	4	12	D
Mollusca	Sphaeriidae	sp. indet.	8	1	13	2								3	D
Hirudinidae	Glossiphoniidae	*Glossiphonia complanata*		2	1					9				1	D
Hirudinidae	Glossiphoniidae	sp. indet.											1		D
Diptera	Chironomidae	*Chironomus* spp.		1	1	4	1	3						14	E
Annelidae	Oligochaeta	sp. indet.	4	4	3	1	7	8	1		2	2	3	4	n/a
Abundance			**110**	**178**	**106**	**407**	**185**	**301**	**279**	**127**	**122**	**63**	**198**	**39**	
Q-rating			Q3	Q3	Q3	Q3	Q3-4	Q3	Q3-4	Q3	Q3	Q3	Q3	*Q2	
WFD status			Poor	Poor	Poor	Poor	Mod	Poor	Mod	Poor	Poor	Poor	Poor	Bad	

* tentative rating due to poor flows and or lack of suitable riffle areas for sampling (as per Toner et al., 2005)

Table 8.3 Macro-invertebrate Q-sampling results for riverine sites E6, E7, E8 & E9 in the vicinity of Littleton wind farm, September 2023

Group	Family	Species	E6	E7	E8	E9	E10	EPA group
Ephemeroptera	Heptageniidae	*Ecdyonurus dispar*		7		4		**A**
Ephemeroptera	Heptageniidae	*Rhithrogena semicolorata*		1			1	**A**
Ephemeroptera	Baetidae	*Alainites muticus*		1			1	**B**
Plecoptera	Leuctridae	*Leuctra fusc*		4	2	3	6	**B**
Trichoptera	Cased caddis pupa	sp. indet.	2					**B**
Trichoptera	Glossosomatidae	*Agapetus fuscipes*	11	2				**B**
Trichoptera	Goeridae	*Silo pallipes*	4	5	4			**B**
Trichoptera	Limnephilidae	*Drusus annulatus*		1				**B**
Trichoptera	Limnephilidae	*Potamophylax cingulatus*			6			**B**
Trichoptera	Sericostomatidae	*Sericostoma personatum*	2	2	10	4	3	**B**
Odonata	Coenagrionidae	sp. indet.					1	**B**
Ephemeroptera	Baetidae	*Baetis rhodani*	16	23	12	14	21	**C**
Ephemeroptera	Caenidae	*Caenis rivulorum*		1		1	1	**C**
Ephemeroptera	Ephemerellidae	*Serratella ignita*	1	2		1	4	**C**
Trichoptera	Hydropsychidae	*Hydropsyche instabilis*	1			2		**C**
Trichoptera	Hydropsychidae	*Hydropsyche siltalai*		1			2	**C**
Trichoptera	Rhyacophilidae	*Rhyacophila dorsalis*		5				**C**
Crustacea	Gammaridae	*Gammarus duebeni*		5	21	16	16	**C**
Coleoptera	Elmidae	*Elmis aenea*		3		4		**C**
Diptera	Dixidae	sp. indet.	1					**C**
Diptera	Pediciidae	*Dicranota sp.*		1		2		**C**
Diptera	Simuliidae	sp. indet.	65	22	15			**C**
Hemiptera	Gerridae	Gerridae nymph		1				**C**
Gastropoda	Lymnaeidae	*Stagnicola fuscus*			3			**C**
Gastropoda	Lymnaeidae	*Lymnaea stagnalis*					2	**C**

Group	Family	Species	E6	E7	E8	E9	E10	EPA group
Gastropoda	Planorbidae	*Bathyomphalus contortus*			3		1	**C**
Gastropoda	Tateidae	*Potamopyrgus antipodarum*	11	1	8		9	**C**
Platyhelminthes	Tricladida	sp. indet.	2					**C**
Arachnida	Hydrachnidiae	sp. indet.			2		1	**C**
Crustacea	Asellidae	*Asellus aquaticus*			10	2	6	**D**
Mollusca	Lymnaeidae	*Ampullacaena balthica*			5			**D**
Mollusca	Sphaeriidae	sp. indet.			3		6	**D**
Annelidae	Oligochaeta	sp. indet.	2		3			**n/a**
Abundance			**118**	**88**	**107**	**53**	**81**	
Q-rating			Q3	Q4	Q3	Q4	Q3-4	
WFD status			Poor	Good	Poor	Good	Mod	

Table 8.4 Macro-invertebrate sweep sample results for lake sites L1-L10 no. lake/wetland sites in the vicinity of Littleton wind farm, October 2023

Group	Family	Species	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10
Ephemeroptera	Baetidae	*Cloeon* sp.	8		21	16			14		21	4
Ephemeroptera	Caenidae	*Caenis horaria*					3					
Ephemeroptera	Caenidae	*Caenis rivulorum*	1									
Trichoptera	Leptoceridae	*Athripsodes aterrimus*					5					1
Trichoptera	Leptoceridae	*Mystacides longicornis*					2					
Trichoptera	Limnephilidae	sp. indet. (early instar)			4		1					
Trichoptera	Phryganeidae	*Agrypnia obsoleta*	1	19	1	3						3
Trichoptera	Polycentropodidae	*Plectrocnemia conspersa*	5		2	6						
Odonata	Aeshnidae	*Anax imperator*	3	4	5				1			
Odonata	Libellulidae	*Sympetrum* sp.	4	4	3	4			4			3
Odonata	Coenagrionidae	sp. indet.	54	73	64	41	21	2	29	8	2	8
Coleoptera	Dytiscidae	*Acilius canaliculatus*							1			
Coleoptera	Dytiscidae	Dytiscidae larva	2			1						
Coleoptera	Dytiscidae	*Hydroporus palustris*							1			
Coleoptera	Dytiscidae	*Hyphydrus ovatus*	3				2					
Coleoptera	Dytiscidae	*Nebrioporus depressus*					2					
Coleoptera	Gyrinidae	*Gyrinus aeratus*	2	6			3					2
Coleoptera	Gyrinidae	*Gyrinus substriatus*		2				3		4		
Coleoptera	Halipliidae	*Haliplus ruficollis* group					6		1			
Coleoptera	Hydrophilidae	*Helophorus brevipalpis*							1	1		
Coleoptera	Hydrophilidae	*Laccobius minutus*							1			
Coleoptera	Noteridae	*Noterus clavicornis*					4		3			
Diptera	Chaoboridae	sp. indet.				22		2				
Diptera	Chironomidae	*Chironomus* spp.		8	6	16	10	16	4	8		6
Diptera	Chironomidae	Non-*Chironomus* spp.		3	1	5	4	1			2	2

Group	Family	Species	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10
Diptera	Dixidae	sp. indet.							18			1
Mollusca	Lymnaeidae	*Ampullacaena balthica*	7		3		2	109	46			
Mollusca	Lymnaeidae	*Galba truncatula*			6		1					
Mollusca	Planorbidae	*Gyraulis crista*							1			
Mollusca	Planorbidae	*Planorbis planorbis*								8		
Mollusca	Sphaeriidae	sp. indet.	11	42	104	108		2	20	5		
Mollusca	Tateidae	*Potamopyrgus antipodarum*							39			
Hemiptera	Corixidae	*Corixa panzeri*								53		
Hemiptera	Corixidae	*Corixa punctata*							4			
Hemiptera	Corixidae	*Cymatia bonsdorfii*	3	26								
Hemiptera	Corixidae	*Hesperocorixa linnaei*	19		53	42	16		32	1		3
Hemiptera	Corixidae	*Hesperocorixa sahlbergi*								1	8	
Hemiptera	Gerridae	*Gerris* sp.								1		1
Hemiptera	Nepidae	*Ranatra linearis*	2									
Arachnida	Hydrachnidiae	sp. indet.					7					
Arachnida	Dictynidae	*Argyroneta aquatica*					2		1			1
Hirudinidae	Glossiphoniidae	sp. indet.			1							
Crustacea	Asellidae	*Asellus aquaticus*	22				1		1			
Abundance			**147**	**187**	**274**	**264**	**92**	**135**	**222**	**90**	**33**	**35**

Table 8.5 Macro-invertebrate sweep sample results for lake sites L11-L17 no. lake/wetland sites in the vicinity of Littleton wind farm, October 2023

Group	Family	Species	L11	L12	L13	L14	L15	L16	L17
Ephemeroptera	Baetidae	*Centroptilum luteolum*							13
Ephemeroptera	Baetidae	*Cloeon simile*							2
Ephemeroptera	Baetidae	*Cloeon* sp.			3		38		
Ephemeroptera	Caenidae	*Caenis horaria*							19
Trichoptera	Limnephilidae	*Limnephilus marmoratus*							
Odonata	Aeshnidae	*Aeshna* sp.							1
Odonata	Aeshnidae	*Anax imperator*							2
Odonata	Libellulidae	*Sympetrum* sp.		6	2		1	2	5
Odonata	Coenagrionidae	sp. indet.	6	12	16	5	8	26	11
Coleoptera	Dytiscidae	Dytiscidae larva				3			
Coleoptera	Dytiscidae	*Graptodytes pictus*							
Coleoptera	Dytiscidae	*Nebrioporus depressus*		1					
Coleoptera	Gyrinidae	*Gyrinus aeratus*	6			1			
Coleoptera	Gyrinidae	*Gyrinus substriatus*			3	1		1	
Coleoptera	Haliplidae	*Haliplus ruficollis* group	1					4	1
Coleoptera	Noteridae	*Noterus clavicornis*			1				
Diptera	Chaoboridae	sp. indet.	2	1					
Diptera	Chironomidae	*Chironomus* spp.		1	3		2		3
Diptera	Chironomidae	Non-*Chironomus* spp.	6	9			2	16	1
Mollusca	Lymnaeidae	*Ampullacaena balthica*		4					
Mollusca	Lymnaeidae	*Lymnaea stagnalis*		2					
Mollusca	Sphaeriidae	sp. indet.							1
Mollusca	Tateidae	*Potamopyrgus antipodarum*							7
Hemiptera	Notonectidae	*Notonecta marmorea viridis*				2	1	3	
Hemiptera	Corixidae	*Corixa panzeri*					2	1	

Group	Family	Species	L11	L12	L13	L14	L15	L16	L17
Hemiptera	Corixidae	*Corixa punctata*		2					
Hemiptera	Corixidae	*Hesperocorixa linnaei*						1	
Hemiptera	Corixidae	*Hesperocorixa sahlbergi*	3	1	14	12	5	1	
Hemiptera	Corixidae	*Sigara* sp.							
Hemiptera	Gerridae	*Gerris* sp.				2			
Arachnida	Hydrachnidiae	sp. indet.		2	3	6		6	
Arachnida	Dictynidae	*Argyroneta aquatica*	2					2	
Crustacea	Asellidae	*Asellus aquaticus*	9	6					
Abundance			**35**	**47**	**45**	**32**	**59**	**63**	**66**



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Fisheries assessment of Littleton wind farm, Co. Tipperary

Prepared by Triturus Environmental Ltd. for Fehily Timoney & Company

March 2024

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1. Introduction

1.1 Background

Triturus Environmental Ltd. were contracted by Fehily Timoney & Company to undertake a baseline fisheries assessment of numerous watercourses in the vicinity of the proposed Littleton wind farm, located near Littleton, Co. Tipperary (**Figure 2.1**).

The survey was undertaken to establish baseline fisheries data used in the preparation of the EIAR for the proposed project. In order to gain an accurate overview of the existing and potential fisheries value of the riverine watercourses within the vicinity of the proposed wind farm, a catchment-wide electro-fishing survey across 30 no. riverine sites was undertaken (**Table 2.1; Figure 2.1**)**.** Electro-fishing helped to identify the importance of the watercourses as nurseries and habitats for salmonids, lamprey and European eel (*Anguilla anguilla*), as well as other species, and helped to further inform impact assessment and any subsequent mitigation for the project. Furthermore, a fisheries habitat appraisal was undertaken at 17 no. lake/wetland habitats in October 2023 (**Table 2.1; Figure 2.2**). The surveys would serve to update previous surveys of the site (by Triturus in 2021) whilst also accounting for any changes in proposed infrastructure and site layout in the interim period.

Triturus Environmental Ltd. made an application under Section 14 of the Fisheries (Consolidation) Act, 1959 as substituted by Section 4 of the Fisheries (Amendment) Act, 1962, to undertake a catchment-wide electro-fishing survey in the vicinity of the proposed Littleton wind farm. The surveys were undertaken in September (riverine sites) and October (lake sites) 2023.

1.2 Fisheries asset of the survey area

The aquatic fisheries sites were located within the Suir_SC_040, Goul_SC_010 and Nore_SC_070 river sub-catchments within the South Eastern River Basin District and hydrometric areas 15 (Nore) and 16 (Suir). Survey sites survey sites were present on the Clover River (EPA code: 16C04), Drish River (16D02), Black River (16B01), North Glengoole River (16N28), Breegagh River (16B03), River Goul (15G02), Ardreagh River (15A03), Lisduff Stream (15L08), Tincashel River (15T05), Clomantanagh Lower Stream (15C91), Gorteenahilla River (15G08), Lismaine Stream (15L16), Lisdowney Stream (15L02), River Nore (15N01) and several unnamed watercourses, in addition to 17 no. lake/wetland habitats in cutover bog (**Table 2.1**).

The Drish River, a tributary of the River Suir, is known to support *Lampetra* sp. (O'Connor, 2007; Kurz & Costello, 1999) as well as Atlantic salmon (*Salmo salar*), brown trout (*Salmo trutta*) and pike (*Esox lucius*) (1993 data presented in AECOM, 2020). The trout and pike in the Drish were found to be fast growing and similar to those in comparable rivers in the Irish midlands (CFB data referenced in AECOM, 2020). The river suffered significant pollution from a zinc and lead mine at Lisheen until the recent past (AECOM, 2020; O'Connor, 2007).

The Clover River, a tributary of the Drish River, is known to support brown trout, three-spined stickleback (*Gasterosteus aculeatus*), perch (*Perca fluviatilis*) and stone loach (*Barbatula barbatula*)

(Triturus 2021 data). The Breegagh River, another Drish River tributary, also supports brown trout, stone loach and three-spined stickleback in addition to Atlantic salmon and *Lampetra* sp. (Triturus 2021 data). The Black River (Two Mile Borris) is known to support Atlantic salmon, brown trout, European eel and stone loach (Triturus 2021 data) in addition to lamprey *Lampetra* sp. (O'Connor, 2007). The North Glengoole River, a Black River tributary, supports Atlantic salmon, brown trout, European eel and three-spined stickleback (Triturus 2021 data).

In terms of the proposed GCR option, the route crosses the River Goul and several tributaries (Ardreagh River, Lisduff Stream & Tincashel River) which are known to support Atlantic salmon, brown trout, stone loach and three-spined stickleback (IFI 2021 data). The Gorteenahilla River, a tributary of the Nuenna River, supports Atlantic salmon, brown trout, *Lampetra* sp. and three-spined stickleback (Triturus 2021-2022 data). The Lismaine Stream frequently runs dry and provides poor quality fisheries habitat (Triturus data). The Lisdowney Stream, a River Nore tributary, supports Atlantic salmon, brown trout, European eel and three-spined stickleback (Triturus 2021 data; IFI 2021 data). The River Nore in the vicinity of Ballyragget supports a range of fish species including Atlantic salmon, brown trout, *Lampetra* sp., European eel, minnow (*Phoxinus phoxinus*), stone loach and rudd (*Scardinius erythropthalmus*) (Triturus 2021 data).

Fisheries data for the other watercourses surveyed was not available at the time of survey.

2. Methodology

2.1 Fish stock assessment (electro-fishing)

A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish sites on watercourses in the vicinity of the proposed Littleton wind farm (**Table 2.1, Figure 2.1**) on the 5th, 6th, 7th and 21st September 2023 following notification to Inland Fisheries Ireland and under the conditions of a Department of the Environment, Climate and Communications (DECC) licence. Both river and holding tank water temperature was monitored continually throughout the survey to ensure temperatures of 20°C were not exceeded, thus minimising stress to the captured fish due to low dissolved oxygen levels. A portable battery-powered aerator was also used to further reduce stress to any captured fish contained in the holding tank.

Salmonids, European eel and other captured fish species were transferred to a holding container with oxygenated fresh river water following capture. To reduce fish stress levels, anaesthesia was not applied to captured fish. All fish were measured to the nearest millimetre and released in-situ following a suitable recovery period.

As three primary species groups were targeted during the survey, i.e., salmonids, lamprey, and eel, the electro-fishing settings were tailored for each species. By undertaking electro-fishing using the rapid electro-fishing technique (see methodology below), the broad characterisation of the fish community at each sampling reach could be determined as a longer representative length of channel can be surveyed. Electro-fishing methodology followed accepted European standards (CEN, 2003) and adhered to best practice (e.g., CFB, 2008).

2.1.1 Salmonids and European eel

For salmonid species and European eel, as well as all other incidental species, electro-fishing was carried out in an upstream direction for a 10-minute CPUE, an increasingly common standard approach for wadable streams (Matson et al., 2018). A total of approx. 50-100m channel length was surveyed at each site, where feasible, in order to gain a better representation of fish stock assemblages. At certain, more minor watercourse sites or sites with limited access, it was more feasible to undertake electro-fishing for a 5-minute CPUE. Discrepancies in fishing effort (CPUE) between sites are accounted for in the subsequent results section (**Table 3.1**).

Relative conductivity of the water at each site was checked in-situ with a conductivity meter and the electro-fishing backpack was energised with the appropriate voltage and frequency to provide enough draw to attract salmonids and European eel to the anode without harm. For the moderate to high conductivity waters of the sites (draining calcareous geologies) a voltage of 200-250v, frequency of 35-40Hz and pulse duration of 3.5-4ms was utilised to draw fish to the anode without causing physical damage.

2.1.2 Lamprey

Electro-fishing for lamprey ammocoetes was conducted using targeted electro-fishing (as per Harvey

& Cowx, 2003) in objectively suitable areas of sand/silt, where encountered. As lamprey take longer to emerge from silts and require a more persistent approach, they were targeted at a lower frequency (30Hz) burst DC pulse setting which also allowed detection of European eel in sediment, if present. Settings for lamprey followed those recommended and used by Harvey & Cowx (2003), APEM (2004) and Niven & McAuley (2013). Using this approach, the anode was placed under the water's surface, approx. 10-15cm above the sediment, to prevent immobilising lamprey ammocoetes within the sediment. The anode was energised with 100V of pulsed DC for 15-20 seconds and then turned off for approximately five seconds to allow ammocoetes to emerge from their burrows. The anode was switched on and off in this way for approximately two minutes. Immobilised ammocoetes were collected by a second operator using a fine-mesh hand net as they emerged.

Lamprey species were identified to species level, where possible, with the assistance of a hand lens, through external pigmentation patterns and trunk myomere counts as described by Potter & Osborne (1975) and Gardiner (2003).

2.2 Fisheries habitat

A fisheries habitat appraisal of all 47 no. aquatic survey sites (including lakes) was undertaken to establish their fisheries value. The surveys focused on evaluating the spawning, nursery and or holding habitat for salmonids and lamprey species but also considered European eel and other fish species. The appraisals of salmonids and lamprey were cognisant of species-specific habitat requirements and preferences as outlined in O'Grady (2006), Hendry et al. (2003), Armstrong et al. (2003), Harvey & Cowx (2003), Maitland (2003) and Hendry & Cragg-Hine (1997). River habitat surveys and fisheries assessments were also carried out utilising elements of the approaches in the River Habitat Survey Methodology (Environment Agency, 2003) and Fishery Assessment Methodology (O'Grady, 2006) to broadly characterise the riverine sites (i.e., channel profiles, substrata etc.).

2.3 Biosecurity

A strict biosecurity protocol following IFI (2010) and the Check-Clean-Dry approach was adhered to during surveys for all equipment and PPE used. Disinfection of all equipment and PPE before and after use with Virkon™ was conducted to prevent the transfer of pathogens or invasive propagules between survey sites. Specific consideration was given to highly virulent crayfish plague (*Aphanomyces astaci*) given the known occurrence of both white-clawed crayfish in the survey area and crayfish plague in the downstream-connecting catchment. Surveys were undertaken at sites in a downstream order to minimise the risk of upstream propagule mobilisation of pathogens and invasive species. Where feasible, equipment was also thoroughly dried (through UV exposure) between survey areas. Any aquatic invasive species or pathogens recorded within or adjoining the survey areas were geo-referenced. All Triturus staff are certified in 'Good fieldwork practice: slowing the spread of invasive non-native species' by the University of Leeds.

Table 2.1 Location of 47 no. electro-fishing & fisheries appraisal sites in the vicinity of Littleton wind farm, Co. Tipperary, September 2023

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)	GCR crossing
Electro-fishing sites						
A1	Unnamed stream	n/a	Longfordpass North	622135	660772	
A2	Unnamed stream	n/a	Clooncleagh	619285	660881	
A3	Unnamed stream	n/a	R639 road crossing, Leigh	622188	658445	
A4	Unnamed stream	n/a	Noard	621555	656463	
A5	Clover River	16C04	Noard	621241	655973	
A6	Clover River	16C04	R639 road crossing, Leigh	621356	657637	
A7	Clover River	16C04	Noard	619601	659306	
B1	Drish River	16D02	Longfordpass South	624723	657212	
B2	Drish River	16D02	Bridge 100m u/s Longfordpass Bridge	624889	660463	Yes
B3	Drish River	16D02	Castletown Bridge	621680	663563	
B4	Drish River	16D02	Ballyduff Bridge	618961	661310	
B5	Drish River	16D02	Drish Bridge	614891	658369	
C1	Black River	16B01	Clonoura	623707	654329	
C2	Black River	16B01	Derryvella	621096	652818	
C3	North Glengoole River	16N28	Derryvella	620969	652602	
C4	Black River	16B01	Derryhogan	619908	653512	
C5	Black River	16B01	N75 crossing, Two Mile Borris	619120	657824	
D1	Breegagh River	16B03	Kileen	621369	650304	
D2	Breegagh River	16B03	Ballymurreen Bridge	617399	653051	
D3	Breegagh River	16B03	Archerstown Bridge	613950	656841	
E1	River Goul	15G02	R689 road crossing, Fennor	627891	660586	Yes
E2	Ardreagh River	15A03	Lisduff	629611	660275	Yes
E3	Lisduff Stream	15L08	Lisduff	630069	660402	Yes
E4	Tincashel River	15T05	Lisduff	630645	660666	Yes
E5	Clomantanagh Lower Stream	15C91	Clomantagh Lower	635617	663477	Yes
E6	Unnamed stream	n/a	Kilrush	637410	665322	Yes
E7	Gorteenahilla River	15G08	Ballyguider Bridge	638977	666778	Yes
E8	Lismaine Stream	15L16	Clone	642128	667587	Yes
E9	Lisdowney Stream	15L02	Grange Bridge	643580	668665	Yes
E10	River Nore	15N01	Parksgrove	644041	671505	Yes
Fisheries appraisal sites						
L1	Lake/wetland	n/a	Longfordpass South	623838	657293	
L2	Lake/wetland	n/a	Bawnreagh	624148	657036	

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)	GCR crossing
L3	Lake/wetland	n/a	Bawnreagh	624203	656996	
L4	Lake/wetland	n/a	Bawnreagh	623830	656968	
L5	Lake/wetland	n/a	Bawnreagh	623886	656483	
L6	Lake/wetland	n/a	Leigh	623554	656506	
L7	Lake/wetland	n/a	Leigh	623573	656457	
L8	Lake/wetland	n/a	Clonoura	623966	655791	
L9	Lake/wetland	n/a	Clonoura	623089	655449	
L10	Lake/wetland	n/a	Clonoura	623128	655375	
L11	Lake/wetland	n/a	Clonoura	623259	655119	
L12	Lake/wetland	n/a	Clonoura	623355	654846	
L13	Lake/wetland	n/a	Noard	622700	655234	
L14	Lake/wetland	n/a	Noard	622759	655206	
L15	Lake/wetland	n/a	Noard	622190	654897	
L16	Lake/wetland	n/a	Lanespark	622163	654688	
L17	Lake/wetland	n/a	Noard	621406	651982	

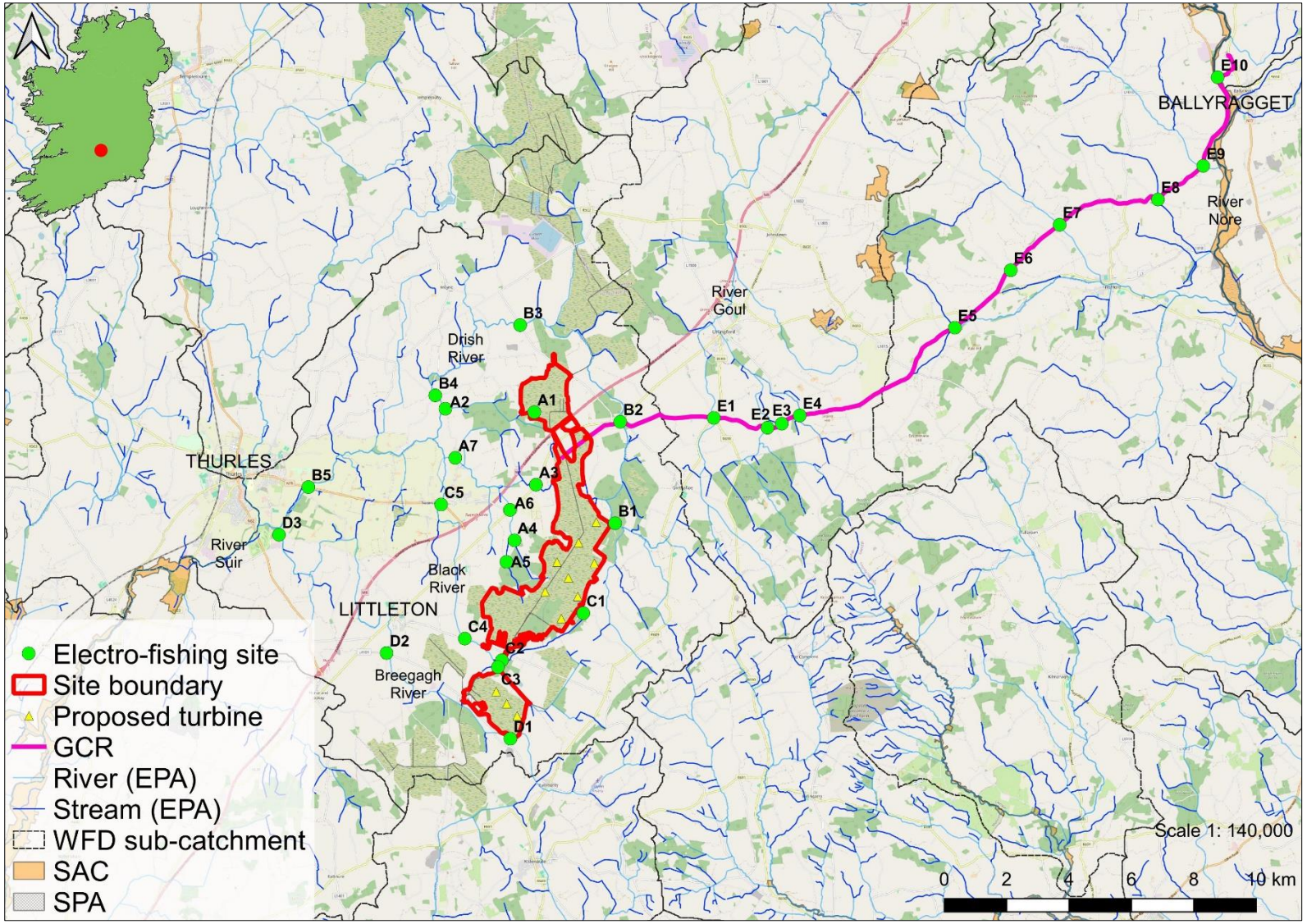


Figure 2.1 Overview of the 30 no. electro-fishing survey sites in vicinity of the proposed Littleton wind farm project, Co. Tipperary

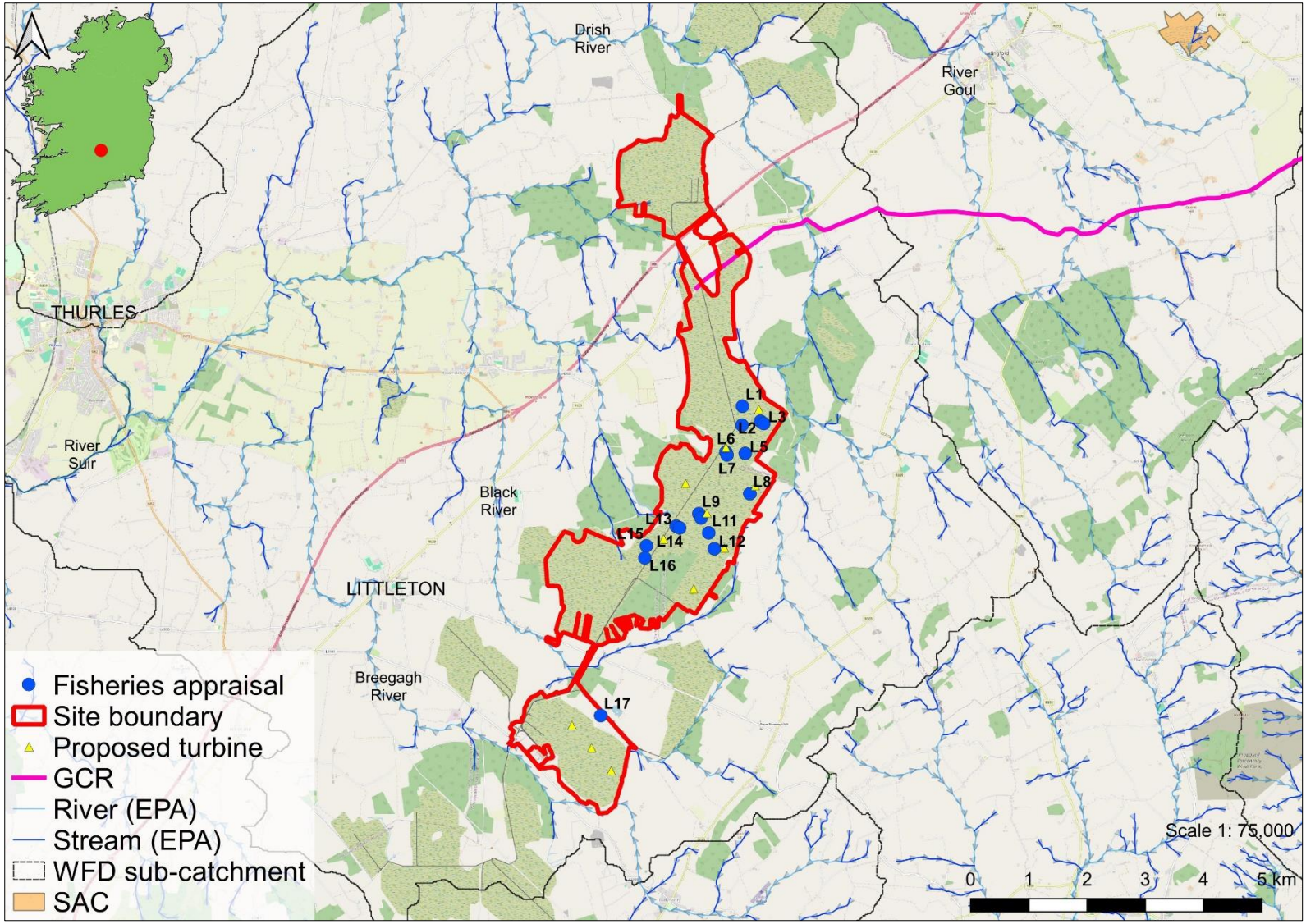


Figure 2.2 Overview of the 17 no. fisheries habitat appraisal sites in vicinity of the proposed Littleton wind farm project, Co. Tipperary

3. Results

A catchment-wide electro-fishing survey of 30 no. riverine sites in the vicinity of the proposed Littleton wind farms was conducted in September 2023, following notification to Inland Fisheries Ireland (IFI) and the National Parks and Wildlife Service (NPWS). A fisheries habitat appraisal was undertaken at 17 no. lake/wetland habitats in October 2023. The results of the survey are discussed below in terms of fish population structure, population size and the suitability and value of the surveyed areas as nursery and spawning habitat for salmonids, European eel and lamprey species. Scientific names are provided at first mention only.

3.1 Fisheries assessment (riverine sites)

3.1.1 Site A1 – unnamed stream, Longfordpass North

Three-spined stickleback (*Gasterosteus aculeatus*) (*n*=4) was the only fish species recorded via electro-fishing at site A1 on the uppermost reaches of an unnamed Drish River tributary (**Figure 3.1**).

With the exception of low densities of this species, the site was of very poor fisheries value at the time of survey given observed low seasonal flows (stagnant), very shallow nature, heavy siltation and historical modifications.

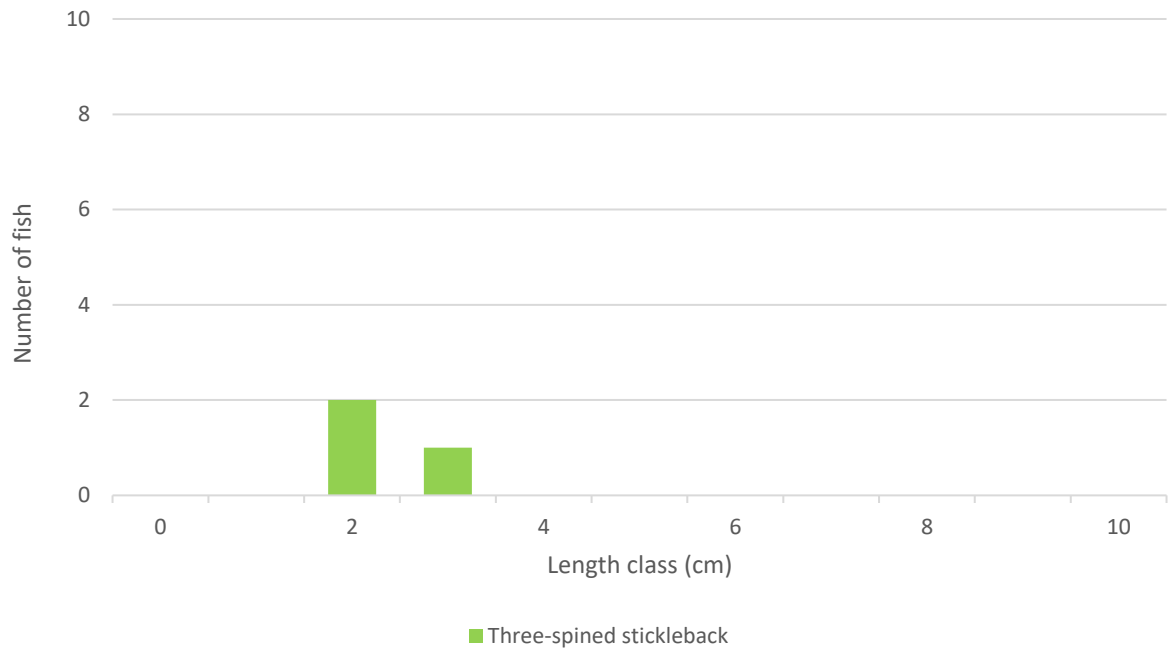


Figure 3.1 Length frequency distribution recorded via electro-fishing at site A1 on an unnamed Drish River tributary, September 2023



Plate 3.1 Representative image of site A1 on an unnamed Drish River tributary, September 2023

3.1.2 Site A2 – unnamed stream, Clooncleagh

Site A2 was located on the lower reaches of an unnamed Drish River tributary at a local road crossing, approximately 3.2km downstream of site A1. The stream was <1.5m wide and was semi-dry at the time of survey, with only remnant shallow pools of stagnant water (no flows). Site A2 was not of fisheries value given its dry, ephemeral nature and absence of aquatic habitats.



Plate 3.2 Representative image of site A2 on an unnamed Drish River tributary, September 2023

3.1.3 Site A3 – Unnamed stream, Leigh

No fish were recorded via electro-fishing at site A3 on an unnamed Clover River tributary. The site was not of fisheries value given its semi-dry, ephemeral nature and poor quality aquatic habitats with no flows (semi-dry at the time of survey, with only localised ponding of 0.1m deep stagnant water between debris dams).



Plate 3.3 Representative image of site A3 on an unnamed Clover River tributary, September 2023

3.1.4 Site A4 – Unnamed stream, Noard

Brown trout (*Salmo trutta*) (*n*=3), stone loach (*Barbatula barbatula*) (*n*=1), three-spined stickleback (*n*=14) and perch (*Perca fluviatilis*) (*n*=1) were recorded via electro-fishing at site A4 (**Figure 3.2**).

The site was of poor value for salmonids, supporting only a low density of adult trout present in deeper holding pools. Spawning habitat was absent given very significant siltation, with slow-flowing glide resulting in poor quality nursery habitat. Despite abundant soft sediment accumulations, the site was unsuitable for lamprey given the flocculent, humic nature of the sediment and absence of suitable spawning gravels. The site was also of poor suitability for European eel with none recorded.

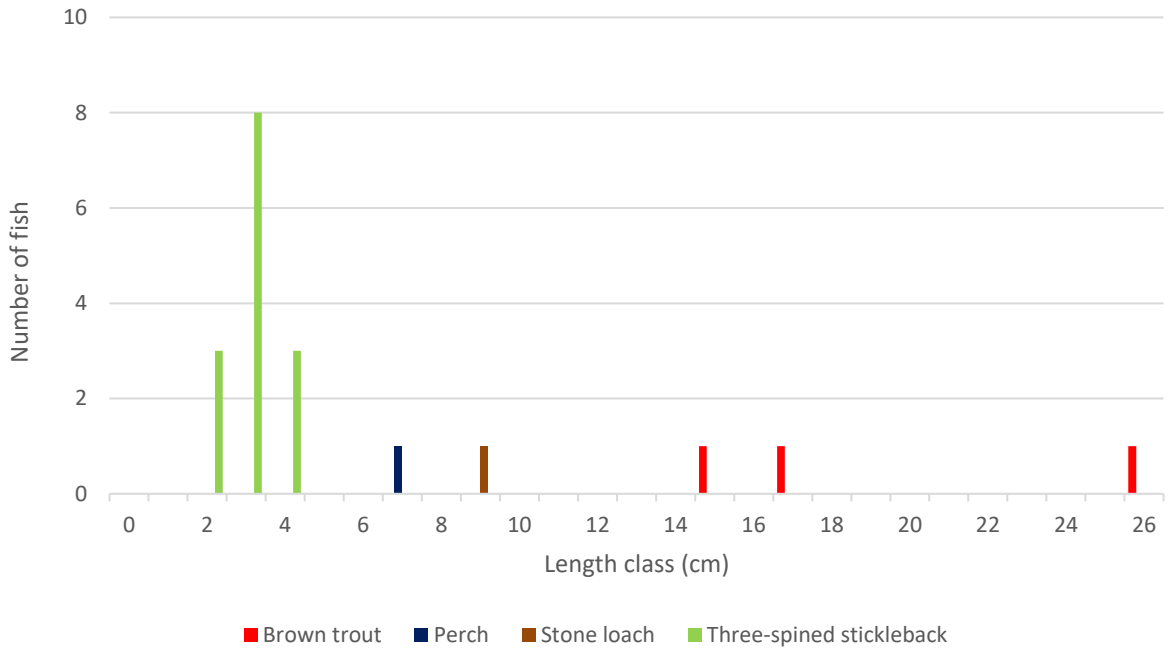


Figure 3.2 Length frequency distribution recorded via electro-fishing at site A4 on an unnamed Clover River tributary, September 2023



Plate 3.4 Brown trout, stone loach and perch recorded at site A4, September 2023

3.1.5 Site A5 – Clover River, Noard

Three-spined stickleback (*n*=6) was the only fish species recorded via electro-fishing at site A5 on the upper reaches of the Clover River (**Figure 3.3**). With the exception of low numbers of stickleback, the river was not of fisheries value at this location given siltation and enrichment pressures, very poor hydromorphology (maintained channel), poor flows and intermittent connectivity with downstream habitats (instream blockages).

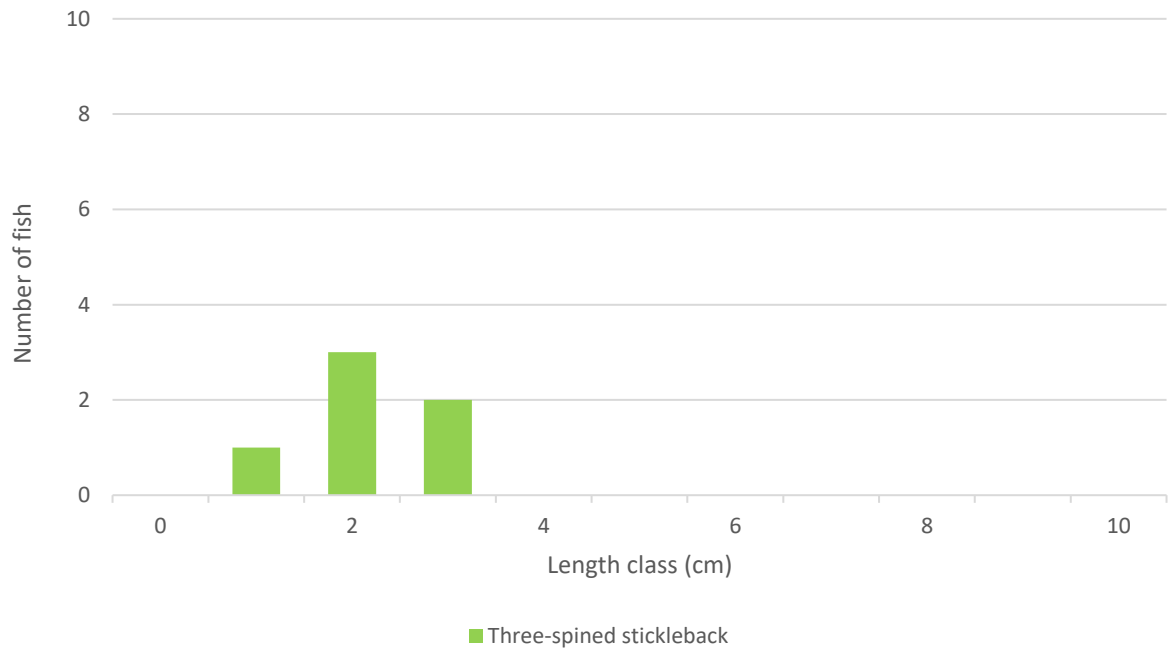


Figure 3.3 Length frequency distribution recorded via electro-fishing at site A5 on the Clover River, September 2023



Plate 3.5 Representative image of site A5 on the upper reaches of the Clover River, September 2023

3.1.6 Site A6 – Clover River, Noard

Brown trout (*n*=13), stone loach (*n*=5), perch (*n*=1) and three-spined stickleback (*n*=2) were recorded via electro-fishing at site A6 (**Figure 3.3**).

Despite significant siltation pressures, the site was evidently of good value as an adult trout habitat. However, due to significant siltation pressures salmonid spawning habitat was limited to a small, faster-flowing area upstream of the bridge. This also offered some moderate value for spawning lamprey but ammocoete habitat was sub-optimal (largely flocculent, humic deposits) and none were recorded. Despite some good suitability for European eel, none were recorded.

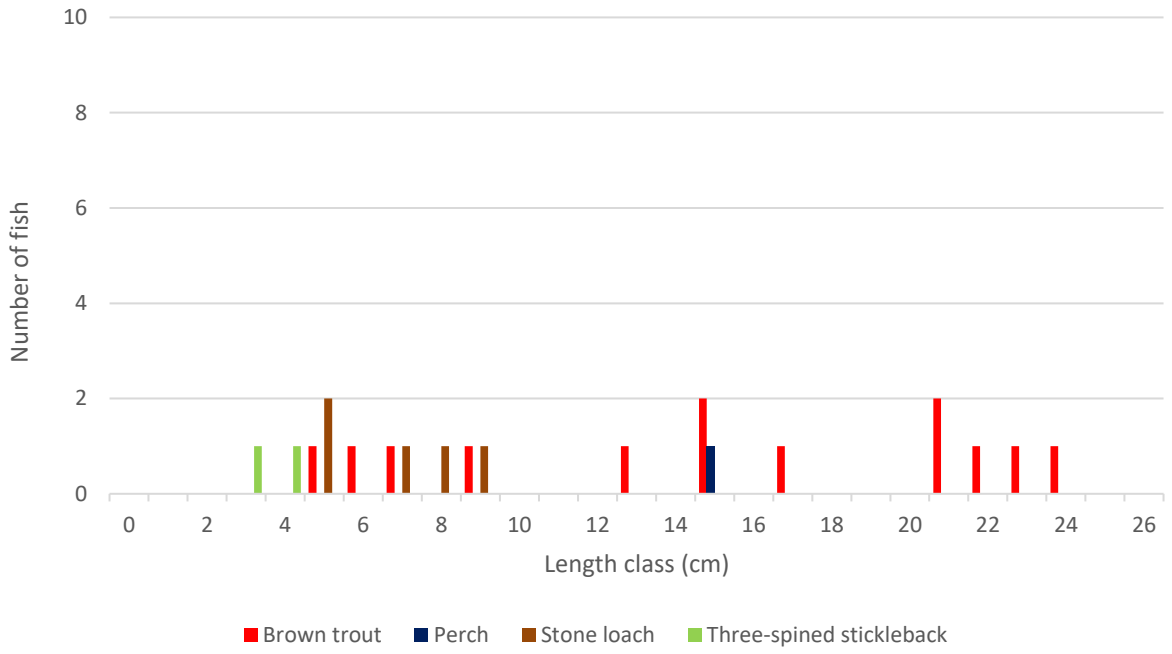


Figure 3.4 Length frequency distribution recorded via electro-fishing at site A6 on the Clover River, September 2023



Plate 3.6 Brown trout and stone loach recorded at site A6 on the Clover River, September 2023

3.1.7 Site A7 – Clover River, Noard

Atlantic salmon (*Salmo salar*) (*n*=1), brown trout (*n*=11), stone loach (*n*=4), lamprey (*Lampetra* sp.) (*n*=2) and pike (*Esox lucius*) (*n*=2) were recorded via electro-fishing at site A7 on the lower reaches of the Clover River (16C04) (**Figure 3.5**).

The site was a moderate quality salmonid habitat only given evident siltation pressures which impacted the spawning potential of the river at this location. The generally shallow nature of the site also reduced the value as a nursery habitat. Some moderate quality holding habitat was present locally due to undercut banks, overhanging vegetation and pools associated with large woody debris. Whilst a low density of *Lampetra* sp. ammocoetes and transformers were recorded (1 per m^2), the site was considered sub-optimal due to the flocculent and humic nature of the soft sediment deposits. Despite some good suitability for European eel, none were recorded.

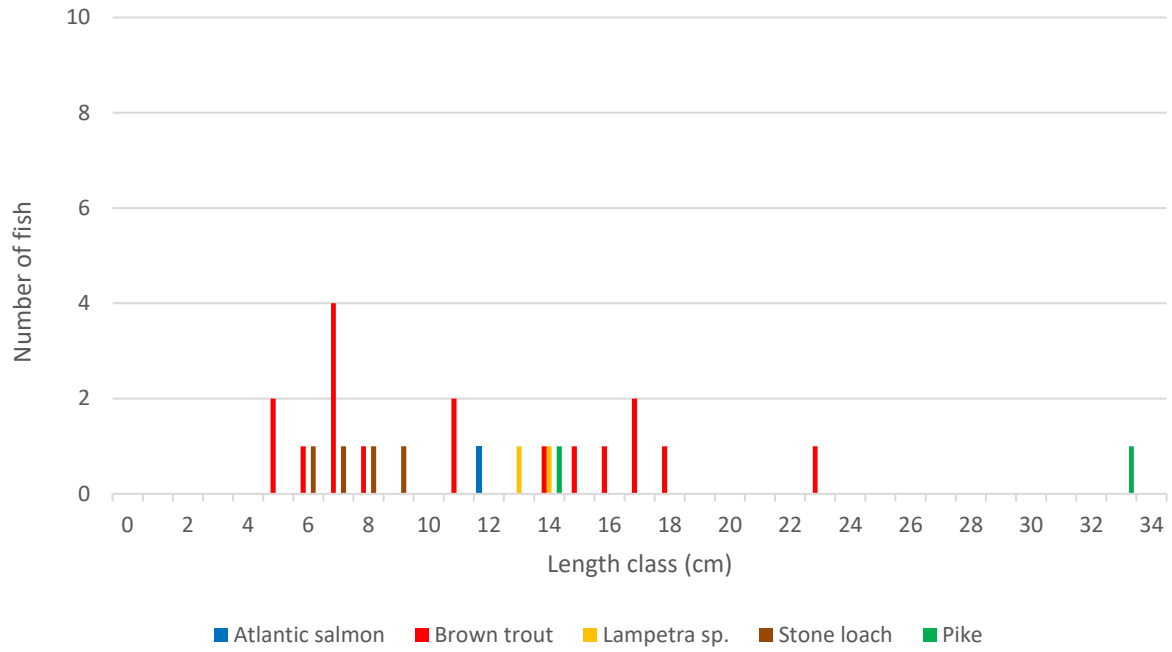


Figure 3.5 Length frequency distribution recorded via electro-fishing at site A7 on the Clover River, September 2023



Plate 3.7 *Lampetra* sp. transformer and brown trout recorded at site A7, September 2023

3.1.8 Site B1 – Drish River, Longfordpass South

Three-spined stickleback (*n*=16) was the only fish species recorded via electro-fishing at site B1 on the upper reaches of the Drish River (16D02) (**Figure 3.6**). The river at this location was of very poor value for salmonids given heavy siltation, poor hydromorphology, poor flows and heavy macrophyte cover. Despite some good suitability for European eel, none were recorded.

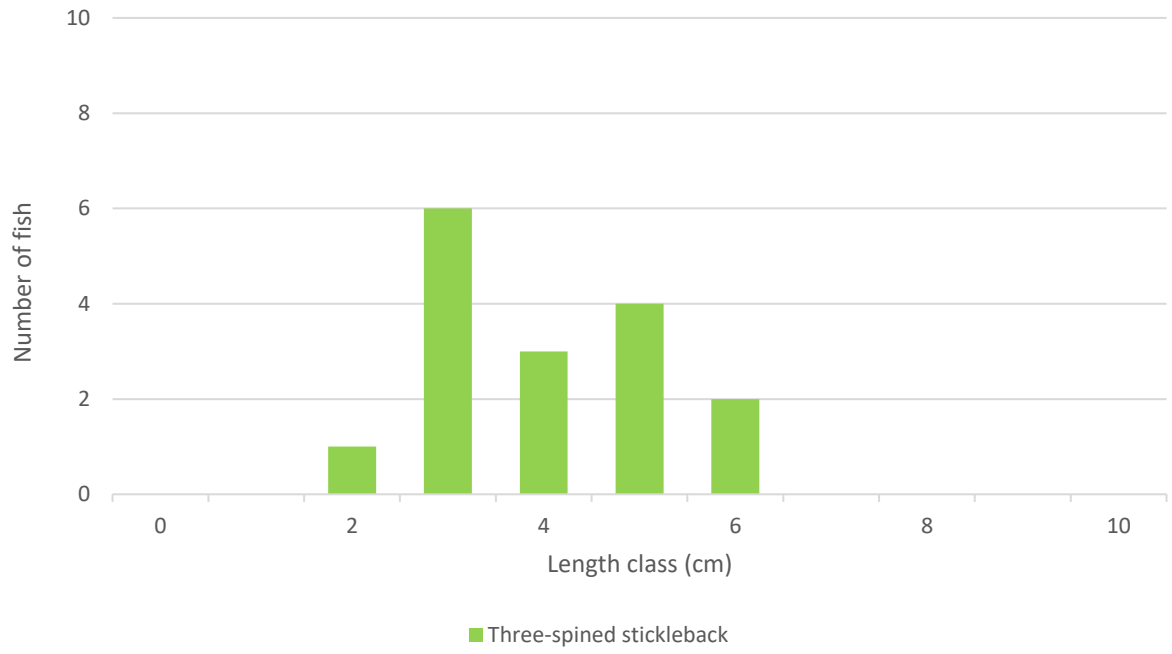


Figure 3.6 Length frequency distribution recorded via electro-fishing at site A7, September 2023



Plate 3.7 Representative image of site B1 on the Drish River, September 2023

3.1.9 Site B2 – Drish River, Longfordpass North

Atlantic salmon (*Salmo salar*) (*n*=1), European eel (*Anguilla anguilla*) (*n*=1) and three-spined stickleback (*n*=15) were recorded via electro-fishing at site B2 on the Drish River (16D02) (**Figure 3.7**).

The site was of poor salmonid value given known flow issues in addition to poor hydromorphology and poor connectivity with downstream habitats (i.e. the site is typically stagnant pond-like glide). However, a single Atlantic salmon parr was recorded in fast glide of an inflowing channel downstream of the bridge. Boulder dominated areas in vicinity of the bridge apron provided good suitability for European eel and supported a low density.

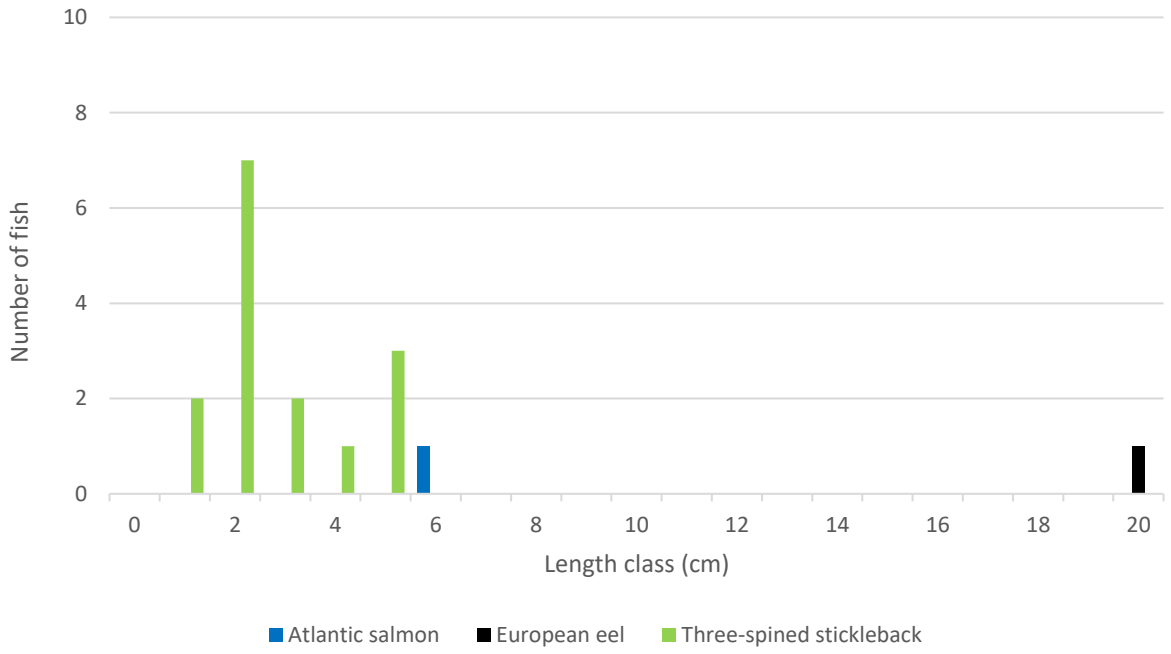


Figure 3.7 Length frequency distribution recorded via electro-fishing at site B2, September 2023



Plate 3.9 Atlantic salmon parr and juvenile European eel recorded at site B2 on the Drish River, September 2023

3.1.10 Site B3 – Drish River, Castletown Bridge

Brown trout (*n*=1), lamprey (*Lampetra* sp.) (*n*=1), stone loach (*n*=9), three-spined stickleback (*n*=5) and pike (*n*=1) were recorded via electro-fishing at site B3 on the Drish River (16D02) at Castletown Bridge (**Figure 3.8**).

Despite some suitability, no salmonids were recorded and the quality of the nursery and spawning habitat was poor with evident water quality pressures. Some very limited salmonid and lamprey spawning habitat was present (but sup-optimal). Deeper glide areas provided some good suitability as adult holding habitat. Soft sediment deposits were shallow and provided poor quality lamprey nursery habitat although a low density were recorded. Despite some good suitability, no European eel were recorded, although the value of the site was reduced given poorly accessible boulder refugia.

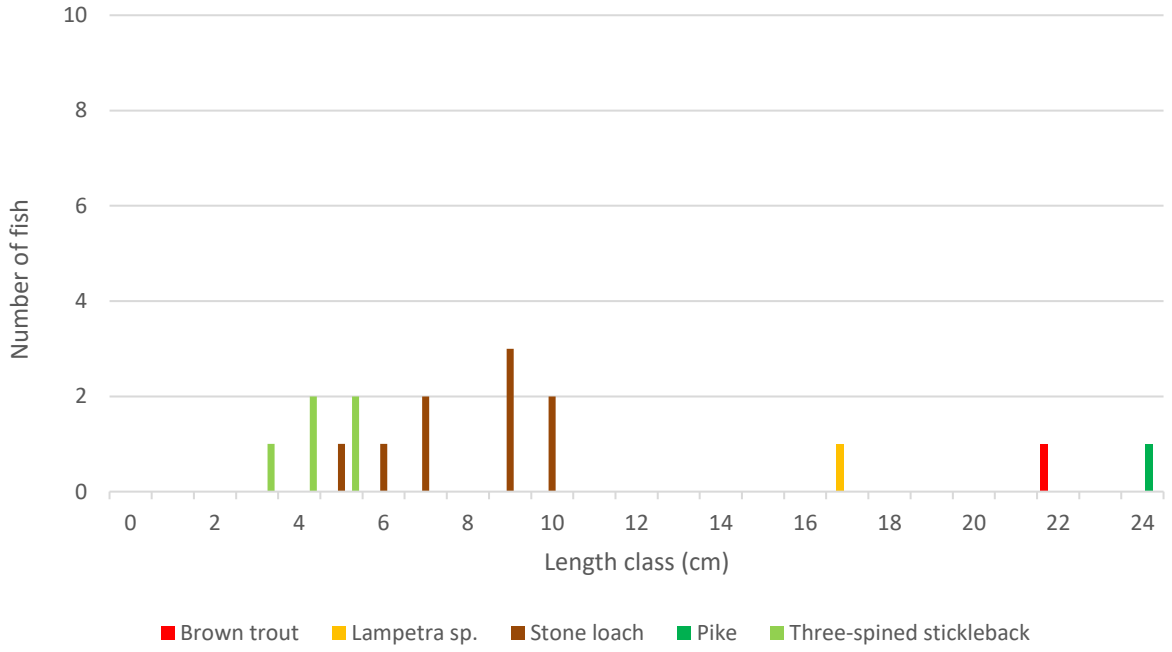


Figure 3.8 Length frequency distribution recorded via electro-fishing at site B3, September 2023



Plate 3.10 Large *Lampetra* sp. ammocoete recorded at site B3 on the Drish River, September 2023

3.1.11 Site B4 – Drish River, Ballyduff Bridge

Atlantic salmon (*n*=76), brown trout (*n*=41) and stone loach (*n*=3) were recorded via electro-fishing at site B4 on the Drish River (16D02) at Ballyduff Bridge (**Figure 3.9**).

The site was an excellent quality salmonid nursery, with abundant fast-flowing bryophyte-rich glide supporting a high density of juvenile Atlantic salmon and, less so, brown trout. Good quality spawning habitat (especially for Atlantic salmon) was widespread with abundant mixed gravels and cobbles (including upstream of bridge). Overhanging marginal vegetation and trees in addition to larger boulder and bank scours provided valuable thermal refugia for adult salmonids. Despite some good suitability, no European eel were recorded. The high energy site was unsuitable for lamprey ammocoetes although some localised spawning habitat was present.

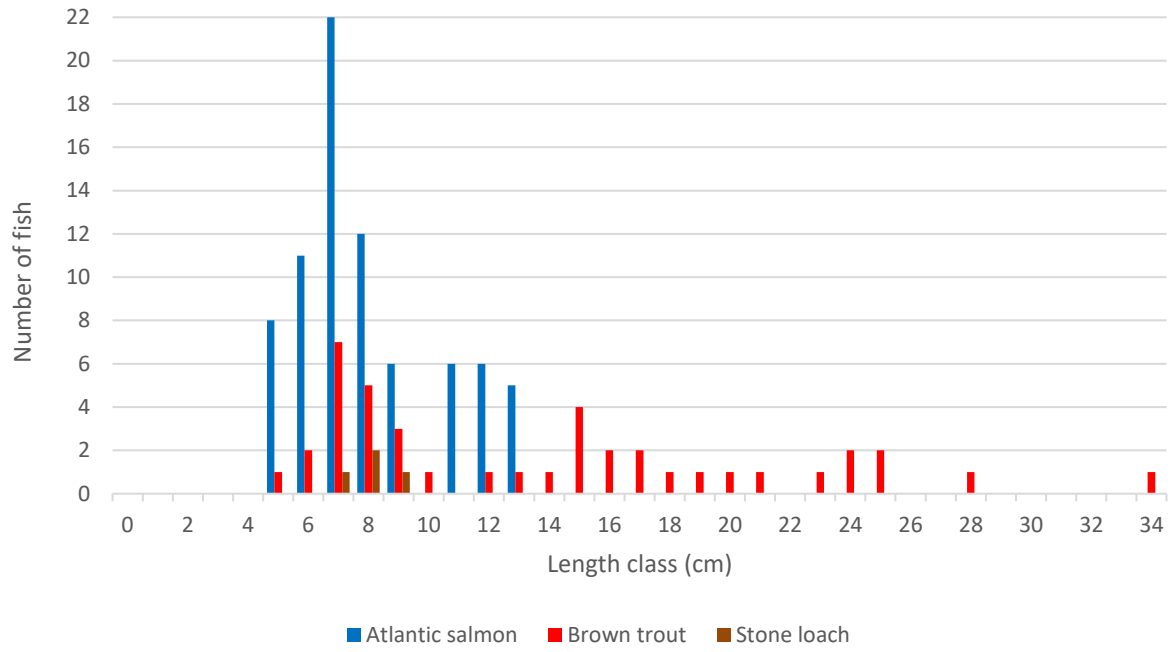


Figure 3.9 Length frequency distribution recorded via electro-fishing at site B4, September 2023



Plate 3.11 Juvenile Atlantic salmon (top) and brown trout recorded at site B4 on the Drish River at Ballyduff Bridge, September 2023

3.1.12 Site B5 – Drish River, Drish Bridge

Atlantic salmon (*n*=48), brown trout (*n*=10), European eel (*n*=2), lamprey (*Lampetra* sp.) (*n*=5), minnow (*Phoxinus phoxinus*) (*n*=20) and stone loach (*n*=1) were recorded via electro-fishing at site B5 on the Drish River at Drish Bridge (N75) (**Figure 3.10**).

The site was of very high value for salmonids with excellent quality nursery habitat present (especially for Atlantic salmon) given an abundance of macrophyte beds in swift glide. The site also provided excellent quality holding habitat by way of deeper pool (e.g. under bridge) and overhanging marginal vegetation. Such areas, in addition to frequent large boulder, were also of high suitability for European eel. Although localised, high quality salmonid and lamprey spawning habitat was present upstream of the bridge. The site was also of value for *Lampetra* sp. with a low density recorded in sub-optimal (sand-dominated) soft sediment deposits associated with macrophyte beds (2.5 per m^2).

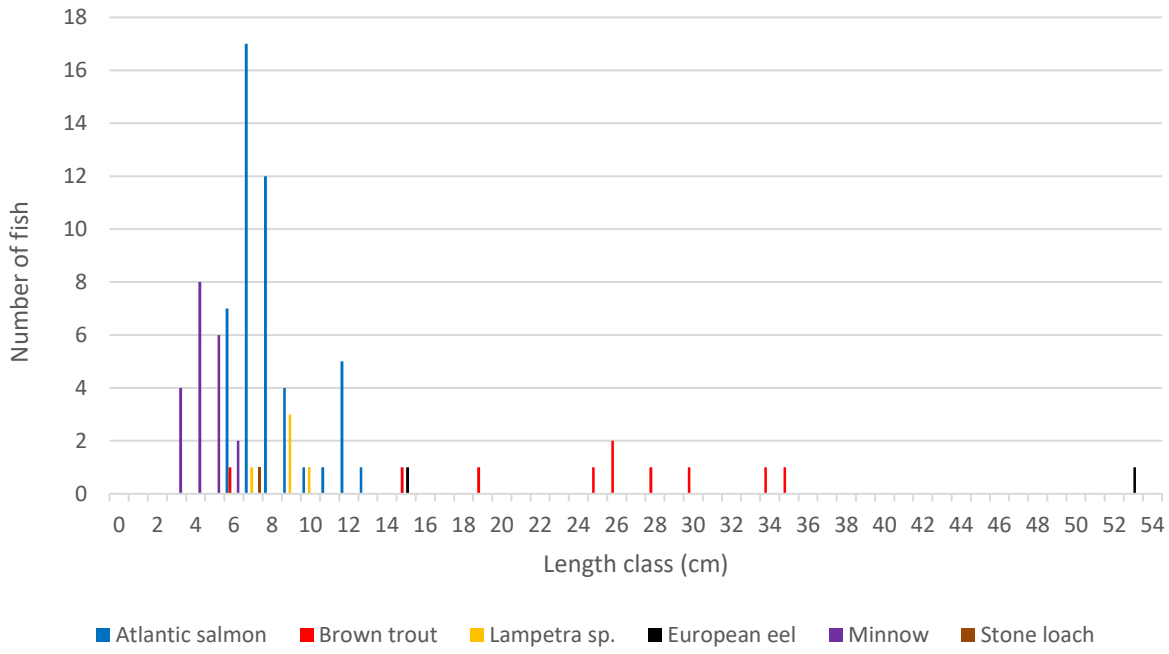


Figure 3.10 Length frequency distribution recorded via electro-fishing at site B5, September 2023



Plate 3.12 Large adult brown trout and Atlantic salmon parr recorded at site B5 on the Drish River upstream of Drish Bridge, September 2023

3.1.13 Site C1 – Black River, Clonoura

Site C1 was located on the uppermost reaches of the Black River (16B01) that drained to the south of the proposed wind farm site. The site was dry at the time of survey, with no pools of standing water

and a dry mud base in a remnant channel. Site C1 was not of fisheries value given its ephemeral nature and absence of aquatic habitats.



Plate 3.13 Representative image of site C1 on the Black River, September 2023 (dry, ephemeral channel)

3.1.14 Site C2 – Black River, Derryvella

Brown trout (*n*=10) and three-spined stickleback (*n*=5) were the only fish species recorded via electro-fishing at site C2 on the upper reaches of the Black River (16B01) (**Figure 3.11**). Although recorded previously at the site (Triturus 2021 data), no Atlantic salmon were captured.

Despite historical modifications, poor flows and siltation pressures (peat escapement), the site was of some moderate value as a salmonid nursery, at least in vicinity of the culvert where riffle habitat was present. The salmonid spawning value was compromised by siltation but the value likely improved during higher flows. Submerged tree roots and bank scours provided valuable holding areas for adult salmonids. Whilst some limited lamprey spawning habitat was present, ammocoete habitat was unsuitable given the flocculent nature of the silt (peat-dominated). Despite some suitability for European eel none were recorded (limited refugia).

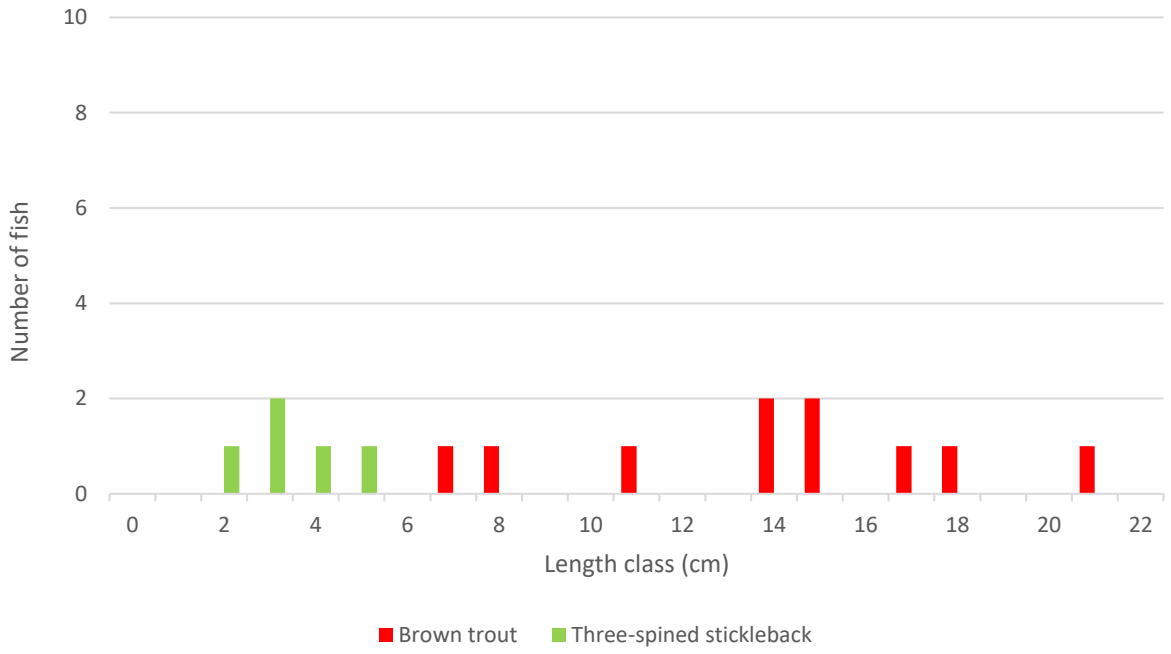


Figure 3.11 Length frequency distribution recorded via electro-fishing at site C2, September 2023



Plate 3.14 Mixed cohort brown trout recorded at site C2 on the Black River, September 2023

3.1.15 Site C3 – North Glengoole River, Derryvella

Brown trout (*n*=3) and three-spined stickleback (*n*=2) were the only fish species recorded via electro-fishing at site C3 on the North Glengoole River (16N28) (**Figure 3.12**). Although recorded previously (Triturus 2021 data), no Atlantic salmon were captured.

The site was of moderate value for salmonids only, supporting a low density of mixed cohort brown trout, given significant siltation pressures. The shallow stream provided some suitable spawning habitat (exposed gravels) although these were heavily silted. Localised small pools associated with the culvert, bank scours and macrophyte stands provided some holding habitat for adult salmonids. Despite some suitability for European eel, none were recorded.

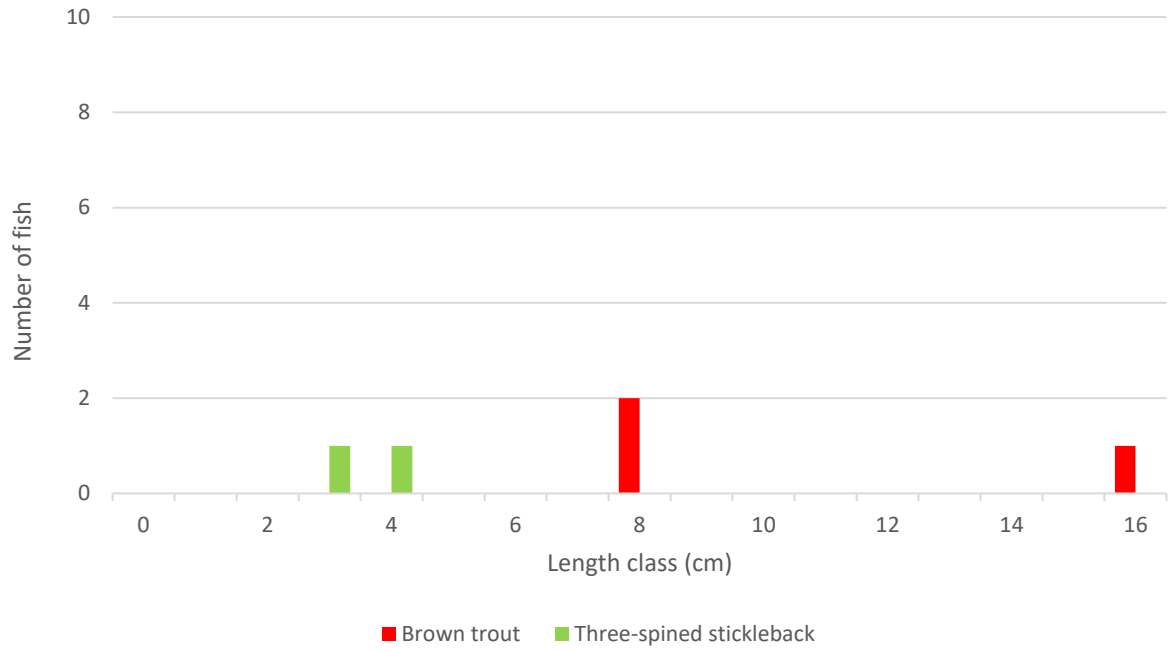


Figure 3.12 Length frequency distribution recorded via electro-fishing at site C3, September 2023



Plate 3.16 Brown trout and three-spined stickleback recorded at site C3 on the North Glengoole River, September 2023

3.1.16 Site C4 – Black River, Derryhogan

Brown trout (*n*=8) and stone loach (*n*=2) were the only two fish species recorded via electro-fishing at site C4 on the Black River (16B01) (**Figure 3.13**).

The site was a moderate quality salmonid spawning and nursery habitat. Holding habitat, by way of deeper pools, bank undercuts and submerged tree root systems, was of good quality. Adult trout dominated, with only low numbers of juveniles present. Despite high siltation, soft sediment accumulations did not support lamprey ammocoetes (largely humic or clay-based in nature). Some very limited superficial spawning gravels suitable for lamprey were present in the vicinity of the culvert although spawning habitat improved upstream, where riffles were more commonplace. Aside from submerged tree root systems, suitability for European eel was relatively poor given limited accessible instream refugia (none recorded).

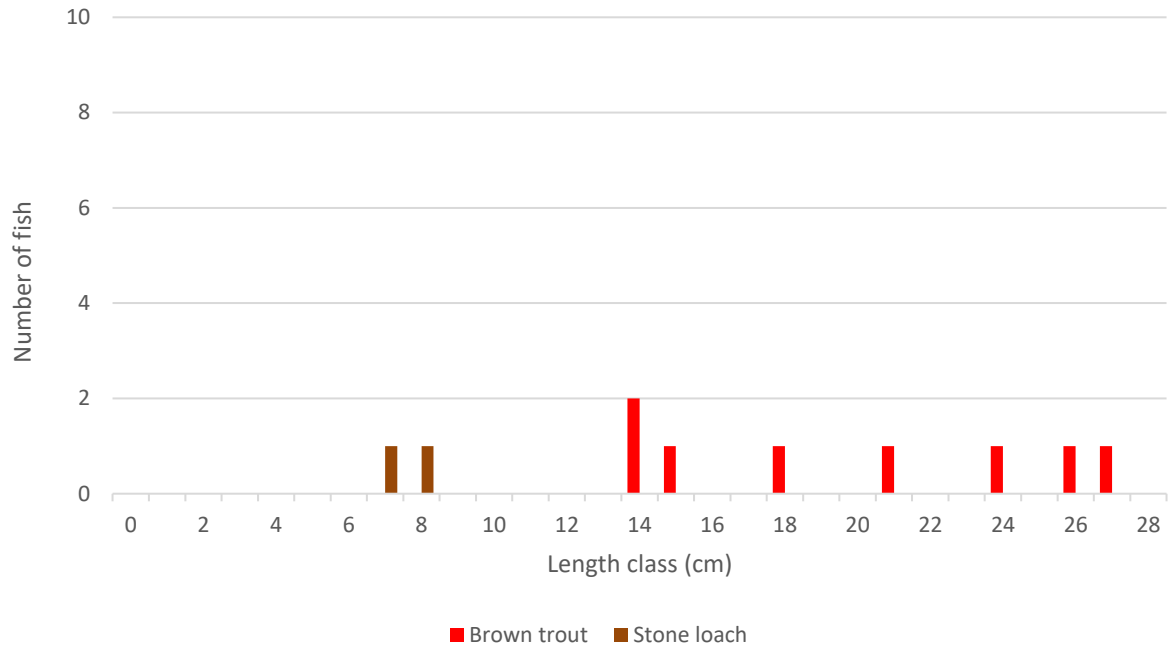


Figure 3.13 Length frequency distribution recorded via electro-fishing at site C4, September 2023



Plate 3.16 Adult brown trout recorded at site C4 on the Black River, September 2023

3.1.17 Site C5 – Black River, Two Mile Borris

Atlantic salmon (*n*=17), brown trout (*n*=19), European eel (*n*=7), lamprey (*Lampetra* sp.) (*n*=5) and stone loach (*n*=3) were recorded via electro-fishing at site C5 on the Black River (16B01) at the N75 road crossing (**Figure 3.14**).

The site was of highest value as a salmonid nursery, with boulder-rich glide and riffle supporting a moderate density of Atlantic salmon parr and a lower number of juvenile brown trout. Deeper glide with frequent bank scours and submerged tree roots provided valuable holding areas for adult trout. Spawning substrata was sparse and impacted by siltation pressures (but nonetheless present). The site was also of high value for European eel with abundant boulder and cobble supporting a moderate density of juveniles and small adults. Soft sediment accumulations were largely confined to the road culvert and these humic areas supported a low density of small *Lampetra* sp. ammocoetes (3.3 per m^2).

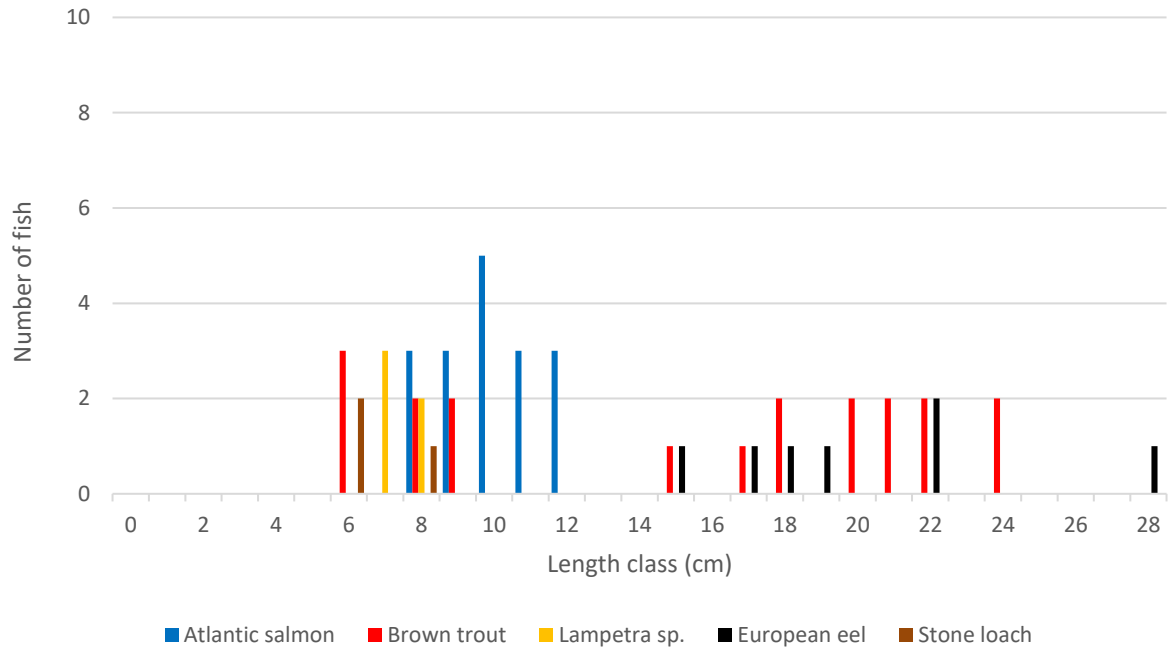


Figure 3.14 Length frequency distribution recorded via electro-fishing at site C5, September 2023



Plate 3.17 Atlantic salmon parr and brown trout recorded at site C5 on the Black River, September 2023

3.1.18 Site D1 – Breegagh River, Killeen

Atlantic salmon (*n*=17) and brown trout (*n*=30) were the only fish species recorded via electro-fishing at site D1 on the Breegagh River (16B03) (**Figure 3.15**).

The site was of good value as a salmonid nursery, supporting a moderate density of Atlantic salmon parr and juvenile trout. The site was of highest value as a holding habitat for adult trout, with frequent scoured banks and instream LWD providing valuable deeper glide and pool areas in an otherwise shallow river section. The site was of poor quality as a spawning habitat given significant siltation pressures. Despite some suitability, no European eel were recorded.

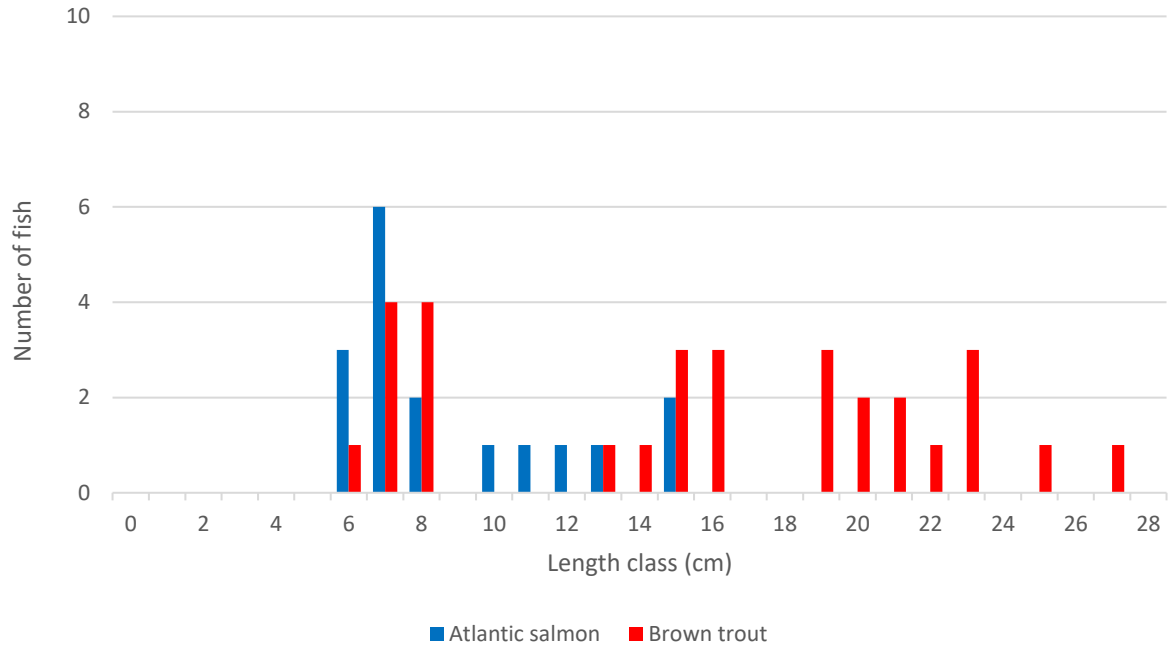


Figure 3.15 Length frequency distribution recorded via electro-fishing at site D1, September 2023



Plate 3.18 Representative image of site D1 on the Breegagh River, September 2023

3.1.19 Site D2 – Breegagh River, Ballymurreen Bridge

Atlantic salmon (*n*=10), brown trout (*n*=12), lamprey (*Lampetra* sp.) (*n*=5) and stone loach (*n*=5) were recorded via electro-fishing at site D2 on the Breegagh River (16B03) at Ballymurreen Bridge (**Figure 3.16**).

The site was a moderate quality salmonid nursery, with the value reduced in recent years due to evident siltation pressures which reduced the distribution of gravel and cobble areas. The shallow site was of relatively poor value as a holding habitat for adult salmonids although some scoured areas and overhanging vegetation provided valuable areas. Whilst some good quality nursery areas were present in association with *Ranunculus* beds, the site was poor overall given widespread siltation and low macrophyte cover. Lamprey ammocoete habitat was widespread although much of the soft sediment accumulations were clay-dominated and thus sub-optimal for *Lampetra* sp. Lamprey spawning habitat by way of finer gravels was present but highly localised. The site was of poor value for European eel given a paucity of accessible instream refugia and the shallow nature.

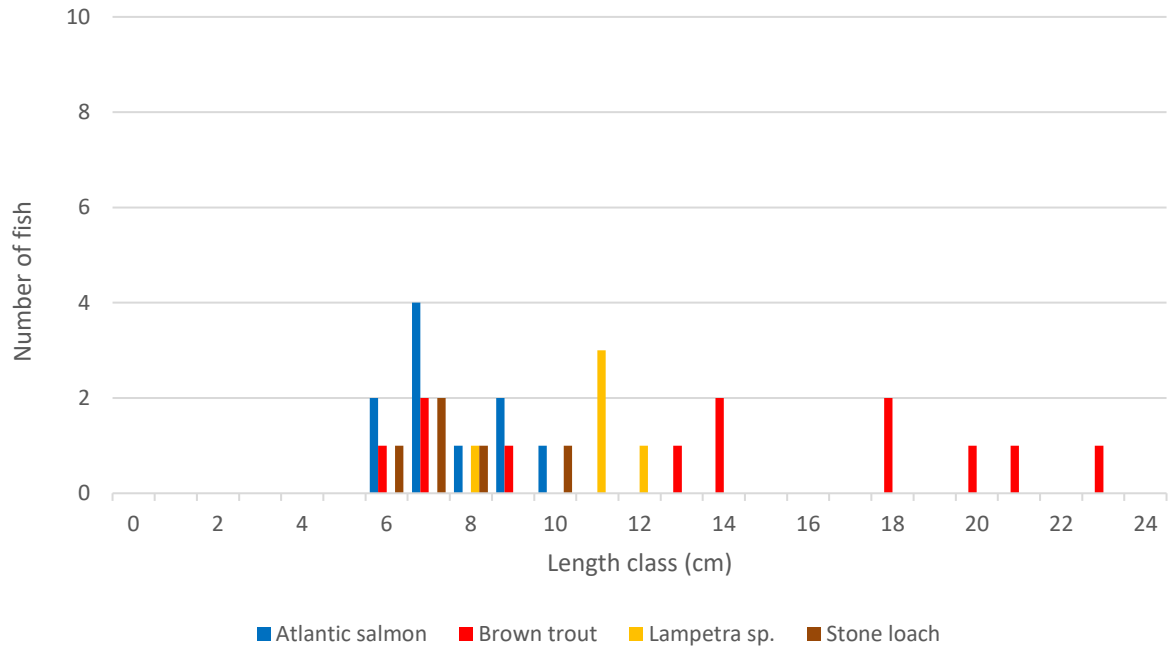


Figure 3.16 Length frequency distribution recorded via electro-fishing at site D2, September 2023



Plate 3.19 Atlantic salmon parr ad brown trout recorded at site D2 on the Breegagh River, September 2023

3.1.20 Site D3 – Breegagh River, Archerstown Bridge

Atlantic salmon (*n*=29), brown trout (*n*=39), European eel (*n*=3), minnow (*n*=2) and stone loach (*n*=6) were recorded via electro-fishing at site D3 on the lower reaches of the Breegagh River (16B03) at Archerstown Bridge (**Figure 3.17**).

The site was of very high value for salmonids with excellent quality nursery habitat present (especially for Atlantic salmon) given an abundance of macrophyte beds in swift glide. The site also provided excellent quality holding habitat by way of deeper pool (e.g. downstream of bridge), extensive macrophyte beds and overhanging marginal vegetation. Such areas, in addition to frequent large boulder, were also of high suitability for European eel. High quality spawning habitat for both salmonids and lamprey was present upstream and downstream of the bridge. However, there was a paucity of suitable lamprey nursery habitat with soft sediment accumulations shallow and flocculent in nature.

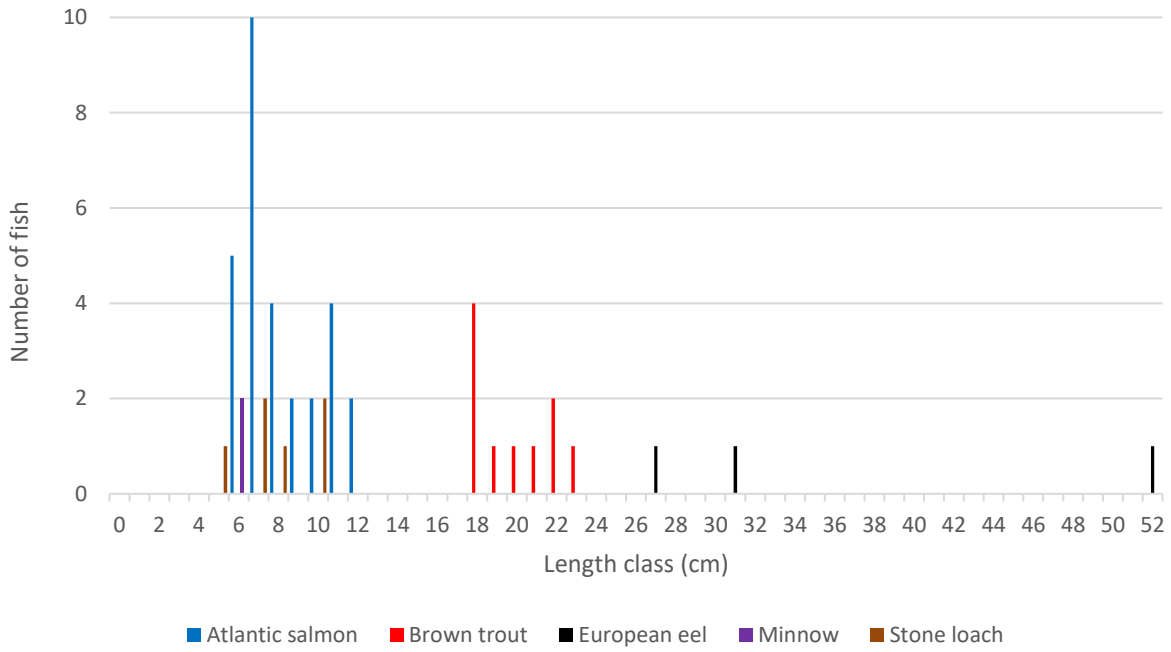


Figure 3.17 Length frequency distribution recorded via electro-fishing at site D3, September 2023

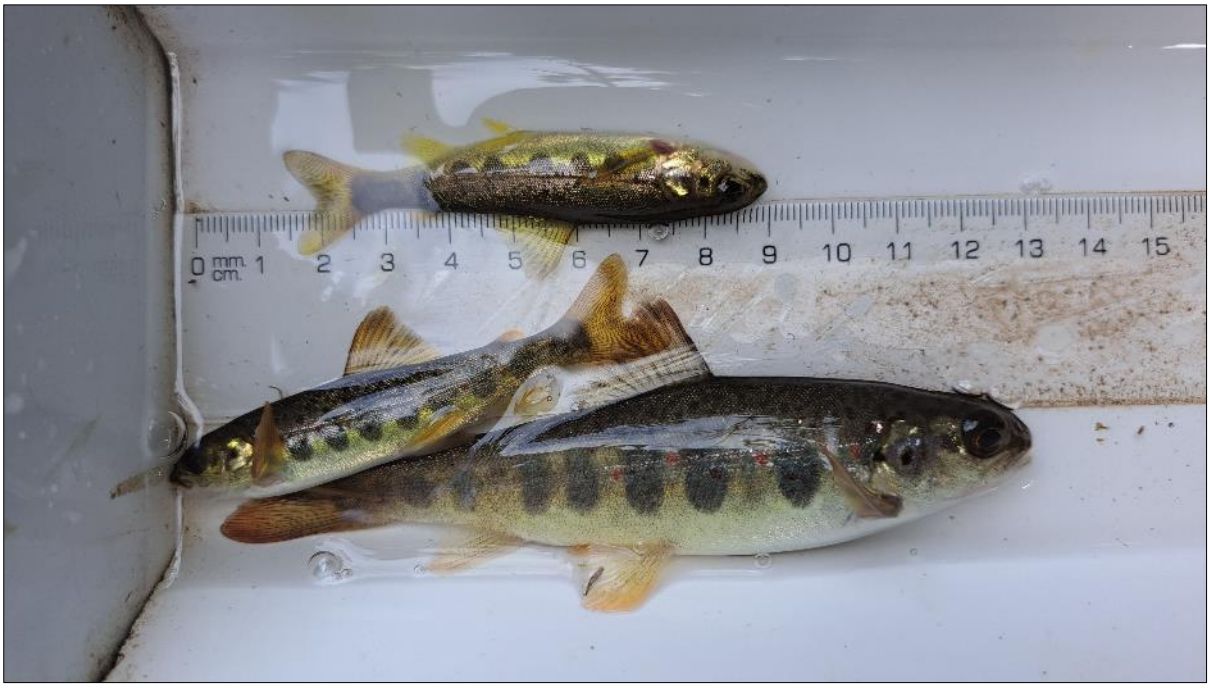


Plate 3.20 Mixed cohort Atlantic salmon parr recorded at site D3 on the Breegagh River at Archerstown Bridge, September 2023

3.1.21 Site E1 – River Goul, Fennor

Brown trout (*n*=10), stone loach (*n*=4) and lamprey (*Lampetra* sp.) (*n*=2) were recorded via electro-fishing at site E1 on the upper reaches of the River Goul (15G02) (**Figure 3.18**).

The site was a moderate quality salmonid habitat, at best, supporting a low density of brown trout only, given significant siltation pressures and poor hydromorphology. The quality of salmonid nursery habitat was poor with an absence of suitable spawning habitat (due to siltation). The narrow channel featured frequently undercut clay banks and these coupled with LWD and occasional pools provided some holding habitat for small adult salmonids. European eel habitat was moderate overall although none were recorded. Whilst soft sediment accumulations were dominant, these supported only a low density of lamprey ammocoetes due to the clay nature of the sediment.

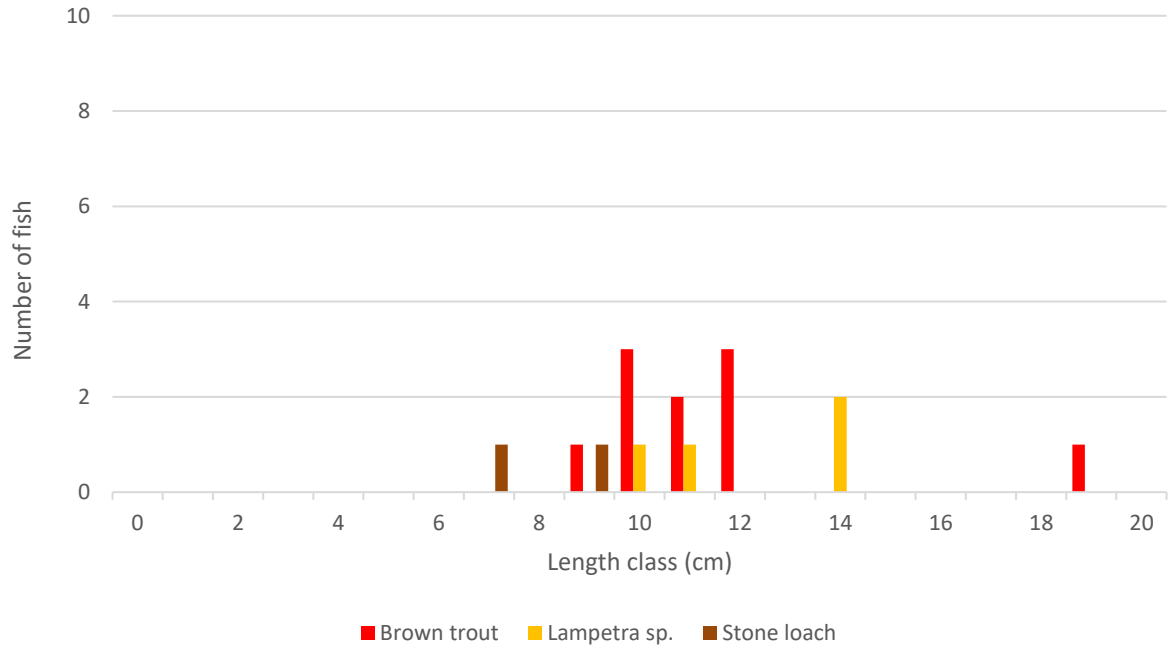


Figure 3.18 Length frequency distribution recorded via electro-fishing at site E1, September 2023



Plate 3.21 *Lampetra* sp. ammocoetes recorded at site E1 on the River Goul, September 2023

3.1.22 Site E2 – Ardreagh River, Lisduff

Atlantic salmon (*n*=8), brown trout (*n*=9), European eel (*n*=2) and three-spined stickleback(*n*=24) were recorded via electro-fishing at site E2 on the Ardreagh River (15A03) (**Figure 3.19**).

The site was a moderate quality salmonid nursery and spawning habitat due to evident siltation pressures. A low density of juvenile trout and salmon were present. Holding opportunities were typically absent given the shallow nature of the site. The site was of moderate value for European eel. Although some limited lamprey spawning habitat was present, calcification of the bed and siltation pressures and the predominance of larger substrata reduced the value overall. Suitable ammocoete habitat was absent.

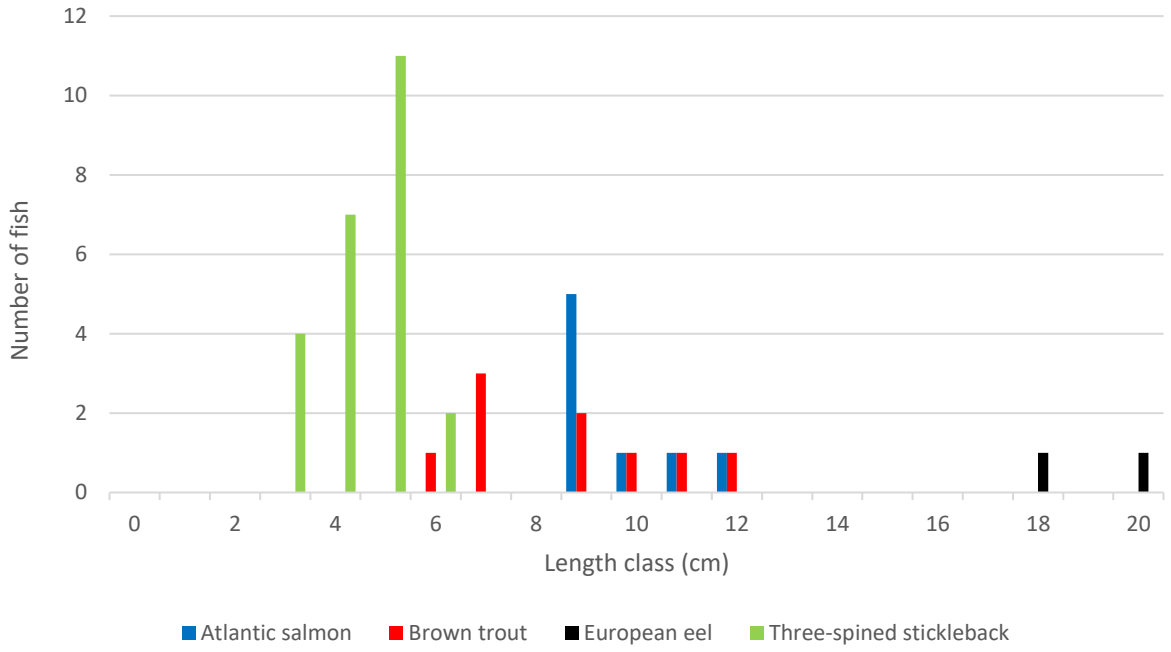


Figure 3.19 Length frequency distribution recorded via electro-fishing at site E2, September 2023



Plate 3.22 (from top) Three-spined stickleback, brown trout, Atlantic salmon and European eel recorded at site E2 on the Ardreagh River, September 2023

3.1.23 Site E3 – Lisduff Stream, Lisduff

No fish were recorded via electro-fishing at site E3 on the Lisduff Stream (15L08). The site was not of fisheries value at the time of survey given its very shallow (possibly ephemeral) nature, historical modifications and poor quality aquatic habitats.



Plate 3.23 Representative image of site E3 on the Lisduff Stream, September 2023

3.1.24 Site E4 – Tincashel River, Lisduff

Brown trout (*n*=12) was the only fish species recorded via electro-fishing at site E4 on the Tincashel Stream (15T05) (**Figure 3.20**).

The site was a good quality salmonid nursery, despite its generally shallow and historically modified nature. Natural bed calcification reduced the capacity of the site as a salmonid/lamprey spawning habitat although some good quality substrata were present locally. The shallow site was also of poor value as a salmonid holding habitat. Good quality lamprey spawning habitat (fine gravels) was present locally although suitable ammocoete habitat was absent in vicinity of the survey site. Despite some moderate suitability, no European eel were recorded.

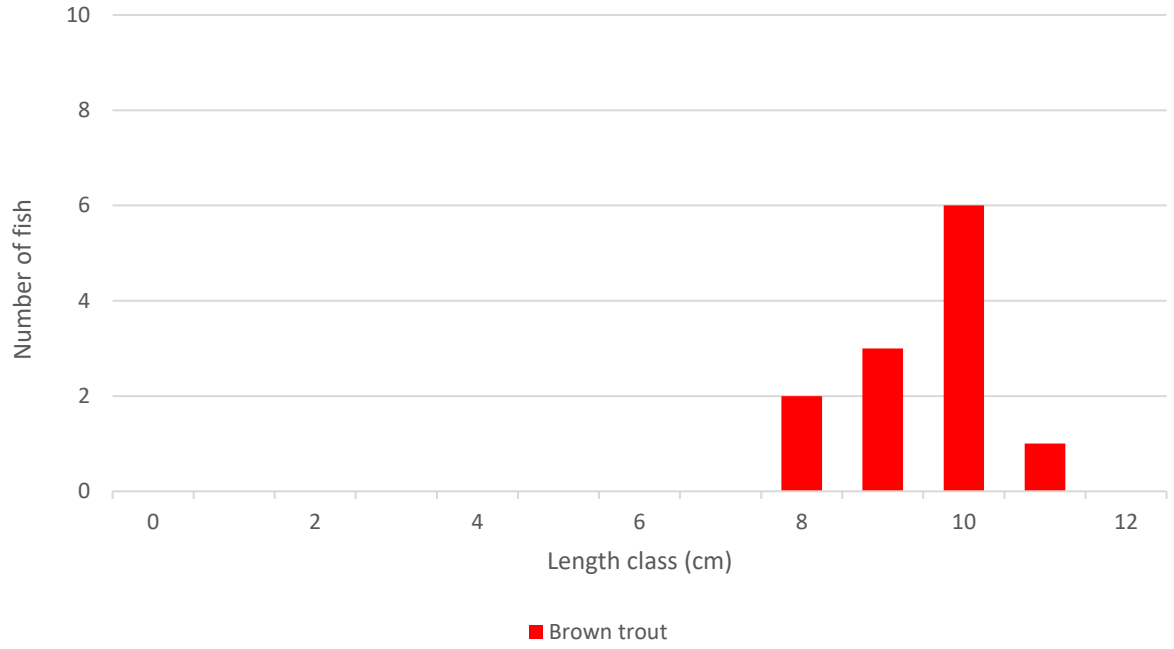


Figure 3.20 Length frequency distribution recorded via electro-fishing at site E4, September 2023



Plate 3.24 Representative image of site E4 on the Tincashel River, September 2023

3.1.25 Site E5 – Clomantanagh Lower Stream, Clomantanagh Lower

No fish were recorded via electro-fishing at site E5 on the Clomantagh Lower Stream (15C91). The site was not of fisheries value given its very heavily silted and modified nature, an absence of flows and poor connectivity with downstream habitats.



Plate 3.25 Representative image of site E5 on the Clomantanagh River, September 2023

3.1.26 Site E6 – unnamed stream, Kilrush

No fish were recorded via electro-fishing at site E6 on an unnamed, unmapped tributary of the Nuenna River. The site was of poor fisheries value given its heavily silted and shallow nature and poor connectivity with downstream habitats. The stream showed some ephemeral characteristics and may run dry, seasonally.



Plate 3.26 Representative image of site E6 on an unmapped Nuenna River tributary, September 2023

3.1.27 Site E7 – Gorteenahilla River, Ballyguider Bridge

Atlantic salmon (*n*=48) and brown trout (*n*=23) were the only fish species recorded via electro-fishing at site E7 on the Gorteenahilla River (15G08) at Ballyguider Bridge (**Figure 3.21**).

The site was of very high value as a salmonid nursery, with abundant Atlantic salmon parr and a low density of brown trout. The site also provided some localised good quality holding areas for adult salmonids (e.g. pool downstream of apron). However, the site was of moderate value only as a spawning habitat given the predominance of larger substrata in addition to siltation and enrichment pressures (i.e. floc cover). The high energy site was unsuitable for lamprey. Despite some good suitability, no European eel were recorded.

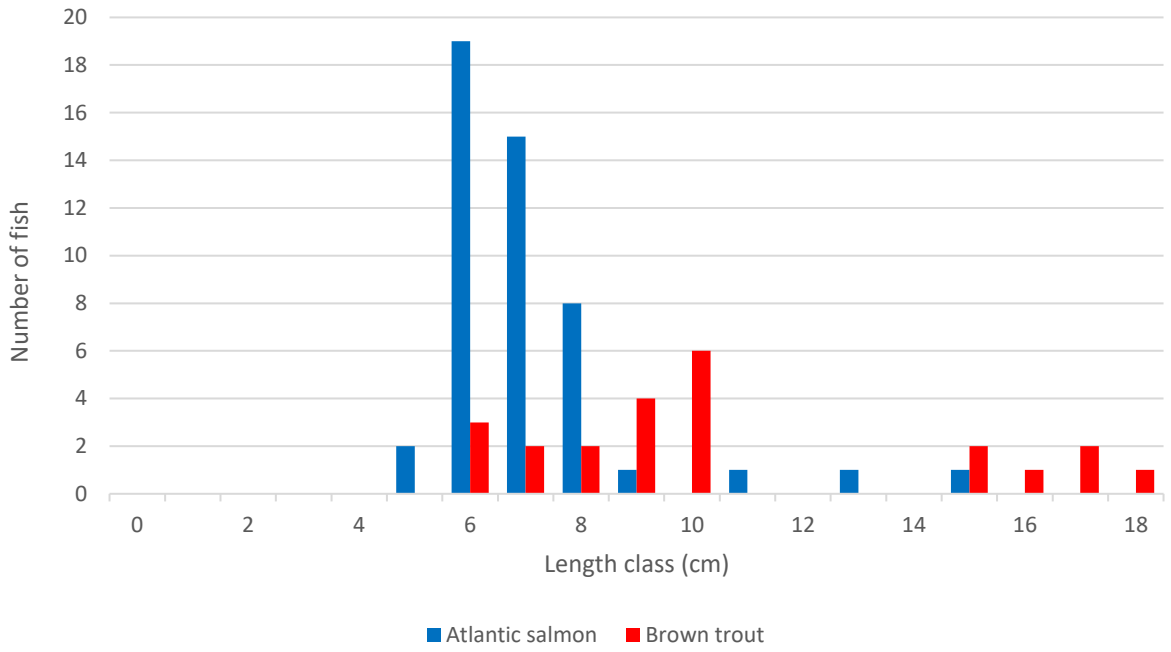


Figure 3.21 Length frequency distribution recorded via electro-fishing at site E7, September 2023



Plate 3.27 Brown trout (top) and Atlantic salmon parr recorded at site E7 on the Gorteenahilla River, September 2023

3.1.28 Site E8 – Lismaine Stream, Clone

Three-spined stickleback (*n*=8) were the only fish recorded via electro-fishing at site E8 on the Lismaine Stream (15L16), a tributary of the River Nore (**Figure 3.22**). With the exception of low densities of this species, the site was not of fisheries value at the time of survey given very poor flows in addition to

the shallow nature of the site and siltation pressures. However, there was some physical suitability for small salmonids (known further downstream - Triturus 2021 data).

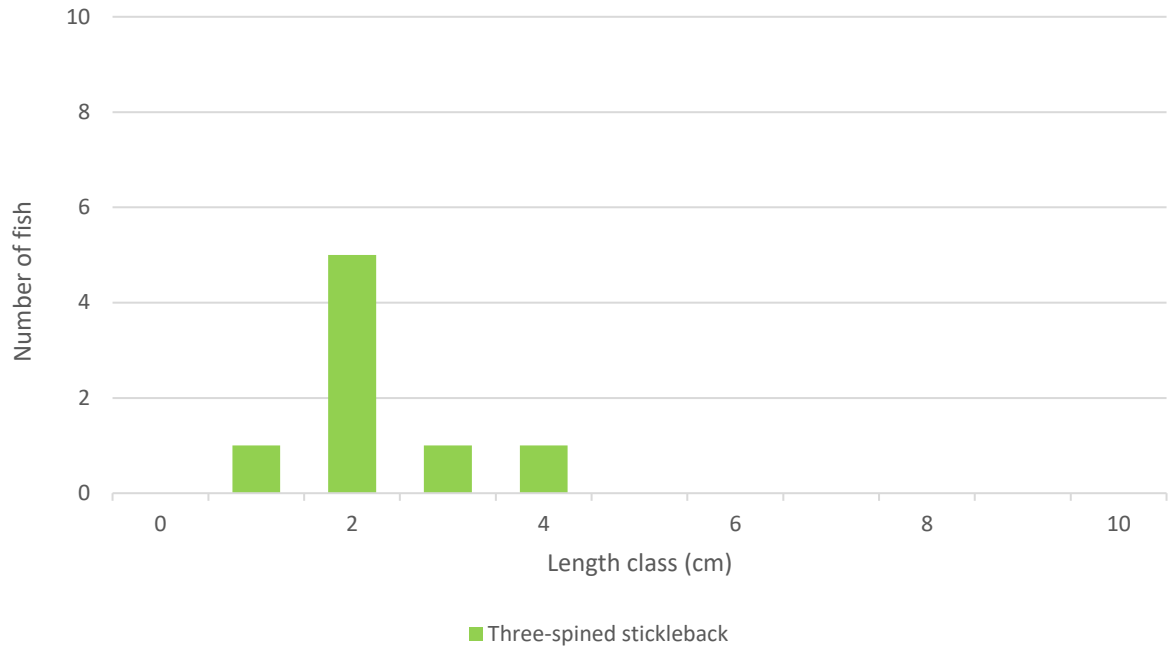


Figure 3.22 Length frequency distribution recorded via electro-fishing at site E8, September 2023



Plate 3.20 Representative image of site E8 on the Lismaine Stream, September 2023

3.1.29 Site E9 – Lisdowney Stream, Grange Bridge

Atlantic salmon (*n*=22), brown trout (*n*=18), European eel (*n*=2) and three-spined stickleback (*n*=5) were recorded via electro-fishing at site E9 on the Lisdowney Stream (15L02) at Grange Bridge (**Figure 3.23**).

The site was of good value for salmonids supporting moderate densities of Atlantic salmon and brown trout. The site was of highest value as a salmonid nursery with frequent swift glide although the paucity of instream refugia reduced the value overall. Localised pool and deep glide/undercuts provided some valuable holding habitat for adult salmonids (especially downstream of the large weir). The site was of some value for spawning salmonids and lamprey but high calcification/compaction rates reduced the capacity of the site. The high energy site was unsuitable as a lamprey nursery habitat. European eel suitability was locally good in deep pools/glide with a low density recorded.

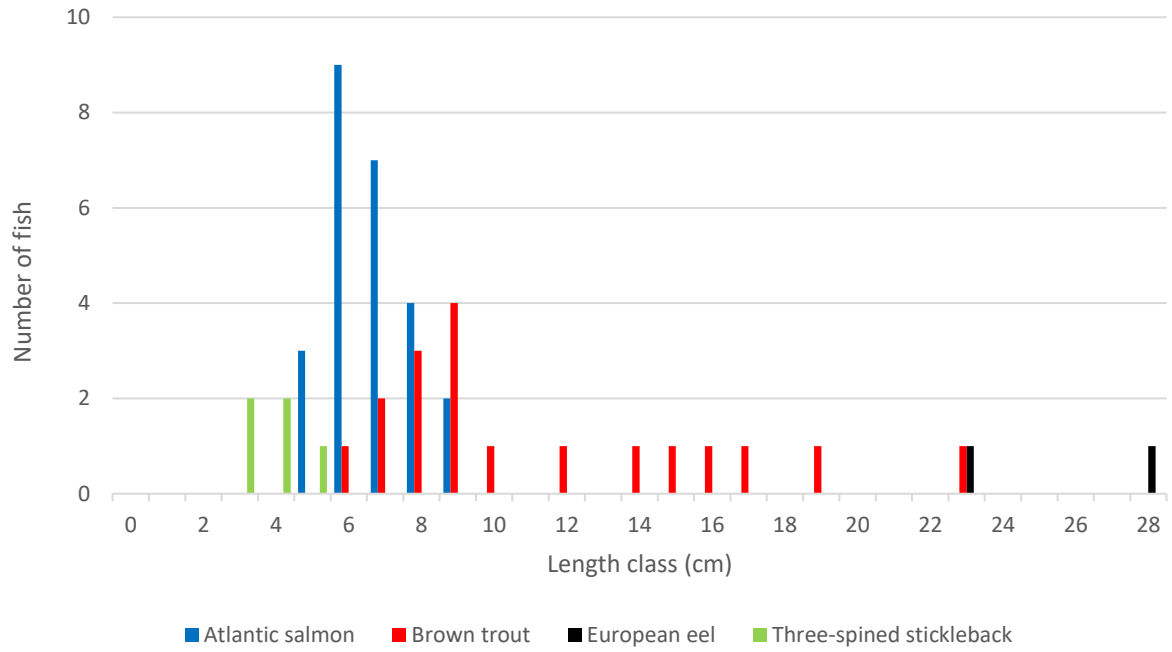


Figure 3.23 Length frequency distribution recorded via electro-fishing at site E9, September 2023



Plate 3.29 European eel recorded at site E9 on the Lisdowney Stream, September 2023

3.1.30 Site E10 – River Nore, Parksgrove

Electro-fishing was not undertaken at site E10 on the River Nore (15N01) due to prohibitive depths and water volumes. However, the river in the vicinity of Ballyragget is known to support Atlantic salmon, brown trout, *Lampetra* sp., European eel, minnow, stone loach and rudd (*Scardinius erythropthalmus*) (Triturus 2021 data). The deep glide at the proposed crossing was of value only as a salmonid holding habitat, with little suitability as spawning or nursery areas. Lamprey spawning habitat was also largely absent although marginal soft sediment deposits provided some moderate quality nursery areas.



Plate 3.30 Representative image of site E10 on the River Nore, September 2023

3.2 Lacustrine survey site results

3.2.1 Site L1 – lake/wetland, Longfordpass South

Site L1 was a small, interconnected twin-basin lake of c.1ha located in the vicinity of proposed turbine T1 in Littleton Bog. With the exception of three-spined stickleback (recorded via sweep sampling), site L1 was of poor fisheries value given its shallow, fluctuating and peat nature.



Plate 3.31 Representative image of site L1, October 2023

3.2.2 Site L2 – lake/wetland, Bawnreagh

Site L2 was located within an extensive area of cutover bog (Littleton Bog), within the proposed site boundary. With the exception of three-spined stickleback (considered likely present), site L2 was of poor fisheries value given its very shallow, peat nature and lack of connectivity to superior fisheries habitats (e.g. flowing watercourses).



Plate 3.32 Representative image of site L2, October 2023

3.2.3 Site L3 – lake/wetland, Bawnreagh

Site L3 was located within an extensive area of cutover bog (Littleton Bog), within the proposed site boundary and adjacent to site L2. With the exception of three-spined stickleback (considered likely present), site L3 was of poor fisheries value given its very shallow, peat nature and lack of connectivity to superior fisheries habitats (e.g. flowing watercourses).



Plate 3.33 Representative image of site L3, October 2023

3.2.4 Site L4 – lake/wetland, Bawnreagh

Site L4 was a small lake located between proposed turbines T1 & T2. With the exception of three-spined stickleback (considered likely present), site L4 was of poor fisheries value given its very shallow, peat nature and lack of connectivity to superior fisheries habitats (e.g. flowing watercourses).



Plate 3.34 Representative image of site L4, October 2023

3.2.5 Site L5 – lake/wetland, Bawnreagh

Site L5 was a small, irregularly shaped cutover lake located in the vicinity of proposed turbine T2. With the exception of three-spined stickleback (recorded in sweep sample), site L5 was of poor fisheries value given its shallow, peat nature and lack of connectivity to superior fisheries habitats (e.g. flowing watercourses). However, there was some low suitability for European eel.



Plate 3.35 Representative image of site L5, October 2023

3.2.6 Site L6 – lake/wetland, Bawnreagh

Site L6 was a large wetland complex with a small central ponding area. The site was not of fisheries value given its very shallow, peat nature, lack of connectivity to superior fisheries habitats (e.g. flowing watercourses) and likely ephemeral nature.



Plate 3.36 Representative image of site L6, October 2023

3.2.7 Site L7 – lake/wetland, Bawnreagh

Site L7 was a small pond located adjacent to site L6. The small 200m^2 pond was situated in a larger wetland area. The site was not of fisheries value given its very shallow, peat nature, lack of connectivity to superior fisheries habitats (e.g. flowing watercourses) and likely ephemeral nature.



Plate 3.37 Representative image of site L7, October 2023

3.2.8 Site L8 – lake/wetland, Lanespark

Site L8 was a small pond and wetland complex located approximately 150m south of proposed turbine T3. A small pond of c. 40m^2 was situated in a larger (0.2ha) seasonally flooded wetland area. Given the small, shallow size of the pond and seasonal nature of the supporting wetland area, site L8 was not of fisheries value.



Plate 3.38 Representative image of site L8, October 2023

3.2.9 Site L9 – lake/wetland, Clonoura

Site L9 was a small seasonal cutover peatland pool c. 120m^2 with a small pocket of open water 0.1-0.2m deep. Given the small, shallow size of the pond and seasonal nature of the supporting wetland area, site L9 was not of fisheries value.



Plate 3.39 Representative image of site L9, October 2023

3.2.10 Site L10 – lake/wetland, Clonoura

Site L10 was located adjacent to proposed turbine T5. The site was not of fisheries value given its shallow, peat nature and lack of connectivity to superior fisheries habitats (e.g. flowing watercourses.



Plate 3.40 Representative image of site L10, October 2023

3.2.11 Site L11 – lake/wetland, Clonoura

Site L11 was located within the proposed site boundary, 250m south of site proposed turbine T5. The cutover peat lake was of poor fisheries value given its heavily silted, generally shallow nature and isolation from other aquatic habitats.



Plate 3.41 Representative image of site L11

3.2.12 Site L12 – lake/wetland, Noard

Site L12 was located within the proposed site boundary 175m west of proposed turbine T6. The cutover peat lake was not considered of fisheries value given its heavily silted, shallow nature and isolation from other aquatic habitats.



Plate 3.42 Representative image of site L12

3.2.13 Site L13 – lake/wetland, Noard

Site L13 was located within the proposed site boundary <300m north of proposed turbine T7. The cutover peat lake was considered of poor fisheries value given its heavily silted, shallow nature and isolation from other aquatic habitats. However, there was some low potential for European eel given the presence of the species in the nearby tributary of the Clover River (Triturus 2021 data).



Plate 3.43 Representative image of site L13

3.2.14 Site L14 – lake/wetland, Noard

Site L14 was located within the proposed site boundary and immediately west of site L13. The cutover peat lake was considered of poor fisheries value given its heavily silted, shallow nature and isolation from other aquatic habitats. However, there was some low potential for European eel given the presence of the species in the nearby tributary of the Clover River (Triturus 2021 data).



Plate 3.44 Representative image of site L14

3.2.15 Site L15 – lake/wetland, Noard

Site L15 was a small 200m^2 cutover peat basin waterbody located 300m south-west of proposed turbine T7. The cutover lake was of poor fisheries value given its heavily silted, shallow nature and isolation from other aquatic habitats.



Plate 3.45 Representative image of site L15, October 2023

3.2.16 Site L16 – lake/wetland, Derryhogan

Site L16 was located within the proposed site boundary approximately 300m south of turbine T7. The site was not considered of fisheries value given its heavily silted, shallow nature and isolation from other aquatic habitats.



Plate 3.46 Representative image of site L16

3.2.17 Site L17 – lake/wetland, Lanespark

Site L17 was located at the southern extent of the proposed site boundary near Lanespark Bog, adjacent to Loch Doire Bhile and the North Glengoole Stream, and approximately 500m from both proposed turbine T9 and T10. The artificial lake was not considered of fisheries value given its shallow nature, isolation from other aquatic habitats and absence of fish stocking history (in contrast to the nearby Loch Doire Bhile which supports stocked brown and rainbow trout).



Plate 3.47 Representative image of site L17

Table 3.1 Fish species densities per m^2 recorded via **electro-fishing** at riverine sites in the vicinity of Littleton wind farm via electro-fishing in September 2023. Values in bold represent the highest densities recorded for each species, respectively. *= no. ammocoetes per m^2 of targeted habitat fished. Greyed out values indicate no fish recorded during the survey

Site	Watercourse	CPUE (elapsed time)	Approx. area fished (m^2)	Fish density (number fish per m^2)								
				Atlantic salmon	Brown trout	*Lampetra* sp. *	European eel	Stone loach	Perch	Pike	Minnow	Three-spined stickleback
A1	Unnamed stream	5	40	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.075
A2	Unnamed stream	5	50	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
A3	Unnamed stream	5	70	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
A4	Unnamed stream	10	245	0.000	0.012	0.000	0.000	0.004	**0.004**	0.000	0.000	0.057
A5	Clover River	10	280	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.021
A6	Clover River	10	260	0.000	0.050	0.000	0.000	0.019	0.004	0.000	0.000	0.008
A7	Clover River	10	180	0.006	0.094	1 per m^2	0.000	0.022	0.000	**0.011**	0.000	0.000
B1	Drish River	10	150	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.107**
B2	Drish River	10	180	0.006	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.083
B3	Drish River	10	300	0.000	0.003	0.67 per m^2	0.000	**0.030**	0.000	0.003	0.000	0.017
B4	Drish River	10	320	**0.238**	**0.128**	0.000	0.000	0.013	0.000	0.000	0.000	0.000
B5	Drish River	10	280	0.171	0.036	2.5 per m^2	0.007	0.004	0.000	0.000	**0.071**	0.000
C1	Black River	n/a	n/a - dry channel	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.000
C2	Black River	5	100	0.000	0.100	0.000	0.000	0.000	0.000	0.000	0.000	0.050
C3	North Glengoole River	10	150	0.000	0.020	0.000	0.000	0.000	0.000	0.000	0.000	0.007

Site	Watercourse	CPUE (elapsed time)	Approx. area fished (m^2)	Fish density (number fish per m^2)								
				Atlantic salmon	Brown trout	*Lampetra* sp. *	European eel	Stone loach	Perch	Pike	Minnow	Three-spined stickleback
C4	Black River	10	350	0.000	0.023	0.000	0.000	0.006	0.000	0.000	0.000	0.000
C5	Black River	10	250	0.068	0.076	**3.3 per m^2**	**0.028**	0.012	0.000	0.000	0.000	0.000
D1	Breegagh River	10	240	0.071	0.125	0.000	0.000	0.000	0.000	0.000	0.000	0.000
D2	Breegagh River	10	280	0.036	0.043	0.5 per m^2	0.000	0.018	0.000	0.000	0.000	0.000
D3	Breegagh River	10	240	0.121	0.163	0.000	0.013	0.025	0.000	0.000	0.008	0.000
E1	River Goul	10	200	0.000	0.050	0.25 per m^2	0.000	0.010	0.000	0.000	0.000	0.000
E2	Ardreagh River	5	80	0.100	0.113	0.000	0.025	0.000	0.000	0.000	0.000	0.300
E3	Lisduff Stream	5	45	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
E4	Tincashel River	10	140	0.000	0.086	0.000	0.000	0.000	0.000	0.000	0.000	0.000
E5	Clomantanagh Lower Stream	10	120	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
E6	Unnamed stream	5	75	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
E7	Gorteenahilla River	10	280	0.171	0.082	0.000	0.000	0.000	0.000	0.000	0.000	0.000
E8	Lismaine Stream	10	160	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.050
E9	Lisdowney Stream	10	280	0.089	0.064	0.000	0.007	0.000	0.000	0.000	0.000	0.018
E10	River Nore	n/a	n/a - too deep	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Table 3.2 Summary of fish species of higher conservation value and relative abundances (low, medium, high & very high) recorded in the vicinity of the proposed Littleton wind farm, September-October 2023

Site	Watercourse	Relative abundance				Other species
		Atlantic salmon	Brown trout	*Lampetra* sp.	European eel	
Riverine sites						
A1	Unnamed stream	No fish recorded				
A2	Unnamed stream	No fish recorded				
A3	Unnamed stream	No fish recorded				
A4	Unnamed stream		Low			Perch, stone loach, three-spined stickleback
A5	Clover River					Three-spined stickleback
A6	Clover River		Medium			Perch, stone loach, three-spined stickleback
A7	Clover River	Low	Medium	Low		Pike, stone loach
B1	Drish River					Three-spined stickleback
B2	Drish River	Low			Low	Three-spined stickleback
B3	Drish River		Low	Low		Pike, stone loach, three-spined stickleback
B4	Drish River	Very high	High			Stone loach
B5	Drish River	High	Low	Medium	Low	Minnow, stone loach
C1	Black River	No fish recorded – dry channel				
C2	Black River		Low			Three-spined stickleback
C3	North Glengoole River		Low			Three-spined stickleback
C4	Black River		Low			Stone loach
C5	Black River	Medium	Medium	Medium	Medium	Stone loach
D1	Breegagh River	Medium	High			
D2	Breegagh River	Medium	Medium	Medium		Stone loach
D3	Breegagh River	High	Very high		Low	Minnow, stone loach
E1	River Goul		Low	Low		Stone loach
E2	Ardreagh River	Low	Low		Low	Three-spined stickleback
E3	Lisduff Stream	No fish recorded				
E4	Tincashel River		Medium			
E5	Clomantanagh Lower Stream	No fish recorded				

Site	Watercourse	Relative abundance				Other species
		Atlantic salmon	Brown trout	*Lampetra* sp.	European eel	
E6	Unnamed stream	No fish recorded				
E7	Gorteenahilla River	Very high	Medium			
E8	Lismaine Stream					Three-spined stickleback
E9	Lisdowney Stream	High	Medium		Low	Three-spined stickleback
E10	River Nore	Fisheries appraisal only				
Lacustrine sites						
L1	Lake/wetland					Three-spined stickleback
L2	Lake/wetland					
L3	Lake/wetland					
L4	Lake/wetland					
L5	Lake/wetland					Three-spined stickleback
L6	Lake/wetland					
L7	Lake/wetland					
L8	Lake/wetland					
L9	Lake/wetland					
L10	Lake/wetland					
L11	Lake/wetland					
L12	Lake/wetland					
L13	Lake/wetland				Some low potential	
L14	Lake/wetland				Some low potential	
L15	Lake/wetland					
L16	Lake/wetland					
L17	Lake/wetland					

Conservation value: Atlantic salmon (*Salmo salar*), brook lamprey (La*mpetra planeri*) and river lamprey (*Lampetra fluviatilis*) are listed under Annex II of the Habitats Directive [92/42/EEC]. Atlantic salmon and river lamprey are also listed under Annex V of the Habitats Directive [92/42/EEC]. European eel are 'critically endangered' according to most recent ICUN red list (Pike et al., 2020) and listed as 'critically engendered' in Ireland (King et al., 2011). With the exception of the Inland Fisheries Acts 1959 to 2017, brown trout and coarse fish species have no legal protection in Ireland.

4. Discussion

The riverine watercourses in the vicinity of the proposed Littleton wind farm, inclusive of those crossed by the proposed GCR, were typically lowland channels which had been extensively straightened and or deepened historically as part of arterial drainage and land reclamation works, resulting in poor hydromorphology and reduced habitat heterogeneity. Whilst some good instream recovery had occurred locally (e.g. Drish River[1], Black River, Breegagh River, Lisdowney Stream), significant siltation and hydromorphological pressures were evident throughout the survey area. Historical straightening and deepening of watercourses damages habitat and hydromorphological heterogeneity, removes instream structure and refugia, encourages sediment deposition and invariably results in an irreparable reduction in fisheries potential, particularly for salmonids (O'Briain et al., 2019; O'Grady et al., 2017, O'Grady, 2006) but also European eel and lamprey species. Furthermore, bank clearance works which typically accompany arterial drainage (as observed in this survey) reduce riparian cover along watercourses and increase thermal stress to fish (especially less thermally-plastic salmonids) having multiple effects on populations (O'Briain et al., 2020, 2017).

Whilst a total of 8 no. riverine sites supported either three-spined stickleback only or no fish populations, the majority of the riverine survey sites supported high conservation value fish species (**Table 3.2**). A typical diversity of fish species for Irish midland rivers – namely Atlantic salmon, brown trout, lamprey (*Lampetra* sp.), European eel, stone loach, minnow, pike, perch and three-spined stickleback – were recorded during the electro-fishing survey. The recorded assemblages were in keeping with previous surveys of the area (Triturus, 2023). The lakes and wetlands located within the proposed site boundary typically originate from historical cutover bog activities and as such are shallow, highly turbid (peat stained), poorly vegetated, isolated from other aquatic habitats and of lower productivity. None were considered of significant fisheries value. However, sites located near the Clover River (e.g. sites L13 & L14) and site L17 (habitat creation calcareous) had some low potential for European eel.

Salmonid populations were widespread with the survey area, being present at 19 no. riverine sites. Atlantic salmon were recorded from a total of 11 no. sites[2] on the Clover River (A7), Drish River (B2, B4, B5), Black River (C5), Breegagh River (D1, D2, D3), Ardreagh River (E2), Gorteenahilla River (E7) and the Lisdowney Stream (E9). Although the quality of salmonid habitat was typically reduced due to the significant aforementioned pressures, particularly high densities of juvenile salmonids were recorded at sites on the Drish River (B4, B5), Breegagh River (D3), Gorteenahilla River (E7) and Lisdowney Stream (E9) where high quality salmonid nursery habitat was present. With the exception sites A7 (Clover River) and E2 (Ardreagh River), these sites supported at least two size classes of Atlantic salmon parr (0+ and ≥1+), validating the use of these watercourses as annual spawning locations.

Lamprey ammocoetes (*Lampetra* sp.) were recorded from 6 no. sites on the Clover River (A7), Drish River (B3 & B5), Black River (C5), Breegagh River (D2) and River Goul (E1) during targeted electro-

[1] The Drish River was heavily polluted by zinc and lead mine at Lisheen in the recent past (AECOM, 2020; O'Connor, 2007), with fish life significantly affected. However, good recovery is now evident in this watercourse despite other pressures, including siltation and hydromorphology.

[2] Atlantic salmon are also known from the River Nore in the vicinity of Ballyragget but electro-fishing was not feasible at site E10 due to prohibitive depths

fishing (**Table 3.1, 3.2**). Ammocoetes were present in low to medium densities only at these sites, (0.5-3.3per m^2; **Table 3.1**). An early stage *Lampetra* sp. transformer were also recorded at site A7. The restricted distribution and low density populations of lamprey reflected the paucity of suitable nursery (soft sediment) habitat within the vicinity of the proposed project, in addition to the presence of sub-optimal or absence of spawning habitat (as per characteristics provided in Dawson et al., 2015; Aronsuu & Virkkala, 2014; Rooney et al., 2013; Lasne et al., 2010; Goodwin et al., 2008; Gardiner, 2003). This is primarily due to significant arterial drainage pressures.

European eel are Red-listed in Ireland (King et al., 2011) and are classed as 'critically endangered' on a global scale (Pike et al., 2020). The species was recorded in low densities at a total of 6 no. sites on the Drish River (B2 & B5), Black River (C5), Breegagh River (D3), Ardreagh River (E2) and the Lisdowney Stream (E9) (**Table 3.2**). The absence of eel from many survey sites largely reflected the poor hydromorphology and reduced instream habitat heterogeneity resulting from historical modifications (arterial drainage), providing a low frequency of suitable refugia (e.g. boulders, pools) required by the species (Laffaille et al., 2003). The relatively high frequency of instream barriers in the survey catchments (based on IFI's National Barriers Programme database) likely affects eel distribution, in addition to the large distance between the survey area and marine/transitional habitats (Matondo et al., 2021; Degerman et al., 2019; Chadwick et al., 2007) (>115km nearest instream distance).

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1. Introduction

1.1 Background

Triturus Environmental Ltd. were commissioned by Fehily Timoney and Company to conduct baseline aquatic surveys to inform EIAR preparation for the proposed Littleton wind farm project. The following report provides a baseline assessment of the aquatic ecology including fisheries and biological water quality, as well as protected aquatic species and habitats in the vicinity of the proposed project, located near Littleton, Co. Tipperary.

Undertaken on a catchment-wide scale, the baseline surveys focused on the detection of freshwater habitats and species of high conservation value. These included surveys for white-clawed crayfish (*Austropotamobius pallipes*), otter (*Lutra lutra*), macro-invertebrates (biological water quality) and fish of high conservation value, inclusive of supporting nursery and spawning habitat. The surveys also documented macrophyte and aquatic bryophyte communities including Annex I habitat associations in the vicinity of the project (**Figure 2.1**). Aquatic surveys were undertaken in September and October 2021.

1.2 Project description

A full description of the proposed project will be provided in any Environmental Impact Assessment Report (EIAR) used to support consenting applications.

2. Methodology

2.1 Selection of watercourses for assessment

All freshwater watercourses which could be affected directly or indirectly by the proposed wind farm project were considered as part of the current baseline. A total of 20 no. riverine sites were selected for detailed aquatic assessment (see **Table 2.1, Figure 2.1** below). The nomenclature for the watercourses surveyed is as per the Environmental Protection Agency (EPA). Riverine survey sites survey sites were present on the Clover River (EPA code: 16C04), Drish River (16D02), Cooleeny River (16C14), Ballygammane River (16B55), North Glengoole River (16N28), Breegagh River (16B03) and several unnamed watercourses (**Table 2.1**). Additionally, a total of 17 no. lakes/wetlands located within the proposed site boundary at Littleton Bog were also surveyed in October 2021 (**Table 2.1; Figure 2.2**).

The aquatic survey sites were located within the Suir_SC_040 river sub-catchment. The proposed wind farm site boundary did not overlap with any European sites. However, there was potential downstream hydrological connectivity between the proposed project and the Lower River Suir SAC (002137), a site designated for a range of aquatic qualifying interests (NPWS, 2017a).

Please note this aquatic report should be read in conjunction with the Environmental Impact Assessment Report (EIAR) prepared for the proposed project. More specific aquatic methodology is outlined below and in the appendices of this report.

2.2 Aquatic site surveys

Aquatic surveys of the watercourses within the vicinity of the proposed wind farm project were conducted in September 2021. Survey effort focused on both instream and riparian habitats at each aquatic sampling location (**Figure 2.1**). Surveys at each of these sites included a fisheries assessment (electro-fishing and or fisheries habitat appraisal), white-clawed crayfish survey, otter survey (within 150m of the survey site), macrophyte and aquatic bryophyte survey and (at a subset) biological water quality sampling (Q-sampling) (**Figure 2.1**). To help verify site surveys, environmental DNA (eDNA) sampling was undertaken for white-clawed crayfish and crayfish plague (*Aphanomyces astaci*) at 5 no. strategically chosen riverine locations within the vicinity of the project. This holistic approach informed the overall aquatic ecological evaluation of each site in context of the proposed project and ensured that any habitats and species of high conservation value would be detected to best inform mitigation for the wind farm project.

In addition to the ecological characteristics of the site, a broad aquatic and riparian habitat assessment was conducted utilising elements of the methodology given in the Environment Agency's 'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003' (EA, 2003) and the Irish Heritage Council's 'A Guide to Habitats in Ireland' (Fossitt, 2000). This broad characterisation helped define the watercourses' conformity or departure from naturalness. All sites were assessed in terms of:

- Physical watercourse/waterbody characteristics (i.e. width, depth etc.) including associated evidence of historical drainage

- Substrate type, listing substrate fractions in order of dominance (i.e. bedrock, boulder, cobble, gravel, sand, silt etc.)
- Flow type by proportion of riffle, glide and pool in the sampling area
- An appraisal of the macrophyte and aquatic bryophyte community at each site
- Riparian vegetation composition

Table 2.1 Location of 37 no. aquatic survey sites in the vicinity of Littleton wind farm, Co. Tipperary (* indicates eDNA sampling)

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
Riverine sites					
A1	Unnamed stream	n/a	Longfordpass North	622853	659892
A2	Unnamed stream	n/a	Longfordpass North	622135	660772
A3	Unnamed stream	n/a	R639 road bridge	622188	658445
A4	Unnamed stream	n/a	Noard	622365	655435
A5	Clover River	16C04	R639 road bridge	621359	657544
A6	Clover River	16C04	Noard	621675	654968
B1	Unnamed stream	n/a	Longfordpass South	624135	658002
B2*	Drish River	16D02	Longfordpass Bridge	624845	660559
B3	Drish River	16D02	Castletown Bridge	621680	663563
B4	Cooleeny River	16C14	Killoran	620898	665459
B5	Drish River	16D02	d/s Ballyduff Bridge	619037	661227
B6	Ballygammane River	16B55	Athlummon	617128	660048
C1	Black River	16B01	Clonoura	623692	654684
C2	Black River	16B01	Derryvella	621096	652818
C3	North Glengoole River	16N28	Derryvella	621512	651948
C4	North Glengoole River	16N28	Derryvella	620969	652602
C5*	Black River	16B01	Derryhogan	619908	653512
C6	Black River	16B01	N75 crossing, Two Mile Borris	619120	657824
D1	Breegagh River	16B03	Killeen	620848	650493
D2*	Breegagh River	16B03	Ballymurreen Bridge	617399	653051
Lacustrine sites					
L1	Lake/wetland	n/a	Longfordpass South	623839	657293
L2	Lake/wetland	n/a	Bawnreagh	624150	657039
L3	Lake/wetland	n/a	Bawnreagh	624200	656995
L4	Lake/wetland	n/a	Bawnreagh	623830	656971
L5	Lake/wetland	n/a	Bawnreagh	623887	656489
L6	Lake/wetland	n/a	Bawnreagh	623764	656277
L7	Lake/wetland	n/a	Bawnreagh	623868	656219
L8	Lake/wetland	n/a	Lanespark	622641	656208
L9	Lake/wetland	n/a	Clonoura	623521	655503
L10	Lake/wetland	n/a	Clonoura	623259	655121
L11	Lake/wetland	n/a	Clonoura	623353	654846

Site no.	Watercourse	EPA code	Location	X (ITM)	Y (ITM)
L12	Lake/wetland	n/a	Noard	622697	655234
L13	Lake/wetland	n/a	Noard	622758	655209
L14	Lake/wetland	n/a	Noard	622163	654688
L15	Lake/wetland	n/a	Noard	621925	654547
L16	Lake/wetland	n/a	Derryhogan	621931	654343
L17	Lake/wetland	n/a	Lanespark	621400	651988

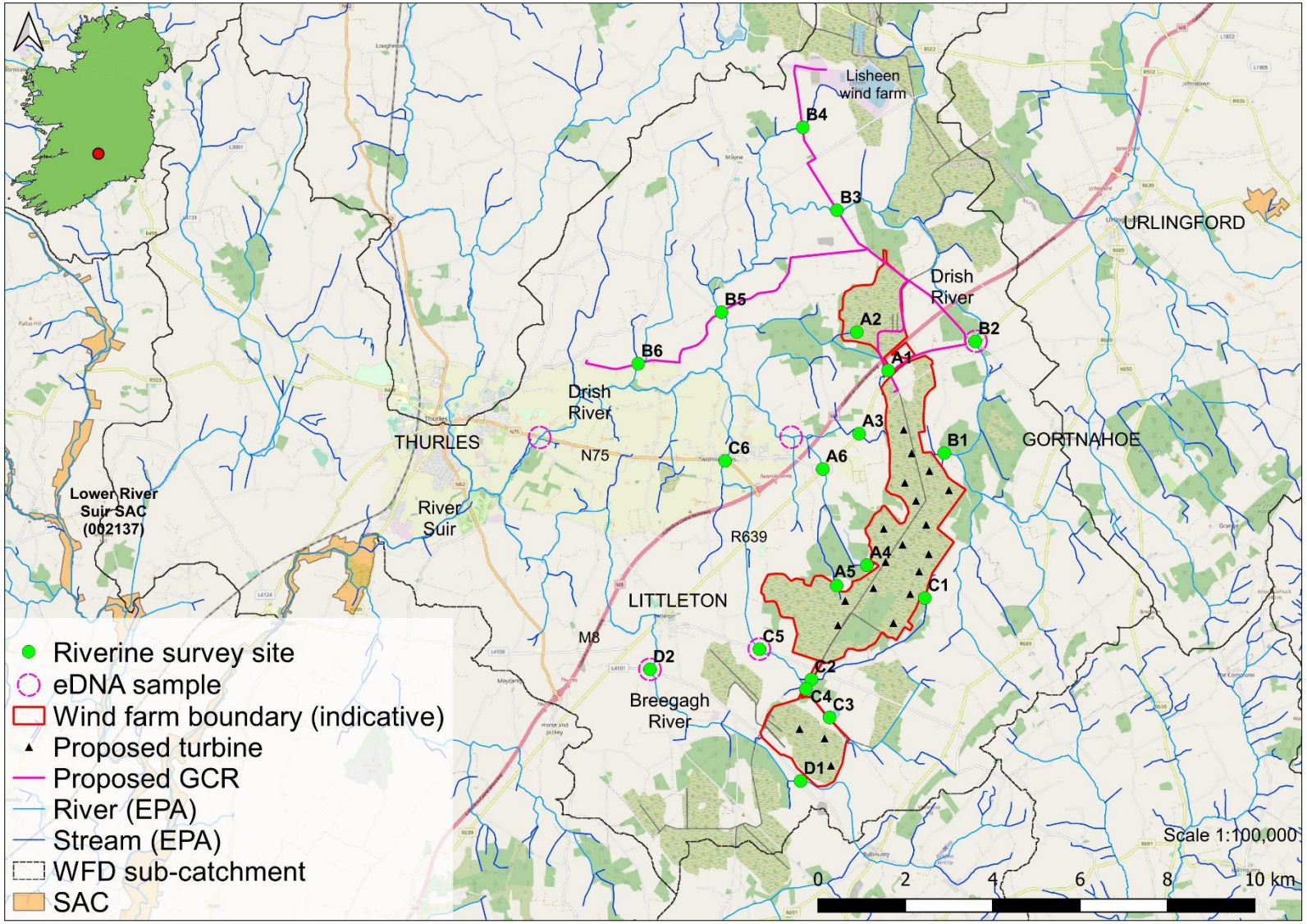


Figure 2.1 Overview of the 20 no. riverine survey sites in vicinity of the proposed Littleton wind farm project, Co. Tipperary

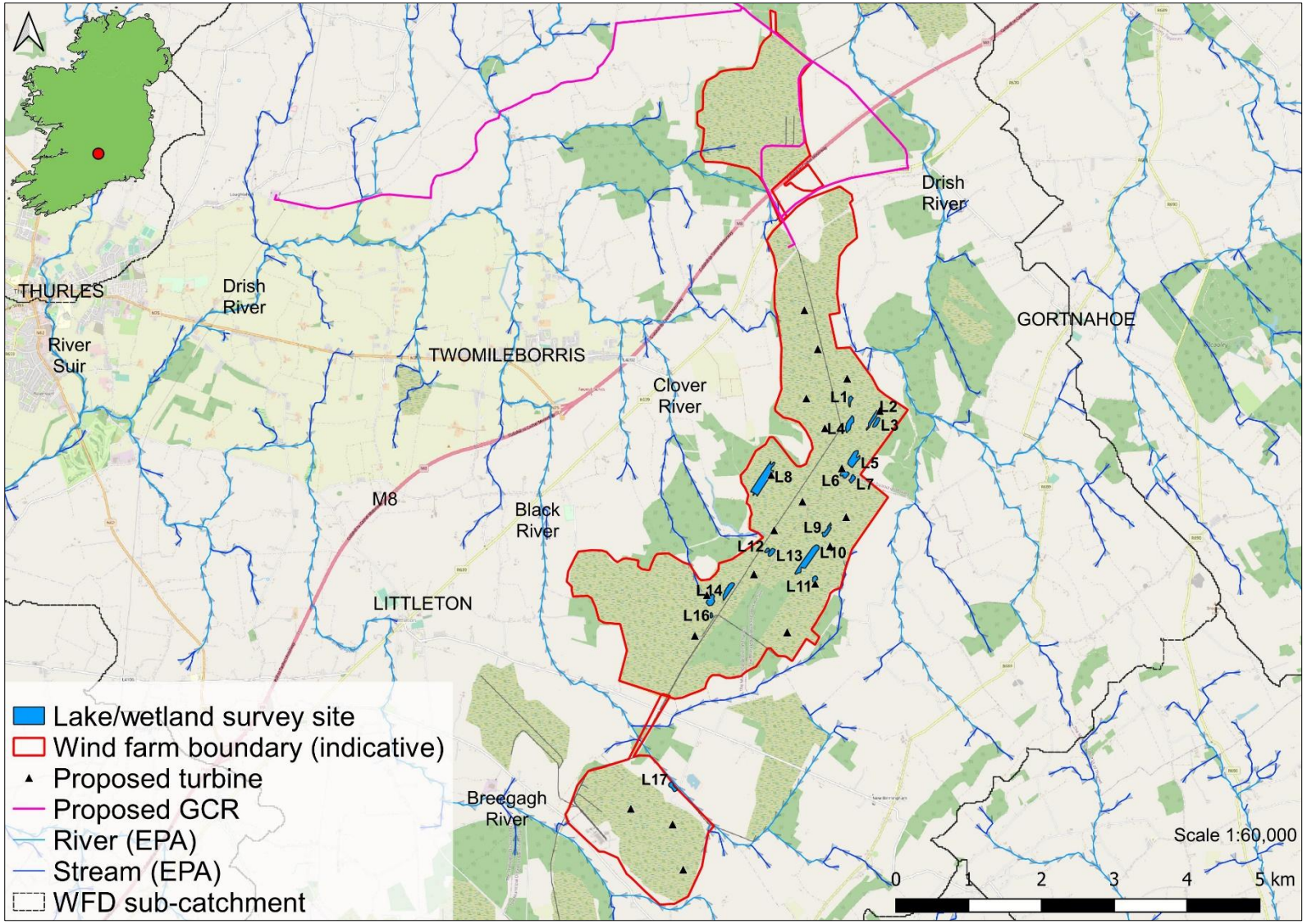


Figure 2.2 Overview of the 17 no. lacustrine survey sites in vicinity of the proposed Littleton wind farm project, Co. Tipperary

2.3 Fisheries assessment (electro-fishing) & appraisal

A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish sites on riverine watercourses in the vicinity of the proposed Littleton wind farm in September 2021 (**Table 2.1, Figure 2.1; Appendix A**), following notification to Inland Fisheries Ireland, under the conditions of a Department of the Environment, Climate and Communications (DECC) licence. The survey was undertaken in accordance with best practice (CFB, 2008; CEN, 2003) and Section 14 licencing requirements.

Furthermore, a fisheries habitat appraisal of all aquatic survey sites, including 17 no. lake/wetland habitats (**Table 2.1**), was undertaken to establish their importance for salmonid, lamprey, European eel and other fish species. The baseline assessment also considered the quality of spawning, nursery and holding habitat for salmonids and lamprey within the vicinity of the survey sites. For detailed survey methodology, please refer to accompanying fisheries assessment report in **Appendix A.**

2.4 White-clawed crayfish survey

White-clawed crayfish surveys were undertaken at the aquatic survey sites in September 2021 under a National Parks and Wildlife (NPWS) open licence (no. C145/2021), as prescribed by Sections 9, 23 and 34 of the Wildlife Act (1976-2021), to capture and release crayfish to their site of capture, under condition no. 6 of the licence. As per Inland Fisheries Ireland recommendations, the crayfish sampling started at the uppermost site(s) of the wind farm catchment/sub-catchments in the survey area to minimise the risk of transferring invasive propagules (including crayfish plague) in an upstream direction.

Hand-searching of instream refugia and sweep netting was undertaken according to Reynolds et al. (2010). An appraisal of white-clawed crayfish habitat at each site was conducted based on physical channel attributes, water chemistry and incidental records in mustelid spraint. Additionally, a desktop review of crayfish records within the wider Littleton wind farm survey area was completed.

2.5 eDNA analysis

To validate site surveys and to detect potentially cryptically low populations within the study area, 5 no. composite water samples were collected from the Clover River, Drish River (2 sites), Black River and Breegagh River and analysed for white-clawed crayfish and crayfish plague eDNA (**Figure 2.1**). The water samples were collected on 29th September 2021, with the sites strategically chosen to maximise longitudinal (instream) coverage within the catchment (i.e. facilitating a greater likelihood of species detection).

In accordance with best practice, a composite (500ml) water sample was collected from the sampling point, maximising the geographic spread at the site (20 x 25ml samples at each site), thus increasing the chance of detecting the target species' DNA. The composite sample was filtered on-site using a sterile proprietary eDNA sampling kit. The fixed sample was stored at room temperature and sent to the laboratory for analysis within 48 hours of collection. A total of n=12 qPCR replicates were analysed for the site. Given the high sensitivity of eDNA analysis, a single positive qPCR replicate is considered as proof of the species' presence (termed qPCR No Threshold, or qPCR NT). Whilst an eDNA approach is not currently quantitative, the detection of the target species' DNA indicates the presence of the

species at and or upstream of the sampling point. Please refer to **Appendix C** for full eDNA laboratory analysis methodology.

2.6 Biological water quality (Q-sampling)

A total of 12 no. riverine survey sites were assessed for biological water quality through Q-sampling in September 2021. All samples were taken with a standard kick sampling hand net (250mm width, 500µm mesh size) from areas of riffle/glide utilising a 2-minute kick sample, as per Environmental Protection Authority (EPA) methodology (Feeley et al., 2020). Large cobble was also washed at each site for 1-minute (where present) to collect attached macro-invertebrates (as per Feeley et al., 2020). Samples were elutriated and fixed in 70% ethanol for subsequent laboratory identification. Samples were converted to Q-ratings as per Toner et al. (2005) and assigned to WFD status classes (**Table 2.2**). Any rare invertebrate species were identified from the NPWS Red List publications for beetles (Foster et al., 2009), mayflies (Kelly-Quinn & Regan, 2012), stoneflies (Feeley et al., 2020) and other relevant taxa (i.e. Byrne et al., 2009; Nelson et al., 2011).

Table 2.2 Reference categories for EPA Q-ratings (Q1 to Q5)

Q value	WFD status	Pollution status	Condition
Q5 or Q4-5	High status	Unpolluted	Satisfactory
Q4	Good status	Unpolluted	Satisfactory
Q3-4	Moderate status	Slightly polluted	Unsatisfactory
Q3 or Q2-3	Poor status	Moderately polluted	Unsatisfactory
Q2, Q1-2 or Q1	Bad status	Seriously polluted	Unsatisfactory

2.7 Lacustrine macro-invertebrate communities

A subset of 10 no. lake/wetland sites were sampled for macro-invertebrates via sweep netting in October 2021. A standard lake net (250mm width, mesh size 500µm) was used to sweep macrophytes to capture macro-invertebrates. The net was also moved along the lake/lake bed to collect epibenthic and epiphytic invertebrates from the substratum (as per Cheal et al., 1993). A 3-minute sampling period was employed. To ensure appropriate habitat coverage, the sampling period was also divided amongst the range of meso-habitats present at the survey site to get a representative sample for sub-habitats.

2.8 Macrophytes and aquatic bryophytes

Surveys of the macrophyte and aquatic bryophyte community were conducted by instream wading at each of the wetted aquatic survey sites, with specimens collected (by hand, sweep nets or via grapnel) for on-site identification. An assessment of the aquatic vegetation community helped to identify any rare macrophyte species (Flora Protection Order or Wyse-Jackson et al., 2016) or habitats corresponding to the Annex I habitats, e.g., 'Water courses of plain to montane levels, with submerged or floating vegetation of the *Ranunculion fluitantis* and *Callitricho-Batrachion* (low water level during summer) or aquatic mosses [3260]' (more commonly referred to as 'floating river vegetation').

2.9 Otter signs

The presence of otter (*Lutra lutra*) at each aquatic survey site was determined through the recording of otter signs within 150m of each survey site. Notes on the age and location (ITM coordinates) were made for each otter sign recorded, in addition to the quantity and visible constituents of spraint (i.e. remains of fish, crustaceans, molluscs etc.).

2.10 Aquatic ecological evaluation

The evaluation of aquatic ecological receptors contained within this report uses the geographic scale and criteria defined in the 'Guidelines for Assessment of Ecological Impacts of National Road Schemes' (NRA, 2009).

2.11 Biosecurity

A strict biosecurity protocol following IFI (2010) and the Check-Clean-Dry approach was adhered to during surveys for all equipment and PPE used. Disinfection of all equipment and PPE before and after use with Virkon™ was conducted to prevent the transfer of pathogens or invasive propagules between survey sites. Specific consideration was given to highly virulent crayfish plague given known historical outbreaks in the connecting downstream catchments. Surveys were undertaken at sites in a downstream order to minimise the risk of upstream propagule mobilisation of pathogens and invasive species. Where feasible, equipment was also thoroughly dried (through UV exposure) between survey areas. Any aquatic invasive species or pathogens recorded within or adjoining the survey areas were geo-referenced. All Triturus staff are certified in 'Good fieldwork practice: slowing the spread of invasive non-native species' by the University of Leeds.

3. Receiving environment

3.1 Littleton wind farm catchment and survey area description

The proposed Littleton wind farm is located in an extensive area of cutover bog within the townlands of Noard, Ballybeg, Kileen, Newhill, Derryhogna, Kilmakill, Lansespark, Derryvella, Leigh, Clonoura, Longfordpass North, Longfordpass South and Bawnreagh approximately 2.5km west of Littleton, County Tipperary (**Figure 2.1**). The proposed wind farm site is within the South Eastern River Basin District and within hydrometric area 16 (Suir). The aquatic survey sites were located within the located in the Suir_SC_040 river sub-catchment. The watercourses and aquatic surveys sites in the vicinity of Littleton wind farm are typically small, historically modified lowland depositing channels (FW2; Fossitt, 2000) which flow over areas of Tournaisian and Visean limestone and calcareous shale (Geological Survey of Ireland data). Land use practices in the wider survey area comprise peat bogs (CORINE 412), transitional woodland scrub (324) with localised coniferous forests (312) and adjoining pastures (231).

3.2 Fisheries asset of the survey area

The Drish River, a tributary of the River Suir, is known to support *Lampetra* sp. (O'Connor, 2007; Kurz & Costello, 1999) as well as Atlantic salmon (*Salmo salar*), brown trout (*Salmo trutta*) and pike (*Esox lucius*) (1993 data presented in AECOM, 2020). The trout and pike in the Drish were found to be fast growing and similar to those in comparable rivers in the Irish midlands (CFB data referenced in AECOM, 2020). The river suffered significant pollution from a zinc and lead mine at Lisheen until the recent past (AECOM, 2020; O'Connor, 2007).

The Black River (Two Mile Borris) and the Breegagh River, both tributaries of the Drish River, are known to support *Lampetra* sp. (O'Connor, 2007)

Atlantic salmon are also known from the Breegagh River (Malone O'Regan, 2020).

Fisheries data for the other watercourses surveyed was not available at the time of survey.

3.3 Protected aquatic species data

A sensitive species data request was submitted to the National Parks and Wildlife Service for the 10km grid squares containing and adjoining the proposed wind farm project (i.e. S04, S05, S15, S16, S25 & S26). Furthermore, additional data held by the EPA and NBDC was also reviewed for these grid squares. Records for a low number of rare or protected aquatic species were available although none overlapped directly with the proposed wind farm.

A very high number of contemporary, white-clawed crayfish (*Austropotamobius pallipes*) records (>100) were available for the respective grid squares in the 2000-2014 period (**Figure 3.1**), with a further 50 approx. historical records. A low number of records were available for the Drish River, Clover River (single record), Black River (including at survey site C6) and Lough Doire Bhile (near lake site L17) (**Figure 3.1**).

A low number of contemporary otter (*lutra lutra*) records (2005-2015) were available for the relevant grid squares, with records from the Black River and Drish River (**Figure 3.1**).

A low number of records for freshwater pearl mussel (*Margaritifera margaritifera*) were available for the 10km grid squares S05 (Clodiagh River) and S04 (Multeen River) in the 1987-2006 period (**Figure 3.1**). However, there is no hydrological connectivity between these populations and the proposed project. No records were available in the vicinity of the proposed Littleton wind farm.

A single historical record (1985) for river lamprey (*Lampetra fluviatilis*) was available for the River Suir (grid square S04). *Lampetra* sp. are also known from a number of watercourses in vicinity of the proposed wind farm (see section 3.2 above).

Two records for Flora (Protection) Order 2022 macrophyte species opposite-leaved pondweed (*Groenlandia densa*) were available from a former pond in the vicinity of Urlingford but these were historical only (i.e. pre-1900).

Records for common frog (*Rana temporaria*) were widespread throughout 10km grid squares S04, S05, S15, S16, S25 & S26, with several records available in the vicinity of the proposed wind farm (data not shown). A single record for smooth newt (*Lissotriton vulgaris*) was available for bog habitat at Derryvella adjacent to the North Glengoole River at survey site C3 from 2010.

3.4 EPA water quality data (existing data)

The following outlines the available water quality data for the watercourses in context of the proposed wind farm project. Only recent water quality is summarised below. Contemporary EPA biological monitoring data was available for the Drish, Clover and Black Rivers only. Please note that biological water quality analysis was undertaken as part of this study, with the results presented in the **section 4** and **Appendix B** of this report.

3.4.1 Drish River

The Drish River (EPA code: 16D02) drains north and then south-west of the proposed wind farm site boundary before joining the River Suir downstream of Thurles. There was a total of 5 no. contemporary EPA biological monitoring stations on the river. The Drish River achieved **Q3** (poor status) at the four uppermost stations (RS16D020040, RS16D020070 (site B3), RS16D020100 & RS16D020200) in 2020. The lowermost station (RS16D020400) achieved **Q3-4 (moderate status)** in 2020.

The Drish_010, _020, _040 & _050 river waterbodies were all of poor status in the 2016-2021 period and were considered 'at risk' of failing to achieve good status (WFD Risk 3rd cycle),. The lower reaches (Drish_060) achieved moderate status in the same period but were also considered 'at risk'. Peat extraction, forestry and agriculture are the primary threats to water quality in these waterbodies (EPA, 2019).

3.4.2 Clover River

There were 2 no. contemporary EPA biological monitoring stations on the Clover River (16C04), a tributary of the Black River. The Clover achieved **Q3 (poor status)** at station RS16C040100 (survey site A2) in 2020 but this elevated to Q3-4 (moderate status) in the lower reaches at station RS16C040300 (also in 2020).

The upper reaches of the Clover River (Clover_010 waterbody) were of poor status in the 2016-2021 period, whilst the lower reaches (Clover_020 waterbody) were of moderate status. Both waterbodies were considered 'at risk' of not achieving good status. Peat extraction and forestry are the significant threats to water quality in these waterbodies (EPA, 2019).

3.4.3 Black River

There were 2 no. contemporary EPA biological monitoring stations on the Black River (16B01), a tributary of the Drish River. At Black River Bridge (station RS16B010030) and station RS16B010100 (near site C6) the river achieved **Q3-4 (moderate status)** in 2020.

The Black (Twomileborris)_010 waterbody (encompassing most of the river) was of moderate WFD status in the 2016-2021 period and was considered 'at risk' of achieving good status. The lower reaches of the Black River are part of the Drish_050 waterbody which was of poor status in the same period and also 'at risk'. (as outlined above). Peat extraction is the primary threat to water quality in these waterbodies (EPA, 2019).

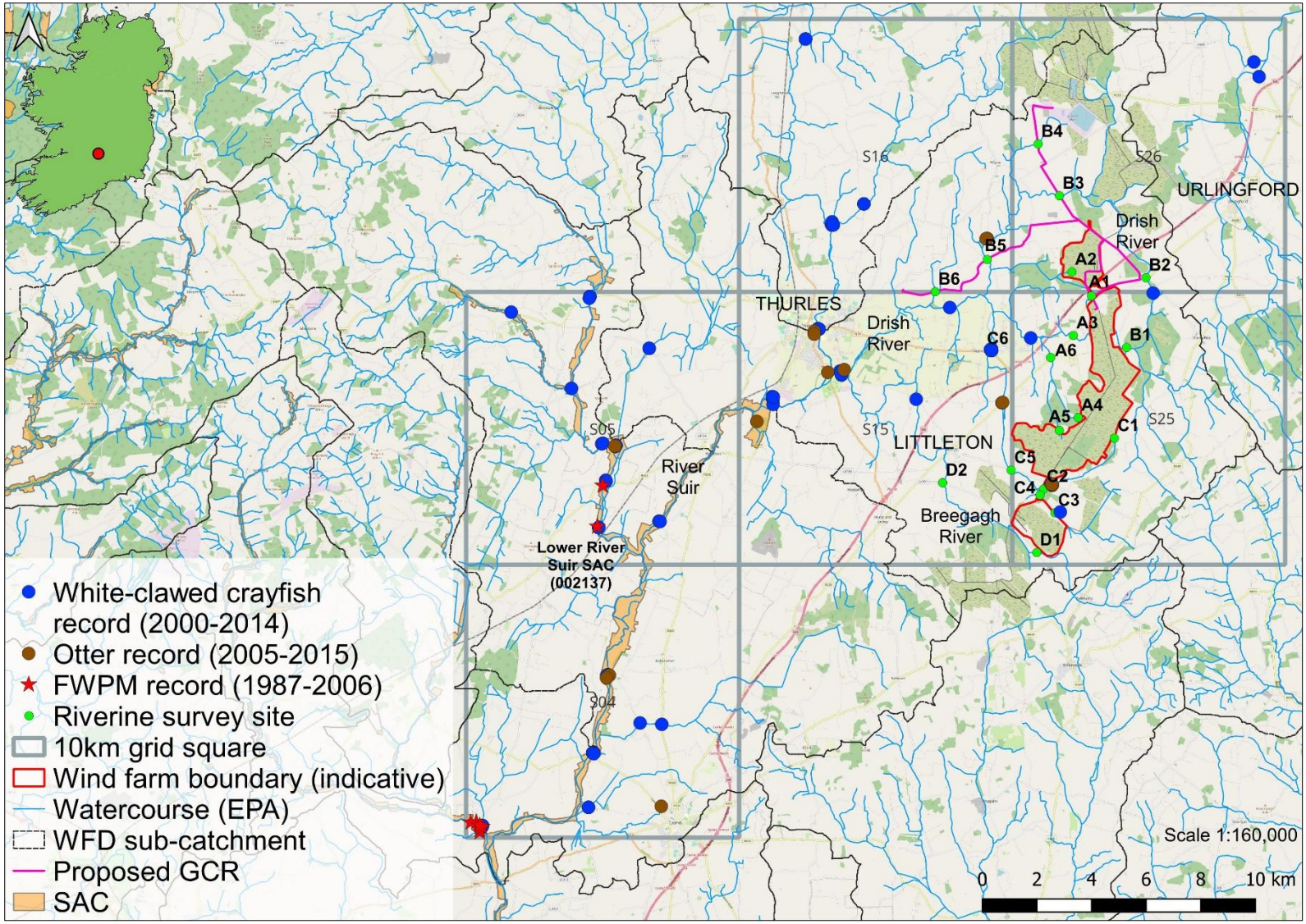


Figure 3.1 Distribution of selected protected species records in the vicinity of the proposed Littleton wind farm (source: NPWS, EPA & NBDC data)

4. Results of aquatic surveys

The following section summarises each of the 20 no. riverine and 17 no. lake/wetland survey sites in terms of aquatic habitats, physical characteristics and overall value for fish, macro-invertebrates and macrophyte/aquatic bryophyte communities. Biological water quality (Q-sample) and macro-invertebrate sweep sample results are summarised for a subset of 12 no. riverine and 10 no. lake/wetland sites, respectively, in **Appendix B**. Habitat codes are according to Fossitt (2000). Scientific names are provided at first mention only. Sites were surveyed in September 2021. Please refer to **Appendix A** (fisheries assessment report) for more detailed fisheries results. A summary of the fish species recorded at each survey site is provided in **Table 4.2**. A summary of the aquatic species and habitats of high conservation concern recorded during the surveys is provided in **Table 4.3**. An evaluation of the aquatic ecological importance of each survey site based on these aquatic surveys is provided and summarised in **Table 4.4**.

4.1 Riverine survey site results

4.1.1 Site A1 – unnamed stream, Longfordpass North

Site A1 was located on the upper reaches of an unnamed stream (no EPA code), approximately 0.4km north of a proposed substation. Although mapped by the EPA, no flowing watercourse was present at this location, situated adjacent to a Bord na Móna rail line. Whilst drainage swales were present along the rail line, these did not support flowing or standing water at the time of survey. No aquatic habitats were recorded in the vicinity of the site.

Site A1 was not of fisheries value given its dry, ephemeral nature and absence of aquatic habitats. No otter signs were recorded in the vicinity of the site.

Given the dry nature of the site, it was not possible to collected a biological water quality sample at the time of survey.

Given the absence of aquatic habitats, the aquatic ecological evaluation of site A1 was of **lower importance (lower value)** (**Table 4.4**).



Plate 4.1 Representative image of site A1 on an unnamed Drish River tributary, September 2021 (watercourse mapped by EPA but no channel or water present)

4.1.2 Site A2 – unnamed stream, Longfordpass North

Site A2 was located on the uppermost reaches of an unnamed stream (no EPA code) within the proposed site boundary. Situated in an extensive area of cutover bog (PB4), the Drish River tributary had been extensively straightened and deepened, with V-shaped banks to 4-5m in height. The homogenous channel averaged 1-1.5m wide and <0.1m deep with imperceptible flows at the time of survey (near stagnant glide and pool). The channel had been excavated with a gravel-dominated base. Occasional cobble and bolder was also present. However, these were heavily silted (flocculent deposits from peat escapement). The stream was considered likely ephemeral (seasonal) at this location. Given the low flows and high riparian shading, macrophytes were absent with the exception of very localised water horsetail (*Equisetum fluviatile*) and common reed (*Phragmites australis*) along channel margins. No aquatic bryophytes were recorded. The channel was heavily scrubbed over with high levels of terrestrial encroachment from willow (*Salix* sp.), downy birch (*Betula pubescens*) and bramble (*Rubus fruticosus* agg.). The site was bordered by dry meadow habitat (GS2) and cutover bog habitat in the wider area.

Three-spined stickleback (*Gasterosteus aculeatus*) was the only fish species recorded via electro-fishing at site A1 (**Appendix A**). With the exception of low densities of this species, the site was of very poor fisheries value at the time of survey given observed low seasonal flows (stagnant), very shallow nature, heavy siltation and historical modifications. There was no suitability for salmonids, lamprey, European eel or other fish species at the time of survey. The site had no suitability for white-clawed crayfish given very shallow water. No otter signs were recorded in vicinity of the site.

A biological water quality sample was not collected at this site.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site A2 was of **local importance (lower value)** (**Table 4.4**).



Plate 4.2 Representative image of site A2 on an unnamed Drish River tributary, September 2021

4.1.3 Site A3 – Unnamed stream, Leigh

Site A3 was located on an unnamed stream (no EPA code) draining to the north-west of the proposed site boundary. The Clover River tributary (FW2) had been historically straightened and deepened at this location and was semi-dry at the time of survey, with only small localised pools of standing, stagnant rainwater and no flows. The channel featured a base of cobble and mixed gravels bedded in mud. No aquatic vegetation was present and the ephemeral channel likely only conveys water after heavy rainfall events or during floods.

Site A3 was not of fisheries value given its dry, ephemeral nature and absence of aquatic habitats. No otter signs were recorded in the vicinity of the site.

Given the semi-dry nature of the site (rainwater pools only), it was not possible to collected a biological water quality sample at the time of survey.

Given the absence of aquatic habitats, the aquatic ecological evaluation of site A3 was of **lower importance (lower value)** (**Table 4.4**).



Plate 4.3 Representative image of site A3 on an unnamed Clover River tributary, September 2021 (semi-dry, ephemeral channel)

4.1.4 Site A4 – Unnamed stream, Noard

Site A4 was located on the uppermost reaches of an unnamed stream (no EPA code) in an extensive area of cutover bog (PB4), near the proposed location of turbine T12. The lowland depositing stream (FW2) had been extensively straightened and deepened historically, with steep V-shaped banks of 3-4m high. The stream was a homogenous 2.5-3m wide and 0.2-0.3m deep. The stream suffered from low summer flows at the time of survey (glide habitat only) with very high peat staining. The substrata comprised almost exclusively deep silt (peat), with localised, heavily bedded small boulder. The over-deepened channel supported abundant common reed which covered >95% of the channel. Water mint (*Mentha aquatica*) was occasional on sloping banks. In addition to high shading from common reed, willow and birch lined the channel, resulting in local tunnelling. The site was bordered by bracken (*Pteridium aquilinum*) scrub (HH3) and willow scrub (WS1) in an area of cutover bog.

Three-spined stickleback and European eel (*Anguilla anguilla*) were the only fish recorded via electro-fishing at site A4 (**Appendix A**). With the exception of low densities of these species, the stream was of poor fisheries value at the time of survey given poor flows and heavy siltation (from peat escapement). Suitability for European eel was poor but some desirable characteristics for the species were present (e.g. instream refugia, macrophyte & fish prey base). Poor flows, heavy vegetation cover, heavy siltation and historical modifications precluded the presence of salmonids or lamprey from the site. There was poor suitability for white-clawed crayfish and none were recorded. No otter signs were recorded in the vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (good status)** (**Appendix B**). However, it should be noted that this is a tentative rating given poor flows and lack of suitable riffle

areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of Red-listed European eel, the aquatic ecological evaluation of site A4 was of **local importance (higher value)** (**Table 4.4**).



Plate 4.4 Representative image of site A4 on an unnamed Clover River tributary, September 2021

4.1.5 Site A5 – Clover River, Noard

Site A5 was located on the uppermost reaches of the Clover River (16C04) (also known as the Derheen River), approx. 150m downstream of a wetland area in cutover bog near proposed turbine T16. The lowland river (FW2) at this location had been historically straightened and extensively deepened, with steep V-shaped banks of 5-8m in height. Whilst flowing through a channel of up to 6-7m wide, the river itself was invariably <1m wide at the time of survey. The profile was of slow-flowing glide that averaged a homogenous 0.2-0.3m deep, with no riffle or pool areas. The substrata comprised almost exclusively deep (peat-derived) silt, often up to 0.3m in depth. Some superficial gravels were present but very heavily bedded in silt. Peat-staining was high at the time of survey. Macrophyte cover was high overall, with abundant bulrush (*Typha latifolia*) instream and frequent water mint and common reed along channel margins. Water horsetail was occasional, with bottle sedge (*Carex rostrata*) also present. Terrestrial encroachment was high given the narrow width of the channel. Scattered hawthorn (*Crataegus monoygna*), gorse (*Ulex europaeus*) and willow were present within the channel. The site was bordered by willow and bracken-dominated scrub, in a wider area of extensive cutover bog (PB4).

Three-spined stickleback was the only fish species recorded via electro-fishing at site A5 (**Appendix A**). With the exception of high densities of these species, the site was of very poor fisheries value given

its diminutive size, poor flows and heavy siltation (from peat escapement). These characteristics precluded the presence of salmonids or lamprey. Despite some suitability for European eel, none were recorded. Eel habitat was poor overall and was notably much improved in the upstream-connecting wetland system located within Littleton Bog. White-clawed crayfish habitat was poor overall (given heavy siltation) and none were recorded. No otter signs were recorded in the vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (good status)** (**Appendix B**). However, it should be noted that this is a tentative rating given poor flows and lack of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site A5 was of **local importance (lower value)** (**Table 4.4**).



Plate 4.5 Representative image of site A5 on the uppermost reaches of the Clover River, September 2021

4.1.6 Site A6 – Clover River, Noard

Site A6 was located on the Clover River (16C04) at the R639 crossing, approx. 2.8km downstream of site A5. The lowland depositing river (FW2) at this location had been historically straightened and extensively deepened, with V-shaped bank heights of 5-6m. The river averaged 6-8m wide (narrower upstream of bridge) and 0.4-0.8m deep. Upstream of the bridge, shallower riffles and glide was present (0.1-0.3m deep). The profile was of slow-flowing, deep homogenous glide with riffle and shallower glide present upstream. Peat-staining was high at the time of survey. The cobble and mixed gravel substrata were very heavily silted in all but the fastest-flowing areas. Boulder was occasional, with large woody debris (LWD) frequent downstream of the bridge adding some valuable habitat

heterogeneity. Riparian shading was high, with macrophytes confined to upstream of the bridge in a more open section of channel (historical tree clearance). Here, unbranched bur-reed (*Sparganium emersum*) was occasional instream, with frequent marginal stands of fool's watercress (*Apium nodiflorum*), localised lesser water parsnip (*Berula erecta*), blue water speedwell (*Veronica anagallis-aquatica*) and water starwort (*Callitriche* sp.). Common duckweed (*Lemna minor*) was also frequent. Aquatic bryophytes were rare and limited to occasional *Leptodictyum riparium* on larger cobble and boulder. The channel was lined by mature treelines of sycamore (*Acer psuedoplatanus*), ash (*Fraxinus excelsior*) and elder (*Sambucus nigra*) with scrubby understories. The site was bordered by buildings and artificial surfaces (BL3) and improved pasture (GA1).

A total of four fish species were recorded via electro-fishing at site A6 (**Appendix A**). The site was dominated by adult brown trout (*Salmo trutta*), with low numbers of juveniles. Low numbers of perch (*Perca fluviatilis*), stone loach (*Barbatula barbatula*) and a single three-spined stickleback were also recorded. Despite significant siltation pressures, the site was evidently of good value as an adult trout habitat. Due to siltation pressures, spawning habitat was limited to a small, faster-flowing area upstream of the bridge. This also offered some moderate value for spawning lamprey but ammocoete habitat was sub-optimal (largely flocculent, humic deposits) and none were recorded. Despite some good suitability for European eel, none were recorded. Two predated white-clawed crayfish were recorded (likely otter predation), although no live crayfish were recorded. Otter spraint was recorded on marginal boulders immediately upstream of the bridge (ITM 621355, 657615).

Biological water quality, based on Q-sampling, was calculated as **Q3-4 (moderate status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids, utilisation by otter and the possible presence of white-clawed crayfish (prey remains recorded), the aquatic ecological evaluation of site A6 was of **local importance (higher value)** (**Table 4.4**).



Plate 4.6 Representative image of site A6 on the Clover River, September 2021 (upstream of road culvert)

4.1.7 Site B1 – Unnamed stream, Longfordpass South

Site B1 was located on the upper reaches of an unnamed Drish River tributary, approx. 0.3km upstream of the Drish River confluence. The stream (FW2) had been heavily modified (straightened and deepened) and flows were intermittent at the time of survey, with frequent peat dams instream obstructing flow. The homogenous channel averaged 2m wide and <0.1m deep, with very deep silt (peat) deposits on the bed of up to 0.75m deep. Stagnant standing water was present locally, with several dry sections (between peat dams). The channel was heavily vegetated by terrestrial species and willow. However, more open areas supported abundant common duckweed and water mint. Reed canary grass (*Phalaris arundinacea*) was also frequent along the riparian zone. The site was bordered by dry meadows habitat (GS2) and recently planted immature sitka spruce (*Picea sitchensis*) woodland (WS2) with alder (*Alnus glutinosa*) borders. Mature coniferous forestry (WD4) was present along the north bank.

Three-spined stickleback was the only fish species recorded via electro-fishing at site B1 (**Appendix A**). With the exception of moderate densities of this species, the heavily-vegetated and modified channel was not of fisheries value at the time of survey given a lack of flow and very heavy siltation (peat). There was no suitability for white-clawed crayfish. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (good status)** (**Appendix B**). However, it should be noted that this is a tentative rating given poor flows and lack of suitable riffle areas for sampling (as per Toner et al., 2005). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the absence of aquatic species or habitats of high conservation value, the aquatic ecological evaluation of site B1 was of **local importance (lower value)** (**Table 4.4**).



Plate 4.7 Representative image of site B1 on an unnamed Drish River tributary, September 2021

4.1.8 Site B2 – Drish River, Longfordpass Bridge

Site B2 was located on the Drish River (16D02) at Longfordpass Bridge on the R639 road. The lowland depositing river (FW2) had been extensively straightened and deepened historically, resulting in very poor hydromorphology. The river suffered from very low water levels at the time of survey with no flows present (i.e. ponding habitat). The channel was a homogenous 10-12m wide and 0.1-0.3m deep with deep silt deposits of >0.3m locally. Near the upstream local road bridge, hard substrata were present (boulder and cobble with mixed gravels). However, elsewhere deep silt dominated. The site was very heavily vegetated (near 100% cover), with open ponding areas very localised. These supported a diverse range of macrophytes including abundant branched bur-reed (*Sparganium erectum*) with spiked water milfoil (*Myriophyllum spicatum*), lesser pondweed (*Potamogeton pusillus*), river water dropwort (*Oenanthe fluviatilis*), water-forget-me-not (*Myosotis scorpioides*), yellow water lily (*Nuphar lutea*) and fool's watercress. Cover of common duckweed and ivy-leaved duckweed (*Lemna trisulca*) was high. The aquatic moss *Fontinalis antipyretica* was present on the dry, perched bridge apron (1m fall), indicating intermittent higher flows (e.g. in winter). Filamentous algae was also present on harder substrata. The channel was lined by reed canary grass with occasional bittersweet (*Solanum dulcamara*), hedge bindweed (*Calystegia sepium*) and willowherbs (*Epilobium* spp.). The site was bordered by improved pasture (GA1).

Three-spined stickleback were the only fish recorded via electro-fishing at site B2 (**Figure 3.6**). With the exception of moderate densities of this species, the site was of very poor fisheries value at the time of survey given a seasonal lack of flow and impounding/ponding of water between stands of

instream vegetation. Whilst some suitability still remained for European eel, none were recorded. However, the Drish River at this location would have greater fisheries value for European eel and perhaps salmonids during higher flow periods (e.g. winter). Despite some habitat suitability, no white-clawed crayfish were recorded during the survey and crayfish eDNA was not detected in the sample collected from the site (**Table 4.1**). A regular otter spraint site was recorded on the upstream side of the dry bridge apron (ITM 624888, 660462) – this did not contain crayfish remains.

A biological water quality sample was not collected at this site.

Given utilisation by otter, the aquatic ecological evaluation of site B2 was of **local importance (higher value)** (**Table 4.4**).



Plate 4.8 Representative image of site B2 on the Drish River at Longfordpass Bridge, September 2021 (facing downstream to bridge)

4.1.9 Site B3 – Drish River, Castletown Bridge

Site B3 was located on the Drish River (16D02) at Castletown Bridge, a proposed GCR crossing approx. 6km downstream of site B2. The lowland alkaline river (FW2) at this location had been arterially drained historically but retained some good semi-natural features. The river suffered from very low summer flows at the time of survey. The water width was 5-6m on average in a heavily-vegetated channel up to 8-10m wide. The depth averaged 0.3-1m with deeper pool areas to 1.5m locally. The profile was of very slow-flowing glide, with localised faster runs between macrophyte beds exposing gravel substrata. The substrata were predominantly cobble and medium to coarse gravels with frequent boulder. However, these were bedded in silt and moderately calcified (compacted). The compacted bed was also moderately to heavily silted, given low flows and depositional conditions. The river at this location was very heavily vegetated (>90% cover) with abundant lesser water parsnip

and broad-leaved pondweed (*Potamogeton natans*), in addition to common reed, branched bur-reed and frequent stands of heterophyllous common clubrush (*Schoenoplectus lacustris*) in gravel-dominated areas of faster flows. Yellow lily was common, with common duckweed and ivy-leaved duckweed frequent. Reed canary grass was also frequent instream. River water dropwort was occasional. The moss *Rhynchostegium riparium* was occasional. Filamentous algae was present, locally. Adjoining the river margins was a herbaceous community supporting primarily reed canary grass, bittersweet, marsh willowherb (*Epilobium palustre*), great willowherb (*Epilobium hirsutum*), water mint and water-forget-me-not. The site was bordered by improved pasture (GA1) and, downstream, an intermittent treeline (WL2) of ash, hawthorn and sycamore.

A total of four fish species were recorded via electro-fishing at site B3 (**Appendix A**). Low numbers of stone loach and three-spined stickleback were present, with single examples of pike (*Esox lucius*) (juvenile) and European eel also recorded. Despite some suitability, no salmonids or lamprey were recorded. Salmonid and lamprey spawning habitat was present but very localised (mostly downstream of bridge) and limited in extent due to very high vegetation cover, siltation and low flows. Salmonid nursery habitat was poor, given low seasonal flows. Some good-quality holding habitat for adult salmonids was present in association with macrophyte beds and overhanging vegetation. European eel suitability was high, with ample instream refugia present. Despite some good suitability, no white-clawed crayfish were recorded, although the value of the site was reduced given compaction of substrata and poorly accessible boulder refugia. White-clawed crayfish eDNA was detected on the Drish River approx. 5.7km downstream at site B5 (see section 4.5). No otter signs were recorded in vicinity of the site, despite good foraging suitability.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of Red-listed European eel, the aquatic ecological evaluation of site B3 was of **local importance (higher value)** (**Table 4.4**).



Plate 4.9 Representative image of site B3 on the Drish River, September 2021 (facing upstream from Castletown Bridge)

4.1.10 Site B4 – Cooleeny River, Killoran

Site B4 was located on the upper reaches of the Cooleeny River (16C14) at a proposed GCR crossing. The Drish River tributary at this location was dry at the time of survey, with no flows or standing water present. As a result, there was no aquatic value. The channel featured a dry mud base and had been historically straightened and deepened. The river at this location likely only conveys water after heavy rainfall events or during floods (i.e. ephemeral).

Site B4 was not of fisheries value given its dry, ephemeral nature and absence of aquatic habitats. No otter signs were recorded in the vicinity of the site.

Given the dry, ephemeral nature of the site, it was not possible to collected a biological water quality sample at the time of survey.

Given the absence of aquatic habitats, the aquatic ecological evaluation of site B4 was of **lower importance (lower value)** (**Table 4.4**).



Plate 4.10 Representative image of site B4 on the Cooleeny River, September 2021 (dry, ephemeral channel)

4.1.11 Site B5 – Drish River, d/s Ballyduff Bridge

Site B5 was located on the Drish River (16D02) 100m downstream of Ballyduff Bridge at a proposed GCR crossing, approx. 5.7km downstream of site B3. The swift-flowing, lowland alkaline river (FW2) was largely natural at this location and averaged 10-12m wide and 0.2-0.5m deep. Localised deeper pool to 0.8m was present downstream of the bridge. The site was typified by swift, shallow glide and occasional riffle and pool. The substrata were dominated by heavily compacted and calcified cobble with occasional interstitial gravels and frequent boulder. Siltation was low overall and no soft sediment deposits were present, even in association with macrophyte beds or pool slacks (i.e., high-energy site). Given the compacted bed and high-energy nature, macrophytes were limited to infrequent water crowfoot (*Ranunculus* sp.) and marginal beds of fool's watercress, watercress and water mint, with a single stand of iris (*Iris psuedacorus*) on a mid-channel island downstream of the bridge. Ivy-leaved duckweed was present but rare given high flows. Reed canary grass with bittersweet, nettle (*Urtica dioica*) and hedge bindweed lined the channel. However, the cover of aquatic bryophytes was very high (>75%) with abundant *Fontinalis antipyretica* and frequent *Rhynchostegium riparium*. The calcicolous liverwort *Pellia endiviifolia* was occasional with *Riccardia chamedryfolia* on the bridge abutments. Filamentous algae was present (5%) cover, indicating enrichment. The site was bordered by mature treelines of sycamore and ash with occasional willow and elder.

A total of five fish species were recorded via electro-fishing at site B5 (**Appendix A**). The site was dominated by mixed cohort Atlantic salmon and brown trout, with stone loach, minnow (*Phoxinus phoxinus*), European eel and pike also captured. The site was an excellent-quality salmonid nursery

with a high density of juvenile Atlantic salmon and brown trout present in cobble-dominated zones. Deeper pools and undercuts/overhangs supported moderate numbers of adult trout, and provided some good holding habitat for migratory adults. European eel habitat was moderate-quality given natural bed compaction (high flow rates & calcification) and poorly-accessible boulder refugia. Lamprey ammocoete habitat was not present, though some localised interstitial gravels were present which provided some lower value for spawning. Despite some suitability for white-clawed crayfish (reduced due to bed compaction/calcification), none were recorded during sweep netting and hand-searching. However, white-clawed crayfish eDNA was detected at the site (**Table 4.1**). Both otter and invasive mink (*Neovison vison*) spraint was recorded on the upstream side of the bridge abutment (ITM 618948, 661308). Neither contained crayfish remains.

Biological water quality, based on Q-sampling, was calculated as **Q3-4 (moderate status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids (including Atlantic salmon) and European eel, in addition to utilisation by otter, the aquatic ecological evaluation of site B5 was of **local importance (higher value)** (**Table 4.4**).



Plate 4.11 Representative image of site B5 on the Drish River, September 2021 (facing downstream from Ballyduff Bridge)

4.1.12 Site B6 – Ballygammane River, Athlummon

Site B6 was located on the Ballygammane River (16B55) at a local road crossing and proposed GCR crossing, approx. 0.6km upstream of the Drish River confluence. The river at this location had been straightened historically, with more recent modifications evident (e.g. pipe culvert from adjacent

house). However, some semi-natural characteristics remained. The small alkaline river (FW2) had been historically straightened and deepened but showed some good instream recovery. The river averaged 2.5-3m wide in a channel of up to 5-6m. The trapezoidal channel featured banks of 2-2.5m in height. Water levels were low at the time of survey and the site averaged 0.1-0.2m deep with only very localised pool to 0.6m near the adjoining pipe culvert. The profile comprised a series of swift-flowing, shallow glide and riffle sequences with only very localised pool. The substrata were dominated by compacted, calcified boulder and cobble, much of which was exposed during the survey. Mixed medium to coarse gravels were present locally. Siltation was light overall, though some deep deposits were present near each respective culvert (up to 0.2m deep). Due to calcification, high shading and livestock poaching, macrophytes were limited to only very occasional fool's watercress along channel margins. However, cover of submerged *Pellia endiviifolia* was high, with occasional *Brachythecium rivulare* and *Riccardia chamedryfolia* present on the tops of larger boulder. The site was lined by mature treelines of ash, hawthorn and alder with scrubby understories, and was bordered by improved pasture (GA1) and a broad-leaved plantation (WS2).

A total of four fish species were recorded via electro-fishing at site B6 (**Appendix A**). The site was dominated by mixed cohort brown trout with low numbers of Atlantic salmon, with minnow, three-spined stickleback and *Lampetra* sp. also recorded. Despite its very shallow nature, the site supported moderate densities of Atlantic salmon parr and mixed cohort brown trout. The numbers of adult trout were low given the paucity of deeper holding habitat. Spawning habitat was present but the value was reduced by both siltation and calcification pressures (spawning habitat better suited to Atlantic salmon). The site was of most value as a salmonid nursery. Whilst some soft sediment accumulations were present, these were largely flocculent and no ammocoetes were recorded. However, a low number of *Lampetra* sp. transformers (near-adults) were captured. The site had low suitability for European eel and white-clawed crayfish given the shallow depth and lack of accessible refugia - neither species was recorded. No otter signs were recorded in vicinity of the site

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids (including Atlantic salmon) and *Lampetra* sp., the aquatic ecological evaluation of site B6 was of **local importance (higher value)** (**Table 4.4**).



Plate 4.12 Representative image of site B6 on the Ballygammane River, September 2021

4.1.13 Site C1 – Black River, Clonoura

Site C1 was located on the uppermost reaches of the Black River (16B01) that drained to the south of the proposed wind farm site. The site was dry at the time of survey, with no pools of standing water and a dry mud base. As a result, there was no aquatic value. The river channel had been straightened and deepened historically and averaged 1.5-2m wide with bank heights of 1-2m. Evidently, the channel was ephemeral, likely only conveying water during wetter periods. The channel was heavily scrubbed over with high levels of terrestrial encroachment and willow scrub. The site was bordered by a broad-leaved plantation (WS2) with tillage (BC3) to the east.

Site C1 was not of fisheries value given its dry, ephemeral nature and absence of aquatic habitats. No otter signs were recorded in the vicinity of the site.

Given the dry, ephemeral nature of the site, it was not possible to collected a biological water quality sample at the time of survey.

Given the absence of aquatic habitats, the aquatic ecological evaluation of site C1 was of **lower importance (lower value)** (**Table 4.4**).



Plate 4.13 Representative image of site C1 on the Black River, September 2021 (dry, ephemeral channel)

4.1.14 Site C2 – Black River, Derryvella

Site C2 was located on the Black River (16B02), approx. 3.6km downstream from site C1. The lowland depositing river (FW2) had been straightened and deepened historically, with some recovery evident. The stream was culverted underneath a Bord na Móna rail line via a large corrugated pipe culvert. Upstream, flows were low and the channel was heavily scrubbed. Downstream of the culvert, the channel narrowed and flows improved. Shallow glide and riffle predominated with occasional pool, grading to slow-flowing glide downstream. The river averaged 2-2.5m wide and 0.1-0.2m deep, with locally deeper pool to 0.3-0.5m. The substrata near the culvert were dominated by moderately-silted small cobble and medium-coarse gravels with occasional small boulder. However, downstream silt deposits became deep and frequent albeit flocculent (peat-derived with some sand). The river was heavily shaded by willow scrub. As a result, macrophytes were limited to the vicinity of the culvert. Water mint and fool's watercress were both present, in addition to localised common reed. No aquatic bryophytes were recorded, though some *Pellia* sp. liverwort grew on muddy banks. The site was bordered by an area of cutover bog (PB4) with abundant scrub (WS1).

A total of three fish species were recorded via electro-fishing at site C2 (**Appendix A**). The site supported a small population of mixed-cohort brown trout, with a single Atlantic salmon parr (0+) and three-spined stickleback also captured. Despite historical modifications, poor flows and siltation pressures (peat escapement), the site was of some moderate value as a salmonid nursery, at least in vicinity of the culvert where riffle habitat was present. The salmonid spawning value was compromised by siltation but the value likely improved during higher flows. Holding habitat was limited to the culvert pool with shallow glide dominating downstream. Whilst some limited lamprey

spawning habitat was present, ammocoete habitat was unsuitable given the flocculent nature of the silt (peat-dominated). Despite some suitability for European eel and white-clawed crayfish none were recorded (limited refugia). No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids (including Atlantic salmon), the aquatic ecological evaluation of site C2 was of **local importance (higher value)** (**Table 4.4**).



Plate 4.14 Representative image of site C2 on the Black River, September 2021 (downstream of pipe culvert)

4.1.15 Site C3 – North Glengoole River, Derryvella

Site C3 was located on the North Glengoole River (16N28) at a local road crossing adjacent to Loch Doire Bhile, approx. 1.1km upstream of the Black River confluence. The lowland depositing river (FW2) had been historically straightened and deepened with steep V-shaped banks of 2-3m in height. The river averaged 2m wide and 0.1-0.15m deep, with localised small pools to 0.25m maximum. The profile comprised very shallow glide and riffle with limited pool. The river flowed through a perched twin-bore pipe culvert (0.3m fall). The substrata were dominated by medium to coarse gravels with small cobble and occasional small boulder. However, these were moderately compacted, with moderate to high siltation (peat-derived, plumes underfoot). The narrow channel was heavily shaded by riparian scrub and macrophytes were limited to occasional lesser water parsnip and watercress in more open areas. Common duckweed was present but scarce. Aquatic bryophytes were limited to rare *Rhynchostegium riparoides*, with *Pellia* sp. on muddy banks. The site was lined with dense bramble-

dominated scrub (WS1) with willow and gorse and adjoined an area of recolonising cutover bog (PB4). Heavy tunnelling was present upstream and downstream of the culvert.

Four fish species were recorded via electro-fishing at site C3 (**Appendix A**). The site supported a low density of juvenile brown with a single Atlantic salmon parr (1+) recorded. Two juvenile European eel were also recorded, in addition to a low density of three-spined stickleback. Salmonid spawning habitat, whilst present, was compromised by siltation and compaction of substrata. The value of the salmonid nursery habitat was reduced given low flows, shallow depth and the presence of a culvert which evidently acted as a migration barrier at base flows. Indeed, all fish recorded were confined to the pool immediately downstream of the culvert, despite some suitability for salmonids upstream. European eel were present in low densities. The site was considered unsuitable for lamprey given compaction of substrata, siltation and lack of suitable soft sediment deposits for ammocoetes (flocculent only). No white-clawed crayfish were recorded (paucity of suitable refugia). No otter signs were recorded in vicinity of the site.

A biological water quality sample was not collected at this site.

Given the presence of salmonids (including Atlantic salmon) and Red-listed European eel, the aquatic ecological evaluation of site C3 was of **local importance (higher value)** (**Table 4.4**).



Plate 4.15 Representative image of site C3 on the North Glengoole River, September 2021

4.1.16 Site C4 – North Glengoole River, Derryvella

Site C4 was located on the North Glengoole River (16N28) at a Bord na Móna rail crossing (culvert), approx. 0.8km downstream of site C3 and 0.25km upstream of the Black River confluence. The lowland depositing river (FW2) had been historically straightened and deepened with V-shaped banks of up to 4m in height and old embankments evident along the channel. The river averaged 2-2.5m wide and 0.1-0.2m deep, with locally deeper pool to 0.4m. Shallow glide and riffle predominated, with only localised pool. In shallower areas near the culvert the substrata comprised mixed gravels and small cobble with occasional boulder. However, outside of this area, depositional silt dominated (up to 0.2m deep). Hard substrata were exposed to moderate siltation and partial bedding. Siltation would have been higher if not for macrophyte growth. Cover of macrophytes was high (>75%) with abundant fool's watercress, frequent water mint and localised bulrush. Floating mats of *Agrostis* sp. grass were present along channel margins. Aquatic bryophytes were not recorded. The river channel was open with only scattered gorse, hawthorn and willow. A well-developed herbaceous layer supporting purple loosestrife (*Lythrum salicaria*), willowherbs (*Epilobium* spp.), hogweed (*Heracleum sphondylium*), reed canary grass and rank grasses was present along the channel margins. The site was bordered by dry meadows habitat (GS2) and improved pasture (GA1) in a wider landscape of cutover bog (PB4).

Brown trout and three-spined stickleback were the only two fish species recorded via electro-fishing at site C4 (**Appendix A**). The site supported a moderate density of juvenile brown trout and low numbers of small adults with a single three-spined stickleback also recorded. The site was of good value as a salmonid nursery, with good, albeit highly localised, spawning habitat present also. Holding habitat for adults was moderate, at best (largely confined to vicinity of the pipe culvert). Whilst some lamprey spawning habitat was present, ammocoete habitat was not recorded (flocculent and peat-dominated). Despite some suitability, no European eel were recorded. White-clawed crayfish habitat was moderate overall, with the value reduced due to a lack of accessible refugia or banks for burrowing (i.e. hard, excavated banks). No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3-4 (moderate status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids, the aquatic ecological evaluation of site C4 was of **local importance (higher value)** (**Table 4.4**).



Plate 4.16 Representative image of site C4 on the North Glengoole River, September 2021

4.1.17 Site C5 – Black River, Derryhogan

Site C5 was located on the Black River (16B01) at a local road bridge, approx. 1.5km downstream of site C2. The river had been extensively straightened and deepened, with very steep (near vertical) V-shaped banks of 4-5m in height. The river flowed under the local road via a pipe corrugated culvert (that was accessible to fish). The river averaged a homogenous 3-4m in a channel up to 5-6m wide. The depth varied from 0.2 to 0.5m, with occasional pool areas to 1m. Deep slow-flowing glide dominated the site, with occasional pool. Riffle was present upstream of the road culvert. The substrata comprised compacted and heavily silted mixed gravels and cobble, with occasional boulder (near culvert only). Bank erosion was frequent (exposed clay) and contributed to the silt loading. Siltation was high overall (largely peat-derived) with deep silt-sand deposits present along channel margins (up to 0.2m deep). The site was heavily shaded by mature treelines of ash, elder, hawthorn and cypress (Cupressaceae family) with poorly-developed understories. As a result, macrophytes were not present. Aquatic bryophytes were not recorded, with the liverworts *Pellia endiviifolia* and *Conocephalum conicum* on muddy banks. The site was bordered by improved pasture (GA1).

Brown trout and stone loach were the only two fish species recorded via electro-fishing at site C5 (**Appendix A**). Adult trout dominated, with only low numbers of juveniles present. The site was a moderate-quality salmonid habitat, with moderate-quality spawning and nursery habitat. Holding habitat, by way of deeper pools, bank undercuts and submerged tree root systems, was of good quality. Despite high siltation, soft sediment accumulations did not support lamprey ammocoetes (largely humic or clay-based in nature). Some very limited superficial spawning gravels suitable for lamprey were present in the vicinity of the culvert although spawning habitat improved upstream, where riffles were more commonplace. Aside from submerged tree root systems, suitability for

European eel and white-clawed crayfish was relatively poor given limited accessible instream refugia such as boulders and macrophytes (neither species recorded). However, white-clawed crayfish eDNA was detected at the site, in addition to crayfish plague (*Aphanomyces astaci*) (**Table 4.1**). No otter signs were recorded in vicinity of the site.

A biological water quality sample was not collected at this site.

Given the presence of salmonids and the detection of white-clawed crayfish eDNA, the aquatic ecological evaluation of site C5 was of **local importance (higher value)** (**Table 4.4**).



Plate 4.17 Representative image of site C5 on the Black River, September 2021

4.1.18 Site C6 – Black River, Two Mile Borris

Site C6 was located on the Black River (16B01) at the N75 road crossing, approx. 5km downstream of site C5. As per upstream, the lowland river (FW2) at this location had been straightened and deepened historically, flowing in a steep, 5-8m high trapezoidal channel. The river averaged 6-8m wide and 0.2-0.6m deep, with locally deeper areas to 0.9m. Slow-flowing glide predominated, with localised riffles near the road bridge and occasional pools. The substrata were dominated by cobble with frequent boulder and small interstitial patches of mixed gravels. Siltation was moderate overall (peat), given low flows, but soft sediment accumulations were localised. The substrata were relatively mobile. The site supported a diverse range of macrophytes, with frequent lesser water parsnip and occasional water starwort (*Callitriche* sp.), water mint, water crowfoot (*Ranunculus* sp.) and watercress (*Nasturtium officinale*). Curled pondweed (*Potamogeton crispus*) was present but rare. Common duckweed and ivy-leaved duckweed were both common. Coverage of aquatic bryophytes was high, with abundant *Fontinalis antipyretica* on larger cobble/boulder. Given the presence of several indicator species (EC, 2013) and the high coverage of bryophytes, the aquatic plant community was

considered representative of the Annex I habitat 'Water courses of plain to montane levels, with submerged or floating vegetation of *Ranunculion fluitantis* and *Callitricho-Batrachion* (low water level during summer) or aquatic mosses [3260]'. Riparian shading was relatively high given the presence of maturing alder treelines along the channel (both banks). The site was bordered by improved pasture (GA1) and grassy verges habitat (GS2).

A total of four fish species were recorded via electro-fishing from site C6 (**Appendix A**). The site was dominated by relatively high numbers of mixed-cohort brown trout with moderate densities of Atlantic salmon parr. *Lampetra* sp. ammocoetes were recorded at moderate densities of 3.3 per m^2. A single stone loach was also captured. The site was of excellent value as a salmonid nursery given the abundance of vegetated cobble refugia in addition to macrophyte beds (including *Ranunculus* sp.). Good-quality salmonid and lamprey spawning habitat was present but was compromised by siltation and limited in extent. Holding habitat for adult salmonids was also of good-quality given the presence of macrophyte refugia, vegetation overhangs and deeper glide areas. Small areas of soft sediment provided some locally good-quality ammocoete habitat. Despite some good suitability (i.e. ample refugia), no European eel or white-clawed crayfish were recorded. However, abundant crayfish remains were identified in otter spraint underneath the road bridge (ITM 619150, 657803; **Plate 4.38**).

Biological water quality, based on Q-sampling, was calculated as **Q4 (good status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids (including Atlantic salmon), *Lampetra* sp., Annex I floating river vegetation [3260] and utilisation by otter, the aquatic ecological evaluation of site C6 was of **local importance (higher value)** (**Table 4.4**).



Plate 4.18 Representative image of site C6 on the Black River, September 2021

4.1.19 Site D1 – Breegagh River, Killeen

Site D1 was located on the Breegagh River (16B03) at a local road crossing, where the river flowed through a large three-bore box culvert. The small lowland river (FW2) had been straightened and deepened historically, with cobble/boulder revetments in the vicinity of the road culvert. The river averaged 2.5-3m wide and 0.3-0.7m deep in homogenous deep, slow-flowing glide. Pool was occasional. Riffles were limited to the vicinity of the culvert. Peat-staining was not present at the time of survey. The substrata were dominated by compacted cobble with occasional boulder and limited interstitial mixed gravels. The site suffered from heavy siltation, although deposits were flocculent, with only very localised, shallow accumulations. Large woody debris (LWD) was frequent instream which improved habitat heterogeneity of the straightened channel. The river flowed through a maturing broad-leaved plantation and shading was high. As a result, macrophytes were limited to occasional fool's watercress, water mint and lesser water parsnip along channel margins in more open areas. Reed canary grass was abundant along channel margins and created overhangs of high value for salmonids. Aquatic bryophytes were absent with the exception of localised *Brachythecium rivulare* on exposed boulder near the culvert. The site was bordered by a broad-leaved plantation of sycamore, wych elm (*Ulmus glabra*) and alder (WD1), with dense bramble scrub (WS1) and improved pasture (GA1).

Atlantic salmon and brown trout were the only two fish species recorded at site D1 (**Appendix A**). Brown trout dominated the site, with mixed cohorts present. A moderate number of Atlantic salmon parr (two cohorts) were also recorded. The site was of excellent value as an adult salmonid habitat, supporting a high density of adult brown trout, with some good holding habitat present (scoured banks, vegetation overhangs etc.). The site was of moderate value only as a nursery given siltation pressures and predominance of deep homogenous glide. Similarly, spawning habitat for both salmonids and lamprey was largely absent given compaction of the bed and siltation (some present upstream of farm culvert, however). Despite some good suitability (ample refugia), no European eel were recorded. No white-clawed crayfish were recorded and suitability was low overall given siltation and general lack of refugia. No otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids (including Atlantic salmon), the aquatic ecological evaluation of site D1 was of **local importance (higher value)** (**Table 4.4**).



Plate 4.19 Representative image of site D1 on the Breegagh River, September 2021 (facing upstream from culvert)

4.1.20 Site D2 – Breegagh River, Ballymurreen Bridge

Site D2 was located on the Breegagh River (16B03) at Ballymurreen Bridge, approx. 4.8km downstream of site D1. The lowland river (FW2) had been straightened historically but not deepened and retained many good semi-natural characteristics. The river averaged 4-5m wide (channel up to 7m wide in places) and 0.2-0.4m deep. Locally deeper glide and pool to 0.8m was present. The heterogenous profile comprised swift-flowing glide with occasional riffles near the bridge, and pool becoming more frequent downstream. In faster-flowing areas, the substrata were dominated by relatively mobile and clean cobble and mixed gravels, with occasional small boulder. Sand patches were also present. However, deeper glide was more depositing in nature and soft sediment deposits were abundant. Siltation was moderate overall and peat-staining was not present at the time of survey. The site supported a range of macrophytes. Lesser water parsnip was frequent, with occasional water crowfoot (*Ranunculus* sp.), watercress and localised branched bur-reed. Water forget-me-not, reed canary grass and water mint were common along channel margins. Common duckweed and filamentous algae were present, indicating enrichment. Aquatic bryophytes were limited to very occasional *Brachythecium rivulare* on larger, more stable boulder. The river was flanked on the east bank by a mature treeline of blackthorn (*Prunus spinosa*), hawthorn, ash, elder, sycamore and bramble, with the west bank open featuring improved grassland (GA1).

A total of four fish species were recorded via electro-fishing at site D2 (**Appendix A**). The site supported moderate densities of brown trout and Atlantic salmon with low numbers of stone loach and three-spined stickleback also present. *Lampetra* sp. were present in high numbers. The site was an excellent quality salmonid nursery with moderate densities of juvenile Atlantic salmon and brown

trout. A moderate density of adult brown trout was also present in deeper glide and pool. Both salmonid and lamprey spawning habitat was of good-quality, albeit threatened by siltation. The site was of most value as a lamprey nursery habitat, with excellent-quality lamprey ammocoete habitat present, particularly in association with macrophyte beds. *Lampetra* sp. ammocoetes were widespread at moderate densities (13.7 per m^2). A single *Lampetra* sp. transformer was also recorded. Despite some moderate suitability, European eel and white-clawed crayfish were not recorded. However, white-clawed crayfish eDNA was detected at the site (**Table 4.1**). Despite high suitability, no otter signs were recorded in vicinity of the site.

Biological water quality, based on Q-sampling, was calculated as **Q3 (poor status)** (**Appendix B**). No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via Q-sampling.

Given the presence of salmonids (including Atlantic salmon), *Lampetra* sp. and the detection of white-clawed crayfish eDNA, the aquatic ecological evaluation of site D2 was of **local importance (higher value)** (**Table 4.4**).



Plate 4.20 Representative image of site D2 on the Breegagh River, September 2021 (facing downstream from Ballymurreen Bridge)

4.2 Lacustrine survey site results

4.2.1 Site L1 – lake/wetland, Longfordpass South

Site L1 was located within an extensive area of cutover bog (Littleton Bog), within the proposed site boundary. The open site comprised two small lake basins with associated wetland areas covering an area of c.1ha. The lakes were evidently seasonal (ephemeral) and averaged 0.1-0.2m deep with very few deeper areas. The bed was comprised entirely of soft silt (peat). Peat staining was high at the time of survey. The basins were fed by run-off from extensive cutover bog via narrow peatland drains supporting small stands of bulrush and cotton grass. These were also present in the lake basins alongside localised bottle sedge and bog pondweed. The lake was situated in cutover bog (PB4).

The cutover peat lake was not considered of fisheries value given its heavily silted, ephemeral, shallow nature and isolation from other aquatic habitats. The site was of high value for amphibians although none were recorded during the site visit. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic habitats of high conservation value, the aquatic ecological evaluation of site L1 was of **lower importance (lower value)** (**Table 4.4**).



Plate 4.21 Representative image of site L1, October 2021

4.2.2 Site L2 – lake/wetland, Bawnreagh

Site L2 was located within an extensive area of cutover bog (Littleton Bog), within the proposed site boundary. The large, shallow linear cutover lake covered an area of c.1ha and ranged from 0.2-0.5m

deep. The bed was comprised entirely of soft silt (peat). Peat staining was high at the time of survey. Macrophyte coverage was low with only occasional bog pondweed, broad-leaved pondweed and bulbous rush (*Juncus bulbosus*). Stonewort (*Chara* sp.) and bladderwort (*Utricularia* sp.) were present along the margins but rare overall. Cottongrass and bottle sedge were abundant in the peaty littorals. The lake was situated in cutover bog (PB4) with heath and scattered pre-thicket lodgepole pine.

The cutover peat lake was not considered of fisheries value given its heavily silted, shallow nature and isolation from other aquatic habitats. The site was of high value for amphibians although none were recorded during the site visit. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic habitats of high conservation value, the aquatic ecological evaluation of site L2 was of **lower importance (lower value)** (**Table 4.4**).



Plate 4.22 Representative image of site L2, October 2021

4.2.3 Site L3 – lake/wetland, Bawnreagh

Site L3 was located within an extensive area of cutover bog (Littleton Bog), within the proposed site boundary and adjacent to site L2. The shallow linear cutover lake covered an area of c.0.5ha and ranged from 0.2-0.6m deep. The bed was comprised entirely of soft silt (peat). Peat staining was high at the time of survey. Macrophyte coverage was low with only occasional bog pondweed, broad-leaved pondweed and bulbous rush. Cottongrass and bottle sedge were abundant in the exposed peaty littorals. The lake was situated in cutover bog (PB4) with heath and scattered pre-thicket lodgepole pine.

The cutover peat lake was not considered of fisheries value given its heavily silted, shallow nature and isolation from other aquatic habitats. The site was of high value for amphibians although none were recorded during the site visit. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic habitats of high conservation value, the aquatic ecological evaluation of site L3 was of **lower importance (lower value)** (**Table 4.4**).



Plate 4.23 Representative image of site L3, October 2021

4.2.4 Site L4 – lake/wetland, Bawnreagh

Site L4 was located within an extensive area of cutover bog (Littleton Bog), within the proposed site boundary. The large shallow cutover lake covered an area of c.1.1ha and ranged from 0.2-1m deep. The bed was comprised entirely of soft silt (peat). Peat staining was high at the time of survey. Macrophyte growth was low with only very occasional broad-leaved pondweed and bog pondweed in the open water. Stonewort (*Nitella* sp.) was present in the peaty margins but rare overall. Abundant cotton grass was present on the peaty littorals with occasional marsh pennywort. The lake was situated in lowland blanket bog (PB3)/cutover bog (PB4) with heath and pre-thicket lodgepole pine.

The cutover peat lake was considered of poor fisheries value given its heavily silted, shallow nature and isolation from other aquatic habitats. The site was of high value for amphibians although none were recorded during the site visit. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic habitats of high conservation value, the aquatic ecological evaluation of site L4 was of **lower importance (lower value)** (**Table 4.4**).



Plate 4.24 Representative image of site L4, October 2021

4.2.5 Site L5 – lake/wetland, Bawnreagh

Site L5 was located within an extensive area of cutover bog (Littleton Bog), within the proposed site boundary. The large shallow cutover lake covered an area of c.1.4ha and ranged from 0.2-0.4m deep in the margins to up to 1.3m in open water. The bed was comprised entirely of soft silt (peat). Peat staining was high at the time of survey. The open water supported occasional bog pondweed with small, scattered stands of common reed. Stonewort (*Chara* sp.) was also recorded as rare (indicative of higher alkalinity). Bottle sedge and cotton grass were locally abundant along the lake margins with occasional marsh pennywort (*Hydrocotyle vulgaris*). The lake was situated in cutover bog (PB4) with abundant lodgepole pine and downy birch on the shorelines.

The cutover peat lake was considered of poor fisheries value given its heavily silted, shallow nature and isolation from other aquatic habitats. The site was of high value for amphibians although none were recorded during the site visit. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic habitats of high conservation value, the aquatic ecological evaluation of site L5 was of **lower importance (lower value)** (**Table 4.4**).



Plate 4.25 Representative image of site L5, October 2021

4.2.6 Site L6 – lake/wetland, Bawnreagh

Site L6 was located within an extensive area of cutover bog (Littleton Bog), within the proposed site boundary, adjacent to site L5. The small, shallow cutover lake covered an area of c.0.14ha and ranged from 0.2-0.4m deep. The bed was comprised entirely of soft silt (peat). Peat staining was moderate at the time of survey. Macrophyte coverage was low in open water with only occasional bog pondweed. The littorals supported abundant bottle sedge and cotton grass, with occasional stands of bulrush. The lake was situated in cutover bog (PB4) with mixed broad-leaved woodland (WD1) to the south of the site.

The cutover peat lake was considered of poor fisheries value given its heavily silted, shallow nature and isolation from other aquatic habitats. However, the occurrence of *Piscicola* sp. leech (i.e. a fish parasite) (**Appendix B**) would indicate the presence of a fish population (likely three-spined stickleback). The site was of high value for amphibians although none were recorded during the site visit. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic habitats of high conservation value, the aquatic ecological evaluation of site L6 was of **lower importance (lower value)** (**Table 4.4**).



Plate 4.26 Representative image of site L6, October 2021

4.2.7 Site L7 – lake/wetland, Bawnreagh

Site L7 was located within an extensive area of cutover bog (Littleton Bog), within the proposed site boundary. The shallow cutover lake covered an area of c.0.25ha and ranged from 0.2-0.6m deep. The bed was comprised entirely of soft silt (peat). Peat staining was moderate at the time of survey. The lake supported frequent bladderwort (*Utricularia* sp.) with occasional bog pondweed and rare fen pondweed (*Potamogeton coloratus*) (the latter indicative of higher alkalinity). Decaying *Sphagnum cuspidatum* was also present in the lake basin. Scattered stands of bottle sedge and common reed were present on the peaty littorals alongside abundant cotton grass. The lake was situated in cutover bog (PB4) with mixed broad-leaved woodland (WD1) to the south of the site.

The cutover peat lake was not considered of fisheries value given its heavily silted, shallow nature and isolation from other aquatic habitats. The site was of high value for amphibians although none were recorded during the site visit. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic habitats of high conservation value, the aquatic ecological evaluation of site L7 was of **lower importance (lower value)** (**Table 4.4**).



Plate 4.27 Representative image of site L6, October 2021

4.2.8 Site L8 – lake/wetland, Lanespark

Site L8 was located within an extensive area of cutover bog (Littleton Bog), within the proposed site boundary. The lake was situated in a deep depression created from historical cutover with 1.5m to 2m high banks. The large linear cutover lake covered an area of c.5ha with frequent islands, deep margins (0.7m) and an even deeper central basin (to 1.4m). The bed was comprised entirely of soft silt (peat). Peat staining was high at the time of survey. Macrophyte coverage was low with only occasional bog pondweed in open water. Cottongrass and bottle sedge were abundant and formed large tracts in the peaty littorals. The lake was situated in cutover bog (PB4) with abundant heather (*Calluna vulgaris*) and mature birch woodland. Coniferous afforestation (WD4) was present to the north of the site.

The cutover peat lake was not considered of fisheries value given its heavily silted, shallow nature and isolation from other aquatic habitats. The site was of high value for amphibians although none were recorded during the site visit. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic habitats of high conservation value, the aquatic ecological evaluation of site L8 was of **lower importance (lower value)** (**Table 4.4**).



Plate 4.28 Representative image of site L8, October 2021

4.2.9 Site L9 – lake/wetland, Clonoura

Site L9 was located within an extensive area of cutover bog (Littleton Bog), within the proposed site boundary. The large, shallow cutover lake covered an area of c.0.8ha and ranged from 0.2m to 1m in depth with a bed comprised entirely of soft silt (peat). Peat staining was high at the time of survey. The lake supported frequent bladderwort (*Utricularia* sp.) and occasional bog pondweed, with bulrush and abundant bottle sedge around the margins. Bog pimpernel (*Lysimachia tenella*) was also recorded along the lakeshore (although this was rare). Abundant cotton grass was present on the peaty littorals. The lake was situated in cutover bog (PB4) with mixed broad-leaved woodland (WD1) dominated by willow to the east and north of the lake.

The cutover lake was of poor fisheries value given its heavily silted, generally shallow nature and isolation from other aquatic habitats. The site was of high value for amphibians although none were recorded during the site visit. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic habitats of high conservation value, the aquatic ecological evaluation of site L9 was of **lower importance (lower value)** (**Table 4.4**).



Plate 4.29 Representative image of site L9, October 2021

4.2.10 Site L10 – lake/wetland, Clonoura

Site L10 was located within an extensive area of cutover bog (Littleton Bog), within the proposed site boundary, south of site L9. The large, shallow cutover lake covered an area of c.3.5ha and ranged from 0.2m to 1m in depth with a bed comprised entirely of soft silt (peat). The eastern margin was steeper and deeper than the western and northern margins which had more gradual sloping shorelines. Peat staining was high at the time of survey, exacerbated by significant wind fetch. Macrophyte coverage was low with only occasional bog pondweed (*Potamogeton polygonifolius*) in open water. Stands of bottle sedge and bulrush were scattered around the lake margins. Abundant cotton grass (*Eriophorum angustifolium*) was present on the peaty littorals The lake was situated in cutover bog (PB4) with localised bog woodland (WN7) support downy birch and willow (*Salix* sp.).

The cutover peat lake was of poor fisheries value given its heavily silted, generally shallow nature and isolation from other aquatic habitats. The site was of high value for amphibians although none were recorded during the site visit. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic habitats of high conservation value, the aquatic ecological evaluation of site L10 was of **lower importance (lower value)** (**Table 4.4**).



Plate 4.30 Representative image of site L10, October 2021

4.2.11 Site L11 – lake/wetland, Clonoura

Site L11 was located within an extensive area of cutover bog (Littleton Bog), within the proposed site boundary. The small, shallow cutover lake covered an area of c.0.38ha and averaged 0.2-0.3m deep. The bed was comprised entirely of soft silt (peat). Peat staining was high at the time of survey. Macrophyte coverage was low with only occasional bog pondweed and water horsetail in open water. Frequent stands of bottle sedge and bulrush were present in the margins with abundant cotton grass on the peaty littorals. The lake was situated in cutover bog (PB4) with downy birch and willow (*Salix* sp.) growing along the low gradient and cutover shorelines.

The cutover peat lake was not considered of fisheries value given its heavily silted, shallow nature and isolation from other aquatic habitats. The site was of high value for amphibians although none were recorded during the site visit. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic habitats of high conservation value, the aquatic ecological evaluation of site L11 was of **lower importance (lower value)** (**Table 4.4**).



Plate 4.31 Representative image of site L11, October 2021

4.2.12 Site L12 – lake/wetland, Noard

Site L12 was located within an extensive area of cutover bog (Littleton Bog), within the proposed site boundary. The small, shallow cutover lake covered an area of c.0.18ha and was 0.1-0.3m deep. The bed was comprised entirely of soft silt (peat). Peat staining was high at the time of survey. Macrophyte coverage was low with only occasional bog pondweed. The peaty littorals (including exposed lakebed) supported abundant cotton grass in addition to rushes (*Juncus* spp.). The lake was situated in cutover bog (PB4) with immature downy birch and willow (*Salix* sp.) growing along the shoreline.

The cutover peat lake was considered of poor fisheries value given its heavily silted, shallow nature and isolation from other aquatic habitats. However, there was some low potential for European eel given the presence of the species in the nearby Clover River (survey site A4). The site was of high value for amphibians although none were recorded during the site visit. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic habitats of high conservation value, the aquatic ecological evaluation of site L12 was of **lower importance (lower value)** (**Table 4.4**).



Plate 4.32 Representative image of site L12, October 2021

4.2.13 Site L13 – lake/wetland, Noard

Site L13 was located within an extensive area of cutover bog (Littleton Bog), within the proposed site boundary, and immediately west of site L12. The small, shallow oval-shaped cutover lake covered an area of c.0.3ha and was 0.1-0.3m deep. The bed was comprised entirely of soft silt (peat). Peat staining was high at the time of survey. Macrophyte coverage was low with only occasional bog pondweed. The peaty littorals (including exposed lakebed) supported abundant cotton grass in addition to rushes (*Juncus* spp.). The lake was situated in cutover bog (PB4) with immature downy birch and willow (*Salix* sp.) growing along the shoreline.

The cutover peat lake was considered of poor fisheries value given its heavily silted, shallow nature and isolation from other aquatic habitats. However, there was some low potential for European eel given the presence of the species in the nearby Clover River (survey site A4). The site was of high value for amphibians although none were recorded during the site visit. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic habitats of high conservation value, the aquatic ecological evaluation of site L13 was of **lower importance (lower value)** (**Table 4.4**).



Plate 4.33 Representative image of site L13, October 2021

4.2.14 Site L14 – lake/wetland, Noard

Site L14 was located within an extensive area of cutover bog (Littleton Bog), within the proposed site boundary. The shallow cutover lake and wetland covered an area of c.1.4ha and ranged from 0.1-0.3m deep. The bed was comprised entirely of soft silt (peat). Turbidity was low at the time of survey (i.e. low peat staining). The site was heavily vegetated with abundant water mint, bulrush, marsh horsetail (*Equisetum palustre*) in wetland areas and occasional bog pondweed in open water sections. Water starwort (*Callitriche* sp.) was also occasional. Spike rush (*Eleocharis palustris*), *Juncus* spp. and bottle sedge were present along the margins. Abundant cotton grass was present on the peaty littorals. The lake was situated in cutover bog (PB4) with downy birch, willow (*Salix* sp.) and lodgepole pine growing along the low gradient and cutover shorelines.

The cutover peat lake and wetland was not considered of fisheries value given its heavily silted, shallow nature and isolation from other aquatic habitats. The site was of high value for amphibians although none were recorded during the site visit. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic habitats of high conservation value, the aquatic ecological evaluation of site L14 was of **lower importance (lower value)** (**Table 4.4**).



Plate 4.34 Representative image of site L14, October 2021

4.2.15 Site L15 – lake/wetland, Noard

Site L15 was located within an extensive area of cutover bog (Littleton Bog), within the proposed site boundary. The large, shallow cutover lake covered an area of c.2ha and averaged 0.3-0.4m deep in the margins but deepened to 0.7m in the central basin. The bed was comprised entirely of soft silt (peat). Peat staining was high at the time of survey. The lake supported frequent bladderwort (*Utricularia* sp.) with occasional bog pondweed and water starwort (*Callitriche* sp.). Water mint and bottle sedge were scattered along the margins, along with abundant rushes (*Juncus* spp.). The lake was situated in cutover bog (PB4) with downy birch and willow (*Salix* sp.) growing along the shoreline with scattered lodgepole pine (*Pinus contorta*).

The cutover lake was of poor fisheries value given its heavily silted, shallow nature and isolation from other aquatic habitats. The site was of high value for amphibians although none were recorded during the site visit. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic habitats of high conservation value, the aquatic ecological evaluation of site L15 was of **lower importance (lower value)** (**Table 4.4**).



Plate 4.35 Representative image of site L15, October 2021

4.2.16 Site L16 – lake/wetland, Derryhogan

Site L16 was located within an extensive area of cutover bog (Littleton Bog), within the proposed site boundary adjacent to site L15. The site was a complex of pond and anastomosing wetland habitats which covered an area of c.0.2ha and ranged from 0.1-0.3m deep. The north of the basin comprised more open water but graded into wetland with channels and pools to the south west. A drain was cut along the north side of the pond that was discharging water to the pond and wetland adjoining the existing peatland track running northwest to south east. The open water and pools supported frequent bog pondweed with very localised broad-leaved pondweed (*Potamogeton natans*) and stonewort (*Chara* sp.). Bulrush was locally frequent with occasional bottle sedge. Filamentous growth was abundant. The peaty littorals supported abundant cotton grass. The lake was situated in cutover bog (PB4) with downy birch and willow (*Salix* sp.) growing along the shoreline with scattered lodgepole pine.

The cutover lake and wetland complex was of poor fisheries value given its heavily silted, shallow nature and isolation from other aquatic habitats. The site was of high value for amphibians although none were recorded during the site visit. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic habitats of high conservation value, the aquatic ecological evaluation of site L16 was of **lower importance (lower value)** (**Table 4.4**).



Plate 4.36 Representative image of site L16, October 2021

4.2.17 Site L17 – lake/wetland, Lanespark

Site L17 was located at the southern extent of the proposed site boundary near Lanespark Bog, adjacent to Loch Doire Bhile and the North Glengoole Stream. As with Loch Doire Bhile, the site had been excavated as part of habitat creation on cutover bog. The shallow, clear-water lake covered an area of c.0.7ha and ranged from 0.2m to 1m deep. The substrata comprised gravels and clay. The lake was fringed by common reed with occasional stands of broad-leaved pondweed. Stonewort (*Chara* sp.) was abundant on the lakebed. The open, gravelly banks supported scattered willow (*Salix* sp.) with coniferous afforestation (WD4) present to the north of the site.

The artificial lake was not considered of fisheries value given its shallow nature, isolation from other aquatic habitats and absence of fish stocking history (in contrast to the nearby Loch Doire Bhile which supports stocked brown and rainbow trout). Whilst there was some good suitability for white-clawed crayfish, none were recorded. The species is known from the adjoining Loch Doire Bhile. The site was of high value for amphibians although none were recorded during the site visit. No otter signs were recorded in vicinity of the site.

No macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded via sweep netting (**Appendix B**).

Given the absence of aquatic habitats of high conservation value, the aquatic ecological evaluation of site L17 was of **lower importance (lower value)** (**Table 4.4**).



Plate 4.37 Representative image of site L17, October 2021

4.3 White-clawed crayfish survey

No live white-clawed crayfish were recorded via hand-searching and sweep netting of instream refugia during the surveys undertaken at 16 no. wetted riverine and 17 no. lacustrine sites in September and October 2021, respectively.

However, abundant crayfish remains (some very fresh) were identified in otter spraint at site C6 on the Black River (**Plate 4.38**). Two predated white-clawed crayfish were present at site A6 on the Clover River (likely from otter predation), although no live crayfish were recorded.

Furthermore, white-clawed crayfish eDNA was detected at sites on the Drish River, Clover River, Black River and Breegagh River (**Table 4.1**).

Crayfish plague was detected at sites on the Clover River and Black River (see section 4.4 below).



Plate 4.38 Regular otter spraint site at site C6 on the Black River with abundant remains of white-clawed crayfish, October 2021

4.4 eDNA analysis

Despite the fact that no live, white-clawed crayfish were recorded during the site surveys, composite water samples collected from the Clover River (FK180), Breegagh River (FK181), Black River (FK182) and Drish River (FK183) returned a positive result for white-clawed crayfish eDNA (**Table 4.1; Appendix C**). Particularly strong signatures were present at the Clover River and Black River sites. The sample from the Drish River at site B2 (FK184) was negative for white-clawed crayfish eDNA, i.e. freshwater crayfish eDNA not present or was present below the limit of detection in a series of 12 qPCR replicates (0 positive qPCR replicates out of 12).

Composite water samples from the Clover River (FK180) and Black River (FK183) tested positive for crayfish plague (12 & 5 of 12 qPCR replicates, respectively) (**Table 4.1; Appendix C**). No crayfish plague eDNA was detected in the Breegagh River (FK181) or Drish River (FK183 & FK184) samples.

Table 4.1 eDNA results in the vicinity of the proposed Littleton wind farm, Co. Tipperary (positive qPCR replicates out of 12 in parentheses)

Sample	Watercourse (site)	White-clawed crayfish	Crayfish plague
FK184	Drish River (site B2)	Negative (0/12)	Negative (0/12)
FK183	Drish River, N75 road crossing	**Positive (1/12)**	Negative (0/12)
FK180	Clover River, Borris	**Positive (12/12)**	**Positive (12/12)**
FK182	Black River (site C5)	**Positive (12/12)**	**Positive (5/12)**
FK181	Breegagh River (site D2)	**Positive (2/12)**	Negative (0/12)

4.5 Otter signs

A total of 4 no. otter signs were recorded across 37 no. survey sites during the course of aquatic surveys undertaken in September-October 2021. All were recorded from riverine sites.

A regular spraint site with fresh prints, was recorded underneath the road bridge at site C6 on the Black River (ITM 619150, 657803). This contained abundant (and fresh) white-clawed crayfish remains. Regular spraint sites were also recorded at site B2 on the Drish River and site A6 on the Clover River.

No otter signs were recorded in the cutover bog lake and pond sites albeit otters are likely to use them at certain times of the year (e.g. spring) when amphibians are breeding.

No breeding (holts) or resting (couch) areas were identified in the vicinity of the survey sites in July 2022.

4.6 Invasive aquatic species

The invasive pathogen crayfish plague (*Aphanomyces astaci*) was detected via eDNA analysis in the Clover River and Black River (see section 4.4 above).

American mink (*Neovison vison*) spraint was recorded at Ballyduff Bridge (site B5) on the Drish River. The species is considered a high-risk impact species in Ireland (O'Flynn et al., 2014).

4.7 Biological water quality (macro-invertebrates)

No rare or protected macro-invertebrate species (according to national red lists) were recorded in the biological water quality samples taken from a total of 12 no. riverine sites in September 2021 (**Figure 4.1, Appendix B**).

Site C6 on the Black River achieved **Q4 (good status)** water quality and thus met the target good status (≥Q4) requirements of the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 and the Water Framework Directive (2000/60/EC) (**Figure 4.1**). This was given the presence of one group A taxa in fair numbers (5% of total abundance), namely the stonefly *Protonemura meyeri* (**Appendix B**).

Sites A6 on the Clover River, B5 on the Drish River and C4 on the North Glengoole Stream achieved **Q3-4 (moderate status)** water quality (**Figure 4.1**). This was given the low numbers (<5%) of group A species mayflies including *Ecdyonurus dispar* (**Appendix B**).

The remaining 8 no. sampling sites on an unnamed stream (A4), Clover River (A5), unnamed stream (B1), Drish River (B3), Ballygammane River (B6), Black River (C2) and the Breegagh River (D1 & D2) **or Q3 (poor status)** based on an absence of group A species; low numbers or an absence of group B species and a dominance of group C species such as the mayfly *Baetis rhodani*, the caseless caddis *Hydropsyche instabilis*, freshwater shrimp (*Gammarus duebeni*) and the riffle beetle *Elmis aenea* (**Appendix B**).

It should be noted that the ratings for sites A4, A5 and B1 were tentative due to low summer flows and or a lack of suitable riffle areas for sampling (Toner et al., 2005).

4.8 Lacustrine macro-invertebrates

No rare or protected macro-invertebrate species were recorded in the sweep samples taken from 10 no. lake/wetland sites in October 2021 (**Appendix B**).

The shallow, peat lakes and wetlands supported a varied diversity of species, typically dominated by baetid mayflies *Centroptilum luteolum* and *Cloeon dipterum*, bluet damselflies such as *Coenagrion* sp., water boatmen (*Hesperocorixa* spp.) and freshwater hoglouse (*Asellus aquaticus*) and a low diversity of Sphaeriidae and Planorbidae molluscan species (**Appendix B**).

4.9 Macrophytes and aquatic bryophytes

No rare or protected macrophytes or aquatic bryophyte species were recorded during the survey. The Annex I habitat 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation or aquatic mosses [3260]' (aka floating river vegetation) was recorded on the Black River at site C6. Several indicator species (EC, 2013) were present, such as water crowfoot (*Ranunculus* sp.) and water starwort (*Callitriche* sp.), with a particularly high coverage of aquatic bryophytes, including abundant *Fontinalis antipyretica*. This Annex habitat was not recorded at the remaining survey sites.

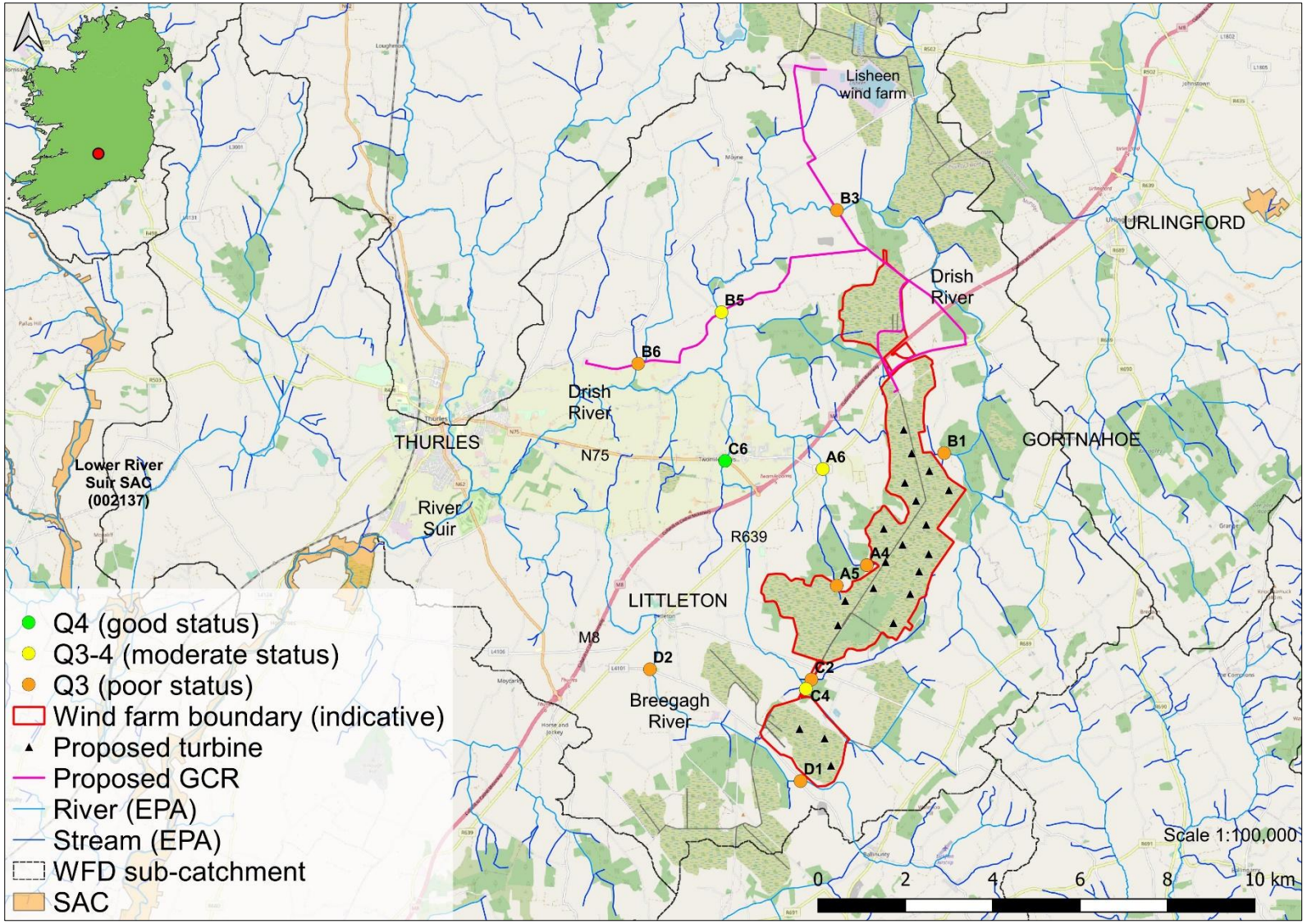


Figure 4.1 Overview of the biological water quality status in the vicinity of the proposed Littleton wind farm project, Co. Tipperary

4.10 Aquatic ecological evaluation

An aquatic ecological evaluation of each survey site was based on the results of fisheries surveys, white-clawed crayfish surveys, otter surveys, macrophyte and aquatic bryophyte surveys, eDNA analysis and biological water quality (**Table 4.4**). None of the 37 no. survey sites were evaluated as greater than **local importance (higher value)** in terms of their aquatic ecology.

A total of 13 no. sites on the Clover River (site A6) and unnamed tributary (A4), Drish River (B2, B3 & B5), Ballygammane River (B6), Black River (C2, C5 & C6), North Glengoole Stream (C3 & C4), Breegagh River (D1 & D2) were evaluated as **local importance (higher value)** in terms of their aquatic ecology due to the presence of species and or habitats of higher conservation value (**Table 4.4**).

The remaining 24 no. sites (i.e. sites A1, A2, A3, A5, B1, B4, C1, L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L13, L14, L15, L16 & L17) were evaluated as **local importance (lower value)**, given the absence of aquatic species or habitats of high conservation value (**Table 4.4**).

Table 4.2 Summary of fish species of higher conservation value and relative abundances (low, medium, high & very high) recorded via **electro-fishing** per riverine survey site in the vicinity of the proposed Littleton wind farm, September 2021

Site	Watercourse	Relative abundance				Other species
		Atlantic salmon	Brown trout	*Lampetra* sp.	European eel	
A1	Unnamed stream					Three-spined stickleback
A2	Unnamed stream	No fish recorded – dry channel				
A3	Unnamed stream	No fish recorded – dry channel				
A4	Unnamed stream				Low	Three-spined stickleback
A5	Clover River					Three-spined stickleback
A6	Clover River		Medium			Three-spined stickleback, perch, stone loach
B1	Unnamed stream					Three-spined stickleback
B2	Drish River					Three-spined stickleback
B3	Drish River				Low	Three-spined stickleback, pike, stone loach
B4	Cooleeny River	No fish recorded – dry channel				
B5	Drish River	High	High		Low	Minnow, pike, stone loach
B6	Ballygammane River	Low	Medium	Low		Minnow, three-spined stickleback
C1	Black River	No fish recorded – dry channel				
C2	Black River	Low	Low			Three-spined stickleback
C3	North Glengoole River	Low	Low		Low	Three-spined stickleback
C4	North Glengoole River		Medium			Three-spined stickleback
C5	Black River		Low			Stone loach
C6	Black River	Medium	High		Low	Stone loach
D1	Breegagh River	Medium	High			
D2	Breegagh River	Medium	Medium	High		Three-spined stickleback, stone loach

Conservation value: Atlantic salmon (*Salmo salar*), brook lamprey (L*ampetra planeri*) and river lamprey (*Lampetra fluviatilis*) are listed under Annex II of the Habitats Directive [92/42/EEC]. Atlantic salmon and river lamprey are also listed under Annex V of the Habitats Directive [92/42/EEC]. European eel are 'critically endangered' according to most recent ICUN red list (Pike et al., 2020) and listed as 'critically engendered' in Ireland (King et al., 2011). With the exception of the Inland Fisheries Acts 1959 to 2017, brown trout and coarse fish species have no legal protection in Ireland.

Table 4.3 Summary of aquatic species & habitats of higher conservation value recorded in the vicinity of the proposed Laurclavagh wind farm, July 2022

Site	Watercourse	White-clawed crayfish	Otter signs[4]	Annex I aquatic habitats	Rare or protected macrophytes/ aquatic bryophytes	Rare or protected macro-invertebrates	Other species/habitats of high conservation value
Riverine sites							
A1	Unnamed stream	None recorded	No signs	Not present	None recorded	None recorded	None recorded
A2	Unnamed stream	None recorded	No signs	Not present	None recorded	None recorded	None recorded
A3	Unnamed stream	None recorded	No signs	Not present	None recorded	None recorded	None recorded
A4	Unnamed stream	None recorded	No signs	Not present	None recorded	None recorded	**European eel**
A5	Clover River	None recorded	No signs	Not present	None recorded	None recorded	None recorded
A6	Clover River	**None recorded but predated crayfish recorded**	**Regular spraint site**	Not present	None recorded	None recorded	None recorded
B1	Unnamed stream	None recorded	No signs	Not present	None recorded	None recorded	None recorded
B2	Drish River	None recorded; negative eDNA sample	**Regular spraint site**	Not present	None recorded	None recorded	None recorded
B3	Drish River	None recorded	No signs	Not present	None recorded	None recorded	**European eel**
B4	Cooleeny River	None recorded	No signs	Not present	None recorded	None recorded	None recorded
B5	Drish River	None recorded	No signs	Not present	None recorded	None recorded	**Atlantic salmon, European eel**
B6	Ballygammane River	None recorded	No signs	Not present	None recorded	None recorded	**Atlantic salmon, *Lampetra* sp.**
C1	Black River	None recorded	No signs	Not present	None recorded	None recorded	None recorded
C2	Black River	None recorded	No signs	Not present	None recorded	None recorded	**Atlantic salmon,**
C3	North Glengoole River	None recorded	No signs	Not present	None recorded	None recorded	**Atlantic salmon, European eel**

Site	Watercourse	White-clawed crayfish	Otter signs[4]	Annex I aquatic habitats	Rare or protected macrophytes/ aquatic bryophytes	Rare or protected macro-invertebrates	Other species/habitats of high conservation value
C4	North Glengoole River	None recorded	No signs	Not present	None recorded	None recorded	None recorded
C5	Black River	**None recorded but positive eDNA sample**	No signs	Not present	None recorded	**White-clawed crayfish (eDNA only)**	None recorded
C6	Black River	**None recorded but remains identified in otter spraint**	**Regular spraint site with prints**	**Floating river vegetation [3260]**	None recorded	**White-clawed crayfish (otter spraint)**	**Atlantic salmon, European eel**
D1	Breegagh River	None recorded	No signs	Not present	None recorded	None recorded	**Atlantic salmon**
D2	Breegagh River	**None recorded but positive eDNA sample**	No signs	Not present	None recorded	**White-clawed crayfish (eDNA only)**	**Atlantic salmon, *Lampetra* sp.**
Lacustrine sites							
L1	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L2	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L3	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L4	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L5	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L6	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L7	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L8	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L9	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L10	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L11	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded

Site	Watercourse	White-clawed crayfish	Otter signs[4]	Annex I aquatic habitats	Rare or protected macrophytes/ aquatic bryophytes	Rare or protected macro-invertebrates	Other species/habitats of high conservation value
L12	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L13	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L14	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L15	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L16	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded
L17	Lake/wetland	None recorded	No signs	Not present	None recorded	None recorded	None recorded

Conservation value: White-clawed crayfish (*Austropotamobius pallipes*), Atlantic salmon (*Salmo salar*) and Eurasian otter (*Lutra lutra*) are listed under Annex II and Annex V of the Directive on the Conservation of Natural Habitats of Wild Fauna and Flora (92/43/EEC) ('EU Habitats Directive') and white-clawed crayfish and otter are protected under the Irish Wildlife Acts 1976-2021. White-clawed crayfish (Füreder et al., 2010) are listed as 'Endangered' according to the IUCN Red List. The European Union (Invasive Alien Species) (Freshwater Crayfish) Regulations 2018 (SI 354/2018) affords further protection to native white-clawed crayfish by prohibiting the introduction and spread of five no. invasive 'Union concern' crayfish species listed under EU Regulation 1143/2014. European eel are 'critically endangered' according to most recent ICUN red list (Pike et al., 2020) and listed as 'critically engendered' in Ireland (King et al., 2011). With the exception of the Inland Fisheries Acts 1959 to 2017, brown trout and coarse fish species have no legal protection in Ireland. Six-stamened waterwort (*Elatine hexandra*) is listed as 'near threatened' in Ireland (Wyse-Jackson et al., 2016).

[4] Otter signs within 150m of the survey site

Table 4.4 Aquatic ecological evaluation summary of the Littleton wind farm survey sites according to NRA (2009) criteria

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
Riverine sites				
A1	Unnamed stream	n/a	Local importance (lower value)	Historically realigned stream that was dry at this location at the time of survey with an absence of aquatic habitats or species
A2	Unnamed stream	n/a	Local importance (lower value)	Uppermost reaches of heavily modified stream with poor summer flows & siltation pressures; three-spined stickleback recorded via electro-fishing; no aquatic species or habitats of high conservation value
A3	Unnamed stream	n/a	Local importance (lower value)	Historically modified ephemeral stream that was dry at this location at the time of survey with an absence of aquatic habitats or species
A4	Unnamed stream	n/a	**Local importance (higher value)**	Upper reaches of heavily modified, heavily vegetated lowland stream with very poor hydromorphology & significant siltation pressures; European eel & three-spined stickleback recorded via electro-fishing; Q3 (poor status) water quality (tentative rating)
A5	Clover River	16C04	Local importance (lower value)	Upper reaches of heavily modified lowland river with very poor hydromorphology & significant siltation pressures; three-spined stickleback recorded via electro-fishing; Q3 (poor status) water quality (tentative rating); no aquatic species or habitats of high conservation value
A6	Clover River	16C04	**Local importance (higher value)**	Historically modified lowland river with some instream recovery but significant siltation pressures; brown trout, perch, stone loach & three-spined stickleback recorded via electro-fishing; Q3-4 (moderate status) water quality
B1	Unnamed stream	n/a	Local importance (lower value)	Upper reaches of heavily modified, heavily vegetated lowland stream with very poor hydromorphology, significant siltation pressures, poor flows & poor fluvial connectivity; three-spined stickleback recorded via electro-fishing; Q3 (poor status) water quality (tentative rating); no aquatic species or habitats of high conservation value
B2	Drish River	16D02	**Local importance (higher value)**	Very heavily modified lowland river with very high coverage of aquatic vegetation, very poor hydromorphology & no summer flows; three-spined stickleback recorded via electro-fishing; regular otter spraint site recorded
B3	Drish River	16D02	**Local importance (higher value)**	Historically modified lowland alkaline river with high aquatic vegetation cover & low summer flows but some instream recovery; European eel, pike, stone loach & three-spined stickleback recorded via electro-fishing; Q3 (poor status) water quality
B4	Cooleeny River	16C14	Local importance (lower value)	Historically modified ephemeral lowland river that was dry at this location at the time of survey with an absence of aquatic habitats or species
B5	Drish River	16D02	**Local importance (higher value)**	Semi-natural, swift-flowing lowland alkaline river of high fisheries value; Atlantic salmon, brown trout, European eel, stone loach, minnow & pike recorded via electro-fishing; white-

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
				clawed crayfish eDNA detected; regular otter spraint site recorded; Q3-4 (moderate status) water quality
B6	Ballygammane River	16B55	**Local importance (higher value)**	Historically modified high-energy lowland alkaline river with some instream recovery & low summer flows; Atlantic salmon, brown trout, *Lampetra* sp., minnow & three-spined stickleback recorded via electro-fishing; Q3 (poor status) water quality
C1	Black River	16B01	Local importance (lower value)	Upper reaches of historically modified ephemeral lowland river that was dry at this location at the time of survey with an absence of aquatic habitats or species
C2	Black River	16B01	**Local importance (higher value)**	Heavily modified lowland river with poor summer flows & significant siltation pressures; Atlantic salmon, brown trout & three-spined stickleback recorded via electro-fishing; Q3 (poor status) water quality
C3	North Glengoole River	16N28	**Local importance (higher value)**	Small historically modified lowland river with poor hydromorphology & significant siltation pressures; Atlantic salmon, brown trout & European eel & three-spined stickleback recorded via electro-fishing
C4	North Glengoole River	16N28	**Local importance (higher value)**	Small historically modified lowland river with some instream recovery but siltation pressures; brown trout & three-spined stickleback recorded via electro-fishing; Q3-4 (moderate status) water quality
C5	Black River	16B01	**Local importance (higher value)**	Heavily modified lowland river with very poor hydromorphology & significant siltation pressures; brown trout & stone loach recorded via electro-fishing; white-clawed crayfish eDNA detected
C6	Black River	16B01	**Local importance (higher value)**	Historically modified lowland alkaline river with some good instream recovery & high fisheries value; Atlantic salmon, brown trout, *Lampetra* sp. & stone loach recorded via electro-fishing; regular otter spraint site recorded containing abundant white-clawed crayfish remains; Annex I floating river vegetation [3260] present; Q4 (good status) water quality
D1	Breegagh River	16B03	**Local importance (higher value)**	Heavily modified lowland river with poor hydromorphology & significant siltation pressures; Atlantic salmon & brown trout recorded via electro-fishing; Q3 (poor status) water quality
D2	Breegagh River	16B03	**Local importance (higher value)**	Historically modified lowland alkaline river with good instream recovery & high fisheries value; Atlantic salmon, brown trout, *Lampetra* sp. & three-spined stickleback recorded via electro-fishing; white-clawed crayfish eDNA detected; Q3 (poor status) water quality

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
Lacustrine sites				
L1	Lake/wetland	n/a	Local importance (lower value)	Small, shallow seasonal peat wetland/lake complex of 1ha in cutover bog; no aquatic species or habitats of high conservation value recorded
L2	Lake/wetland	n/a	Local importance (lower value)	Large 1ha, shallow linear peat lake in cutover bog with high peat staining & low macrophyte cover; no aquatic species or habitats of high conservation value recorded
L3	Lake/wetland	n/a	Local importance (lower value)	Small 0.5ha shallow linear peat lake in cutover bog with high peat staining & low macrophyte cover; no aquatic species or habitats of high conservation value recorded
L4	Lake/wetland	n/a	Local importance (lower value)	Large 1.1ha, shallow peat lake in cutover bog with high peat staining & low macrophyte cover; no aquatic species or habitats of high conservation value recorded
L5	Lake/wetland	n/a	Local importance (lower value)	Large 1.4ha, shallow lake with calcareous influences in cutover bog with low peat staining & moderate macrophyte cover; no aquatic species or habitats of high conservation value recorded
L6	Lake/wetland	n/a	Local importance (lower value)	Small 0.14ha shallow lake in cutover bog with moderate peat staining & low macrophyte cover; *Piscicola* sp. fish leech indicates presence of fish population; no aquatic species or habitats of high conservation value recorded
L7	Lake/wetland	n/a	Local importance (lower value)	Small 0.25ha, shallow lake with calcareous influences in cutover bog with low peat staining & moderate macrophyte cover; no aquatic species or habitats of high conservation value recorded
L8	Lake/wetland	n/a	Local importance (lower value)	Large 5ha linear shallow lake in cutover bog with high peat staining & low macrophyte cover; no aquatic species or habitats of high conservation value recorded
L9	Lake/wetland	n/a	**Local importance (higher value)**	Small 0.8ha shallow peat lake in cutover bog with high peat staining & low macrophyte cover; no aquatic species or habitats of high conservation value recorded
L10	Lake/wetland	n/a	Local importance (lower value)	Large 3.5ha, shallow peat lake in cutover bog with high peat staining & low macrophyte cover; no aquatic species or habitats of high conservation value recorded
L11	Lake/wetland	n/a	Local importance (lower value)	Small 0.38ha, shallow peat lake in cutover bog with high peat staining & low macrophyte cover; no aquatic species or habitats of high conservation value recorded
L12	Lake/wetland	n/a	Local importance (lower value)	Small 0.18ha, shallow peat lake in cutover bog with high peat staining & low macrophyte cover; no aquatic species or habitats of high conservation value recorded
L13	Lake/wetland	n/a	Local importance (lower value)	Small 0.3ha, shallow peat lake in cutover bog with high peat staining & low macrophyte cover; no aquatic species or habitats of high conservation value recorded
L14	Lake/wetland	n/a	Local importance (lower value)	Large 1.4ha shallow peat lake & wetland complex in cutover bog with high vegetation cover; no aquatic species or habitats of high conservation value recorded
L15	Lake/wetland	n/a	Local importance (lower value)	Large 2ha shallow peat lake in cutover bog with high peat staining & moderate macrophyte cover; no aquatic species or habitats of high conservation value recorded

Site no.	Watercourse	EPA code	Evaluation of importance	Rationale summary
L16	Lake/wetland	n/a	Local importance (lower value)	Small 0.2ha shallow peat lake & wetland complex in cutover bog with high vegetation cover; no aquatic species or habitats of high conservation value recorded
L17	Lake/wetland	n/a	Local importance (lower value)	Small 0.7ha, shallow clear-water artificial lake on calcareous substrata excavated as part of habitat creation works with abundant macrophytes; no aquatic species or habitats of high conservation value recorded

Conservation value: Atlantic salmon (*Salmo salar*), *Lampetra* spp. and otter (*Lutra lutra*) are all listed under Annex II of the Habitats Directive [92/42/EEC]. Furthermore, Atlantic salmon, *Lampetra* spp. are also listed under Annex V of the Habitats Directive [92/42/EEC] while otter are also listed on under Annex IV of the Habitats Directive [92/42/EEC]. Otters (along with their breeding and resting places) are also protected under provisions of the Irish Wildlife Acts 1976 to 2021. European eel are 'critically endangered' according to most recent ICUN red list (Pike et al., 2020) and listed as 'critically engendered' in Ireland (King et al., 2011). With the exception of the Inland Fisheries Acts 1959 to 2017, brown trout and coarse fish species have no legal protection in Ireland.

5. Discussion

5.1 Most valuable areas for aquatic ecology

A total of 14 no. sites on the Clover River (site A6) and unnamed tributary (A4), Drish River (B2, B3 & B5), Ballygammane River (B6), Black River (C2, C5 & C6), North Glengoole Stream (C3 & C4), Breegagh River (D1 & D2) and a peat lake at site L9 were evaluated as **local importance (higher value)** in terms of their aquatic ecology due to the presence of species and or habitats of higher conservation value (**Table 4.4**). This was due to the presence of higher conservation value species such as Atlantic salmon (7 no. sites), lamprey (*Lampetra* sp.) (2 no. sites), European eel (5 no. sites), otter (3 no. sites), white-clawed crayfish (4 no. sites, eDNA & in otter spraint), protected macrophytes (1 no. site) and or Annex I aquatic habitats (2 no. sites) (**Table 4.4**).

The remaining 23 no. sites (i.e. sites A1, A2, A3, A5, B1, B4, C1, L1, L2, L3, L4, L5, L6, L7, L8, L10, L11, L12, L13, L13, L14, L15, L16 & L17) were evaluated as **local importance (lower value)**, given the absence of aquatic species or habitats of high conservation value (**Table 4.4**). Sites on two unnamed Clover River tributaries (A2 & A3), Cooleeny River (B4) and the Black River (C1) were dry at the time of survey (September 2021) and did not support aquatic habitats or species.

5.1.1 Fish species of high conservation value

Atlantic salmon were recorded from a total of 7 no. sites (Table 4.2; **Appendix A**). These were located on the Drish River (site B5), Ballygammane River (B6), Black River (C2 & C6) and its North Glengoole River tributary (C3) and the Breegagh River (D1 & D2). Brown trout were also recorded at these sites, in addition to site A6 on the Clover River, North Glengoole River (V4) and the Black River (C5). The highest relative densities of salmonids and better quality salmonid habitats were present at sites on the Drish River[1], Black River and Breegagh River, although abundances of both Atlantic salmon and brown trout were typically low across the survey area (**Appendix A**). The quality of salmonid was typically poor due to significant hydromorphological pressures resulting from arterial drainage (i.e. extensive straightening & deepening).

Lamprey ammocoetes (*Lampetra* sp.) were recorded from 2 no. sites on the Black River (C6, low density) and Breegagh River (D2, high density) during targeted electro-fishing, *Lampetra* sp. transformers were also recorded at site B6 on the Ballygammane River. This highly restricted distribution was considered to reflect the paucity of suitable nursery (soft sediment) habitat within the vicinity of the proposed project, in addition to the presence of sub-optimal or absence of spawning habitat, primarily due to significant arterial drainage pressures (**Appendix A**).

European eel were only recorded in low densities at a total of 5 no. sites on an unnamed Clover River tributary (A4), Drish River (B3 & B5), North Glengoole River (C3) and the Black River (C6) (**Table 4.1; Appendix A**). The paucity of eel recorded during the electro-fishing surveys was considered to reflect

[1] The Drish River was heavily polluted by zinc and lead mine at Lisheen in the recent past (AECOM, 2020; O'Connor, 2007), with fish life significantly affected. However, good recovery is now evident in this watercourse despite other pressures, including siltation and hydromorphology.

a combination sub-optimal habitat resulting from historical modifications and low summer flows at numerous survey sites and the large instream distance from marine habitats (**Appendix A**).

Whilst some of the more mature cutover lake survey sites had inherently more aquatic value, none were considered of significant fisheries value due to their generally very shallow nature, peat substrata, lower pH and poor connectivity or isolation from other aquatic habitats supporting fish populations. There was some low European eel potential in those lakes situated in close proximity to the riverine watercourses found to support the species (e.g. lake site L12 & L17).

5.1.2 Otter

Despite widespread suitability, only a low number of otter signs (4 no.) were recorded during the survey. All were recorded from riverine sites with the lakes surveyed providing poor otter habitat, primarily due to insufficient prey resources. Regular spraint sites were recorded at sites A6 on the Clover River, B2 on the Drish River and C6 on the Black River.

This paucity of signs was considered to mainly reflect the influence of historical instream modifications (straightening, deepening) on the health and distribution of fish populations, the key prey resource of otter (Krawczyk et al., 2016; Ruiz-Olmo & Jiménez, 2009). Otters are food-limited and prey availability is a crucial factor in determining mortality, breeding success and the status of local populations (Sittenthaler et al., 2019; Ruiz-Olmo et al., 2002). Furthermore, otter sign marking is routinely associated with prominent features such as large instream boulders and tree root systems (Almeida et al., 2012). Historical drainage, such as that carried out historically in the vicinity of the proposed project, significantly reduces instream habitat heterogeneity (O'Grady, 2017) and the availability or marking areas (outposts), which therefore results in the deposition and detection of fewer otter signs such as spraints, irrespective of watercourse utilisation (e.g. for foraging).

No breeding (holt) or couch (resting) areas were identified in the vicinity of the survey sites in September-October 2021.

While there was suitability for otter to use the cutover bog lakes onsite these habitats were extremely numerous and otters likely use them when prey resources are optimal e.g. during the spring when amphibians breed. They may move from the adjoining river systems into Littleton Bog in accordance with the natural cyclicity of prey availability.

5.1.3 White-clawed crayfish & crayfish plague

Despite suitability at numerous sites, no live, white-clawed crayfish were recorded during targeted surveys in September-October 2022. However, abundant crayfish remains (including some very fresh) were identified in otter spraint at site C6 on the Black River (**Plate 4.38**). This would indicate the presence of crayfish in the vicinity of the site. Indeed, contemporary and historic records are available for the river at this location (**Figure 3.1**). Two predated (recently killed) white-clawed crayfish were present at site A6 on the Clover River (likely from otter predation) and the species was previously known form the river (**Figure 3.1**). In verification of site surveys, white-clawed crayfish eDNA was detected at sites on the Clover River and Black River (site C5), in addition to the Drish River (site B2 & other site) and Breegagh River (site D2) (**Table 4.1**).

Most of the 17 no. survey lakes were inherently unsuitable for the white-clawed crayfish given their unsuitable peat geologies, water chemistry (acidic) and physical habitat attributes (Demers et al., 2005; Lucey & McGarrigle, 1987). However, there was good suitability at site L17, a small artificial alkaline lake adjacent to Loch Doire Bhile, a site known to support crayfish (NPWS data). No crayfish were recorded from site L17 via hand searching or sweep netting.

Crayfish plague was detected at sites on the Clover River and Black River (12 & 5 positive qPCR replicates out of 12, respectively; **Table 4.1**), but not in the Drish or Breegagh Rivers. Whilst plague outbreaks have occurred in the wider Suir catchment since 2017 (NPWS, 2017b), these results represent the first known records of the pathogen in the Suir_SC_040 river sub-catchment (as per National Crayfish Plague Surveillance Program data of Swords & Griffin, 2022; Swords et al., 2021, 2020; White et al., 2019). Crayfish plague, which can cause up to 100% mortality in white-clawed crayfish populations (Edgerton et al., 2004), is listed as one of the world's 100 worst invasive species (GISD, 2022; Lowe et al., 2000) and is becoming highly prevalent across Ireland. *Aphanomyces astaci* is considered an obligate crayfish parasite not capable of surviving for a long period outside a crayfish host (Strand et al., 2011; Söderhäll & Cerenius, 1999). Therefore, the simultaneous detection of both crayfish plague and white-clawed crayfish signatures in the same watercourse (i.e. Clover River & Black River) is an unusual but increasingly common observation in Ireland that may suggest latent infections and some developing natural resistance in Irish crayfish populations (pers. obs.).

5.1.4 Macrophytes & aquatic bryophytes

No other rare or protected macrophytes or aquatic bryophytes species were recorded during the survey. The Annex I habitat 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation or aquatic mosses [3260]' (aka floating river vegetation) was recorded on the Black River at site C6. Several indicator species (EC, 2013) were present, such as water crowfoot (*Ranunculus* sp.) and water starwort (*Callitriche* sp.), with a particularly high coverage of aquatic bryophytes, including abundant *Fontinalis antipyretica*. This Annex habitat was not recorded at the remaining survey sites.

5.1.5 Macro-invertebrates & biological water quality

No rare or protected macro-invertebrate species (according to national red lists) were recorded in the biological water quality samples taken from 12 no. wetted riverine sites in September 2021 or 17 no. sweep samples from lake sites in October 2021 (**Appendix B**).

Site C6 on the Black River achieved **Q4 (good status)** water quality and thus met the target good status (≥Q4) requirements of the European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 and the Water Framework Directive (2000/60/EC) (**Figure 4.1**). The remaining 11 no. riverine sample sites achieved **Q3-4 (moderate status)** (sites A6, B5 & C4) or **Q3 (poor status)** (sites A4, A5, B1, B3, B6, C2, D1 & D2) in September 2021.

With the exception of site C6 on the Black River, the biological water quality in the vicinity of the proposed project was unsatisfactory and was not meeting good status targets. Peat extraction (leading to siltation) and forestry are the significant threats to water quality in the survey area (EPA, 2019).

Furthermore, low summer flows and widespread hydromorphological modifications also influenced biological water quality in September 2021.

5.2 Aquatic ecology summary

The riverine watercourses in the vicinity of the proposed Littleton wind farm were typically lowland channels which had been extensively straightened and or deepened historically as part of arterial drainage and land reclamation works, resulting in poor hydromorphology and reduced habitat heterogeneity. Whilst some good instream recovery had occurred locally (e.g. Drish River, Black River, Breegagh River), significant siltation and hydromorphological pressures were evident throughout the survey area. The lakes and wetlands located within the proposed site boundary typically originate from historical cutover bog activities and as such are shallow, highly turbid (peat stained), poorly vegetated and of lower productivity, providing relatively poor habitat for many higher conservation value species or habitats. None of these lake/wetland sites corresponded to Annex I lake habitats. (e.g. 3160).

None of the 37 no. survey sites were evaluated as greater than **local importance (higher value)** in terms of their aquatic ecology. Whilst a number of high conservation value species (e.g. Atlantic salmon, otter, white-clawed crayfish) and habitats (e.g. floating river vegetation) were recorded in September-October 2021, the majority of sites (24 no.) were evaluated as **local importance (lower value)** in terms of their aquatic ecology.

Atlantic salmon and brown trout were widespread within survey area but typically present at lower densities. Lamprey (*Lampetra* sp.) and European eel were recorded at a low number of sites, primarily reflecting sub-optimal habitats. Other fish species recorded were pike, perch, stone loach, minnow and three-spined stickleback. Although no live white-clawed crayfish were recorded, the species was detected from the Clover River and Black River (otter spraint & eDNA) as well as the Drish River and Breegagh River (eDNA only). No other rare or protected macro-invertebrates were recorded. Invasive crayfish plague was detected in the Clover and Black Rivers. A low number of otter signs were recorded in vicinity of the project (no holts or couches). Site C6 on the Black River supported Annex I floating river vegetation habitat [3260]. The highest value watercourses within vicinity of the project in terms of aquatic ecology were those with higher flow volumes and better instream recovery from arterial drainage, namely the Drish River, Black River and, to a lesser extent, the Breegagh River.

5.3 Recommendations for further surveys

Given the location and large scale of the proposed project, there are several recommendations for further study which were beyond the scope of this survey. These would include the following;

- Collect eDNA samples at lake/wetland sites in vicinity of proposed works/infrastructure to validate presence or absence of fish and amphibian populations (i.e. smooth newt & common frog)
- Collect additional eDNA sample for white-clawed crayfish at lake site L17 given habitat suitability and presence of species in nearby Loch Doire Bhile

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7. Appendix A – fisheries assessment report

Please see accompanying fisheries assessment report

8. Appendix B – Q-sample results (biological water quality)

Table 8.1 Macro-invertebrate Q-sampling results for 12 no. riverine sites in the vicinity of Littleton wind farm, September 2021

Group	Family	Species	A4	A5	A6	B1	B3	B5	B6	C2	C4	C6	D1	D2	EPA group
Ephemeroptera	Heptageniidae	*Ecdyonurus dispar*			1										A
Ephemeroptera	Heptageniidae	*Ecdyonurus* sp.									1				A
Ephemeroptera	Heptageniidae	sp. indet.						1							A
Plecoptera	Nemouridae	*Protonemura meyeri*										9			A
Ephemeroptera	Baetidae	*Alainites muticus*			1				1			1	1		B
Ephemeroptera	Baetidae	*Centroptilum luteolum*						1							B
Ephemeroptera	Baetidae	*Cloeon dipterum*		1											B
Plecoptera	Leuctridae	*Leuctra hippopus*			1					1		5	3		B
Trichoptera	Goeridae	*Silo pallipes*									1	1			B
Trichoptera	Limnephilidae	sp. indet.						1							B
Trichoptera	Sericostomatidae	*Sericostoma personatum*			1			2			1				B
Odonata	Coenagrionidae	*Coenagrion* sp.		1		2									B
Ephemeroptera	Baetidae	*Baetis rhodani*			7		21	5	2		22	1	23	9	C
Ephemeroptera	Caenidae	*Caenis luctuosa*					4								C
Trichoptera	Hydropsychidae	*Hydropsyche instabilis*			66			6	1	59	3	35	22	59	C
Trichoptera	Polycentropodidae	*Polycentropus flavomaculatus*					16	2					1	2	C
Trichoptera	Psychomyiidae	*Tinodes waeneri*			4										C
Trichoptera	Psychomyiidae	*Tinodes* sp.												6	C
Trichoptera	Rhyacophilidae	*Rhyacophila dorsalis*									2		1		C
Mollusca	Bithnyiidae	*Bithynia tentaculata*				2	13								C
Mollusca	Lymnaeidae	*Stagnicola fuscus*				1									C
Mollusca	Planorbidae	*Planorbis planorbis*				7									C
Mollusca	Sphaeriidae	sp. indet.		3	10	1	2								C
Mollusca	Tateidae	*Potamopyrgus antipodarum*										2		3	C
Crustacea	Gammaridae	*Gammarus duebeni*	4	2	4	1	9	5	18	35	45	20	12	37	C

Group	Family	Species	A4	A5	A6	B1	B3	B5	B6	C2	C4	C6	D1	D2	EPA group
Coleoptera	Dytiscidae	*Acilius canaliculatus*	1												C
Coleoptera	Dytiscidae	*Dyiscus semisulcatus*	1												C
Coleoptera	Dytiscidae	*Hydroporus tessellatus*				4									C
Coleoptera	Dytiscidae	*Hygrotus inaequalis*				1									C
Coleoptera	Dytiscidae	*Ilybius ater*				1									C
Coleoptera	Dytiscidae	*Ilybius fuliginosus*		3		1									C
Coleoptera	Dytiscidae	*Nebrioporus depressus*						4						1	C
Coleoptera	Elmidae	*Elmis aenea*			4		6	9	1	38	33	17	8	27	C
Coleoptera	Elmidae	*Limnius volckmari*						3			2			2	C
Coleoptera	Gyrinidae	sp. indet.			2						1	1	1		C
Coleoptera	Gyrinidae	*Gyrinus caspius*		2	1	3									C
Coleoptera	Halipliidae	*Haliplus lineatocollis*					2	4				1			C
Coleoptera	Hydraenidae	*Hydraena gracilis*					1	1		1					C
Coleoptera	Hydrophilidae	*Helophorus aequalis*		3											C
Coleoptera	Hydrophilidae	*Helophorus brevipalpis*								1					C
Coleoptera	Hydrophilidae	*Helophorus grandis*				1									C
Coleoptera	Noteridae	*Laccobius minutus*				1									C
Diptera	Ceratopogonidae	sp. indet.						1			1				C
Diptera	Chauboridae	sp. indet.													C
Diptera	Chironomidae	non-*Chironomus* spp.			1		4		2	4	7	4	2		C
Diptera	Culicidae	sp. indet.												1	C
Diptera	Pediciidae	*Dicranota sp.*							3	2	4		3	2	C
Diptera	Simuliidae	sp. indet.					4				15	4			C
Diptera	Thaumleidae	sp. indet.								1					C
Diptera	Tipuliidae	Tipula sp.						1	2						C
Hemiptera	Corixidae	*Corixidae nymph*				1									C
Hemiptera	Corixidae	*Hesperocorixa linnaei*					1								C

Group	Family	Species	A4	A5	A6	B1	B3	B5	B6	C2	C4	C6	D1	D2	EPA group
Hemiptera	Corixidae	*Hesperocorixa sahlbergi*	1	9			1								C
Hemiptera	Gerridae	*Gerris* sp.				5			2	1	4	1	1		C
Hemiptera	Hydrometridae	*Hydrometra stagnorum*	1	2											C
Hirudinidae	Piscicolidae	*Piscicola* sp.											1		C
Arachnida	Hydrachnidiae	Hydrachnidiae						1			1				C
Crustacea	Asellidae	*Asellus aquaticus*	3	69	11	6	4					1		3	D
Mollusca	Lymnaeidae	*Ampullaceana balthica*						4						1	D
Mollusca	Physidae	*Physa fontinalis*					8								D
Hirudinidae	Erpobdellidae	*Erpobdella testacea*							1						D
Hirudinidae	Glossiphoniidae	*Glossiphonia complanata*			3		1			1			1	2	D
Diptera	Chironomidae	*Chironomus* sp.				3									E
Abundance			**11**	**95**	**117**	**41**	**97**	**51**	**33**	**144**	**143**	**103**	**80**	**155**	
Q-rating			Q3*	Q3*	Q3-4	Q3*	Q3	Q3-4	Q3	Q3	Q3-4	Q4	Q3	Q3	
WFD status			Poor	Poor	Mod	Poor	Poor	Mod	Poor	Poor	Mod	Good	Poor	Poor	

* tentative rating due to poor flows and or lack of suitable riffle areas for sampling (as per Toner et al., 2005)

Table 8.2 Macro-invertebrate sweep sample results for 10 no. lake/wetland sites in the vicinity of Littleton wind farm, September 2021

Group	Family	Species	L2	L4	L5	L6	L7	L9	L10	L11	L12	L13
Ephemeroptera	Baetidae	*Centroptilum luteolum*	2	12	37	22						
Ephemeroptera	Baetidae	*Cloeon dipterum*			33		75	18				
Ephemeroptera	Leptophlebiidae	*Paraleptophlebia cincta*		7							1	3
Trichoptera	Leptoceridae	sp. indet.		1								
Trichoptera	Limnephilidae	*Limnephilus marmoratus*			2			6				
Trichoptera	Phryganeidae	*Agrypnia varia*		1	1							
Odonata	Aeshnidae	*Brachytron pratense*				1						
Odonata	Coenagrionidae	*Coenagrion* sp.	1	1	4	2	4	2	3	2	19	9
Odonata	Libellulidae	*Sympetrum* sp.	7				1					
Ephemeroptera	Caenidae	*Caenis horaria*			2							
Trichoptera	Polycentropodidae	*Plectrocnemia conspersa*					3					
Trichoptera	Polycentropodidae	*Plectrocnemia geniculata*	1									
Mollusca	Lymnaeidae	*Lymnaea stagnalis*								1		
Mollusca	Planorbidae	*Bathyomphalus contortus*					14					
Mollusca	Planorbidae	*Gyraulis laevis*			1							
Mollusca	Planorbidae	*Planorbis planorbis*						2				
Mollusca	Sphaeriidae	sp. indet.		14		53						
Coleoptera	Dytiscidae	sp. indet.									2	2
Coleoptera	Dytiscidae	*Hygrotus inaequalis*							1			
Coleoptera	Dytiscidae	*Laccophilus minutus*	1									
Coleoptera	Dytiscidae	*Rhantus exsoletus*						1				
Coleoptera	Gyrinidae	*Gyrinus marinus*			1							
Coleoptera	Gyrinidae	*Gyrinus minutus*		3		1			1			1
Coleoptera	Haliplidae	*Haliplus ruficollis* group			1							
Coleoptera	Haliplidae	sp. indet.			1							

Group	Family	Species	L2	L4	L5	L6	L7	L9	L10	L11	L12	L13
Coleoptera	Hydraenidae	*Hydraena gracilis*										
Coleoptera	Hydrophilidae	*Enochrus* sp.					1					
Diptera	Chironomidae	non-*Chironomus* spp.		4	7			6		1		
Diptera	Thaumleidae	sp. indet.	2		3	1	2	3				
Diptera	Tipuliidae	Tipula sp.						1				
Hemiptera	Corixidae	*Corixa punctata*								1		
Hemiptera	Corixidae	*Hesperocorixa linnaei*		7	54			1		1	2	
Hemiptera	Corixidae	*Hesperocorixa sahlbergi*								1		
Hemiptera	Corixidae	*Hesperocorixa* sp.	7				51				204	105
Hemiptera	Notonectidae	*Notonecta marmorea viridis*						2		1		2
Hemiptera	Notonectidae	*Notonecta obliqua*										1
Hirudinidae	Piscicolidae	*Piscicola* sp.				2						
Arachnida	Hydrachnidiae	Hydrachnidiae	1		1					1	2	
Crustacea	Asellidae	*Asellus aquaticus*			3		88	26	2	1		
Mollusca	Lymnaeidae	*Ampullaceana balthica*			1	1	3			2		
Mollusca	Physidae	*Physa fontinalis*						1				
Annelida	Naididae (Tubificidae)	sp. indet.		1							1	
Annelidae	Oligochaeta	sp. indet.	1	1		2	4		3		5	
Abundance			**23**	**52**	**152**	**85**	**246**	**69**	**10**	**12**	**236**	**123**

9. Appendix C – eDNA analysis lab report

SureScreen Scientifics

Folio No: E12289
Report No: 1
Client: Triturus Environmental Limited
Contact: Ross Macklin

TECHNICAL REPORT

ANALYSIS OF ENVIRONMENTAL DNA IN WATER FOR AQUATIC SPECIES DETECTION

SUMMARY

When aquatic organisms inhabit a waterbody such as a pond, lake or river they continuously release small amounts of their DNA into the environment. By collecting and analysing water samples, we can detect these small traces of environmental DNA (eDNA) to confirm the presence or absence of the target species within the waterbody.

RESULTS

Date sample received in laboratory: 02/11/2021
Date results reported: 16/11/2021
Matters affecting result: None

Forensic Scientists and Consultant Engineers
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Company Registration No. 08950940

SureScreen Scientifics

TARGET SPECIES: Crayfish plague *(Aphanomyces astaci)*

Lab ID	Site Name	OS Reference	SIC	DC	IC	Result	Positive Replicates
FK180	Clover River	-	Pass	Pass	Pass	Positive	12/12
FK181	Breegah River D2	-	Pass	Pass	Pass	Negative	0/12
FK182	Black River C5	-	Pass	Pass	Pass	Positive	5/12
FK183	Drish River N75 road bridge	-	Pass	Pass	Pass	Negative	0/12
FK184	Drish River B2	-	Pass	Pass	Pass	Negative	0/12

TARGET SPECIES: White-clawed crayfish *(Austropotamobius pallipes)*

Lab ID	Site Name	OS Reference	SIC	DC	IC	Result	Positive Replicates
FK180	Clover River	-	Pass	Pass	Pass	Positive	12/12
FK181	Breegah River D2	-	Pass	Pass	Pass	Positive	2/12
FK182	Black River C5	-	Pass	Pass	Pass	Positive	12/12
FK183	Drish River N75 road bridge	-	Pass	Pass	Pass	Negative	1/12
FK184	Drish River B2	-	Pass	Pass	Pass	Negative	0/12

If you have any questions regarding results, please contact us: ForensicEcology@surescreen.com

Reported by: **MSc Gabriela Danickova** Approved by: **PhD Chris Troth**

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METHODOLOGY

The samples detailed above have been analysed for the presence of target species eDNA following scientifically published eDNA assays and protocols which have been thoroughly tested, developed and verified for use by SureScreen Scientifics.

The analysis is conducted in two phases. The sample first goes through an extraction process where the filter is incubated in order to obtain any DNA within the sample. The extracted sample is then tested via real time PCR (also called q-PCR) for each of the selected target species. This process uses species-specific molecular markers (known as primers) to amplify a select part of the DNA, allowing it to be detected and measured in 'real time' as the analytical process develops. qPCR combines amplification and detection of target DNA into a single step. With qPCR, fluorescent dyes specific to the target sequence are used to label targeted PCR products during thermal cycling. The accumulation of fluorescent signals during this reaction is measured for fast and objective data analysis. The primers used in this process are specific to a part of mitochondrial DNA only found in each individual species. Separate primers are used for each of the species, ensuring no DNA from any other species present in the water is amplified.

If target species DNA is present, the DNA is amplified up to a detectable level, resulting in positive species detection. If target species DNA is not present then amplification does not occur, and a negative result is recorded.

Analysis of eDNA requires scrupulous attention to detail to prevent risk of contamination. True positive controls, negative controls and spiked synthetic DNA are included in every analysis and these have to be correct before any result is declared and reported. Stages of the DNA analysis are also conducted in different buildings at our premises for added security.

SureScreen Scientifics Ltd is ISO9001 accredited and participate in Natural England's proficiency testing scheme for GCN eDNA testing. We also carry out regular inter-laboratory checks on accuracy of results as part of our quality control procedures.

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INTERPRETATION OF RESULTS

SIC: **Sample Integrity Check** [Pass/Fail]
When samples are received in the laboratory, they are inspected for any tube leakage, suitability of sample (not too much mud or weed etc.) and absence of any factors that could potentially lead to inconclusive results.

DC: **Degradation Check** [Pass/Fail]
Analysis of the spiked DNA marker to see if there has been degradation of the kit or sample, between the date it was made to the date of analysis. Degradation of the spiked DNA marker may indicate a risk of false negative results.

IC: **Inhibition Check** [Pass/Fail]
The presence of inhibitors within a sample are assessed using a DNA marker. If inhibition is detected, samples are purified and re-analysed. Inhibitors cannot always be removed, if the inhibition check fails, the sample should be re-collected.

Result: **Presence of eDNA** [Positive/Negative/Inconclusive]

Positive: DNA was identified within the sample, indicative of species presence within the sampling location at the time the sample was taken or within the recent past at the sampling location.

Positive Replicates: Number of positive qPCR replicates out of a series of 12. If one or more of these are found to be positive the pond is declared positive for species presence. It may be assumed that small fractions of positive analyses suggest low level presence, but this cannot currently be used for population studies. Even a score as low as 1/12 is declared positive. 0/12 indicates negative species presence.

Negative: eDNA was not detected or is below the threshold detection level and the test result should be considered as evidence of species absence, however, does not exclude the potential for species presence below the limit of detection.

Inconclusive: Controls indicate inhibition or degradation of the sample, resulting in the inability to provide conclusive evidence for species presence or absence.

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APPENDIX 6.3

Littleton Wind Farm Bat Report

APPENDIX 6.3

Littleton Wind Farm Bat Report

FEHILY TIMONEY

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LITTLETON WIND FARM

Littleton Wind Farm Bat Report

Prepared for:

Littleton Wind Farm DAC

Date: **May 2026**

Document No:

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Littleton Wind Farm Bat Assessment

REVISION CONTROL TABLE, CLIENT, KEYWORDS AND ABSTRACT

User is responsible for Checking the Revision Status of This Document

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1	Final	OC/BOD/NSC/KB	BOD	RM	06/05/2026

Client: Littleton Wind Farm DAC

Keywords: Littleton, Wind Farm, Bats

Abstract: This report details the bat surveys conducted at the proposed Littleton Wind Farm, Co. Tipperary in 2023 and 2025.

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1. INTRODUCTION

This report details the results of the bat surveys carried out for the proposed development during 2023 and 2025 with 2023 surveys carried out based on an evolving layout. Surveys in 2024 were not conducted due to programme elongation on project delivery.

The proposed development comprises a 11-turbine wind farm, associated grid connection infrastructure and turbine delivery route. The assessment considers turbines with an 81 m blade length, ensuring that potential bat-sensitive habitats within this distance are fully evaluated (200m + blade length). In addition to a desktop study, the following field surveys were undertaken within and adjacent to the Proposed Development:

- Bat activity transects
- Static detector surveys at proposed turbine locations
- Roost/ Dusk Emergence surveys

All surveys adhered to NatureScot (2021) and Collins (2023) guidelines throughout all surveys of the proposed development. These guidelines remain current at the time of writing. These guidelines are the standard approach for bat survey and impact assessment for wind farm developments in Ireland.

Figures 6-3, 6-4, 6-5, 6-6, 6-7, 6-10, 6-11 and 6-12 (relevant figures for this report) are provided in the EIAR Appendix VI and are therefore not included within this bat report. These figures support the wider ecological context of the assessment and should be read alongside the findings presented herein. The figures relevant to this report are:

- Figure 6-3: Static Detector Locations 2023
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- Figure 6-6: Grid Connection Survey Locations
- Figure 6-7: Habitat Map
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1.1 Statement of Authority

Contributor	Role	Biography
Rita Mansfield	Report Reviewer	Rita holds a BSc.(Hons) in Applied Ecology and a H. Dip Environmental Protection and Pollution Control. Rita is experienced as a technical ecology lead within the environmental and planning services sector. She is a qualified ecologist with responsibility for environmental impact assessment, planning applications (conventional and strategic infrastructure development), Appropriate Assessment, foreshore licensing, and stakeholder engagement for large scale plans and projects in Ireland, including for wind energy developments. Rita has undertaken and managed a wide range of ecological field assessments including mammal, herpetofauna, bird, fishery, invertebrate and habitat assessments. Rita has held numerous licences under the Wildlife Act and Habitats Directive for disturbance to species which included mitigation (e.g. construction of artificial otter holt, bat exclusion). Rita has provided advice on ecological / environmental design to various private and public sector clients. Rita is an experienced Project Manager and Senior Associate Director at FT. With 22 years' experience specialising in statutory consent and environmental assessment for large scale public infrastructure projects in the energy, water (including flood relief schemes) and transport sectors. Rita provides technical advisory services through all stages of project delivery from feasibility assessment, impact assessment, CPO, design, contract administration and construction.
Orla Commins	Report Author Static detector surveys 2025 Static detector analysis	Orla Commins is a Graduate Ecologist with Fehily Timoney and Company. She holds a first-class BSc in Ecology and Environmental Biology from University College Cork. Since joining Fehily Timoney, she has prepared comprehensive Appropriate Assessments, Ecological Impact Assessments and has completed ornithological reports, bat reports, a wide range of field work, mapping and data management.
Ben O'Dwyer	Report Author	Ben is a Senior Project Ecologist with Fehily Timoney with over 9 years' experience in ecological assessment and holds a BSc (Hons) in Wildlife Biology from Institute of Technology Tralee (now MTU). He has prepared EcIAs, EIAR Biodiversity chapters, AA Screening reports and Natura Impact Statements for numerous large scale infrastructure projects in the renewable energy, commercial, waste management and transport sectors. He is an experienced and versatile field surveyor and his experience across a broad range of habitats and projects in Ireland has given him an extensive knowledge of protected sites and species across the country.

Contributor	Role	Biography
Kate O'Regan	Bat activity survey 2023	Kate O'Regan is a Project Ecologist with Fehily Timoney and Company. She holds a first-class BSc. in Zoology and first-class MSc in Marine Biology from University College Cork. She has completed numerous bat surveys for proposed wind farm developments and has prepared reports and desktop studies for a number of renewable energy projects since joining Fehily Timoney. She has previous experience in data management, statistical analysis, mapping and technical report writing. Kate has also completed a wide range of surveys including bird, intertidal, subtidal, insect and mammal surveys.
Chandra Walter	Bat activity survey 2023 Static detector surveys 2023	Chandra Walter is a Project Ecologist with Fehily Timoney. Chandra holds a BSc in Ecology from University College Cork and an MSc in Organic Horticulture from University College Cork. (Both First Class Honours). Her degrees focused on nature conservation and included a wide variety of surveying skills, including habitat surveys, bird surveys and insect surveys, research skills and report writing. She has completed numerous bat surveys for proposed wind farm developments and also completed reporting and assessment for a diverse range of projects.

1.2 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:

- Vespertilionidae, which contains eight Irish species (Daubenton's bat, Natterer's bat , whiskered bat, Leisler's bat, brown long-eared bat, soprano pipistrelle, common pipistrelle and Nathusius' pipistrelle; and
- Rhinolophidae, which contain one Irish species, the lesser horseshoe bat.

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). Therefore, these bat species mentioned above are therefore excluded from further assessment, and this report will focus on the eight bat species that occur within the distribution range of the proposed development.

Nathusius' Pipistrelle while present on site, its most regularly recorded population occurs in Northern Ireland, where the species is encountered more frequently. Records from the remainder of the country are comparatively infrequent and typically relate to passage individuals or small numbers of foraging bats. Therefore, while the species may be present within the wider region, it is generally considered to occur in low numbers outside its main concentration in Northern Ireland.

1.3 Legislation

1.3.1 Protected Status of bats in Ireland

In the Republic of Ireland, under Annex IV of the EU Habitats Directive (92/43/EEC) and Schedule 5 of the Wildlife Acts 1976 as amended, all bats and their roosts are protected by law. It is an offence to deliberately disturb, injure or kill a bat, or disturb its roost without the appropriate licence.

1.3.2 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 (SAC) specifically for their protection however, there are no SACs designated for lesser horseshoe within the county or within 10km of the proposed development.

All species of bat in Ireland are strictly protected under the Habitats Directive to include deliberate disturbance of these species as well as deterioration or destruction of breeding or resting places.

1.3.3 International Legislation

Ireland has ratified two international wildlife laws which include for the protection of bats:

- 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.
- 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.

1.4 Site Location

The Wind Farm Site is located within the jurisdiction of Tipperary County Council. The majority of settlements closest to the site are situated to the west of the site. Ballinunty is the nearest, c.2 km southeast of the proposed turbine array. The village of Gortnahoe lies c. 2.5 km northeast of the site at its closest point, while New Birmingham is situated c. 2 km to the east. The small centre of population of Ballysloe is also located to the east, at just over 3 km from the nearest turbine. Littleton and Twomileborris are the only settlements within the central study area situated to the west of the site, located c. 2.6 km and c. 2 km from the proposed turbine array, respectively. The village of Killenaule lies c. 4 km southeast of the site and Horse and Jockey is c. 4.7 km to the west.

Urlingford is located c. 6.8 km north of the site and Johnstown c. 10.5 km to the north

The most notable settlements within the area are Thurles and Cashel. Thurles is located c. 9 km west of the site, while Cashel is c. 17 km to the southwest.

The Wind Farm Site is located within a bog group and includes lands in the townlands of Longfordpass North Longfordpass South, Leigh, Bawnreagh, Clonoura, Noard, Derryhogan, Derryvella, Ballybeg, Lanespark, Newhill and Killeen, County Tipperary. Refer to Figure 4.1, contained within Volume 4 of the EIAR, for the location of the Proposed Development.

The BEMP Lands are contained within the Wind Farm Site.

The TDR travels from the port of entry of Foynes to Junction 4 of the M8 Motorway to the Proposed Wind Farm Site entrance on the R639 at Longford Pass. The TDR passes through the townlands of Islands, Mountfinn, Urlingford, Fennor, Graiguepadeen, and Longford Pass North and Longford Pass East.

The proposed GC route will exit north of the Proposed Wind Farm Site along the Local Road L4114 and traverse the following townlands within County Tipperary: Longfordpass East, Graiguepadeen, Longfordpass North, Fennor and Longfordpass South. The cable then enters County Kilkenny, and traverses the following townland within the public road, terminating at the Ballyragget 110kV Substation: Freshford Lots, Borrisnoe, Killawardy, Clomantagh Upper, Acragar, Moneenaun, Urlingford, Kilrush, Glenreagh, Kilduff, Borrisnafarney, Barnane, Sweethill, Ridge, Balief Lower, Bohernarude, Kilmacuddy, Killoskehan, Cloncannon, Grange, Moatpark, Barna, Ballybeg, Parksgrove, Baunaniska, Ballyconra, Stook, Graigueswood, Clone, Borrisbeg, Borrismore, Gortagarry, Clomantagh (Mt. Garret), Mountfinn, Barnagrotty, Balief Upper, Clomantagh Lower, Tobernapeastia, Darbyshill, Monabrika, Aghnameadle and Blakefield.

The habitats at the application site were the subject of a detailed survey and assessment by Fehily Timoney and Company ecologists between July and October 2025. A habitat map of the Proposed Development lands is provided in Figure 6-7, Volume IV. All habitats described below have been classified in accordance with Fossitt (2000).

The Proposed Development is predominantly located within cutover bog (PB4) which often occurs in mosaics with areas of scrub (WS1) of grey willow/downy birch or gorse, immature woodland (WS2) and wet grassland (GS4). Raised bog (PB1) occurs around the edges of the Site. Calcareous and neutral grassland (GS1) occurs along the existing bog railway along the northern site access route and also in the southern part of Lanespark Bog, establishing respectively on imported material associated with the bog railway and on dry cutover bog. Various woodland types occur in small areas, such as (mixed) broadleaved woodland (WD1), (mixed) conifer woodland (WD3), oak-birch-holly woodland (WN1) and bog woodland (WN7).

Waterbodies within the Site include a network of drainage ditches (FW4), dystrophic lakes (FL1) and acid oligotrophic lakes (FL2), which has been established by flooding of drainage ditches and cutover bog. Reed and large sedge swamps (FS1) occurs, vegetating some ditches and surrounding some lakes. The hedgerows and treelines within the Site are associated with the agricultural lands in the proposed borrow pit footprint; a linear Scrub (WS1) formation also occurs in association with dystrophic lakes (FL1).

Artificial habitats within the Site include earth banks (BL2), buildings and artificial surfaces (BL3), spoil and bare ground (ED2) and recolonising bare ground (ED3).

The habitats along the proposed grid connection are dominated by linear wooded habitats including hedgerows and treelines, grassy verges and surrounding agricultural habitats dominated by improved agricultural grassland (GA1). The presence of a turlough (FL6) at the Loughans adjacent to the GC is noted. Habitat types at each turbine location and associated hardstanding are presented in Table 6-7 of the Biodiversity Chapter 6 of the EIAR.

1.5 Bat Survey Aims

This bat survey report aims to provide the following information on bat activity in 2023 & 2025 within the survey area:

- Bat species list for the development & surrounding area;
- Location of bat presence within the development;
- Bat activity levels within the development;
- Location of roosts and swarming sites in the surrounding area if present.

2. METHODOLOGY

Bat surveys were conducted by Fehily Timoney and Company at the site over the 2023 and 2025 bat activity seasons to ensure compliance with the most recently published guidelines pertaining to surveying, impact assessment, and mitigation for bats at onshore wind turbines NatureScot (2021).

2.1 Zone of Influence (ZoI)

In accordance with NatureScot (2021) a collation of relevant bat information within 10km of the proposed wind energy site was gathered. The data search should be related to the scheme's ZoI[1] and consider the core sustenance zone (CSZs) (based on Bat Conservation Trust) of species likely to be present none of which have a CSV larger than 10km.

2.2 Desktop Study

A desktop data search was conducted in January 2026 to collate existing information 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 10km radius[2] of the development site from the National Bat Database held by the National Biodiversity Data Centre (www.biodiversityireland.ie)[3];
- Review of Ordnance Survey mapping and aerial photography of the development site boundaries and their environs (i.e. 200 m plus rotor radius of the boundary of each turbine location[4]) and of the other infrastructure areas within the site, Grid Connection Route and Turbine Delivery Route;
- Review of the National Monuments Service (NMS), and National Inventory of Architectural Heritage (NIAH) buildings within the development site boundaries, Grid Connection Route and Turbine Delivery Route;
- Review of the NIEA, Natural Environment Division - guidance on Bat Surveys, Assessment and Mitigation for Onshore Wind Turbine Developments in Northern Ireland.
- Records available on the NPWS and the National Biodiversity Data Centre (NBDC) websites were requested & reviewed, in addition to records of rare/sensitive species within the hectads (10km grid squares) overlapping the Site obtained by request from NPWS (received 12th November 2025). NBDC data for the 1 km grid squares overlapping the GCR and TDR provided desktop information for these locations.
- Records of designated sites within a 10km radius of the development where bats form part or all of the reason for designation (https://www.npws.ie/protected-sites);

[1] ZoI is defined by CIEEM (2018) as 'the areas/resources that may be affected by the biophysical changes caused by activities associated with a project'.
[2] A 10km 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, 2023).
[3] A specific data request was not made to Bat Conservation Ireland because they regularly update NBDC with their records and it is only judged to provide an additional useful source of data if a location is deigned of high potential for bat roosts.
[4] As per NatureScot (2021) guidance.

- Collation of data on known underground sites within a 10km radius of the development from the Cave Database for the Republic of Ireland, compiled by Trinity College (http://www.ubss.org.uk/search_irishcaves.php)

2.2.1 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 on NBDC website. 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.

2.2.2 Bat Conservation Ireland Data Request

Data on the occurrence of bat species and roosts within 30 km of the site was obtained from Bat Conservation Ireland on 27 November 2023. This dataset was interrogated to assess whether any known bat roosts occur within the potential Zone of Influence (ZoI) of the proposed wind farm, grid connection and turbine delivery route.

2.2.3 Review of Ordnance Survey mapping, Aerial photography & Historical Sites

The desktop study included a review of Ordnance Survey mapping and aerial photography for the development site and its environs (i.e. 200 m plus rotor radius from the boundary of each turbine location), in addition to the Grid Connection Route and Turbine Delivery Route. The imagery was examined to identify habitats with potential suitability for bat foraging and commuting, including woodland and commercial forestry, hedgerows, treelines, scrub, riparian corridors and watercourses. The review also considered landscape connectivity and the presence of linear features which may function as commuting corridors. Furthermore, aerial imagery was assessed to identify structures with potential to support roosting bats, such as buildings, bridges and other built features, which were flagged for verification during field surveys.

A review of records from the National Monuments Service (NMS) and the National Inventory of Architectural Heritage (NIAH) was undertaken to identify buildings and structures within the development site boundaries, Grid Connection Route and Turbine Delivery Route that may offer potential roosting opportunities for bats. This informed the scope and focus of subsequent field assessments.

Walkover surveys were subsequently carried out to ground-truth the findings of the desk-based review. These surveys verified the presence, extent and condition of habitats identified through mapping and aerial imagery and enabled detailed mapping of habitats suitable for bat roosting, foraging and commuting. Field surveys also included inspection of identified structures and trees for potential roosting features, confirming their suitability or otherwise for bats.

2.3 Survey Methodology

All surveys adhered to NatureScot (2021) guidelines at the time of survey. The following is a brief description of main types of surveys completed in 2023 and 2025.

- Static surveys: placement of automated recording devices within the survey area. The units are set up during the daylight hours, commence recording 30 minutes before sunset and stop recording 30 minutes after sunrise.
- Walking transect: bat surveys completed on-foot where the surveyor(s) walk the survey site from sunset to at least 120 minutes after sunset. Spot counts can also be conducted along transect surveys.
- Roost surveys: The methods used in the bat roost survey include desktop searches, visual searches at potential roost structures, passive bat detector monitoring, and a search for Potential Roost Features (PRFs) in trees.
- Emergence surveys: bat surveys completed at dusk where the surveyors stood upstream and downstream of various bridges for 120 minutes after sunset. Methods include visual observations, handheld bat detectors and infrared scope.

2.3.1 Habitat Suitability Assessment

Habitat suitability assessments were undertaken in accordance with Bat Conservation Trust (2020) Core Sustenance Zones (CSZ), Collins (2023) and NatureScot (2021) guidance, including specific habitat requirements for bat species on site with specific walkovers targeting 200m + rotor (81m) of each turbine. An initial desktop survey was completed to identify habitats within and adjacent to the site with potential to support roosting, foraging and commuting bats. This was followed by site walkover surveys to ground-truth the desk study findings and verify habitat suitability and the presence of any potential bat roosting features (PBRFs) or areas of high value habitat.

Where suitable habitat was identified, these areas were considered within the design process and avoided where possible. These habitats can be seen in Figure 6-7 of the Biodiversity Chapter 6 of the EIAR.

The potential of these habitats for bat fauna is considered in this framework also.

- Bats may use trees with heavy ivy growth as occasional roosts. Bats may use mature trees with tree holes etc., as roosting sites all year around. However, in general, there is a paucity of these two types of mature trees within the survey area. They are present in the adjacent landscape or within the blocks of agricultural land enclosed by the survey area.
- Foraging and commuting areas are available to bats adjacent to and within the development areas along scrub habitats, treeline tracks and riparian linear features. There is less foraging and commuting capacity over bare peat and similar low height vegetation habitats. The exception to this is Leisler's bats and Nathusius's pipistrelles, which are bat species that fly high over the landscape. They are not as reliant on linear habitats to traverse through the landscape.

Along the grid route all bridges at river crossing points were inspected for the presence of potential roosting features (PRFs) and signs of occupancy by bats such as staining, droppings and feeding remains. Two of the bridges which were inspected required further surveying and emergence surveys were undertaken. The TDR was also assessed for suitable habitat and presence of potential bat roosting features.

2.3.2

2.3.2 Bat Activity/ Transect Surveys

Under the NatureScot (2021) guidance, the use of transect surveys is discretionary, with survey requirements designed on a site-by-site basis. Transect surveys were undertaken on this proposed wind farm to support the findings of desktop and static deployment data to strengthen the evidence base underpinning the overall assessment. Transects are complementary to data collected from static bat detectors and can aid in identifying commuting and foraging corridors and to help gain understanding of bat abundance within the survey area. Point counts (of a fixed duration) can be incorporated into transects to survey specific features to provide information on comparative density of use.

Transects were completed in each of the three rounds in 2023 with the use of Batlogger M2 bat detector. Survey dates and routes are illustrated in Figure 6-5. Temperature and wind were measured for each transect survey. Batlogger M2 detectors recorded temperature for each transect and weather conditions can be seen below in Table 2-1. Additional walked transects were not undertaken in 2025 due to health and safety constraints arising from the presence of wild horses onsite.

The static detector data collected is considered sufficient to accurately characterise bat activity across the site and as such, transect surveys represent additional survey effort in excess of requirements, providing supplementary information on bat activity. The 2023 transect surveys confirmed the main flightlines and patterns of bat usage within the survey area, which remained consistent with the findings from subsequent static monitoring.

Table 2-1: Summary of transect survey dates, timing & weather conditions for 2023

Date	Start Time	End Time	Survey type	Weather Conditions
25/05/23 (Round 1)	21:29	00:08	Transect survey: Walked transect covering the southern section of the main bog along existing track for 9.7km lasting 2.6h.	Sunset: 21:25 Precipitation: Dry Wind: 16km/h Temperature: 15°C
27/07/23 (Round 2)	21:24	23:20	Transect survey: Walked transect covering the southern section of the main bog along existing track for 7.5km lasting 1.9h.	Sunset: 21:36 Precipitation: Dry Wind: 16km/h Temperature: 15°C
20/09/23 (Round 3)	19:34	21:34	Transect survey: Walked transect covering the southern section of the main bog along existing track for 7.5km lasting 2h.	Sunset: 19:42 Precipitation: Dry Wind: 14km/h Temperature: 14°C

2.3.3 Roost Assessment Surveys

NatureScot (2021) recommends that "features that could support maternity roosts and significant hibernation and/or swarming sites (both of which may attract bats from numerous colonies from a large catchment) within 200m plus rotor radius of the boundary of the proposed development should be subject to further investigation" (300m radius of proposed turbine locations was surveyed, adhering to NatureScot 2021 guidance).

Surveyors utilised the assessment criteria described in Collins (2023) – Page 35, Table 4.1, which provides guidelines for assessing potential suitability of habitat features as bat roosts and for foraging bats. This allows surveyors to assign features a score of 'negligible', 'low', 'moderate' or 'high' status in terms of the presence of Potential Roost Features (PRFs) or quality of habitat for commuting and/or foraging. Where a potential roost feature was determined to have greater than negligible suitability, the PRF was subjected to further assessment. Based on the features present and the location of trees and/or other structures, the potential use of the feature can also be considered, and classified (as in Hundt, 2012 and BTHK, 2023).

Surveyors employed non-invasive assessments of trees from ground level (ground level tree assessment/GLTA). All trees to be felled as part of the development were assessed. Additionally, in accordance with (UK Bat Mitigation Guidelines 2025) we adopted a 200m potential zone of influence from construction activities and assessed all trees and structures for roosting suitability within this zone.

A roost survey encompassing assessment of structures and GLTA surveys was also undertaken along the proposed grid connection. Two bridges at river crossing points along the proposed grid connection route were inspected for the presence of potential roosting features (PRFs) and signs of occupancy by bats such as staining, droppings and feeding remains. These locations can be seen in Figure 6-6 of the Biodiversity Chapter 6 of the EIAR.

The TDR was also assessed for the presence of potential bat roosting features. The turbine delivery route will affect immature trees at one location: Node 3 (removal of trees). The affected trees are immature specimens originating from roadside landscaping with no potential bat roosting features. Detailed description of the habitats along the Turbine Delivery Route can be found in the Biodiversity Chapter 6 of the EIAR.

2.3.4 Roost Emergence

Within the study area of the wind farm grid connection route and turbine delivery route, walkover surveys were undertaken to identify potential bat roost features. No potential roost features were observed during these surveys for the wind farm and turbine delivery route.

Based on assessment of bridges along the grid connection route for bat roosting potential, two bridges were identified as requiring emergence surveys (assessed as having low suitability, refer to Table 3-3 for further details). Dusk bat emergence surveys at these locations commenced 15 minutes prior to sunset and concluded 1.5 hours after sunset. Trained observers conducted watches to search for the occurrence of dusk emergences at these potential roosting sites). Surveyors took written notes and used hand-held Batlogger M2 bat detectors, which enabled the collection of geo-referenced records of bat activity. Subsequently, the captured acoustic recordings were subjected to analysis using the BatExplorer software. A summary of the times, weather conditions, and locations for the surveys conducted is provided in Table 2-2 with results from the surveys seen in Section 3.5 below.

Table 2-2: Summary of emergence survey dates, timing & weather conditions for 2025

Location	Date	Start Time	End Time	Survey type	Weather Conditions
Gorteenahilla Stream Bridge ITM 640307, 664969	13/10/25	18:25	20:10	Dusk emergence survey	Sunset: 18:41 Precipitation: Fine light mist Temperature: 13°C Visibility: Very good Wind speed: F2-3
Borrisbeg Stream Bridge (2) ITM 631586, 663278	14/10/25	18:20	20:05	Dusk emergence survey	Sunset: 18:39 Precipitation: Dry Temperature: 12°C Visibility: Excellent Wind speed: F2

2.3.5 Winter Roost Inspections

NatureScot (2021) recommends that winter roost surveys should also be carried out for any potential hibernation roost within 200m plus rotor radius (81m). No potential hibernation roosts were identified within the study area during surveys.

2.3.6 Static Bat Detector Surveys

NatureScot (2021) guidelines require as a minimum three deployments of static detectors aimed at covering spring (April to May), summer (June to mid-August) and autumn (mid-August to October), each with a minimum deployment period of 10 nights (within compliant weather parameters). Compliant weather conditions are defined as: temperatures at ≥ 8°C at dusk, maximum ground-level wind speed of 5 m/s, and no, or only very light, periodic rainfall. For the purposes of this report, Spring is designated as Round 1, Summer as Round 2 and Autumn as Round 3.

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 round 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). Statics were placed about 2m above ground to align with the NIEA (2024) guidelines. This results in a far greater sampling effort over a shorter round of time than can be achieved through manual survey.

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 the static surveys as recommended in the revised (NatureScot, 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 NatureScot (2021), 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 rounds: Round 1 spring (April-May), Round 2 summer (June-mid-August) and Round 3 autumn (mid-August-October) during 2023 & 2025. To account for nights with unsuitable weather conditions, detectors were deployed longer than the minimum required 10 consecutive nights (NatureScot, 2021) to ensure that enough data could be gathered during suitable weather conditions. Table 2-3 and Table 2-4 below highlight deployment dates for 2023 and 2025 static detectors respectively highlighting the number of consecutive nights across the three survey rounds of each year.

NatureScot (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".

A total of 11 detectors were deployed to cover all 11 potential turbine locations for all survey rounds in 2023 and 2025. The detectors were placed at or close to proposed turbine locations in analogous habitats (see Figure 6-3 & 6-4 and Table 2-3 & Table 2-4 for distances to turbine locations).

Table 2-3: Static Detector Locations 2023 in Relation to Final Turbine Layout and Rotor Sweep Area

Detector Location	Distance to Turbine (m)	Fossit habitats at deployment locations	Fossit habitats at 2023 turbine location	Dates Deployed
L1	54m	WS1 - Scrub	WS1 - Scrub	Round 1: 17/05/23 - 13/06/23 Round 2: 27/07/23 - 24/08/23 Round 3: 20/09/23 - 11/10/23
L2	123m	PB4 - Cutover bog	PB4 - Cutover bog	Round 1: 17/05/23 - 13/06/23 Round 2: 27/07/23 - 24/08/23 Round 3: 20/09/23 - 11/10/23
L3	339m	PB4 - Cutover bog	PB4 - Cutover bog	Round 1: 17/05/23 - 13/06/23 Round 2: 27/07/23 - 24/08/23 Round 3: 20/09/23 - 11/10/23
L4	68m	WS1 - Scrub (edge)	WS1 - Scrub	Round 1: 17/05/23 - 13/06/23 Round 2: 27/07/23 - 24/08/23 Round 3: 20/09/23 - 11/10/23
L5	358m	PB4 - Cutover bog	PB4 - Cutover bog	Round 1: 17/05/23 - 13/06/23 Round 2: 27/07/23 - 24/08/23 Round 3: 20/09/23 - 11/10/23
L6	150m	PB4 - Cutover Bog/ WS2 - Immature woodland (edge)	WS1 - Scrub	Round 1: 17/05/23 - 13/06/23 Round 2: 27/07/23 - 24/08/23 Round 3: 20/09/23 - 11/10/23
L7	46m	PB4 - Cutover Bog/ WS2 - Immature woodland (edge)	PB4 - Cutover bog	Round 1: 17/05/23 - 13/06/23 Round 2: 27/07/23 - 24/08/23 Round 3: 20/09/23 - 11/10/23

Detector Location	Distance to Turbine (m)	Fossit habitats at deployment locations	Fossit habitats at 2023 turbine location	Dates Deployed
L8	266m	PB4 - Cutover bog	WS2 - Immature woodland	Round 1: 17/05/23 - 13/06/23 Round 2: 27/07/23 - 24/08/23 Round 3: 20/09/23 - 11/10/23
L9	0m	PB4 - Cutover bog WS1 - Edge of Scrub	WS1 - Scrub	Round 1: 17/05/23 - 13/06/23 Round 2: 27/07/23 - 24/08/23 Round 3: 20/09/23 - 11/10/23
L10	0m	PB4 - Cutover bog	PB4 - Cutover bog	Round 1: 17/05/23 - 13/06/23 Round 2: 27/07/23 - 24/08/23 Round 3: 20/09/23 - 11/10/23
L11	71m	PB4 - Cutover Bog/ WS2 - Immature woodland (edge)	WS2 - Immature woodland	Round 1: 17/05/23 - 13/06/23 Round 2: 27/07/23 - 24/08/23 Round 3: 20/09/23 - 11/10/23

Table 2-4: Static Detector Locations 2025 in Relation to Final Turbine Layout and Rotor Sweep Area

Detector Location	Distance to Turbine (m)	Fossit habitats at deployment location(s)	Fossit habitats at 2025 turbine location	Dates Deployed
LT1	0m	WS1 - Scrub	WS1 - Scrub	Round 1: 20/05/25 - 05/06/25 Round 2: 30/07/25 - 25/08/25 Round 3: 25/08/25 - 18/09/25
LT2	0m	PB4 - Cutover bog/ WS1 - Scrub (edge)	PB4 - Cutover bog/ WS1 - Scrub (edge)	Round 1: 20/05/25 - 05/06/25 Round 2: 30/07/25 - 25/08/25 Round 3: 25/08/25 - 18/09/25
LT3	0m	PB4 - Cutover Bog/ WS2 - Immature woodland (edge)	WS2 - Immature Woodland	Round 1: 19/05/25 - 05/06/25 Round 2: 30/07/25 - 25/08/25 Round 3: 25/08/25 - 18/09/25
LT4	0m	WS2 - Immature woodland (edge)	WS2 - Immature Woodland	Round 1: 19/05/25 - 05/06/25 Round 2: 24/07/25 - 21/08/25 Round 3: 21/08/25 - 17/09/25
LT5	0m	PB4 - Cutover Bog/ WS2 - Immature woodland (edge)	PB4 - Cutover Bog/ WS2 - Immature woodland (edge)	Round 1: 19/05/25 - 05/06/25 Round 2: 24/07/25 - 21/08/25 Round 3: 21/08/25 - 17/09/25
LT6	0m	PB4 - Cutover Bog	PB4 - Cutover Bog	Round 1: 19/05/25 - 05/06/25 Round 2: 24/07/25 - 21/08/25 Round 3: 21/08/25 - 17/09/25
LT7	0m	PB4 - Cutover Bog/ WS2 - Immature woodland (edge)	PB4 - Cutover Bog/ WS2 - Immature woodland (edge)	Round 1: 19/05/25 - 05/06/25 Round 2: 24/07/25 - 21/08/25 Round 3: 21/08/25 - 17/09/25

Detector Location	Distance to Turbine (m)	Fossit habitats at deployment location(s)	Fossit habitats at 2025 turbine location	Dates Deployed
LT8	146m	PB4 - Cutover bog/ WS1 - Scrub (edge)	WS2 - Immature woodland (edge)	Round 1: 19/05/25 - 05/06/25 Round 2: 24/07/25 - 21/08/25 Round 3: 21/08/25 - 17/09/25
LT9	0m	WS1 - Scrub WS2 - Immature woodland (adjacent)	WS1 - Scrub WS2 - Immature woodland (adjacent)	Round 1: 19/05/25 - 05/06/25 Round 2: 29/07/25 - 25/08/25 Round 3: 25/08/25 - 18/09/25
LT10	0m	PB4 - Cutover bog	PB4 - Cutover bog	Round 1: 19/05/25 - 05/06/25 Round 2: 29/07/25 - 25/08/25 Round 3: 25/08/25 - 18/09/25
LT11	0m	PB4 - Cutover bog	PB4 - Cutover bog	Round 1: 19/05/25 - 05/06/25 Round 2: 29/07/25 - 25/08/25 Round 3: 25/08/25 - 18/09/25

Data Analysis

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).

Data was manually verified in order to provide an additional layer of quality assurance. All files with auto-ID for Nathusius's pippistrelle and brown long eared bat were manually checked, as they are often misidentified by Kaleidoscope Pro (5.3.9) along with all NoID files and a minimum of 10% of each of the other file types.

Bat activity during static detector surveys was measured by the number of bat passes recorded. Bat passes are commonly used as a metric for bat activity and determine species presence (Kerbiriou et al., 2019). For our analysis, a bat pass is defined as the detection of sound calls from a single bat species within a 15 second sound file. If several species are detected within the same sound file, Kaleidoscope auto-id will choose as label the most predominant species present in the sound file, while during manual verification, the rarest species recorded in the checked file was chosen as label.

2.3.7 Habitat Assessments at Turbine Locations (+Rotor)

Habitats within a 281 m radius (200 m plus rotor sweep) of each proposed turbine location were classified using relevés to ensure accurate habitat identification. The majority of turbine locations (T01–T06, T10 and T11) are situated predominantly within cutover bog (PB4), frequently characterised by low Sphagnum cover (LS1/LS2) and typical communities dominated by Eriophorum angustifolium or Calluna vulgaris. Several of these areas also include mosaics with bare peat (BP1/BP2) and, in some instances, occur within scrub (WS1) or immature woodland (WS2) clearings. T02 and T04 comprise mosaic habitats of scrub (WS1) or immature woodland (WS2) interspersed with cutover bog. T07 and T08 are located within immature woodland (WS2), while T09 is situated entirely within scrub (WS1). Overall, the habitat assessment indicates a predominance of modified peatland habitats, with localized areas of scrub and immature woodland across the turbine locations. Table 2-5 below shows the habitat classification with more detail shown in the Biodiversity Chapter 6 of the EIAR.

Table 2-5: Habitat at Each Turbine Location

Relevé	Habitat Type
T01 Turbine Location	Cutover bog (PB4), Low Sphagnum (LS2) *Eriophorum angustifolium* cutover bog type (occurring within open Scrub WS1)
T02 Turbine Location	Mosaic of Scrub (WS1) and Cutover bog (PB4) - Low Sphagnum (LS1) *Calluna vulgaris* cutover bog type
T03 Turbine Location	Cutover bog (PB4), Bare Peat (BP2) *Eriophorum angustifolium* cutover bog type (occurring within immature woodland WS2 clearing)
T04 Turbine Location	Mosaic of Immature Woodland (WS2) and Cutover bog (PB4) (occurring within Immature woodland WS2 clearing)
T05 Turbine Location	Cutover bog (PB4) Low sphagnum (LS2) *Eriophorum angustifolium* cutover bog type
T06 Turbine Location	Cutover bog (PB4), Bare Peat (BP2) *Eriophorum angustifolium*
T07 Turbine Location	Immature woodland (WS2)
T08 Turbine Location	Immature woodland (WS2)
T09 Turbine Location	Scrub (WS1)
T10 Turbine Location	Cutover Bog (PB4), Bare Peat (BP1) *Calluna vulgaris* cutover bog type
T11 Turbine Location	Cutover bog (PB4), Bare Peat (BP2) *Eriophorum angustifolium*–cutover bog type

2.4 Analysis

2.4.1 Ecobat

The nightly number of bat passes recorded per species on the static units were analysed using the website-based tool Ecobat (http://www.ecobat.org.uk/) which is designed and managed by the University of Exeter, and is hosted by the Mammal Society UK.

"Acoustic surveys using bat detectors are widely used to determine species' presence and to quantify the activity of foraging bats as they are cost-effective, can be automated to run for long time periods, and are non-intrusive. Activity levels are dependent on a number of factors including seasonality, weather conditions and location, with the type of bat detector used during the survey also affecting detection rates.

Using bat passes to assess the relative importance of a site for policymakers therefore requires practitioners to account for how these multiple factors may have influenced the number of bat passes recorded at a site. Although professional opinion is valuable, it can often be based on intuition, is context dependent and can vary considerably between practitioners (Hulme, 2014).

It is therefore likely that an assessment of the ecological value of a site (and the impacts of any proposed action) will vary between practitioners based upon their own level of experience and knowledge of the region and/or species.

Ecobat compares surveys submitted by the user with a national reference dataset and objectively quantifies bat activity levels. It offers a web-based interface for depositing data rapidly and securely, automatically generating a numerical indicator of the relative importance of a night's worth of activity, by contrasting with a comparable reference range. The output can be used by ecologists to accurately quantify what bat activity means for use during ecological impact assessments.

Ecobat uses percentiles to provide a numerical representation of activity levels relative to the surrounding landscape for each night of surveying. Percentiles can then be assigned to activity categories (low, moderate, high) to provide a quantifiable measure of bat activity. Percentiles provide a numerical indicator of the relative importance of a nights' worth of bat activity by comparing it with a national database. For example, activity data in the 80th percentile would indicate that the recorded data were in the top 20% of activity for the reference range". (Ecobat, 2020).

The Ecobat analysis was undertaken for each survey period separately. The reference range datasets were stratified to include:

- Only national-level records.
- Records using any make of bat detector.

Categorisation of activity level is based on the following table from NatureScot (2021):

Table 2-6: Percentile Score and Categorised Level of Bat Activity

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

2.4.2 Site Risk Assessment & Impact Assessment

According to NatureScot (2021) wind farms can affect bats in the following ways:

1. Collision mortality, barotrauma 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).

According to the NatureScot (2021) 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, it is recommended to consider the relevant factors in the assessment process:

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

Using the NatureScot (2021) guidelines outlined in Table 3-16, a site risk assessment for the individual turbines in relation to each bat species recorded was completed.

2.5 Calibration and testing of recording equipment

Calibration and testing of recording equipment was carried out in accordance with NatureScot (2021). Checks are logged in excel, providing an audit trail to ensure that all data can be relied upon and form a robust and defendable data set. Unique numbering of static detectors, SD cards and microphones allows for reverse checking, if any issues arise, e.g. following a microphone failure. Checks undertaken include pre-deployment device setting and battery checks, and pre-deployment microphone sensitivity checks

2.6 Limitations

Static detector 8 (L8, LT8) was located 232m from Turbine 8 (T8). While the detector was not positioned immediately adjacent to the turbine location, the surrounding habitat within this distance is comparable to that at the turbine comprising similar scrub and woodland features. As such, the detector location is considered representative of bat activity within the wider area of T8 and does not limit the interpretation of bat use of the local habitat.

Static detector 11 (LT11) did not record data for Round 1 in 2025. However, due to the total number of detectors exceeding minimum requirements (detectors at ten turbine locations plus one third of additional turbine locations for projects with over ten turbines), this does not represent a significant limitation.

Static detector 3 (L3) was not deployed for Round 3 in 2023 due to targeted vandalism of detectors in Rounds 1 and 2 in that year. However, as above, due to the total number of detectors exceeding minimum requirements, this does not represent a significant limitation.

Activity transect surveys were not undertaken in 2025, due to the presence of wild horses onsite restricting nighttime access for health and safety reasons. Considering that transect surveys are discretionary under NatureScot (2021) guidance, and that three rounds of activity surveys providing complementary information in exceedance of requirements were undertaken in 2023, this does not represent a significant limitation.

It is not considered that any of these survey specific constraints represent a significant limitation or data gap to adequately assessing the impacts of the Proposed Development on bat species within and surrounding the site.

3. RESULTS

This section provides the detailed results for bat surveys conducted during the 2023 and 2025 survey periods, as well as habitat assessment surveys conducted in summer 2023 & 2025. Habitat surveys undertaken in 2023 informed the constraints study and assisted in identifying appropriate turbine locations, ensuring that areas of higher quality or sensitive habitat were avoided in the final layout.

3.1 Desktop Survey

There are five 10 km grid squares overlapped by the proposed development (including grid connection and TDR): S25, S26, S36, S46 and S47. The proposed wind farm is mainly encompassed in 10 km grid square S25 and a smaller area of S26 encompasses the northern section of the site. These 10 km grid squares held previous bat records as detailed in Table 3-1 below (NBDC maps, most recent data search 25/11/2025). The data requested from NPWS did not contain any bat species in the requested grid squares.

Records in the NBDC maps reflect survey effort or data input, and do not automatically reflect bat presence in a given area (an area without records may not have been previously surveys or data may not have been publicly shared).

Table 3-1: Bat records in 10km Grid squares S25, S26, S36, S46 and S47

Species	S25	S26	S36	S46	S47
Brown long-eared bat (*Plecotus auritus*)	1	0	2	4	1
Common Pipistrelle (*Pipistrellus pipistrellus*)	320	7	125	3	8
Nathusius's Pipistrelle *(Pipistrellus nathusii)*	1	0	0	0	0
Soprano Pipistrelle (*Pipistrellus pygmaeus*)	77	4	18	5	8
Pipistrellus pipistrellus sensu lato	54	1	23	0	1
Daubenton's bat (*Myotis daubentonii*)	1	2	0	230	110
Leisler's bat (*Nyctalus leisleri*)	37	7	18	3	7
Natterer's bat *(Myotis nattereri)*	0	0	1	2	1

It is noted that the high numbers of desktop records for Daubenton's bat in S46 and S47 are associated with the River Nore.

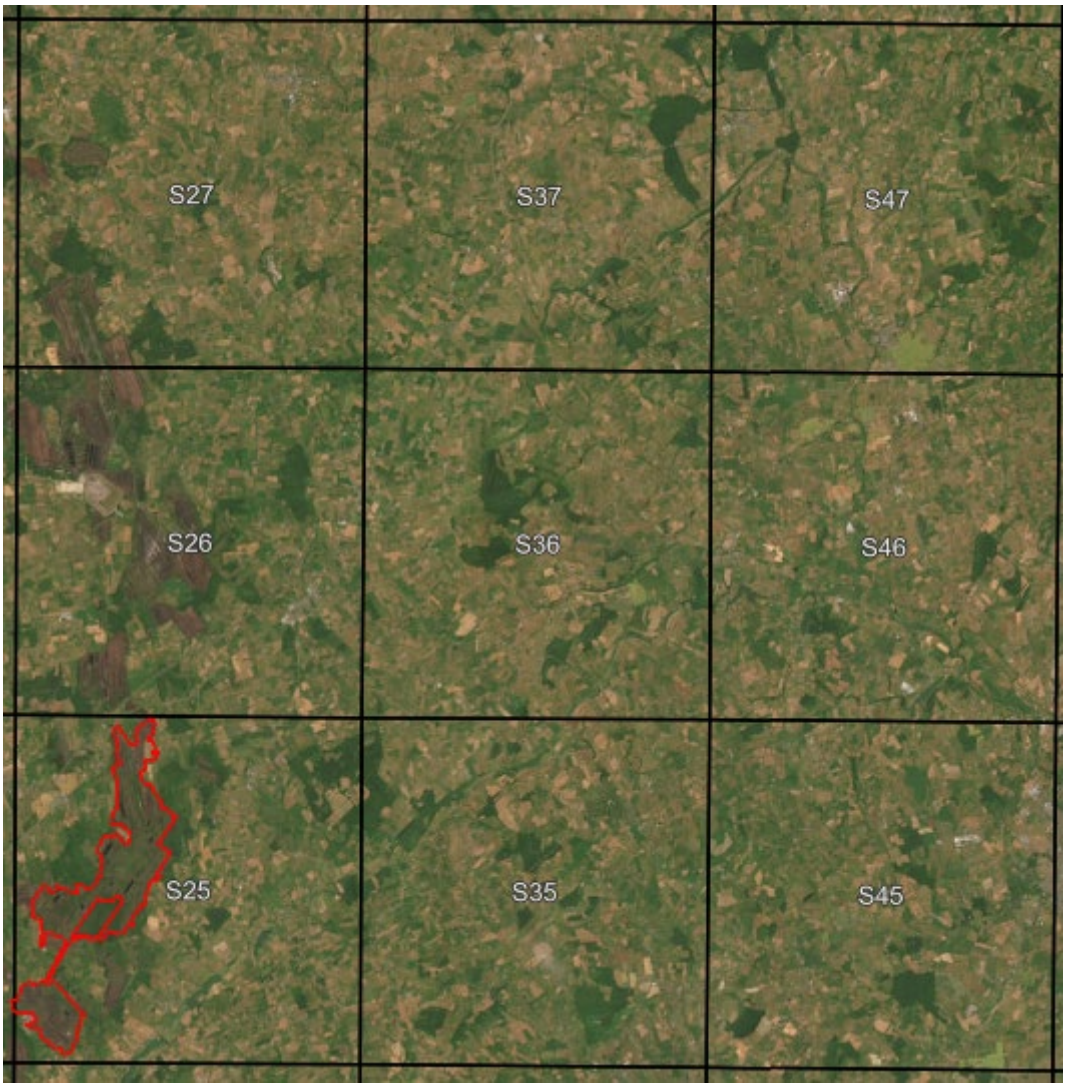


Figure 3-1: Grid squares S25, S26, S36, S46 and S47 overlapping the proposed development (including grid connection and turbine delivery route)

3.1.1 Bat Landscapes

Bat landscapes are plotted in 5 km grid squares, of which five overlap the proposed wind farm and can be seen below in Figure 3-2.

For the southern turbines (T9-T11), the bat landscape association model (Lundy et al., 2011) suggests that the development is part of a landscape that is of moderate suitability for all bats. These southern turbines and their environs are of low suitability for Nathusius's Pipistrelle and Lesser horseshoe bat, of low - moderate suitability for Leisler's bat, Natterer's bat and Whiskered bat, of moderate suitability for Brown long-eared bat, Soprano Pipistrelle and Daubenton's bat, while common pipistrelle has the highest suitability of moderate - high suitability.

The grid square encompassing turbines 1-6 and has an overall moderate suitability for all bats. These turbines and their environs are of low suitability for Nathusius's Pipistrelle and Lesser horseshoe bat, of moderate suitability for Brown long-eared bat, Soprano pipistrelle, Leisler's bat, Daubentons bat, Whiskered bat and Natterer's bat, while common pipistrelle has the highest suitability of moderate - high suitability.

For turbines 7 and 8 the grid square associated with the landscape has an overall moderate suitability for all bats. These turbines and their environs are of low suitability for Nathusius's Pipistrelle and Lesser horseshoe bat, of low-moderate suitability for Daubenton's bat, Whiskered bat and Natterer's bat, of moderate suitability for Brown long-eared bat, Soprano pipistrelle and Leisler's bat and of moderate-high suitability for Common pipistrelle.



Figure 3-2: NBDC Bat Landscape Map of Proposed Wind Farm

3.1.2 Bat Conservation Ireland Data

Examination of BCI data on bat roosts confirmed there are no known roosts present in this dataset in the 1 km grid squares within 300 m of the proposed wind farm and grid connection.

The dataset includes one record of a common pipistrelle roost located in a 1 km grid square c. 120m from the R693/R639 Roundabout TDR node. There are no buildings or potential roosting features at this TDR node which could potentially host bats. The closest building within the relevant 1 km grid square is located 600m away from this TDR node, and proposed works at the TDR node are unlikely to affect landscape-scale connectivity for bats.

3.1.3 Natura 2000 Sites

The only Natura 2000 sites designated for bats in Ireland are for lesser horseshoe bats. The proposed development is not within the potential ZoI of any sites designated for this species and is located outside their established range.

3.1.4 Ordnance Survey mapping, Aerial photography, Underground & Historical Sites

The desk-based review of Ordnance Survey mapping, aerial photography, and records from the National Monuments Service (NMS) and National Inventory of Architectural Heritage (NIAH) did not identify any underground structures, historic buildings, bridges, or other features within the development site or Turbine Delivery Route that would be considered of notable value for roosting bats. No historical structures with suitability for bat roosting were identified within the study areas. Two bridges mentioned above were observed along the Grid Connection Route as potential roost features both of which underwent an emergence survey discussed below.

Walkover surveys confirmed the findings of the desk study. No underground features or historic structures of relevance to bats were recorded on site or along associated routes. Furthermore, no potential roosting features of significance were identified during field inspections.

3.2 Habitat Suitability Assessment

All habitats within the site were assessed with regard to their suitability for bats. During the design phase, areas identified as having higher suitability were avoided. Consequently, habitats subject to construction impacts are not considered to be of high suitability for bats.

Within the main development site, habitats to be impacted comprise predominantly bare peat, scrub, and immature woodland of generally low structural diversity. These habitats are assessed as being of low suitability for bat species present or likely to be present in the area. No Potential Roosting Features (PRFs) were identified within the site.

Habitat to be removed within the peat deposition area is comprised of immature non-native eucalyptus plantation with limited suitability for bats. Linear habitats proposed for removal are either of low suitability and/or will be reinstated as part of the replanting proposals outlined in the Biodiversity Enhancement Management Plan (BEMP) (Appendix 6.1). In several locations, removal relates to narrow linear strips of habitat, which will not compromise the integrity of edge habitats or overall landscape connectivity. In areas where removal passes through blocks of habitat, the formation of new linear corridors will maintain connectivity and may provide enhanced foraging opportunities.

Habitat removal associated with the substation will involve the loss of an area of bog woodland established on cutaway bog. This habitat is assessed as being of low suitability for roosting bats, and no PRFs were identified within the affected woodland. Extensive areas of similar woodland and scrub habitat are present within the surrounding landscape, providing alternative opportunities for commuting and foraging bats. In addition, proposed replanting at the substation will reinstate linear features and maintain habitat connectivity in the longer term. As such, impacts to bat habitat at the substation are anticipated to be temporary and short term in nature.

Habitats along the grid connection route are dominated by linear wooded features including hedgerows and treelines, grassy verges, and adjacent agricultural land characterised by improved grassland. Overall habitat suitability for bats along this route is considered to be primarily low, although areas of higher quality landscape are present in parts of the wider hinterland surrounding the grid connection, particularly where woodland and higher quality treelines and hedgerows are present in the surrounding landscape.

All bridge crossings over rivers were inspected. No evidence of bat roosts or Potential Roosting Features (PRFs) was identified at all bridges except the Borrisbeg Stream (2) Bridge, where moderate suitability PRFs with no evidence of occupation by bats were observed. Numerous trees were assessed for PRFs; however, these features are considered to be of low suitability due to limited suitability and small size of PRFs and existing disturbance associated with the busy road corridor. Works along the grid connection route will involve limited vegetation trimming, with no substantive removal of low suitability bat habitat.

Habitats along the turbine delivery route comprise dry meadows and grassy verges, scrub, hedgerows, and recolonising bare ground. These habitats are assessed as being of low suitability for bats.

While small sections of hedgerow and scrub will be removed to facilitate turbine delivery, no PRFs were identified and the habitats affected are considered to be of low suitability for roosting, commuting, or foraging bats.

Overall, habitat within the site and associated routes is assessed as being of low suitability for bats. This is primarily due to the dominance of bare peat and low-quality immature woodland and scrub habitats, which provide limited structural diversity and fewer roosting opportunities. In addition, existing disturbance from adjacent road infrastructure along the grid route and turbine delivery route further reduces the likelihood of significant bat activity within affected areas.

3.3 Bat Activity/Transect Surveys

3.3.1 Bat Activity/Transect Surveys 2023

During the 2023 bat activity season, three dusk transect surveys were completed on the dates detailed in Table 3-2. The transect routes and the spatial distribution of recorded bat activity are illustrated in EIAR Appendix VI (Figures 6-10, 6-11 and 6-12). Total bat passes recorded using Batlogger M2 detectors are summarised in Table 3-2.

The results indicate that foraging bat activity was associated with the linear features surveyed in 2023. The transects included the southern entrance track to Littleton Bog and the entrance to Lanespark Bog, extending along access tracks towards the proposed turbine locations. These surveys were undertaken to supplement and validate data obtained from static bat detectors positioned at the turbine locations. The findings support the conclusion that the access tracks are not located within habitats classified as high-quality or high-value for bats.

Table 3-2: Total bat passes per transect survey

	Transect		
Species	**Round 1 - 29/06/23**	**Round 2 - 27/07/23**	**Round 3 - 20/09/2023**
Common pipistrelle	37	37	3
Soprano pipistrelle	20	36	40
Nathusius's pipistrelle	1	0	3
Leisler's bat	13	18	23
Brown Long-eared bat	2	1	8
Daubenton's bat	1	2	0
Whiskered bat	0	0	0
Natterers bat	0	0	0
Total passes	74	94	77

3.4 Roost Survey Results

3.4.1 Proposed Wind Farm

Surveys of the proposed wind farm study area (300m turbine buffer and 200m access track/infrastructure buffer) determined that potential roosting features are absent as no mature trees with PRFs were observed aside from intermittent mature trees of ash covered in ivy outside of the site boundary but within 200m of the borrow pit construction. These trees were assessed and found to have low potential due to heavily managed hedgerows and the trees being intermittent reducing the quality of the commuting corridor.

3.4.2 Grid Connection & TDR

Thew connection route and TDR accommodation works locations were assessed for the presence of buildings, bridges and trees which could potentially offer suitable bat roosting habitat. No derelict buildings with bat roosting potential/potential to be affected by the proposed grid connection ore TDR were identified. No potential tree roost features were identified within the TDR works ZoI. Several bridges and trees occur along the grid connection route which were assessed as set out hereunder.

3.4.2.1 Bridges

The results of bridge assessments/inspections carried out at bridges along the proposed grid connection are detailed below and locations of these bridges can be seen in Figure 6-6 of the Biodiversity Chapter of the EIAR. No reinforcement works are proposed for bridges along the TDR; the proposed grid cable crossing methodology for all bridges is HDD.

Black River (EPA name Drish 16) Bridge

This two-arch concrete bridge did not contain any PRFs. Minor erosion of concrete was noted in some areas but no gaps or cavities providing sufficient shelter for roosting bats are present. As such, this bridge has no roosting potential.



Plate 3-1: Black River Bridge

Goul River Bridge

This double arch bridge has been extended laterally by the addition of two precast pipe culverts on the south-eastern side. The older arches on the north-western side comprise a brick-built arch and an older masonry arch which has been shot-creted and also repaired in some parts with brick. The only cavity recorded was formed between the joint of a cast concrete culvert and brick arch; however, this cavity was extremely wet due to water seepage from above making it unsuitable for bat roosting. As such, this bridge has no roosting potential.



Plate 3-2: Goul River Bridge

Ardreagh Stream Bridge

This stream located within Urlingford Village is crossed by a long culvert where it flows under the main street. The structure is comprised of two low cast concrete arches with no bat roosting potential.



Plate 3-3: Ardreagh Stream Bridge

Borrisbeg Stream Bridge (1)

This crossing structure over this stagnant channel is a low single arch bridge with the invert level being lower than would be typically favoured by bats for bridge roosting. No gaps in the stonework under arch were visible. Some small cracks and ivy cover are present on the parapets, however overall, roosting potential remains negligible.



Plate 3-4: Borrisbeg Stream Bridge (1)

Borrisbeg Stream Bridge (2)

This bridge structure carries the R693 road over the channel draining the adjacent Loughane turlough. As such, it remains dry for long periods, and was dry when surveyed in late September/early October 2025. The structure is a single arch formed by an older masonry barrel vault which has been extended laterally by the addition of a bottomless concrete box culvert on the upstream side.

Numerous gaps are present in the stonework of the barrel arch, and several gaps are also present in the spandrel wall, with the majority of crevices in the barrel arch having some suitability for roosting bats based on their size, accessibility, location and condition. No signs of bat occupancy were recorded during the inspection however. It was noted that very dense tree and bramble cover surrounding the channel up and down-stream may limit access for bats, although some gaps permitting entry are likely to exist.

Based on the presence of PRFs under this bridge it was assessed to have moderate roosting potential and the requirement for an emergence survey was identified.



Plate 3-5: Borrisbeg Stream Bridge (2)

Gorteenahilla Stream Bridge

This single arch bridge has a highly modified channel upstream, with vertical walls comprised of concrete and masonry c. 3-4m high forming the banks. The parapets are concrete on the upstream side, and stone on the downstream side. The arch barrel is masonry. The pointing on the downstream side (parapet & spandrel walls) is in good condition, with no gaps observed. At the downstream arch which forms an opening in a retaining wall running along the southern side of the R693, the Gorteenahilla discharges immediately into the Nuenna River, which is characterised on this section by a riverbed comprised of limestone bedrock, forming a series of cascades and deep pools. As such, no access from either side of the bridge over the Gorteenahilla was possible. No PRFs were visible from vantage points overlooking the bridge. Due to restricted access, an emergence survey was required.



Plate 3-6: Gorteenahilla Stream Bridge (upstream)



Plate 3-7: Gorteenahilla Stream Bridge (downstream)

Bridge over un-named channel

This 2-arch masonry bridge over a drain crossing under the R694 on northern outskirts of Freshford was dry when surveyed. The parapets and spandrel walls had recently been repointed. Dense vegetation obstructs the upstream arches. The arches are not obstructed on the downstream side, but are too low for roosting bats. Both arch barrels have been completely covered in shotcrete. Due to the absence of PRFs and low arches, potential for bat roosting at this bridge is negligible.



Plate 3-8: Bridge over un-named channel on northern outskirts of Freshford

Lismaine Stream Bridge

Both parapets are new, constructed relatively recently of masonry. The entire bridge has been replaced with a modern structure. The bridge arch is formed by a concrete box culvert and retaining walls are present downstream. A such, potential for bat roosting at this bridge is negligible.



Plate 3-9: Lismaine Stream Bridge

Lisdowney Stream Bridge

The entire bridge has been rebuilt and replaced with a modern structure. Some gaps occur between the concrete lintels forming the arch and also where the arch joins the abutments at both ends, but these gaps are too exposed for roosting and the smooth concrete surfaces provide no grip. No signs of occupancy by bats were observed. A such, potential for bat roosting at this bridge is negligible.



Plate 3-10: Lisdowney Stream Bridge

3.4.2.2 Trees

The results of ground-level tree assessments (GLTA) carried out along the proposed grid connection are detailed below. No trees with potential for bat roosting are present in areas potentially affected by vegetation trimming associated with the TDR.

While a number of trees with low potential for bat roosting were noted along the grid connection as described below, these are unlikely to be affected by TDR works, and the PRFs present are limited in size, providing space for individual or low numbers of bats only.

Location 1

ITM 629518 663643

Ivy-covered beech tree line; low roosting potential. No PRFs visible but potential for PRFs under ivy. Disturbed location beside busy regional road and lack of roost features observed in mature tree reduces potential suitability for roosting bats. Not subject to effects from grid connection works.

[photograph not available]

Location 2

ITM 629814 663512

Scots pine with knothole; low roosting potential. Knothole is low down and lacks cover and connectivity, reducing suitability for roosting bats. Disturbed location beside busy regional road, lack of connectivity with surrounding landscape and small size of knothole limiting potential roosting space to several bats, indicating low suitability for roosting bats. Not subject to effects from grid connection works.



Plate 3-11: Scots pine at Location 2

Location 3

ITM 629901 663525

Beech tree with knothole in upper limb; low roosting potential. The knothole is tilted upward, reducing shelter. Disturbed location beside busy regional road, limited connectivity with surrounding landscape and orientation of knothole limiting suitability for roosting bats to low. Limb is not over road so PRF not subject to effects from grid connection works.



Plate 3-12: Beech at Location 3

Location 4

ITM 629901 663525

Veteran ash with some small knotholes with low roosting potential. No PRFs over road. Not subject to effects from grid connection works. Disturbed location beside busy regional road and limited space in PRFs limits potential for roosting to individual or low numbers of bats; unlikely to be used regularly due to lack of appropriate conditions.



Plate 3-13: Ash at Location 4

Location 5

ITM 637186 664655

Mature oak; has two knotholes with some potential for use by individual or low numbers of roosting bats but neither is located over the road. The limited roosting space available, in combination with the disturbed location beside a busy regional road reduces potential suitability for roosting bats to low. Not subject to effects from grid connection works.



Plate 3-14: Oak at Location 5

Location 6

ITM 637211 664663

Mature oak with branch partly overhanging road verge which has rot and lifting bark. No PRFs visible but potential for PRFs to occur in this branch. Unlikely to be affected by grid connection works. Disturbed location beside busy regional road and lack of PRFs visible from the ground reduces potential suitability for roosting bats to low. Not subject to effects from grid connection works.



Plate 3-15: Oak at Location 6

Location 7

ITM 640746 666069

Ash tree with dense ivy. No confirmed PRFs visible. Disturbed location beside busy regional road and absence of PRFs visible from ground reduces potential suitability for roosting bats to low. Not subject to effects from grid connection works.

[photograph not available]

Location 8

ITM 642227 667627

Ash tree; has small knothole in branch above road. Knothole is exposed, not deep. Low roosting potential. PRF is located 5m above road. Not affected by grid connection works. Disturbed location along busy regional road and lack of space and shelter reduces potential suitability for roosting bats to low.



Plate 3-16: Ash at Location 8

Location 9

ITM 642241 667697

Mature ash tree with knothole in branch. Knothole is not deep; exposed; low roosting potential. Disturbed location along busy regional road and lack of shelter and space reduces potential suitability for roosting bats to low. Not subject to effects from grid connection works.



Plate 3-17: Ash at Location 9

Location 10

ITM 643515 668606

Mature beech with knotholes and main limb broken off. Knotholes have low-moderate roosting potential. Disturbed location along busy regional road and the disturbed nature of broken limbs on tree reduces potential suitability for roosting bats to low. Not subject to effects from grid connection works.



Plate 3-18: Beech at Location 10

3.5 Roost emergence/ re-entry surveys

The trees within the wind farm roost survey study area are predominantly immature and semi-mature. No potential bat roost features were observed within the wind farm roost survey study area.

No bats were observed emerging from either of the two bridges which required further surveying along the Grid Connection Route. A total of four species, namely Leisler's, brown long-eared, common and soprano pipistrelle bat were active in the locality of the bridges but did not emerge from the bridges (see Table 3-4). While the Borrisbeg Stream Bridge (2) has moderate roosting potential, no signs of occupancy by bats were observed. See Table 3-3 for details relating to both emergence surveys and general observations on the bridges surveyed.

Table 3-3: Emergence survey results

Bridge	Survey Date	Comment	Status
Gorteenahilla Stream Bridge (downstream)	13-10-25	No emergence observed; no bats observed. Bridge was very busy with traffic and excessive lighting from floodlights further downstream. Streetlights along road were not causing excessive light pollution immediately downstream of bridge.	Low potential; no emergence observed.
Gorteenahilla Stream Bridge (upstream)	13-10-25	No emergence observed; several bats observed hunting upstream. Streetlights along road were not causing excessive light pollution immediately upstream of bridge.	Low potential; no emergence observed.
Borrisbeg Stream Bridge (2) (downstream)	14-10-25	No emergence observed; no bats seen along channel on either side. Bats detected flying along tree line outside tree tunnel over the dry river channel. This channel with its small tree tunnel may be too restricted for hunting bats Bridge was inspected before emergence survey, using both infrared scope and torch, all crevices visible with torch; no bats were observed with torch nor heat sources detected with scope. No signs of occupancy by bats.	No emergence observed; no signs of occupancy; not a winter roost.
Borrisbeg Stream Bridge (2) (upstream)	14-10-25	No emergence observed; no bats detected along channel on either side. Bats detected flying along tree line outside tree tunnel over the dry river channel. This channel with its small tree tunnel may be too restricted for hunting bats.	No emergence observed; no signs of occupancy; not a winter roost.

Table 3-4: Summary of species active in surrounding areas during emergence surveys (no emergence recorded)

Species	Borrisbeg Stream Bridge (2) (upstream)	Borrisbeg Stream Bridge (2) (downstream)	Gorteenahilla Stream Bridge (upstream)	Gorteenahilla Stream Bridge (downstream)	Total
Nyctalus leisleri	0	0	3	0	3
Pipistrellus pipistrellus	4	9	4	2	19
Pipistrellus pygmaeus	2	2	10	2	16
Plecotus auritus	5	9	0	0	14
Total	11	20	17	4	52

3.6 Static Detector Surveys

Detector deployment locations can be seen in EIAR Appendix VI Figure 6-3 and 6-4.

3.6.1 2023 Static Surveys

The locations of the 2023 static detectors were chosen to specifically reflect the proposed infrastructure layout during that period. Since the proposed layout has been updated since then through iterative constraints studies to minimise potential effects, the 2023 static detector results are primarily indicative of bat activity at the site scale, rather than the finalised turbine locations. Table 3-5 below summarises the results, in relation to bat species, recorded on the static detectors deployed in 2023. A total of 11 static units were deployed during each survey period. Overall, eight bat species were recorded (common pipistrelle, soprano pipistrelle, Nathusius's pipistrelle, Leisler's bat, brown long-eared bat, Natterer's bat, Daubenton's bat and whiskered bat). Manual verification of acoustic data ensured accurate species identification.

Table 3-5: Summary results of Static Bat Detectors deployed during 2023 survey rounds 1 to 3

Static Detector No.	Species detected during Spring (Round 1)	Species detected during Summer (Round 2)	Species detected during Autumn (Round 3)
L1	*Myotis daubentonii* *Myotis mystacinus* *Nyctalus leisleri* *Pipistrellus nathusii* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*	*Myotis daubentonii* *Myotis mystacinus* *Myotis nattereri* *Nyctalus leisleri* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*	*Myotis daubentonii* *Myotis mystacinus* *Myotis nattereri* *Nyctalus leisleri* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*
L2	*Myotis daubentonii* *Myotis mystacinus* *Myotis nattereri* *Nyctalus leisleri* *Pipistrellus nathusii* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*	*Myotis daubentonii* *Nyctalus leisleri* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*	*Myotis daubentonii* *Myotis nattereri* *Nyctalus leisleri* *Pipistrellus nathusii* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*
L3	*Myotis daubentonii* *Myotis nattereri* *Nyctalus leisleri* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*	*Myotis daubentonii* *Myotis mystacinus* *Myotis nattereri* *Nyctalus leisleri* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*	N/A (Vandalism)

Static Detector No.	Species detected during Spring (Round 1)	Species detected during Summer (Round 2)	Species detected during Autumn (Round 3)
L4	*Myotis daubentonii* *Myotis mystacinus* *Myotis nattereri* *Nyctalus leisleri* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*	*Myotis daubentonii* *Myotis mystacinus* *Myotis nattereri* *Nyctalus leisleri* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*	*Myotis daubentonii* *Myotis mystacinus* *Myotis nattereri* *Nyctalus leisleri* *Pipistrellus nathusii* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*
L5	*Myotis daubentonii* *Myotis nattereri* *Nyctalus leisleri* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*	*Myotis daubentonii* *Myotis mystacinus* *Myotis nattereri* *Nyctalus leisleri* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*	*Myotis daubentonii* *Myotis nattereri* *Nyctalus leisleri* *Pipistrellus nathusii* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*
L6	*Myotis daubentonii* *Myotis mystacinus* *Myotis nattereri* *Nyctalus leisleri* *Pipistrellus nathusii* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*	*Myotis daubentonii* *Myotis mystacinus* *Myotis nattereri* *Nyctalus leisleri* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*	*Myotis daubentonii* *Myotis mystacinus* *Myotis nattereri* *Nyctalus leisleri* *Pipistrellus nathusii* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*
L7	*Myotis daubentonii* *Myotis mystacinus* *Nyctalus leisleri* *Pipistrellus nathusii* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*	*Myotis daubentonii* *Myotis mystacinus* *Myotis nattereri* *Nyctalus leisleri* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*	*Myotis daubentonii* *Myotis mystacinus* *Myotis nattereri* *Nyctalus leisleri* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*
L8	*Myotis daubentonii* *Myotis mystacinus* *Myotis nattereri* *Nyctalus leisleri* *Pipistrellus nathusii* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*	*Myotis daubentonii* *Myotis mystacinus* *Myotis nattereri* *Nyctalus leisleri* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*	*Myotis daubentonii* *Myotis mystacinus* *Myotis nattereri* *Nyctalus leisleri* *Pipistrellus nathusii* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*

Static Detector No.	Species detected during Spring (Round 1)	Species detected during Summer (Round 2)	Species detected during Autumn (Round 3)
L9	*Myotis daubentonii* *Myotis mystacinus* *Nyctalus leisleri* *Pipistrellus nathusii* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*	*Myotis daubentonii* *Myotis mystacinus* *Myotis nattereri* *Nyctalus leisleri* *Pipistrellus nathusii* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*	*Myotis daubentonii* *Myotis mystacinus* *Myotis nattereri* *Nyctalus leisleri* *Pipistrellus nathusii* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*
L10	*Myotis daubentonii* *Myotis mystacinus* *Myotis nattereri* *Nyctalus leisleri* *Pipistrellus nathusii* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*	*Myotis daubentonii* *Myotis mystacinus* *Myotis nattereri* *Nyctalus leisleri* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*	*Myotis daubentonii* *Myotis mystacinus* *Myotis nattereri* *Nyctalus leisleri* *Pipistrellus nathusii* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*
L11	*Myotis daubentonii* *Myotis mystacinus* *Myotis nattereri* *Nyctalus leisleri* *Pipistrellus nathusii* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*	*Myotis daubentonii* *Myotis mystacinus* *Myotis nattereri* *Nyctalus leisleri* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*	*Myotis daubentonii* *Myotis mystacinus* *Myotis nattereri* *Nyctalus leisleri* *Pipistrellus nathusii* *Pipistrellus pipistrellus* *Pipistrellus pygmaeus* *Plecotus auritus*

Common Pipistrelle

The total number of recordings for common pipistrelle at the proposed development during the 2023 survey season was 18762 no. recordings; 44.2% of total recordings for this season. These were recorded over 76 nights which gives an average of 246.87 no. recordings per night.

Soprano Pipistrelle

The total number of recordings for soprano pipistrelle at the proposed development during the 2023 survey season was 14798 no. recordings; 34.86% of total recordings for this season. These were recorded over 76 nights which gives an average of 194.71 no. recordings per night.

Nathusius's Pipistrelle

The total number of recordings for nathusius's pipistrelle at the proposed development during the 2023 survey season was 289 no. recordings; 0.68% of total recordings for this season. These were recorded over 76 nights which gives an average of 3.8 no. recordings per night.

Leislers Bat

The total number of recordings for Leislers bat at the proposed development during the 2023 survey season was 5794 no. recordings; 13.65% of total recordings for this season. These were recorded over 76 nights which gives an average of 76.24 no. recordings per night.

Daubentons Bat

The total number of recordings for Daubentons bat at the proposed development during the 2023 survey season was 1161 no. recordings; 2.74% of total recordings for this season. These were recorded over 76 nights which gives an average of 15.28 no. recordings per night.

Natterers Bat

The total number of recordings for Natterers bat at the proposed development during the 2023 survey season was 464 no. recordings; 1.1% of total recordings for this season. These were recorded over 76 nights which gives an average of 6.12 no. recordings per night.

Whiskered Bat

The total number of recordings for Whiskered bat at the proposed development during the 2023 survey season was 373 no. recordings; 0.88% of total recordings for this season. These were recorded over 76 nights which gives an average of 4.91 no. recordings per night.

Brown Long-eared bat

The total number of recordings for Brown long-eared bat at the proposed development during the 2023 survey season was 808 no. recordings; 1.9% of total recordings for this season. These were recorded over 76 nights which gives an average of 10.63 no. recordings per night.

All Rounds (2023):

As indicated below in Figure 3-3 the highest level of activity was recorded during the spring round observing a total of 24855 bat passes over 27 nights giving an average of 920.56 passes per night, with the highest overall activity recorded at L6, L2 and L1 respectively. Habitats surrounding detectors for turbines 1 and 2 (2023) consist of areas of scrub and cutover bog while turbine 6 (2023) is on the edge of an immature woodland providing a linear corridor for commuting bats hence the highest overall level of bat passes in 2023 with 4254 recordings.

The summer round had a total of 15586 bat passes over 28 nights giving an average of 556.64 passes recorded per night. Within the summer round, the detectors with the highest activity were L1, L10 and L8 (2023) respectively. Habitats surrounding these deployment locations consist of scrub and cutover bog at L1 and L10 while L8 is on the edge of an immature woodland providing a linear corridor for commuting bats.

Autumn had the lowest activity in each detector in comparison to spring and summer with a total of 1972 bat passes recorded giving an average of 93.9 passes recorded per night. Detector L10 (2023) had the highest number of bat passes recorded with 1010 records compared to the next highest which was Detector L11 (2023) with 169 records.

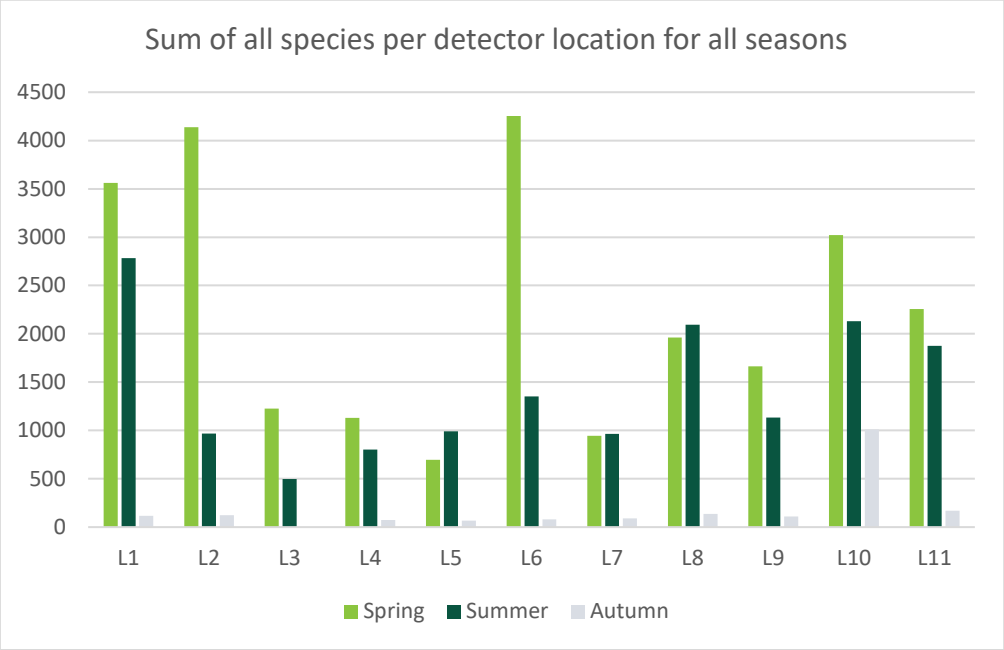


Figure 3-3: Sum of all species passes per detector location for all seasons in 2023

Table 3-6: Sum of all species passes per detector location for all seasons in 2023

Detector Reference	Spring	Summer	Autumn	Total
L1	3563	2782	116	6461
L2	4138	967	124	5229
L3	1228	496	0	1724
L4	1129	801	73	2003
L5	696	990	66	1752
L6	4254	1352	79	5685
L7	945	965	90	2000
L8	1962	2095	135	4192
L9	1663	1134	110	2907
L10	3022	2129	1010	6161
L11	2255	1875	169	4299
Total	24855	15586	1972	42413

3.6.1.1 2023 - Round 1 (Spring)

During the spring deployment there were a total of 24,855 passes recorded across 11 detectors (refer to Table 3-7). Common Pipistrelle account for 56.22% of the passes recorded with 25.85% of spring common pipistrelle calls having been recorded at Detector L6, 15.56% at Detector L1 and 15.09% at Detector L2 (2023). Soprano pipistrelle account for the next highest number of recorded passes with 27.46% followed by Leisler's bat which account for 11.27% of calls recorded. The remaining species collectively account for only 5.05% of the passes recorded. Detectors L6, L2 and L1 (2023) have the three highest number of recordings respectively. The habitats at Detector L6 (2023) consist of cutover bog with scrub and immature woodland in the surrounding areas while Detector L2 (2023) is in cutover bog with small, scattered patches of scrub. Detector L1 (2023) is located within scrub habitat bordered by cutover bog. Figure 3-4 shows a season-wide trend where common pipistrelle, soprano pipistrelle and Leisler's bat activity peaks from 22:00 to 23:00 and decreases from then onwards with a slight increase at 03:00 before decreasing again.

Table 3-7: Total number of passes recorded per species per detector for spring 2023

Detector (2023)	General Location/ Habitat Association	Myotis Daubentonii	Myotis nattereri	Myotis mystacinus	Nyctalus leisleri	Pipistrellus pipistrellus	Pipistrellus pygmaeus	Pipistrellus nathusii	Plecotus auritus	Total
L1	WS1 - Scrub	41	0	3	108	2175	1067	139	30	3563
L2	PB4 - Cutover bog	31	9	27	77	2108	1837	24	25	4138
L3	PB4 - Cutover bog	19	9	0	47	949	200	0	4	1228
L4	WS1 - Scrub	61	3	3	162	629	263	0	8	1129
L5	PB4 - Cutover bog	19	3	0	187	315	168	0	4	696
L6	WS2 - Immature woodland	58	15	1	229	3612	243	57	39	4254
L7	PB4 - Cutover bog	43	0	9	206	414	253	9	11	945
L8	WS2 - Immature woodland	114	11	23	297	1235	219	14	49	1962
L9	WS1 - Scrub	42	17	6	514	482	579	0	23	1663
L10	PB4 - Cutover bog	74	10	16	591	1279	981	6	65	3022
L11	WS2 - Immature woodland	22	7	4	384	776	1015	15	32	2255
Total		524	84	92	2802	13974	6825	264	290	24855

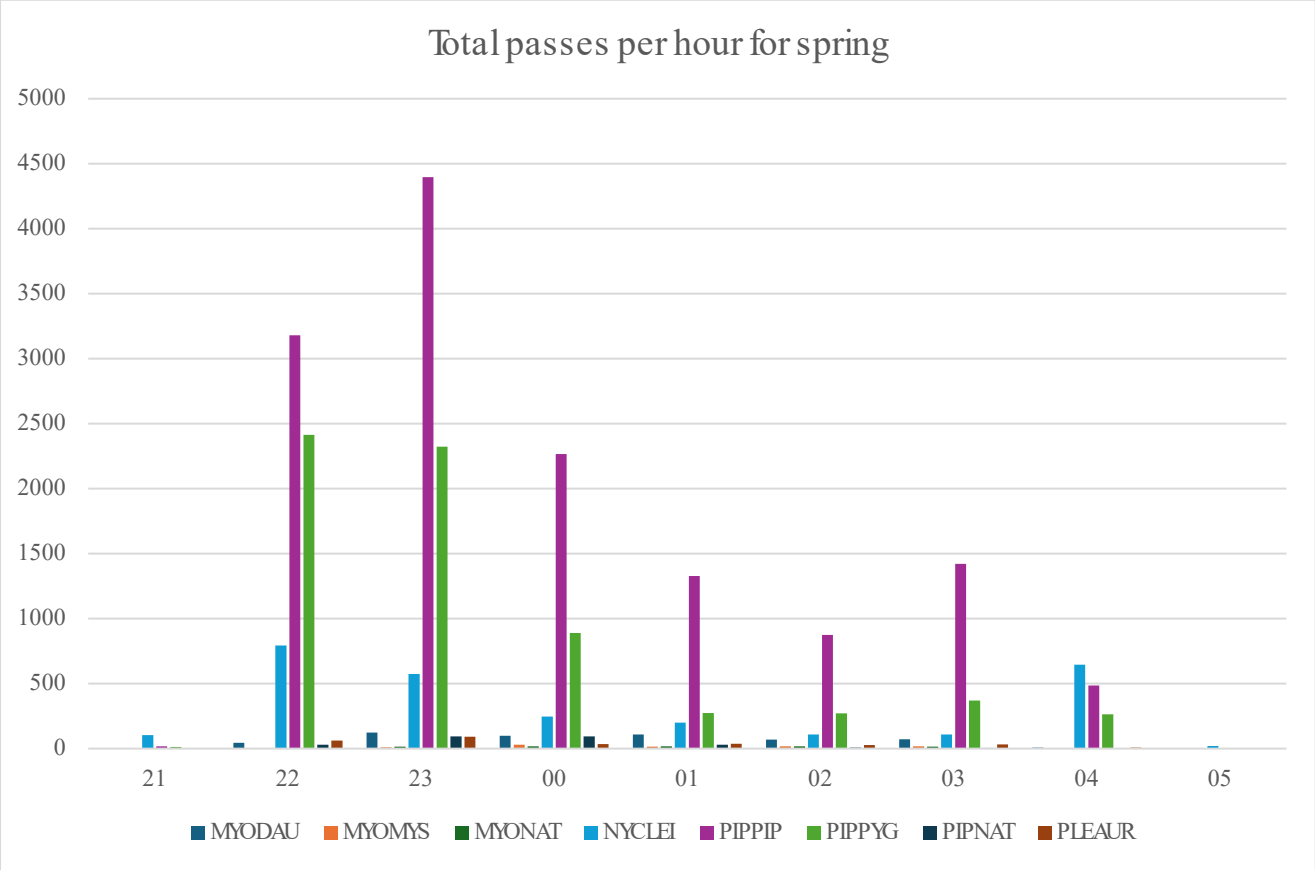


Figure 3-4: Total number of bat passes per hour per species for all 2023 spring detector locations

3.6.1.2 2023 - Round 2 (Summer)

During the summer deployment there were a total of 15,586 passes recorded across 11 detectors (refer to Table 3-8). Soprano Pipistrelle account for 43.88% of the passes recorded with 23.37% of summer soprano pipistrelle calls recorded at L1, 20.84% at L10 and 15.34% at L11 (2023). Common pipistrelle account for the next highest number of recorded passes with 29.73% followed by Leisler's bat which account for 16.83% of calls recorded. The remaining species collectively account for 9.57% of passes recorded. Turbines 1, 10 and 8 (2023) have the three highest number of recordings respectively. Detector L1 (2023) is located within scrub habitat bordered by cutover bog. Detector L10 (2023) is located on cutover bog with scrub adjacent, similarly to Detector L8 (2023) which is near immature woodland providing an edge habitat for commuting bats. Figure 3-5 shows a season-wide trend where common pipistrelle and soprano pipistrelle activity peaks at 22:00 and decreases until 03:00 where it increases until 05:00 before decreasing again. Analysis of bat passes relative to emergence times do not indicate the potential presence of any roosts near the proposed wind farm (see Appendix 2).

Table 3-8: Total number of passes recorded per species per detector for summer 2023

Detector (2023)	General Location/ Habitat Association	Myotis Daubentonii	Myotis nattereri	Myotis mystacinus	Nyctalus leisleri	Pipistrellus pipistrellus	Pipistrellus pygmaeus	Pipistrellus nathusii	Plecotus auritus	Total
L1	WS1 - Scrub	51	18	58	221	724	1598	0	112	2782
L2	PB4 - Cutover bog	47	0	0	128	224	548	0	20	967
L3	PB4 - Cutover bog	13	31	8	89	147	198	0	10	496
L4	WS1 - Scrub	25	19	11	194	224	305	0	23	801
L5	PB4 - Cutover bog	30	2	3	231	330	351	0	43	990
L6	WS2 - Immature woodland	54	47	25	367	466	330	0	63	1352
L7	PB4 - Cutover bog	38	4	13	166	302	424	0	18	965
L8	WS2 - Immature woodland	47	5	11	345	1367	269	0	51	2095
L9	WS1 - Scrub	43	106	30	313	220	342	6	74	1134
L10	PB4 - Cutover bog	59	61	41	228	298	1425	0	17	2129
L11	WS2 - Immature woodland	50	23	35	341	331	1049	0	46	1875
Total		457	316	235	2623	4633	6839	6	477	15586

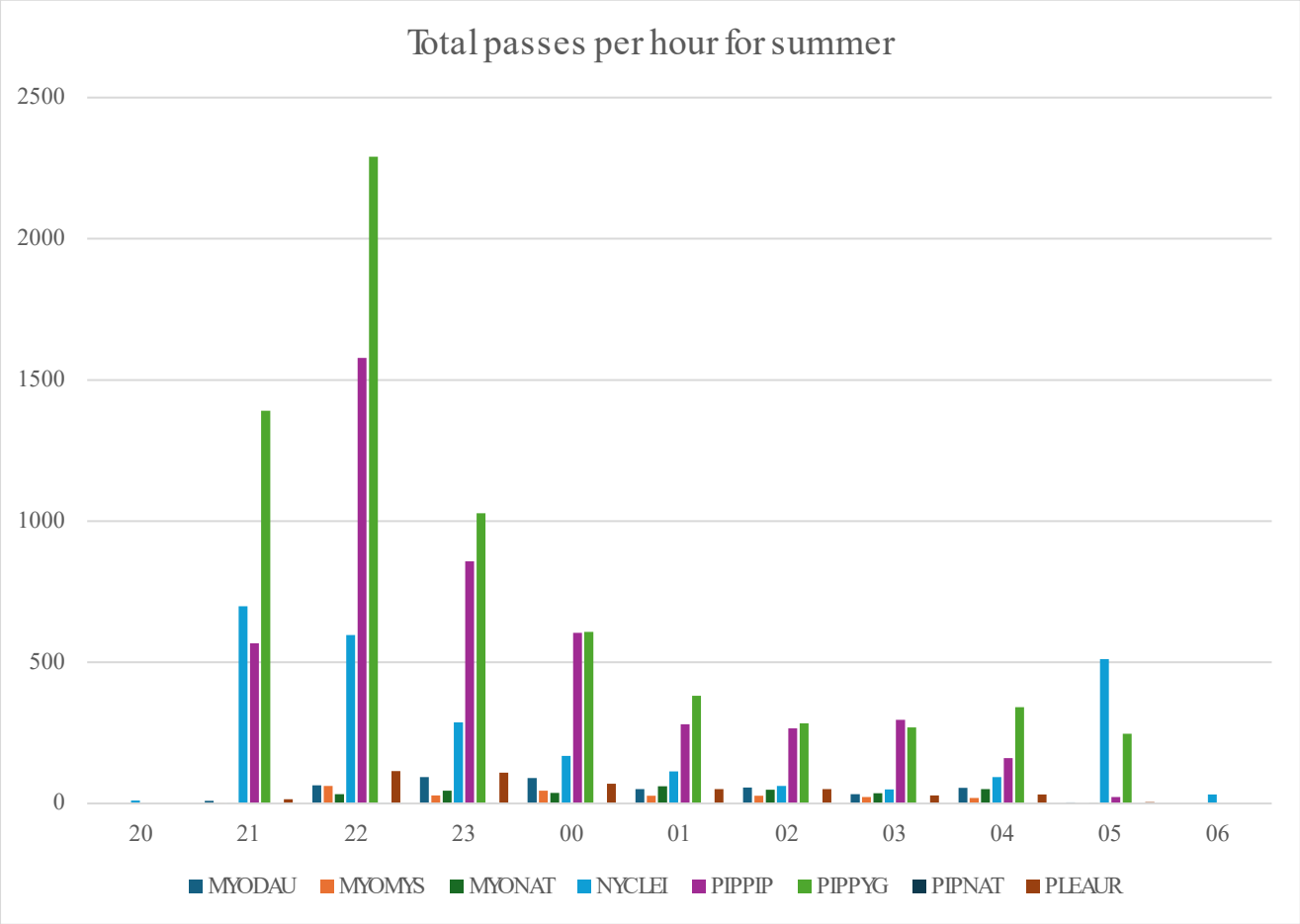


Figure 3-5: Total number of bat passes per hour per species for all 2023 summer detector locations

3.6.1.3 2023 - Round 3 (Autumn)

During the autumn deployment there were a total of 1,972 passes recorded across 11 detectors (refer to Table 3-9). Soprano Pipistrelle account for 57.51% of the passes recorded with 82.45% of autumn soprano pipistrelle calls recorded at L10 and 5.47% at L11. Leisler's bat account for the next highest number of recorded passes with 16.89% followed by Daubenton's bat which account for 9.13% of calls recorded. The remaining species collectively account for 16.48% of passes recorded. Turbines 10, 11 and 8 have the three highest number of recordings respectively. Detectors L10 and L11 (2023) are located on cutover bog adjacent to scrub and immature woodland while Detector T8 is located on cutover bog near immature woodland. Figure 3-6 shows a shows a season-wide trend where Soprano pipistrelle activity peaks at 19:00 while Leisler's bat and common pipistrelle peak at 20:00; all other species peak at 21:00. There is an increase in Leisler's bat activity at 05:00 before it decreases again at 06:00.

Table 3-9: Total number of passes recorded per species per detector for autumn 2023

Row Labels	General Location/ Habitat Association	Myotis Daubentonii	Myotis nattereri	Myotis mystacinus	Nyctalus leisleri	Pipistrellus pipistrellus	Pipistrellus pygmaeus	Pipistrellus nathusii	Plecotus auritus	Total
L1	WS1 - Scrub	5	1	3	62	12	31	0	2	116
L2	PB4 - Cutover bog	20	4	0	47	10	34	3	6	124
L3	PB4 - Cutover bog	-	-	-	-	-	-	-	-	-
L4	WS1 - Scrub	16	4	13	24	3	10	2	1	73
L5	PB4 - Cutover bog	15	3	0	20	10	12	3	3	66
L6	WS2 - Immature woodland	13	1	2	25	24	8	2	4	79
L7	PB4 - Cutover bog	30	3	3	30	6	8	0	10	90
L8	WS2 - Immature woodland	20	5	2	57	27	15	2	7	135
L9	WS1 - Scrub	14	15	16	27	13	19	2	4	110
L10	PB4 - Cutover bog	20	12	1	22	17	935	1	2	1010
L11	WS2 - Immature woodland	27	16	6	19	33	62	4	2	169
Total		180	64	46	333	155	1134	19	41	1972

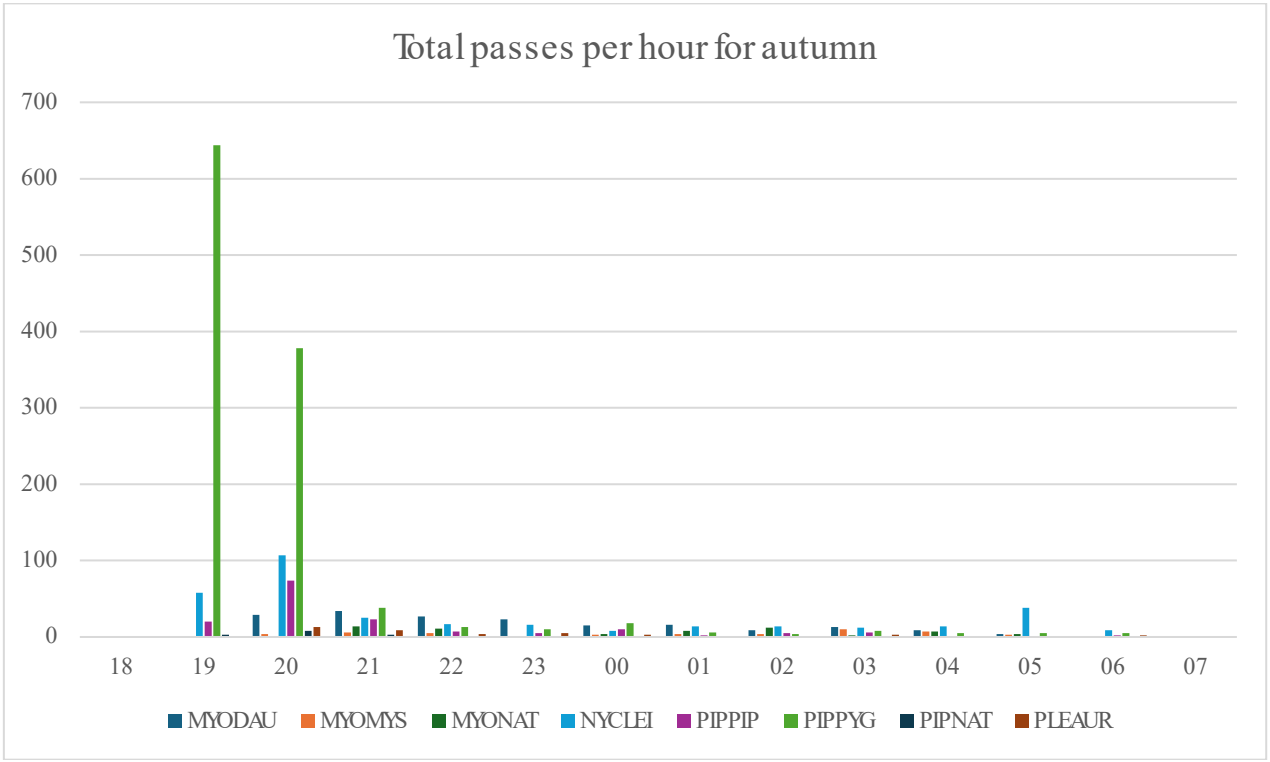


Figure 3-6: Total number of bat passes per hour per species for all 2023 autumn detector locations

3.6.2 2025 Static Surveys

The location of the 2025 statics were chosen specifically to reflect the layout of the proposed infrastructure. This approach ensures the survey data directly informs the placement of turbine infrastructure, helping to minimise potential impacts on important bat habitats. Table 3-10 below summarises the results, in relation to bat species, recorded on the static detectors deployed in 2025. A total of 11 static units were deployed during each survey period. Overall, eight bat species were recorded (common pipistrelle, soprano pipistrelle, Nathusius's pipistrelle, Leisler's bat, brown long-eared bat, Natterer's bat, Daubenton's bat and whiskered bat). Manual verification of acoustic data ensured accurate species identification.

Table 3-10: Summary results of Static Bat Detectors deployed during 2025 survey rounds 1 to 3

Static Detector No. and location habitats	Species detected during Spring (Round 1)	Species detected during Summer (Round 2)	Species detected during Autumn (Round 3)
LT1	Myotis daubentonii Myotis mystacinus Myotis nattereri Nyctalus leisleri Pipistrellus nathusii Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus	Myotis daubentonii Myotis mystacinus Myotis nattereri Nyctalus leisleri Pipistrellus nathusii Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus	Myotis daubentonii Myotis nattereri Nyctalus leisleri Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus
LT2	Myotis daubentonii Nyctalus leisleri Pipistrellus nathusii Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus	Myotis daubentonii Myotis mystacinus Myotis nattereri Nyctalus leisleri Pipistrellus nathusii Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus	Myotis daubentonii Nyctalus leisleri Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus
LT3	Myotis daubentonii Myotis mystacinus Myotis nattereri Nyctalus leisleri Pipistrellus nathusii Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus	Myotis daubentonii Myotis mystacinus Myotis nattereri Nyctalus leisleri Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus	Myotis daubentonii Myotis mystacinus Myotis nattereri Nyctalus leisleri Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus

Static Detector No. and location habitats	Species detected during Spring (Round 1)	Species detected during Summer (Round 2)	Species detected during Autumn (Round 3)
LT4	Myotis daubentonii Myotis mystacinus Nyctalus leisleri Pipistrellus nathusii Pipistrellus pipistrellus Pipistrellus pygmaeus	Myotis daubentonii Myotis mystacinus Myotis nattereri Nyctalus leisleri Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus	Myotis daubentonii Myotis nattereri Nyctalus leisleri Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus
LT5	Myotis daubentonii Myotis mystacinus Nyctalus leisleri Pipistrellus nathusii Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus	Myotis daubentonii Myotis mystacinus Myotis nattereri Nyctalus leisleri Pipistrellus nathusii Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus	Myotis daubentonii Myotis mystacinus Myotis nattereri Nyctalus leisleri Pipistrellus nathusii Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus
LT6	Myotis daubentonii Myotis mystacinus Nyctalus leisleri Pipistrellus nathusii Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus	Myotis daubentonii Myotis mystacinus Myotis nattereri Nyctalus leisleri Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus	Myotis daubentonii Myotis nattereri Nyctalus leisleri Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus
LT7	Myotis daubentonii Nyctalus leisleri Pipistrellus nathusii Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus	Myotis daubentonii Myotis mystacinus Myotis nattereri Nyctalus leisleri Pipistrellus nathusii Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus	Myotis daubentonii Myotis nattereri Nyctalus leisleri Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus
LT8	Myotis daubentonii Myotis nattereri Nyctalus leisleri Pipistrellus nathusii Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus	Myotis daubentonii Myotis mystacinus Myotis nattereri Nyctalus leisleri Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus	Myotis daubentonii Myotis mystacinus Myotis nattereri Nyctalus leisleri Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus

Static Detector No. and location habitats	Species detected during Spring (Round 1)	Species detected during Summer (Round 2)	Species detected during Autumn (Round 3)
LT9	Myotis daubentonii Myotis nattereri Nyctalus leisleri Pipistrellus nathusii Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus	Myotis daubentonii Myotis mystacinus Myotis nattereri Nyctalus leisleri Pipistrellus nathusii Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus	Myotis daubentonii Myotis mystacinus Myotis nattereri Nyctalus leisleri Pipistrellus nathusii Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus
LT10	Myotis daubentonii Myotis mystacinus Myotis nattereri Nyctalus leisleri Pipistrellus nathusii Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus	Myotis daubentonii Myotis mystacinus Myotis nattereri Nyctalus leisleri Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus	Myotis daubentonii Myotis mystacinus Myotis nattereri Nyctalus leisleri Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus
LT11	N/A (Broken)	Myotis daubentonii Myotis mystacinus Myotis nattereri Nyctalus leisleri Pipistrellus nathusii Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus	Myotis daubentonii Myotis nattereri Nyctalus leisleri Pipistrellus nathusii Pipistrellus pipistrellus Pipistrellus pygmaeus Plecotus auritus

Common Pipistrelle

The total number of recordings for common pipistrelle at the proposed development was 12747 no. recordings; 31.54% of total recordings for the 2025 season. These were recorded over 103 nights which gives an average of 123.76 no. recordings per night.

Soprano Pipistrelle

The total number of recordings for soprano pipistrelle at the proposed development was 16980 no. recordings; 42.02% of total recordings for the 2025 season. These were recorded over 103 nights which gives an average of 164.85 no. recordings per night.

Leisler's Bat

The total number of recordings for Leisler's bat at the proposed development was 7699 no. recordings; 19.05% of total recordings for the 2025 season. These were recorded over 103 nights which gives an average of 74.75 no. recordings per night.

Brown Long-eared Bat

The total number of recordings for brown long-eared bat at the proposed development was 785 no. recordings; 1.94% of total recordings for the 2025 season. These were recorded over 103 nights which gives an average of 7.62 no. recordings per night.

Daubenton's Bat

The total number of recordings for Daubenton's bat at the proposed development was 1076 no. recordings; 2.66% of total recordings for the 2025 season. These were recorded over 103 nights which gives an average of 10.45 no. recordings per night.

Whiskered Bat

The total number of recordings for Whiskered bat at the proposed development was 225 no. recordings; 0.56% of total recordings for the 2025 season. These were recorded over 103 nights which gives an average of 2.18 no. recordings per night.

Natterer's Bat

The total number of recordings for Natterers bat at the proposed development was 678 no. recordings; 1.68% of total recordings for the 2025 season. These were recorded over 103 nights which gives an average of 6.58 no. recordings per night.

Nathusius's Pipistrelle

The total number of recordings for nathusius's pipistrelle at the proposed development was 224 no. recordings; 0.55% of total recordings for the 2025 season. These were recorded over 103 nights which gives an average of 2.17 no. recordings per night.

All Rounds:

As indicated below in Table 3-11 the highest level of activity was recorded during the summer 2025 round observing a total of 22281 bat passes over 58 nights giving an average of 384.2 passes per night with the highest activity in summer recorded at Detectors LT11, LT10 and LT1 (2025) respectively. Detector LT1 (2025) is located within scrub bounded by cutover bog but also connected to the wider network of wooded habitats onsite. Detector LT10 (2025) is located in cutover bog with areas of scrub surrounding. Detector LT11 (2025) is located on cutover bog with both scrub and immature woodland nearby with the immature woodland providing a linear corridor for commuting bats.

The spring 2025 round had a total of 11559 bat passes over 17 nights giving an average of 679.9 passes per night with the highest activity of 2025 being observed at LT8 with a total of 3171 passes recorded in spring. The habitat at LT8 is immature woodland; Detector LT8 (2025) was placed to the east of T8 in an area of cutover bog bordered by scrub linked to immature woodland at T8, representative of the interconnected habitat mosaic in which LT8 is located. The wooded edge habitats in this area serve as linear features which may be used by commuting and foraging bats. Detectors LT6 and LT10 (2025) had the next highest numbers of bat passes recorded with 2638 and 1622 respectively. The habitat at LT6 habitat consists of cutover bog; however, there are edge habitats formed by scrub and immature woodland nearby. Detector LT10 (2025) is located within cutover bog, with nearby scrub edges providing commuting routes for bats.

Autumn had the lowest bat activity recorded in 2025 with 6574 bat passes recorded giving an average of 234.79 bat passes recorded per night. Detectors LT8, LT9 and LT1 (2025) had the highest numbers of passes recorded in the autumn round.

For all detectors, with the exception of LT6 and LT8, summer had the highest level of activity.

For LT6 and LT8, spring had the highest level of activity, the habitats surrounding these turbines are cutover bog with immature woodland and scrub.

Summer had consistently high levels of activity throughout all detectors; however, spring and autumn activity levels varied between detectors but a significant gap between these two rounds and summer with the exception of LT6 and LT8.

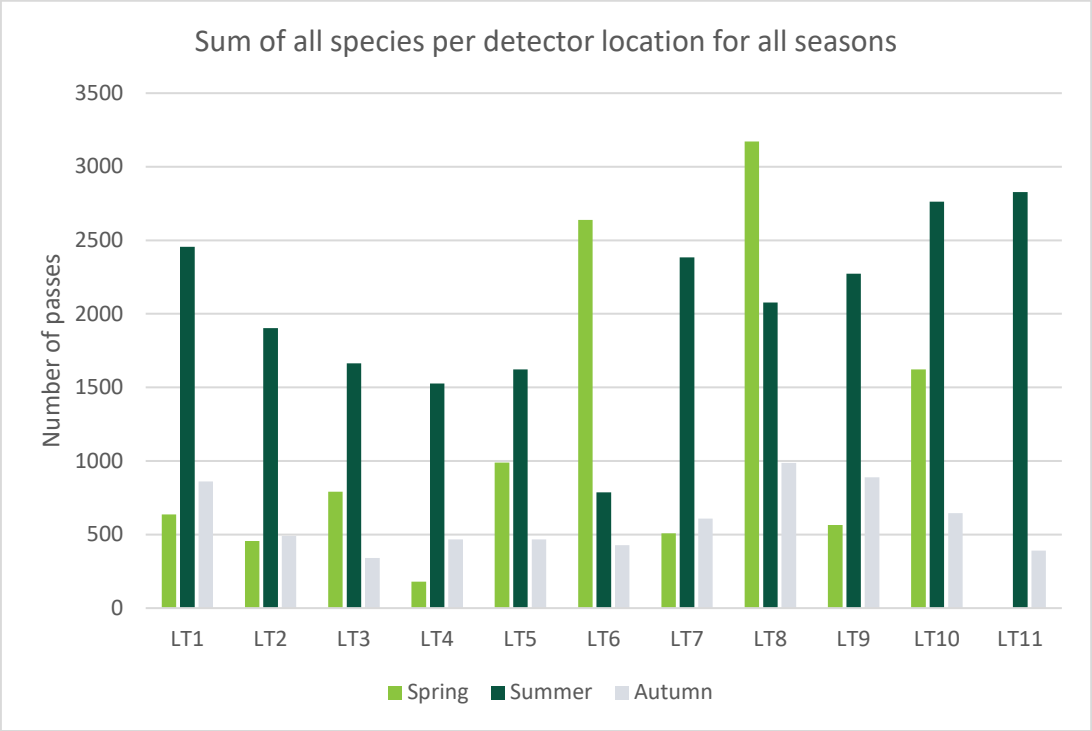


Figure 3-7: Sum of all species per detector location for all seasons in 2025

Table 3-11: Sum of all species per detector location for all seasons in 2025

	Spring	Summer	Autumn	Total
LT1	636	2455	861	3952
LT2	457	1904	491	2852
LT3	791	1664	341	2796
LT4	180	1526	466	2172
LT5	990	1622	467	3079
LT6	2638	786	427	3851
LT7	509	2384	609	3502
LT8	3171	2077	987	6235
LT9	565	2274	890	3729
LT10	1622	2762	645	5029
LT11	0	2827	390	3217
Total	11559	22281	6574	40414

3.6.2.1 2025 - Spring (Round 1)

During the spring deployment there were a total of 11559 passes recorded across 11 detectors (refer to Table 3-12). Common Pipistrelle account for 59.77% of the passes recorded with 36.33% of spring common pipistrelle calls have been recorded at Detector LT8 (2025). Soprano pipistrelle account for the next highest number of recorded passes with 19.59% followed by Leisler's bat which account for 16.43% of calls recorded. The remaining species collectively account for only 4.21% of the passes recorded. Detectors LT6, LT8 and LT10 (2025) have the three highest number of recordings respectively. All of these detectors were located on cutover bog with Detector LT6 (2025) having linear habitats of scrub and immature woodland in the surrounding area while Detector LT10 (2025) has scrub habitat adjacent. Detector LT8 (2025) has scrub adjacent to the deployment location, which is connected to nearby immature woodland. Figure 3-8 shows that shows a season-wide trend where common pipistrelle, soprano pipistrelle and Leisler's bat activity peaks at 23:00 and decreases from then onwards.

Table 3-12: Total number of passes recorded per species per detector for spring 2025

Row Labels	General Location/ Habitat Association	Myotis Daubentonii	Myotis nattereri	Myotis mystacinus	Nyctalus leisleri	Pipistrellus pipistrellus	Pipistrellus pygmaeus	Pipistrellus nathusii	Plecotus auritus	Total
LT1	WS1 - Scrub	14	2	4	143	306	131	34	2	636
LT2	PB4 - Cutover bog	2	0	0	156	175	114	9	1	457
LT3	PB4 - Cutover bog	16	3	1	92	388	280	7	4	791
LT4	WS1 - Scrub	4	0	3	89	47	32	5	0	180
LT5	PB4 - Cutover bog	6	0	6	796	119	54	6	3	990
LT6	WS2 - Immature woodland	11	0	2	122	1977	443	48	35	2638
LT7	PB4 - Cutover bog	18	0	0	163	211	89	17	11	509
LT8	WS2 - Immature woodland	16	2	0	150	2510	407	66	20	3171
LT9	WS1 - Scrub	12	50	0	56	164	271	1	11	565
LT10	PB4 - Cutover bog	19	1	4	132	1012	443	2	9	1622
LT11	WS2 - Immature woodland	-	-	-	-	-	-	-	-	-
Total		118	58	20	1899	6909	2264	195	96	11559

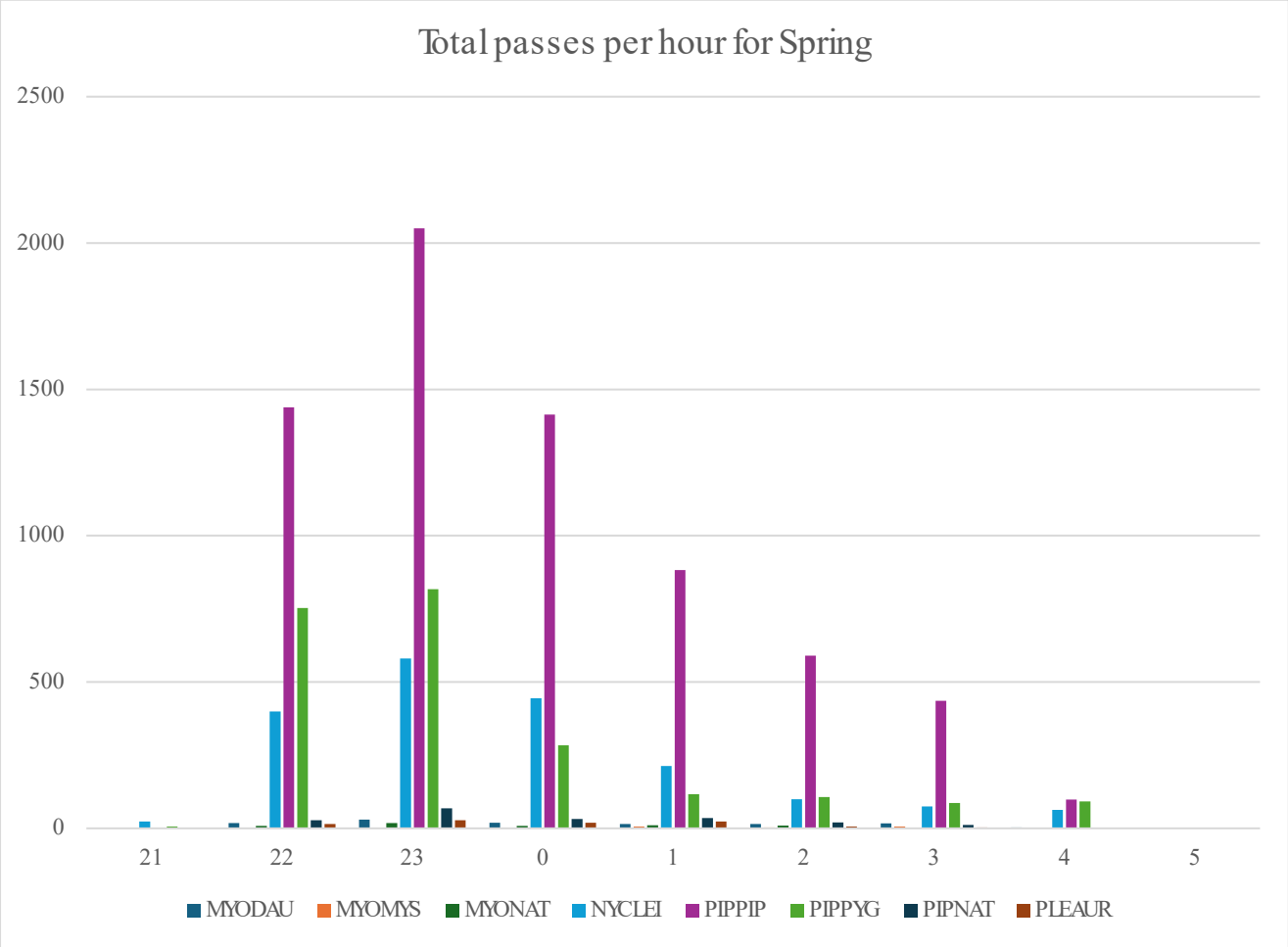


Figure 3-8: Total number of bat passes per hour per species for all 2025 spring detector locations

3.6.2.2 2025 - Summer (Round 2)

During the summer deployment there were a total of 22,281 passes recorded across 11 detectors (refer to Table 3-13). Soprano Pipistrelle account for 53.32% of passes recorded with 16.68% of summer soprano pipistrelle calls recorded at LT10 and 15.97% at LT11. Common Pipistrelle account for the next highest number of recorded passes with 22.26% followed by Leisler's bat which account for 17.71% of the passes recorded. The remaining species collected collectively account for only 6.71% of the passes recorded. Detectors LT11, LT10 and LT1 (2025) have the top three highest number of recordings respectively. Detector LT10 (2025) is located on cutover bog with scrub adjacent, and LT11 (2025) is located on cutover bog with scrub and immature woodland adjacent. Detector LT1 (2025) is located within scrub habitat. Figure 3-9 shows a season-wide trend where common pipistrelle, soprano pipistrelle and Leisler's bat activity peaks at 22:00, decreases until 03:00 and rises slightly for common pipistrelle and Leisler's bat again between 03:00 to 05:00 before almost completely ceasing by 06:00.

Table 3-13: Total number of passes recorded per species per detector for summer 2025

Row Labels	General Location/ Habitat Association	Myotis Daubentonii	Myotis nattereri	Myotis mystacinus	Nyctalus leisleri	Pipistrellus pipistrellus	Pipistrellus pygmaeus	Pipistrellus nathusii	Plecotus auritus	Total
LT1	WS1 - Scrub	36	4	36	287	601	1468	2	21	2455
LT2	PB4 - Cutover bog	32	17	25	389	450	958	2	31	1904
LT3	PB4 - Cutover bog	66	11	5	347	343	865	0	27	1664
LT4	WS1 - Scrub	28	10	16	414	292	751	0	15	1526
LT5	PB4 - Cutover bog	37	17	11	444	391	670	6	46	1622
LT6	WS2 - Immature woodland	33	11	13	219	217	285	0	8	786
LT7	PB4 - Cutover bog	33	17	16	515	869	880	4	50	2384
LT8	WS2 - Immature woodland	75	20	13	529	451	951	0	38	2077
LT9	WS1 - Scrub	71	177	5	318	485	1173	4	41	2274
LT10	PB4 - Cutover bog	68	35	27	152	477	1982	0	21	2762
LT11	WS2 - Immature woodland	81	52	6	332	383	1897	4	72	2827
Total		560	371	173	3946	4959	11880	22	370	22281

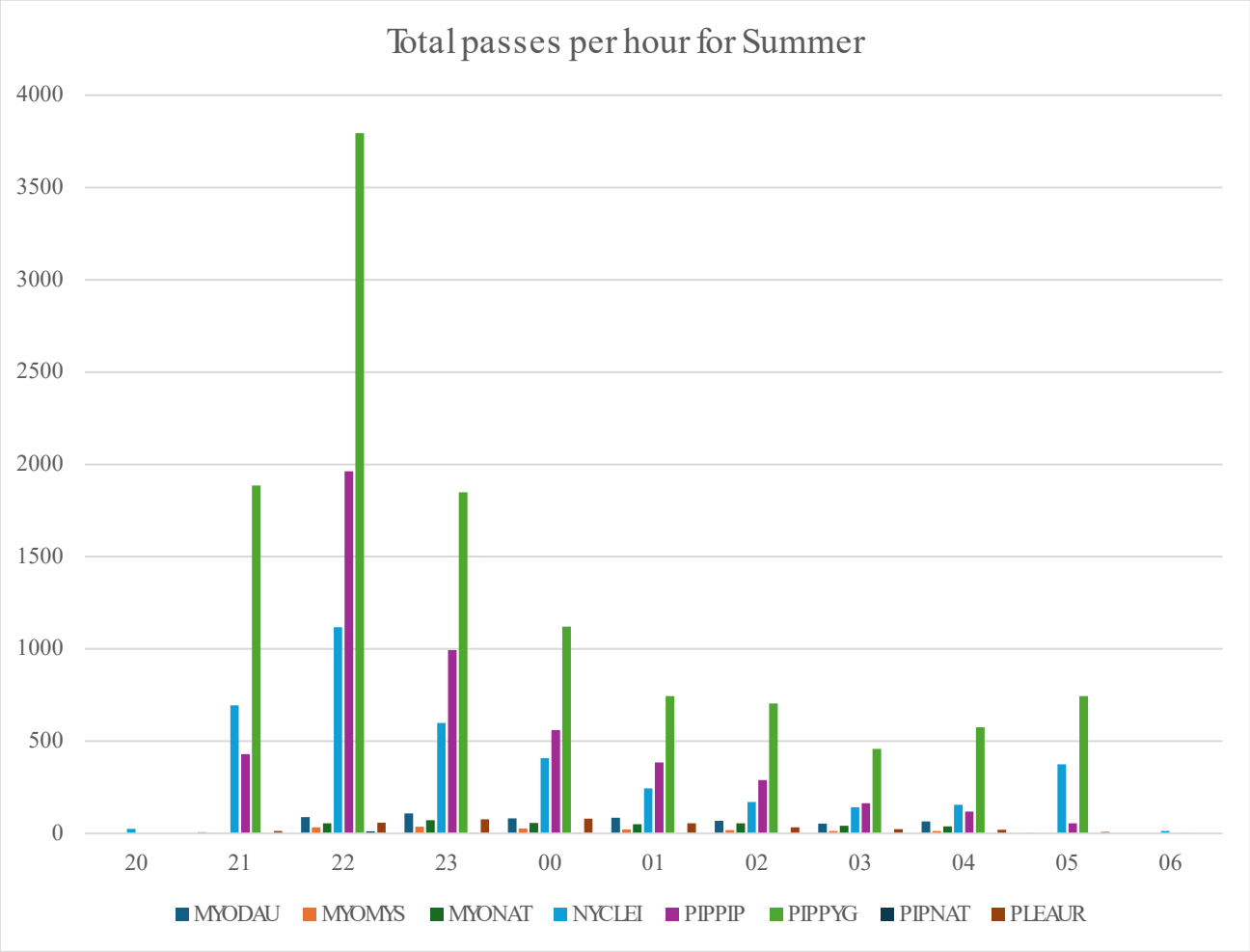


Figure 3-9: Total number of bat passes per hour per species for all 2025 summer detector locations

3.6.2.3 2025 - Autumn (Round 3)

During the autumn deployment there were a total of 6574 passes recorded across 11 detectors (refer to Table 3-14).

Soprano pipistrelle account for 43.14% of passes recorded with 19.57% of autumn soprano pipistrelle calls recorded at Detector LT1 (2025) and 18.58% at LT10. Leisler's bat accounts for the next highest number of recorded passes with 28.2% followed by common pipistrelle which account for 13.37% of the passes recorded. The remaining species collectively account for only 15.29% of recorded passes. Detectors LT8, LT9 and LT1 (2025) have the top three highest number of recordings respectively. Detectors LT9 and LT1 (2025) are located in scrub with immature woodland also adjacent at Detector LT9. The detector LT8 (2025) deployment location is on cutover bog adjacent to scrub connected to nearby immature woodland habitat. Figure 3-10 shows that common pipistrelle, soprano pipistrelle and Leisler's bat activity peaks at 21:00 and decreases until 05:00 where it rises slightly before decreasing again at 06:00.

Table 3-14: Total number of passes recorded per species per detector for autumn 2025

Row Labels	General Location/ Habitat Association	Myotis Daubentonii	Myotis nattereri	Myotis mystacinus	Nyctalus leisleri	Pipistrellus pipistrellus	Pipistrellus pygmaeus	Pipistrellus nathusii	Plecotus auritus	Total
LT1	WS1 - Scrub	23	5	0	149	106	555	0	23	861
LT2	PB4 - Cutover bog	20	0	0	176	48	242	0	5	491
LT3	PB4 - Cutover bog	11	4	9	114	28	166	0	9	341
LT4	WS1 - Scrub	17	15	0	207	66	126	0	35	466
LT5	PB4 - Cutover bog	12	10	1	208	64	129	1	42	467
LT6	WS2 - Immature woodland	25	10	0	148	77	153	0	14	427
LT7	PB4 - Cutover bog	39	10	0	226	60	250	0	24	609
LT8	WS2 - Immature woodland	20	13	10	450	306	150	0	38	987
LT9	WS1 - Scrub	181	160	9	76	34	326	4	100	890
LT10	PB4 - Cutover bog	20	6	3	27	52	527	0	10	645
LT11	WS2 - Immature woodland	30	16	0	73	38	212	2	19	390
Total		398	249	32	1854	879	2836	7	319	6574

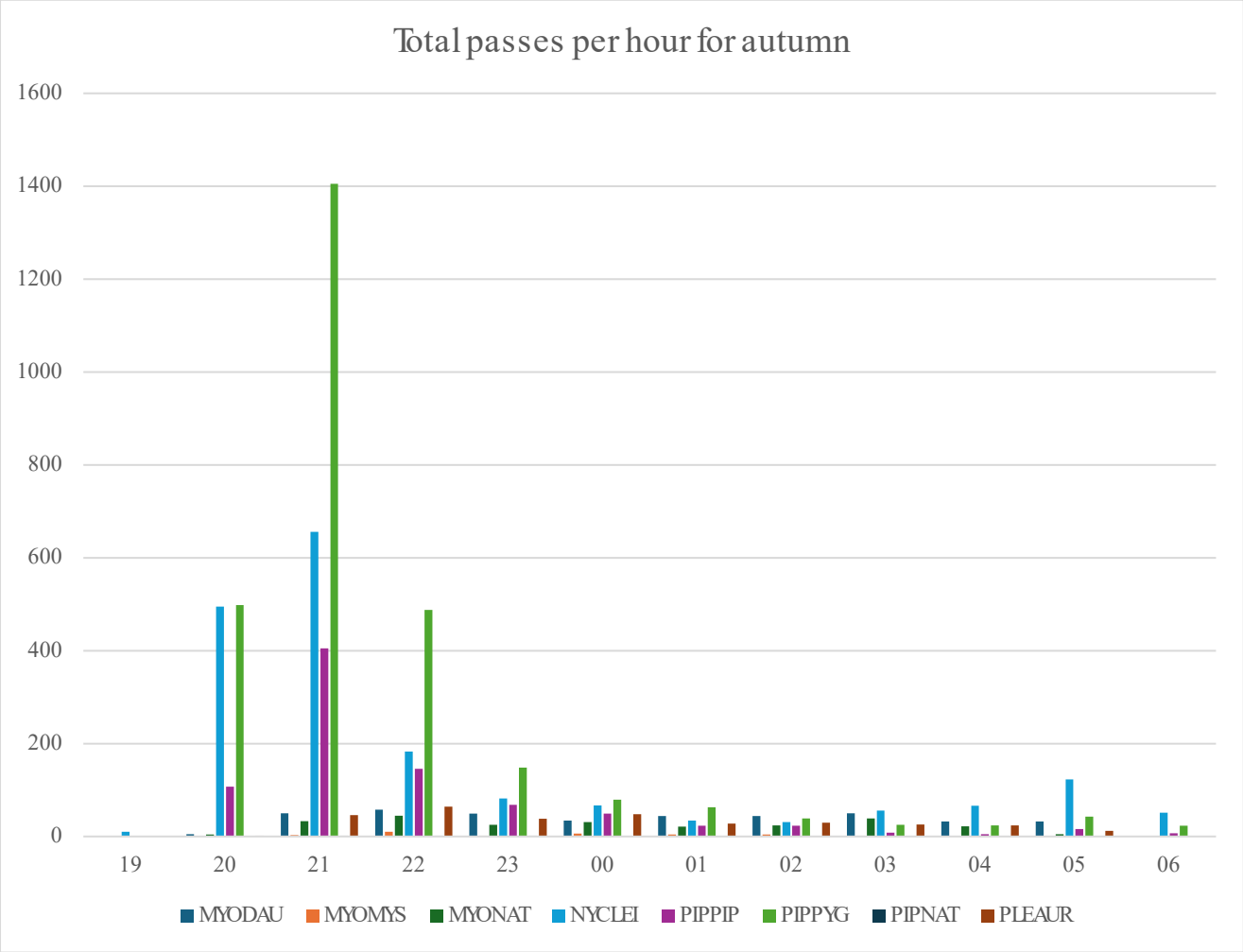


Figure 3-10: Total number of bat passes per hour per species for all 2025 Autumn detector locations

3.6.3 Association of bat activity with habitat features

Table 3-15 identifies the proposed turbine locations and the detector with activity for that location based on habitat type and location within the site. It further identifies if the activity level is accurate (static present at exact location of the turbine) or representative (activity levels within similar habitat within the site) for further NatureScot analysis. This is consistent with NatureScot et al. (2021), which advises that, "Where it is not possible to position static detectors at the exact turbine locations, they should be placed in representative habitats that provide the best indication of bat activity levels likely to occur at the turbine locations".

Table 3-15: Turbine locations and associated detectors

Proposed Turbine	Detector Location Accurate	Detector Location Representative	Rationale
T01	2025	2023	2025 static detector LT1 was placed within the turbine location providing an accurate positioning of the detector relative to the turbine location. 2023 (L1) while not within the precise location of the final turbine layout, is within the same area of scrub providing a reliable indicator of the bat activity in the area
T02	2025	2023	2025 static detector LT2 was placed within the turbine location providing an accurate positioning of the detector relative to the turbine location. 2023 (L2) while not within the precise location of the final turbine layout, is within the same area of cutover bog providing a reliable indicator of the bat activity in the area
T03	2025	2023	2025 static detector LT3 was placed within the turbine location providing an accurate positioning of the detector relative to the turbine location. Detector L3 (2023) was located on cutover bog close to final turbine layout, representative of the habitat type and general location of the 2023 turbine location.
T04	2025	2023	2025 static detector LT4 was placed within the turbine location providing an accurate positioning of the detector relative to the turbine location. 2023 L4 while not within the precise location of the final turbine layout, is within the same area of scrub providing a reliable indicator of the bat activity in the area
T05	2025	2023	2025 static detector LT5 was placed within the turbine location providing an accurate positioning of the detector relative to the turbine location. 2023 (L5) while not within the precise location of the final turbine layout, is within the same area of cutover bog providing a reliable indicator of the bat activity in the area
T06	2025	2023	2025 static detector (LT6) was placed within the turbine location providing an accurate positioning of the detector relative to the turbine location. 2023 (L6) while not within the precise location of the final turbine layout, is within the same area of cutover bog/ immature woodland interface, providing a reliable indicator of the bat activity in the area
T07	2025	2023	2025 static detector (LT7) was placed within the turbine location providing an accurate positioning of the detector relative to the turbine location. 2023 (L7) while not within the precise location of the final turbine

Proposed Turbine	Detector Location Accurate	Detector Location Representative	Rationale
			layout, is within the same area of cutover bog along the same edge of woodland providing a reliable indicator of the bat activity in the area.
T08		2023, 2025	Detector LT8 (2025) was placed in cutover bog at the edge of scrub connected to the area of immature woodland area where T8 is proposed to be located; therefore the detector data is representative of the turbine location, and the habitat mosaic present in this part of the site. Similarly, detector L8 (2023) was located in cutover bog at the edge of immature woodland and as such is representative of the habitat type where T8 is proposed to be located.
T09	2023, 2025		The static detectors for 2025 (LT9) and 2023 (L9) were both placed within the turbine location providing an accurate positioning of the detector relative to the turbine location.
T10	2023, 2025		The static detectors for 2025 (LT10) and 2023 (L10) were both placed within the turbine location providing an accurate positioning of the detector relative to the turbine location
T11	2025	2023	2025 static detector (LT11) was placed within the turbine location providing an accurate positioning of the detector relative to the turbine location. 2023 (L7) while not within the precise location of the final turbine layout, is within the same area of cutover bog along the same edge of woodland providing a reliable indicator of the bat activity in the area.

3.6.4 Activity Assessment

Statistical analysis was carried out for the data obtained for each of the years 2023 and 2025 using Ecobat refer to Appendices 1 & 2). Refer to Table 3-17and Table 3-18 for visualisation of median levels and Appendices 1 and 2 for full breakdown of analyses. As per Table 3-16 below, the colour scheme applies to the following values for each species recorded:

Table 3-16: Bat activity levels categorised by percentile scores

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

Table 3-17: Activity per species and detector (2023)

Activity level classification based on median percentiles categorised as per Table 3-16 above.

			Median Percentiles							
		Location	Myotis daubentonii	Myotis mystacinus	Myotis nattereri	Nyctalus leisleri	Pipistrellus nathusii	Pipistrellus pipistrellus	Pipistrellus pygmaeus	Plecotus auritus
2023	Spring	L1	6	2	0	1	37	4	9	4
		L2	6	2	6	1	18	4	11	4
		L3	8	0	6	2	0	2	4	1
		L4	9	2	6	2	0	0	2	1
		L5	1	0	10	2	0	0	1	1
		L6	9	2	15	4	23	8	1	7
		L7	6	2	0	3	11	0	1	4
		L8	14	4	6	6	14	1	1	7
		L9	6	4	13	6	0	0	5	4
		L10	12	4	10	8	8	1	6	13
		L11	9	2	6	6	8	2	15	13
	Summer	L1	11	6	13	4	0	1	13	13
		L2	11	0	0	1	0	0	6	4
		L3	4	6	19	2	0	0	3	5
		L4	2	3	12	4	0	0	2	4
		L5	6	3	6	4	0	0	3	4
		L6	9	6	18	4	0	1	3	13

			Median Percentiles							
		Location	Myotis daubentonii	Myotis mystacinus	Myotis nattereri	Nyctalus leisleri	Pipistrellus nathusii	Pipistrellus pipistrellus	Pipistrellus pygmaeus	Plecotus auritus
		L7	6	3	6	2	0	0	3	9
		L8	9	3	6	8	0	2	1	9
		L9	8	4	33	9	8	0	2	15
		L10	11	5	19	5	0	0	12	4
		L11	10	5	12	6	0	0	8	9
	Autumn	L1	11	3	22	3	0	0	0	7
	Autumn	L2	6	0	5	0	11	0	0	1
	Autumn	L3	-	-	-	-	-	-	-	-
	Autumn	L4	5	3	5	0	8	0	0	1
	Autumn	L5	3	0	5	0	11	0	0	1
	Autumn	L6	7	3	5	4	11	0	0	4
	Autumn	L7	11	3	5	4	0	0	0	4
	Autumn	L8	1	3	22	1	8	0	0	1
	Autumn	L9	13	3	20	3	11	0	0	1
	Autumn	L10	5	1	15	0	8	0	12	4
	Autumn	L11	5	1	12	0	14	0	0	1

Table 3-18: Activity per species and detector (2025)

Activity level classification based on median percentiles categorised as per Table 3-16 above.

			Median Percentiles							
		Location	Myotis daubentonii	Myotis mystacinus	Myotis nattereri	Nyctalus leisleri	Pipistrellus nathusii	Pipistrellus pipistrellus	Pipistrellus pygmaeus	Plecotus auritus
2025	Spring	LT1	5	1	5	1	18	0	1	4
		LT2	1	0	0	1	13	0	1	1
		LT3	5	1	5	1	8	0	1	3
		LT4	7	2	0	0	15	0	0	0
		LT5	4	1	0	16	22	0	0	1
		LT6	1	1	0	3	34	4	4	9
		LT7	5	0	0	3	13	1	1	4
		LT8	1	0	5	5	35	8	4	13
		LT9	1	0	19	1	8	0	4	3
		LT10	5	2	5	4	13	2	5	3
		LT11	-	-	-	-	-	-	-	-
	Summer	LT1	6	3	7	5	9	0	13	7
		LT2	6	3	15	10	9	0	9	4
		LT3	9	3	7	9	0	0	8	4
		LT4	6	3	7	7	0	0	6	1
		LT5	6	3	7	10	9	0	4	7

			Median Percentiles							
		Location	Myotis daubentonii	Myotis mystacinus	Myotis nattereri	Nyctalus leisleri	Pipistrellus nathusii	Pipistrellus pipistrellus	Pipistrellus pygmaeus	Plecotus auritus
		LT6	9	6	7	7	0	0	3	1
		LT7	6	3	7	9	9	1	7	4
		LT8	9	5	15	12	0	0	9	4
		LT9	11	3	32	6	9	0	9	7
		LT10	12	6	15	3	0	0	16	4
		LT11	14	3	15	9	9	0	14	9
	Autumn	LT1	6	0	7	2	0	0	7	4
	Autumn	LT2	6	0	0	5	0	0	3	1
	Autumn	LT3	2	1	10	2	0	0	1	1
	Autumn	LT4	2	0	7	3	0	0	0	9
	Autumn	LT5	2	1	13	3	8	0	0	9
	Autumn	LT6	6	0	7	4	0	0	1	1
	Autumn	LT7	7	0	7	5	0	0	2	3
	Autumn	LT8	2	1	7	9	0	0	1	9
	Autumn	LT9	21	1	33	2	8	0	2	18
	Autumn	LT10	6	1	7	0	0	0	3	1
	Autumn	LT11	6	0	7	1	8	0	2	1

Assessment of Site Risk - Collision Mortality Risk

Based on the two-stage approach assessing potential risk to bats (NatureScot 2021), taking into consideration habitat and development related features (refer to Table 3-19). An overall assessment of risk can then be made by considering the site assessment in relation to the bat activity output from Table 3-17 and Table 3-18 (refer to Table 3-19) and taking into account the relative vulnerability of each species of bat present at the population level based on the NatureScot (2021) receptor evaluation (adapted from Wray et al., 2010) aligned to the Irish context referencing IWM 134 '*Bat mitigation Guidelines for Ireland*' (Marnell et al., 2022) and Article 17 Reporting/Guidance (refer to Table 3-19).

Eight species of bat were recorded during the 2023 and 2025 bat surveys at the proposed development. Table 3-22 provides an ecological evaluation 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, namely Common pipistrelle, Soprano pipistrelle, Nathusius's pipistrelle and Leisler's bat (Table 3-22).

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

Using the NatureScot guidelines outlined in Table 3-19, the following risk assessment for the individual turbines in relation to each bat species recorded was completed using the following values:

Project Size = **Medium** (>10 turbines, other wind energy developments within 10km)

Habitat Risk = **Low** (habitats mainly consist of cutover bog, immature woodland and scrub with low bat activity and no roost features)

Therefore, based on Table 3-19, a Site Risk Assessment score value of 2 was applied to the site as a whole. The impact assessment is determined by multiplying the Site Risk Assessment value (2) by the Ecobat median percentile (most frequent activity category) activity values for each turbine, converted to the activity score as shown in Table 3-21. See Table 3-21 for conversion of median percentiles to Ecobat activity levels (there are 5 ecobat activity levels across the median percentile range of 0-100)

The Impact Assessment is then carried out for the individual turbines using the overall site assessment value (2) and compared to the Risk Assessment Matrix (Table 3-21) in order to determine the level of overall risk to the population.

Table 3-19: Initial site risk assessment NatureScot (2021)

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.

Table 3-20: Stage 1 site risk assessment based on habitat and project size as outlined in NatureScot (2021)

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

Table 3-21: Risk assessment matrix

	Ecobat activity percentile category					
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)

Table 3-22: Level of potential vulnerability of populations of Irish bats species (NatureScot, 2021; adapted from Wray *et al.*, 2010)

	Low collision risk	Medium collision risk	High collision risk
Common species	N/A	N/A	Common pipistrelle Soprano pipistrelle Leisler's bat
Rare Species	Brown long-eared bat Daubentons bat Natterers bat	N/A	Nathusius's pipistrelle
Rarer Species	Whiskered bat	N/A	N/A

The median percentile activity levels for each of the High Risk (leisler, common pipistrelle, soprano pipistrelle and nathusius's pipistrelle) were averaged across each survey season and converted to the corresponding Ecobat activity category for use in the risk assessment matrix (Table 3-21).

Table 3-23: Risk assessment for each detector location for the four high risk bat species for 2023

			Leislers bat		Common pipistrelle		Soprano pipistrelle		Nathusius's pipistrelle	
	Detector ID	Site risk value	Ecobat median category	Detector risk (site risk x median category)	Ecobat median category	Detector risk (site risk x median category)	Ecobat median category	Detector risk (site risk x median category)	Ecobat median category	Detector risk (site risk x median category)
Spring	L1	2	1	2	1	2	1	2	2	4
	L2	2	1	2	1	2	1	2	1	2
	L3	2	1	2	1	2	1	2	0	0
	L4	2	1	2	0	0	1	2	0	0
	L5	2	1	2	0	0	1	2	0	0
	L6	2	1	2	1	2	1	2	2	4
	L7	2	1	2	0	0	1	2	1	2
	L8	2	1	2	1	2	1	2	1	2
	L9	2	1	2	0	0	1	2	0	0
	L10	2	1	2	1	2	1	2	1	2
	L11	2	1	2	1	2	1	2	1	2

			Leislers bat		Common pipistrelle		Soprano pipistrelle		Nathusius's pipistrelle	
	Detector ID	Site risk value	Ecobat median category	Detector risk (site risk x median category)	Ecobat median category	Detector risk (site risk x median category)	Ecobat median category	Detector risk (site risk x median category)	Ecobat median category	Detector risk (site risk x median category)
Summer	L1	2	1	2	1	2	1	2	0	0
	L2	2	1	2	0	0	1	2	0	0
	L3	2	1	2	0	0	1	2	0	0
	L4	2	1	2	0	0	1	2	0	0
	L5	2	1	2	0	0	1	2	0	0
	L6	2	1	2	1	2	1	2	0	0
	L7	2	1	2	0	0	1	2	0	0
	L8	2	1	2	1	2	1	2	0	0
	L9	2	1	2	0	0	1	2	1	2
	L10	2	1	2	0	0	1	2	0	0
	L11	2	1	2	0	0	1	2	0	0

			Leislers bat		Common pipistrelle		Soprano pipistrelle		Nathusius's pipistrelle	
	Detector ID	Site risk value	Ecobat median category	Detector risk (site risk x median category)	Ecobat median category	Detector risk (site risk x median category)	Ecobat median category	Detector risk (site risk x median category)	Ecobat median category	Detector risk (site risk x median category)
Autumn	L1	2	1	2	0	0	0	0	0	0
	L2	2	0	0	0	0	0	0	1	2
	L3	2	-	-	-	-	-	-	-	-
	L4	2	0	0	0	0	0	0	1	2
	L5	2	0	0	0	0	0	0	1	2
	L6	2	1	2	0	0	0	0	1	2
	L7	2	1	2	0	0	0	0	0	0
	L8	2	1	2	0	0	0	0	1	2
	L9	2	1	2	0	0	0	0	1	2
	L10	2	0	0	0	0	1	2	1	2
	L11	2	0	0	0	0	0	0	1	2

Table 3-24: Risk assessment for each detector location for the four high risk bat species for 2025

			Leislers bat		Common pipistrelle		Soprano pipistrelle		Nathusius'spipistrelle	
	Detector ID	Site risk value	Ecobat median category	Detector risk (site risk x median category)	Ecobat median category	Detector risk (site risk x median category)	Ecobat median category	Detector risk (site risk x median category)	Ecobat median category	Detector risk (site risk x median category)
Spring	LT1	2	1	2	0	0	1	2	1	2
	LT2	2	1	2	0	0	1	2	1	2
	LT3	2	1	2	0	0	1	2	1	2
	LT4	2	0	0	0	0	0	0	1	2
	LT5	2	1	2	0	0	0	0	2	4
	LT6	2	1	2	1	2	1	2	2	4
	LT7	2	1	2	1	2	1	2	1	2
	LT8	2	1	2	1	2	1	2	2	4
	LT9	2	1	2	0	0	1	2	1	2
	LT10	2	1	2	1	2	1	2	1	2
	LT11	2	-	-	-	-	-	-	-	-

			Leislers bat		Common pipistrelle		Soprano pipistrelle		Nathusius'spipistrelle	
	Detector ID	Site risk value	Ecobat median category	Detector risk (site risk x median category)	Ecobat median category	Detector risk (site risk x median category)	Ecobat median category	Detector risk (site risk x median category)	Ecobat median category	Detector risk (site risk x median category)
Summer	LT1	2	1	2	0	0	1	2	1	2
	LT2	2	1	2	0	0	1	2	1	2
	LT3	2	1	2	0	0	1	2	0	0
	LT4	2	1	2	0	0	1	2	0	0
	LT5	2	1	2	0	0	1	2	1	2
	LT6	2	1	2	0	0	1	2	0	0
	LT7	2	1	2	1	2	1	2	1	2
	LT8	2	1	2	0	0	1	2	0	0
	LT9	2	1	2	0	0	1	2	1	2
	LT10	2	1	2	0	0	1	2	0	0
	LT11	2	1	2	0	0	1	2	1	2

			Leislers bat		Common pipistrelle		Soprano pipistrelle		Nathusius'spipistrelle	
	Detector ID	Site risk value	Ecobat median category	Detector risk (site risk x median category)	Ecobat median category	Detector risk (site risk x median category)	Ecobat median category	Detector risk (site risk x median category)	Ecobat median category	Detector risk (site risk x median category)
Autumn	LT1	2	1	2	0	0	1	2	0	0
	LT2	2	1	2	0	0	1	2	0	0
	LT3	2	1	2	0	0	1	2	0	0
	LT4	2	1	2	0	0	0	0	0	0
	LT5	2	1	2	0	0	0	0	1	2
	LT6	2	1	2	0	0	1	2	0	0
	LT7	2	1	2	0	0	1	2	0	0
	LT8	2	1	2	0	0	1	2	0	0
	LT9	2	1	2	0	0	1	2	1	2
	LT10	2	0	0	0	0	1	2	0	0
	LT11	2	1	2	0	0	1	2	1	2

3.6.4.1 Summary of Findings

Across both survey years, activity levels recorded at detector locations were generally low, with most species falling within the lowest Ecobat activity categories.

Eight bat species were recorded during the surveys. In accordance with NatureScot (2021) guidance (adapted to the Irish context), four species are considered high collision risk in relation to wind energy developments: Common pipistrelle, Soprano pipistrelle, Nathusius's pipistrelle and Leisler's bat. All species recorded are listed as 'Least Concern' on the Irish Red List and are protected under the EU Habitats Directive (Annex IV) and the Wildlife Acts.

The site was assessed using the two-stage NatureScot (2021) approach. Given that the project comprises a medium-sized development (>10 turbines) and is located primarily within low-risk habitats (cutover bog, immature woodland and scrub, with no identified roost features and generally low bat activity), an overall Site Risk Level of 2 (Low) was assigned.

Seasonally, slightly higher activity percentiles were observed during summer at some locations, particularly for common and soprano pipistrelle, and Nathusius's pipistrelle. However, these increases did not alter the overall risk classification due to the low site risk score and generally low-to-moderate activity categories.

Overall, the assessment indicates that the proposed development presents a low collision mortality risk to local bat populations, including the four higher-risk species, when considered in the context of habitat suitability, recorded activity levels, and species vulnerability at the population level.

4. DISCUSSION

4.1 Static Detector Analysis

As per SNH (2021) guidance, wind farms present four potential risks to bats (i) Collision mortality, barotrauma and other injuries, (ii) Loss or damage to commuting and foraging habitat, (iii) Loss of, or damage to, roosts (iv) Displacement of individuals or populations

The species considered at highest risk from death by collision or barotrauma at wind developments are Leisler's bat and Nathusius's pipistrelle (SNH, 2021). These species habitually forage and commute in open airspace and at the heights of the rotor swept area of wind turbines. Based on Ecobat analysis (median percentile activity score) of 2023 & 2025 data, Leisler's bat had low activity at all turbine locations. In 2023, Nathusius's pipistrelle activity was low across all turbines, except for L1 and L6 static detectors during Round 1 (Spring), recorded a median percentile of 37 & 23 respectively giving a score of low-moderate (scores between 21-40) compared with the low median percentiles ranging from 0-20 observed on all other detectors that year. Similarly, in 2025, Nathusius's pipistrelle activity remained low across all rounds and locations with exceptions seen during Round 1 (Spring), detectors LT5, LT6, and LT8 giving median percentile scores of 22, 34 & 35 respectively giving a low-moderate level of activity, while all other detectors recorded low activity levels within the 0-20 median percentile.

This slight increase in median percentile while still being low/ low-moderate for Nathusius' pipistrelle is due to Nathusius' pipistrelle being more common in the North of Ireland than in the south where Littleton is located. As such, its core distribution zone does not typically extend into the Littleton area. As a result, Ecobat which compares activity levels only against its national (all-Ireland) dataset rather than region-specific baselines produces a higher score for the species despite the fact that very little Nathusius' pipistrelle activity was recorded on site. The software reflects limitations in the dataset rather than local activity for Nathusius's bat. This pattern mirrors the behaviour of Ecobat percentiles for lesser horseshoe bat, a species whose natural Irish range is confined to the west. When recordings occur outside this typical range, Ecobat again produces misleading percentiles because the comparison pool does not represent the species' true geographical distribution. In both cases, the tool can over-emphasise relative activity; to put this in perspective, Nathusius's bat had the lowest number of recordings of all species across the proposed wind farm.

Based on actual number of recordings (as opposed to Ecobat scores) Nathusius's pipistrelle activity throughout the site was lowest in comparison with all other species present at all turbine locations. Notwithstanding the slightly higher median percentiles for this species at some turbine locations, the impact level associated with turbine risk for Nathusius's pipistrelle remains low at all proposed turbine locations.

Soprano Pipistrelle and Common Pipistrelle are identified as being the next most vulnerable group of bats to collision fatality at wind farms in Ireland (SNH, 2021). These species are widespread and common in Ireland and will generally be recorded at sites throughout the country. Their status as widespread species with a high risk of collision mortality puts them in the category of species with medium population vulnerability to wind farms (SNH, 2021).

During Static Detector surveys in 2023, Common pipistrelle was the most common species recorded with soprano pipistrelle the second most common, while in 2025 soprano pipistrelle was the most common species recorded with common pipistrelle being the second most recorded species. While these species were the species with the highest overall occurrence in 2023 and 2025, Ecobat analysis did not indicate high activity levels for either species. Based on Ecobat analysis (median percentile activity score) of 2023 and 2025, common and soprano pipistrelle had low activity at all turbine locations. As such, the impact level associated with turbine risk for these species remained low at all locations.

Common pipistrelles have been demonstrated to be attracted to wind turbines and occur around wind turbines at higher levels than at control locations nearby (Richardson et al 2021). Therefore, it is assessed that despite the consistently low activity levels indicated for this species by Ecobat analysis, there is potential for common pipistrelle to be affected by the proposed wind farm prior to mitigation.

4.2 Activity Surveys

Activity surveys recorded bat activity from six of the eight species detected by static detectors, with no records of whiskered bat or Natterer's bat during activity surveys. Foraging and commuting activity was observed across all habitat types present within the study area. However, bat activity was not evenly distributed and was most strongly associated with key commuting corridors, particularly along the southern access route into Littleton Bog and the eastern margin of Lanespark Bog (where proposed turbines T9, T10 and T11 are located). Activity was most concentrated along the southern entrance to Littleton bog and entrance to Lanespark bog during survey round 1, while rounds 2 and 3 showed the majority of bat observations occurring along the eastern side of Lanespark Bog with Littleton bog showing much lower levels of activity.

The patterns of activity recorded during the activity surveys closely align with the findings of the static detector surveys, providing complementary information on the spatial distribution of bat activity and habitat usage patterns of the bat species across the site, reinforcing static bat detector results.

4.3 Risk and Impact Assessment

This risk assessment has been prepared in accordance with NatureScot (2021) guidance which identifies the following potential risks to bats associated with windfarms:

- Collision mortality, barotrauma and other injuries
- Loss or degradation of commuting and foraging habitats
- Loss, or damage to roost sites
- Displacement of individuals or populations

Information on bat distribution and activity within the Proposed Wind Farm has been used to assess the potential impacts on bat populations for each of these four risks.

4.3.1 Collision mortality

4.3.1.1 Assessment of Site Risk

The likely impact of a proposed development on bats is related to site-based risk factors, including habitat and development features. The site risk assessment as seen in Section 3.2.4 above evaluated site-based risk factors of habitat risk and project site and concluded a final risk assessment of low risk to bats, taking into account the lack of roosts, low habitat value and medium-scale project.

4.3.1.2 Assessment of Collision Risk

Four high-risk species were recorded during surveys, as shown in Table 3-21: Leisler's bat, Common pipistrelle, Soprano pipistrelle, and Nathusius's pipistrelle. Collision risk for these species was evaluated using the NatureScot risk assessment matrix presented in Table 3-22. In line with NatureScot guidance, assessments were based on median activity levels to determine overall risk.

Activity levels for all four species were low; therefore, significant collision-related impacts are not anticipated. Activity levels will continue to be monitored during the operational phase, in accordance with best-practice guidance mitigation measures. Additional mitigation will be introduced after Year 1 if required.

All four high risk bat species showed low levels of activity throughout all rounds for 2023 and 2025. Leisler's bat, Common pipistrelle and soprano pipistrelle all had a score of 2 giving them low overall risk for each of the turbine locations in 2023 and 2025. Nathusius's pipistrelle also got a low overall risk score (score of 2 at all locations except for L1 and L6 in 2023 and LT5, LT6 and LT8 in 2025 where it received a score of 4; overall risk scores of 0-4 indicate low risk). Collision Risk Summary

In accordance with NatureScot (2021) guidance and site-specific activity thresholds, the site-level collision risk for all high-risk bat species at the Proposed Wind Farm was assessed as Low. Overall, bat activity levels were consistent with the habitat present across the Littleton Proposed Wind Farm, which primarily comprises cutover bog (PB4), scrub (WS1), and immature woodland (WS2)—all of which provide features suitable for commuting and foraging bats. Both static detector data and manual transect surveys indicated activity levels typical of bog habitats of low suitability, with generally low bat activity recorded throughout the site.

4.3.2 Loss or Damage to Commuting and Foraging Habitat

In the absence of appropriate design measures, the loss or degradation of commuting and foraging habitat could reduce feeding opportunities and/or displace local bat populations. Littleton Bog is predominantly composed of cutover bog, scrub, and immature woodland, with a full description of habitats provided in Section 3.2 above.

Further details on vegetation removal required within and around the development footprint is detailed in Table 6-28 of Chapter 6 of the EIAR. Any tree removal will be undertaken to maintain an appropriate buffer between turbine blade tips and adjacent canopy, in line with current best practice (Natural England, 2014; NatureScot, 2021). As all suitable bat habitat being lost is of low suitability and there is low levels of bat activity throughout the site it is no expected to negatively impact bat populations in the area. The removal of dense areas of immature woodland of scrub may result in a positive effect to bat populations by increasing linear edge habitat which is known to support commuting and foraging activity.

Most turbines have been positioned to avoid key linear habitat features. Where turbine siting necessitates the removal of linear immature woodland or scrub, these areas are of low ecological value and based on results gathered from static detectors and manual transect activity surveys confirm low activity levels for bats in the area. Furthermore, linear planting habitat occurring elsewhere on site to offset this habitat removal which will incorporate native species appropriate to the local area and will aim to strengthen existing habitat connectivity and ecological function. More detail on the replanting scheme can be found in Appendix 6:1 the Biodiversity Enhancement and Management Plan (BEMP) of the Biodiversity Chapter 6 of the EIAR.

Although these measures will maintain and enhance ecological corridors in the long term, a short- to medium-term reduction in connectivity may occur until newly planted or enhanced features become established. Full details of the enhancement planting are provided in the Biodiversity Management and Enhancement Plan (BMEP) (Appendix 6-4). Following implementation of the replanting measures outlined in the BMEP, no significant effects on bat commuting or foraging habitat are expected.

The proposed substation and temporary construction compound are located within a long linear block of immature woodland and scrub that will be removed during construction. This corridor will be replanted upon completion of works, reinstating bat commuting routes; therefore, only a short-term adverse effect is anticipated. In addition, connectivity on the western side of the woodland block will be maintained by trees retained on the opposite side of the existing rail line. Therefore, only a short-term effect is anticipated.

The peat deposition area will require the clearance of low-quality scrub and associated habitat, which will naturally regenerate over time. Given the low habitat suitability and low bat activity recorded in this area, impacts are expected to be negligible.

The borrow pit is located within agricultural grassland (GA1) bounded by hedgerows (WL1), which will be removed. However, similar commuting habitats are widespread in the surrounding landscape and bat activity levels are low; therefore, the impact on bats is also considered negligible.

The turbine delivery route will affect immature trees at one location: Node 3 (removal of trees) discussed in the Biodiversity Chapter 6 of the EIAR. The affected trees are immature specimens originating from roadside landscaping. Grassy verges along road edges and within roundabout islands will be affected by placement of load bearing material. The remainder of the TDR is within the existing road corridor and as such does not have potential for effects on bat populations.

It is not proposed to fell any trees with potential roosting features. No trees with roosting potential were observed during surveys of the Site and TDR.

Potential effects on trees with PRFs along the grid connection arising from grid connection works are imperceptible due to low suitability and limited size of PRFs (limited to potential to host individual or low numbers of roosting bats), limited landscape connectivity, their disturbed location beside regional roads, and separation from works areas placing them outside the ZoI for direct effects.

Overall, given the large proportion of the site that will remain undisturbed, alongside the targeted retention and enhancement of key habitat features, no significant effects on bat commuting or foraging habitat are predicted as a result of the Proposed Project.

4.3.3 Loss of, or damage to, Roosts

No Potential Roost Features (PRFs) were identified within 300 m of the proposed turbine locations or within 200 m of proposed infrastructure at the wind farm site, and no PRFs were identified in areas potentially affected by the TDR. Roost assessments undertaken along the grid connection route included the inspection of bridges and trees. Examination of bridges identified two structures that required emergence surveys; however, no bat emergence or evidence of roost occupancy was recorded during surveys. Both bridges were assessed as having potential for use as night roosts during the summer period. The proposed HDD crossing methodology for rivers along the GC will avoid both direct effects and disturbance of bats potentially roosting in bridges.

The roost survey of trees along the grid connection identified a number of PRFs; however, these features were assessed as having negligible to low suitability. Given their location along the R693/R694 regional roads reducing roosting suitability due to existing traffic disturbance and the absence of direct effects from grid connection works, potential impacts on these PRFs are considered to be imperceptible.

As such, potential effects in this category are limited to Temporary Imperceptible effects at Local scale.

4.3.4 Displacement of Individuals or Populations

The proposed wind farm is situated within Cutover bog (PB4), Scrub (WS1) and Immature woodland (WS2) with smaller areas all of which are of low suitability for commuting, foraging and roosting bats.

As part of the Proposed Project, a number of linear areas of scrub and immature woodland are located within the bat felling buffers and infrastructure development footprint will require removal or partial clearance. Although these features contribute to the site's overall connectivity and habitat diversity, the majority of linear features within the site will be retained, and habitat fragmentation has been avoided in the layout design.

Mitigation measures to minimise the potential risk of displacement include targeted retention of linear habitat features and implementation of enhancement planting to restore and improve connectivity across the site. These measures are further detailed in the Section 2.1 and the Biodiversity Enhancement and Management Plan (BEMP).

4.4 Best Practice and Mitigation Measures

This section outlines the best-practice and site-specific mitigation measures implemented at the proposed development to avoid or minimise the potential for significant impacts on local bat populations.

4.4.1 Standard Best Practice Measures

4.4.1.1 Noise Restrictions

During construction, all machinery will be managed to minimise unnecessary noise and emissions. Equipment will be shut down when idle, and all plant used on site will meet the noise control requirements set out in the Construction Plant and Equipment Permissible Noise Levels Regulations (S.I. No. 632 of 2001, as amended).

Given the short duration of the proposed works and the low levels of bat activity in the surrounding area, noise and vibration effects are anticipated to be minimal.

4.4.1.2 Lighting Restrictions

In general, artificial light creates a barrier to bats so lighting has been 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 will limit night-time works to sections of the route / Site which avoid sensitive features (e.g. mature treelines, conifer plantation edge and tracks). 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 will 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.

During the operational phase, it appears that the lighting on top of wind turbines may affect the likelihood of bats colliding with turbines. Research on this topic, which is reviewed in Powelsland (2009), indicates that intermittent lighting is less likely to cause species to collide with turbines.

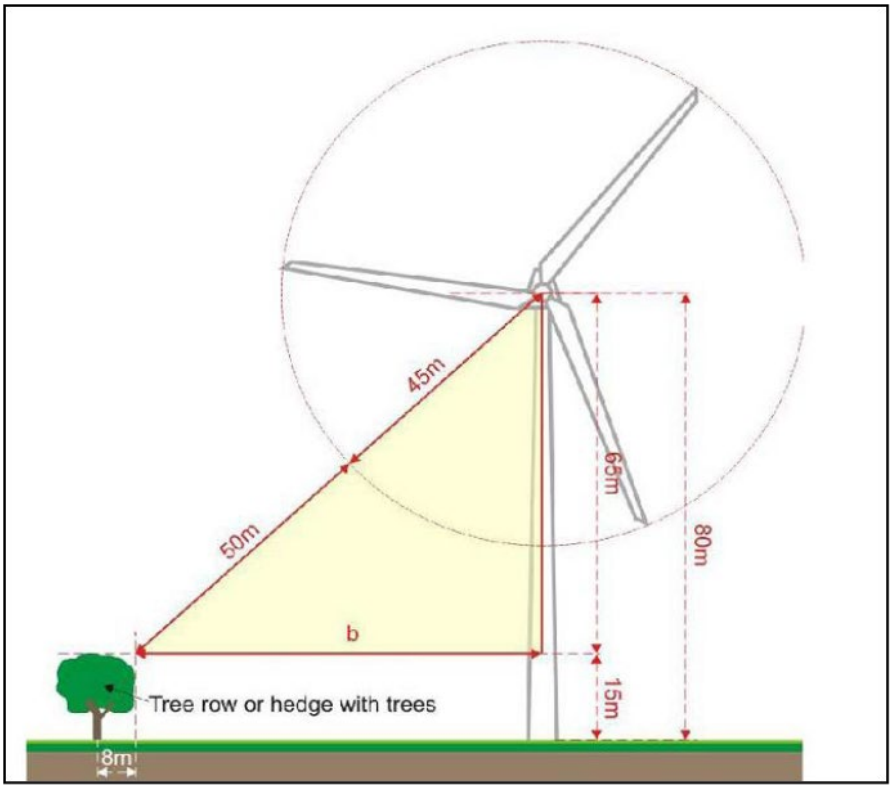
As such, flashing red aviation obstruction lights will be provided on perimeter turbines, subject to approval by the IAA. These will not negatively impact bats (Bennett and Hale 2014).

4.4.1.3 Bat Felling Buffers

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. "*

These distances were taken into account during the design phase of the development. To minimize risk to bat populations, a vegetation clearance buffer zone will be provided around the turbines. The following formula was used to calculate the required felling buffer for the turbines (with example image taken from Natural England – note not reflective of turbine dimensions the subject of this EIAR). Calculations were run for the proposed turbine dimensions in terms of hub height and blade length, and the bat buffer area is assessed in the Biodiversity Chapter 6 of the EIAR.



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

where:
b = the distance on the ground between the edge of the canopy and the turbine (m)
bl = blade length (81m)
hh = hub height (119m)
fh = tree/hedgerow height (12m)

b = √ {(50 + 81)2 − (119 - 12)2} = 75.6m

Based on this calculation, a 76m buffer (rounded up from 75.6m) has been adopted for all turbines.

Each of the locations of the eleven turbines was surveyed and the vegetation height informed the application of the dimensions of the blade tip buffer at turbine locations, dependant on the surrounding habitat and turbine specification. Taking projected tree growth based on species and site conditions into consideration, a tree height of 12m was assessed as a suitably precautionary height for calculation of buffer sizes at all proposed turbines.

Existing treelines, hedgerows and scrub within the bat buffers for any proposed turbine locations will be removed (note these habitat have been assessed for suitability to support other flora and fauna and have been determined as having local value – mitigation pertaining to site clearance will be employed at these areas). Buffers will be maintained throughout the lifetime of the wind farm as tree-free areas. This will be achieved through mechanical means only; the use of chemical substances is prohibited.

During the operational phase, the tree-free buffer zones around the turbines will be managed and maintained during the operational life of the development. These will be kept clear by mechanical means only (no chemicals / herbicides) and maintained on an annual basis in the same condition as during first clearance.

The immediate surroundings of individual turbines will 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 will be achieved through physical management of habitats without the use of toxic substances.

4.4.1.4 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 unlikely event that a bat roost is found, the NPWS will be informed, and the relevant guidelines will be implemented as appropriate (e.g. NRA guidelines).

4.4.1.5 Proposed Habitat Replacement and Enhancement

A detailed description of the proposed habitat loss, replacement and enhancement can be found in the Biodiversity Enhancement and Management Plan (BEMP) (Appendices 4.1 of the Biodiversity Chapter 6 of the EIAR).

Linear features such as hedgerows and treelines serve as commuting corridors for bats (6.1 of the EIAR) and other wildlife). Vegetation buffer clearance around turbines will alter commuting and foraging routes associated with existing hedgerows and woodland edges to avoid bats entering the rotor sweep zone of turbines. Hedgerow and treeline planting will be carried out for the Proposed Development. This will reinstate or replace linear habitat loss to ensure no net loss of these habitats occurs.

Where hedgerows and treelines are affected by turbine clearance buffers, bats will be directed away from tree-free buffers along an alternative commuting route. Where bat buffers are applied, the surrounding hedgerows and treelines should act as commuting corridors, leading bats away from the turbine location, and these hedgerows should not end abruptly at the bat buffer zones. This will be achieved by planting new pollinator-friendly hedgerows, connecting existing hedgerows onsite, around the bat buffers. Willow and Alder will be included in these hedgerows due to their rapid growth. It is proposed to create double lines of hedgerow, with 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.

To address the loss of scrub and immature woodland within the substation compound footprint, the measures set out in the Biodiversity Enhancement Management Plan will be implemented during construction and post-construction phases. Following completion of works, the area of immature woodland removed will be replanted with downy birch root whips, reflecting the primary pioneer species associated with cutover bog woodland at the Site. In addition, a line of downy birch or other suitable locally native standard trees will be planted along the western boundary adjoining the existing rail line and proposed access track to maintain habitat connectivity for bats while the replanted woodland becomes established. Tree protection measures will be installed to safeguard newly planted trees from grazing during the establishment period.

Peat deposition area will remain available for recolonisation by natural or semi-natural habitats during the operational phase, unlike areas within the permanent infrastructure footprint which will be unavailable for the duration of the development. Following construction, these peat deposit areas will be allowed to regenerate naturally, with surrounding local species facilitating the establishment of grassland and/or heathland habitats in continuity with retained habitats across the Site.

Overall, the proposed planting of new linear habitat, along with broadleaved woodland, will result in a net gain of linear landscape and woodland features within the Site. These measures will enhance both foraging and commuting opportunities for bats that use the area. All planting will consist of species indigenous to the local area.

4.4.1.6 Blade Feathering

As per NatureScot 2021 guidelines the turbine blades will be feathered 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% (NatureScot 2021).

As such, the feathering of blades to prevent 'idling' during low wind speeds will be implemented for all turbines.

4.4.1.7 Cut-in Speeds/Curtailment

While bat activity varied by species, no detector/turbine locations had activity for any species higher than low/moderate levels (based on Ecobat median percentile scores).

Therefore, increased cut-in speeds are not required from commencement of operation, but will rather be reserved for implementation where required based on operational monitoring (see Sections 6.10.3.4.3 and 6.10.3.4.4).

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 effects to bats.

The feathering of turbine blades combined with increased cut-in speeds have been shown to reduce bat fatalities from 30% and up to 90% (Adams et al., 2021, Arnett et al., 2011, 2013; Baerwald et al., 2009). The most recent of studies showed a 63% decrease in fatalities (Adams et al., 2021).

4.4.2 Bat Monitoring Plan

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

4.4.2.1 Pre Construction Surveys

If three years lapse from between EIAR/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; NatureScot, 2021; NIEA, 2021) and includes static detector, activity and roost inspection surveys.

It is not proposed to fell any trees with potential roosting features. No trees with roosting potential were observed during surveys of the Site and TDR.

Potential effects on trees with PRFs along the grid connection arising from grid connection works are imperceptible due to the negligible to low suitability of PRFs, their disturbed location beside the R693 regional road, and separation from works areas placing them outside the ZoI for direct effects.

If new bat roosts are present in areas affected by proposed felling, a bat derogation license will be sought from the National Parks and Wildlife Service.

4.4.2.2 Operational Curtailment

Monitoring will be carried out for the first three years of operation, and an annual review at the end of each of these years will determine whether increased cut-in speeds should be implemented.

If, following any of the initial three 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 be implemented.

Alternatively, if it is found that the results of bat activity surveys and fatality searches reconfirm the level of bat activity at turbine locations remains low or low/moderate then curtailment will not be required.

Bat activity will subsequently be monitored in years 5, 10, 15, 20, 25 and 30 with further review after each monitoring period.

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.

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

If the requirement for curtailment is identified following the initial 3-year monitoring period, the following measures will be implemented:

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 could 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.

If required based on operational monitoring results, cut-in speeds should be increased to 5.5 m/s during the bat activity season (April-October) or where temperatures are optimal for bat activity, from 30 minutes prior to sunset and to 30 minutes after sunrise at turbines where surveillance shows high bat activity levels for High and Medium-Risk species and/or if bat carcasses are recorded.

The duration required depends on the level of mitigation required for each individual turbine i.e. a full bat activity season or only spring and autumn (duration will be determined by the first year of surveillance).

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

- When the air temperature is above approximately 10°C at nacelle height (as bat activity is reduced below this temperature) and;
- Where the wind speed is above 5 - 6.5m/s at nacelle height. It has been shown that curtailing the operations of wind turbines at low wind speeds can reduce bat mortality dramatically, particularly during late summer and the early autumn months.

Due to the considerable unnecessary down time resulting from the "blanket curtailment" and the advances in smart curtailment a focused curtailment regime is further proposed as an optional means of achieving the level of curtailment indicated as required by operational monitoring.

This will 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-construction surveys will be undertaken for the first three years of operation to confirm if curtailment is required in line with post-construction activity levels. The post construction surveys will be used to update the 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)

4.4.2.2.1 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 the scheme will 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 monitoring schedule.

The primary components bat mortality study will be as follows (whether curtailment is in place or not):

a) Carcass removal trials to establish levels of predator removal of possible fatalities. This will 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 will be used for subsequent fatality monitoring.

b) Turbine searches for fatalities will be undertaken following best practice in terms of search area (focusing on the hard standing) (NatureScot, 2021) and at intervals selected to effectively sample fatality rates as determined by carcass removal trials in (a) above.

c) A standardised approach with a possible control group and/or variation in search techniques such as straight line transects/ randomly selected spiral transects/ dog searches will be undertaken. This will provide a means of robustly estimating the post construction collision fatality impact (if any).

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

4.4.2.3 Mitigation Measures during Decommissioning

Mitigation measures for the Proposed Wind Farm that will apply for the decommissioning phase relate to the protection of water quality (as outlined in Chapter 9 of the EIAR - Hydrology and Water Quality). There will be no additional vegetation removal, and infrastructure removal will be of the turbines foundations and hardstand areas left in place and covered with local soil/topsoil to revegetate at the decommissioning stage. It is considered that leaving the turbine foundations, access tracks and hardstand areas in-situ will cause less environmental damage than removing them. Grid connection infrastructure including the on-site substation and ancillary electrical equipment shall form part of the national grid and will be left in situ (as outlined in Chapter 4 of the EIAR – Project Description), therefore no potential impacts during decommissioning stage are likely to occur. Hence no mitigation measures are required for these elements.

4.4.2.4 Post Construction Surveys

Monitoring of bat activity at turbine locations using static detectors will take place for at least three 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 requirements.

During years one to three of operation bat activity will be measured during monitoring periods 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.

4.4.3 Residual Effects

Taking into account the small area of suitable habitat to be lost relative to the area of suitable habitat in the wider landscape and given the standard best practice measures above and adaptive mitigation measures proposed, no significant long-term residual effects on bats are anticipated with regard to:

1. 1Collision mortality, barotrauma and other injuries,
2. Loss or damage to roosts, and
3. Displacement of individuals or populations.

There is no potential for the construction of the Proposed Development to result in Significant effects on the local bat population at any geographic scale, given the small area of suitable habitat to be lost relative to the area of suitable habitat in the wider landscape and given the standard best practice measures outlined above which will be implemented during construction combined with the purposeful design of the Proposed Development so as to avoid high value bat habitat. Similarly, during operation, the monitoring and mitigation proposed will ensure no significant residual effect on local bat populations.

A residual effect is anticipated in relation to the loss of commuting and foraging habitat, due to the removal of linear habitat required to facilitate construction and bat buffers. While this loss will be offset through a comprehensive habitat enhancement and replanting programme, it will take approximately 3-7 years for new trees to establish and restore full habitat functionality. As such, a Short-term Not-significant effect at Local scale arising from minor changes in ecological connectivity may occur during this period.

4.4.4 Cumulative Effects

The assessment concludes that no significant cumulative impacts on bats are anticipated. Forestry activities in the surrounding area occur at sufficient distance from the Proposed Development and are not expected to result in cumulative pressures on local bat populations. Other wind farms are located over 4 km from the site, and when considered alongside the proposed mitigation measures, no cumulative effects on bats via land or air pathways are likely. Review of EIARs for nearby wind farms further indicates that, with mitigation in place, no cumulative impacts on bats are expected to arise. More information on cumulative impacts is available in Section 6.12 of the Biodiversity Chapter 6 of the EIAR

4.5 Conclusion

Eight bat species were recorded during surveys, all of which are listed as Least Concern on the Irish Red List and are included on Annex IV of the EU Habitats Directive. Bat survey results and Ecobat analysis indicate low to low levels of bat activity across the proposed wind farm. Across all species, low to moderate median percentiles were recorded only for Nathusius's pipistrelle; however, this is indicative of the bias arising from uneven distribution of this species and comparison against the national population without regard to this uneven distribution by Ecobat, rather than actual higher levels of activity for this species. Bat activity within the study area was predominantly associated with linear and edge habitats while open habitats supported lower levels of use. Overall, the proposed wind farm adheres to a precautionary approach in line with NatureScot (2021) guidance and current best practice, ensuring that potential impacts on bats are effectively minimised.

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FEHILY TIMONEY

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

APPENDIX 1

Ecobat Results 2023

Ecobat Report
2025-12-15

Geo filter: all, Time filter: all

Summary

Bats were detected on **27** nights between **17/05/2023** and **12/06/2023**, using **11** static bat detectors. Throughout this period, **8** species were recorded. **Table 1.** Detectors were placed at the following locations:

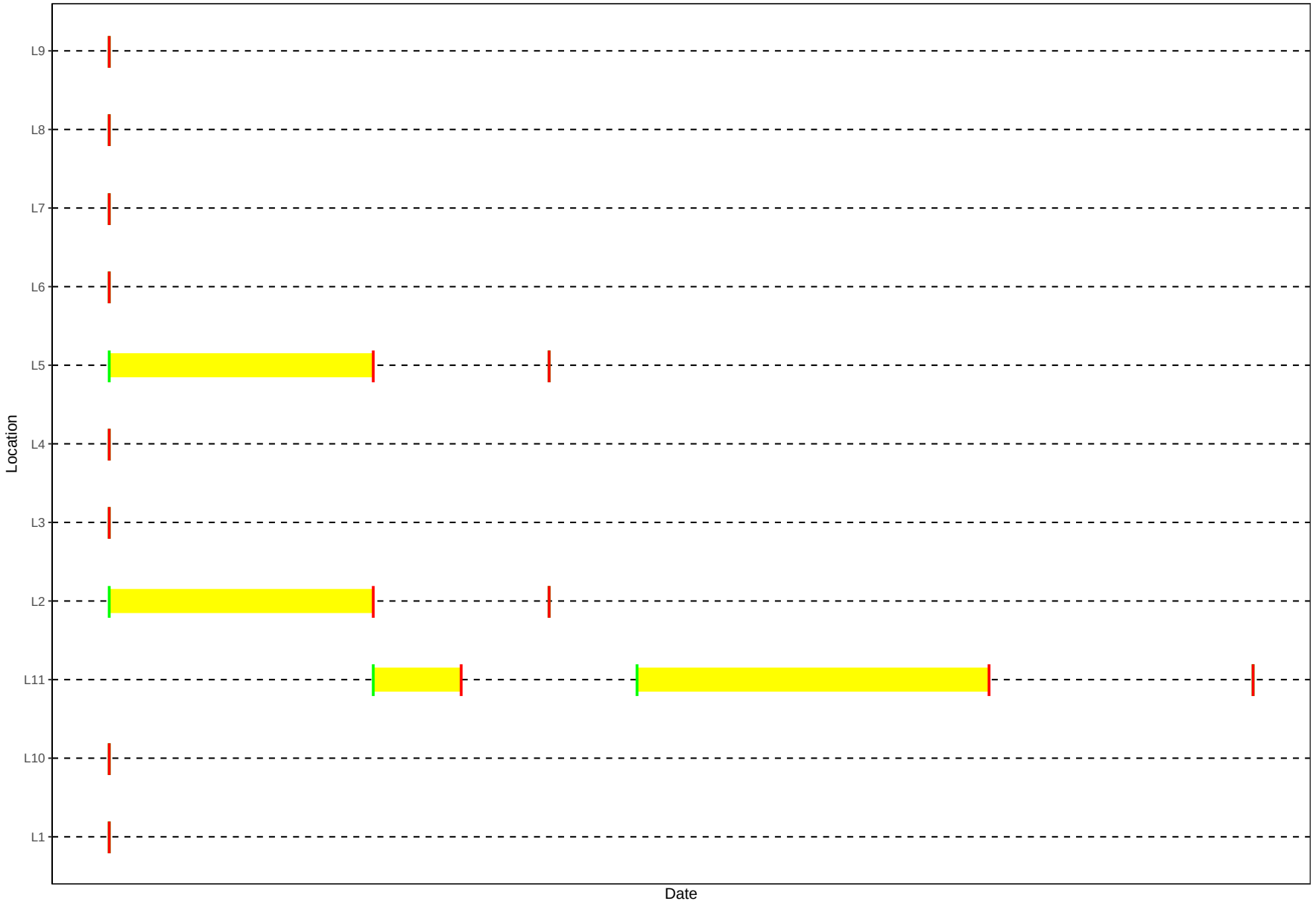
Detector ID	Latitude	Longitude
L1	52.66497	7.644556
L2	52.66041	7.649355
L3	52.65497	7.651278
L4	52.65501	7.659723
L5	52.64908	7.662925
L6	52.64642	7.653317
L7	52.64459	7.668046
L8	52.64051	7.659876
L9	52.61667	7.690955
L10	52.61366	7.686230
L11	52.60997	7.683222

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
L1	27
L10	27
L11	21
L2	23
L3	12
L4	27
L5	26
L6	27
L7	27
L8	27
L9	27

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


L9
L8
L7
L6
L5
L4
L3
L2
L11
L10
L1
Location
Date

Part 1: Percentile 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.

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 Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L1	Myotis daubentonii	0	0	0	0	0	21
L1	Myotis mystacinus	0	0	0	0	0	3
L1	Nyctalus leisleri	0	0	0	0	0	24
L1	Pipistrellus nathusii	0	0	2	4	3	5
L1	Pipistrellus pipistrellus	0	0	0	0	0	27
L1	Pipistrellus pygmaeus	0	0	0	0	0	26
L1	Plecotus auritus	0	0	0	0	1	16
L10	Myotis daubentonii	0	0	0	0	0	21
L10	Myotis mystacinus	0	0	0	0	0	11
L10	Myotis nattereri	0	0	0	0	0	6
L10	Nyctalus leisleri	0	0	0	2	3	22
L10	Pipistrellus nathusii	0	0	0	0	0	5
L10	Pipistrellus pipistrellus	0	0	0	0	0	27
L10	Pipistrellus pygmaeus	0	0	0	0	2	25
L10	Plecotus auritus	0	0	0	1	1	9
L11	Myotis daubentonii	0	0	0	0	0	11
L11	Myotis mystacinus	0	0	0	0	0	3
L11	Myotis nattereri	0	0	0	0	0	6

Detector ID	Species/Species Group	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L11	Nyctalus leisleri	0	0	0	0	5	16
L11	Pipistrellus nathusii	0	0	0	0	0	7
L11	Pipistrellus pipistrellus	0	0	0	0	0	18
L11	Pipistrellus pygmaeus	0	0	0	0	2	17
L11	Plecotus auritus	0	0	0	0	0	10
L2	Myotis daubentonii	0	0	0	0	0	17
L2	Myotis mystacinus	0	0	0	0	0	7
L2	Myotis nattereri	0	0	0	0	0	6
L2	Nyctalus leisleri	0	0	0	0	0	22
L2	Pipistrellus nathusii	0	0	0	0	2	4
L2	Pipistrellus pipistrellus	0	0	0	0	0	23
L2	Pipistrellus pygmaeus	0	0	0	0	6	17
L2	Plecotus auritus	0	0	0	0	0	10
L3	Myotis daubentonii	0	0	0	0	0	8
L3	Myotis nattereri	0	0	0	0	1	4
L3	Nyctalus leisleri	0	0	0	0	0	11
L3	Pipistrellus pipistrellus	0	0	0	0	0	12
L3	Pipistrellus pygmaeus	0	0	0	0	0	12
L3	Plecotus auritus	0	0	0	0	0	3
L4	Myotis daubentonii	0	0	0	0	1	22
L4	Myotis mystacinus	0	0	0	0	0	3

Detector ID	Species/Species Group	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L4	Myotis nattereri	0	0	0	0	0	3
L4	Nyctalus leisleri	0	0	0	0	0	27
L4	Pipistrellus pipistrellus	0	0	0	0	0	26
L4	Pipistrellus pygmaeus	0	0	0	0	0	25
L4	Plecotus auritus	0	0	0	0	0	6
L5	Myotis daubentonii	0	0	0	0	0	11
L5	Myotis nattereri	0	0	0	0	0	2
L5	Nyctalus leisleri	0	0	0	0	0	25
L5	Pipistrellus pipistrellus	0	0	0	0	0	25
L5	Pipistrellus pygmaeus	0	0	0	0	0	25
L5	Plecotus auritus	0	0	0	0	0	4
L6	Myotis daubentonii	0	0	0	0	0	19
L6	Myotis mystacinus	0	0	0	0	0	1
L6	Myotis nattereri	0	0	0	0	2	2
L6	Nyctalus leisleri	0	0	0	0	0	27
L6	Pipistrellus nathusii	0	0	0	0	8	8
L6	Pipistrellus pipistrellus	0	0	0	0	0	27
L6	Pipistrellus pygmaeus	0	0	0	0	0	26
L6	Plecotus auritus	0	0	0	0	0	16
L7	Myotis daubentonii	0	0	0	0	0	21
L7	Myotis mystacinus	0	0	0	0	0	9
L7	Nyctalus leisleri	0	0	0	0	0	26

Detector ID	Species/Species Group	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L7	Pipistrellus nathusii	0	0	0	0	0	8
L7	Pipistrellus pipistrellus	0	0	0	0	0	27
L7	Pipistrellus pygmaeus	0	0	0	0	0	27
L7	Plecotus auritus	0	0	0	0	0	8
L8	Myotis daubentonii	0	0	0	0	2	23
L8	Myotis mystacinus	0	0	0	0	0	15
L8	Myotis nattereri	0	0	0	0	0	9
L8	Nyctalus leisleri	0	0	0	0	0	27
L8	Pipistrellus nathusii	0	0	0	0	0	8
L8	Pipistrellus pipistrellus	0	0	0	0	0	27
L8	Pipistrellus pygmaeus	0	0	0	0	0	26
L8	Plecotus auritus	0	0	0	0	2	20
L9	Myotis daubentonii	0	0	0	0	0	22
L9	Myotis mystacinus	0	0	0	0	0	2
L9	Myotis nattereri	0	0	0	0	1	8
L9	Nyctalus leisleri	0	0	0	2	3	21
L9	Pipistrellus pipistrellus	0	0	0	0	0	27
L9	Pipistrellus pygmaeus	0	0	0	0	0	26
L9	Plecotus auritus	0	0	0	0	0	14

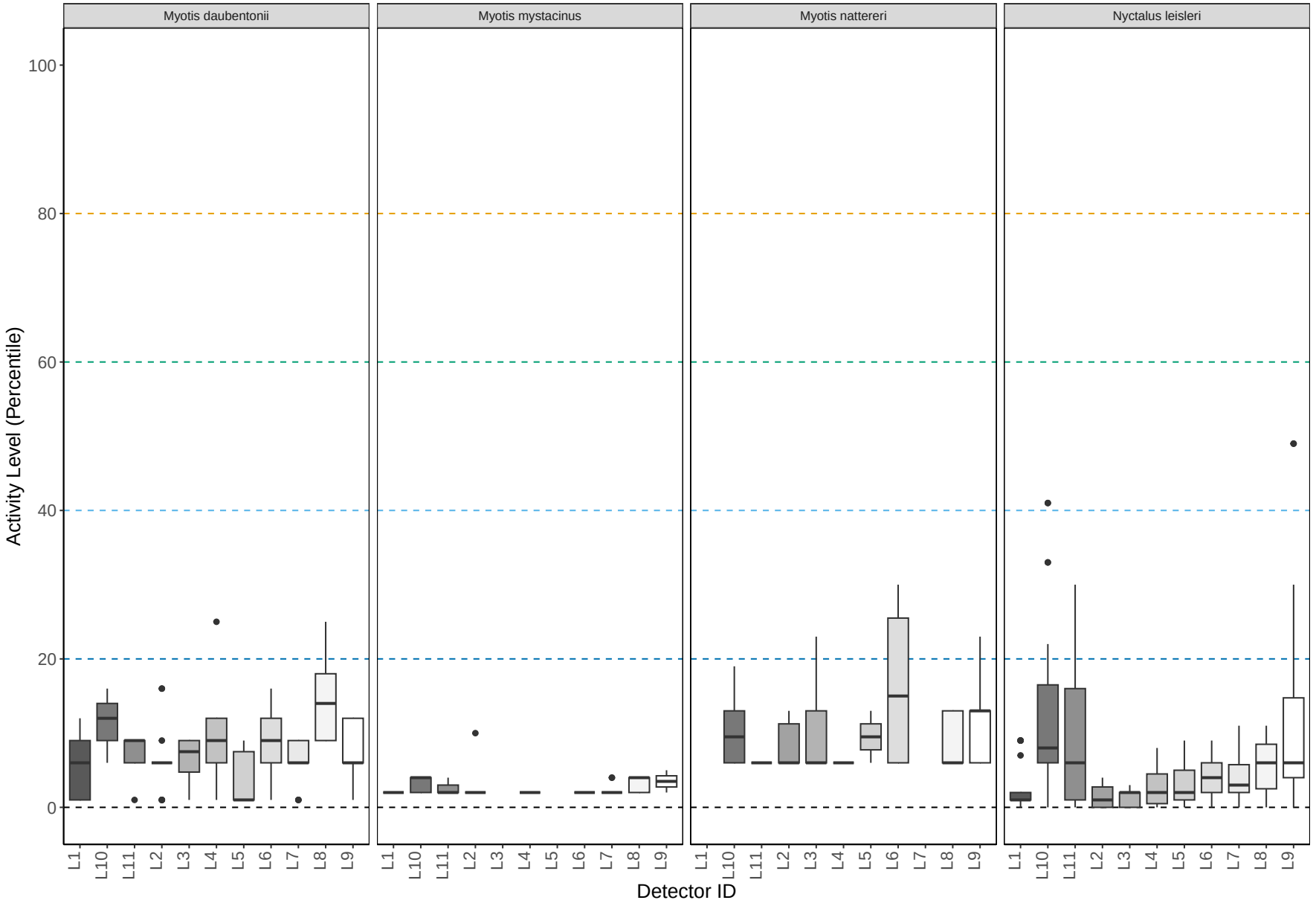
Table 4. Summary table showing key metrics for each species recorded. The reference range is the number of nights for each species that your data were compared to. We recommend a Reference Range of 200+ to be confident in the relative activity level.

Detector ID	Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded	Reference Range
L1	Myotis daubentonii	6	3.5 - 9	12	21	6850
L1	Myotis mystacinus	2	2 - 2	2	3	2737
L1	Nyctalus leisleri	1	1 - 5	9	24	61799
L1	Pipistrellus nathusii	37	21.5 - 47.5	74	14	3409
L1	Pipistrellus pipistrellus	4	3.5 - 6	9	27	1547099
L1	Pipistrellus pygmaeus	9	8 - 9.5	12	26	411071
L1	Plecotus auritus	4	2.5 - 4	20	17	23389
L10	Myotis daubentonii	12	9 - 13	16	21	6850
L10	Myotis mystacinus	4	3 - 4	4	11	2737
L10	Myotis nattereri	10	6 - 13	19	6	1749
L10	Nyctalus leisleri	8	7.5 - 19	41	27	61799
L10	Pipistrellus nathusii	8	8 - 8	14	5	3409
L10	Pipistrellus pipistrellus	1	1.5 - 3.5	7	27	1547099
L10	Pipistrellus pygmaeus	6	5.5 - 10.5	21	27	411071
L10	Plecotus auritus	13	5 - 21.5	42	11	23389
L11	Myotis daubentonii	9	5 - 9	9	11	6850
L11	Myotis mystacinus	2	2 - 2	4	3	2737
L11	Myotis nattereri	6	6 - 6	6	6	1749
L11	Nyctalus leisleri	6	4.5 - 15.5	30	21	61799
L11	Pipistrellus nathusii	8	8 - 13	18	7	3409
L11	Pipistrellus pipistrellus	2	1.5 - 3	5	18	1547099
L11	Pipistrellus pygmaeus	15	10 - 18	20	19	411071
L11	Plecotus auritus	13	7 - 14	15	10	23389
L2	Myotis daubentonii	6	3.5 - 7.5	16	17	6850
L2	Myotis mystacinus	2	2 - 2	10	7	2737
L2	Myotis nattereri	6	6 - 9.5	13	6	1749
L2	Nyctalus leisleri	1	1.5 - 3.5	4	22	61799
L2	Pipistrellus nathusii	18	8 - 28	38	6	3409
L2	Pipistrellus pipistrellus	4	3 - 9	16	23	1547099
L2	Pipistrellus pygmaeus	11	9 - 19	34	23	411071
L2	Plecotus auritus	4	2.5 - 8	15	10	23389
L3	Myotis daubentonii	8	3.5 - 9	9	8	6850
L3	Myotis nattereri	6	6 - 14.5	23	5	1749

Detector ID	Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded	Reference Range
L3	Nyctalus leisleri	2	1.5 - 3	3	11	61799
L3	Pipistrellus pipistrellus	2	1.5 - 6	10	12	1547099
L3	Pipistrellus pygmaeus	4	2.5 - 5	6	12	411071
L3	Plecotus auritus	1	1 - 1	1	3	23389
L4	Myotis daubentonii	9	6.5 - 10.5	25	23	6850
L4	Myotis mystacinus	2	2 - 2	2	3	2737
L4	Myotis nattereri	6	6 - 6	6	3	1749
L4	Nyctalus leisleri	2	2.5 - 4.5	8	27	61799
L4	Pipistrellus pipistrellus	0	1.5 - 3	4	26	1547099
L4	Pipistrellus pygmaeus	2	2 - 3	4	25	411071
L4	Plecotus auritus	1	1 - 1	9	6	23389
L5	Myotis daubentonii	1	1 - 6	9	11	6850
L5	Myotis nattereri	10	9.5 - 9.5	13	2	1749
L5	Nyctalus leisleri	2	2 - 5	9	25	61799
L5	Pipistrellus pipistrellus	0	0 - 0	1	25	1547099
L5	Pipistrellus pygmaeus	1	1 - 1.5	2	25	411071
L5	Plecotus auritus	1	1 - 1	1	4	23389
L6	Myotis daubentonii	9	7.5 - 12	16	19	6850
L6	Myotis mystacinus	2	0	2	1	2737
L6	Myotis nattereri	15	6 - 24	30	4	1749
L6	Nyctalus leisleri	4	3 - 5.5	9	27	61799
L6	Pipistrellus nathusii	23	14 - 28	35	16	3409
L6	Pipistrellus pipistrellus	8	6.5 - 11	18	27	1547099
L6	Pipistrellus pygmaeus	1	1.5 - 4	6	26	411071
L6	Plecotus auritus	7	2.5 - 9.5	15	16	23389
L7	Myotis daubentonii	6	5 - 7.5	9	21	6850
L7	Myotis mystacinus	2	2 - 3	4	9	2737
L7	Nyctalus leisleri	3	3.5 - 6.5	11	26	61799
L7	Pipistrellus nathusii	11	8 - 14	14	8	3409
L7	Pipistrellus pipistrellus	0	0 - 0	1	27	1547099
L7	Pipistrellus pygmaeus	1	2 - 4	6	27	411071
L7	Plecotus auritus	4	4 - 4	4	8	23389
L8	Myotis daubentonii	14	12.5 - 17	25	25	6850
L8	Myotis mystacinus	4	3 - 4	4	15	2737
L8	Myotis nattereri	6	6 - 9.5	13	9	1749
L8	Nyctalus leisleri	6	4.5 - 7.5	11	27	61799

Detector ID	Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded	Reference Range
L8	Pipistrellus nathusii	14	11 - 16	18	8	3409
L8	Pipistrellus pipistrellus	1	2 - 6.5	11	27	1547099
L8	Pipistrellus pygmaeus	1	1 - 3	5	26	411071
L8	Plecotus auritus	7	4 - 10.5	20	22	23389
L9	Myotis daubentonii	6	6 - 9	12	22	6850
L9	Myotis mystacinus	4	3.5 - 3.5	5	2	2737
L9	Myotis nattereri	13	6 - 16	23	9	1749
L9	Nyctalus leisleri	6	5 - 18	49	26	61799
L9	Pipistrellus pipistrellus	0	1 - 2	3	27	1547099
L9	Pipistrellus pygmaeus	5	4 - 7	13	26	411071
L9	Plecotus auritus	4	2.5 - 7	13	14	23389

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).


Myotis daubentonii
Myotis mystacinus
Myotis nattereri
Nyctalus leisleri
Activity Level (Percentile)
100
80
60
40
20
0
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID

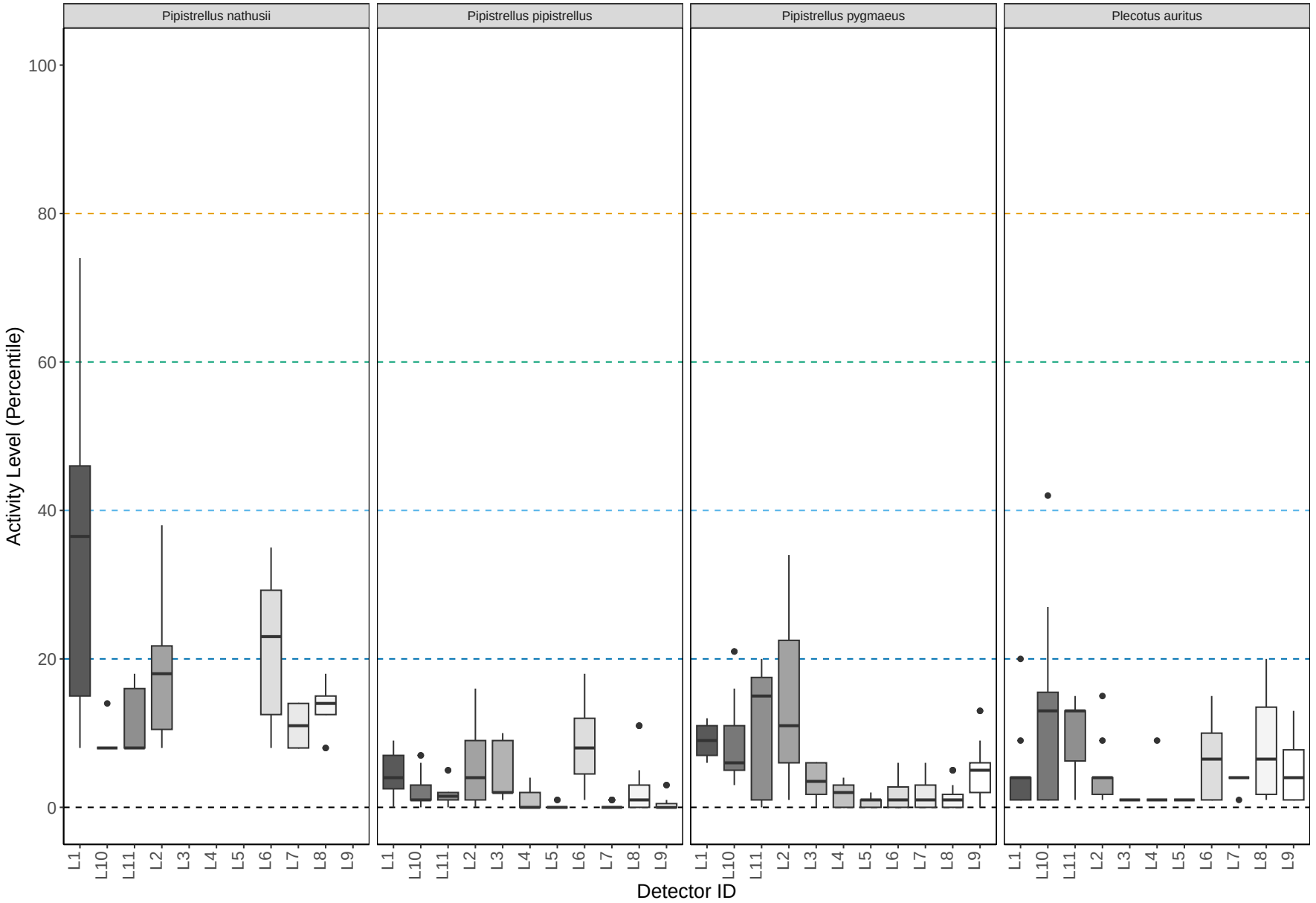
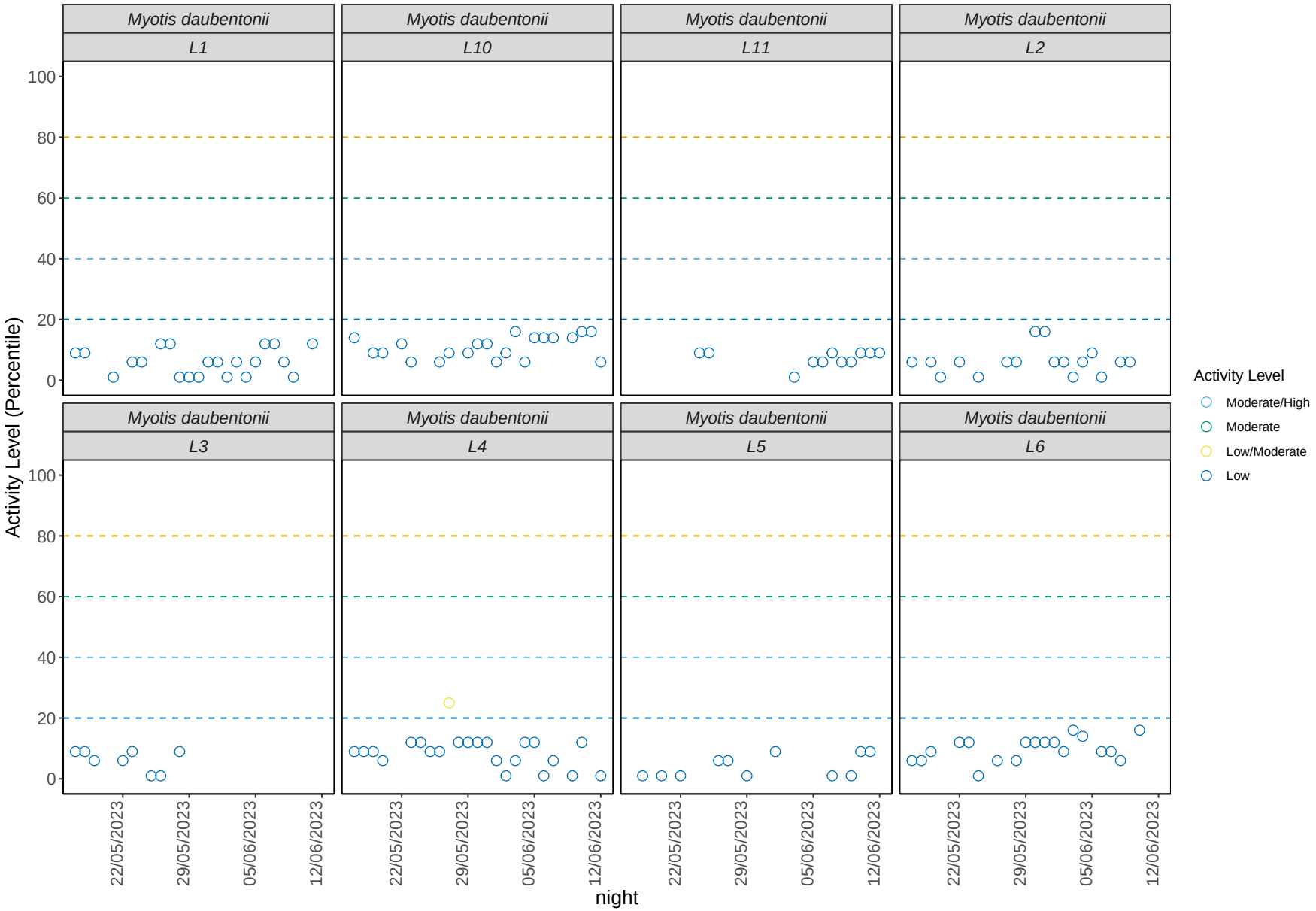
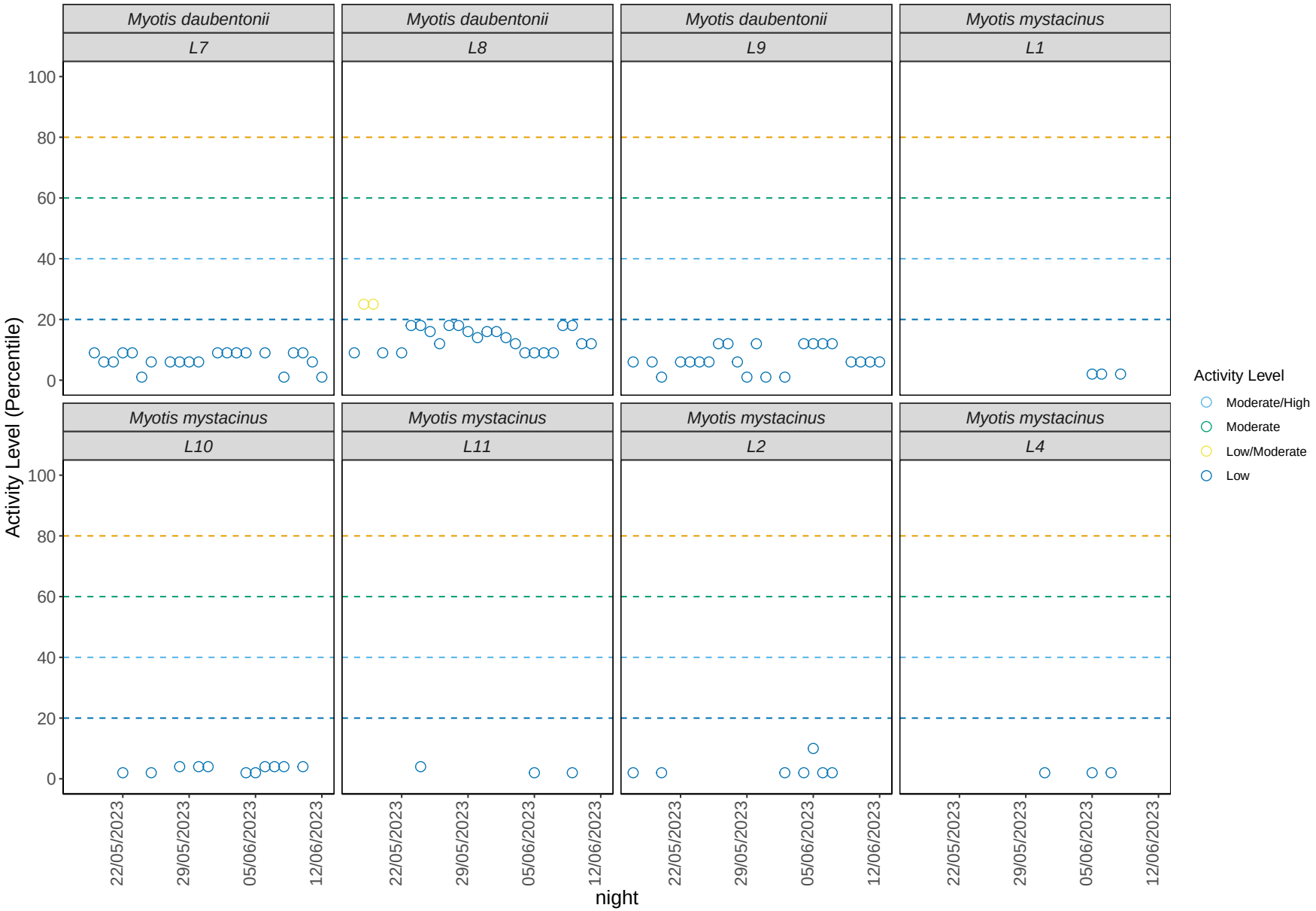
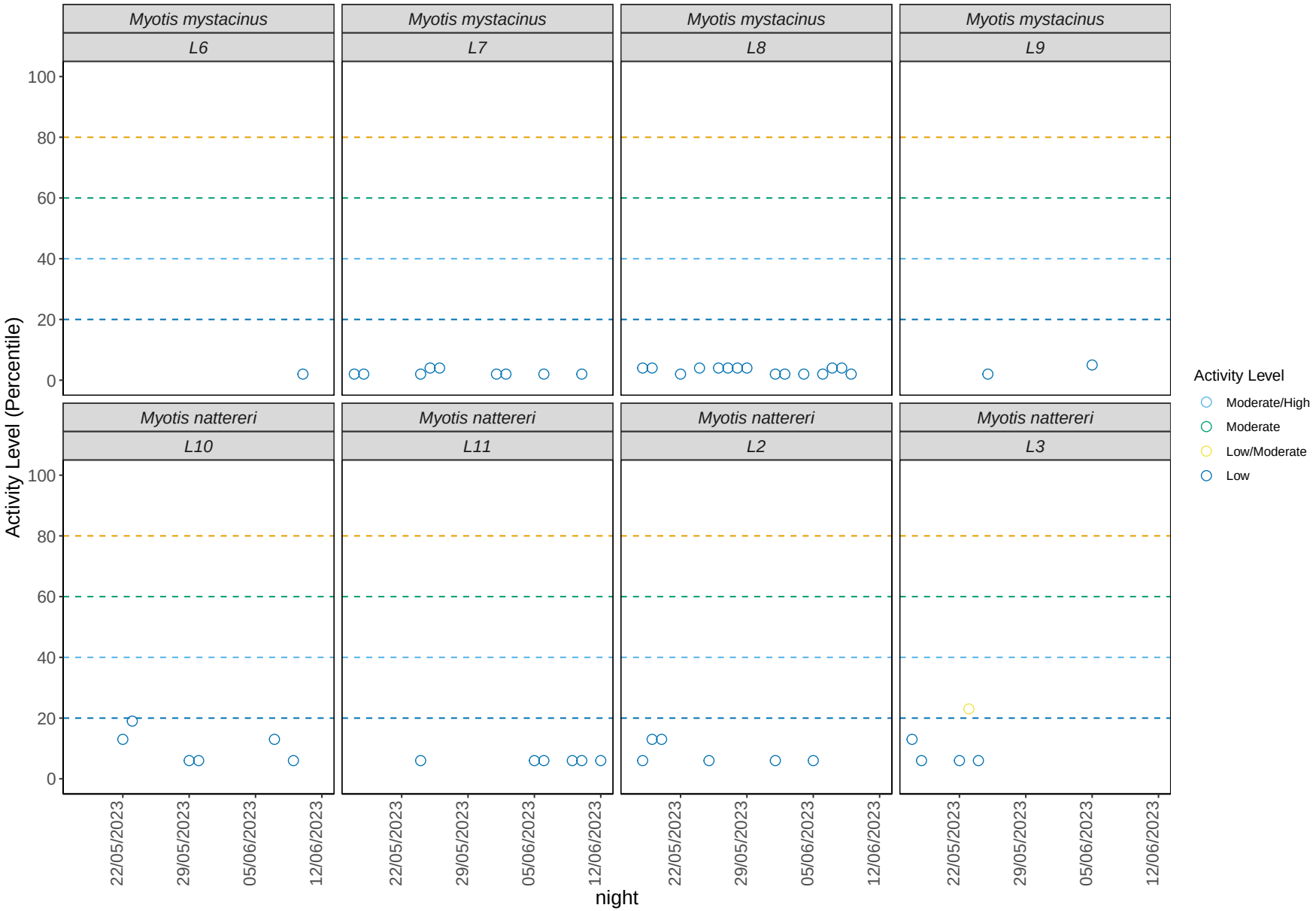
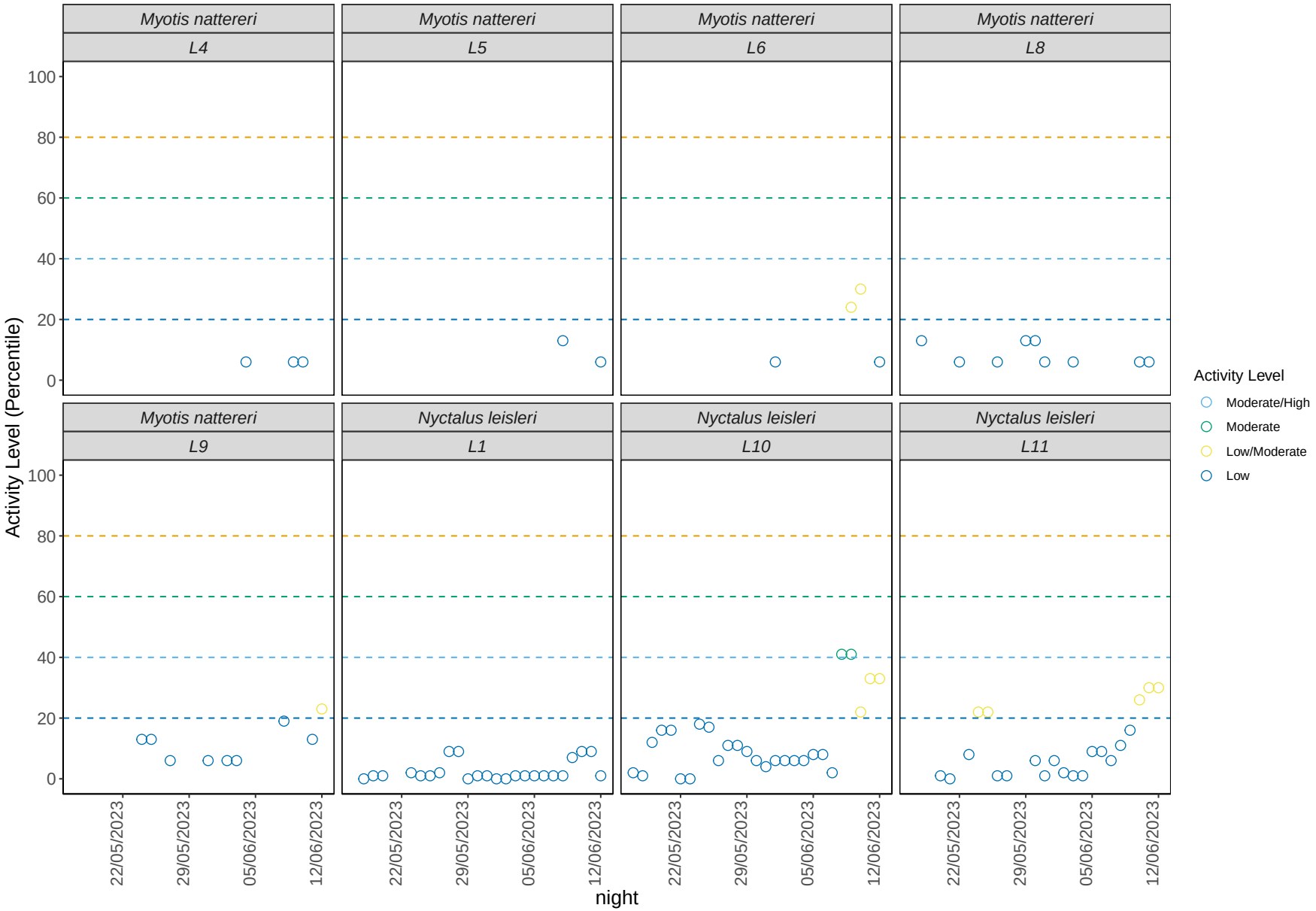

Pipistrellus nathusii
Pipistrellus pipistrellus
Pipistrellus pygmaeus
Plecotus auritus
Activity Level (Percentile)
100
80
60
40
20
0
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID

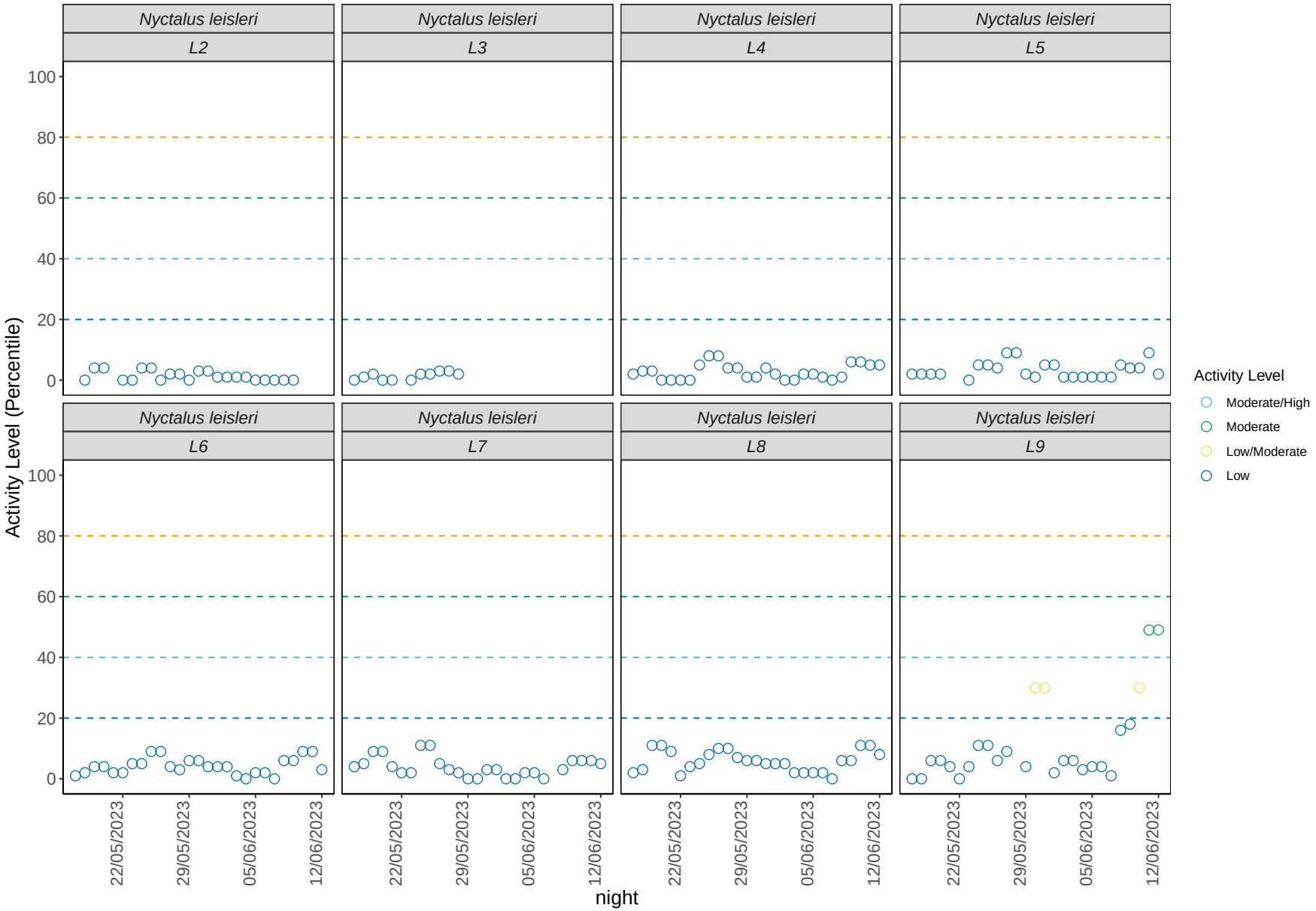
Figure 3. The activity level (percentile) of bats recorded across each night of the bat survey.

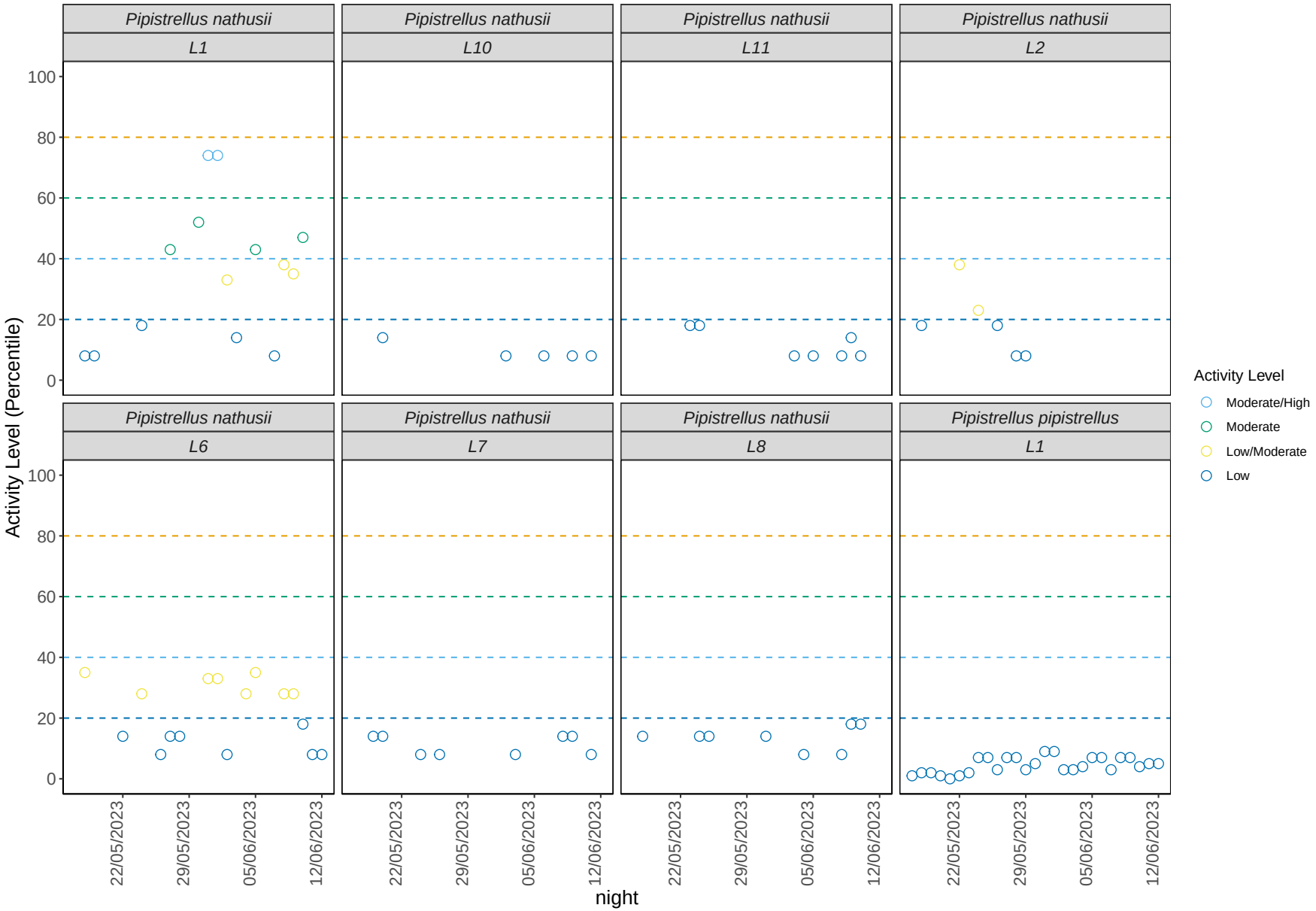

Myotis daubentonii
L1
L10
L11
L2
L3
L4
L5
L6
Activity Level (Percentile)
100
80
60
40
20
0
22/05/2023
29/05/2023
05/06/2023
12/06/2023
night
Activity Level
Moderate/High
Moderate
Low/Moderate
Low

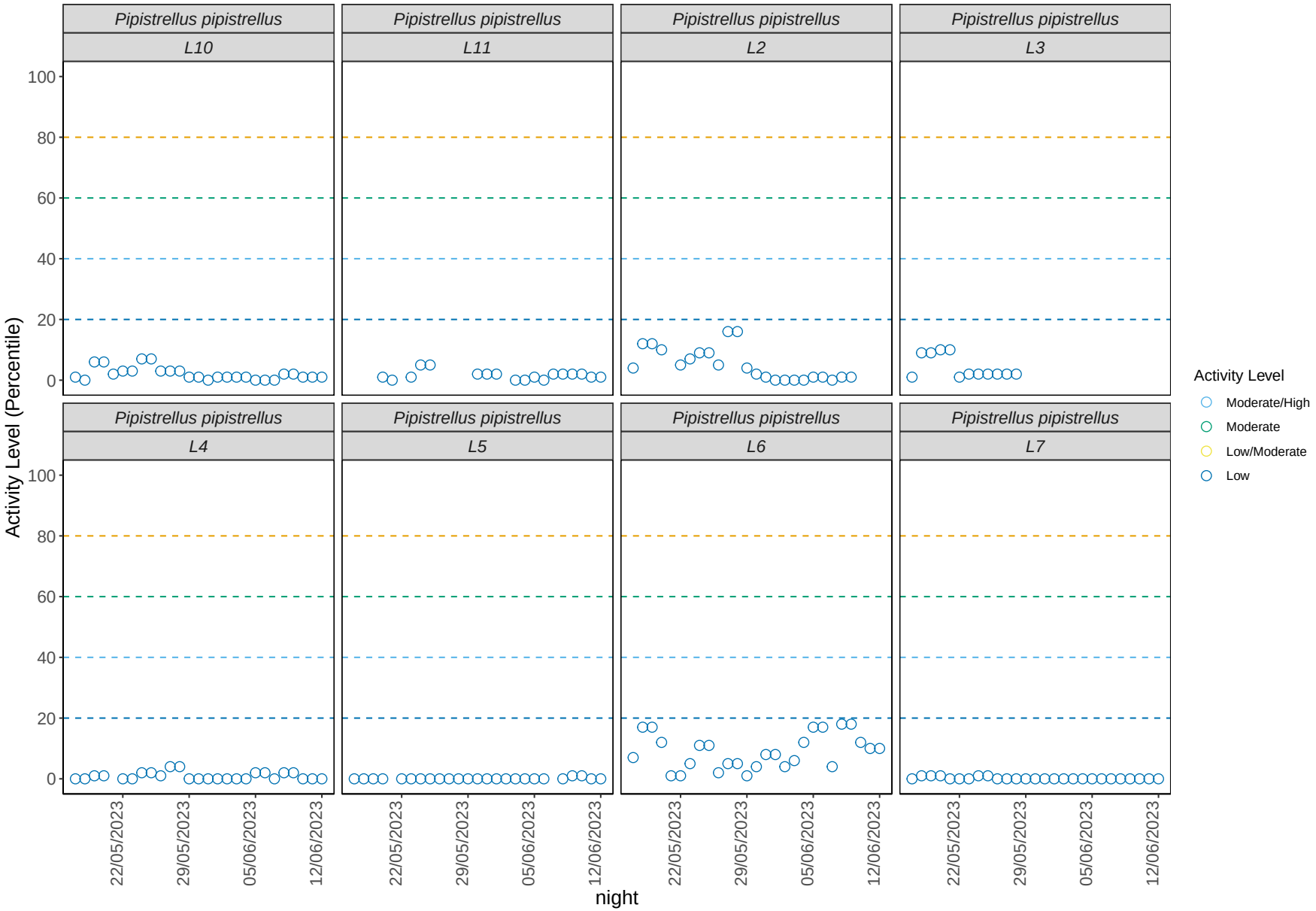

Myotis daubentonii
L7
Myotis daubentonii
L8
Myotis daubentonii
L9
Myotis mystacinus
L1
Myotis mystacinus
L10
Myotis mystacinus
L11
Myotis mystacinus
L2
Myotis mystacinus
L4
Activity Level (Percentile)
100
80
60
40
20
0
22/05/2023
29/05/2023
05/06/2023
12/06/2023
night
Activity Level
Moderate/High
Moderate
Low/Moderate
Low

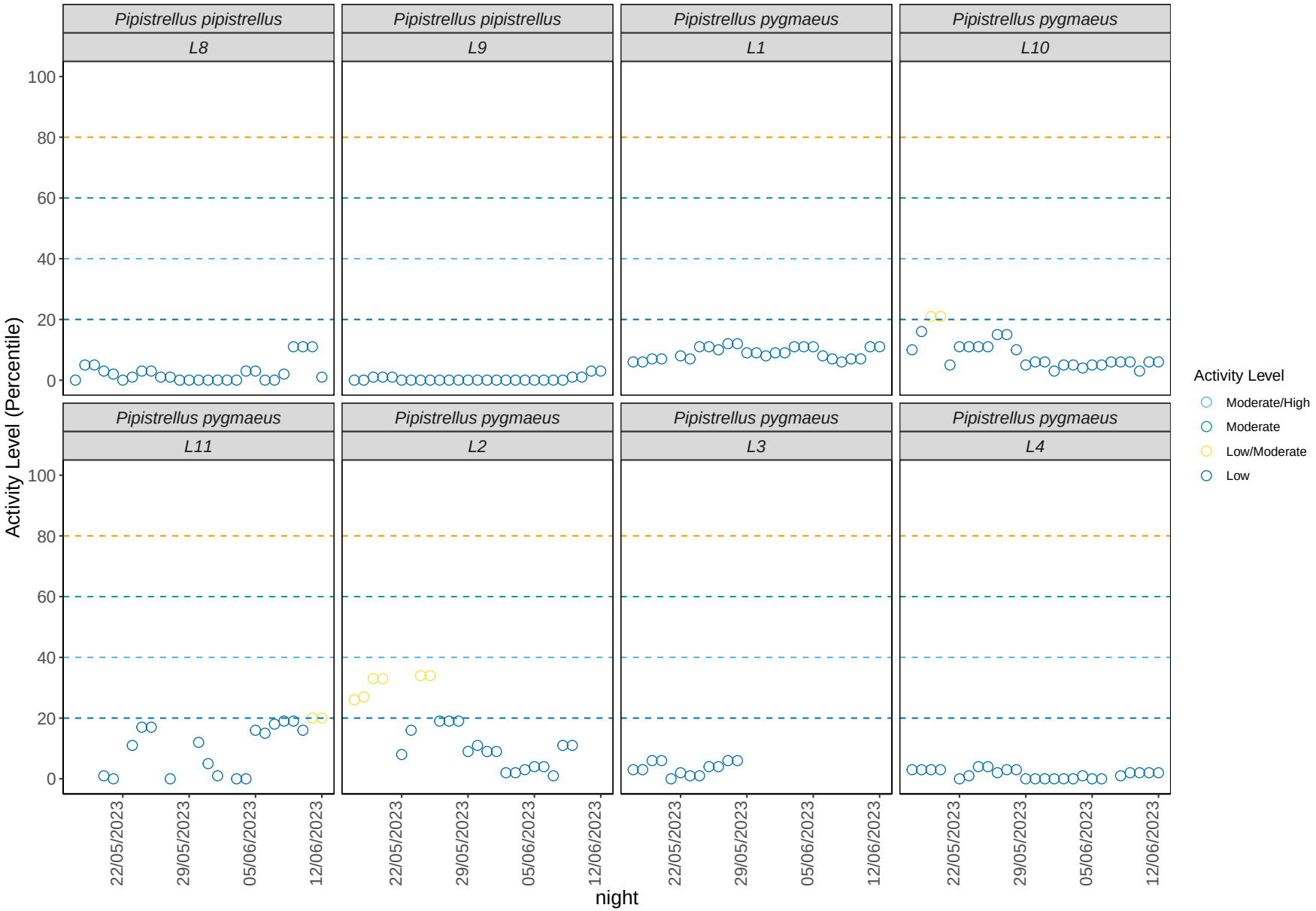

Myotis mystacinus
L6
Myotis mystacinus
L7
Myotis mystacinus
L8
Myotis mystacinus
L9
Myotis nattereri
L10
Myotis nattereri
L11
Myotis nattereri
L2
Myotis nattereri
L3
Activity Level (Percentile)
100
80
60
40
20
0
22/05/2023
29/05/2023
05/06/2023
12/06/2023
night
Activity Level
Moderate/High
Moderate
Low/Moderate
Low

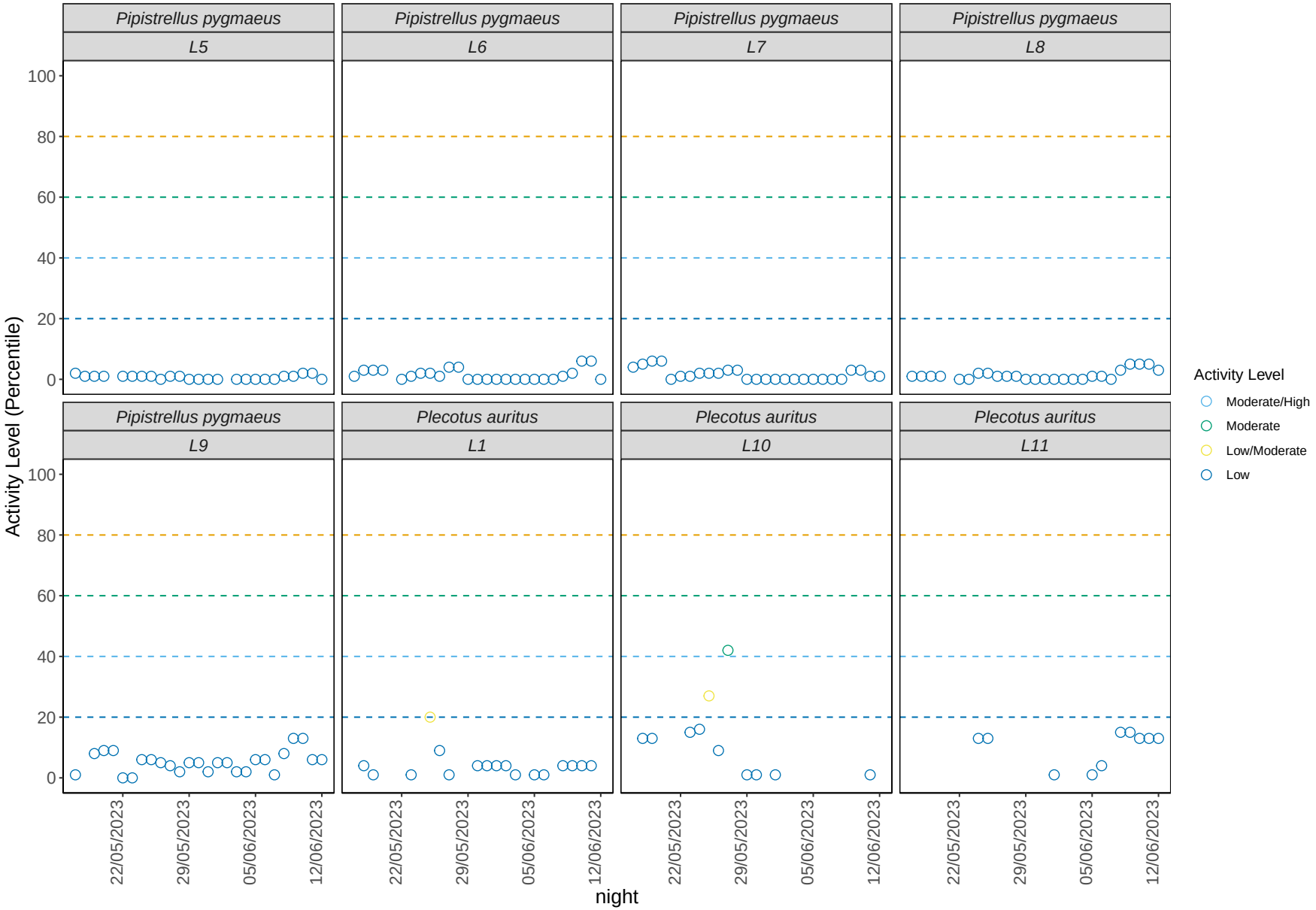

Myotis nattereri
L4
Myotis nattereri
L5
Myotis nattereri
L6
Myotis nattereri
L8
Myotis nattereri
L9
Nyctalus leisleri
L1
Nyctalus leisleri
L10
Nyctalus leisleri
L11
Activity Level (Percentile)
100
80
60
40
20
0
22/05/2023
29/05/2023
05/06/2023
12/06/2023
night
Activity Level
Moderate/High
Moderate
Low/Moderate
Low

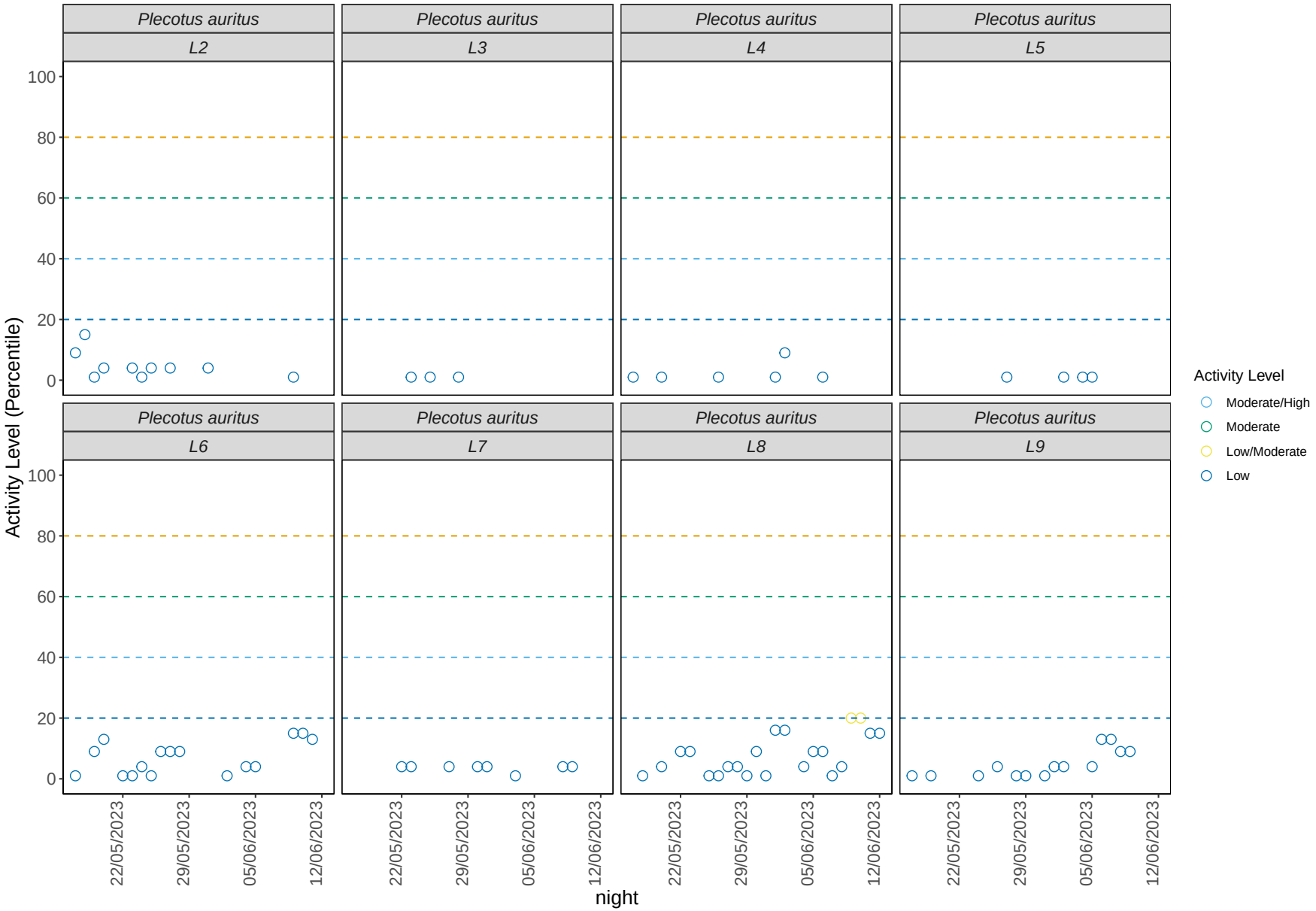

Nyctalus leisleri
L2
L3
L4
L5
L6
L7
L8
L9
Activity Level (Percentile)
0
20
40
60
80
100
22/05/2023
29/05/2023
05/06/2023
12/06/2023
night
Activity Level
Moderate/High
Moderate
Low/Moderate
Low


Pipistrellus nathusii
L1
Pipistrellus nathusii
L10
Pipistrellus nathusii
L11
Pipistrellus nathusii
L2
Pipistrellus nathusii
L6
Pipistrellus nathusii
L7
Pipistrellus nathusii
L8
Pipistrellus pipistrellus
L1
Activity Level (Percentile)
0
20
40
60
80
100
22/05/2023
29/05/2023
05/06/2023
12/06/2023
night
Activity Level
Moderate/High
Moderate
Low/Moderate
Low


Pipistrellus pipistrellus
L10
L11
L2
L3
L4
L5
L6
L7
Activity Level (Percentile)
100
80
60
40
20
0
22/05/2023
29/05/2023
05/06/2023
12/06/2023
night
Activity Level
Moderate/High
Moderate
Low/Moderate
Low


Pipistrellus pipistrellus
L8
Pipistrellus pipistrellus
L9
Pipistrellus pygmaeus
L1
Pipistrellus pygmaeus
L10
Pipistrellus pygmaeus
L11
Pipistrellus pygmaeus
L2
Pipistrellus pygmaeus
L3
Pipistrellus pygmaeus
L4
Activity Level (Percentile)
100
80
60
40
20
0
22/05/2023
29/05/2023
05/06/2023
12/06/2023
night
Activity Level
Moderate/High
Moderate
Low/Moderate
Low


Pipistrellus pygmaeus
L5
Pipistrellus pygmaeus
L6
Pipistrellus pygmaeus
L7
Pipistrellus pygmaeus
L8
Pipistrellus pygmaeus
L9
Plecotus auritus
L1
Plecotus auritus
L10
Plecotus auritus
L11
Activity Level (Percentile)
100
80
60
40
20
0
22/05/2023
29/05/2023
05/06/2023
12/06/2023
night
Activity Level
Moderate/High
Moderate
Low/Moderate
Low


Plecotus auritus
L2
L3
L4
L5
L6
L7
L8
L9
Activity Level (Percentile)
100
80
60
40
20
0
22/05/2023
29/05/2023
05/06/2023
12/06/2023
night
Activity Level
Moderate/High
Moderate
Low/Moderate
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 Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L1	Myotis daubentonii	May	0	0	0	0	0	11
L1	Myotis daubentonii	Jun	0	0	0	0	0	10
L1	Myotis mystacinus	Jun	0	0	0	0	0	3
L1	Nyctalus leisleri	May	0	0	0	0	0	12
L1	Nyctalus leisleri	Jun	0	0	0	0	0	12
L1	Pipistrellus nathusii	May	0	0	1	2	0	3
L1	Pipistrellus nathusii	Jun	0	0	1	2	3	2
L1	Pipistrellus pipistrellus	May	0	0	0	0	0	15
L1	Pipistrellus pipistrellus	Jun	0	0	0	0	0	12
L1	Pipistrellus pygmaeus	May	0	0	0	0	0	14
L1	Pipistrellus pygmaeus	Jun	0	0	0	0	0	12
L1	Plecotus auritus	May	0	0	0	0	1	7
L1	Plecotus auritus	Jun	0	0	0	0	0	9
L10	Myotis daubentonii	May	0	0	0	0	0	10
L10	Myotis daubentonii	Jun	0	0	0	0	0	11
L10	Myotis mystacinus	May	0	0	0	0	0	5
L10	Myotis mystacinus	Jun	0	0	0	0	0	6

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L10	Myotis nattereri	May	0	0	0	0	0	4
L10	Myotis nattereri	Jun	0	0	0	0	0	2
L10	Nyctalus leisleri	May	0	0	0	0	0	15
L10	Nyctalus leisleri	Jun	0	0	0	2	3	7
L10	Pipistrellus nathusii	May	0	0	0	0	0	1
L10	Pipistrellus nathusii	Jun	0	0	0	0	0	4
L10	Pipistrellus pipistrellus	May	0	0	0	0	0	15
L10	Pipistrellus pipistrellus	Jun	0	0	0	0	0	12
L10	Pipistrellus pygmaeus	May	0	0	0	0	2	13
L10	Pipistrellus pygmaeus	Jun	0	0	0	0	0	12
L10	Plecotus auritus	May	0	0	0	1	1	7
L10	Plecotus auritus	Jun	0	0	0	0	0	2
L11	Myotis daubentonii	May	0	0	0	0	0	2
L11	Myotis daubentonii	Jun	0	0	0	0	0	9
L11	Myotis mystacinus	May	0	0	0	0	0	1
L11	Myotis mystacinus	Jun	0	0	0	0	0	2
L11	Myotis nattereri	May	0	0	0	0	0	1
L11	Myotis nattereri	Jun	0	0	0	0	0	5
L11	Nyctalus leisleri	May	0	0	0	0	2	7
L11	Nyctalus leisleri	Jun	0	0	0	0	3	9
L11	Pipistrellus nathusii	May	0	0	0	0	0	2
L11	Pipistrellus nathusii	Jun	0	0	0	0	0	5

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L11	Pipistrellus pipistrellus	May	0	0	0	0	0	7
L11	Pipistrellus pipistrellus	Jun	0	0	0	0	0	11
L11	Pipistrellus pygmaeus	May	0	0	0	0	0	8
L11	Pipistrellus pygmaeus	Jun	0	0	0	0	2	9
L11	Plecotus auritus	May	0	0	0	0	0	2
L11	Plecotus auritus	Jun	0	0	0	0	0	8
L2	Myotis daubentonii	May	0	0	0	0	0	9
L2	Myotis daubentonii	Jun	0	0	0	0	0	8
L2	Myotis mystacinus	May	0	0	0	0	0	2
L2	Myotis mystacinus	Jun	0	0	0	0	0	5
L2	Myotis nattereri	May	0	0	0	0	0	4
L2	Myotis nattereri	Jun	0	0	0	0	0	2
L2	Nyctalus leisleri	May	0	0	0	0	0	13
L2	Nyctalus leisleri	Jun	0	0	0	0	0	9
L2	Pipistrellus nathusii	May	0	0	0	0	2	4
L2	Pipistrellus pipistrellus	May	0	0	0	0	0	14
L2	Pipistrellus pipistrellus	Jun	0	0	0	0	0	9
L2	Pipistrellus pygmaeus	May	0	0	0	0	6	8
L2	Pipistrellus pygmaeus	Jun	0	0	0	0	0	9
L2	Plecotus auritus	May	0	0	0	0	0	9
L2	Plecotus auritus	Jun	0	0	0	0	0	1

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L3	Myotis daubentonii	May	0	0	0	0	0	8
L3	Myotis nattereri	May	0	0	0	0	1	4
L3	Nyctalus leisleri	May	0	0	0	0	0	11
L3	Pipistrellus pipistrellus	May	0	0	0	0	0	12
L3	Pipistrellus pygmaeus	May	0	0	0	0	0	12
L3	Plecotus auritus	May	0	0	0	0	0	3
L4	Myotis daubentonii	May	0	0	0	0	1	12
L4	Myotis daubentonii	Jun	0	0	0	0	0	10
L4	Myotis mystacinus	May	0	0	0	0	0	1
L4	Myotis mystacinus	Jun	0	0	0	0	0	2
L4	Myotis nattereri	Jun	0	0	0	0	0	3
L4	Nyctalus leisleri	May	0	0	0	0	0	15
L4	Nyctalus leisleri	Jun	0	0	0	0	0	12
L4	Pipistrellus pipistrellus	May	0	0	0	0	0	14
L4	Pipistrellus pipistrellus	Jun	0	0	0	0	0	12
L4	Pipistrellus pygmaeus	May	0	0	0	0	0	14
L4	Pipistrellus pygmaeus	Jun	0	0	0	0	0	11
L4	Plecotus auritus	May	0	0	0	0	0	3
L4	Plecotus auritus	Jun	0	0	0	0	0	3
L5	Myotis daubentonii	May	0	0	0	0	0	6
L5	Myotis daubentonii	Jun	0	0	0	0	0	5

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L5	Myotis nattereri	Jun	0	0	0	0	0	2
L5	Nyctalus leisleri	May	0	0	0	0	0	13
L5	Nyctalus leisleri	Jun	0	0	0	0	0	12
L5	Pipistrellus pipistrellus	May	0	0	0	0	0	14
L5	Pipistrellus pipistrellus	Jun	0	0	0	0	0	11
L5	Pipistrellus pygmaeus	May	0	0	0	0	0	14
L5	Pipistrellus pygmaeus	Jun	0	0	0	0	0	11
L5	Plecotus auritus	May	0	0	0	0	0	1
L5	Plecotus auritus	Jun	0	0	0	0	0	3
L6	Myotis daubentonii	May	0	0	0	0	0	11
L6	Myotis daubentonii	Jun	0	0	0	0	0	8
L6	Myotis mystacinus	Jun	0	0	0	0	0	1
L6	Myotis nattereri	Jun	0	0	0	0	2	2
L6	Nyctalus leisleri	May	0	0	0	0	0	15
L6	Nyctalus leisleri	Jun	0	0	0	0	0	12
L6	Pipistrellus nathusii	May	0	0	0	0	3	4
L6	Pipistrellus nathusii	Jun	0	0	0	0	5	4
L6	Pipistrellus pipistrellus	May	0	0	0	0	0	15
L6	Pipistrellus pipistrellus	Jun	0	0	0	0	0	12
L6	Pipistrellus pygmaeus	May	0	0	0	0	0	14
L6	Pipistrellus pygmaeus	Jun	0	0	0	0	0	12

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L6	Plecotus auritus	May	0	0	0	0	0	10
L6	Plecotus auritus	Jun	0	0	0	0	0	6
L7	Myotis daubentonii	May	0	0	0	0	0	11
L7	Myotis daubentonii	Jun	0	0	0	0	0	10
L7	Myotis mystacinus	May	0	0	0	0	0	5
L7	Myotis mystacinus	Jun	0	0	0	0	0	4
L7	Nyctalus leisleri	May	0	0	0	0	0	15
L7	Nyctalus leisleri	Jun	0	0	0	0	0	11
L7	Pipistrellus nathusii	May	0	0	0	0	0	4
L7	Pipistrellus nathusii	Jun	0	0	0	0	0	4
L7	Pipistrellus pipistrellus	May	0	0	0	0	0	15
L7	Pipistrellus pipistrellus	Jun	0	0	0	0	0	12
L7	Pipistrellus pygmaeus	May	0	0	0	0	0	15
L7	Pipistrellus pygmaeus	Jun	0	0	0	0	0	12
L7	Plecotus auritus	May	0	0	0	0	0	5
L7	Plecotus auritus	Jun	0	0	0	0	0	3
L8	Myotis daubentonii	May	0	0	0	0	2	12
L8	Myotis daubentonii	Jun	0	0	0	0	0	11
L8	Myotis mystacinus	May	0	0	0	0	0	8
L8	Myotis mystacinus	Jun	0	0	0	0	0	7

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L8	Myotis nattereri	May	0	0	0	0	0	6
L8	Myotis nattereri	Jun	0	0	0	0	0	3
L8	Nyctalus leisleri	May	0	0	0	0	0	15
L8	Nyctalus leisleri	Jun	0	0	0	0	0	12
L8	Pipistrellus nathusii	May	0	0	0	0	0	4
L8	Pipistrellus nathusii	Jun	0	0	0	0	0	4
L8	Pipistrellus pipistrellus	May	0	0	0	0	0	15
L8	Pipistrellus pipistrellus	Jun	0	0	0	0	0	12
L8	Pipistrellus pygmaeus	May	0	0	0	0	0	14
L8	Pipistrellus pygmaeus	Jun	0	0	0	0	0	12
L8	Plecotus auritus	May	0	0	0	0	0	11
L8	Plecotus auritus	Jun	0	0	0	0	2	9
L9	Myotis daubentonii	May	0	0	0	0	0	13
L9	Myotis daubentonii	Jun	0	0	0	0	0	9
L9	Myotis mystacinus	May	0	0	0	0	0	1
L9	Myotis mystacinus	Jun	0	0	0	0	0	1
L9	Myotis nattereri	May	0	0	0	0	0	4
L9	Myotis nattereri	Jun	0	0	0	0	1	4
L9	Nyctalus leisleri	May	0	0	0	0	2	12
L9	Nyctalus leisleri	Jun	0	0	0	2	1	9
L9	Pipistrellus pipistrellus	May	0	0	0	0	0	15
L9	Pipistrellus pipistrellus	Jun	0	0	0	0	0	12

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L9	Pipistrellus pygmaeus	May	0	0	0	0	0	14
L9	Pipistrellus pygmaeus	Jun	0	0	0	0	0	12
L9	Plecotus auritus	May	0	0	0	0	0	7
L9	Plecotus auritus	Jun	0	0	0	0	0	7

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
L1	Myotis daubentonii	May	6	3.5 - 9	12	11
L1	Myotis daubentonii	Jun	6	3.5 - 9	12	10
L1	Myotis mystacinus	Jun	2	2 - 2	2	3
L1	Nyctalus leisleri	May	1	1 - 5	9	12
L1	Nyctalus leisleri	Jun	1	1 - 5	9	12
L1	Pipistrellus nathusii	May	31	21.5 - 47.5	74	6
L1	Pipistrellus nathusii	Jun	37	21.5 - 47.5	74	8
L1	Pipistrellus pipistrellus	May	3	3.5 - 6	9	15
L1	Pipistrellus pipistrellus	Jun	5	3.5 - 6	9	12
L1	Pipistrellus pygmaeus	May	9	8 - 9.5	12	14
L1	Pipistrellus pygmaeus	Jun	9	8 - 9.5	11	12
L1	Plecotus auritus	May	4	2.5 - 4	20	8
L1	Plecotus auritus	Jun	4	2.5 - 4	4	9
L10	Myotis daubentonii	May	9	9 - 13	14	10
L10	Myotis daubentonii	Jun	14	9 - 13	16	11
L10	Myotis mystacinus	May	4	3 - 4	4	5
L10	Myotis mystacinus	Jun	4	3 - 4	4	6
L10	Myotis nattereri	May	10	6 - 13	19	4
L10	Myotis nattereri	Jun	10	6 - 13	13	2
L10	Nyctalus leisleri	May	9	7.5 - 19	18	15
L10	Nyctalus leisleri	Jun	8	7.5 - 19	41	12
L10	Pipistrellus nathusii	May	14	8 - 8	14	1
L10	Pipistrellus nathusii	Jun	8	8 - 8	8	4
L10	Pipistrellus pipistrellus	May	3	1.5 - 3.5	7	15
L10	Pipistrellus pipistrellus	Jun	1	1.5 - 3.5	2	12
L10	Pipistrellus pygmaeus	May	11	5.5 - 10.5	21	15
L10	Pipistrellus pygmaeus	Jun	5	5.5 - 10.5	6	12
L10	Plecotus auritus	May	13	5 - 21.5	42	9
L10	Plecotus auritus	Jun	1	5 - 21.5	1	2
L11	Myotis daubentonii	May	9	5 - 9	9	2
L11	Myotis daubentonii	Jun	6	5 - 9	9	9
L11	Myotis mystacinus	May	4	2 - 2	4	1
L11	Myotis mystacinus	Jun	2	2 - 2	2	2

Detector ID	Species/Species Group	month	Median Percentile	95% CIs	Max. Percentile	Nights Recorded
L11	Myotis nattereri	May	6	6 - 6	6	1
L11	Myotis nattereri	Jun	6	6 - 6	6	5
L11	Nyctalus leisleri	May	1	4.5 - 15.5	22	9
L11	Nyctalus leisleri	Jun	9	4.5 - 15.5	30	12
L11	Pipistrellus nathusii	May	18	8 - 13	18	2
L11	Pipistrellus nathusii	Jun	8	8 - 13	14	5
L11	Pipistrellus pipistrellus	May	2	1.5 - 3	5	7
L11	Pipistrellus pipistrellus	Jun	1	1.5 - 3	2	11
L11	Pipistrellus pygmaeus	May	8	10 - 18	17	8
L11	Pipistrellus pygmaeus	Jun	16	10 - 18	20	11
L11	Plecotus auritus	May	13	7 - 14	13	2
L11	Plecotus auritus	Jun	13	7 - 14	15	8
L2	Myotis daubentonii	May	6	3.5 - 7.5	16	9
L2	Myotis daubentonii	Jun	6	3.5 - 7.5	9	8
L2	Myotis mystacinus	May	2	2 - 2	2	2
L2	Myotis mystacinus	Jun	2	2 - 2	10	5
L2	Myotis nattereri	May	10	6 - 9.5	13	4
L2	Myotis nattereri	Jun	6	6 - 9.5	6	2
L2	Nyctalus leisleri	May	2	1.5 - 3.5	4	13
L2	Nyctalus leisleri	Jun	0	1.5 - 3.5	1	9
L2	Pipistrellus nathusii	May	18	8 - 28	38	6
L2	Pipistrellus pipistrellus	May	8	3 - 9	16	14
L2	Pipistrellus pipistrellus	Jun	0	3 - 9	1	9
L2	Pipistrellus pygmaeus	May	19	9 - 19	34	14
L2	Pipistrellus pygmaeus	Jun	4	9 - 19	11	9
L2	Plecotus auritus	May	4	2.5 - 8	15	9
L2	Plecotus auritus	Jun	1	2.5 - 8	1	1
L3	Myotis daubentonii	May	8	3.5 - 9	9	8
L3	Myotis nattereri	May	6	6 - 14.5	23	5
L3	Nyctalus leisleri	May	2	1.5 - 3	3	11
L3	Pipistrellus pipistrellus	May	2	1.5 - 6	10	12
L3	Pipistrellus pygmaeus	May	4	2.5 - 5	6	12
L3	Plecotus auritus	May	1	1 - 1	1	3
L4	Myotis daubentonii	May	12	6.5 - 10.5	25	13
L4	Myotis daubentonii	Jun	6	6.5 - 10.5	12	10
L4	Myotis mystacinus	May	2	2 - 2	2	1

Detector ID	Species/Species Group	month	Median Percentile	95% CIs	Max. Percentile	Nights Recorded
L4	Myotis mystacinus	Jun	2	2 - 2	2	2
L4	Myotis nattereri	Jun	6	6 - 6	6	3
L4	Nyctalus leisleri	May	3	2.5 - 4.5	8	15
L4	Nyctalus leisleri	Jun	2	2.5 - 4.5	6	12
L4	Pipistrellus pipistrellus	May	1	1.5 - 3	4	14
L4	Pipistrellus pipistrellus	Jun	0	1.5 - 3	2	12
L4	Pipistrellus pygmaeus	May	3	2 - 3	4	14
L4	Pipistrellus pygmaeus	Jun	1	2 - 3	2	11
L4	Plecotus auritus	May	1	1 - 1	1	3
L4	Plecotus auritus	Jun	1	1 - 1	9	3
L5	Myotis daubentonii	May	1	1 - 6	6	6
L5	Myotis daubentonii	Jun	9	1 - 6	9	5
L5	Myotis nattereri	Jun	10	9.5 - 9.5	13	2
L5	Nyctalus leisleri	May	2	2 - 5	9	13
L5	Nyctalus leisleri	Jun	2	2 - 5	9	12
L5	Pipistrellus pipistrellus	May	0	0 - 0	0	14
L5	Pipistrellus pipistrellus	Jun	0	0 - 0	1	11
L5	Pipistrellus pygmaeus	May	1	1 - 1.5	2	14
L5	Pipistrellus pygmaeus	Jun	0	1 - 1.5	2	11
L5	Plecotus auritus	May	1	1 - 1	1	1
L5	Plecotus auritus	Jun	1	1 - 1	1	3
L6	Myotis daubentonii	May	9	7.5 - 12	12	11
L6	Myotis daubentonii	Jun	11	7.5 - 12	16	8
L6	Myotis mystacinus	Jun	2	0	2	1
L6	Myotis nattereri	Jun	15	6 - 24	30	4
L6	Nyctalus leisleri	May	4	3 - 5.5	9	15
L6	Nyctalus leisleri	Jun	4	3 - 5.5	9	12
L6	Pipistrellus nathusii	May	14	14 - 28	35	7
L6	Pipistrellus nathusii	Jun	28	14 - 28	35	9
L6	Pipistrellus pipistrellus	May	5	6.5 - 11	17	15
L6	Pipistrellus pipistrellus	Jun	11	6.5 - 11	18	12
L6	Pipistrellus pygmaeus	May	2	1.5 - 4	4	14
L6	Pipistrellus pygmaeus	Jun	0	1.5 - 4	6	12
L6	Plecotus auritus	May	7	2.5 - 9.5	13	10
L6	Plecotus auritus	Jun	9	2.5 - 9.5	15	6
L7	Myotis daubentonii	May	6	5 - 7.5	9	11

Detector ID	Species/Species Group	month	Median Percentile	95% CIs	Max. Percentile	Nights Recorded
L7	Myotis daubentonii	Jun	9	5 - 7.5	9	10
L7	Myotis mystacinus	May	2	2 - 3	4	5
L7	Myotis mystacinus	Jun	2	2 - 3	2	4
L7	Nyctalus leisleri	May	4	3.5 - 6.5	11	15
L7	Nyctalus leisleri	Jun	3	3.5 - 6.5	6	11
L7	Pipistrellus nathusii	May	11	8 - 14	14	4
L7	Pipistrellus nathusii	Jun	11	8 - 14	14	4
L7	Pipistrellus pipistrellus	May	0	0 - 0	1	15
L7	Pipistrellus pipistrellus	Jun	0	0 - 0	0	12
L7	Pipistrellus pygmaeus	May	2	2 - 4	6	15
L7	Pipistrellus pygmaeus	Jun	0	2 - 4	3	12
L7	Plecotus auritus	May	4	4 - 4	4	5
L7	Plecotus auritus	Jun	4	4 - 4	4	3
L8	Myotis daubentonii	May	16	12.5 - 17	25	14
L8	Myotis daubentonii	Jun	12	12.5 - 17	18	11
L8	Myotis mystacinus	May	4	3 - 4	4	8
L8	Myotis mystacinus	Jun	2	3 - 4	4	7
L8	Myotis nattereri	May	10	6 - 9.5	13	6
L8	Myotis nattereri	Jun	6	6 - 9.5	6	3
L8	Nyctalus leisleri	May	6	4.5 - 7.5	11	15
L8	Nyctalus leisleri	Jun	5	4.5 - 7.5	11	12
L8	Pipistrellus nathusii	May	14	11 - 16	14	4
L8	Pipistrellus nathusii	Jun	13	11 - 16	18	4
L8	Pipistrellus pipistrellus	May	1	2 - 6.5	5	15
L8	Pipistrellus pipistrellus	Jun	2	2 - 6.5	11	12
L8	Pipistrellus pygmaeus	May	1	1 - 3	2	14
L8	Pipistrellus pygmaeus	Jun	1	1 - 3	5	12
L8	Plecotus auritus	May	4	4 - 10.5	9	11
L8	Plecotus auritus	Jun	15	4 - 10.5	20	11
L9	Myotis daubentonii	May	6	6 - 9	12	13
L9	Myotis daubentonii	Jun	6	6 - 9	12	9
L9	Myotis mystacinus	May	2	3.5 - 3.5	2	1
L9	Myotis mystacinus	Jun	5	3.5 - 3.5	5	1
L9	Myotis nattereri	May	10	6 - 16	13	4
L9	Myotis nattereri	Jun	13	6 - 16	23	5
L9	Nyctalus leisleri	May	6	5 - 18	30	14

Detector ID	Species/Species Group	month	Median Percentile	95% CIs	Max. Percentile	Nights Recorded
L9	Nyctalus leisleri	Jun	6	5 - 18	49	12
L9	Pipistrellus pipistrellus	May	0	1 - 2	1	15
L9	Pipistrellus pipistrellus	Jun	0	1 - 2	3	12
L9	Pipistrellus pygmaeus	May	5	4 - 7	9	14
L9	Pipistrellus pygmaeus	Jun	6	4 - 7	13	12
L9	Plecotus auritus	May	1	2.5 - 7	4	7
L9	Plecotus auritus	Jun	9	2.5 - 7	13	7

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 Exceptional Activity	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	0	0	0	3	196
Myotis mystacinus	0	0	0	0	0	54
Myotis nattereri	0	0	0	0	4	46
Nyctalus leisleri	0	0	0	4	11	248
Pipistrellus nathusii	0	0	2	4	13	45
Pipistrellus pipistrellus	0	0	0	0	0	266
Pipistrellus pygmaeus	0	0	0	0	10	252
Plecotus auritus	0	0	0	1	4	116

Table 8. Summary table showing key metrics for each species recorded.

Species/Species Group	Median Percentile	95% CIs	Max. Percentile	Nights Recorded
Myotis daubentonii	9	9 - 13	25	199
Myotis mystacinus	2	3.5 - 3.5	10	54
Myotis nattereri	6	9.5 - 9.5	30	50
Nyctalus leisleri	4	7.5 - 19	49	263
Pipistrellus nathusii	14	8 - 8	74	64
Pipistrellus pipistrellus	1	6.5 - 11	18	266
Pipistrellus pygmaeus	3	9 - 19	34	262
Plecotus auritus	4	7 - 14	42	121

Figure 4. The activity level (percentile) of bats recorded across each night of the bat survey for the **entire site**.

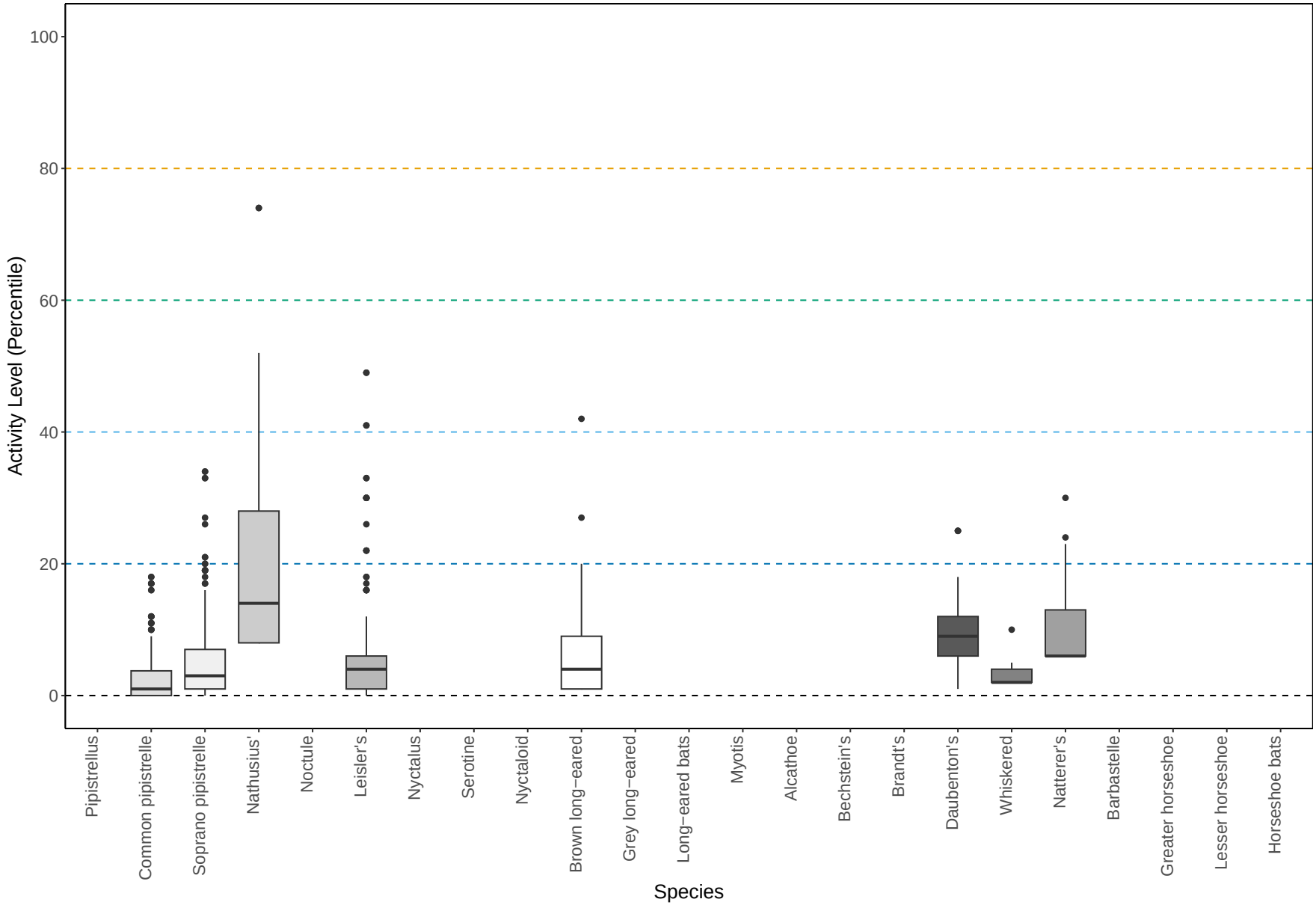
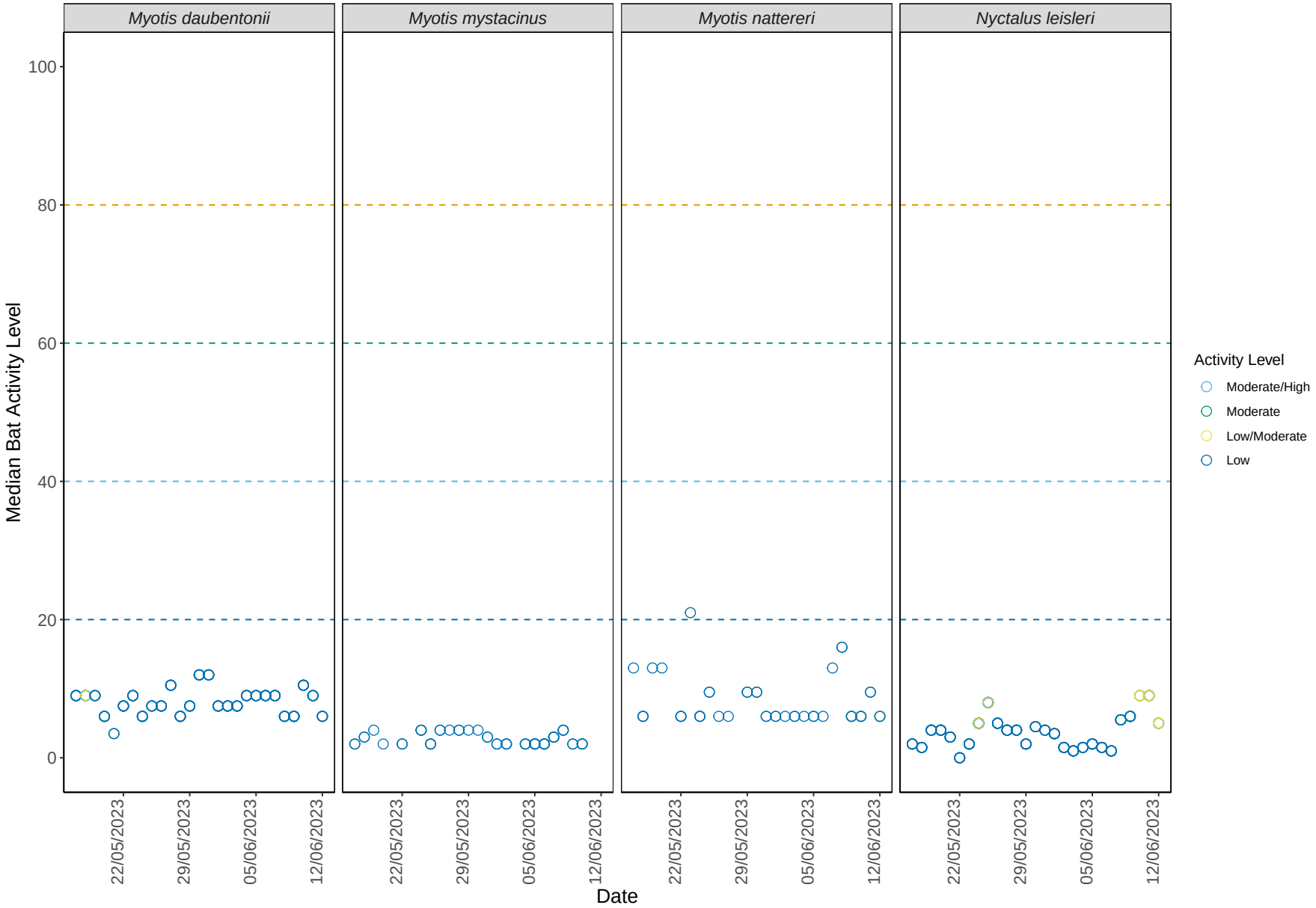
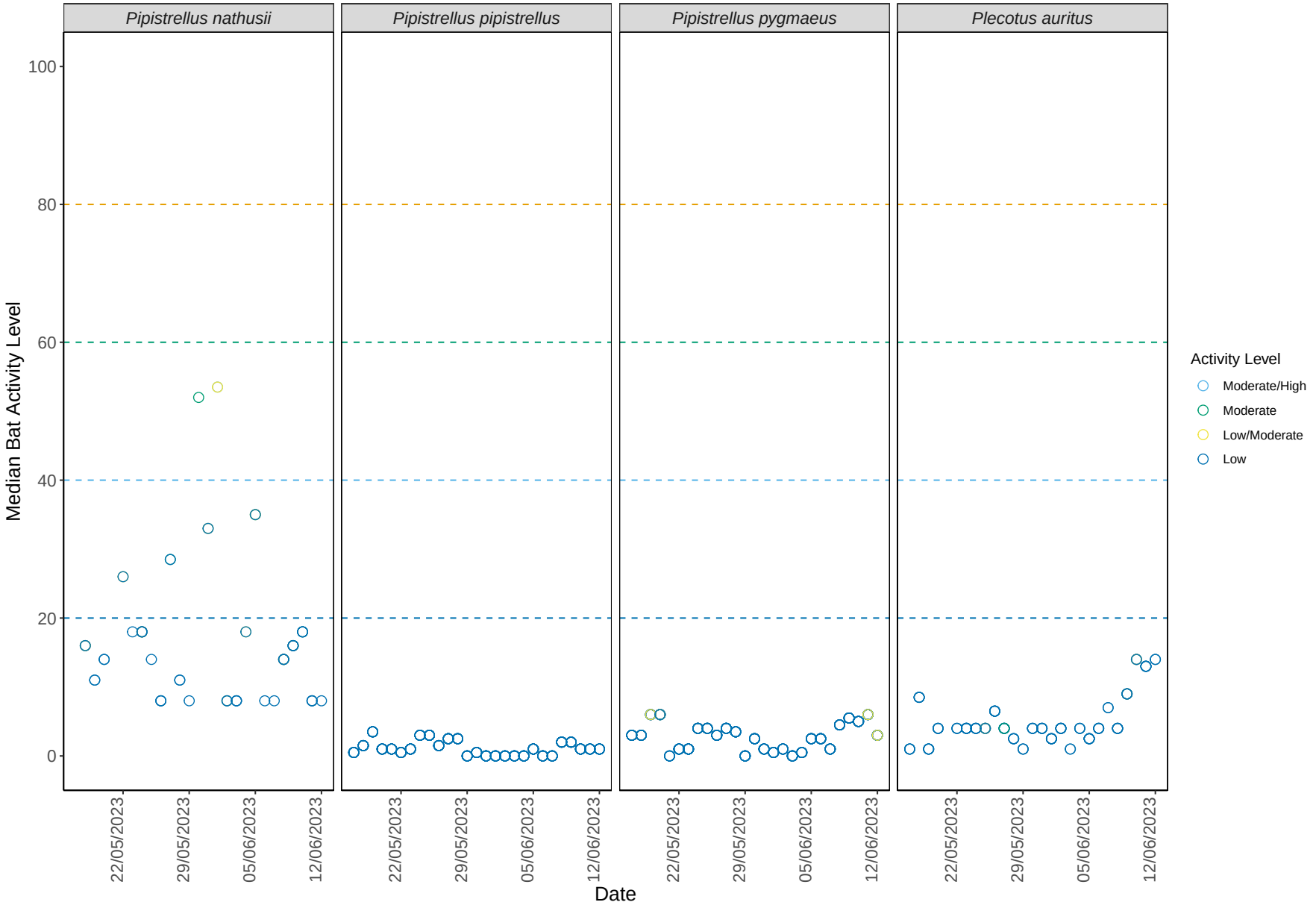

Activity Level (Percentile)
100
80
60
40
20
0
Pipistrellus
Common pipistrelle
Soprano pipistrelle
Nathusius'
Noctule
Leisler's
Nyctalus
Serotine
Nyctaloid
Brown long−eared
Grey long−eared
Long−eared bats
Myotis
Alcathoe
Bechstein's
Brandt's
Daubenton's
Whiskered
Natterer's
Barbastelle
Greater horseshoe
Lesser horseshoe
Horseshoe bats
Species

Figure 5. The median activity levels of bats recorded across all detectors each night.


Myotis daubentonii
Myotis mystacinus
Myotis nattereri
Nyctalus leisleri
Median Bat Activity Level
100
80
60
40
20
0
22/05/2023
29/05/2023
05/06/2023
12/06/2023
Date
Activity Level
Moderate/High
Moderate
Low/Moderate
Low


Pipistrellus nathusii
Pipistrellus pipistrellus
Pipistrellus pygmaeus
Plecotus auritus
Median Bat Activity Level
100
80
60
40
20
0
22/05/2023
29/05/2023
05/06/2023
12/06/2023
Date
Activity Level
Moderate/High
Moderate
Low/Moderate
Low

Per Site, Per Month

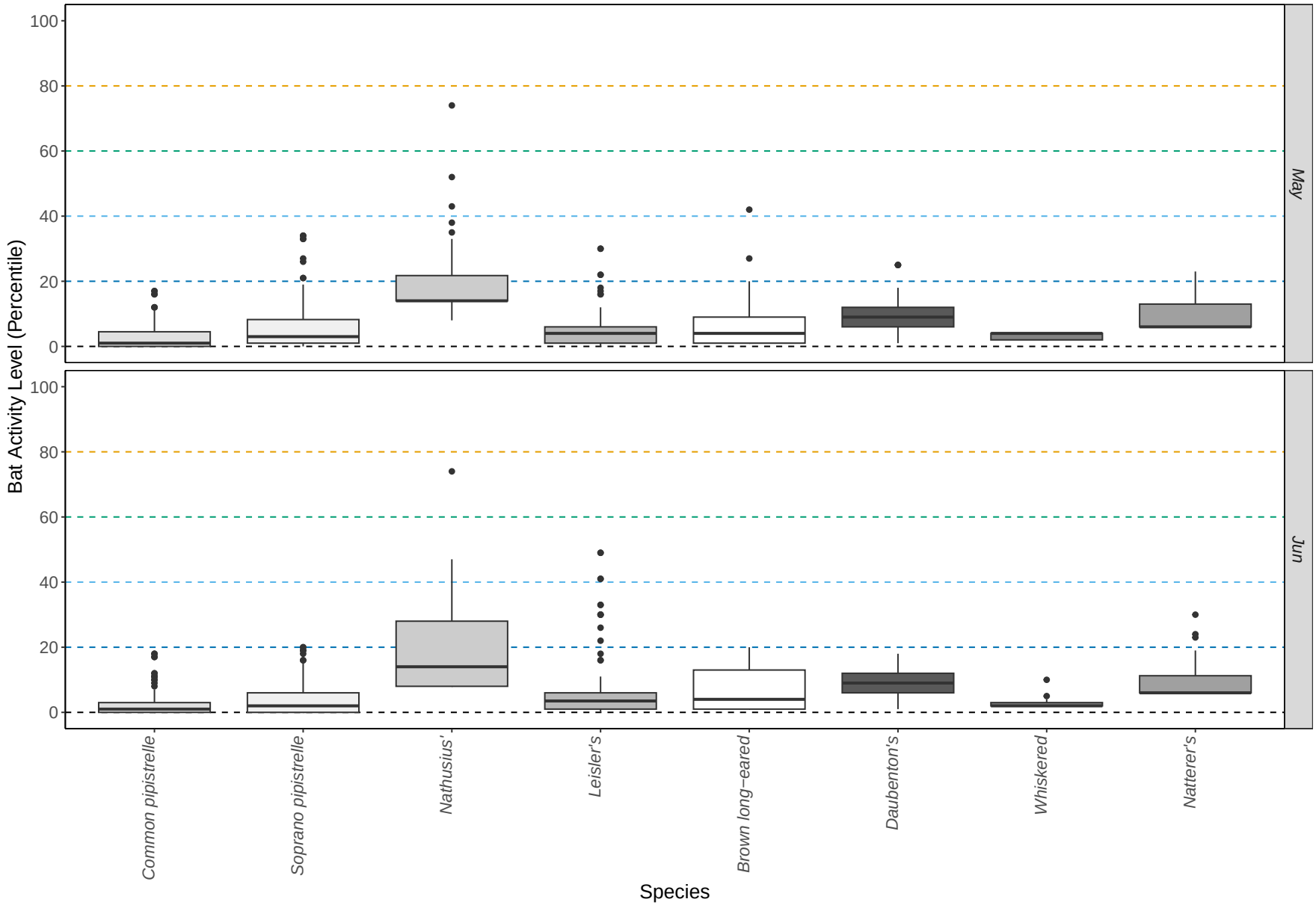
Table 9. Summary table showing the number of nights recorded bat activity fell into each activity band for each species during each month.

Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
Myotis daubentonii	May	0	0	0	0	3	105
Myotis daubentonii	Jun	0	0	0	0	0	91
Myotis mystacinus	May	0	0	0	0	0	23
Myotis mystacinus	Jun	0	0	0	0	0	31
Myotis nattereri	May	0	0	0	0	1	23
Myotis nattereri	Jun	0	0	0	0	3	23
Nyctalus leisleri	May	0	0	0	0	4	143
Nyctalus leisleri	Jun	0	0	0	4	7	105
Pipistrellus nathusii	May	0	0	1	2	5	22
Pipistrellus nathusii	Jun	0	0	1	2	8	23
Pipistrellus pipistrellus	May	0	0	0	0	0	151
Pipistrellus pipistrellus	Jun	0	0	0	0	0	115
Pipistrellus pygmaeus	May	0	0	0	0	8	140
Pipistrellus pygmaeus	Jun	0	0	0	0	2	112
Plecotus auritus	May	0	0	0	1	2	65
Plecotus auritus	Jun	0	0	0	0	2	51

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	May	9	9 - 13	25	108
Myotis daubentonii	Jun	9	9 - 13	18	91
Myotis mystacinus	May	4	3.5 - 3.5	4	23
Myotis mystacinus	Jun	2	3.5 - 3.5	10	31
Myotis nattereri	May	6	6 - 9.5	23	24
Myotis nattereri	Jun	6	9.5 - 9.5	30	26
Nyctalus leisleri	May	4	7.5 - 19	30	147
Nyctalus leisleri	Jun	4	7.5 - 19	49	116
Pipistrellus nathusii	May	14	8 - 8	74	30
Pipistrellus nathusii	Jun	14	8 - 8	74	34
Pipistrellus pipistrellus	May	1	6.5 - 11	17	151
Pipistrellus pipistrellus	Jun	1	6.5 - 11	18	115
Pipistrellus pygmaeus	May	3	9 - 19	34	148
Pipistrellus pygmaeus	Jun	2	9 - 19	20	114
Plecotus auritus	May	4	7 - 14	42	68
Plecotus auritus	Jun	4	7 - 14	20	53

Figure 6. The activity level (percentile) of bats recorded across each night of the bat survey for the entire site, split between months.


Bat Activity Level (Percentile)
100
80
60
40
20
0
May
Jun
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Brown long−eared
Daubenton's
Whiskered
Natterer's
Species

Part 2: Nightly Analysis

Entire Survey Period

Sunrise and Sunset Times

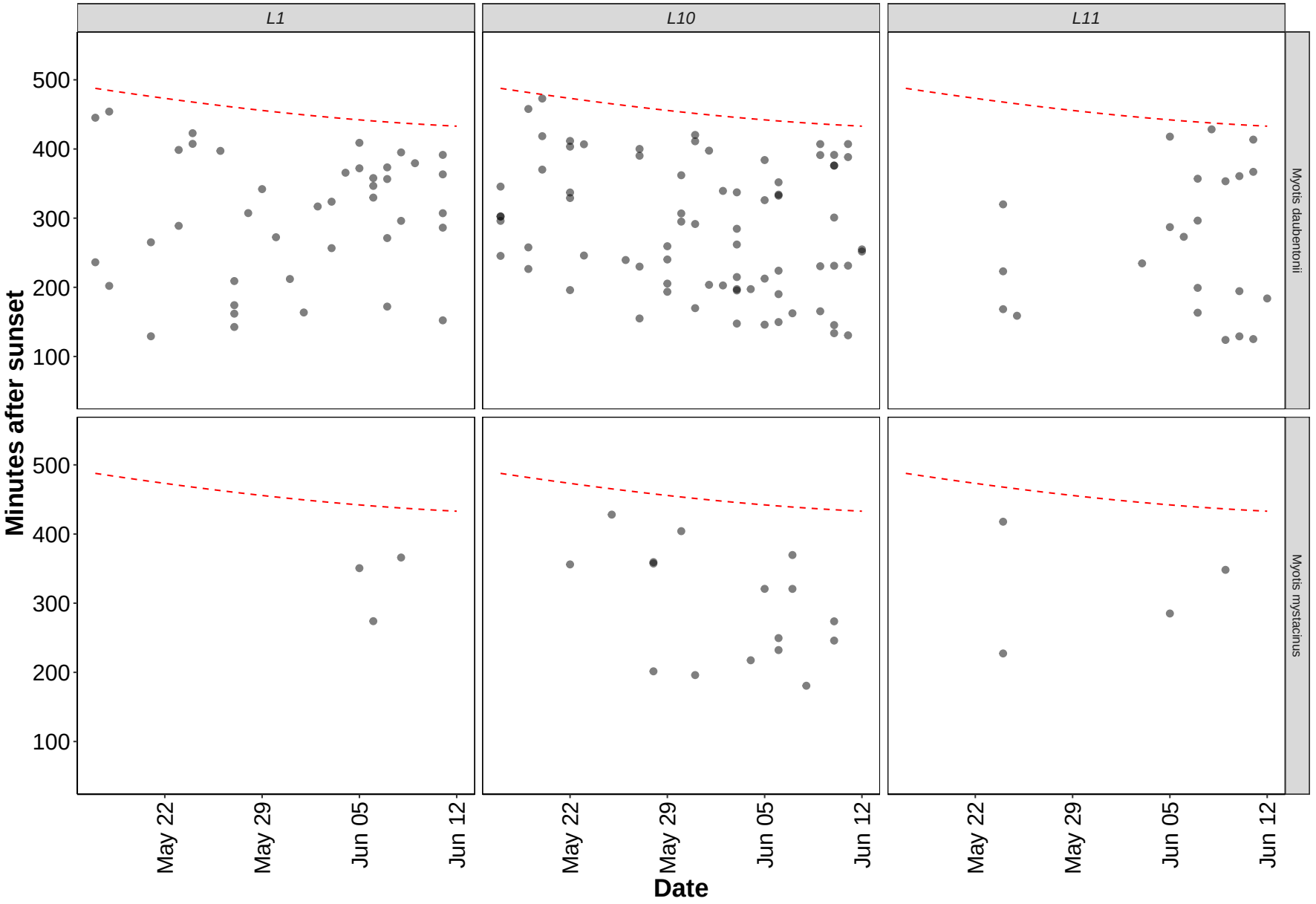
Table 11. The times of sunset and sunrise the following morning for surveys beginning on the date shown.

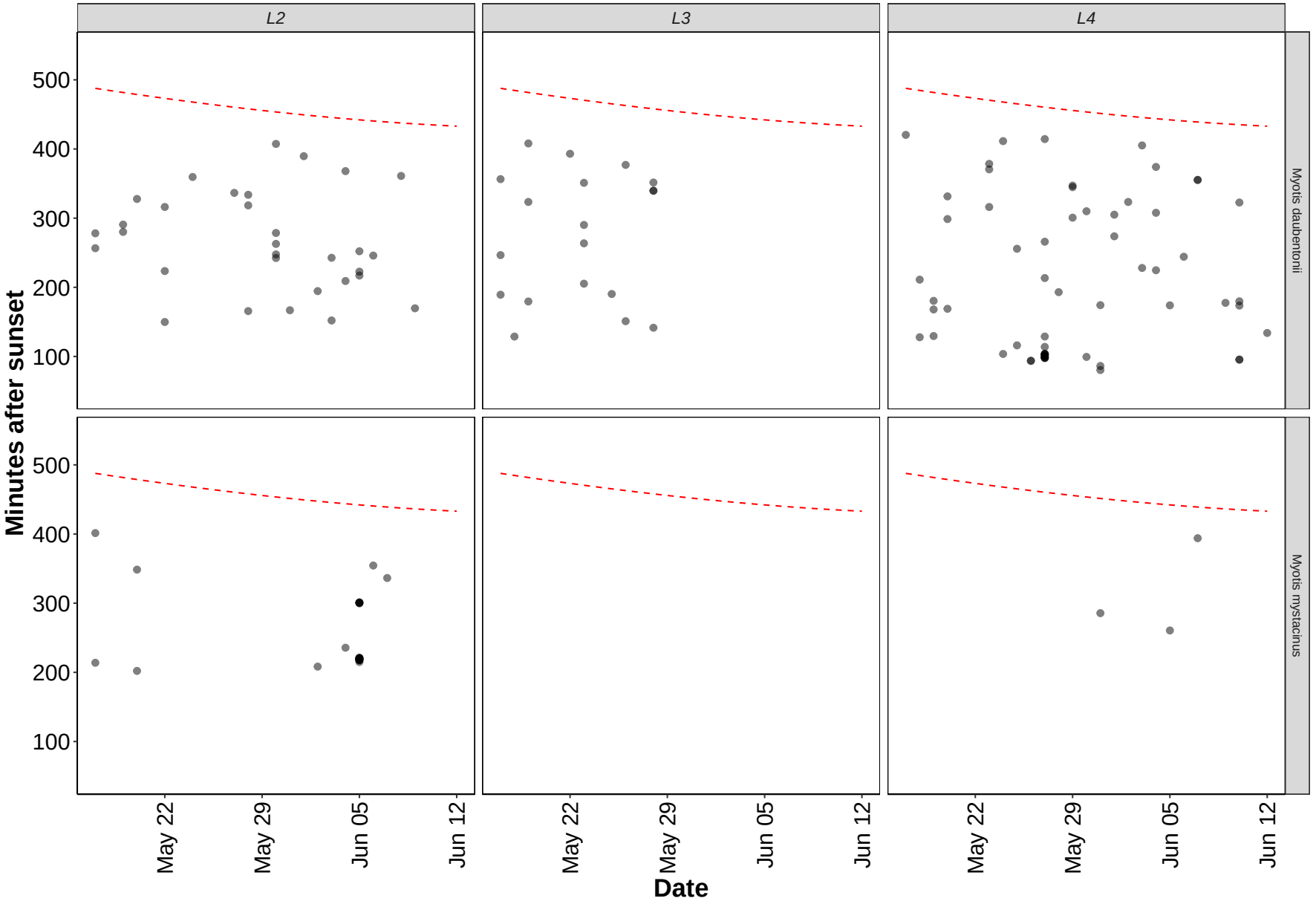
Night (y-m-d)	Sunset (h:m)	Sunrise (h:m)	Night Length (hours)
2023-05-17	20:22	04:30	8.1
2023-05-18	20:24	04:28	8.1
2023-05-19	20:25	04:27	8.0
2023-05-20	20:27	04:26	8.0
2023-05-21	20:28	04:24	7.9
2023-05-22	20:30	04:23	7.9
2023-05-23	20:31	04:22	7.8
2023-05-24	20:33	04:20	7.8
2023-05-25	20:34	04:19	7.8
2023-05-26	20:35	04:18	7.7
2023-05-27	20:37	04:17	7.7
2023-05-28	20:38	04:16	7.6
2023-05-29	20:39	04:15	7.6
2023-05-30	20:41	04:14	7.6
2023-05-31	20:42	04:13	7.5
2023-06-01	20:43	04:12	7.5
2023-06-02	20:44	04:12	7.5
2023-06-03	20:45	04:11	7.4
2023-06-04	20:46	04:10	7.4
2023-06-05	20:47	04:09	7.4
2023-06-06	20:48	04:09	7.3
2023-06-07	20:49	04:08	7.3
2023-06-08	20:50	04:08	7.3
2023-06-09	20:51	04:07	7.3
2023-06-10	20:52	04:07	7.3
2023-06-11	20:53	04:07	7.2
2023-06-12	20:53	04:06	7.2

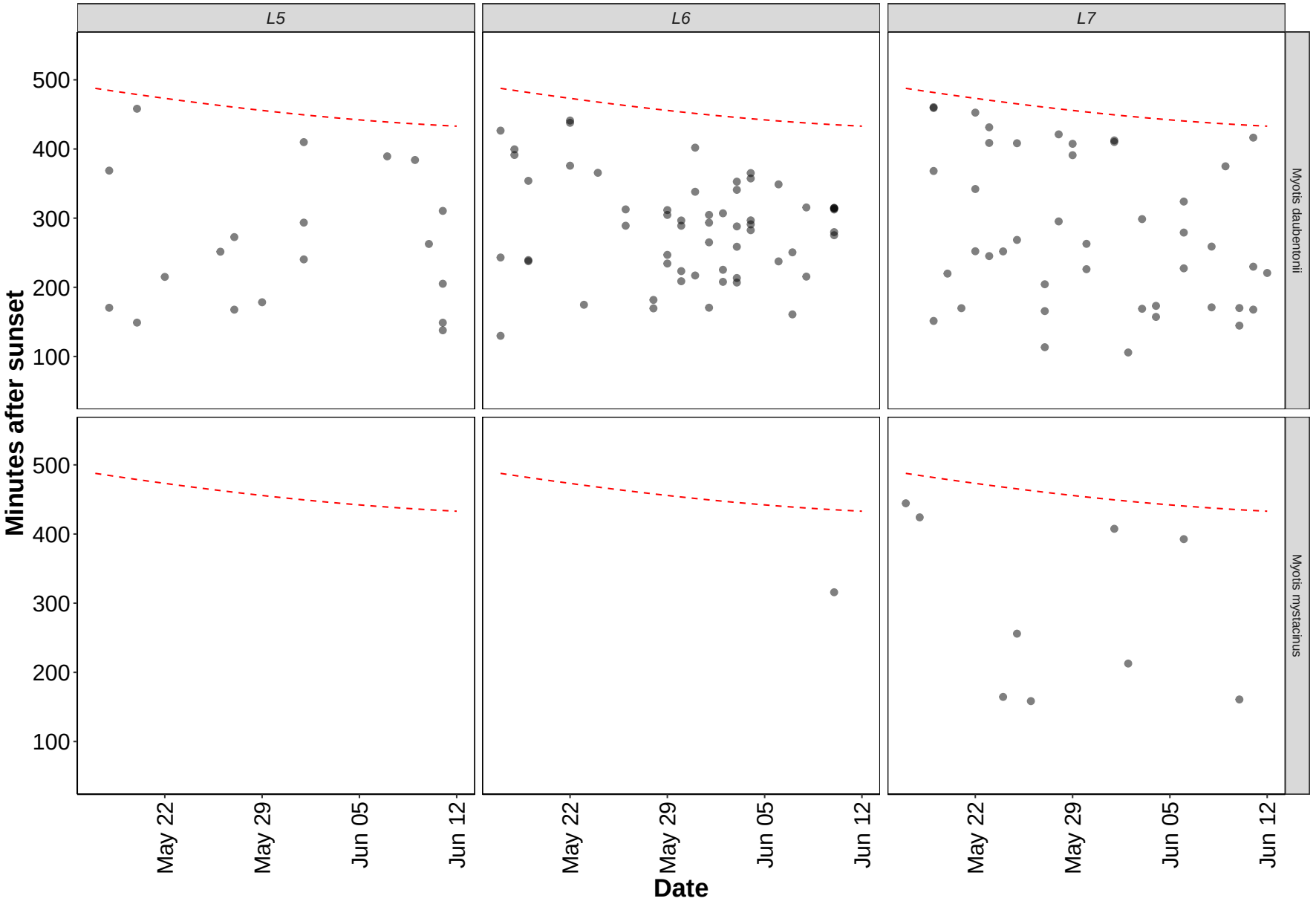
Distribution of Bat Activity Across the Night through Time

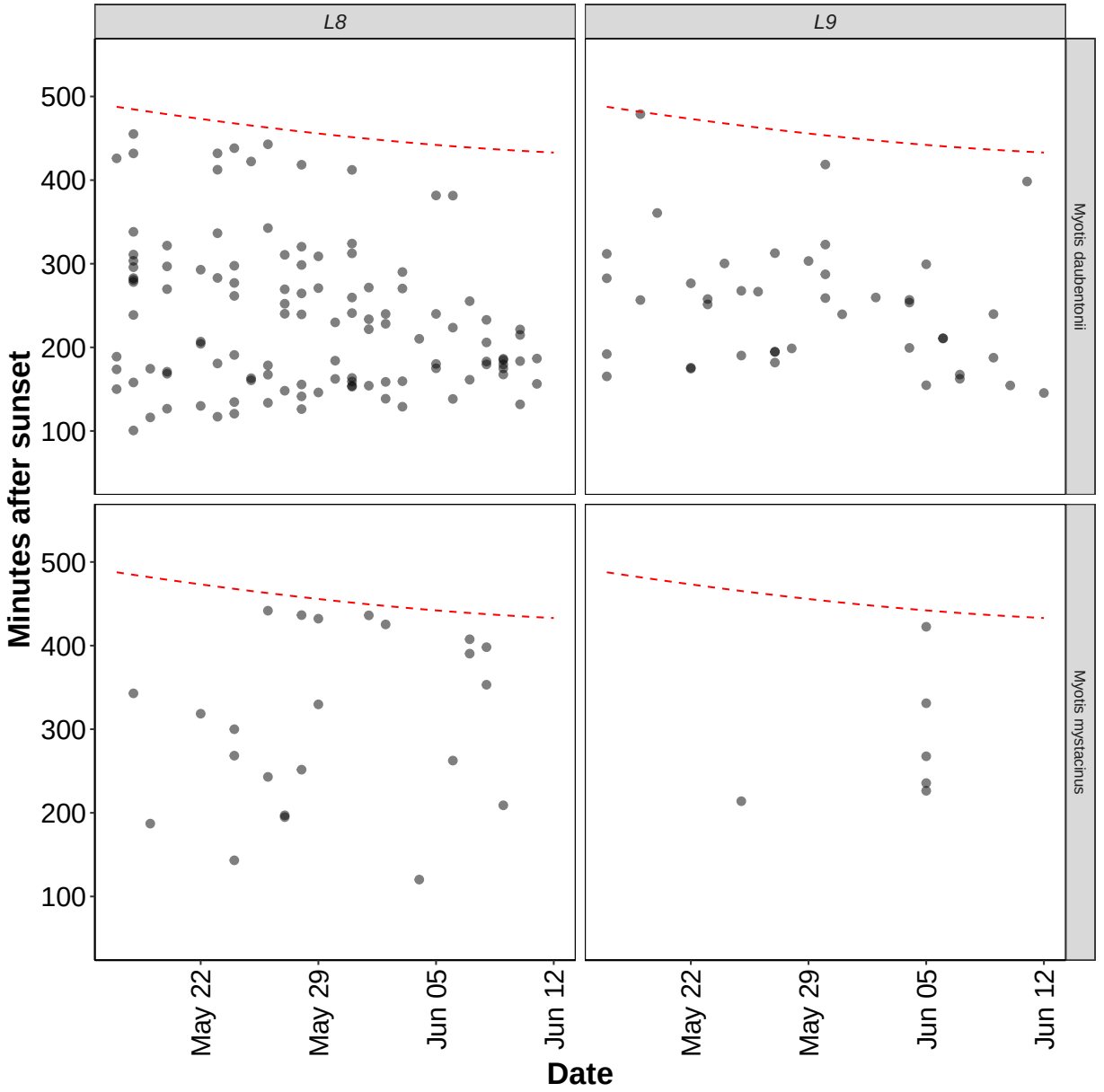
Per Detector

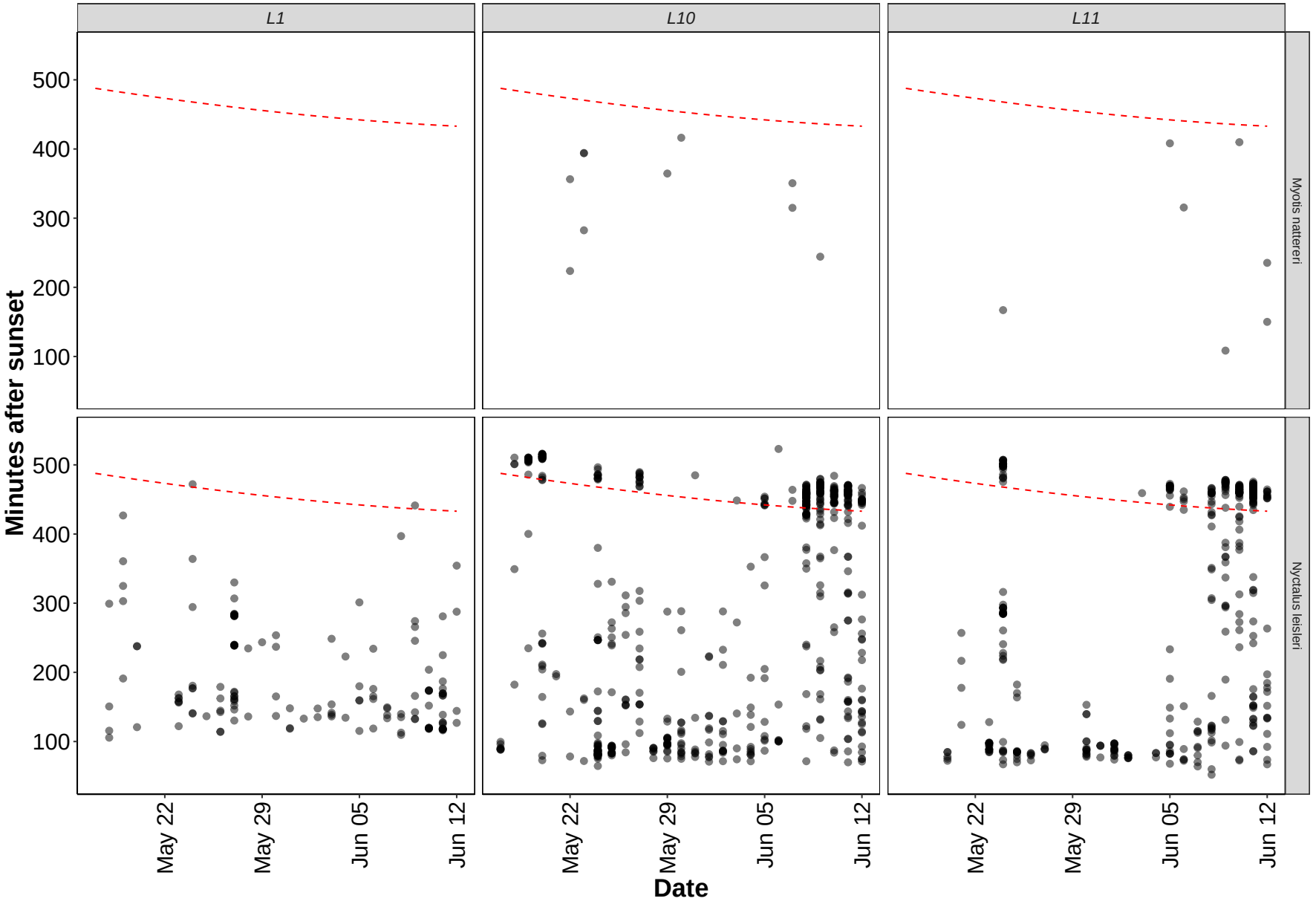
Figure 7. Timing of bat calls plotted as minutes before/after sunset, whereby 0 on the y axis represents sunset. Sunrise throughout the survey period is depicted as the red dashed line. Colours indicate kernel densities, with darkest colours showing peaks of activity. These colours are comparative only within each plot, and do not account for overall activity.

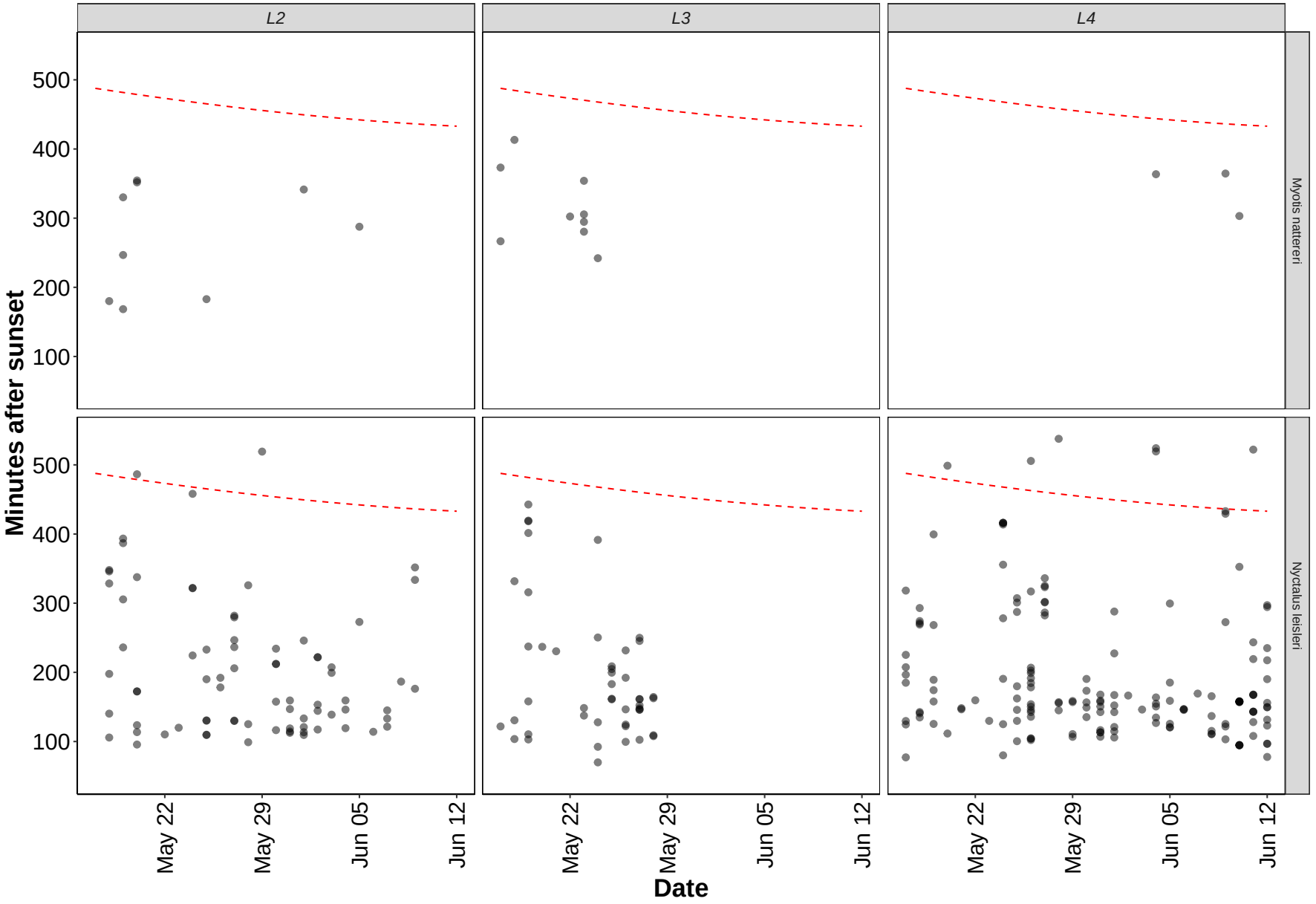

L1
L10
L11
Myotis daubentonii
Myotis mystacinus
Minutes after sunset
500
400
300
200
100
May 22
May 29
Jun 05
Jun 12
Date

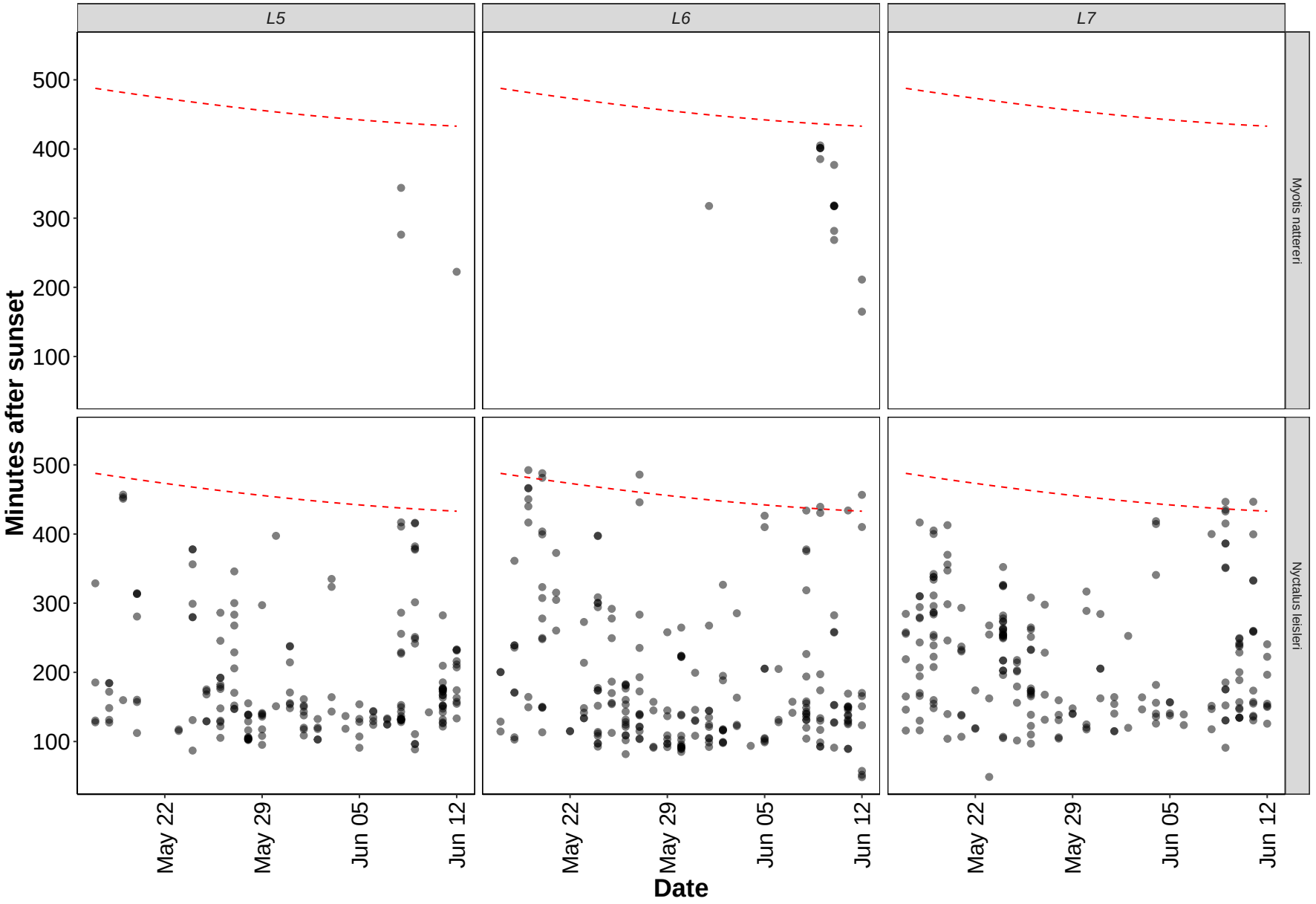

L2
L3
L4
Myotis daubentonii
Myotis mystacinus
Minutes after sunset
500
400
300
200
100
May 22
May 29
Jun 05
Jun 12
Date

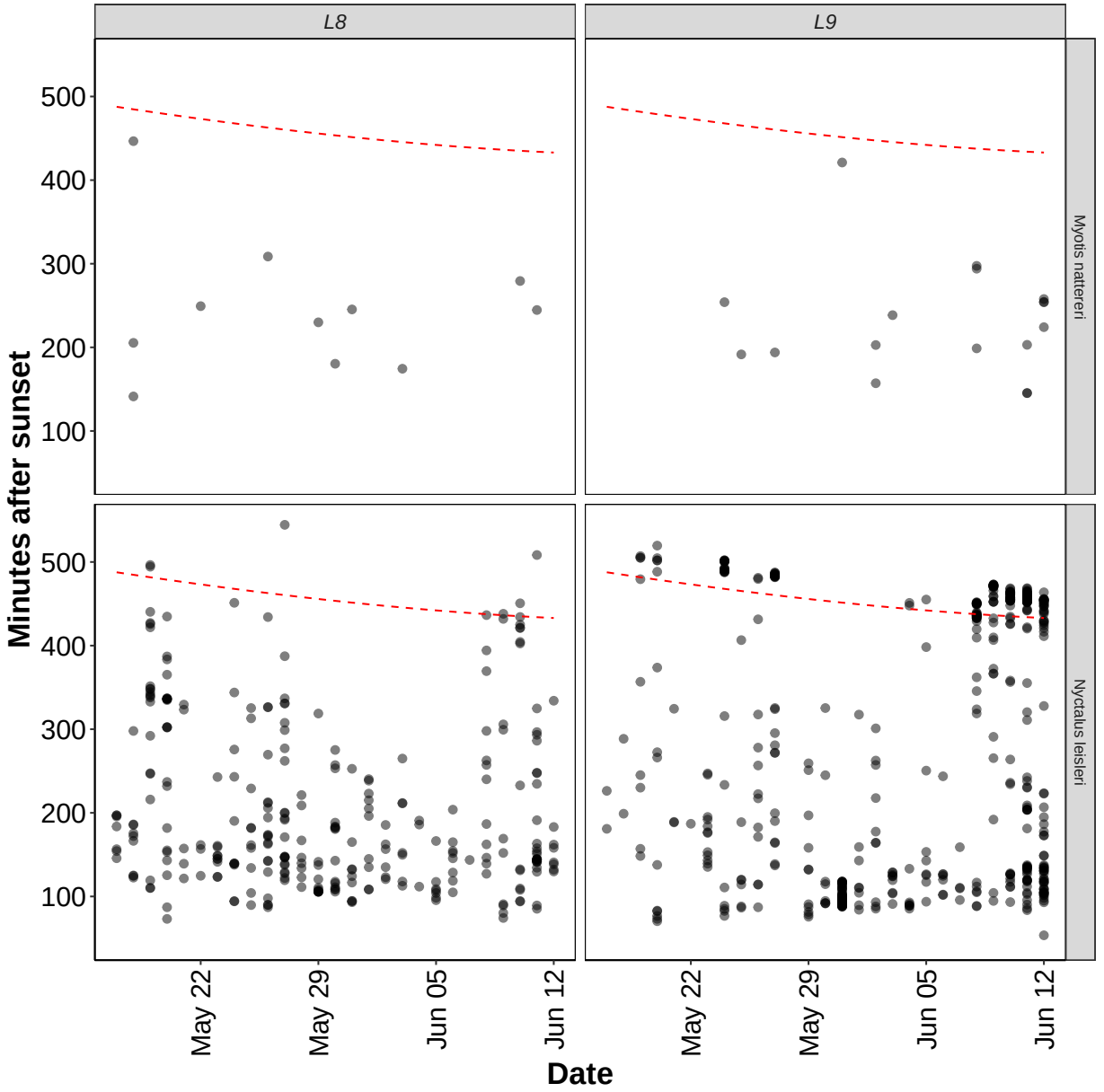

L5
L6
L7
Myotis daubentonii
Myotis mystacinus
Minutes after sunset
500
400
300
200
100
May 22
May 29
Jun 05
Jun 12
Date

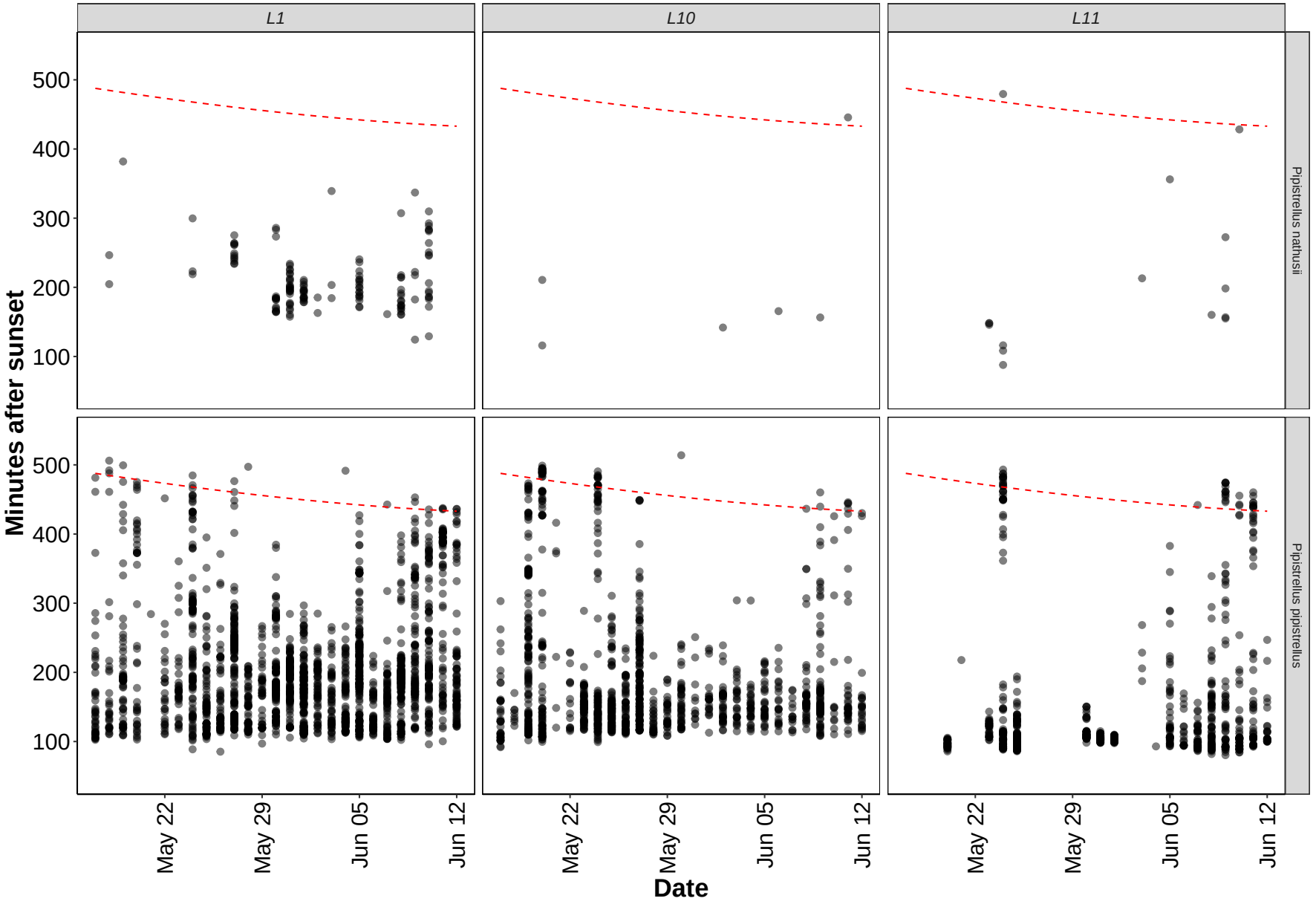

L8
L9
Myotis daubentonii
Myotis mystacinus
Minutes after sunset
500
400
300
200
100
May 22
May 29
Jun 05
Jun 12
Date

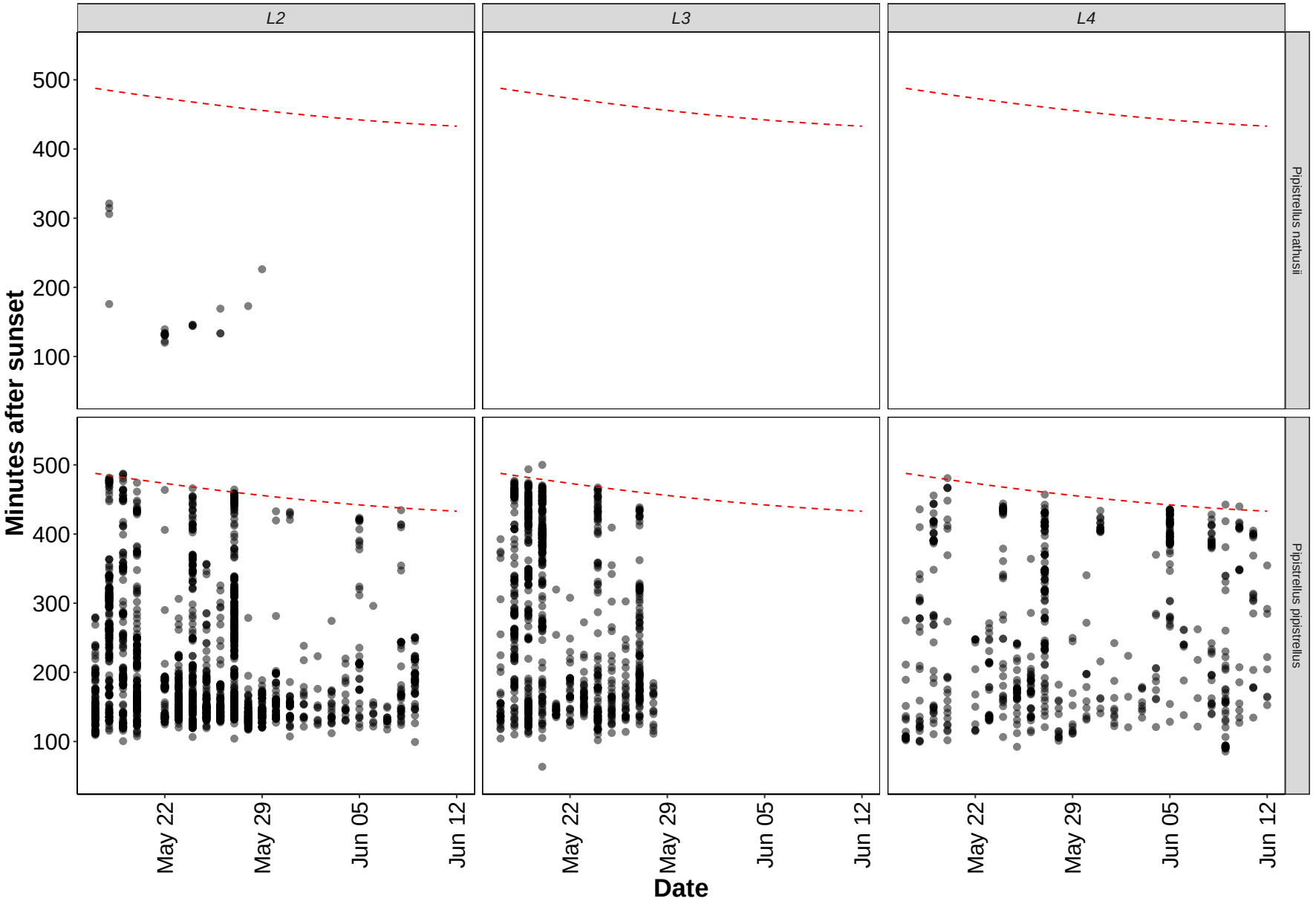

L1
L10
L11
Myotis nattereri
Nyctalus leisleri
Minutes after sunset
500
400
300
200
100
May 22
May 29
Jun 05
Jun 12
Date

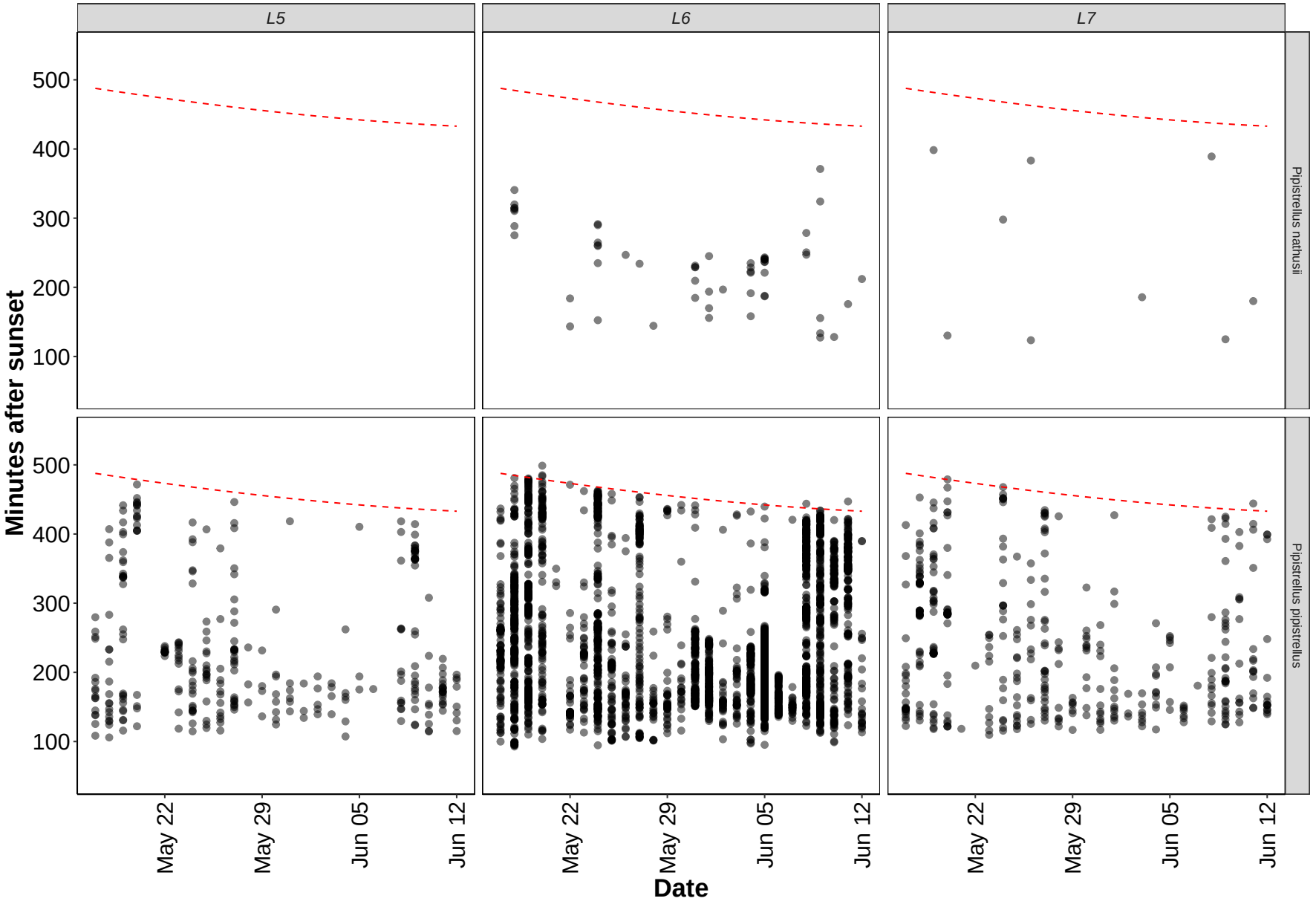

L2
L3
L4
Myotis nattereri
Nyctalus leisleri
Minutes after sunset
500
400
300
200
100
May 22
May 29
Jun 05
Jun 12
Date

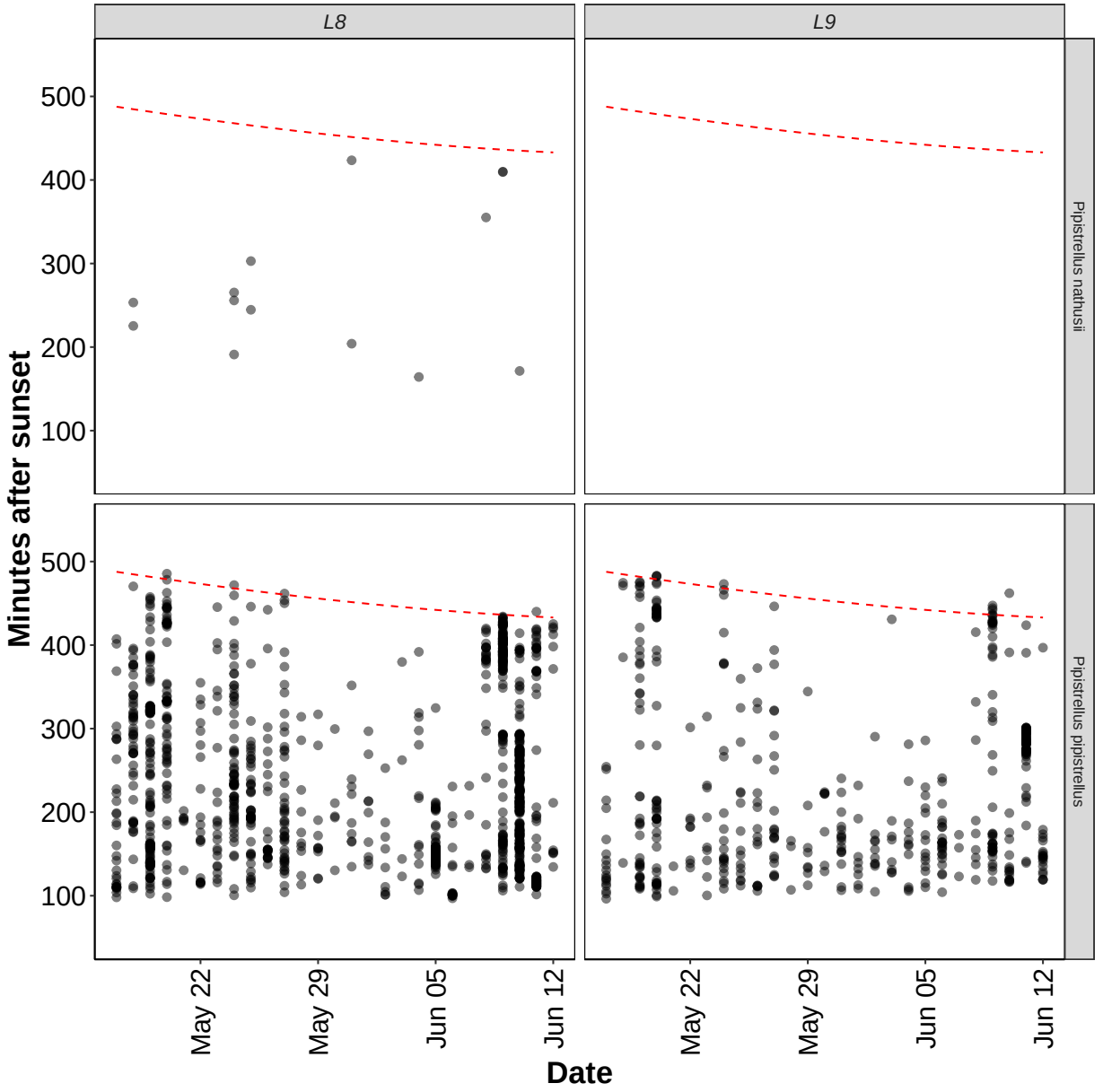

L5
L6
L7
Myotis nattereri
Nyctalus leisleri
Minutes after sunset
500
400
300
200
100
May 22
May 29
Jun 05
Jun 12
Date

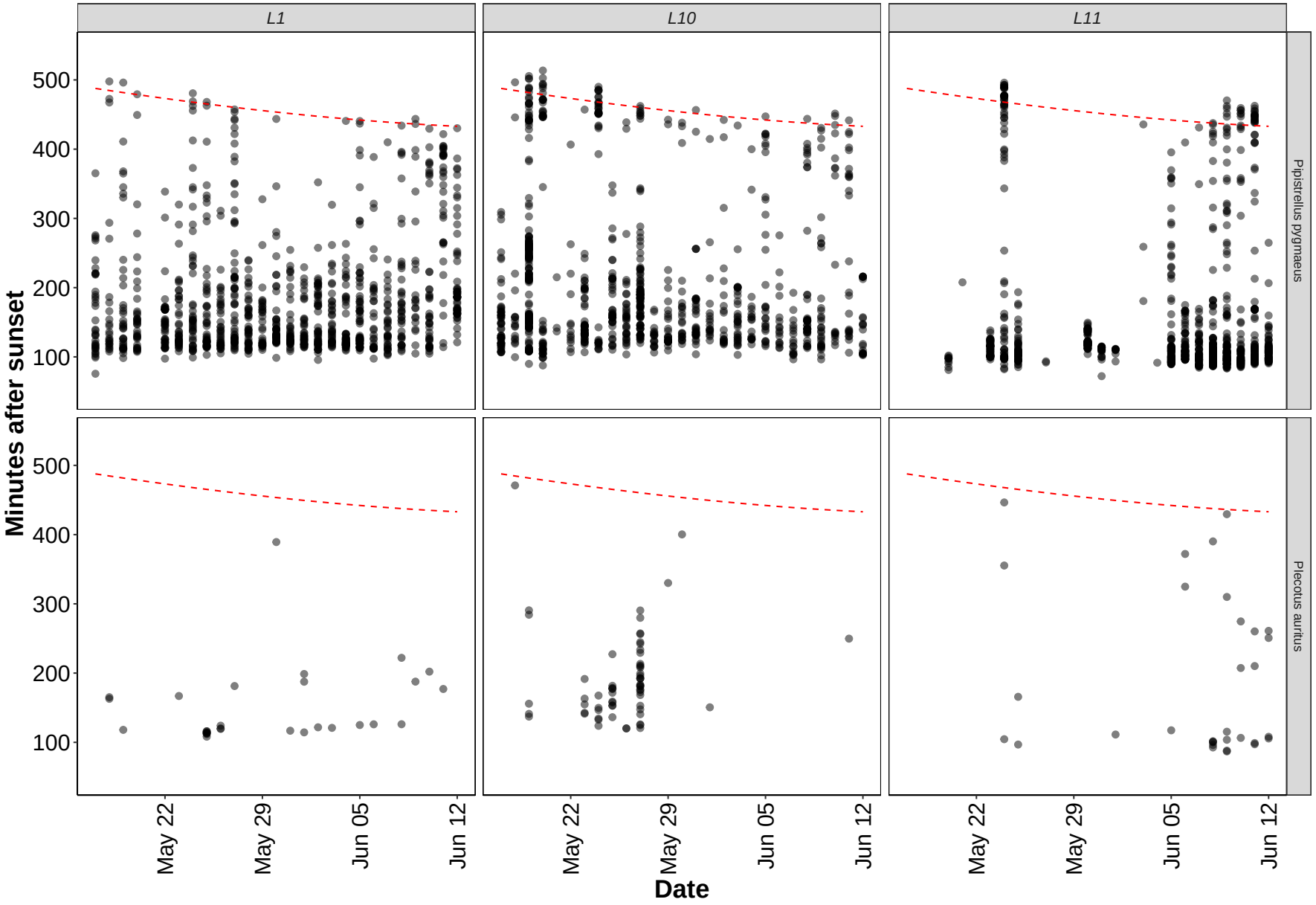

L8
L9
Myotis nattereri
Nyctalus leisleri
Minutes after sunset
500
400
300
200
100
May 22
May 29
Jun 05
Jun 12
Date

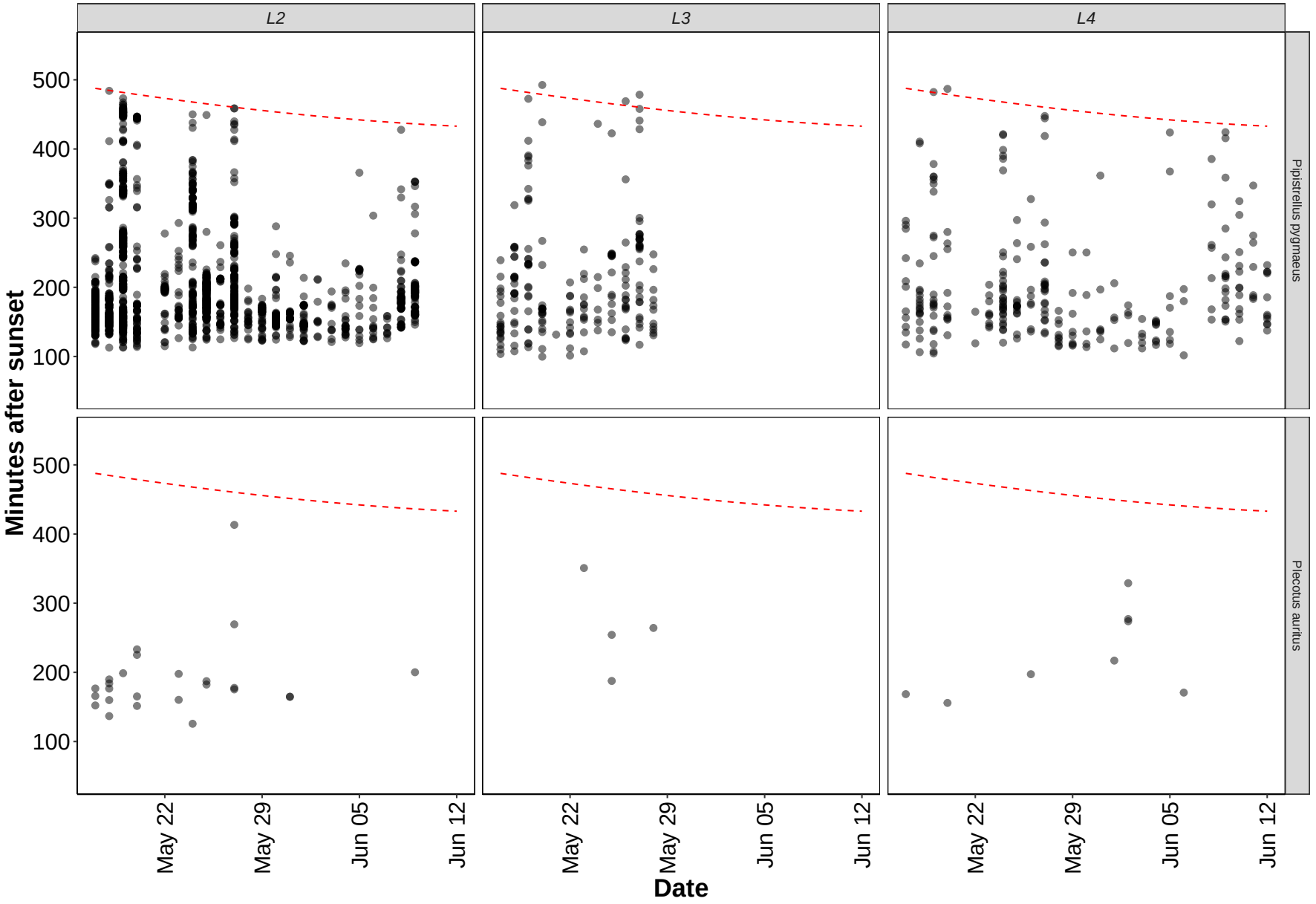

L1
L10
L11
Pipistrellus nathusii
Pipistrellus pipistrellus
Minutes after sunset
500
400
300
200
100
May 22
May 29
Jun 05
Jun 12
Date


L2
L3
L4
Pipistrellus nathusii
Pipistrellus pipistrellus
Minutes after sunset
500
400
300
200
100
May 22
May 29
Jun 05
Jun 12
Date


L5
L6
L7
Pipistrellus nathusii
Pipistrellus pipistrellus
Minutes after sunset
500
400
300
200
100
May 22
May 29
Jun 05
Jun 12
Date


L8
L9
Pipistrellus nathusii
Pipistrellus pipistrellus
Minutes after sunset
500
400
300
200
100
May 22
May 29
Jun 05
Jun 12
Date


L1
L10
L11
Pipistrellus pygmaeus
Plecotus auritus
Minutes after sunset
500
400
300
200
100
May 22
May 29
Jun 05
Jun 12
Date


L2
L3
L4
Pipistrellus pygmaeus
Plecotus auritus
Minutes after sunset
500
400
300
200
100
May 22
May 29
Jun 05
Jun 12
Date

Roost Emergence Time and Bat Observation

Based on: Russ, Jon. 2012. British Bat Calls a Guide to species Identification. Pelagic Publishing.

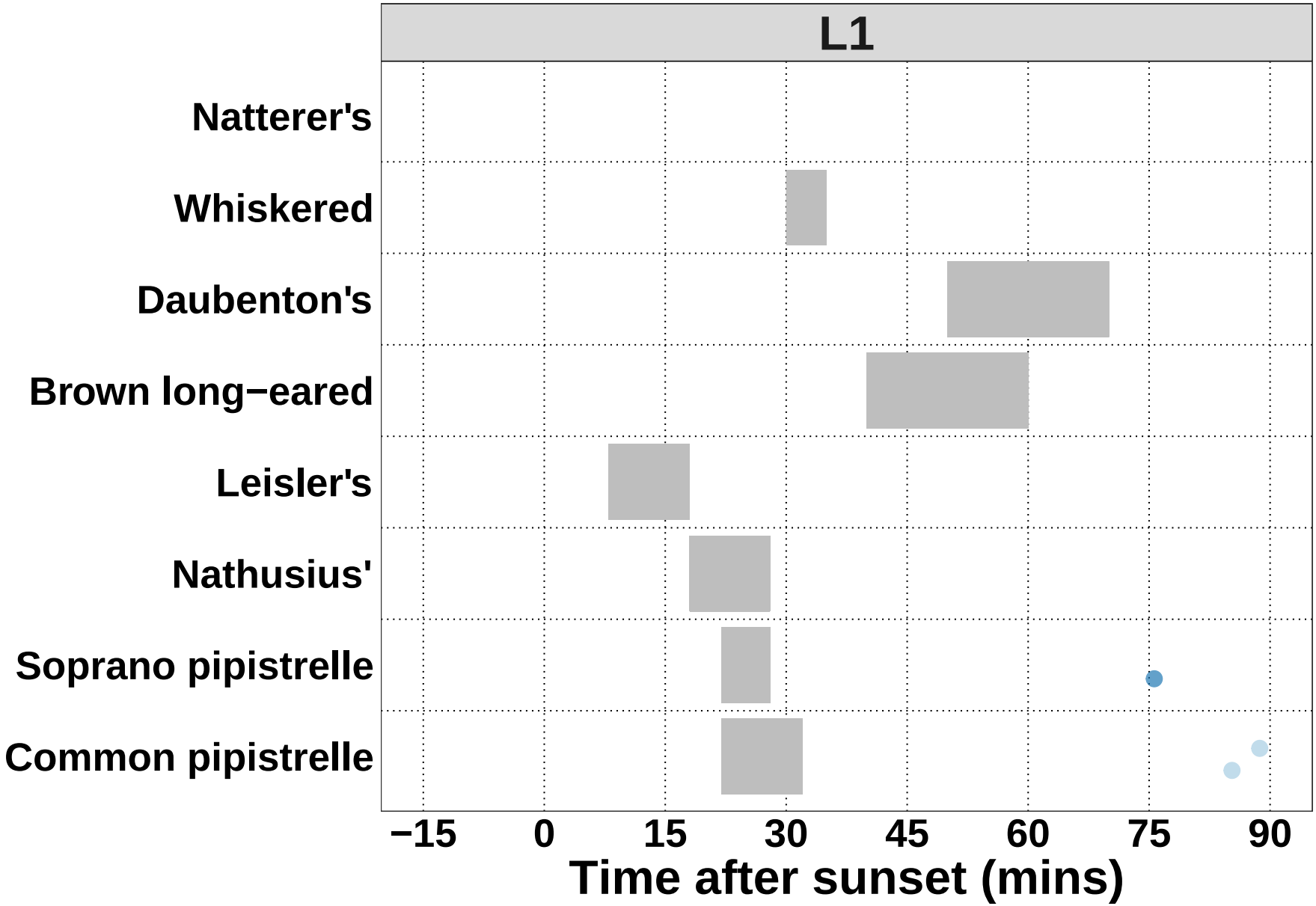
Bat Passes Potentially Indicating Close Proximity to a Roost (Russ 2012)

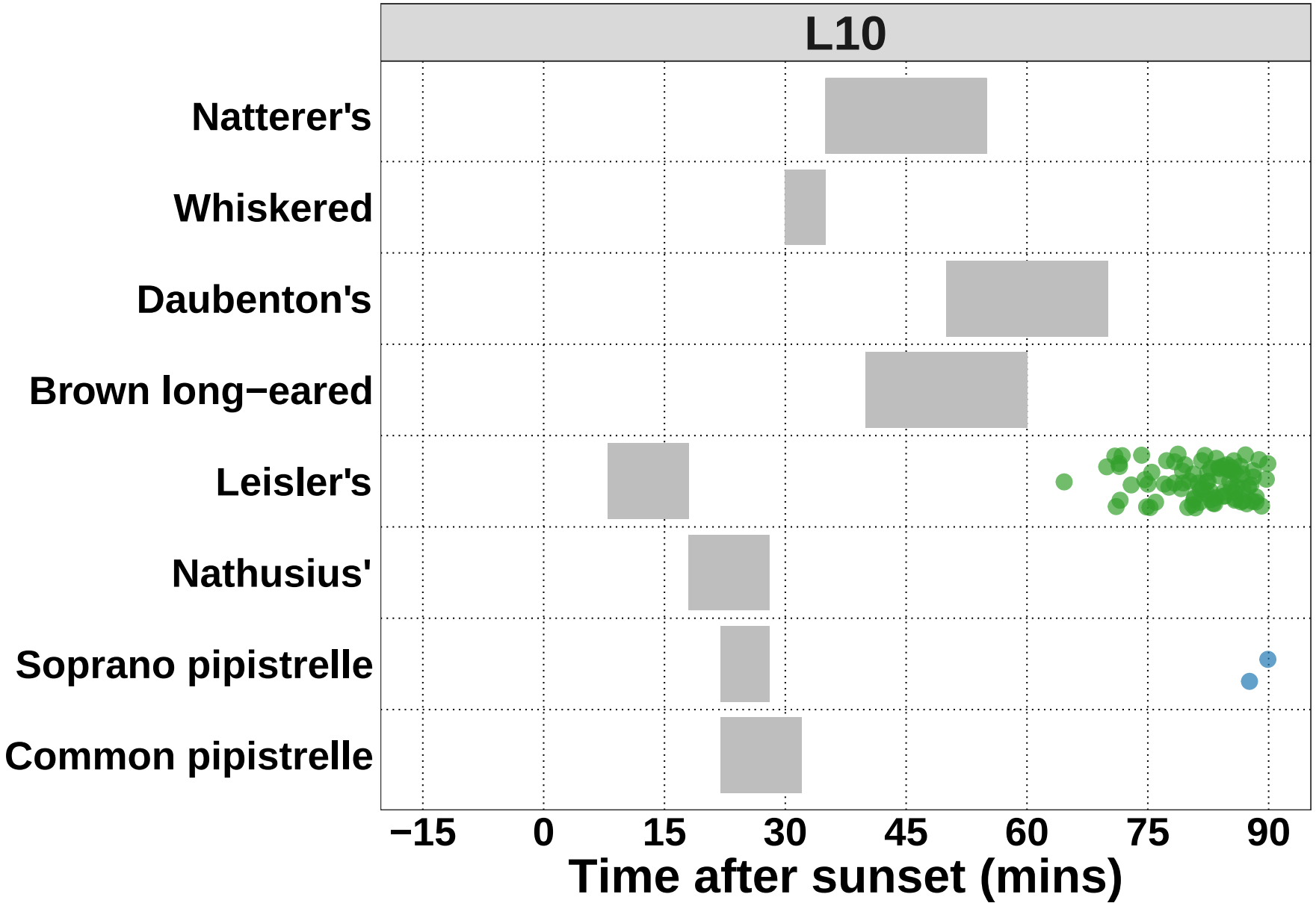
Table 12. Number of bat calls recorded before the upper time of the species-specific emergence time range, and which therefore may potentially indicate the presence of a nearby roost.

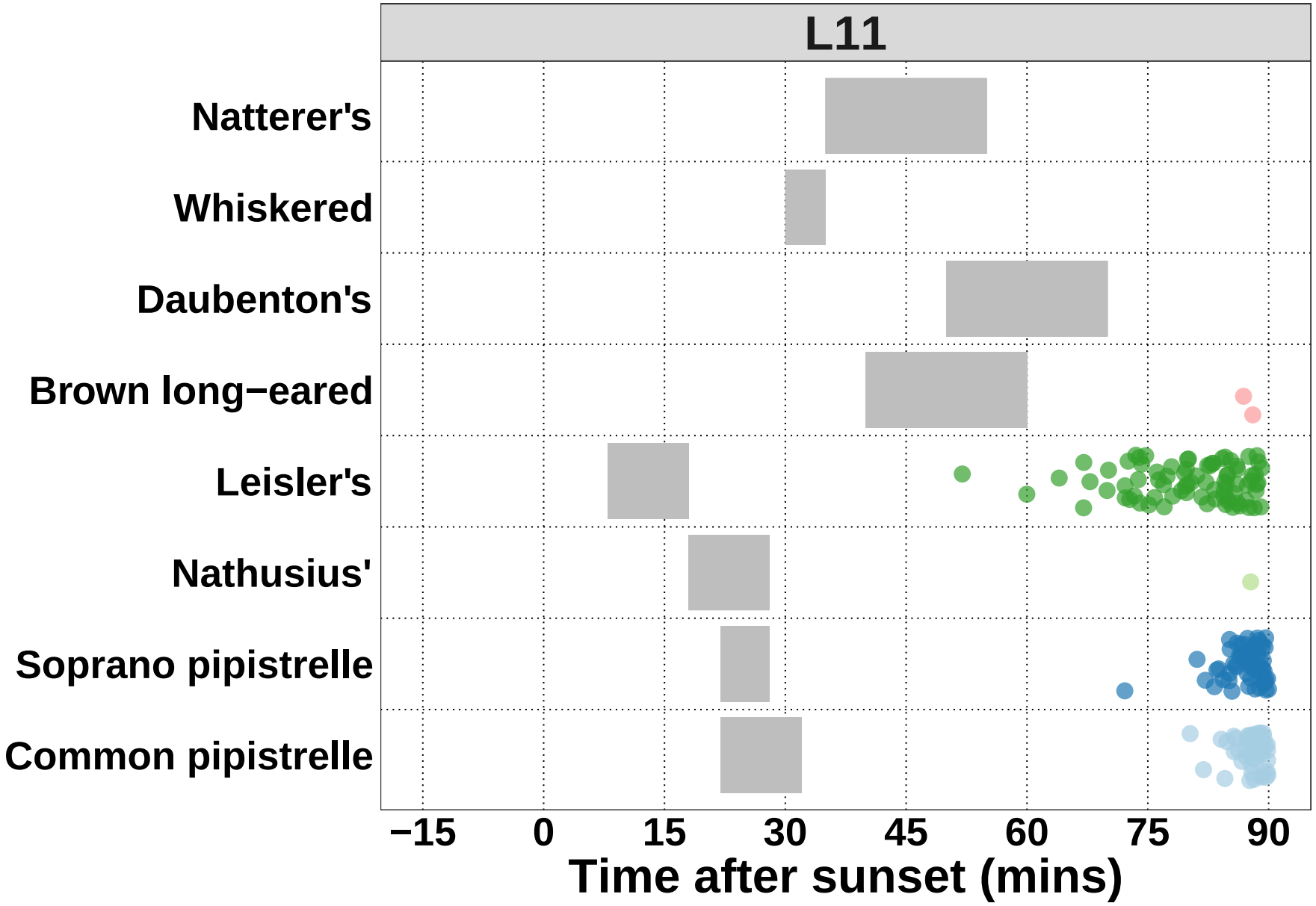
Species	Detector ID

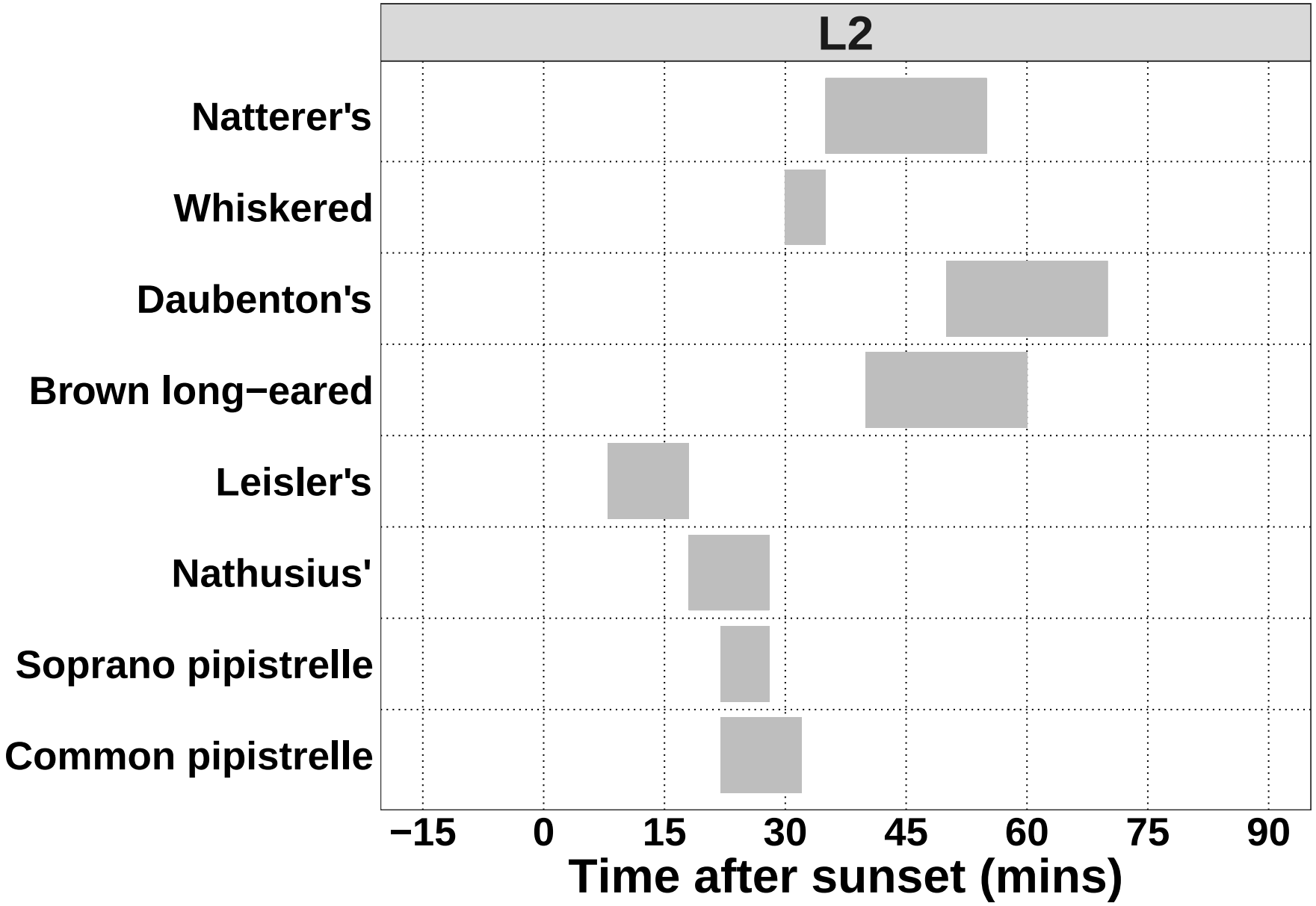
Bat Passes Potentially Indicating Close Proximity to a Roost (Russ 2012)

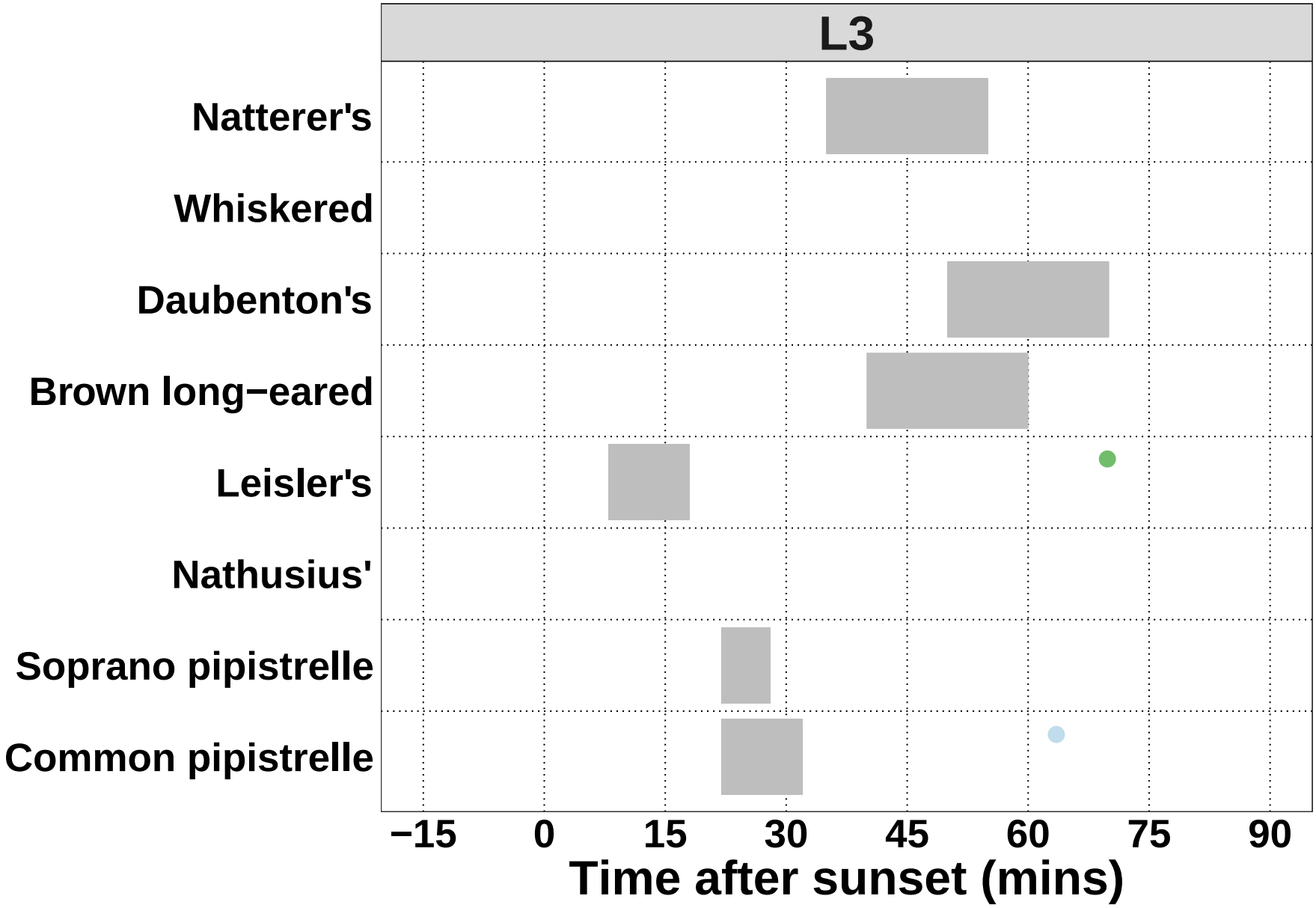
Figure 8. Time from 15 minutes before to 90 minutes after sunset. Species-specific emergence time ranges are shown as grey bars. Bat passes overlapping species-specific grey bars, or occuring earlier than this time range, may potentially indicate the presence of a nearby roost.

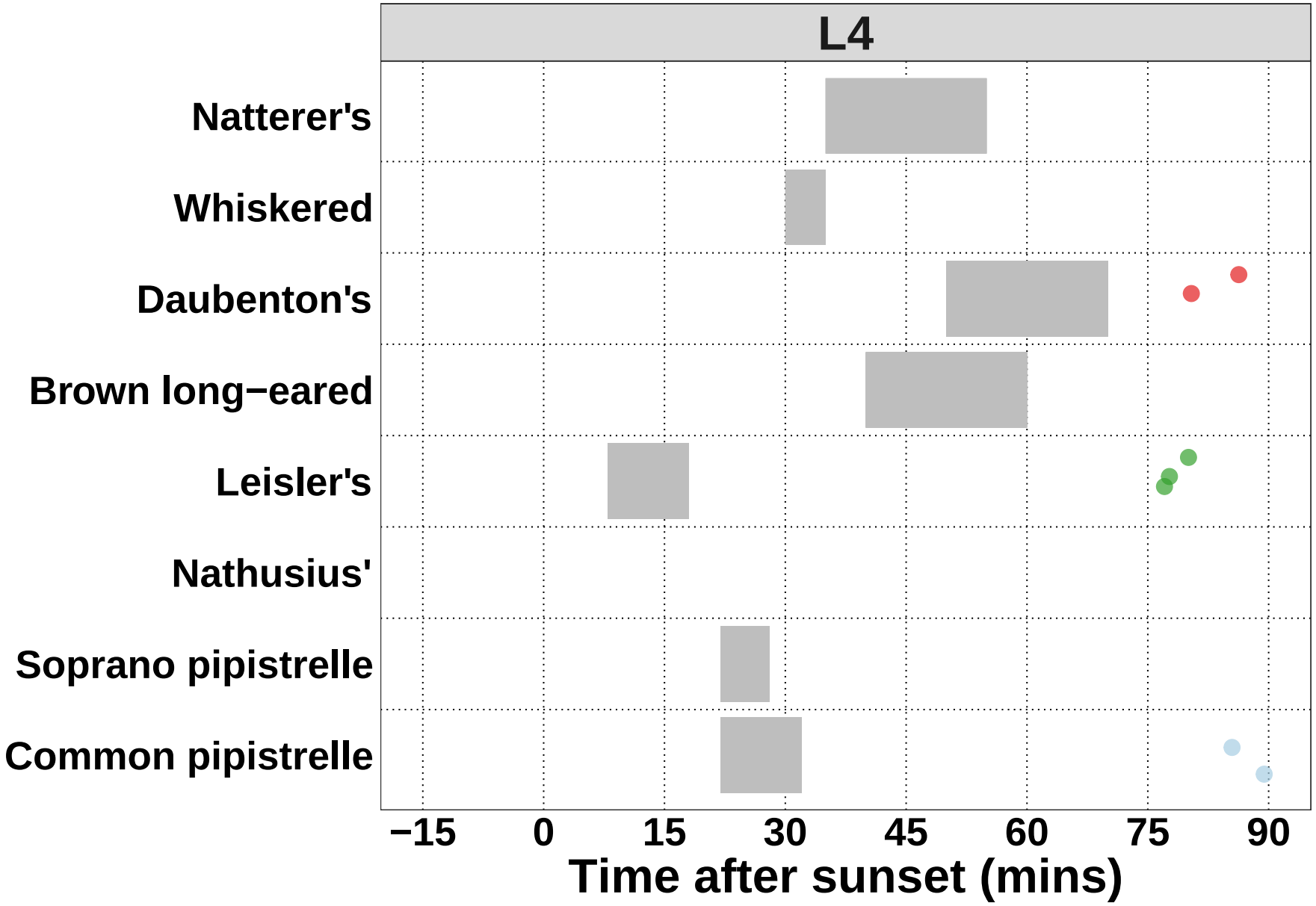

L1
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

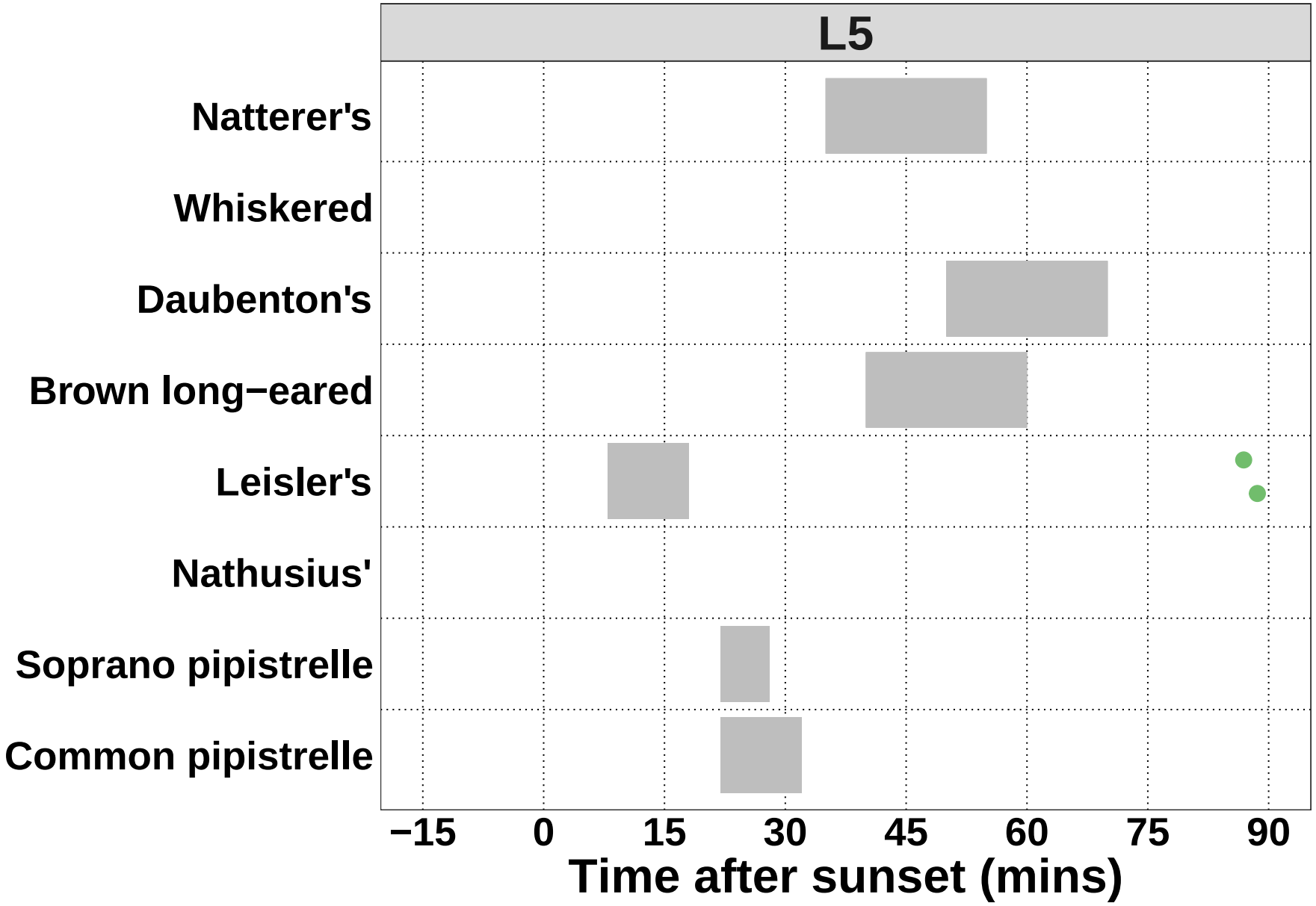

L10
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

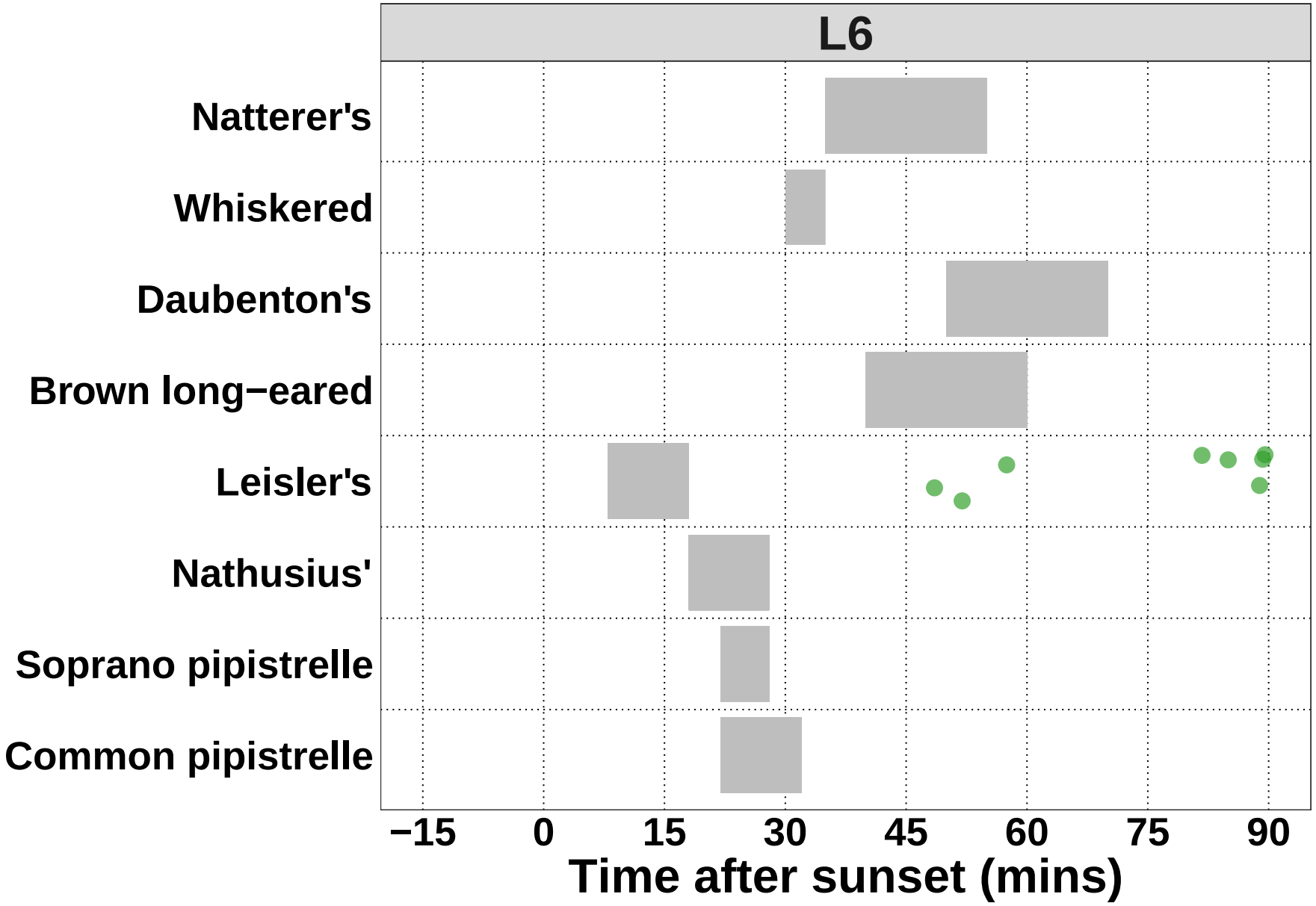

L11
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

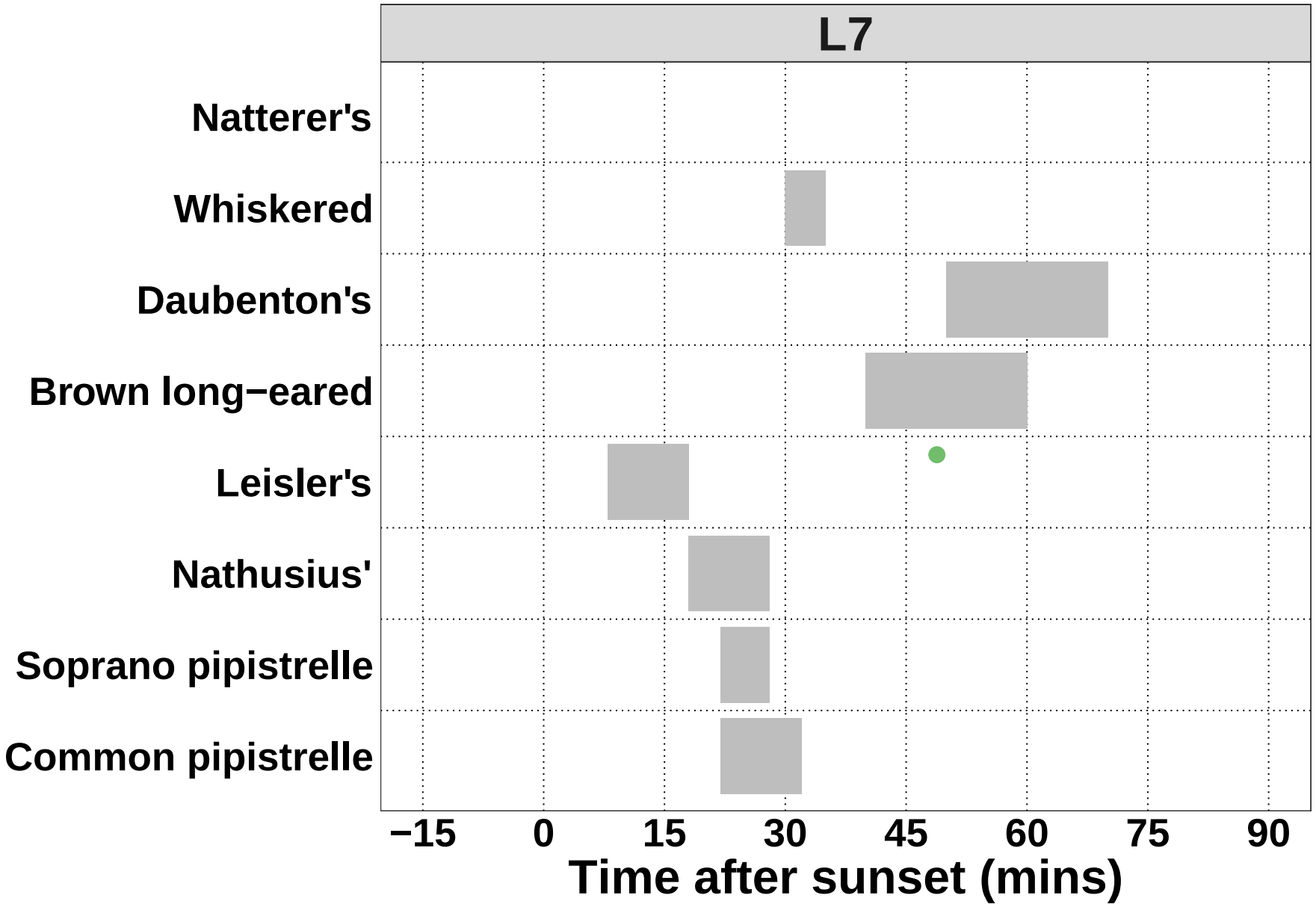

L2
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

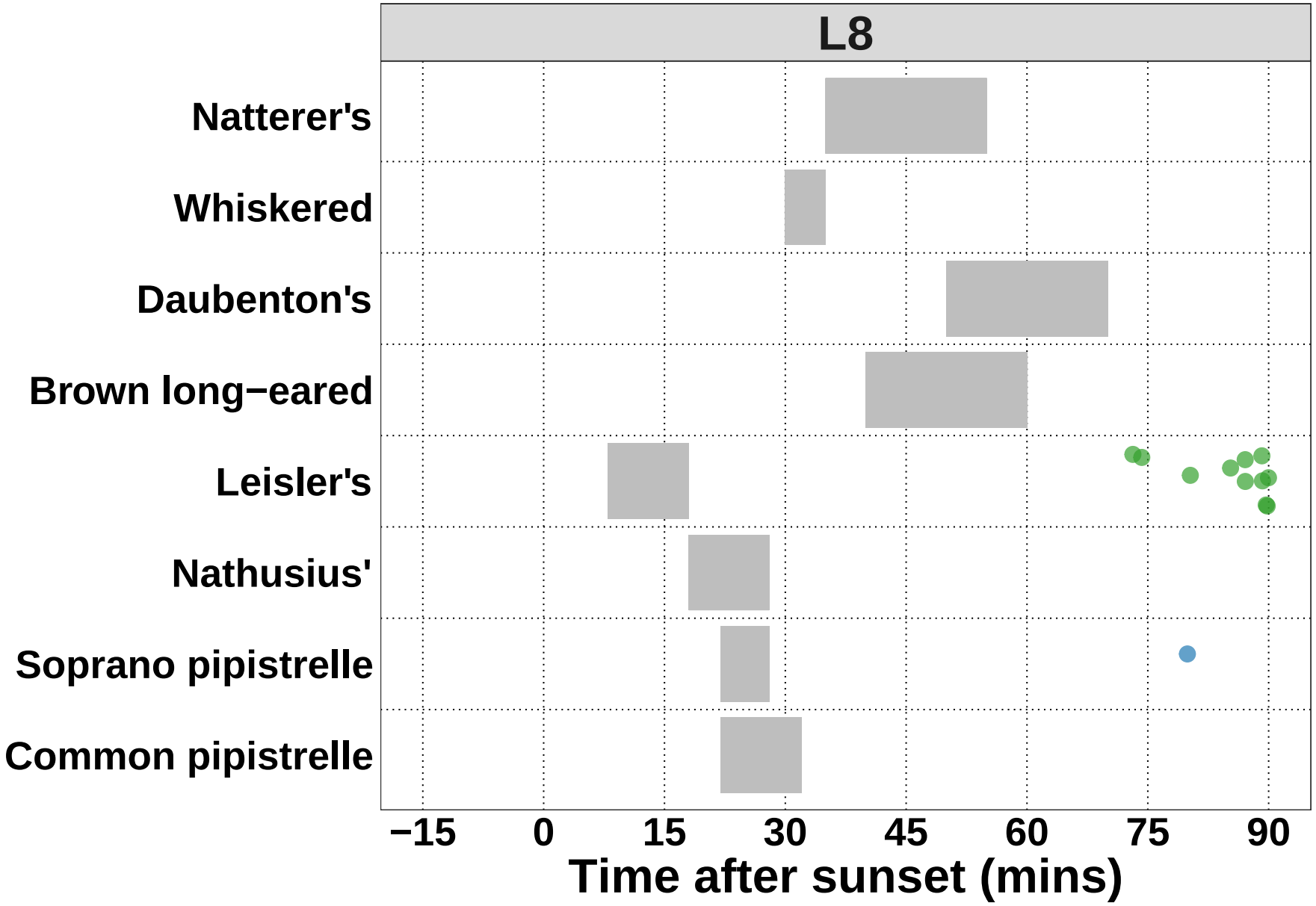

L3
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

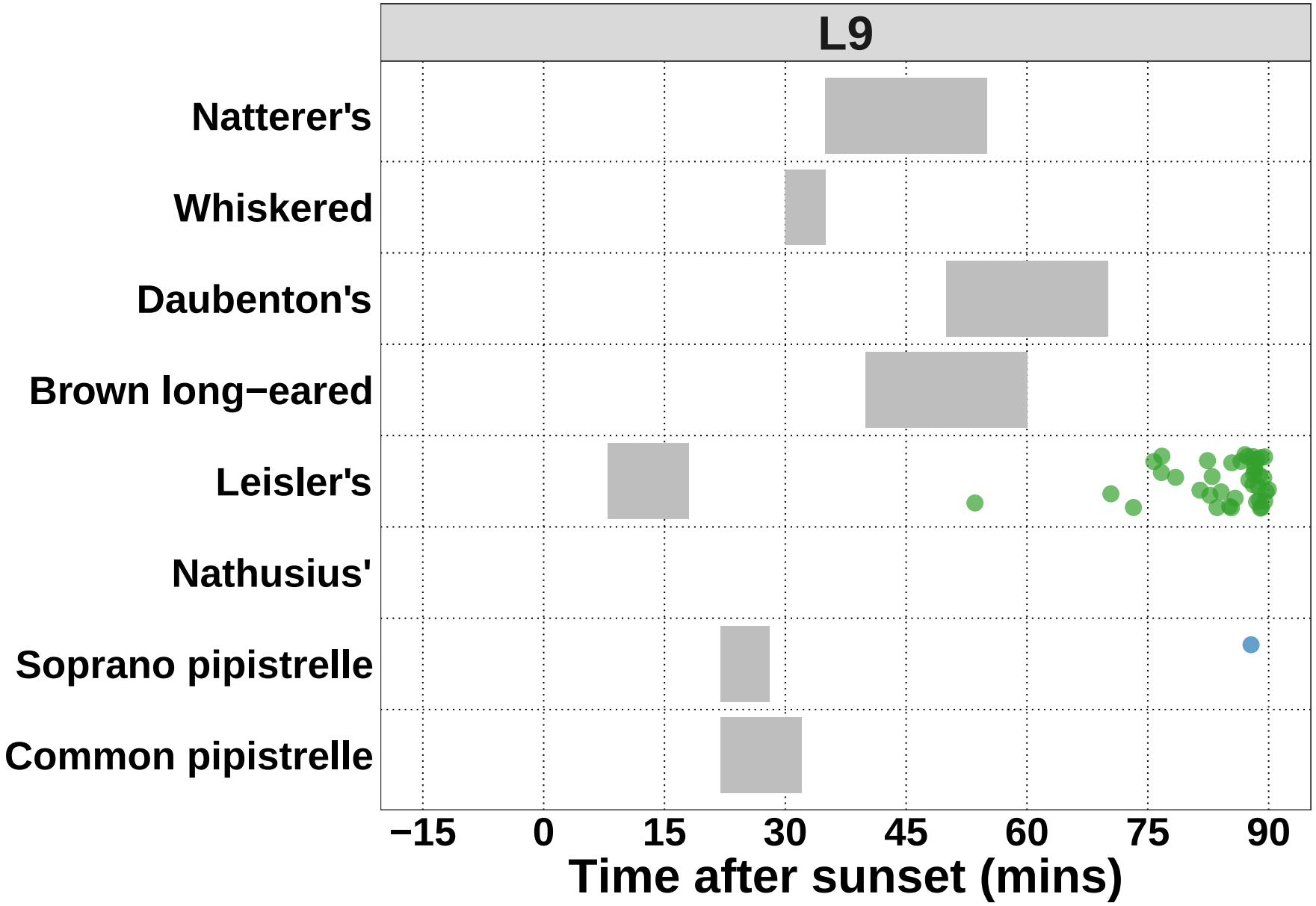

L4
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)


L5
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)


L6
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)


L7
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)


L8
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)


L9
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)

Count 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 (%)
Myotis daubentonii	524	2.1
Myotis mystacinus	92	0.4
Myotis nattereri	84	0.3
Nyctalus leisleri	2838	11.4
Pipistrellus nathusii	264	1.1
Pipistrellus pipistrellus	13974	56.1
Pipistrellus pygmaeus	6825	27.4
Plecotus auritus	290	1.2
Total	24891	100.0

Per Detector

The number of passes recorded for each species at each detector.

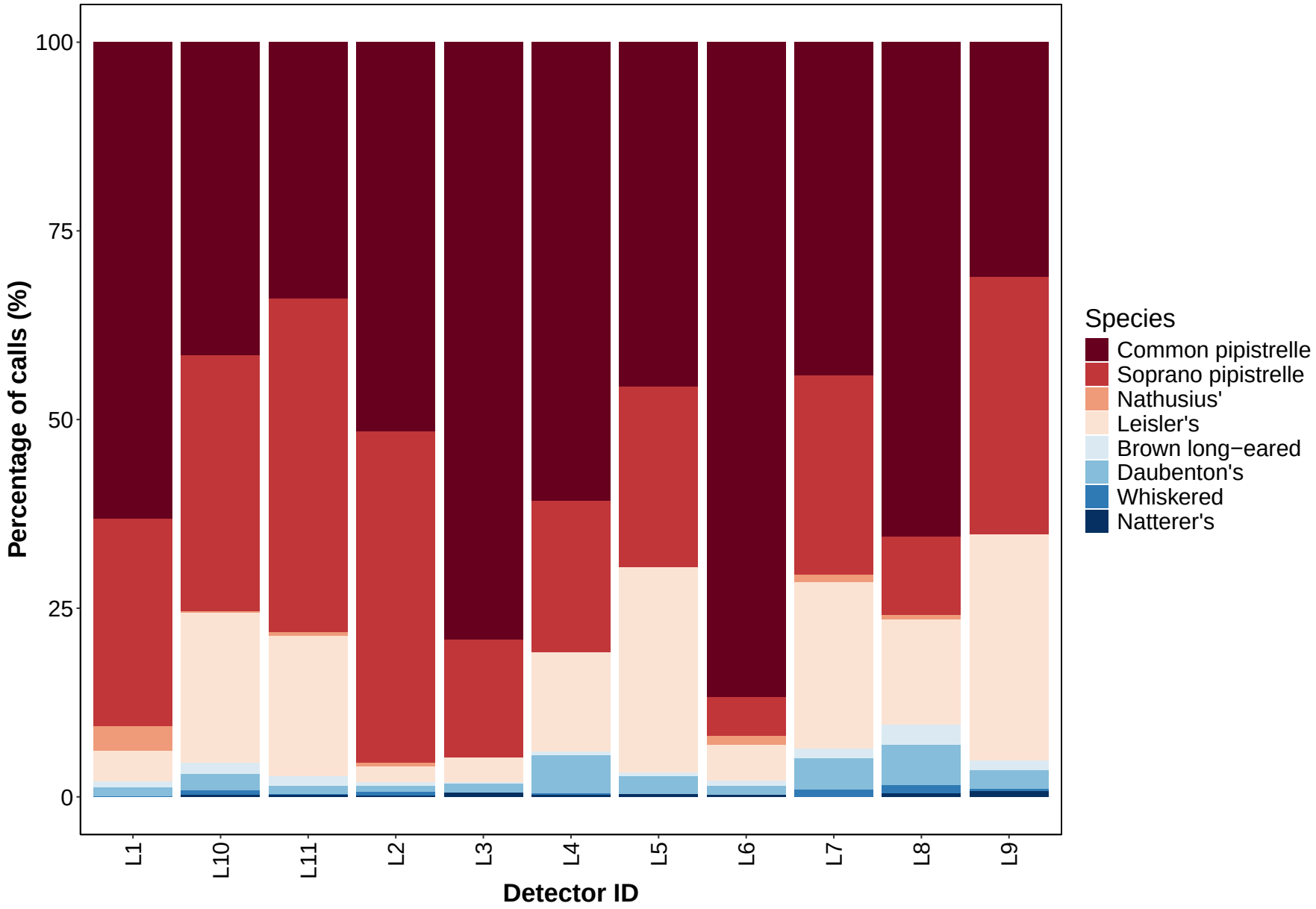
Species	Detector ID	Count (no.)	Percentage by Detector (%)
Common pipistrelle	L1	2175	60.4334537
Common pipistrelle	L10	1279	42.3229649
Common pipistrelle	L11	776	34.4124169
Common pipistrelle	L2	2108	50.9424843
Common pipistrelle	L3	949	77.2801303
Common pipistrelle	L4	629	55.7130204
Common pipistrelle	L5	315	45.2586207
Common pipistrelle	L6	3612	84.9083216
Common pipistrelle	L7	414	43.8095238
Common pipistrelle	L8	1235	62.9459735
Common pipistrelle	L9	482	28.9837643
Soprano pipistrelle	L1	1067	29.6471242
Soprano pipistrelle	L10	981	32.4619457
Soprano pipistrelle	L11	1015	45.0110865
Soprano pipistrelle	L2	1837	44.3934268
Soprano pipistrelle	L3	200	16.2866450
Soprano pipistrelle	L4	263	23.2949513
Soprano pipistrelle	L5	168	24.1379310
Soprano pipistrelle	L6	243	5.7122708
Soprano pipistrelle	L7	253	26.7724868
Soprano pipistrelle	L8	219	11.1620795
Soprano pipistrelle	L9	579	34.8165965
Nathusius'	L1	139	3.8621839
Nathusius'	L10	6	0.1985440
Nathusius'	L11	15	0.6651885
Nathusius'	L2	24	0.5799903
Nathusius'	L6	57	1.3399154
Nathusius'	L7	9	0.9523810
Nathusius'	L8	14	0.7135576
Leisler's	L1	144	4.0011114
Leisler's	L10	591	19.5565850
Leisler's	L11	384	17.0288248

Species	Detector ID	Count (no.)	Percentage by Detector (%)
Leisler's	L2	77	1.8608023
Leisler's	L3	47	3.8273616
Leisler's	L4	162	14.3489814
Leisler's	L5	187	26.8678161
Leisler's	L6	229	5.3831688
Leisler's	L7	206	21.7989418
Leisler's	L8	297	15.1376147
Leisler's	L9	514	30.9079976
Brown long-eared	L1	30	0.8335649
Brown long-eared	L10	65	2.1508934
Brown long-eared	L11	32	1.4190687
Brown long-eared	L2	25	0.6041566
Brown long-eared	L3	4	0.3257329
Brown long-eared	L4	8	0.7085917
Brown long-eared	L5	4	0.5747126
Brown long-eared	L6	39	0.9167842
Brown long-eared	L7	11	1.1640212
Brown long-eared	L8	49	2.4974516
Brown long-eared	L9	23	1.3830427
Daubenton's	L1	41	1.1392053
Daubenton's	L10	74	2.4487095
Daubenton's	L11	22	0.9756098
Daubenton's	L2	31	0.7491542
Daubenton's	L3	19	1.5472313
Daubenton's	L4	61	5.4030115
Daubenton's	L5	19	2.7298851
Daubenton's	L6	58	1.3634227
Daubenton's	L7	43	4.5502646
Daubenton's	L8	114	5.8103976
Daubenton's	L9	42	2.5255562
Whiskered	L1	3	0.0833565
Whiskered	L10	16	0.5294507
Whiskered	L11	4	0.1773836
Whiskered	L2	27	0.6524891
Whiskered	L4	3	0.2657219
Whiskered	L6	1	0.0235073

Species	Detector ID	Count (no.)	Percentage by Detector (%)
Whiskered	L7	9	0.9523810
Whiskered	L8	23	1.1722732
Whiskered	L9	6	0.3607937
Natterer's	L10	10	0.3309067
Natterer's	L11	7	0.3104213
Natterer's	L2	9	0.2174964
Natterer's	L3	9	0.7328990
Natterer's	L4	3	0.2657219
Natterer's	L5	3	0.4310345
Natterer's	L6	15	0.3526093
Natterer's	L8	11	0.5606524
Natterer's	L9	17	1.0222489

Species Composition

Figure 10. Percentage species composition of passes at each detector.


100
75
50
25
0
Percentage of calls (%)
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID
Species
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Brown long−eared
Daubenton's
Whiskered
Natterer's

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.

Nighlty 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	L1	13.4
Common pipistrelle	L10	4.9
Common pipistrelle	L11	6.7
Common pipistrelle	L2	11.9
Common pipistrelle	L3	9.0
Common pipistrelle	L4	2.9
Common pipistrelle	L5	2.2
Common pipistrelle	L6	21.8
Common pipistrelle	L7	2.7
Common pipistrelle	L8	4.6
Common pipistrelle	L9	2.3
Soprano pipistrelle	L1	5.6
Soprano pipistrelle	L10	4.4
Soprano pipistrelle	L11	11.3
Soprano pipistrelle	L2	7.2
Soprano pipistrelle	L3	2.6
Soprano pipistrelle	L4	1.7
Soprano pipistrelle	L5	1.1
Soprano pipistrelle	L6	1.4
Soprano pipistrelle	L7	1.1
Soprano pipistrelle	L8	1.2
Soprano pipistrelle	L9	3.6
Nathusius'	L1	1.3
Nathusius'	L10	0.1
Nathusius'	L11	0.1
Nathusius'	L2	0.4
Nathusius'	L6	0.6
Nathusius'	L7	0.2
Nathusius'	L8	0.3
Leisler's	L1	0.7
Leisler's	L10	2.2
Leisler's	L11	1.9
Leisler's	L2	0.5
Leisler's	L3	0.8
Leisler's	L4	0.9
Leisler's	L5	0.9

Species	Detector ID	Median Pass Rate
Leisler's	L6	1.3
Leisler's	L7	1.1
Leisler's	L8	1.7
Leisler's	L9	1.7
Brown long-eared	L1	0.3
Brown long-eared	L10	0.5
Brown long-eared	L11	0.5
Brown long-eared	L2	0.3
Brown long-eared	L3	0.1
Brown long-eared	L4	0.1
Brown long-eared	L5	0.1
Brown long-eared	L6	0.3
Brown long-eared	L7	0.3
Brown long-eared	L8	0.3
Brown long-eared	L9	0.3
Daubenton's	L1	0.3
Daubenton's	L10	0.5
Daubenton's	L11	0.4
Daubenton's	L2	0.3
Daubenton's	L3	0.3
Daubenton's	L4	0.4
Daubenton's	L5	0.1
Daubenton's	L6	0.4
Daubenton's	L7	0.3
Daubenton's	L8	0.7
Daubenton's	L9	0.3
Whiskered	L1	0.1
Whiskered	L10	0.3
Whiskered	L11	0.1
Whiskered	L2	0.1
Whiskered	L4	0.1
Whiskered	L6	0.1
Whiskered	L7	0.1
Whiskered	L8	0.2
Whiskered	L9	0.4
Natterer's	L10	0.2

Species	Detector ID	Median Pass Rate
Natterer's	L11	0.1
Natterer's	L2	0.1
Natterer's	L3	0.1
Natterer's	L4	0.1
Natterer's	L5	0.2
Natterer's	L6	0.4
Natterer's	L8	0.1
Natterer's	L9	0.3

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.

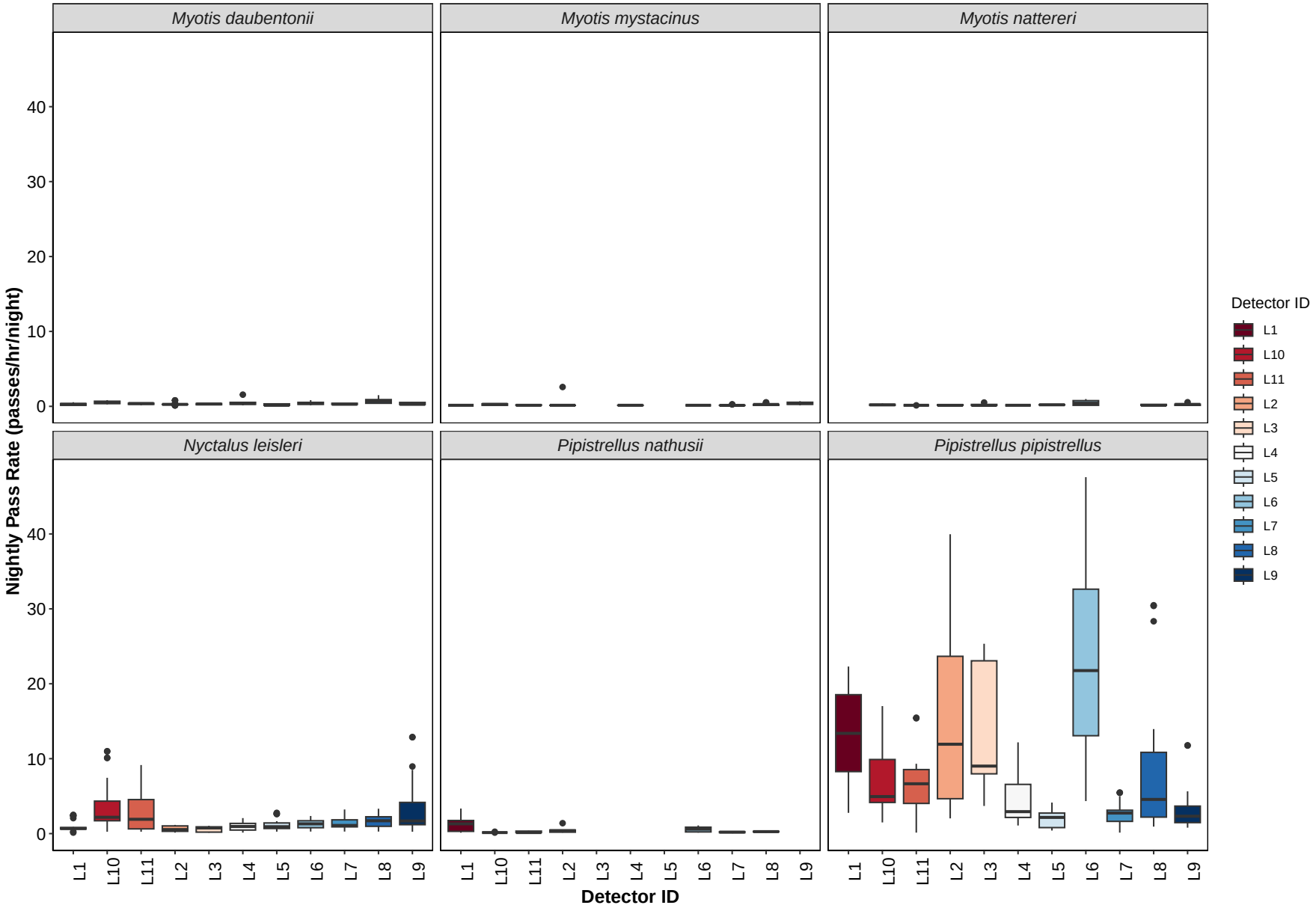
Species	Detector ID	Mean Pass Rate
Common pipistrelle	L1	13.1
Common pipistrelle	L10	7.4
Common pipistrelle	L11	6.5
Common pipistrelle	L2	14.2
Common pipistrelle	L3	13.0
Common pipistrelle	L4	4.6
Common pipistrelle	L5	1.9
Common pipistrelle	L6	23.9
Common pipistrelle	L7	2.5
Common pipistrelle	L8	8.3
Common pipistrelle	L9	3.4
Soprano pipistrelle	L1	5.9
Soprano pipistrelle	L10	6.0
Soprano pipistrelle	L11	8.2
Soprano pipistrelle	L2	12.1
Soprano pipistrelle	L3	2.6
Soprano pipistrelle	L4	1.6
Soprano pipistrelle	L5	1.0
Soprano pipistrelle	L6	1.5
Soprano pipistrelle	L7	1.5
Soprano pipistrelle	L8	1.4
Soprano pipistrelle	L9	3.8
Nathusius'	L1	1.3
Nathusius'	L10	0.2
Nathusius'	L11	0.2
Nathusius'	L2	0.5
Nathusius'	L6	0.6
Nathusius'	L7	0.2
Nathusius'	L8	0.3
Leisler's	L1	1.0

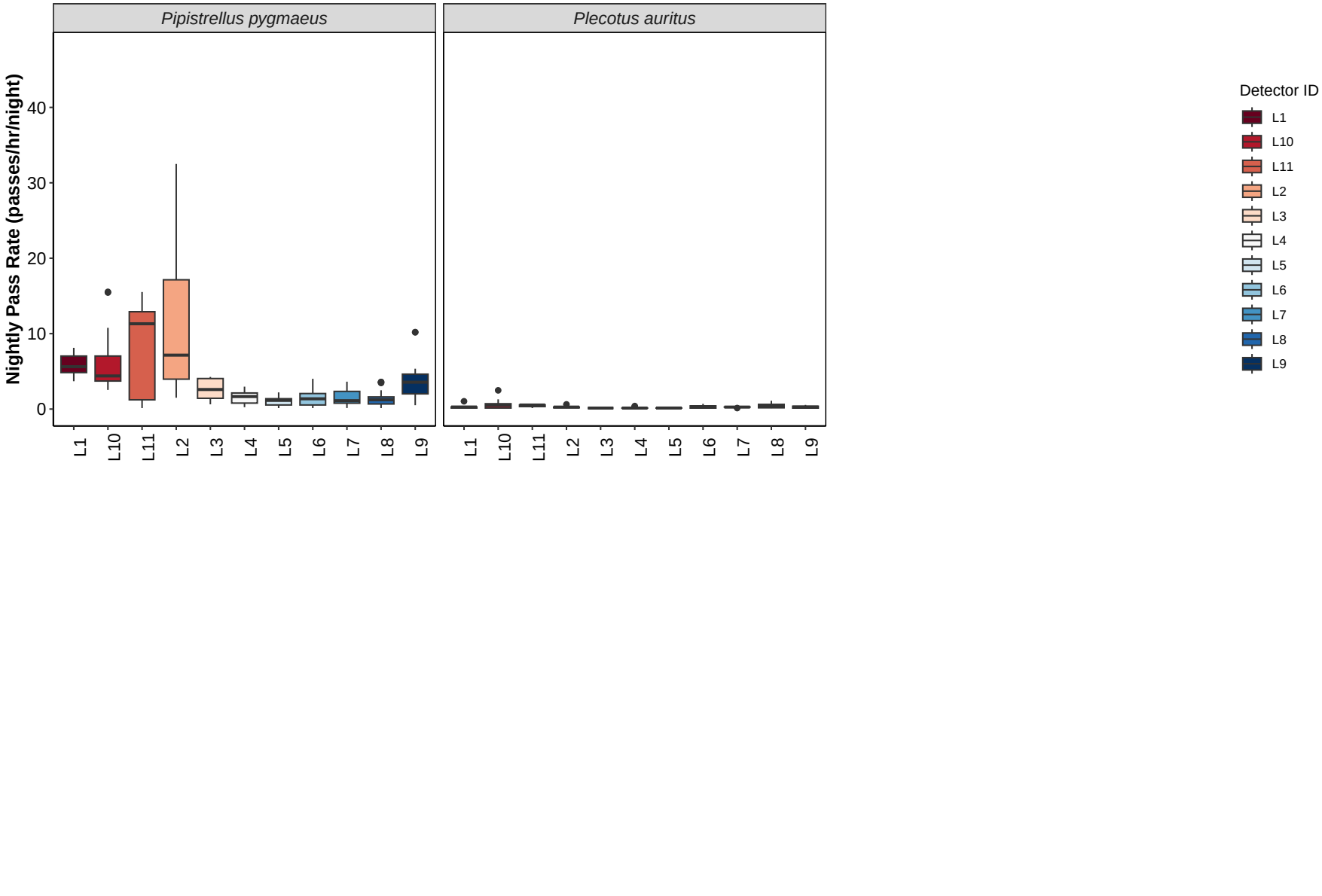
Species	Detector ID	Mean Pass Rate
Leisler's	L10	3.7
Leisler's	L11	3.1
Leisler's	L2	0.6
Leisler's	L3	0.6
Leisler's	L4	0.9
Leisler's	L5	1.2
Leisler's	L6	1.3
Leisler's	L7	1.3
Leisler's	L8	1.8
Leisler's	L9	3.4
Brown long-eared	L1	0.3
Brown long-eared	L10	0.6
Brown long-eared	L11	0.5
Brown long-eared	L2	0.3
Brown long-eared	L3	0.1
Brown long-eared	L4	0.2
Brown long-eared	L5	0.1
Brown long-eared	L6	0.3
Brown long-eared	L7	0.2
Brown long-eared	L8	0.4
Brown long-eared	L9	0.3
Daubenton's	L1	0.3
Daubenton's	L10	0.5
Daubenton's	L11	0.3
Daubenton's	L2	0.3
Daubenton's	L3	0.3
Daubenton's	L4	0.4
Daubenton's	L5	0.2
Daubenton's	L6	0.4
Daubenton's	L7	0.3
Daubenton's	L8	0.7
Daubenton's	L9	0.3
Whiskered	L1	0.1
Whiskered	L10	0.3
Whiskered	L11	0.2
Whiskered	L2	0.5

Species	Detector ID	Mean Pass Rate
Whiskered	L4	0.1
Whiskered	L6	0.1
Whiskered	L7	0.2
Whiskered	L8	0.2
Whiskered	L9	0.4
Natterer’s	L10	0.2
Natterer’s	L11	0.1
Natterer’s	L2	0.2
Natterer’s	L3	0.2
Natterer’s	L4	0.1
Natterer’s	L5	0.2
Natterer’s	L6	0.5
Natterer’s	L8	0.2
Natterer’s	L9	0.3

Per Detector

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)
0
10
20
30
40
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID
Detector ID


Pipistrellus pygmaeus
Plecotus auritus
Nightly Pass Rate (passes/hr/night)
0
10
20
30
40
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID
Detector ID
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9

Split by Month

Total Bat Passes per Detector each Month

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	May	Jun
Common pipistrelle	L1	1276	1379
Common pipistrelle	L10	1106	434
Common pipistrelle	L11	406	477
Common pipistrelle	L2	2314	229
Common pipistrelle	L3	1238	0
Common pipistrelle	L4	548	354
Common pipistrelle	L5	242	127
Common pipistrelle	L6	2217	2669
Common pipistrelle	L7	358	162
Common pipistrelle	L8	710	983
Common pipistrelle	L9	311	370
Soprano pipistrelle	L1	622	535
Soprano pipistrelle	L10	923	332
Soprano pipistrelle	L11	339	810
Soprano pipistrelle	L2	1915	251
Soprano pipistrelle	L3	245	0
Soprano pipistrelle	L4	202	96
Soprano pipistrelle	L5	115	78
Soprano pipistrelle	L6	184	106
Soprano pipistrelle	L7	228	83
Soprano pipistrelle	L8	114	153
Soprano pipistrelle	L9	343	402
Nathusius'	L1	57	79
Nathusius'	L10	2	4
Nathusius'	L11	6	6
Nathusius'	L2	23	0
Nathusius'	L6	28	39
Nathusius'	L7	6	6
Nathusius'	L8	8	8
Leisler's	L1	84	88
Leisler's	L10	290	450
Leisler's	L11	154	329
Leisler's	L2	77	28
Leisler's	L3	51	0
Leisler's	L4	112	82
Leisler's	L5	123	97

Species	Detector ID	May	Jun
Leisler's	L6	156	109
Leisler's	L7	169	91
Leisler's	L8	220	140
Leisler's	L9	270	385
Brown long-eared	L1	20	15
Brown long-eared	L10	53	2
Brown long-eared	L11	8	26
Brown long-eared	L2	20	1
Brown long-eared	L3	3	0
Brown long-eared	L4	3	5
Brown long-eared	L5	1	3
Brown long-eared	L6	22	19
Brown long-eared	L7	10	5
Brown long-eared	L8	20	49
Brown long-eared	L9	8	20
Daubenton's	L1	24	23
Daubenton's	L10	33	47
Daubenton's	L11	6	21
Daubenton's	L2	24	15
Daubenton's	L3	18	0
Daubenton's	L4	53	22
Daubenton's	L5	8	11
Daubenton's	L6	32	32
Daubenton's	L7	24	25
Daubenton's	L8	88	49
Daubenton's	L9	29	25
Whiskered	L1	0	3
Whiskered	L10	9	12
Whiskered	L11	2	2
Whiskered	L2	2	23
Whiskered	L4	1	2
Whiskered	L6	0	1
Whiskered	L7	7	4
Whiskered	L8	19	9
Whiskered	L9	1	5
Natterer's	L10	7	3

Species	Detector ID	May	Jun
Natterer's	L11	1	5
Natterer's	L2	6	2
Natterer's	L3	9	0
Natterer's	L4	0	3
Natterer's	L5	0	3
Natterer's	L6	0	14
Natterer's	L8	9	3
Natterer's	L9	6	11

Survey Effort

Table 19. The number of survey nights per month per detector.

month	Detector ID	No. of Survey Nights
May	L1	15
May	L10	15
May	L11	9
May	L2	14
May	L3	12
May	L4	15
May	L5	14
May	L6	15
May	L7	15
May	L8	15
May	L9	15
Jun	L1	12
Jun	L10	12
Jun	L11	12
Jun	L2	9
Jun	L4	12
Jun	L5	12
Jun	L6	12
Jun	L7	12
Jun	L8	12
Jun	L9	12

Nightly Bat Passes 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	May	Jun
Common pipistrelle	L1	10.5	14.3
Common pipistrelle	L10	9.6	4.2
Common pipistrelle	L11	6.7	6.7
Common pipistrelle	L2	20.9	2.7
Common pipistrelle	L3	9.0	NA
Common pipistrelle	L4	3.9	2.4
Common pipistrelle	L5	2.3	0.7
Common pipistrelle	L6	15.1	29.4
Common pipistrelle	L7	3.1	1.7
Common pipistrelle	L8	4.5	6.3
Common pipistrelle	L9	2.3	3.4
Soprano pipistrelle	L1	5.6	5.6
Soprano pipistrelle	L10	7.0	3.8
Soprano pipistrelle	L11	5.0	12.1
Soprano pipistrelle	L2	14.4	2.9
Soprano pipistrelle	L3	2.6	NA
Soprano pipistrelle	L4	2.1	1.1
Soprano pipistrelle	L5	1.2	0.6
Soprano pipistrelle	L6	1.7	0.6
Soprano pipistrelle	L7	1.8	0.8
Soprano pipistrelle	L8	1.2	1.2
Soprano pipistrelle	L9	3.4	4.2
Nathusius'	L1	1.0	1.3
Nathusius'	L10	0.2	0.1
Nathusius'	L11	0.4	0.1
Nathusius'	L2	0.4	NA
Nathusius'	L6	0.3	0.8
Nathusius'	L7	0.2	0.2
Nathusius'	L8	0.3	0.3
Leisler's	L1	0.7	0.7
Leisler's	L10	2.2	2.2
Leisler's	L11	0.7	2.7
Leisler's	L2	0.9	0.4
Leisler's	L3	0.8	NA
Leisler's	L4	1.0	0.9
Leisler's	L5	0.9	0.8

Species	Detector ID	May	Jun
Leisler's	L6	1.3	1.2
Leisler's	L7	1.1	1.1
Leisler's	L8	1.7	1.5
Leisler's	L9	1.6	1.7
Brown long-eared	L1	0.3	0.3
Brown long-eared	L10	0.5	0.1
Brown long-eared	L11	0.5	0.6
Brown long-eared	L2	0.3	0.1
Brown long-eared	L3	0.1	NA
Brown long-eared	L4	0.1	0.1
Brown long-eared	L5	0.1	0.1
Brown long-eared	L6	0.3	0.4
Brown long-eared	L7	0.3	0.3
Brown long-eared	L8	0.2	0.7
Brown long-eared	L9	0.1	0.4
Daubenton's	L1	0.3	0.3
Daubenton's	L10	0.4	0.7
Daubenton's	L11	0.4	0.3
Daubenton's	L2	0.2	0.3
Daubenton's	L3	0.3	NA
Daubenton's	L4	0.5	0.3
Daubenton's	L5	0.1	0.4
Daubenton's	L6	0.4	0.5
Daubenton's	L7	0.3	0.4
Daubenton's	L8	0.8	0.6
Daubenton's	L9	0.3	0.3
Whiskered	L1	NA	0.1
Whiskered	L10	0.3	0.3
Whiskered	L11	0.3	0.1
Whiskered	L2	0.1	0.1
Whiskered	L4	0.1	0.1
Whiskered	L6	NA	0.1
Whiskered	L7	0.1	0.1
Whiskered	L8	0.3	0.1
Whiskered	L9	0.1	0.7
Natterer's	L10	0.2	0.2

Species	Detector ID	May	Jun
Natterer's	L11	0.1	0.1
Natterer's	L2	0.2	0.1
Natterer's	L3	0.1	NA
Natterer's	L4	NA	0.1
Natterer's	L5	NA	0.2
Natterer's	L6	NA	0.4
Natterer's	L8	0.2	0.1
Natterer's	L9	0.2	0.3

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.

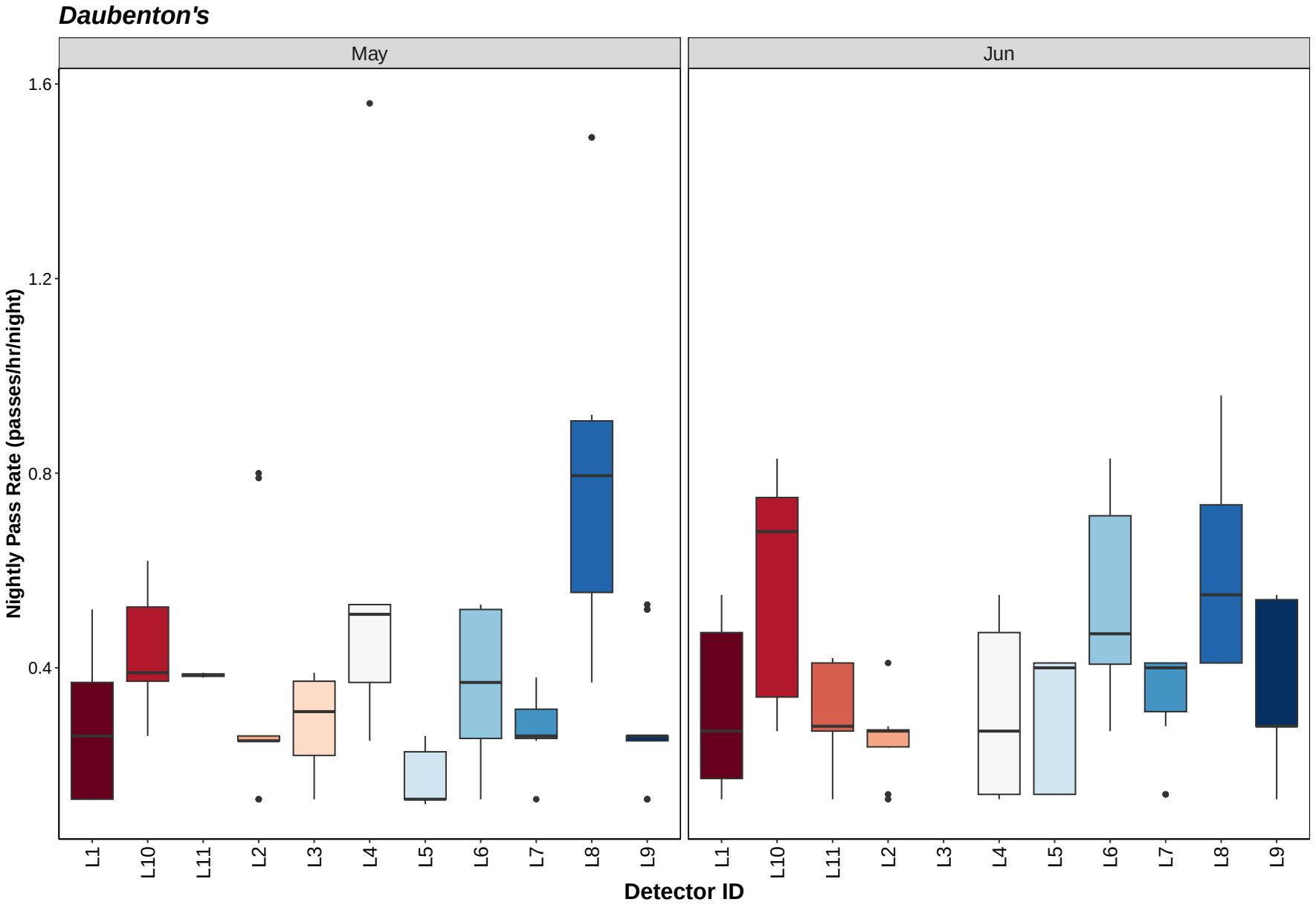
Species	Detector ID	May	Jun
Common pipistrelle	L1	11.0	15.7
Common pipistrelle	L10	9.4	4.9
Common pipistrelle	L11	7.5	5.9
Common pipistrelle	L2	21.1	3.5
Common pipistrelle	L3	13.0	NA
Common pipistrelle	L4	5.0	4.0
Common pipistrelle	L5	2.2	1.6
Common pipistrelle	L6	18.8	30.4
Common pipistrelle	L7	3.0	1.8
Common pipistrelle	L8	6.0	11.2
Common pipistrelle	L9	2.6	4.2
Soprano pipistrelle	L1	5.7	6.1
Soprano pipistrelle	L10	7.8	3.8
Soprano pipistrelle	L11	5.5	10.1
Soprano pipistrelle	L2	17.4	3.8
Soprano pipistrelle	L3	2.6	NA
Soprano pipistrelle	L4	1.8	1.2
Soprano pipistrelle	L5	1.0	1.0
Soprano pipistrelle	L6	1.7	1.2
Soprano pipistrelle	L7	1.9	0.9
Soprano pipistrelle	L8	1.0	1.8
Soprano pipistrelle	L9	3.1	4.6
Nathusius'	L1	1.2	1.3
Nathusius'	L10	0.2	0.1
Nathusius'	L11	0.4	0.2
Nathusius'	L2	0.5	NA
Nathusius'	L6	0.5	0.6
Nathusius'	L7	0.2	0.2
Nathusius'	L8	0.3	0.3
Leisler's	L1	0.9	1.0

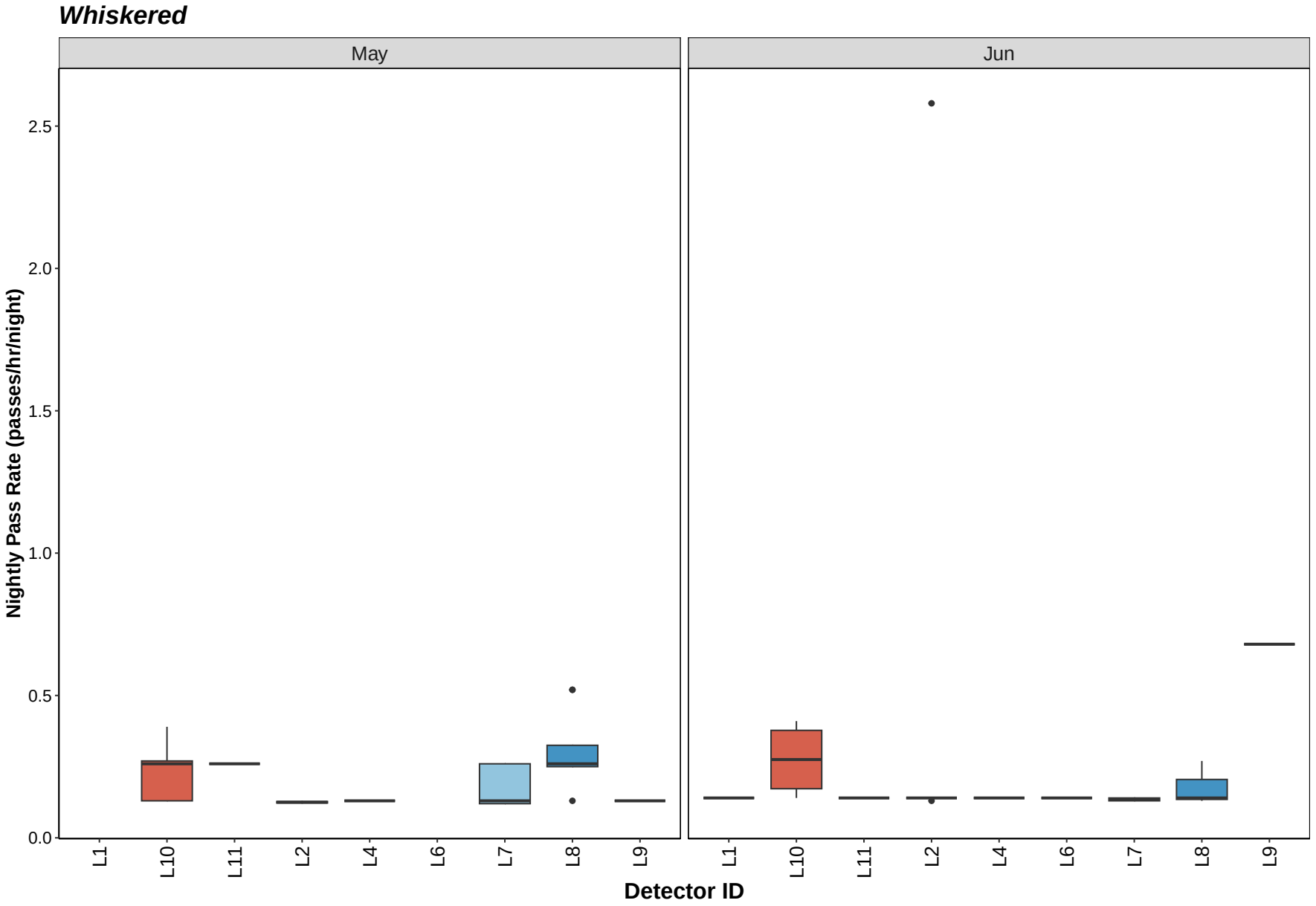
Species	Detector ID	May	Jun
Leisler's	L10	2.5	5.1
Leisler's	L11	2.2	3.8
Leisler's	L2	0.8	0.4
Leisler's	L3	0.6	NA
Leisler's	L4	1.0	0.9
Leisler's	L5	1.2	1.1
Leisler's	L6	1.3	1.2
Leisler's	L7	1.4	1.1
Leisler's	L8	1.9	1.6
Leisler's	L9	2.5	4.4
Brown long-eared	L1	0.3	0.2
Brown long-eared	L10	0.8	0.1
Brown long-eared	L11	0.5	0.4
Brown long-eared	L2	0.3	0.1
Brown long-eared	L3	0.1	NA
Brown long-eared	L4	0.1	0.2
Brown long-eared	L5	0.1	0.1
Brown long-eared	L6	0.3	0.4
Brown long-eared	L7	0.3	0.2
Brown long-eared	L8	0.2	0.6
Brown long-eared	L9	0.1	0.4
Daubenton's	L1	0.3	0.3
Daubenton's	L10	0.4	0.6
Daubenton's	L11	0.4	0.3
Daubenton's	L2	0.3	0.3
Daubenton's	L3	0.3	NA
Daubenton's	L4	0.5	0.3
Daubenton's	L5	0.2	0.3
Daubenton's	L6	0.4	0.5
Daubenton's	L7	0.3	0.3
Daubenton's	L8	0.8	0.6
Daubenton's	L9	0.3	0.4
Whiskered	L1	NA	0.1
Whiskered	L10	0.2	0.3
Whiskered	L11	0.3	0.1
Whiskered	L2	0.1	0.6

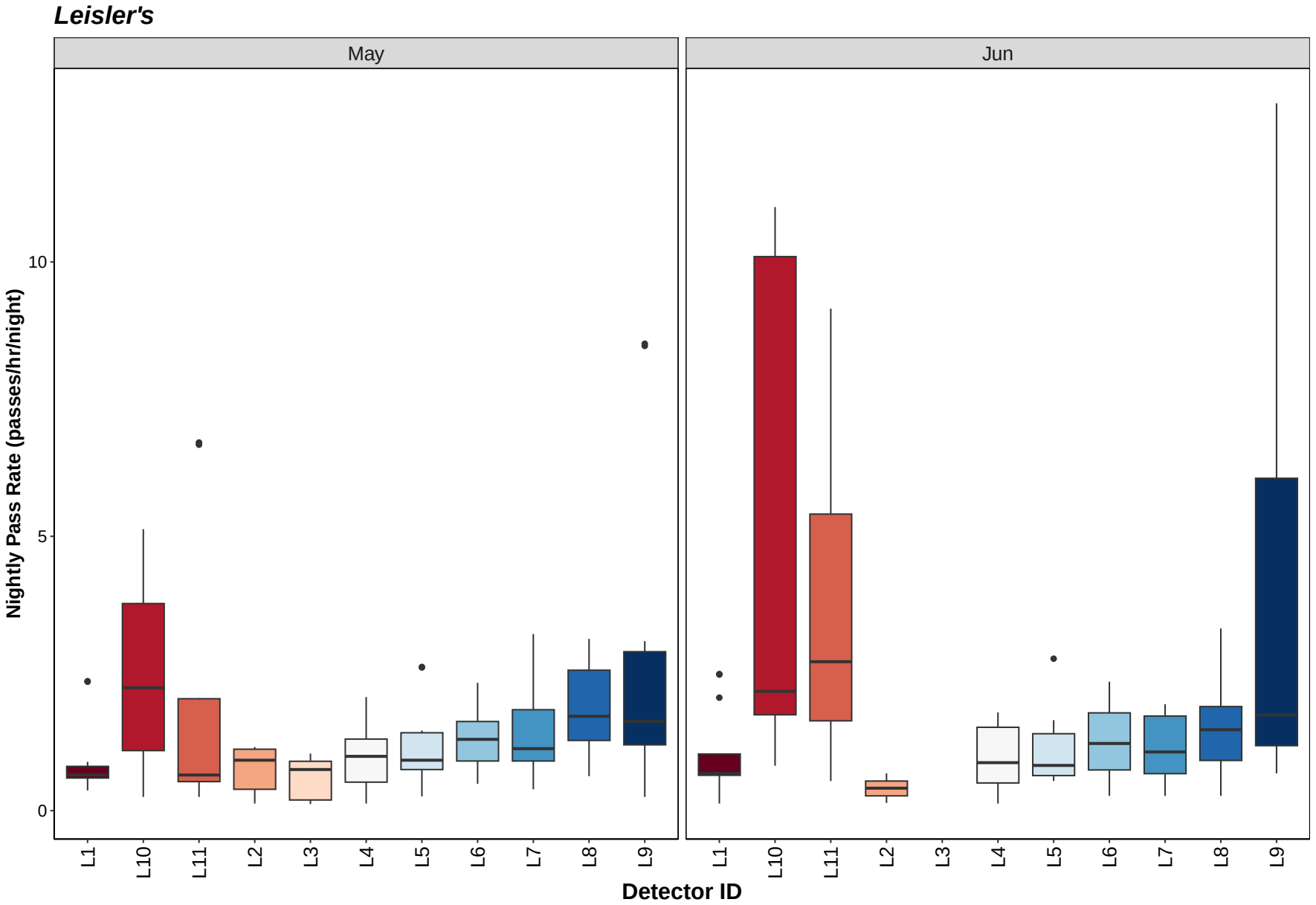
Species	Detector ID	May	Jun
Whiskered	L4	0.1	0.1
Whiskered	L6	NA	0.1
Whiskered	L7	0.2	0.1
Whiskered	L8	0.3	0.2
Whiskered	L9	0.1	0.7
Natterer's	L10	0.2	0.2
Natterer's	L11	0.1	0.1
Natterer's	L2	0.2	0.1
Natterer's	L3	0.2	NA
Natterer's	L4	NA	0.1
Natterer's	L5	NA	0.2
Natterer's	L6	NA	0.5
Natterer's	L8	0.2	0.1
Natterer's	L9	0.2	0.3

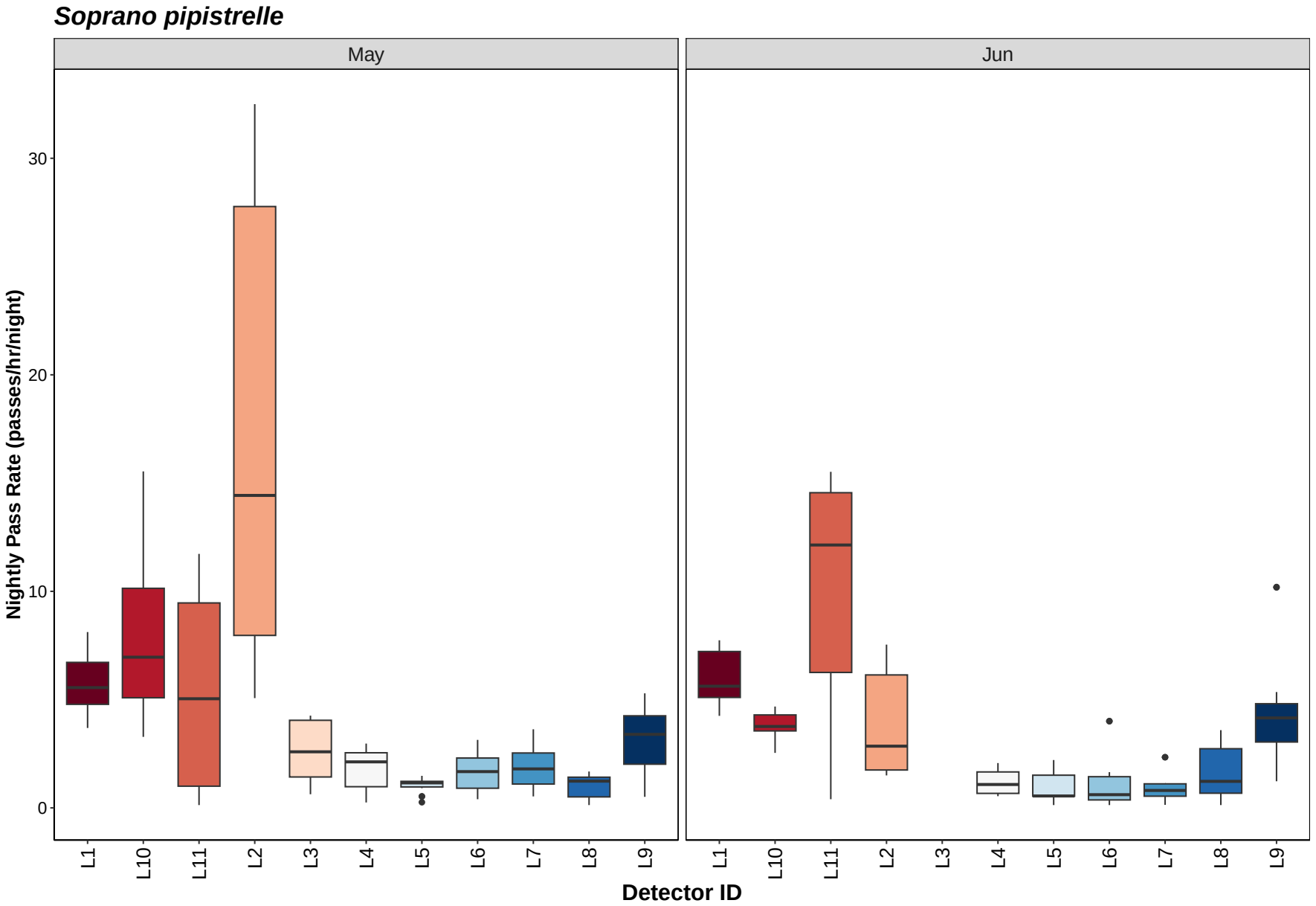
Per Detector

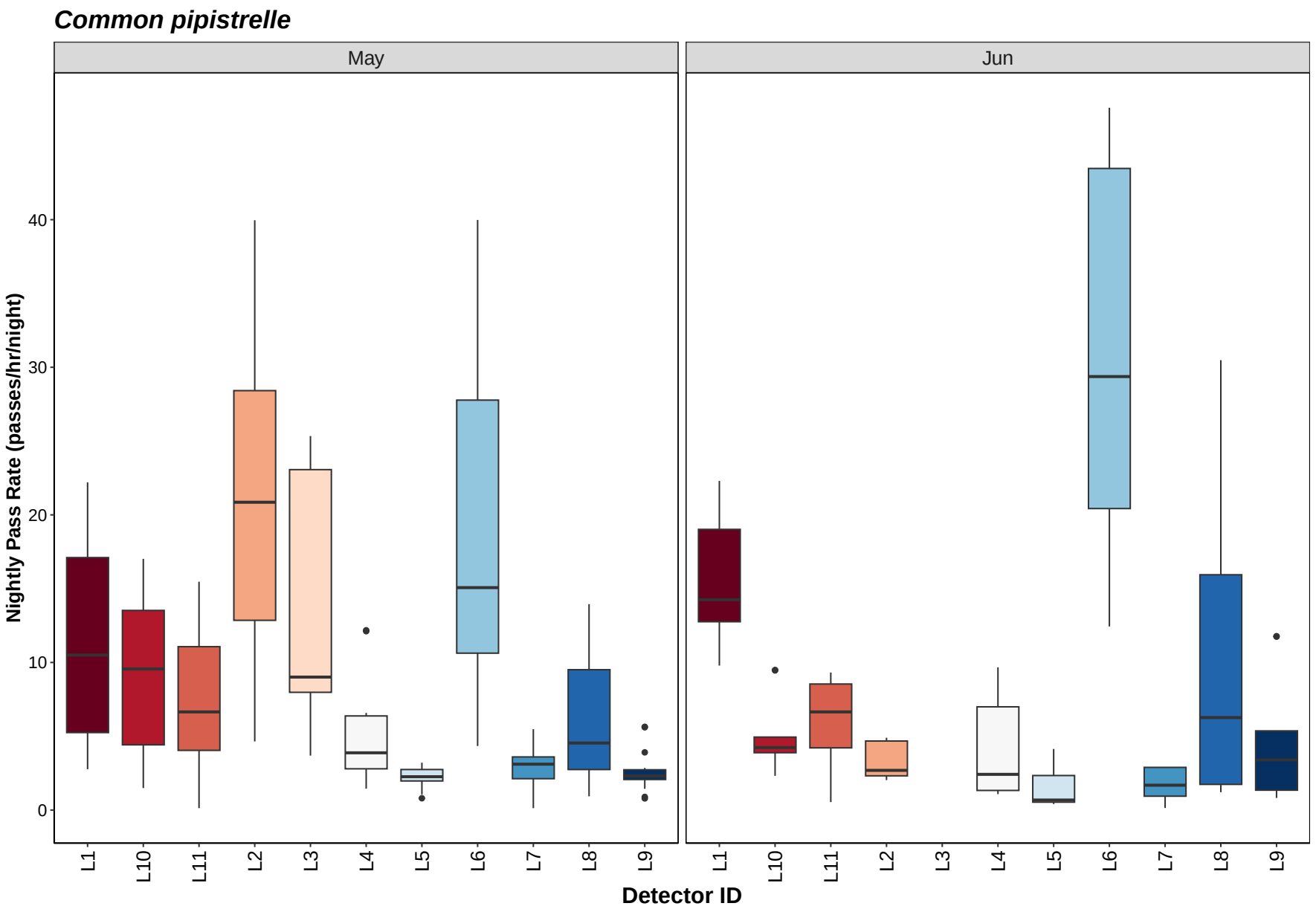
Figure 12. Figures show boxplots for the number of bat passes per hour by detector, for each month. The ‘box’ shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The ‘whiskers’ extend from the box and represent 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.

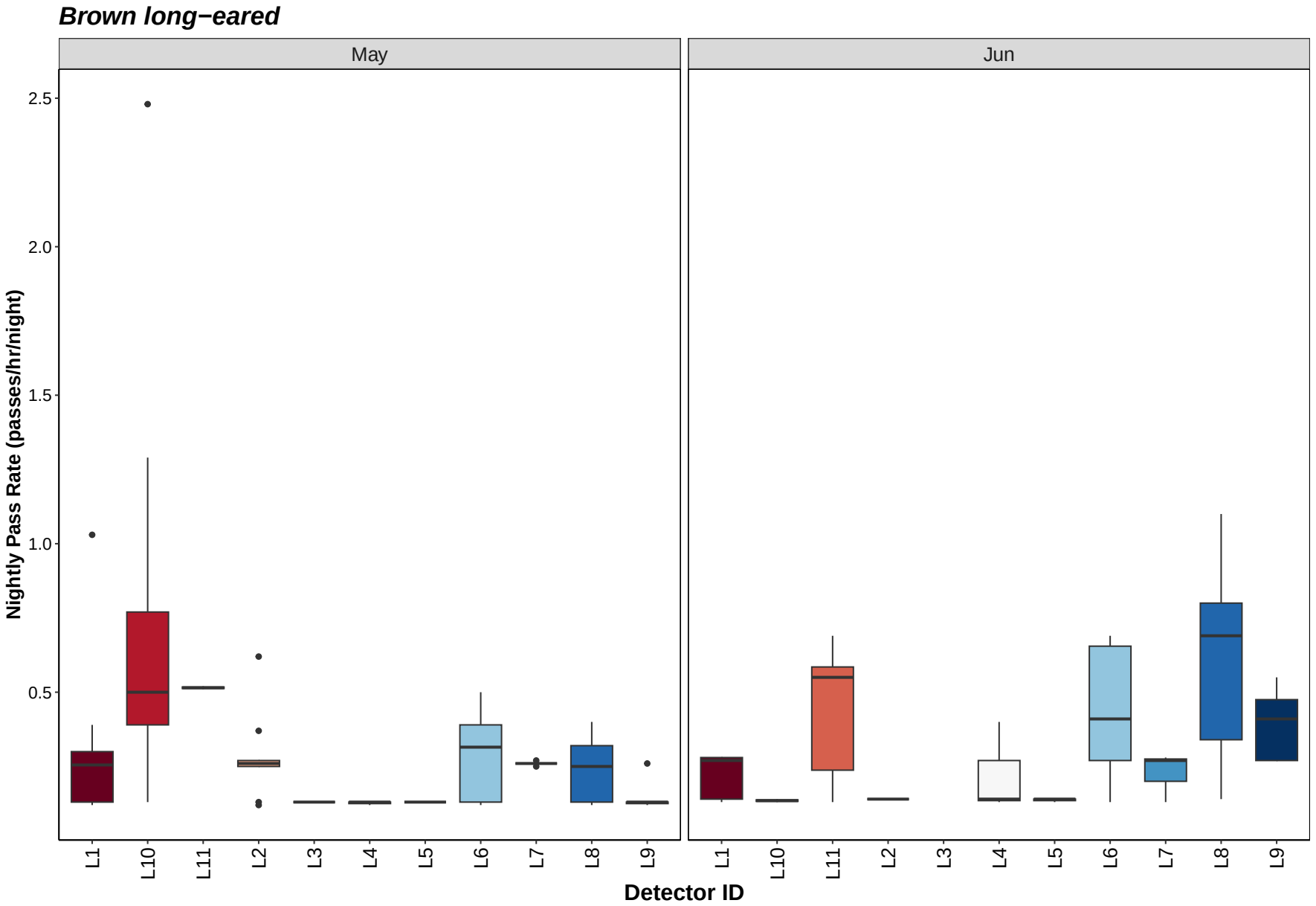

Daubenton's
May
Jun
Nightly Pass Rate (passes/hr/night)
1.6
1.2
0.8
0.4
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID

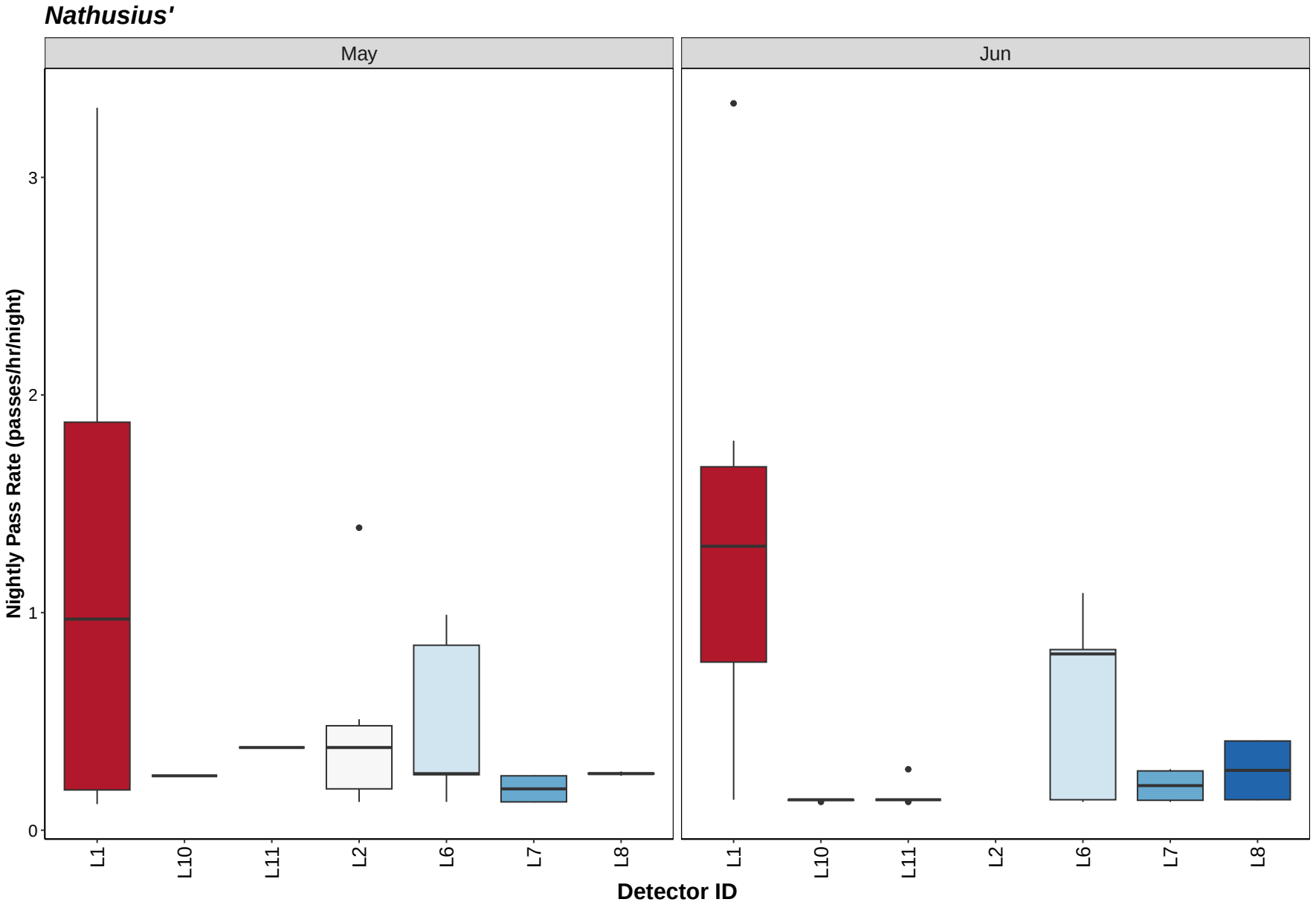

Whiskered
May
Jun
Nightly Pass Rate (passes/hr/night)
0.0
0.5
1.0
1.5
2.0
2.5
L1
L10
L11
L2
L4
L6
L7
L8
L9
Detector ID

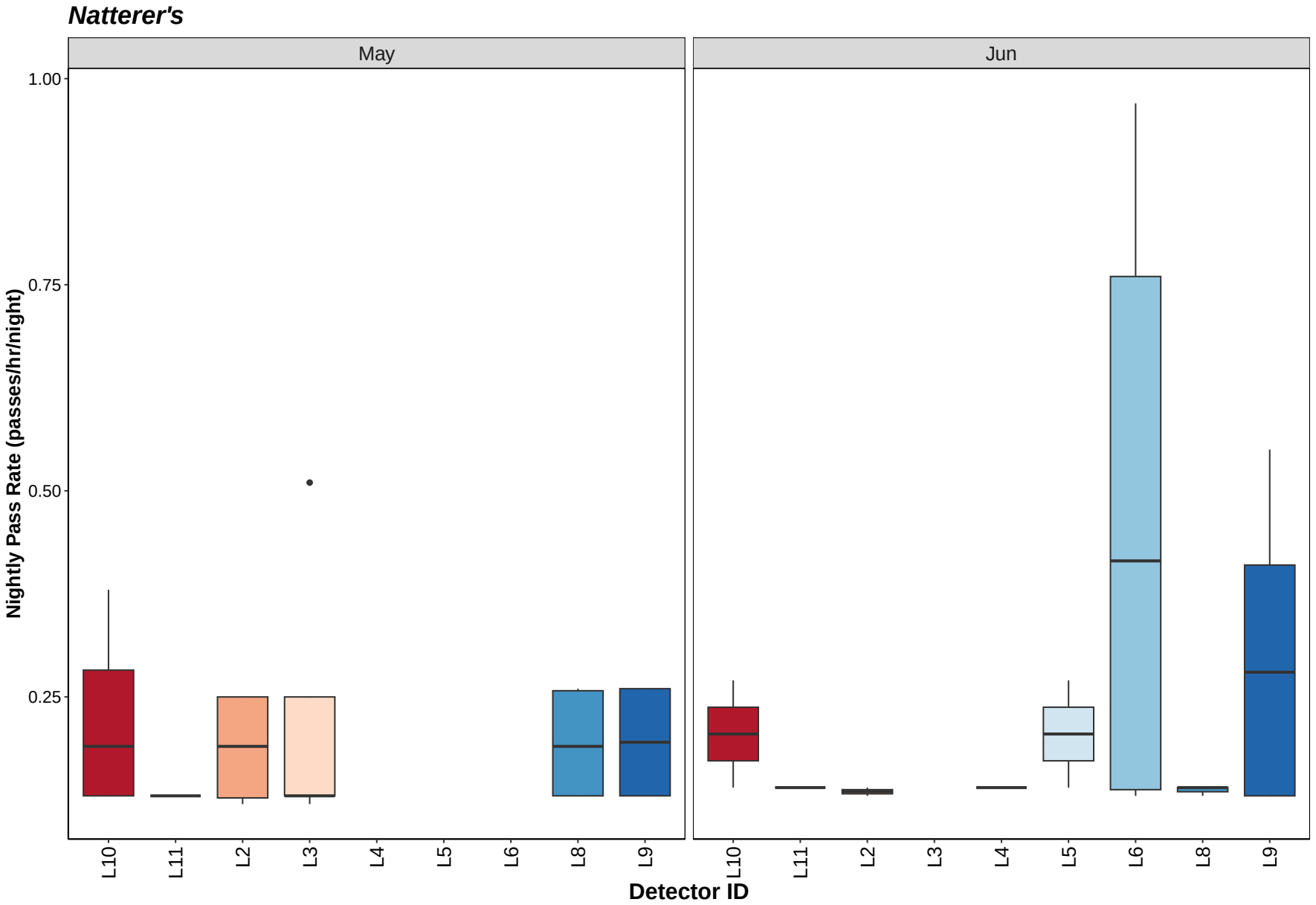

Leisler's
May
Jun
Nightly Pass Rate (passes/hr/night)
0
5
10
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID


Soprano pipistrelle
May
Jun
Nightly Pass Rate (passes/hr/night)
0
10
20
30
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID


Common pipistrelle
May
Jun
Nightly Pass Rate (passes/hr/night)
0
10
20
30
40
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID


Brown long−eared
May
Jun
Nightly Pass Rate (passes/hr/night)
2.5
2.0
1.5
1.0
0.5
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID


Nathusius'
May
Jun
Nightly Pass Rate (passes/hr/night)
0
1
2
3
L1
L10
L11
L2
L6
L7
L8
Detector ID


Natterer's
May
Jun
1.00
0.75
0.50
0.25
Nightly Pass Rate (passes/hr/night)
L10
L11
L2
L3
L4
L5
L6
L8
L9
Detector ID

Bat Activity per Detector Location

Figure 13. Detector ID reference:

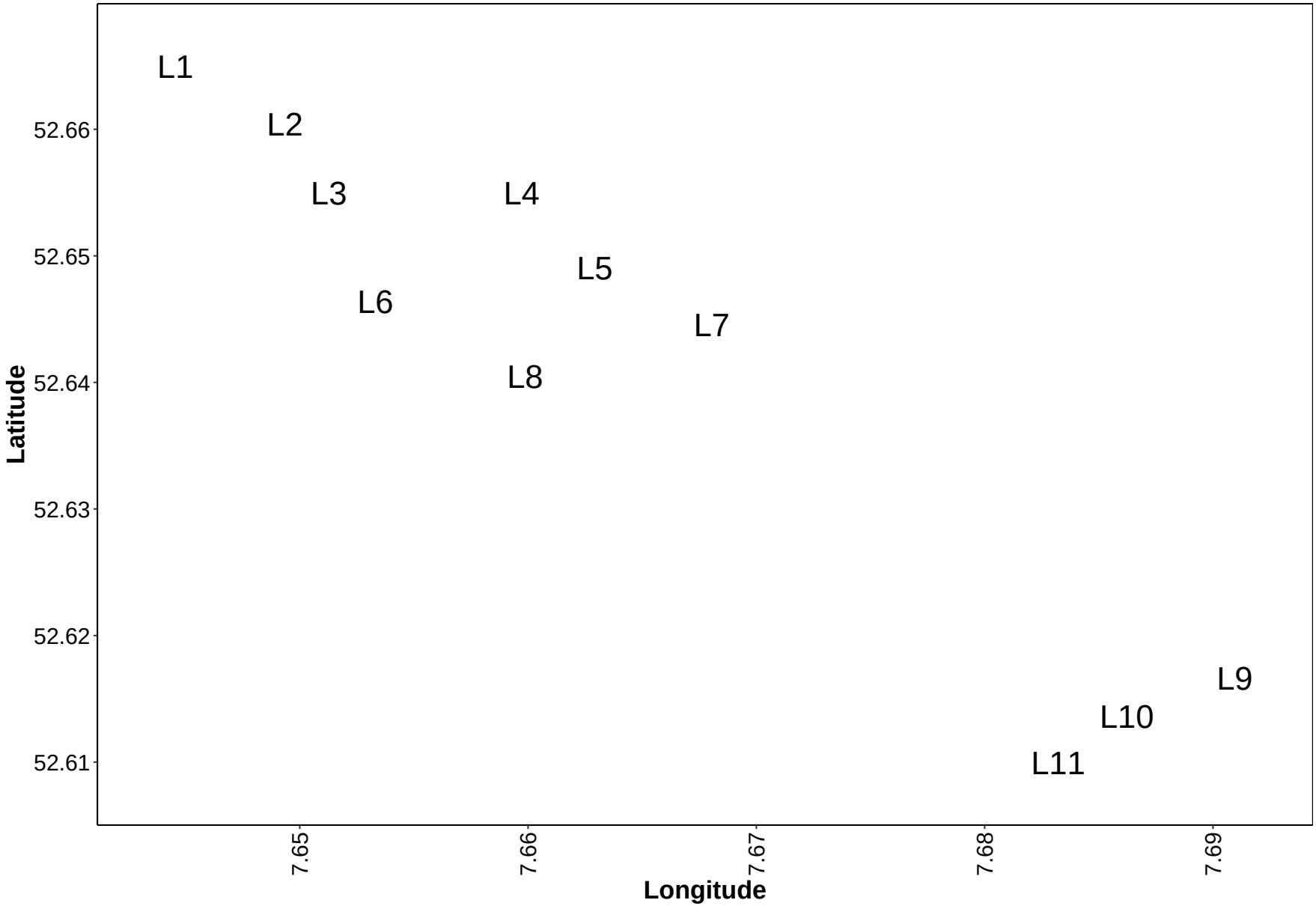
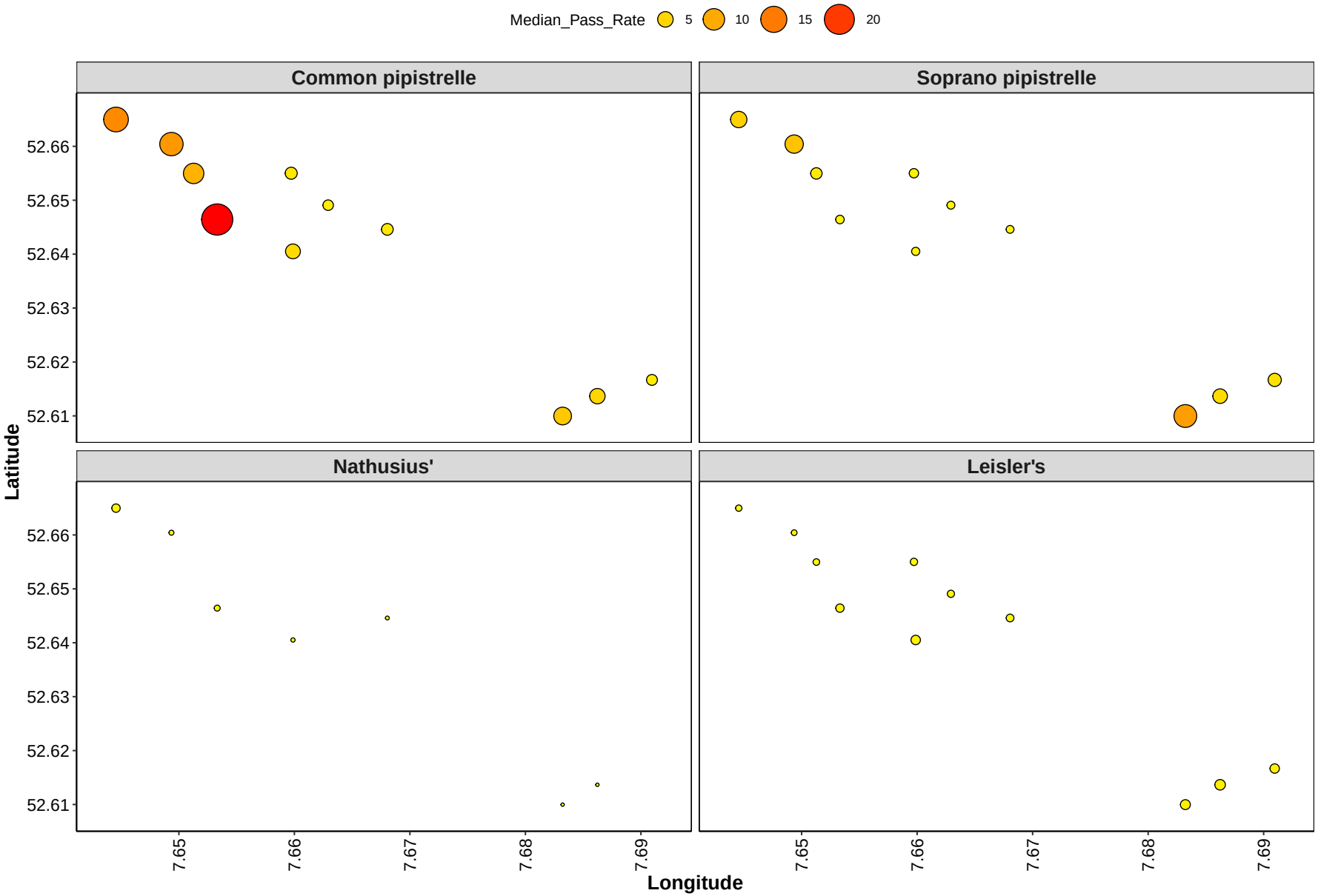

L1
L2
L3
L4
L5
L6
L7
L8
L9
L10
L11
52.66
52.65
52.64
52.63
52.62
52.61
Latitude
7.65
7.66
7.67
7.68
7.69
Longitude

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
5
10
15
20
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
7.65
7.66
7.67
7.68
7.69
Longitude

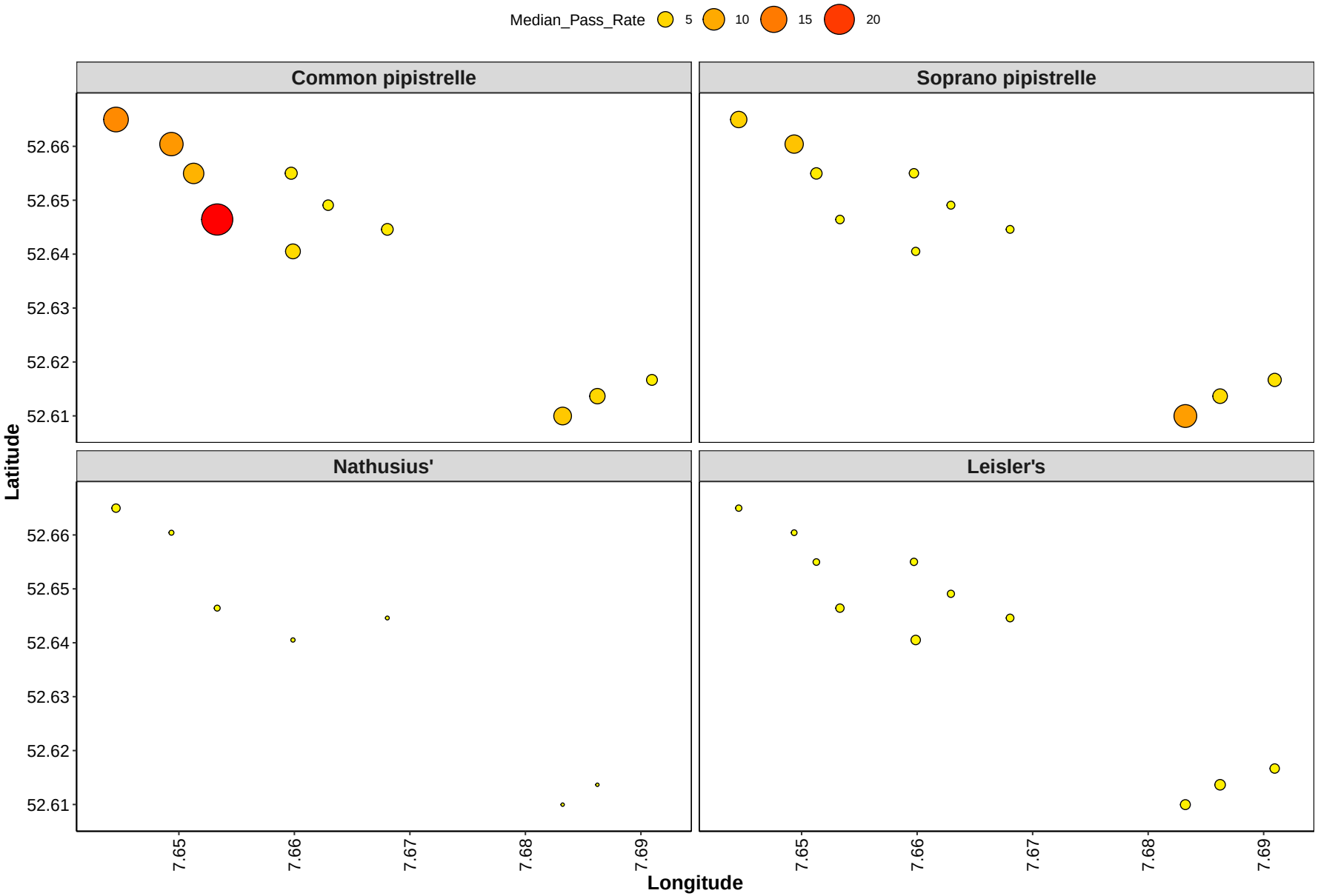
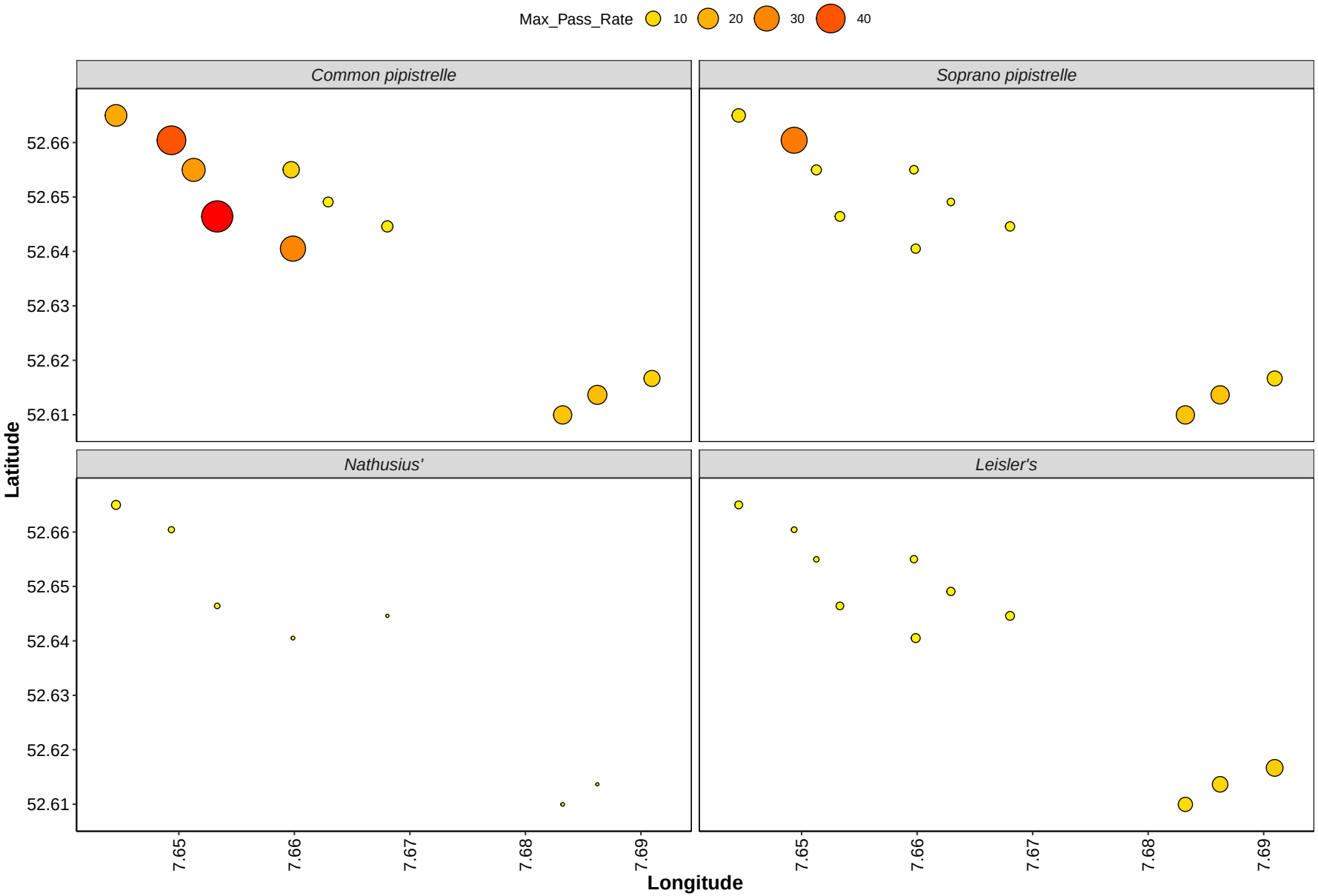
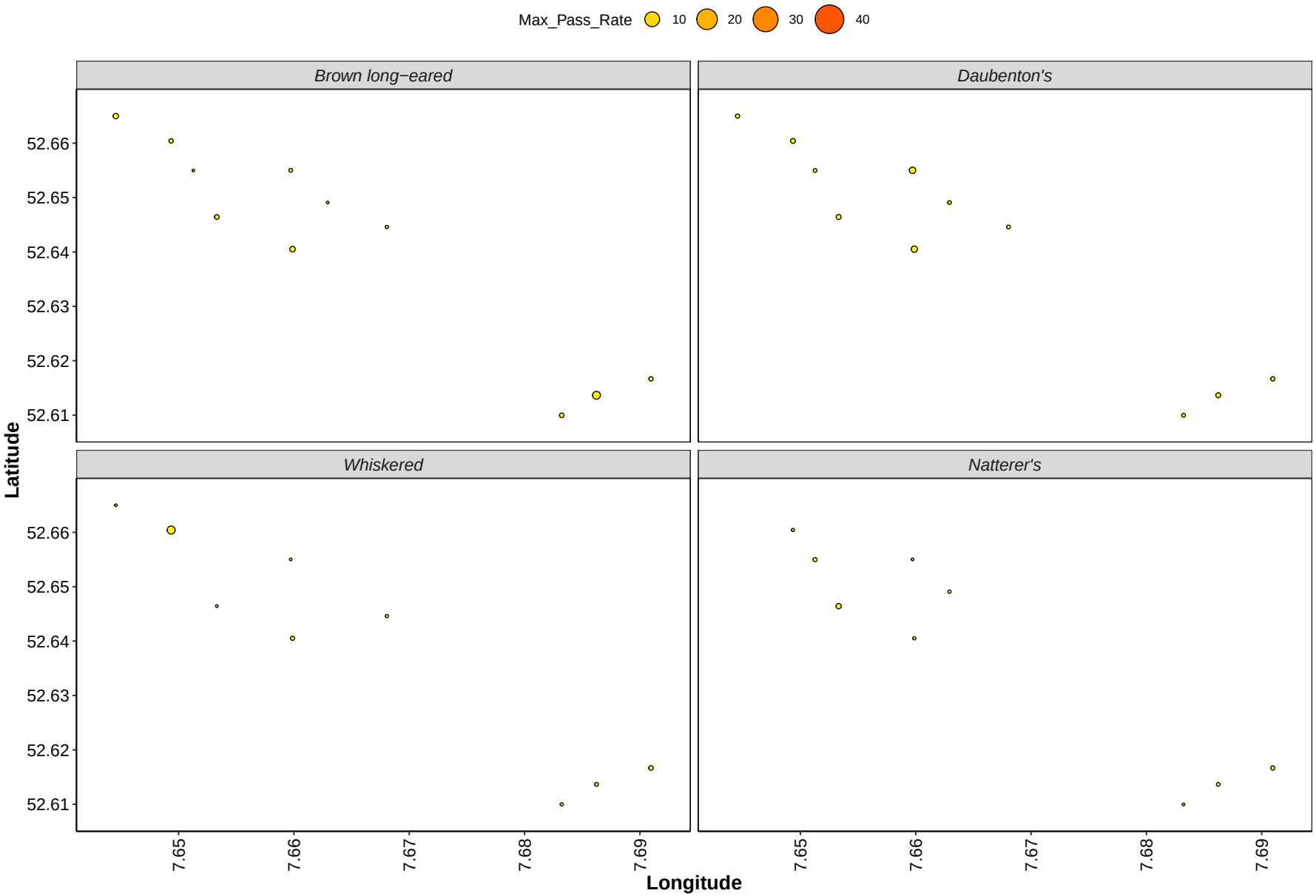

Median_Pass_Rate
5
10
15
20
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
7.65
7.66
7.67
7.68
7.69
Longitude

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
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
7.65
7.66
7.67
7.68
7.69
Longitude


Max_Pass_Rate
10
20
30
40
Brown long−eared
Daubenton's
Whiskered
Natterer's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
Longitude
7.65
7.66
7.67
7.68
7.69

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

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	L1	0.1
Brown long-eared	L10	0.0
Brown long-eared	L11	0.0
Brown long-eared	L2	0.0
Brown long-eared	L3	0.0
Brown long-eared	L4	0.0
Brown long-eared	L5	0.0
Brown long-eared	L6	0.1
Brown long-eared	L7	0.0
Brown long-eared	L8	0.3
Brown long-eared	L9	0.1
Common pipistrelle	L1	13.4
Common pipistrelle	L10	4.9
Common pipistrelle	L11	6.6
Common pipistrelle	L2	11.9
Common pipistrelle	L3	9.0
Common pipistrelle	L4	2.9
Common pipistrelle	L5	2.1
Common pipistrelle	L6	21.8
Common pipistrelle	L7	2.7
Common pipistrelle	L8	4.6
Common pipistrelle	L9	2.3
Daubenton's	L1	0.3
Daubenton's	L10	0.4
Daubenton's	L11	0.1
Daubenton's	L2	0.2
Daubenton's	L3	0.2
Daubenton's	L4	0.4
Daubenton's	L5	0.0
Daubenton's	L6	0.3
Daubenton's	L7	0.3
Daubenton's	L8	0.7
Daubenton's	L9	0.3
Leisler's	L1	0.7
Leisler's	L10	2.2
Leisler's	L11	1.9

Species	Detector ID	Median Pass Rate
Leisler's	L2	0.5
Leisler's	L3	0.6
Leisler's	L4	0.9
Leisler's	L5	0.9
Leisler's	L6	1.3
Leisler's	L7	1.1
Leisler's	L8	1.7
Leisler's	L9	1.6
Nathusius'	L1	0.1
Nathusius'	L10	0.0
Nathusius'	L11	0.0
Nathusius'	L2	0.0
Nathusius'	L3	0.0
Nathusius'	L4	0.0
Nathusius'	L5	0.0
Nathusius'	L6	0.1
Nathusius'	L7	0.0
Nathusius'	L8	0.0
Nathusius'	L9	0.0
Natterer's	L1	0.0
Natterer's	L10	0.0
Natterer's	L11	0.0
Natterer's	L2	0.0
Natterer's	L3	0.0
Natterer's	L4	0.0
Natterer's	L5	0.0
Natterer's	L6	0.0
Natterer's	L7	0.0
Natterer's	L8	0.0
Natterer's	L9	0.0
Soprano pipistrelle	L1	5.6
Soprano pipistrelle	L10	4.4
Soprano pipistrelle	L11	8.7
Soprano pipistrelle	L2	7.2
Soprano pipistrelle	L3	2.6
Soprano pipistrelle	L4	1.4

Species	Detector ID	Median Pass Rate
Soprano pipistrelle	L5	1.1
Soprano pipistrelle	L6	1.4
Soprano pipistrelle	L7	1.1
Soprano pipistrelle	L8	1.2
Soprano pipistrelle	L9	3.5
Whiskered	L1	0.0
Whiskered	L10	0.0
Whiskered	L11	0.0
Whiskered	L2	0.0
Whiskered	L3	0.0
Whiskered	L4	0.0
Whiskered	L5	0.0
Whiskered	L6	0.0
Whiskered	L7	0.0
Whiskered	L8	0.1
Whiskered	L9	0.0

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.

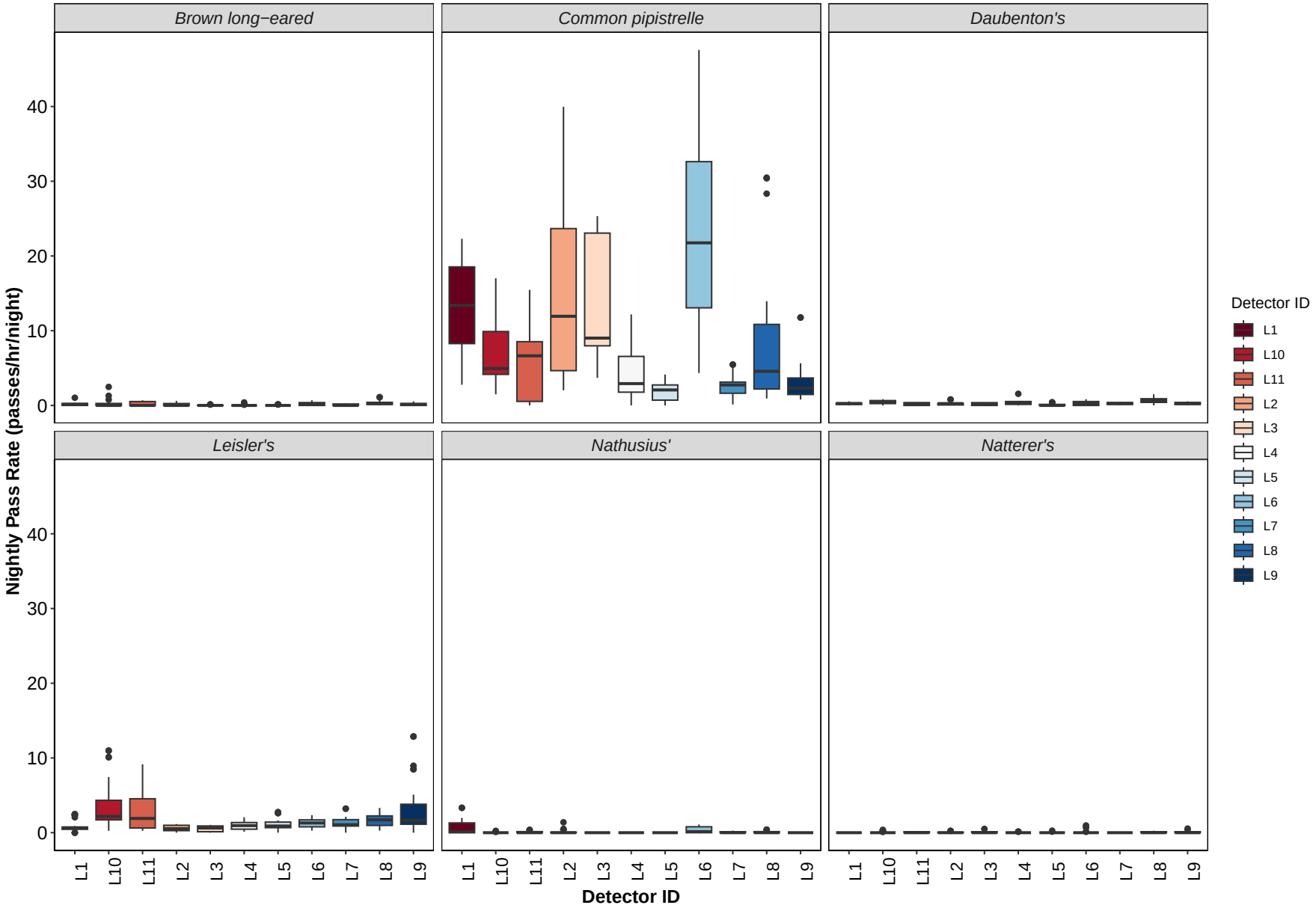
Species	Detector ID	Mean Pass Rate
Brown long-eared	L1	0.2
Brown long-eared	L10	0.3
Brown long-eared	L11	0.2
Brown long-eared	L2	0.1
Brown long-eared	L3	0.0
Brown long-eared	L4	0.0
Brown long-eared	L5	0.0
Brown long-eared	L6	0.2
Brown long-eared	L7	0.1
Brown long-eared	L8	0.3
Brown long-eared	L9	0.1
Common pipistrelle	L1	13.1
Common pipistrelle	L10	7.4
Common pipistrelle	L11	5.6
Common pipistrelle	L2	14.2
Common pipistrelle	L3	13.0
Common pipistrelle	L4	4.4
Common pipistrelle	L5	1.9
Common pipistrelle	L6	23.9
Common pipistrelle	L7	2.5
Common pipistrelle	L8	8.3
Common pipistrelle	L9	3.4
Daubenton's	L1	0.2
Daubenton's	L10	0.4
Daubenton's	L11	0.2
Daubenton's	L2	0.2
Daubenton's	L3	0.2
Daubenton's	L4	0.4
Daubenton's	L5	0.1
Daubenton's	L6	0.3
Daubenton's	L7	0.2
Daubenton's	L8	0.7
Daubenton's	L9	0.3
Leisler's	L1	0.8
Leisler's	L10	3.7
Leisler's	L11	3.1

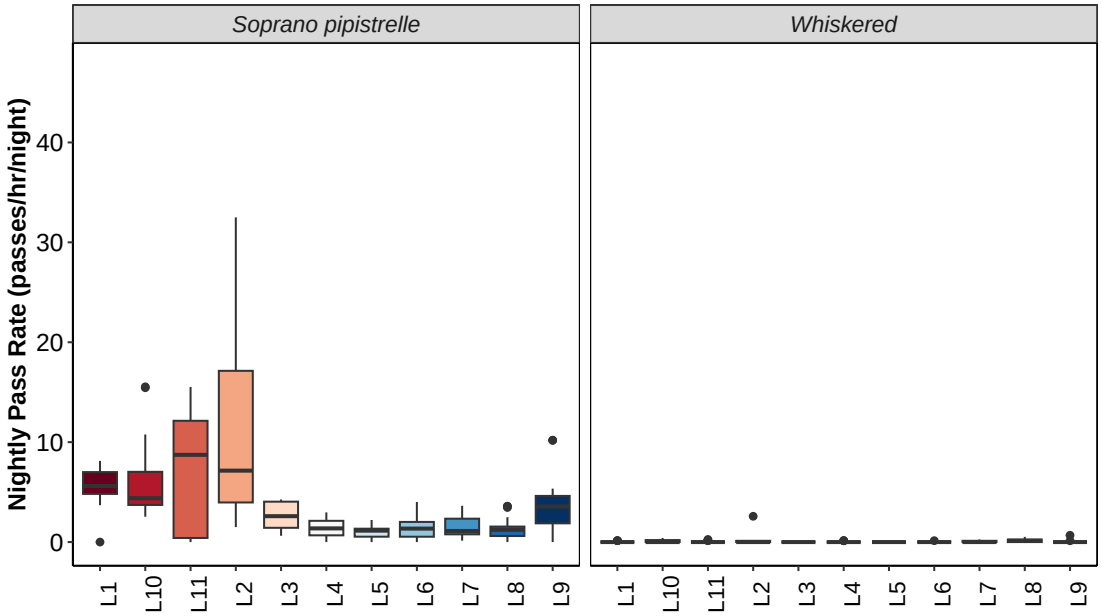
Species	Detector ID	Mean Pass Rate
Leisler's	L2	0.6
Leisler's	L3	0.5
Leisler's	L4	0.9
Leisler's	L5	1.1
Leisler's	L6	1.3
Leisler's	L7	1.3
Leisler's	L8	1.8
Leisler's	L9	3.3
Nathusius'	L1	0.7
Nathusius'	L10	0.0
Nathusius'	L11	0.1
Nathusius'	L2	0.1
Nathusius'	L3	0.0
Nathusius'	L4	0.0
Nathusius'	L5	0.0
Nathusius'	L6	0.3
Nathusius'	L7	0.1
Nathusius'	L8	0.1
Nathusius'	L9	0.0
Natterer's	L1	0.0
Natterer's	L10	0.0
Natterer's	L11	0.0
Natterer's	L2	0.0
Natterer's	L3	0.1
Natterer's	L4	0.0
Natterer's	L5	0.0
Natterer's	L6	0.1
Natterer's	L7	0.0
Natterer's	L8	0.1
Natterer's	L9	0.1
Soprano pipistrelle	L1	5.7
Soprano pipistrelle	L10	6.0
Soprano pipistrelle	L11	7.4
Soprano pipistrelle	L2	12.1
Soprano pipistrelle	L3	2.6
Soprano pipistrelle	L4	1.4

Species	Detector ID	Mean Pass Rate
Soprano pipistrelle	L5	1.0
Soprano pipistrelle	L6	1.4
Soprano pipistrelle	L7	1.5
Soprano pipistrelle	L8	1.3
Soprano pipistrelle	L9	3.7
Whiskered	L1	0.0
Whiskered	L10	0.1
Whiskered	L11	0.0
Whiskered	L2	0.1
Whiskered	L3	0.0
Whiskered	L4	0.0
Whiskered	L5	0.0
Whiskered	L6	0.0
Whiskered	L7	0.1
Whiskered	L8	0.1
Whiskered	L9	0.0

Per Detector

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.


Brown long−eared
Common pipistrelle
Daubenton's
Leisler's
Nathusius'
Natterer's
Nightly Pass Rate (passes/hr/night)
0
10
20
30
40
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID
Detector ID


Soprano pipistrelle
Whiskered
Nightly Pass Rate (passes/hr/night)
0
10
20
30
40
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9

Detector ID

Survey Effort

Table 24. The number of nights bats were detected per month per detector.

month	Detector ID	No. of Survey Nights
May	L1	15
May	L10	15
May	L11	9
May	L2	14
May	L3	12
May	L4	15
May	L5	14
May	L6	15
May	L7	15
May	L8	15
May	L9	15
Jun	L1	12
Jun	L10	12
Jun	L11	12
Jun	L2	9
Jun	L4	12
Jun	L5	12
Jun	L6	12
Jun	L7	12
Jun	L8	12
Jun	L9	12

Nighlty 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	Jun	May
Brown long-eared	L1	0.2	0.1
Brown long-eared	L10	0.0	0.1
Brown long-eared	L11	0.2	0.0
Brown long-eared	L2	0.0	0.2
Brown long-eared	L3	NA	0.0
Brown long-eared	L4	0.0	0.0
Brown long-eared	L5	0.0	0.0
Brown long-eared	L6	0.1	0.1
Brown long-eared	L7	0.0	0.0
Brown long-eared	L8	0.5	0.1
Brown long-eared	L9	0.3	0.0
Common pipistrelle	L1	14.3	10.5
Common pipistrelle	L10	4.2	9.6
Common pipistrelle	L11	6.6	4.1
Common pipistrelle	L2	2.7	20.9
Common pipistrelle	L3	NA	9.0
Common pipistrelle	L4	2.4	3.2
Common pipistrelle	L5	0.7	2.3
Common pipistrelle	L6	29.4	15.1
Common pipistrelle	L7	1.7	3.1
Common pipistrelle	L8	6.3	4.5
Common pipistrelle	L9	3.4	2.3
Daubenton's	L1	0.3	0.1
Daubenton's	L10	0.7	0.4
Daubenton's	L11	0.3	0.0
Daubenton's	L2	0.3	0.2
Daubenton's	L3	NA	0.2
Daubenton's	L4	0.2	0.4
Daubenton's	L5	0.0	0.0
Daubenton's	L6	0.4	0.3
Daubenton's	L7	0.4	0.3
Daubenton's	L8	0.5	0.8
Daubenton's	L9	0.3	0.2
Leisler's	L1	0.7	0.6
Leisler's	L10	2.2	2.2
Leisler's	L11	2.7	0.7

Species	Detector ID	Jun	May
Leisler's	L2	0.4	0.9
Leisler's	L3	NA	0.6
Leisler's	L4	0.9	1.0
Leisler's	L5	0.8	0.9
Leisler's	L6	1.2	1.3
Leisler's	L7	1.0	1.1
Leisler's	L8	1.5	1.7
Leisler's	L9	1.7	1.6
Nathusius'	L1	0.6	0.0
Nathusius'	L10	0.0	0.0
Nathusius'	L11	0.0	0.0
Nathusius'	L2	0.0	0.0
Nathusius'	L3	NA	0.0
Nathusius'	L4	0.0	0.0
Nathusius'	L5	0.0	0.0
Nathusius'	L6	0.3	0.0
Nathusius'	L7	0.0	0.0
Nathusius'	L8	0.0	0.0
Nathusius'	L9	0.0	0.0
Natterer's	L1	0.0	0.0
Natterer's	L10	0.0	0.0
Natterer's	L11	0.0	0.0
Natterer's	L2	0.0	0.0
Natterer's	L3	NA	0.0
Natterer's	L4	0.0	0.0
Natterer's	L5	0.0	0.0
Natterer's	L6	0.0	0.0
Natterer's	L7	0.0	0.0
Natterer's	L8	0.0	0.0
Natterer's	L9	0.0	0.0
Soprano pipistrelle	L1	5.6	5.4
Soprano pipistrelle	L10	3.8	7.0
Soprano pipistrelle	L11	12.0	3.3
Soprano pipistrelle	L2	2.9	14.4
Soprano pipistrelle	L3	NA	2.6
Soprano pipistrelle	L4	0.9	2.1

Species	Detector ID	Jun	May
Soprano pipistrelle	L5	0.5	1.2
Soprano pipistrelle	L6	0.6	1.4
Soprano pipistrelle	L7	0.8	1.8
Soprano pipistrelle	L8	1.2	1.2
Soprano pipistrelle	L9	4.2	3.2
Whiskered	L1	0.0	0.0
Whiskered	L10	0.1	0.0
Whiskered	L11	0.0	0.0
Whiskered	L2	0.1	0.0
Whiskered	L3	NA	0.0
Whiskered	L4	0.0	0.0
Whiskered	L5	0.0	0.0
Whiskered	L6	0.0	0.0
Whiskered	L7	0.0	0.0
Whiskered	L8	0.1	0.1
Whiskered	L9	0.0	0.0

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.

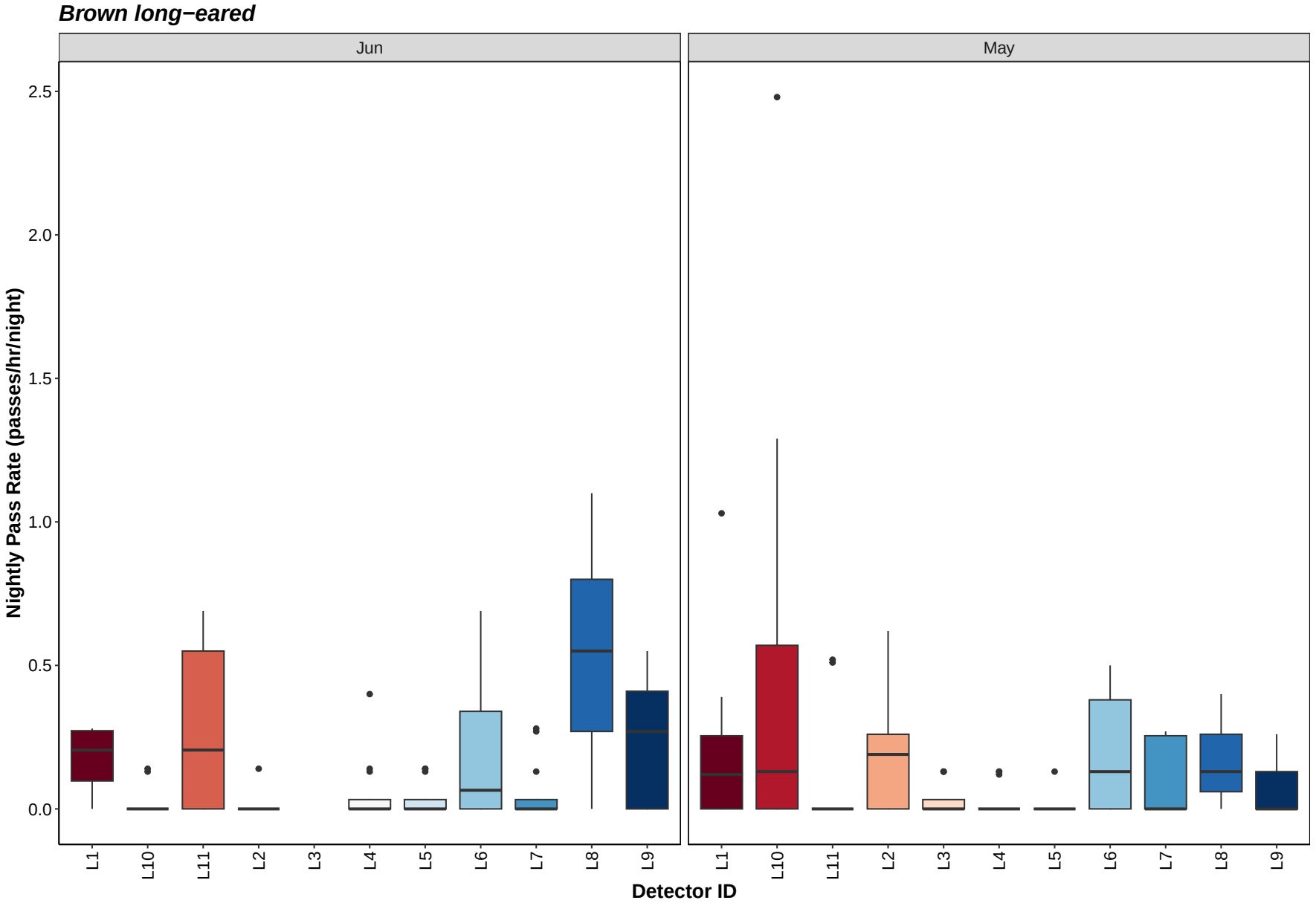
Species	Detector ID	Jun	May
Brown long-eared	L1	0.2	0.2
Brown long-eared	L10	0.0	0.5
Brown long-eared	L11	0.3	0.1
Brown long-eared	L2	0.0	0.2
Brown long-eared	L3	NA	0.0
Brown long-eared	L4	0.1	0.0
Brown long-eared	L5	0.0	0.0
Brown long-eared	L6	0.2	0.2
Brown long-eared	L7	0.1	0.1
Brown long-eared	L8	0.6	0.2
Brown long-eared	L9	0.2	0.1
Common pipistrelle	L1	15.7	11.0
Common pipistrelle	L10	4.9	9.4
Common pipistrelle	L11	5.4	5.8
Common pipistrelle	L2	3.5	21.1
Common pipistrelle	L3	NA	13.0
Common pipistrelle	L4	4.0	4.7
Common pipistrelle	L5	1.5	2.2
Common pipistrelle	L6	30.4	18.8
Common pipistrelle	L7	1.8	3.0
Common pipistrelle	L8	11.2	6.0
Common pipistrelle	L9	4.2	2.6
Daubenton's	L1	0.3	0.2
Daubenton's	L10	0.5	0.3
Daubenton's	L11	0.2	0.1
Daubenton's	L2	0.2	0.2
Daubenton's	L3	NA	0.2
Daubenton's	L4	0.2	0.5
Daubenton's	L5	0.1	0.1
Daubenton's	L6	0.4	0.3
Daubenton's	L7	0.3	0.2
Daubenton's	L8	0.6	0.8
Daubenton's	L9	0.3	0.2
Leisler's	L1	1.0	0.7
Leisler's	L10	5.1	2.5
Leisler's	L11	3.8	2.2

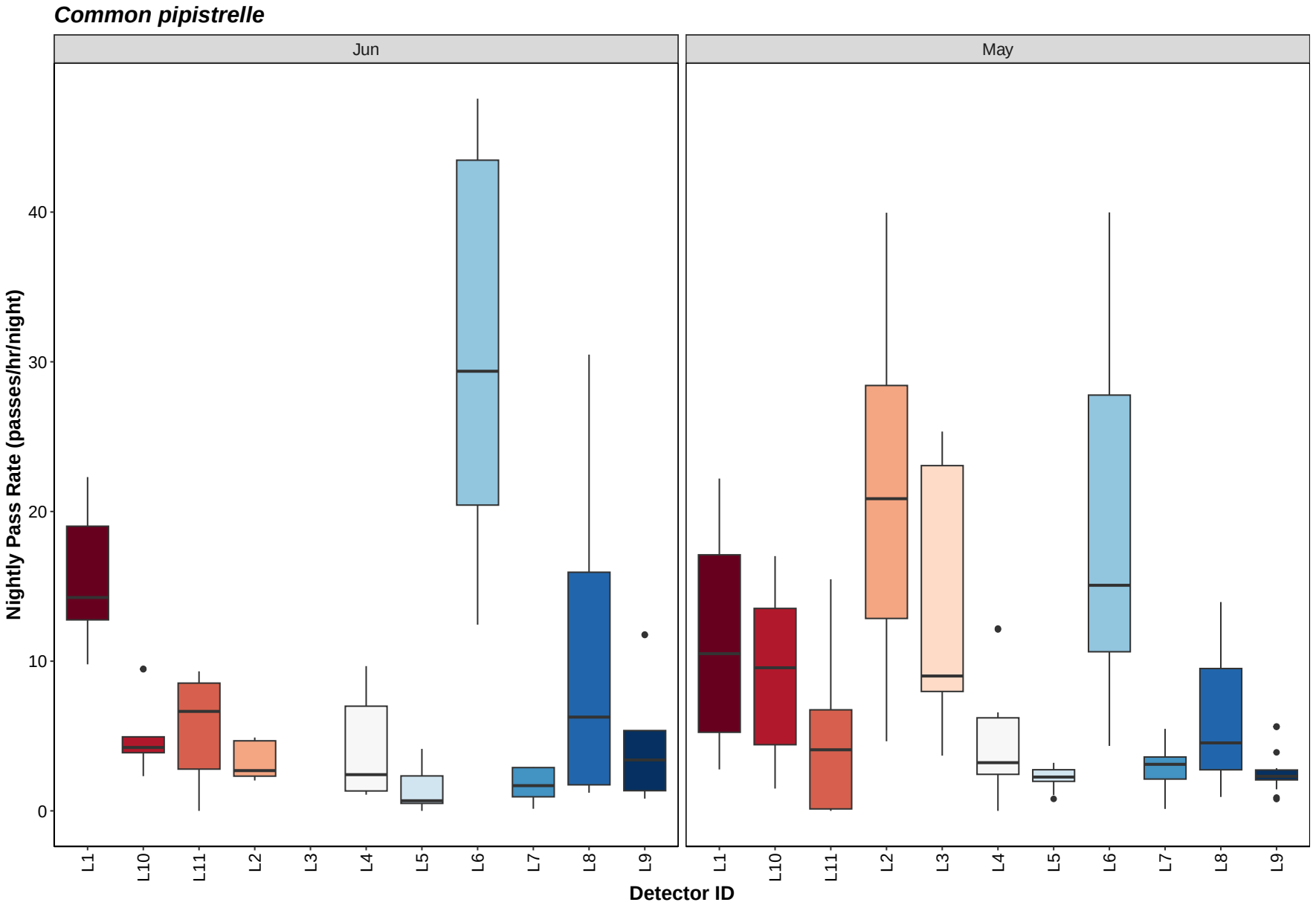
Species	Detector ID	Jun	May
Leisler's	L2	0.4	0.7
Leisler's	L3	NA	0.5
Leisler's	L4	0.9	1.0
Leisler's	L5	1.1	1.1
Leisler's	L6	1.2	1.3
Leisler's	L7	1.0	1.4
Leisler's	L8	1.6	1.9
Leisler's	L9	4.4	2.3
Nathusius'	L1	0.9	0.5
Nathusius'	L10	0.0	0.0
Nathusius'	L11	0.1	0.1
Nathusius'	L2	0.0	0.2
Nathusius'	L3	NA	0.0
Nathusius'	L4	0.0	0.0
Nathusius'	L5	0.0	0.0
Nathusius'	L6	0.4	0.2
Nathusius'	L7	0.1	0.1
Nathusius'	L8	0.1	0.1
Nathusius'	L9	0.0	0.0
Natterer's	L1	0.0	0.0
Natterer's	L10	0.0	0.1
Natterer's	L11	0.1	0.0
Natterer's	L2	0.0	0.1
Natterer's	L3	NA	0.1
Natterer's	L4	0.0	0.0
Natterer's	L5	0.0	0.0
Natterer's	L6	0.2	0.0
Natterer's	L7	0.0	0.0
Natterer's	L8	0.0	0.1
Natterer's	L9	0.1	0.1
Soprano pipistrelle	L1	6.1	5.3
Soprano pipistrelle	L10	3.8	7.8
Soprano pipistrelle	L11	9.3	4.9
Soprano pipistrelle	L2	3.8	17.4
Soprano pipistrelle	L3	NA	2.6
Soprano pipistrelle	L4	1.1	1.7

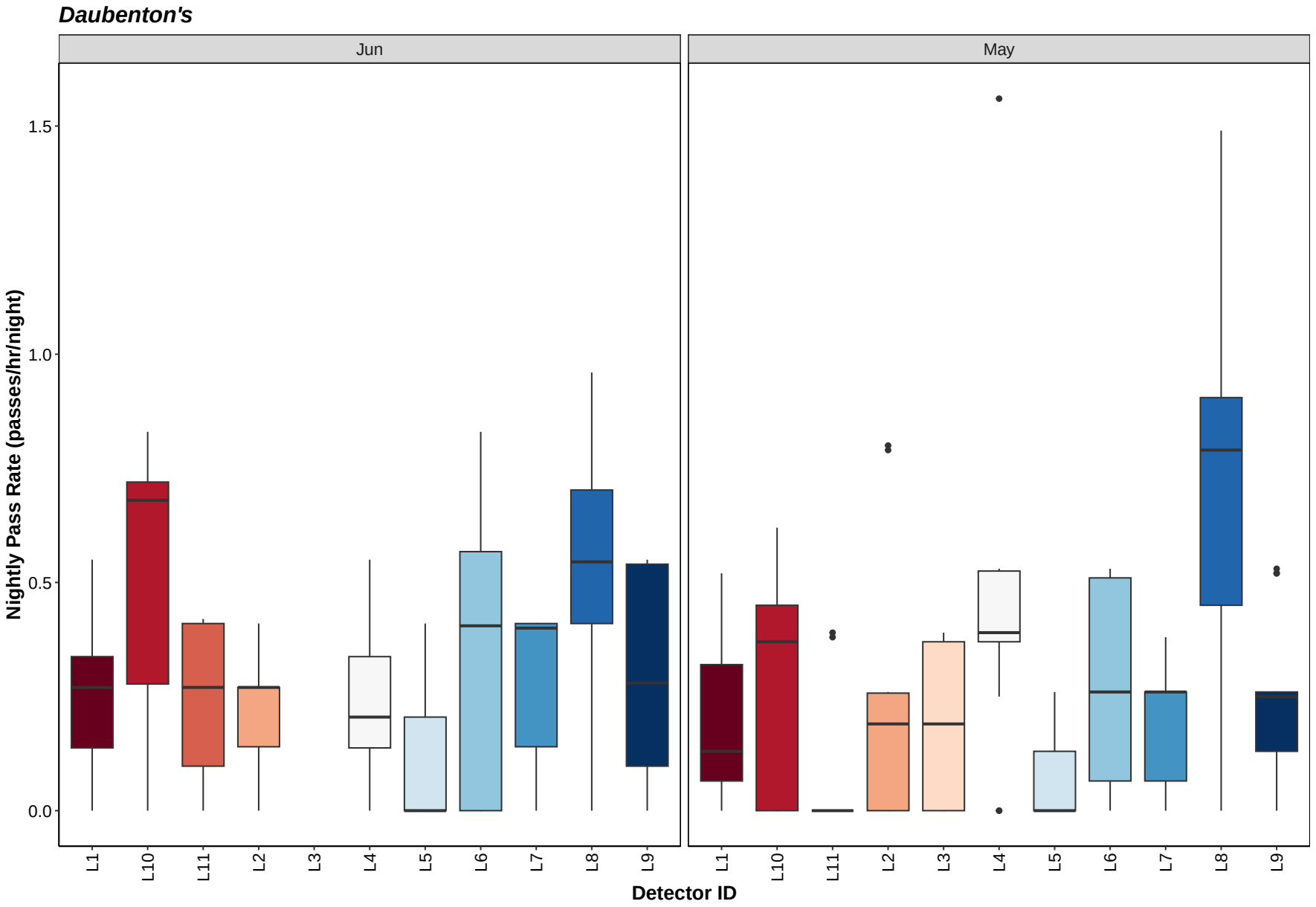
Species	Detector ID	Jun	May
Soprano pipistrelle	L5	0.9	1.0
Soprano pipistrelle	L6	1.2	1.6
Soprano pipistrelle	L7	0.9	1.9
Soprano pipistrelle	L8	1.8	1.0
Soprano pipistrelle	L9	4.6	2.9
Whiskered	L1	0.0	0.0
Whiskered	L10	0.1	0.1
Whiskered	L11	0.0	0.0
Whiskered	L2	0.3	0.0
Whiskered	L3	NA	0.0
Whiskered	L4	0.0	0.0
Whiskered	L5	0.0	0.0
Whiskered	L6	0.0	0.0
Whiskered	L7	0.0	0.1
Whiskered	L8	0.1	0.2
Whiskered	L9	0.1	0.0

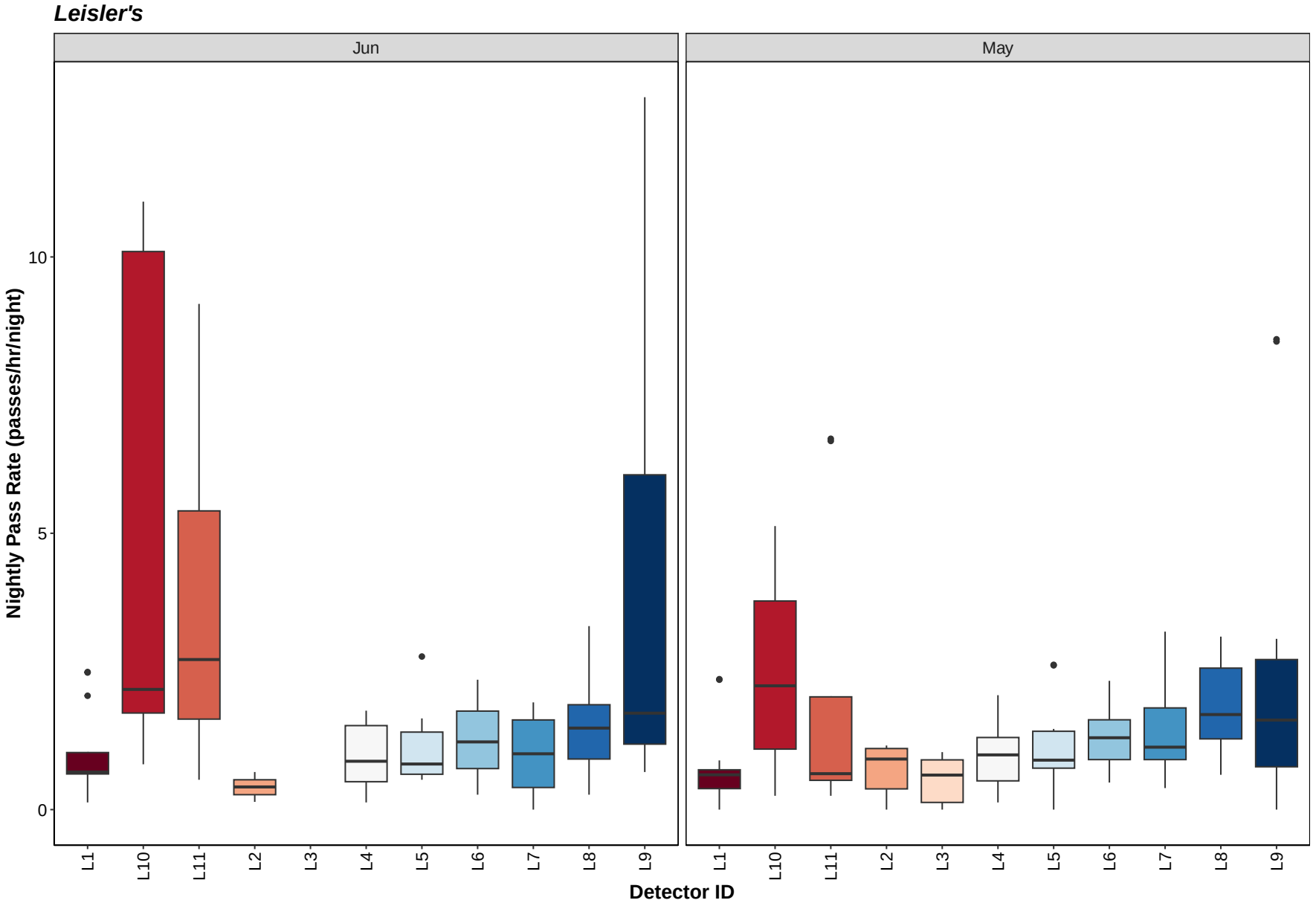
Per Detector

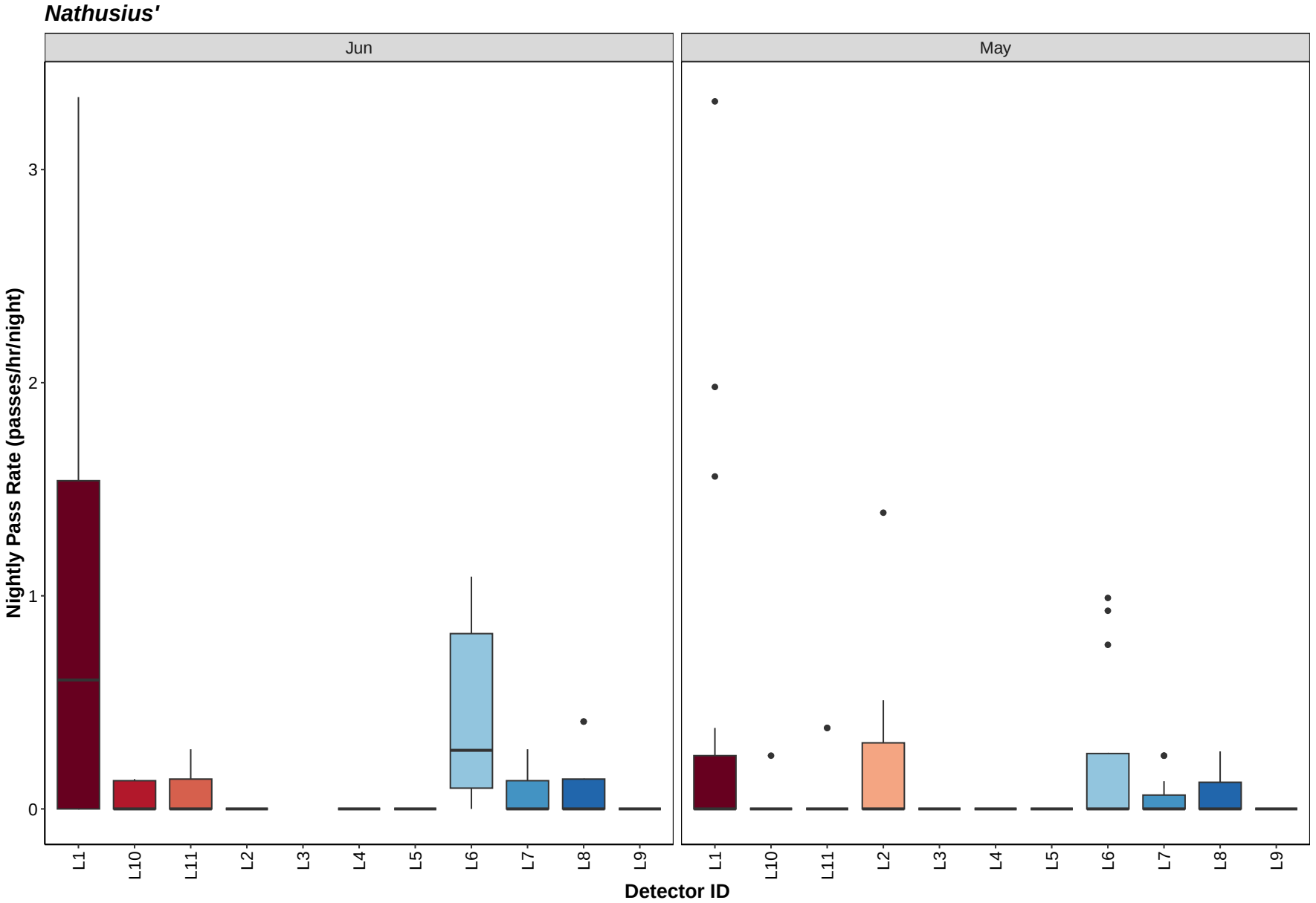
Figure 17. Figures show boxplots for the number of bat passes per hour by detector, for each month. The ‘box’ shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The ‘whiskers’ extend from the box and represent 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.

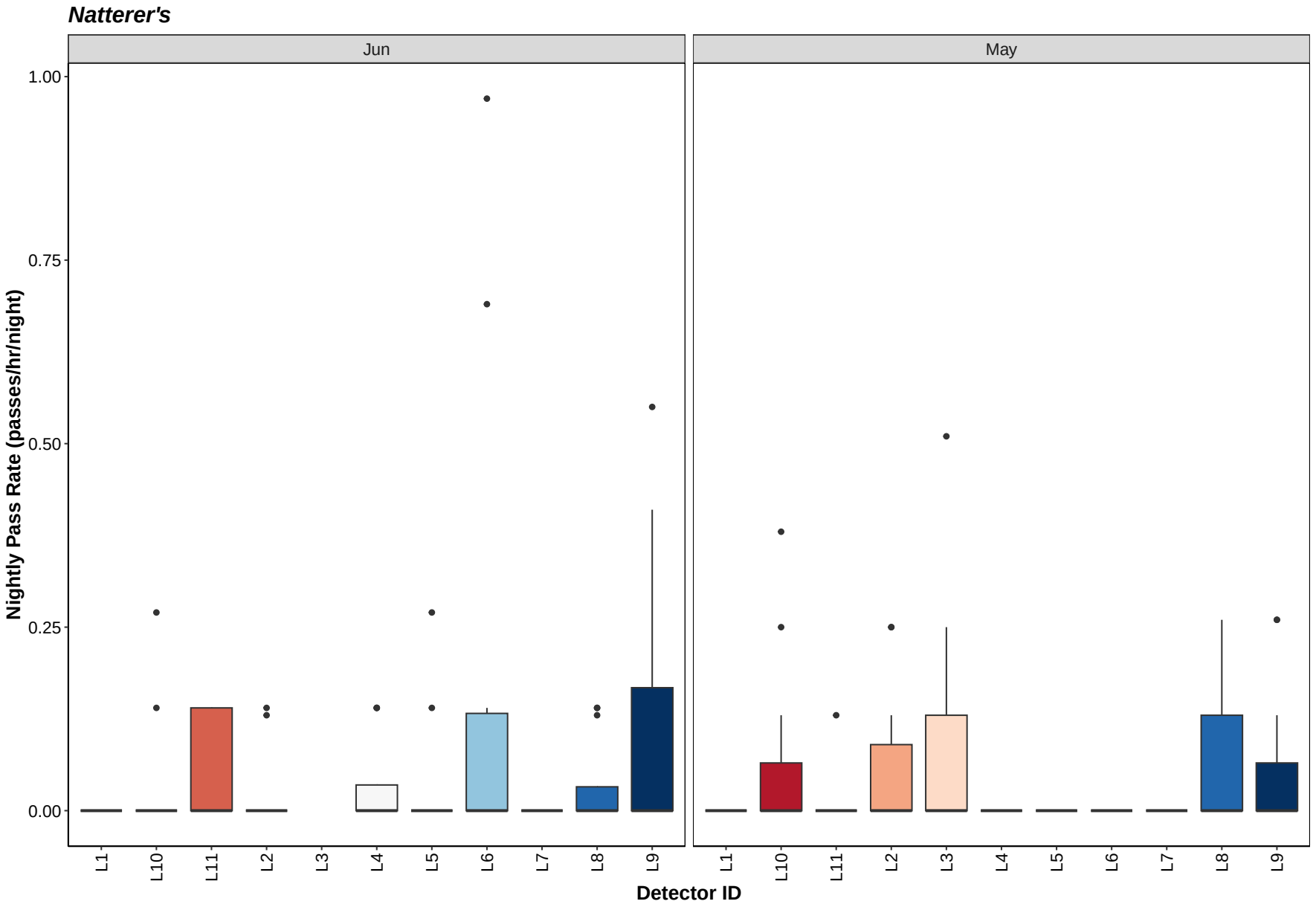

Brown long−eared
Jun
May
Nightly Pass Rate (passes/hr/night)
2.5
2.0
1.5
1.0
0.5
0.0
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID

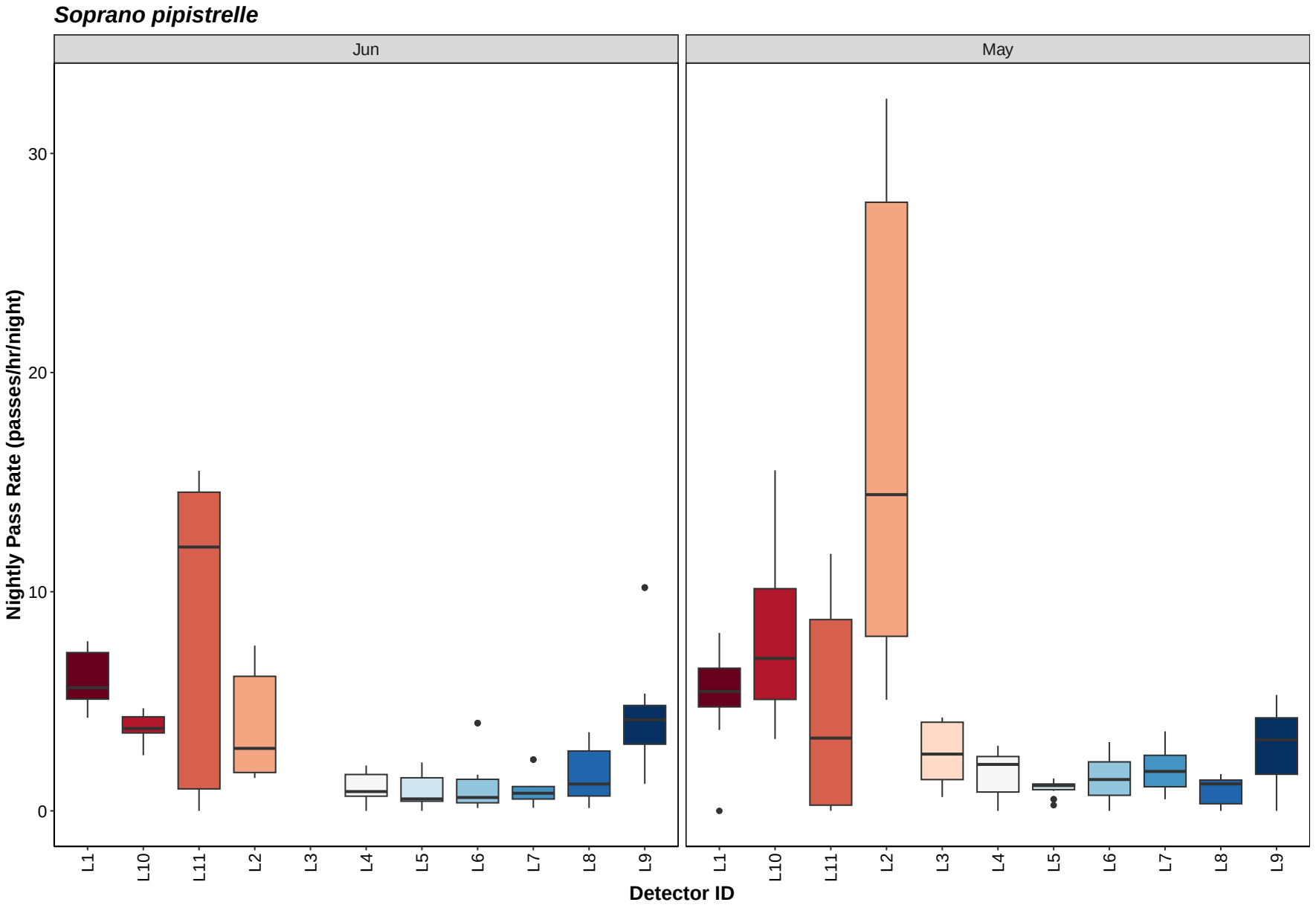

Common pipistrelle
Jun
May
Nightly Pass Rate (passes/hr/night)
0
10
20
30
40
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID

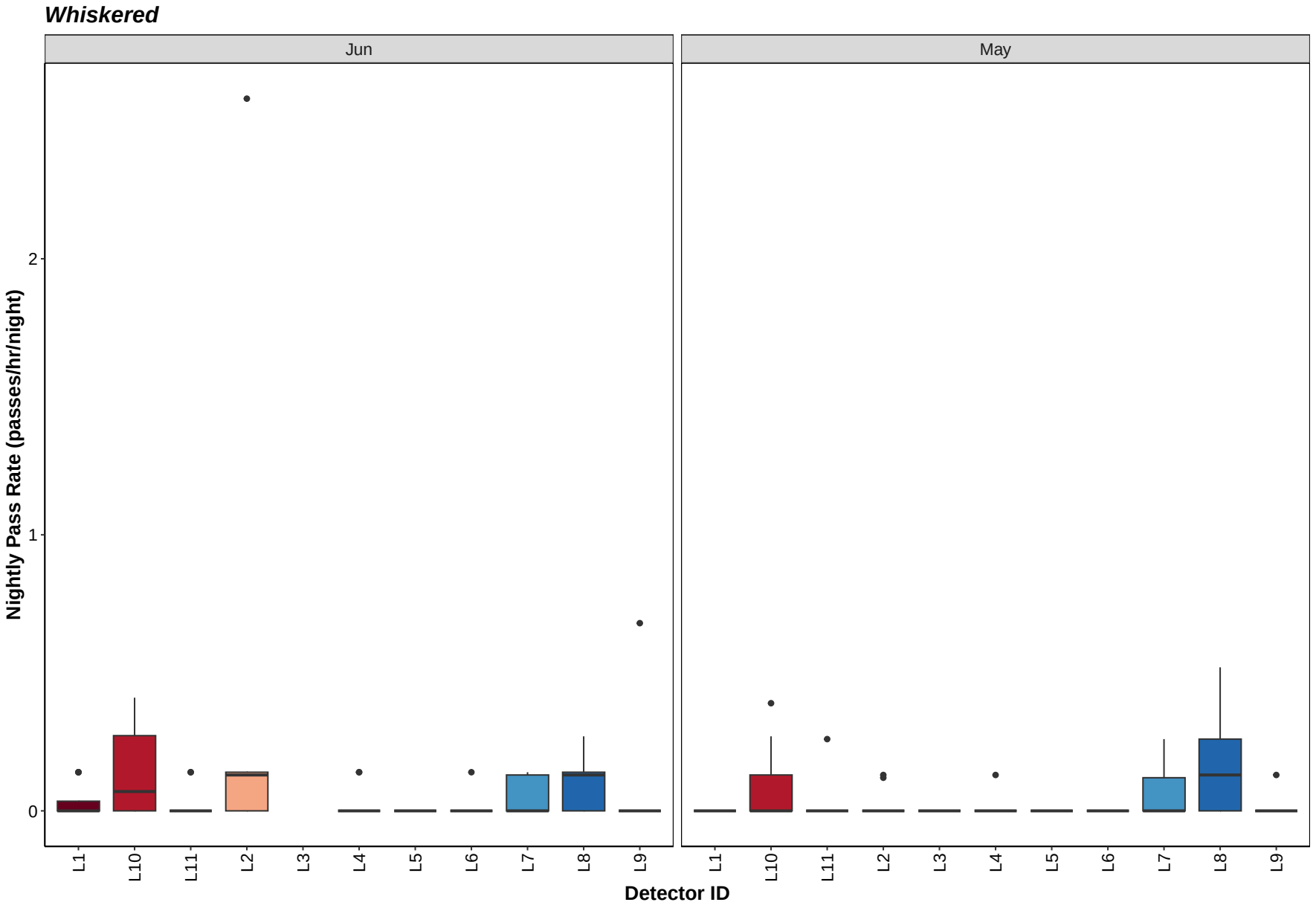

Daubenton's
Jun
May
Nightly Pass Rate (passes/hr/night)
1.5
1.0
0.5
0.0
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID


Leisler's
Jun
May
Nightly Pass Rate (passes/hr/night)
10
5
0
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID


Nathusius'
Jun
May
Nightly Pass Rate (passes/hr/night)
0
1
2
3
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID


Natterer's
Jun
May
1.00
0.75
0.50
0.25
0.00
Nightly Pass Rate (passes/hr/night)
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID


Soprano pipistrelle
Jun
May
Nightly Pass Rate (passes/hr/night)
0
10
20
30
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID


Whiskered
Jun
May
Nightly Pass Rate (passes/hr/night)
0
1
2
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID

Bat Activity per Detector Location

Figure 18. Detector ID reference:

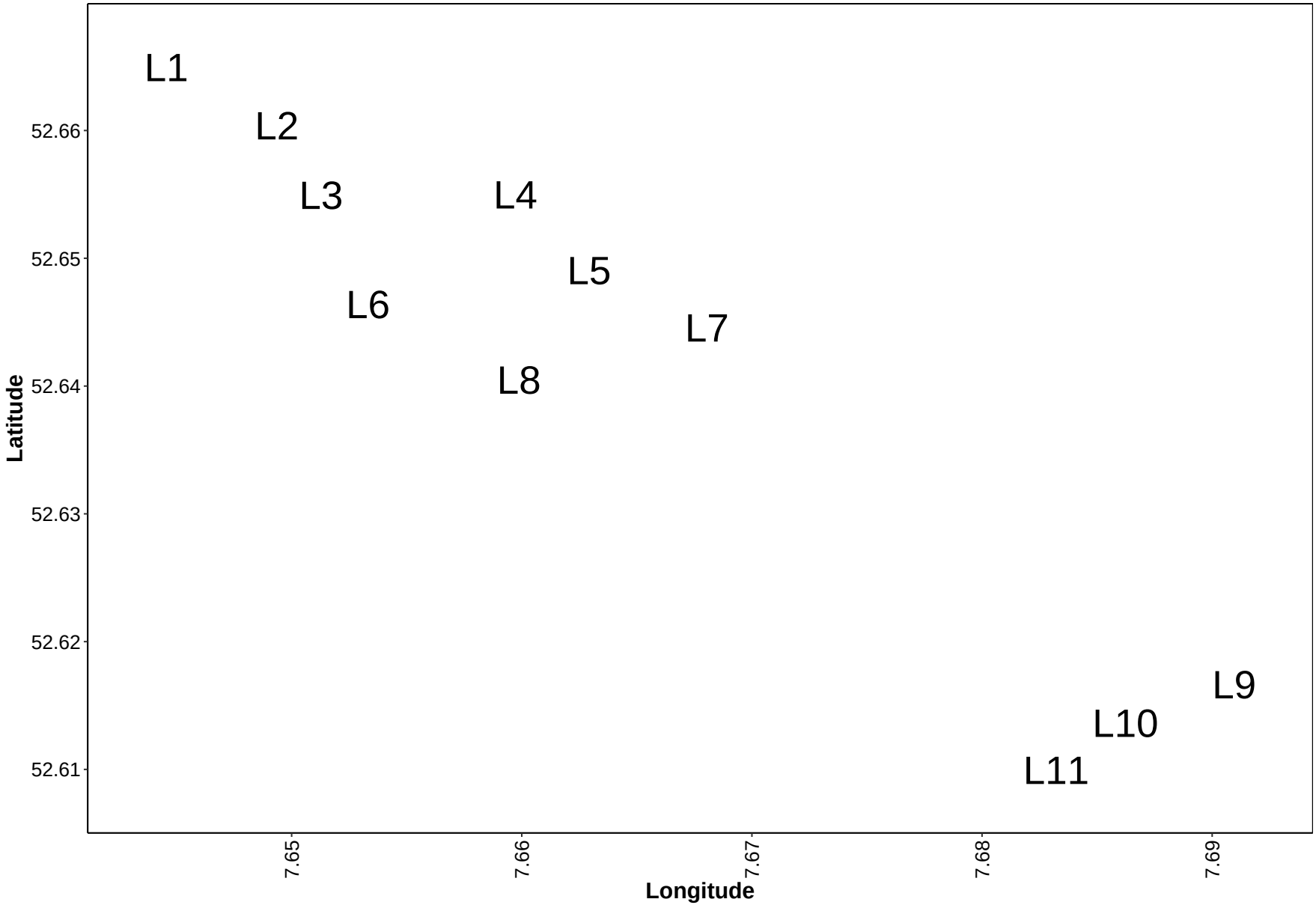
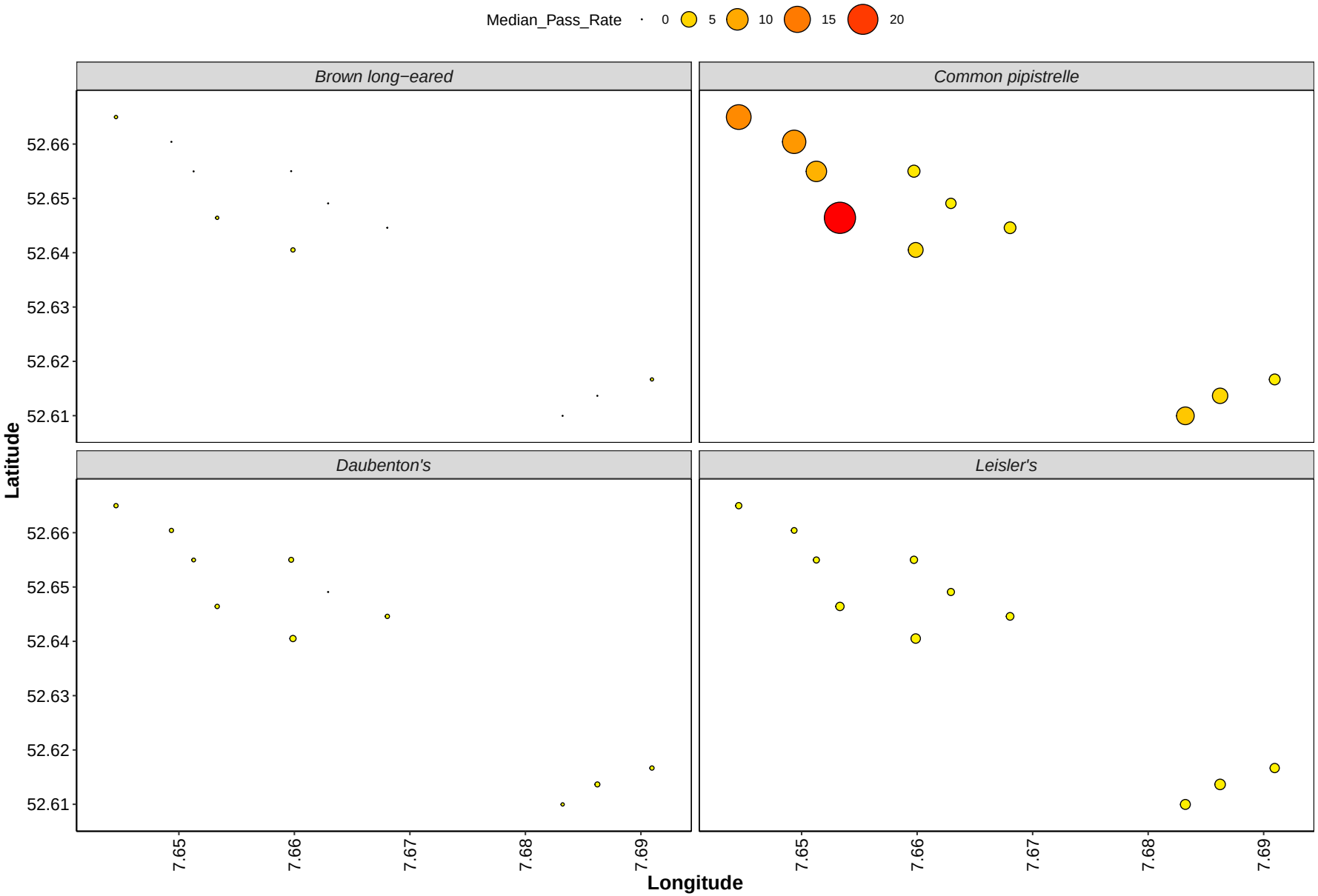

L1
L2
L3
L4
L5
L6
L7
L8
L9
L10
L11
52.66
52.65
52.64
52.63
52.62
52.61
Latitude
7.65
7.66
7.67
7.68
7.69
Longitude

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
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
Longitude
−7.65
−7.66
−7.67
−7.68
−7.69

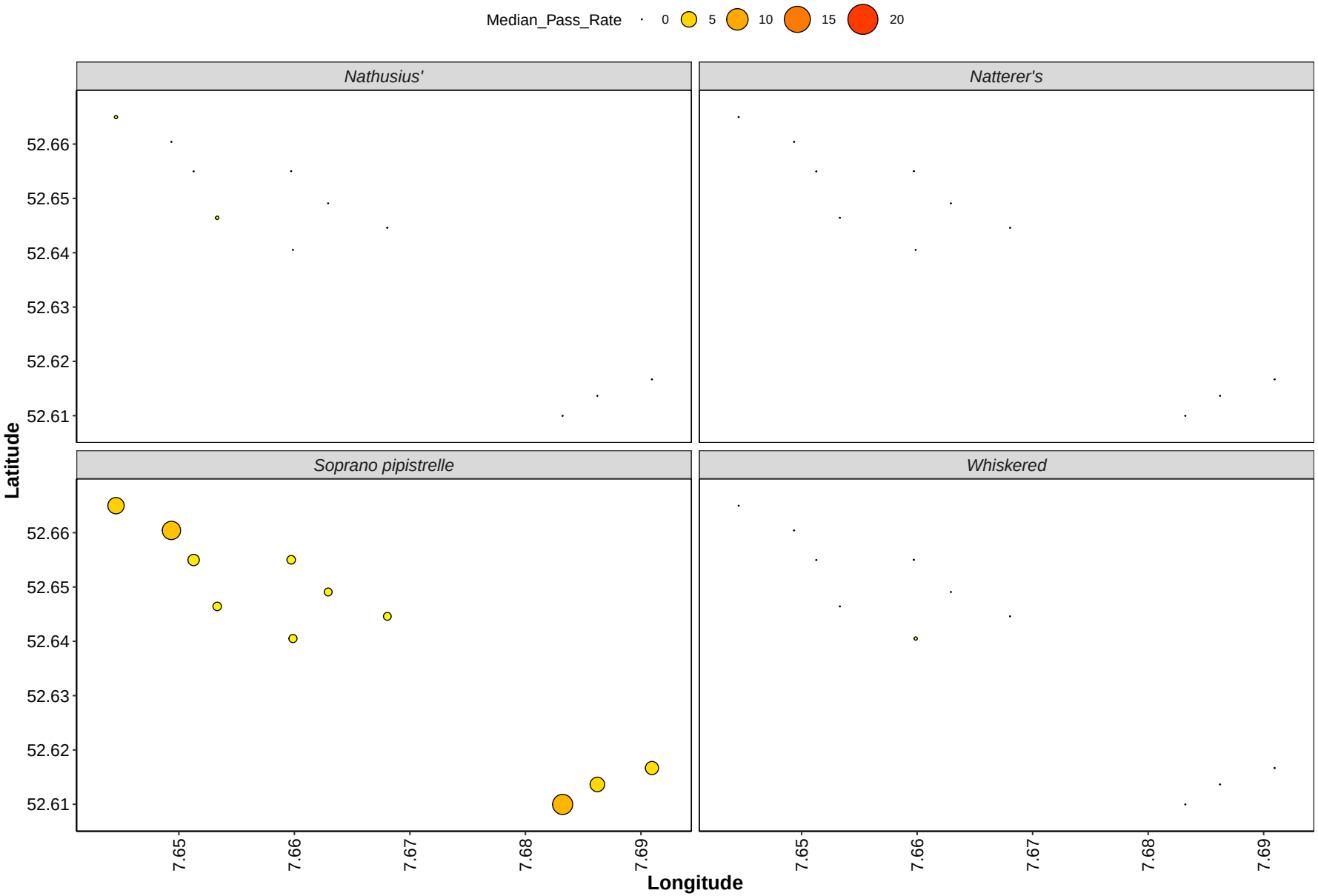
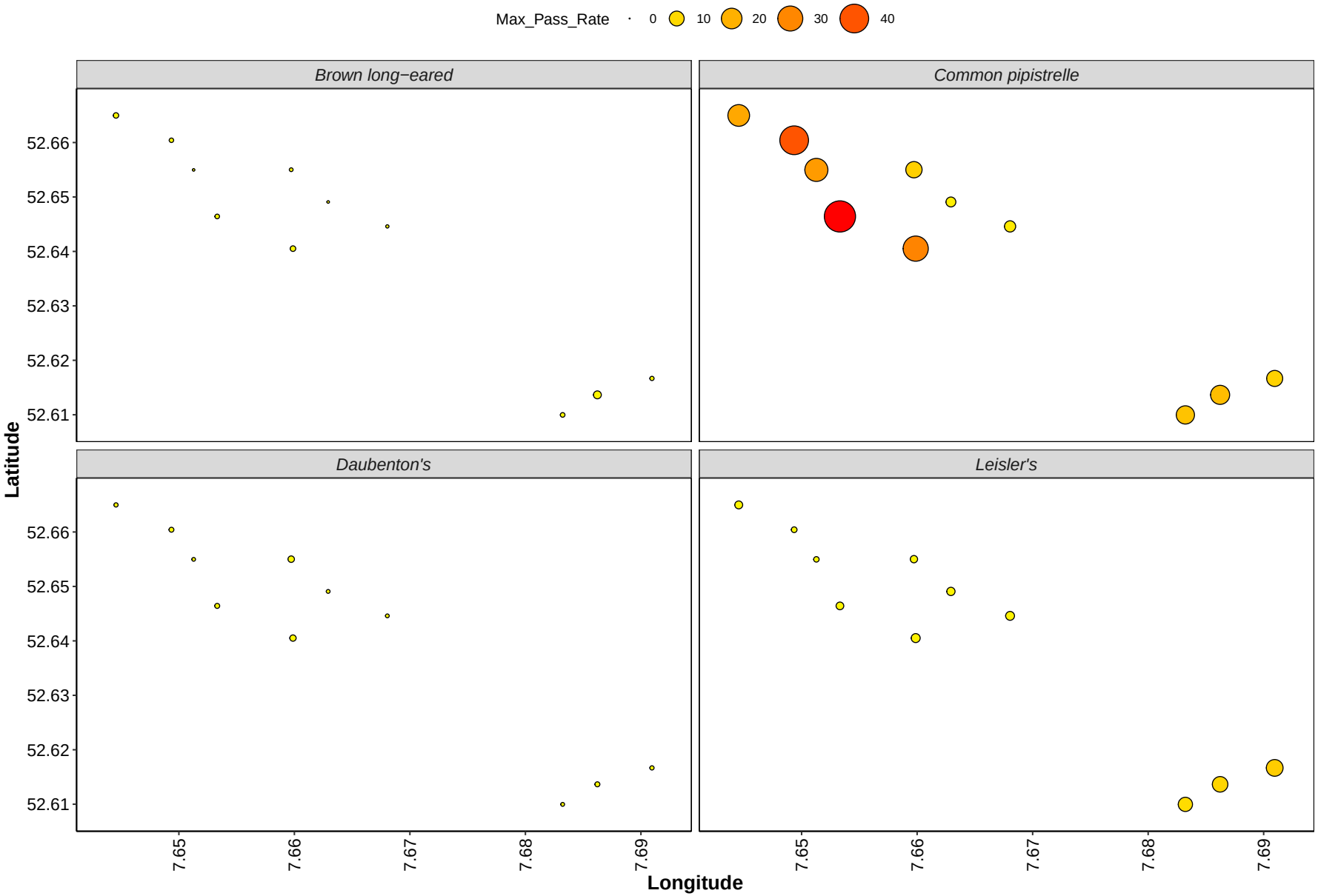
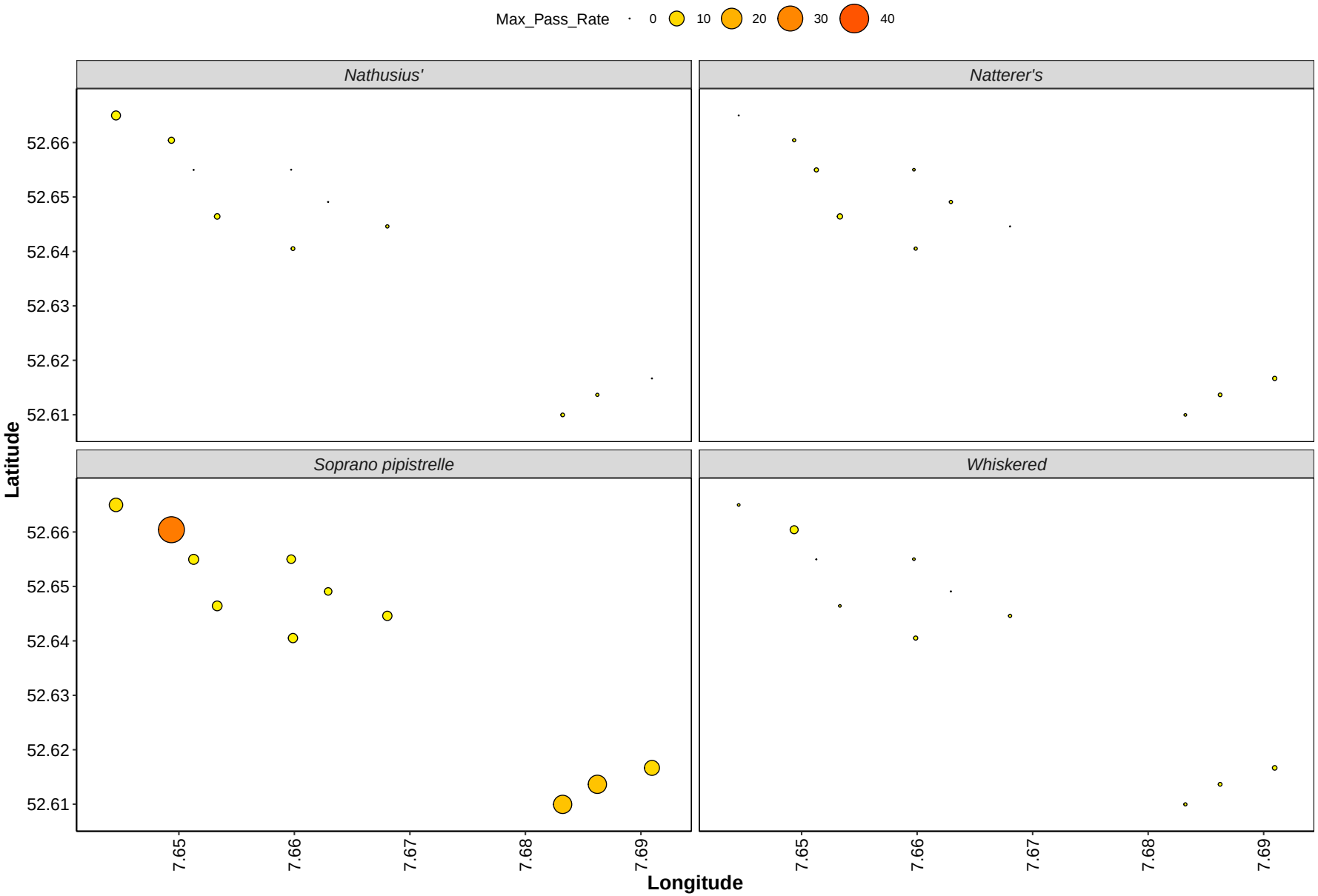

Median_Pass_Rate
0
5
10
15
20
Nathusius'
Natterer's
Soprano pipistrelle
Whiskered
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
Longitude
7.65
7.66
7.67
7.68
7.69

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
Brown long−eared
Common pipistrelle
Daubenton's
Leisler's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
7.65
7.66
7.67
7.68
7.69
Longitude


Max_Pass_Rate
0
10
20
30
40
Nathusius'
Natterer's
Soprano pipistrelle
Whiskered
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
Longitude
7.65
7.66
7.67
7.68
7.69

Thank you for using Ecobat!

Ecobat Report

2025-12-15

Geo filter: all, Time filter: all

Summary

Bats were detected on **27** nights between **27/07/2023** and **23/08/2023**, using **11** static bat detectors. Throughout this period, **8** species were recorded. **Table 1.** Detectors were placed at the following locations:

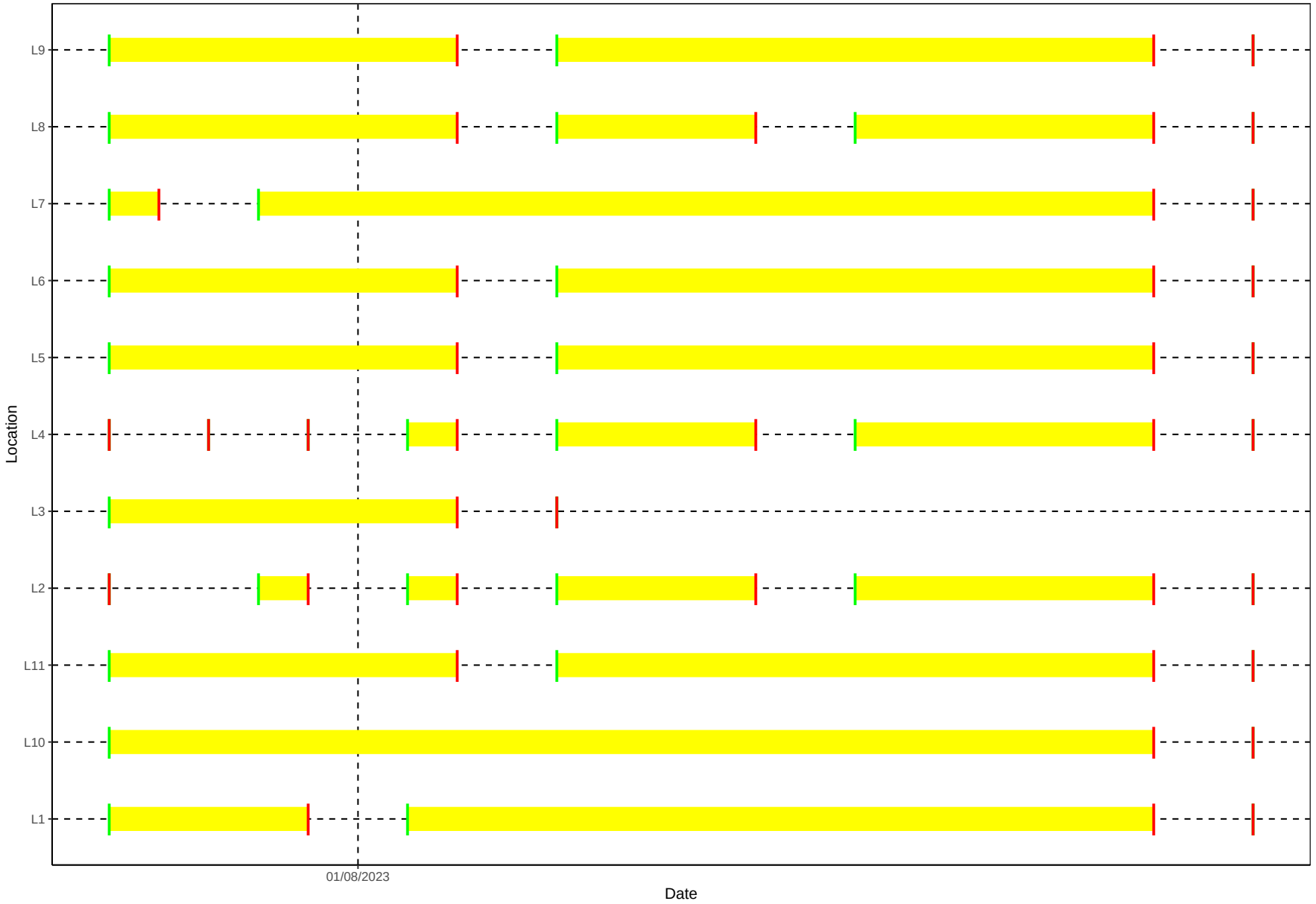
Detector ID	Latitude	Longitude
L1	52.66497	7.644556
L2	52.66041	7.649355
L3	52.65497	7.651278
L4	52.65501	7.659723
L5	52.64908	7.662925
L6	52.64642	7.653317
L7	52.64459	7.668046
L8	52.64051	7.659876
L9	52.61667	7.690955
L10	52.61366	7.686230
L11	52.60997	7.683222

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
L1	26
L10	27
L11	26
L2	22
L3	15
L4	22
L5	26
L6	26
L7	26
L8	25
L9	26

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


L9
L8
L7
L6
L5
L4
L3
L2
L11
L10
L1
Location
01/08/2023
Date

Part 1: Percentile 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.

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 Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L1	Myotis daubentonii	0	0	0	0	0	18
L1	Myotis mystacinus	0	0	0	0	0	15
L1	Myotis nattereri	0	0	0	0	2	6
L1	Nyctalus leisleri	0	0	0	0	2	19
L1	Pipistrellus pipistrellus	0	0	0	0	0	22
L1	Pipistrellus pygmaeus	0	0	0	0	4	22
L1	Plecotus auritus	0	0	0	3	2	12
L10	Myotis daubentonii	0	0	0	0	2	15
L10	Myotis mystacinus	0	0	0	0	0	16
L10	Myotis nattereri	0	0	0	0	7	14
L10	Nyctalus leisleri	0	0	0	0	0	26
L10	Pipistrellus pipistrellus	0	0	0	0	0	25
L10	Pipistrellus pygmaeus	0	0	0	0	6	21
L10	Plecotus auritus	0	0	0	0	0	11
L11	Myotis daubentonii	0	0	0	0	1	13
L11	Myotis mystacinus	0	0	0	0	0	11
L11	Myotis nattereri	0	0	0	0	0	13
L11	Nyctalus leisleri	0	0	0	2	0	23
L11	Pipistrellus pipistrellus	0	0	0	0	0	22

Detector ID	Species/Species Group	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L11	Pipistrellus pygmaeus	0	0	0	0	2	22
L11	Plecotus auritus	0	0	0	0	2	13
L2	Myotis daubentonii	0	0	0	0	0	14
L2	Nyctalus leisleri	0	0	0	0	0	22
L2	Pipistrellus pipistrellus	0	0	0	0	0	21
L2	Pipistrellus pygmaeus	0	0	0	0	0	22
L2	Plecotus auritus	0	0	0	0	0	11
L3	Myotis daubentonii	0	0	0	0	0	8
L3	Myotis mystacinus	0	0	0	0	0	4
L3	Myotis nattereri	0	0	0	2	1	5
L3	Nyctalus leisleri	0	0	0	0	0	13
L3	Pipistrellus pipistrellus	0	0	0	0	0	12
L3	Pipistrellus pygmaeus	0	0	0	0	0	13
L3	Plecotus auritus	0	0	0	0	0	6
L4	Myotis daubentonii	0	0	0	0	0	14
L4	Myotis mystacinus	0	0	0	0	0	7
L4	Myotis nattereri	0	0	0	0	2	10
L4	Nyctalus leisleri	0	0	0	0	0	21
L4	Pipistrellus pipistrellus	0	0	0	0	0	20
L4	Pipistrellus pygmaeus	0	0	0	0	0	21
L4	Plecotus auritus	0	0	0	0	0	11

Detector ID	Species/Species Group	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L5	Myotis daubentonii	0	0	0	0	0	16
L5	Myotis mystacinus	0	0	0	0	0	3
L5	Myotis nattereri	0	0	0	0	0	2
L5	Nyctalus leisleri	0	0	0	0	0	26
L5	Pipistrellus pipistrellus	0	0	0	0	0	23
L5	Pipistrellus pygmaeus	0	0	0	0	0	24
L5	Plecotus auritus	0	0	0	0	0	15
L6	Myotis daubentonii	0	0	0	0	2	15
L6	Myotis mystacinus	0	0	0	0	0	11
L6	Myotis nattereri	0	0	0	0	7	7
L6	Nyctalus leisleri	0	0	0	2	0	24
L6	Pipistrellus pipistrellus	0	0	0	0	0	22
L6	Pipistrellus pygmaeus	0	0	0	0	0	22
L6	Plecotus auritus	0	0	0	0	2	15
L7	Myotis daubentonii	0	0	0	0	0	17
L7	Myotis mystacinus	0	0	0	0	0	7
L7	Myotis nattereri	0	0	0	0	0	4
L7	Nyctalus leisleri	0	0	0	0	0	24
L7	Pipistrellus pipistrellus	0	0	0	0	0	22
L7	Pipistrellus pygmaeus	0	0	0	0	0	22
L7	Plecotus auritus	0	0	0	0	0	9

Detector ID	Species/Species Group	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L8	Myotis daubentonii	0	0	0	0	0	15
L8	Myotis mystacinus	0	0	0	0	0	8
L8	Myotis nattereri	0	0	0	0	0	4
L8	Nyctalus leisleri	0	0	0	0	0	24
L8	Pipistrellus pipistrellus	0	0	0	0	0	22
L8	Pipistrellus pygmaeus	0	0	0	0	0	21
L8	Plecotus auritus	0	0	0	0	0	16
L9	Myotis daubentonii	0	0	0	0	0	16
L9	Myotis mystacinus	0	0	0	0	0	14
L9	Myotis nattereri	0	0	0	1	11	1
L9	Nyctalus leisleri	0	0	0	0	0	26
L9	Pipistrellus nathusii	0	0	0	0	0	4
L9	Pipistrellus pipistrellus	0	0	0	0	0	23
L9	Pipistrellus pygmaeus	0	0	0	0	0	25
L9	Plecotus auritus	0	0	0	0	3	14

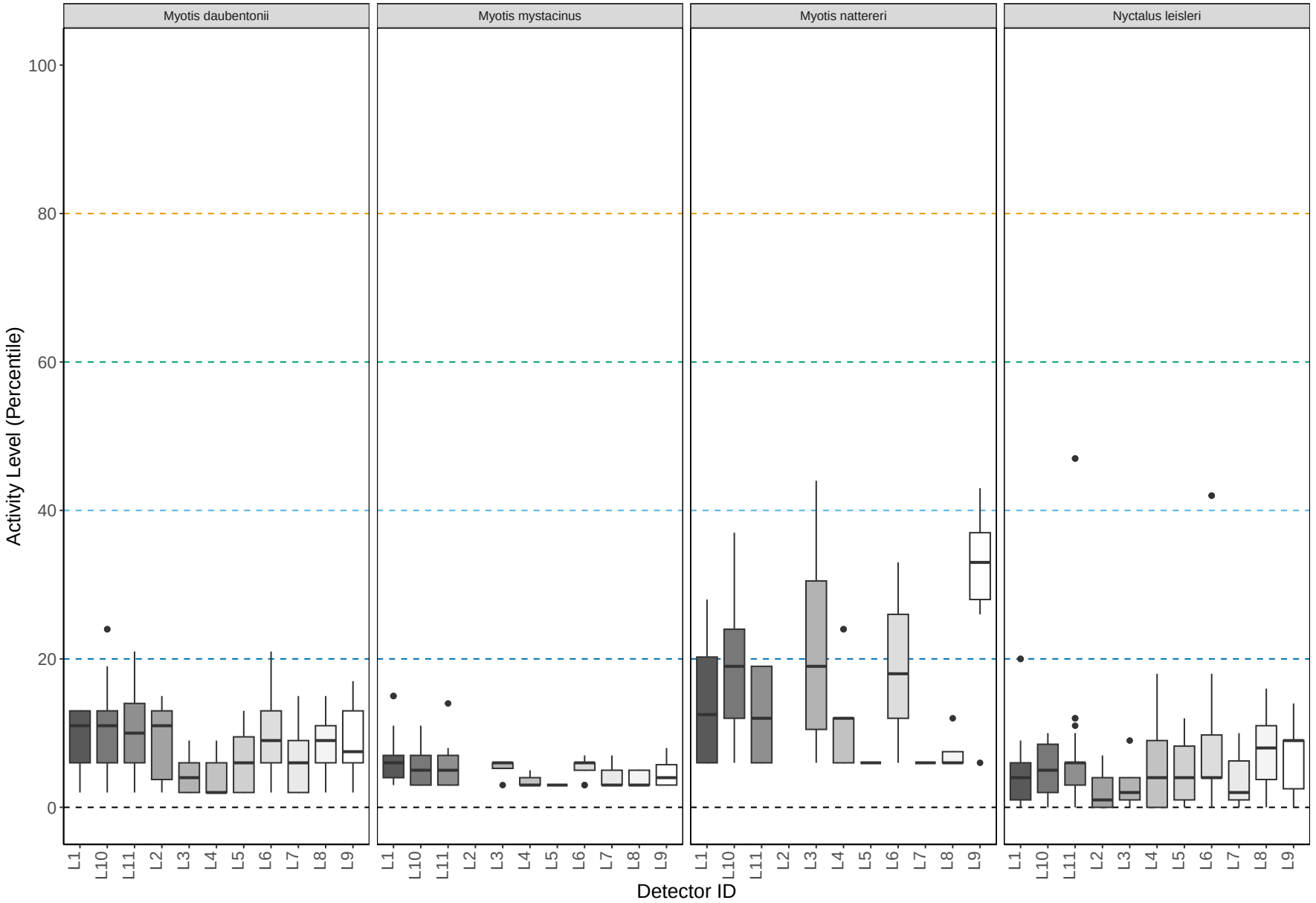
Table 4. Summary table showing key metrics for each species recorded. The reference range is the number of nights for each species that your data were compared to. We recommend a Reference Range of 200+ to be confident in the relative activity level.

Detector ID	Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded	Reference Range
L1	Myotis daubentonii	11	6.5 - 12	13	18	6783
L1	Myotis mystacinus	6	4.5 - 9	15	15	2880
L1	Myotis nattereri	13	6 - 21.5	28	8	1981
L1	Nyctalus leisleri	4	4 - 10.5	20	21	61584
L1	Pipistrellus pipistrellus	1	1 - 2	3	22	1537758
L1	Pipistrellus pygmaeus	13	12 - 16	23	26	411085
L1	Plecotus auritus	13	9.5 - 28	43	17	23576
L10	Myotis daubentonii	11	7.5 - 15	24	17	6783
L10	Myotis mystacinus	5	4 - 7	11	16	2880
L10	Myotis nattereri	19	12.5 - 24.5	37	21	1981
L10	Nyctalus leisleri	5	4 - 7	10	26	61584
L10	Pipistrellus pipistrellus	0	0 - 0	1	25	1537758
L10	Pipistrellus pygmaeus	12	10 - 16	23	27	411085
L10	Plecotus auritus	4	1 - 6.5	9	11	23576
L11	Myotis daubentonii	10	6 - 13.5	21	14	6783
L11	Myotis mystacinus	5	3 - 8.5	14	11	2880
L11	Myotis nattereri	12	9 - 15.5	19	13	1981
L11	Nyctalus leisleri	6	4.5 - 9	47	25	61584
L11	Pipistrellus pipistrellus	0	0 - 0	1	22	1537758
L11	Pipistrellus pygmaeus	8	7 - 13	27	24	411085
L11	Plecotus auritus	9	4 - 13.5	21	15	23576
L2	Myotis daubentonii	11	5.5 - 13	15	14	6783
L2	Nyctalus leisleri	1	2 - 5	7	22	61584
L2	Pipistrellus pipistrellus	0	0 - 0	0	21	1537758
L2	Pipistrellus pygmaeus	6	4.5 - 7	12	22	411085
L2	Plecotus auritus	4	2.5 - 4	15	11	23576
L3	Myotis daubentonii	4	2 - 6	9	8	6783
L3	Myotis mystacinus	6	6 - 6	6	4	2880
L3	Myotis nattereri	19	9 - 35	44	8	1981
L3	Nyctalus leisleri	2	1.5 - 5	9	13	61584
L3	Pipistrellus pipistrellus	0	0 - 0	1	12	1537758
L3	Pipistrellus pygmaeus	3	3 - 4.5	5	13	411085
L3	Plecotus auritus	5	1 - 11	13	6	23576

Detector ID	Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded	Reference Range
L4	Myotis daubentonii	2	2 - 5.5	9	14	6783
L4	Myotis mystacinus	3	3 - 4	5	7	2880
L4	Myotis nattereri	12	6 - 15	24	12	1981
L4	Nyctalus leisleri	4	6 - 11	18	21	61584
L4	Pipistrellus pipistrellus	0	0 - 0	1	20	1537758
L4	Pipistrellus pygmaeus	2	2.5 - 5	7	21	411085
L4	Plecotus auritus	4	1 - 6.5	9	11	23576
L5	Myotis daubentonii	6	4 - 8.5	13	16	6783
L5	Myotis mystacinus	3	3 - 3	3	3	2880
L5	Myotis nattereri	6	6 - 6	6	2	1981
L5	Nyctalus leisleri	4	3 - 6.5	12	26	61584
L5	Pipistrellus pipistrellus	0	0 - 0	1	23	1537758
L5	Pipistrellus pygmaeus	3	2 - 4	7	24	411085
L5	Plecotus auritus	4	2.5 - 11	18	15	23576
L6	Myotis daubentonii	9	6.5 - 14	21	17	6783
L6	Myotis mystacinus	6	4.5 - 6	7	11	2880
L6	Myotis nattereri	18	12 - 26	33	14	1981
L6	Nyctalus leisleri	4	5 - 11	42	26	61584
L6	Pipistrellus pipistrellus	1	1 - 1	2	22	1537758
L6	Pipistrellus pygmaeus	3	2 - 4	6	22	411085
L6	Plecotus auritus	13	8.5 - 15	21	17	23576
L7	Myotis daubentonii	6	4 - 8.5	15	17	6783
L7	Myotis mystacinus	3	3 - 5	7	7	2880
L7	Myotis nattereri	6	6 - 6	6	4	1981
L7	Nyctalus leisleri	2	2 - 5.5	10	24	61584
L7	Pipistrellus pipistrellus	0	0 - 0	1	22	1537758
L7	Pipistrellus pygmaeus	3	2.5 - 5	9	22	411085
L7	Plecotus auritus	9	4 - 9	9	9	23576
L8	Myotis daubentonii	9	6 - 11	15	15	6783
L8	Myotis mystacinus	3	3 - 4	5	8	2880
L8	Myotis nattereri	6	6 - 6	12	4	1981
L8	Nyctalus leisleri	8	6.5 - 10.5	16	24	61584
L8	Pipistrellus pipistrellus	2	1.5 - 7	12	22	1537758
L8	Pipistrellus pygmaeus	1	1.5 - 4	5	21	411085
L8	Plecotus auritus	9	6.5 - 11	17	16	23576
L9	Myotis daubentonii	8	6 - 11.5	17	16	6783

Detector ID	Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded	Reference Range
L9	Myotis mystacinus	4	3 - 5.5	8	14	2880
L9	Myotis nattereri	33	27 - 36.5	43	13	1981
L9	Nyctalus leisleri	9	5.5 - 9	14	26	61584
L9	Pipistrellus nathusii	8	8 - 8	18	4	3151
L9	Pipistrellus pipistrellus	0	0 - 0	1	23	1537758
L9	Pipistrellus pygmaeus	2	2.5 - 5	6	25	411085
L9	Plecotus auritus	15	9 - 17	24	17	23576

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).


Myotis daubentonii
Myotis mystacinus
Myotis nattereri
Nyctalus leisleri
Activity Level (Percentile)
100
80
60
40
20
0
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID

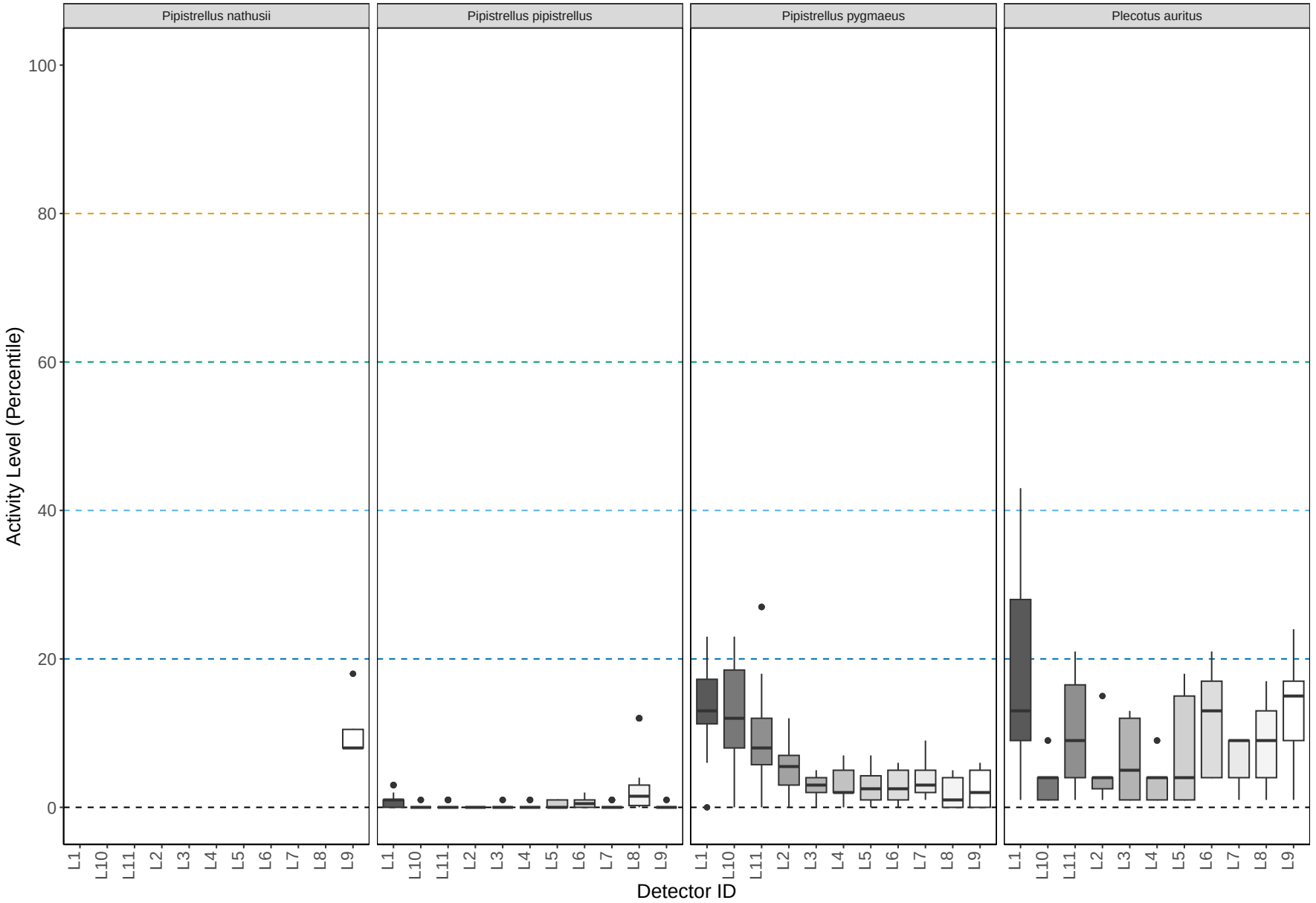
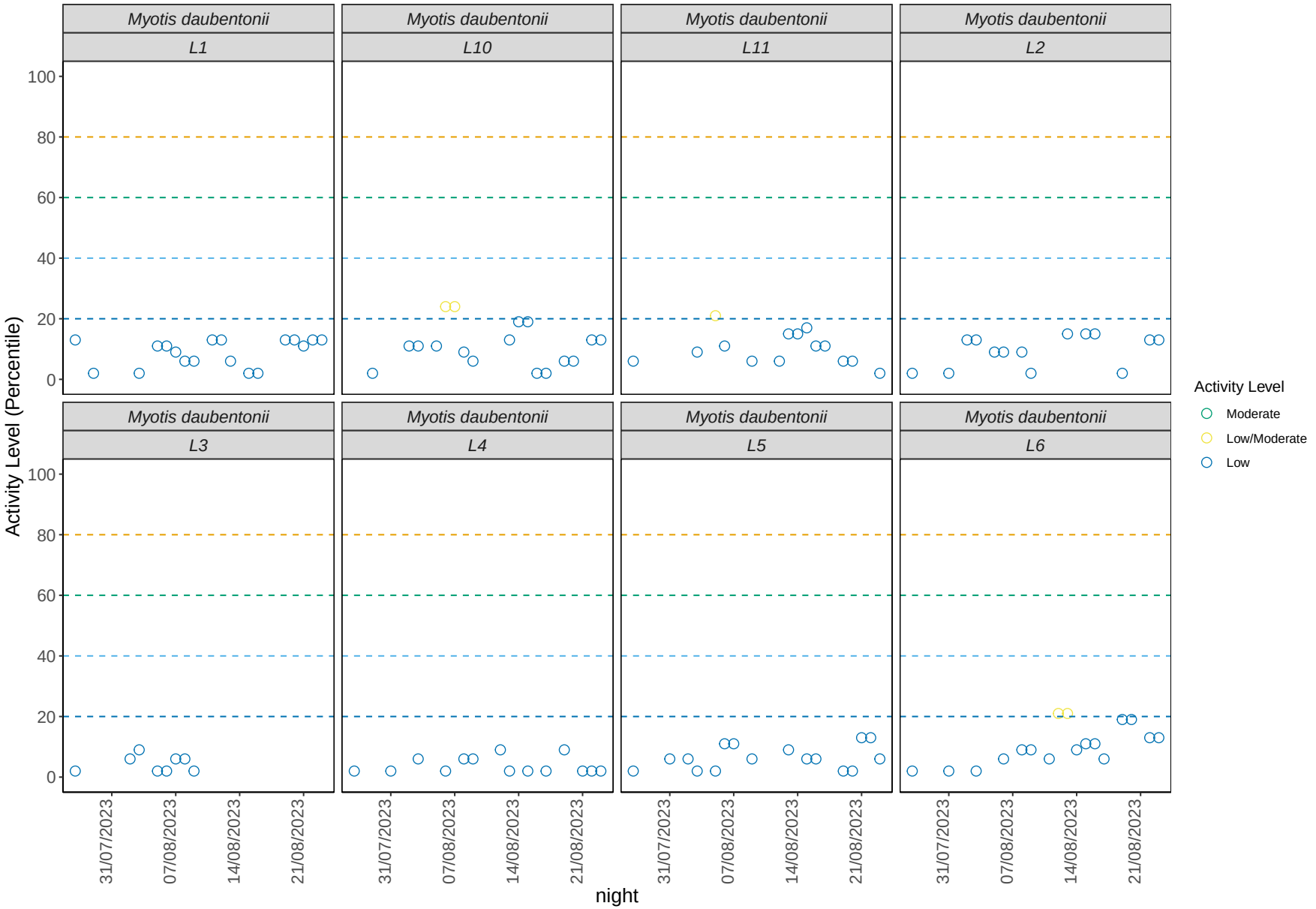
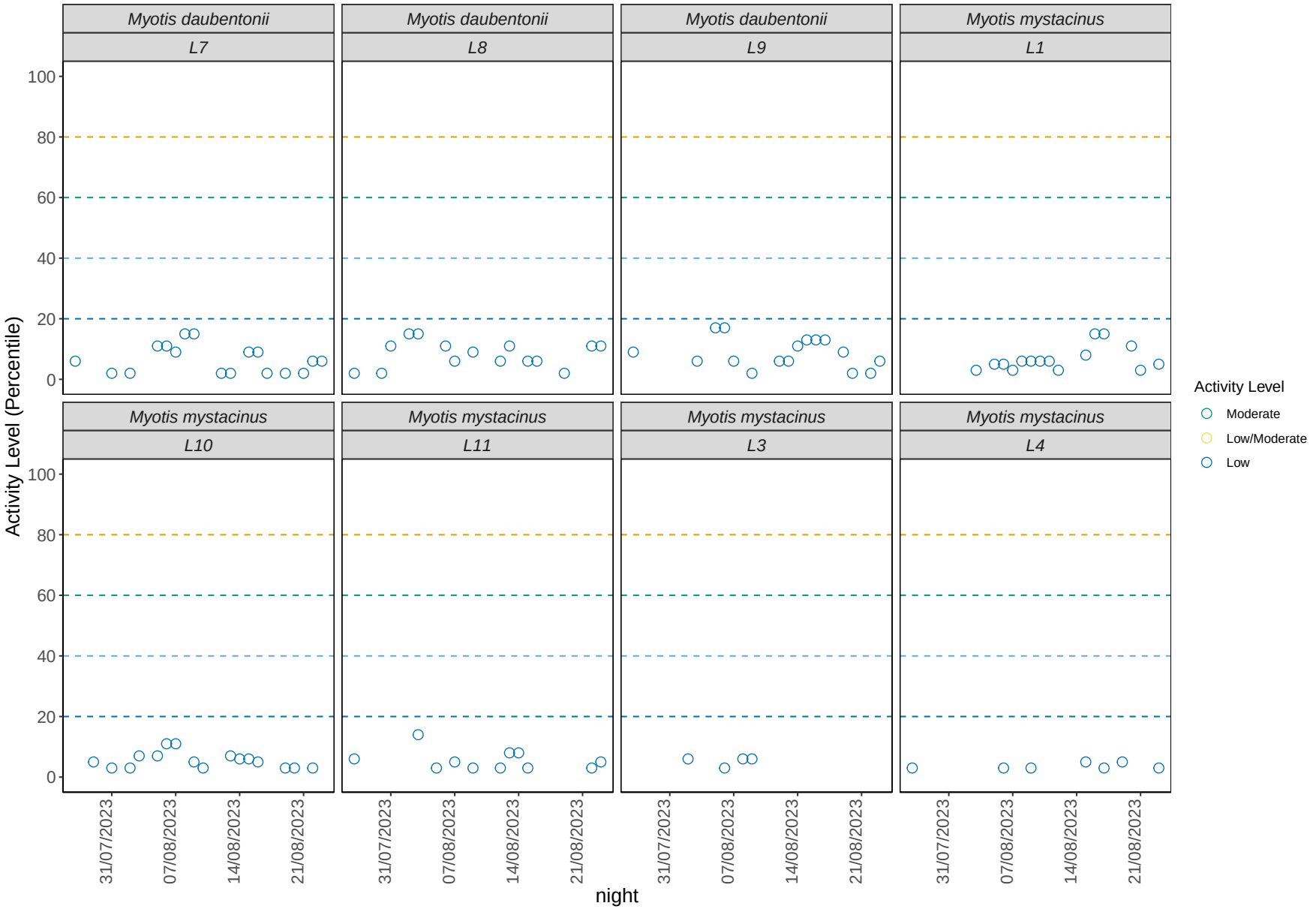
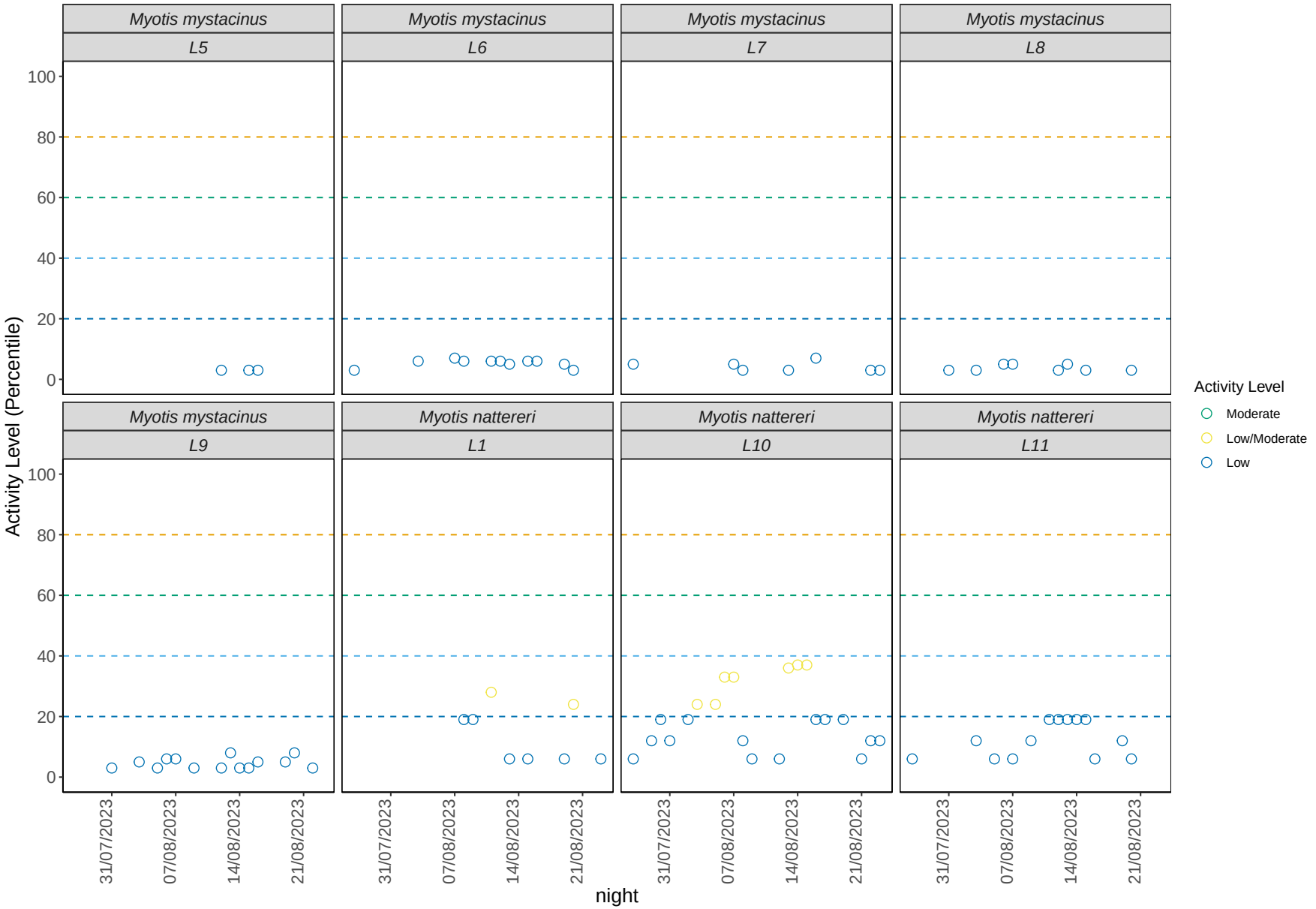
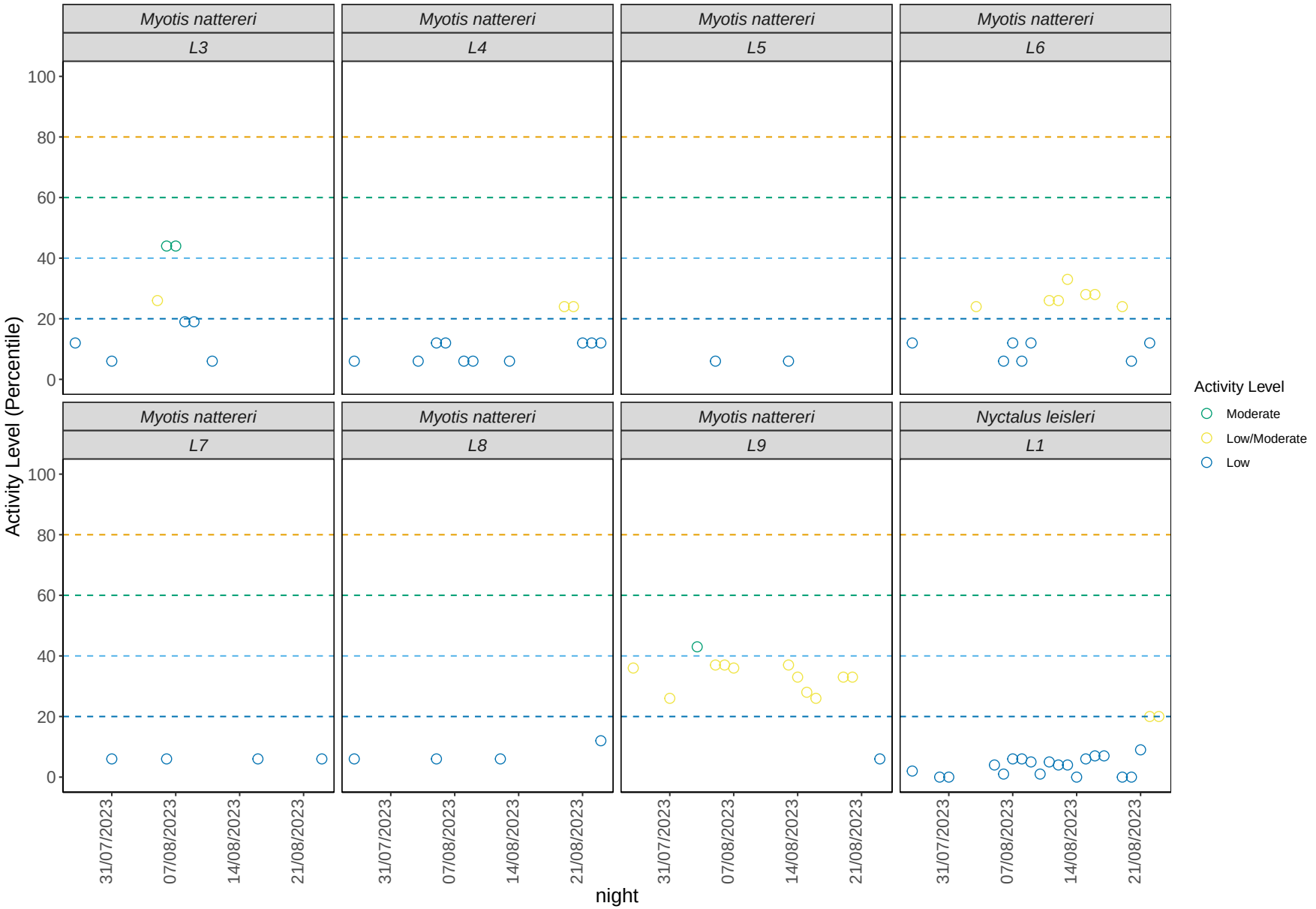

Pipistrellus nathusii
Pipistrellus pipistrellus
Pipistrellus pygmaeus
Plecotus auritus
Activity Level (Percentile)
100
80
60
40
20
0
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID

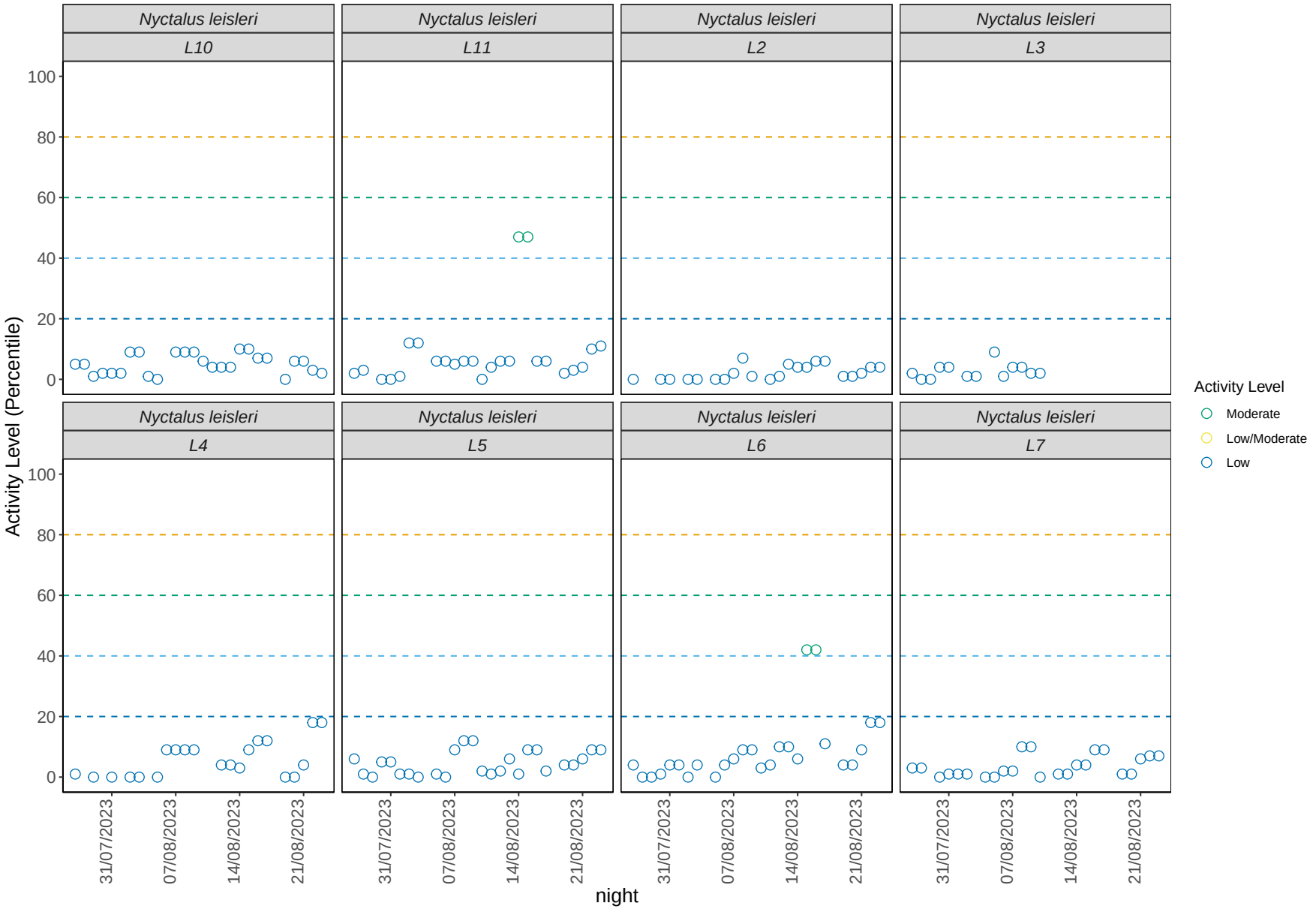
Figure 3. The activity level (percentile) of bats recorded across each night of the bat survey.

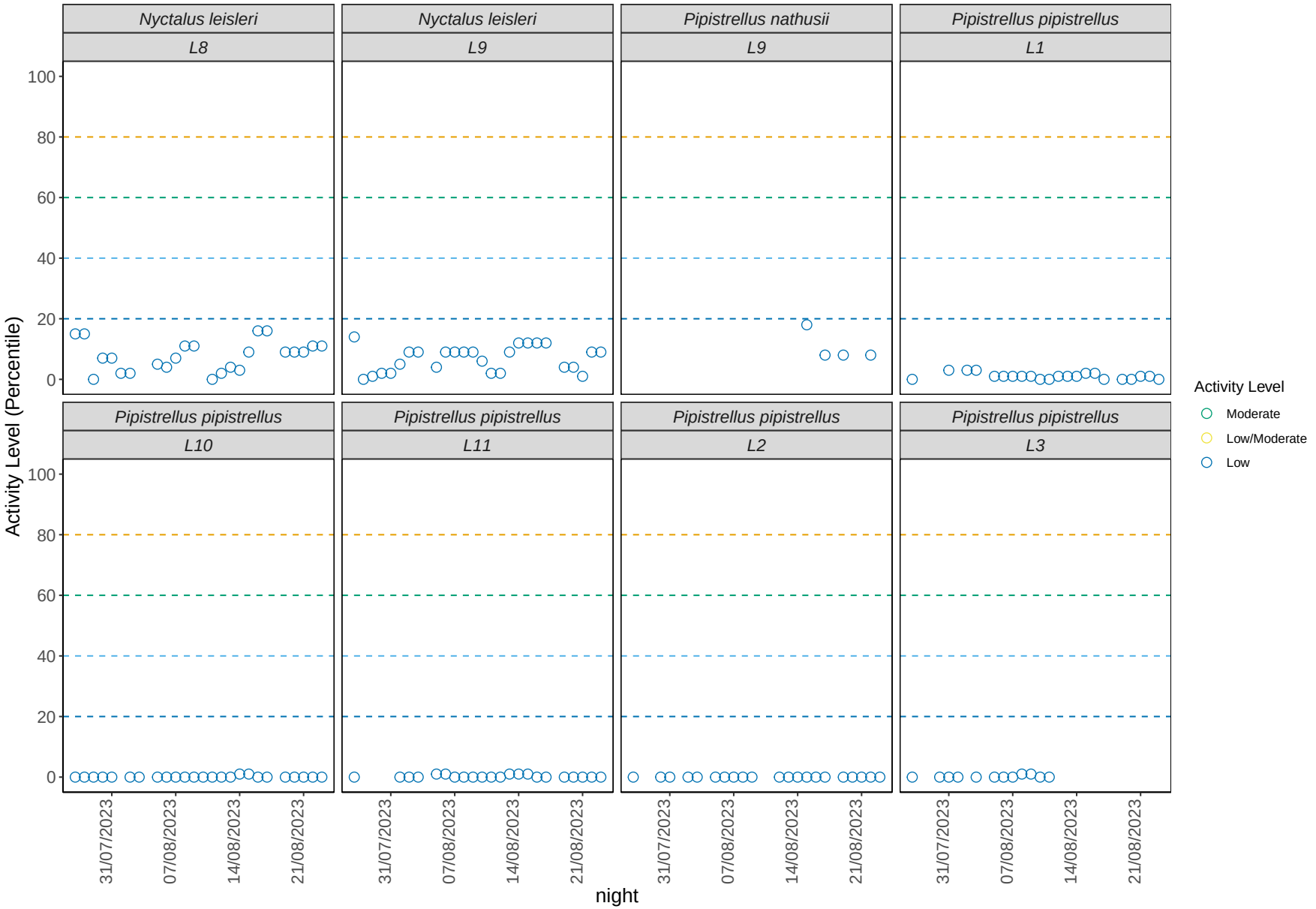

Myotis daubentonii
L1
L10
L11
L2
L3
L4
L5
L6
Activity Level (Percentile)
0
20
40
60
80
100
31/07/2023
07/08/2023
14/08/2023
21/08/2023
night
Activity Level
Moderate
Low/Moderate
Low

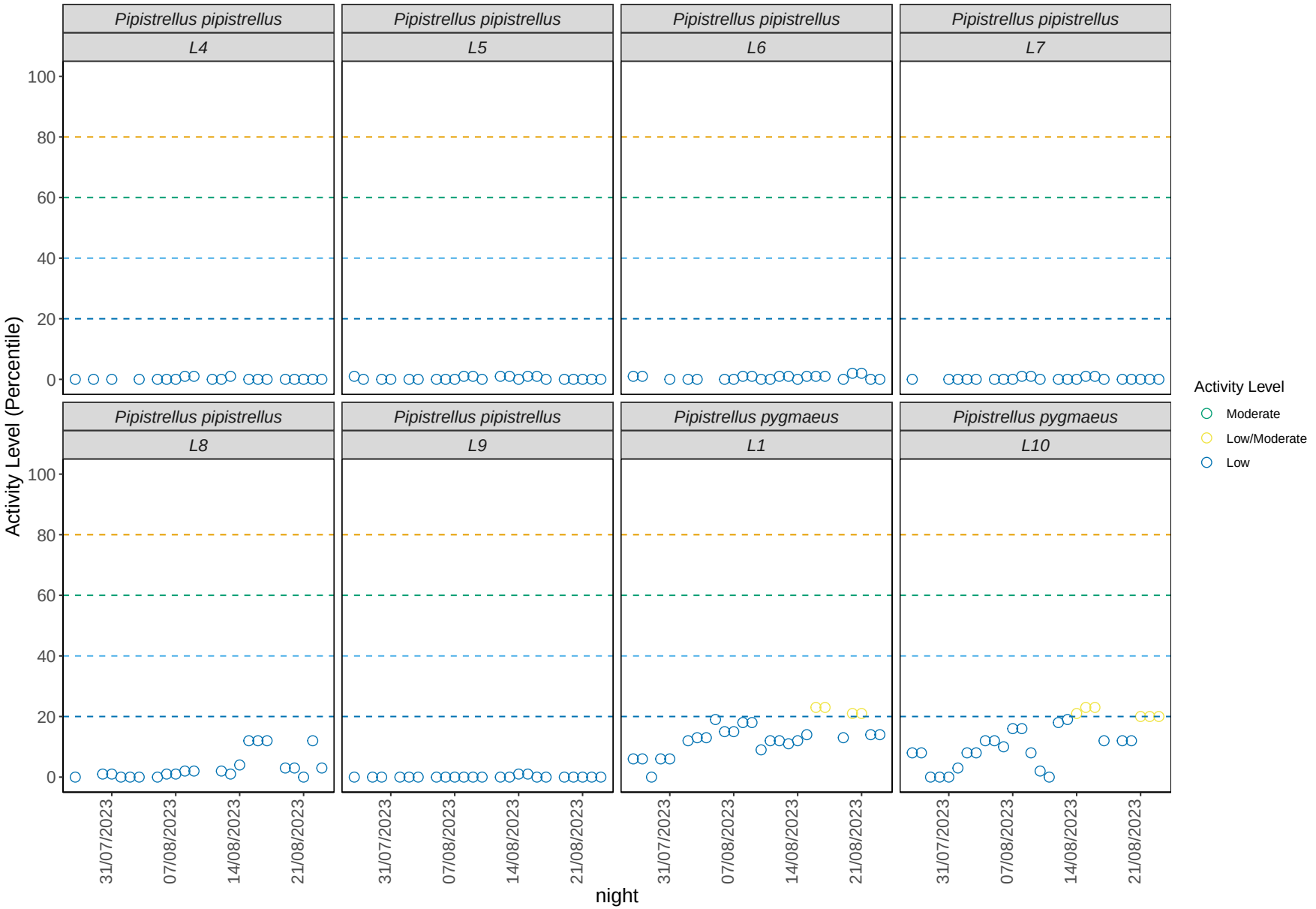

Myotis daubentonii
L7
Myotis daubentonii
L8
Myotis daubentonii
L9
Myotis mystacinus
L1
Myotis mystacinus
L10
Myotis mystacinus
L11
Myotis mystacinus
L3
Myotis mystacinus
L4
Activity Level (Percentile)
100
80
60
40
20
0
31/07/2023
07/08/2023
14/08/2023
21/08/2023
night
Activity Level
Moderate
Low/Moderate
Low

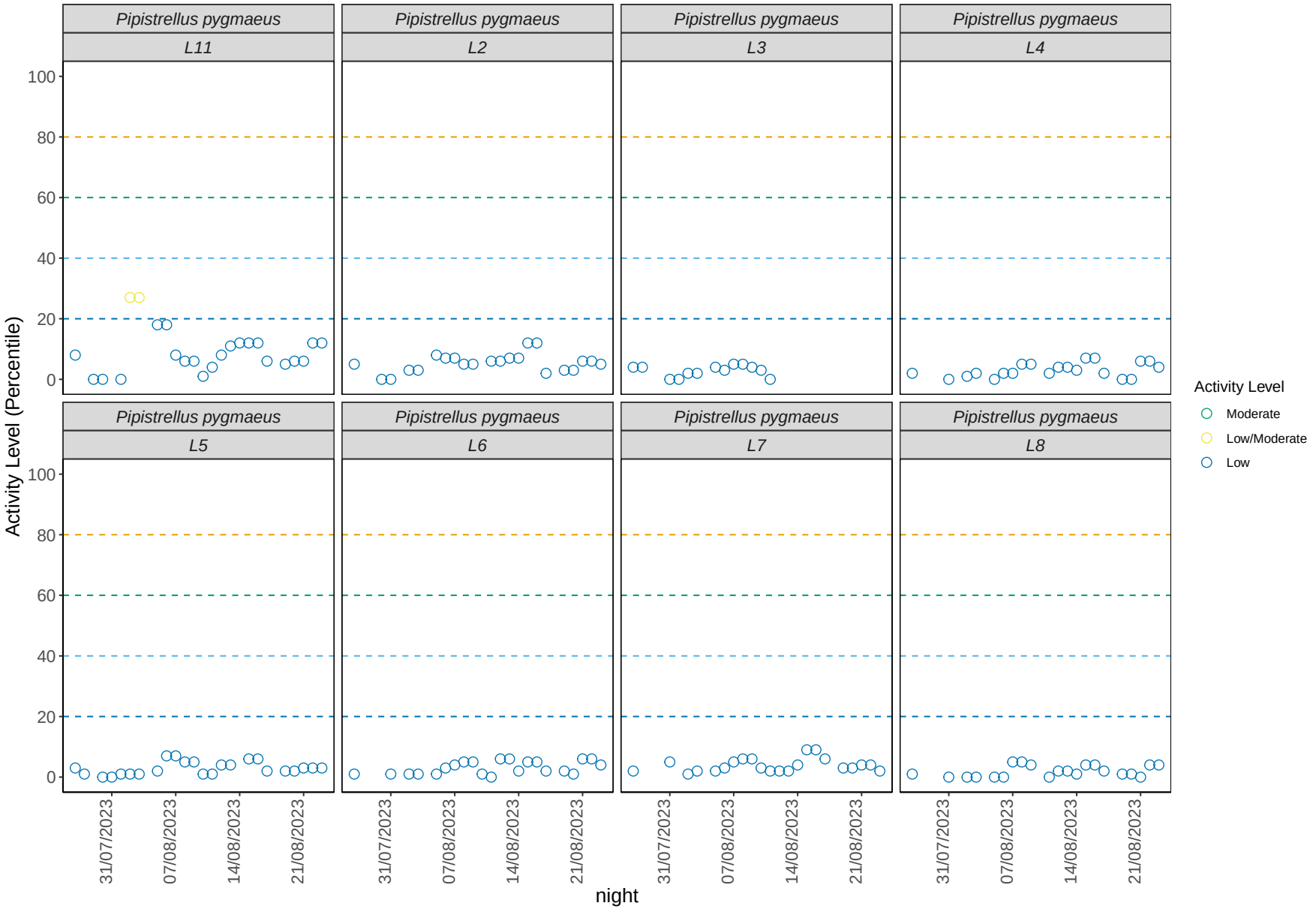

Myotis mystacinus
L5
Myotis mystacinus
L6
Myotis mystacinus
L7
Myotis mystacinus
L8
Myotis mystacinus
L9
Myotis nattereri
L1
Myotis nattereri
L10
Myotis nattereri
L11
Activity Level (Percentile)
100
80
60
40
20
0
31/07/2023
07/08/2023
14/08/2023
21/08/2023
night
Activity Level
Moderate
Low/Moderate
Low

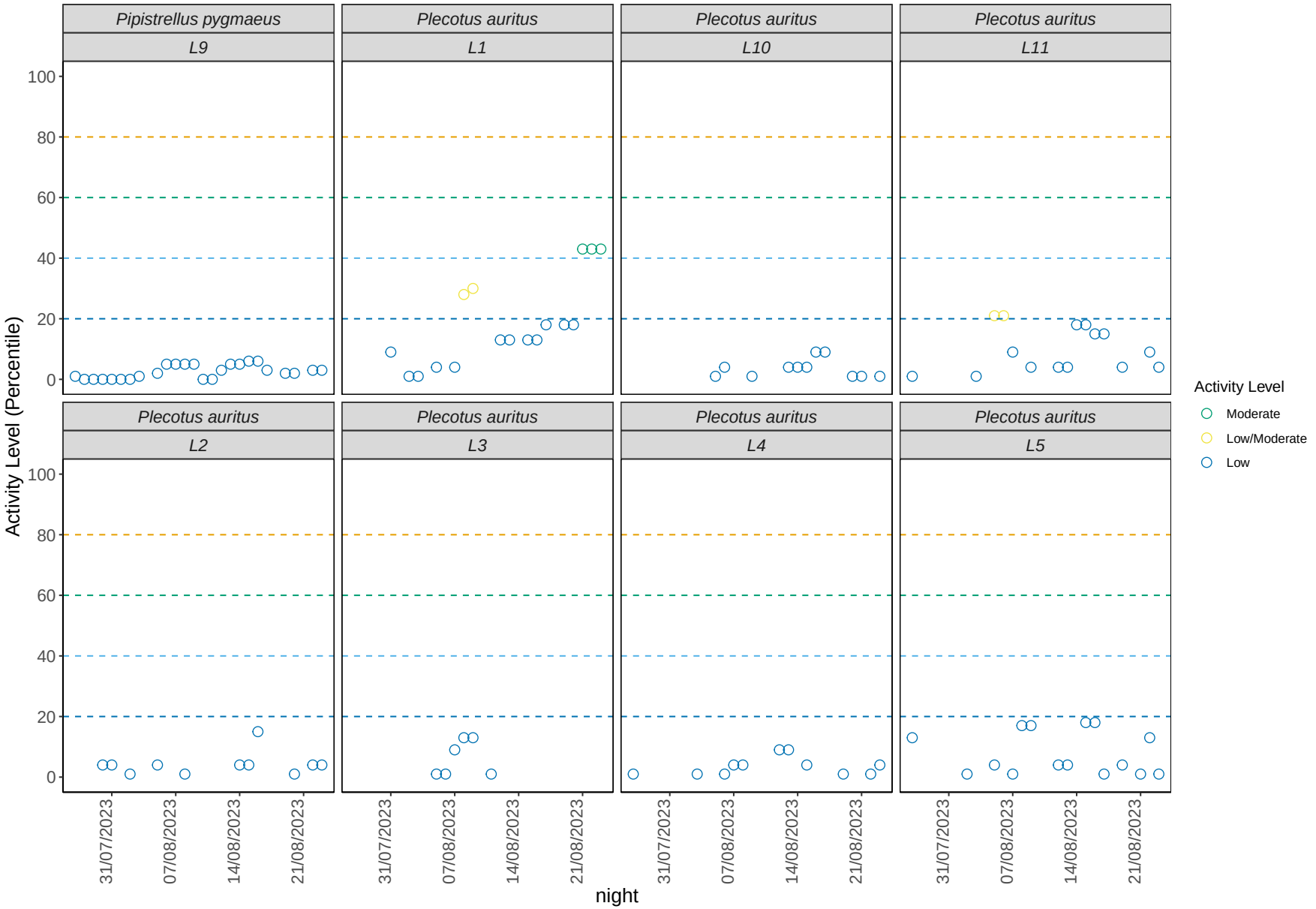

Myotis nattereri
L3
Myotis nattereri
L4
Myotis nattereri
L5
Myotis nattereri
L6
Myotis nattereri
L7
Myotis nattereri
L8
Myotis nattereri
L9
Nyctalus leisleri
L1
Activity Level (Percentile)
0
20
40
60
80
100
31/07/2023
07/08/2023
14/08/2023
21/08/2023
night
Activity Level
Moderate
Low/Moderate
Low

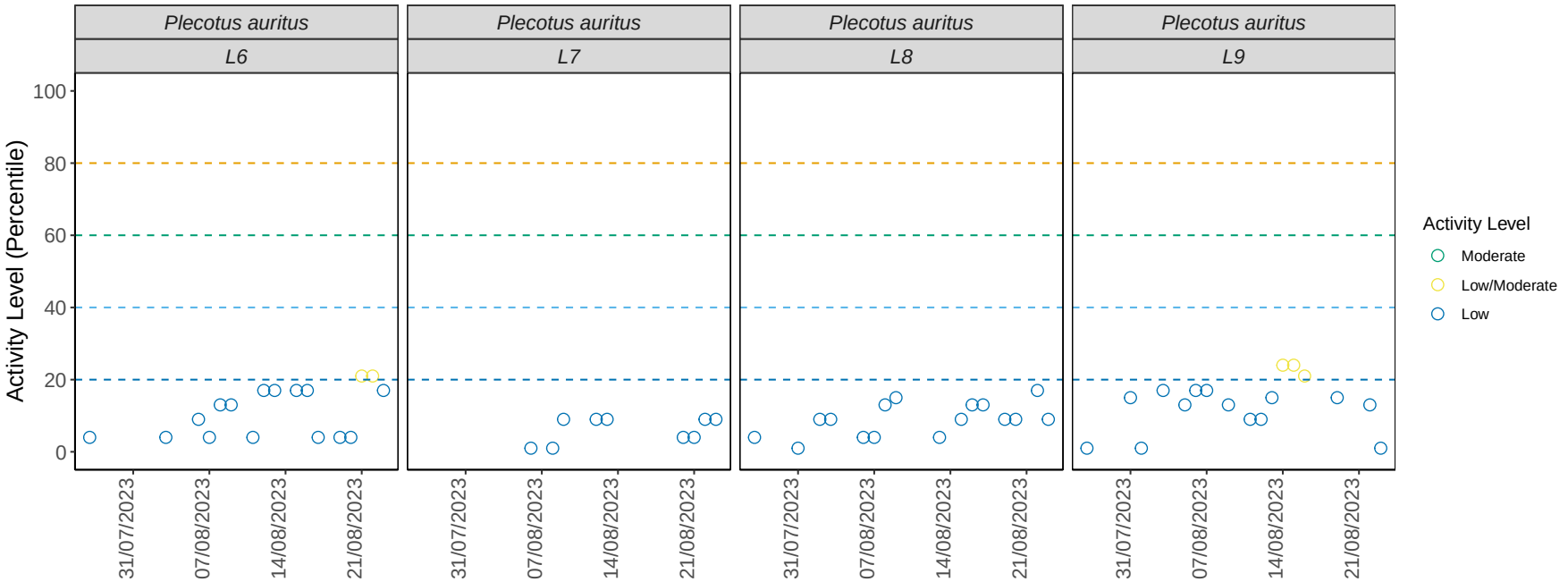

Nyctalus leisleri
L10
L11
L2
L3
L4
L5
L6
L7
Activity Level (Percentile)
100
80
60
40
20
0
31/07/2023
07/08/2023
14/08/2023
21/08/2023
night
Activity Level
Moderate
Low/Moderate
Low


Nyctalus leisleri
L8
Nyctalus leisleri
L9
Pipistrellus nathusii
L9
Pipistrellus pipistrellus
L1
Pipistrellus pipistrellus
L10
Pipistrellus pipistrellus
L11
Pipistrellus pipistrellus
L2
Pipistrellus pipistrellus
L3
Activity Level (Percentile)
100
80
60
40
20
0
31/07/2023
07/08/2023
14/08/2023
21/08/2023
night
Activity Level
Moderate
Low/Moderate
Low


Pipistrellus pipistrellus
L4
Pipistrellus pipistrellus
L5
Pipistrellus pipistrellus
L6
Pipistrellus pipistrellus
L7
Pipistrellus pipistrellus
L8
Pipistrellus pipistrellus
L9
Pipistrellus pygmaeus
L1
Pipistrellus pygmaeus
L10
Activity Level (Percentile)
100
80
60
40
20
0
31/07/2023
07/08/2023
14/08/2023
21/08/2023
night
Activity Level
Moderate
Low/Moderate
Low


Pipistrellus pygmaeus
L11
L2
L3
L4
L5
L6
L7
L8
Activity Level (Percentile)
100
80
60
40
20
0
31/07/2023
07/08/2023
14/08/2023
21/08/2023
night
Activity Level
Moderate
Low/Moderate
Low


Pipistrellus pygmaeus
L9
Plecotus auritus
L1
Plecotus auritus
L10
Plecotus auritus
L11
Plecotus auritus
L2
Plecotus auritus
L3
Plecotus auritus
L4
Plecotus auritus
L5
Activity Level (Percentile)
100
80
60
40
20
0
31/07/2023
07/08/2023
14/08/2023
21/08/2023
night
Activity Level
Moderate
Low/Moderate
Low


Plecotus auritus
L6
Plecotus auritus
L7
Plecotus auritus
L8
Plecotus auritus
L9
Activity Level (Percentile)
100
80
60
40
20
0
31/07/2023
07/08/2023
14/08/2023
21/08/2023
Activity Level
Moderate
Low/Moderate
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 Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L1	Myotis daubentonii	Jul	0	0	0	0	0	2
L1	Myotis daubentonii	Aug	0	0	0	0	0	16
L1	Myotis mystacinus	Aug	0	0	0	0	0	15
L1	Myotis nattereri	Aug	0	0	0	0	2	6
L1	Nyctalus leisleri	Jul	0	0	0	0	0	3
L1	Nyctalus leisleri	Aug	0	0	0	0	2	16
L1	Pipistrellus pipistrellus	Jul	0	0	0	0	0	2
L1	Pipistrellus pipistrellus	Aug	0	0	0	0	0	20
L1	Pipistrellus pygmaeus	Jul	0	0	0	0	0	5
L1	Pipistrellus pygmaeus	Aug	0	0	0	0	4	17
L1	Plecotus auritus	Jul	0	0	0	0	0	1
L1	Plecotus auritus	Aug	0	0	0	3	2	11
L10	Myotis daubentonii	Jul	0	0	0	0	0	1
L10	Myotis daubentonii	Aug	0	0	0	0	2	14
L10	Myotis mystacinus	Jul	0	0	0	0	0	2
L10	Myotis mystacinus	Aug	0	0	0	0	0	14
L10	Myotis nattereri	Jul	0	0	0	0	0	4
L10	Myotis nattereri	Aug	0	0	0	0	7	10
L10	Nyctalus leisleri	Jul	0	0	0	0	0	5

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L10	Nyctalus leisleri	Aug	0	0	0	0	0	21
L10	Pipistrellus pipistrellus	Jul	0	0	0	0	0	5
L10	Pipistrellus pipistrellus	Aug	0	0	0	0	0	20
L10	Pipistrellus pygmaeus	Jul	0	0	0	0	0	5
L10	Pipistrellus pygmaeus	Aug	0	0	0	0	6	16
L10	Plecotus auritus	Aug	0	0	0	0	0	11
L11	Myotis daubentonii	Jul	0	0	0	0	0	1
L11	Myotis daubentonii	Aug	0	0	0	0	1	12
L11	Myotis mystacinus	Jul	0	0	0	0	0	1
L11	Myotis mystacinus	Aug	0	0	0	0	0	10
L11	Myotis nattereri	Jul	0	0	0	0	0	1
L11	Myotis nattereri	Aug	0	0	0	0	0	12
L11	Nyctalus leisleri	Jul	0	0	0	0	0	4
L11	Nyctalus leisleri	Aug	0	0	0	2	0	19
L11	Pipistrellus pipistrellus	Jul	0	0	0	0	0	1
L11	Pipistrellus pipistrellus	Aug	0	0	0	0	0	21
L11	Pipistrellus pygmaeus	Jul	0	0	0	0	0	3
L11	Pipistrellus pygmaeus	Aug	0	0	0	0	2	19
L11	Plecotus auritus	Jul	0	0	0	0	0	1
L11	Plecotus auritus	Aug	0	0	0	0	2	12
L2	Myotis daubentonii	Jul	0	0	0	0	0	2

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L2	Myotis daubentonii	Aug	0	0	0	0	0	12
L2	Nyctalus leisleri	Jul	0	0	0	0	0	3
L2	Nyctalus leisleri	Aug	0	0	0	0	0	19
L2	Pipistrellus pipistrellus	Jul	0	0	0	0	0	3
L2	Pipistrellus pipistrellus	Aug	0	0	0	0	0	18
L2	Pipistrellus pygmaeus	Jul	0	0	0	0	0	3
L2	Pipistrellus pygmaeus	Aug	0	0	0	0	0	19
L2	Plecotus auritus	Jul	0	0	0	0	0	2
L2	Plecotus auritus	Aug	0	0	0	0	0	9
L3	Myotis daubentonii	Jul	0	0	0	0	0	1
L3	Myotis daubentonii	Aug	0	0	0	0	0	7
L3	Myotis mystacinus	Aug	0	0	0	0	0	4
L3	Myotis nattereri	Jul	0	0	0	0	0	2
L3	Myotis nattereri	Aug	0	0	0	2	1	3
L3	Nyctalus leisleri	Jul	0	0	0	0	0	5
L3	Nyctalus leisleri	Aug	0	0	0	0	0	8
L3	Pipistrellus pipistrellus	Jul	0	0	0	0	0	3
L3	Pipistrellus pipistrellus	Aug	0	0	0	0	0	9
L3	Pipistrellus pygmaeus	Jul	0	0	0	0	0	3
L3	Pipistrellus pygmaeus	Aug	0	0	0	0	0	10
L3	Plecotus auritus	Aug	0	0	0	0	0	6

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L4	Myotis daubentonii	Jul	0	0	0	0	0	2
L4	Myotis daubentonii	Aug	0	0	0	0	0	12
L4	Myotis mystacinus	Jul	0	0	0	0	0	1
L4	Myotis mystacinus	Aug	0	0	0	0	0	6
L4	Myotis nattereri	Jul	0	0	0	0	0	1
L4	Myotis nattereri	Aug	0	0	0	0	2	9
L4	Nyctalus leisleri	Jul	0	0	0	0	0	3
L4	Nyctalus leisleri	Aug	0	0	0	0	0	18
L4	Pipistrellus pipistrellus	Jul	0	0	0	0	0	3
L4	Pipistrellus pipistrellus	Aug	0	0	0	0	0	17
L4	Pipistrellus pygmaeus	Jul	0	0	0	0	0	2
L4	Pipistrellus pygmaeus	Aug	0	0	0	0	0	19
L4	Plecotus auritus	Jul	0	0	0	0	0	1
L4	Plecotus auritus	Aug	0	0	0	0	0	10
L5	Myotis daubentonii	Jul	0	0	0	0	0	2
L5	Myotis daubentonii	Aug	0	0	0	0	0	14
L5	Myotis mystacinus	Aug	0	0	0	0	0	3
L5	Myotis nattereri	Aug	0	0	0	0	0	2
L5	Nyctalus leisleri	Jul	0	0	0	0	0	5
L5	Nyctalus leisleri	Aug	0	0	0	0	0	21
L5	Pipistrellus pipistrellus	Jul	0	0	0	0	0	4

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L5	Pipistrellus pipistrellus	Aug	0	0	0	0	0	19
L5	Pipistrellus pygmaeus	Jul	0	0	0	0	0	4
L5	Pipistrellus pygmaeus	Aug	0	0	0	0	0	20
L5	Plecotus auritus	Jul	0	0	0	0	0	1
L5	Plecotus auritus	Aug	0	0	0	0	0	14
L6	Myotis daubentonii	Jul	0	0	0	0	0	2
L6	Myotis daubentonii	Aug	0	0	0	0	2	13
L6	Myotis mystacinus	Jul	0	0	0	0	0	1
L6	Myotis mystacinus	Aug	0	0	0	0	0	10
L6	Myotis nattereri	Jul	0	0	0	0	0	1
L6	Myotis nattereri	Aug	0	0	0	0	7	6
L6	Nyctalus leisleri	Jul	0	0	0	0	0	5
L6	Nyctalus leisleri	Aug	0	0	0	2	0	19
L6	Pipistrellus pipistrellus	Jul	0	0	0	0	0	3
L6	Pipistrellus pipistrellus	Aug	0	0	0	0	0	19
L6	Pipistrellus pygmaeus	Jul	0	0	0	0	0	2
L6	Pipistrellus pygmaeus	Aug	0	0	0	0	0	20
L6	Plecotus auritus	Jul	0	0	0	0	0	1
L6	Plecotus auritus	Aug	0	0	0	0	2	14
L7	Myotis daubentonii	Jul	0	0	0	0	0	2
L7	Myotis daubentonii	Aug	0	0	0	0	0	15

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L7	Myotis mystacinus	Jul	0	0	0	0	0	1
L7	Myotis mystacinus	Aug	0	0	0	0	0	6
L7	Myotis nattereri	Jul	0	0	0	0	0	1
L7	Myotis nattereri	Aug	0	0	0	0	0	3
L7	Nyctalus leisleri	Jul	0	0	0	0	0	4
L7	Nyctalus leisleri	Aug	0	0	0	0	0	20
L7	Pipistrellus pipistrellus	Jul	0	0	0	0	0	2
L7	Pipistrellus pipistrellus	Aug	0	0	0	0	0	20
L7	Pipistrellus pygmaeus	Jul	0	0	0	0	0	2
L7	Pipistrellus pygmaeus	Aug	0	0	0	0	0	20
L7	Plecotus auritus	Aug	0	0	0	0	0	9
L8	Myotis daubentonii	Jul	0	0	0	0	0	3
L8	Myotis daubentonii	Aug	0	0	0	0	0	12
L8	Myotis mystacinus	Jul	0	0	0	0	0	1
L8	Myotis mystacinus	Aug	0	0	0	0	0	7
L8	Myotis nattereri	Jul	0	0	0	0	0	1
L8	Myotis nattereri	Aug	0	0	0	0	0	3
L8	Nyctalus leisleri	Jul	0	0	0	0	0	5
L8	Nyctalus leisleri	Aug	0	0	0	0	0	19
L8	Pipistrellus pipistrellus	Jul	0	0	0	0	0	3
L8	Pipistrellus pipistrellus	Aug	0	0	0	0	0	19

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L8	Pipistrellus pygmaeus	Jul	0	0	0	0	0	2
L8	Pipistrellus pygmaeus	Aug	0	0	0	0	0	19
L8	Plecotus auritus	Jul	0	0	0	0	0	2
L8	Plecotus auritus	Aug	0	0	0	0	0	14
L9	Myotis daubentonii	Jul	0	0	0	0	0	1
L9	Myotis daubentonii	Aug	0	0	0	0	0	15
L9	Myotis mystacinus	Jul	0	0	0	0	0	1
L9	Myotis mystacinus	Aug	0	0	0	0	0	13
L9	Myotis nattereri	Jul	0	0	0	0	2	0
L9	Myotis nattereri	Aug	0	0	0	1	9	1
L9	Nyctalus leisleri	Jul	0	0	0	0	0	5
L9	Nyctalus leisleri	Aug	0	0	0	0	0	21
L9	Pipistrellus nathusii	Aug	0	0	0	0	0	4
L9	Pipistrellus pipistrellus	Jul	0	0	0	0	0	3
L9	Pipistrellus pipistrellus	Aug	0	0	0	0	0	20
L9	Pipistrellus pygmaeus	Jul	0	0	0	0	0	5
L9	Pipistrellus pygmaeus	Aug	0	0	0	0	0	20
L9	Plecotus auritus	Jul	0	0	0	0	0	2
L9	Plecotus auritus	Aug	0	0	0	0	3	12

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
L1	Myotis daubentonii	Jul	8	6.5 - 12	13	2
L1	Myotis daubentonii	Aug	11	6.5 - 12	13	16
L1	Myotis mystacinus	Aug	6	4.5 - 9	15	15
L1	Myotis nattereri	Aug	13	6 - 21.5	28	8
L1	Nyctalus leisleri	Jul	0	4 - 10.5	2	3
L1	Nyctalus leisleri	Aug	5	4 - 10.5	20	18
L1	Pipistrellus pipistrellus	Jul	2	1 - 2	3	2
L1	Pipistrellus pipistrellus	Aug	1	1 - 2	3	20
L1	Pipistrellus pygmaeus	Jul	6	12 - 16	6	5
L1	Pipistrellus pygmaeus	Aug	14	12 - 16	23	21
L1	Plecotus auritus	Jul	9	9.5 - 28	9	1
L1	Plecotus auritus	Aug	16	9.5 - 28	43	16
L10	Myotis daubentonii	Jul	2	7.5 - 15	2	1
L10	Myotis daubentonii	Aug	11	7.5 - 15	24	16
L10	Myotis mystacinus	Jul	4	4 - 7	5	2
L10	Myotis mystacinus	Aug	6	4 - 7	11	14
L10	Myotis nattereri	Jul	12	12.5 - 24.5	19	4
L10	Myotis nattereri	Aug	19	12.5 - 24.5	37	17
L10	Nyctalus leisleri	Jul	2	4 - 7	5	5
L10	Nyctalus leisleri	Aug	6	4 - 7	10	21
L10	Pipistrellus pipistrellus	Jul	0	0 - 0	0	5
L10	Pipistrellus pipistrellus	Aug	0	0 - 0	1	20
L10	Pipistrellus pygmaeus	Jul	0	10 - 16	8	5
L10	Pipistrellus pygmaeus	Aug	12	10 - 16	23	22
L10	Plecotus auritus	Aug	4	1 - 6.5	9	11
L11	Myotis daubentonii	Jul	6	6 - 13.5	6	1
L11	Myotis daubentonii	Aug	11	6 - 13.5	21	13
L11	Myotis mystacinus	Jul	6	3 - 8.5	6	1
L11	Myotis mystacinus	Aug	4	3 - 8.5	14	10
L11	Myotis nattereri	Jul	6	9 - 15.5	6	1
L11	Myotis nattereri	Aug	12	9 - 15.5	19	12
L11	Nyctalus leisleri	Jul	1	4.5 - 9	3	4
L11	Nyctalus leisleri	Aug	6	4.5 - 9	47	21

Detector ID	Species/Species Group	month	Median Percentile	95% CIs	Max. Percentile	Nights Recorded
L11	Pipistrellus pipistrellus	Jul	0	0 - 0	0	1
L11	Pipistrellus pipistrellus	Aug	0	0 - 0	1	21
L11	Pipistrellus pygmaeus	Jul	0	7 - 13	8	3
L11	Pipistrellus pygmaeus	Aug	8	7 - 13	27	21
L11	Plecotus auritus	Jul	1	4 - 13.5	1	1
L11	Plecotus auritus	Aug	9	4 - 13.5	21	14
L2	Myotis daubentonii	Jul	2	5.5 - 13	2	2
L2	Myotis daubentonii	Aug	13	5.5 - 13	15	12
L2	Nyctalus leisleri	Jul	0	2 - 5	0	3
L2	Nyctalus leisleri	Aug	2	2 - 5	7	19
L2	Pipistrellus pipistrellus	Jul	0	0 - 0	0	3
L2	Pipistrellus pipistrellus	Aug	0	0 - 0	0	18
L2	Pipistrellus pygmaeus	Jul	0	4.5 - 7	5	3
L2	Pipistrellus pygmaeus	Aug	6	4.5 - 7	12	19
L2	Plecotus auritus	Jul	4	2.5 - 4	4	2
L2	Plecotus auritus	Aug	4	2.5 - 4	15	9
L3	Myotis daubentonii	Jul	2	2 - 6	2	1
L3	Myotis daubentonii	Aug	6	2 - 6	9	7
L3	Myotis mystacinus	Aug	6	6 - 6	6	4
L3	Myotis nattereri	Jul	9	9 - 35	12	2
L3	Myotis nattereri	Aug	23	9 - 35	44	6
L3	Nyctalus leisleri	Jul	2	1.5 - 5	4	5
L3	Nyctalus leisleri	Aug	2	1.5 - 5	9	8
L3	Pipistrellus pipistrellus	Jul	0	0 - 0	0	3
L3	Pipistrellus pipistrellus	Aug	0	0 - 0	1	9
L3	Pipistrellus pygmaeus	Jul	4	3 - 4.5	4	3
L3	Pipistrellus pygmaeus	Aug	3	3 - 4.5	5	10
L3	Plecotus auritus	Aug	5	1 - 11	13	6
L4	Myotis daubentonii	Jul	2	2 - 5.5	2	2
L4	Myotis daubentonii	Aug	2	2 - 5.5	9	12
L4	Myotis mystacinus	Jul	3	3 - 4	3	1
L4	Myotis mystacinus	Aug	3	3 - 4	5	6
L4	Myotis nattereri	Jul	6	6 - 15	6	1
L4	Myotis nattereri	Aug	12	6 - 15	24	11
L4	Nyctalus leisleri	Jul	0	6 - 11	1	3
L4	Nyctalus leisleri	Aug	7	6 - 11	18	18

Detector ID	Species/Species Group	month	Median Percentile	95% CIs	Max. Percentile	Nights Recorded
L4	Pipistrellus pipistrellus	Jul	0	0 - 0	0	3
L4	Pipistrellus pipistrellus	Aug	0	0 - 0	1	17
L4	Pipistrellus pygmaeus	Jul	1	2.5 - 5	2	2
L4	Pipistrellus pygmaeus	Aug	3	2.5 - 5	7	19
L4	Plecotus auritus	Jul	1	1 - 6.5	1	1
L4	Plecotus auritus	Aug	4	1 - 6.5	9	10
L5	Myotis daubentonii	Jul	4	4 - 8.5	6	2
L5	Myotis daubentonii	Aug	6	4 - 8.5	13	14
L5	Myotis mystacinus	Aug	3	3 - 3	3	3
L5	Myotis nattereri	Aug	6	6 - 6	6	2
L5	Nyctalus leisleri	Jul	5	3 - 6.5	6	5
L5	Nyctalus leisleri	Aug	4	3 - 6.5	12	21
L5	Pipistrellus pipistrellus	Jul	0	0 - 0	1	4
L5	Pipistrellus pipistrellus	Aug	0	0 - 0	1	19
L5	Pipistrellus pygmaeus	Jul	1	2 - 4	3	4
L5	Pipistrellus pygmaeus	Aug	3	2 - 4	7	20
L5	Plecotus auritus	Jul	13	2.5 - 11	13	1
L5	Plecotus auritus	Aug	4	2.5 - 11	18	14
L6	Myotis daubentonii	Jul	2	6.5 - 14	2	2
L6	Myotis daubentonii	Aug	11	6.5 - 14	21	15
L6	Myotis mystacinus	Jul	3	4.5 - 6	3	1
L6	Myotis mystacinus	Aug	6	4.5 - 6	7	10
L6	Myotis nattereri	Jul	12	12 - 26	12	1
L6	Myotis nattereri	Aug	24	12 - 26	33	13
L6	Nyctalus leisleri	Jul	1	5 - 11	4	5
L6	Nyctalus leisleri	Aug	6	5 - 11	42	21
L6	Pipistrellus pipistrellus	Jul	1	1 - 1	1	3
L6	Pipistrellus pipistrellus	Aug	0	1 - 1	2	19
L6	Pipistrellus pygmaeus	Jul	1	2 - 4	1	2
L6	Pipistrellus pygmaeus	Aug	4	2 - 4	6	20
L6	Plecotus auritus	Jul	4	8.5 - 15	4	1
L6	Plecotus auritus	Aug	13	8.5 - 15	21	16
L7	Myotis daubentonii	Jul	4	4 - 8.5	6	2
L7	Myotis daubentonii	Aug	6	4 - 8.5	15	15
L7	Myotis mystacinus	Jul	5	3 - 5	5	1
L7	Myotis mystacinus	Aug	3	3 - 5	7	6

Detector ID	Species/Species Group	month	Median Percentile	95% CIs	Max. Percentile	Nights Recorded
L7	Myotis nattereri	Jul	6	6 - 6	6	1
L7	Myotis nattereri	Aug	6	6 - 6	6	3
L7	Nyctalus leisleri	Jul	2	2 - 5.5	3	4
L7	Nyctalus leisleri	Aug	2	2 - 5.5	10	20
L7	Pipistrellus pipistrellus	Jul	0	0 - 0	0	2
L7	Pipistrellus pipistrellus	Aug	0	0 - 0	1	20
L7	Pipistrellus pygmaeus	Jul	4	2.5 - 5	5	2
L7	Pipistrellus pygmaeus	Aug	3	2.5 - 5	9	20
L7	Plecotus auritus	Aug	9	4 - 9	9	9
L8	Myotis daubentonii	Jul	2	6 - 11	11	3
L8	Myotis daubentonii	Aug	10	6 - 11	15	12
L8	Myotis mystacinus	Jul	3	3 - 4	3	1
L8	Myotis mystacinus	Aug	3	3 - 4	5	7
L8	Myotis nattereri	Jul	6	6 - 6	6	1
L8	Myotis nattereri	Aug	6	6 - 6	12	3
L8	Nyctalus leisleri	Jul	7	6.5 - 10.5	15	5
L8	Nyctalus leisleri	Aug	9	6.5 - 10.5	16	19
L8	Pipistrellus pipistrellus	Jul	1	1.5 - 7	1	3
L8	Pipistrellus pipistrellus	Aug	2	1.5 - 7	12	19
L8	Pipistrellus pygmaeus	Jul	1	1.5 - 4	1	2
L8	Pipistrellus pygmaeus	Aug	2	1.5 - 4	5	19
L8	Plecotus auritus	Jul	3	6.5 - 11	4	2
L8	Plecotus auritus	Aug	9	6.5 - 11	17	14
L9	Myotis daubentonii	Jul	9	6 - 11.5	9	1
L9	Myotis daubentonii	Aug	6	6 - 11.5	17	15
L9	Myotis mystacinus	Jul	3	3 - 5.5	3	1
L9	Myotis mystacinus	Aug	5	3 - 5.5	8	13
L9	Myotis nattereri	Jul	31	27 - 36.5	36	2
L9	Myotis nattereri	Aug	33	27 - 36.5	43	11
L9	Nyctalus leisleri	Jul	2	5.5 - 9	14	5
L9	Nyctalus leisleri	Aug	9	5.5 - 9	12	21
L9	Pipistrellus nathusii	Aug	8	8 - 8	18	4
L9	Pipistrellus pipistrellus	Jul	0	0 - 0	0	3
L9	Pipistrellus pipistrellus	Aug	0	0 - 0	1	20
L9	Pipistrellus pygmaeus	Jul	0	2.5 - 5	1	5
L9	Pipistrellus pygmaeus	Aug	3	2.5 - 5	6	20

Detector ID	Species/Species Group	month	Median Percentile	95% CIs	Max. Percentile	Nights Recorded
L9	Plecotus auritus	Jul	8	9 - 17	15	2
L9	Plecotus auritus	Aug	15	9 - 17	24	15

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 Exceptional Activity	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	0	0	0	5	161
Myotis mystacinus	0	0	0	0	0	96
Myotis nattereri	0	0	0	3	30	66
Nyctalus leisleri	0	0	0	4	2	248
Pipistrellus nathusii	0	0	0	0	0	4
Pipistrellus pipistrellus	0	0	0	0	0	234
Pipistrellus pygmaeus	0	0	0	0	12	235
Plecotus auritus	0	0	0	3	9	133

Table 8. Summary table showing key metrics for each species recorded.

Species/Species Group	Median Percentile	95% CIs	Max. Percentile	Nights Recorded
Myotis daubentonii	6	7.5 - 15	24	166
Myotis mystacinus	5	6 - 6	15	96
Myotis nattereri	12	9 - 35	44	99
Nyctalus leisleri	4	6.5 - 10.5	47	254
Pipistrellus nathusii	8	8 - 8	18	4
Pipistrellus pipistrellus	0	1.5 - 7	12	234
Pipistrellus pygmaeus	4	7 - 13	27	247
Plecotus auritus	9	9.5 - 28	43	145

Figure 4. The activity level (percentile) of bats recorded across each night of the bat survey for the **entire site**.

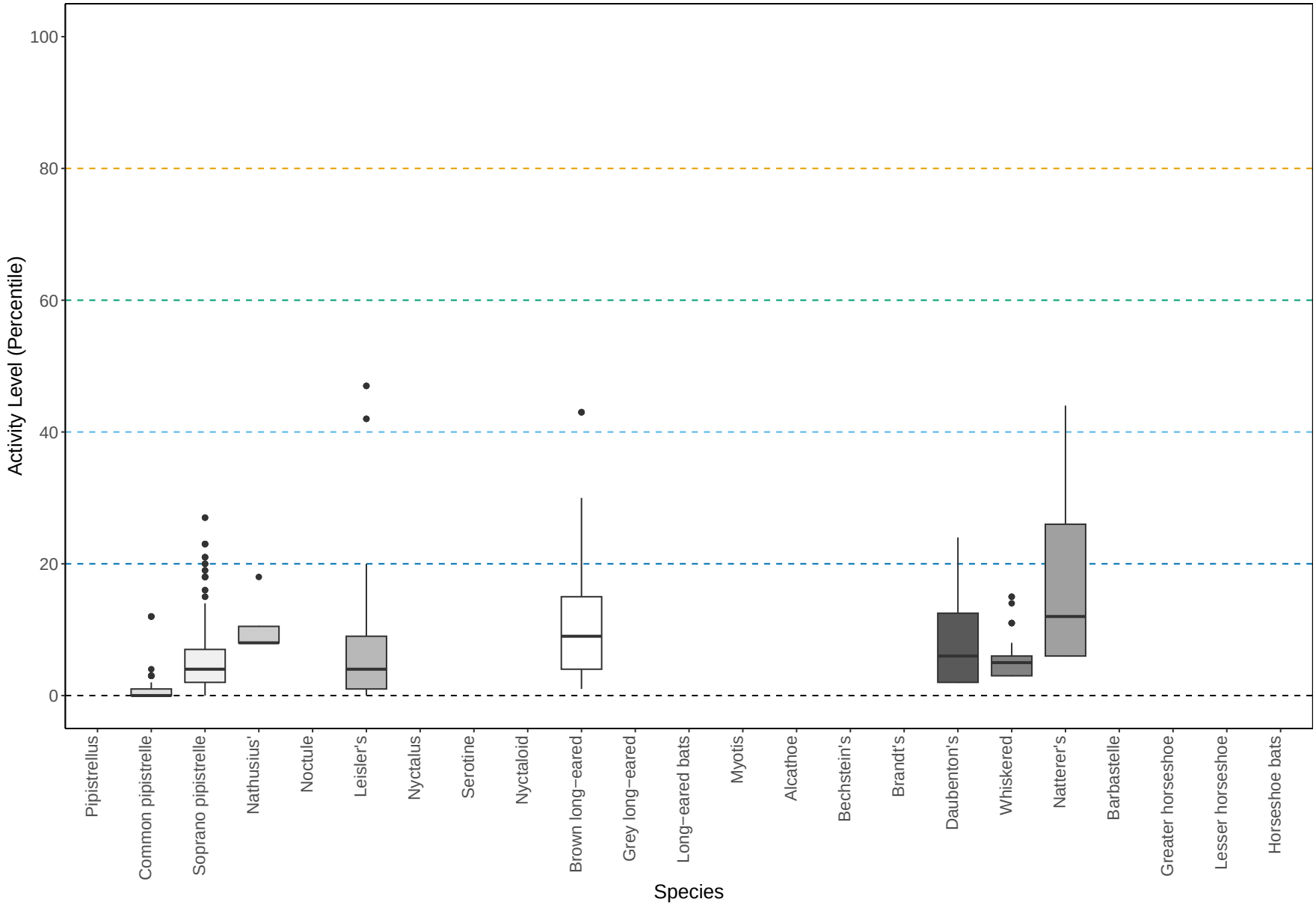
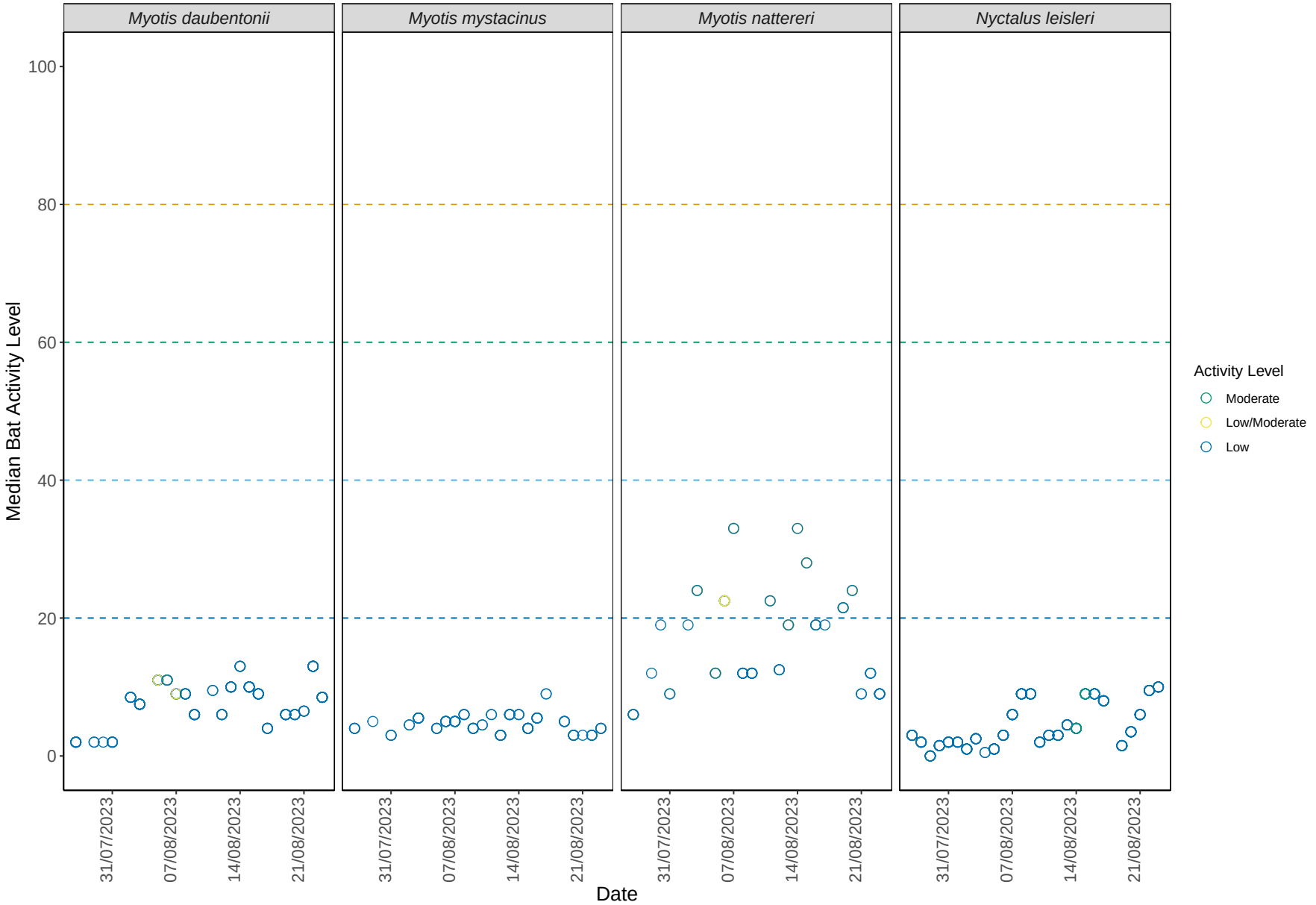
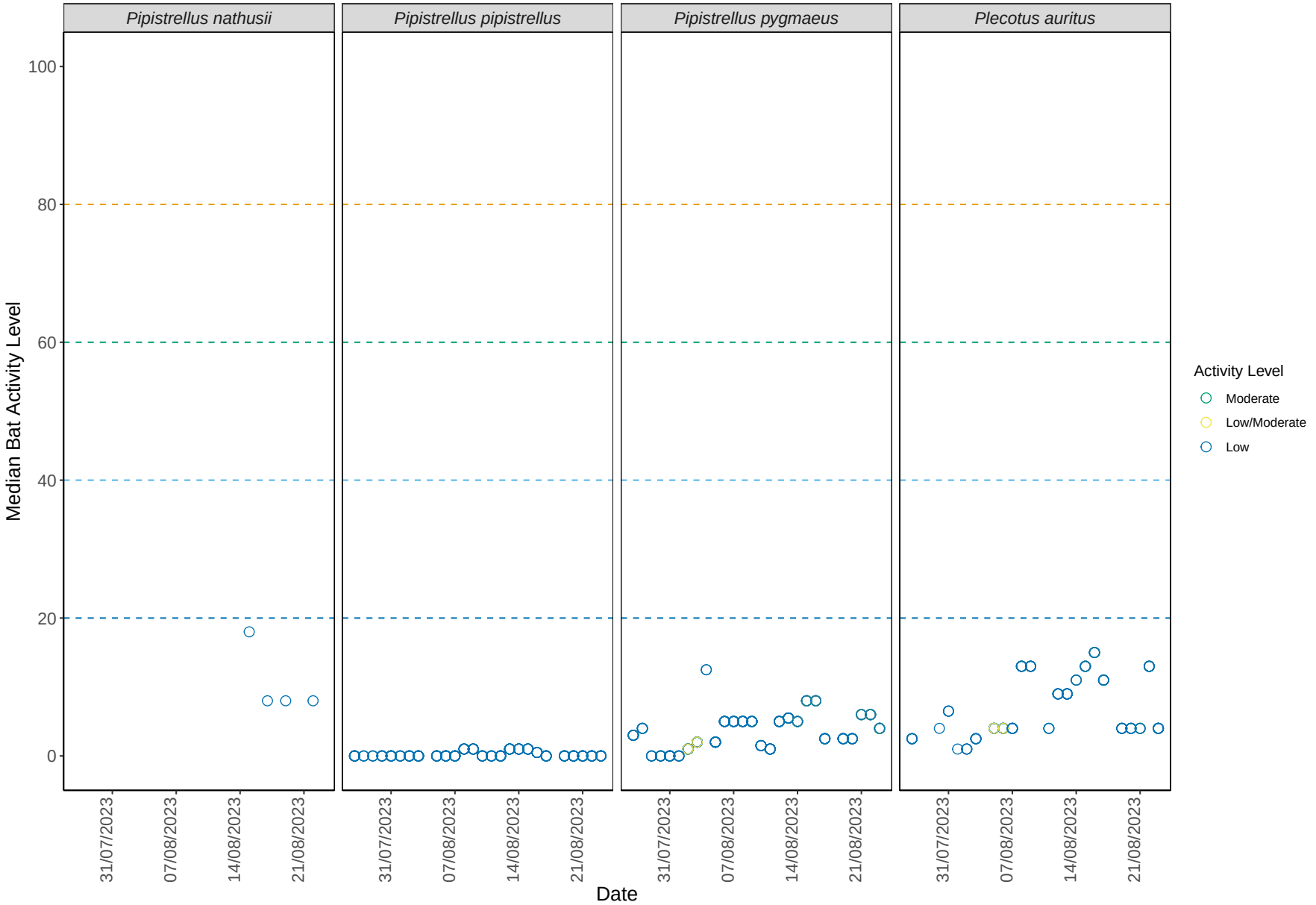

Activity Level (Percentile)
100
80
60
40
20
0
Pipistrellus
Common pipistrelle
Soprano pipistrelle
Nathusius'
Noctule
Leisler's
Nyctalus
Serotine
Nyctaloid
Brown long−eared
Grey long−eared
Long−eared bats
Myotis
Alcathoe
Bechstein's
Brandt's
Daubenton's
Whiskered
Natterer's
Barbastelle
Greater horseshoe
Lesser horseshoe
Horseshoe bats
Species

Figure 5. The median activity levels of bats recorded across all detectors each night.


Myotis daubentonii
Myotis mystacinus
Myotis nattereri
Nyctalus leisleri
Median Bat Activity Level
100
80
60
40
20
0
31/07/2023
07/08/2023
14/08/2023
21/08/2023
Date
Activity Level
Moderate
Low/Moderate
Low


Pipistrellus nathusii
Pipistrellus pipistrellus
Pipistrellus pygmaeus
Plecotus auritus
Median Bat Activity Level
100
80
60
40
20
0
31/07/2023
07/08/2023
14/08/2023
21/08/2023
Date
Activity Level
Moderate
Low/Moderate
Low

Per Site, Per Month

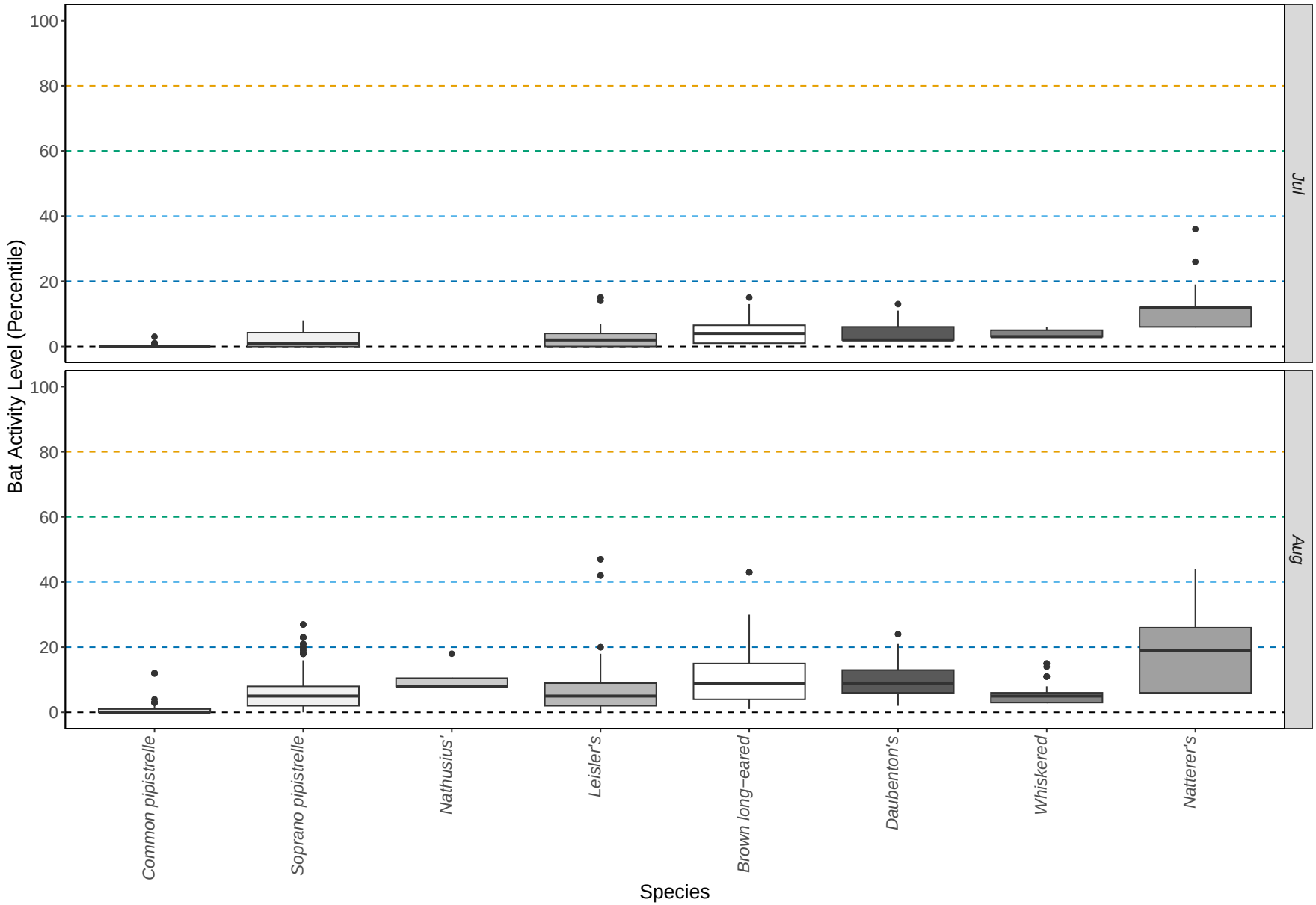
Table 9. Summary table showing the number of nights recorded bat activity fell into each activity band for each species during each month.

Species/Species Group	month	Nights of Exceptional Activity	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	0	0	0	0	19
Myotis daubentonii	Aug	0	0	0	0	5	142
Myotis mystacinus	Jul	0	0	0	0	0	8
Myotis mystacinus	Aug	0	0	0	0	0	88
Myotis nattereri	Jul	0	0	0	0	2	11
Myotis nattereri	Aug	0	0	0	3	28	55
Nyctalus leisleri	Jul	0	0	0	0	0	47
Nyctalus leisleri	Aug	0	0	0	4	2	201
Pipistrellus nathusii	Aug	0	0	0	0	0	4
Pipistrellus pipistrellus	Jul	0	0	0	0	0	32
Pipistrellus pipistrellus	Aug	0	0	0	0	0	202
Pipistrellus pygmaeus	Jul	0	0	0	0	0	36
Pipistrellus pygmaeus	Aug	0	0	0	0	12	199
Plecotus auritus	Jul	0	0	0	0	0	11
Plecotus auritus	Aug	0	0	0	3	9	122

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	2	7.5 - 15	13	19
Myotis daubentonii	Aug	9	7.5 - 15	24	147
Myotis mystacinus	Jul	3	4.5 - 6	6	8
Myotis mystacinus	Aug	5	6 - 6	15	88
Myotis nattereri	Jul	12	9 - 35	36	13
Myotis nattereri	Aug	19	9 - 35	44	86
Nyctalus leisleri	Jul	2	6.5 - 10.5	15	47
Nyctalus leisleri	Aug	5	6.5 - 10.5	47	207
Pipistrellus nathusii	Aug	8	8 - 8	18	4
Pipistrellus pipistrellus	Jul	0	1.5 - 7	3	32
Pipistrellus pipistrellus	Aug	0	1.5 - 7	12	202
Pipistrellus pygmaeus	Jul	1	7 - 13	8	36
Pipistrellus pygmaeus	Aug	5	7 - 13	27	211
Plecotus auritus	Jul	4	9.5 - 28	15	11
Plecotus auritus	Aug	9	9.5 - 28	43	134

Figure 6. The activity level (percentile) of bats recorded across each night of the bat survey for the entire site, split between months.


Bat Activity Level (Percentile)
100
80
60
40
20
0
Jul
Aug
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Brown long−eared
Daubenton's
Whiskered
Natterer's
Species

Part 2: Nightly Analysis

Entire Survey Period

Sunrise and Sunset Times

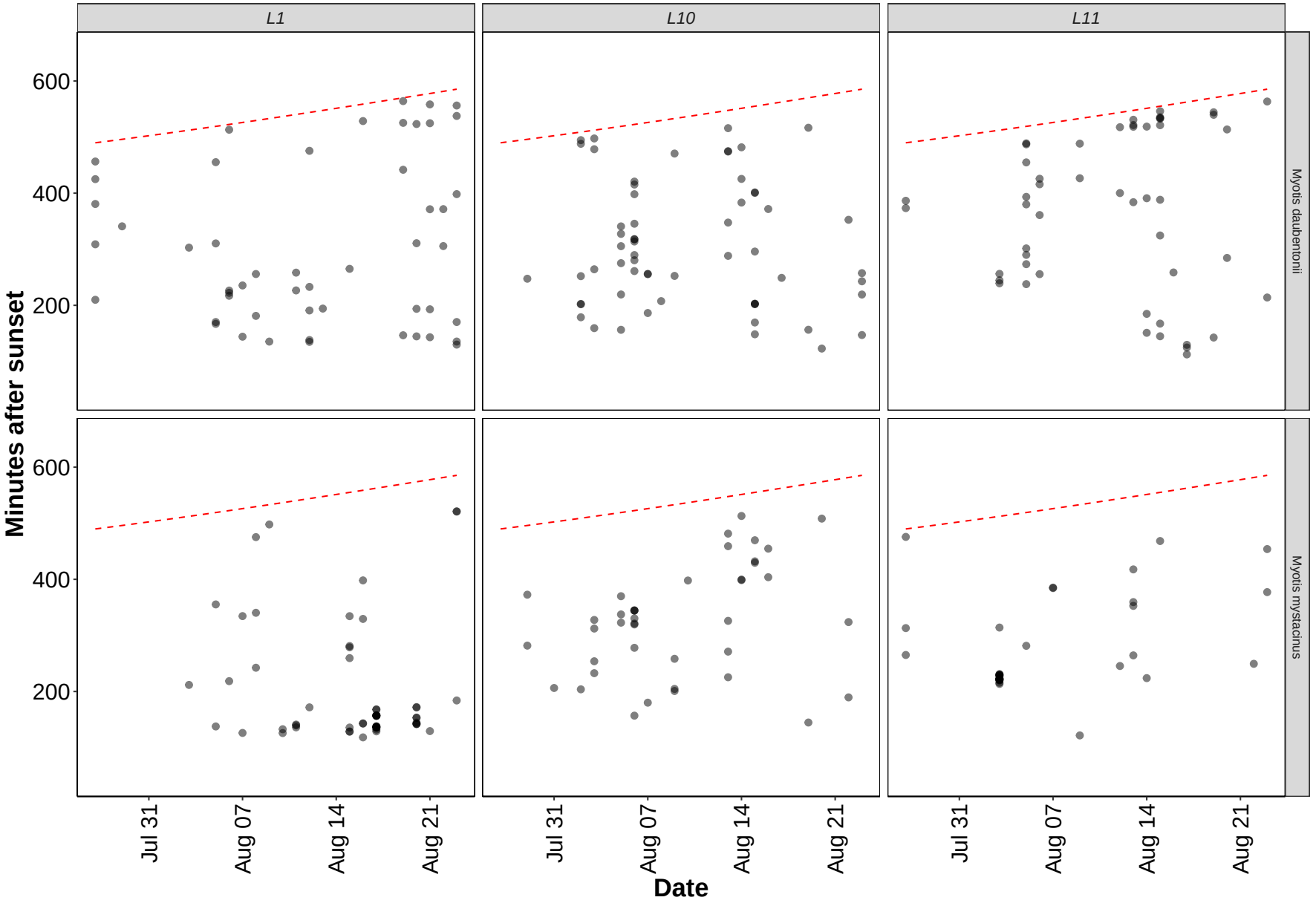
Table 11. The times of sunset and sunrise the following morning for surveys beginning on the date shown.

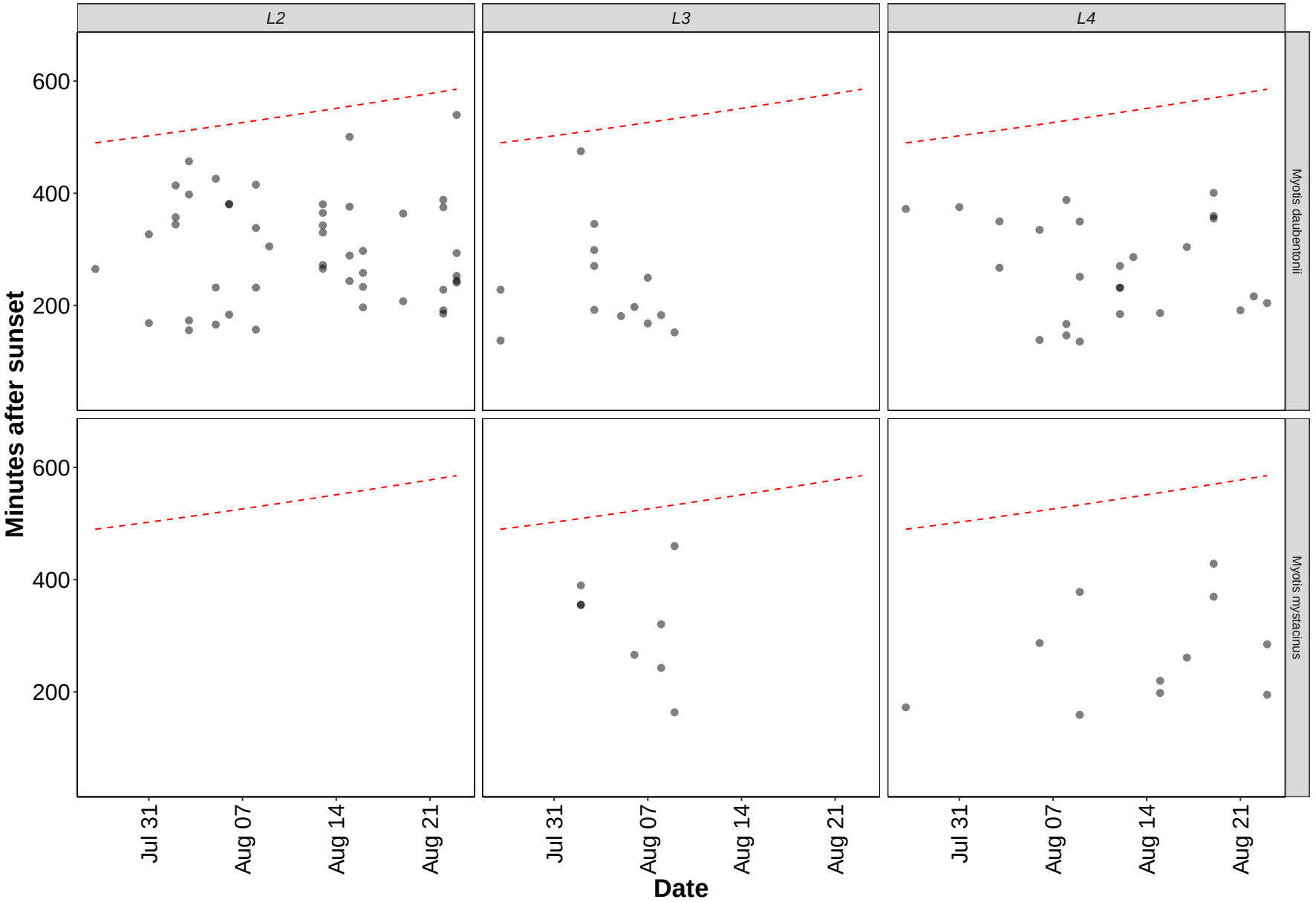
Night (y-m-d)	Sunset (h:m)	Sunrise (h:m)	Night Length (hours)
2023-07-27	20:32	04:42	8.2
2023-07-28	20:31	04:44	8.2
2023-07-29	20:29	04:45	8.3
2023-07-30	20:28	04:47	8.3
2023-07-31	20:26	04:48	8.4
2023-08-01	20:24	04:50	8.4
2023-08-02	20:23	04:52	8.5
2023-08-03	20:21	04:53	8.5
2023-08-04	20:19	04:55	8.6
2023-08-05	20:17	04:57	8.7
2023-08-06	20:16	04:58	8.7
2023-08-07	20:14	05:00	8.8
2023-08-08	20:12	05:02	8.8
2023-08-09	20:10	05:03	8.9
2023-08-10	20:08	05:05	8.9
2023-08-11	20:06	05:07	9.0
2023-08-12	20:04	05:08	9.1
2023-08-13	20:02	05:10	9.1
2023-08-14	20:00	05:12	9.2
2023-08-15	19:58	05:13	9.3
2023-08-16	19:56	05:15	9.3
2023-08-17	19:54	05:17	9.4
2023-08-19	19:50	05:20	9.5
2023-08-20	19:48	05:22	9.6
2023-08-21	19:46	05:23	9.6
2023-08-22	19:43	05:25	9.7
2023-08-23	19:41	05:27	9.8

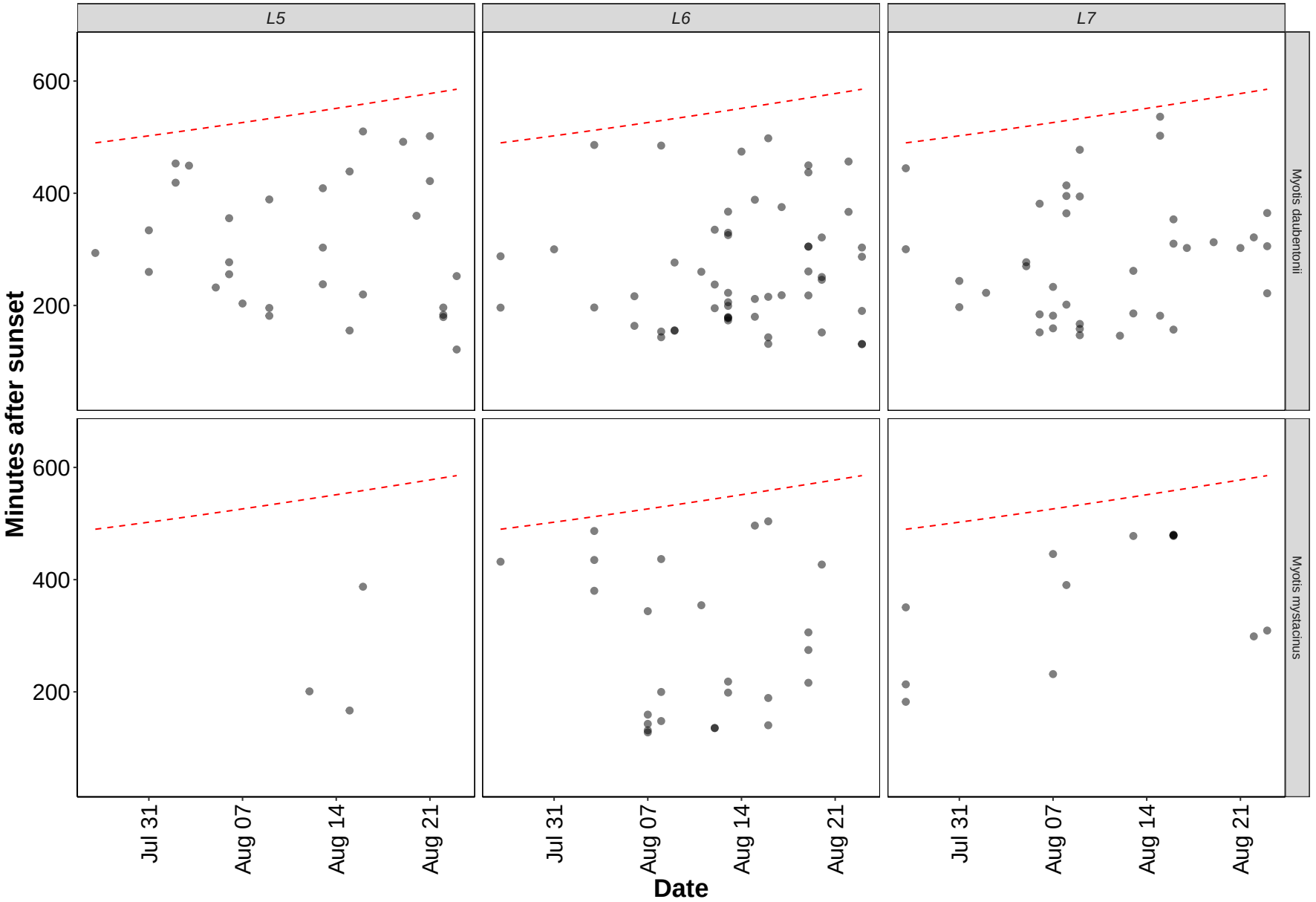
Distribution of Bat Activity Across the Night through Time

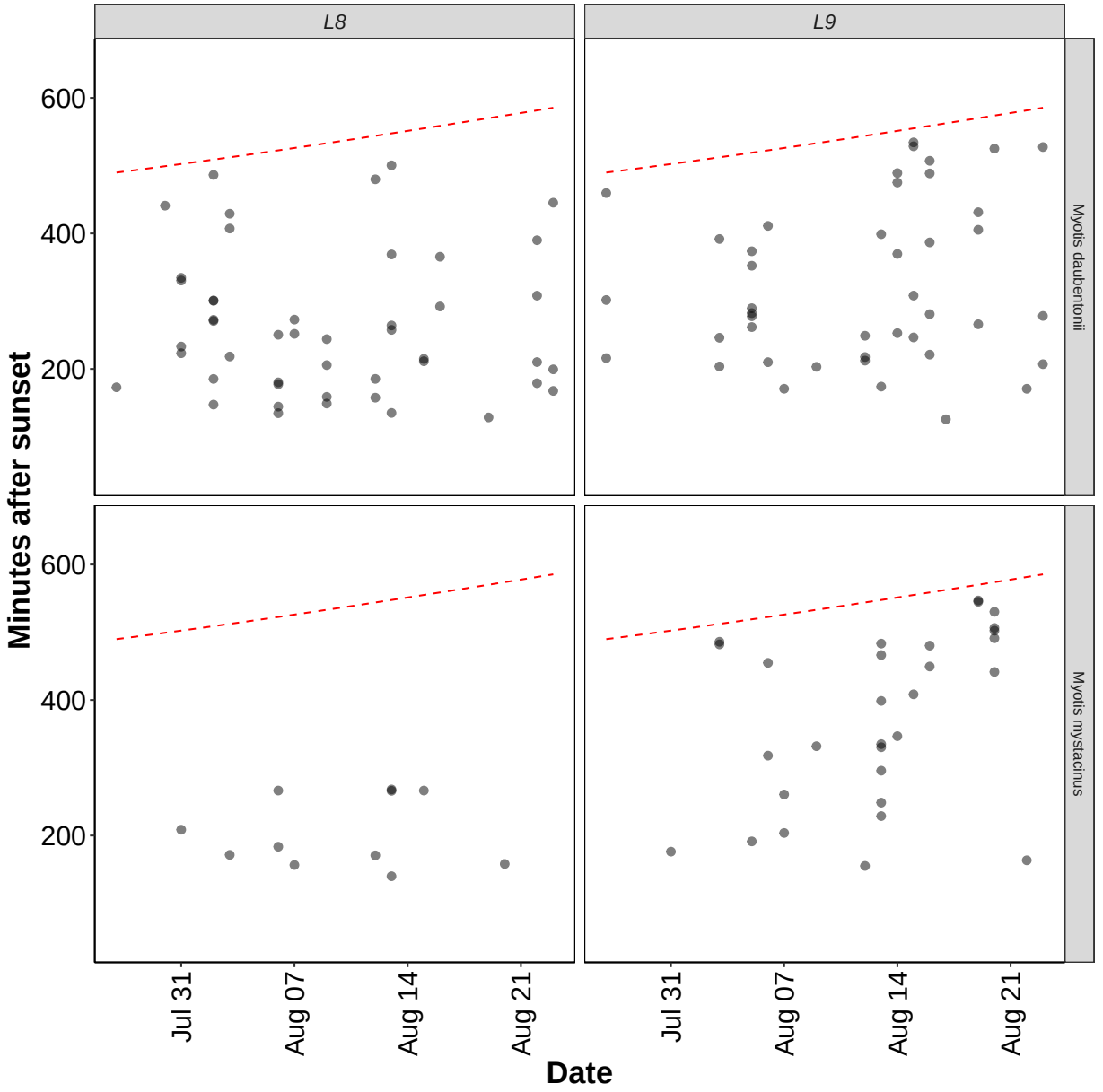
Per Detector

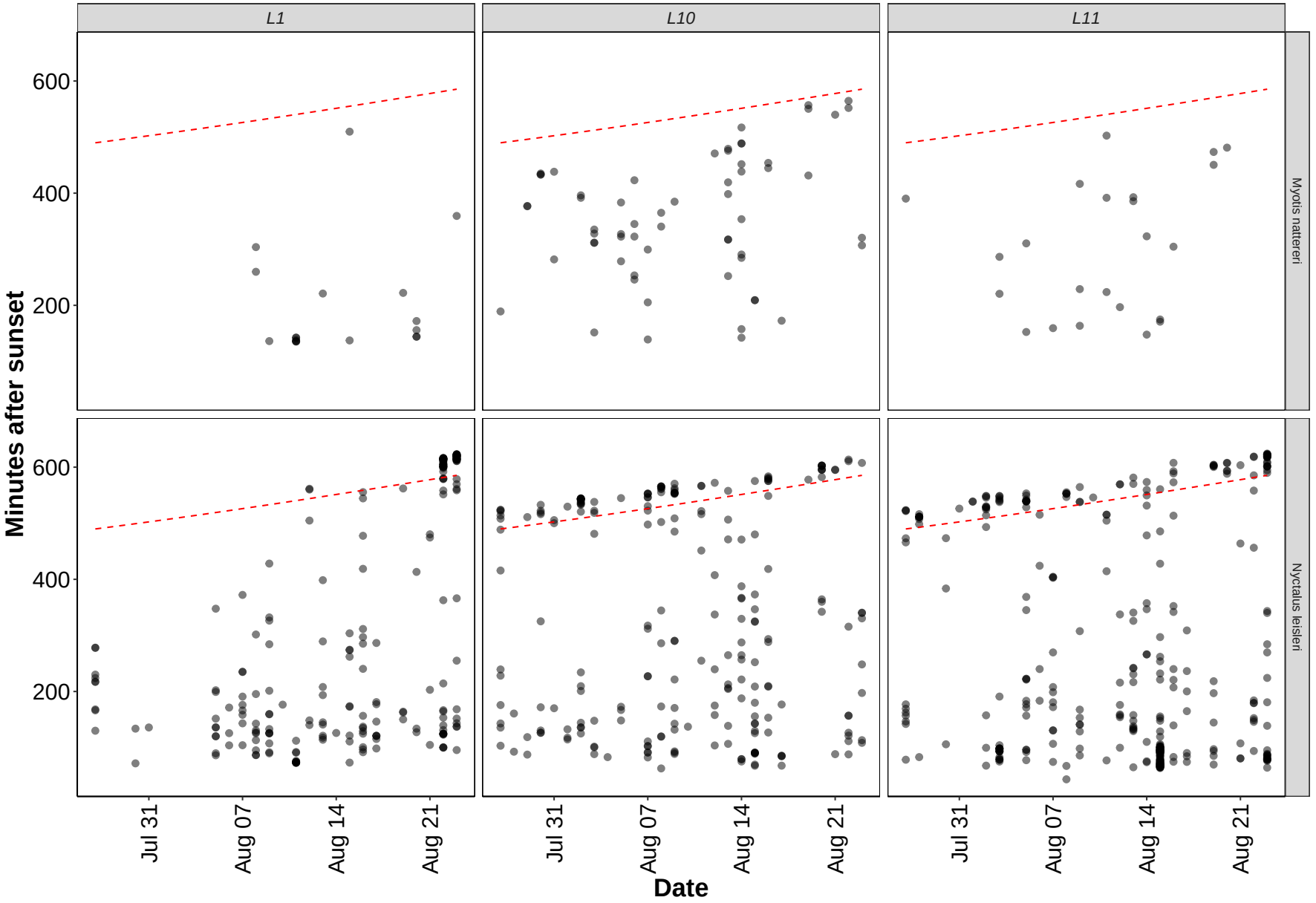
Figure 7. Timing of bat calls plotted as minutes before/after sunset, whereby 0 on the y axis represents sunset. Sunrise throughout the survey period is depicted as the red dashed line. Colours indicate kernel densities, with darkest colours showing peaks of activity. These colours are comparative only within each plot, and do not account for overall activity.

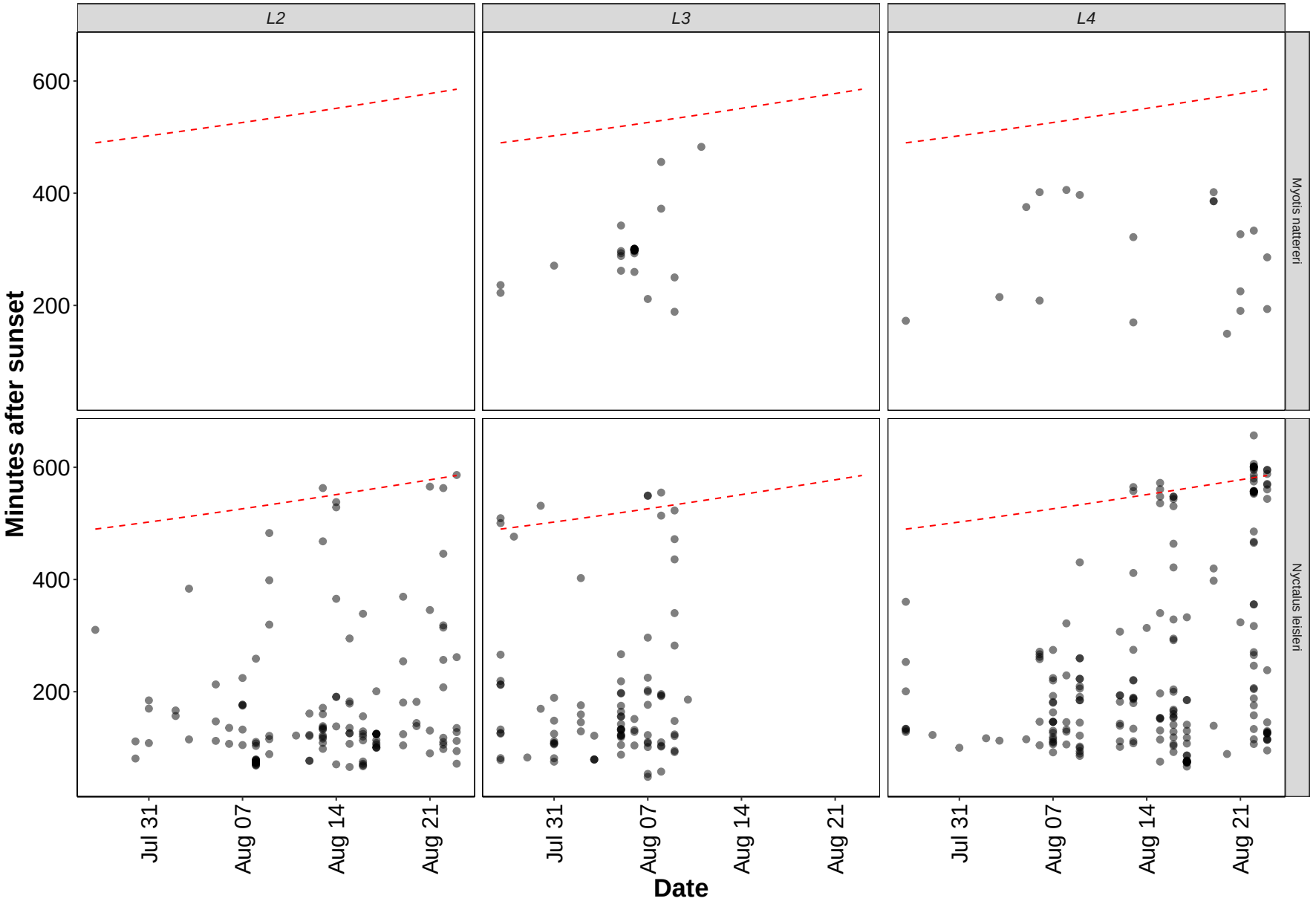

L1
L10
L11
Myotis daubentonii
Myotis mystacinus
Minutes after sunset
600
400
200
Jul 31
Aug 07
Aug 14
Aug 21
Date

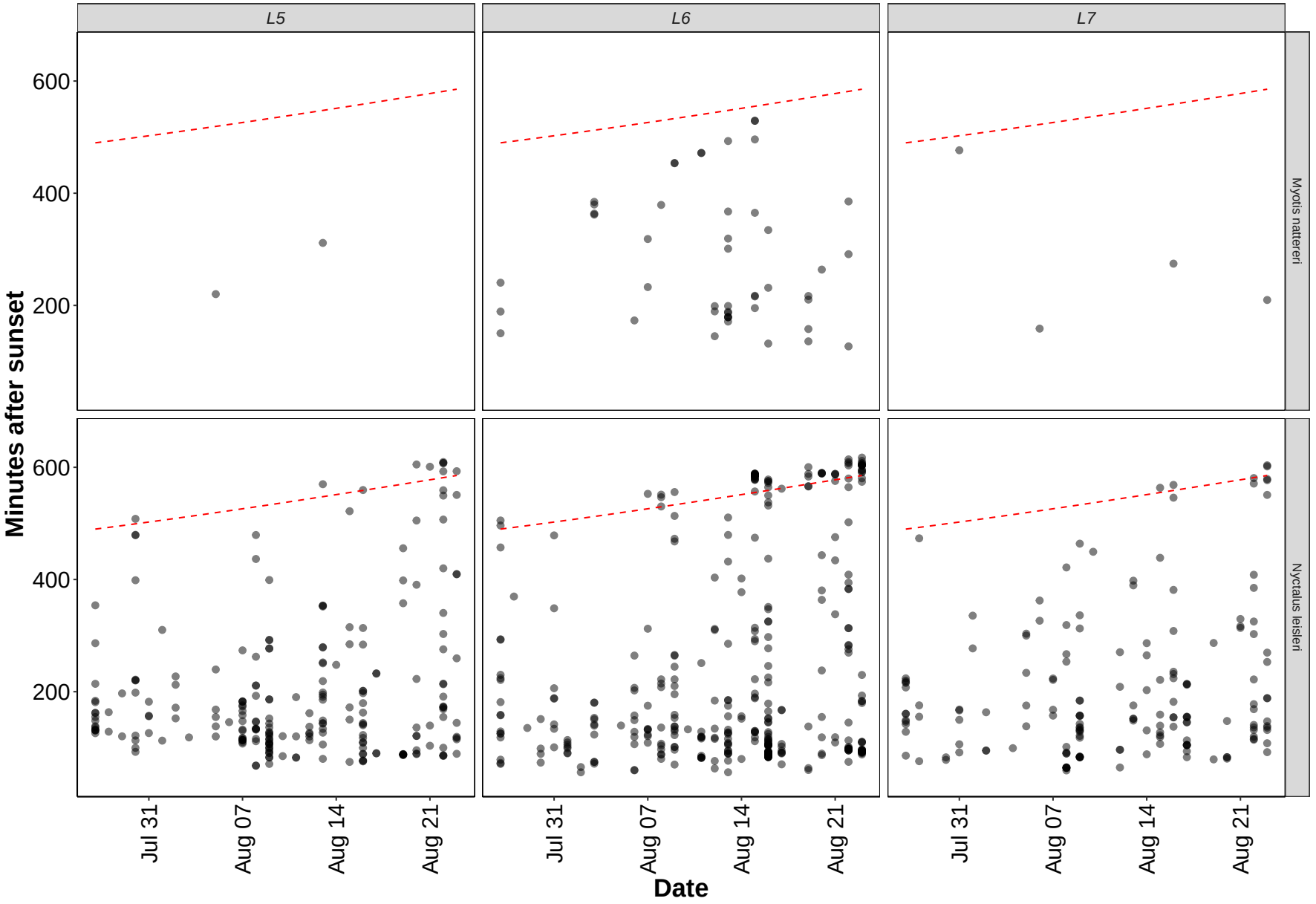

L2
L3
L4
Myotis daubentonii
Myotis mystacinus
Minutes after sunset
600
400
200
Jul 31
Aug 07
Aug 14
Aug 21
Date

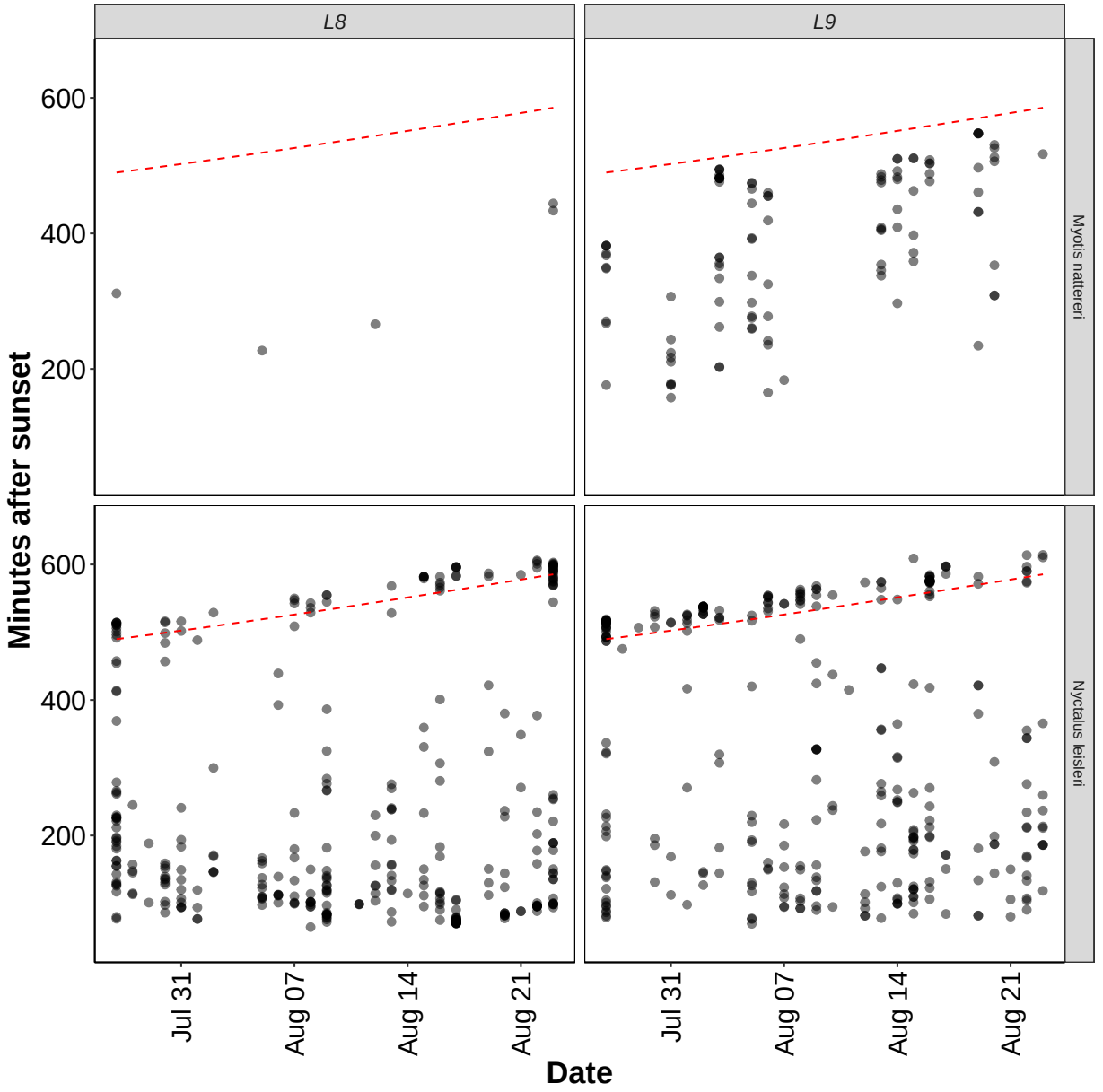

L5
L6
L7
Myotis daubentonii
Myotis mystacinus
Minutes after sunset
600
400
200
Jul 31
Aug 07
Aug 14
Aug 21
Date

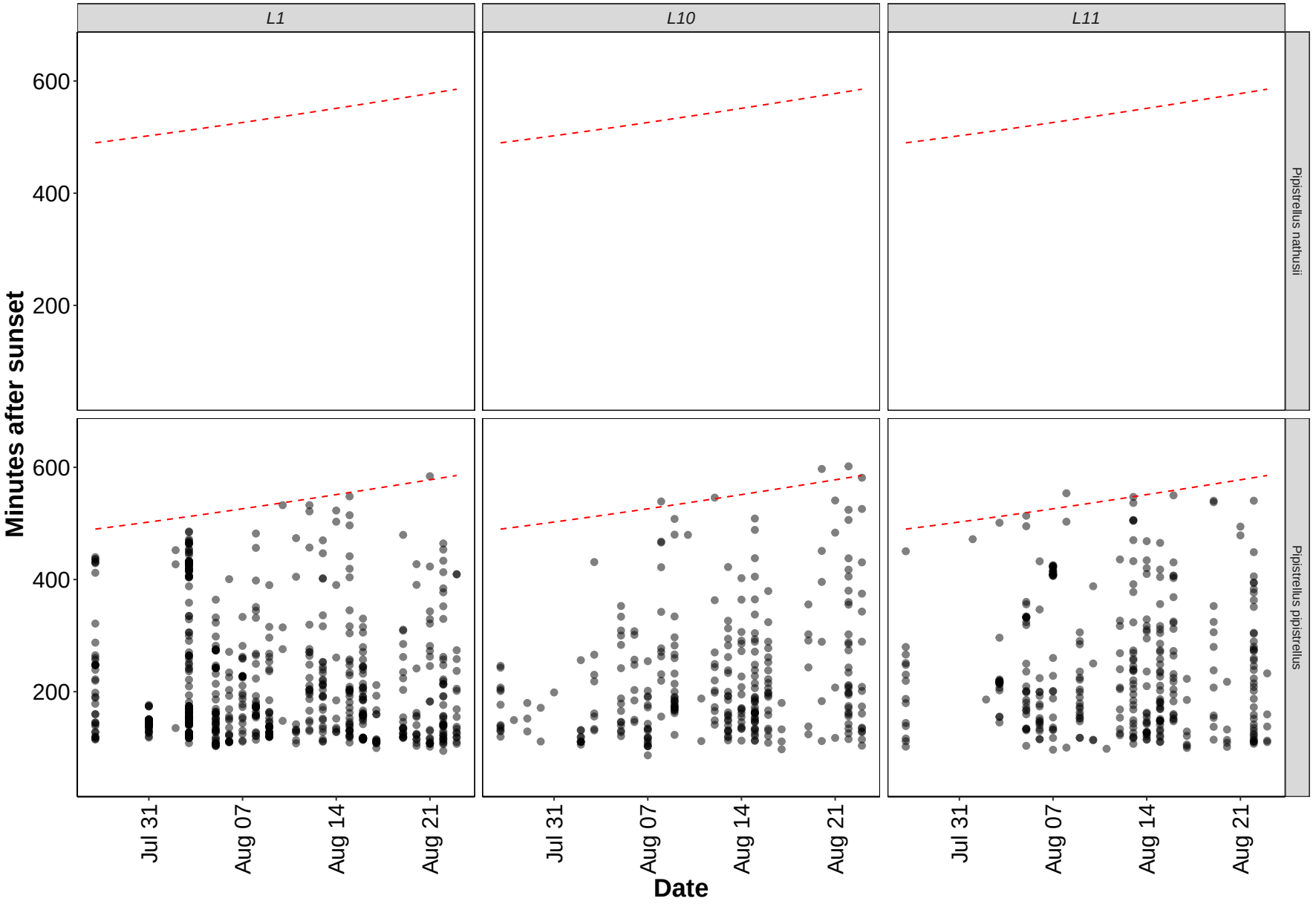

L8
L9
Myotis daubentonii
Myotis mystacinus
Minutes after sunset
600
400
200
Jul 31
Aug 07
Aug 14
Aug 21
Date

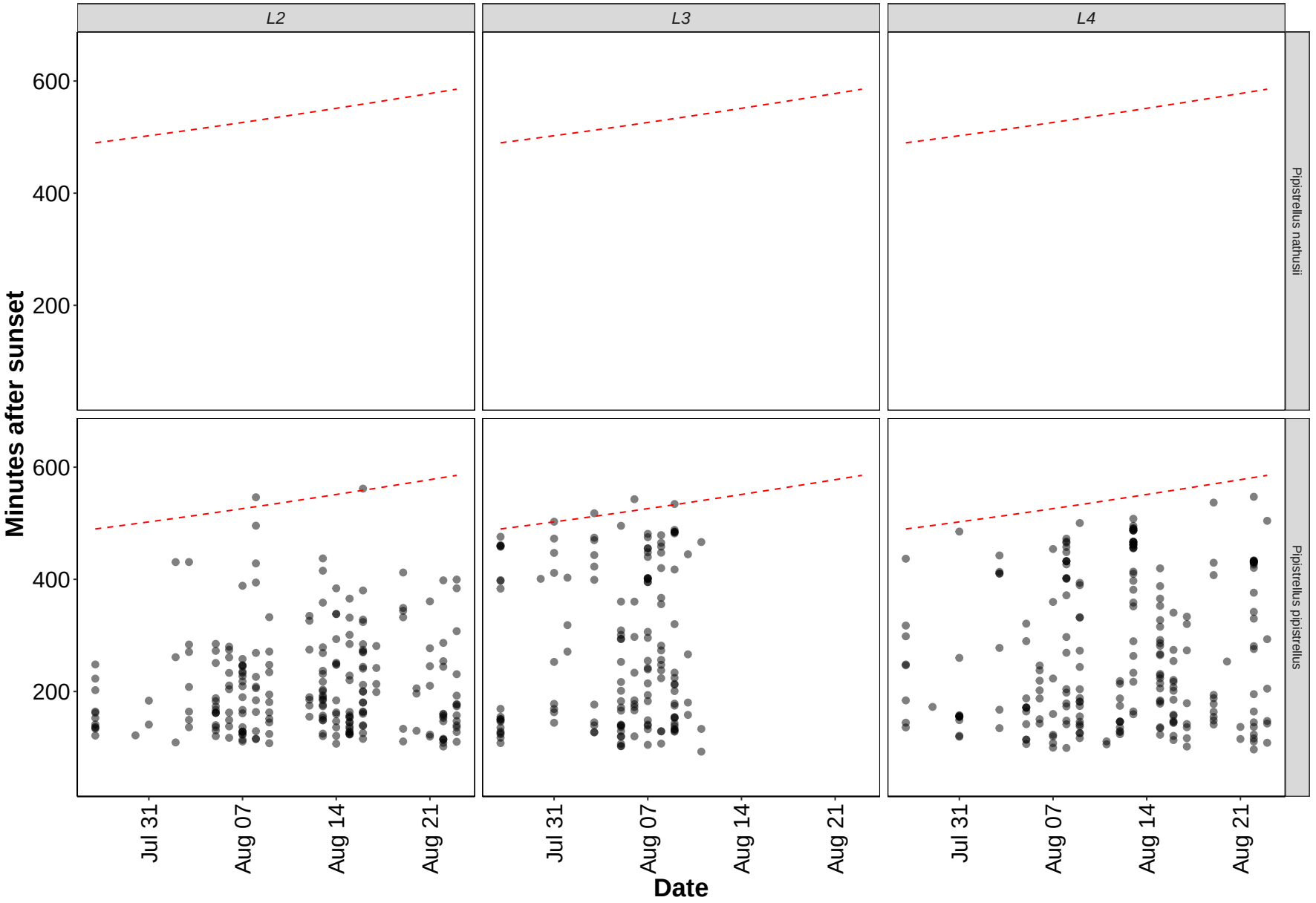

L1
L10
L11
Myotis nattereri
Nyctalus leisleri
Minutes after sunset
600
400
200
Jul 31
Aug 07
Aug 14
Aug 21
Date

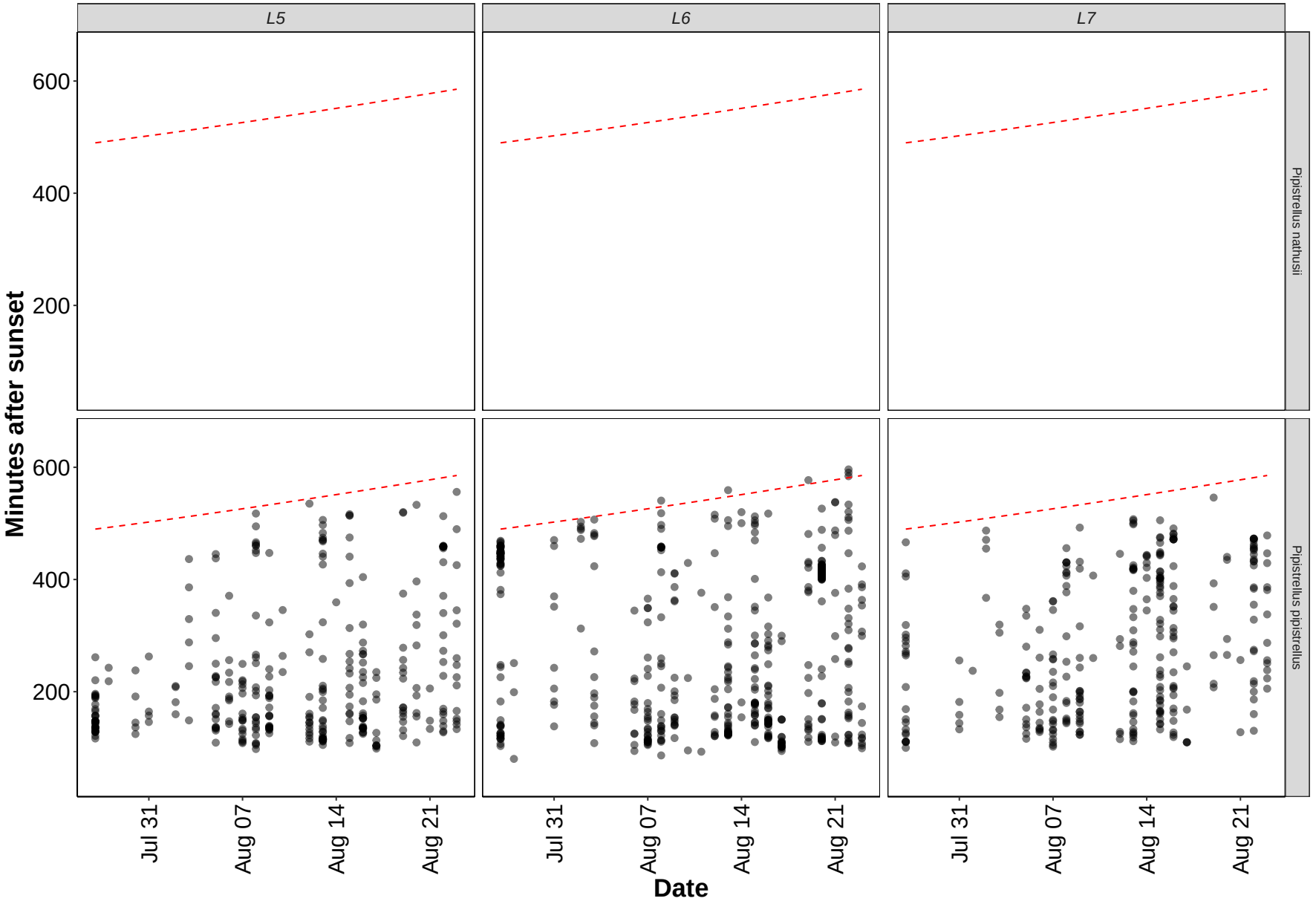

L2
L3
L4
Myotis nattereri
Nyctalus leisleri
Minutes after sunset
600
400
200
Jul 31
Aug 07
Aug 14
Aug 21
Date

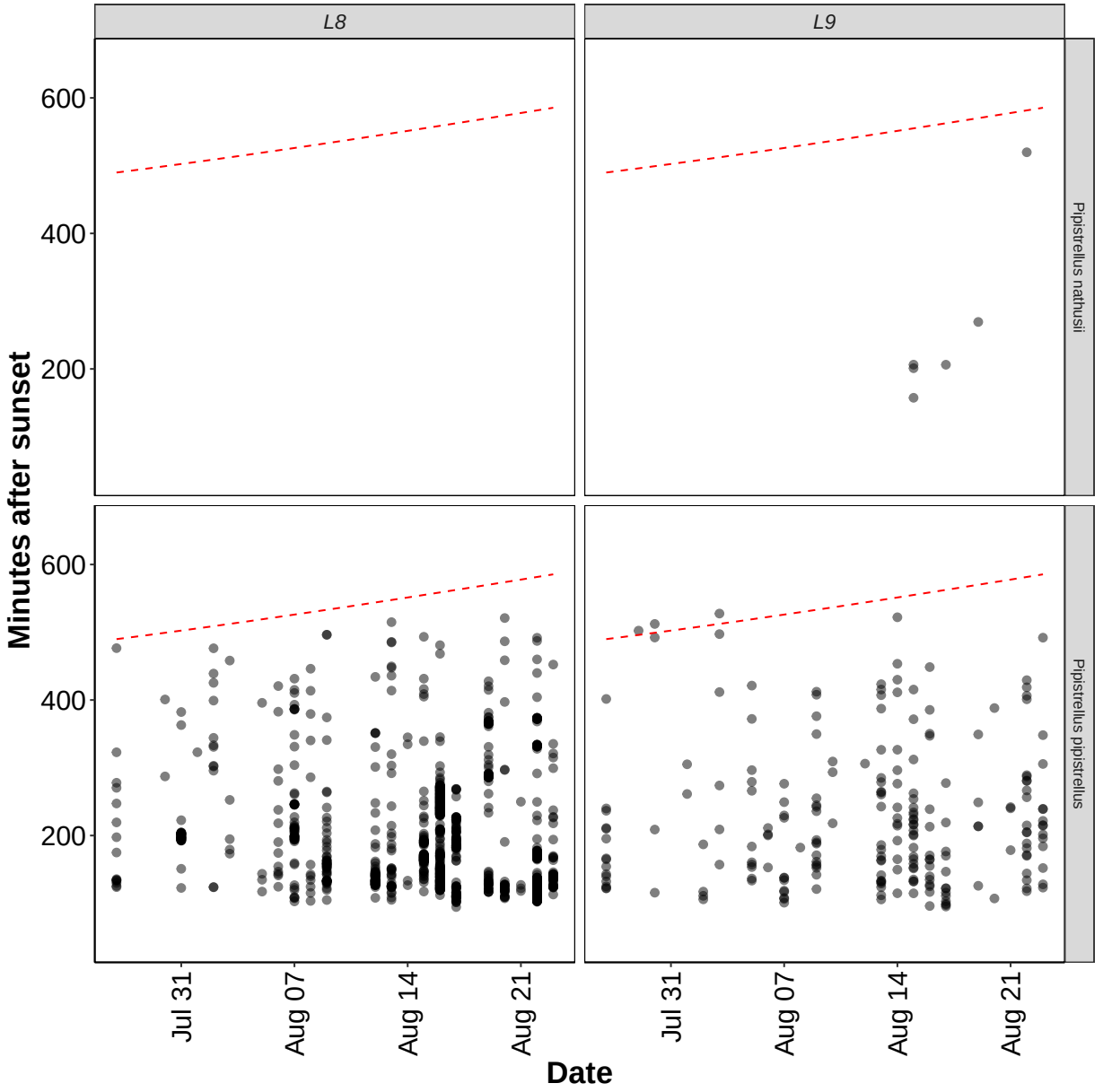

L5
L6
L7
Myotis nattereri
Nyctalus leisleri
Minutes after sunset
600
400
200
Jul 31
Aug 07
Aug 14
Aug 21
Date

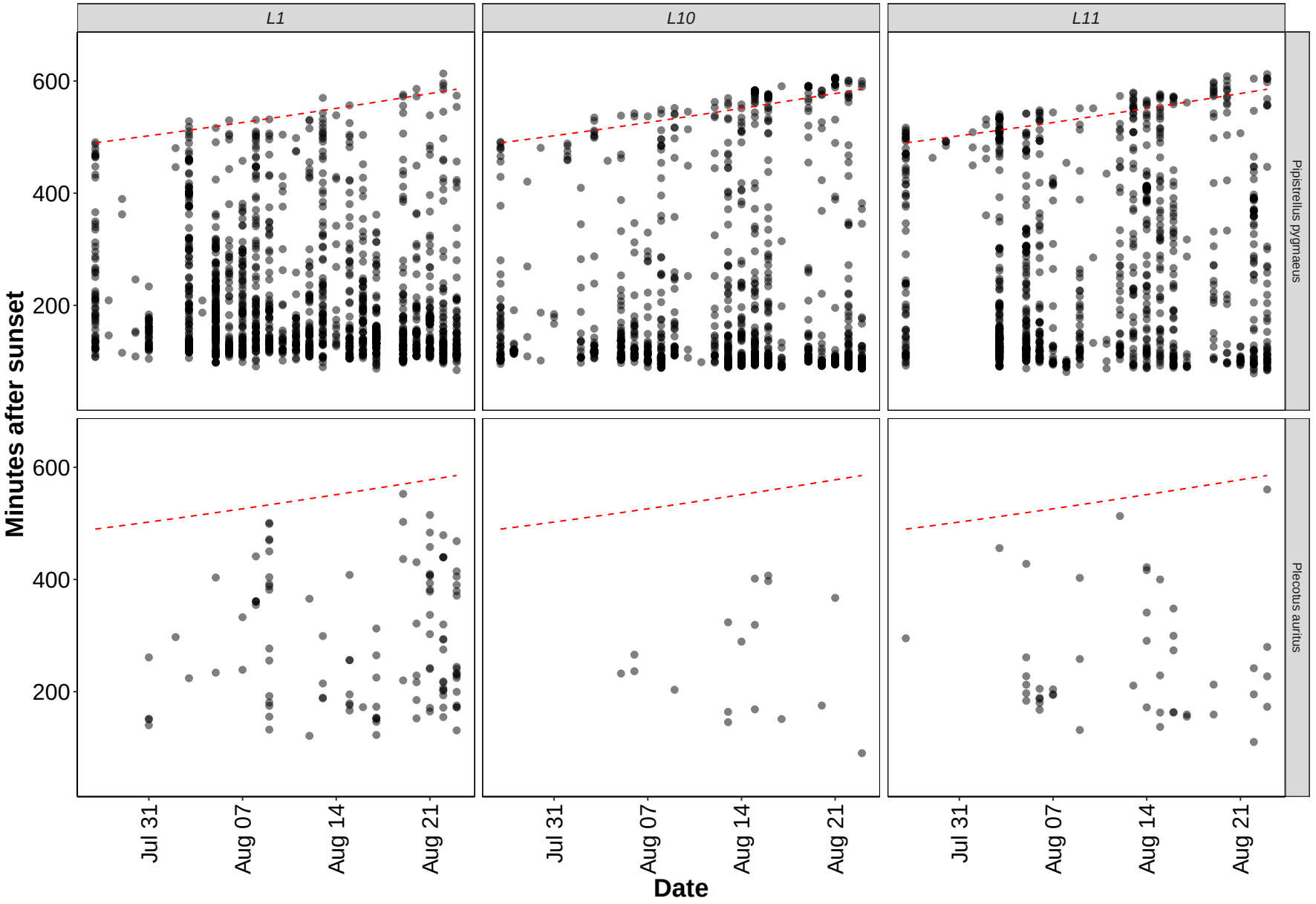

L8
L9
Myotis nattereri
Nyctalus leisleri
Minutes after sunset
600
400
200
Jul 31
Aug 07
Aug 14
Aug 21
Date


L1
L10
L11
Pipistrellus nathusii
Pipistrellus pipistrellus
Minutes after sunset
600
400
200
Jul 31
Aug 07
Aug 14
Aug 21
Date


L2
L3
L4
Pipistrellus nathusii
Pipistrellus pipistrellus
Minutes after sunset
600
400
200
Jul 31
Aug 07
Aug 14
Aug 21
Date


L5
L6
L7
Pipistrellus nathusii
Pipistrellus pipistrellus
Minutes after sunset
600
400
200
Jul 31
Aug 07
Aug 14
Aug 21
Date


L8
L9
Pipistrellus nathusi
Pipistrellus pipistrellus
Minutes after sunset
600
400
200
Jul 31
Aug 07
Aug 14
Aug 21
Date


L1
L10
L11
Pipistrellus pygmaeus
Plecotus auritus
Minutes after sunset
600
400
200
Jul 31
Aug 07
Aug 14
Aug 21
Date

Roost Emergence Time and Bat Observation

Based on: Russ, Jon. 2012. British Bat Calls a Guide to species Identification. Pelagic Publishing.

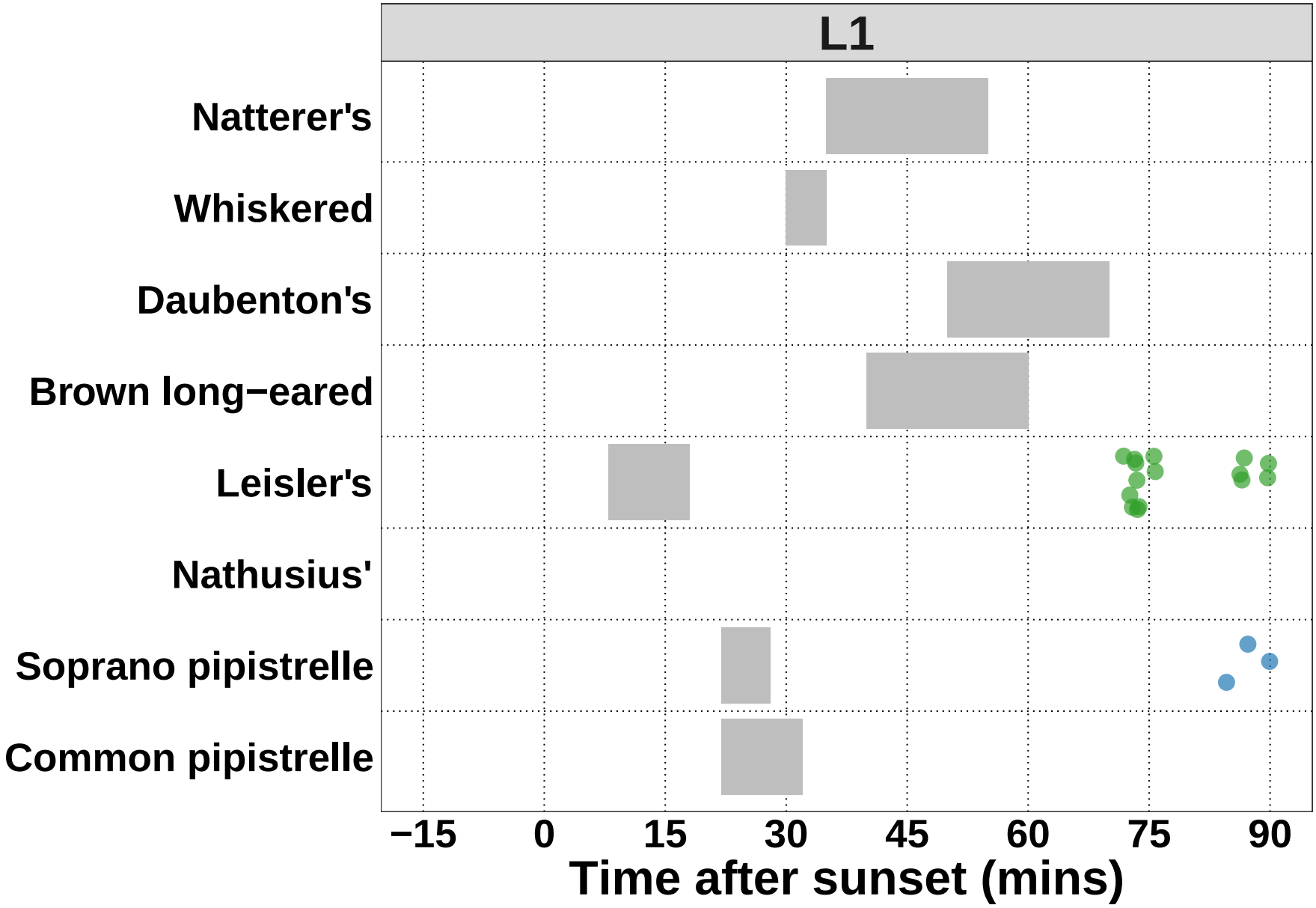
Bat Passes Potentially Indicating Close Proximity to a Roost (Russ 2012)

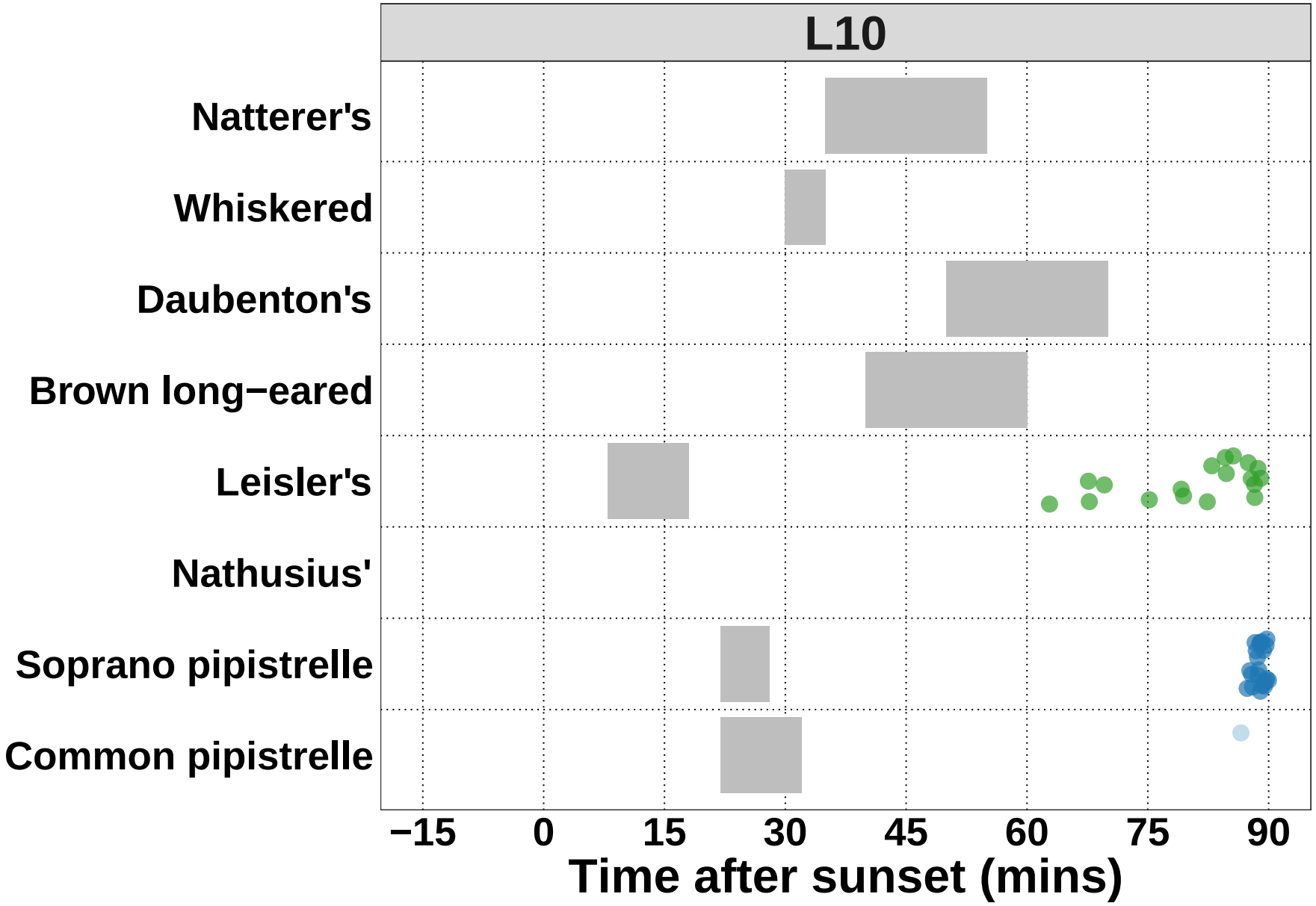
Table 12. Number of bat calls recorded before the upper time of the species-specific emergence time range, and which therefore may potentially indicate the presence of a nearby roost.

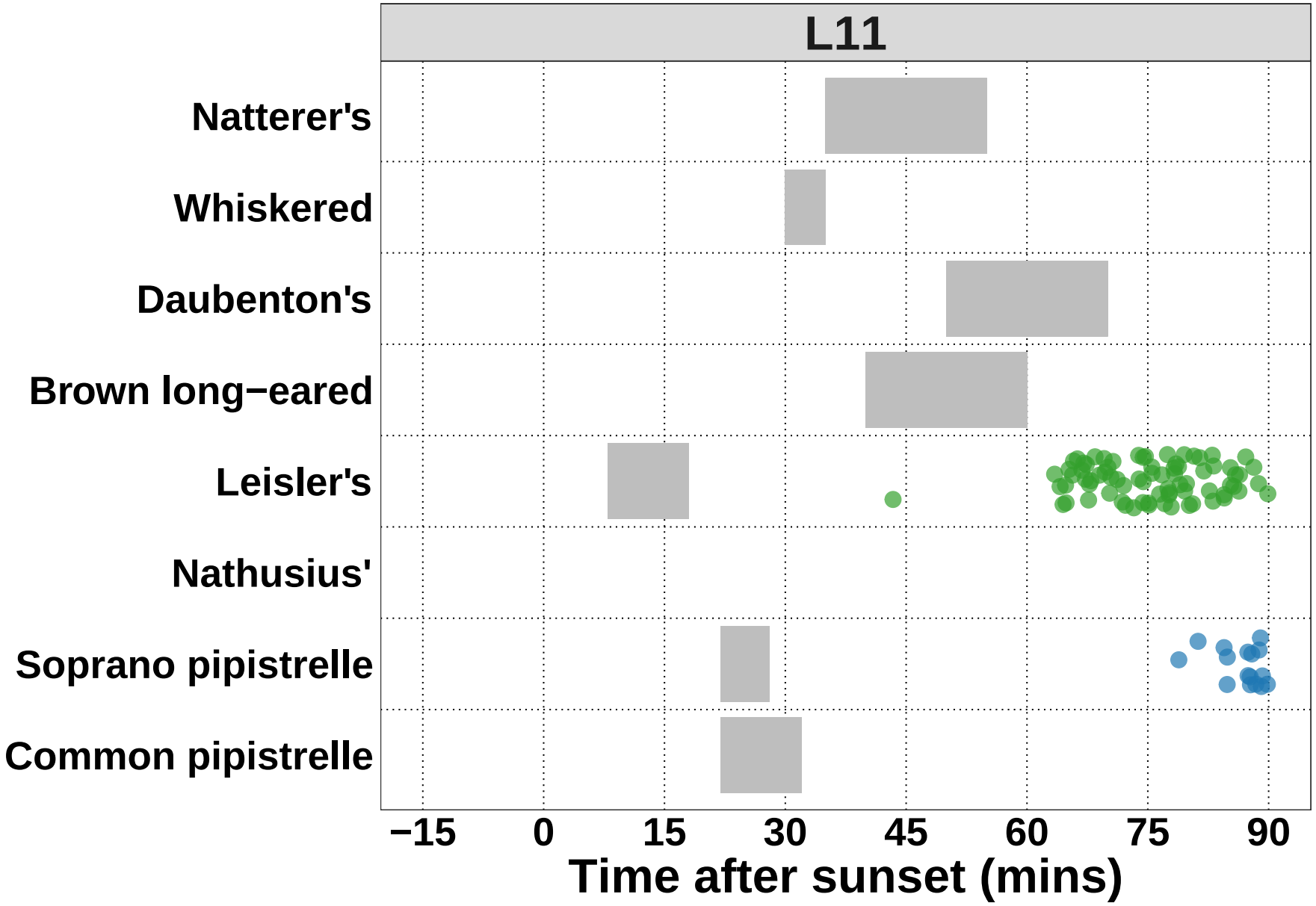
Species	Detector ID

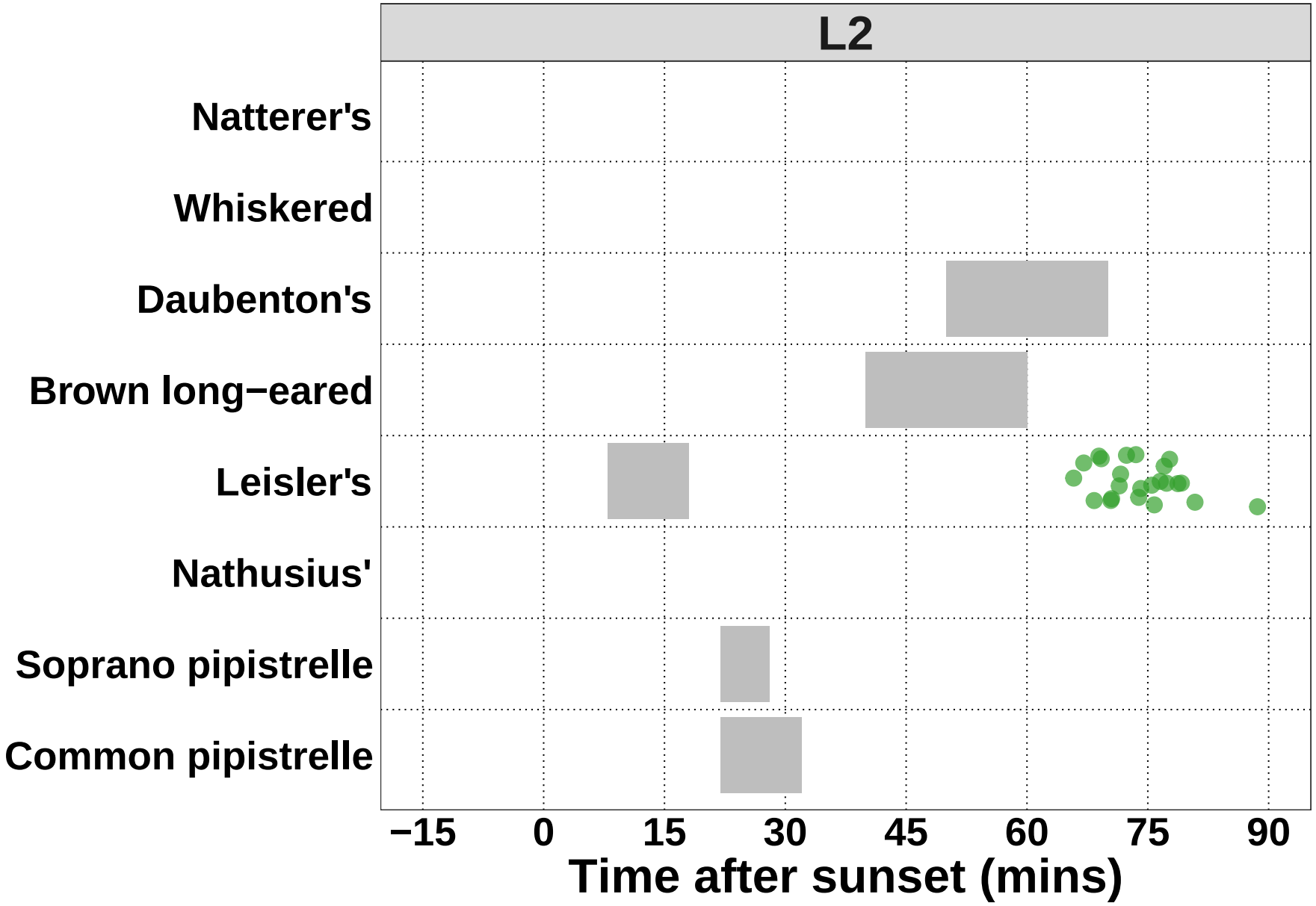
Bat Passes Potentially Indicating Close Proximity to a Roost (Russ 2012)

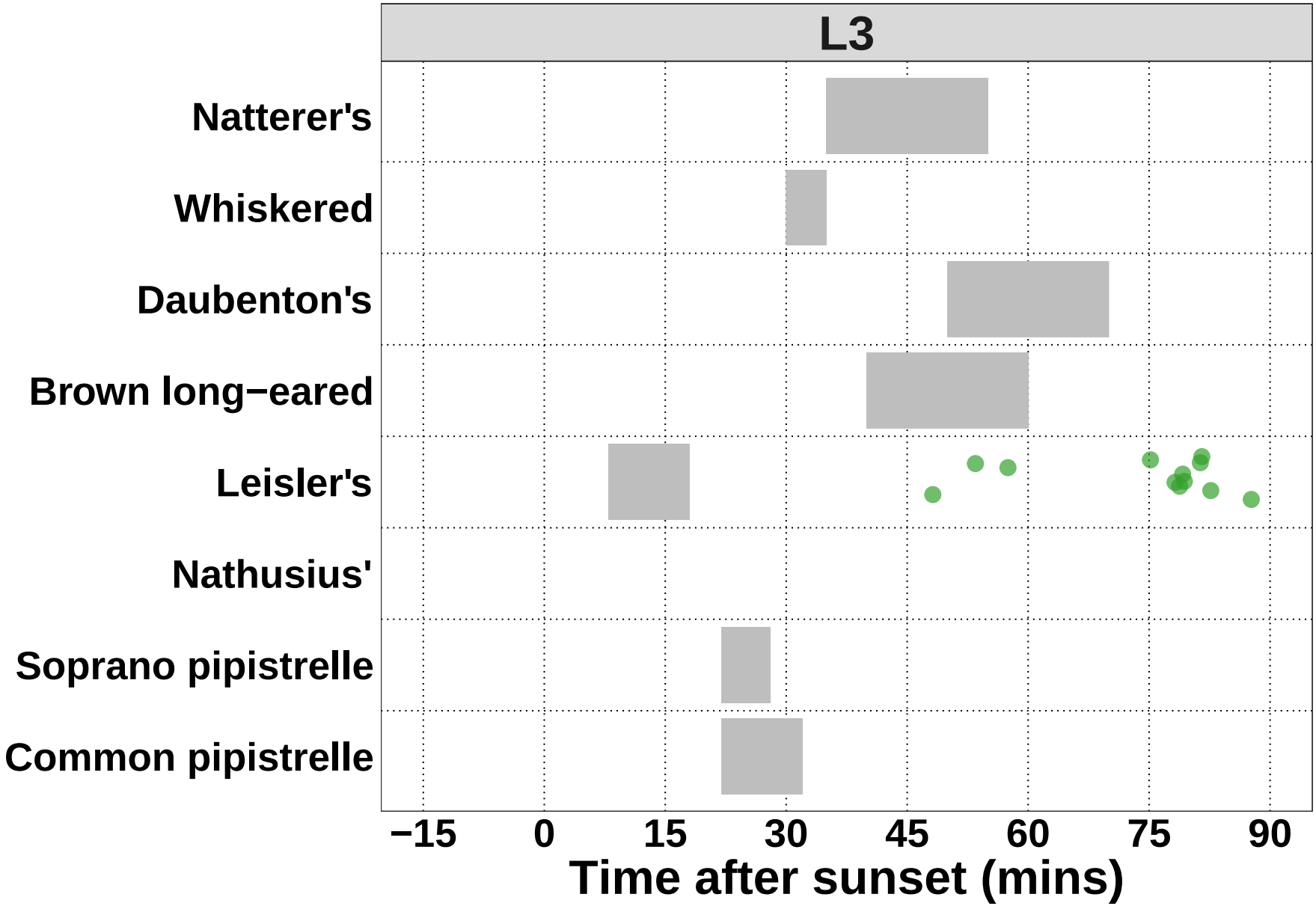
Figure 8. Time from 15 minutes before to 90 minutes after sunset. Species-specific emergence time ranges are shown as grey bars. Bat passes overlapping species-specific grey bars, or occuring earlier than this time range, may potentially indicate the presence of a nearby roost.

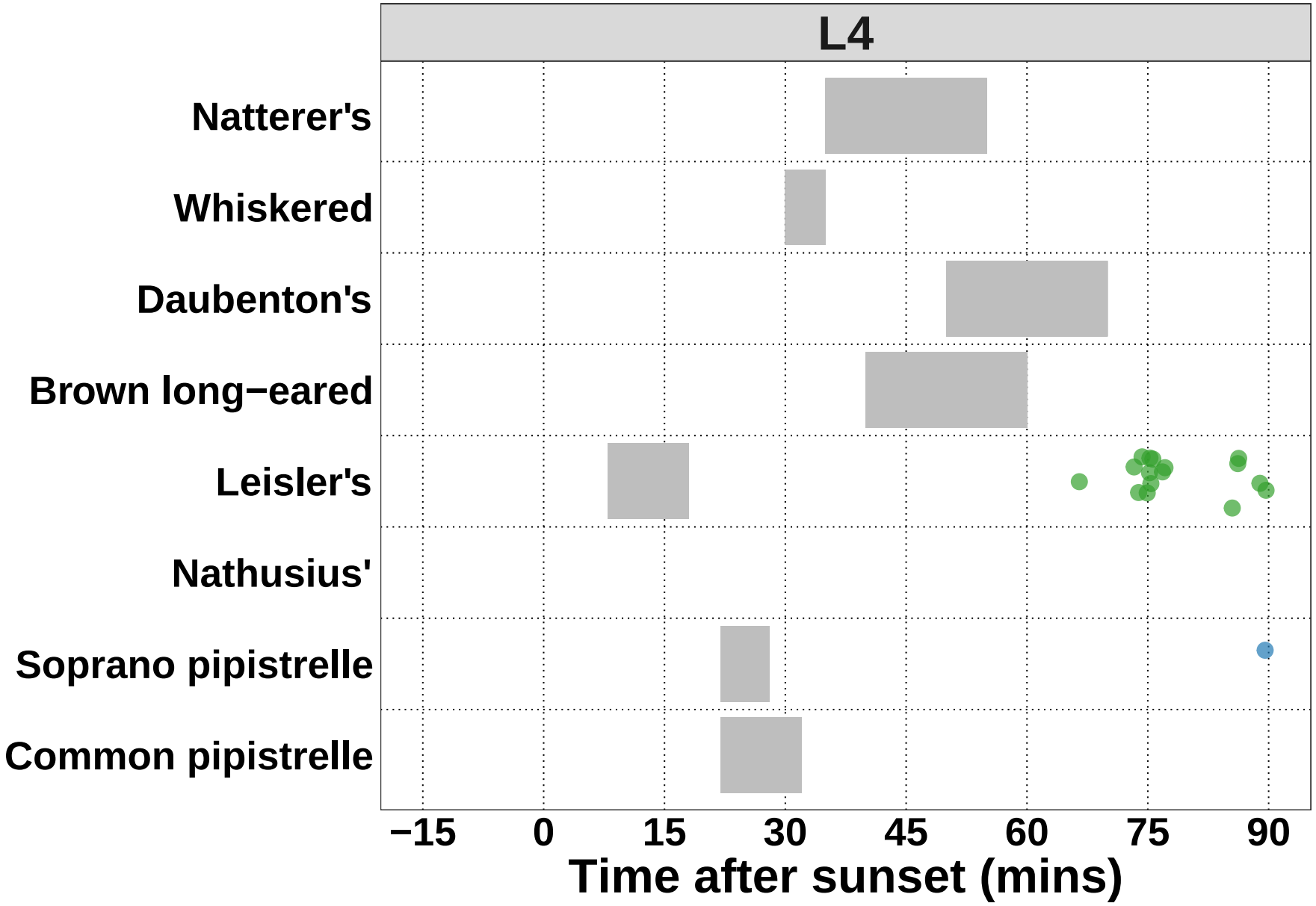

L1
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

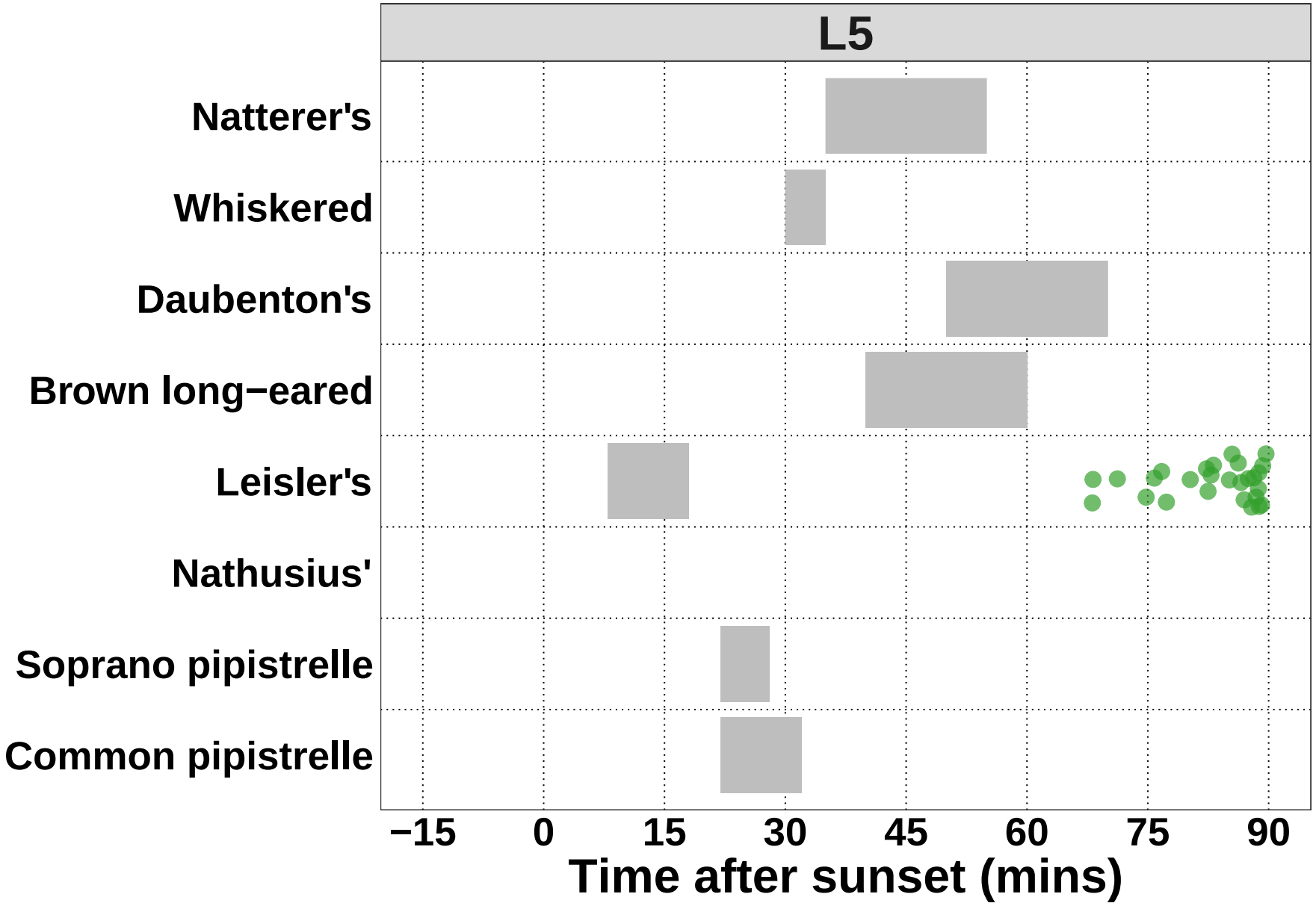

L10
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

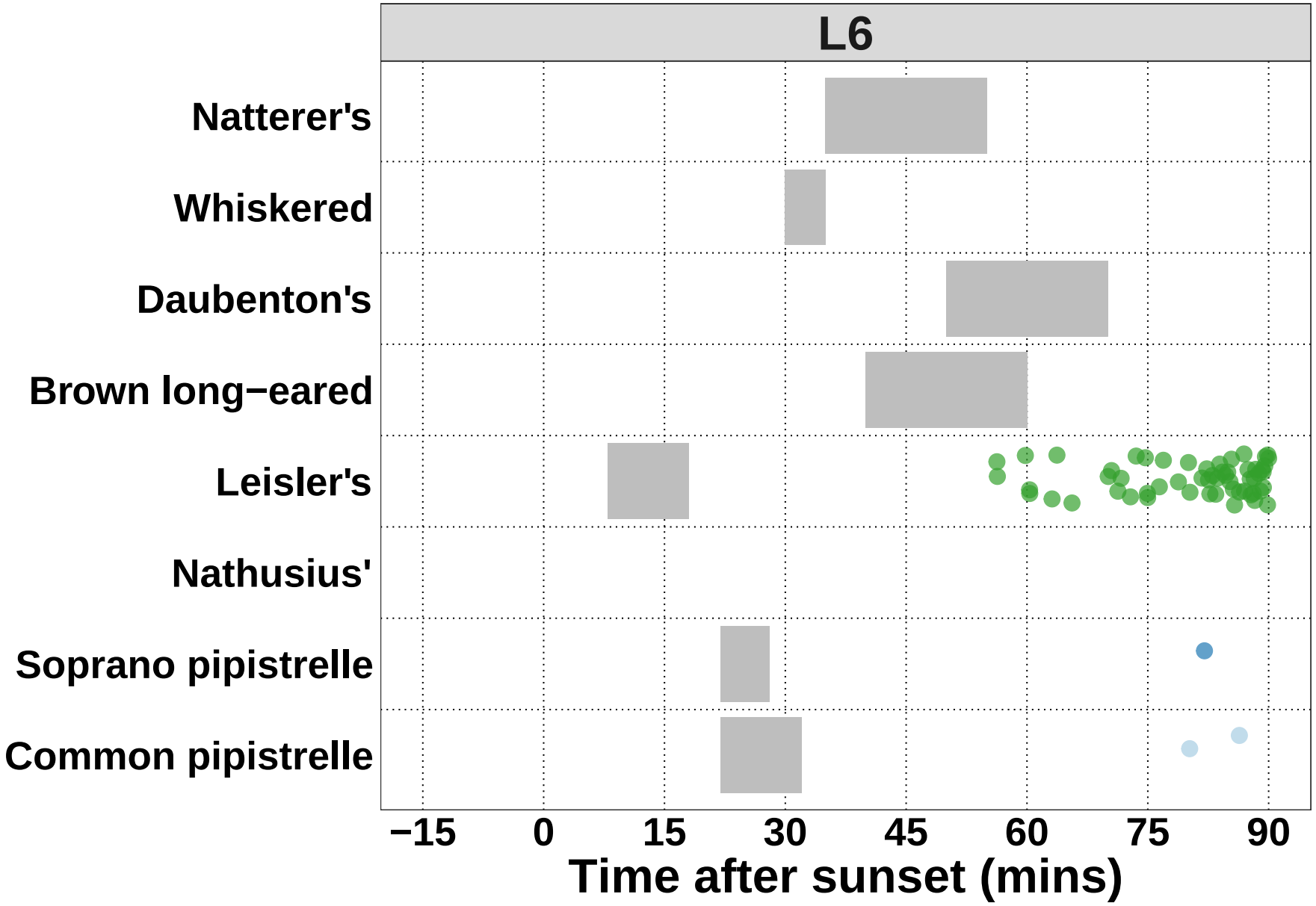

L11
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

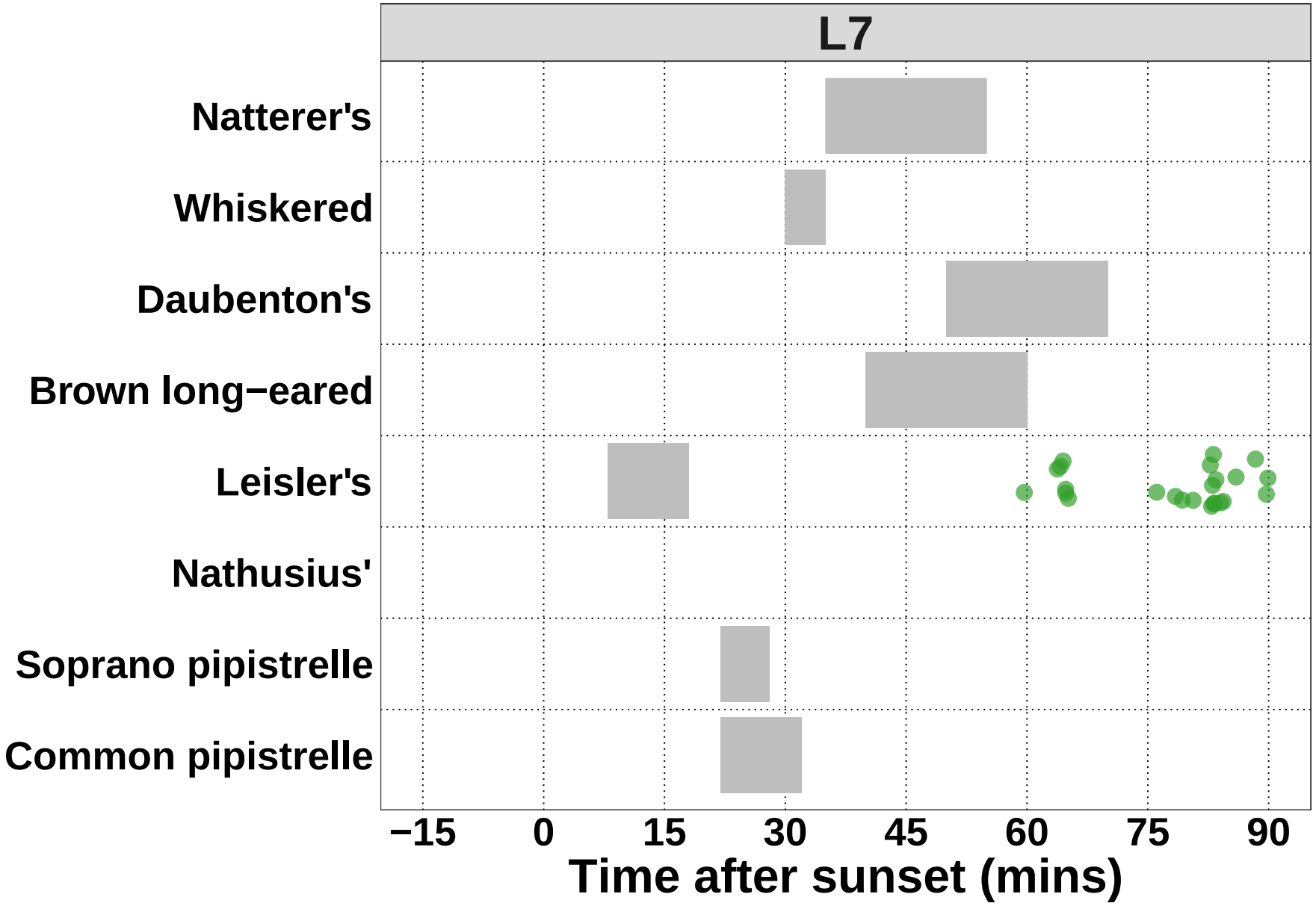

L2
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

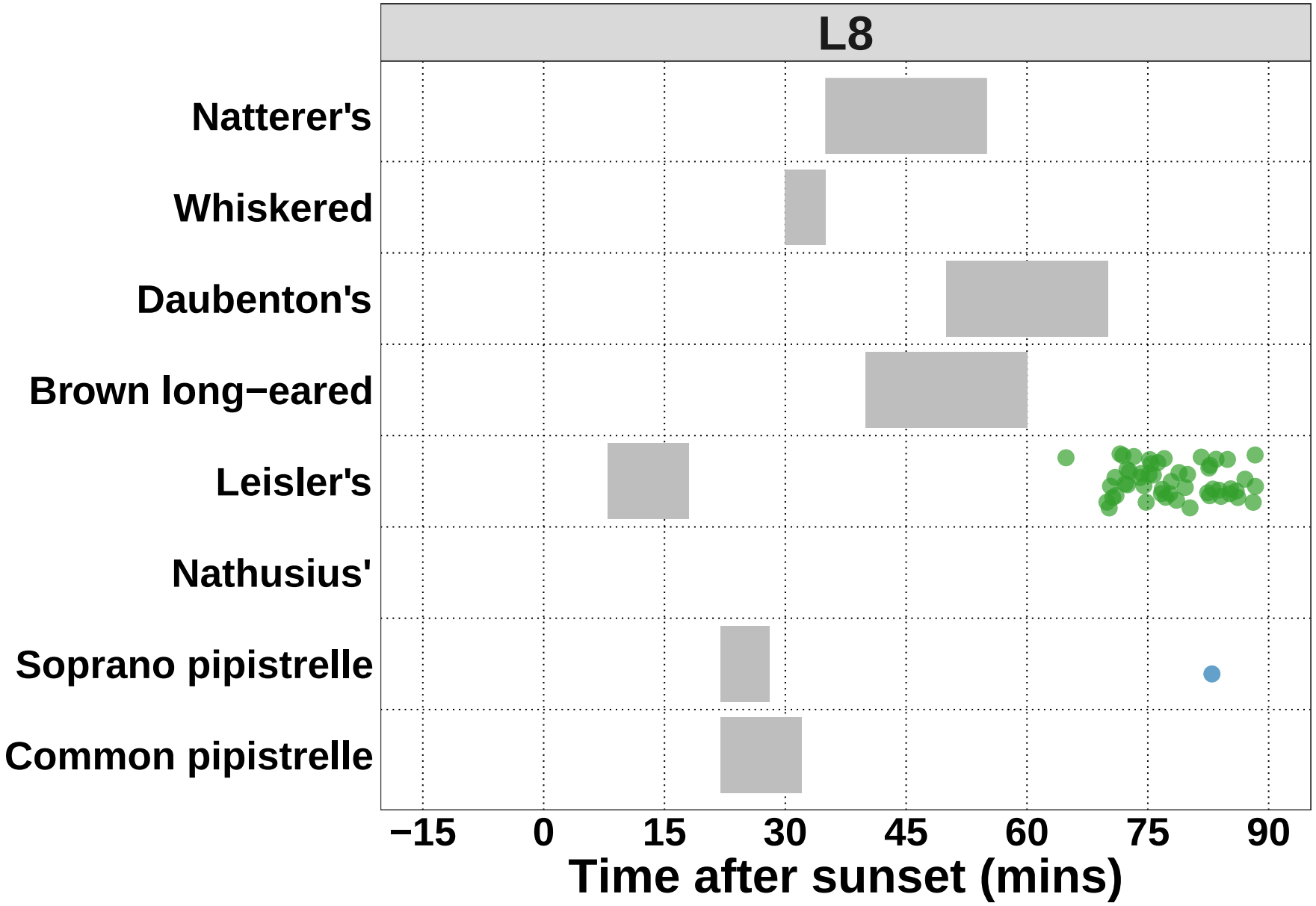

L3
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

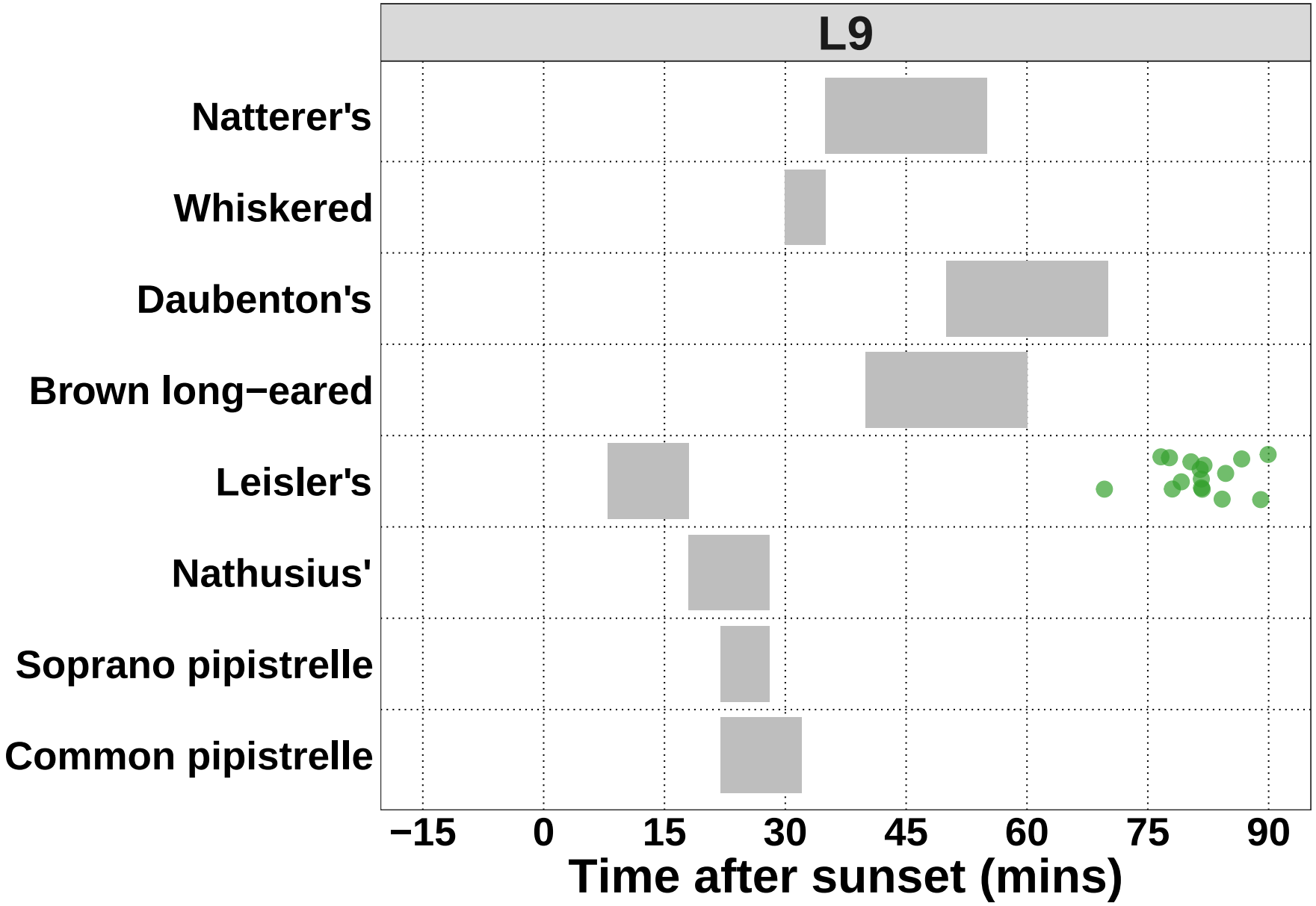

L4
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)


L5
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)


L6
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)


L7
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)

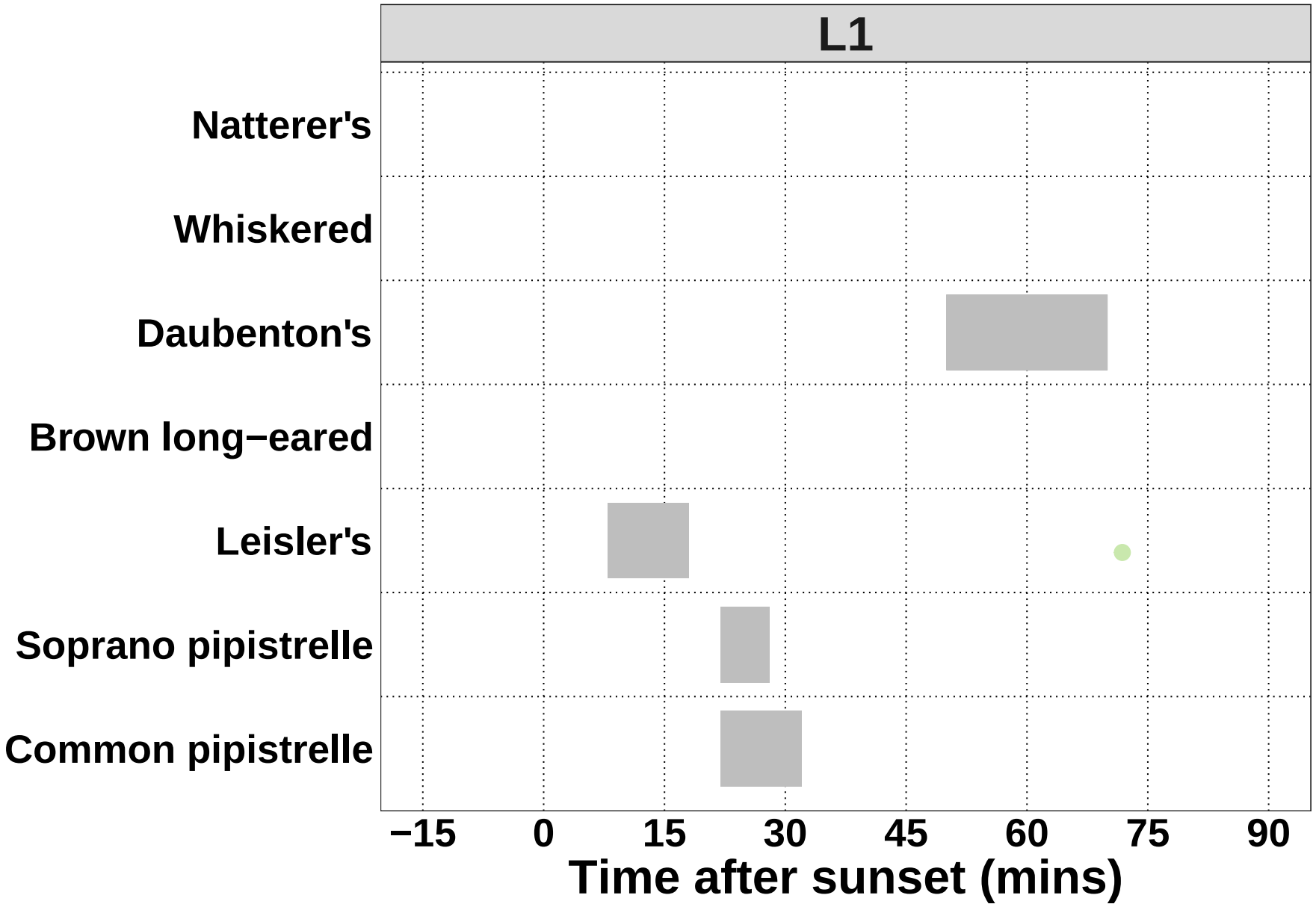

L8
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

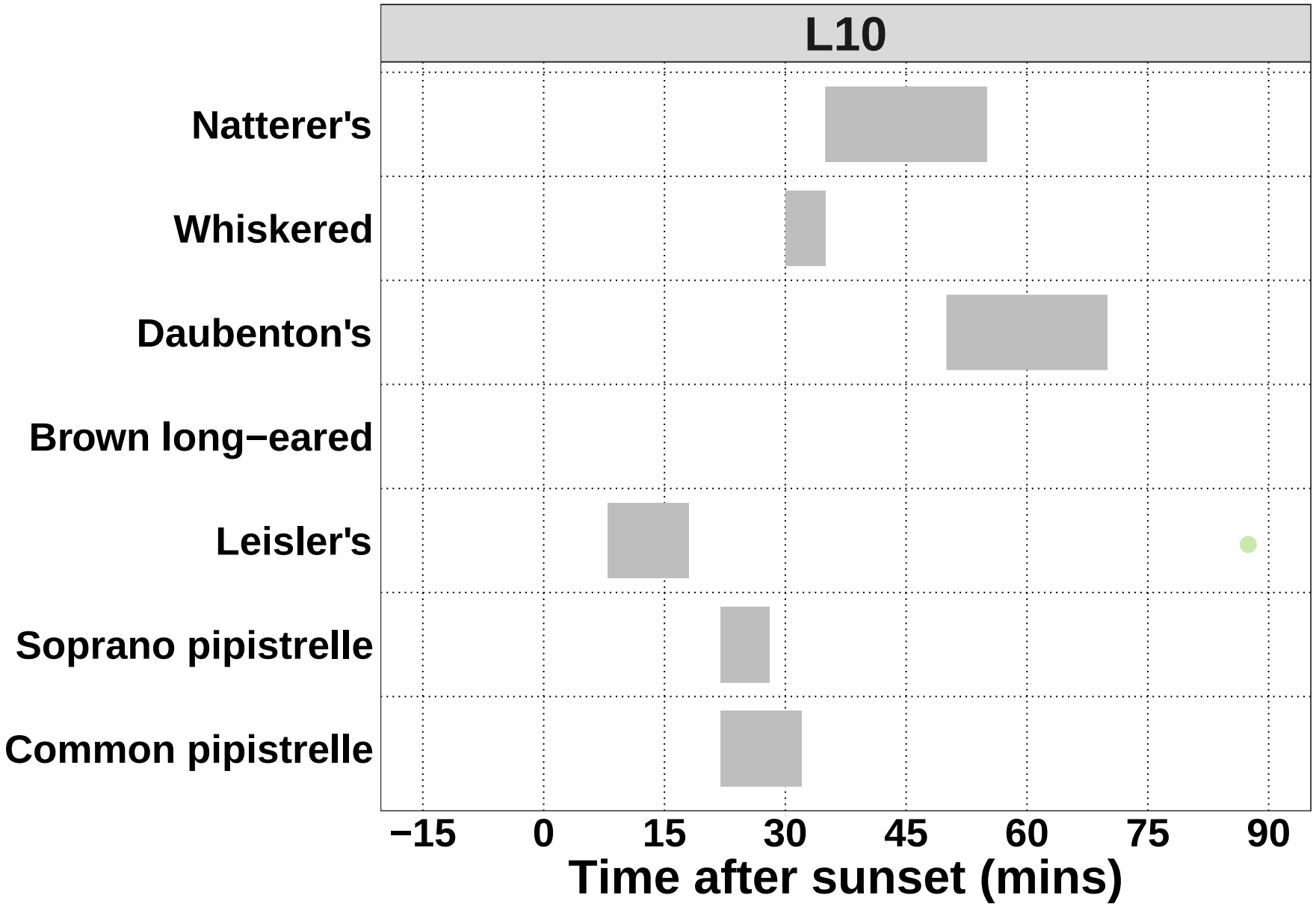

L9
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

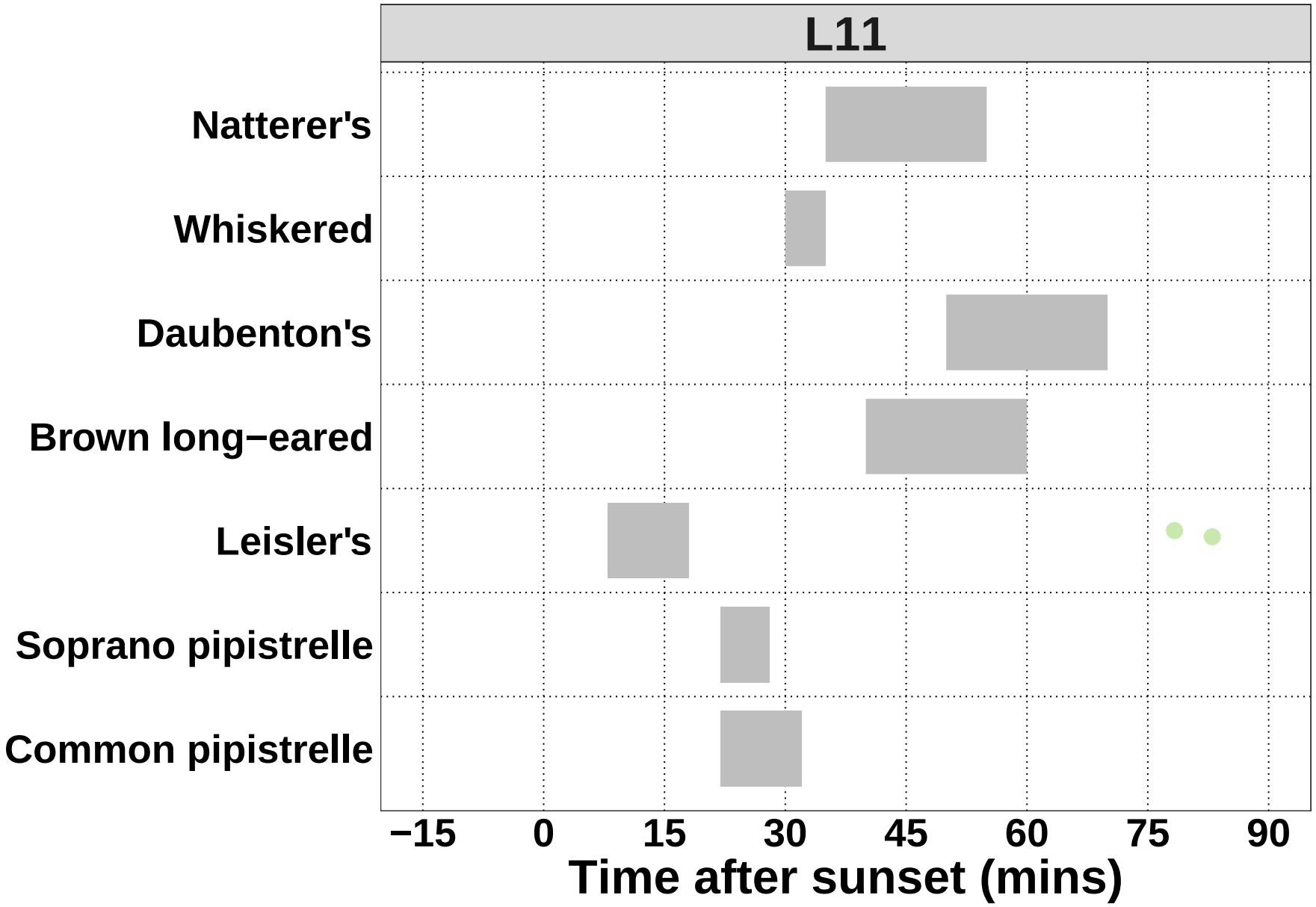
Bat Passes Potentially Indicating Close Proximity to a Roost (Maternity Period Only) - *Maternity period defined as 15th June - 30th July.

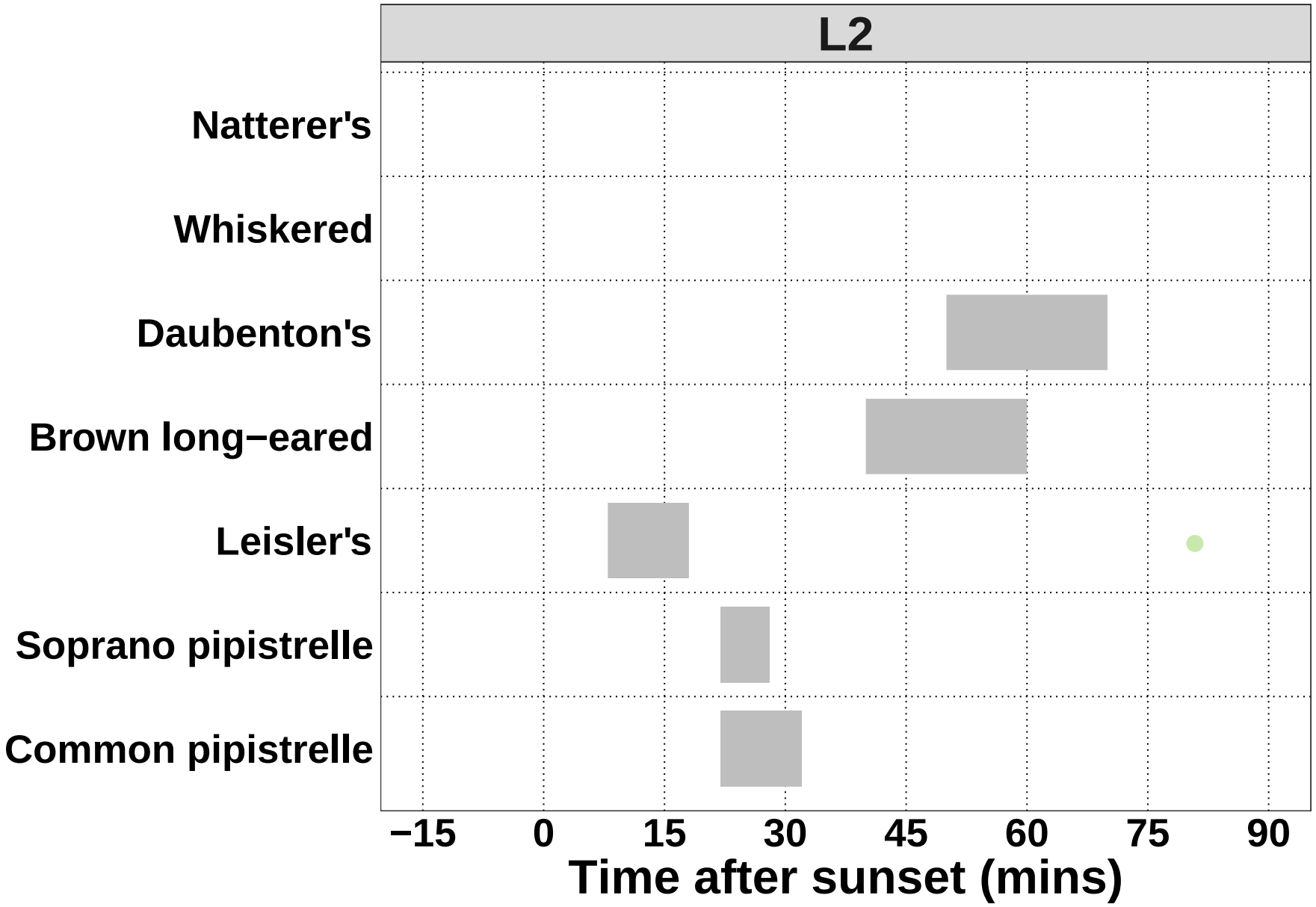
Species	Detector ID

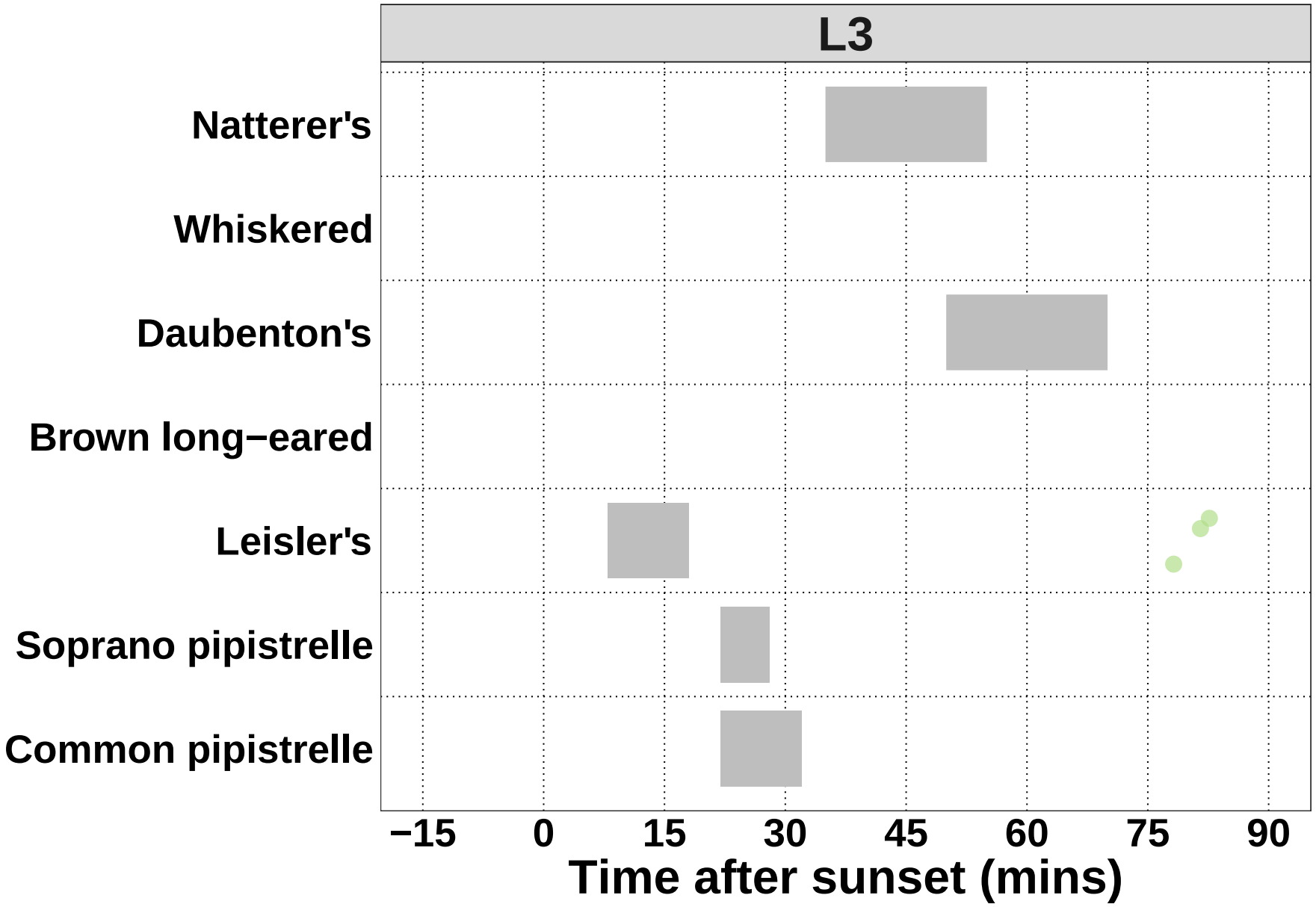
Bat Passes Potentially Indicating Close Proximity to a Roost (Maternity Period Only) - Maternity period defined as 15th June - 30th July.

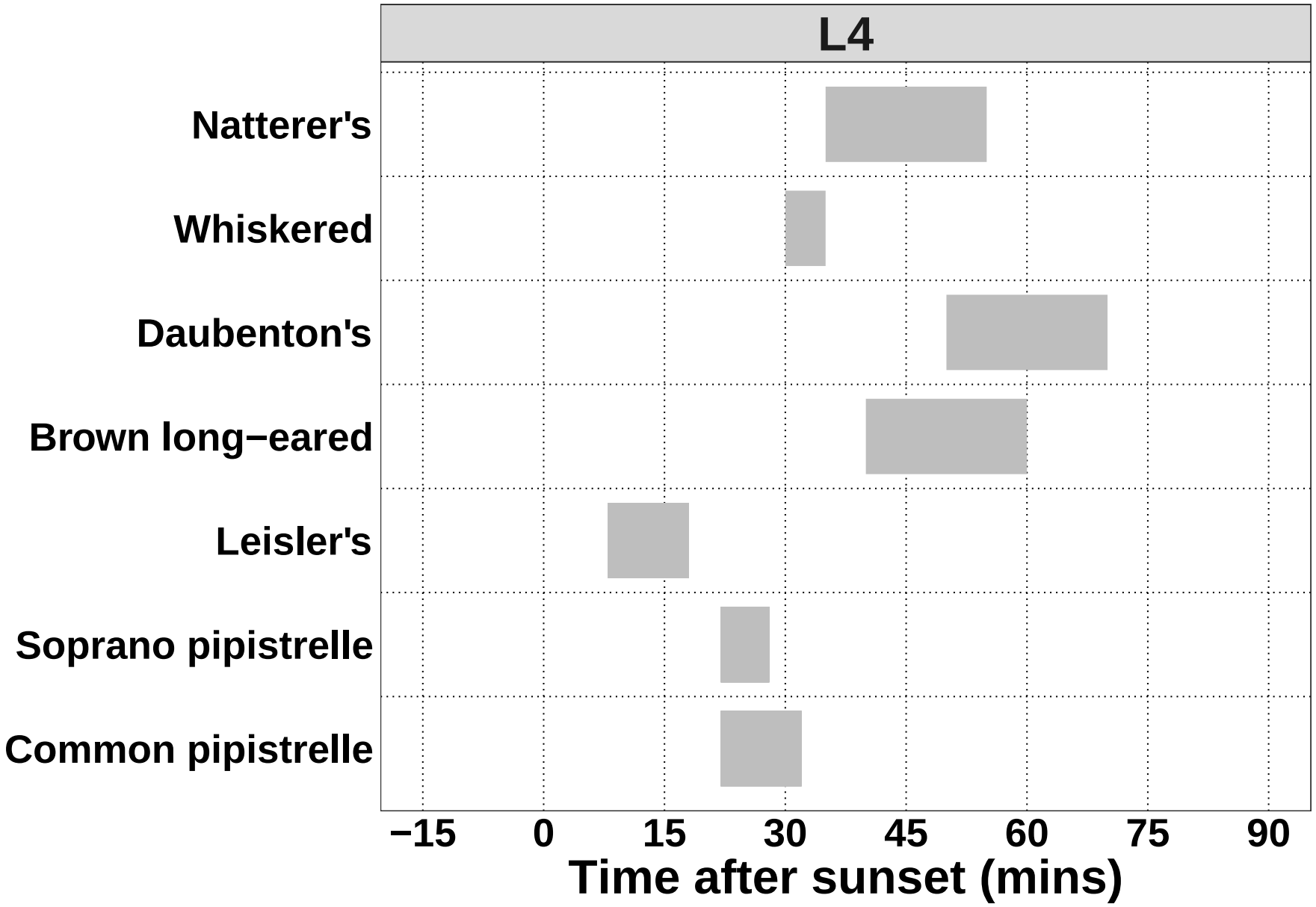

L1
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

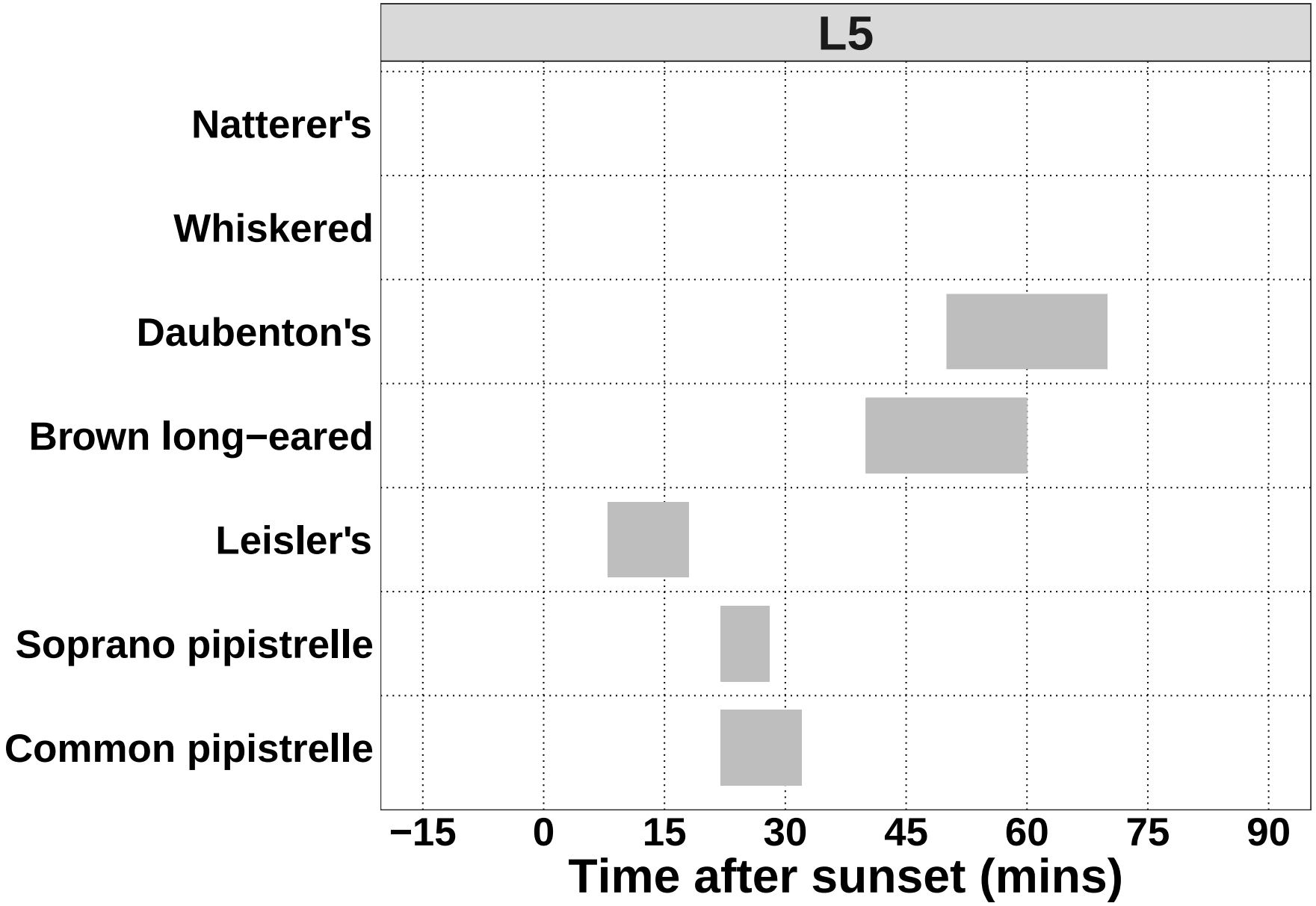

L10
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

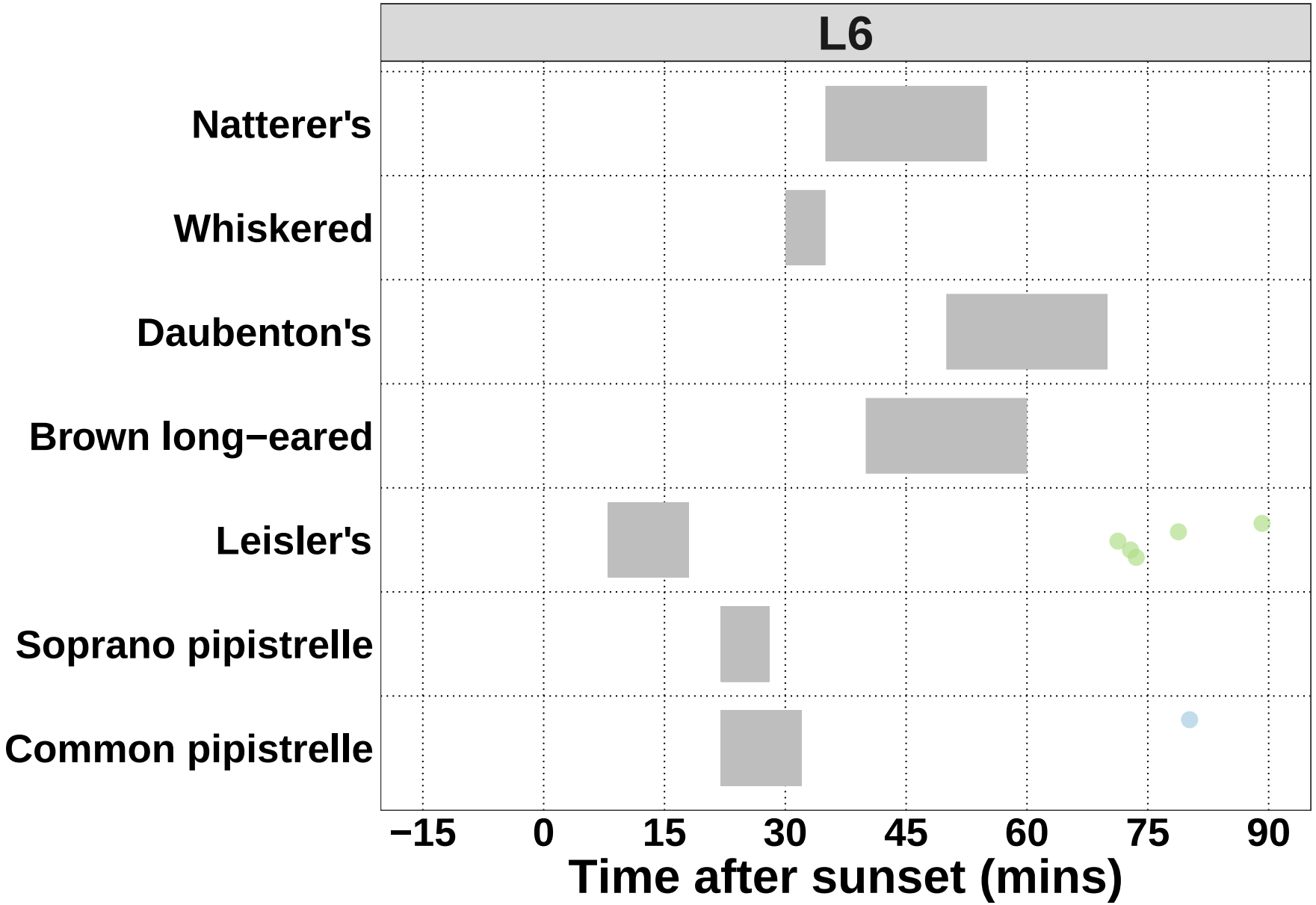

L11
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

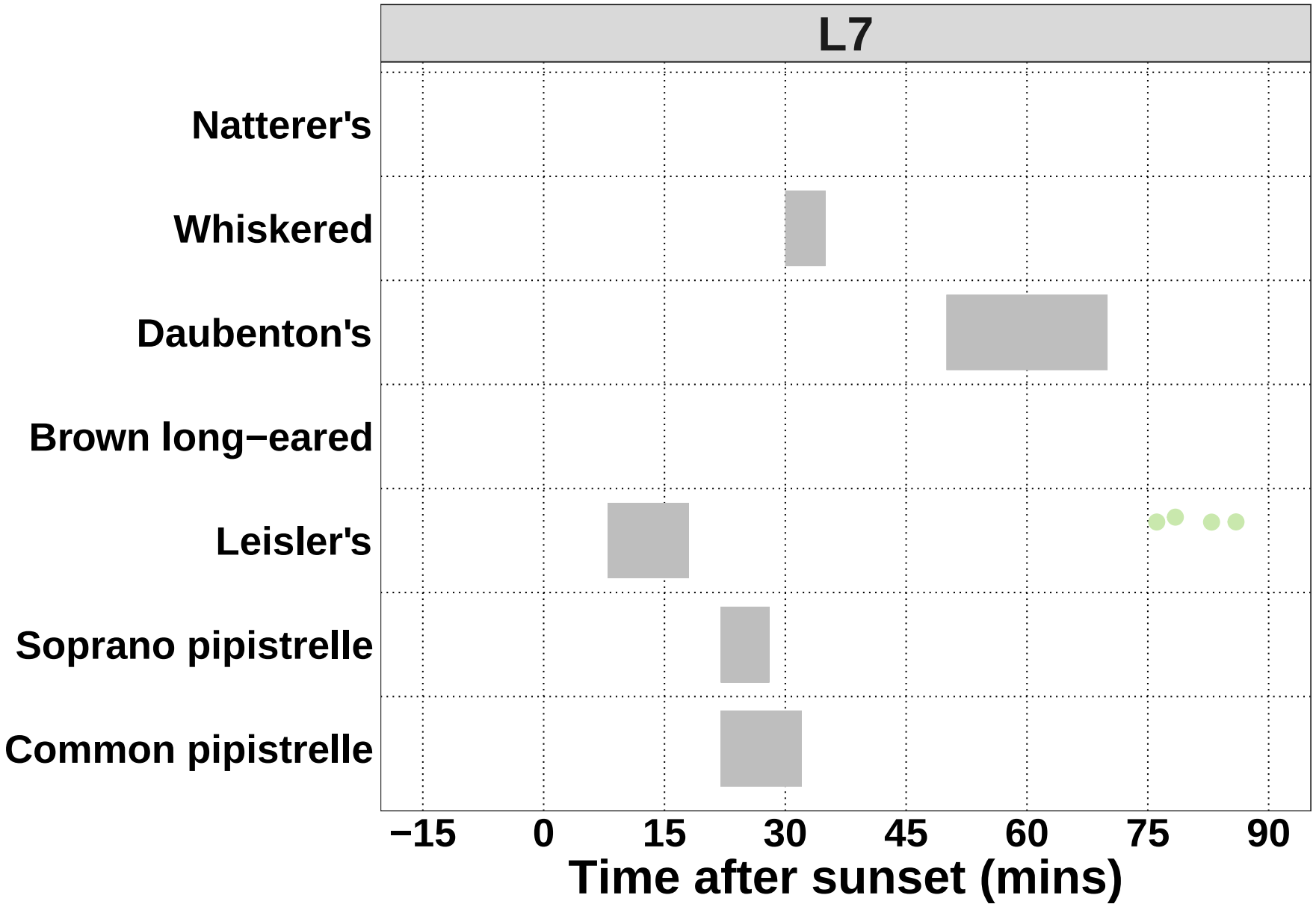

L2
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

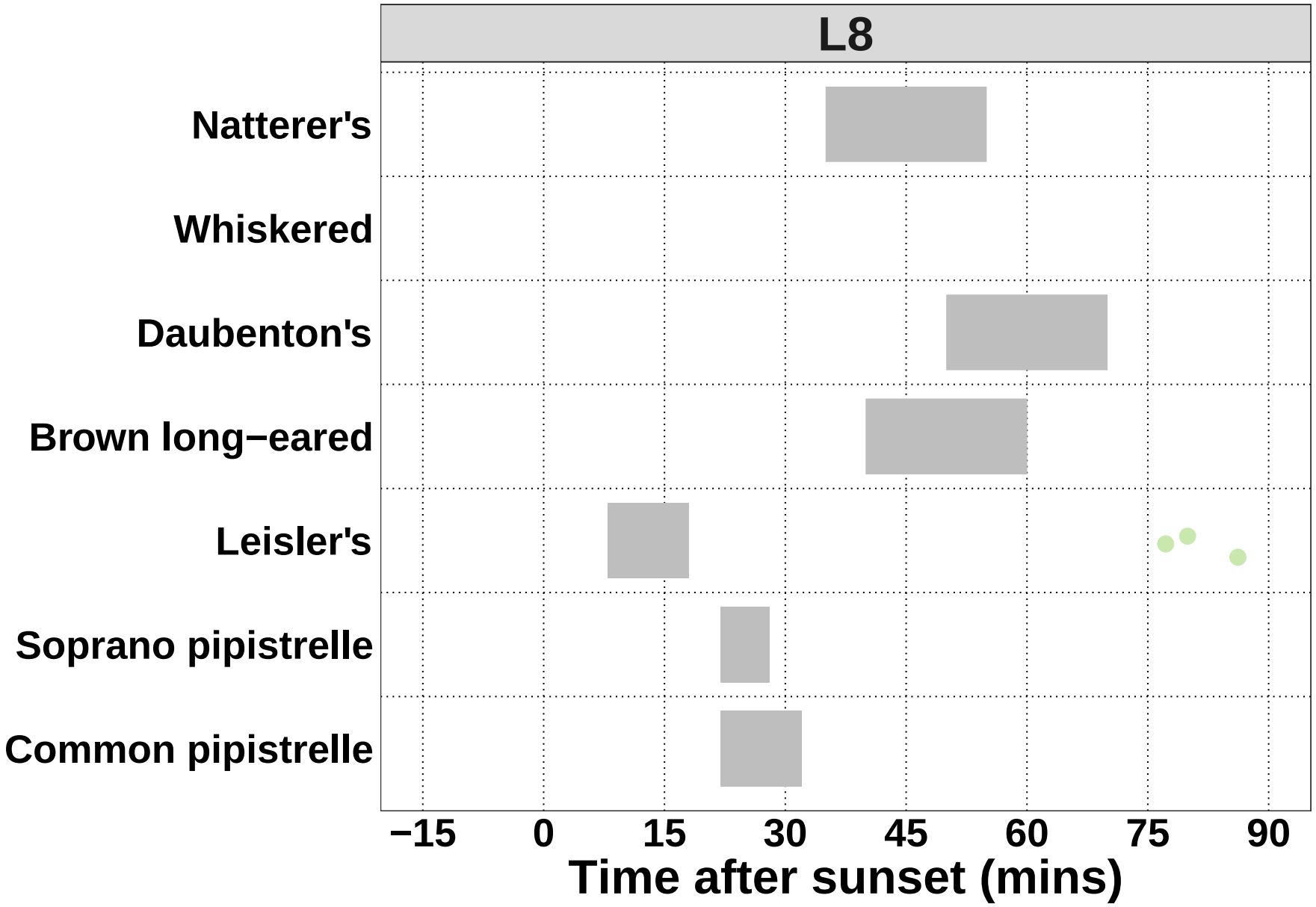

L3
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

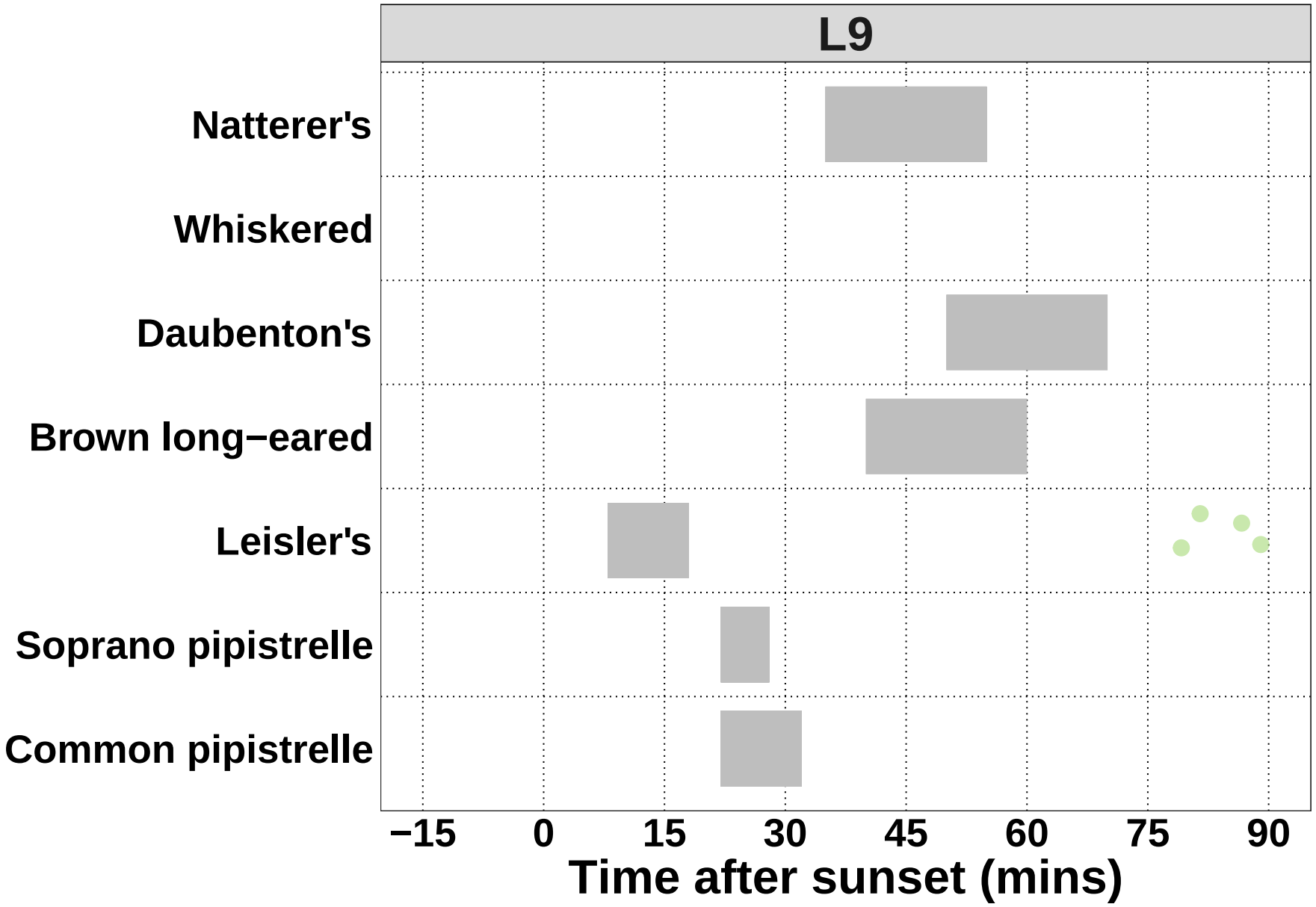

L4
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)


L5
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)


L6
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)


L7
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)


L8
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)


L9
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

Count 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 (%)
Myotis daubentonii	457	2.9
Myotis mystacinus	235	1.5
Myotis nattereri	316	2.0
Nyctalus leisleri	2623	16.8
Pipistrellus nathusii	6	0.0
Pipistrellus pipistrellus	4633	29.7
Pipistrellus pygmaeus	6839	43.9
Plecotus auritus	477	3.1
Total	15586	99.9

Per Detector

The number of passes recorded for each species at each detector.

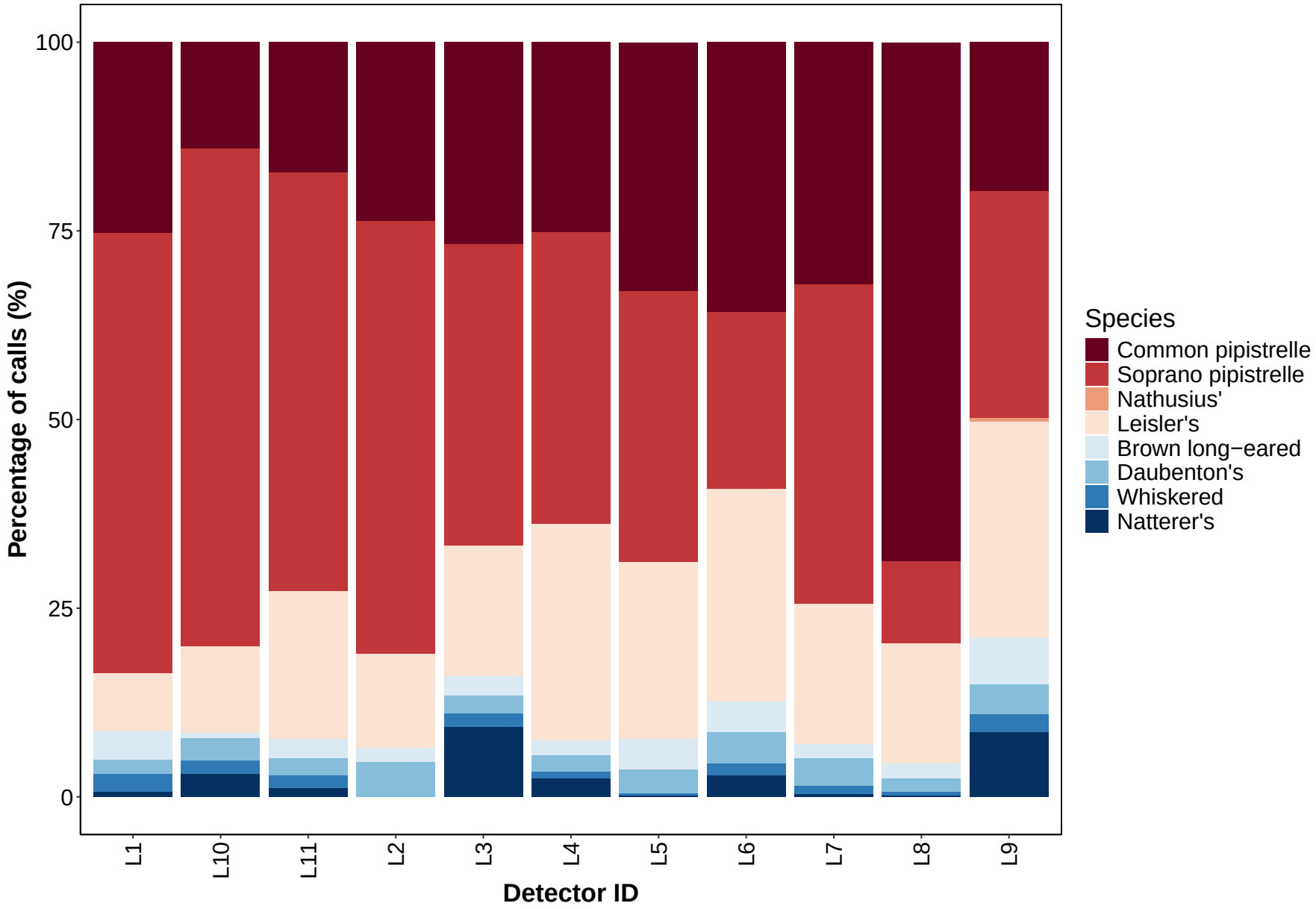
Species	Detector ID	Count (no.)	Percentage by Detector (%)
Common pipistrelle	L1	724	26.0244428
Common pipistrelle	L10	298	13.9971818
Common pipistrelle	L11	331	17.6533333
Common pipistrelle	L2	224	23.1644261
Common pipistrelle	L3	147	29.6370968
Common pipistrelle	L4	224	27.9650437
Common pipistrelle	L5	330	33.3333333
Common pipistrelle	L6	466	34.4674556
Common pipistrelle	L7	302	31.2953368
Common pipistrelle	L8	1367	65.2505967
Common pipistrelle	L9	220	19.4003527
Soprano pipistrelle	L1	1598	57.4406902
Soprano pipistrelle	L10	1425	66.9328323
Soprano pipistrelle	L11	1049	55.9466667
Soprano pipistrelle	L2	548	56.6701138
Soprano pipistrelle	L3	198	39.9193548
Soprano pipistrelle	L4	305	38.0774032
Soprano pipistrelle	L5	351	35.4545455
Soprano pipistrelle	L6	330	24.4082840
Soprano pipistrelle	L7	424	43.9378238
Soprano pipistrelle	L8	269	12.8400955
Soprano pipistrelle	L9	342	30.1587302
Nathusius'	L9	6	0.5291005
Leisler's	L1	221	7.9439252
Leisler's	L10	228	10.7092532
Leisler's	L11	341	18.1866667
Leisler's	L2	128	13.2368149
Leisler's	L3	89	17.9435484
Leisler's	L4	194	24.2197253
Leisler's	L5	231	23.3333333
Leisler's	L6	367	27.1449704
Leisler's	L7	166	17.2020725

Species	Detector ID	Count (no.)	Percentage by Detector (%)
Leisler's	L8	345	16.4677804
Leisler's	L9	313	27.6014109
Brown long-eared	L1	112	4.0258807
Brown long-eared	L10	17	0.7984969
Brown long-eared	L11	46	2.4533333
Brown long-eared	L2	20	2.0682523
Brown long-eared	L3	10	2.0161290
Brown long-eared	L4	23	2.8714107
Brown long-eared	L5	43	4.3434343
Brown long-eared	L6	63	4.6597633
Brown long-eared	L7	18	1.8652850
Brown long-eared	L8	51	2.4343675
Brown long-eared	L9	74	6.5255732
Daubenton's	L1	51	1.8332135
Daubenton's	L10	59	2.7712541
Daubenton's	L11	50	2.6666667
Daubenton's	L2	47	4.8603930
Daubenton's	L3	13	2.6209677
Daubenton's	L4	25	3.1210986
Daubenton's	L5	30	3.0303030
Daubenton's	L6	54	3.9940828
Daubenton's	L7	38	3.9378238
Daubenton's	L8	47	2.2434368
Daubenton's	L9	43	3.7918871
Whiskered	L1	58	2.0848311
Whiskered	L10	41	1.9257868
Whiskered	L11	35	1.8666667
Whiskered	L3	8	1.6129032
Whiskered	L4	11	1.3732834
Whiskered	L5	3	0.3030303
Whiskered	L6	25	1.8491124
Whiskered	L7	13	1.3471503
Whiskered	L8	11	0.5250597
Whiskered	L9	30	2.6455026
Natterer's	L1	18	0.6470165
Natterer's	L10	61	2.8651949

Species	Detector ID	Count (no.)	Percentage by Detector (%)
Natterer's	L11	23	1.2266667
Natterer's	L3	31	6.2500000
Natterer's	L4	19	2.3720350
Natterer's	L5	2	0.2020202
Natterer's	L6	47	3.4763314
Natterer's	L7	4	0.4145078
Natterer's	L8	5	0.2386635
Natterer's	L9	106	9.3474427

Species Composition

Figure 10. Percentage species composition of passes at each detector.


100
75
50
25
0
Percentage of calls (%)
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID
Species
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Brown long−eared
Daubenton's
Whiskered
Natterer's

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.

Nighlty 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	L1	3.9
Common pipistrelle	L10	1.2
Common pipistrelle	L11	2.2
Common pipistrelle	L2	1.4
Common pipistrelle	L3	1.3
Common pipistrelle	L4	1.0
Common pipistrelle	L5	1.9
Common pipistrelle	L6	2.7
Common pipistrelle	L7	1.9
Common pipistrelle	L8	5.1
Common pipistrelle	L9	1.0
Soprano pipistrelle	L1	7.7
Soprano pipistrelle	L10	7.2
Soprano pipistrelle	L11	4.4
Soprano pipistrelle	L2	3.1
Soprano pipistrelle	L3	2.2
Soprano pipistrelle	L4	1.7
Soprano pipistrelle	L5	1.7
Soprano pipistrelle	L6	1.8
Soprano pipistrelle	L7	2.2
Soprano pipistrelle	L8	1.2
Soprano pipistrelle	L9	1.9
Nathusius'	L9	0.1
Leisler's	L1	1.1
Leisler's	L10	1.2
Leisler's	L11	1.4
Leisler's	L2	0.5
Leisler's	L3	0.7
Leisler's	L4	1.1
Leisler's	L5	1.0
Leisler's	L6	1.2
Leisler's	L7	0.7
Leisler's	L8	1.7
Leisler's	L9	1.7
Brown long-eared	L1	0.4
Brown long-eared	L10	0.2

Species	Detector ID	Median Pass Rate
Brown long-eared	L11	0.3
Brown long-eared	L2	0.2
Brown long-eared	L3	0.2
Brown long-eared	L4	0.2
Brown long-eared	L5	0.2
Brown long-eared	L6	0.4
Brown long-eared	L7	0.3
Brown long-eared	L8	0.3
Brown long-eared	L9	0.5
Daubenton's	L1	0.4
Daubenton's	L10	0.5
Daubenton's	L11	0.4
Daubenton's	L2	0.4
Daubenton's	L3	0.2
Daubenton's	L4	0.1
Daubenton's	L5	0.2
Daubenton's	L6	0.3
Daubenton's	L7	0.2
Daubenton's	L8	0.3
Daubenton's	L9	0.3
Whiskered	L1	0.3
Whiskered	L10	0.2
Whiskered	L11	0.2
Whiskered	L3	0.3
Whiskered	L4	0.1
Whiskered	L5	0.1
Whiskered	L6	0.3
Whiskered	L7	0.1
Whiskered	L8	0.1
Whiskered	L9	0.2
Natterer's	L1	0.2
Natterer's	L10	0.3
Natterer's	L11	0.2
Natterer's	L3	0.3
Natterer's	L4	0.2
Natterer's	L5	0.1

Species	Detector ID	Median Pass Rate
Natterer's	L6	0.3
Natterer's	L7	0.1
Natterer's	L8	0.1
Natterer's	L9	0.9

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.

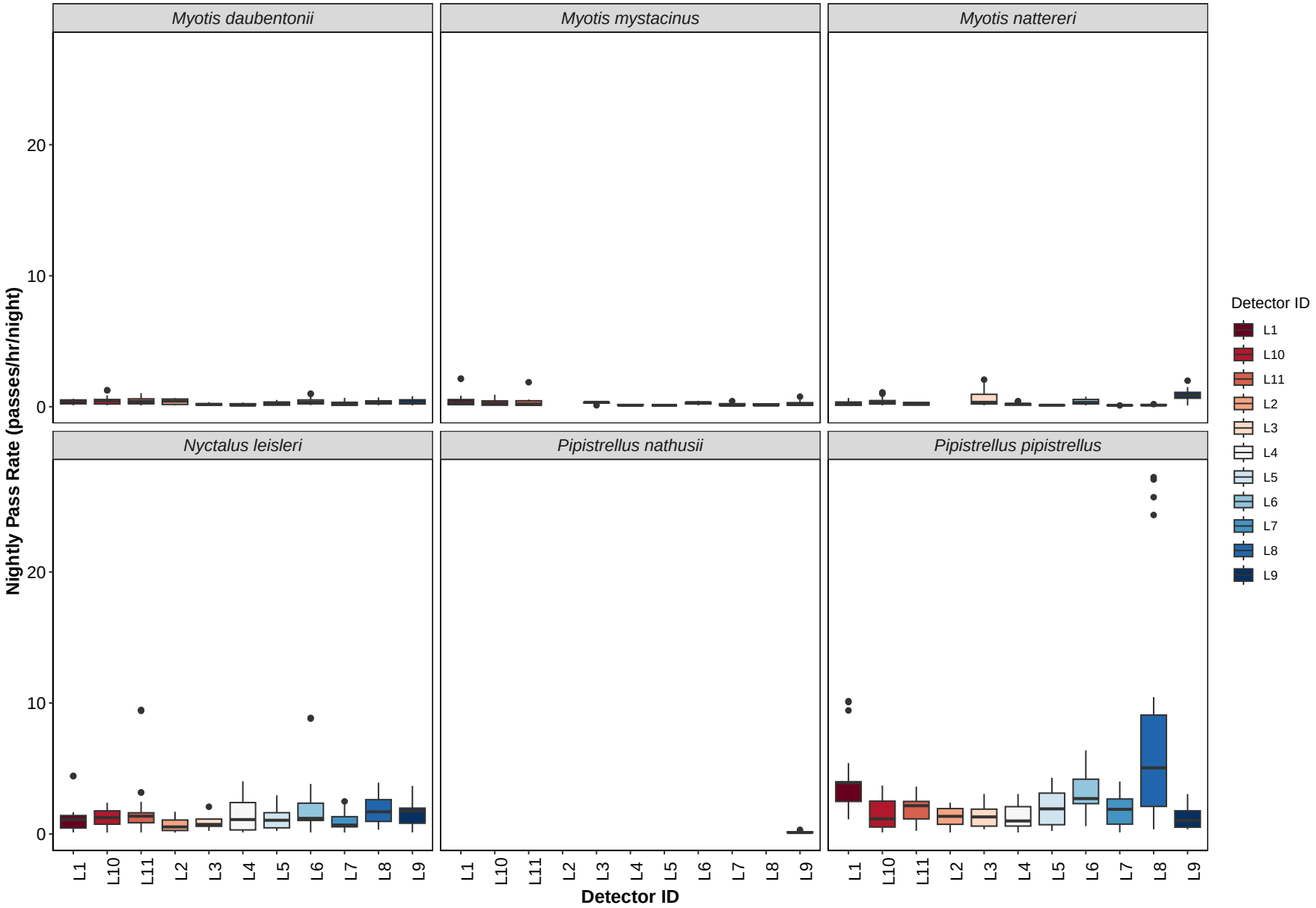
Species	Detector ID	Mean Pass Rate
Common pipistrelle	L1	4.2
Common pipistrelle	L10	1.6
Common pipistrelle	L11	2.0
Common pipistrelle	L2	1.4
Common pipistrelle	L3	1.4
Common pipistrelle	L4	1.3
Common pipistrelle	L5	1.9
Common pipistrelle	L6	3.1
Common pipistrelle	L7	1.8
Common pipistrelle	L8	8.6
Common pipistrelle	L9	1.2
Soprano pipistrelle	L1	8.0
Soprano pipistrelle	L10	7.0
Soprano pipistrelle	L11	5.9
Soprano pipistrelle	L2	3.2
Soprano pipistrelle	L3	2.0
Soprano pipistrelle	L4	2.0
Soprano pipistrelle	L5	2.0
Soprano pipistrelle	L6	2.0
Soprano pipistrelle	L7	2.4
Soprano pipistrelle	L8	1.4
Soprano pipistrelle	L9	1.7
Nathusius'	L9	0.2
Leisler's	L1	1.3
Leisler's	L10	1.3
Leisler's	L11	2.0
Leisler's	L2	0.7
Leisler's	L3	0.9
Leisler's	L4	1.4
Leisler's	L5	1.2

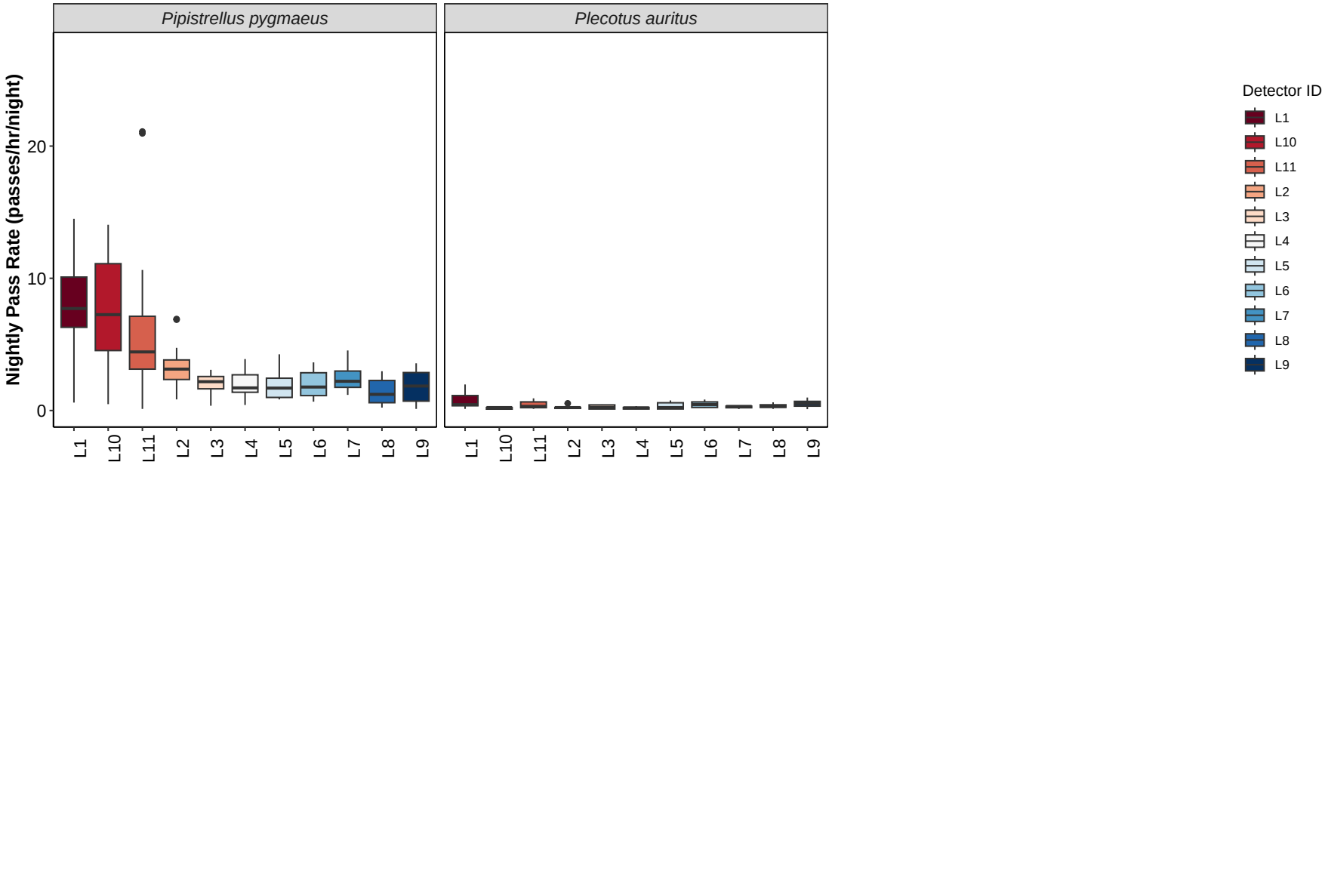
Species	Detector ID	Mean Pass Rate
Leisler's	L6	2.0
Leisler's	L7	1.0
Leisler's	L8	1.9
Leisler's	L9	1.6
Brown long-eared	L1	0.8
Brown long-eared	L10	0.2
Brown long-eared	L11	0.4
Brown long-eared	L2	0.2
Brown long-eared	L3	0.3
Brown long-eared	L4	0.2
Brown long-eared	L5	0.3
Brown long-eared	L6	0.5
Brown long-eared	L7	0.3
Brown long-eared	L8	0.3
Brown long-eared	L9	0.5
Daubenton's	L1	0.4
Daubenton's	L10	0.5
Daubenton's	L11	0.4
Daubenton's	L2	0.4
Daubenton's	L3	0.2
Daubenton's	L4	0.2
Daubenton's	L5	0.3
Daubenton's	L6	0.4
Daubenton's	L7	0.3
Daubenton's	L8	0.3
Daubenton's	L9	0.4
Whiskered	L1	0.6
Whiskered	L10	0.3
Whiskered	L11	0.4
Whiskered	L3	0.3
Whiskered	L4	0.1
Whiskered	L5	0.1
Whiskered	L6	0.3
Whiskered	L7	0.2
Whiskered	L8	0.2
Whiskered	L9	0.2

Species	Detector ID	Mean Pass Rate
Natterer's	L1	0.3
Natterer's	L10	0.4
Natterer's	L11	0.2
Natterer's	L3	0.7
Natterer's	L4	0.2
Natterer's	L5	0.1
Natterer's	L6	0.4
Natterer's	L7	0.1
Natterer's	L8	0.1
Natterer's	L9	1.0

Per Detector

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)
0
10
20
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID
Detector ID


Pipistrellus pygmaeus
Plecotus auritus
Nightly Pass Rate (passes/hr/night)
0
10
20
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9

Split by Month

Total Bat Passes per Detector each Month

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	L1	99	716
Common pipistrelle	L10	19	350
Common pipistrelle	L11	7	388
Common pipistrelle	L2	12	253
Common pipistrelle	L3	22	126
Common pipistrelle	L4	14	230
Common pipistrelle	L5	45	343
Common pipistrelle	L6	85	528
Common pipistrelle	L7	16	350
Common pipistrelle	L8	81	1663
Common pipistrelle	L9	16	241
Soprano pipistrelle	L1	141	1747
Soprano pipistrelle	L10	93	1632
Soprano pipistrelle	L11	43	1226
Soprano pipistrelle	L2	38	606
Soprano pipistrelle	L3	49	171
Soprano pipistrelle	L4	19	355
Soprano pipistrelle	L5	42	380
Soprano pipistrelle	L6	18	385
Soprano pipistrelle	L7	40	443
Soprano pipistrelle	L8	17	259
Soprano pipistrelle	L9	22	369
Nathusius'	L9	0	6
Leisler's	L1	9	238
Leisler's	L10	39	259
Leisler's	L11	18	430
Leisler's	L2	6	133
Leisler's	L3	30	66
Leisler's	L4	7	271
Leisler's	L5	42	233
Leisler's	L6	27	455
Leisler's	L7	23	189
Leisler's	L8	97	305
Leisler's	L9	47	326
Brown long-eared	L1	3	121
Brown long-eared	L10	0	19

Species	Detector ID	Jul	Aug
Brown long-eared	L11	1	57
Brown long-eared	L2	4	18
Brown long-eared	L3	0	14
Brown long-eared	L4	1	18
Brown long-eared	L5	4	43
Brown long-eared	L6	2	69
Brown long-eared	L7	0	21
Brown long-eared	L8	3	47
Brown long-eared	L9	6	74
Daubenton's	L1	6	54
Daubenton's	L10	1	76
Daubenton's	L11	2	52
Daubenton's	L2	2	49
Daubenton's	L3	1	12
Daubenton's	L4	2	19
Daubenton's	L5	3	35
Daubenton's	L6	2	68
Daubenton's	L7	3	39
Daubenton's	L8	6	40
Daubenton's	L9	3	49
Whiskered	L1	0	77
Whiskered	L10	3	43
Whiskered	L11	3	35
Whiskered	L3	0	10
Whiskered	L4	1	8
Whiskered	L5	0	3
Whiskered	L6	1	27
Whiskered	L7	2	10
Whiskered	L8	1	10
Whiskered	L9	1	30
Natterer's	L1	0	20
Natterer's	L10	8	72
Natterer's	L11	1	25
Natterer's	L3	3	48
Natterer's	L4	1	22
Natterer's	L5	0	2

Species	Detector ID	Jul	Aug
Natterer's	L6	2	46
Natterer's	L7	1	3
Natterer's	L8	1	4
Natterer's	L9	14	97

Survey Effort

Table 19. The number of survey nights per month per detector.

month	Detector ID	No. of Survey Nights
Jul	L1	5
Jul	L10	5
Jul	L11	5
Jul	L2	3
Jul	L3	5
Jul	L4	3
Jul	L5	5
Jul	L6	5
Jul	L7	4
Jul	L8	5
Jul	L9	5
Aug	L1	21
Aug	L10	22
Aug	L11	21
Aug	L2	19
Aug	L3	10
Aug	L4	19
Aug	L5	21
Aug	L6	21
Aug	L7	22
Aug	L8	20
Aug	L9	21

Nightly Bat Passes 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	L1	5.9	3.9
Common pipistrelle	L10	0.4	2.4
Common pipistrelle	L11	0.9	2.2
Common pipistrelle	L2	0.2	1.4
Common pipistrelle	L3	0.6	1.4
Common pipistrelle	L4	0.6	1.0
Common pipistrelle	L5	0.5	2.1
Common pipistrelle	L6	4.9	2.5
Common pipistrelle	L7	1.0	2.0
Common pipistrelle	L8	4.3	5.8
Common pipistrelle	L9	0.4	1.0
Soprano pipistrelle	L1	4.1	8.6
Soprano pipistrelle	L10	0.5	7.4
Soprano pipistrelle	L11	0.5	4.4
Soprano pipistrelle	L2	0.8	3.2
Soprano pipistrelle	L3	2.6	2.1
Soprano pipistrelle	L4	1.2	2.1
Soprano pipistrelle	L5	1.1	1.9
Soprano pipistrelle	L6	1.1	2.0
Soprano pipistrelle	L7	2.4	2.2
Soprano pipistrelle	L8	1.0	1.6
Soprano pipistrelle	L9	0.4	2.0
Nathusius'	L9	NA	0.1
Leisler's	L1	0.2	1.2
Leisler's	L10	0.7	1.2
Leisler's	L11	0.6	1.4
Leisler's	L2	0.2	0.7
Leisler's	L3	0.7	0.7
Leisler's	L4	0.1	1.5
Leisler's	L5	1.3	1.0
Leisler's	L6	0.5	1.4
Leisler's	L7	0.8	0.7
Leisler's	L8	1.8	1.7
Leisler's	L9	0.7	1.8
Brown long-eared	L1	0.4	0.6
Brown long-eared	L10	NA	0.2

Species	Detector ID	Jul	Aug
Brown long-eared	L11	0.1	0.3
Brown long-eared	L2	0.2	0.2
Brown long-eared	L3	NA	0.2
Brown long-eared	L4	0.1	0.2
Brown long-eared	L5	0.5	0.2
Brown long-eared	L6	0.2	0.4
Brown long-eared	L7	NA	0.3
Brown long-eared	L8	0.2	0.3
Brown long-eared	L9	0.4	0.5
Daubenton's	L1	0.4	0.4
Daubenton's	L10	0.1	0.5
Daubenton's	L11	0.2	0.4
Daubenton's	L2	0.1	0.5
Daubenton's	L3	0.1	0.2
Daubenton's	L4	0.1	0.1
Daubenton's	L5	0.2	0.2
Daubenton's	L6	0.1	0.4
Daubenton's	L7	0.2	0.2
Daubenton's	L8	0.1	0.4
Daubenton's	L9	0.4	0.2
Whiskered	L1	NA	0.3
Whiskered	L10	0.2	0.3
Whiskered	L11	0.4	0.2
Whiskered	L3	NA	0.3
Whiskered	L4	0.1	0.1
Whiskered	L5	NA	0.1
Whiskered	L6	0.1	0.3
Whiskered	L7	0.2	0.1
Whiskered	L8	0.1	0.1
Whiskered	L9	0.1	0.2
Natterer's	L1	NA	0.2
Natterer's	L10	0.2	0.3
Natterer's	L11	0.1	0.2
Natterer's	L3	0.2	0.5
Natterer's	L4	0.1	0.2
Natterer's	L5	NA	0.1

Species	Detector ID	Jul	Aug
Natterer's	L6	0.2	0.4
Natterer's	L7	0.1	0.1
Natterer's	L8	0.1	0.1
Natterer's	L9	0.9	0.9

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.

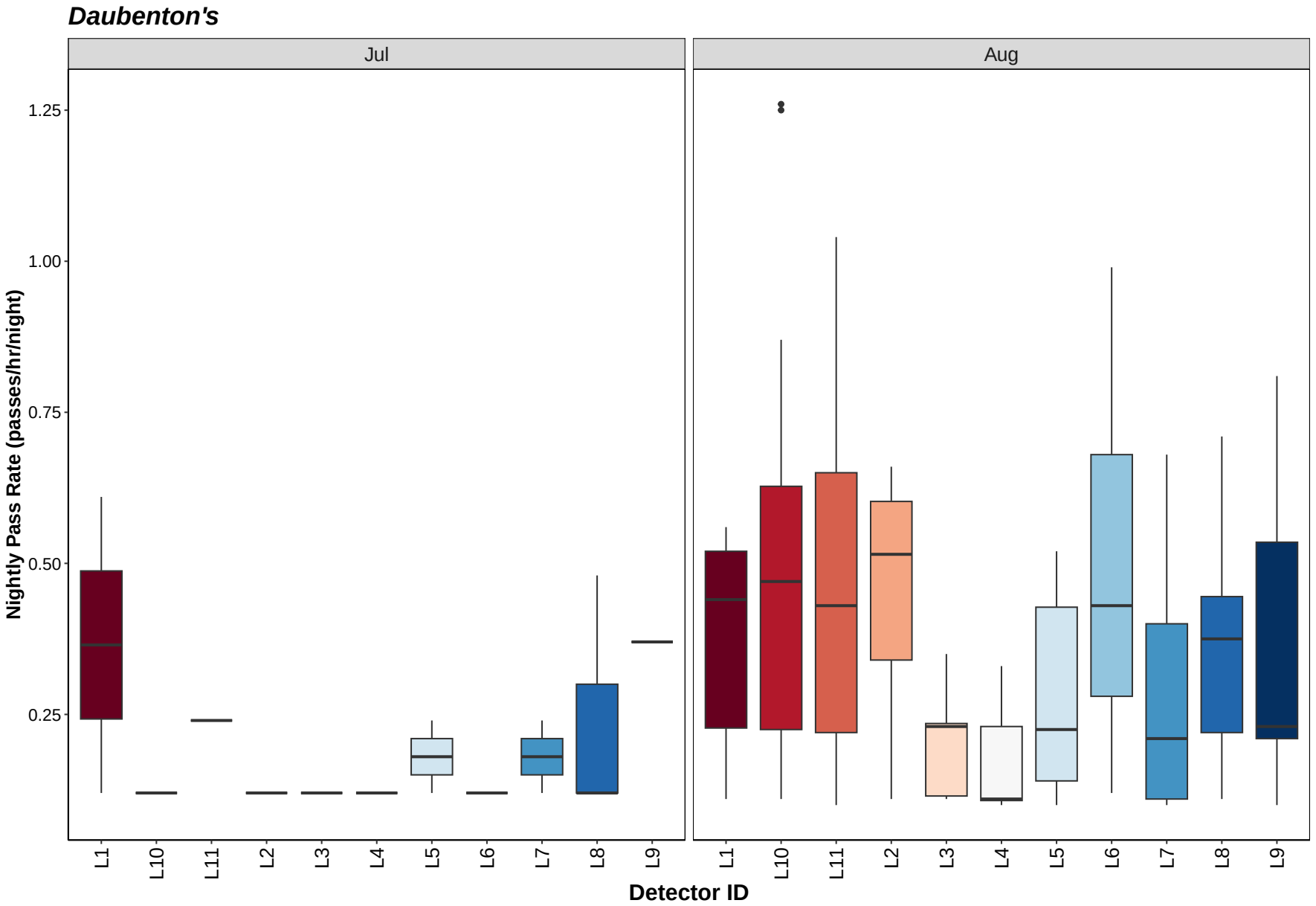
Species	Detector ID	Jul	Aug
Common pipistrelle	L1	5.9	4.0
Common pipistrelle	L10	0.5	1.9
Common pipistrelle	L11	0.9	2.0
Common pipistrelle	L2	0.5	1.5
Common pipistrelle	L3	0.9	1.6
Common pipistrelle	L4	0.6	1.5
Common pipistrelle	L5	1.4	2.0
Common pipistrelle	L6	3.5	3.0
Common pipistrelle	L7	1.0	1.9
Common pipistrelle	L8	3.2	9.4
Common pipistrelle	L9	0.6	1.3
Soprano pipistrelle	L1	3.4	9.1
Soprano pipistrelle	L10	2.3	8.1
Soprano pipistrelle	L11	1.8	6.5
Soprano pipistrelle	L2	1.5	3.5
Soprano pipistrelle	L3	2.0	2.0
Soprano pipistrelle	L4	1.2	2.0
Soprano pipistrelle	L5	1.3	2.1
Soprano pipistrelle	L6	1.1	2.1
Soprano pipistrelle	L7	2.4	2.4
Soprano pipistrelle	L8	1.0	1.5
Soprano pipistrelle	L9	0.5	2.0
Nathusius'	L9	NA	0.2
Leisler's	L1	0.4	1.4
Leisler's	L10	0.9	1.4
Leisler's	L11	0.5	2.2
Leisler's	L2	0.2	0.8
Leisler's	L3	0.7	0.9
Leisler's	L4	0.3	1.6
Leisler's	L5	1.0	1.2

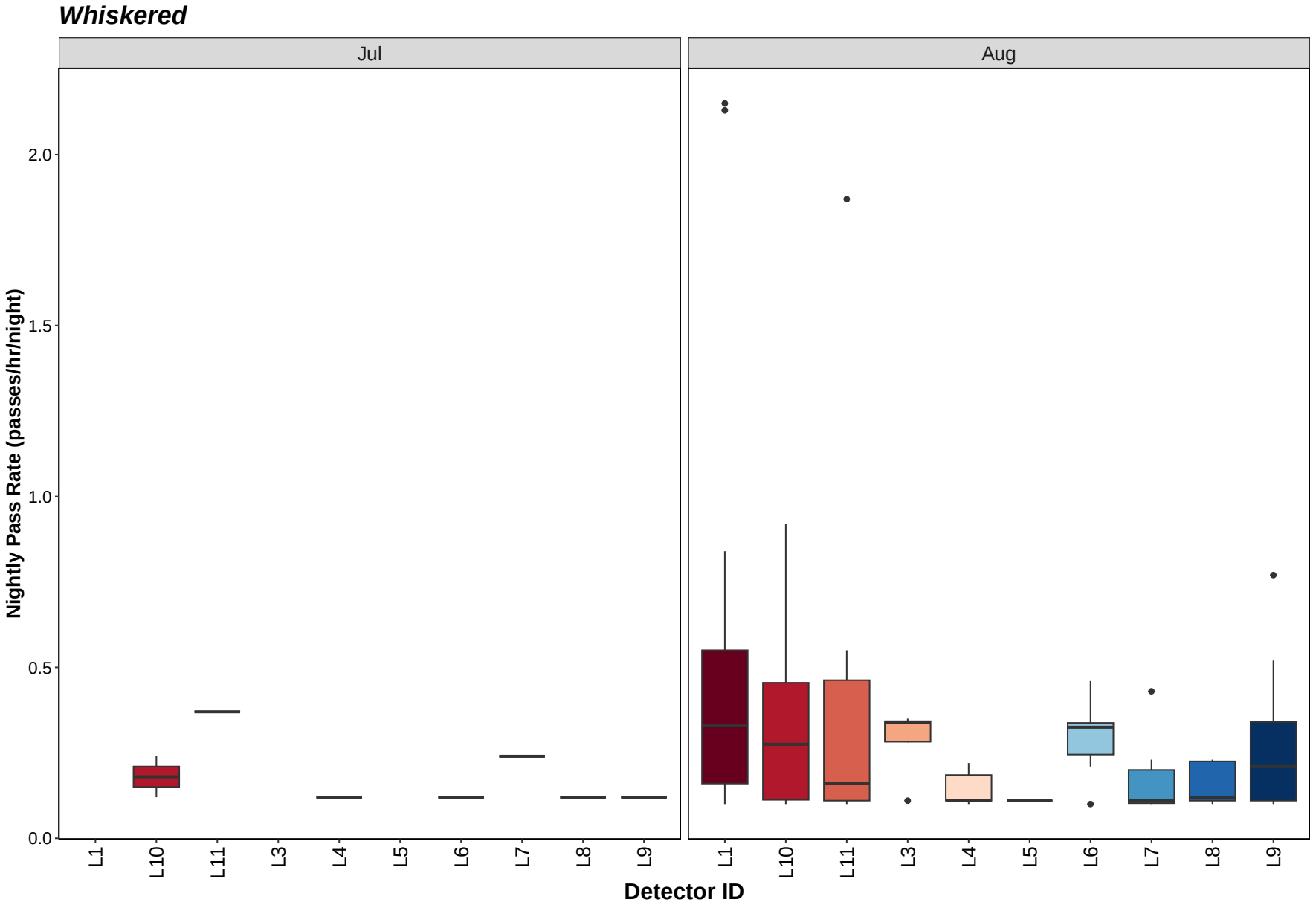
Species	Detector ID	Jul	Aug
Leisler's	L6	0.7	2.3
Leisler's	L7	0.7	1.0
Leisler's	L8	2.4	1.7
Leisler's	L9	1.1	1.7
Brown long-eared	L1	0.4	0.8
Brown long-eared	L10	NA	0.2
Brown long-eared	L11	0.1	0.4
Brown long-eared	L2	0.2	0.2
Brown long-eared	L3	NA	0.3
Brown long-eared	L4	0.1	0.2
Brown long-eared	L5	0.5	0.3
Brown long-eared	L6	0.2	0.5
Brown long-eared	L7	NA	0.3
Brown long-eared	L8	0.2	0.4
Brown long-eared	L9	0.4	0.5
Daubenton's	L1	0.4	0.4
Daubenton's	L10	0.1	0.5
Daubenton's	L11	0.2	0.4
Daubenton's	L2	0.1	0.5
Daubenton's	L3	0.1	0.2
Daubenton's	L4	0.1	0.2
Daubenton's	L5	0.2	0.3
Daubenton's	L6	0.1	0.5
Daubenton's	L7	0.2	0.3
Daubenton's	L8	0.2	0.4
Daubenton's	L9	0.4	0.4
Whiskered	L1	NA	0.6
Whiskered	L10	0.2	0.3
Whiskered	L11	0.4	0.4
Whiskered	L3	NA	0.3
Whiskered	L4	0.1	0.1
Whiskered	L5	NA	0.1
Whiskered	L6	0.1	0.3
Whiskered	L7	0.2	0.2
Whiskered	L8	0.1	0.2
Whiskered	L9	0.1	0.3

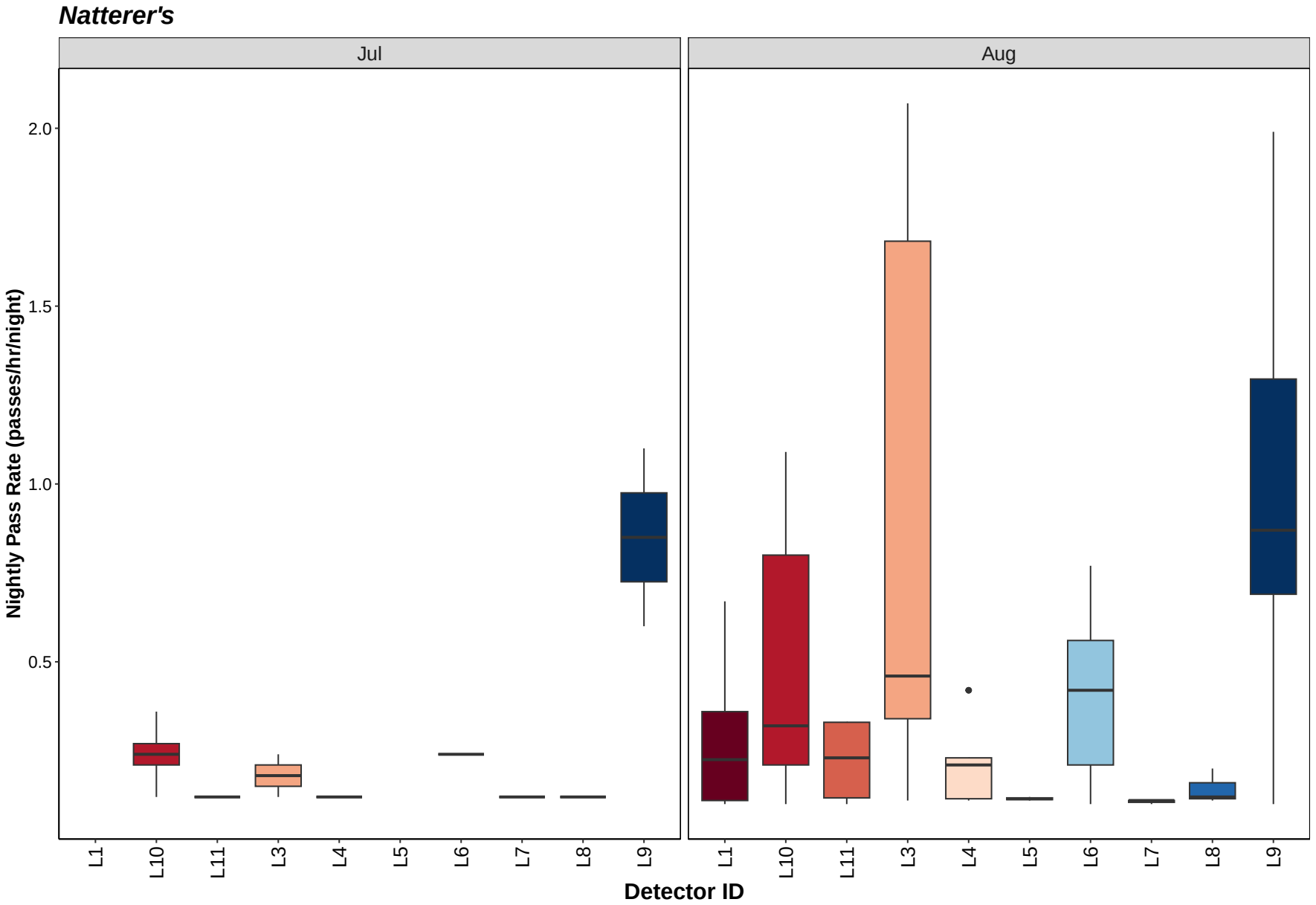
Species	Detector ID	Jul	Aug
Natterer's	L1	NA	0.3
Natterer's	L10	0.2	0.5
Natterer's	L11	0.1	0.2
Natterer's	L3	0.2	0.9
Natterer's	L4	0.1	0.2
Natterer's	L5	NA	0.1
Natterer's	L6	0.2	0.4
Natterer's	L7	0.1	0.1
Natterer's	L8	0.1	0.1
Natterer's	L9	0.9	1.0

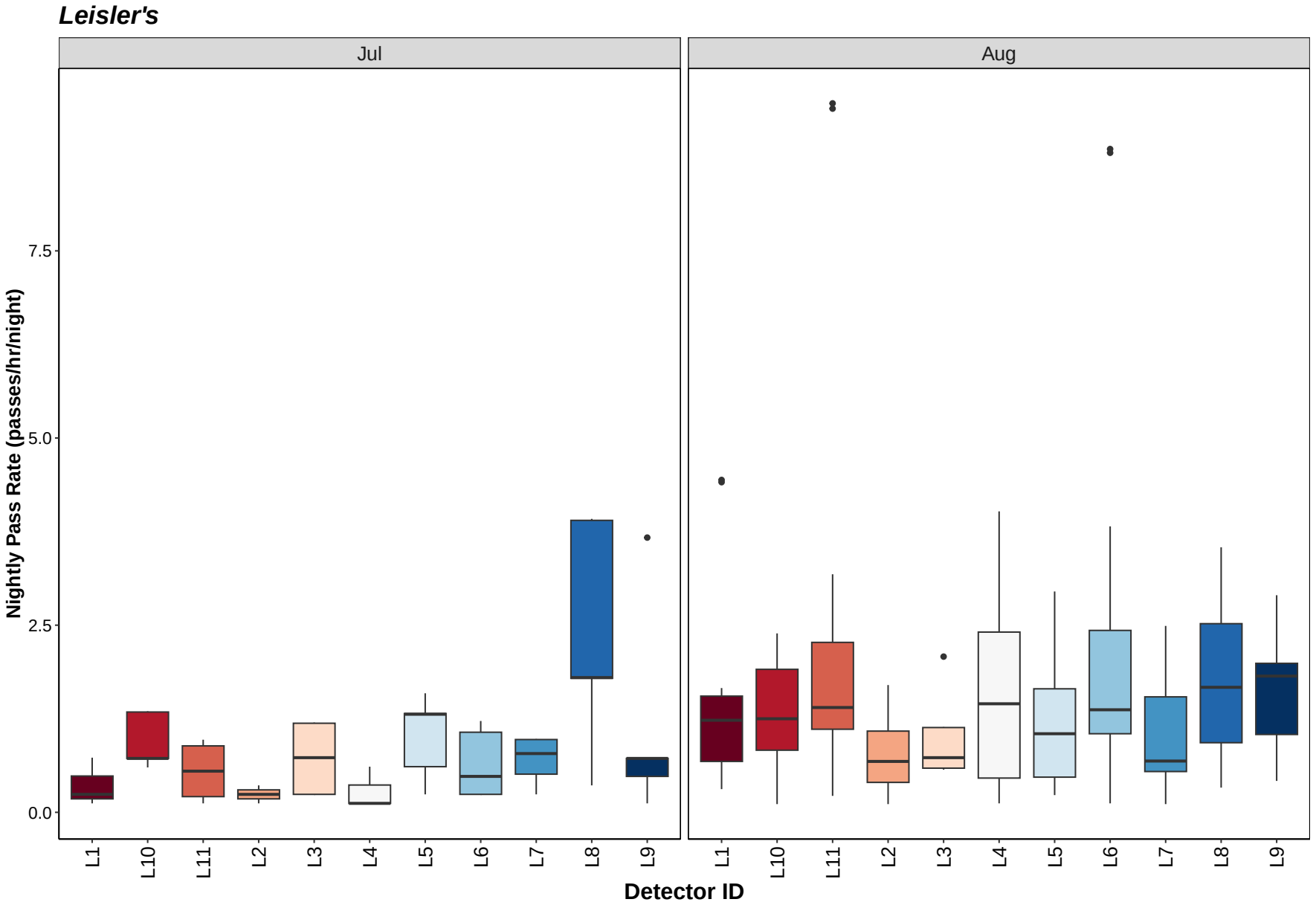
Per Detector

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.

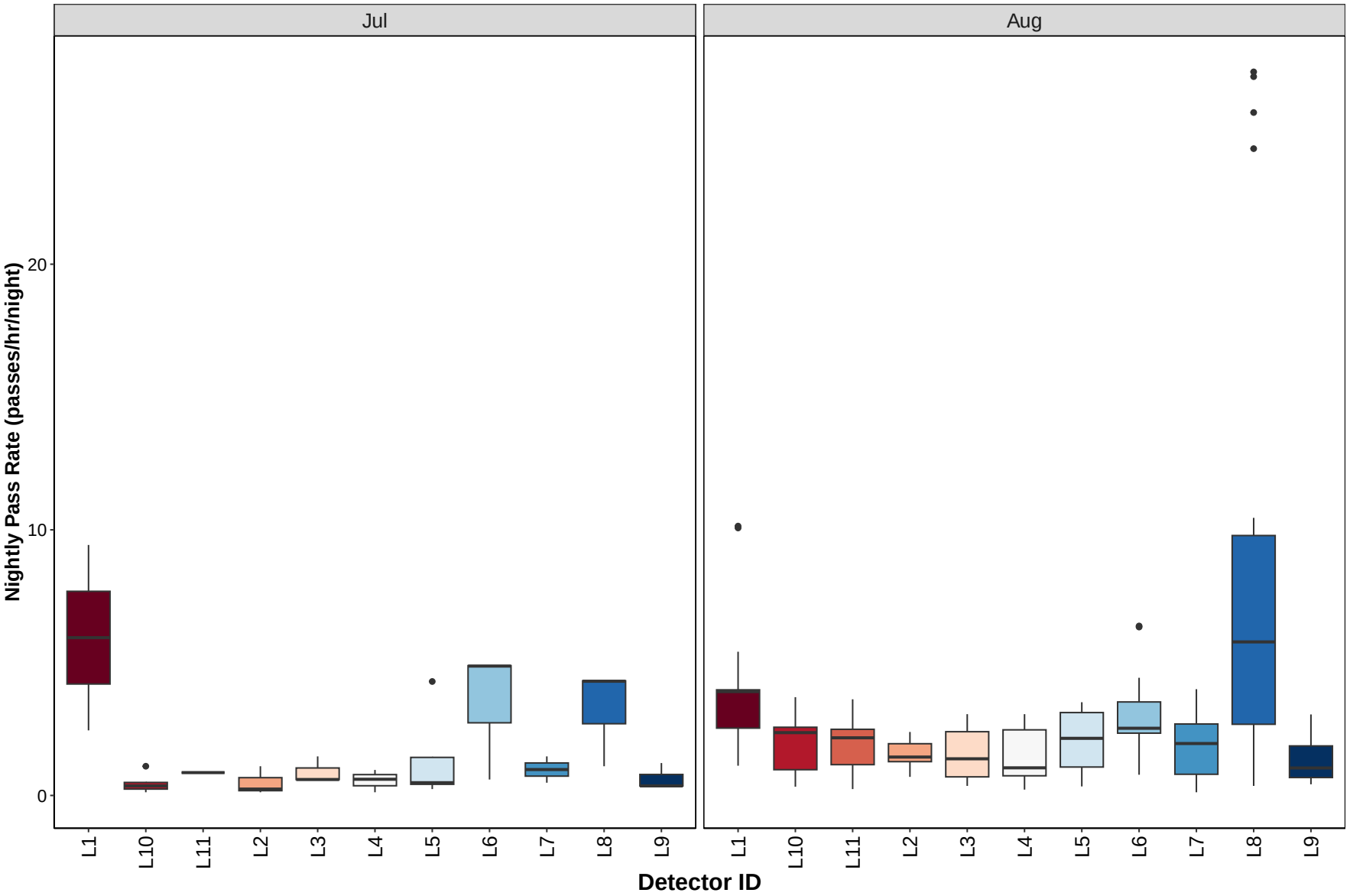

Daubenton's
Jul
Aug
Nightly Pass Rate (passes/hr/night)
1.25
1.00
0.75
0.50
0.25
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID

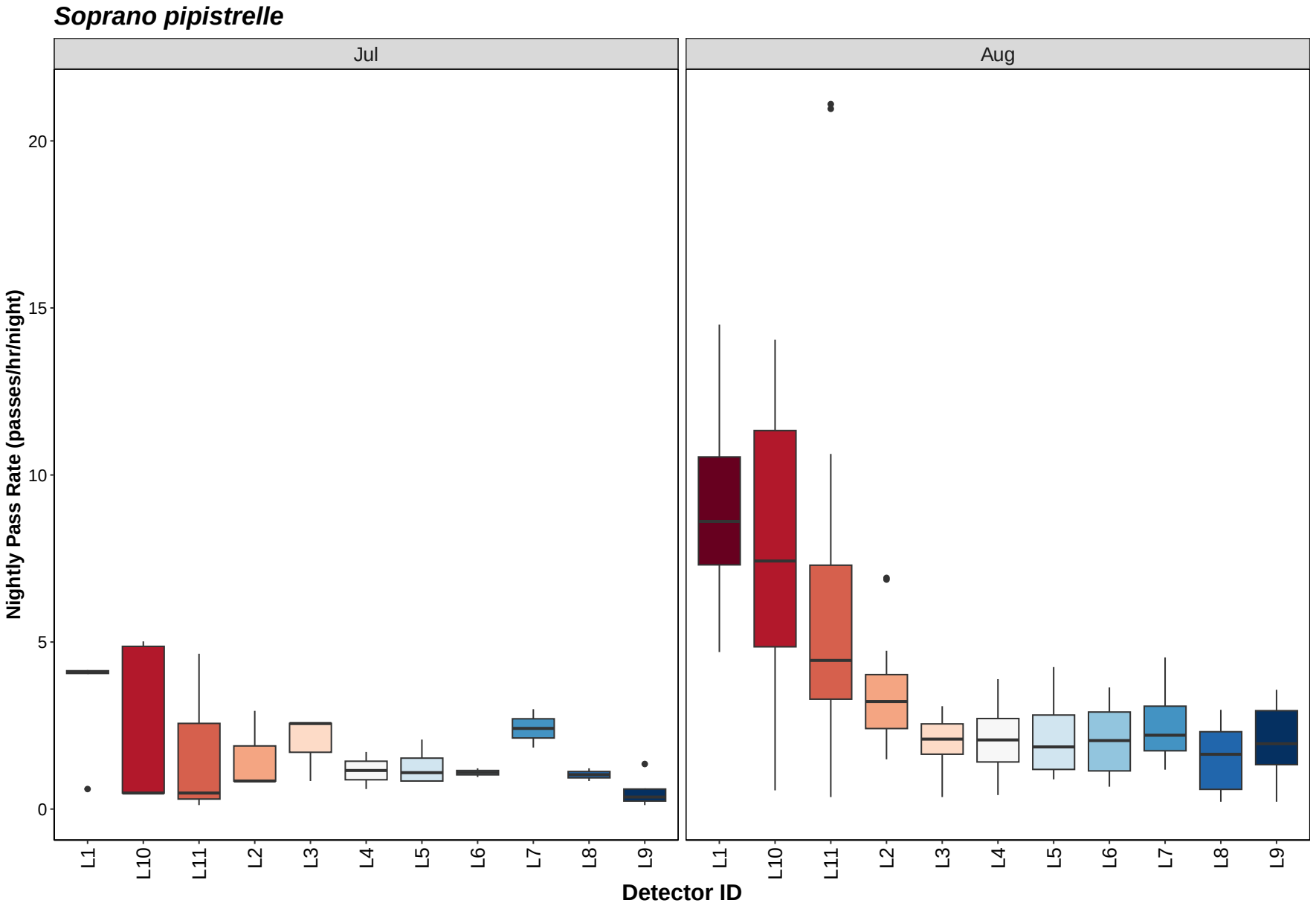

Whiskered
Jul
Aug
Nightly Pass Rate (passes/hr/night)
0.0
0.5
1.0
1.5
2.0
L1
L10
L11
L3
L4
L5
L6
L7
L8
L9
Detector ID

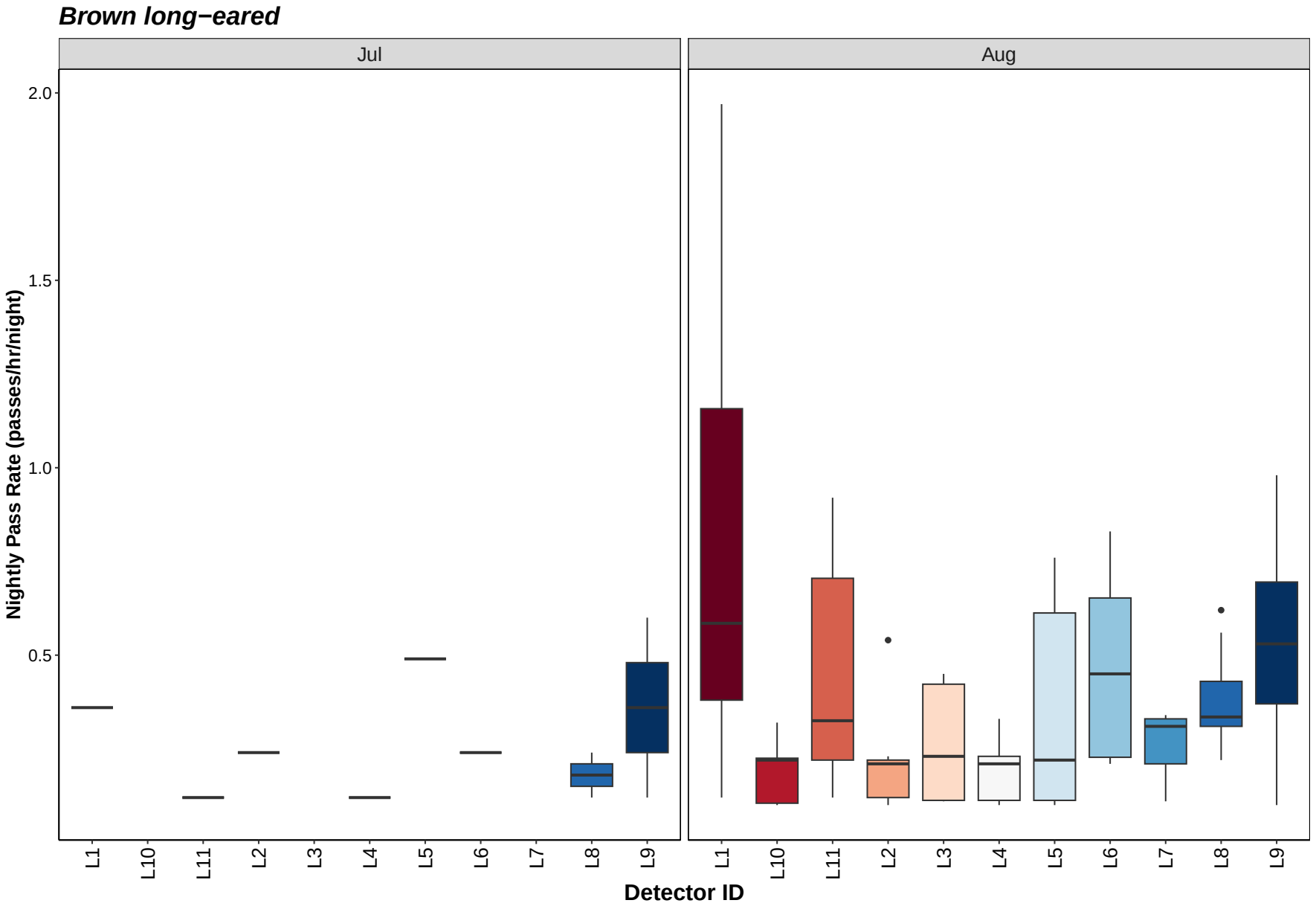

Natterer's
Jul
Aug
Nightly Pass Rate (passes/hr/night)
2.0
1.5
1.0
0.5
L1
L10
L11
L3
L4
L5
L6
L7
L8
L9
Detector ID

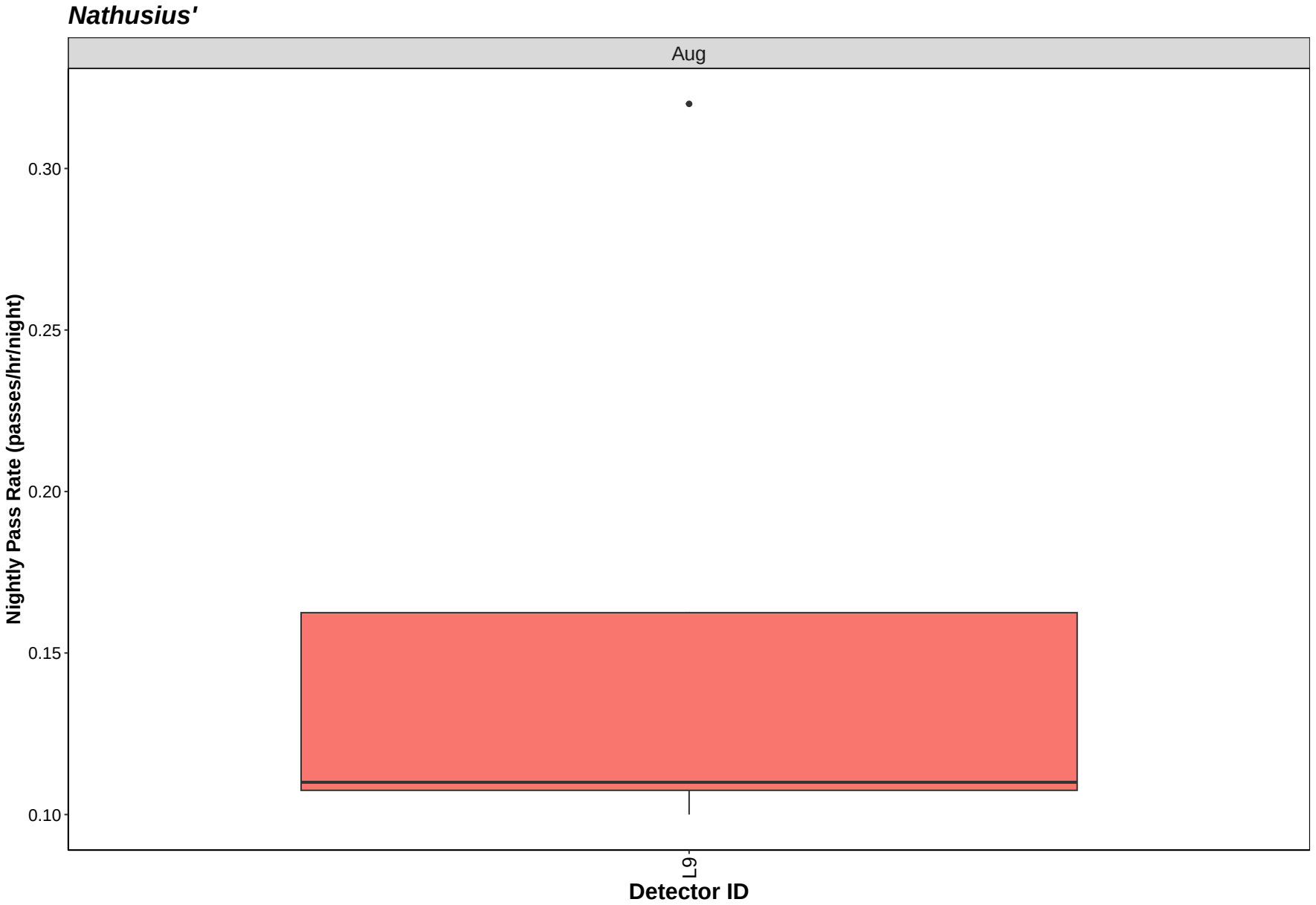

Leisler's
Jul
Aug
Nightly Pass Rate (passes/hr/night)
0.0
2.5
5.0
7.5
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID

Common pipistrelle




Soprano pipistrelle
Jul
Aug
Nightly Pass Rate (passes/hr/night)
0
5
10
15
20
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID


Brown long−eared
Jul
Aug
Nightly Pass Rate (passes/hr/night)
2.0
1.5
1.0
0.5
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID


Nathusius'
Aug
0.30
0.25
0.20
0.15
0.10
Nightly Pass Rate (passes/hr/night)
L9
Detector ID

Bat Activity per Detector Location

Figure 13. Detector ID reference:

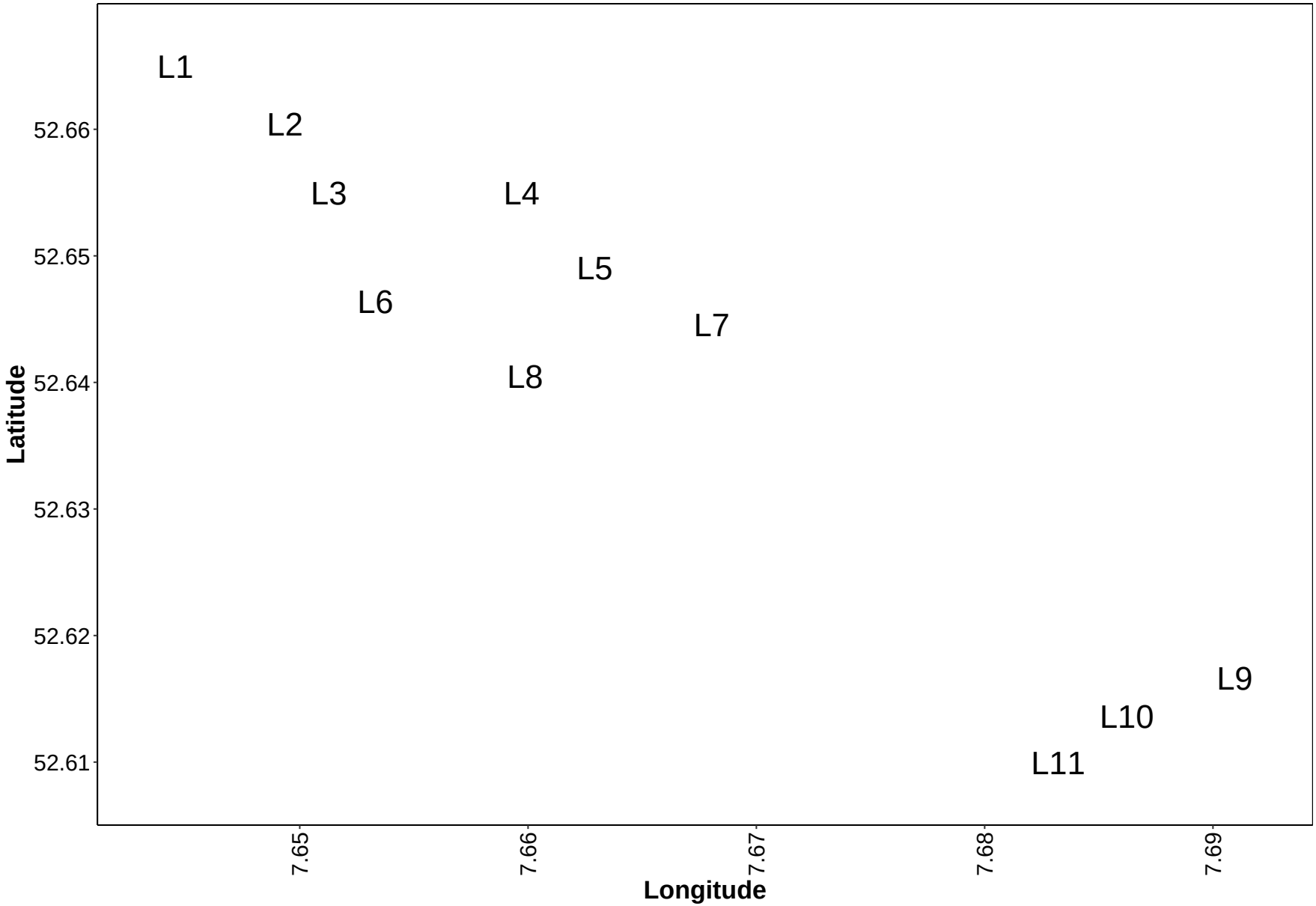
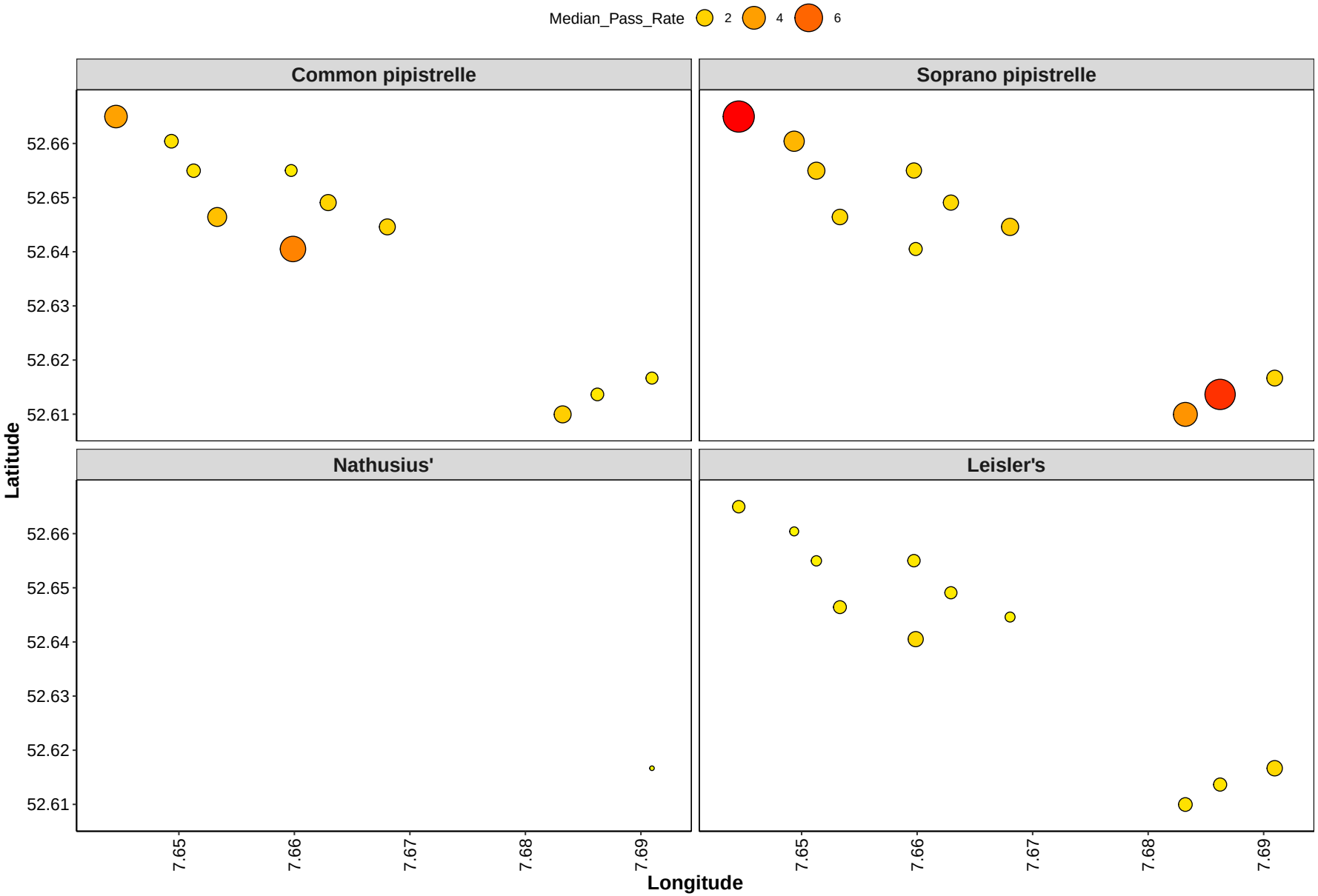

L1
L2
L3
L4
L5
L6
L7
L8
L9
L10
L11
52.66
52.65
52.64
52.63
52.62
52.61
Latitude
7.65
7.66
7.67
7.68
7.69
Longitude

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
2
4
6
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
Longitude
7.65
7.66
7.67
7.68
7.69

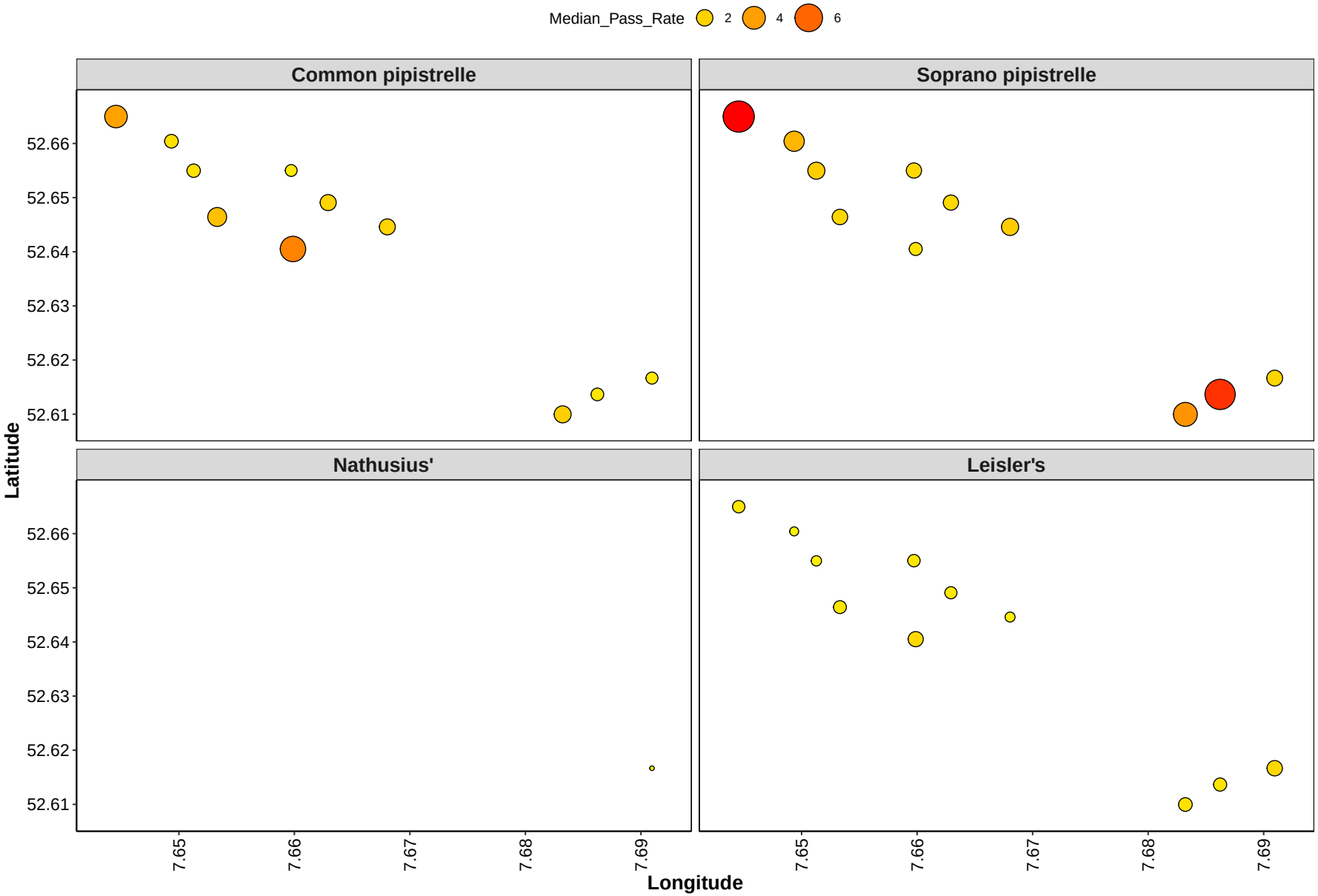
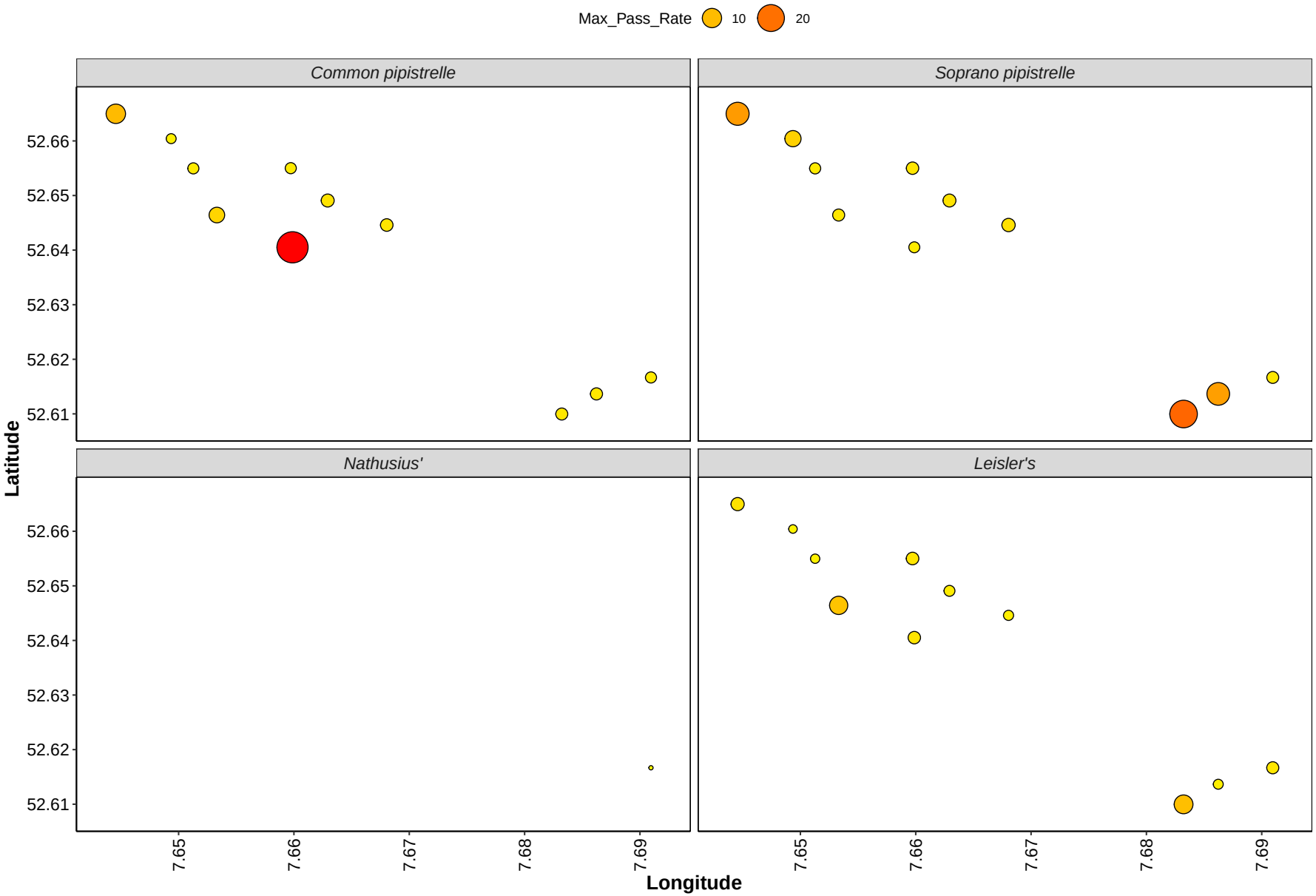
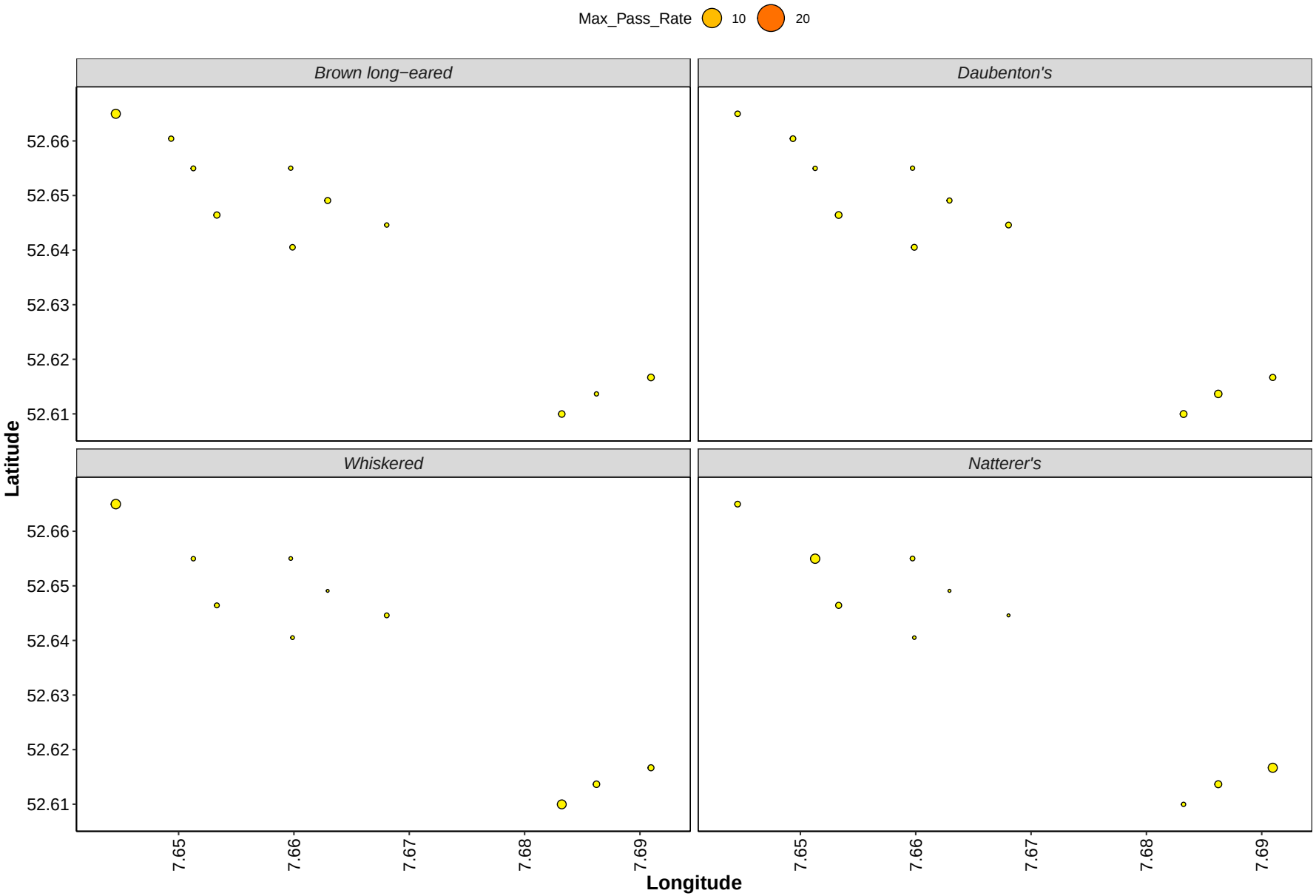

Median_Pass_Rate
2
4
6
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
7.65
7.66
7.67
7.68
7.69
Longitude

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
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
7.65
7.66
7.67
7.68
7.69
Longitude


Max_Pass_Rate
10
20
Brown long−eared
Daubenton's
Whiskered
Natterer's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
Longitude
7.65
7.66
7.67
7.68
7.69

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

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	L1	0.3
Brown long-eared	L10	0.0
Brown long-eared	L11	0.2
Brown long-eared	L2	0.0
Brown long-eared	L3	0.0
Brown long-eared	L4	0.0
Brown long-eared	L5	0.1
Brown long-eared	L6	0.2
Brown long-eared	L7	0.0
Brown long-eared	L8	0.2
Brown long-eared	L9	0.3
Common pipistrelle	L1	3.2
Common pipistrelle	L10	1.1
Common pipistrelle	L11	1.9
Common pipistrelle	L2	1.3
Common pipistrelle	L3	0.7
Common pipistrelle	L4	0.9
Common pipistrelle	L5	1.4
Common pipistrelle	L6	2.5
Common pipistrelle	L7	1.6
Common pipistrelle	L8	4.3
Common pipistrelle	L9	1.0
Daubenton's	L1	0.2
Daubenton's	L10	0.2
Daubenton's	L11	0.2
Daubenton's	L2	0.1
Daubenton's	L3	0.1
Daubenton's	L4	0.1
Daubenton's	L5	0.1
Daubenton's	L6	0.2
Daubenton's	L7	0.1
Daubenton's	L8	0.1
Daubenton's	L9	0.2
Leisler's	L1	0.9
Leisler's	L10	1.2
Leisler's	L11	1.4

Species	Detector ID	Median Pass Rate
Leisler's	L2	0.5
Leisler's	L3	0.7
Leisler's	L4	1.1
Leisler's	L5	1.0
Leisler's	L6	1.2
Leisler's	L7	0.6
Leisler's	L8	1.7
Leisler's	L9	1.7
Nathusius'	L1	0.0
Nathusius'	L10	0.0
Nathusius'	L11	0.0
Nathusius'	L2	0.0
Nathusius'	L3	0.0
Nathusius'	L4	0.0
Nathusius'	L5	0.0
Nathusius'	L6	0.0
Nathusius'	L7	0.0
Nathusius'	L8	0.0
Nathusius'	L9	0.0
Natterer's	L1	0.0
Natterer's	L10	0.2
Natterer's	L11	0.0
Natterer's	L2	0.0
Natterer's	L3	0.1
Natterer's	L4	0.1
Natterer's	L5	0.0
Natterer's	L6	0.1
Natterer's	L7	0.0
Natterer's	L8	0.0
Natterer's	L9	0.0
Soprano pipistrelle	L1	7.7
Soprano pipistrelle	L10	7.2
Soprano pipistrelle	L11	4.0
Soprano pipistrelle	L2	3.1
Soprano pipistrelle	L3	2.0
Soprano pipistrelle	L4	1.7

Species	Detector ID	Median Pass Rate
Soprano pipistrelle	L5	1.6
Soprano pipistrelle	L6	1.4
Soprano pipistrelle	L7	1.8
Soprano pipistrelle	L8	1.1
Soprano pipistrelle	L9	1.7
Whiskered	L1	0.1
Whiskered	L10	0.1
Whiskered	L11	0.0
Whiskered	L2	0.0
Whiskered	L3	0.0
Whiskered	L4	0.0
Whiskered	L5	0.0
Whiskered	L6	0.0
Whiskered	L7	0.0
Whiskered	L8	0.0
Whiskered	L9	0.1

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.

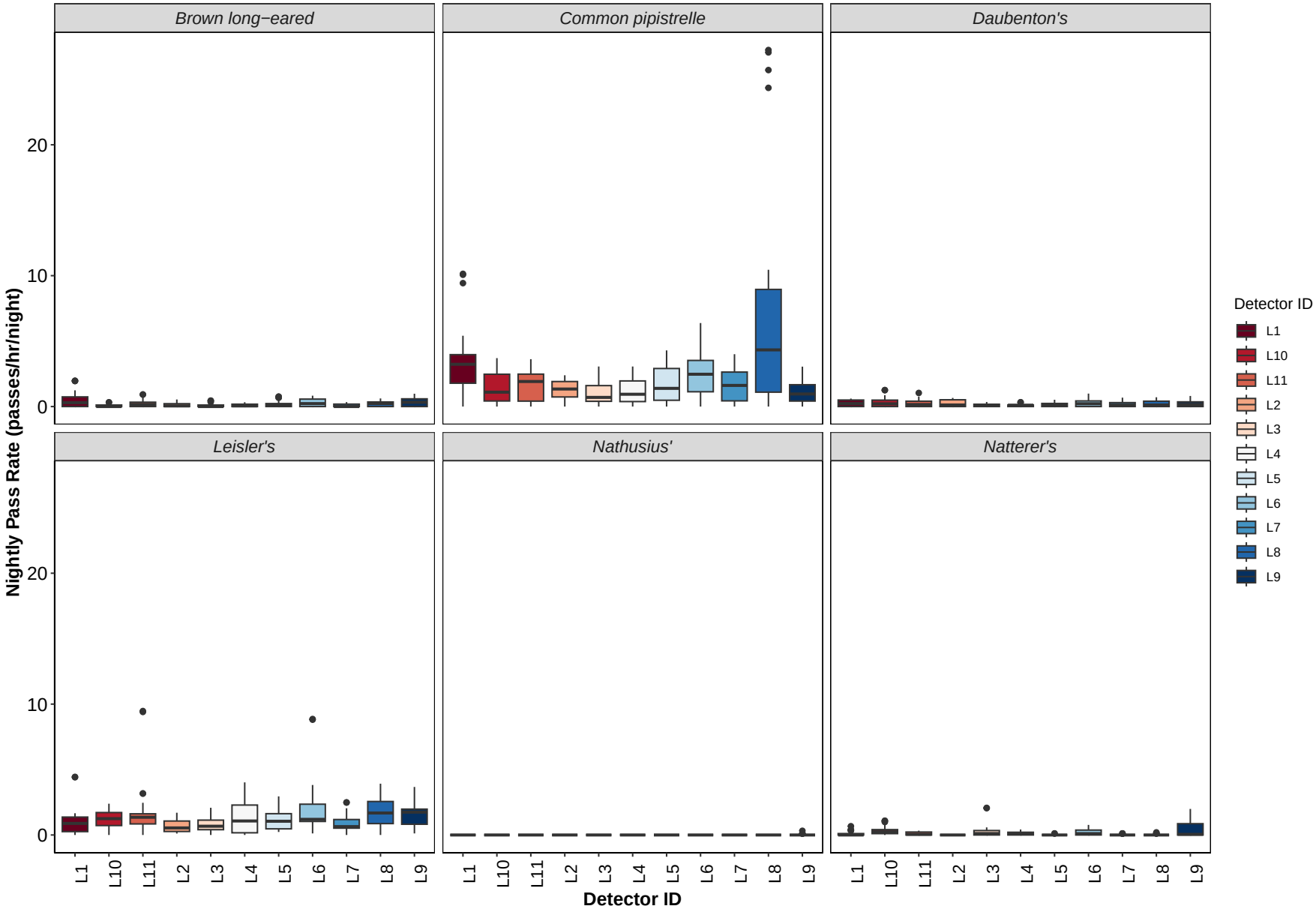
Species	Detector ID	Mean Pass Rate
Brown long-eared	L1	0.5
Brown long-eared	L10	0.1
Brown long-eared	L11	0.2
Brown long-eared	L2	0.1
Brown long-eared	L3	0.1
Brown long-eared	L4	0.1
Brown long-eared	L5	0.2
Brown long-eared	L6	0.3
Brown long-eared	L7	0.1
Brown long-eared	L8	0.2
Brown long-eared	L9	0.3
Common pipistrelle	L1	3.5
Common pipistrelle	L10	1.5
Common pipistrelle	L11	1.7
Common pipistrelle	L2	1.3
Common pipistrelle	L3	1.1
Common pipistrelle	L4	1.2
Common pipistrelle	L5	1.7
Common pipistrelle	L6	2.6
Common pipistrelle	L7	1.5
Common pipistrelle	L8	7.5
Common pipistrelle	L9	1.1
Daubenton's	L1	0.3
Daubenton's	L10	0.3
Daubenton's	L11	0.2
Daubenton's	L2	0.3
Daubenton's	L3	0.1
Daubenton's	L4	0.1
Daubenton's	L5	0.2
Daubenton's	L6	0.3
Daubenton's	L7	0.2
Daubenton's	L8	0.2
Daubenton's	L9	0.2
Leisler's	L1	1.0
Leisler's	L10	1.2
Leisler's	L11	1.9

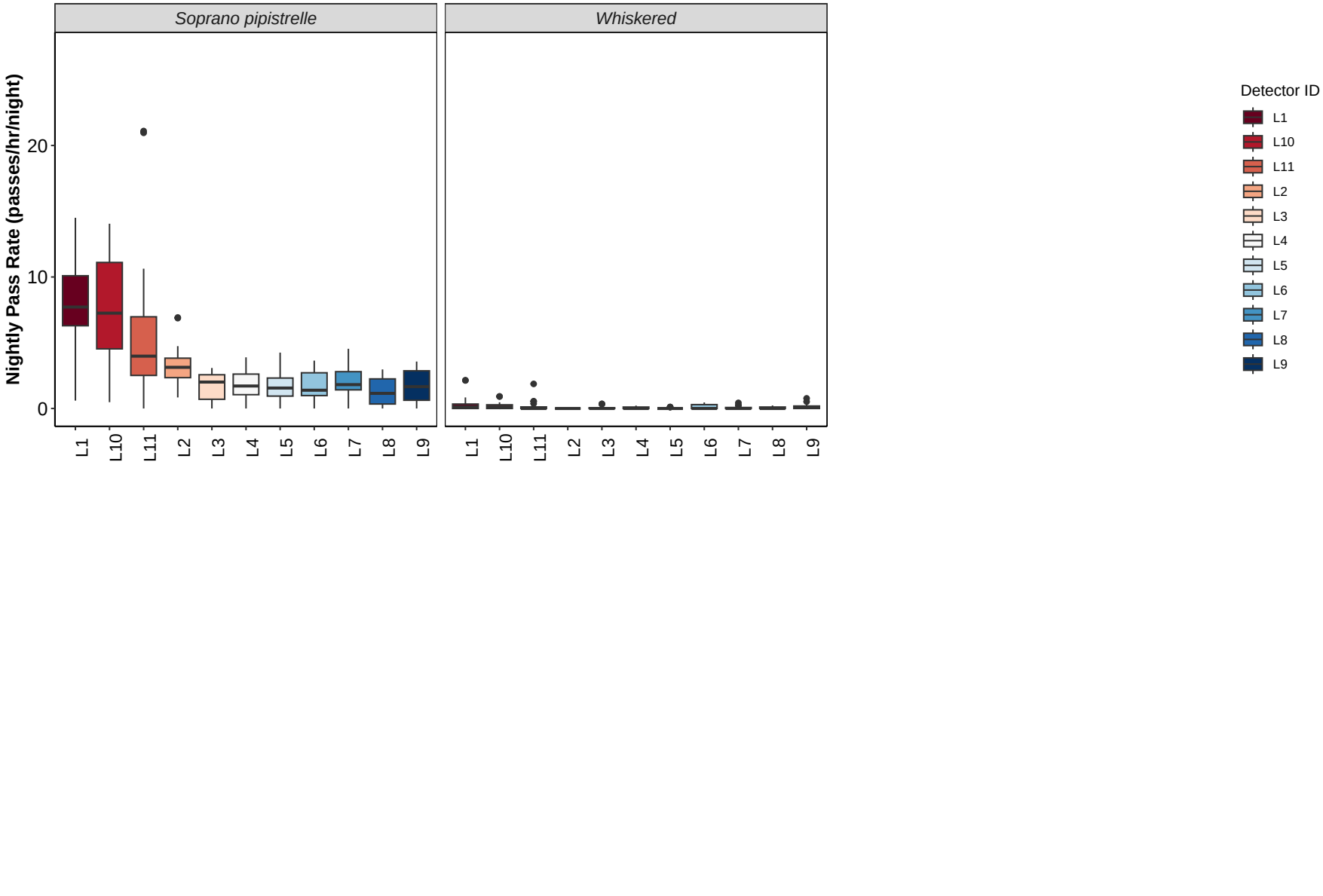
Species	Detector ID	Mean Pass Rate
Leisler's	L2	0.7
Leisler's	L3	0.7
Leisler's	L4	1.4
Leisler's	L5	1.2
Leisler's	L6	2.0
Leisler's	L7	0.9
Leisler's	L8	1.8
Leisler's	L9	1.6
Nathusius'	L1	0.0
Nathusius'	L10	0.0
Nathusius'	L11	0.0
Nathusius'	L2	0.0
Nathusius'	L3	0.0
Nathusius'	L4	0.0
Nathusius'	L5	0.0
Nathusius'	L6	0.0
Nathusius'	L7	0.0
Nathusius'	L8	0.0
Nathusius'	L9	0.0
Natterer's	L1	0.1
Natterer's	L10	0.3
Natterer's	L11	0.1
Natterer's	L2	0.0
Natterer's	L3	0.4
Natterer's	L4	0.1
Natterer's	L5	0.0
Natterer's	L6	0.2
Natterer's	L7	0.0
Natterer's	L8	0.0
Natterer's	L9	0.5
Soprano pipistrelle	L1	8.0
Soprano pipistrelle	L10	7.0
Soprano pipistrelle	L11	5.5
Soprano pipistrelle	L2	3.2
Soprano pipistrelle	L3	1.7
Soprano pipistrelle	L4	1.9

Species	Detector ID	Mean Pass Rate
Soprano pipistrelle	L5	1.8
Soprano pipistrelle	L6	1.7
Soprano pipistrelle	L7	2.1
Soprano pipistrelle	L8	1.2
Soprano pipistrelle	L9	1.7
Whiskered	L1	0.3
Whiskered	L10	0.2
Whiskered	L11	0.2
Whiskered	L2	0.0
Whiskered	L3	0.1
Whiskered	L4	0.0
Whiskered	L5	0.0
Whiskered	L6	0.1
Whiskered	L7	0.1
Whiskered	L8	0.0
Whiskered	L9	0.1

Per Detector

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.


Brown long−eared
Common pipistrelle
Daubenton's
Leisler's
Nathusius'
Natterer's
Nightly Pass Rate (passes/hr/night)
0
10
20
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID
Detector ID


Soprano pipistrelle
Whiskered
Nightly Pass Rate (passes/hr/night)
0
10
20
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9

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	L1	5
Jul	L10	5
Jul	L11	5
Jul	L2	3
Jul	L3	5
Jul	L4	3
Jul	L5	5
Jul	L6	5
Jul	L7	4
Jul	L8	5
Jul	L9	5
Aug	L1	21
Aug	L10	22
Aug	L11	21
Aug	L2	19
Aug	L3	10
Aug	L4	19
Aug	L5	21
Aug	L6	21
Aug	L7	22
Aug	L8	20
Aug	L9	21

Nighlty 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	L1	0.4	0.0
Brown long-eared	L10	0.0	0.0
Brown long-eared	L11	0.2	0.0
Brown long-eared	L2	0.0	0.2
Brown long-eared	L3	0.1	0.0
Brown long-eared	L4	0.1	0.0
Brown long-eared	L5	0.1	0.0
Brown long-eared	L6	0.2	0.0
Brown long-eared	L7	0.0	0.0
Brown long-eared	L8	0.3	0.0
Brown long-eared	L9	0.4	0.0
Common pipistrelle	L1	3.9	0.0
Common pipistrelle	L10	2.2	0.4
Common pipistrelle	L11	2.2	0.0
Common pipistrelle	L2	1.4	0.2
Common pipistrelle	L3	1.3	0.6
Common pipistrelle	L4	1.0	0.6
Common pipistrelle	L5	1.9	0.5
Common pipistrelle	L6	2.5	0.6
Common pipistrelle	L7	1.9	0.2
Common pipistrelle	L8	5.8	1.1
Common pipistrelle	L9	1.0	0.4
Daubenton's	L1	0.2	0.0
Daubenton's	L10	0.3	0.0
Daubenton's	L11	0.2	0.0
Daubenton's	L2	0.3	0.1
Daubenton's	L3	0.1	0.0
Daubenton's	L4	0.1	0.1
Daubenton's	L5	0.1	0.0
Daubenton's	L6	0.3	0.0
Daubenton's	L7	0.1	0.1
Daubenton's	L8	0.2	0.1
Daubenton's	L9	0.2	0.0
Leisler's	L1	1.1	0.1
Leisler's	L10	1.2	0.7
Leisler's	L11	1.4	0.2

Species	Detector ID	Aug	Jul
Leisler's	L2	0.7	0.2
Leisler's	L3	0.6	0.7
Leisler's	L4	1.1	0.1
Leisler's	L5	1.0	1.3
Leisler's	L6	1.4	0.5
Leisler's	L7	0.6	0.8
Leisler's	L8	1.7	1.8
Leisler's	L9	1.8	0.7
Nathusius'	L1	0.0	0.0
Nathusius'	L10	0.0	0.0
Nathusius'	L11	0.0	0.0
Nathusius'	L2	0.0	0.0
Nathusius'	L3	0.0	0.0
Nathusius'	L4	0.0	0.0
Nathusius'	L5	0.0	0.0
Nathusius'	L6	0.0	0.0
Nathusius'	L7	0.0	0.0
Nathusius'	L8	0.0	0.0
Nathusius'	L9	0.0	0.0
Natterer's	L1	0.0	0.0
Natterer's	L10	0.3	0.2
Natterer's	L11	0.1	0.0
Natterer's	L2	0.0	0.0
Natterer's	L3	0.2	0.0
Natterer's	L4	0.1	0.0
Natterer's	L5	0.0	0.0
Natterer's	L6	0.1	0.0
Natterer's	L7	0.0	0.0
Natterer's	L8	0.0	0.0
Natterer's	L9	0.1	0.0
Soprano pipistrelle	L1	8.6	4.1
Soprano pipistrelle	L10	7.4	0.5
Soprano pipistrelle	L11	4.4	0.1
Soprano pipistrelle	L2	3.2	0.8
Soprano pipistrelle	L3	2.1	0.8
Soprano pipistrelle	L4	2.1	0.6

Species	Detector ID	Aug	Jul
Soprano pipistrelle	L5	1.8	0.8
Soprano pipistrelle	L6	2.0	0.0
Soprano pipistrelle	L7	2.0	0.9
Soprano pipistrelle	L8	1.4	0.0
Soprano pipistrelle	L9	2.0	0.4
Whiskered	L1	0.2	0.0
Whiskered	L10	0.1	0.0
Whiskered	L11	0.0	0.0
Whiskered	L2	0.0	0.0
Whiskered	L3	0.0	0.0
Whiskered	L4	0.0	0.0
Whiskered	L5	0.0	0.0
Whiskered	L6	0.0	0.0
Whiskered	L7	0.0	0.0
Whiskered	L8	0.0	0.0
Whiskered	L9	0.1	0.0

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.

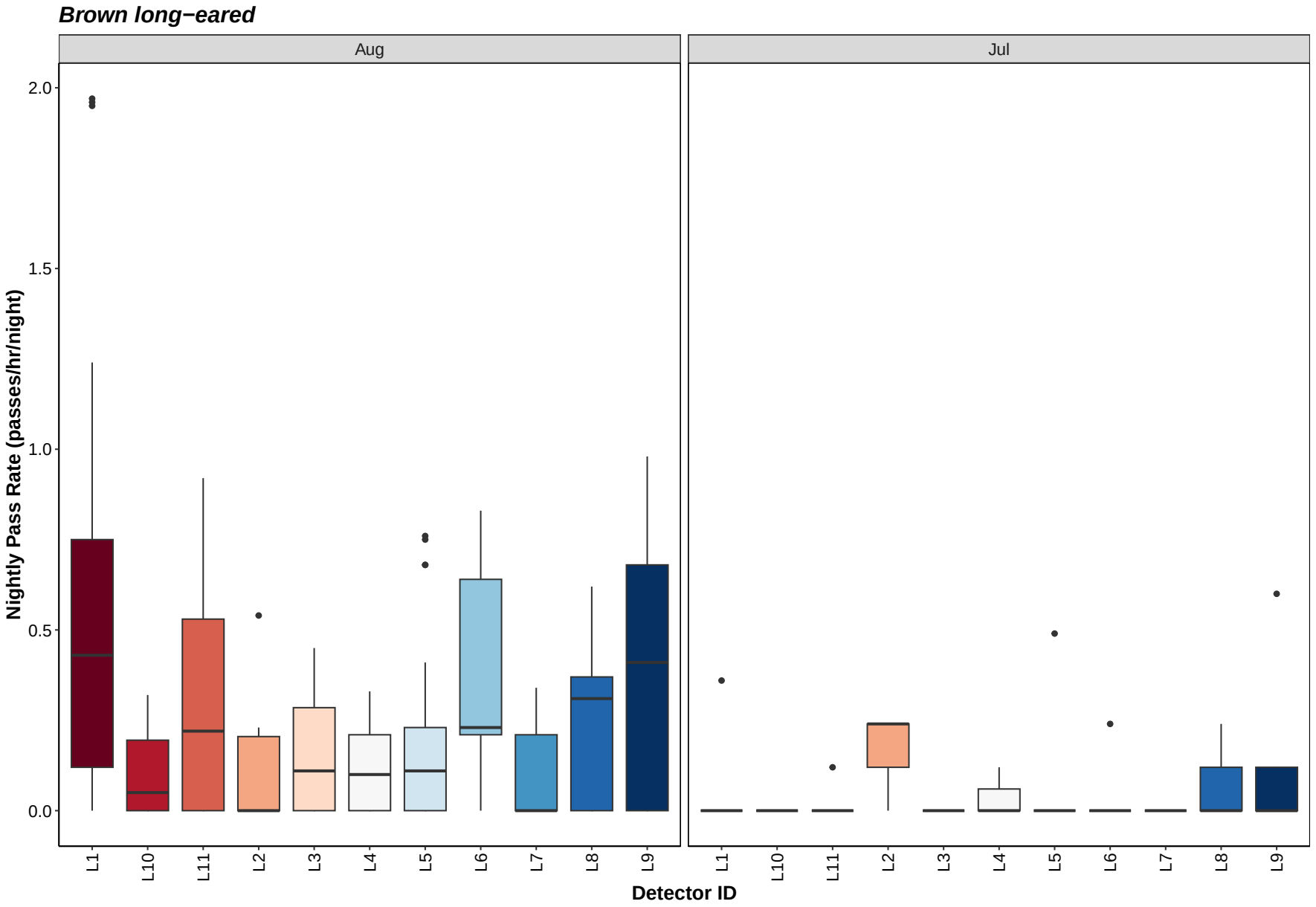
Species	Detector ID	Aug	Jul
Brown long-eared	L1	0.6	0.1
Brown long-eared	L10	0.1	0.0
Brown long-eared	L11	0.3	0.0
Brown long-eared	L2	0.1	0.2
Brown long-eared	L3	0.2	0.0
Brown long-eared	L4	0.1	0.0
Brown long-eared	L5	0.2	0.1
Brown long-eared	L6	0.4	0.0
Brown long-eared	L7	0.1	0.0
Brown long-eared	L8	0.3	0.1
Brown long-eared	L9	0.4	0.1
Common pipistrelle	L1	3.8	2.4
Common pipistrelle	L10	1.7	0.5
Common pipistrelle	L11	2.0	0.2
Common pipistrelle	L2	1.5	0.5
Common pipistrelle	L3	1.4	0.5
Common pipistrelle	L4	1.3	0.6
Common pipistrelle	L5	1.8	1.1
Common pipistrelle	L6	2.7	2.1
Common pipistrelle	L7	1.7	0.5
Common pipistrelle	L8	8.9	1.9
Common pipistrelle	L9	1.3	0.4
Daubenton's	L1	0.3	0.1
Daubenton's	L10	0.4	0.0
Daubenton's	L11	0.3	0.0
Daubenton's	L2	0.3	0.1
Daubenton's	L3	0.1	0.0
Daubenton's	L4	0.1	0.1
Daubenton's	L5	0.2	0.1
Daubenton's	L6	0.3	0.0
Daubenton's	L7	0.2	0.1
Daubenton's	L8	0.2	0.1
Daubenton's	L9	0.3	0.1
Leisler's	L1	1.2	0.2
Leisler's	L10	1.3	0.9
Leisler's	L11	2.2	0.4

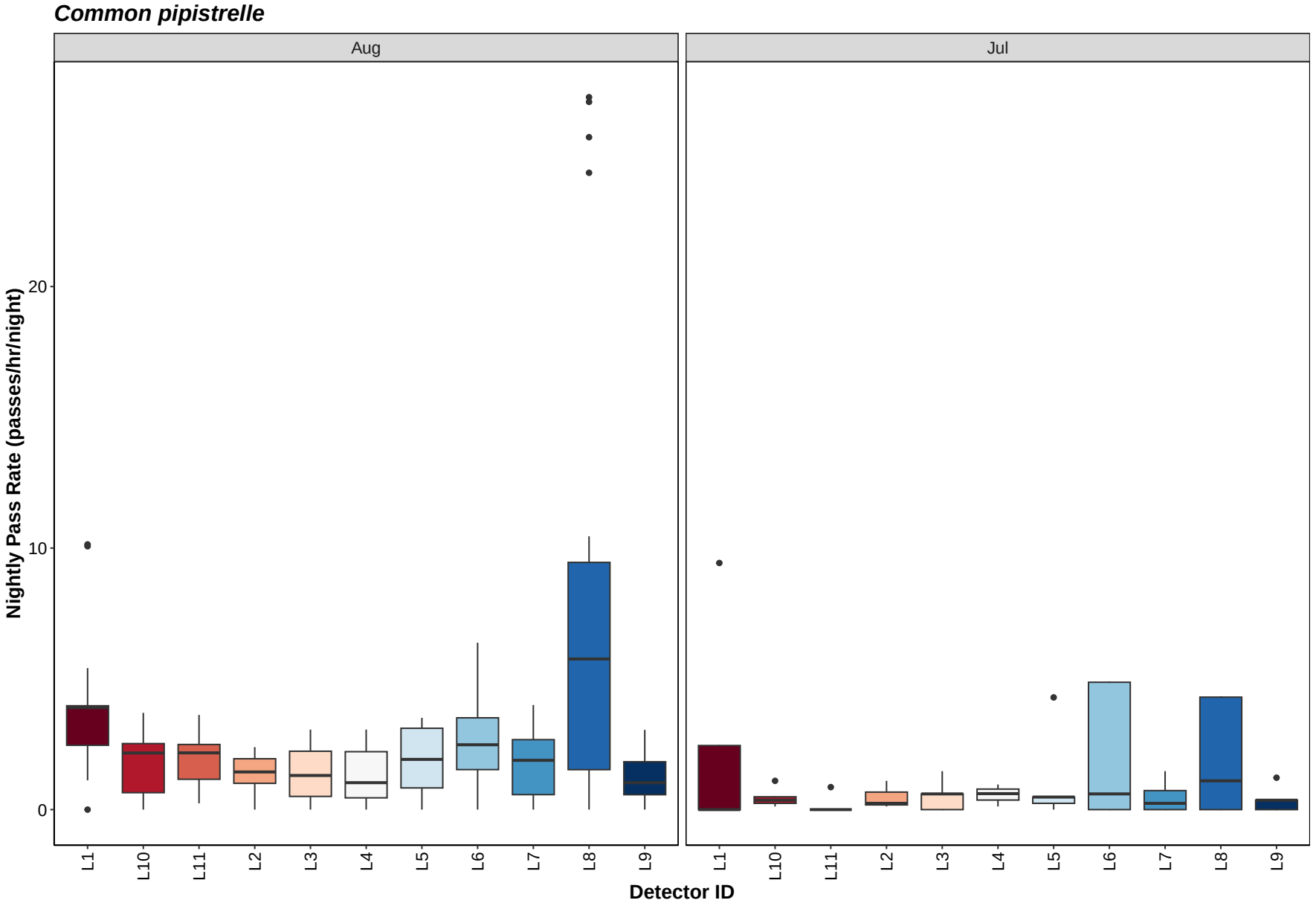
Species	Detector ID	Aug	Jul
Leisler's	L2	0.8	0.2
Leisler's	L3	0.8	0.7
Leisler's	L4	1.5	0.3
Leisler's	L5	1.2	1.0
Leisler's	L6	2.3	0.7
Leisler's	L7	0.9	0.7
Leisler's	L8	1.7	2.4
Leisler's	L9	1.7	1.1
Nathusius'	L1	0.0	0.0
Nathusius'	L10	0.0	0.0
Nathusius'	L11	0.0	0.0
Nathusius'	L2	0.0	0.0
Nathusius'	L3	0.0	0.0
Nathusius'	L4	0.0	0.0
Nathusius'	L5	0.0	0.0
Nathusius'	L6	0.0	0.0
Nathusius'	L7	0.0	0.0
Nathusius'	L8	0.0	0.0
Nathusius'	L9	0.0	0.0
Natterer's	L1	0.1	0.0
Natterer's	L10	0.4	0.2
Natterer's	L11	0.1	0.0
Natterer's	L2	0.0	0.0
Natterer's	L3	0.5	0.1
Natterer's	L4	0.1	0.0
Natterer's	L5	0.0	0.0
Natterer's	L6	0.2	0.0
Natterer's	L7	0.0	0.0
Natterer's	L8	0.0	0.0
Natterer's	L9	0.5	0.3
Soprano pipistrelle	L1	9.1	3.4
Soprano pipistrelle	L10	8.1	2.3
Soprano pipistrelle	L11	6.5	1.0
Soprano pipistrelle	L2	3.5	1.5
Soprano pipistrelle	L3	2.0	1.2
Soprano pipistrelle	L4	2.0	0.8

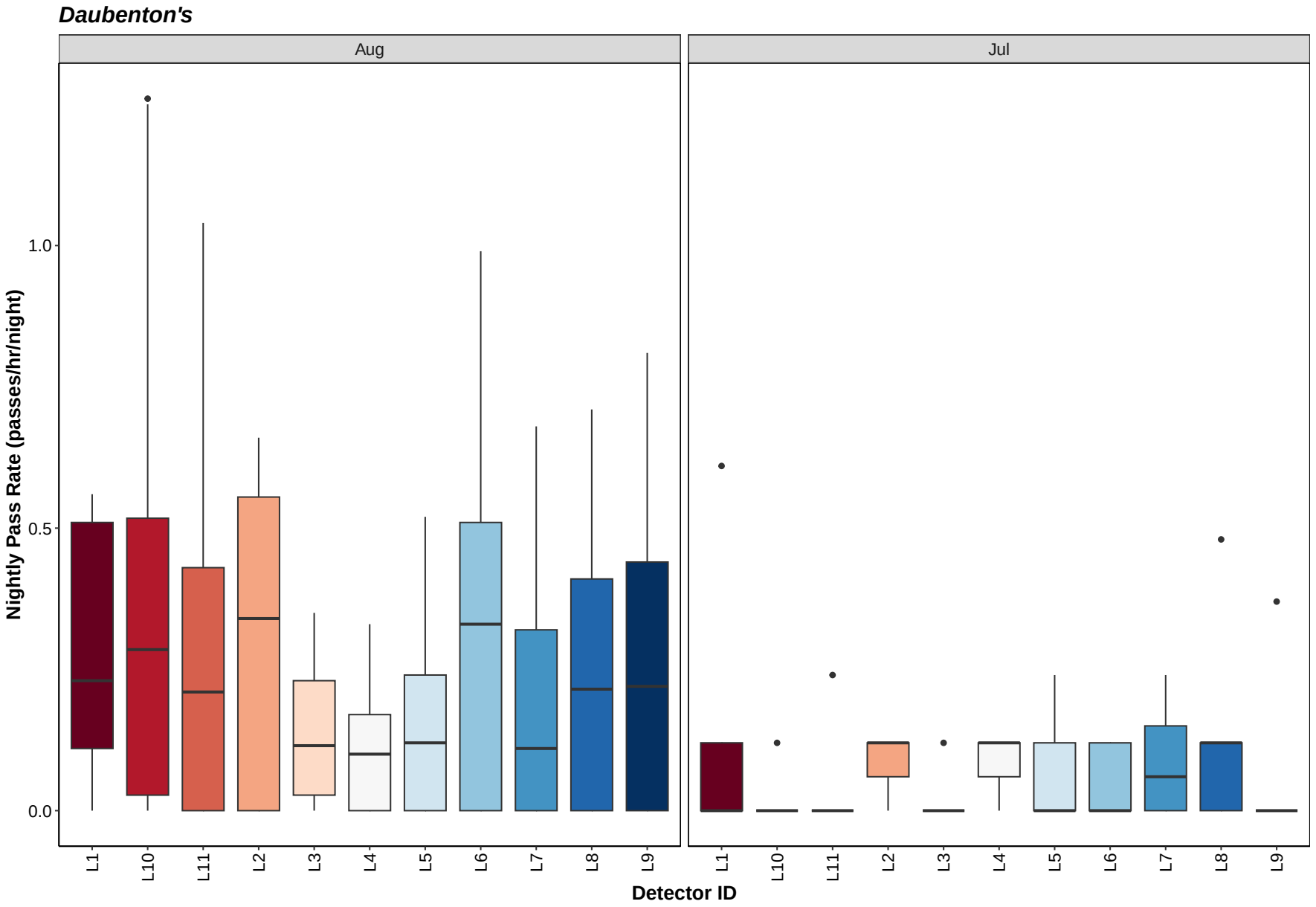
Species	Detector ID	Aug	Jul
Soprano pipistrelle	L5	2.0	1.0
Soprano pipistrelle	L6	2.0	0.4
Soprano pipistrelle	L7	2.2	1.2
Soprano pipistrelle	L8	1.4	0.4
Soprano pipistrelle	L9	1.9	0.5
Whiskered	L1	0.4	0.0
Whiskered	L10	0.2	0.1
Whiskered	L11	0.2	0.1
Whiskered	L2	0.0	0.0
Whiskered	L3	0.1	0.0
Whiskered	L4	0.0	0.0
Whiskered	L5	0.0	0.0
Whiskered	L6	0.1	0.0
Whiskered	L7	0.0	0.1
Whiskered	L8	0.1	0.0
Whiskered	L9	0.2	0.0

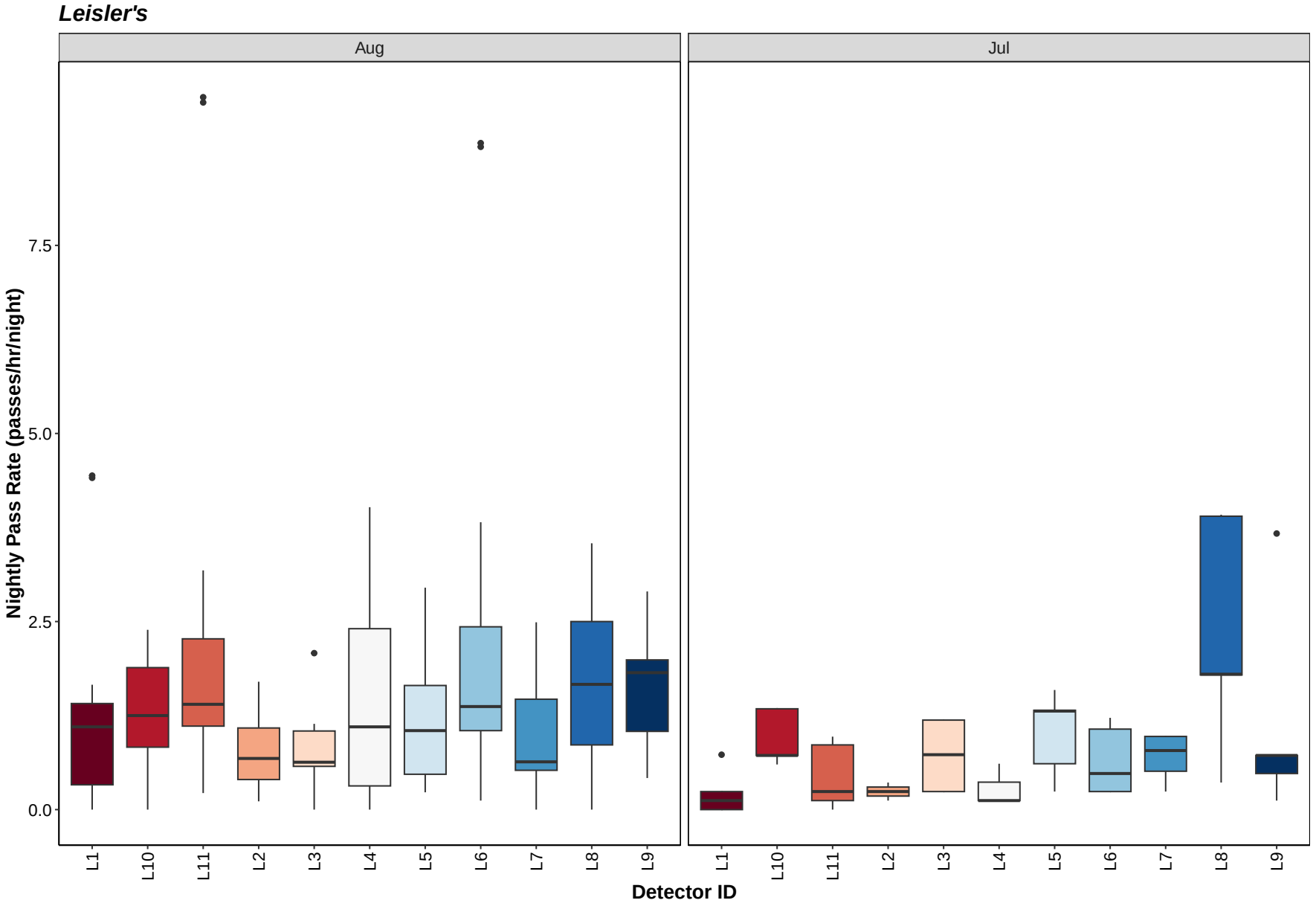
Per Detector

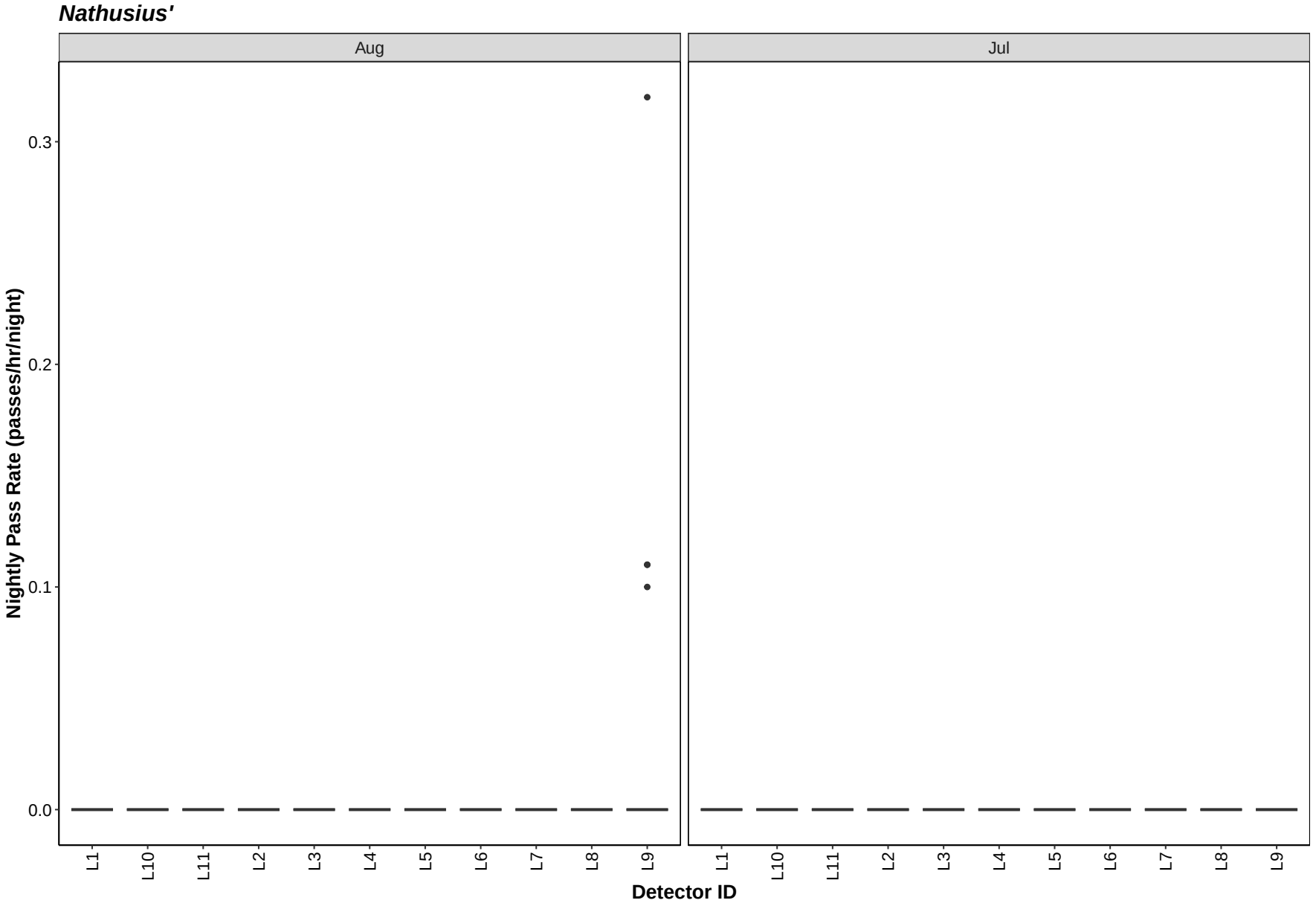
Figure 17. Figures show boxplots for the number of bat passes per hour by detector, for each month. The ‘box’ shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The ‘whiskers’ extend from the box and represent 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.

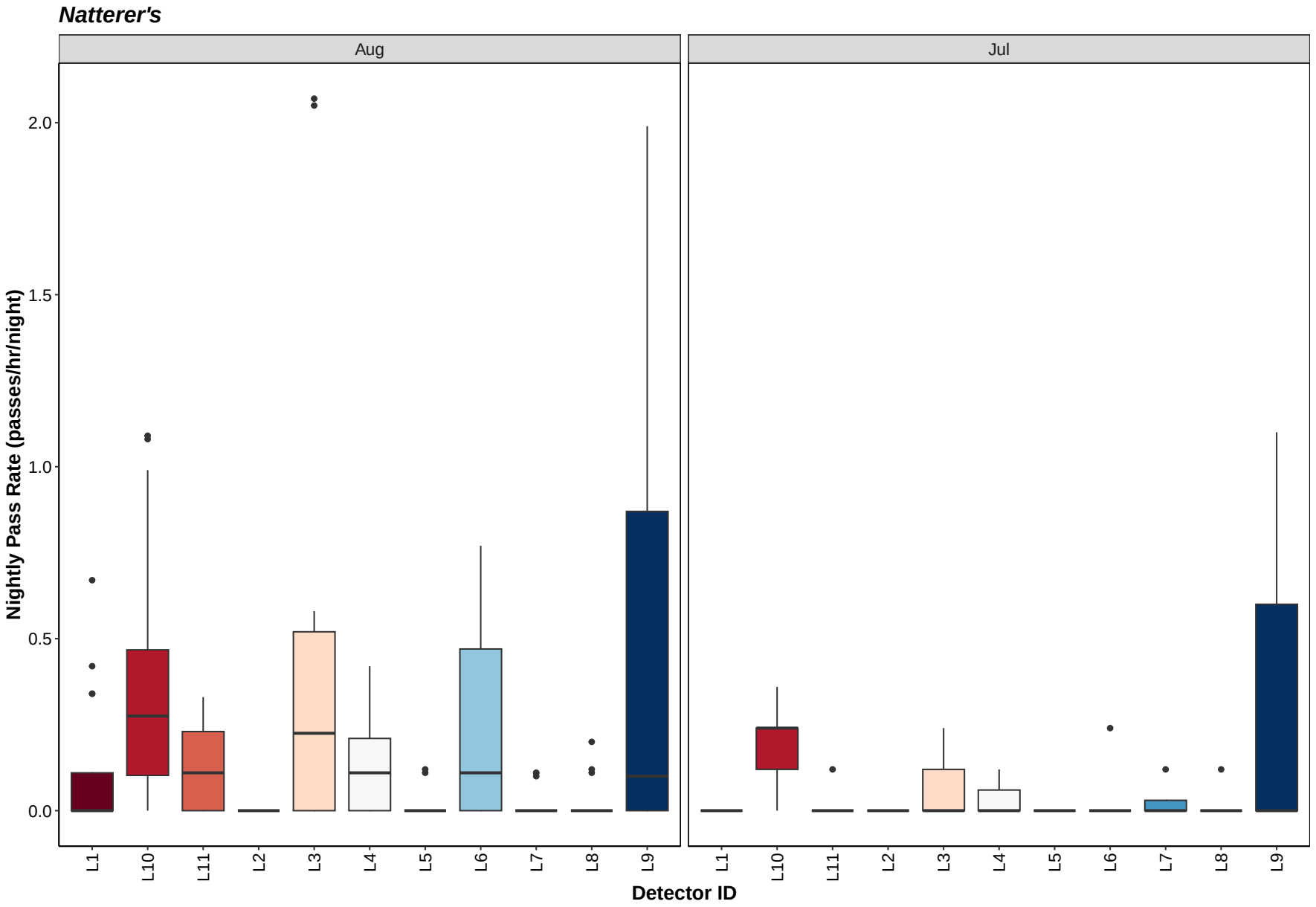

Brown long−eared
Aug
Jul
Nightly Pass Rate (passes/hr/night)
2.0
1.5
1.0
0.5
0.0
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID

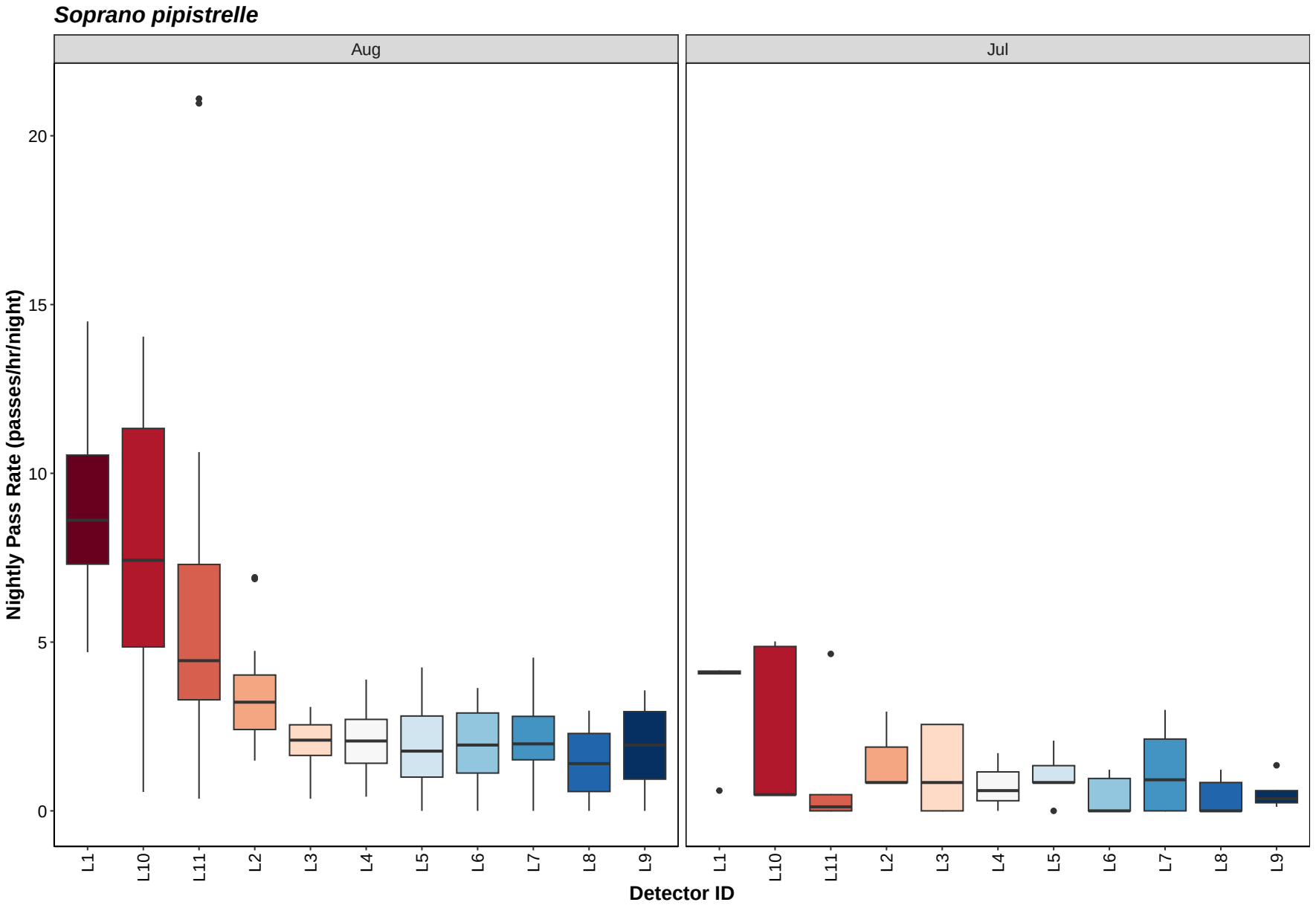

Common pipistrelle
Aug
Jul
Nightly Pass Rate (passes/hr/night)
0
10
20
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID

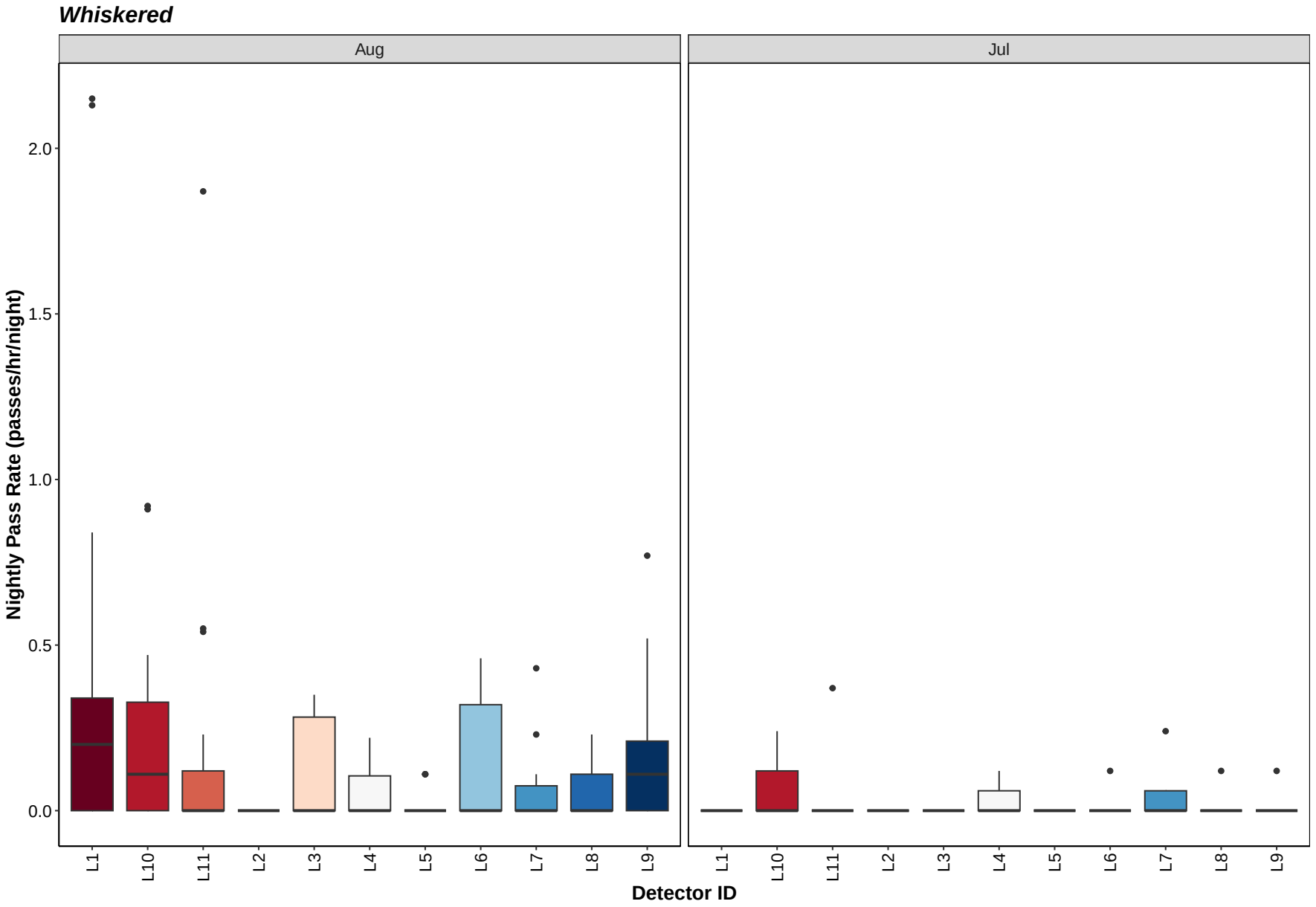

Daubenton's
Aug
Jul
Nightly Pass Rate (passes/hr/night)
1.0
0.5
0.0
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID


Leisler's
Aug
Jul
Nightly Pass Rate (passes/hr/night)
0.0
2.5
5.0
7.5
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID


Nathusius'
Aug
Jul
Nightly Pass Rate (passes/hr/night)
0.0
0.1
0.2
0.3
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID


Natterer's
Aug
Jul
Nightly Pass Rate (passes/hr/night)
2.0
1.5
1.0
0.5
0.0
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID


Soprano pipistrelle
Aug
Jul
Nightly Pass Rate (passes/hr/night)
0
5
10
15
20
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID


Whiskered
Aug
Jul
Nightly Pass Rate (passes/hr/night)
2.0
1.5
1.0
0.5
0.0
L1
L10
L11
L2
L3
L4
L5
L6
L7
L8
L9
Detector ID

Bat Activity per Detector Location

Figure 18. Detector ID reference:

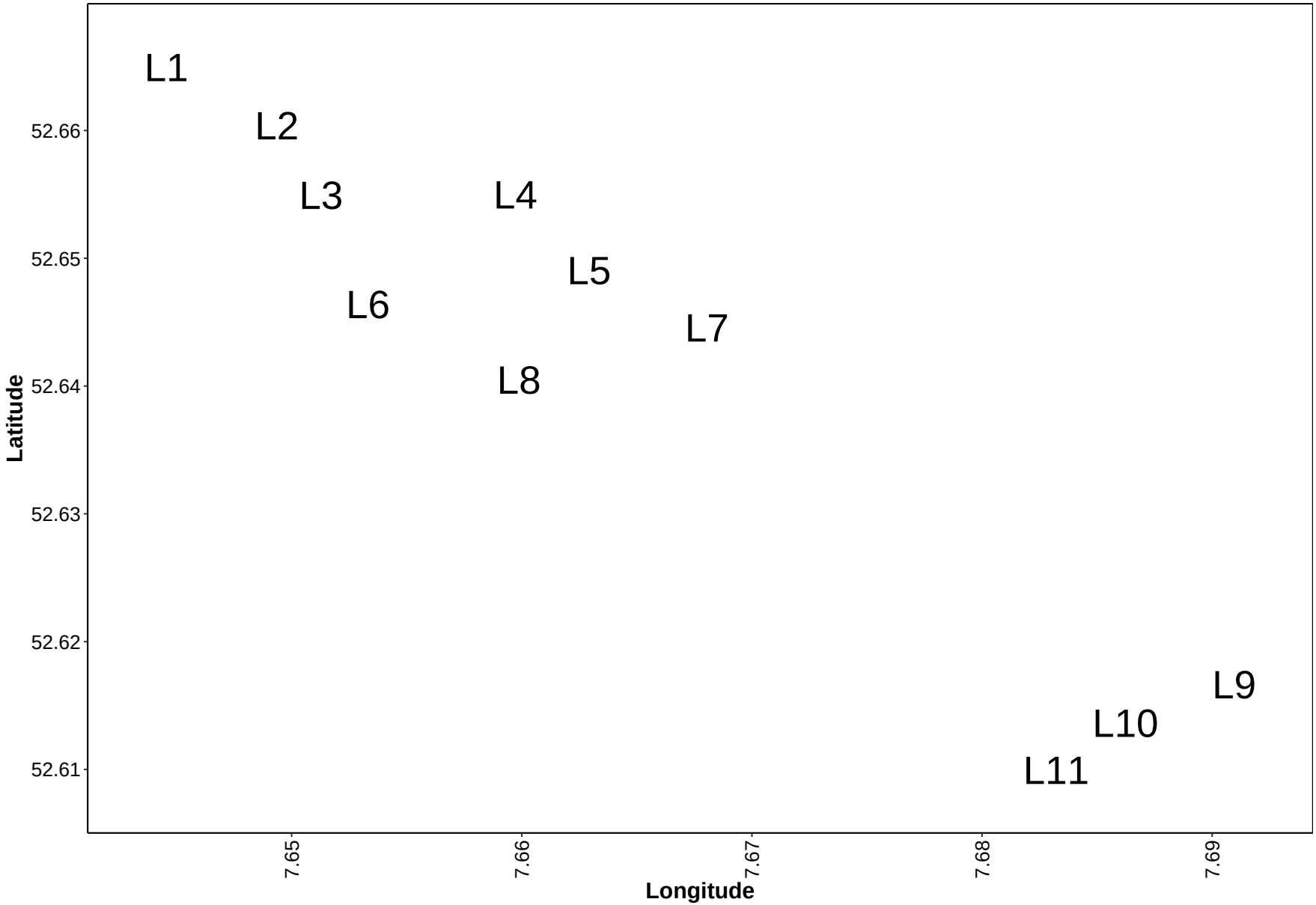
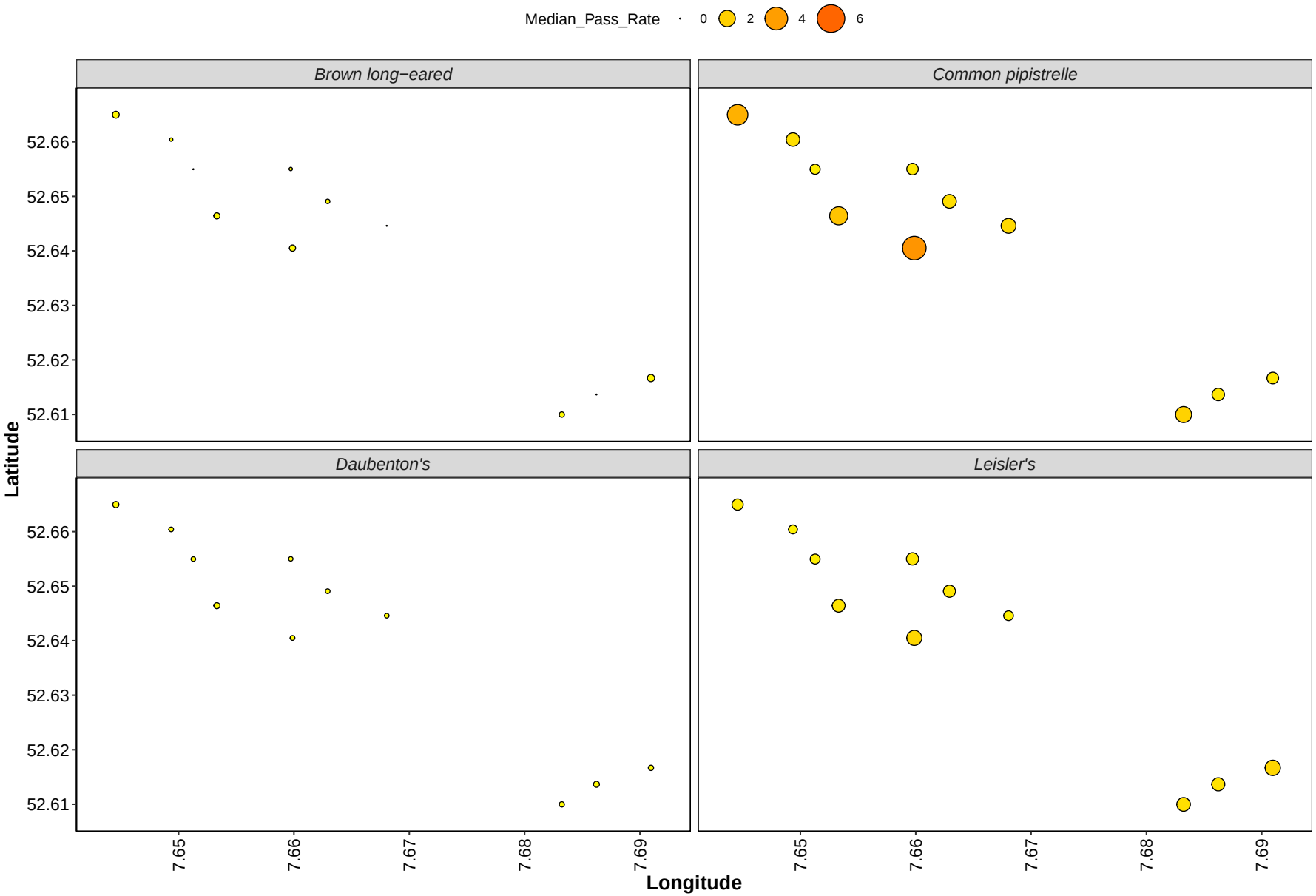

L1
L2
L3
L4
L5
L6
L7
L8
L9
L10
L11
52.66
52.65
52.64
52.63
52.62
52.61
Latitude
7.65
7.66
7.67
7.68
7.69
Longitude

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
2
4
6
Brown long−eared
Common pipistrelle
Daubenton's
Leisler's
52.66
52.65
52.64
52.63
52.62
52.61
Latitude
7.65
7.66
7.67
7.68
7.69
Longitude

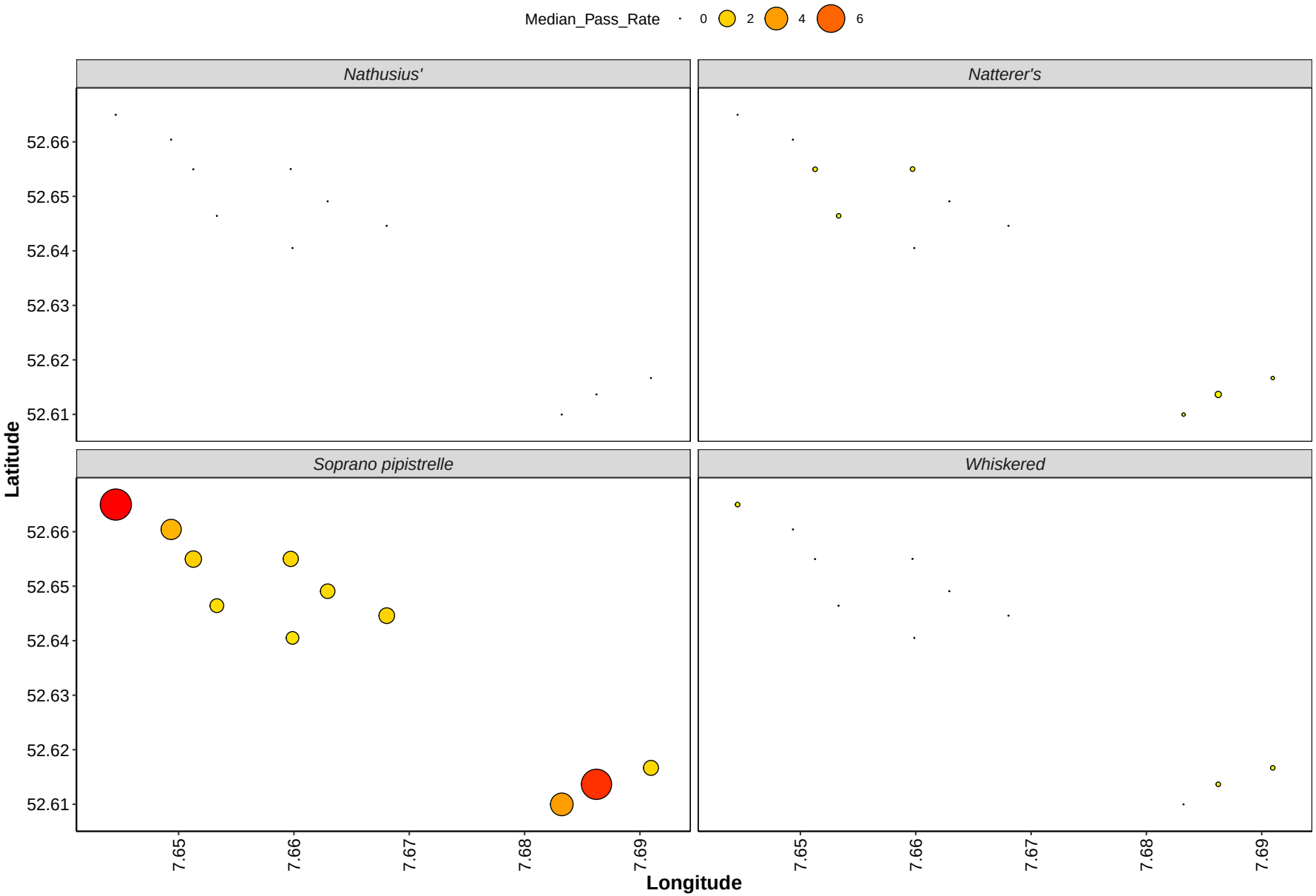
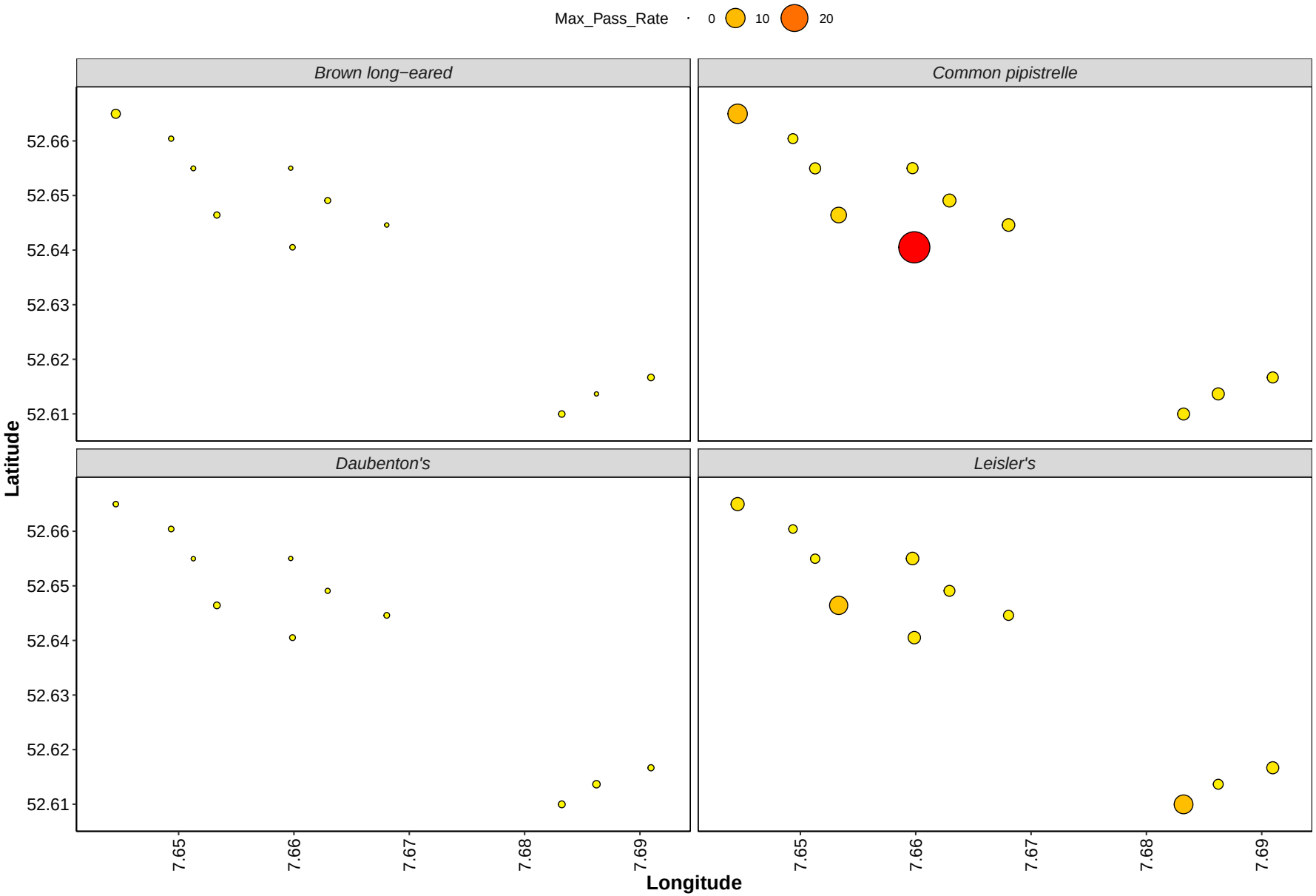
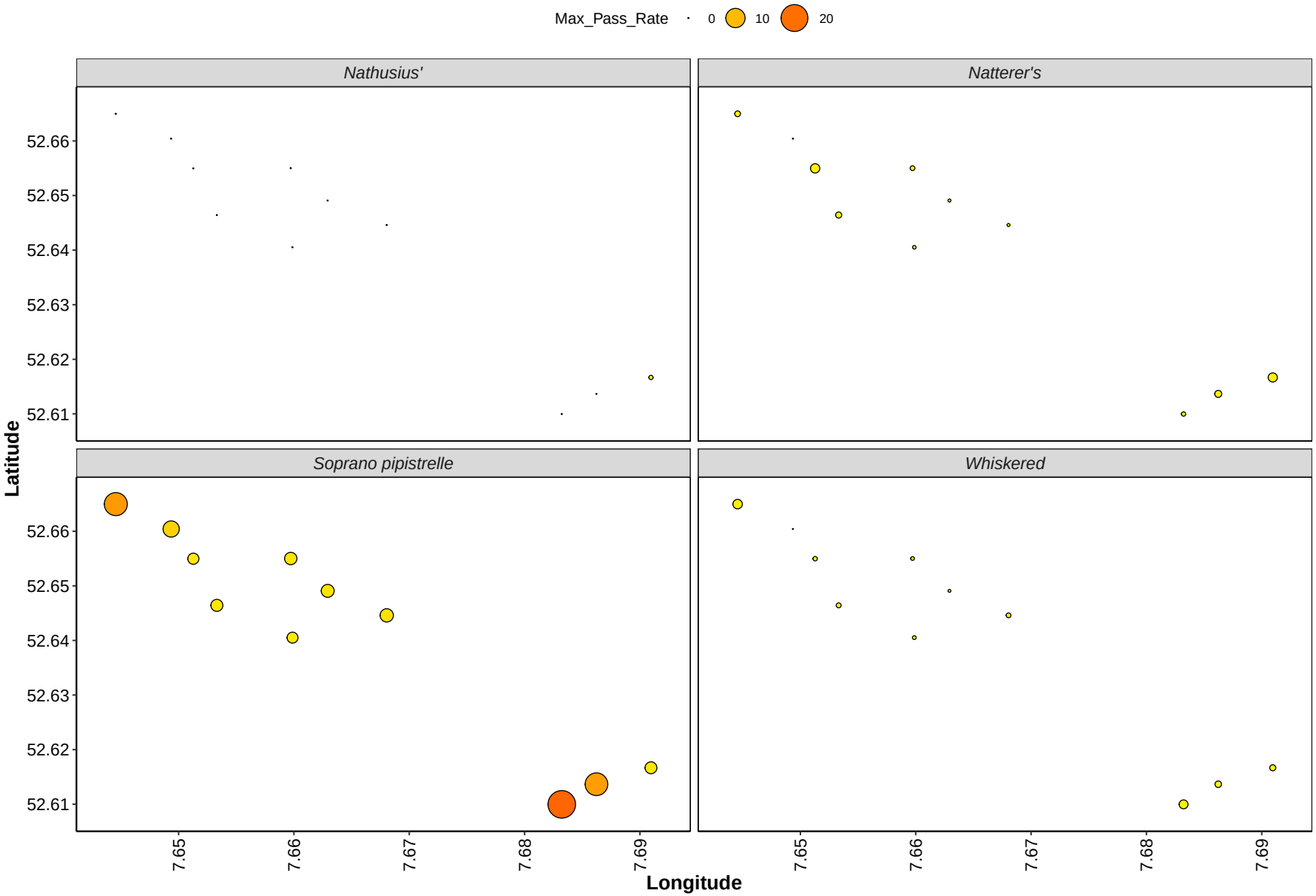

Median_Pass_Rate
0
2
4
6
Nathusius'
Natterer's
Soprano pipistrelle
Whiskered
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
Longitude
-7.65
-7.66
-7.67
-7.68
-7.69

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
Brown long−eared
Common pipistrelle
Daubenton's
Leisler's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
Longitude
−7.65
−7.66
−7.67
−7.68
−7.69


Max_Pass_Rate
0
10
20
Nathusius'
Natterer's
Soprano pipistrelle
Whiskered
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
Longitude
7.65
7.66
7.67
7.68
7.69

Thank you for using Ecobat!

Ecobat Report
2026-01-09

Geo filter: all, Time filter: all

Summary

Bats were detected on **22** nights between **20/09/2023** and **11/10/2023**, using **10** static bat detectors. Throughout this period, **8** species were recorded. **Table 1.** Detectors were placed at the following locations:

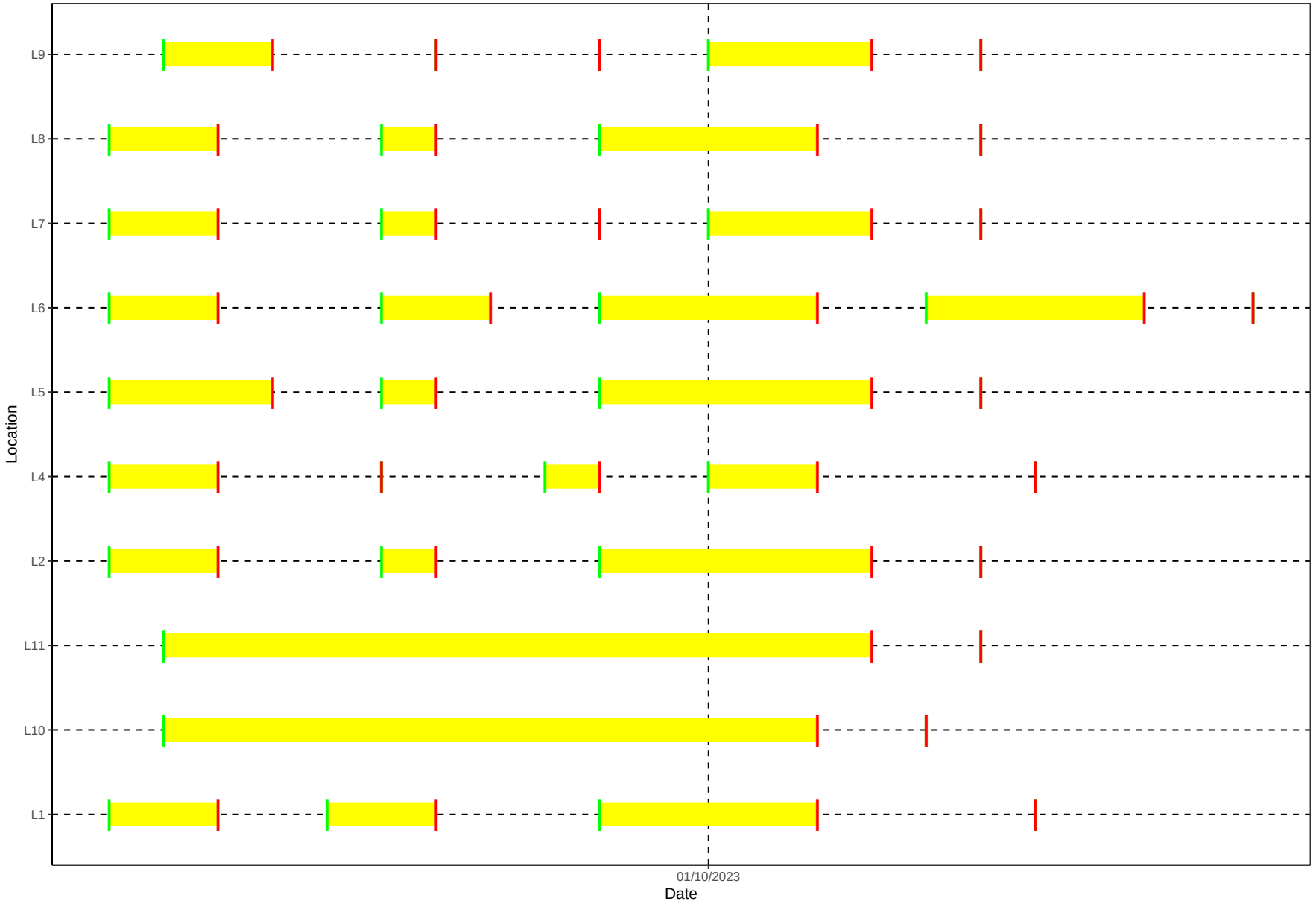
Detector ID	Latitude	Longitude
L1	52.66497	7.644556
L2	52.66041	7.649355
L4	52.65501	7.659723
L5	52.64908	7.662925
L6	52.66497	7.644556
L7	52.66497	7.644556
L8	52.64051	7.659876
L9	52.61667	7.690955
L9	52.66497	7.644556
L10	52.61366	7.686230
L11	52.60997	7.683222
L7	52.64459	7.668046
L6	52.64642	7.653317

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
L1	16
L10	19
L11	20
L2	17
L4	12
L5	18
L6	17
L7	15
L8	16
L9	15

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


L9
L8
L7
L6
L5
L4
L2
L11
L10
L1
Location
01/10/2023
Date

Part 1: Percentile 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.

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 Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L1	Myotis daubentonii	0	0	0	0	0	5
L1	Myotis mystacinus	0	0	0	0	0	3
L1	Myotis nattereri	0	0	0	0	1	0
L1	Nyctalus leisleri	0	0	0	0	0	15
L1	Pipistrellus pipistrellus	0	0	0	0	0	7
L1	Pipistrellus pygmaeus	0	0	0	0	0	10
L1	Plecotus auritus	0	0	0	0	0	2
L10	Myotis daubentonii	0	0	0	0	0	10
L10	Myotis mystacinus	0	0	0	0	0	1
L10	Myotis nattereri	0	0	0	0	0	6
L10	Nyctalus leisleri	0	0	0	0	0	11
L10	Pipistrellus nathusii	0	0	0	0	0	1
L10	Pipistrellus pipistrellus	0	0	0	0	0	10
L10	Pipistrellus pygmaeus	0	0	0	0	6	9
L10	Plecotus auritus	0	0	0	0	0	2
L11	Myotis daubentonii	0	0	0	0	0	13
L11	Myotis mystacinus	0	0	0	0	0	5
L11	Myotis nattereri	0	0	0	0	0	8
L11	Nyctalus leisleri	0	0	0	0	0	7

Detector ID	Species/Species Group	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L11	Pipistrellus nathusii	0	0	0	0	0	3
L11	Pipistrellus pipistrellus	0	0	0	0	0	12
L11	Pipistrellus pygmaeus	0	0	0	0	0	17
L11	Plecotus auritus	0	0	0	0	0	2
L2	Myotis daubentonii	0	0	0	0	0	10
L2	Myotis nattereri	0	0	0	0	0	4
L2	Nyctalus leisleri	0	0	0	0	0	14
L2	Pipistrellus nathusii	0	0	0	0	0	2
L2	Pipistrellus pipistrellus	0	0	0	0	0	8
L2	Pipistrellus pygmaeus	0	0	0	0	0	9
L2	Plecotus auritus	0	0	0	0	0	5
L4	Myotis daubentonii	0	0	0	0	0	8
L4	Myotis mystacinus	0	0	0	0	0	5
L4	Myotis nattereri	0	0	0	0	0	3
L4	Nyctalus leisleri	0	0	0	0	0	9
L4	Pipistrellus nathusii	0	0	0	0	0	2
L4	Pipistrellus pipistrellus	0	0	0	0	0	2
L4	Pipistrellus pygmaeus	0	0	0	0	0	6
L4	Plecotus auritus	0	0	0	0	0	1
L5	Myotis daubentonii	0	0	0	0	0	10
L5	Myotis nattereri	0	0	0	0	0	2

Detector ID	Species/Species Group	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L5	Nyctalus leisleri	0	0	0	0	0	10
L5	Pipistrellus nathusii	0	0	0	0	0	2
L5	Pipistrellus pipistrellus	0	0	0	0	0	7
L5	Pipistrellus pygmaeus	0	0	0	0	0	7
L5	Plecotus auritus	0	0	0	0	0	3
L6	Myotis daubentonii	0	0	0	0	0	11
L6	Myotis mystacinus	0	0	0	0	0	2
L6	Myotis nattereri	0	0	0	0	0	1
L6	Nyctalus leisleri	0	0	0	0	0	12
L6	Pipistrellus nathusii	0	0	0	0	0	2
L6	Pipistrellus pipistrellus	0	0	0	0	0	11
L6	Pipistrellus pygmaeus	0	0	0	0	0	6
L6	Plecotus auritus	0	0	0	0	0	3
L7	Myotis daubentonii	0	0	0	0	0	12
L7	Myotis mystacinus	0	0	0	0	0	3
L7	Myotis nattereri	0	0	0	0	1	2
L7	Nyctalus leisleri	0	0	0	0	0	10
L7	Pipistrellus pipistrellus	0	0	0	0	0	4
L7	Pipistrellus pygmaeus	0	0	0	0	0	7
L7	Plecotus auritus	0	0	0	0	0	6
L8	Myotis daubentonii	0	0	0	0	0	9

Detector ID	Species/Species Group	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L8	Myotis mystacinus	0	0	0	0	0	1
L8	Myotis nattereri	0	0	0	0	2	1
L8	Nyctalus leisleri	0	0	0	0	0	12
L8	Pipistrellus nathusii	0	0	0	0	0	2
L8	Pipistrellus pipistrellus	0	0	0	0	0	11
L8	Pipistrellus pygmaeus	0	0	0	0	0	5
L8	Plecotus auritus	0	0	0	0	0	7
L9	Myotis daubentonii	0	0	0	0	0	8
L9	Myotis mystacinus	0	0	0	0	0	8
L9	Myotis nattereri	0	0	0	0	3	3
L9	Nyctalus leisleri	0	0	0	0	0	10
L9	Pipistrellus nathusii	0	0	0	0	0	2
L9	Pipistrellus pipistrellus	0	0	0	0	0	8
L9	Pipistrellus pygmaeus	0	0	0	0	0	10
L9	Plecotus auritus	0	0	0	0	0	4

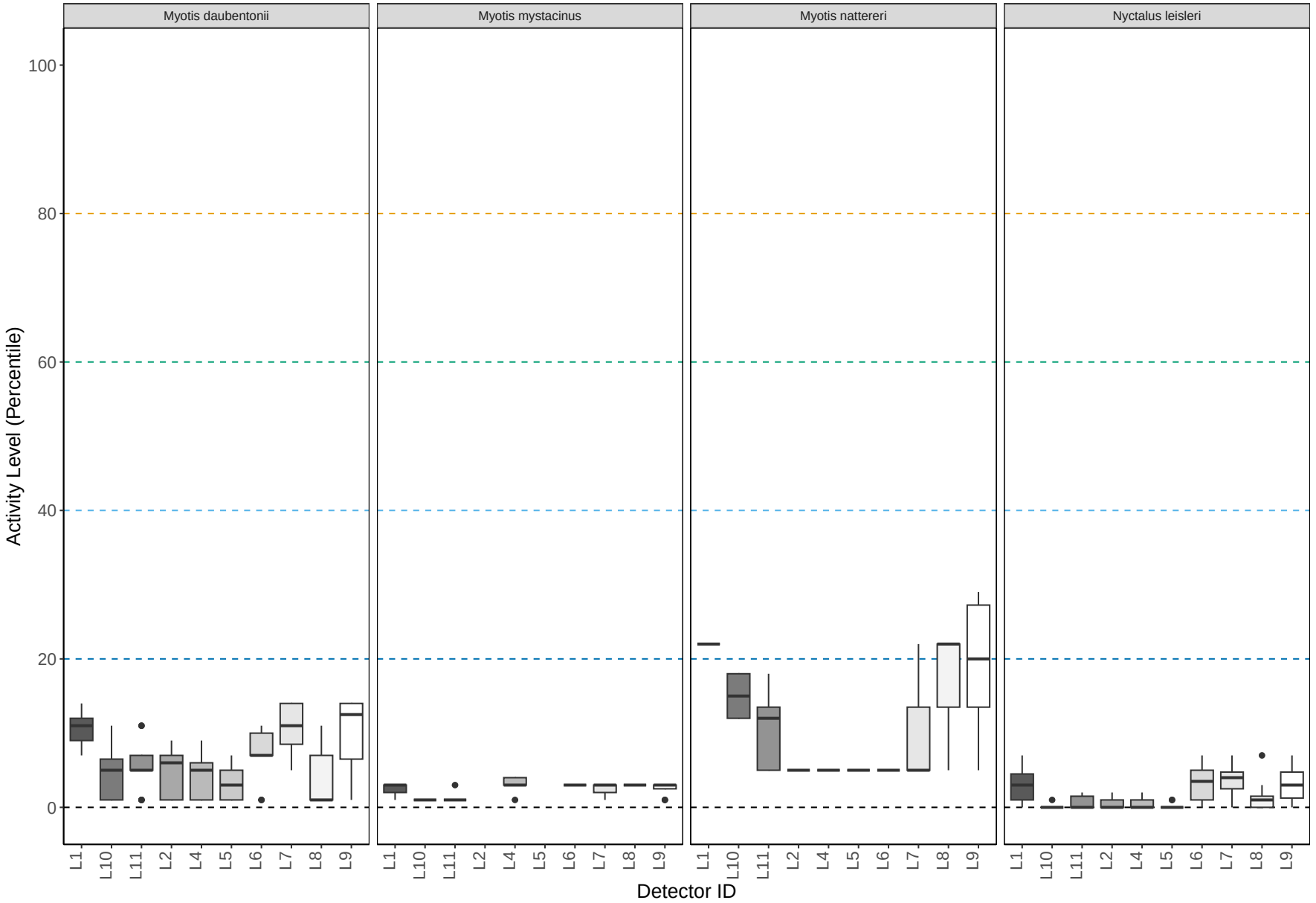
Table 4. Summary table showing key metrics for each species recorded. The reference range is the number of nights for each species that your data were compared to. We recommend a Reference Range of 200+ to be confident in the relative activity level.

Detector ID	Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded	Reference Range
L1	Myotis daubentonii	11	9 - 12.5	14	5	6506
L1	Myotis mystacinus	3	3 - 3	3	3	2691
L1	Myotis nattereri	22	0	22	1	1729
L1	Nyctalus leisleri	3	2.5 - 4.5	7	15	59294
L1	Pipistrellus pipistrellus	0	0 - 0	0	7	1533280
L1	Pipistrellus pygmaeus	0	0 - 0	1	10	405380
L1	Plecotus auritus	7	6.5 - 6.5	12	2	23140
L10	Myotis daubentonii	5	1 - 7	11	10	6506
L10	Myotis mystacinus	1	0	1	1	2691
L10	Myotis nattereri	15	12 - 18	18	6	1729
L10	Nyctalus leisleri	0	0 - 0	1	11	59294
L10	Pipistrellus nathusii	8	0	8	1	3164
L10	Pipistrellus pipistrellus	0	0 - 0	0	10	1533280
L10	Pipistrellus pygmaeus	12	12.5 - 24	25	15	405380
L10	Plecotus auritus	4	4 - 4	4	2	23140
L11	Myotis daubentonii	5	3 - 8	11	13	6506
L11	Myotis mystacinus	1	1 - 1	3	5	2691
L11	Myotis nattereri	12	5 - 15	18	8	1729
L11	Nyctalus leisleri	0	2 - 2	2	7	59294
L11	Pipistrellus nathusii	14	14 - 14	14	3	3164
L11	Pipistrellus pipistrellus	0	0 - 0	0	12	1533280
L11	Pipistrellus pygmaeus	0	0 - 0	1	17	405380
L11	Plecotus auritus	1	1 - 1	1	2	23140
L2	Myotis daubentonii	6	1 - 8	9	10	6506
L2	Myotis nattereri	5	5 - 5	5	4	1729
L2	Nyctalus leisleri	0	1 - 1.5	2	14	59294
L2	Pipistrellus nathusii	11	11 - 11	14	2	3164
L2	Pipistrellus pipistrellus	0	0 - 0	0	8	1533280
L2	Pipistrellus pygmaeus	0	0 - 0	2	9	405380
L2	Plecotus auritus	1	1 - 2.5	4	5	23140
L4	Myotis daubentonii	5	1 - 7	9	8	6506
L4	Myotis mystacinus	3	2 - 4	4	5	2691
L4	Myotis nattereri	5	5 - 5	5	3	1729

Detector ID	Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded	Reference Range
L4	Nyctalus leisleri	0	1 - 2	2	9	59294
L4	Pipistrellus nathusii	8	8 - 8	8	2	3164
L4	Pipistrellus pipistrellus	0	0 - 0	0	2	1533280
L4	Pipistrellus pygmaeus	0	0 - 0	0	6	405380
L4	Plecotus auritus	1	0	1	1	23140
L5	Myotis daubentonii	3	1 - 5	7	10	6506
L5	Myotis nattereri	5	5 - 5	5	2	1729
L5	Nyctalus leisleri	0	0 - 0	1	10	59294
L5	Pipistrellus nathusii	11	11 - 11	14	2	3164
L5	Pipistrellus pipistrellus	0	0 - 0	0	7	1533280
L5	Pipistrellus pygmaeus	0	0 - 0	0	7	405380
L5	Plecotus auritus	1	1 - 1	1	3	23140
L6	Myotis daubentonii	7	4 - 10	11	11	6506
L6	Myotis mystacinus	3	3 - 3	3	2	2691
L6	Myotis nattereri	5	0	5	1	1729
L6	Nyctalus leisleri	4	2 - 5	7	12	59294
L6	Pipistrellus nathusii	11	11 - 11	14	2	3164
L6	Pipistrellus pipistrellus	0	0 - 0	0	11	1533280
L6	Pipistrellus pygmaeus	0	0 - 0	0	6	405380
L6	Plecotus auritus	4	4 - 4	12	3	23140
L7	Myotis daubentonii	11	8 - 13	14	12	6506
L7	Myotis mystacinus	3	3 - 3	3	3	2691
L7	Myotis nattereri	5	5 - 5	22	3	1729
L7	Nyctalus leisleri	4	2.5 - 5.5	7	10	59294
L7	Pipistrellus pipistrellus	0	0 - 0	0	4	1533280
L7	Pipistrellus pygmaeus	0	0 - 0	1	7	405380
L7	Plecotus auritus	4	2.5 - 12	12	6	23140
L8	Myotis daubentonii	1	1 - 7	11	9	6506
L8	Myotis mystacinus	3	0	3	1	2691
L8	Myotis nattereri	22	22 - 22	22	3	1729
L8	Nyctalus leisleri	1	1 - 4	7	12	59294
L8	Pipistrellus nathusii	8	8 - 8	8	2	3164
L8	Pipistrellus pipistrellus	0	0 - 0	0	11	1533280
L8	Pipistrellus pygmaeus	0	0 - 0	0	5	405380
L8	Plecotus auritus	1	1 - 2.5	4	7	23140
L9	Myotis daubentonii	13	7.5 - 14	14	8	6506

Detector ID	Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded	Reference Range
L9	Myotis mystacinus	3	2 - 3	3	8	2691
L9	Myotis nattereri	20	12 - 25.5	29	6	1729
L9	Nyctalus leisleri	3	2 - 5	7	10	59294
L9	Pipistrellus nathusii	11	11 - 11	14	2	3164
L9	Pipistrellus pipistrellus	0	0 - 0	0	8	1533280
L9	Pipistrellus pygmaeus	0	0 - 0	1	10	405380
L9	Plecotus auritus	1	1 - 1	1	4	23140

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).


Myotis daubentonii
Myotis mystacinus
Myotis nattereri
Nyctalus leisleri
Activity Level (Percentile)
100
80
60
40
20
0
L1
L10
L11
L2
L4
L5
L6
L7
L8
L9
Detector ID

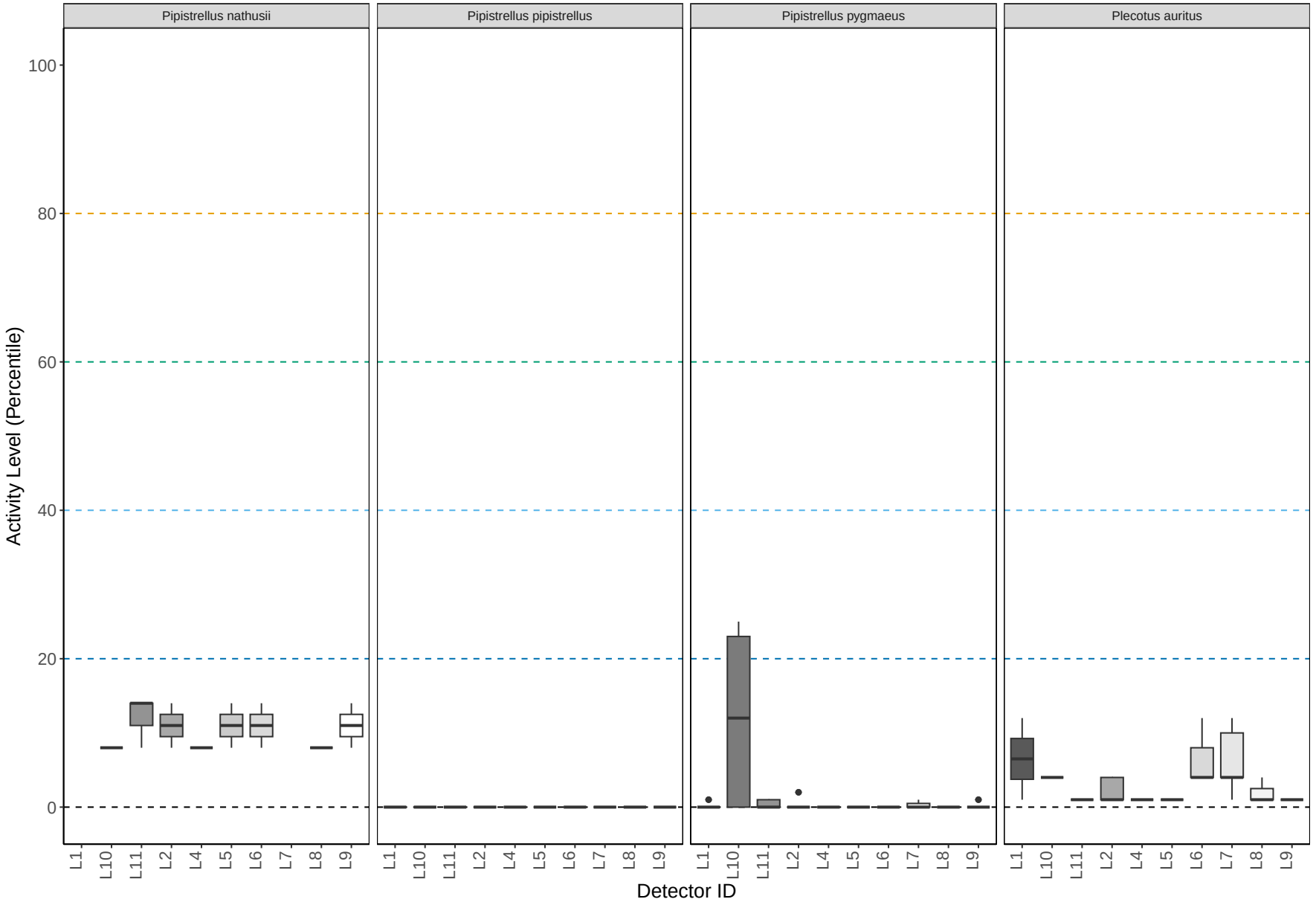
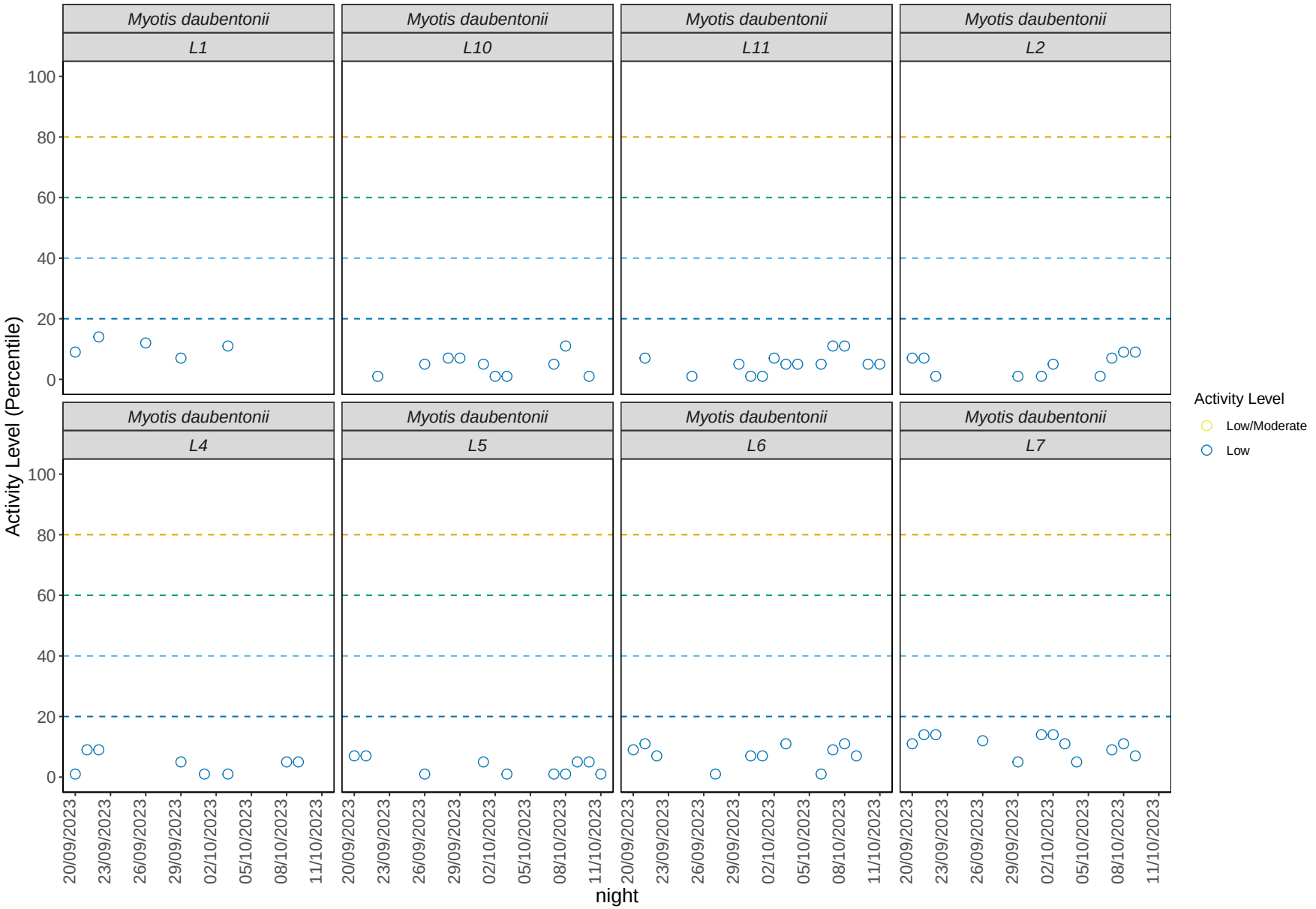
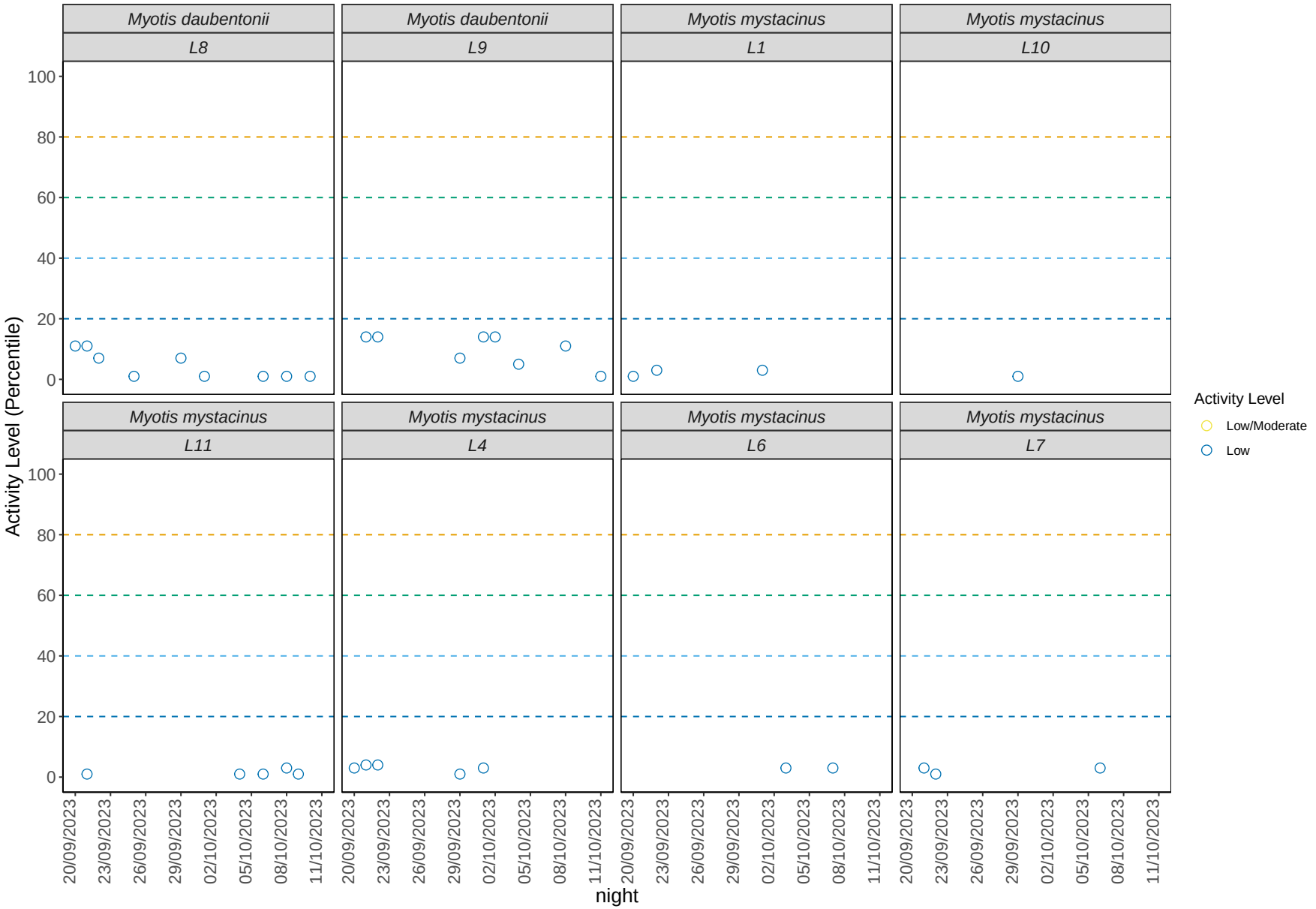
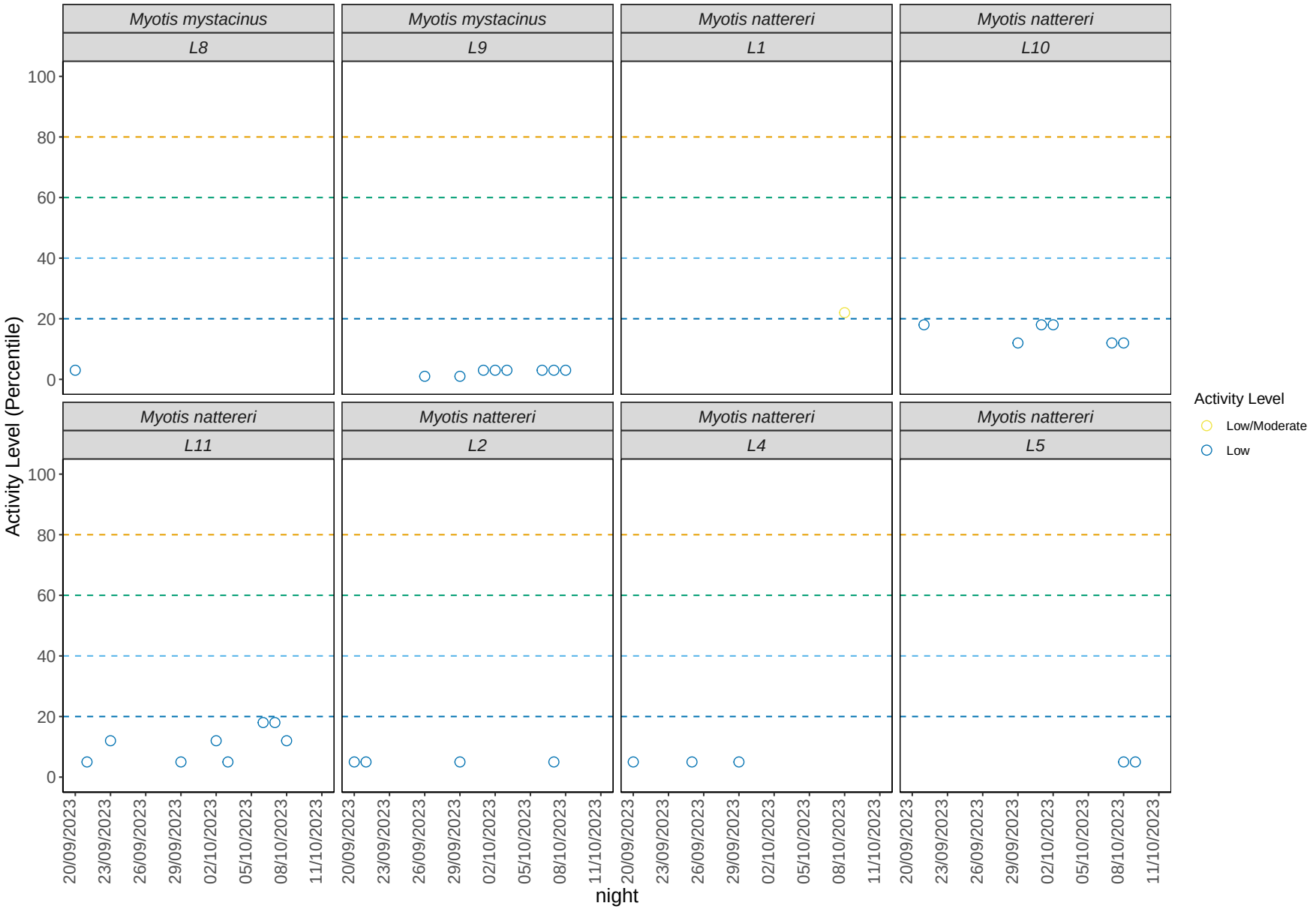
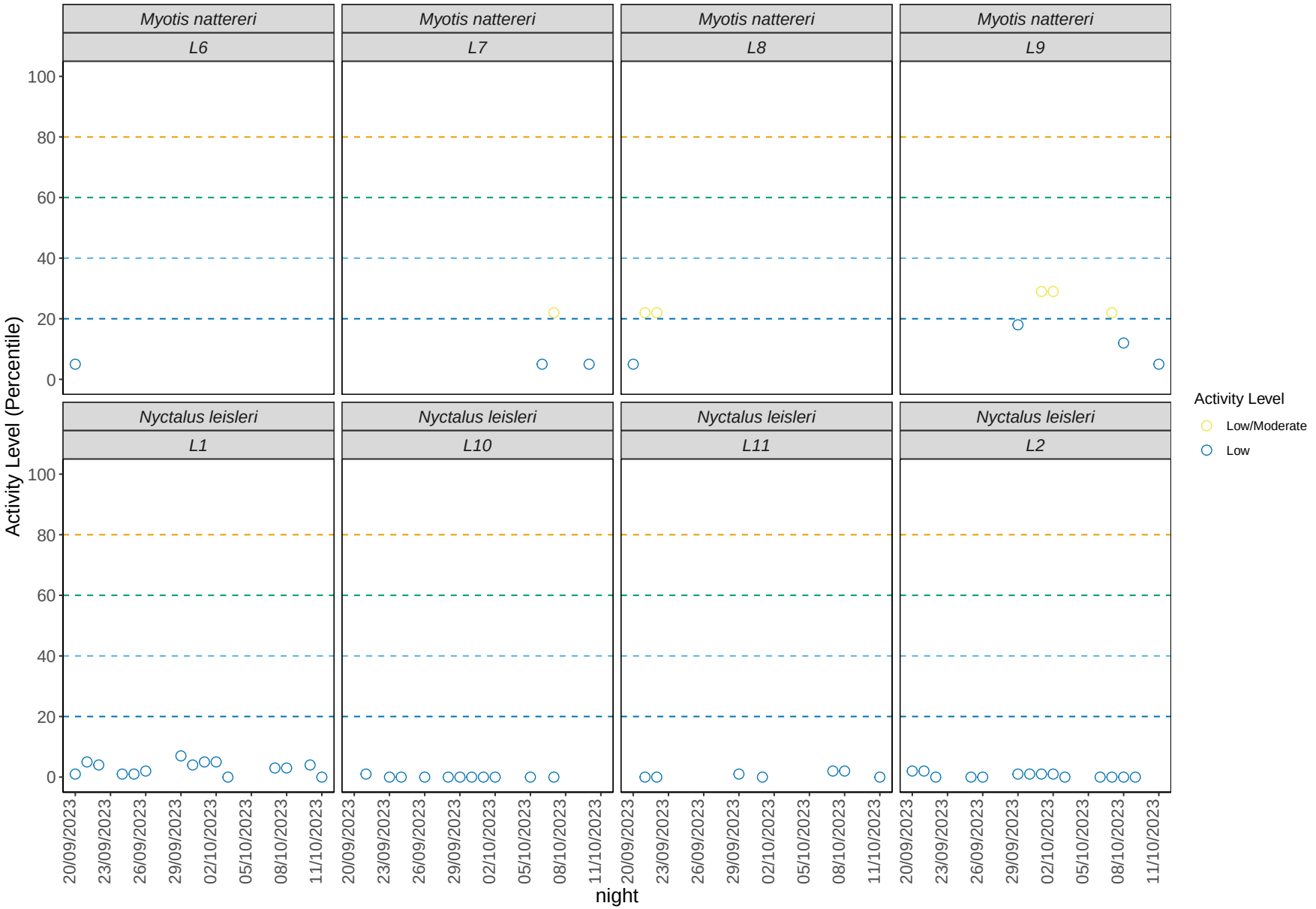

Pipistrellus nathusii
Pipistrellus pipistrellus
Pipistrellus pygmaeus
Plecotus auritus
Activity Level (Percentile)
100
80
60
40
20
0
L1
L10
L11
L2
L4
L5
L6
L7
L8
L9
Detector ID

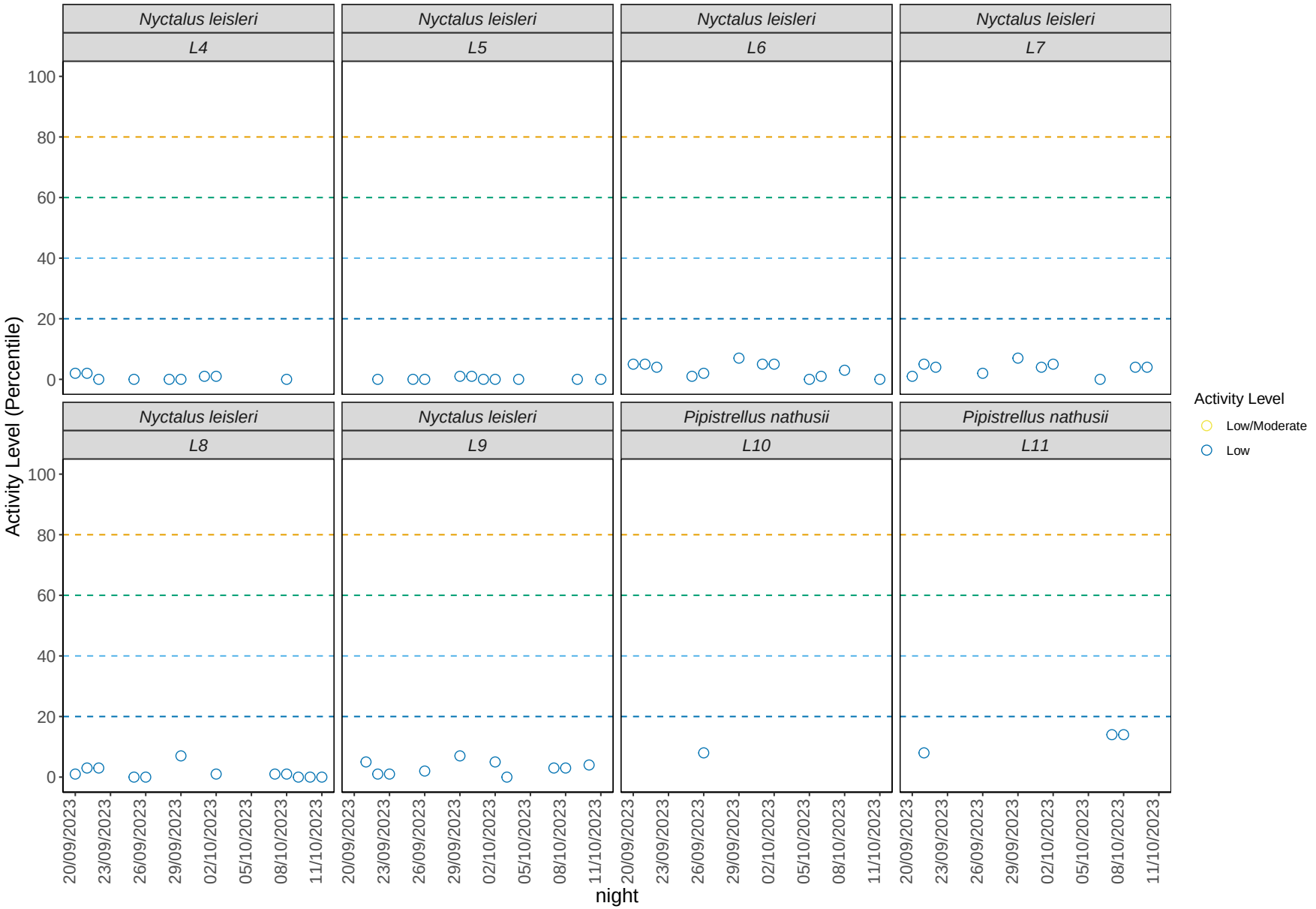
Figure 3. The activity level (percentile) of bats recorded across each night of the bat survey.

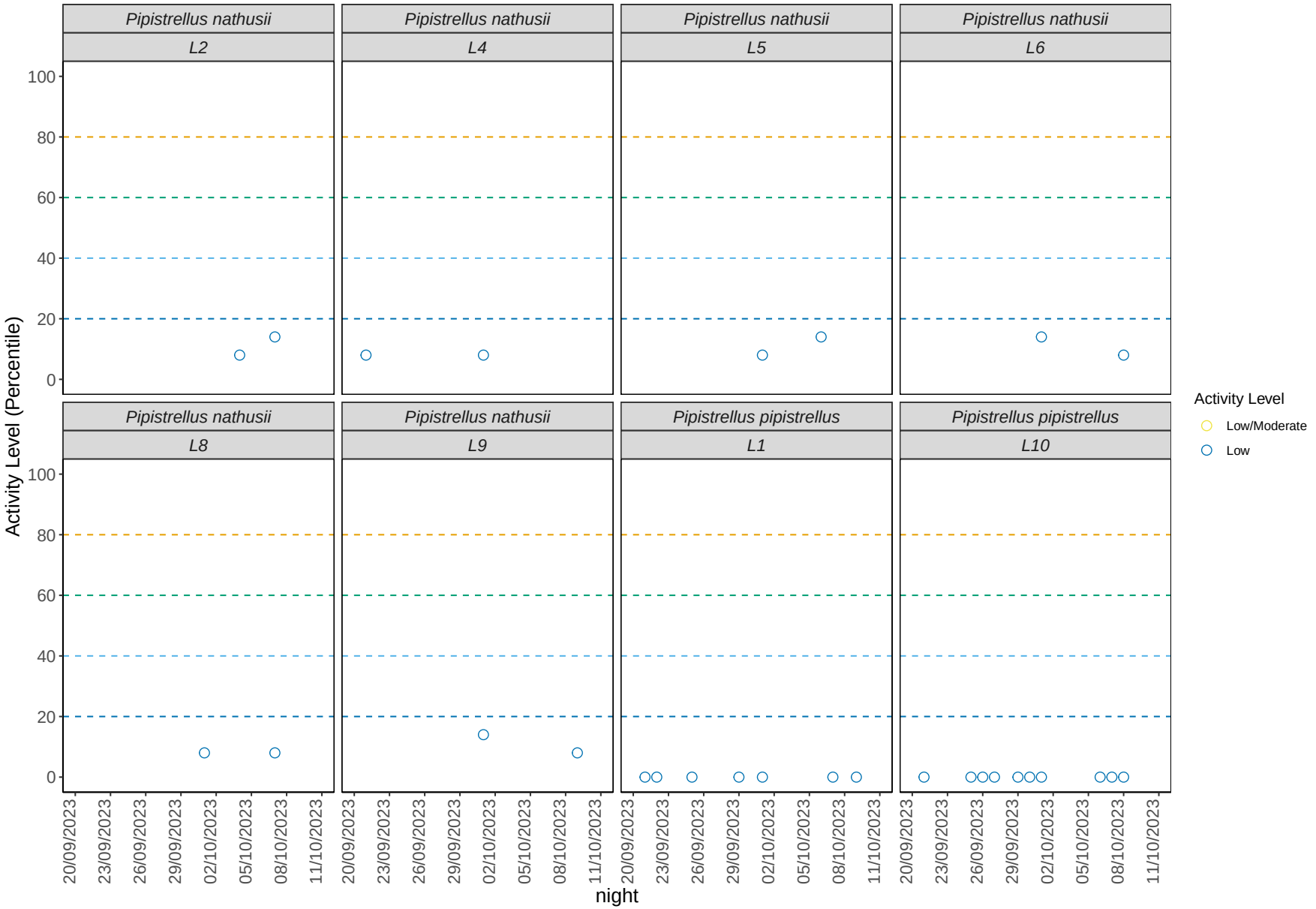

Myotis daubentonii
L1
L10
L11
L2
L4
L5
L6
L7
Activity Level (Percentile)
0
20
40
60
80
100
20/09/2023
23/09/2023
26/09/2023
29/09/2023
02/10/2023
05/10/2023
08/10/2023
11/10/2023
night
Activity Level
Low/Moderate
Low

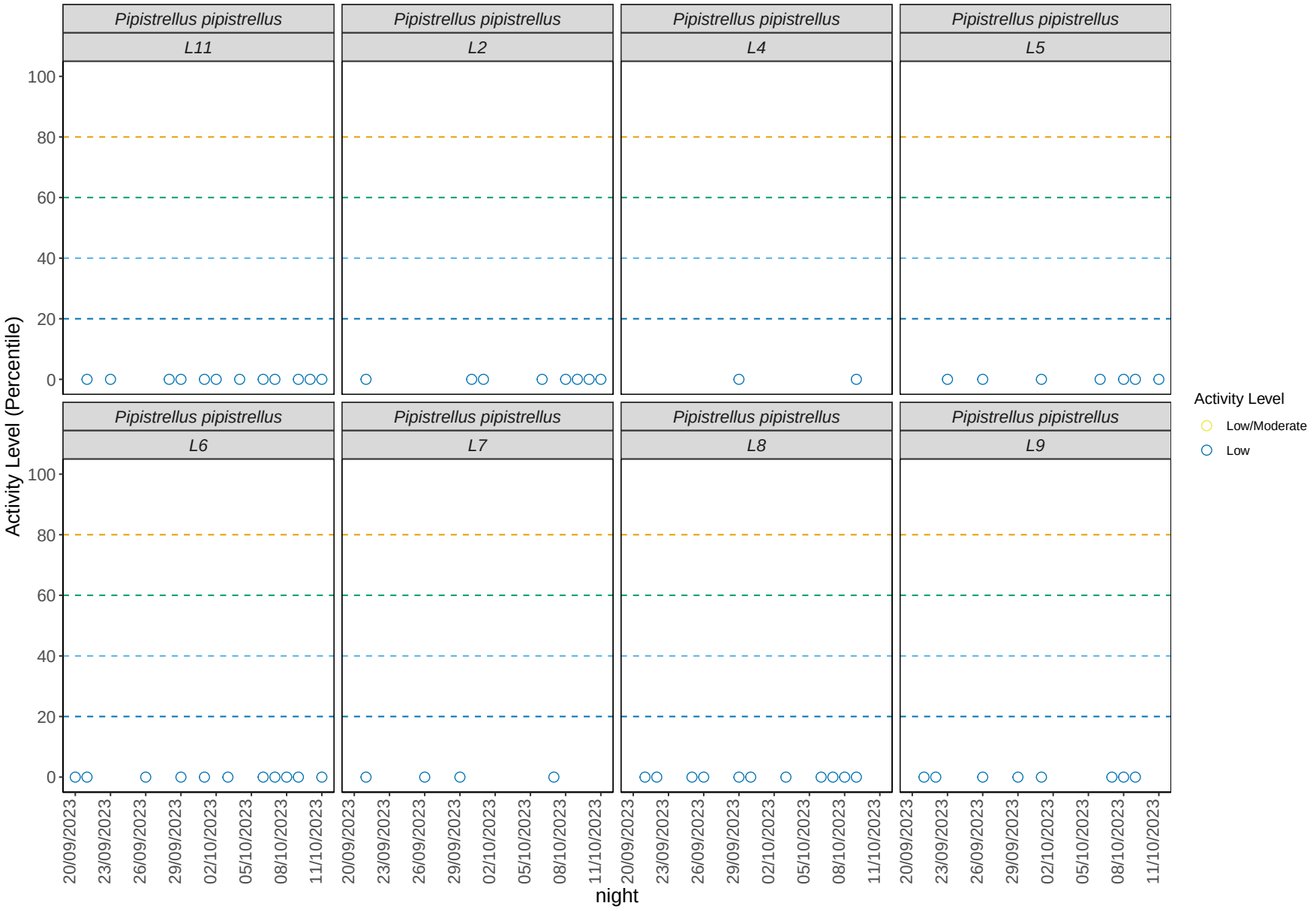

Myotis daubentonii
L8
Myotis daubentonii
L9
Myotis mystacinus
L1
Myotis mystacinus
L10
Myotis mystacinus
L11
Myotis mystacinus
L4
Myotis mystacinus
L6
Myotis mystacinus
L7
Activity Level (Percentile)
100
80
60
40
20
0
20/09/2023
23/09/2023
26/09/2023
29/09/2023
02/10/2023
05/10/2023
08/10/2023
11/10/2023
night
Activity Level
Low/Moderate
Low

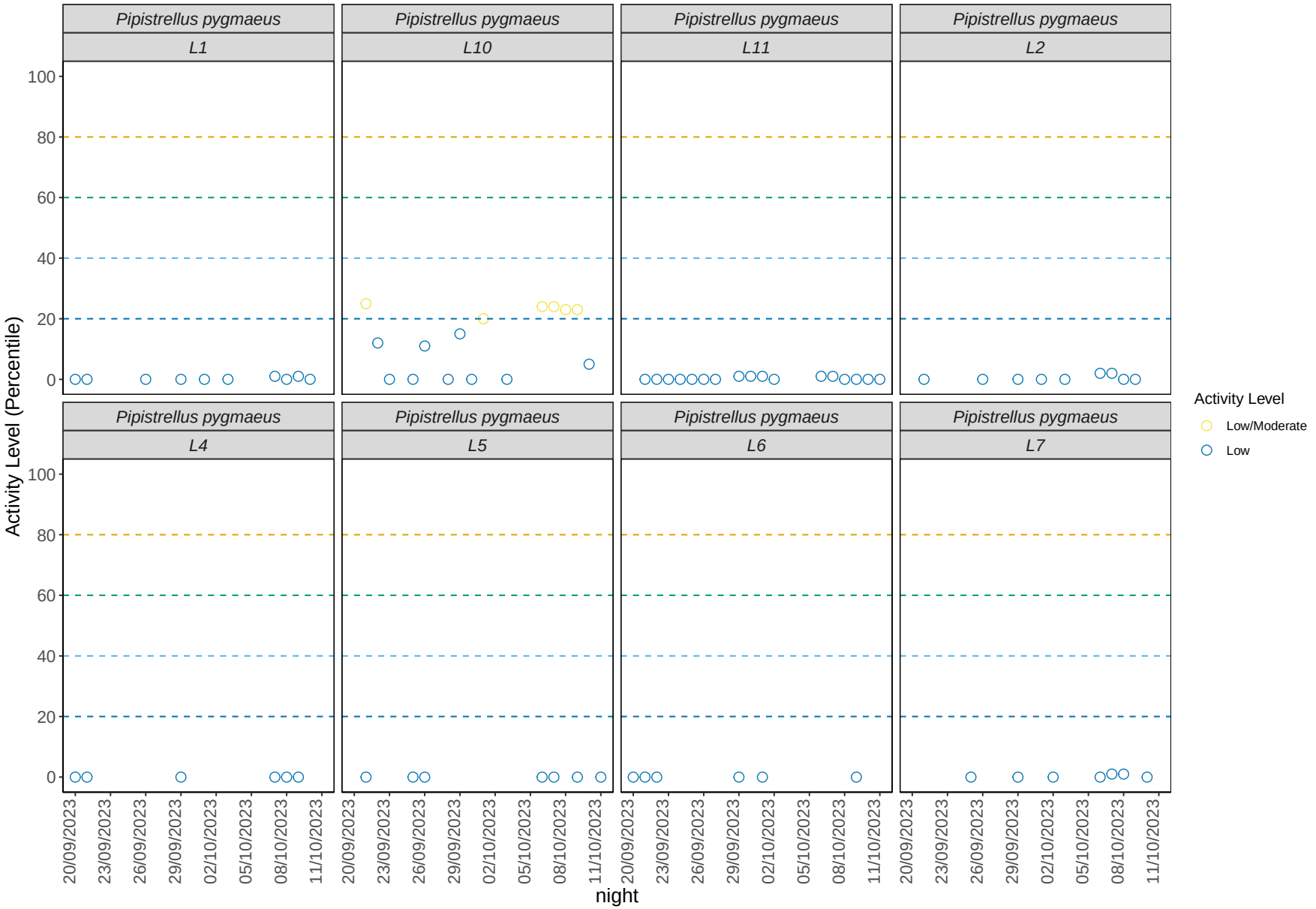

Myotis mystacinus
L8
Myotis mystacinus
L9
Myotis nattereri
L1
Myotis nattereri
L10
Myotis nattereri
L11
Myotis nattereri
L2
Myotis nattereri
L4
Myotis nattereri
L5
Activity Level (Percentile)
0
20
40
60
80
100
20/09/2023
23/09/2023
26/09/2023
29/09/2023
02/10/2023
05/10/2023
08/10/2023
11/10/2023
night
Activity Level
Low/Moderate
Low

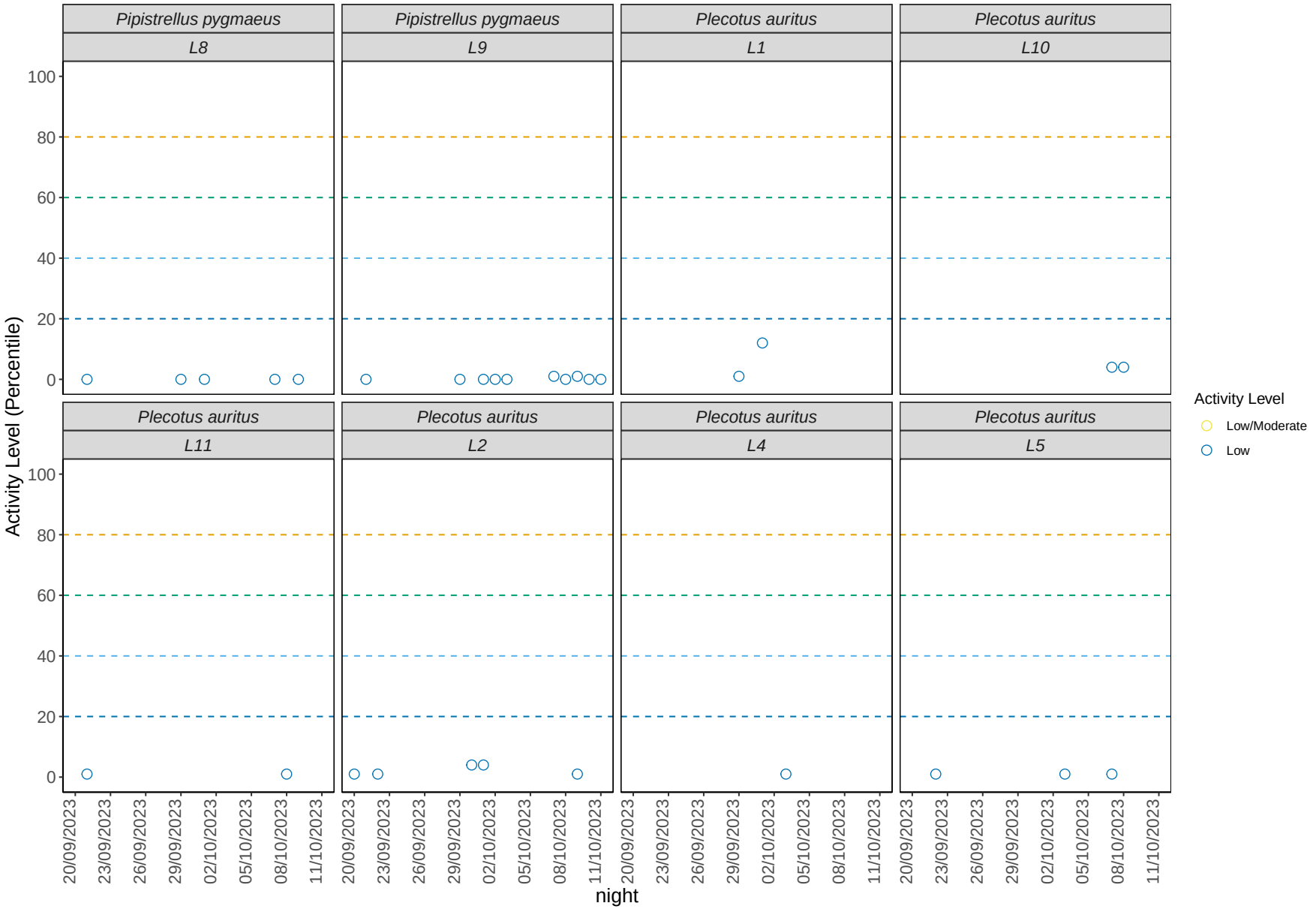

Myotis nattereri
L6
L7
L8
L9
Nyctalus leisleri
L1
L10
L11
L2
Activity Level (Percentile)
0
20
40
60
80
100
20/09/2023
23/09/2023
26/09/2023
29/09/2023
02/10/2023
05/10/2023
08/10/2023
11/10/2023
night
Activity Level
Low/Moderate
Low

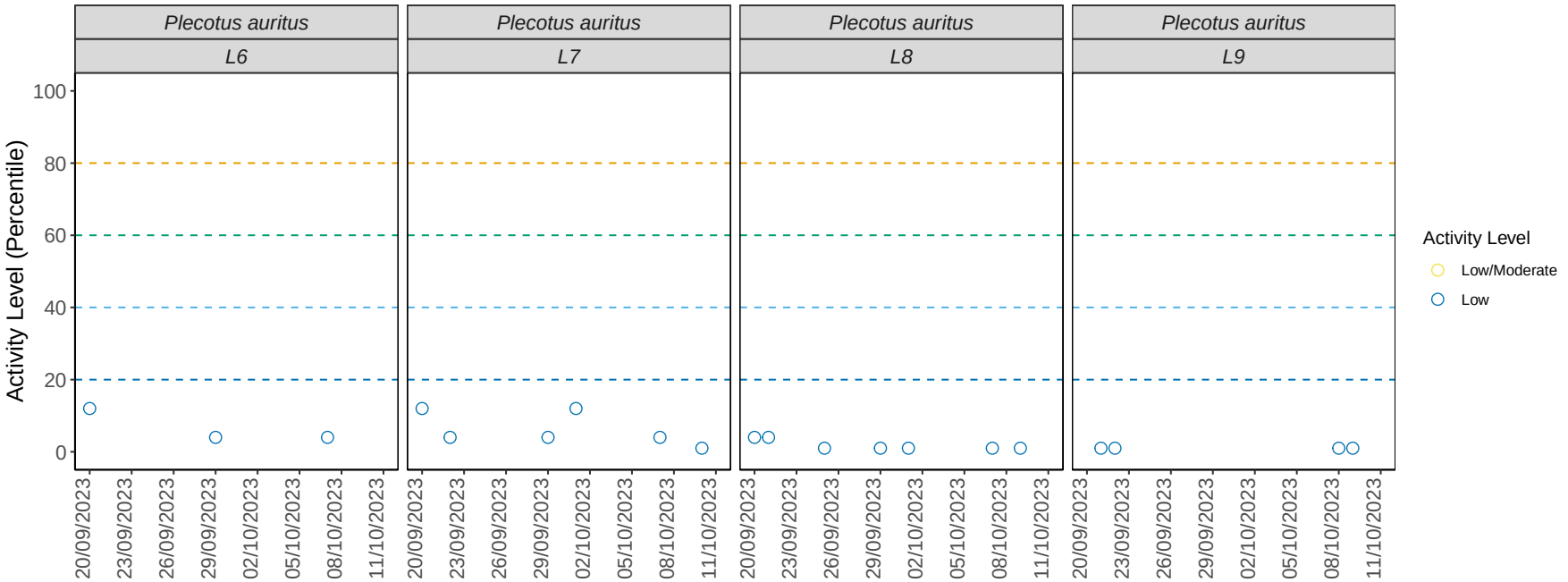

Nyctalus leisleri
L4
Nyctalus leisleri
L5
Nyctalus leisleri
L6
Nyctalus leisleri
L7
Nyctalus leisleri
L8
Nyctalus leisleri
L9
Pipistrellus nathusii
L10
Pipistrellus nathusii
L11
Activity Level (Percentile)
0
20
40
60
80
100
20/09/2023
23/09/2023
26/09/2023
29/09/2023
02/10/2023
05/10/2023
08/10/2023
11/10/2023
night
Activity Level
Low/Moderate
Low


Pipistrellus nathusii
L2
Pipistrellus nathusii
L4
Pipistrellus nathusii
L5
Pipistrellus nathusii
L6
Pipistrellus nathusii
L8
Pipistrellus nathusii
L9
Pipistrellus pipistrellus
L1
Pipistrellus pipistrellus
L10
Activity Level (Percentile)
100
80
60
40
20
0
20/09/2023
23/09/2023
26/09/2023
29/09/2023
02/10/2023
05/10/2023
08/10/2023
11/10/2023
night
Activity Level
Low/Moderate
Low


Pipistrellus pipistrellus
L11
L2
L4
L5
L6
L7
L8
L9
Activity Level (Percentile)
100
80
60
40
20
0
20/09/2023
23/09/2023
26/09/2023
29/09/2023
02/10/2023
05/10/2023
08/10/2023
11/10/2023
night
Activity Level
Low/Moderate
Low


Pipistrellus pygmaeus
L1
L10
L11
L2
L4
L5
L6
L7
Activity Level (Percentile)
0
20
40
60
80
100
night
20/09/2023
23/09/2023
26/09/2023
29/09/2023
02/10/2023
05/10/2023
08/10/2023
11/10/2023
Activity Level
Low/Moderate
Low


Pipistrellus pygmaeus
L8
Pipistrellus pygmaeus
L9
Plecotus auritus
L1
Plecotus auritus
L10
Plecotus auritus
L11
Plecotus auritus
L2
Plecotus auritus
L4
Plecotus auritus
L5
Activity Level (Percentile)
0
20
40
60
80
100
night
20/09/2023
23/09/2023
26/09/2023
29/09/2023
02/10/2023
05/10/2023
08/10/2023
11/10/2023
Activity Level
Low/Moderate
Low


Plecotus auritus
L6
Plecotus auritus
L7
Plecotus auritus
L8
Plecotus auritus
L9
Activity Level (Percentile)
100
80
60
40
20
0
20/09/2023
23/09/2023
26/09/2023
29/09/2023
02/10/2023
05/10/2023
08/10/2023
11/10/2023
Activity Level
Low/Moderate
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 Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L1	Myotis daubentonii	Sep	0	0	0	0	0	4
L1	Myotis daubentonii	Oct	0	0	0	0	0	1
L1	Myotis mystacinus	Sep	0	0	0	0	0	2
L1	Myotis mystacinus	Oct	0	0	0	0	0	1
L1	Myotis nattereri	Oct	0	0	0	0	1	0
L1	Nyctalus leisleri	Sep	0	0	0	0	0	8
L1	Nyctalus leisleri	Oct	0	0	0	0	0	7
L1	Pipistrellus pipistrellus	Sep	0	0	0	0	0	4
L1	Pipistrellus pipistrellus	Oct	0	0	0	0	0	3
L1	Pipistrellus pygmaeus	Sep	0	0	0	0	0	4
L1	Pipistrellus pygmaeus	Oct	0	0	0	0	0	6
L1	Plecotus auritus	Sep	0	0	0	0	0	1
L1	Plecotus auritus	Oct	0	0	0	0	0	1
L10	Myotis daubentonii	Sep	0	0	0	0	0	4
L10	Myotis daubentonii	Oct	0	0	0	0	0	6
L10	Myotis mystacinus	Sep	0	0	0	0	0	1
L10	Myotis nattereri	Sep	0	0	0	0	0	2
L10	Myotis nattereri	Oct	0	0	0	0	0	4
L10	Nyctalus leisleri	Sep	0	0	0	0	0	7

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L10	Nyctalus leisleri	Oct	0	0	0	0	0	4
L10	Pipistrellus nathusii	Sep	0	0	0	0	0	1
L10	Pipistrellus pipistrellus	Sep	0	0	0	0	0	6
L10	Pipistrellus pipistrellus	Oct	0	0	0	0	0	4
L10	Pipistrellus pygmaeus	Sep	0	0	0	0	1	7
L10	Pipistrellus pygmaeus	Oct	0	0	0	0	5	2
L10	Plecotus auritus	Oct	0	0	0	0	0	2
L11	Myotis daubentonii	Sep	0	0	0	0	0	4
L11	Myotis daubentonii	Oct	0	0	0	0	0	9
L11	Myotis mystacinus	Sep	0	0	0	0	0	1
L11	Myotis mystacinus	Oct	0	0	0	0	0	4
L11	Myotis nattereri	Sep	0	0	0	0	0	3
L11	Myotis nattereri	Oct	0	0	0	0	0	5
L11	Nyctalus leisleri	Sep	0	0	0	0	0	3
L11	Nyctalus leisleri	Oct	0	0	0	0	0	4
L11	Pipistrellus nathusii	Sep	0	0	0	0	0	1
L11	Pipistrellus nathusii	Oct	0	0	0	0	0	2
L11	Pipistrellus pipistrellus	Sep	0	0	0	0	0	4
L11	Pipistrellus pipistrellus	Oct	0	0	0	0	0	8
L11	Pipistrellus pygmaeus	Sep	0	0	0	0	0	9

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L11	Pipistrellus pygmaeus	Oct	0	0	0	0	0	8
L11	Plecotus auritus	Sep	0	0	0	0	0	1
L11	Plecotus auritus	Oct	0	0	0	0	0	1
L2	Myotis daubentonii	Sep	0	0	0	0	0	4
L2	Myotis daubentonii	Oct	0	0	0	0	0	6
L2	Myotis nattereri	Sep	0	0	0	0	0	3
L2	Myotis nattereri	Oct	0	0	0	0	0	1
L2	Nyctalus leisleri	Sep	0	0	0	0	0	7
L2	Nyctalus leisleri	Oct	0	0	0	0	0	7
L2	Pipistrellus nathusii	Oct	0	0	0	0	0	2
L2	Pipistrellus pipistrellus	Sep	0	0	0	0	0	2
L2	Pipistrellus pipistrellus	Oct	0	0	0	0	0	6
L2	Pipistrellus pygmaeus	Sep	0	0	0	0	0	3
L2	Pipistrellus pygmaeus	Oct	0	0	0	0	0	6
L2	Plecotus auritus	Sep	0	0	0	0	0	3
L2	Plecotus auritus	Oct	0	0	0	0	0	2
L4	Myotis daubentonii	Sep	0	0	0	0	0	4
L4	Myotis daubentonii	Oct	0	0	0	0	0	4
L4	Myotis mystacinus	Sep	0	0	0	0	0	4
L4	Myotis mystacinus	Oct	0	0	0	0	0	1
L4	Myotis nattereri	Sep	0	0	0	0	0	3
L4	Nyctalus leisleri	Sep	0	0	0	0	0	6

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L4	Nyctalus leisleri	Oct	0	0	0	0	0	3
L4	Pipistrellus nathusii	Sep	0	0	0	0	0	1
L4	Pipistrellus nathusii	Oct	0	0	0	0	0	1
L4	Pipistrellus pipistrellus	Sep	0	0	0	0	0	1
L4	Pipistrellus pipistrellus	Oct	0	0	0	0	0	1
L4	Pipistrellus pygmaeus	Sep	0	0	0	0	0	3
L4	Pipistrellus pygmaeus	Oct	0	0	0	0	0	3
L4	Plecotus auritus	Oct	0	0	0	0	0	1
L5	Myotis daubentonii	Sep	0	0	0	0	0	3
L5	Myotis daubentonii	Oct	0	0	0	0	0	7
L5	Myotis nattereri	Oct	0	0	0	0	0	2
L5	Nyctalus leisleri	Sep	0	0	0	0	0	5
L5	Nyctalus leisleri	Oct	0	0	0	0	0	5
L5	Pipistrellus nathusii	Oct	0	0	0	0	0	2
L5	Pipistrellus pipistrellus	Sep	0	0	0	0	0	2
L5	Pipistrellus pipistrellus	Oct	0	0	0	0	0	5
L5	Pipistrellus pygmaeus	Sep	0	0	0	0	0	3
L5	Pipistrellus pygmaeus	Oct	0	0	0	0	0	4
L5	Plecotus auritus	Sep	0	0	0	0	0	1
L5	Plecotus auritus	Oct	0	0	0	0	0	2

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L6	Myotis daubentonii	Sep	0	0	0	0	0	5
L6	Myotis daubentonii	Oct	0	0	0	0	0	6
L6	Myotis mystacinus	Oct	0	0	0	0	0	2
L6	Myotis nattereri	Sep	0	0	0	0	0	1
L6	Nyctalus leisleri	Sep	0	0	0	0	0	6
L6	Nyctalus leisleri	Oct	0	0	0	0	0	6
L6	Pipistrellus nathusii	Oct	0	0	0	0	0	2
L6	Pipistrellus pipistrellus	Sep	0	0	0	0	0	4
L6	Pipistrellus pipistrellus	Oct	0	0	0	0	0	7
L6	Pipistrellus pygmaeus	Sep	0	0	0	0	0	4
L6	Pipistrellus pygmaeus	Oct	0	0	0	0	0	2
L6	Plecotus auritus	Sep	0	0	0	0	0	2
L6	Plecotus auritus	Oct	0	0	0	0	0	1
L7	Myotis daubentonii	Sep	0	0	0	0	0	5
L7	Myotis daubentonii	Oct	0	0	0	0	0	7
L7	Myotis mystacinus	Sep	0	0	0	0	0	2
L7	Myotis mystacinus	Oct	0	0	0	0	0	1
L7	Myotis nattereri	Oct	0	0	0	0	1	2
L7	Nyctalus leisleri	Sep	0	0	0	0	0	5
L7	Nyctalus leisleri	Oct	0	0	0	0	0	5
L7	Pipistrellus pipistrellus	Sep	0	0	0	0	0	3

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L7	Pipistrellus pipistrellus	Oct	0	0	0	0	0	1
L7	Pipistrellus pygmaeus	Sep	0	0	0	0	0	2
L7	Pipistrellus pygmaeus	Oct	0	0	0	0	0	5
L7	Plecotus auritus	Sep	0	0	0	0	0	3
L7	Plecotus auritus	Oct	0	0	0	0	0	3
L8	Myotis daubentonii	Sep	0	0	0	0	0	5
L8	Myotis daubentonii	Oct	0	0	0	0	0	4
L8	Myotis mystacinus	Sep	0	0	0	0	0	1
L8	Myotis nattereri	Sep	0	0	0	0	2	1
L8	Nyctalus leisleri	Sep	0	0	0	0	0	6
L8	Nyctalus leisleri	Oct	0	0	0	0	0	6
L8	Pipistrellus nathusii	Oct	0	0	0	0	0	2
L8	Pipistrellus pipistrellus	Sep	0	0	0	0	0	6
L8	Pipistrellus pipistrellus	Oct	0	0	0	0	0	5
L8	Pipistrellus pygmaeus	Sep	0	0	0	0	0	2
L8	Pipistrellus pygmaeus	Oct	0	0	0	0	0	3
L8	Plecotus auritus	Sep	0	0	0	0	0	4
L8	Plecotus auritus	Oct	0	0	0	0	0	3
L9	Myotis daubentonii	Sep	0	0	0	0	0	3
L9	Myotis daubentonii	Oct	0	0	0	0	0	5

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L9	Myotis mystacinus	Sep	0	0	0	0	0	2
L9	Myotis mystacinus	Oct	0	0	0	0	0	6
L9	Myotis nattereri	Sep	0	0	0	0	0	1
L9	Myotis nattereri	Oct	0	0	0	0	3	2
L9	Nyctalus leisleri	Sep	0	0	0	0	0	5
L9	Nyctalus leisleri	Oct	0	0	0	0	0	5
L9	Pipistrellus nathusii	Oct	0	0	0	0	0	2
L9	Pipistrellus pipistrellus	Sep	0	0	0	0	0	4
L9	Pipistrellus pipistrellus	Oct	0	0	0	0	0	4
L9	Pipistrellus pygmaeus	Sep	0	0	0	0	0	2
L9	Pipistrellus pygmaeus	Oct	0	0	0	0	0	8
L9	Plecotus auritus	Sep	0	0	0	0	0	2
L9	Plecotus auritus	Oct	0	0	0	0	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
L1	Myotis daubentonii	Sep	11	9 - 12.5	14	4
L1	Myotis daubentonii	Oct	11	9 - 12.5	11	1
L1	Myotis mystacinus	Sep	2	3 - 3	3	2
L1	Myotis mystacinus	Oct	3	3 - 3	3	1
L1	Myotis nattereri	Oct	22	0	22	1
L1	Nyctalus leisleri	Sep	3	2.5 - 4.5	7	8
L1	Nyctalus leisleri	Oct	3	2.5 - 4.5	5	7
L1	Pipistrellus pipistrellus	Sep	0	0 - 0	0	4
L1	Pipistrellus pipistrellus	Oct	0	0 - 0	0	3
L1	Pipistrellus pygmaeus	Sep	0	0 - 0	0	4
L1	Pipistrellus pygmaeus	Oct	0	0 - 0	1	6
L1	Plecotus auritus	Sep	1	6.5 - 6.5	1	1
L1	Plecotus auritus	Oct	12	6.5 - 6.5	12	1
L10	Myotis daubentonii	Sep	6	1 - 7	7	4
L10	Myotis daubentonii	Oct	3	1 - 7	11	6
L10	Myotis mystacinus	Sep	1	0	1	1
L10	Myotis nattereri	Sep	15	12 - 18	18	2
L10	Myotis nattereri	Oct	15	12 - 18	18	4
L10	Nyctalus leisleri	Sep	0	0 - 0	1	7
L10	Nyctalus leisleri	Oct	0	0 - 0	0	4
L10	Pipistrellus nathusii	Sep	8	0	8	1
L10	Pipistrellus pipistrellus	Sep	0	0 - 0	0	6
L10	Pipistrellus pipistrellus	Oct	0	0 - 0	0	4
L10	Pipistrellus pygmaeus	Sep	6	12.5 - 24	25	8
L10	Pipistrellus pygmaeus	Oct	23	12.5 - 24	24	7
L10	Plecotus auritus	Oct	4	4 - 4	4	2
L11	Myotis daubentonii	Sep	3	3 - 8	7	4
L11	Myotis daubentonii	Oct	5	3 - 8	11	9
L11	Myotis mystacinus	Sep	1	1 - 1	1	1
L11	Myotis mystacinus	Oct	1	1 - 1	3	4
L11	Myotis nattereri	Sep	5	5 - 15	12	3
L11	Myotis nattereri	Oct	12	5 - 15	18	5
L11	Nyctalus leisleri	Sep	0	2 - 2	1	3

Detector ID	Species/Species Group	month	Median Percentile	95% CIs	Max. Percentile	Nights Recorded
L11	Nyctalus leisleri	Oct	1	2 - 2	2	4
L11	Pipistrellus nathusii	Sep	8	14 - 14	8	1
L11	Pipistrellus nathusii	Oct	14	14 - 14	14	2
L11	Pipistrellus pipistrellus	Sep	0	0 - 0	0	4
L11	Pipistrellus pipistrellus	Oct	0	0 - 0	0	8
L11	Pipistrellus pygmaeus	Sep	0	0 - 0	1	9
L11	Pipistrellus pygmaeus	Oct	0	0 - 0	1	8
L11	Plecotus auritus	Sep	1	1 - 1	1	1
L11	Plecotus auritus	Oct	1	1 - 1	1	1
L2	Myotis daubentonii	Sep	4	1 - 8	7	4
L2	Myotis daubentonii	Oct	6	1 - 8	9	6
L2	Myotis nattereri	Sep	5	5 - 5	5	3
L2	Myotis nattereri	Oct	5	5 - 5	5	1
L2	Nyctalus leisleri	Sep	1	1 - 1.5	2	7
L2	Nyctalus leisleri	Oct	0	1 - 1.5	1	7
L2	Pipistrellus nathusii	Oct	11	11 - 11	14	2
L2	Pipistrellus pipistrellus	Sep	0	0 - 0	0	2
L2	Pipistrellus pipistrellus	Oct	0	0 - 0	0	6
L2	Pipistrellus pygmaeus	Sep	0	0 - 0	0	3
L2	Pipistrellus pygmaeus	Oct	0	0 - 0	2	6
L2	Plecotus auritus	Sep	1	1 - 2.5	4	3
L2	Plecotus auritus	Oct	3	1 - 2.5	4	2
L4	Myotis daubentonii	Sep	7	1 - 7	9	4
L4	Myotis daubentonii	Oct	3	1 - 7	5	4
L4	Myotis mystacinus	Sep	4	2 - 4	4	4
L4	Myotis mystacinus	Oct	3	2 - 4	3	1
L4	Myotis nattereri	Sep	5	5 - 5	5	3
L4	Nyctalus leisleri	Sep	0	1 - 2	2	6
L4	Nyctalus leisleri	Oct	1	1 - 2	1	3
L4	Pipistrellus nathusii	Sep	8	8 - 8	8	1
L4	Pipistrellus nathusii	Oct	8	8 - 8	8	1
L4	Pipistrellus pipistrellus	Sep	0	0 - 0	0	1
L4	Pipistrellus pipistrellus	Oct	0	0 - 0	0	1
L4	Pipistrellus pygmaeus	Sep	0	0 - 0	0	3
L4	Pipistrellus pygmaeus	Oct	0	0 - 0	0	3
L4	Plecotus auritus	Oct	1	0	1	1

Detector ID	Species/Species Group	month	Median Percentile	95% CIs	Max. Percentile	Nights Recorded
L5	Myotis daubentonii	Sep	7	1 - 5	7	3
L5	Myotis daubentonii	Oct	1	1 - 5	5	7
L5	Myotis nattereri	Oct	5	5 - 5	5	2
L5	Nyctalus leisleri	Sep	0	0 - 0	1	5
L5	Nyctalus leisleri	Oct	0	0 - 0	0	5
L5	Pipistrellus nathusii	Oct	11	11 - 11	14	2
L5	Pipistrellus pipistrellus	Sep	0	0 - 0	0	2
L5	Pipistrellus pipistrellus	Oct	0	0 - 0	0	5
L5	Pipistrellus pygmaeus	Sep	0	0 - 0	0	3
L5	Pipistrellus pygmaeus	Oct	0	0 - 0	0	4
L5	Plecotus auritus	Sep	1	1 - 1	1	1
L5	Plecotus auritus	Oct	1	1 - 1	1	2
L6	Myotis daubentonii	Sep	7	4 - 10	11	5
L6	Myotis daubentonii	Oct	8	4 - 10	11	6
L6	Myotis mystacinus	Oct	3	3 - 3	3	2
L6	Myotis nattereri	Sep	5	0	5	1
L6	Nyctalus leisleri	Sep	5	2 - 5	7	6
L6	Nyctalus leisleri	Oct	2	2 - 5	5	6
L6	Pipistrellus nathusii	Oct	11	11 - 11	14	2
L6	Pipistrellus pipistrellus	Sep	0	0 - 0	0	4
L6	Pipistrellus pipistrellus	Oct	0	0 - 0	0	7
L6	Pipistrellus pygmaeus	Sep	0	0 - 0	0	4
L6	Pipistrellus pygmaeus	Oct	0	0 - 0	0	2
L6	Plecotus auritus	Sep	8	4 - 4	12	2
L6	Plecotus auritus	Oct	4	4 - 4	4	1
L7	Myotis daubentonii	Sep	12	8 - 13	14	5
L7	Myotis daubentonii	Oct	11	8 - 13	14	7
L7	Myotis mystacinus	Sep	2	3 - 3	3	2
L7	Myotis mystacinus	Oct	3	3 - 3	3	1
L7	Myotis nattereri	Oct	5	5 - 5	22	3
L7	Nyctalus leisleri	Sep	4	2.5 - 5.5	7	5
L7	Nyctalus leisleri	Oct	4	2.5 - 5.5	5	5
L7	Pipistrellus pipistrellus	Sep	0	0 - 0	0	3
L7	Pipistrellus pipistrellus	Oct	0	0 - 0	0	1
L7	Pipistrellus pygmaeus	Sep	0	0 - 0	0	2
L7	Pipistrellus pygmaeus	Oct	0	0 - 0	1	5

Detector ID	Species/Species Group	month	Median Percentile	95% CIs	Max. Percentile	Nights Recorded
L7	Plecotus auritus	Sep	4	2.5 - 12	12	3
L7	Plecotus auritus	Oct	4	2.5 - 12	12	3
L8	Myotis daubentonii	Sep	7	1 - 7	11	5
L8	Myotis daubentonii	Oct	1	1 - 7	1	4
L8	Myotis mystacinus	Sep	3	0	3	1
L8	Myotis nattereri	Sep	22	22 - 22	22	3
L8	Nyctalus leisleri	Sep	2	1 - 4	7	6
L8	Nyctalus leisleri	Oct	1	1 - 4	1	6
L8	Pipistrellus nathusii	Oct	8	8 - 8	8	2
L8	Pipistrellus pipistrellus	Sep	0	0 - 0	0	6
L8	Pipistrellus pipistrellus	Oct	0	0 - 0	0	5
L8	Pipistrellus pygmaeus	Sep	0	0 - 0	0	2
L8	Pipistrellus pygmaeus	Oct	0	0 - 0	0	3
L8	Plecotus auritus	Sep	3	1 - 2.5	4	4
L8	Plecotus auritus	Oct	1	1 - 2.5	1	3
L9	Myotis daubentonii	Sep	14	7.5 - 14	14	3
L9	Myotis daubentonii	Oct	11	7.5 - 14	14	5
L9	Myotis mystacinus	Sep	1	2 - 3	1	2
L9	Myotis mystacinus	Oct	3	2 - 3	3	6
L9	Myotis nattereri	Sep	18	12 - 25.5	18	1
L9	Myotis nattereri	Oct	22	12 - 25.5	29	5
L9	Nyctalus leisleri	Sep	2	2 - 5	7	5
L9	Nyctalus leisleri	Oct	3	2 - 5	5	5
L9	Pipistrellus nathusii	Oct	11	11 - 11	14	2
L9	Pipistrellus pipistrellus	Sep	0	0 - 0	0	4
L9	Pipistrellus pipistrellus	Oct	0	0 - 0	0	4
L9	Pipistrellus pygmaeus	Sep	0	0 - 0	0	2
L9	Pipistrellus pygmaeus	Oct	0	0 - 0	1	8
L9	Plecotus auritus	Sep	1	1 - 1	1	2
L9	Plecotus auritus	Oct	1	1 - 1	1	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 Exceptional Activity	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	0	0	0	0	96
Myotis mystacinus	0	0	0	0	0	28
Myotis nattereri	0	0	0	0	7	30
Nyctalus leisleri	0	0	0	0	0	110
Pipistrellus nathusii	0	0	0	0	0	16
Pipistrellus pipistrellus	0	0	0	0	0	80
Pipistrellus pygmaeus	0	0	0	0	6	86
Plecotus auritus	0	0	0	0	0	35

Table 8. Summary table showing key metrics for each species recorded.

Species/Species Group	Median Percentile	95% CIs	Max. Percentile	Nights Recorded
Myotis daubentonii	7	9 - 12.5	14	96
Myotis mystacinus	3	3 - 3	4	28
Myotis nattereri	12	5 - 5	29	37
Nyctalus leisleri	1	2.5 - 5.5	7	110
Pipistrellus nathusii	8	8 - 8	14	16
Pipistrellus pipistrellus	0	0 - 0	0	80
Pipistrellus pygmaeus	0	12.5 - 24	25	92
Plecotus auritus	1	6.5 - 6.5	12	35

Figure 4. The activity level (percentile) of bats recorded across each night of the bat survey for the **entire site**.

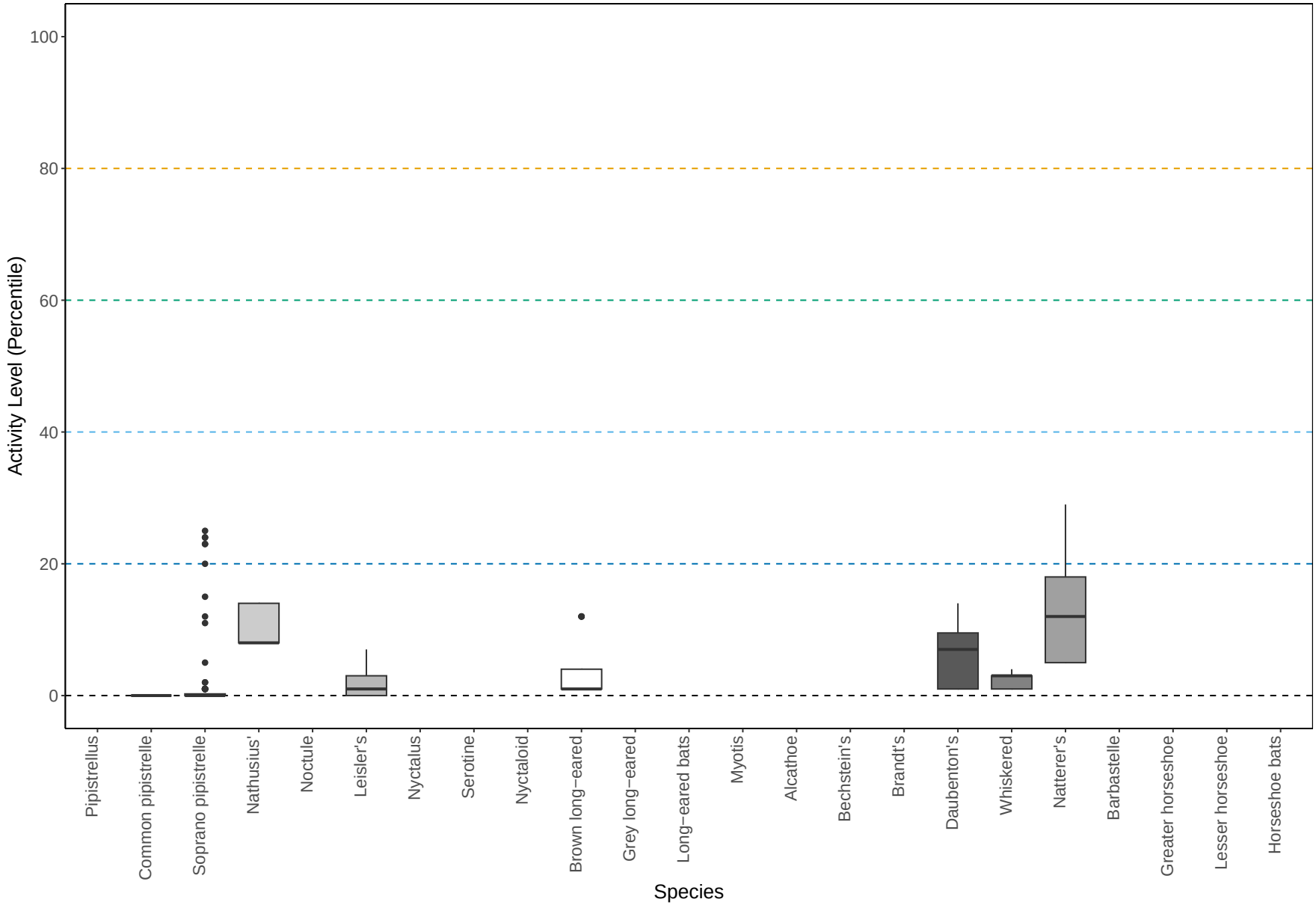

Activity Level (Percentile)
100
80
60
40
20
0
Pipistrellus
Common pipistrelle
Soprano pipistrelle
Nathusius'
Noctule
Leisler's
Nyctalus
Serotine
Nyctaloid
Brown long−eared
Grey long−eared
Long−eared bats
Myotis
Alcathoe
Bechstein's
Brandt's
Daubenton's
Whiskered
Natterer's
Barbastelle
Greater horseshoe
Lesser horseshoe
Horseshoe bats
Species

Figure 5. The median activity levels of bats recorded across all detectors each night.

Per Site, Per Month

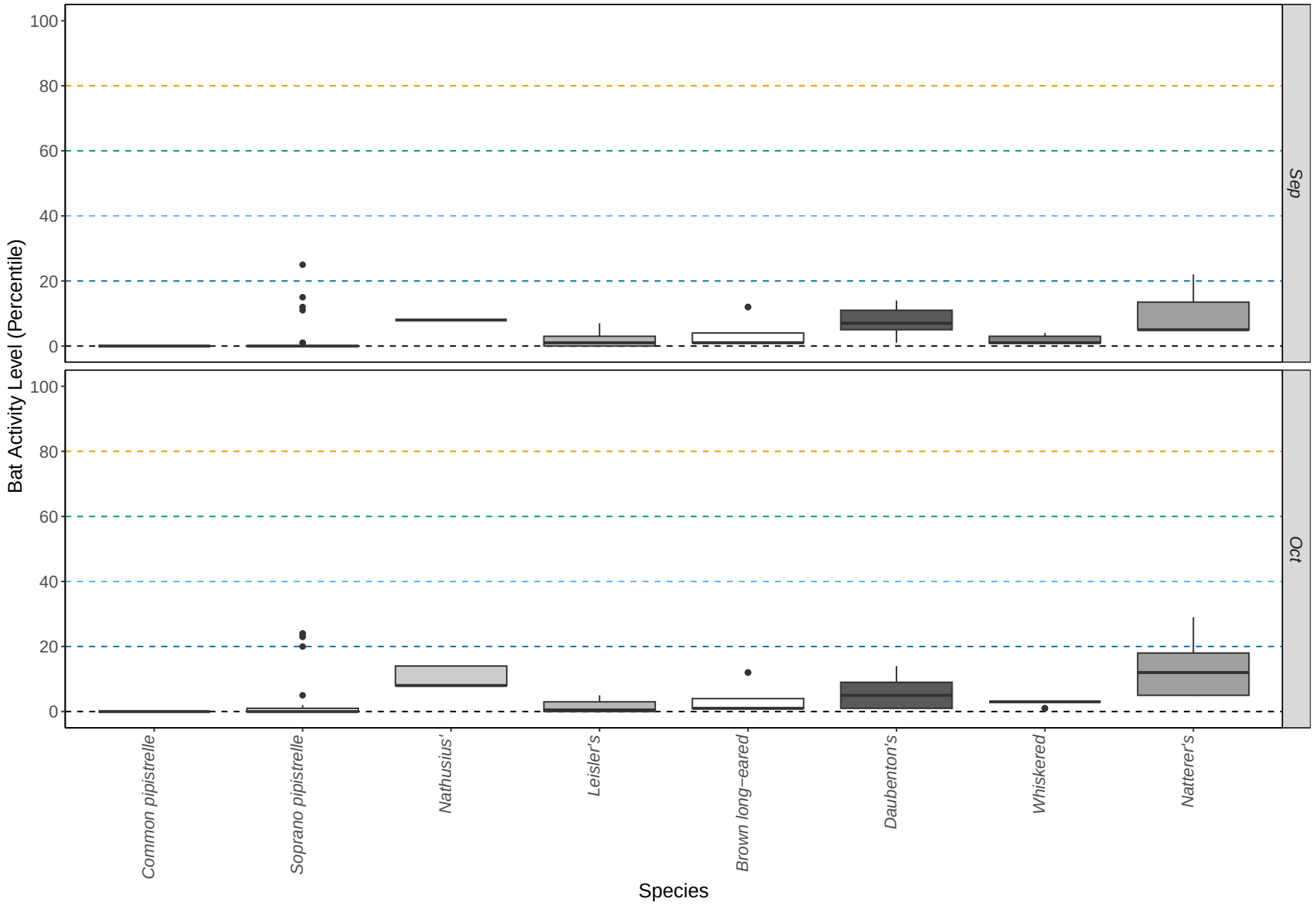
Table 9. Summary table showing the number of nights recorded bat activity fell into each activity band for each species during each month.

Species/Species Group	month	Nights of Exceptional Activity	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	0	0	0	0	0	41
Myotis daubentonii	Oct	0	0	0	0	0	55
Myotis mystacinus	Sep	0	0	0	0	0	13
Myotis mystacinus	Oct	0	0	0	0	0	15
Myotis nattereri	Sep	0	0	0	0	2	14
Myotis nattereri	Oct	0	0	0	0	5	16
Nyctalus leisleri	Sep	0	0	0	0	0	58
Nyctalus leisleri	Oct	0	0	0	0	0	52
Pipistrellus nathusii	Sep	0	0	0	0	0	3
Pipistrellus nathusii	Oct	0	0	0	0	0	13
Pipistrellus pipistrellus	Sep	0	0	0	0	0	36
Pipistrellus pipistrellus	Oct	0	0	0	0	0	44
Pipistrellus pygmaeus	Sep	0	0	0	0	1	39
Pipistrellus pygmaeus	Oct	0	0	0	0	5	47
Plecotus auritus	Sep	0	0	0	0	0	17
Plecotus auritus	Oct	0	0	0	0	0	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	Sep	7	9 - 12.5	14	41
Myotis daubentonii	Oct	5	9 - 12.5	14	55
Myotis mystacinus	Sep	1	3 - 3	4	13
Myotis mystacinus	Oct	3	3 - 3	3	15
Myotis nattereri	Sep	5	5 - 5	22	16
Myotis nattereri	Oct	12	5 - 5	29	21
Nyctalus leisleri	Sep	1	2.5 - 5.5	7	58
Nyctalus leisleri	Oct	1	2.5 - 5.5	5	52
Pipistrellus nathusii	Sep	8	8 - 8	8	3
Pipistrellus nathusii	Oct	8	8 - 8	14	13
Pipistrellus pipistrellus	Sep	0	0 - 0	0	36
Pipistrellus pipistrellus	Oct	0	0 - 0	0	44
Pipistrellus pygmaeus	Sep	0	12.5 - 24	25	40
Pipistrellus pygmaeus	Oct	0	12.5 - 24	24	52
Plecotus auritus	Sep	1	6.5 - 6.5	12	17
Plecotus auritus	Oct	1	6.5 - 6.5	12	18

Figure 6. The activity level (percentile) of bats recorded across each night of the bat survey for the entire site, split between months.


Bat Activity Level (Percentile)
100
80
60
40
20
0
Sep
Oct
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Brown long−eared
Daubenton's
Whiskered
Natterer's
Species

Part 2: Nightly Analysis

Entire Survey Period

Sunrise and Sunset Times

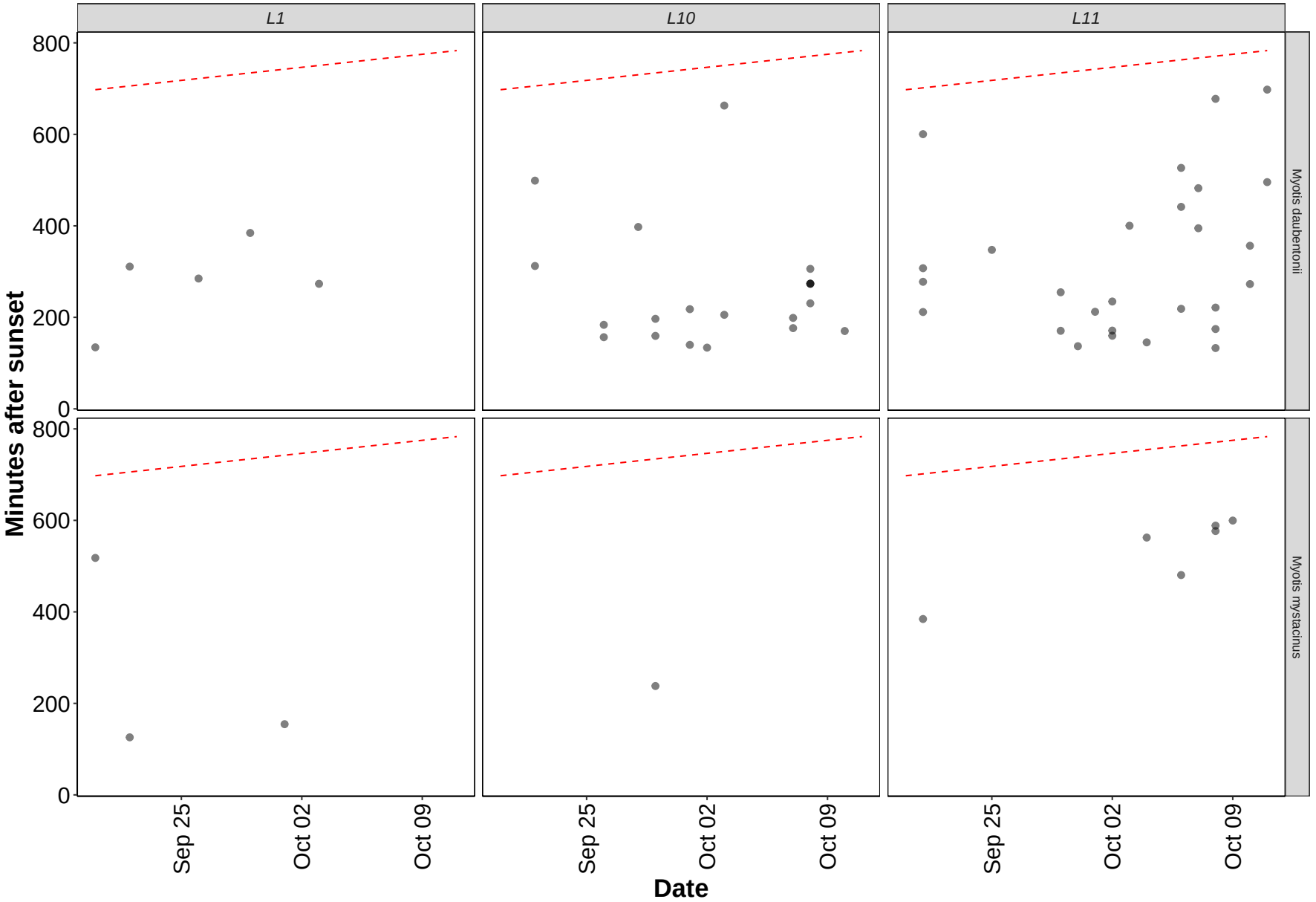
Table 11. The times of sunset and sunrise the following morning for surveys beginning on the date shown.

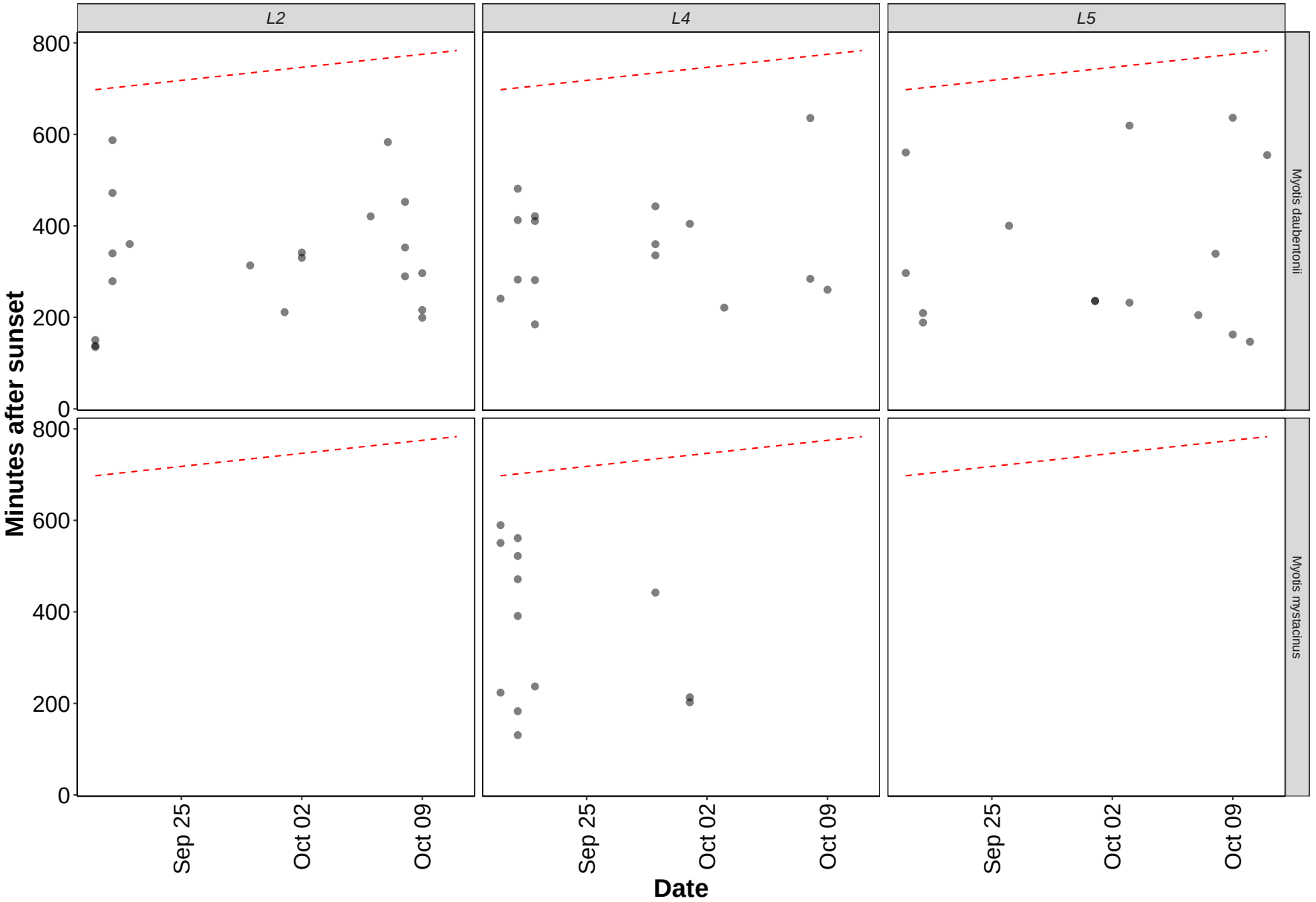
Night (y-m-d)	Sunset (h:m)	Sunrise (h:m)	Night Length (hours)
2023-09-20	18:36	06:13	11.6
2023-09-21	18:33	06:15	11.7
2023-09-22	18:31	06:17	11.8
2023-09-23	18:29	06:18	11.8
2023-09-24	18:26	06:20	11.9
2023-09-25	18:24	06:22	12.0
2023-09-26	18:21	06:23	12.0
2023-09-27	18:19	06:25	12.1
2023-09-28	18:17	06:27	12.2
2023-09-29	18:14	06:28	12.2
2023-09-30	18:12	06:30	12.3
2023-10-01	18:09	06:32	12.4
2023-10-02	18:07	06:34	12.4
2023-10-03	18:05	06:35	12.5
2023-10-04	18:02	06:37	12.6
2023-10-05	18:00	06:39	12.6
2023-10-06	17:58	06:40	12.7
2023-10-07	17:55	06:42	12.8
2023-10-08	17:53	06:44	12.8
2023-10-09	17:51	06:46	12.9
2023-10-10	17:48	06:47	13.0
2023-10-11	17:46	06:49	13.1

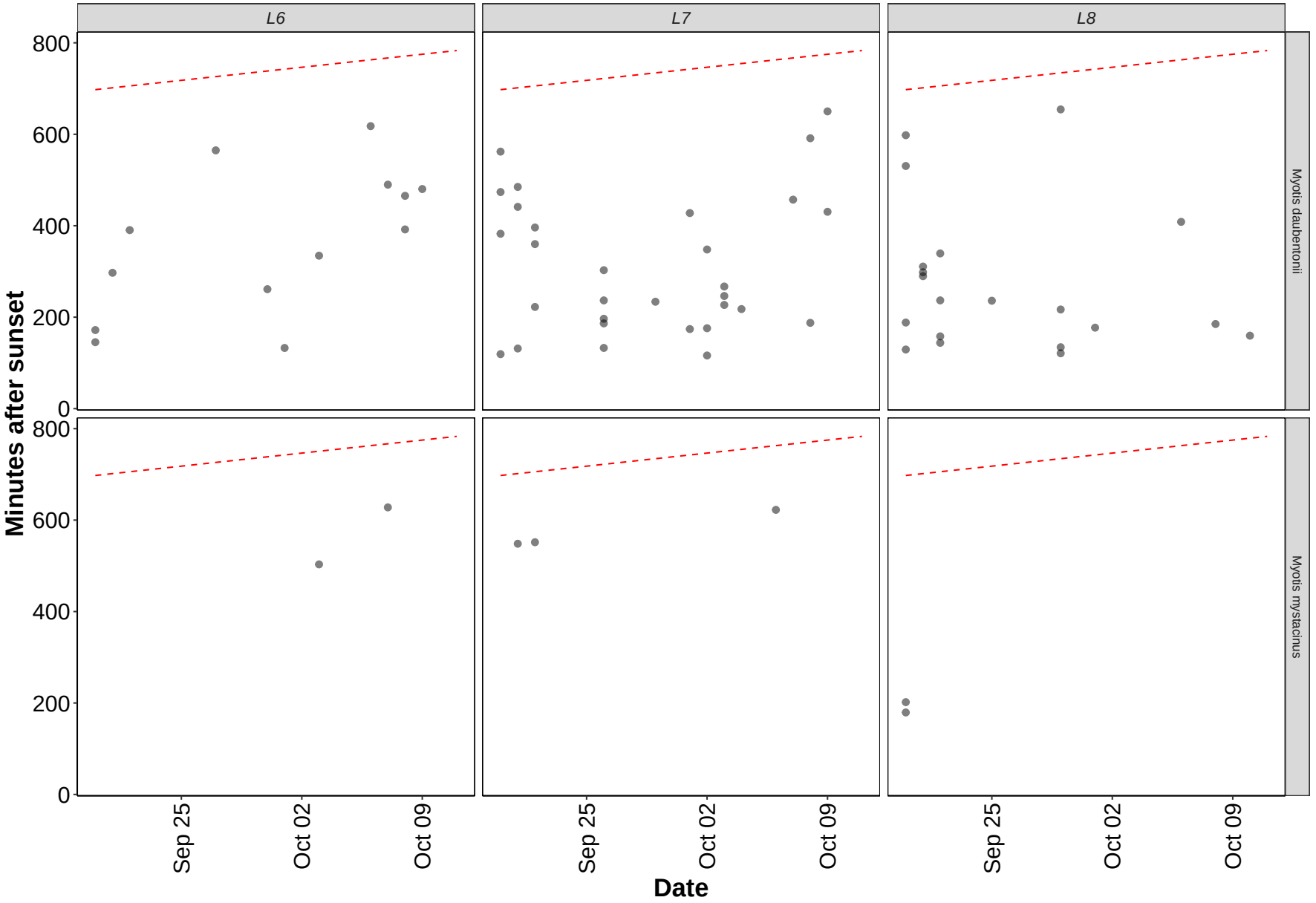
Distribution of Bat Activity Across the Night through Time

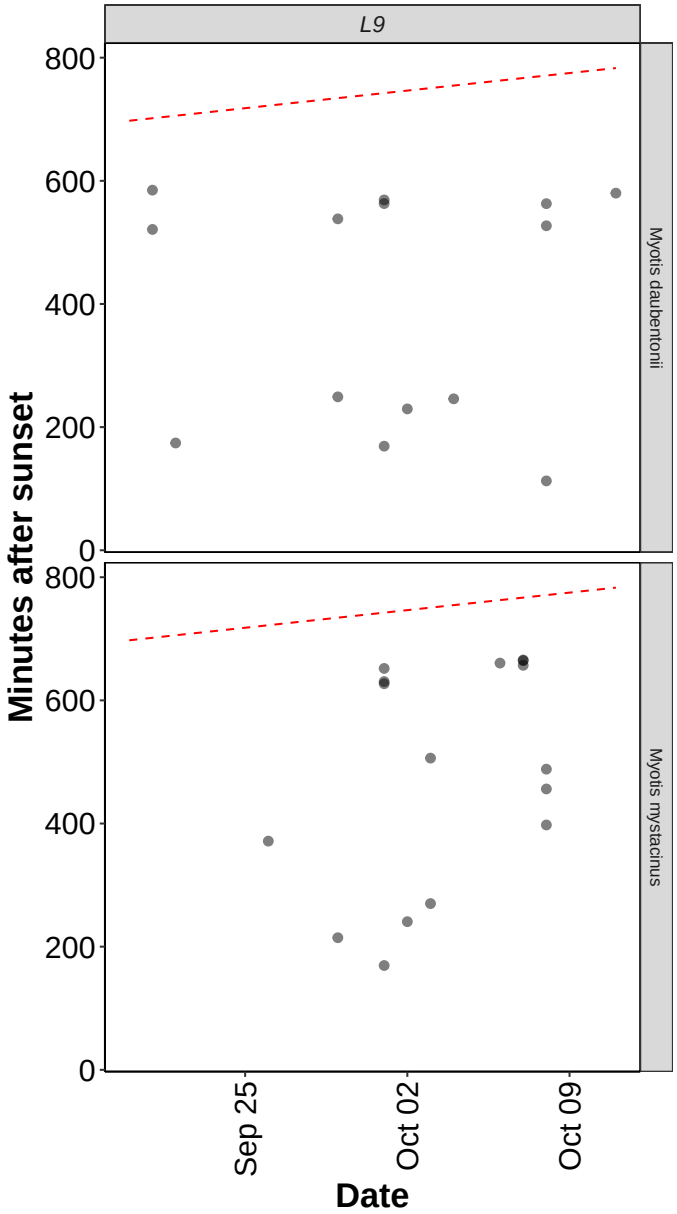
Per Detector

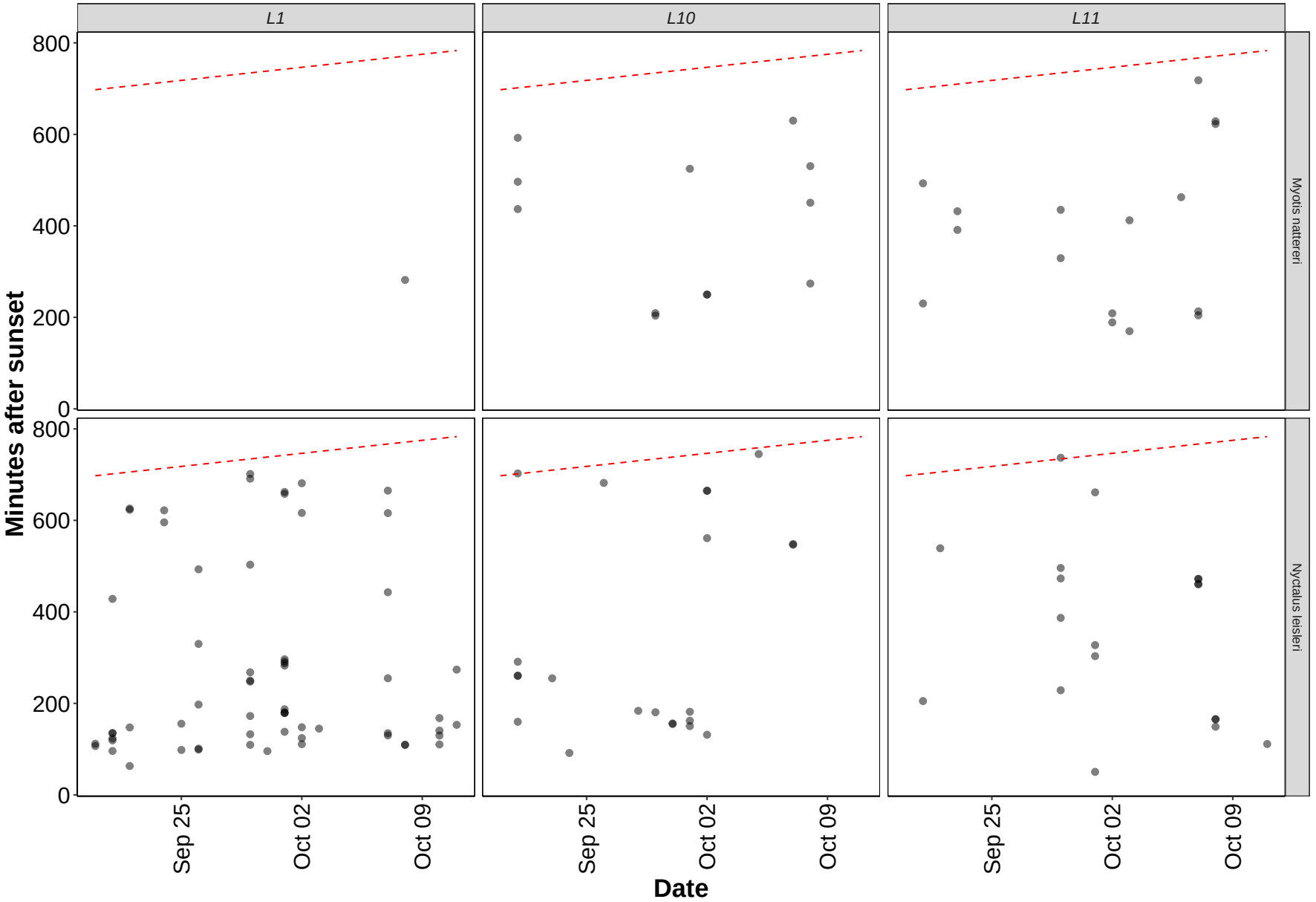
Figure 7. Timing of bat calls plotted as minutes before/after sunset, whereby 0 on the y axis represents sunset. Sunrise throughout the survey period is depicted as the red dashed line. Colours indicate kernel densities, with darkest colours showing peaks of activity. These colours are comparative only within each plot, and do not account for overall activity.

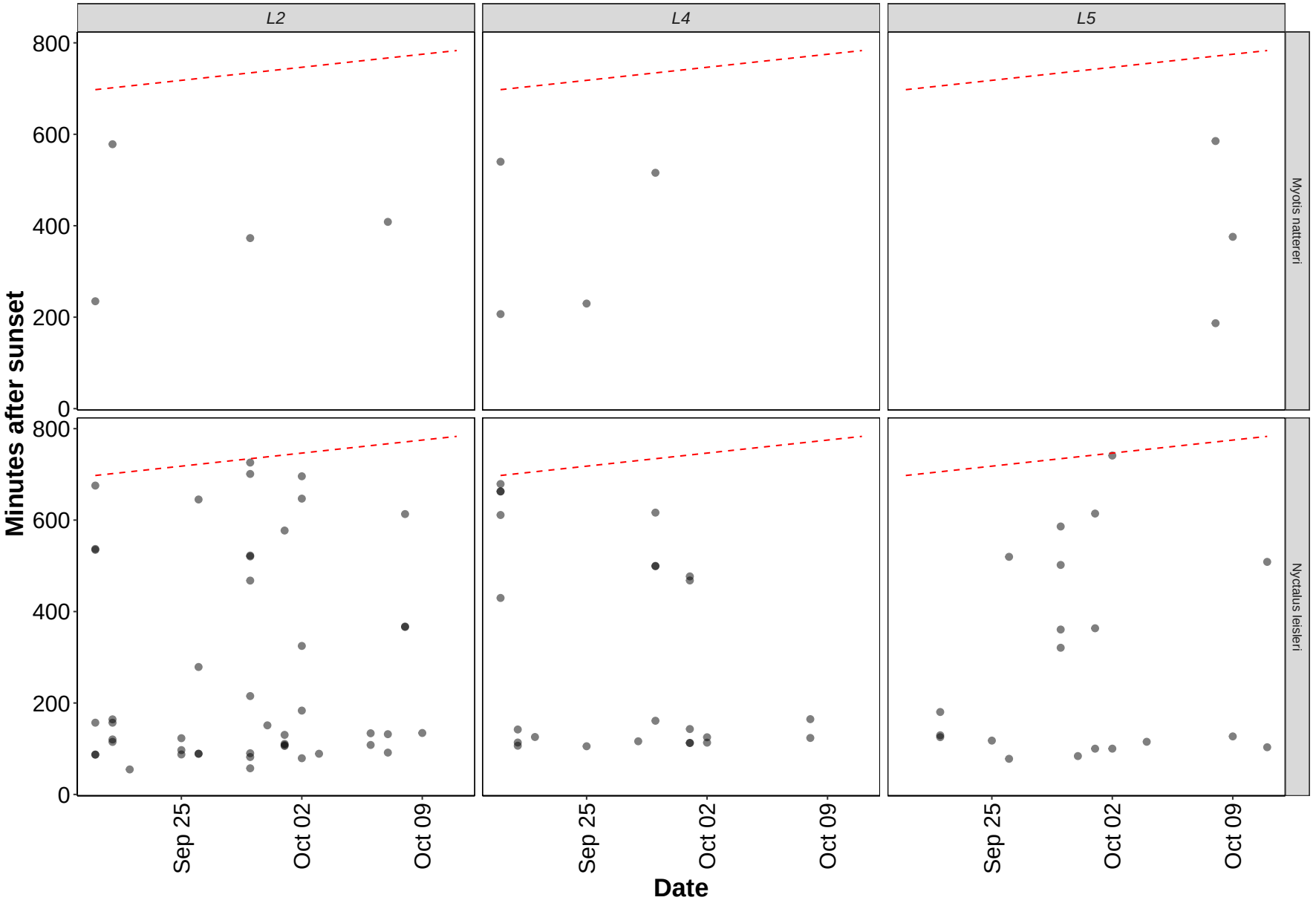

L1
L10
L11
Myotis daubentonii
Myotis mystacinus
Minutes after sunset
0
200
400
600
800
Sep 25
Oct 02
Oct 09
Date

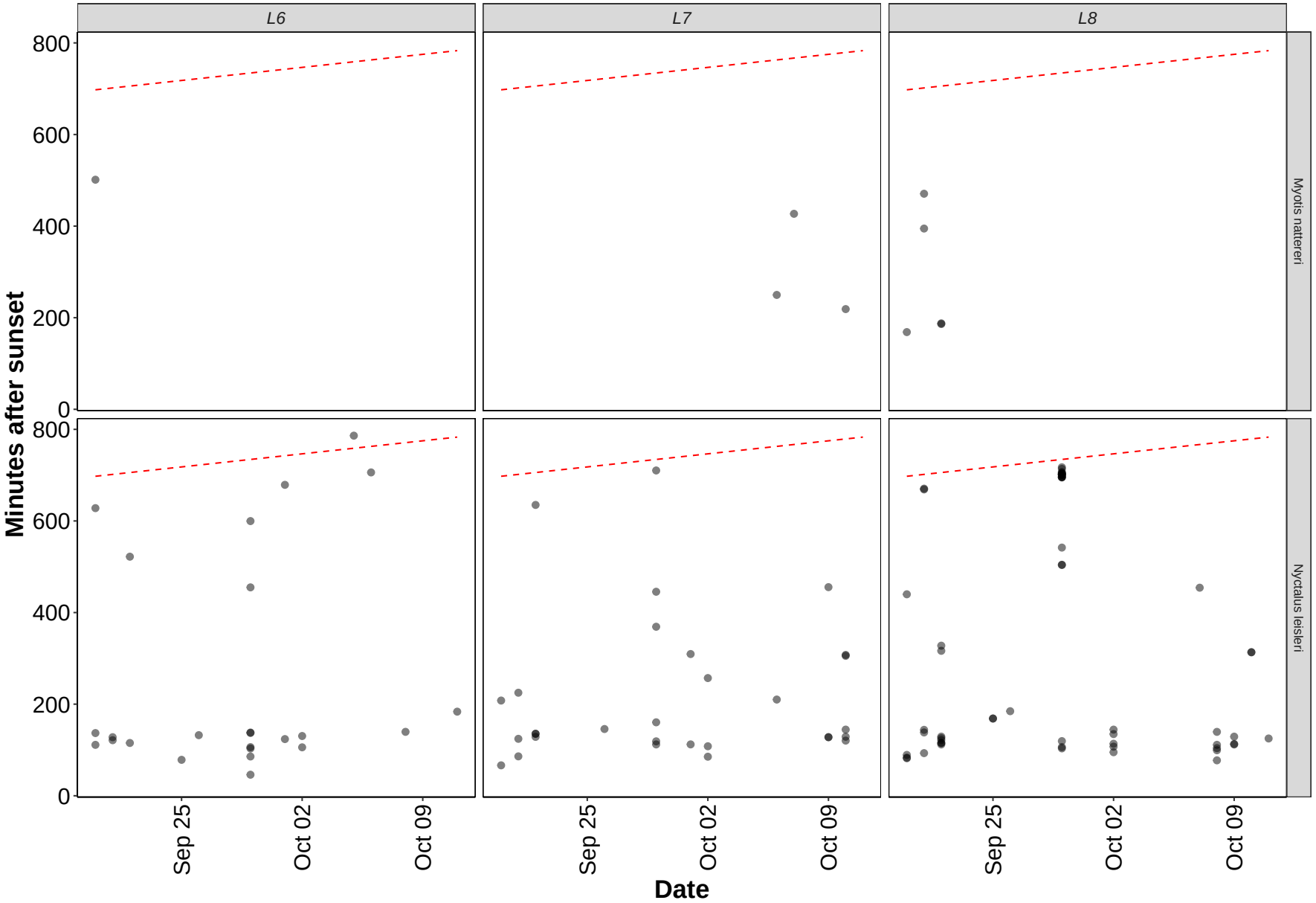

L2
L4
L5
Myotis daubentonii
Myotis mystacinus
Minutes after sunset
0
200
400
600
800
Sep 25
Oct 02
Oct 09
Date

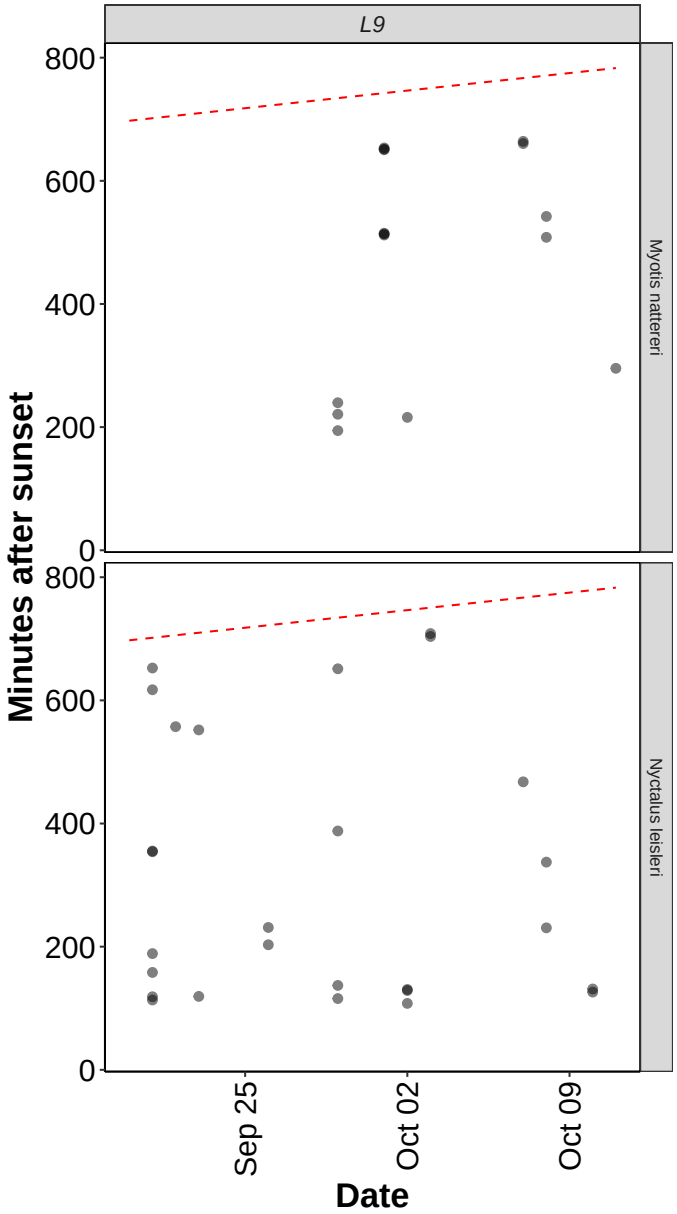

L6
L7
L8
Myotis daubentonii
Myotis mystacinus
Minutes after sunset
0
200
400
600
800
Sep 25
Oct 02
Oct 09
Date

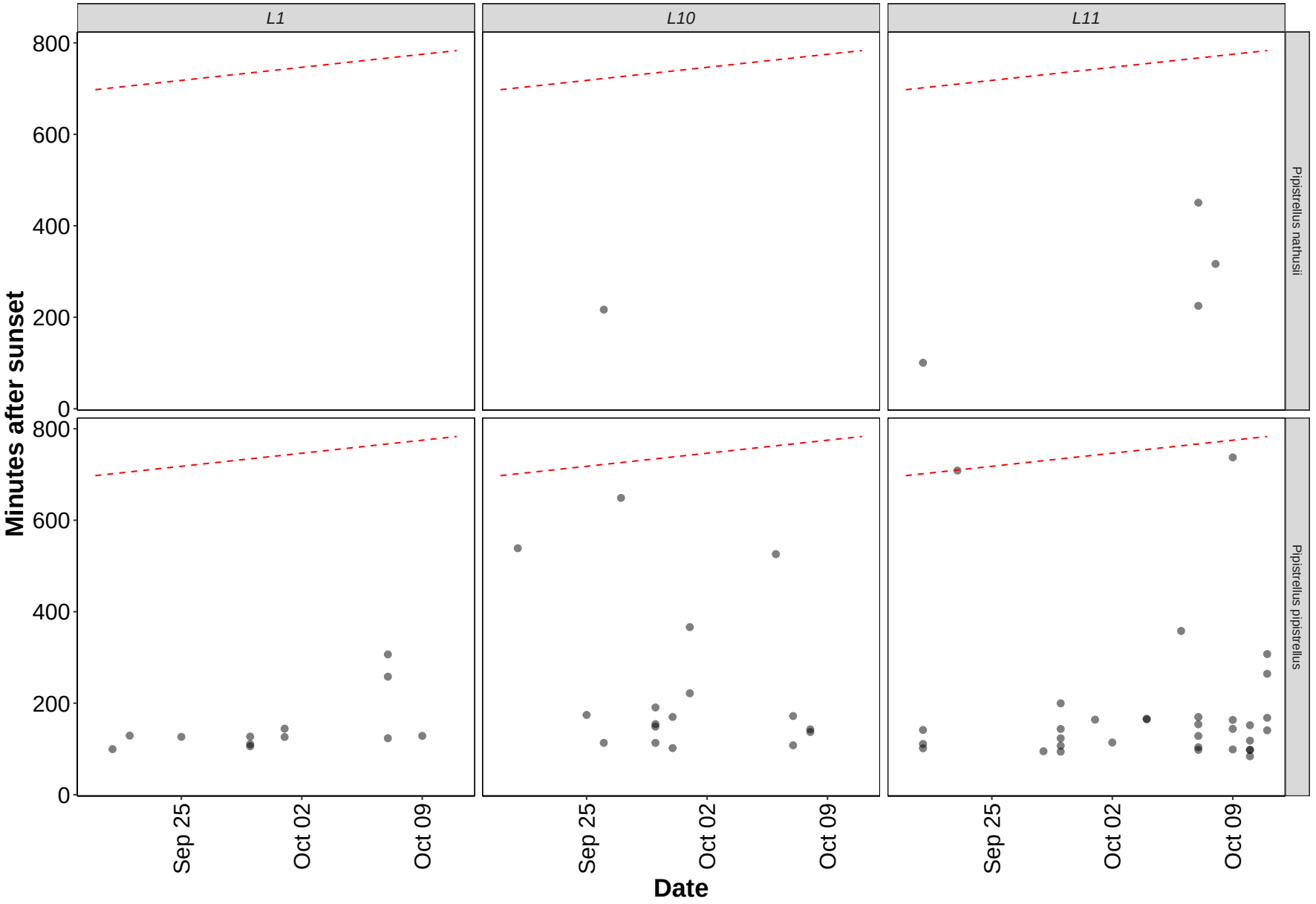

L9
Myotis daubentonii
Myotis mystacinus
Minutes after sunset
0
200
400
600
800
Sep 25
Oct 02
Oct 09
Date

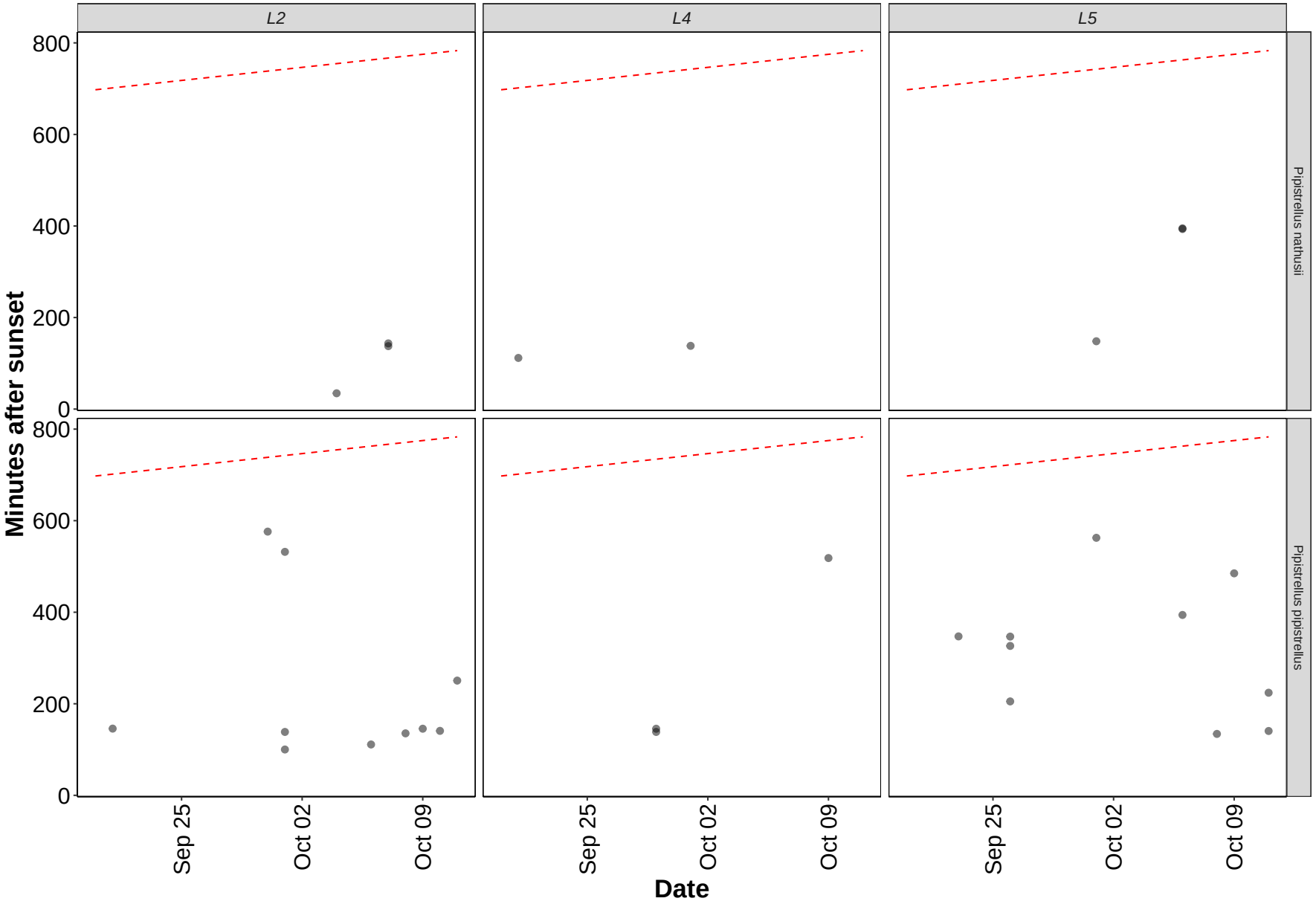

L1
L10
L11
Myotis nattereri
Nyctalus leisleri
Minutes after sunset
0
200
400
600
800
Sep 25
Oct 02
Oct 09
Date

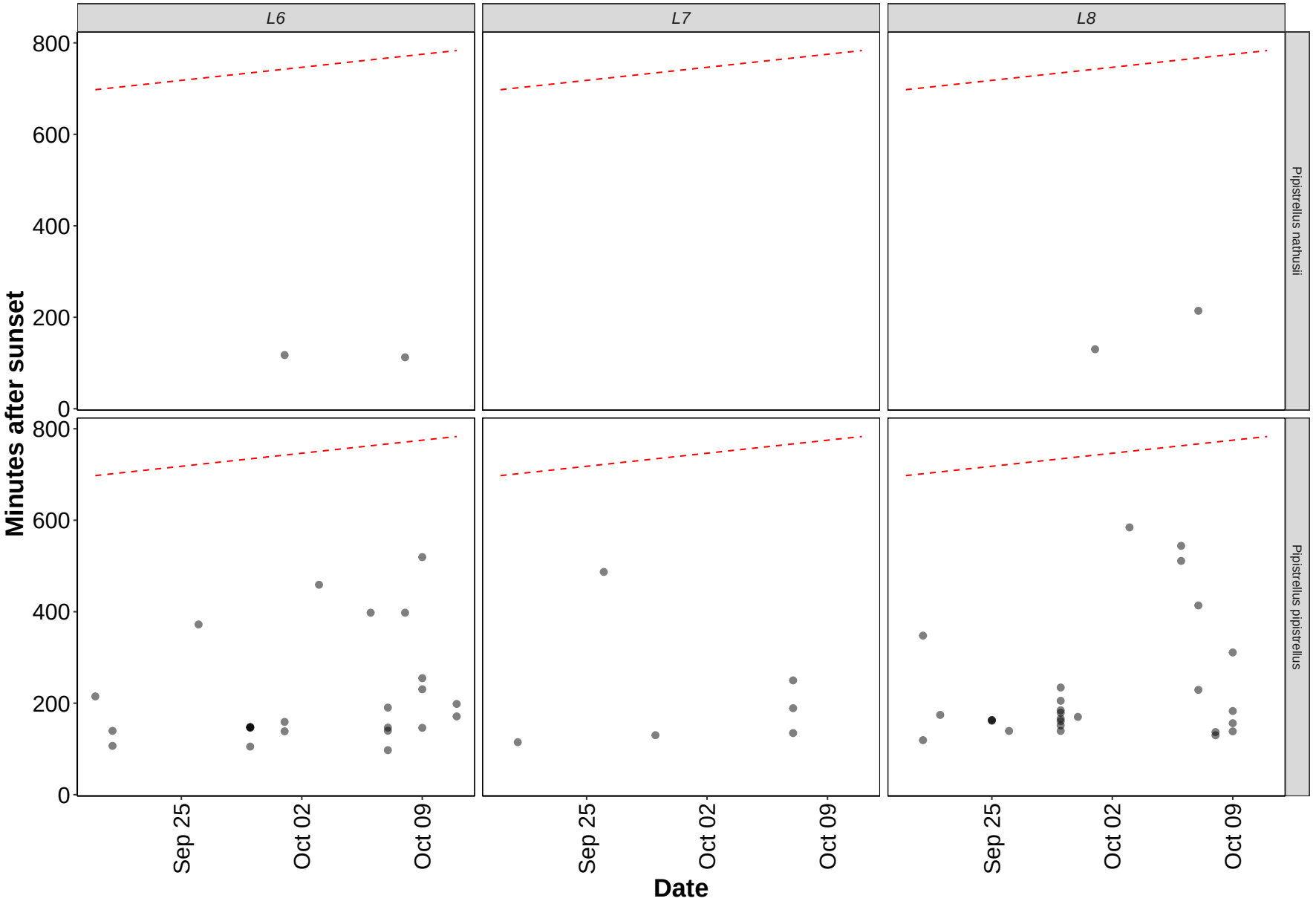

L2
L4
L5
Myotis nattereri
Nyctalus leisleri
Minutes after sunset
0
200
400
600
800
Sep 25
Oct 02
Oct 09
Date

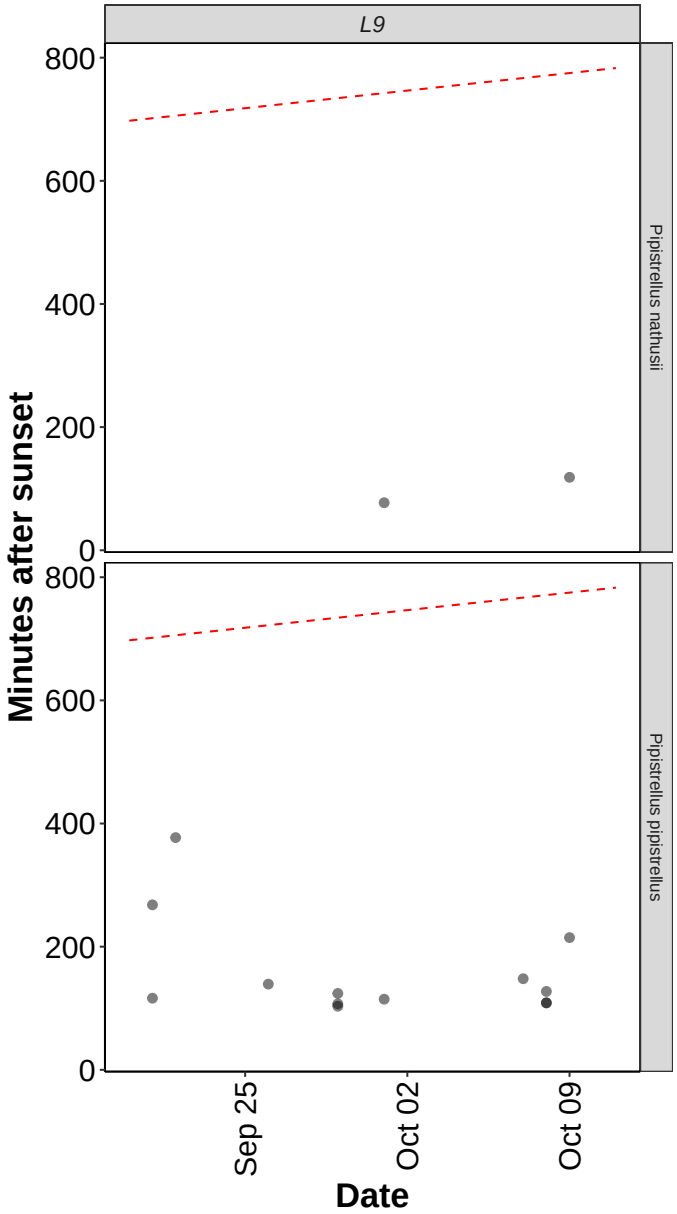

L6
L7
L8
Myotis nattereri
Nyctalus leisleri
Minutes after sunset
0
200
400
600
800
Sep 25
Oct 02
Oct 09
Date

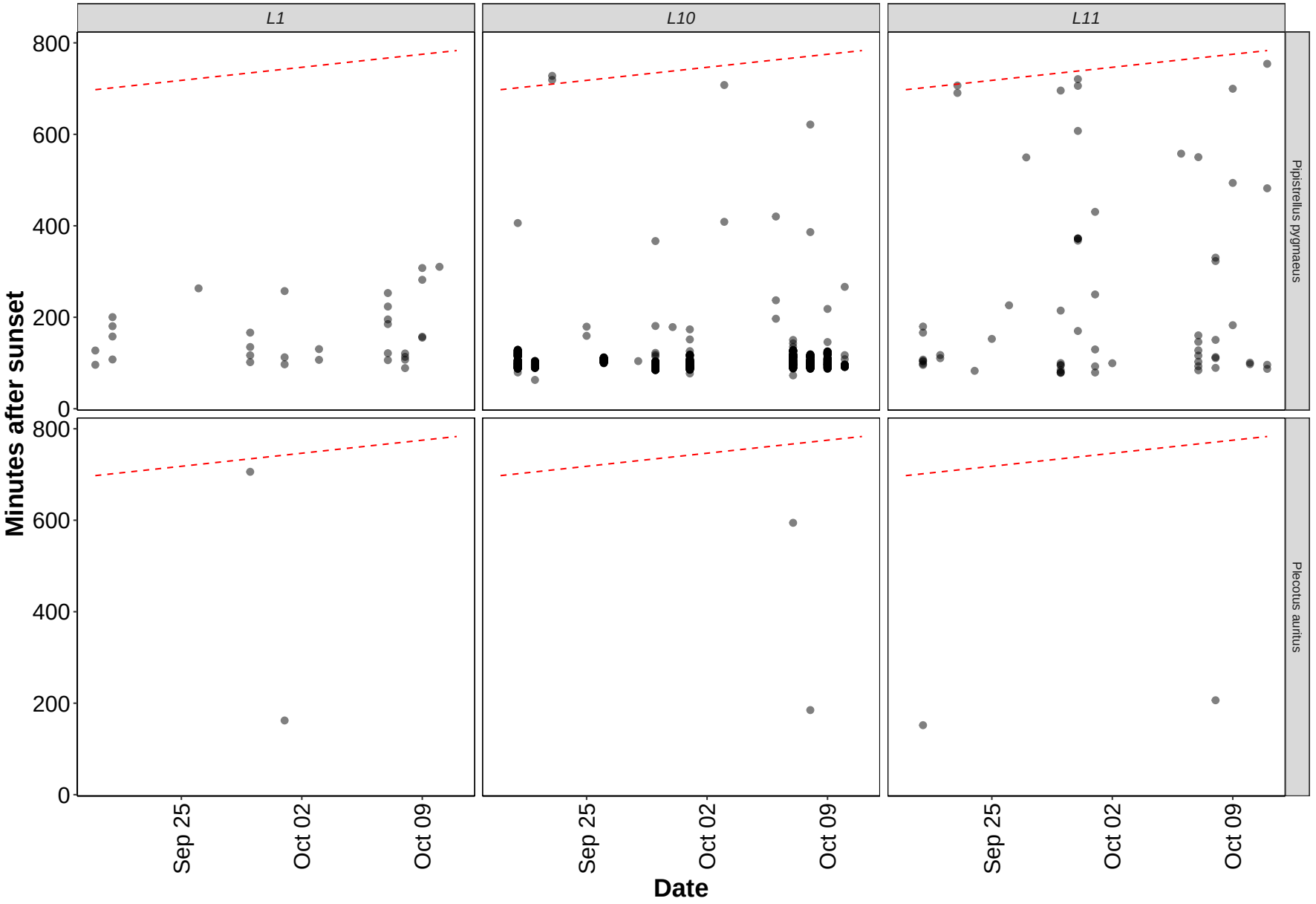

L9
Myotis nattereri
Nyctalus leisleri
Minutes after sunset
0
200
400
600
800
Sep 25
Oct 02
Oct 09
Date


L1
L10
L11
Pipistrellus nathusii
Pipistrellus pipistrellus
Minutes after sunset
0
200
400
600
800
Sep 25
Oct 02
Oct 09
Date


L2
L4
L5
Pipistrellus nathusii
Pipistrellus pipistrellus
Minutes after sunset
0
200
400
600
800
Sep 25
Oct 02
Oct 09
Date


L6
L7
L8
Pipistrellus nathusii
Pipistrellus pipistrellus
Minutes after sunset
0
200
400
600
800
Sep 25
Oct 02
Oct 09
Date


L9
Pipistrellus nathusii
Pipistrellus pipistrellus
Minutes after sunset
0
200
400
600
800
Sep 25
Oct 02
Oct 09
Date


L1
L10
L11
Pipistrellus pygmaeus
Plecotus auritus
Minutes after sunset
0
200
400
600
800
Sep 25
Oct 02
Oct 09
Date

Roost Emergence Time and Bat Observation

Based on: Russ, Jon. 2012. British Bat Calls a Guide to species Identification. Pelagic Publishing.

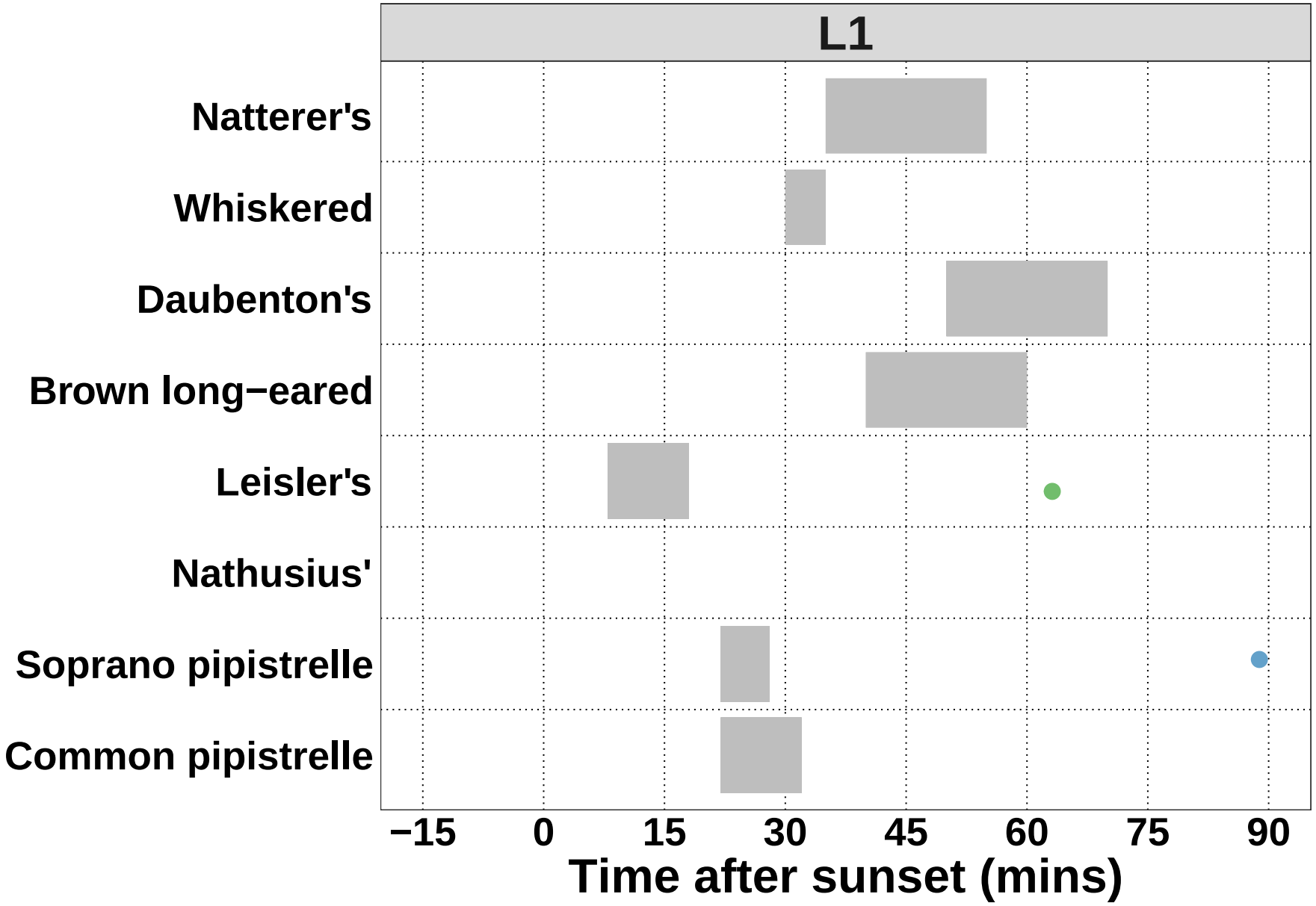
Bat Passes Potentially Indicating Close Proximity to a Roost (Russ 2012)

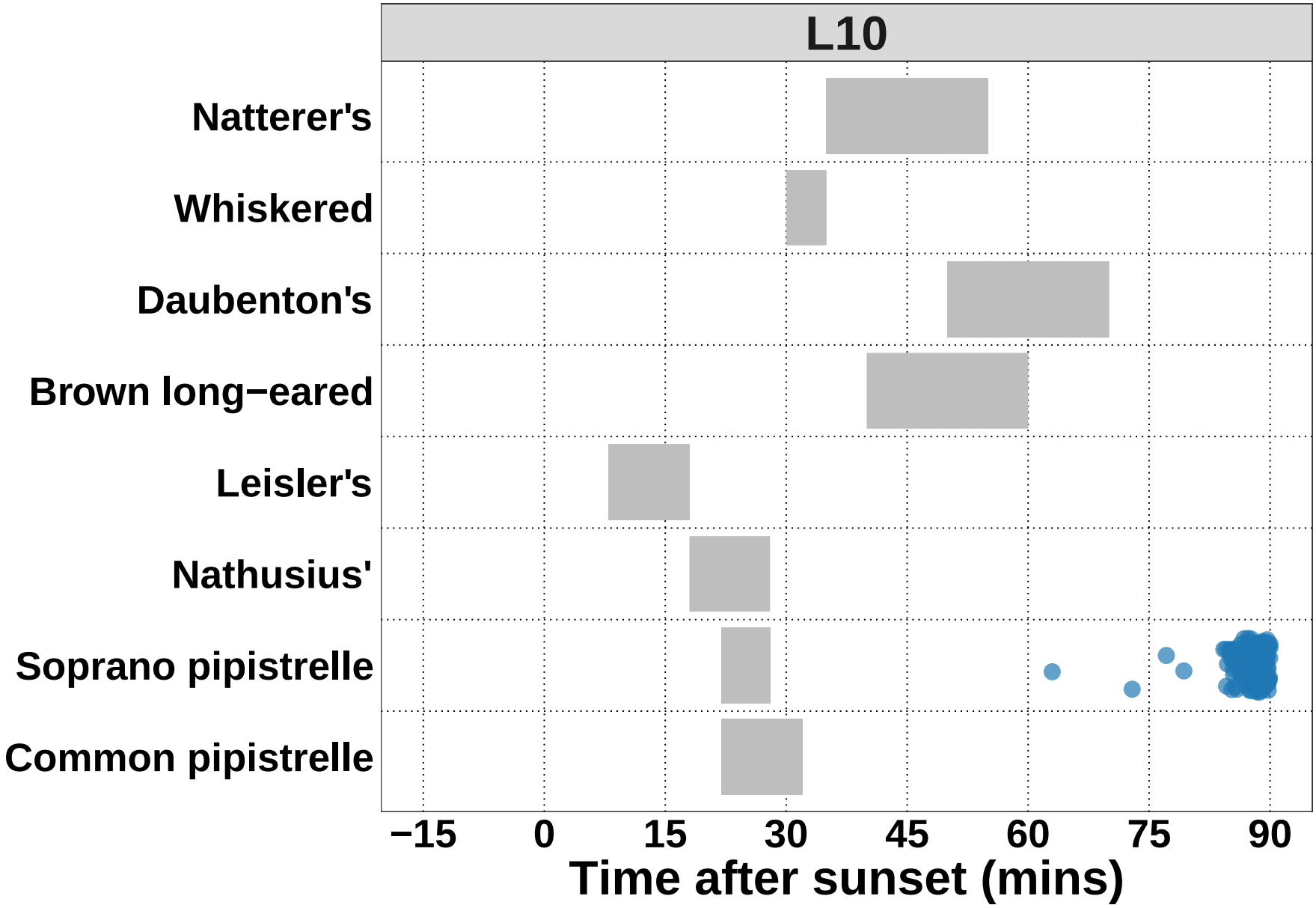
Table 12. Number of bat calls recorded before the upper time of the species-specific emergence time range, and which therefore may potentially indicate the presence of a nearby roost.

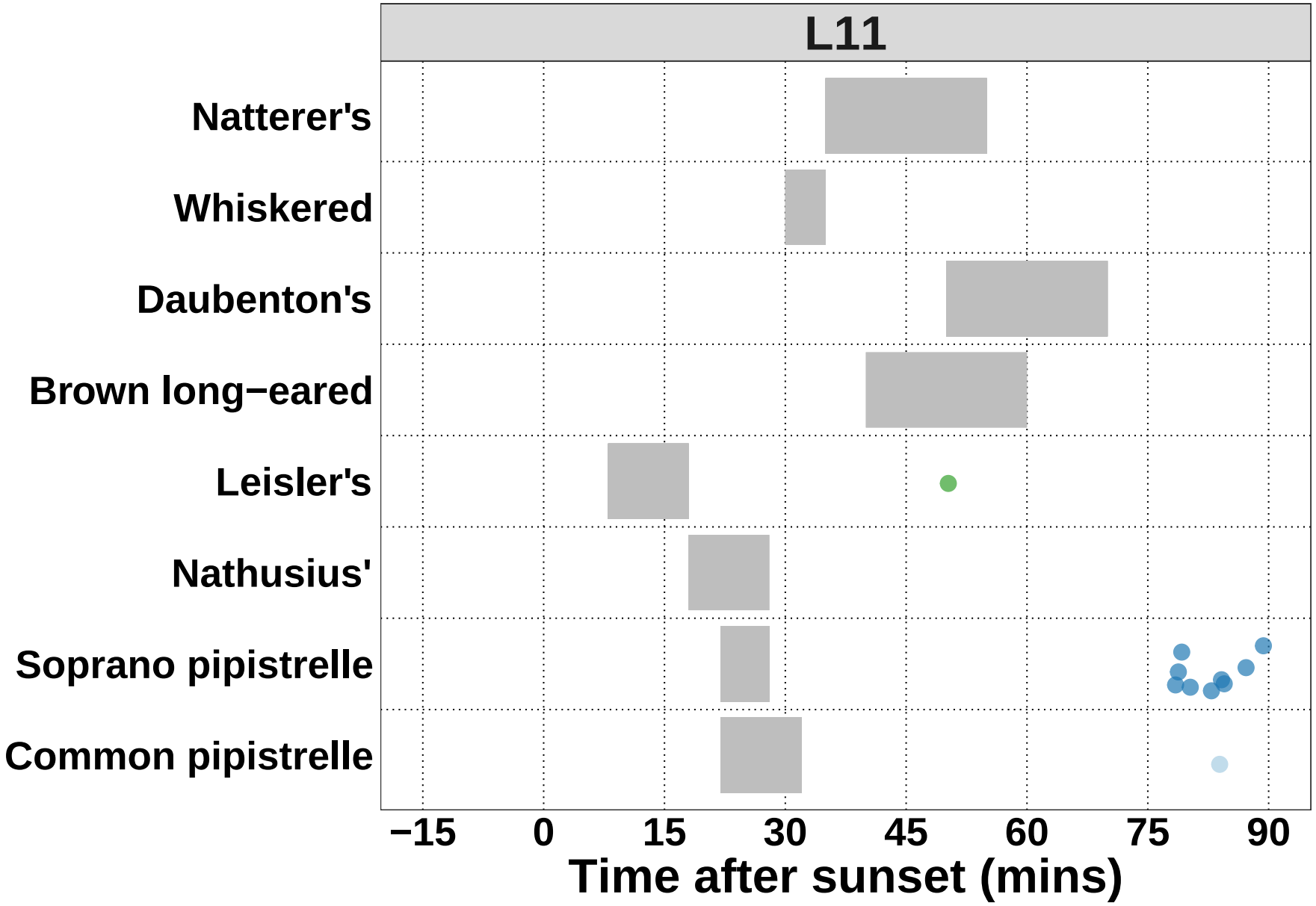
Species	Detector ID

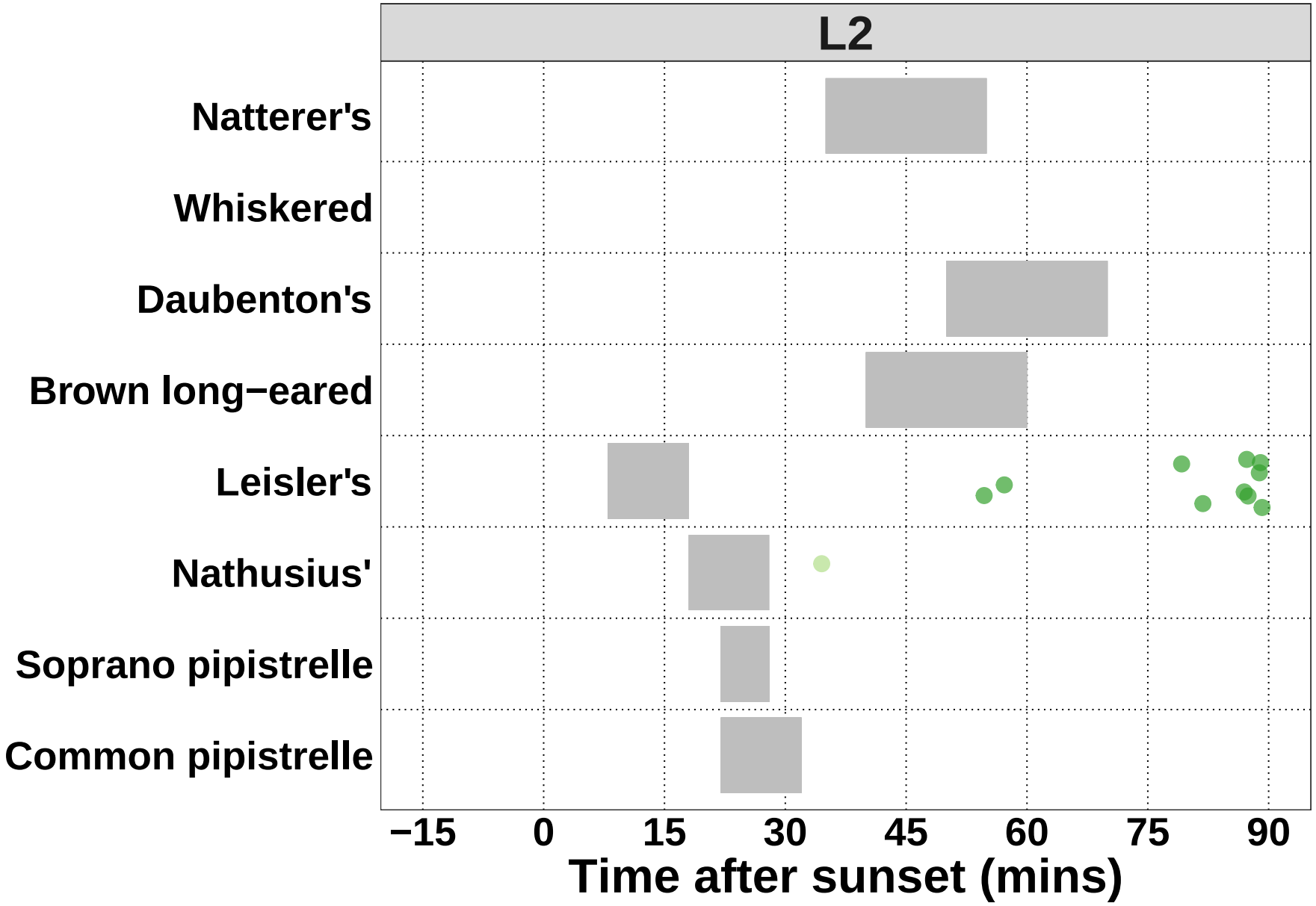
Bat Passes Potentially Indicating Close Proximity to a Roost (Russ 2012)

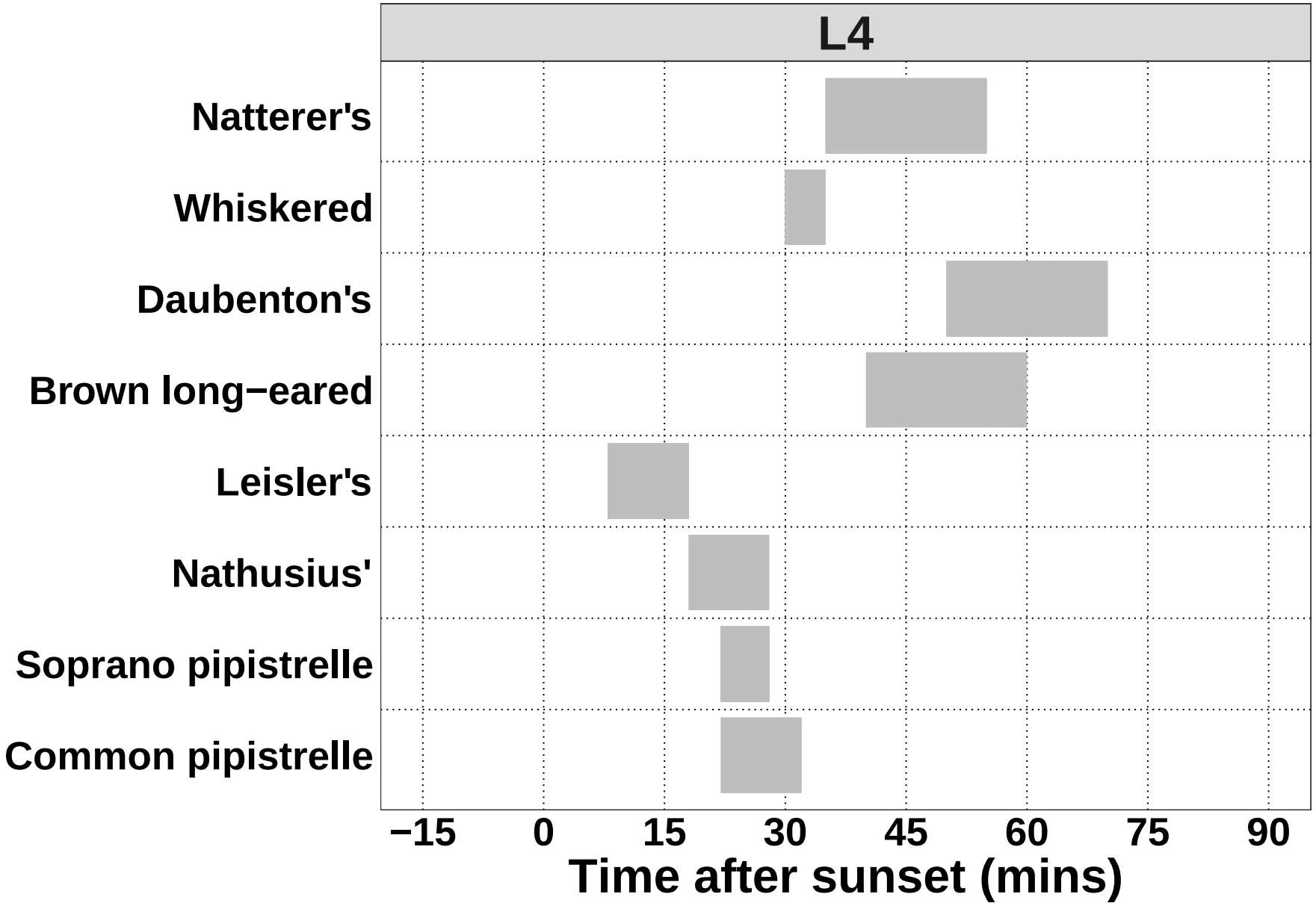
Figure 8. Time from 15 minutes before to 90 minutes after sunset. Species-specific emergence time ranges are shown as grey bars. Bat passes overlapping species-specific grey bars, or occuring earlier than this time range, may potentially indicate the presence of a nearby roost.

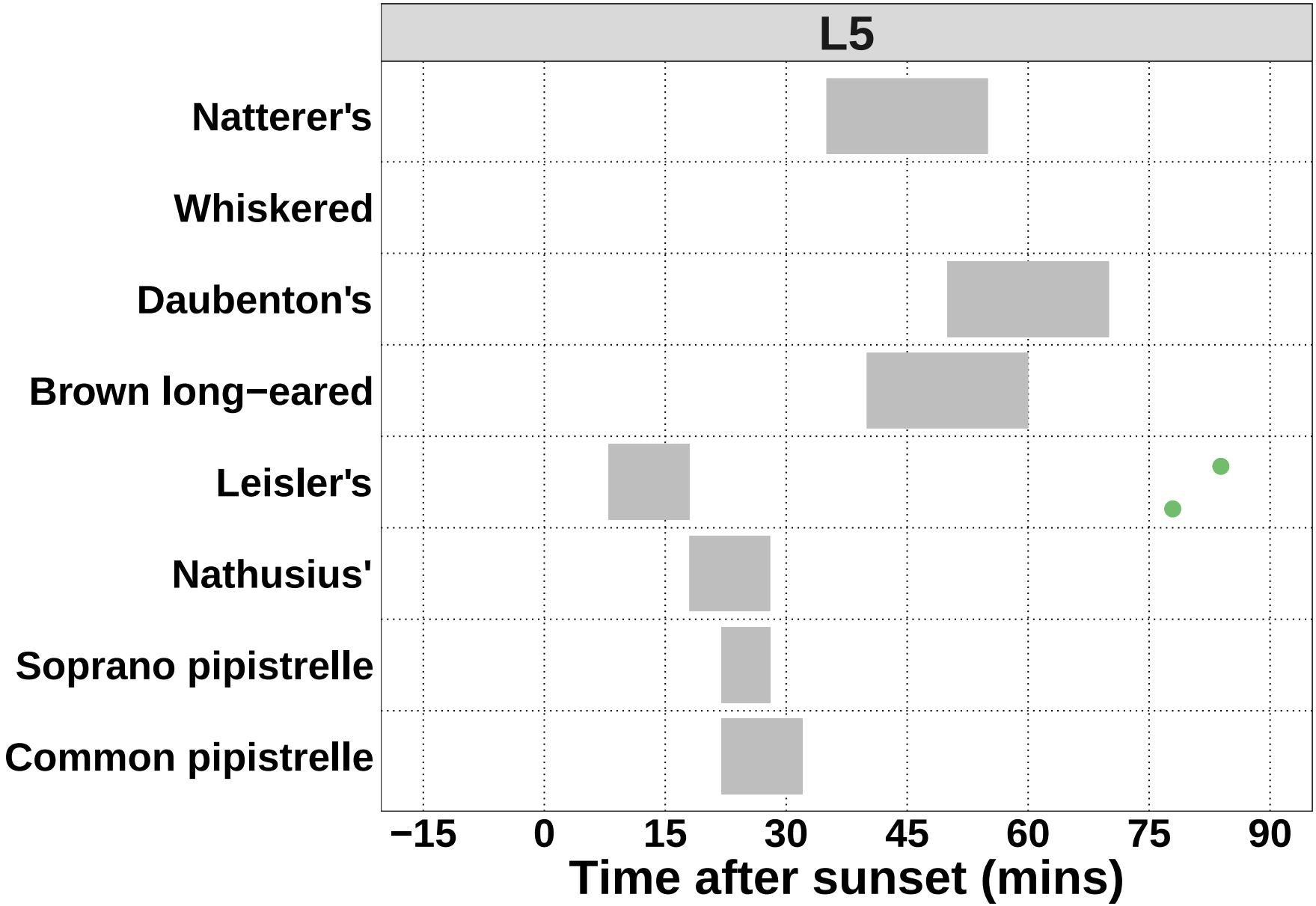

L1
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

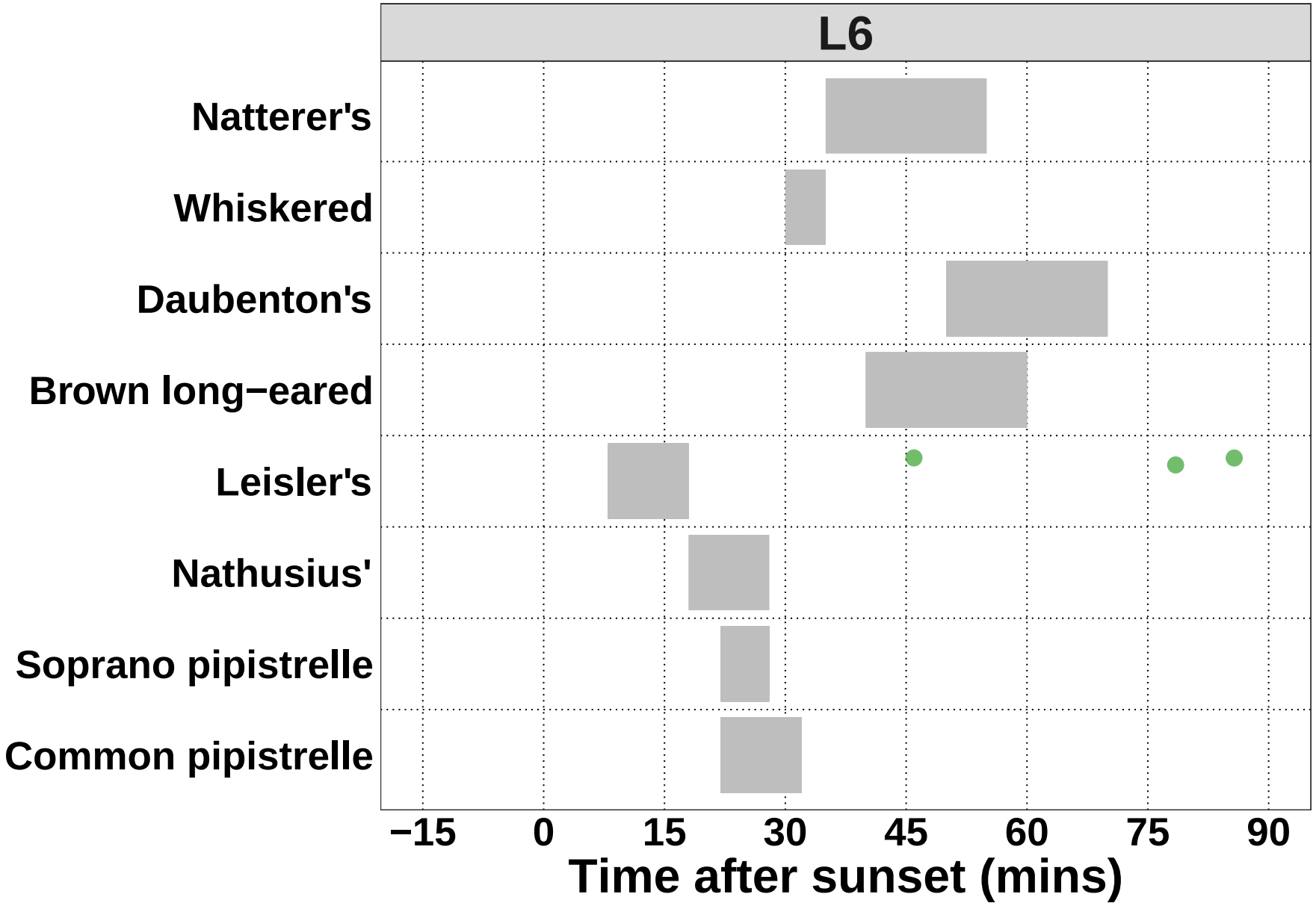

L10
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

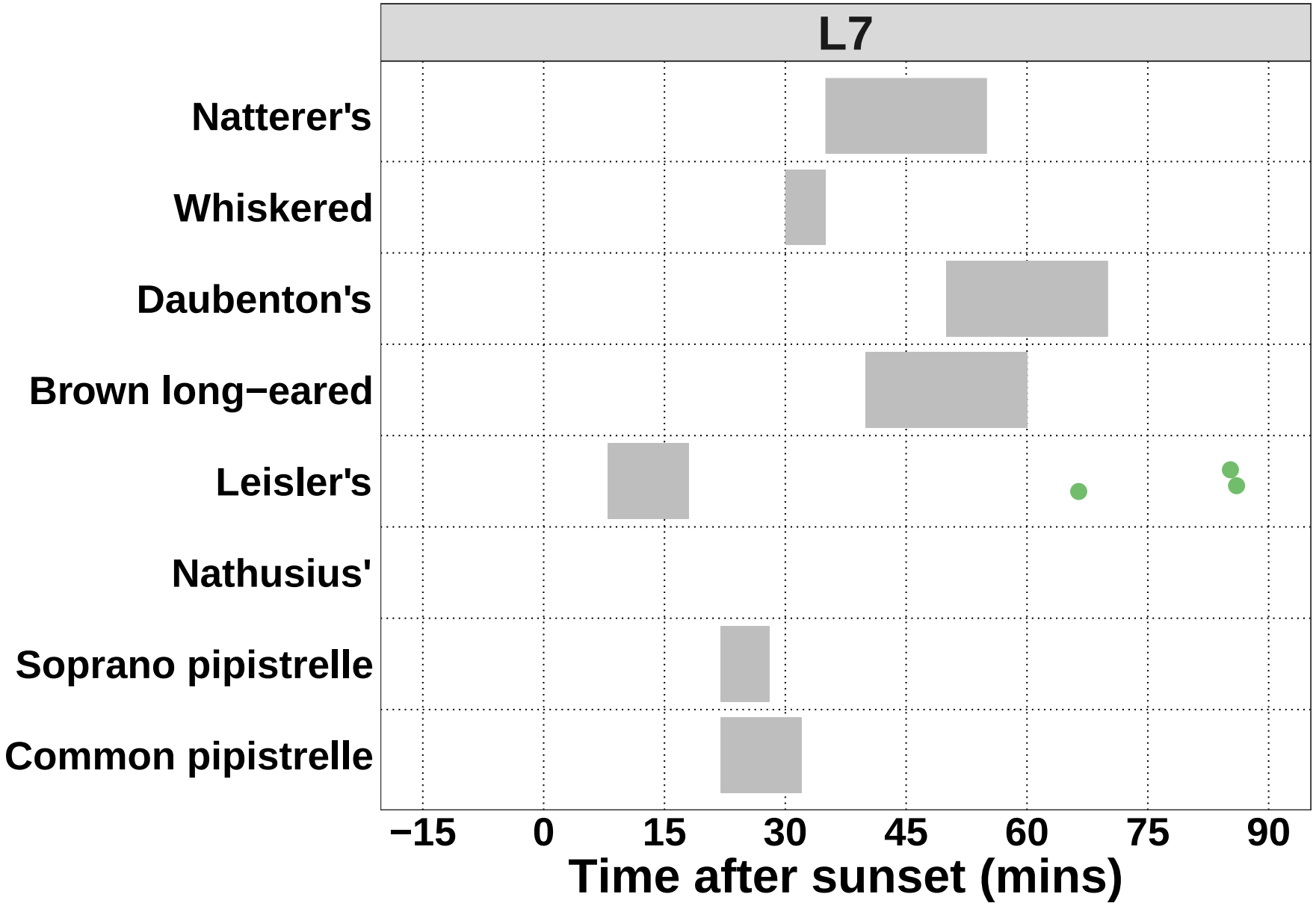

L11
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

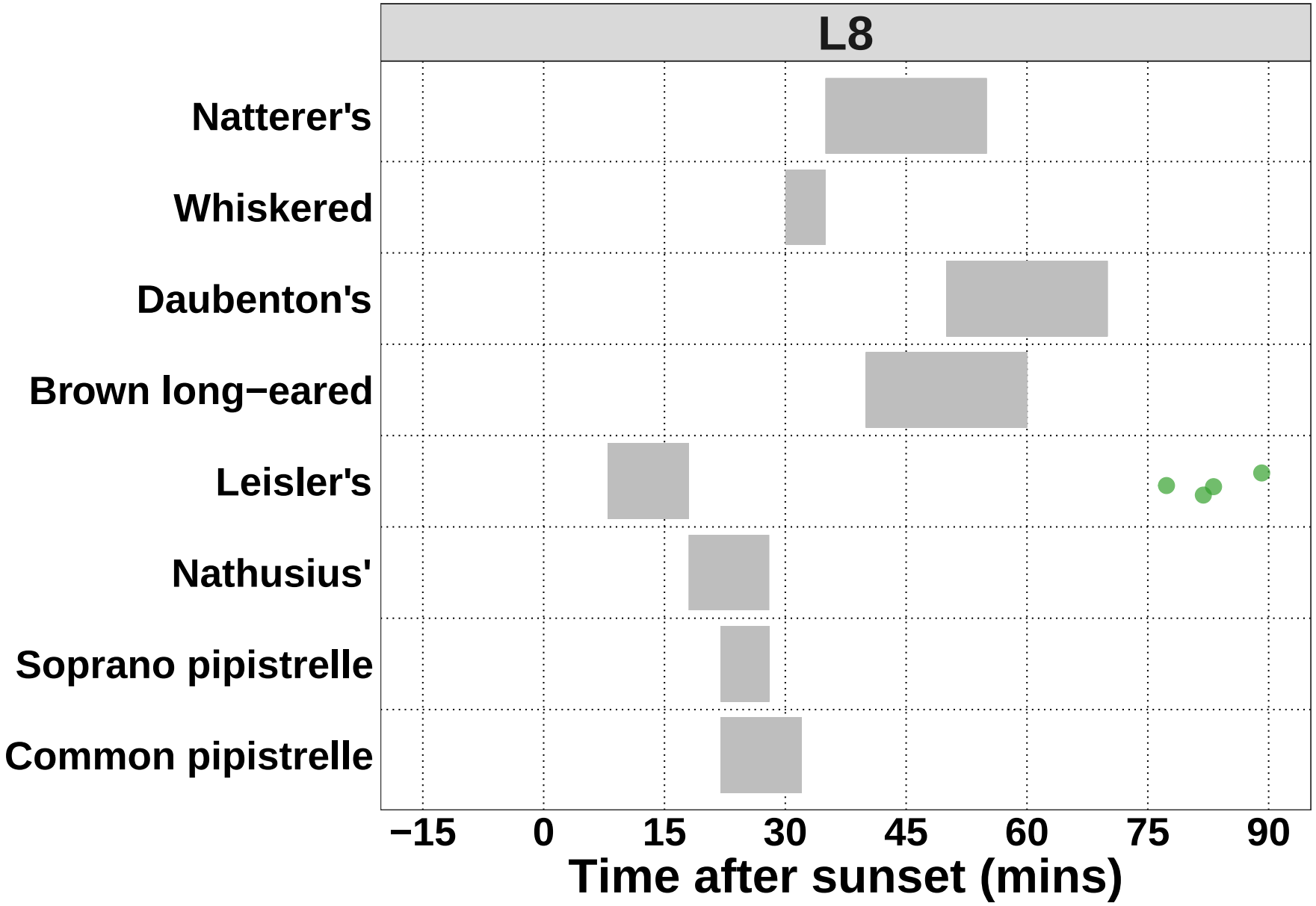

L2
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

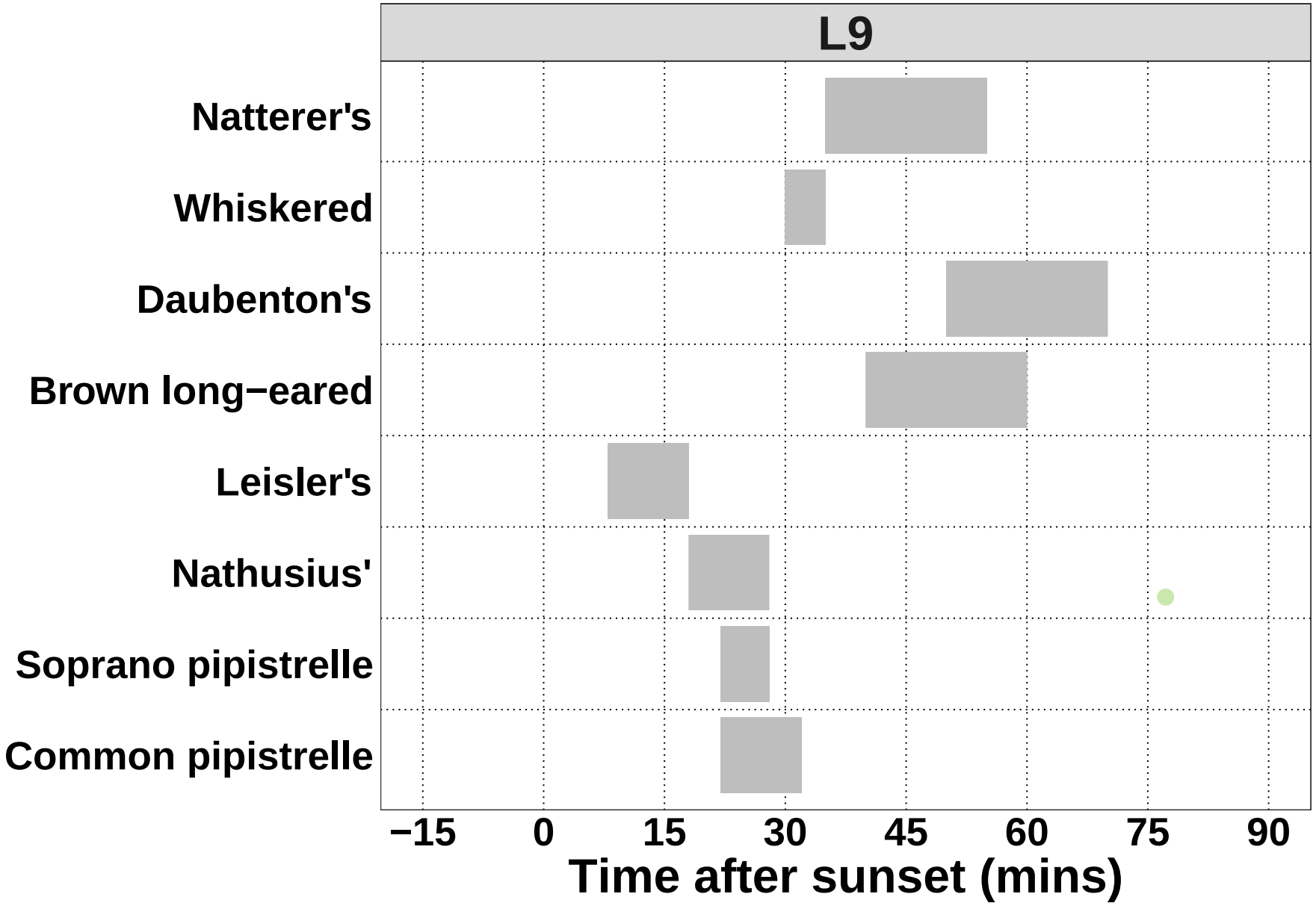

L4
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)


L5
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)


L6
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)


L7
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)


L8
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)


L9
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)

Count 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 (%)
Myotis daubentonii	180	9.1
Myotis mystacinus	46	2.3
Myotis nattereri	64	3.2
Nyctalus leisleri	333	16.9
Pipistrellus nathusii	19	1.0
Pipistrellus pipistrellus	155	7.9
Pipistrellus pygmaeus	1134	57.5
Plecotus auritus	41	2.1
Total	1972	100.0

Per Detector

The number of passes recorded for each species at each detector.

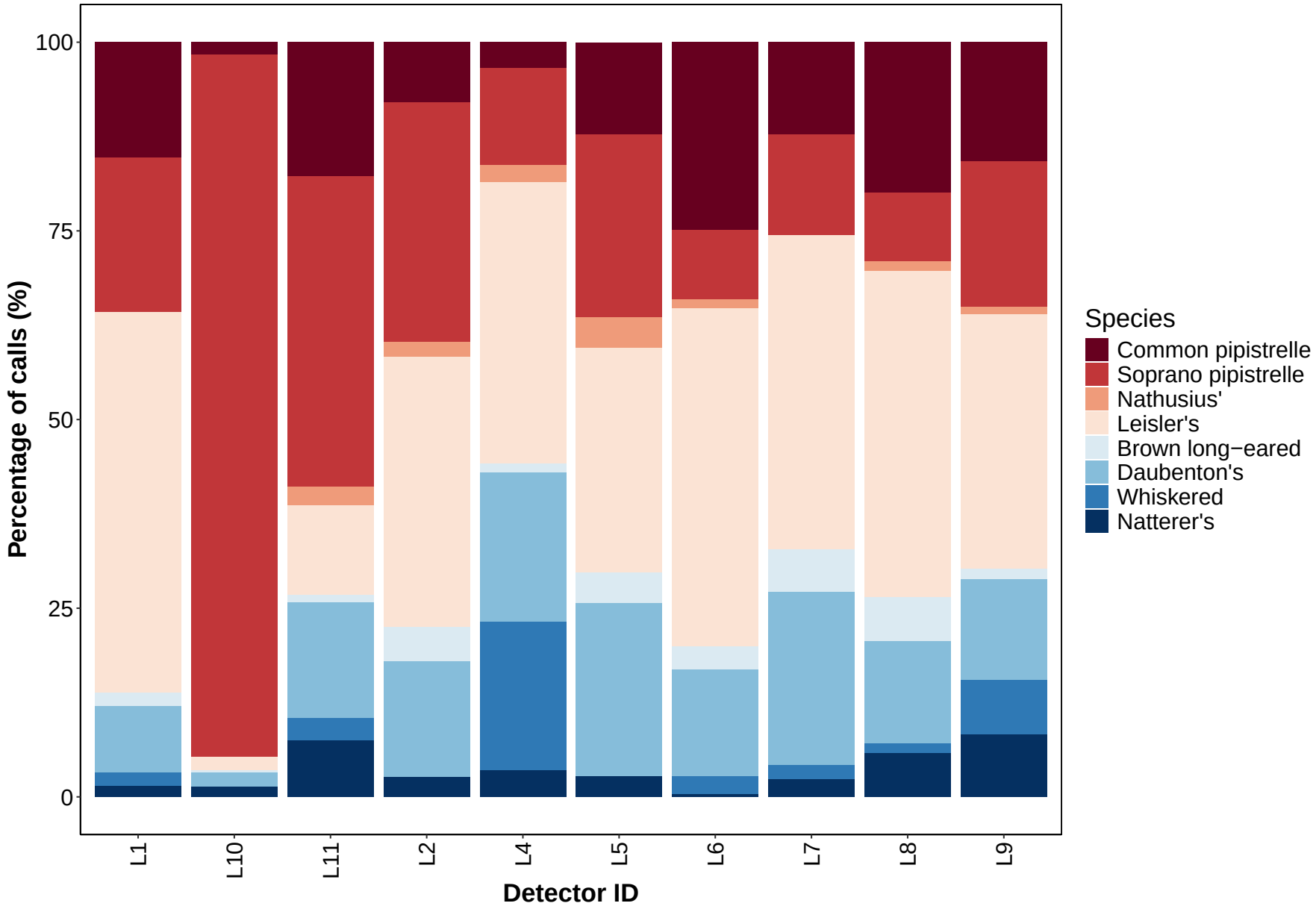
Species	Detector ID	Count (no.)	Percentage by Detector (%)
Common pipistrelle	L1	12	10.3448276
Common pipistrelle	L10	17	1.6831683
Common pipistrelle	L11	33	19.5266272
Common pipistrelle	L2	10	8.0645161
Common pipistrelle	L4	3	4.1095890
Common pipistrelle	L5	10	15.1515152
Common pipistrelle	L6	24	30.3797468
Common pipistrelle	L7	6	6.6666667
Common pipistrelle	L8	27	20.0000000
Common pipistrelle	L9	13	11.8181818
Soprano pipistrelle	L1	31	26.7241379
Soprano pipistrelle	L10	935	92.5742574
Soprano pipistrelle	L11	62	36.6863905
Soprano pipistrelle	L2	34	27.4193548
Soprano pipistrelle	L4	10	13.6986301
Soprano pipistrelle	L5	12	18.1818182
Soprano pipistrelle	L6	8	10.1265823
Soprano pipistrelle	L7	8	8.8888889
Soprano pipistrelle	L8	15	11.1111111
Soprano pipistrelle	L9	19	17.2727273
Nathusius’	L10	1	0.0990099
Nathusius’	L11	4	2.3668639
Nathusius’	L2	3	2.4193548
Nathusius’	L4	2	2.7397260
Nathusius’	L5	3	4.5454545
Nathusius’	L6	2	2.5316456
Nathusius’	L8	2	1.4814815
Nathusius’	L9	2	1.8181818
Leisler’s	L1	62	53.4482759
Leisler’s	L10	22	2.1782178
Leisler’s	L11	19	11.2426036
Leisler’s	L2	47	37.9032258

Species	Detector ID	Count (no.)	Percentage by Detector (%)
Leisler's	L4	24	32.8767123
Leisler's	L5	20	30.3030303
Leisler's	L6	25	31.6455696
Leisler's	L7	30	33.3333333
Leisler's	L8	57	42.2222222
Leisler's	L9	27	24.5454545
Brown long-eared	L1	2	1.7241379
Brown long-eared	L10	2	0.1980198
Brown long-eared	L11	2	1.1834320
Brown long-eared	L2	6	4.8387097
Brown long-eared	L4	1	1.3698630
Brown long-eared	L5	3	4.5454545
Brown long-eared	L6	4	5.0632911
Brown long-eared	L7	10	11.1111111
Brown long-eared	L8	7	5.1851852
Brown long-eared	L9	4	3.6363636
Daubenton's	L1	5	4.3103448
Daubenton's	L10	20	1.9801980
Daubenton's	L11	27	15.9763314
Daubenton's	L2	20	16.1290323
Daubenton's	L4	16	21.9178082
Daubenton's	L5	15	22.7272727
Daubenton's	L6	13	16.4556962
Daubenton's	L7	30	33.3333333
Daubenton's	L8	20	14.8148148
Daubenton's	L9	14	12.7272727
Whiskered	L1	3	2.5862069
Whiskered	L10	1	0.0990099
Whiskered	L11	6	3.5502959
Whiskered	L4	13	17.8082192
Whiskered	L6	2	2.5316456
Whiskered	L7	3	3.3333333
Whiskered	L8	2	1.4814815
Whiskered	L9	16	14.5454545
Natterer's	L1	1	0.8620690
Natterer's	L10	12	1.1881188

Species	Detector ID	Count (no.)	Percentage by Detector (%)
Natterer's	L11	16	9.4674556
Natterer's	L2	4	3.2258065
Natterer's	L4	4	5.4794521
Natterer's	L5	3	4.5454545
Natterer's	L6	1	1.2658228
Natterer's	L7	3	3.3333333
Natterer's	L8	5	3.7037037
Natterer's	L9	15	13.6363636

Species Composition

Figure 10. Percentage species composition of passes at each detector.


100
75
50
25
0
Percentage of calls (%)
L1
L10
L11
L2
L4
L5
L6
L7
L8
L9
Detector ID
Species
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Brown long−eared
Daubenton's
Whiskered
Natterer's

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.

Nighlty 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	L1	0.5
Common pipistrelle	L10	0.1
Common pipistrelle	L11	0.2
Common pipistrelle	L2	0.1
Common pipistrelle	L4	0.1
Common pipistrelle	L5	0.1
Common pipistrelle	L6	0.5
Common pipistrelle	L7	0.7
Common pipistrelle	L8	0.2
Common pipistrelle	L9	0.4
Soprano pipistrelle	L1	0.5
Soprano pipistrelle	L10	6.0
Soprano pipistrelle	L11	0.3
Soprano pipistrelle	L2	0.2
Soprano pipistrelle	L4	0.2
Soprano pipistrelle	L5	0.2
Soprano pipistrelle	L6	0.4
Soprano pipistrelle	L7	0.4
Soprano pipistrelle	L8	0.3
Soprano pipistrelle	L9	0.5
Nathusius'	L10	0.1
Nathusius'	L11	0.2
Nathusius'	L2	0.1
Nathusius'	L4	0.1
Nathusius'	L5	0.1
Nathusius'	L6	0.1
Nathusius'	L8	0.1
Nathusius'	L9	0.1
Leisler's	L1	0.7
Leisler's	L10	0.1
Leisler's	L11	0.2
Leisler's	L2	0.2
Leisler's	L4	0.2
Leisler's	L5	0.2
Leisler's	L6	0.8
Leisler's	L7	0.9

Species	Detector ID	Median Pass Rate
Leisler's	L8	0.4
Leisler's	L9	0.7
Brown long-eared	L1	0.2
Brown long-eared	L10	0.2
Brown long-eared	L11	0.1
Brown long-eared	L2	0.1
Brown long-eared	L4	0.1
Brown long-eared	L5	0.1
Brown long-eared	L6	0.2
Brown long-eared	L7	0.2
Brown long-eared	L8	0.1
Brown long-eared	L9	0.1
Daubenton's	L1	0.4
Daubenton's	L10	0.2
Daubenton's	L11	0.2
Daubenton's	L2	0.2
Daubenton's	L4	0.2
Daubenton's	L5	0.1
Daubenton's	L6	0.3
Daubenton's	L7	0.4
Daubenton's	L8	0.1
Daubenton's	L9	0.5
Whiskered	L1	0.2
Whiskered	L10	0.1
Whiskered	L11	0.1
Whiskered	L4	0.3
Whiskered	L6	0.2
Whiskered	L7	0.2
Whiskered	L8	0.2
Whiskered	L9	0.2
Natterer's	L1	0.3
Natterer's	L10	0.2
Natterer's	L11	0.2
Natterer's	L2	0.1
Natterer's	L4	0.1
Natterer's	L5	0.1

Species	Detector ID	Median Pass Rate
Natterer's	L6	0.1
Natterer's	L7	0.1
Natterer's	L8	0.3
Natterer's	L9	0.3

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.

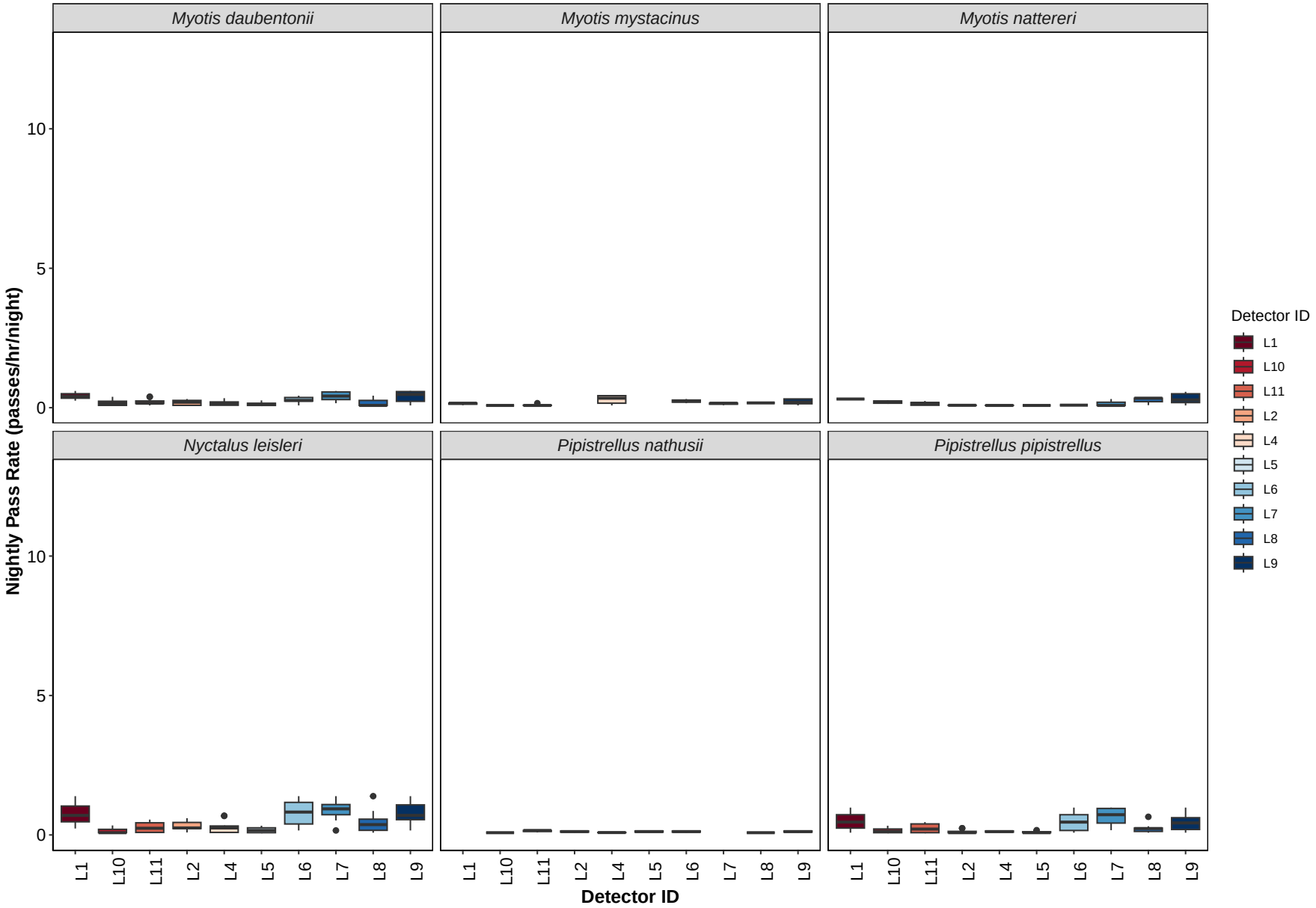
Species	Detector ID	Mean Pass Rate
Common pipistrelle	L1	0.5
Common pipistrelle	L10	0.2
Common pipistrelle	L11	0.2
Common pipistrelle	L2	0.1
Common pipistrelle	L4	0.1
Common pipistrelle	L5	0.1
Common pipistrelle	L6	0.5
Common pipistrelle	L7	0.7
Common pipistrelle	L8	0.2
Common pipistrelle	L9	0.5
Soprano pipistrelle	L1	0.5
Soprano pipistrelle	L10	5.8
Soprano pipistrelle	L11	0.4
Soprano pipistrelle	L2	0.4
Soprano pipistrelle	L4	0.2
Soprano pipistrelle	L5	0.2
Soprano pipistrelle	L6	0.3
Soprano pipistrelle	L7	0.4
Soprano pipistrelle	L8	0.2
Soprano pipistrelle	L9	0.4
Nathusius'	L10	0.1
Nathusius'	L11	0.1
Nathusius'	L2	0.1
Nathusius'	L4	0.1
Nathusius'	L5	0.1
Nathusius'	L6	0.1
Nathusius'	L8	0.1
Nathusius'	L9	0.1
Leisler's	L1	0.8
Leisler's	L10	0.1

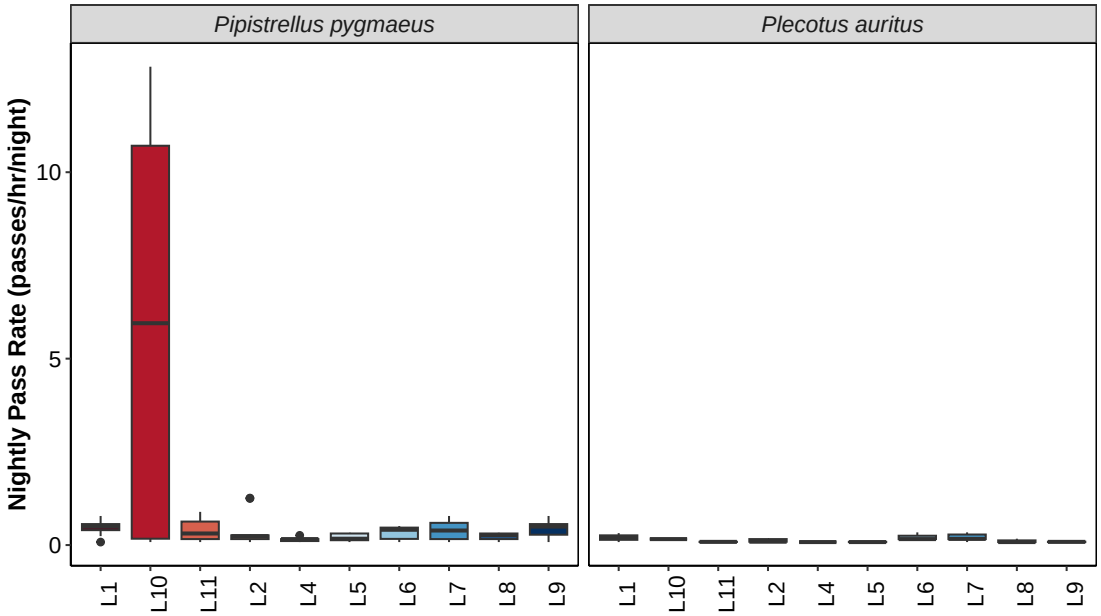
Species	Detector ID	Mean Pass Rate
Leisler's	L11	0.3
Leisler's	L2	0.3
Leisler's	L4	0.3
Leisler's	L5	0.2
Leisler's	L6	0.8
Leisler's	L7	0.9
Leisler's	L8	0.5
Leisler's	L9	0.8
Brown long-eared	L1	0.2
Brown long-eared	L10	0.2
Brown long-eared	L11	0.1
Brown long-eared	L2	0.1
Brown long-eared	L4	0.1
Brown long-eared	L5	0.1
Brown long-eared	L6	0.2
Brown long-eared	L7	0.2
Brown long-eared	L8	0.1
Brown long-eared	L9	0.1
Daubenton's	L1	0.4
Daubenton's	L10	0.2
Daubenton's	L11	0.2
Daubenton's	L2	0.2
Daubenton's	L4	0.2
Daubenton's	L5	0.1
Daubenton's	L6	0.3
Daubenton's	L7	0.4
Daubenton's	L8	0.2
Daubenton's	L9	0.4
Whiskered	L1	0.1
Whiskered	L10	0.1
Whiskered	L11	0.1
Whiskered	L4	0.3
Whiskered	L6	0.2
Whiskered	L7	0.1
Whiskered	L8	0.2
Whiskered	L9	0.2

Species	Detector ID	Mean Pass Rate
Natterer's	L1	0.3
Natterer's	L10	0.2
Natterer's	L11	0.2
Natterer's	L2	0.1
Natterer's	L4	0.1
Natterer's	L5	0.1
Natterer's	L6	0.1
Natterer's	L7	0.2
Natterer's	L8	0.3
Natterer's	L9	0.3

Per Detector

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)
0
5
10
L1
L10
L11
L2
L4
L5
L6
L7
L8
L9
Detector ID
Detector ID


Pipistrellus pygmaeus
Plecotus auritus
Nightly Pass Rate (passes/hr/night)
0
5
10
L1
L10
L11
L2
L4
L5
L6
L7
L8
L9
Detector ID
L1
L10
L11
L2
L4
L5
L6
L7
L8
L9

Detector ID

Split by Month

Total Bat Passes per Detector each Month

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	L1	20	23
Common pipistrelle	L10	10	9
Common pipistrelle	L11	10	26
Common pipistrelle	L2	4	8
Common pipistrelle	L4	2	1
Common pipistrelle	L5	3	6
Common pipistrelle	L6	21	44
Common pipistrelle	L7	20	12
Common pipistrelle	L8	17	14
Common pipistrelle	L9	20	26
Soprano pipistrelle	L1	19	39
Soprano pipistrelle	L10	371	712
Soprano pipistrelle	L11	37	46
Soprano pipistrelle	L2	7	41
Soprano pipistrelle	L4	6	5
Soprano pipistrelle	L5	5	13
Soprano pipistrelle	L6	13	11
Soprano pipistrelle	L7	8	27
Soprano pipistrelle	L8	7	7
Soprano pipistrelle	L9	13	43
Nathusius'	L10	1	0
Nathusius'	L11	1	4
Nathusius'	L2	0	3
Nathusius'	L4	1	1
Nathusius'	L5	0	3
Nathusius'	L6	0	3
Nathusius'	L8	0	2
Nathusius'	L9	0	3
Leisler's	L1	78	64
Leisler's	L10	11	9
Leisler's	L11	6	18
Leisler's	L2	33	21
Leisler's	L4	22	10
Leisler's	L5	13	9
Leisler's	L6	71	46
Leisler's	L7	57	52

Species	Detector ID	Sep	Oct
Leisler's	L8	44	23
Leisler's	L9	52	46
Brown long-eared	L1	1	4
Brown long-eared	L10	0	4
Brown long-eared	L11	1	1
Brown long-eared	L2	4	3
Brown long-eared	L4	0	1
Brown long-eared	L5	1	2
Brown long-eared	L6	6	2
Brown long-eared	L7	8	7
Brown long-eared	L8	6	3
Brown long-eared	L9	2	2
Daubenton's	L1	20	5
Daubenton's	L10	9	12
Daubenton's	L11	7	24
Daubenton's	L2	8	15
Daubenton's	L4	11	6
Daubenton's	L5	7	10
Daubenton's	L6	16	21
Daubenton's	L7	27	33
Daubenton's	L8	17	4
Daubenton's	L9	17	22
Whiskered	L1	3	2
Whiskered	L10	1	0
Whiskered	L11	1	5
Whiskered	L4	15	2
Whiskered	L6	0	6
Whiskered	L7	3	2
Whiskered	L8	2	0
Whiskered	L9	2	19
Natterer's	L1	0	4
Natterer's	L10	5	10
Natterer's	L11	4	11
Natterer's	L2	3	1
Natterer's	L4	3	0
Natterer's	L5	0	2

Species	Detector ID	Sep	Oct
Natterer's	L6	1	0
Natterer's	L7	0	6
Natterer's	L8	9	0
Natterer's	L9	3	21

Survey Effort

Table 19. The number of survey nights per month per detector.

month	Detector ID	No. of Survey Nights
Sep	L1	8
Sep	L10	10
Sep	L11	10
Sep	L2	7
Sep	L4	6
Sep	L5	8
Sep	L6	8
Sep	L7	6
Sep	L8	7
Sep	L9	5
Oct	L1	8
Oct	L10	9
Oct	L11	10
Oct	L2	10
Oct	L4	6
Oct	L5	10
Oct	L6	9
Oct	L7	9
Oct	L8	9
Oct	L9	10

Nightly Bat Passes 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	L1	0.3	0.5
Common pipistrelle	L10	0.1	0.2
Common pipistrelle	L11	0.2	0.2
Common pipistrelle	L2	0.2	0.1
Common pipistrelle	L4	0.2	0.1
Common pipistrelle	L5	0.1	0.1
Common pipistrelle	L6	0.3	0.5
Common pipistrelle	L7	0.5	0.9
Common pipistrelle	L8	0.2	0.2
Common pipistrelle	L9	0.3	0.4
Soprano pipistrelle	L1	0.5	0.5
Soprano pipistrelle	L10	2.5	10.7
Soprano pipistrelle	L11	0.2	0.4
Soprano pipistrelle	L2	0.2	0.2
Soprano pipistrelle	L4	0.2	0.2
Soprano pipistrelle	L5	0.2	0.3
Soprano pipistrelle	L6	0.3	0.4
Soprano pipistrelle	L7	0.3	0.4
Soprano pipistrelle	L8	0.3	0.2
Soprano pipistrelle	L9	0.5	0.4
Nathusius'	L10	0.1	NA
Nathusius'	L11	0.1	0.2
Nathusius'	L2	NA	0.1
Nathusius'	L4	0.1	0.1
Nathusius'	L5	NA	0.1
Nathusius'	L6	NA	0.1
Nathusius'	L8	NA	0.1
Nathusius'	L9	NA	0.1
Leisler's	L1	0.8	0.7
Leisler's	L10	0.1	0.2
Leisler's	L11	0.1	0.4
Leisler's	L2	0.5	0.2
Leisler's	L4	0.2	0.3
Leisler's	L5	0.3	0.1
Leisler's	L6	1.1	0.5
Leisler's	L7	0.9	0.9

Species	Detector ID	Sep	Oct
Leisler's	L8	0.6	0.3
Leisler's	L9	0.7	0.7
Brown long-eared	L1	0.1	0.3
Brown long-eared	L10	NA	0.2
Brown long-eared	L11	0.1	0.1
Brown long-eared	L2	0.1	0.1
Brown long-eared	L4	NA	0.1
Brown long-eared	L5	0.1	0.1
Brown long-eared	L6	0.2	0.2
Brown long-eared	L7	0.2	0.2
Brown long-eared	L8	0.1	0.1
Brown long-eared	L9	0.1	0.1
Daubenton's	L1	0.4	0.4
Daubenton's	L10	0.2	0.1
Daubenton's	L11	0.1	0.2
Daubenton's	L2	0.2	0.2
Daubenton's	L4	0.2	0.1
Daubenton's	L5	0.3	0.1
Daubenton's	L6	0.3	0.3
Daubenton's	L7	0.5	0.4
Daubenton's	L8	0.3	0.1
Daubenton's	L9	0.6	0.4
Whiskered	L1	0.1	0.2
Whiskered	L10	0.1	NA
Whiskered	L11	0.1	0.1
Whiskered	L4	0.4	0.2
Whiskered	L6	NA	0.2
Whiskered	L7	0.1	0.2
Whiskered	L8	0.2	NA
Whiskered	L9	0.1	0.3
Natterer's	L1	NA	0.3
Natterer's	L10	0.2	0.2
Natterer's	L11	0.1	0.2
Natterer's	L2	0.1	0.1
Natterer's	L4	0.1	NA
Natterer's	L5	NA	0.1

Species	Detector ID	Sep	Oct
Natterer's	L6	0.1	NA
Natterer's	L7	NA	0.1
Natterer's	L8	0.3	NA
Natterer's	L9	0.2	0.3

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.

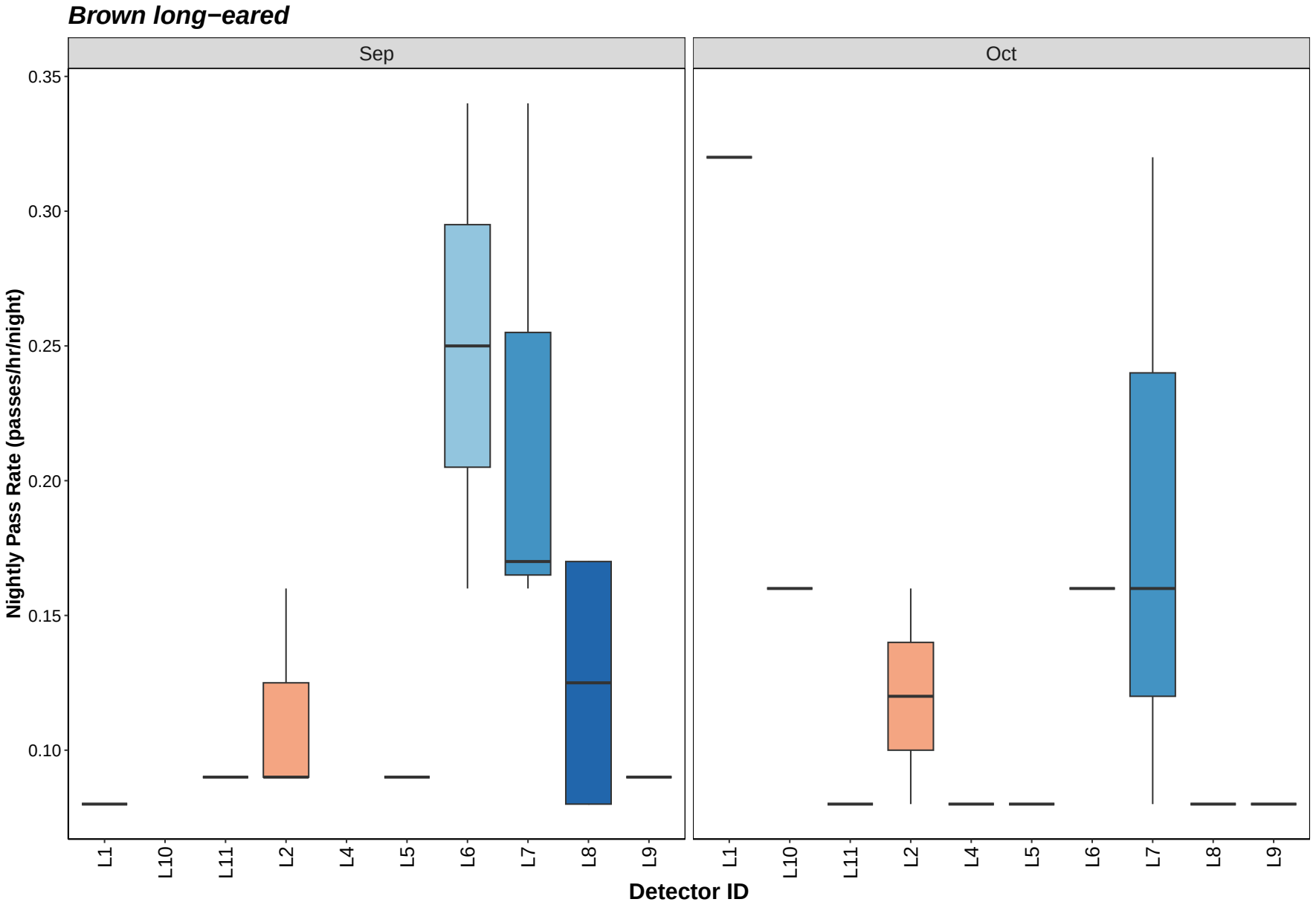
Species	Detector ID	Sep	Oct
Common pipistrelle	L1	0.4	0.6
Common pipistrelle	L10	0.1	0.2
Common pipistrelle	L11	0.2	0.3
Common pipistrelle	L2	0.2	0.1
Common pipistrelle	L4	0.2	0.1
Common pipistrelle	L5	0.1	0.1
Common pipistrelle	L6	0.4	0.5
Common pipistrelle	L7	0.6	0.9
Common pipistrelle	L8	0.2	0.2
Common pipistrelle	L9	0.4	0.5
Soprano pipistrelle	L1	0.4	0.5
Soprano pipistrelle	L10	3.9	8.0
Soprano pipistrelle	L11	0.3	0.5
Soprano pipistrelle	L2	0.2	0.5
Soprano pipistrelle	L4	0.2	0.1
Soprano pipistrelle	L5	0.1	0.3
Soprano pipistrelle	L6	0.3	0.4
Soprano pipistrelle	L7	0.3	0.4
Soprano pipistrelle	L8	0.3	0.2
Soprano pipistrelle	L9	0.5	0.4
Nathusius'	L10	0.1	NA
Nathusius'	L11	0.1	0.2
Nathusius'	L2	NA	0.1
Nathusius'	L4	0.1	0.1
Nathusius'	L5	NA	0.1
Nathusius'	L6	NA	0.1
Nathusius'	L8	NA	0.1
Nathusius'	L9	NA	0.1
Leisler's	L1	0.8	0.7
Leisler's	L10	0.1	0.2

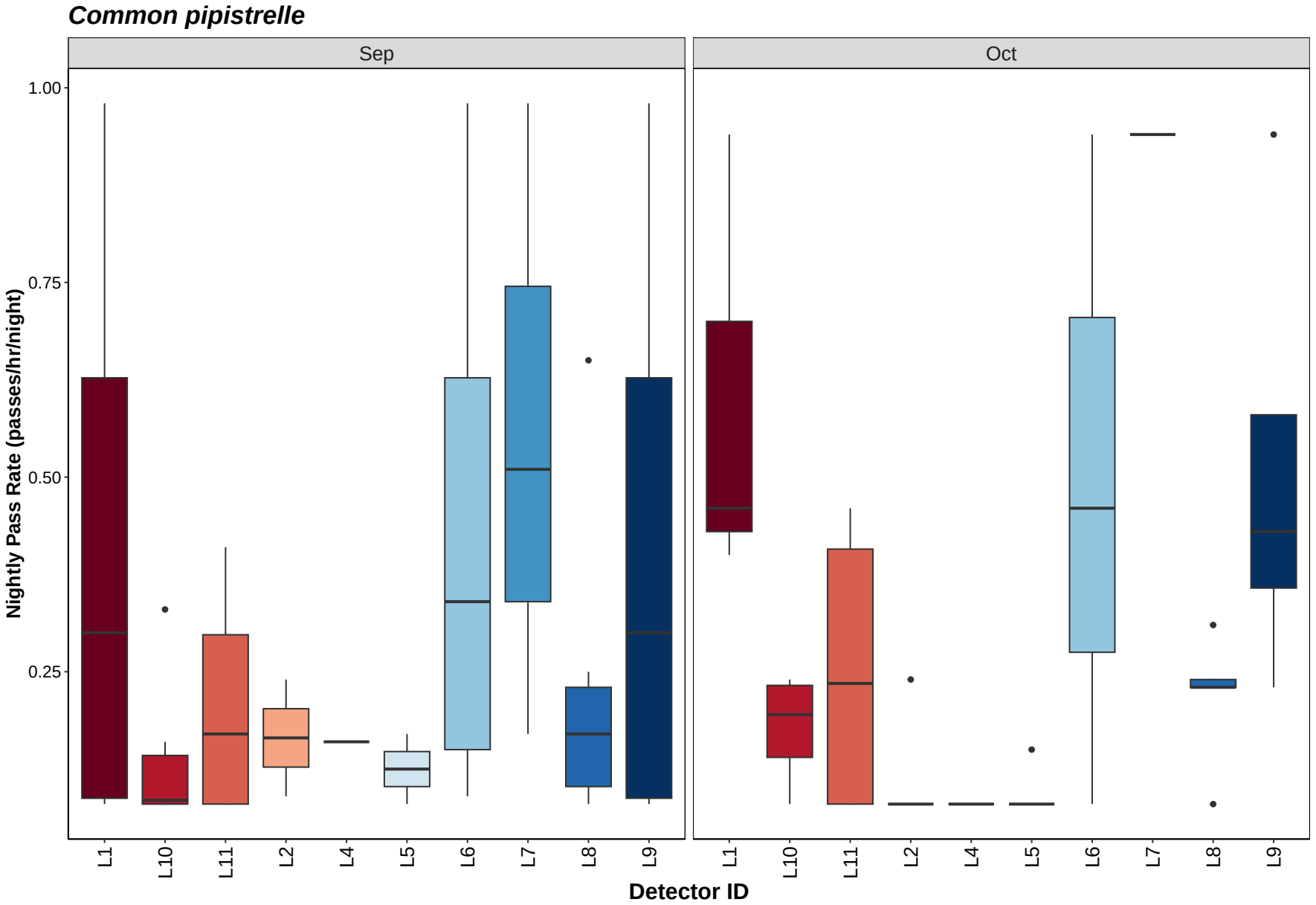
Species	Detector ID	Sep	Oct
Leisler's	L11	0.2	0.4
Leisler's	L2	0.4	0.2
Leisler's	L4	0.3	0.3
Leisler's	L5	0.2	0.1
Leisler's	L6	1.0	0.6
Leisler's	L7	1.0	0.8
Leisler's	L8	0.6	0.3
Leisler's	L9	0.9	0.7
Brown long-eared	L1	0.1	0.3
Brown long-eared	L10	NA	0.2
Brown long-eared	L11	0.1	0.1
Brown long-eared	L2	0.1	0.1
Brown long-eared	L4	NA	0.1
Brown long-eared	L5	0.1	0.1
Brown long-eared	L6	0.2	0.2
Brown long-eared	L7	0.2	0.2
Brown long-eared	L8	0.1	0.1
Brown long-eared	L9	0.1	0.1
Daubenton's	L1	0.4	0.4
Daubenton's	L10	0.2	0.2
Daubenton's	L11	0.1	0.2
Daubenton's	L2	0.2	0.2
Daubenton's	L4	0.2	0.1
Daubenton's	L5	0.2	0.1
Daubenton's	L6	0.3	0.3
Daubenton's	L7	0.5	0.4
Daubenton's	L8	0.3	0.1
Daubenton's	L9	0.5	0.4
Whiskered	L1	0.1	0.2
Whiskered	L10	0.1	NA
Whiskered	L11	0.1	0.1
Whiskered	L4	0.3	0.2
Whiskered	L6	NA	0.2
Whiskered	L7	0.1	0.2
Whiskered	L8	0.2	NA
Whiskered	L9	0.1	0.2

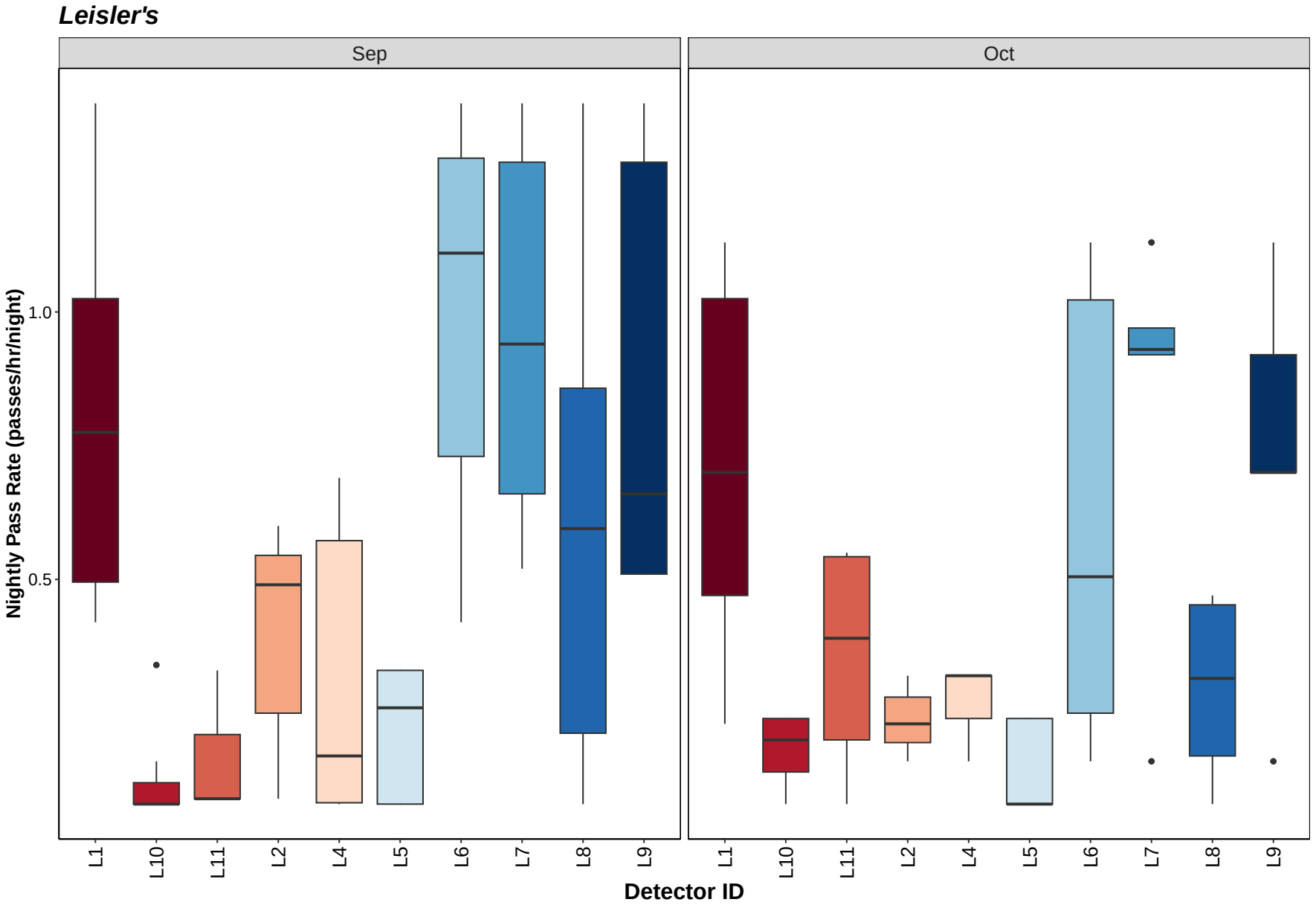
Species	Detector ID	Sep	Oct
Natterer's	L1	NA	0.3
Natterer's	L10	0.2	0.2
Natterer's	L11	0.1	0.2
Natterer's	L2	0.1	0.1
Natterer's	L4	0.1	NA
Natterer's	L5	NA	0.1
Natterer's	L6	0.1	NA
Natterer's	L7	NA	0.2
Natterer's	L8	0.3	NA
Natterer's	L9	0.2	0.3

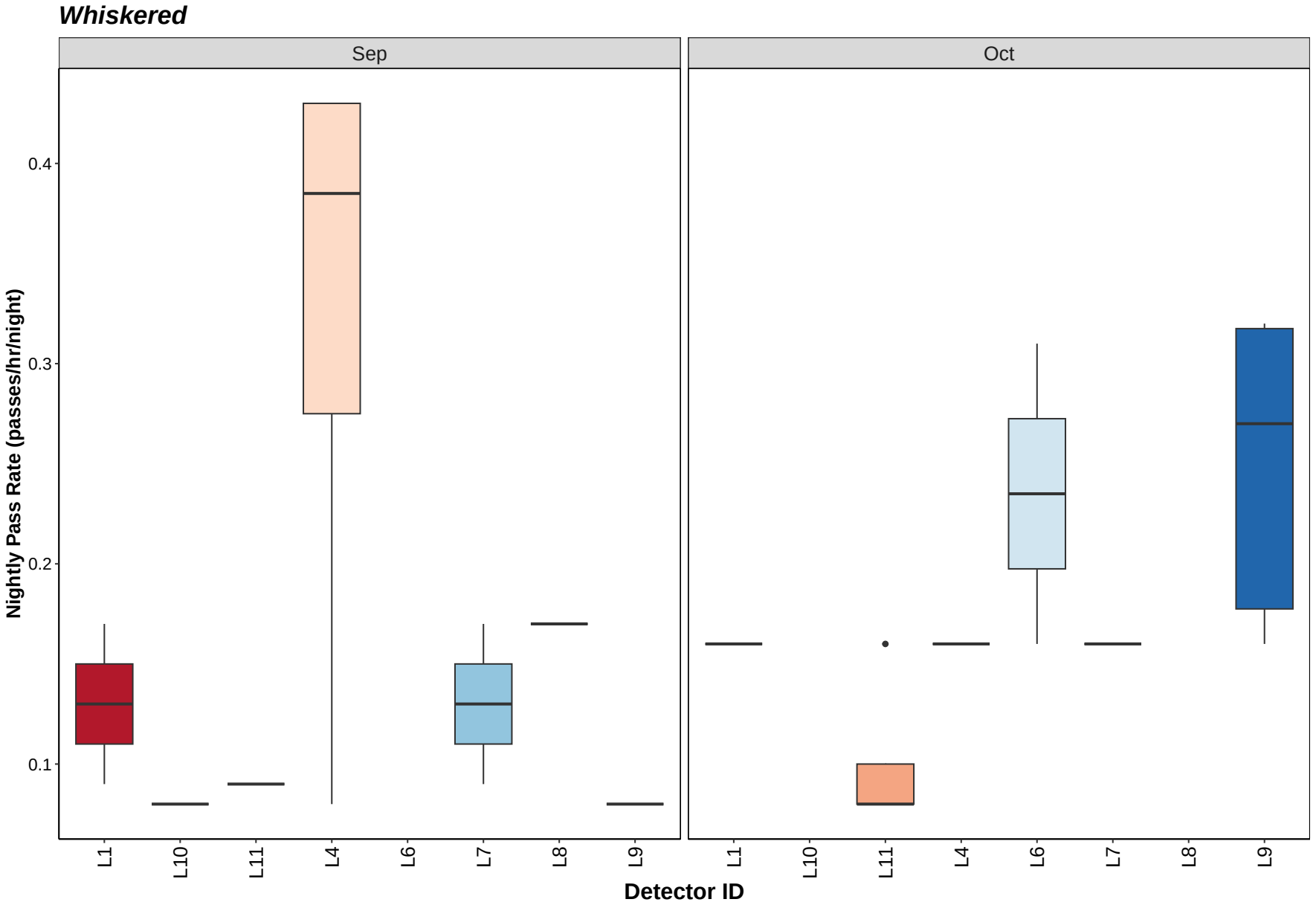
Per Detector

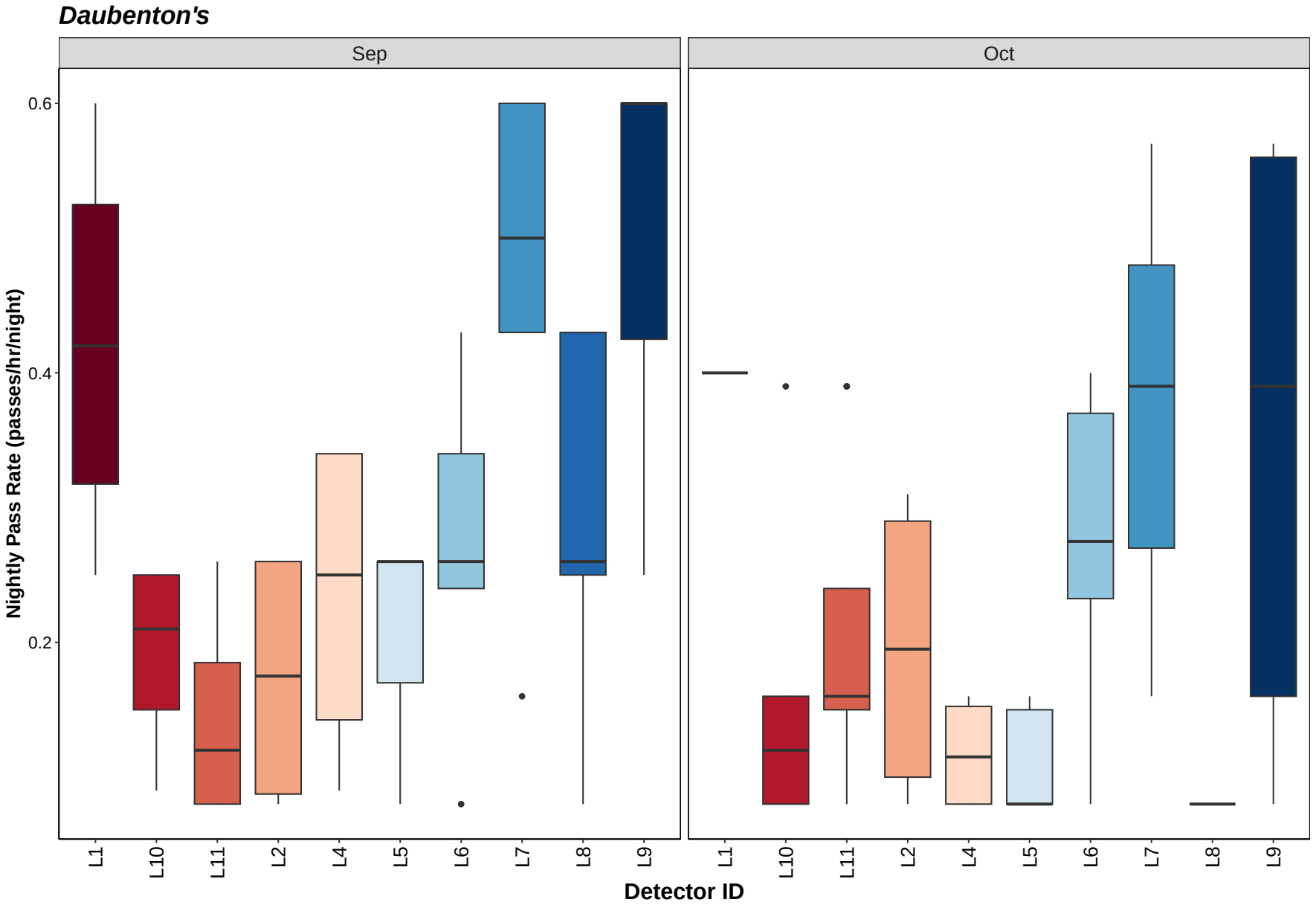
Figure 12. Figures show boxplots for the number of bat passes per hour by detector, for each month. The ‘box’ shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The ‘whiskers’ extend from the box and represent 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.

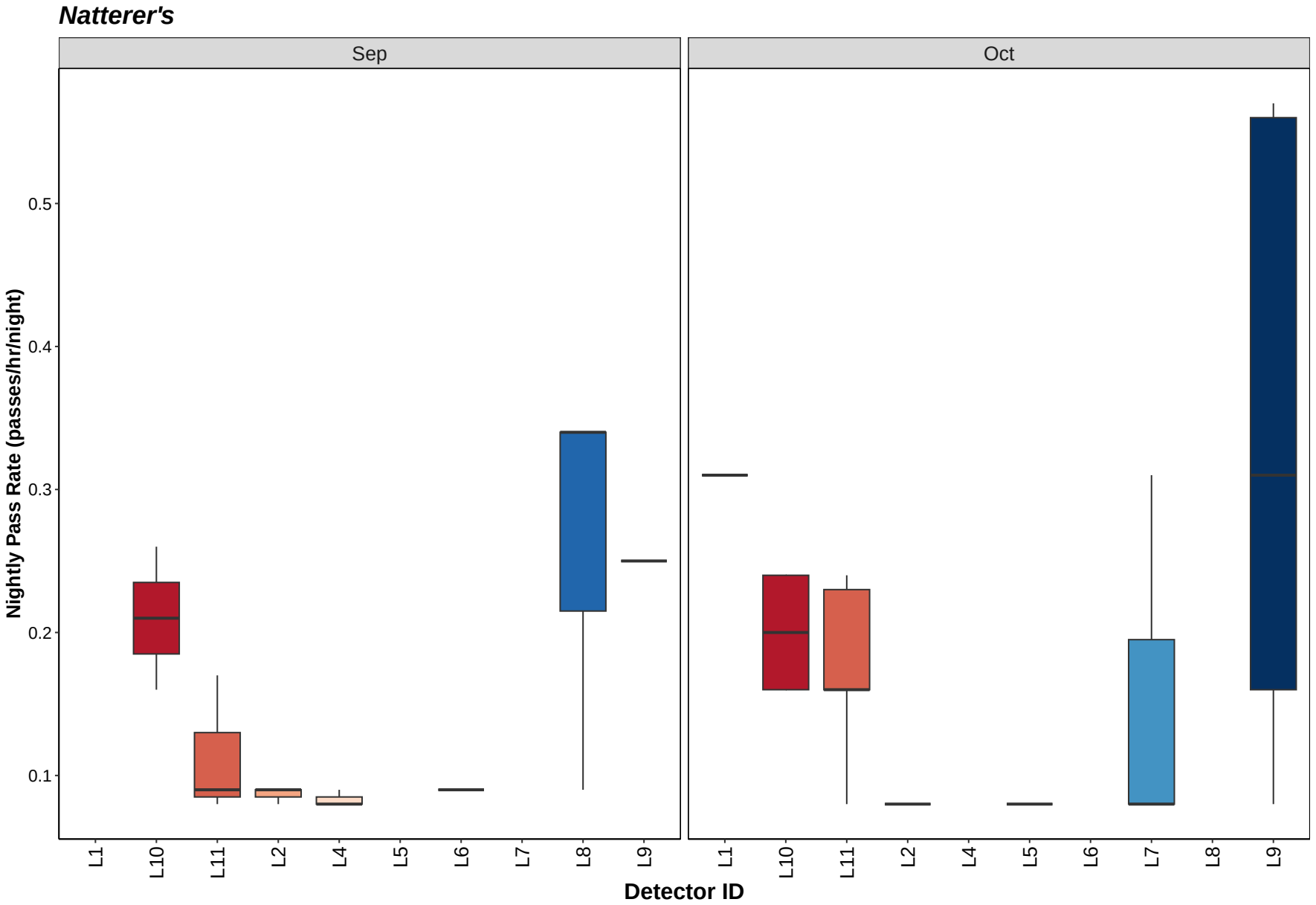

Brown long−eared
Sep
Oct
Nightly Pass Rate (passes/hr/night)
0.35
0.30
0.25
0.20
0.15
0.10
L1
L10
L11
L2
L4
L5
L6
L7
L8
L9
Detector ID

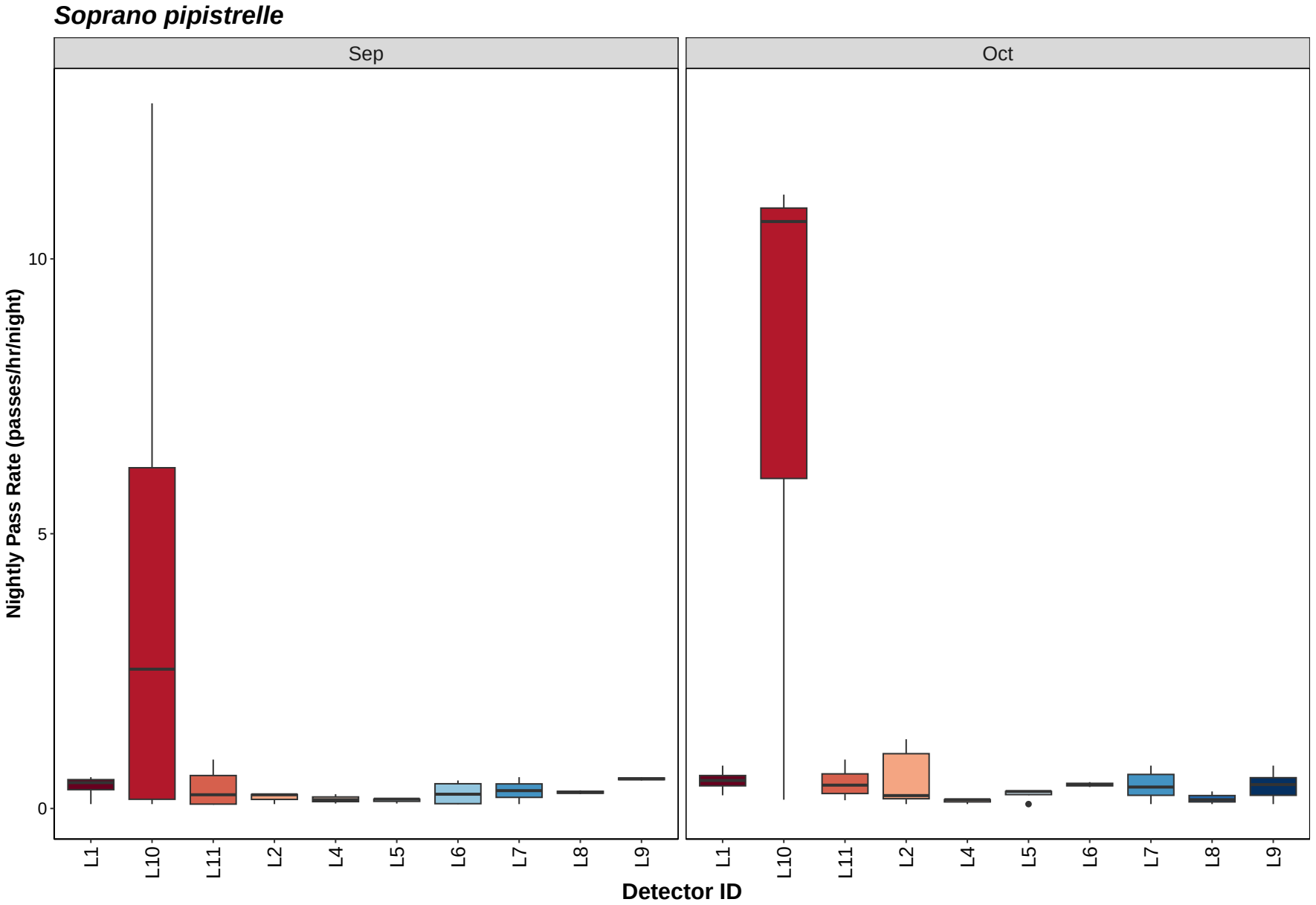

Common pipistrelle
Sep
Oct
1.00
0.75
0.50
0.25
Nightly Pass Rate (passes/hr/night)
L1
L10
L11
L2
L4
L5
L6
L7
L8
L9
Detector ID

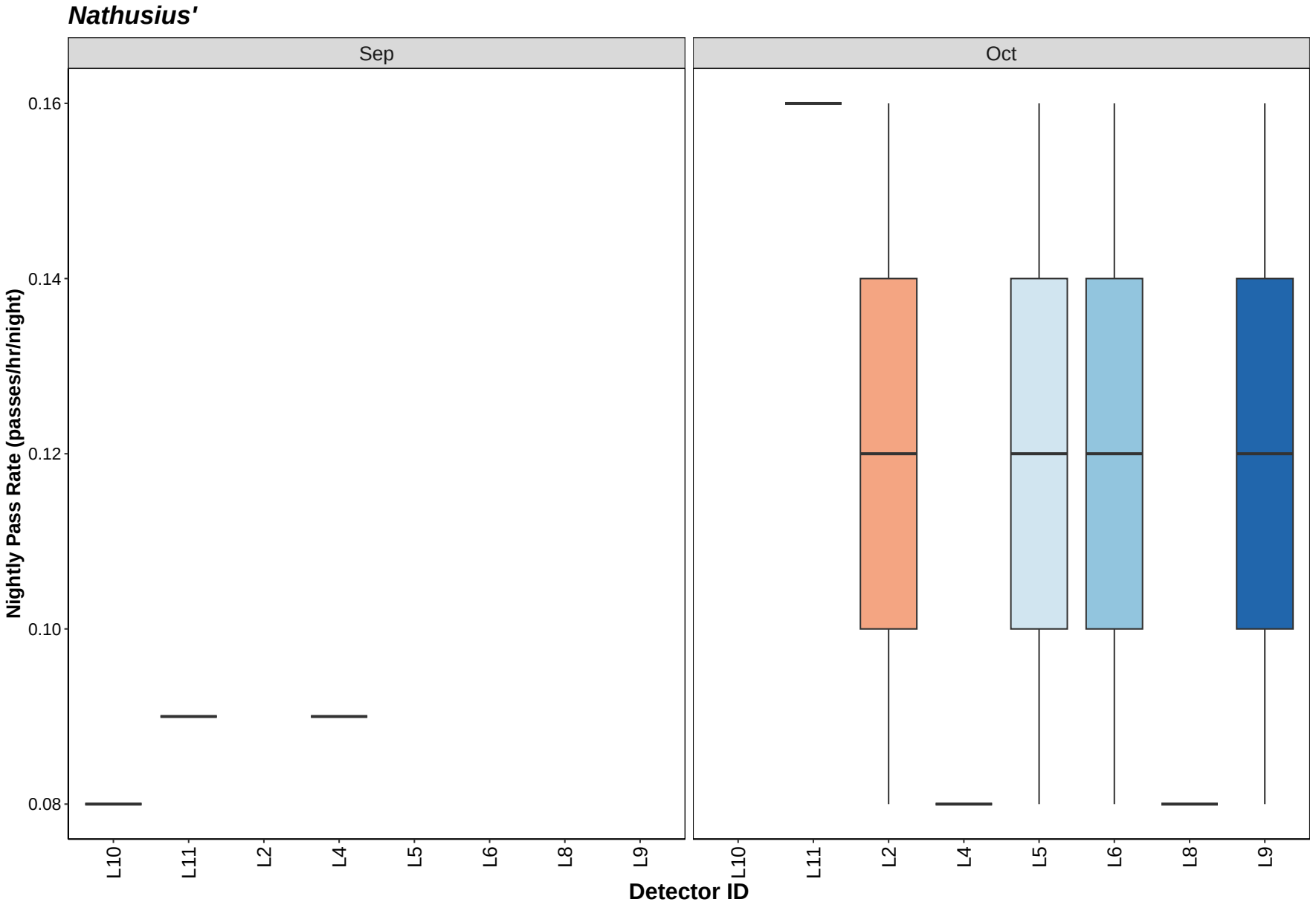

Leisler's
Sep
Oct
Nightly Pass Rate (passes/hr/night)
1.0
0.5
L1
L10
L11
L2
L4
L5
L6
L7
L8
L9
Detector ID


Whiskered
Sep
Oct
Nightly Pass Rate (passes/hr/night)
0.4
0.3
0.2
0.1
L1
L10
L11
L4
L6
L7
L8
L9
Detector ID


Daubenton's
Sep
Oct
Nightly Pass Rate (passes/hr/night)
0.6
0.4
0.2
L1
L10
L11
L2
L4
L5
L6
L7
L8
L9
Detector ID


Natterer's
Sep
Oct
Nightly Pass Rate (passes/hr/night)
0.5
0.4
0.3
0.2
0.1
L1
L10
L11
L2
L4
L5
L6
L7
L8
L9
Detector ID


Soprano pipistrelle
Sep
Oct
Nightly Pass Rate (passes/hr/night)
10
5
0
L1
L10
L11
L2
L4
L5
L6
L7
L8
L9
Detector ID


Nathusius'
Sep
Oct
Nightly Pass Rate (passes/hr/night)
0.16
0.14
0.12
0.10
0.08
L10
L11
L2
L4
L5
L6
L8
L9
Detector ID

Bat Activity per Detector Location

Figure 13. Detector ID reference:

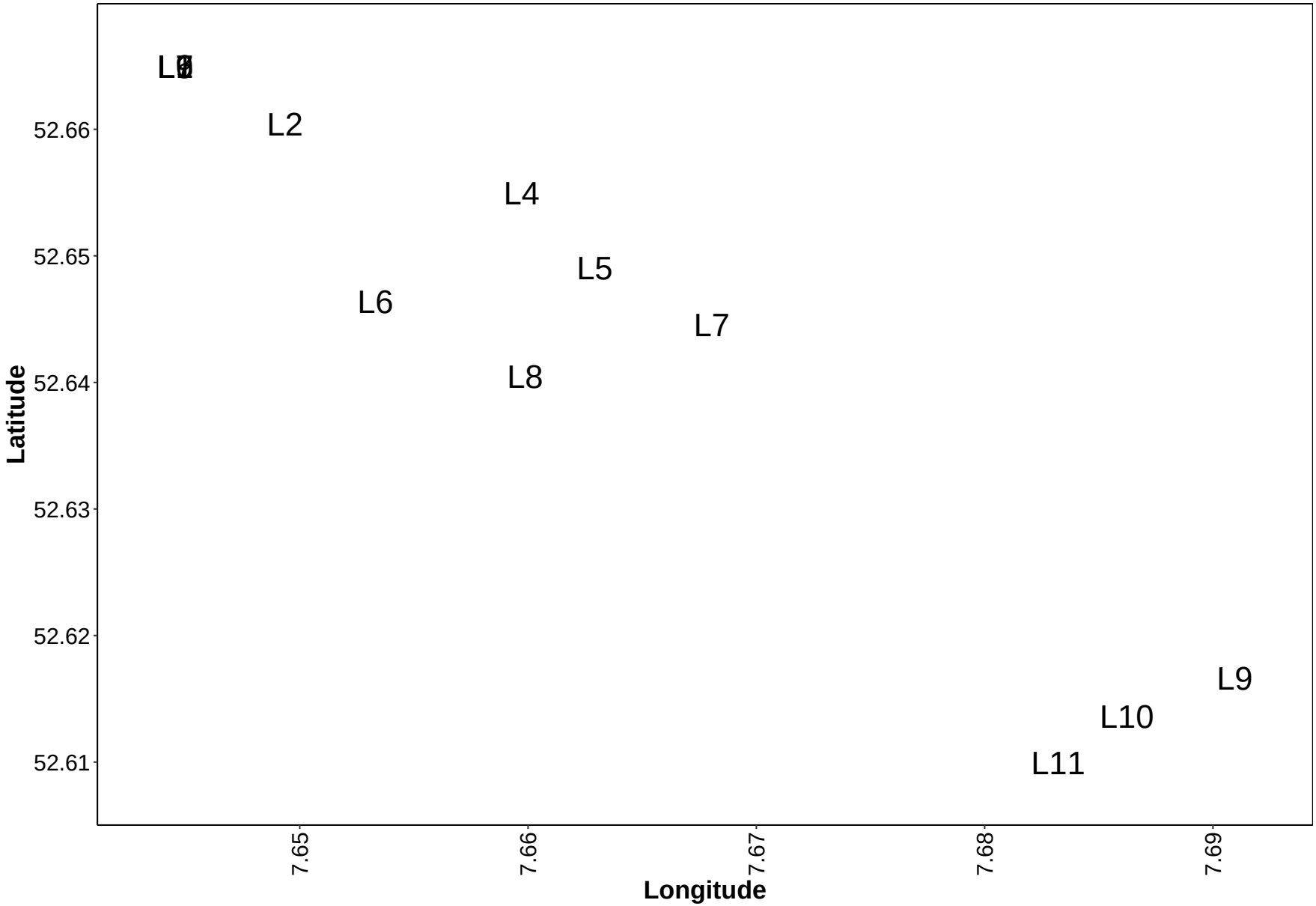
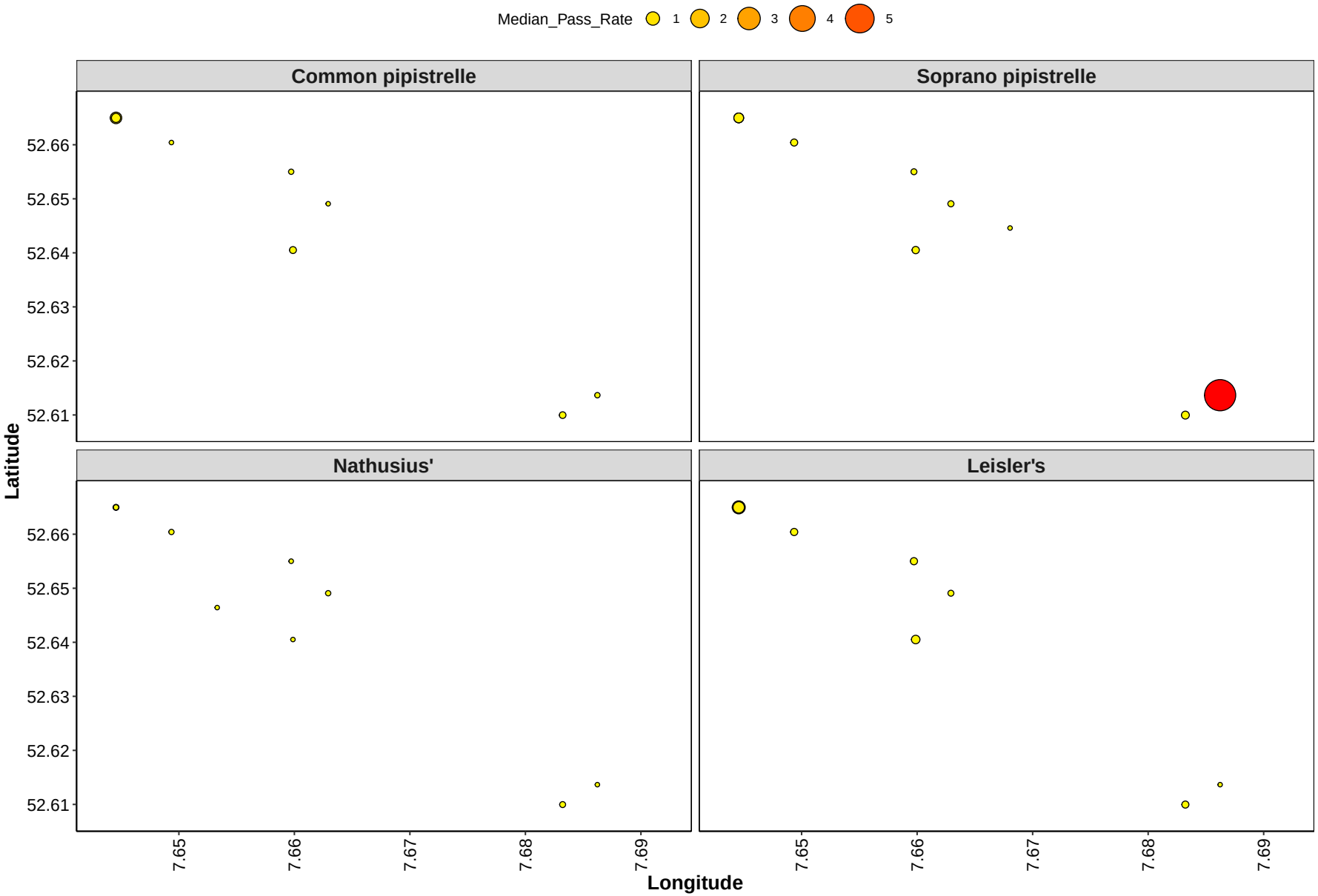

L1
L2
L4
L5
L6
L7
L8
L9
L10
L11
52.66
52.65
52.64
52.63
52.62
52.61
Latitude
7.65
7.66
7.67
7.68
7.69
Longitude

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
1
2
3
4
5
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
Longitude
7.65
7.66
7.67
7.68
7.69

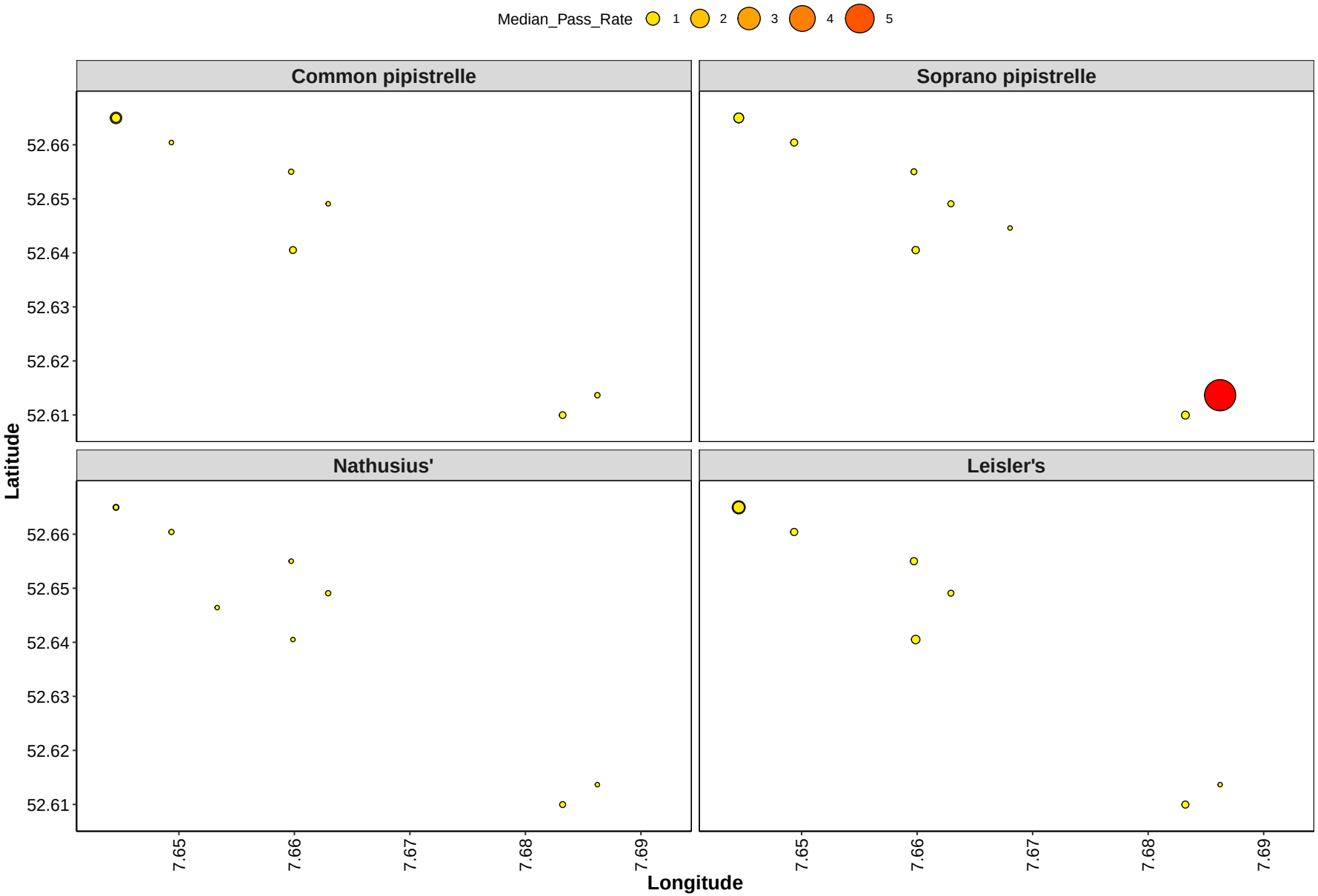
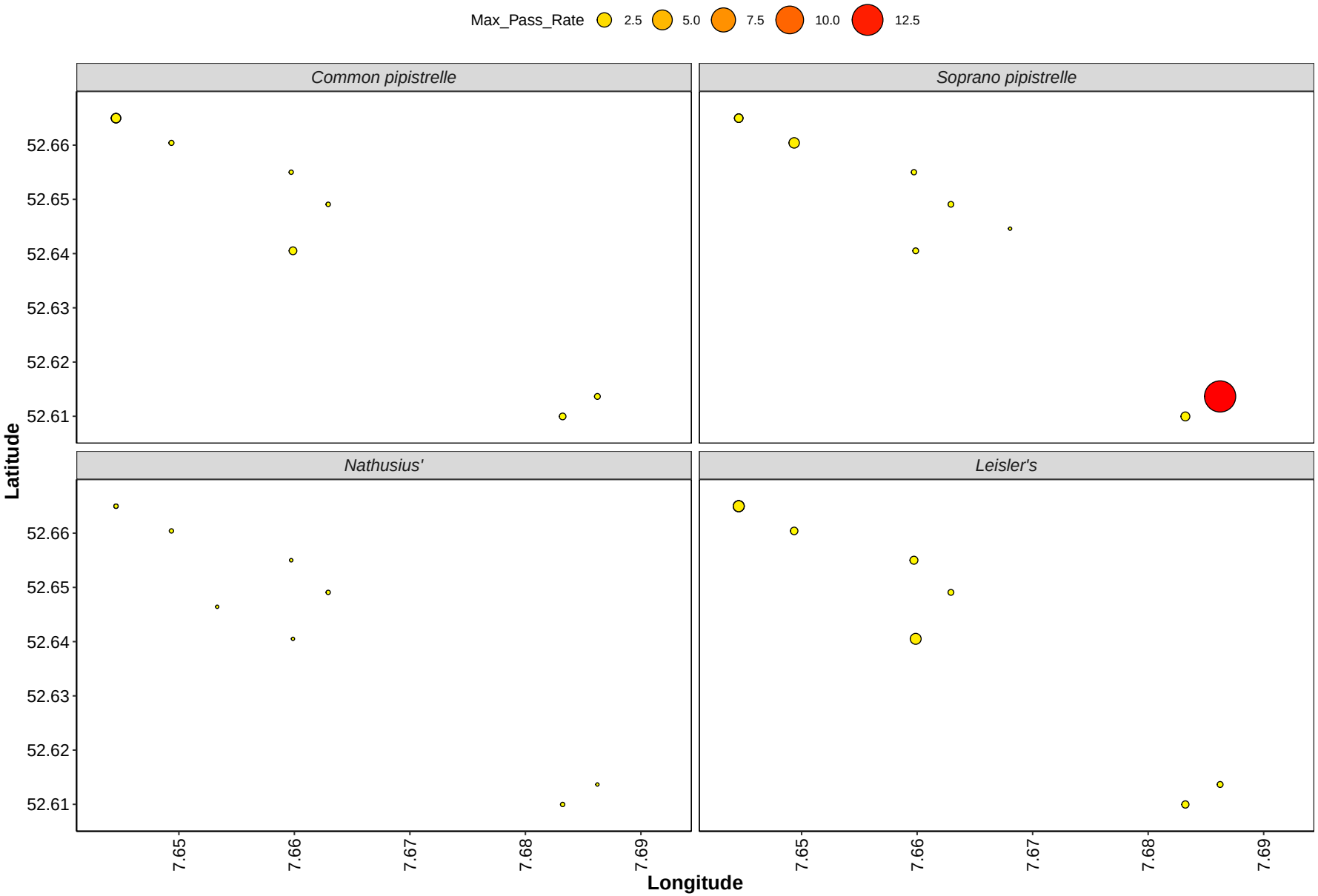
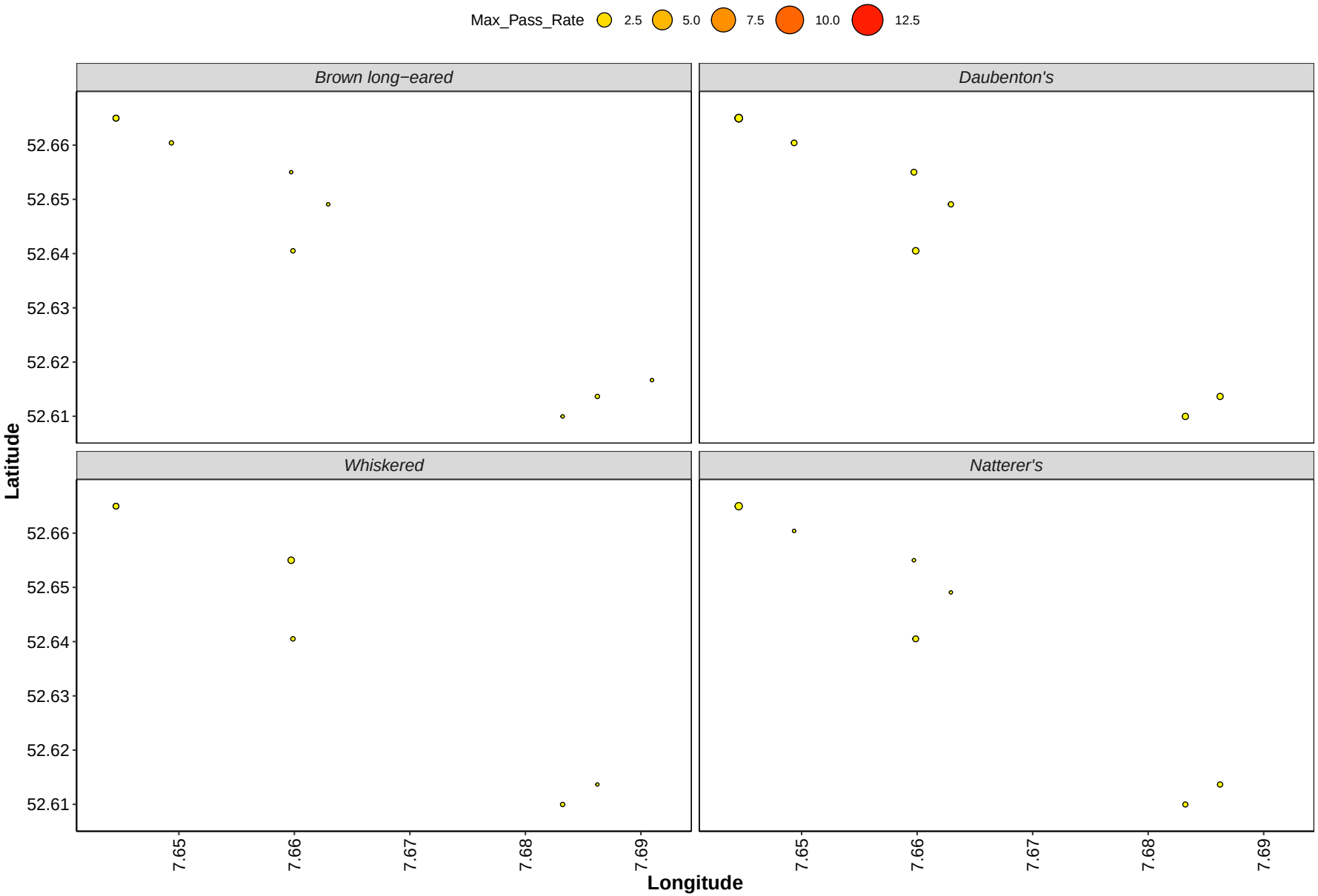

Median_Pass_Rate
1
2
3
4
5
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
Longitude
7.65
7.66
7.67
7.68
7.69

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
2.5
5.0
7.5
10.0
12.5
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
7.65
7.66
7.67
7.68
7.69
Longitude


Max_Pass_Rate
2.5
5.0
7.5
10.0
12.5
Brown long−eared
Daubenton's
Whiskered
Natterer's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
Longitude
7.65
7.66
7.67
7.68
7.69

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

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	L1	0.0
Brown long-eared	L10	0.0
Brown long-eared	L11	0.0
Brown long-eared	L2	0.0
Brown long-eared	L4	0.0
Brown long-eared	L5	0.0
Brown long-eared	L6	0.0
Brown long-eared	L7	0.0
Brown long-eared	L8	0.0
Brown long-eared	L9	0.0
Common pipistrelle	L1	0.0
Common pipistrelle	L10	0.1
Common pipistrelle	L11	0.1
Common pipistrelle	L2	0.0
Common pipistrelle	L4	0.0
Common pipistrelle	L5	0.0
Common pipistrelle	L6	0.1
Common pipistrelle	L7	0.0
Common pipistrelle	L8	0.1
Common pipistrelle	L9	0.0
Daubenton's	L1	0.0
Daubenton's	L10	0.1
Daubenton's	L11	0.1
Daubenton's	L2	0.1
Daubenton's	L4	0.1
Daubenton's	L5	0.1
Daubenton's	L6	0.2
Daubenton's	L7	0.3
Daubenton's	L8	0.1
Daubenton's	L9	0.0
Leisler's	L1	0.7
Leisler's	L10	0.1
Leisler's	L11	0.0
Leisler's	L2	0.2
Leisler's	L4	0.1
Leisler's	L5	0.1

Species	Detector ID	Median Pass Rate
Leisler's	L6	0.4
Leisler's	L7	0.6
Leisler's	L8	0.2
Leisler's	L9	0.5
Nathusius'	L1	0.0
Nathusius'	L10	0.0
Nathusius'	L11	0.0
Nathusius'	L2	0.0
Nathusius'	L4	0.0
Nathusius'	L5	0.0
Nathusius'	L6	0.0
Nathusius'	L7	0.0
Nathusius'	L8	0.0
Nathusius'	L9	0.0
Natterer's	L1	0.0
Natterer's	L10	0.0
Natterer's	L11	0.0
Natterer's	L2	0.0
Natterer's	L4	0.0
Natterer's	L5	0.0
Natterer's	L6	0.0
Natterer's	L7	0.0
Natterer's	L8	0.0
Natterer's	L9	0.0
Soprano pipistrelle	L1	0.3
Soprano pipistrelle	L10	2.2
Soprano pipistrelle	L11	0.2
Soprano pipistrelle	L2	0.1
Soprano pipistrelle	L4	0.0
Soprano pipistrelle	L5	0.0
Soprano pipistrelle	L6	0.0
Soprano pipistrelle	L7	0.0
Soprano pipistrelle	L8	0.0
Soprano pipistrelle	L9	0.2
Whiskered	L1	0.0
Whiskered	L10	0.0

Species	Detector ID	Median Pass Rate
Whiskered	L11	0.0
Whiskered	L2	0.0
Whiskered	L4	0.0
Whiskered	L5	0.0
Whiskered	L6	0.0
Whiskered	L7	0.0
Whiskered	L8	0.0
Whiskered	L9	0.0

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.

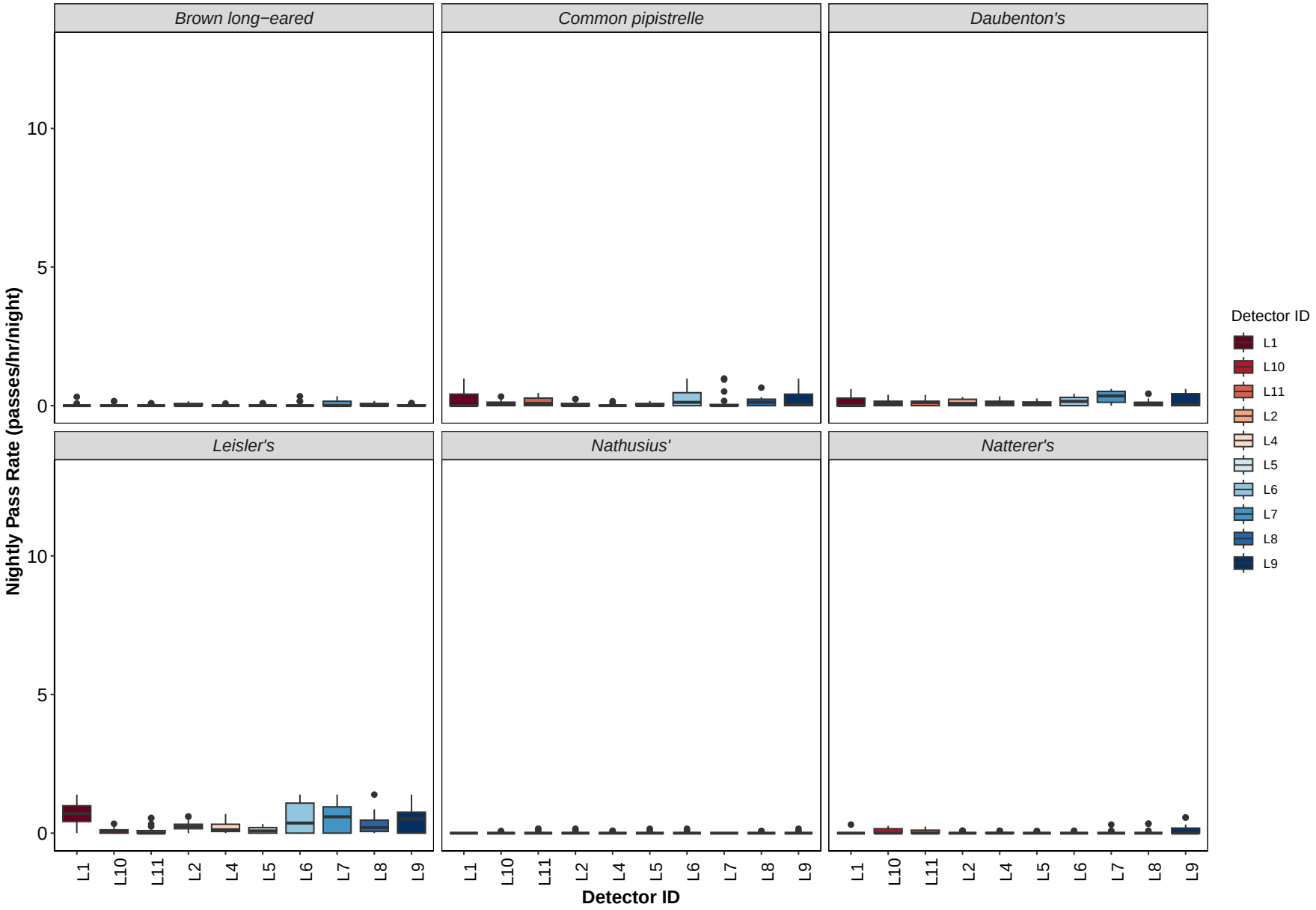
Species	Detector ID	Mean Pass Rate
Brown long-eared	L1	0.0
Brown long-eared	L10	0.0
Brown long-eared	L11	0.0
Brown long-eared	L2	0.0
Brown long-eared	L4	0.0
Brown long-eared	L5	0.0
Brown long-eared	L6	0.0
Brown long-eared	L7	0.1
Brown long-eared	L8	0.0
Brown long-eared	L9	0.0
Common pipistrelle	L1	0.2
Common pipistrelle	L10	0.1
Common pipistrelle	L11	0.1
Common pipistrelle	L2	0.1
Common pipistrelle	L4	0.0
Common pipistrelle	L5	0.0
Common pipistrelle	L6	0.3
Common pipistrelle	L7	0.2
Common pipistrelle	L8	0.2
Common pipistrelle	L9	0.2
Daubenton's	L1	0.1
Daubenton's	L10	0.1
Daubenton's	L11	0.1
Daubenton's	L2	0.1
Daubenton's	L4	0.1
Daubenton's	L5	0.1
Daubenton's	L6	0.2
Daubenton's	L7	0.3
Daubenton's	L8	0.1
Daubenton's	L9	0.2
Leisler's	L1	0.7
Leisler's	L10	0.1
Leisler's	L11	0.1
Leisler's	L2	0.3
Leisler's	L4	0.2
Leisler's	L5	0.1

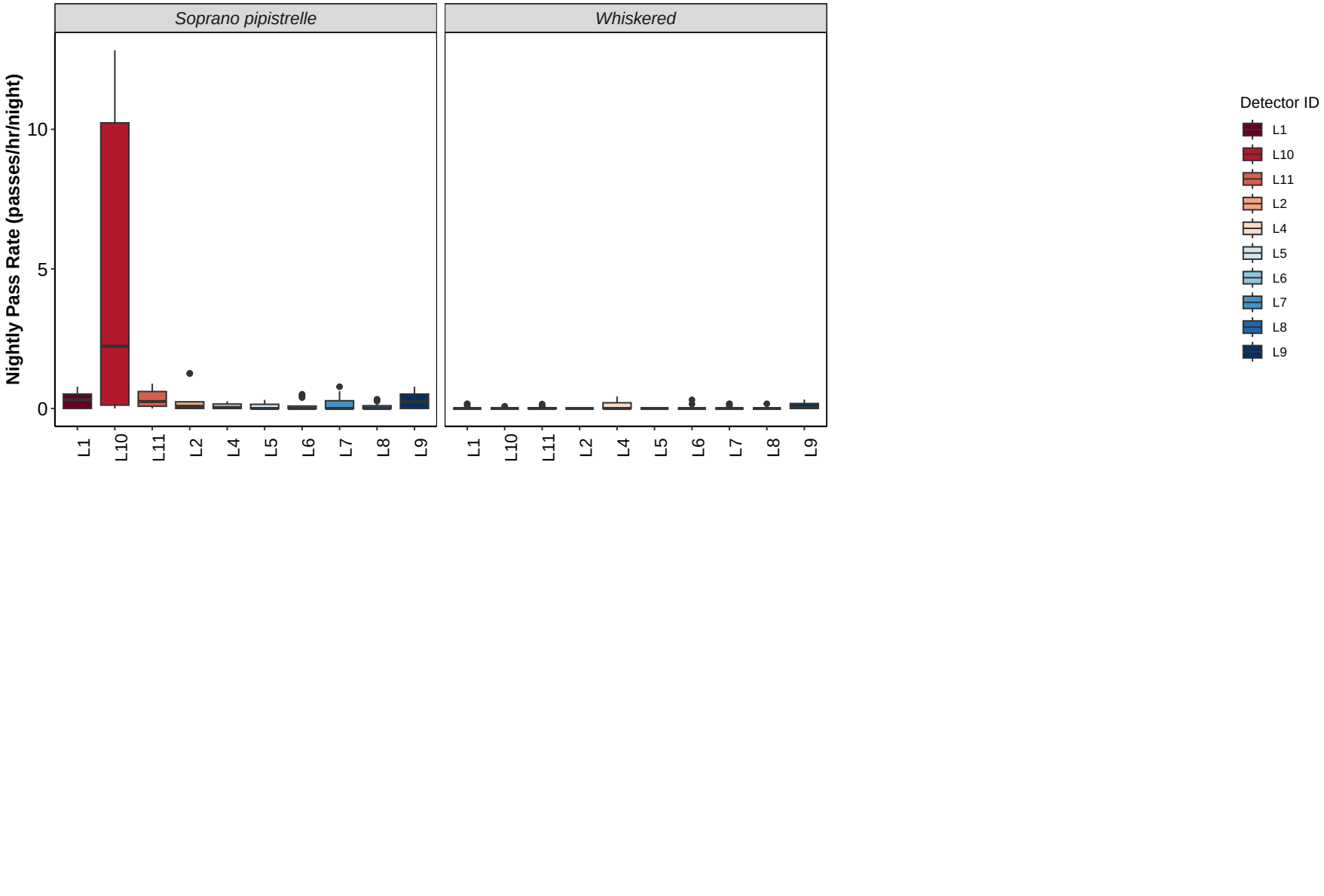
Species	Detector ID	Mean Pass Rate
Leisler's	L6	0.5
Leisler's	L7	0.6
Leisler's	L8	0.3
Leisler's	L9	0.5
Nathusius'	L1	0.0
Nathusius'	L10	0.0
Nathusius'	L11	0.0
Nathusius'	L2	0.0
Nathusius'	L4	0.0
Nathusius'	L5	0.0
Nathusius'	L6	0.0
Nathusius'	L7	0.0
Nathusius'	L8	0.0
Nathusius'	L9	0.0
Natterer's	L1	0.0
Natterer's	L10	0.1
Natterer's	L11	0.1
Natterer's	L2	0.0
Natterer's	L4	0.0
Natterer's	L5	0.0
Natterer's	L6	0.0
Natterer's	L7	0.0
Natterer's	L8	0.0
Natterer's	L9	0.1
Soprano pipistrelle	L1	0.3
Soprano pipistrelle	L10	4.6
Soprano pipistrelle	L11	0.3
Soprano pipistrelle	L2	0.2
Soprano pipistrelle	L4	0.1
Soprano pipistrelle	L5	0.1
Soprano pipistrelle	L6	0.1
Soprano pipistrelle	L7	0.2
Soprano pipistrelle	L8	0.1
Soprano pipistrelle	L9	0.3
Whiskered	L1	0.0
Whiskered	L10	0.0

Species	Detector ID	Mean Pass Rate
Whiskered	L11	0.0
Whiskered	L2	0.0
Whiskered	L4	0.1
Whiskered	L5	0.0
Whiskered	L6	0.0
Whiskered	L7	0.0
Whiskered	L8	0.0
Whiskered	L9	0.1

Per Detector

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.


Brown long−eared
Common pipistrelle
Daubenton's
Leisler's
Nathusius'
Natterer's
Nightly Pass Rate (passes/hr/night)
0
5
10
L1
L10
L11
L2
L4
L5
L6
L7
L8
L9
Detector ID
Detector ID


Soprano pipistrelle
Whiskered
Nightly Pass Rate (passes/hr/night)
0
5
10
L1
L10
L11
L2
L4
L5
L6
L7
L8
L9
Detector ID
L1
L10
L11
L2
L4
L5
L6
L7
L8
L9
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	L1	8
Sep	L10	10
Sep	L11	10
Sep	L2	7
Sep	L4	6
Sep	L5	8
Sep	L6	8
Sep	L7	6
Sep	L8	7
Sep	L9	5
Oct	L1	8
Oct	L10	9
Oct	L11	10
Oct	L2	10
Oct	L4	6
Oct	L5	10
Oct	L6	9
Oct	L7	9
Oct	L8	9
Oct	L9	10

Nighlty 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	L1	0.0	0.0
Brown long-eared	L10	0.0	0.0
Brown long-eared	L11	0.0	0.0
Brown long-eared	L2	0.0	0.0
Brown long-eared	L4	0.0	0.0
Brown long-eared	L5	0.0	0.0
Brown long-eared	L6	0.0	0.0
Brown long-eared	L7	0.0	0.1
Brown long-eared	L8	0.0	0.1
Brown long-eared	L9	0.0	0.0
Common pipistrelle	L1	0.0	0.0
Common pipistrelle	L10	0.0	0.1
Common pipistrelle	L11	0.1	0.0
Common pipistrelle	L2	0.1	0.0
Common pipistrelle	L4	0.0	0.0
Common pipistrelle	L5	0.0	0.0
Common pipistrelle	L6	0.3	0.0
Common pipistrelle	L7	0.0	0.1
Common pipistrelle	L8	0.1	0.2
Common pipistrelle	L9	0.0	0.1
Daubenton's	L1	0.0	0.1
Daubenton's	L10	0.1	0.0
Daubenton's	L11	0.2	0.0
Daubenton's	L2	0.1	0.1
Daubenton's	L4	0.1	0.1
Daubenton's	L5	0.1	0.0
Daubenton's	L6	0.2	0.2
Daubenton's	L7	0.3	0.5
Daubenton's	L8	0.0	0.2
Daubenton's	L9	0.0	0.1
Leisler's	L1	0.7	0.8
Leisler's	L10	0.0	0.1
Leisler's	L11	0.0	0.0
Leisler's	L2	0.2	0.5
Leisler's	L4	0.1	0.2
Leisler's	L5	0.0	0.1

Species	Detector ID	Oct	Sep
Leisler's	L6	0.2	0.8
Leisler's	L7	0.1	0.8
Leisler's	L8	0.1	0.3
Leisler's	L9	0.1	0.6
Nathusius'	L1	0.0	0.0
Nathusius'	L10	0.0	0.0
Nathusius'	L11	0.0	0.0
Nathusius'	L2	0.0	0.0
Nathusius'	L4	0.0	0.0
Nathusius'	L5	0.0	0.0
Nathusius'	L6	0.0	0.0
Nathusius'	L7	0.0	0.0
Nathusius'	L8	0.0	0.0
Nathusius'	L9	0.0	0.0
Natterer's	L1	0.0	0.0
Natterer's	L10	0.0	0.0
Natterer's	L11	0.0	0.0
Natterer's	L2	0.0	0.0
Natterer's	L4	0.0	0.0
Natterer's	L5	0.0	0.0
Natterer's	L6	0.0	0.0
Natterer's	L7	0.0	0.0
Natterer's	L8	0.0	0.0
Natterer's	L9	0.0	0.0
Soprano pipistrelle	L1	0.4	0.0
Soprano pipistrelle	L10	9.8	0.2
Soprano pipistrelle	L11	0.3	0.2
Soprano pipistrelle	L2	0.1	0.0
Soprano pipistrelle	L4	0.0	0.0
Soprano pipistrelle	L5	0.0	0.0
Soprano pipistrelle	L6	0.0	0.0
Soprano pipistrelle	L7	0.0	0.0
Soprano pipistrelle	L8	0.0	0.0
Soprano pipistrelle	L9	0.3	0.0
Whiskered	L1	0.0	0.0
Whiskered	L10	0.0	0.0

Species	Detector ID	Oct	Sep
Whiskered	L11	0.0	0.0
Whiskered	L2	0.0	0.0
Whiskered	L4	0.0	0.2
Whiskered	L5	0.0	0.0
Whiskered	L6	0.0	0.0
Whiskered	L7	0.0	0.0
Whiskered	L8	0.0	0.0
Whiskered	L9	0.2	0.0

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.

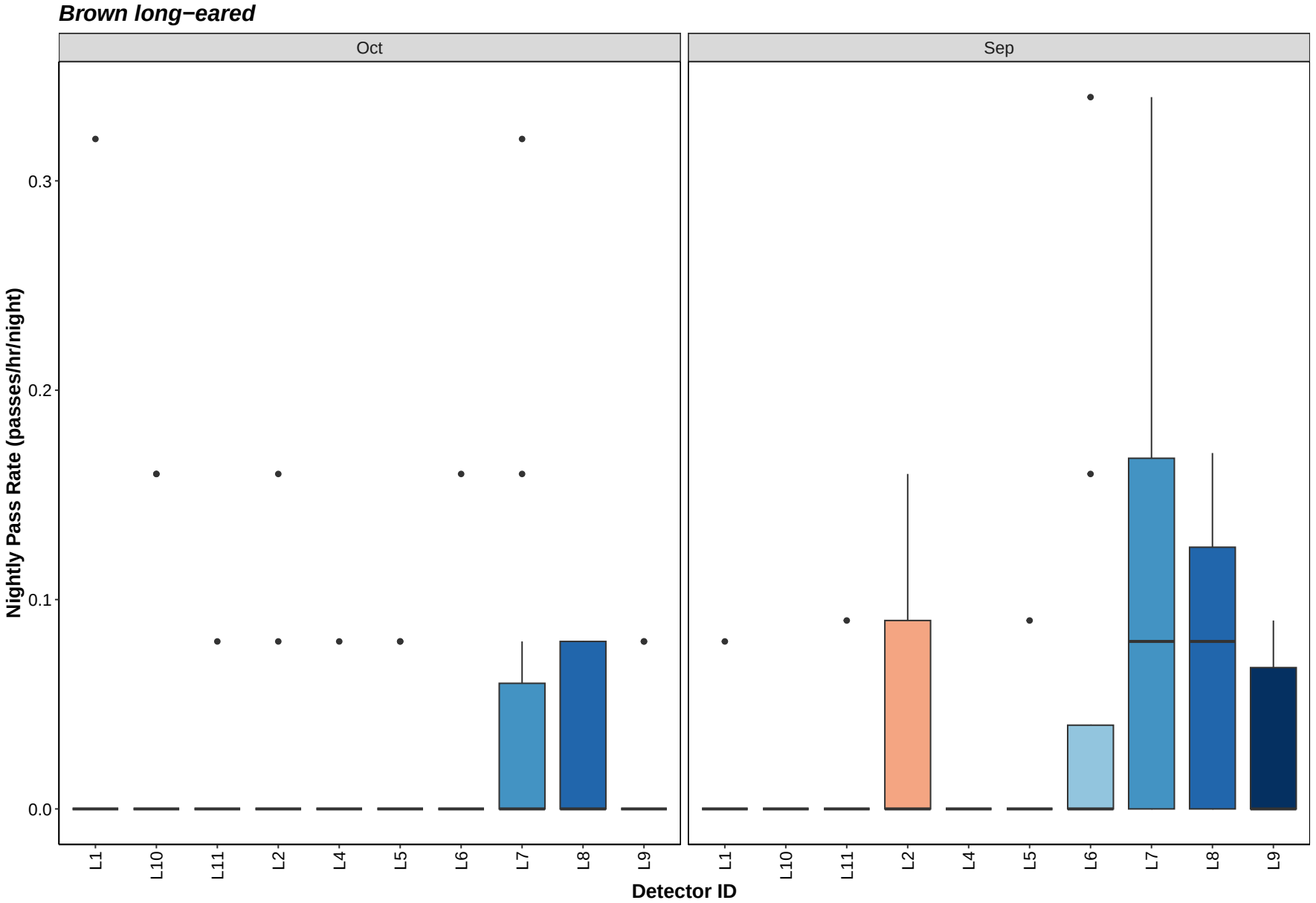
Species	Detector ID	Oct	Sep
Brown long-eared	L1	0.0	0.0
Brown long-eared	L10	0.0	0.0
Brown long-eared	L11	0.0	0.0
Brown long-eared	L2	0.0	0.0
Brown long-eared	L4	0.0	0.0
Brown long-eared	L5	0.0	0.0
Brown long-eared	L6	0.0	0.1
Brown long-eared	L7	0.1	0.1
Brown long-eared	L8	0.0	0.1
Brown long-eared	L9	0.0	0.0
Common pipistrelle	L1	0.2	0.2
Common pipistrelle	L10	0.1	0.1
Common pipistrelle	L11	0.2	0.1
Common pipistrelle	L2	0.1	0.0
Common pipistrelle	L4	0.0	0.0
Common pipistrelle	L5	0.0	0.0
Common pipistrelle	L6	0.3	0.2
Common pipistrelle	L7	0.1	0.3
Common pipistrelle	L8	0.1	0.2
Common pipistrelle	L9	0.2	0.3
Daubenton's	L1	0.0	0.2
Daubenton's	L10	0.1	0.1
Daubenton's	L11	0.2	0.1
Daubenton's	L2	0.1	0.1
Daubenton's	L4	0.1	0.2
Daubenton's	L5	0.1	0.1
Daubenton's	L6	0.2	0.2
Daubenton's	L7	0.3	0.4
Daubenton's	L8	0.0	0.2
Daubenton's	L9	0.2	0.2
Leisler's	L1	0.6	0.8
Leisler's	L10	0.1	0.1
Leisler's	L11	0.1	0.1
Leisler's	L2	0.2	0.4
Leisler's	L4	0.1	0.3
Leisler's	L5	0.1	0.1

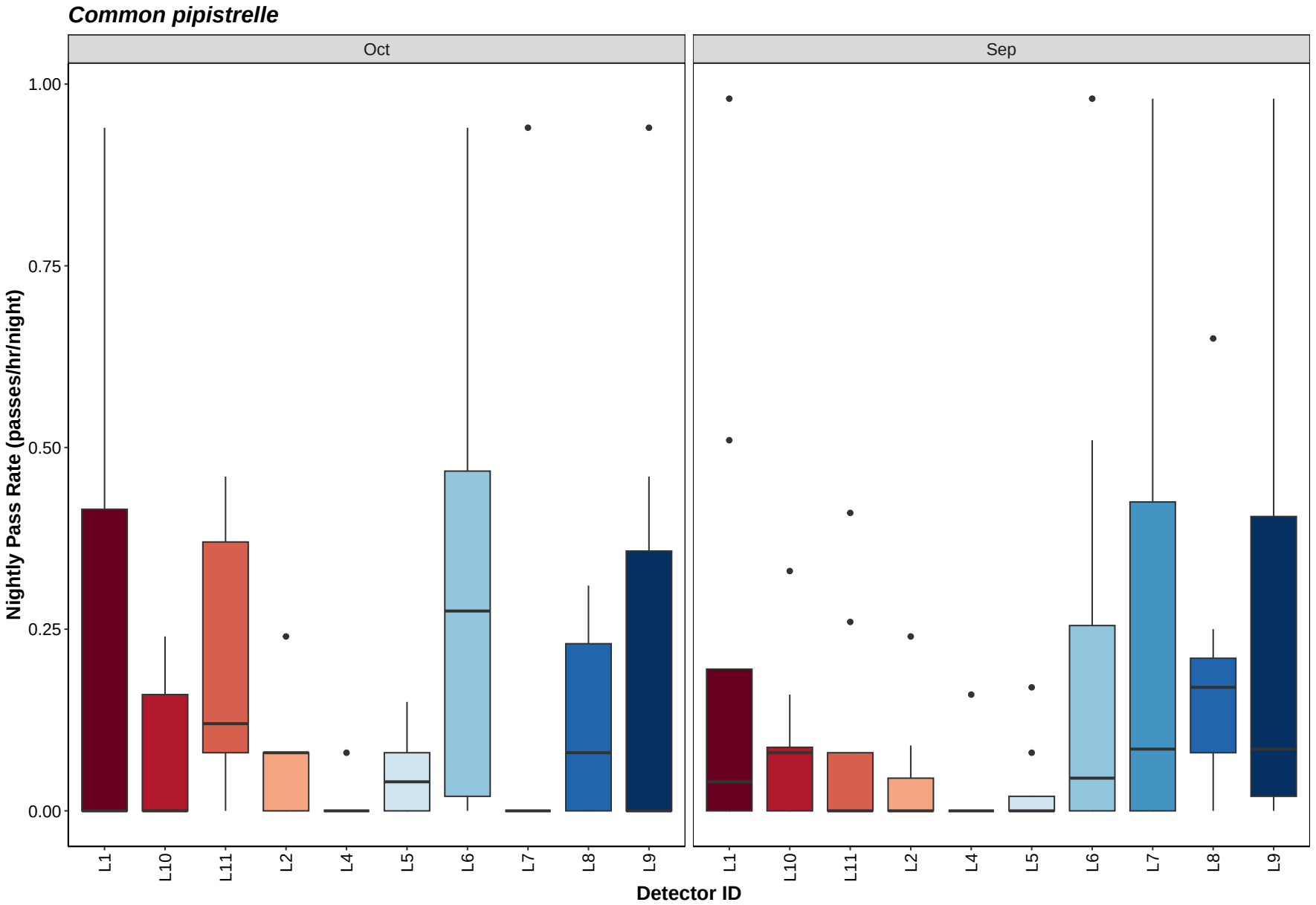
Species	Detector ID	Oct	Sep
Leisler's	L6	0.4	0.7
Leisler's	L7	0.4	0.8
Leisler's	L8	0.2	0.5
Leisler's	L9	0.4	0.7
Nathusius'	L1	0.0	0.0
Nathusius'	L10	0.0	0.0
Nathusius'	L11	0.0	0.0
Nathusius'	L2	0.0	0.0
Nathusius'	L4	0.0	0.0
Nathusius'	L5	0.0	0.0
Nathusius'	L6	0.0	0.0
Nathusius'	L7	0.0	0.0
Nathusius'	L8	0.0	0.0
Nathusius'	L9	0.0	0.0
Natterer's	L1	0.0	0.0
Natterer's	L10	0.1	0.0
Natterer's	L11	0.1	0.0
Natterer's	L2	0.0	0.0
Natterer's	L4	0.0	0.0
Natterer's	L5	0.0	0.0
Natterer's	L6	0.0	0.0
Natterer's	L7	0.0	0.0
Natterer's	L8	0.0	0.1
Natterer's	L9	0.2	0.0
Soprano pipistrelle	L1	0.4	0.2
Soprano pipistrelle	L10	6.2	3.1
Soprano pipistrelle	L11	0.4	0.3
Soprano pipistrelle	L2	0.3	0.1
Soprano pipistrelle	L4	0.1	0.1
Soprano pipistrelle	L5	0.1	0.1
Soprano pipistrelle	L6	0.1	0.1
Soprano pipistrelle	L7	0.2	0.1
Soprano pipistrelle	L8	0.1	0.1
Soprano pipistrelle	L9	0.3	0.2
Whiskered	L1	0.0	0.0
Whiskered	L10	0.0	0.0

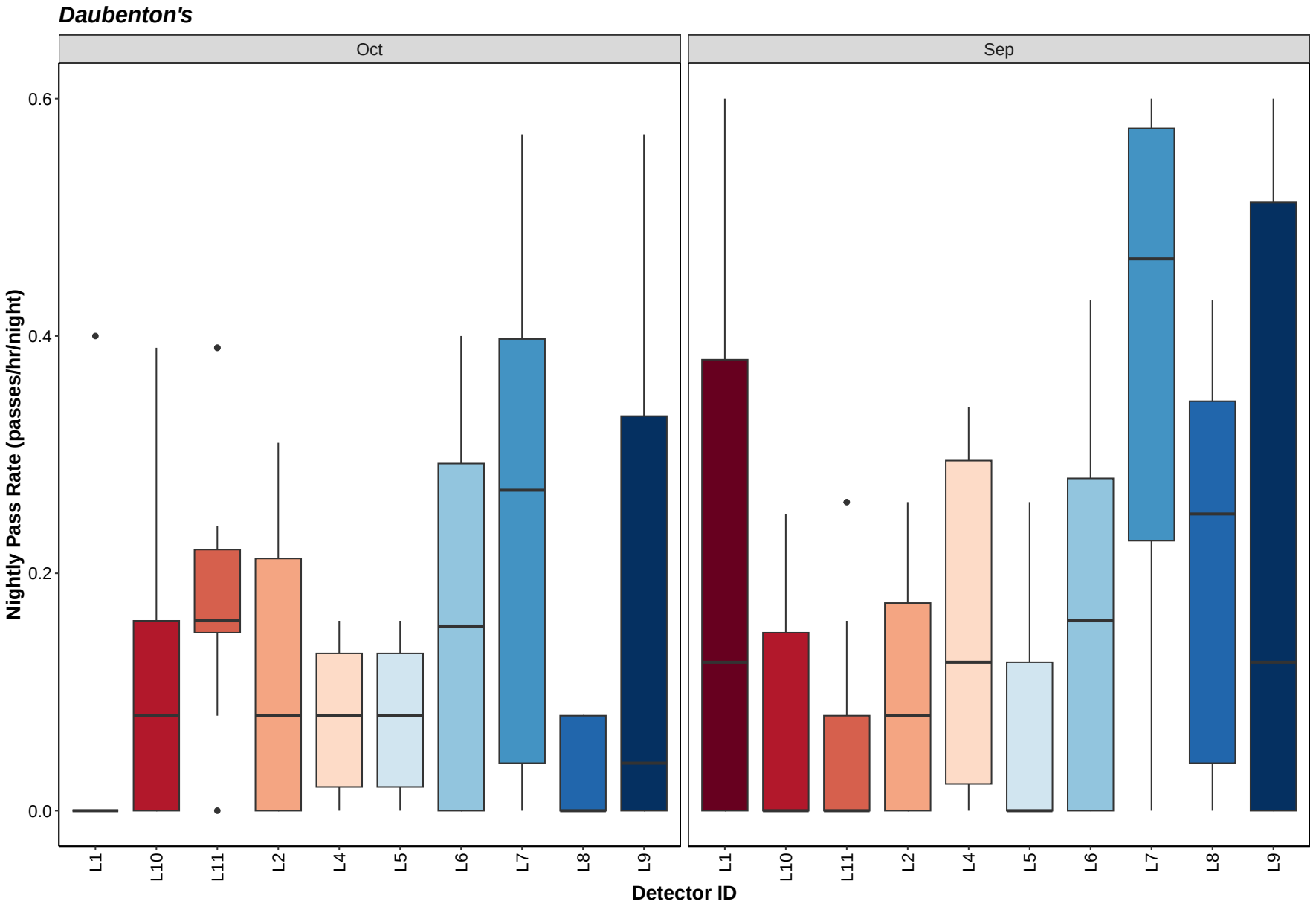
Species	Detector ID	Oct	Sep
Whiskered	L11	0.0	0.0
Whiskered	L2	0.0	0.0
Whiskered	L4	0.0	0.2
Whiskered	L5	0.0	0.0
Whiskered	L6	0.0	0.0
Whiskered	L7	0.0	0.0
Whiskered	L8	0.0	0.0
Whiskered	L9	0.1	0.0

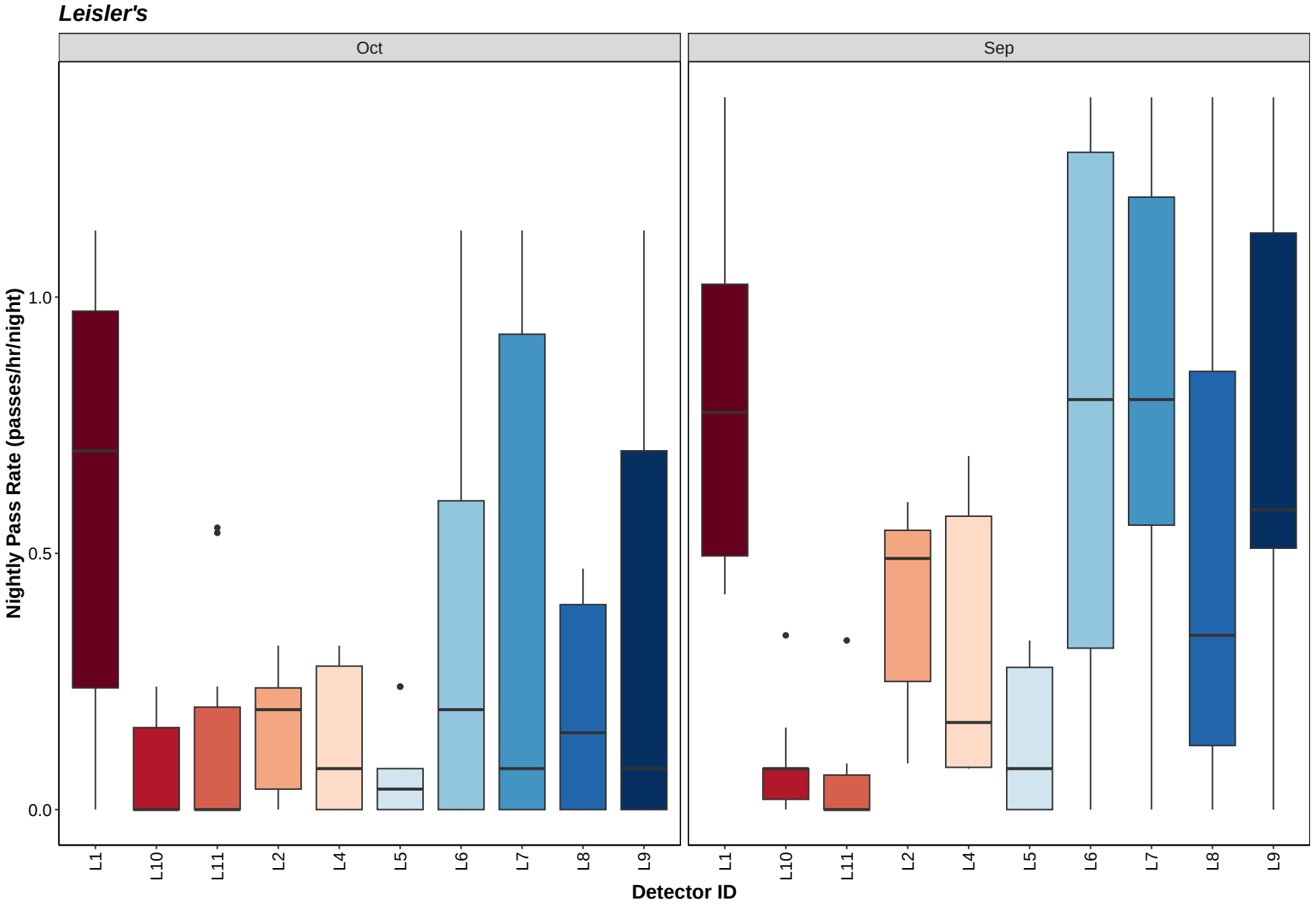
Per Detector

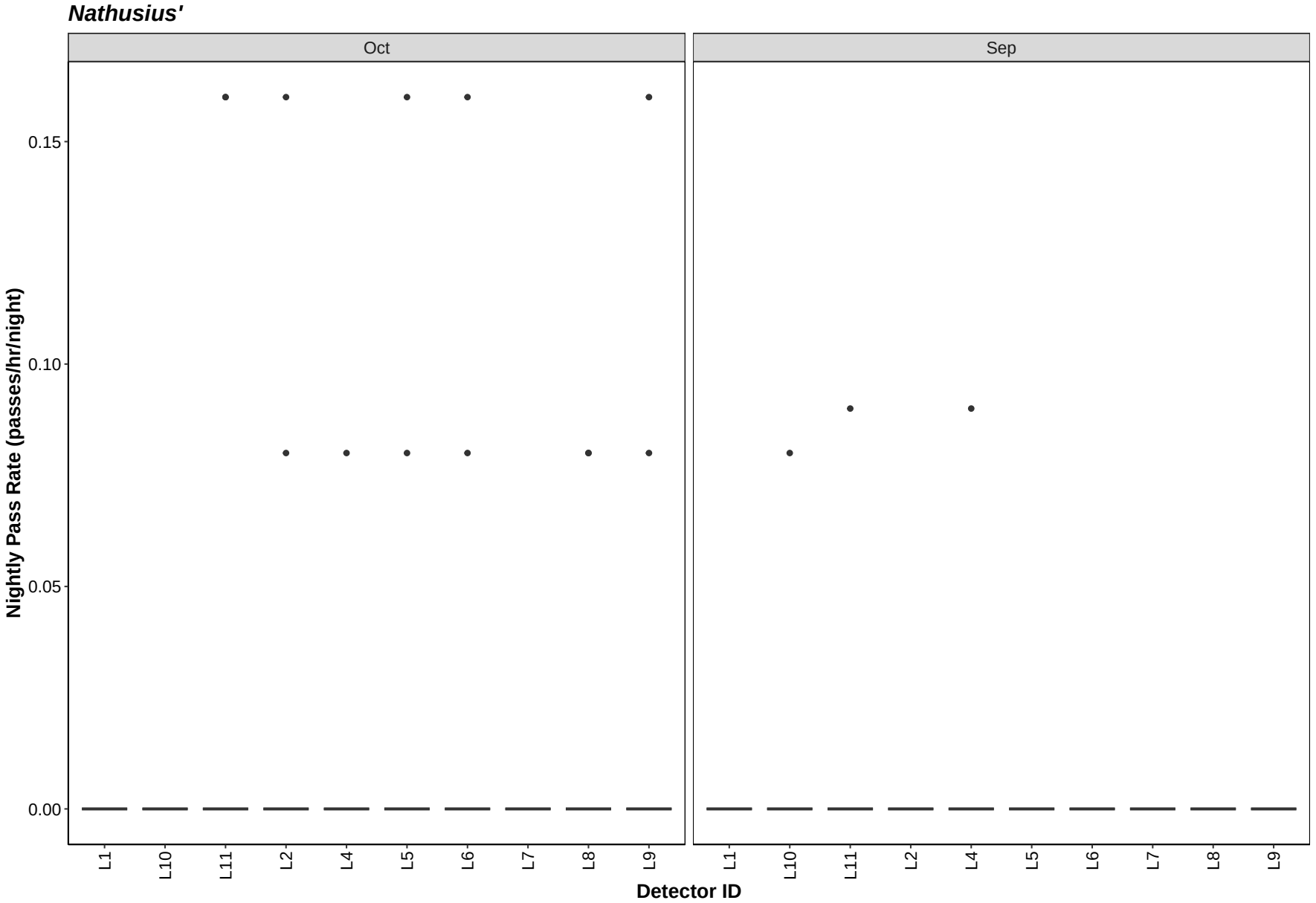
Figure 17. Figures show boxplots for the number of bat passes per hour by detector, for each month. The ‘box’ shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The ‘whiskers’ extend from the box and represent 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.

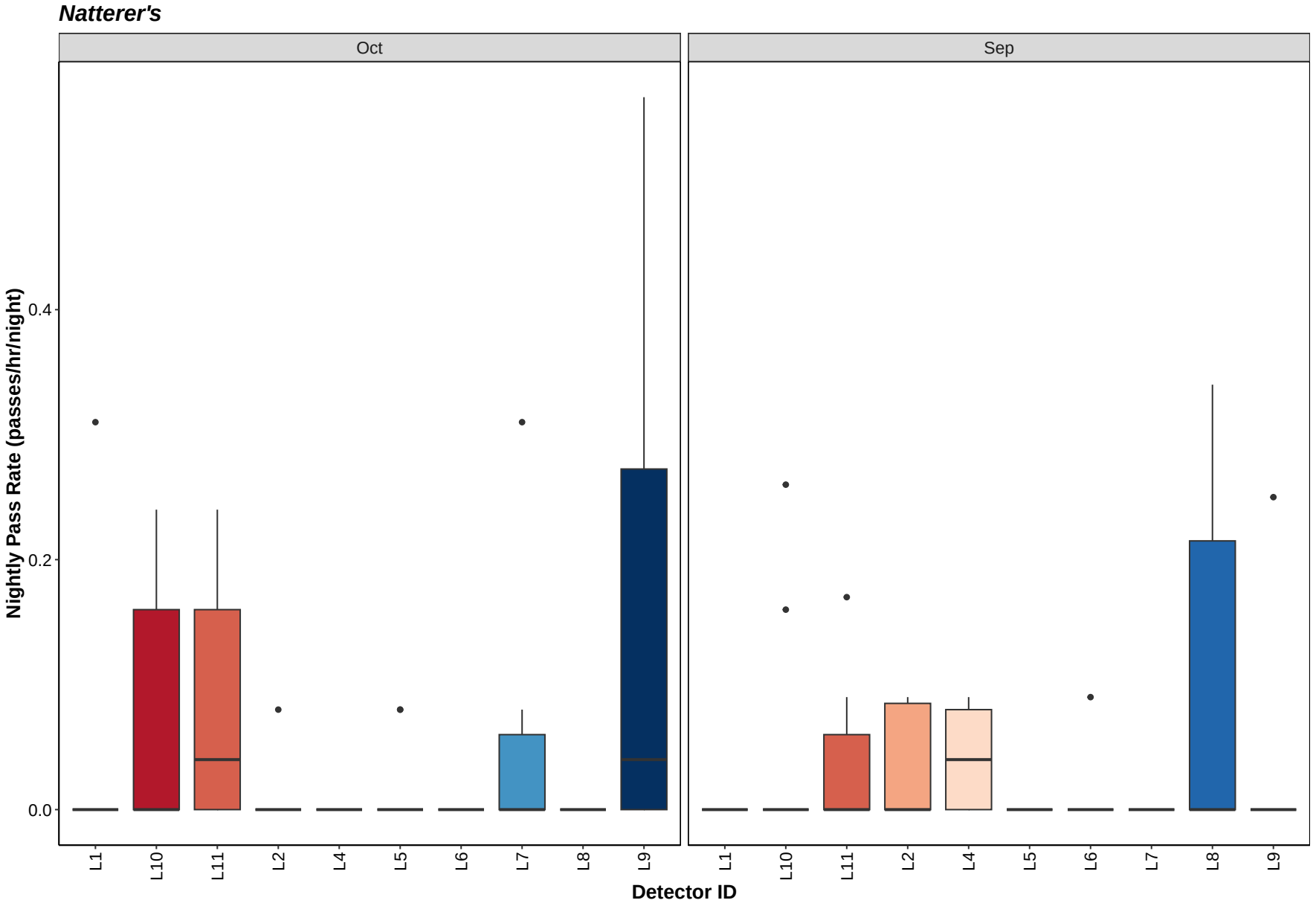

Brown long−eared
Oct
Sep
Nightly Pass Rate (passes/hr/night)
0.0
0.1
0.2
0.3
L1
L10
L11
L2
L4
L5
L6
L7
L8
L9
Detector ID

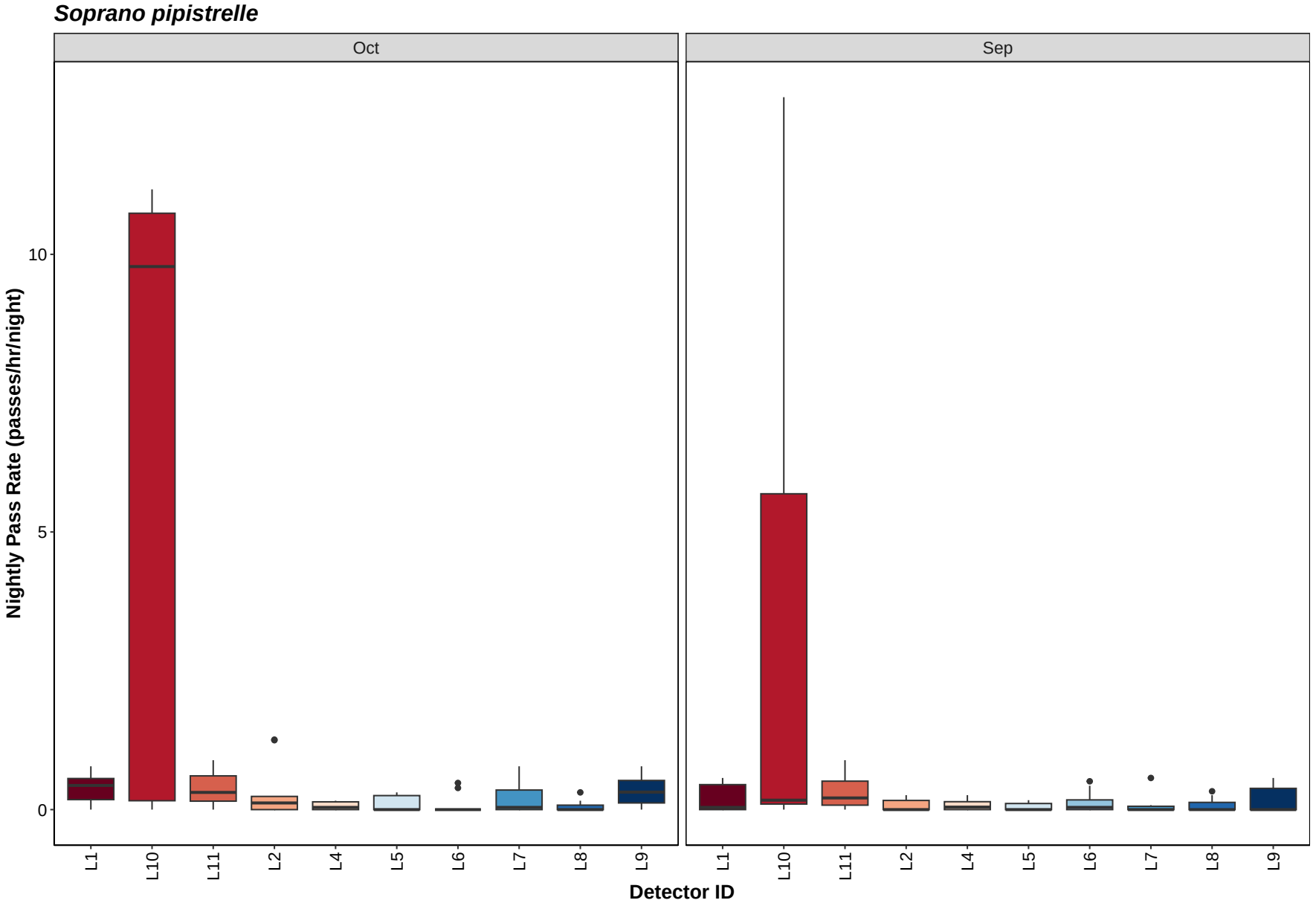

Common pipistrelle
Oct
Sep
Nightly Pass Rate (passes/hr/night)
1.00
0.75
0.50
0.25
0.00
L1
L10
L11
L2
L4
L5
L6
L7
L8
L9
Detector ID

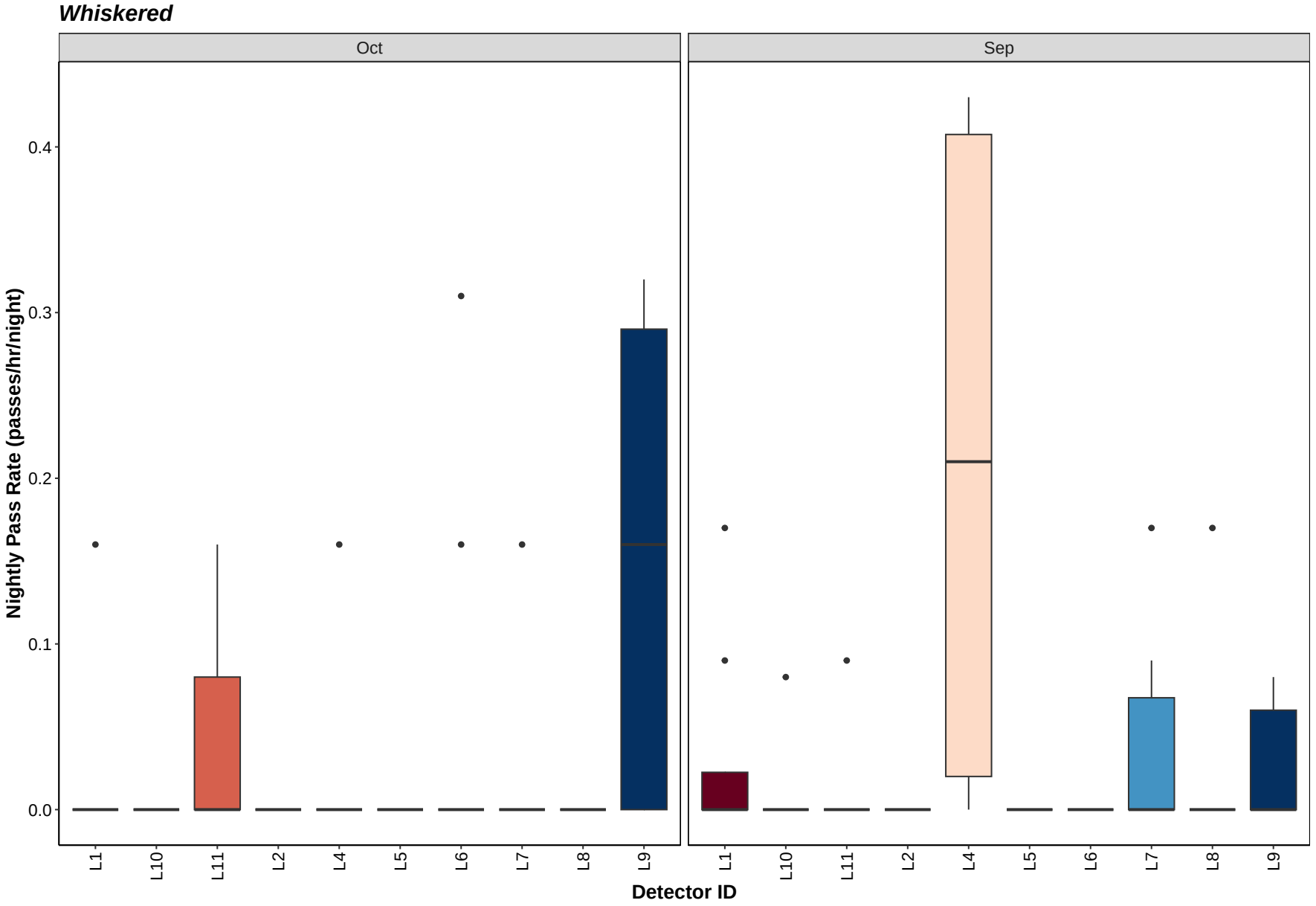

Daubenton's
Oct
Sep
Nightly Pass Rate (passes/hr/night)
0.0
0.2
0.4
0.6
L1
L10
L11
L2
L4
L5
L6
L7
L8
L9
Detector ID


Leisler's
Oct
Sep
Nightly Pass Rate (passes/hr/night)
1.0
0.5
0.0
L1
L10
L11
L2
L4
L5
L6
L7
L8
L9
Detector ID


Nathusius'
Oct
Sep
Nightly Pass Rate (passes/hr/night)
0.15
0.10
0.05
0.00
L1
L10
L11
L2
L4
L5
L6
L7
L8
L9
Detector ID


Natterer's
Oct
Sep
Nightly Pass Rate (passes/hr/night)
0.0
0.2
0.4
L1
L10
L11
L2
L4
L5
L6
L7
L8
L9
Detector ID


Soprano pipistrelle
Oct
Sep
Nightly Pass Rate (passes/hr/night)
10
5
0
L1
L10
L11
L2
L4
L5
L6
L7
L8
L9
Detector ID


Whiskered
Oct
Sep
Nightly Pass Rate (passes/hr/night)
0.0
0.1
0.2
0.3
0.4
L1
L10
L11
L2
L4
L5
L6
L7
L8
L9
Detector ID

Bat Activity per Detector Location

Figure 18. Detector ID reference:

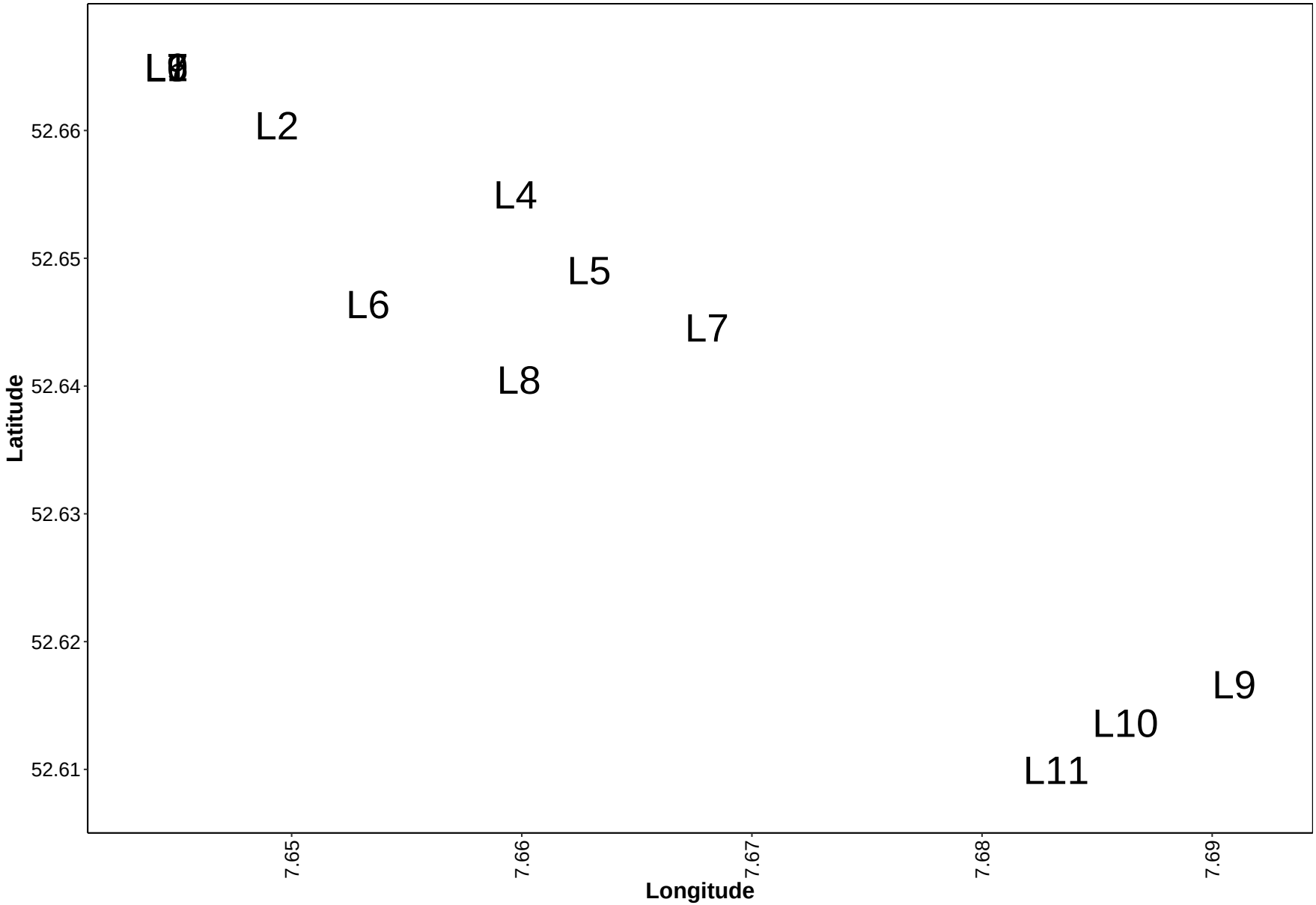
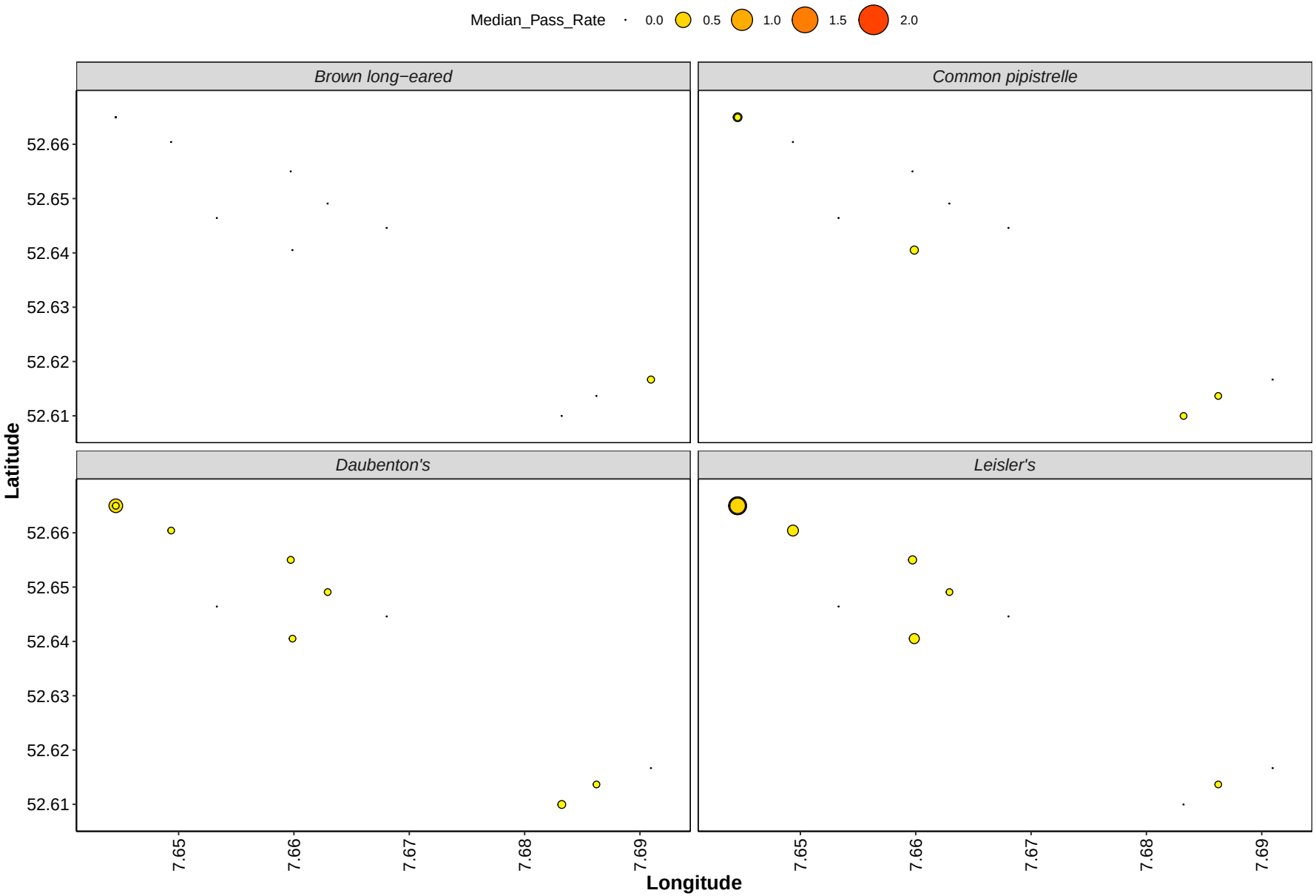

L1
L2
L4
L5
L6
L7
L8
L9
L10
L11
52.66
52.65
52.64
52.63
52.62
52.61
Latitude
7.65
7.66
7.67
7.68
7.69
Longitude

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
0.5
1.0
1.5
2.0
Brown long−eared
Common pipistrelle
Daubenton's
Leisler's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
7.65
7.66
7.67
7.68
7.69
Longitude

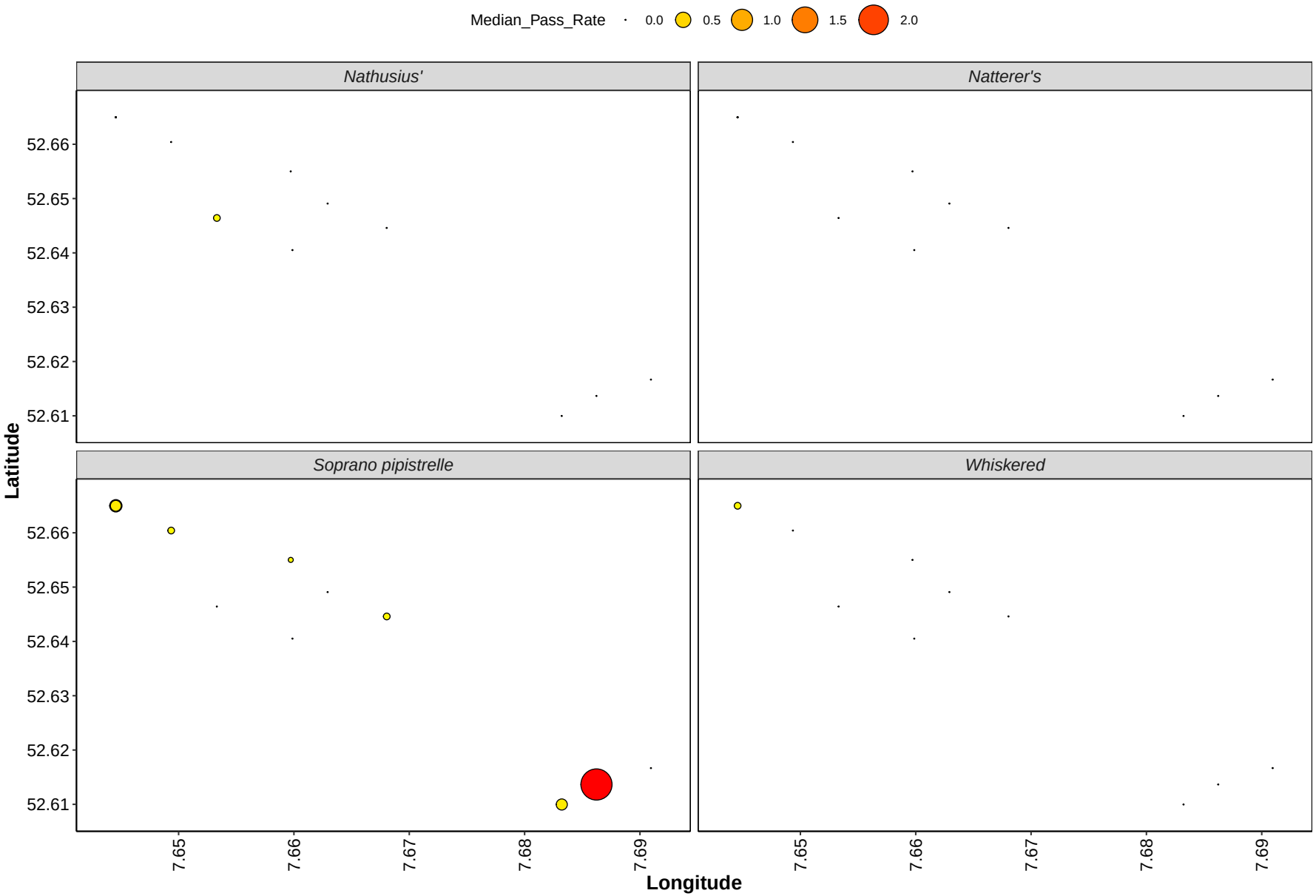
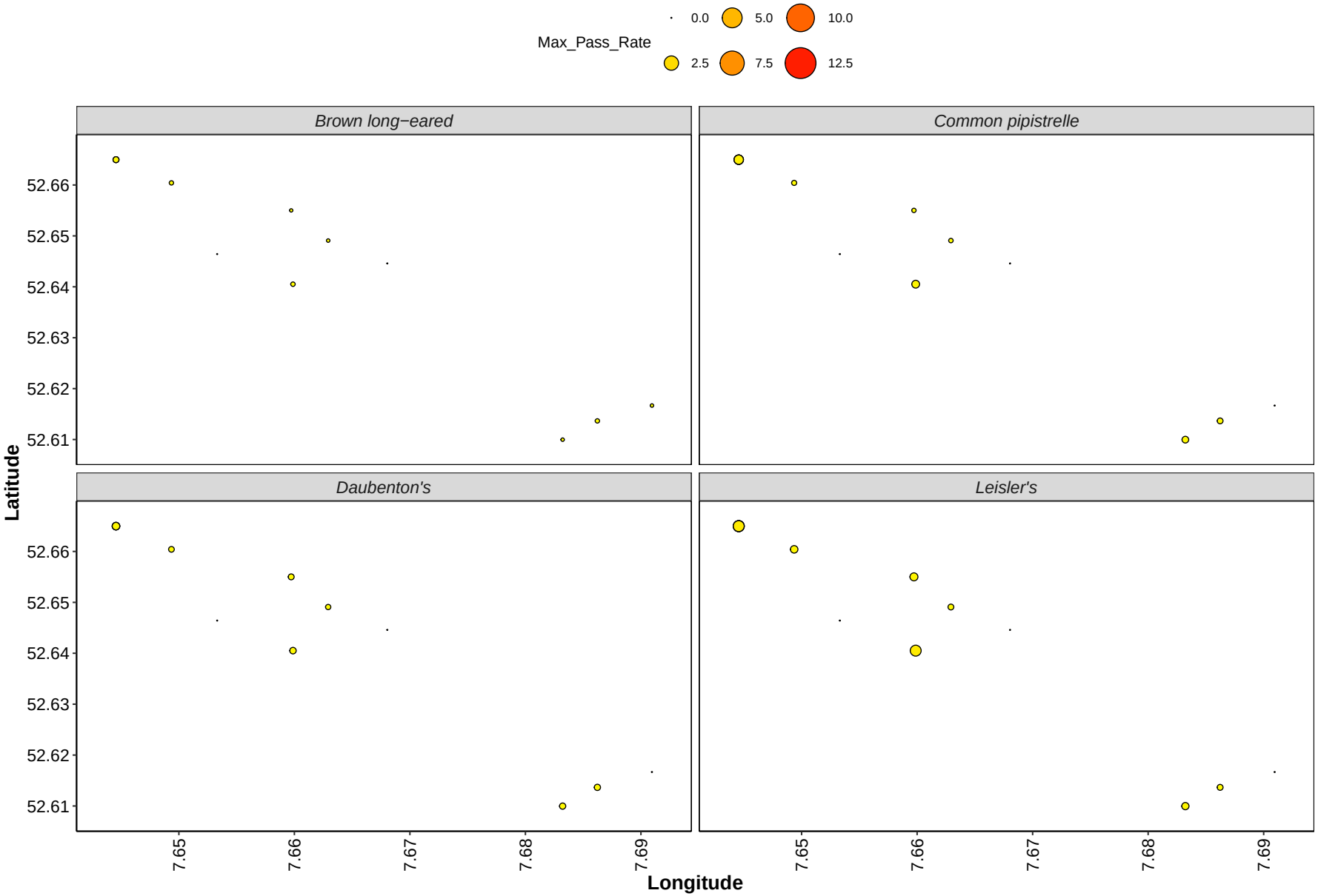
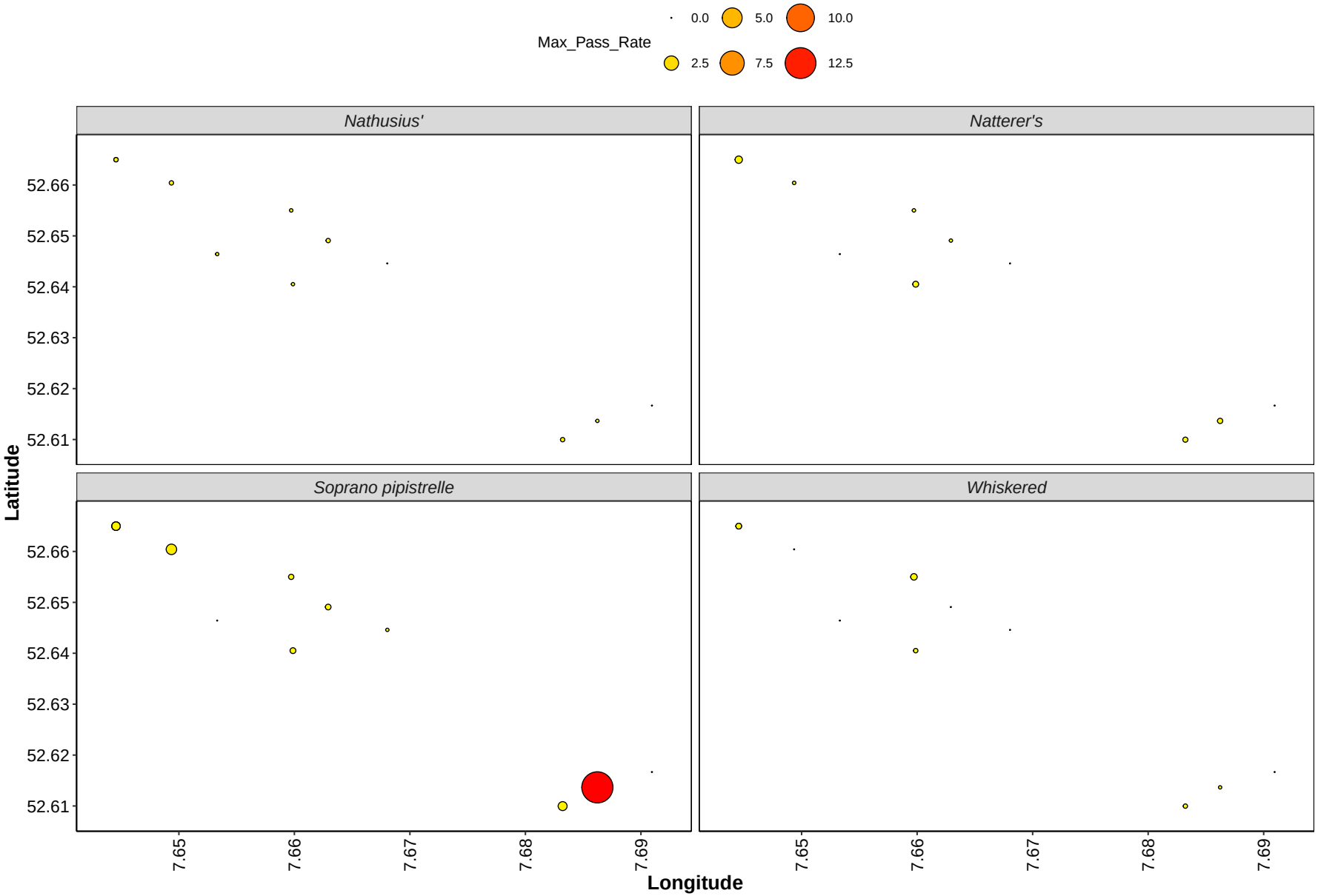

Median_Pass_Rate
0.0
0.5
1.0
1.5
2.0
Nathusius'
Natterer's
Soprano pipistrelle
Whiskered
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
Longitude
7.65
7.66
7.67
7.68
7.69

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
0.0
2.5
5.0
7.5
10.0
12.5
Brown long−eared
Common pipistrelle
Daubenton's
Leisler's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
Longitude
7.65
7.66
7.67
7.68
7.69


Max_Pass_Rate
0.0
2.5
5.0
7.5
10.0
12.5
Nathusius'
Natterer's
Soprano pipistrelle
Whiskered
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
Longitude
7.65
7.66
7.67
7.68
7.69

Thank you for using Ecobat!

FEHILY TIMONEY

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

APPENDIX 2

Ecobat Results 2025

Ecobat Report

2025-11-07

Geo filter: all, Time filter: all

Summary

Bats were detected on **17** nights between **19/05/2025** and **04/06/2025**, using **10** static bat detectors. Throughout this period, **8** species were recorded. **Table 1.** Detectors were placed at the following locations:

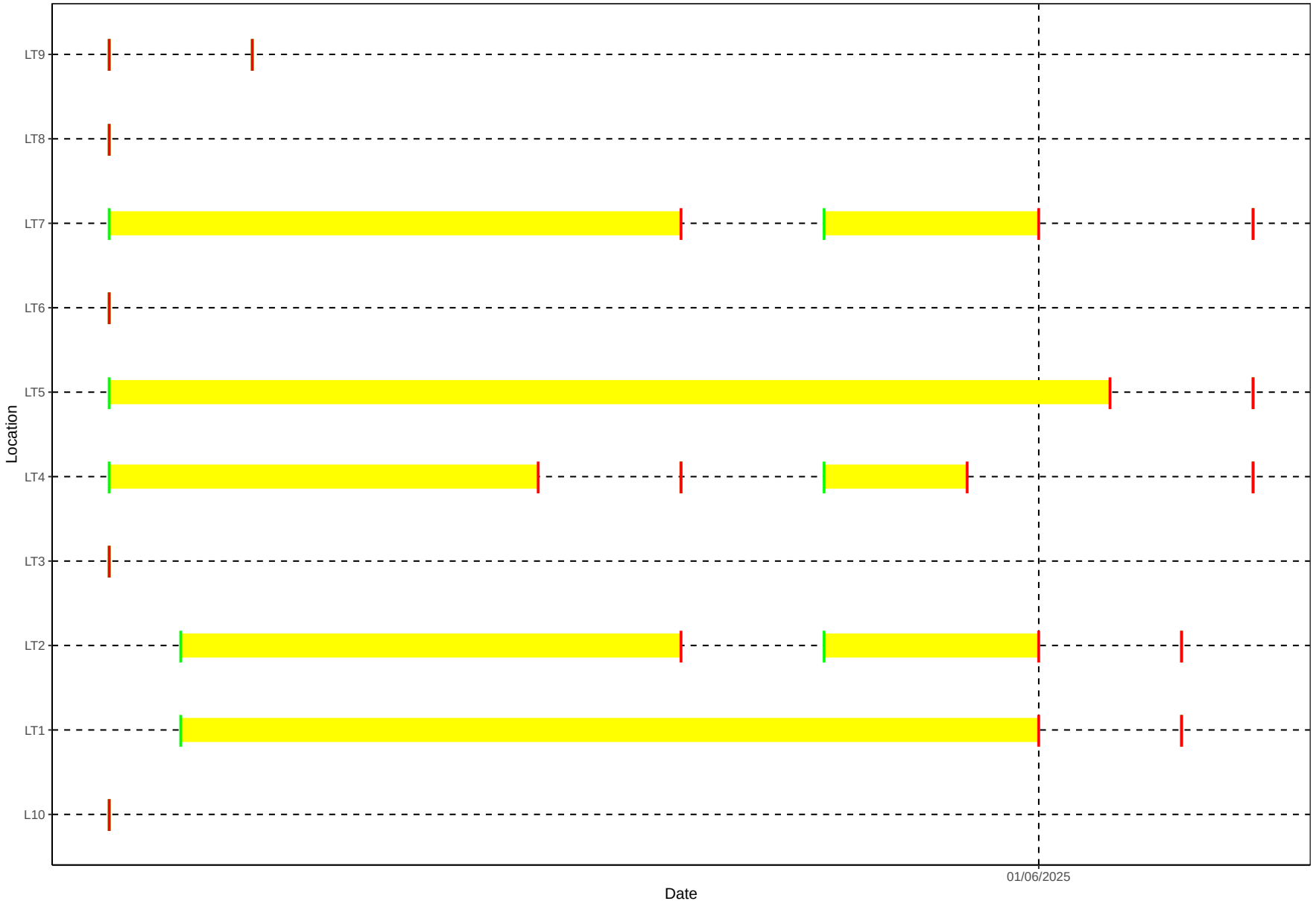
Detector ID	Latitude	Longitude
LT1	52.66497	7.644556
LT2	52.66041	7.649355
LT3	52.65497	7.651278
LT4	52.65501	7.659723
LT5	52.64908	7.662925
LT6	52.64642	7.653317
LT7	52.64459	7.668046
LT8	52.64051	7.659876
LT9	52.61667	7.690955
L10	52.61366	7.686229

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
L10	17
LT1	15
LT2	14
LT3	17
LT4	12
LT5	16
LT6	17
LT7	14
LT8	17
LT9	16

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


LT9
LT8
LT7
LT6
LT5
LT4
LT3
LT2
LT1
L10
Location
01/06/2025
Date

Part 1: Percentile 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.

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 Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L10	Myotis daubentonii	0	0	0	0	0	10
L10	Myotis mystacinus	0	0	0	0	0	2
L10	Myotis nattereri	0	0	0	0	0	1
L10	Nyctalus leisleri	0	0	0	0	0	15
L10	Pipistrellus nathusii	0	0	0	0	0	2
L10	Pipistrellus pipistrellus	0	0	0	0	0	15
L10	Pipistrellus pygmaeus	0	0	0	0	0	16
L10	Plecotus auritus	0	0	0	0	0	6
LT1	Myotis daubentonii	0	0	0	0	0	7
LT1	Myotis mystacinus	0	0	0	0	0	3
LT1	Myotis nattereri	0	0	0	0	0	2
LT1	Nyctalus leisleri	0	0	0	0	0	13
LT1	Pipistrellus nathusii	0	0	0	0	4	5
LT1	Pipistrellus pipistrellus	0	0	0	0	0	14
LT1	Pipistrellus pygmaeus	0	0	0	0	0	14
LT1	Plecotus auritus	0	0	0	0	0	1
LT2	Myotis daubentonii	0	0	0	0	0	1
LT2	Nyctalus leisleri	0	0	0	0	2	10

Detector ID	Species/Species Group	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT2	Pipistrellus nathusii	0	0	0	0	1	2
LT2	Pipistrellus pipistrellus	0	0	0	0	0	13
LT2	Pipistrellus pygmaeus	0	0	0	0	0	13
LT2	Plecotus auritus	0	0	0	0	0	1
LT3	Myotis daubentonii	0	0	0	0	0	10
LT3	Myotis mystacinus	0	0	0	0	0	1
LT3	Myotis nattereri	0	0	0	0	0	3
LT3	Nyctalus leisleri	0	0	0	0	0	13
LT3	Pipistrellus nathusii	0	0	0	0	1	2
LT3	Pipistrellus pipistrellus	0	0	0	0	0	14
LT3	Pipistrellus pygmaeus	0	0	0	0	0	15
LT3	Plecotus auritus	0	0	0	0	0	4
LT4	Myotis daubentonii	0	0	0	0	0	2
LT4	Myotis mystacinus	0	0	0	0	0	2
LT4	Nyctalus leisleri	0	0	0	0	0	11
LT4	Pipistrellus nathusii	0	0	0	0	1	1
LT4	Pipistrellus pipistrellus	0	0	0	0	0	6
LT4	Pipistrellus pygmaeus	0	0	0	0	0	8
LT5	Myotis daubentonii	0	0	0	0	0	4

Detector ID	Species/Species Group	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT5	Myotis mystacinus	0	0	0	0	0	5
LT5	Nyctalus leisleri	0	2	3	0	1	10
LT5	Pipistrellus nathusii	0	0	0	0	2	1
LT5	Pipistrellus pipistrellus	0	0	0	0	0	11
LT5	Pipistrellus pygmaeus	0	0	0	0	0	11
LT5	Plecotus auritus	0	0	0	0	0	3
LT6	Myotis daubentonii	0	0	0	0	0	7
LT6	Myotis mystacinus	0	0	0	0	0	2
LT6	Nyctalus leisleri	0	0	0	0	0	14
LT6	Pipistrellus nathusii	0	0	0	2	5	1
LT6	Pipistrellus pipistrellus	0	0	0	0	2	14
LT6	Pipistrellus pygmaeus	0	0	0	0	2	13
LT6	Plecotus auritus	0	0	0	2	0	4
LT7	Myotis daubentonii	0	0	0	0	0	8
LT7	Nyctalus leisleri	0	0	0	0	0	13
LT7	Pipistrellus nathusii	0	0	0	1	0	3
LT7	Pipistrellus pipistrellus	0	0	0	0	0	8
LT7	Pipistrellus pygmaeus	0	0	0	0	0	11
LT7	Plecotus auritus	0	0	0	0	0	5
LT8	Myotis daubentonii	0	0	0	0	0	8

Detector ID	Species/Species Group	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT8	Myotis nattereri	0	0	0	0	0	2
LT8	Nyctalus leisleri	0	0	0	0	0	14
LT8	Pipistrellus nathusii	0	0	2	0	4	2
LT8	Pipistrellus pipistrellus	0	0	0	0	4	12
LT8	Pipistrellus pygmaeus	0	0	0	0	0	16
LT8	Plecotus auritus	0	0	0	0	0	6
LT9	Myotis daubentonii	0	0	0	0	0	7
LT9	Myotis nattereri	0	0	0	0	5	5
LT9	Nyctalus leisleri	0	0	0	0	0	12
LT9	Pipistrellus nathusii	0	0	0	0	0	1
LT9	Pipistrellus pipistrellus	0	0	0	0	0	15
LT9	Pipistrellus pygmaeus	0	0	0	0	0	15
LT9	Plecotus auritus	0	0	0	0	0	6

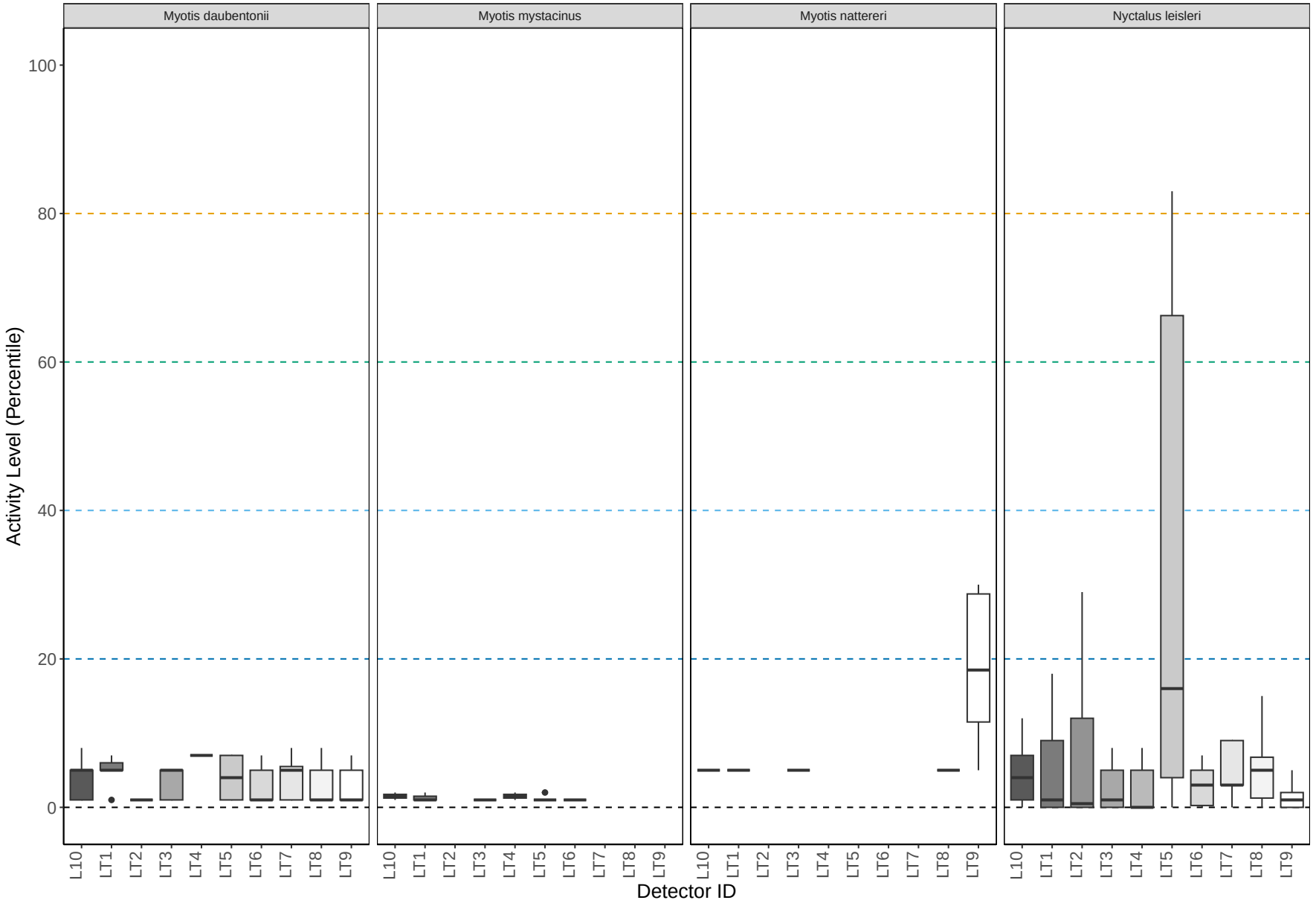
Table 4. Summary table showing key metrics for each species recorded. The reference range is the number of nights for each species that your data were compared to. We recommend a Reference Range of 200+ to be confident in the relative activity level.

Detector ID	Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded	Reference Range
L10	Myotis daubentonii	5	1 - 5	8	10	6444
L10	Myotis mystacinus	2	1.5 - 1.5	2	2	2665
L10	Myotis nattereri	5	0	5	1	1723
L10	Nyctalus leisleri	4	2.5 - 7	12	15	60860
L10	Pipistrellus nathusii	13	13 - 13	13	2	3340
L10	Pipistrellus pipistrellus	2	2 - 5.5	9	15	1540034
L10	Pipistrellus pygmaeus	5	4 - 8	13	16	406510
L10	Plecotus auritus	3	1 - 6.5	9	6	23195
LT1	Myotis daubentonii	5	3 - 7	7	7	6444
LT1	Myotis mystacinus	1	1 - 1	2	3	2665
LT1	Myotis nattereri	5	5 - 5	5	2	1723
LT1	Nyctalus leisleri	1	1.5 - 13.5	18	13	60860
LT1	Pipistrellus nathusii	18	8 - 36	37	9	3340
LT1	Pipistrellus pipistrellus	0	1 - 2	2	14	1540034
LT1	Pipistrellus pygmaeus	1	1 - 4	7	14	406510
LT1	Plecotus auritus	4	0	4	1	23195
LT2	Myotis daubentonii	1	0	1	1	6444
LT2	Nyctalus leisleri	1	1 - 29	29	12	60860
LT2	Pipistrellus nathusii	13	8 - 28	28	3	3340
LT2	Pipistrellus pipistrellus	0	0 - 0	1	13	1540034
LT2	Pipistrellus pygmaeus	1	1.5 - 2.5	3	13	406510
LT2	Plecotus auritus	1	0	1	1	23195
LT3	Myotis daubentonii	5	3 - 5	5	10	6444
LT3	Myotis mystacinus	1	0	1	1	2665
LT3	Myotis nattereri	5	5 - 5	5	3	1723
LT3	Nyctalus leisleri	1	1 - 6.5	8	13	60860
LT3	Pipistrellus nathusii	8	8 - 8	24	3	3340
LT3	Pipistrellus pipistrellus	0	1 - 4	4	14	1540034
LT3	Pipistrellus pygmaeus	1	1 - 7	10	15	406510
LT3	Plecotus auritus	3	1 - 4	4	4	23195
LT4	Myotis daubentonii	7	7 - 7	7	2	6444
LT4	Myotis mystacinus	2	1.5 - 1.5	2	2	2665
LT4	Nyctalus leisleri	0	1 - 8	8	11	60860

Detector ID	Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded	Reference Range
LT4	Pipistrellus nathusii	15	15 - 15	22	2	3340
LT4	Pipistrellus pipistrellus	0	0 - 0	0	6	1540034
LT4	Pipistrellus pygmaeus	0	0 - 0	1	8	406510
LT5	Myotis daubentonii	4	1 - 7	7	4	6444
LT5	Myotis mystacinus	1	1 - 1	2	5	2665
LT5	Nyctalus leisleri	16	8.5 - 46.5	83	16	60860
LT5	Pipistrellus nathusii	22	22 - 22	22	3	3340
LT5	Pipistrellus pipistrellus	0	0 - 0	1	11	1540034
LT5	Pipistrellus pygmaeus	0	0 - 0	1	11	406510
LT5	Plecotus auritus	1	1 - 1	1	3	23195
LT6	Myotis daubentonii	1	1 - 4	7	7	6444
LT6	Myotis mystacinus	1	1 - 1	1	2	2665
LT6	Nyctalus leisleri	3	2.5 - 6	7	14	60860
LT6	Pipistrellus nathusii	34	23 - 40.5	46	8	3340
LT6	Pipistrellus pipistrellus	4	3.5 - 19.5	36	16	1540034
LT6	Pipistrellus pygmaeus	4	3.5 - 16	26	15	406510
LT6	Plecotus auritus	9	2.5 - 42	42	6	23195
LT7	Myotis daubentonii	5	1 - 6.5	8	8	6444
LT7	Nyctalus leisleri	3	3 - 8.5	9	13	60860
LT7	Pipistrellus nathusii	13	10.5 - 30.5	48	4	3340
LT7	Pipistrellus pipistrellus	1	1 - 2	2	8	1540034
LT7	Pipistrellus pygmaeus	1	1 - 1.5	5	11	406510
LT7	Plecotus auritus	4	1 - 17	17	5	23195
LT8	Myotis daubentonii	1	1 - 4.5	8	8	6444
LT8	Myotis nattereri	5	5 - 5	5	2	1723
LT8	Nyctalus leisleri	5	3 - 8	15	14	60860
LT8	Pipistrellus nathusii	35	18.5 - 55	75	8	3340
LT8	Pipistrellus pipistrellus	8	7 - 21.5	35	16	1540034
LT8	Pipistrellus pygmaeus	4	4 - 12.5	16	16	406510
LT8	Plecotus auritus	13	6.5 - 15	16	6	23195
LT9	Myotis daubentonii	1	1 - 4	7	7	6444
LT9	Myotis nattereri	19	10.5 - 29	30	10	1723
LT9	Nyctalus leisleri	1	1 - 3.5	5	12	60860
LT9	Pipistrellus nathusii	8	0	8	1	3340
LT9	Pipistrellus pipistrellus	0	0 - 0	2	15	1540034
LT9	Pipistrellus pygmaeus	4	3.5 - 7	9	15	406510

Detector ID	Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded	Reference Range
LT9	Plecotus auritus	3	1 - 5	9	6	23195

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).


Myotis daubentonii
Myotis mystacinus
Myotis nattereri
Nyctalus leisleri
Activity Level (Percentile)
100
80
60
40
20
0
L10
LT1
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID

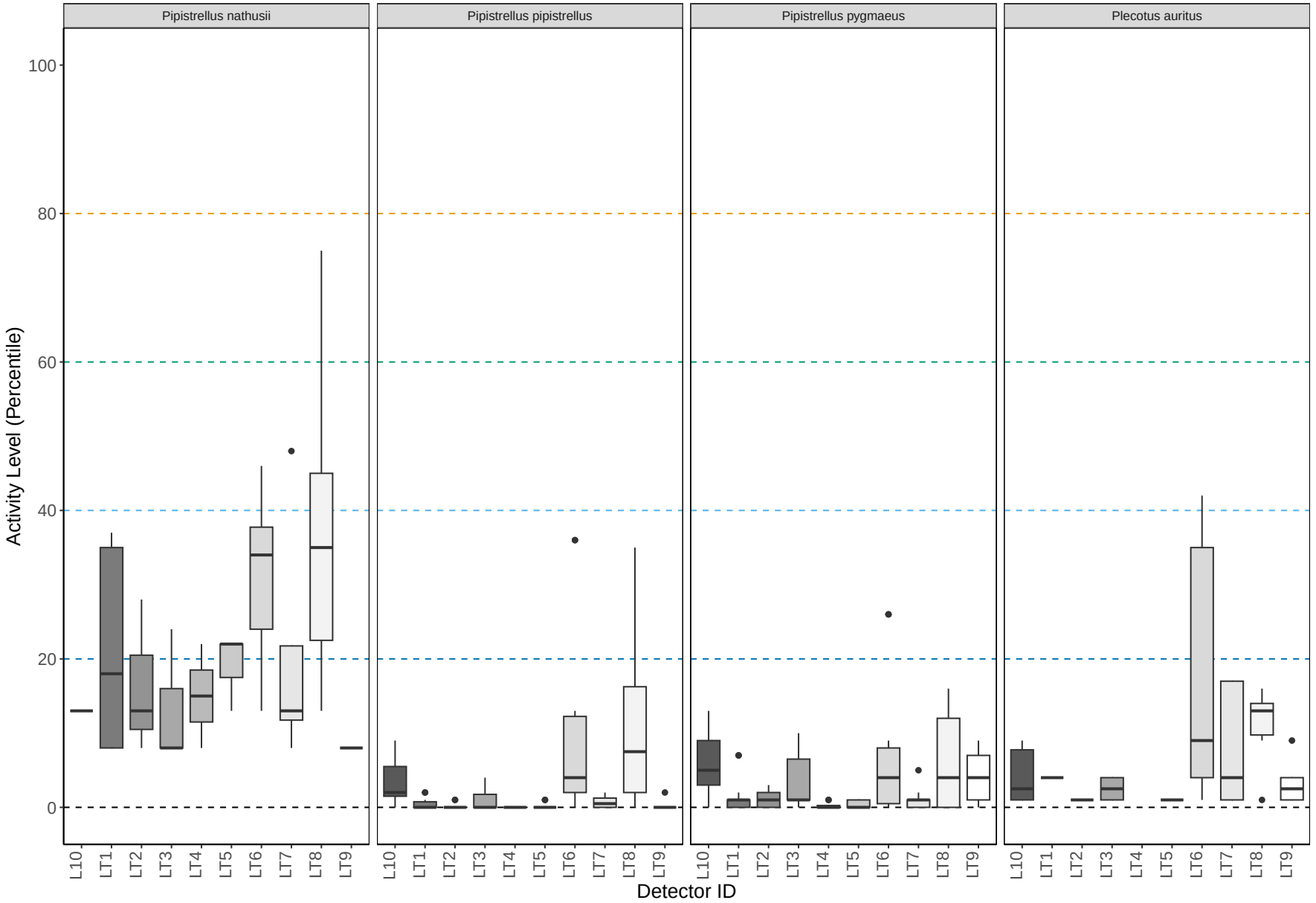
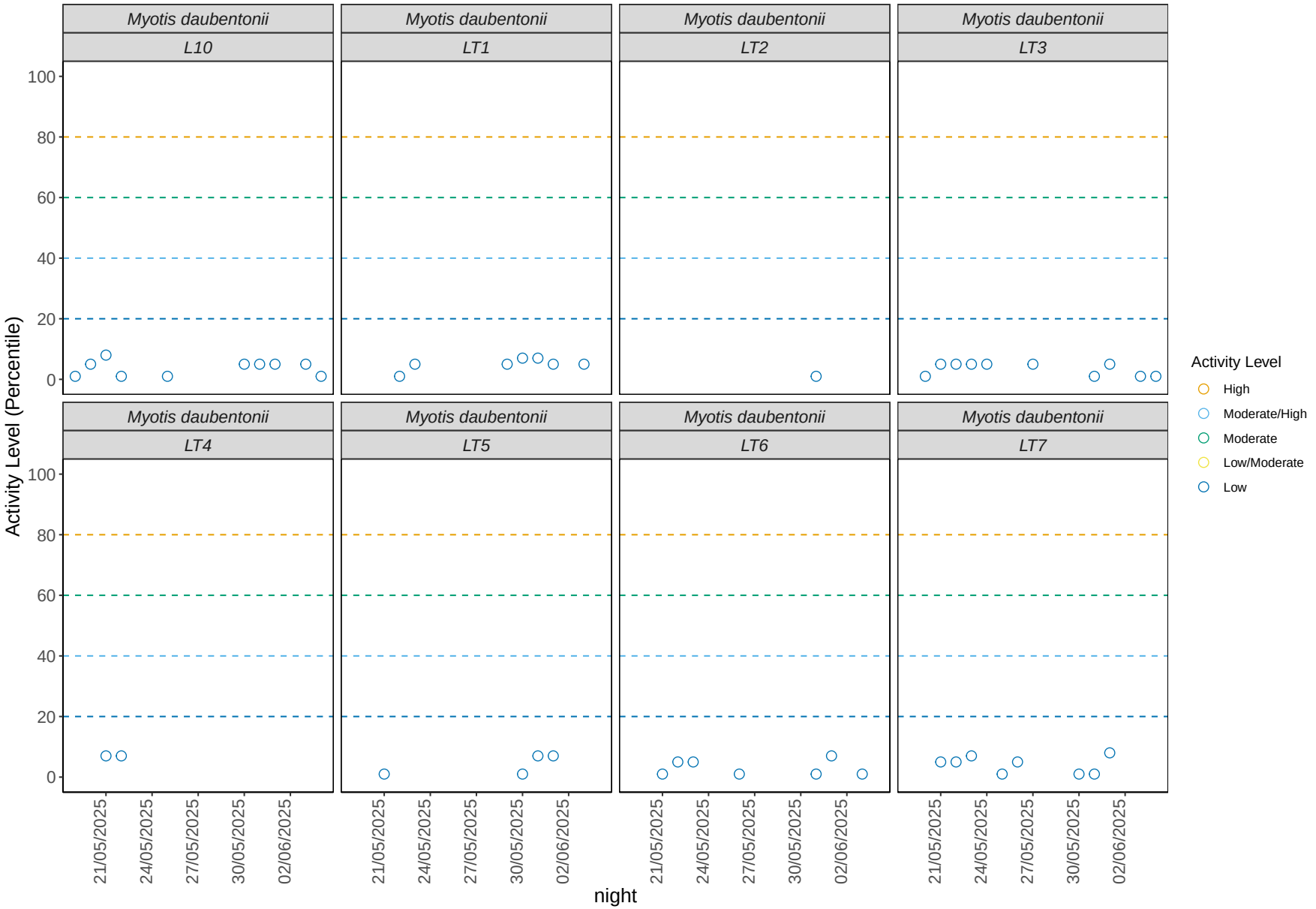
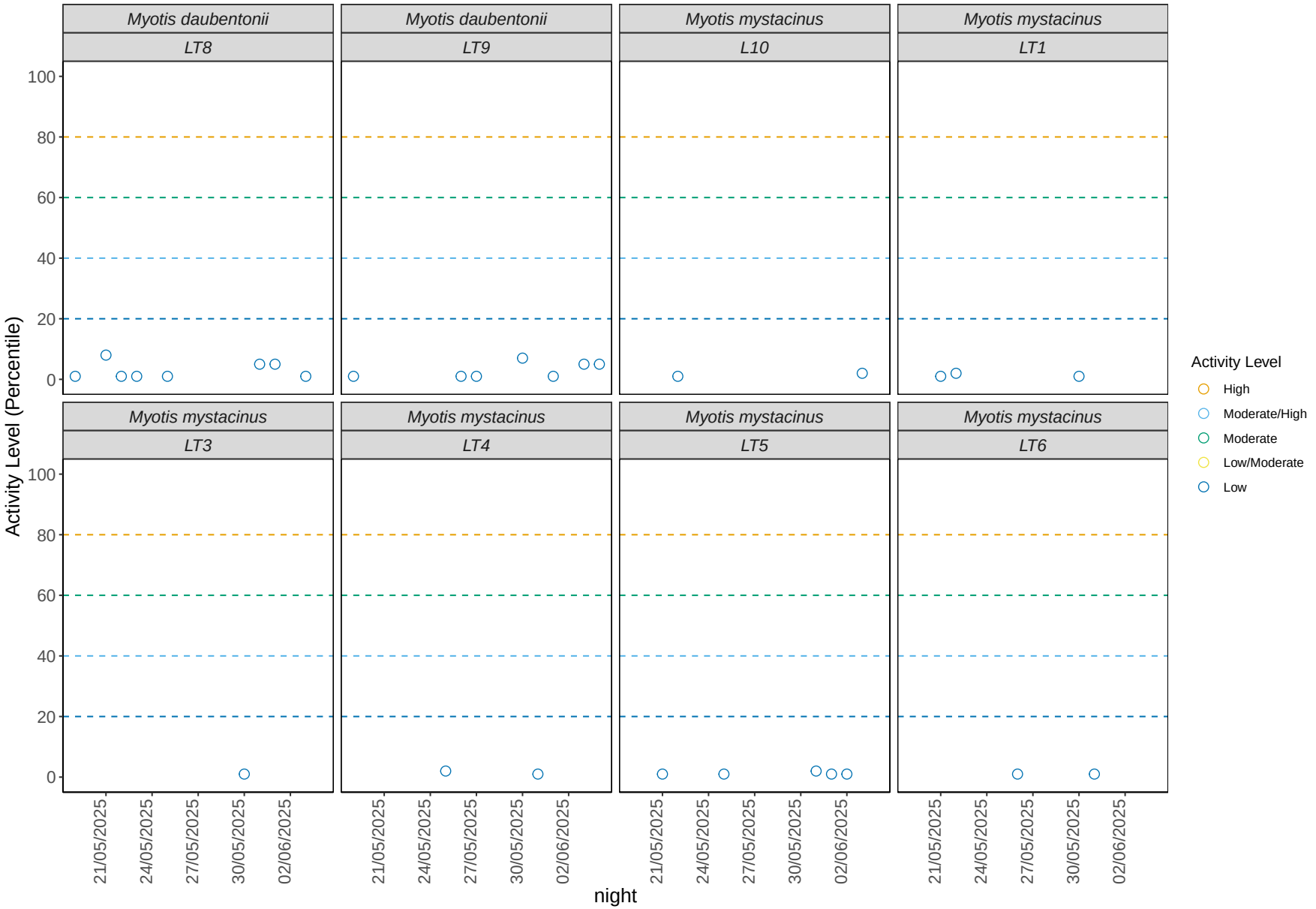
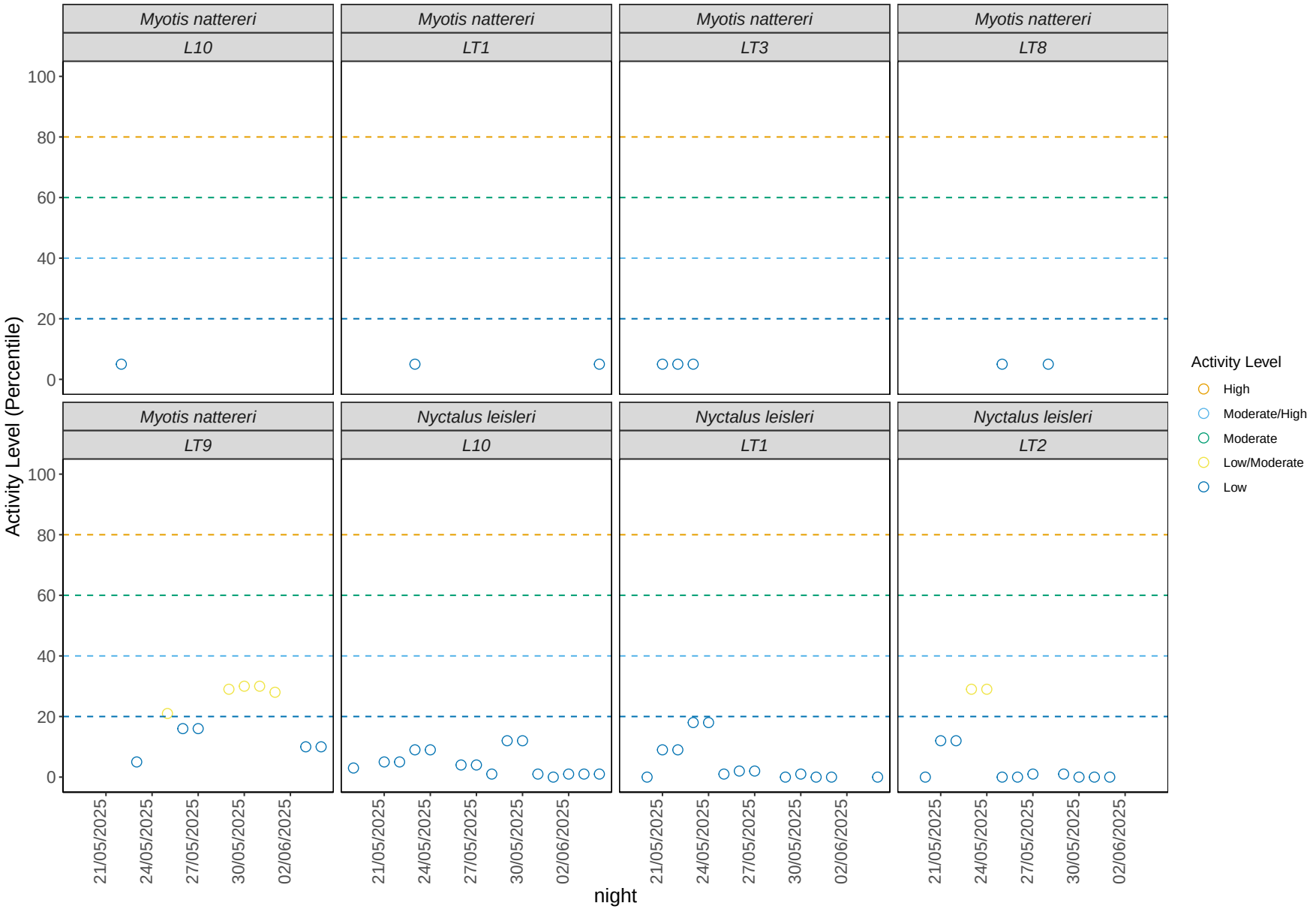
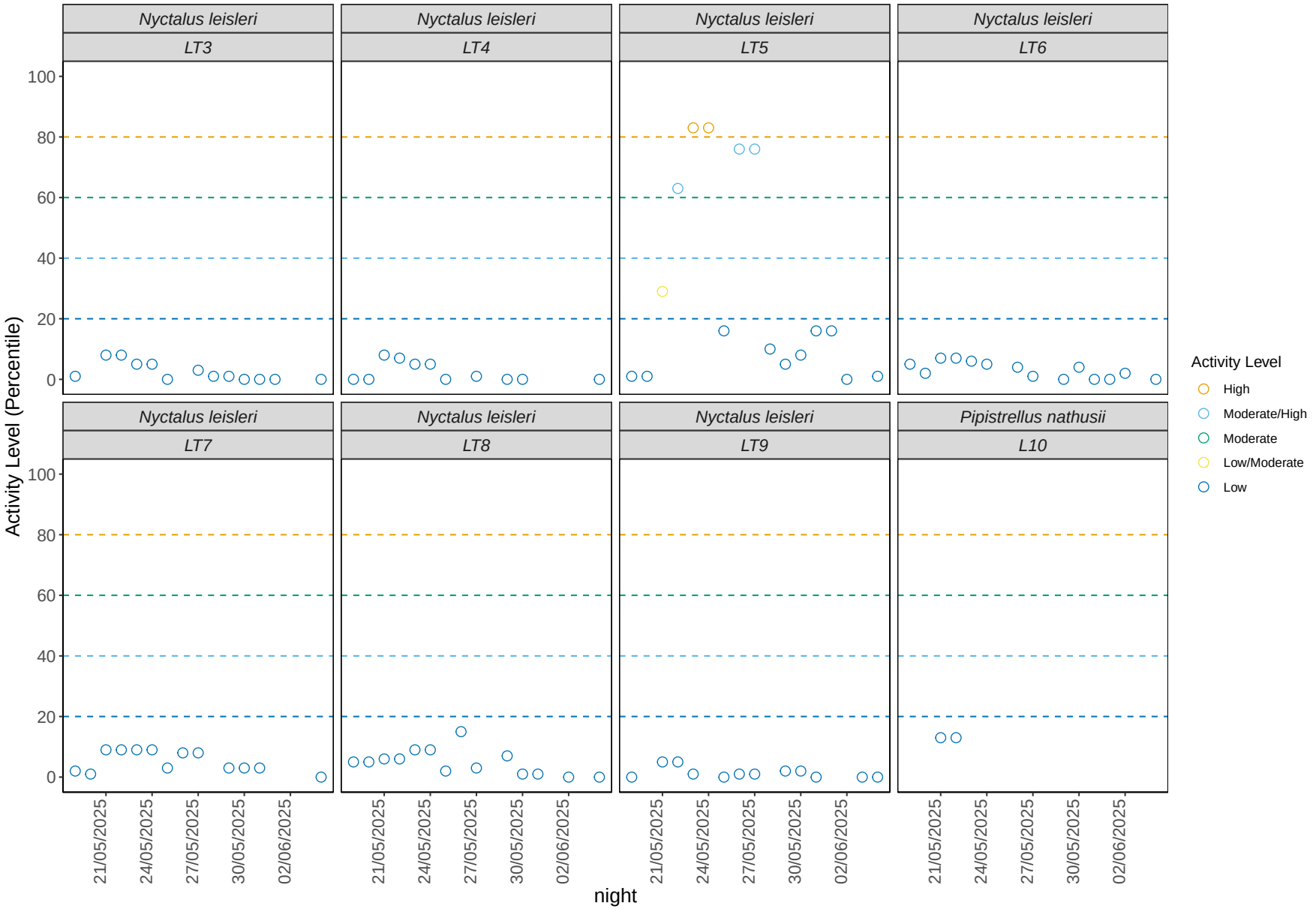

Pipistrellus nathusii
Pipistrellus pipistrellus
Pipistrellus pygmaeus
Plecotus auritus
Activity Level (Percentile)
100
80
60
40
20
0
L10
LT1
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID

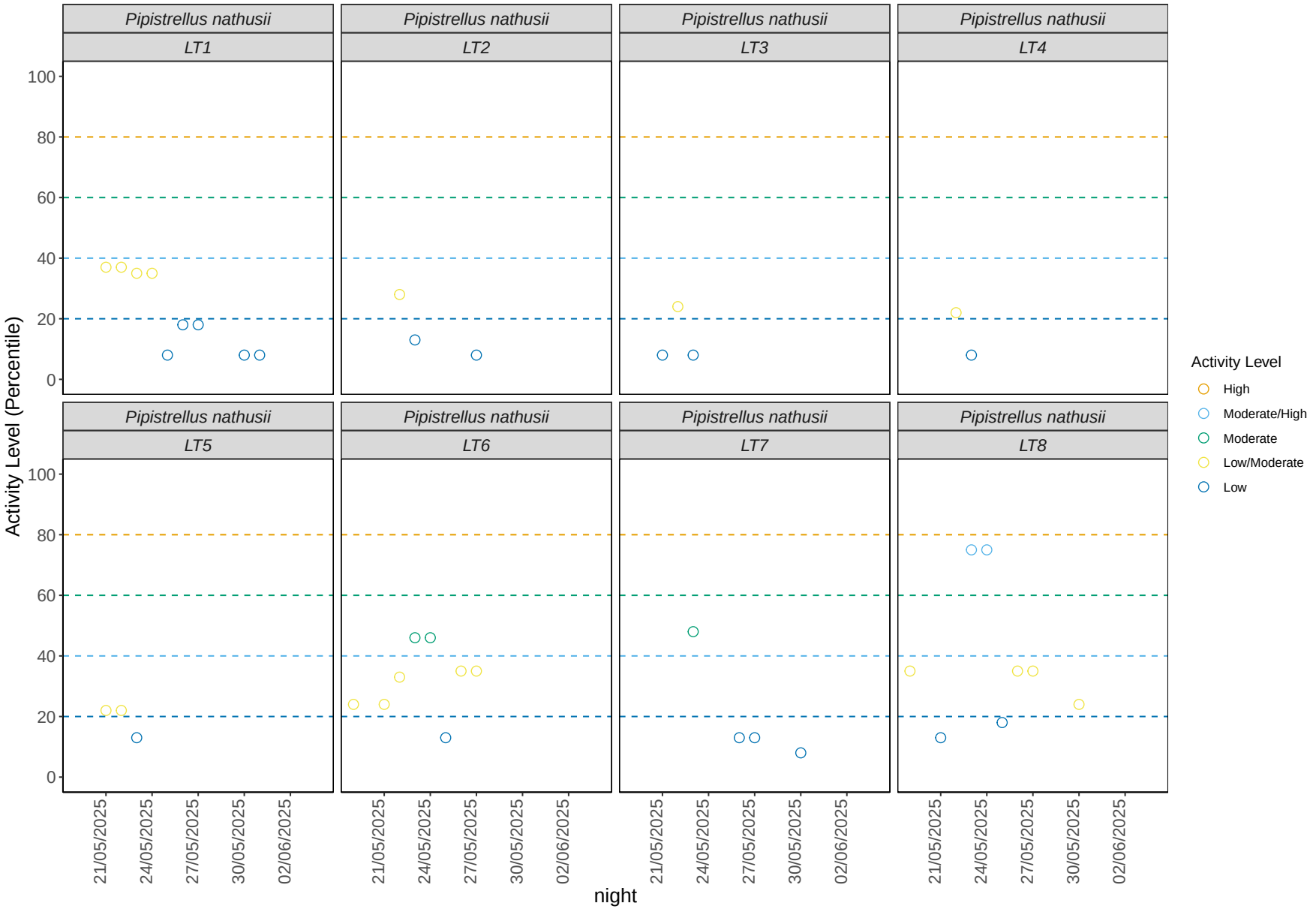
Figure 3. The activity level (percentile) of bats recorded across each night of the bat survey.

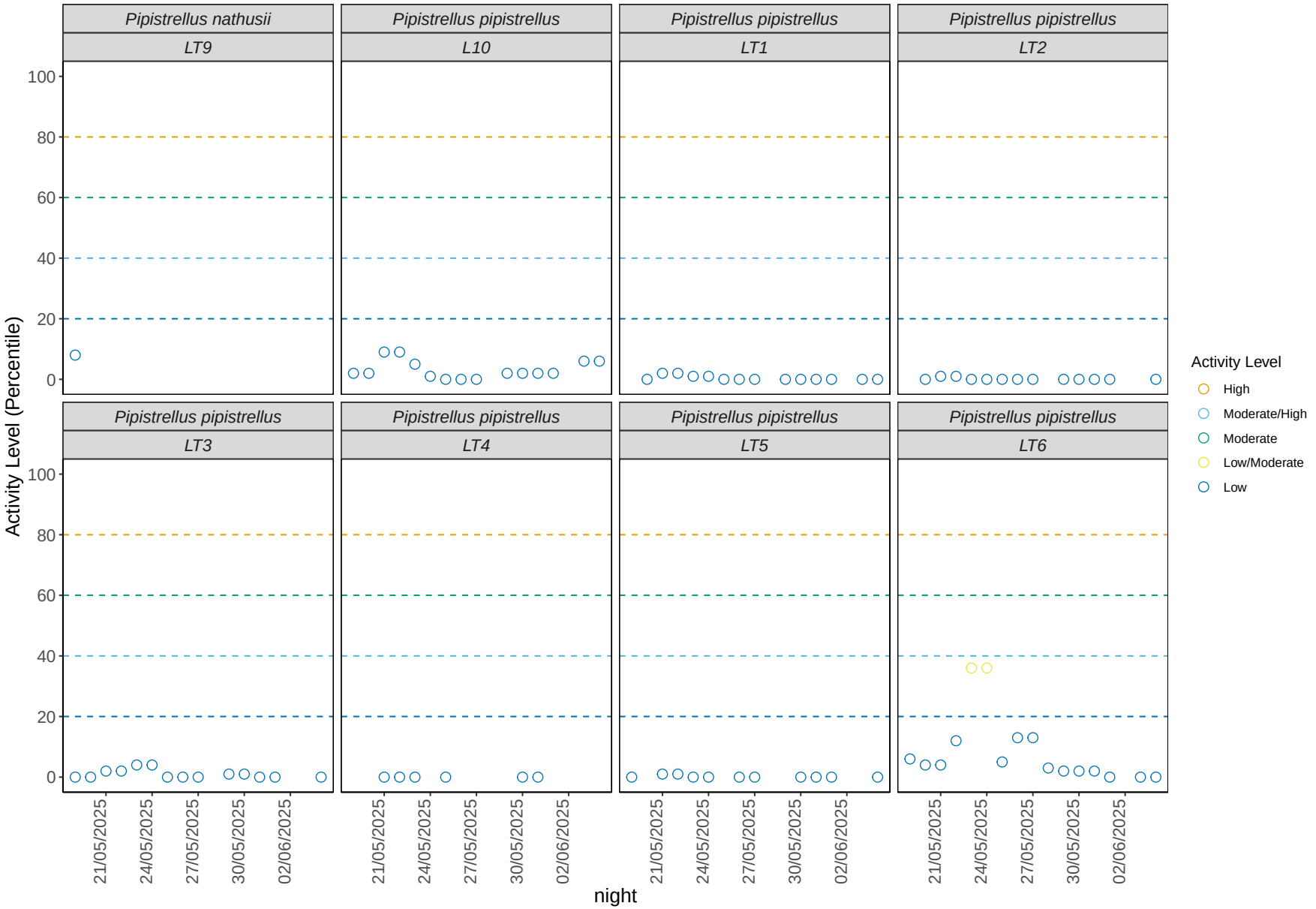

Myotis daubentonii
L10
LT1
LT2
LT3
LT4
LT5
LT6
LT7
Activity Level (Percentile)
100
80
60
40
20
0
21/05/2025
24/05/2025
27/05/2025
30/05/2025
02/06/2025
night
Activity Level
High
Moderate/High
Moderate
Low/Moderate
Low

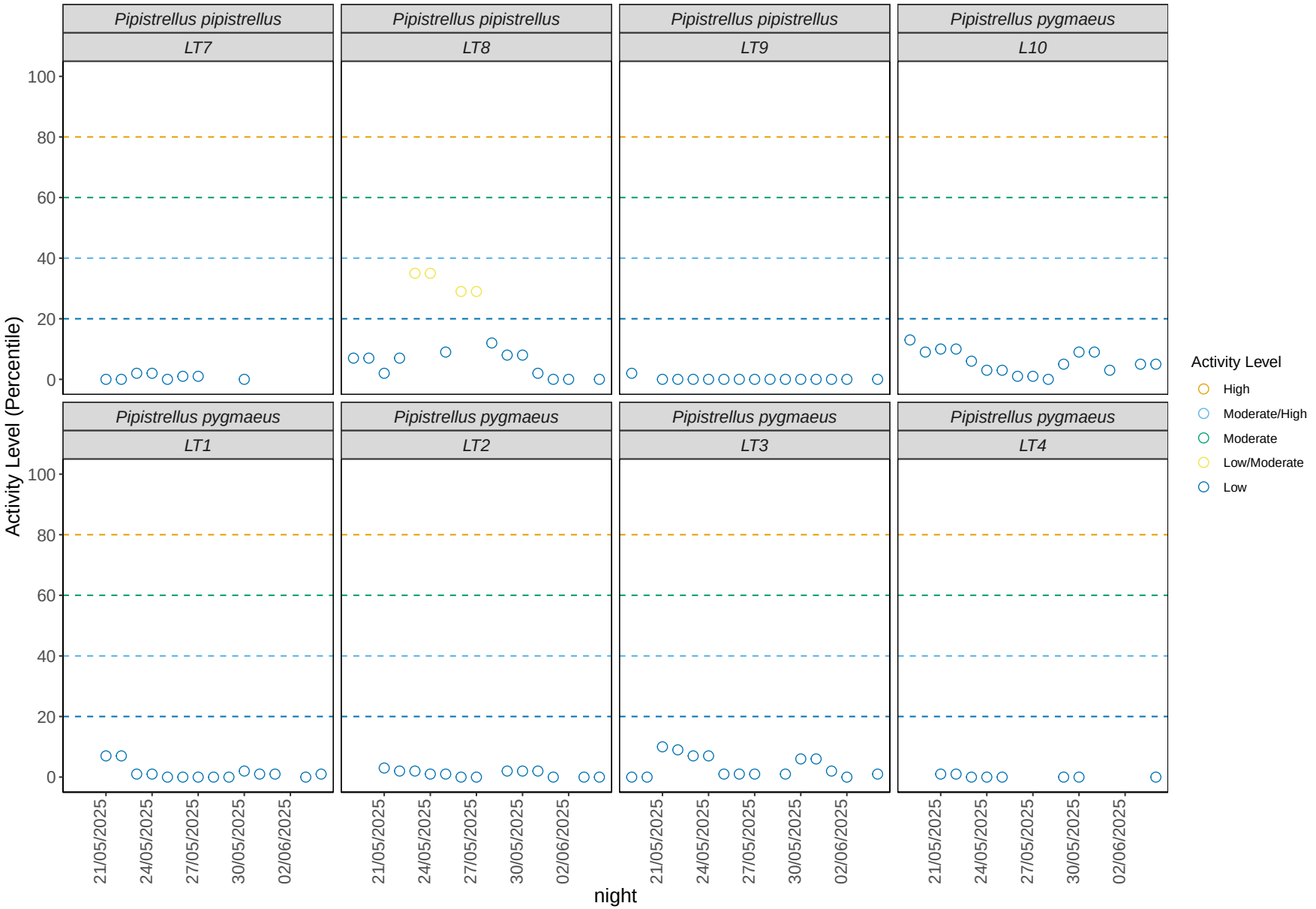

Myotis daubentonii
LT8
Myotis daubentonii
LT9
Myotis mystacinus
L10
Myotis mystacinus
LT1
Myotis mystacinus
LT3
Myotis mystacinus
LT4
Myotis mystacinus
LT5
Myotis mystacinus
LT6
Activity Level (Percentile)
100
80
60
40
20
0
21/05/2025
24/05/2025
27/05/2025
30/05/2025
02/06/2025
night
Activity Level
High
Moderate/High
Moderate
Low/Moderate
Low

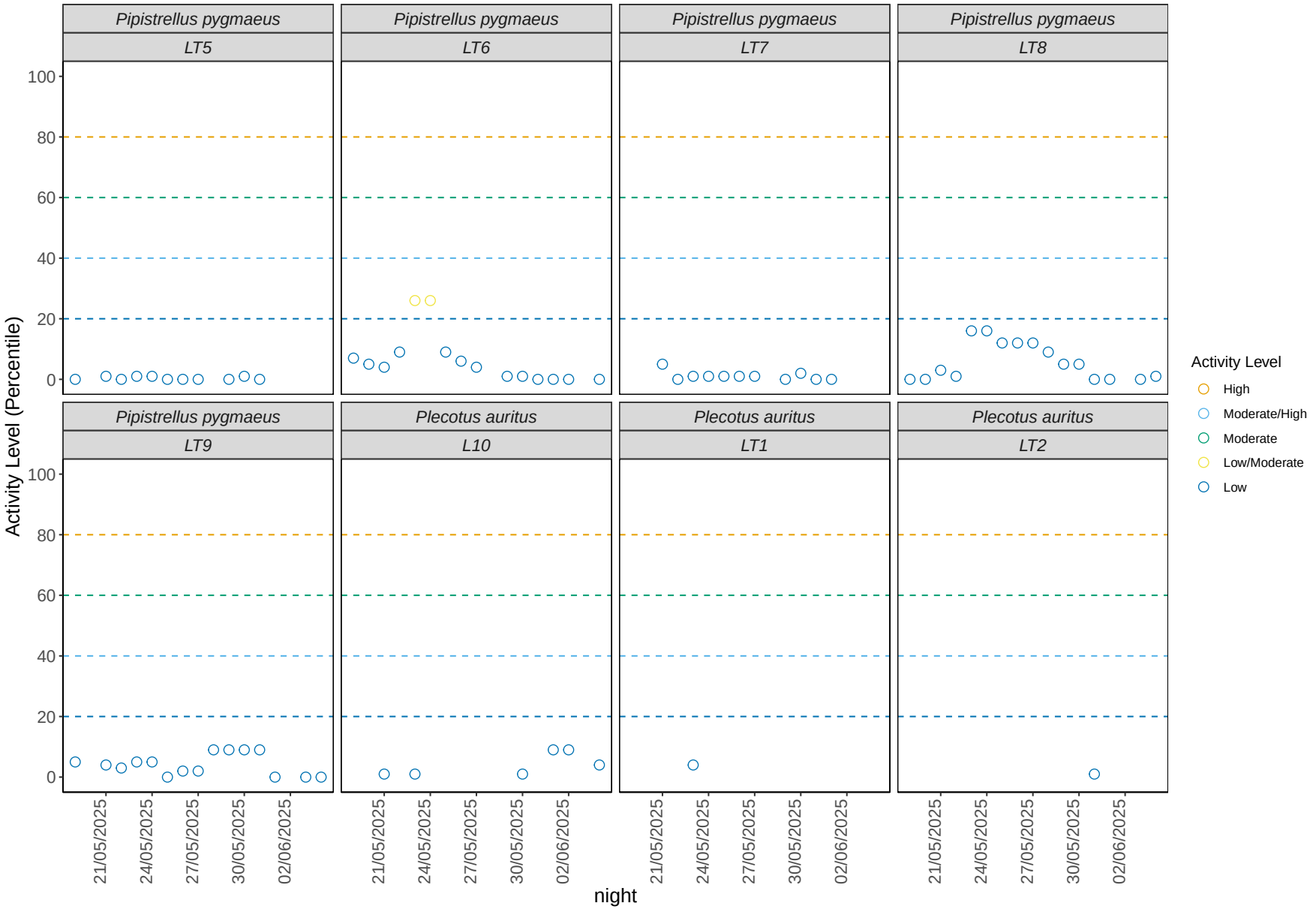

Myotis nattereri
L10
Myotis nattereri
LT1
Myotis nattereri
LT3
Myotis nattereri
LT8
Myotis nattereri
LT9
Nyctalus leisleri
L10
Nyctalus leisleri
LT1
Nyctalus leisleri
LT2
Activity Level (Percentile)
100
80
60
40
20
0
21/05/2025
24/05/2025
27/05/2025
30/05/2025
02/06/2025
night
Activity Level
High
Moderate/High
Moderate
Low/Moderate
Low

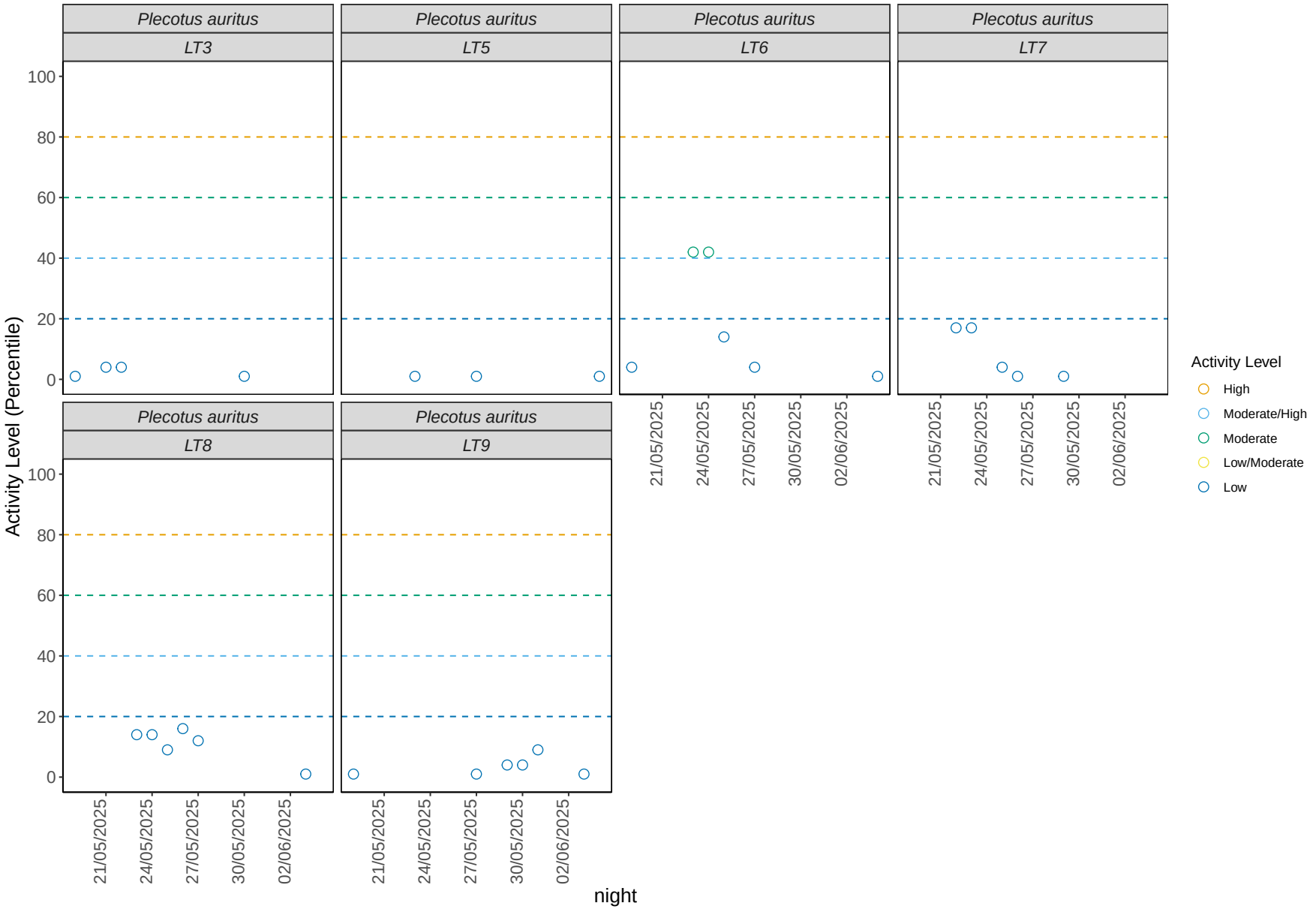

Nyctalus leisleri
LT3
Nyctalus leisleri
LT4
Nyctalus leisleri
LT5
Nyctalus leisleri
LT6
Nyctalus leisleri
LT7
Nyctalus leisleri
LT8
Nyctalus leisleri
LT9
Pipistrellus nathusii
L10
Activity Level (Percentile)
100
80
60
40
20
0
21/05/2025
24/05/2025
27/05/2025
30/05/2025
02/06/2025
night
Activity Level
High
Moderate/High
Moderate
Low/Moderate
Low


Pipistrellus nathusii
LT1
LT2
LT3
LT4
LT5
LT6
LT7
LT8
Activity Level (Percentile)
100
80
60
40
20
0
21/05/2025
24/05/2025
27/05/2025
30/05/2025
02/06/2025
night
Activity Level
High
Moderate/High
Moderate
Low/Moderate
Low


Pipistrellus nathusii
LT9
Pipistrellus pipistrellus
L10
Pipistrellus pipistrellus
LT1
Pipistrellus pipistrellus
LT2
Pipistrellus pipistrellus
LT3
Pipistrellus pipistrellus
LT4
Pipistrellus pipistrellus
LT5
Pipistrellus pipistrellus
LT6
Activity Level (Percentile)
100
80
60
40
20
0
21/05/2025
24/05/2025
27/05/2025
30/05/2025
02/06/2025
night
Activity Level
High
Moderate/High
Moderate
Low/Moderate
Low


Pipistrellus pipistrellus
LT7
Pipistrellus pipistrellus
LT8
Pipistrellus pipistrellus
LT9
Pipistrellus pygmaeus
L10
Pipistrellus pygmaeus
LT1
Pipistrellus pygmaeus
LT2
Pipistrellus pygmaeus
LT3
Pipistrellus pygmaeus
LT4
Activity Level (Percentile)
100
80
60
40
20
0
21/05/2025
24/05/2025
27/05/2025
30/05/2025
02/06/2025
night
Activity Level
High
Moderate/High
Moderate
Low/Moderate
Low


Pipistrellus pygmaeus
LT5
Pipistrellus pygmaeus
LT6
Pipistrellus pygmaeus
LT7
Pipistrellus pygmaeus
LT8
Pipistrellus pygmaeus
LT9
Plecotus auritus
L10
Plecotus auritus
LT1
Plecotus auritus
LT2
Activity Level (Percentile)
100
80
60
40
20
0
21/05/2025
24/05/2025
27/05/2025
30/05/2025
02/06/2025
night
Activity Level
High
Moderate/High
Moderate
Low/Moderate
Low


Plecotus auritus
LT3
LT5
LT6
LT7
LT8
LT9
Activity Level (Percentile)
100
80
60
40
20
0
21/05/2025
24/05/2025
27/05/2025
30/05/2025
02/06/2025
night
Activity Level
High
Moderate/High
Moderate
Low/Moderate
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 Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
L10	Myotis daubentonii	May	0	0	0	0	0	7
L10	Myotis daubentonii	Jun	0	0	0	0	0	3
L10	Myotis mystacinus	May	0	0	0	0	0	1
L10	Myotis mystacinus	Jun	0	0	0	0	0	1
L10	Myotis nattereri	May	0	0	0	0	0	1
L10	Nyctalus leisleri	May	0	0	0	0	0	11
L10	Nyctalus leisleri	Jun	0	0	0	0	0	4
L10	Pipistrellus nathusii	May	0	0	0	0	0	2
L10	Pipistrellus pipistrellus	May	0	0	0	0	0	12
L10	Pipistrellus pipistrellus	Jun	0	0	0	0	0	3
L10	Pipistrellus pygmaeus	May	0	0	0	0	0	13
L10	Pipistrellus pygmaeus	Jun	0	0	0	0	0	3
L10	Plecotus auritus	May	0	0	0	0	0	3
L10	Plecotus auritus	Jun	0	0	0	0	0	3
LT1	Myotis daubentonii	May	0	0	0	0	0	5
LT1	Myotis daubentonii	Jun	0	0	0	0	0	2
LT1	Myotis mystacinus	May	0	0	0	0	0	3
LT1	Myotis nattereri	May	0	0	0	0	0	1

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT1	Myotis nattereri	Jun	0	0	0	0	0	1
LT1	Nyctalus leisleri	May	0	0	0	0	0	11
LT1	Nyctalus leisleri	Jun	0	0	0	0	0	2
LT1	Pipistrellus nathusii	May	0	0	0	0	4	5
LT1	Pipistrellus pipistrellus	May	0	0	0	0	0	11
LT1	Pipistrellus pipistrellus	Jun	0	0	0	0	0	3
LT1	Pipistrellus pygmaeus	May	0	0	0	0	0	11
LT1	Pipistrellus pygmaeus	Jun	0	0	0	0	0	3
LT1	Plecotus auritus	May	0	0	0	0	0	1
LT2	Myotis daubentonii	May	0	0	0	0	0	1
LT2	Nyctalus leisleri	May	0	0	0	0	2	9
LT2	Nyctalus leisleri	Jun	0	0	0	0	0	1
LT2	Pipistrellus nathusii	May	0	0	0	0	1	2
LT2	Pipistrellus pipistrellus	May	0	0	0	0	0	11
LT2	Pipistrellus pipistrellus	Jun	0	0	0	0	0	2
LT2	Pipistrellus pygmaeus	May	0	0	0	0	0	10
LT2	Pipistrellus pygmaeus	Jun	0	0	0	0	0	3
LT2	Plecotus auritus	May	0	0	0	0	0	1
LT3	Myotis daubentonii	May	0	0	0	0	0	7
LT3	Myotis daubentonii	Jun	0	0	0	0	0	3

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT3	Myotis mystacinus	May	0	0	0	0	0	1
LT3	Myotis nattereri	May	0	0	0	0	0	3
LT3	Nyctalus leisleri	May	0	0	0	0	0	11
LT3	Nyctalus leisleri	Jun	0	0	0	0	0	2
LT3	Pipistrellus nathusii	May	0	0	0	0	1	2
LT3	Pipistrellus pipistrellus	May	0	0	0	0	0	12
LT3	Pipistrellus pipistrellus	Jun	0	0	0	0	0	2
LT3	Pipistrellus pygmaeus	May	0	0	0	0	0	12
LT3	Pipistrellus pygmaeus	Jun	0	0	0	0	0	3
LT3	Plecotus auritus	May	0	0	0	0	0	4
LT4	Myotis daubentonii	May	0	0	0	0	0	2
LT4	Myotis mystacinus	May	0	0	0	0	0	2
LT4	Nyctalus leisleri	May	0	0	0	0	0	10
LT4	Nyctalus leisleri	Jun	0	0	0	0	0	1
LT4	Pipistrellus nathusii	May	0	0	0	0	1	1
LT4	Pipistrellus pipistrellus	May	0	0	0	0	0	6
LT4	Pipistrellus pygmaeus	May	0	0	0	0	0	7
LT4	Pipistrellus pygmaeus	Jun	0	0	0	0	0	1
LT5	Myotis daubentonii	May	0	0	0	0	0	3
LT5	Myotis daubentonii	Jun	0	0	0	0	0	1

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT5	Myotis mystacinus	May	0	0	0	0	0	3
LT5	Myotis mystacinus	Jun	0	0	0	0	0	2
LT5	Nyctalus leisleri	May	0	2	3	0	1	7
LT5	Nyctalus leisleri	Jun	0	0	0	0	0	3
LT5	Pipistrellus nathusii	May	0	0	0	0	2	1
LT5	Pipistrellus pipistrellus	May	0	0	0	0	0	9
LT5	Pipistrellus pipistrellus	Jun	0	0	0	0	0	2
LT5	Pipistrellus pygmaeus	May	0	0	0	0	0	11
LT5	Plecotus auritus	May	0	0	0	0	0	2
LT5	Plecotus auritus	Jun	0	0	0	0	0	1
LT6	Myotis daubentonii	May	0	0	0	0	0	5
LT6	Myotis daubentonii	Jun	0	0	0	0	0	2
LT6	Myotis mystacinus	May	0	0	0	0	0	2
LT6	Nyctalus leisleri	May	0	0	0	0	0	11
LT6	Nyctalus leisleri	Jun	0	0	0	0	0	3
LT6	Pipistrellus nathusii	May	0	0	0	2	5	1
LT6	Pipistrellus pipistrellus	May	0	0	0	0	2	11
LT6	Pipistrellus pipistrellus	Jun	0	0	0	0	0	3
LT6	Pipistrellus pygmaeus	May	0	0	0	0	2	10
LT6	Pipistrellus pygmaeus	Jun	0	0	0	0	0	3

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT6	Plecotus auritus	May	0	0	0	2	0	3
LT6	Plecotus auritus	Jun	0	0	0	0	0	1
LT7	Myotis daubentonii	May	0	0	0	0	0	7
LT7	Myotis daubentonii	Jun	0	0	0	0	0	1
LT7	Nyctalus leisleri	May	0	0	0	0	0	12
LT7	Nyctalus leisleri	Jun	0	0	0	0	0	1
LT7	Pipistrellus nathusii	May	0	0	0	1	0	3
LT7	Pipistrellus pipistrellus	May	0	0	0	0	0	8
LT7	Pipistrellus pygmaeus	May	0	0	0	0	0	10
LT7	Pipistrellus pygmaeus	Jun	0	0	0	0	0	1
LT7	Plecotus auritus	May	0	0	0	0	0	5
LT8	Myotis daubentonii	May	0	0	0	0	0	6
LT8	Myotis daubentonii	Jun	0	0	0	0	0	2
LT8	Myotis nattereri	May	0	0	0	0	0	2
LT8	Nyctalus leisleri	May	0	0	0	0	0	12
LT8	Nyctalus leisleri	Jun	0	0	0	0	0	2
LT8	Pipistrellus nathusii	May	0	0	2	0	4	2
LT8	Pipistrellus pipistrellus	May	0	0	0	0	4	9
LT8	Pipistrellus pipistrellus	Jun	0	0	0	0	0	3
LT8	Pipistrellus pygmaeus	May	0	0	0	0	0	13
LT8	Pipistrellus pygmaeus	Jun	0	0	0	0	0	3

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT8	Plecotus auritus	May	0	0	0	0	0	5
LT8	Plecotus auritus	Jun	0	0	0	0	0	1
LT9	Myotis daubentonii	May	0	0	0	0	0	4
LT9	Myotis daubentonii	Jun	0	0	0	0	0	3
LT9	Myotis nattereri	May	0	0	0	0	4	3
LT9	Myotis nattereri	Jun	0	0	0	0	1	2
LT9	Nyctalus leisleri	May	0	0	0	0	0	10
LT9	Nyctalus leisleri	Jun	0	0	0	0	0	2
LT9	Pipistrellus nathusii	May	0	0	0	0	0	1
LT9	Pipistrellus pipistrellus	May	0	0	0	0	0	12
LT9	Pipistrellus pipistrellus	Jun	0	0	0	0	0	3
LT9	Pipistrellus pygmaeus	May	0	0	0	0	0	12
LT9	Pipistrellus pygmaeus	Jun	0	0	0	0	0	3
LT9	Plecotus auritus	May	0	0	0	0	0	5
LT9	Plecotus auritus	Jun	0	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
L10	Myotis daubentonii	May	5	1 - 5	8	7
L10	Myotis daubentonii	Jun	5	1 - 5	5	3
L10	Myotis mystacinus	May	1	1.5 - 1.5	1	1
L10	Myotis mystacinus	Jun	2	1.5 - 1.5	2	1
L10	Myotis nattereri	May	5	0	5	1
L10	Nyctalus leisleri	May	5	2.5 - 7	12	11
L10	Nyctalus leisleri	Jun	1	2.5 - 7	1	4
L10	Pipistrellus nathusii	May	13	13 - 13	13	2
L10	Pipistrellus pipistrellus	May	2	2 - 5.5	9	12
L10	Pipistrellus pipistrellus	Jun	6	2 - 5.5	6	3
L10	Pipistrellus pygmaeus	May	6	4 - 8	13	13
L10	Pipistrellus pygmaeus	Jun	5	4 - 8	5	3
L10	Plecotus auritus	May	1	1 - 6.5	1	3
L10	Plecotus auritus	Jun	9	1 - 6.5	9	3
LT1	Myotis daubentonii	May	5	3 - 7	7	5
LT1	Myotis daubentonii	Jun	5	3 - 7	5	2
LT1	Myotis mystacinus	May	1	1 - 1	2	3
LT1	Myotis nattereri	May	5	5 - 5	5	1
LT1	Myotis nattereri	Jun	5	5 - 5	5	1
LT1	Nyctalus leisleri	May	2	1.5 - 13.5	18	11
LT1	Nyctalus leisleri	Jun	0	1.5 - 13.5	0	2
LT1	Pipistrellus nathusii	May	18	8 - 36	37	9
LT1	Pipistrellus pipistrellus	May	0	1 - 2	2	11
LT1	Pipistrellus pipistrellus	Jun	0	1 - 2	0	3
LT1	Pipistrellus pygmaeus	May	1	1 - 4	7	11
LT1	Pipistrellus pygmaeus	Jun	1	1 - 4	1	3
LT1	Plecotus auritus	May	4	0	4	1
LT2	Myotis daubentonii	May	1	0	1	1
LT2	Nyctalus leisleri	May	1	1 - 29	29	11
LT2	Nyctalus leisleri	Jun	0	1 - 29	0	1
LT2	Pipistrellus nathusii	May	13	8 - 28	28	3
LT2	Pipistrellus pipistrellus	May	0	0 - 0	1	11
LT2	Pipistrellus pipistrellus	Jun	0	0 - 0	0	2

Detector ID	Species/Species Group	month	Median Percentile	95% CIs	Max. Percentile	Nights Recorded
LT2	Pipistrellus pygmaeus	May	2	1.5 - 2.5	3	10
LT2	Pipistrellus pygmaeus	Jun	0	1.5 - 2.5	0	3
LT2	Plecotus auritus	May	1	0	1	1
LT3	Myotis daubentonii	May	5	3 - 5	5	7
LT3	Myotis daubentonii	Jun	1	3 - 5	5	3
LT3	Myotis mystacinus	May	1	0	1	1
LT3	Myotis nattereri	May	5	5 - 5	5	3
LT3	Nyctalus leisleri	May	1	1 - 6.5	8	11
LT3	Nyctalus leisleri	Jun	0	1 - 6.5	0	2
LT3	Pipistrellus nathusii	May	8	8 - 8	24	3
LT3	Pipistrellus pipistrellus	May	1	1 - 4	4	12
LT3	Pipistrellus pipistrellus	Jun	0	1 - 4	0	2
LT3	Pipistrellus pygmaeus	May	4	1 - 7	10	12
LT3	Pipistrellus pygmaeus	Jun	1	1 - 7	2	3
LT3	Plecotus auritus	May	3	1 - 4	4	4
LT4	Myotis daubentonii	May	7	7 - 7	7	2
LT4	Myotis mystacinus	May	2	1.5 - 1.5	2	2
LT4	Nyctalus leisleri	May	1	1 - 8	8	10
LT4	Nyctalus leisleri	Jun	0	1 - 8	0	1
LT4	Pipistrellus nathusii	May	15	15 - 15	22	2
LT4	Pipistrellus pipistrellus	May	0	0 - 0	0	6
LT4	Pipistrellus pygmaeus	May	0	0 - 0	1	7
LT4	Pipistrellus pygmaeus	Jun	0	0 - 0	0	1
LT5	Myotis daubentonii	May	1	1 - 7	7	3
LT5	Myotis daubentonii	Jun	7	1 - 7	7	1
LT5	Myotis mystacinus	May	1	1 - 1	2	3
LT5	Myotis mystacinus	Jun	1	1 - 1	1	2
LT5	Nyctalus leisleri	May	16	8.5 - 46.5	83	13
LT5	Nyctalus leisleri	Jun	1	8.5 - 46.5	16	3
LT5	Pipistrellus nathusii	May	22	22 - 22	22	3
LT5	Pipistrellus pipistrellus	May	0	0 - 0	1	9
LT5	Pipistrellus pipistrellus	Jun	0	0 - 0	0	2
LT5	Pipistrellus pygmaeus	May	0	0 - 0	1	11
LT5	Plecotus auritus	May	1	1 - 1	1	2
LT5	Plecotus auritus	Jun	1	1 - 1	1	1
LT6	Myotis daubentonii	May	1	1 - 4	5	5

Detector ID	Species/Species Group	month	Median Percentile	95% CIs	Max. Percentile	Nights Recorded
LT6	Myotis daubentonii	Jun	4	1 - 4	7	2
LT6	Myotis mystacinus	May	1	1 - 1	1	2
LT6	Nyctalus leisleri	May	4	2.5 - 6	7	11
LT6	Nyctalus leisleri	Jun	0	2.5 - 6	2	3
LT6	Pipistrellus nathusii	May	34	23 - 40.5	46	8
LT6	Pipistrellus pipistrellus	May	5	3.5 - 19.5	36	13
LT6	Pipistrellus pipistrellus	Jun	0	3.5 - 19.5	0	3
LT6	Pipistrellus pygmaeus	May	6	3.5 - 16	26	12
LT6	Pipistrellus pygmaeus	Jun	0	3.5 - 16	0	3
LT6	Plecotus auritus	May	14	2.5 - 42	42	5
LT6	Plecotus auritus	Jun	1	2.5 - 42	1	1
LT7	Myotis daubentonii	May	5	1 - 6.5	7	7
LT7	Myotis daubentonii	Jun	8	1 - 6.5	8	1
LT7	Nyctalus leisleri	May	6	3 - 8.5	9	12
LT7	Nyctalus leisleri	Jun	0	3 - 8.5	0	1
LT7	Pipistrellus nathusii	May	13	10.5 - 30.5	48	4
LT7	Pipistrellus pipistrellus	May	1	1 - 2	2	8
LT7	Pipistrellus pygmaeus	May	1	1 - 1.5	5	10
LT7	Pipistrellus pygmaeus	Jun	0	1 - 1.5	0	1
LT7	Plecotus auritus	May	4	1 - 17	17	5
LT8	Myotis daubentonii	May	1	1 - 4.5	8	6
LT8	Myotis daubentonii	Jun	3	1 - 4.5	5	2
LT8	Myotis nattereri	May	5	5 - 5	5	2
LT8	Nyctalus leisleri	May	6	3 - 8	15	12
LT8	Nyctalus leisleri	Jun	0	3 - 8	0	2
LT8	Pipistrellus nathusii	May	35	18.5 - 55	75	8
LT8	Pipistrellus pipistrellus	May	8	7 - 21.5	35	13
LT8	Pipistrellus pipistrellus	Jun	0	7 - 21.5	0	3
LT8	Pipistrellus pygmaeus	May	5	4 - 12.5	16	13
LT8	Pipistrellus pygmaeus	Jun	0	4 - 12.5	1	3
LT8	Plecotus auritus	May	14	6.5 - 15	16	5
LT8	Plecotus auritus	Jun	1	6.5 - 15	1	1
LT9	Myotis daubentonii	May	1	1 - 4	7	4
LT9	Myotis daubentonii	Jun	5	1 - 4	5	3
LT9	Myotis nattereri	May	21	10.5 - 29	30	7
LT9	Myotis nattereri	Jun	10	10.5 - 29	28	3

Detector ID	Species/Species Group	month	Median Percentile	95% CIs	Max. Percentile	Nights Recorded
LT9	Nyctalus leisleri	May	1	1 - 3.5	5	10
LT9	Nyctalus leisleri	Jun	0	1 - 3.5	0	2
LT9	Pipistrellus nathusii	May	8	0	8	1
LT9	Pipistrellus pipistrellus	May	0	0 - 0	2	12
LT9	Pipistrellus pipistrellus	Jun	0	0 - 0	0	3
LT9	Pipistrellus pygmaeus	May	5	3.5 - 7	9	12
LT9	Pipistrellus pygmaeus	Jun	0	3.5 - 7	0	3
LT9	Plecotus auritus	May	4	1 - 5	9	5
LT9	Plecotus auritus	Jun	1	1 - 5	1	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 Exceptional Activity	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	0	0	0	0	64
Myotis mystacinus	0	0	0	0	0	15
Myotis nattereri	0	0	0	0	5	13
Nyctalus leisleri	0	2	3	0	3	125
Pipistrellus nathusii	0	0	2	3	18	20
Pipistrellus pipistrellus	0	0	0	0	6	122
Pipistrellus pygmaeus	0	0	0	0	2	132
Plecotus auritus	0	0	0	2	0	36

Table 8. Summary table showing key metrics for each species recorded.

Species/Species Group	Median Percentile	95% CIs	Max. Percentile	Nights Recorded
Myotis daubentonii	5	7 - 7	8	64
Myotis mystacinus	1	1.5 - 1.5	2	15
Myotis nattereri	8	5 - 5	30	18
Nyctalus leisleri	2	8.5 - 46.5	83	133
Pipistrellus nathusii	22	8 - 8	75	43
Pipistrellus pipistrellus	0	7 - 21.5	36	128
Pipistrellus pygmaeus	1	4 - 8	26	134
Plecotus auritus	4	6.5 - 15	42	38

Figure 4. The activity level (percentile) of bats recorded across each night of the bat survey for the **entire site**.

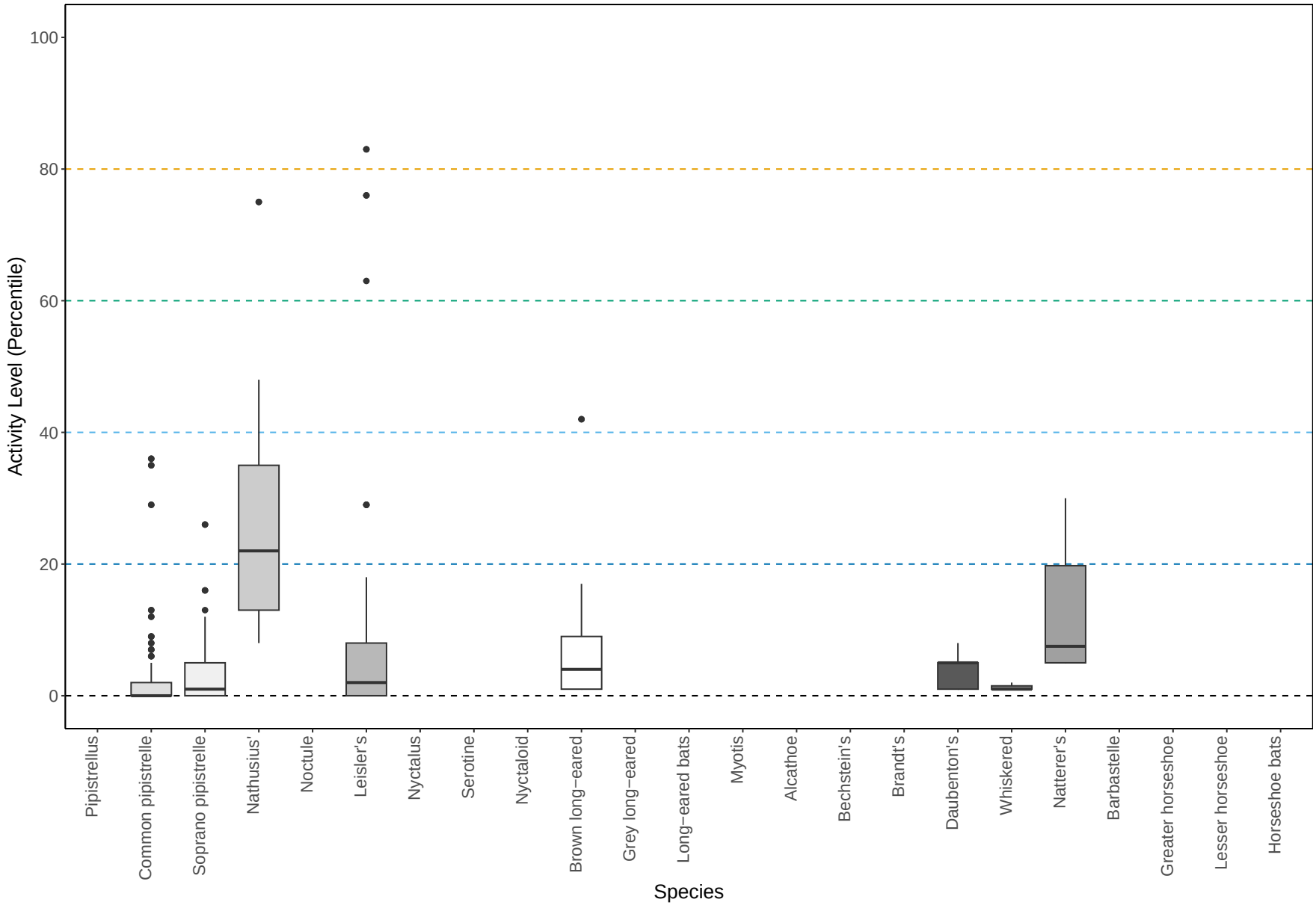

Activity Level (Percentile)
100
80
60
40
20
0
Pipistrellus
Common pipistrelle
Soprano pipistrelle
Nathusius'
Noctule
Leisler's
Nyctalus
Serotine
Nyctaloid
Brown long−eared
Grey long−eared
Long−eared bats
Myotis
Alcathoe
Bechstein's
Brandt's
Daubenton's
Whiskered
Natterer's
Barbastelle
Greater horseshoe
Lesser horseshoe
Horseshoe bats
Species

Figure 5. The median activity levels of bats recorded across all detectors each night.

Per Site, Per Month

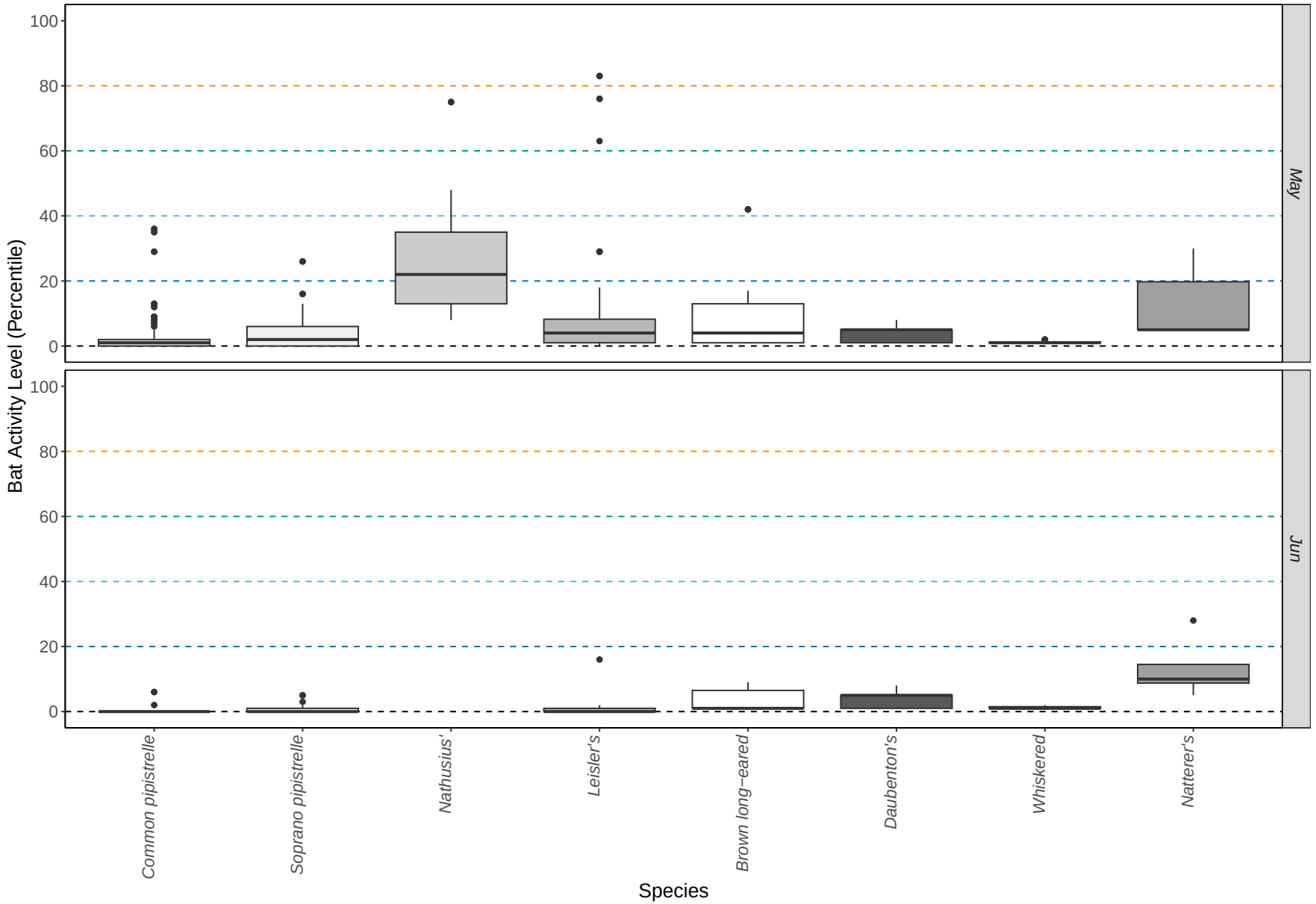
Table 9. Summary table showing the number of nights recorded bat activity fell into each activity band for each species during each month.

Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
Myotis daubentonii	May	0	0	0	0	0	47
Myotis daubentonii	Jun	0	0	0	0	0	17
Myotis mystacinus	May	0	0	0	0	0	12
Myotis mystacinus	Jun	0	0	0	0	0	3
Myotis nattereri	May	0	0	0	0	4	10
Myotis nattereri	Jun	0	0	0	0	1	3
Nyctalus leisleri	May	0	2	3	0	3	104
Nyctalus leisleri	Jun	0	0	0	0	0	21
Pipistrellus nathusii	May	0	0	2	3	18	20
Pipistrellus pipistrellus	May	0	0	0	0	6	101
Pipistrellus pipistrellus	Jun	0	0	0	0	0	21
Pipistrellus pygmaeus	May	0	0	0	0	2	109
Pipistrellus pygmaeus	Jun	0	0	0	0	0	23
Plecotus auritus	May	0	0	0	2	0	29
Plecotus auritus	Jun	0	0	0	0	0	7

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	May	5	7 - 7	8	47
Myotis daubentonii	Jun	5	3 - 7	8	17
Myotis mystacinus	May	1	1.5 - 1.5	2	12
Myotis mystacinus	Jun	1	1.5 - 1.5	2	3
Myotis nattereri	May	5	5 - 5	30	14
Myotis nattereri	Jun	10	5 - 5	28	4
Nyctalus leisleri	May	4	8.5 - 46.5	83	112
Nyctalus leisleri	Jun	0	8.5 - 46.5	16	21
Pipistrellus nathusii	May	22	8 - 8	75	43
Pipistrellus pipistrellus	May	1	7 - 21.5	36	107
Pipistrellus pipistrellus	Jun	0	7 - 21.5	6	21
Pipistrellus pygmaeus	May	2	4 - 8	26	111
Pipistrellus pygmaeus	Jun	0	4 - 8	5	23
Plecotus auritus	May	4	6.5 - 15	42	31
Plecotus auritus	Jun	1	6.5 - 15	9	7

Figure 6. The activity level (percentile) of bats recorded across each night of the bat survey for the entire site, split between months.


Bat Activity Level (Percentile)
100
80
60
40
20
0
May
Jun
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Brown long−eared
Daubenton's
Whiskered
Natterer's
Species

Part 2: Nightly Analysis

Entire Survey Period

Sunrise and Sunset Times

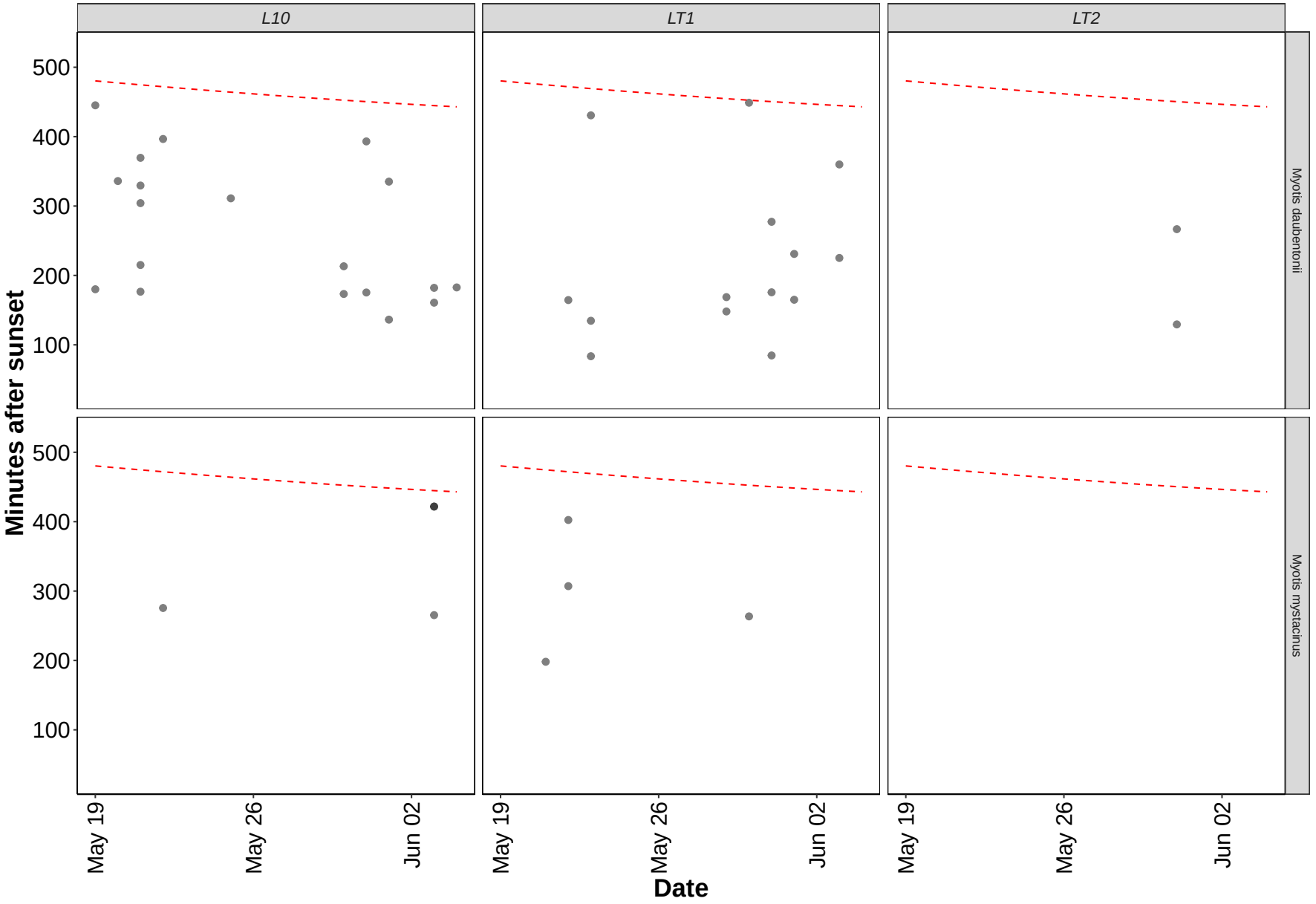
Table 11. The times of sunset and sunrise the following morning for surveys beginning on the date shown.

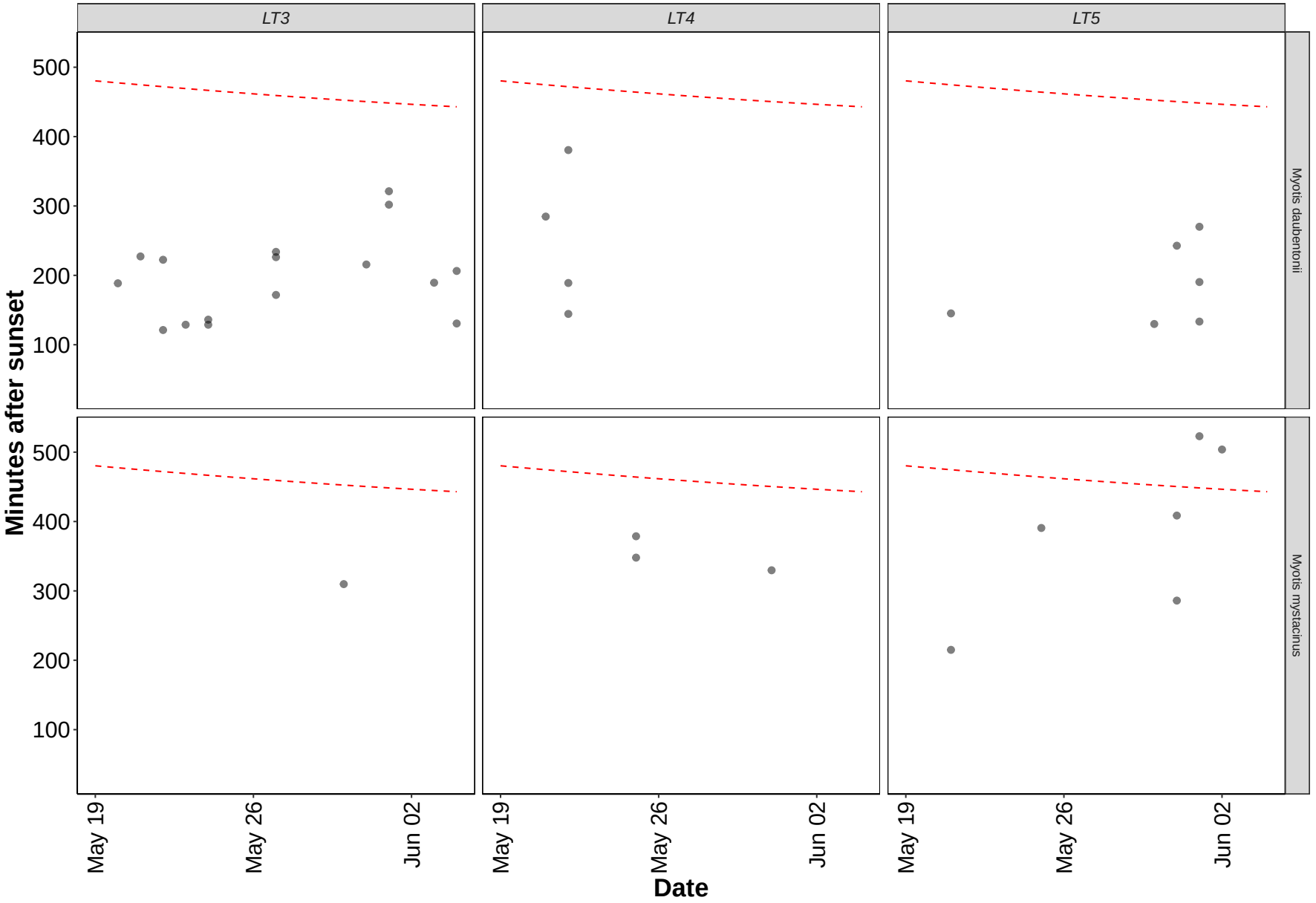
Night (y-m-d)	Sunset (h:m)	Sunrise (h:m)	Night Length (hours)
2025-05-19	20:26	04:26	8.0
2025-05-20	20:27	04:25	8.0
2025-05-21	20:29	04:24	7.9
2025-05-22	20:30	04:22	7.9
2025-05-23	20:32	04:21	7.8
2025-05-24	20:33	04:20	7.8
2025-05-25	20:35	04:19	7.7
2025-05-26	20:36	04:18	7.7
2025-05-27	20:37	04:17	7.7
2025-05-28	20:39	04:16	7.6
2025-05-29	20:40	04:15	7.6
2025-05-30	20:41	04:14	7.5
2025-05-31	20:42	04:13	7.5
2025-06-01	20:44	04:12	7.5
2025-06-02	20:45	04:11	7.4
2025-06-03	20:46	04:10	7.4
2025-06-04	20:47	04:10	7.4

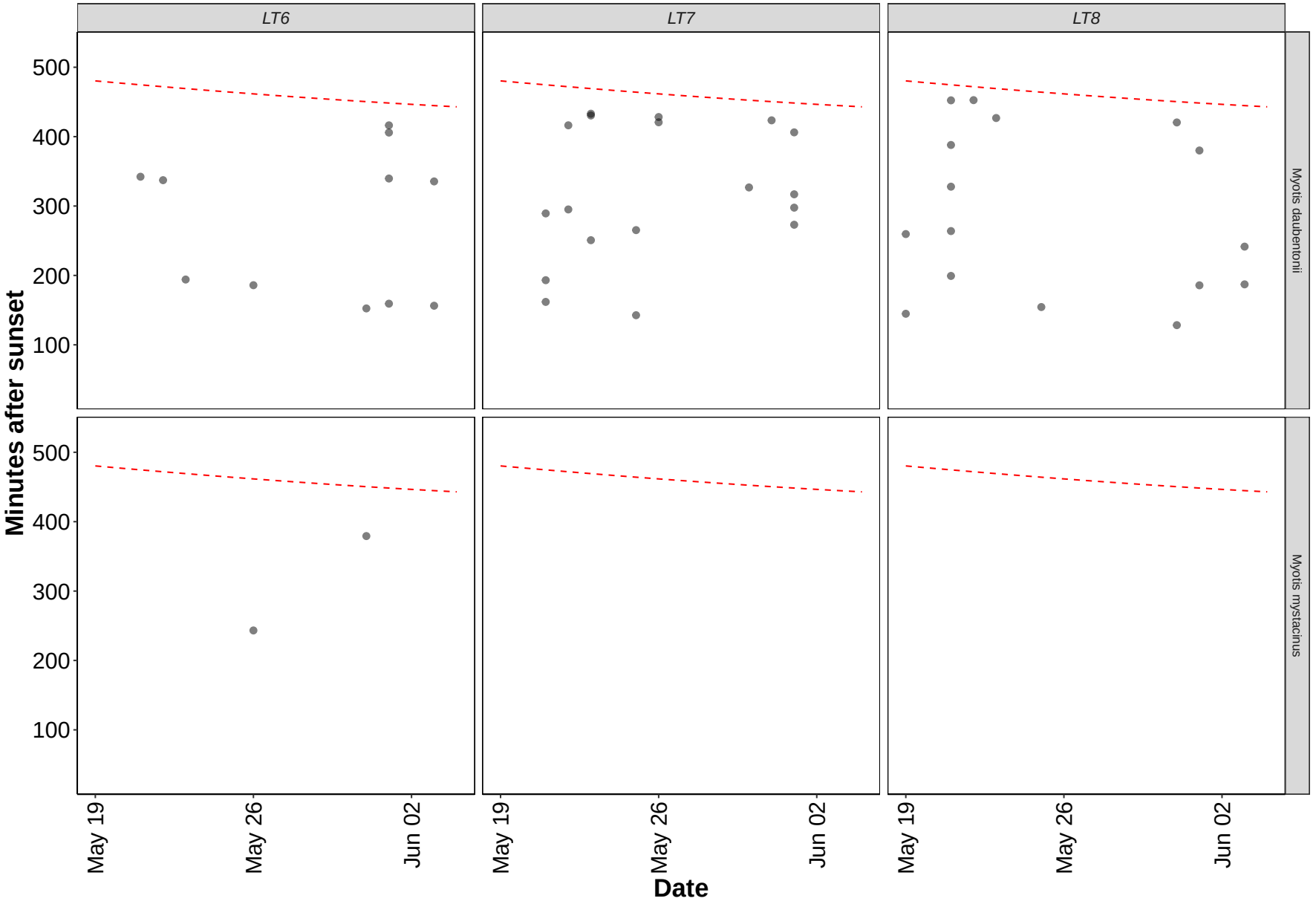
Distribution of Bat Activity Across the Night through Time

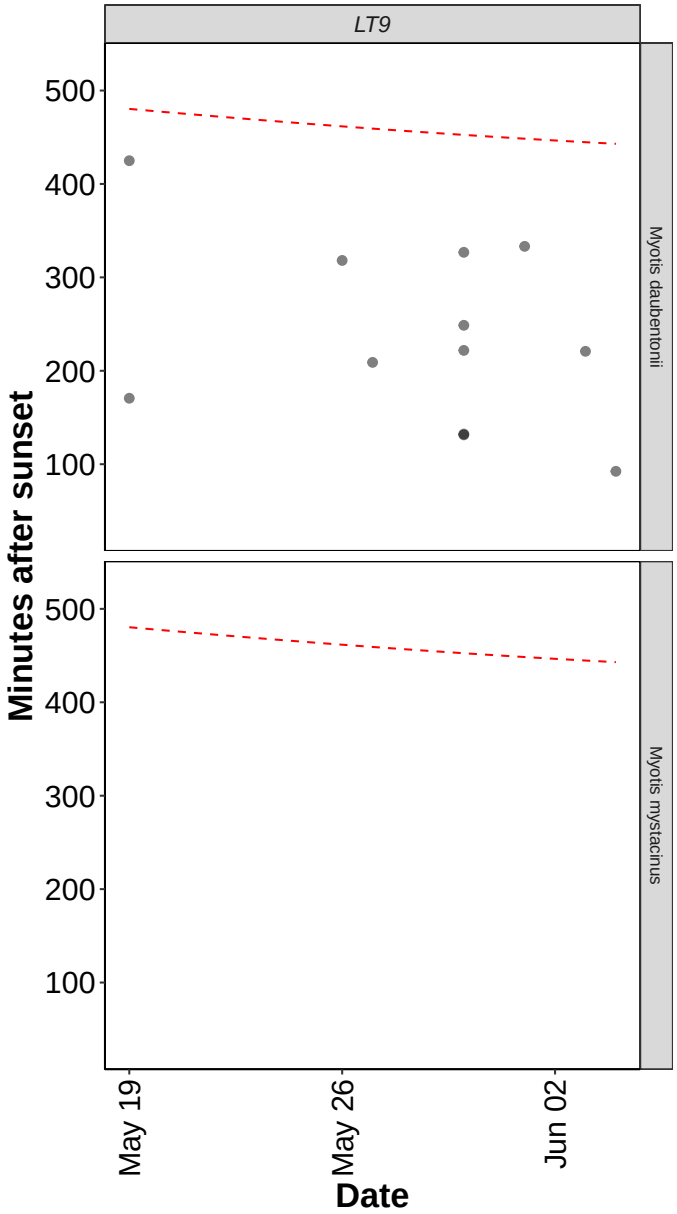
Per Detector

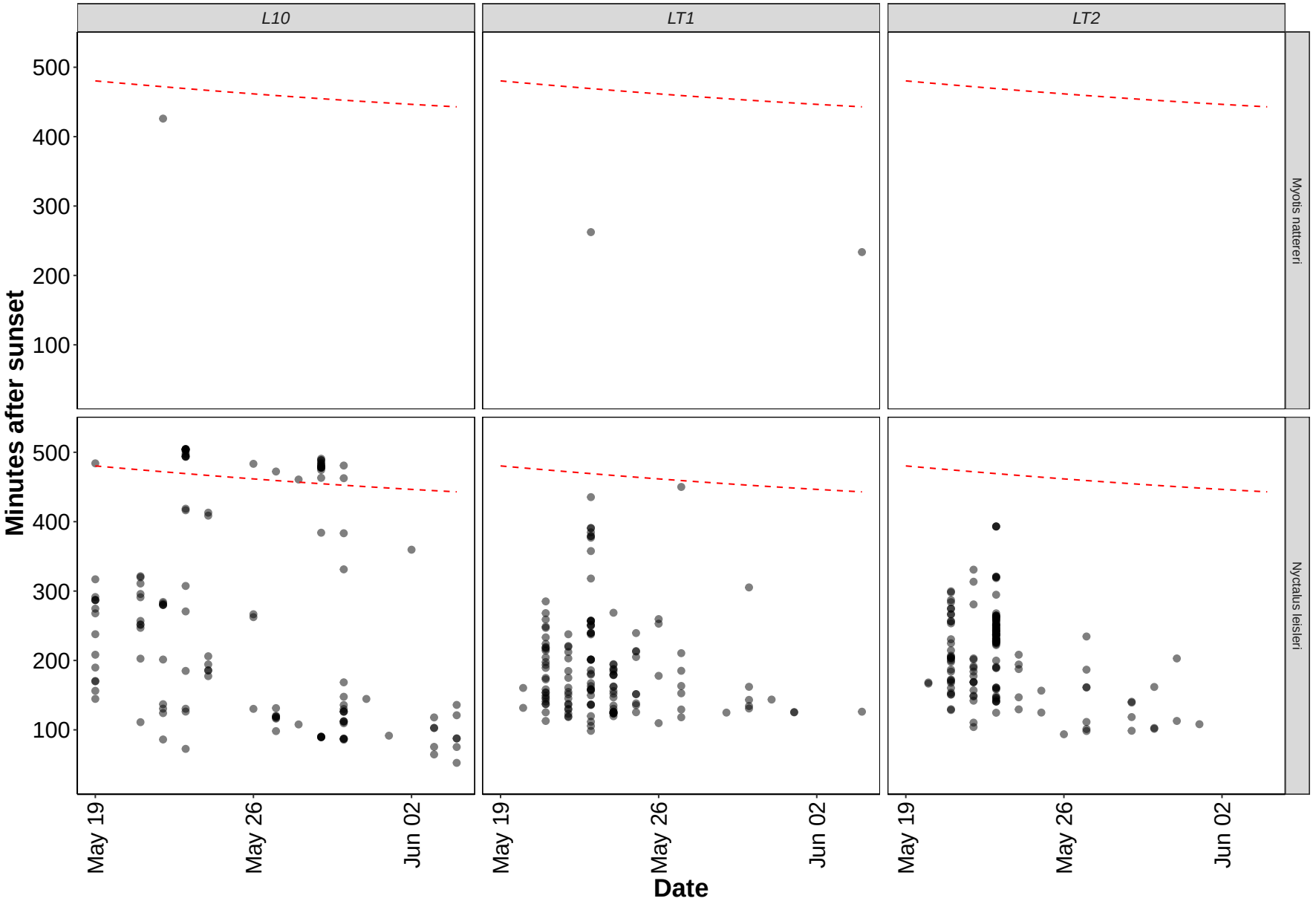
Figure 7. Timing of bat calls plotted as minutes before/after sunset, whereby 0 on the y axis represents sunset. Sunrise throughout the survey period is depicted as the red dashed line. Colours indicate kernel densities, with darkest colours showing peaks of activity. These colours are comparative only within each plot, and do not account for overall activity.

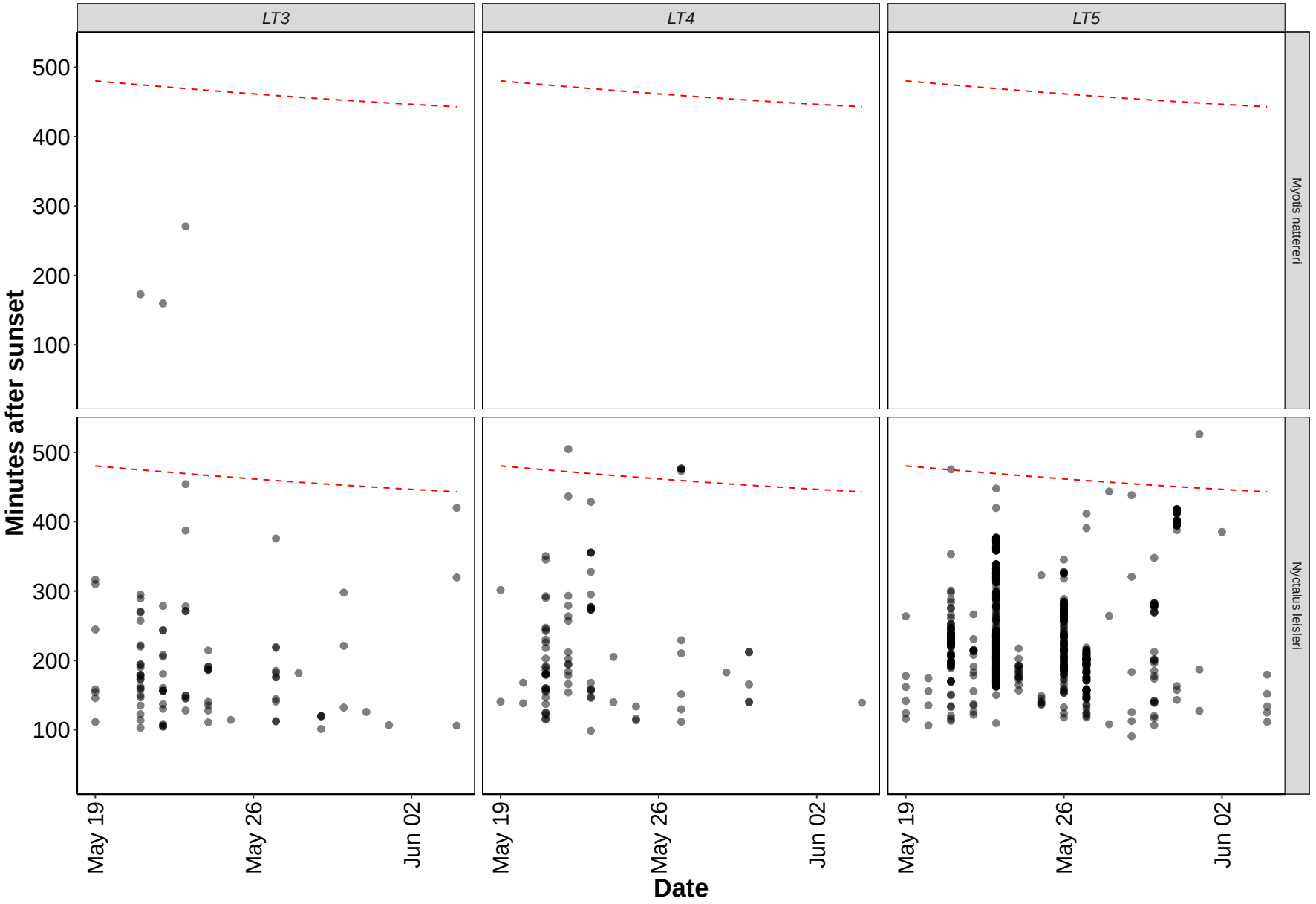

L10
LT1
LT2
Myotis daubentonii
Myotis mystacinus
Minutes after sunset
500
400
300
200
100
May 19
May 26
Jun 02
Date

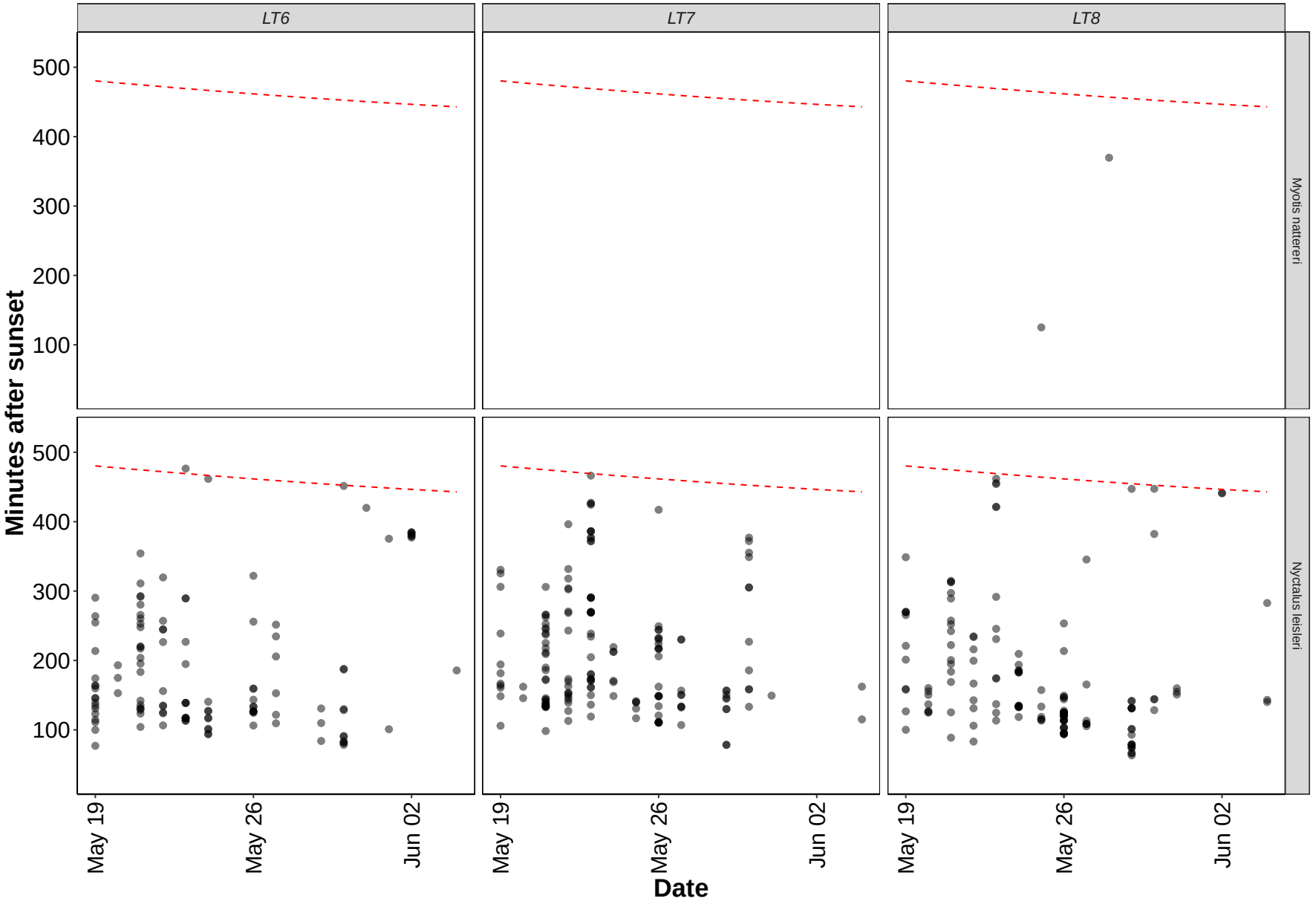

LT3
LT4
LT5
Myotis daubentonii
Myotis mystacinus
Minutes after sunset
500
400
300
200
100
May 19
May 26
Jun 02
Date

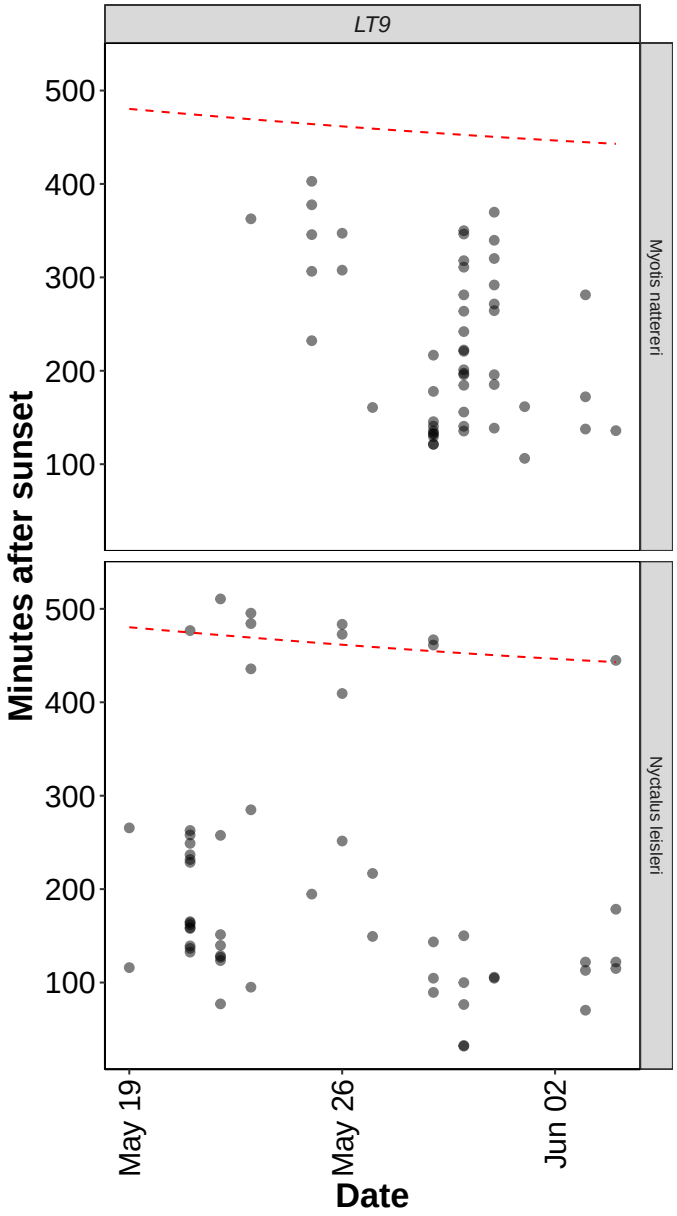

LT6
LT7
LT8
Myotis daubentonii
Myotis mystacinus
Minutes after sunset
500
400
300
200
100
May 19
May 26
Jun 02
Date

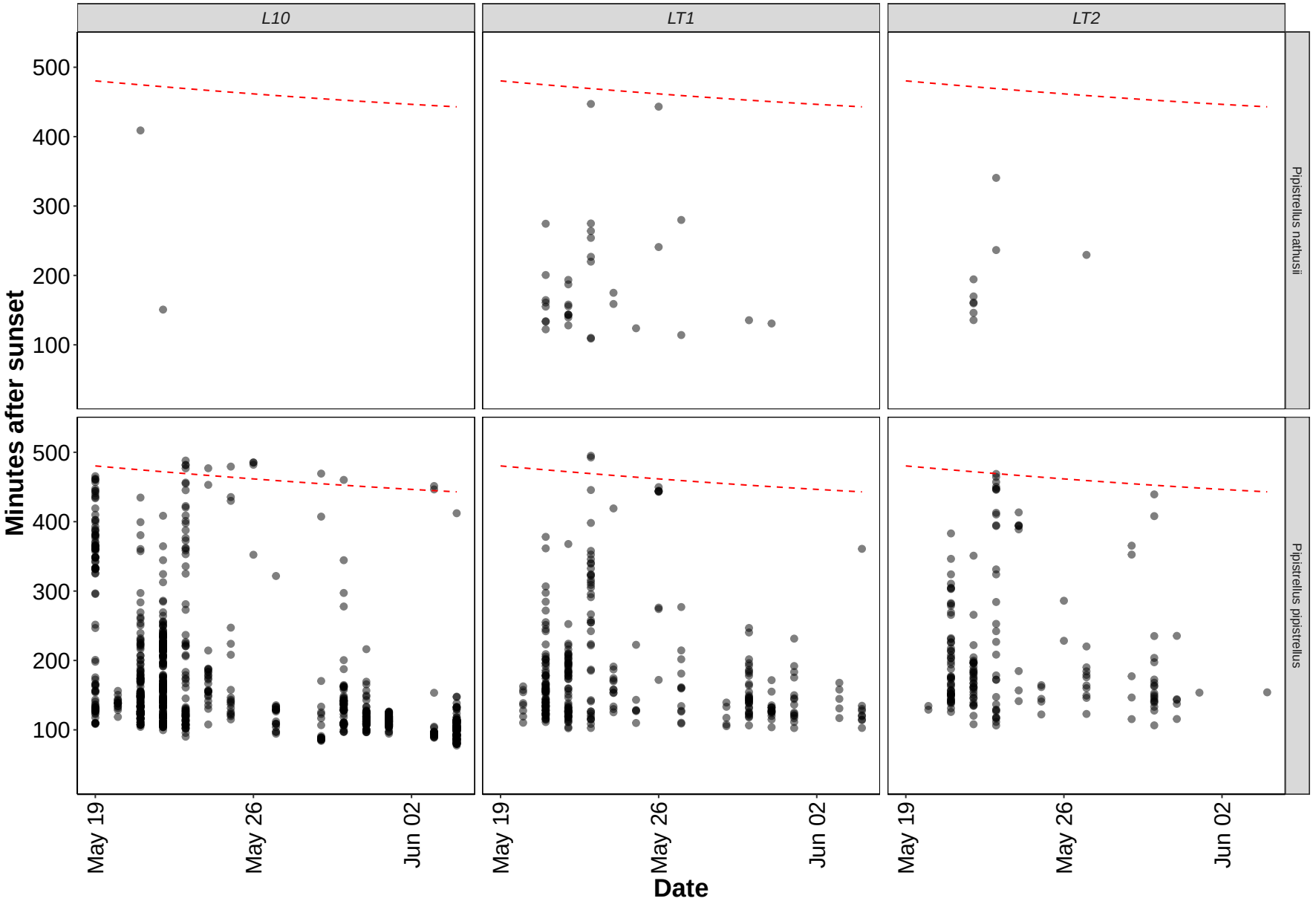

LT9
Myotis daubentonii
Myotis mystacinus
Minutes after sunset
500
400
300
200
100
May 19
May 26
Jun 02
Date

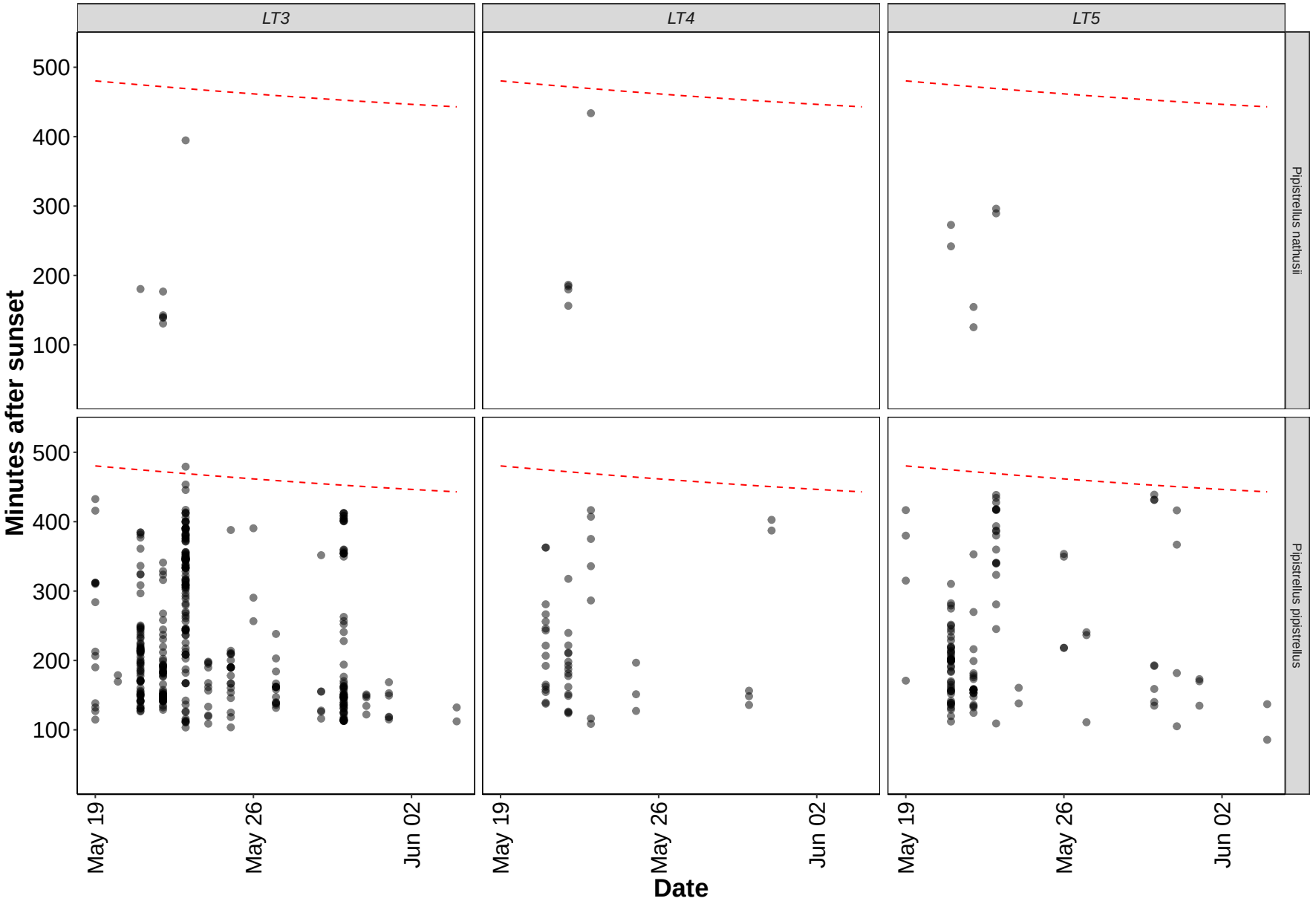

L10
LT1
LT2
Myotis nattereri
Nyctalus leisleri
Minutes after sunset
500
400
300
200
100
May 19
May 26
Jun 02
Date

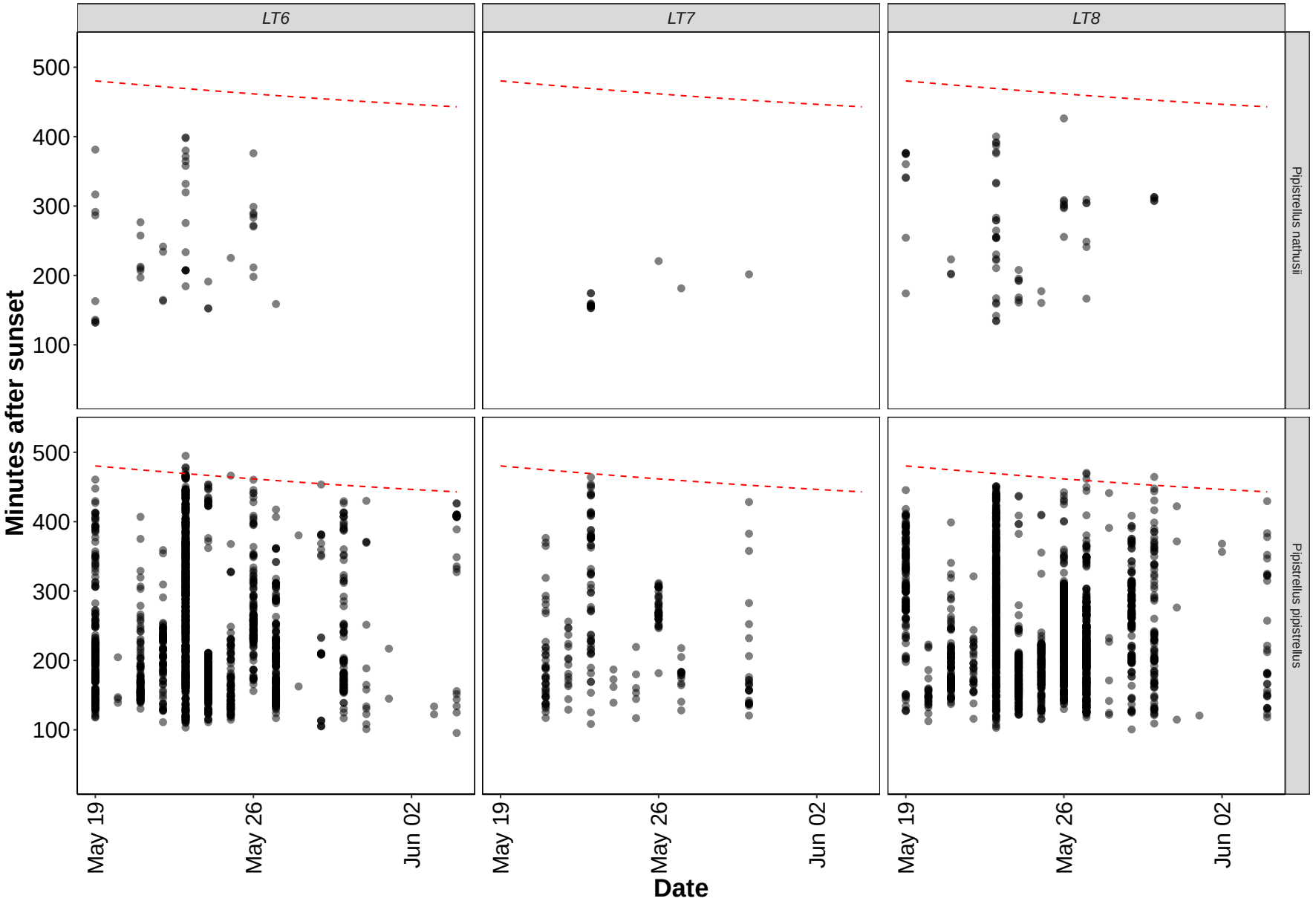

LT3
LT4
LT5
Myotis nattereri
Nyctalus leisleri
Minutes after sunset
500
400
300
200
100
May 19
May 26
Jun 02
Date

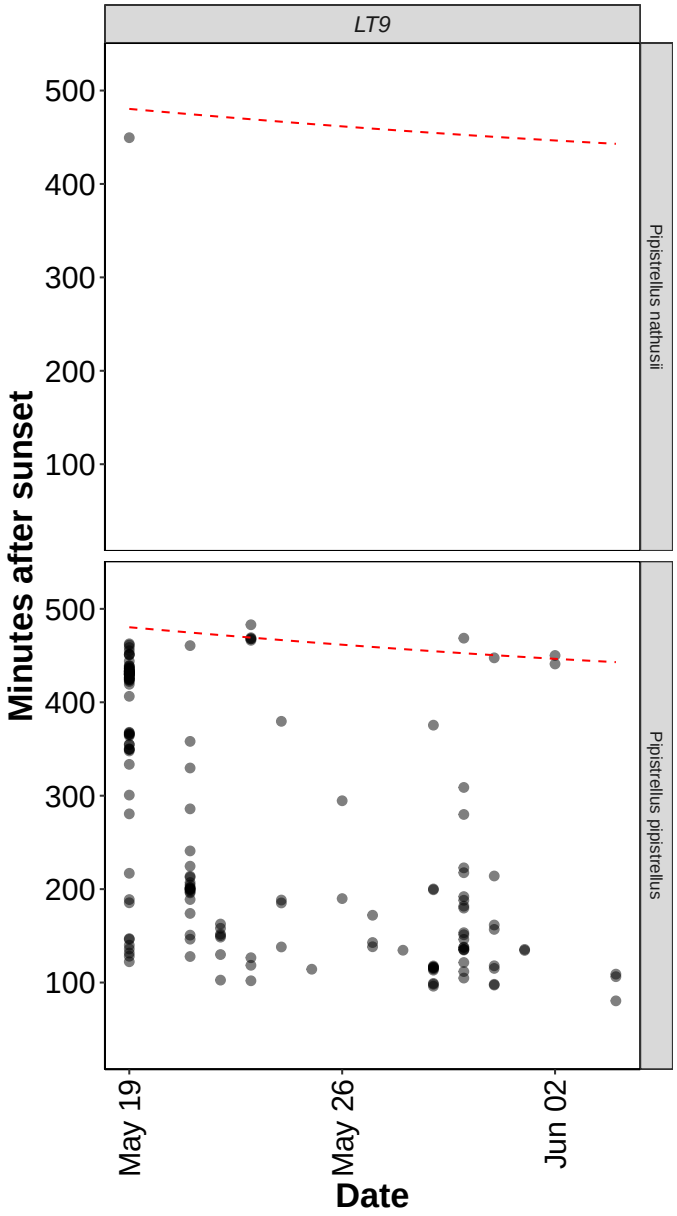

LT6
LT7
LT8
Myotis nattereri
Nyctalus leisleri
Minutes after sunset
500
400
300
200
100
May 19
May 26
Jun 02
Date


LT9
Myotis nattereri
Nyctalus leisleri
Minutes after sunset
500
400
300
200
100
May 19
May 26
Jun 02
Date


L10
LT1
LT2
Pipistrellus nathusii
Pipistrellus pipistrellus
Minutes after sunset
500
400
300
200
100
May 19
May 26
Jun 02
Date


LT3
LT4
LT5
Pipistrellus nathusii
Pipistrellus pipistrellus
Minutes after sunset
500
400
300
200
100
May 19
May 26
Jun 02
Date


LT6
LT7
LT8
Pipistrellus nathusii
Pipistrellus pipistrellus
Minutes after sunset
500
400
300
200
100
May 19
May 26
Jun 02
Date


LT9
Pipistrellus nathusii
Pipistrellus pipistrellus
Minutes after sunset
500
400
300
200
100
May 19
May 26
Jun 02
Date

Roost Emergence Time and Bat Observation

Based on: Russ, Jon. 2012. British Bat Calls a Guide to species Identification. Pelagic Publishing.

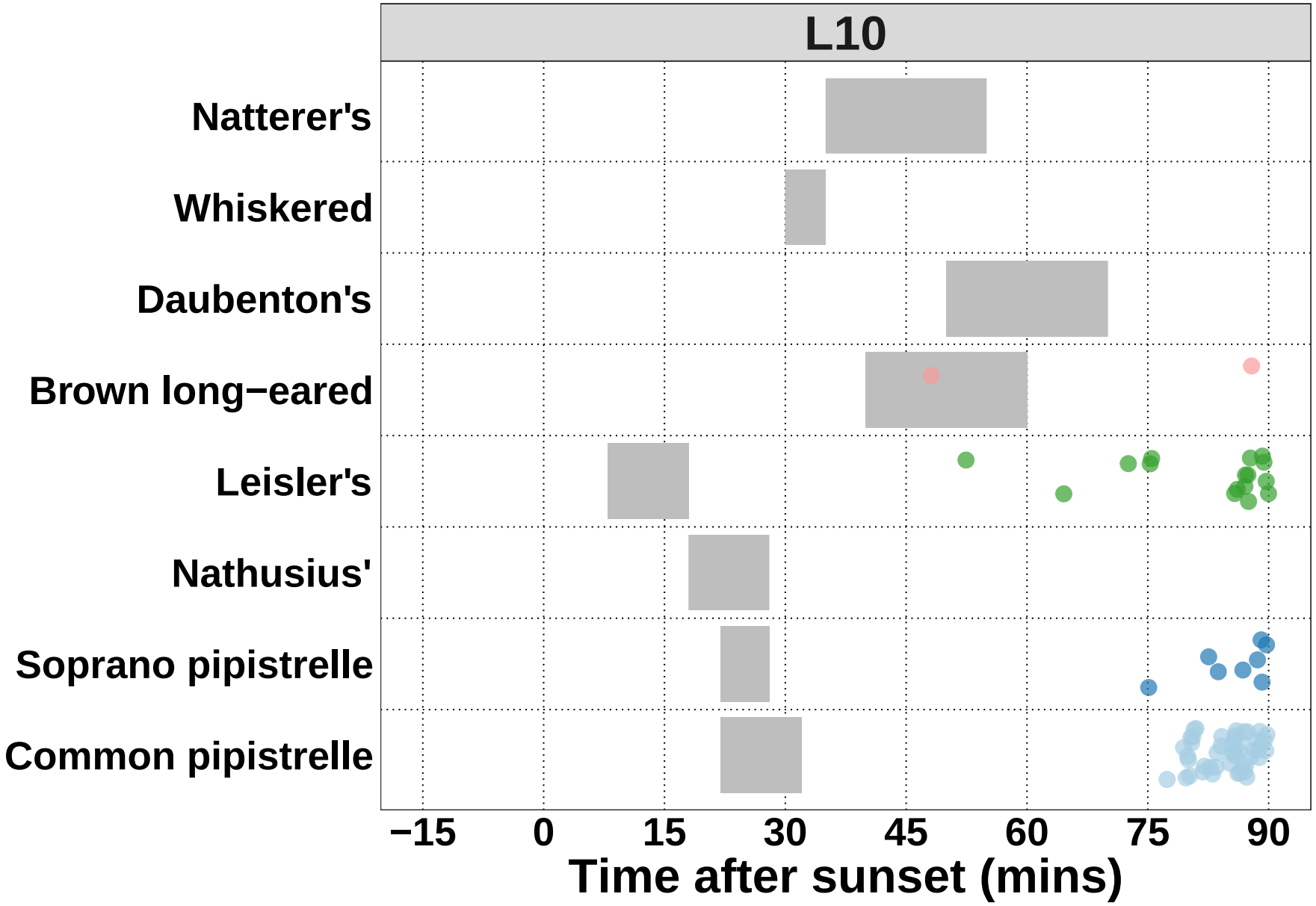
Bat Passes Potentially Indicating Close Proximity to a Roost (Russ 2012)

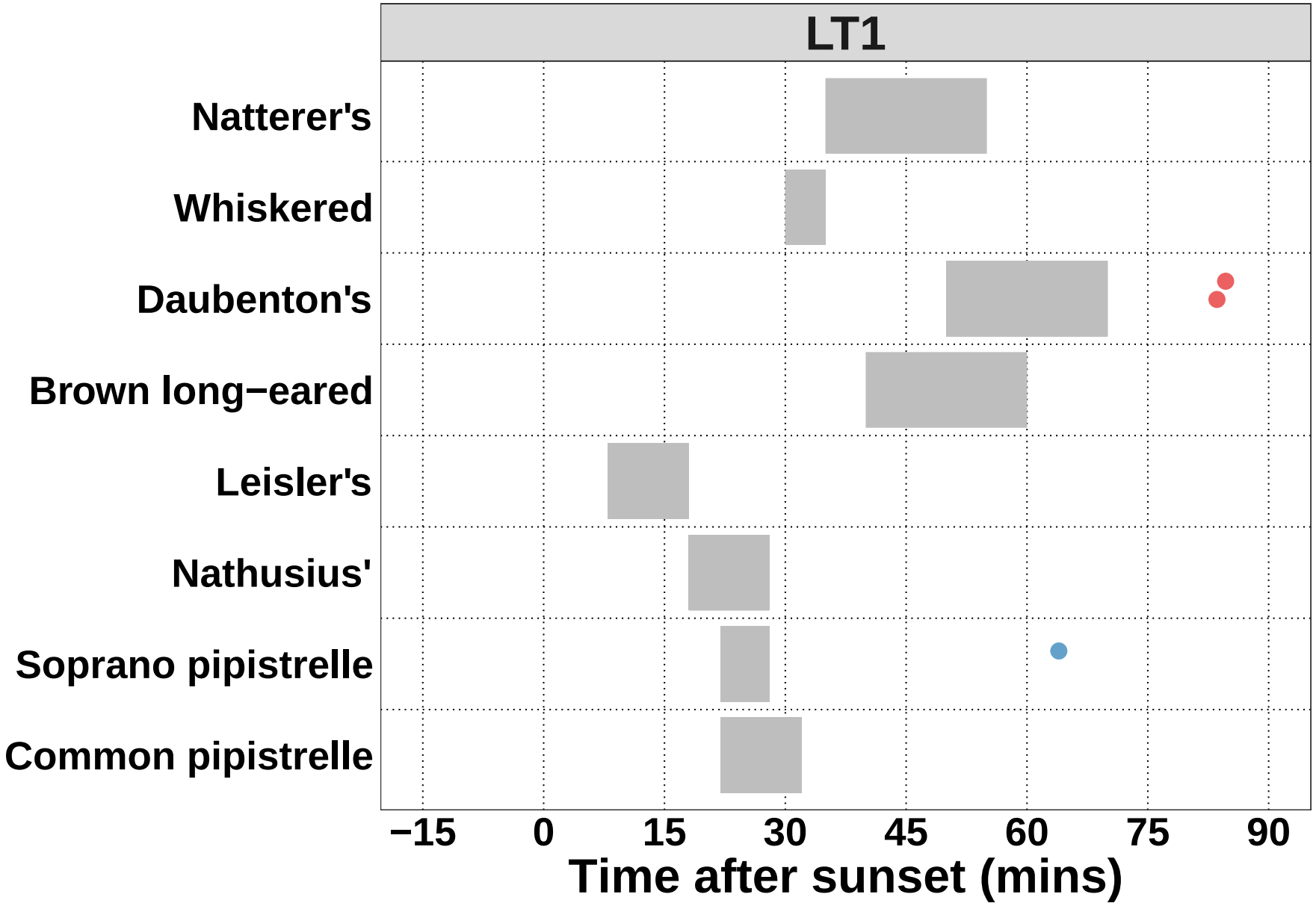
Table 12. Number of bat calls recorded before the upper time of the species-specific emergence time range, and which therefore may potentially indicate the presence of a nearby roost.

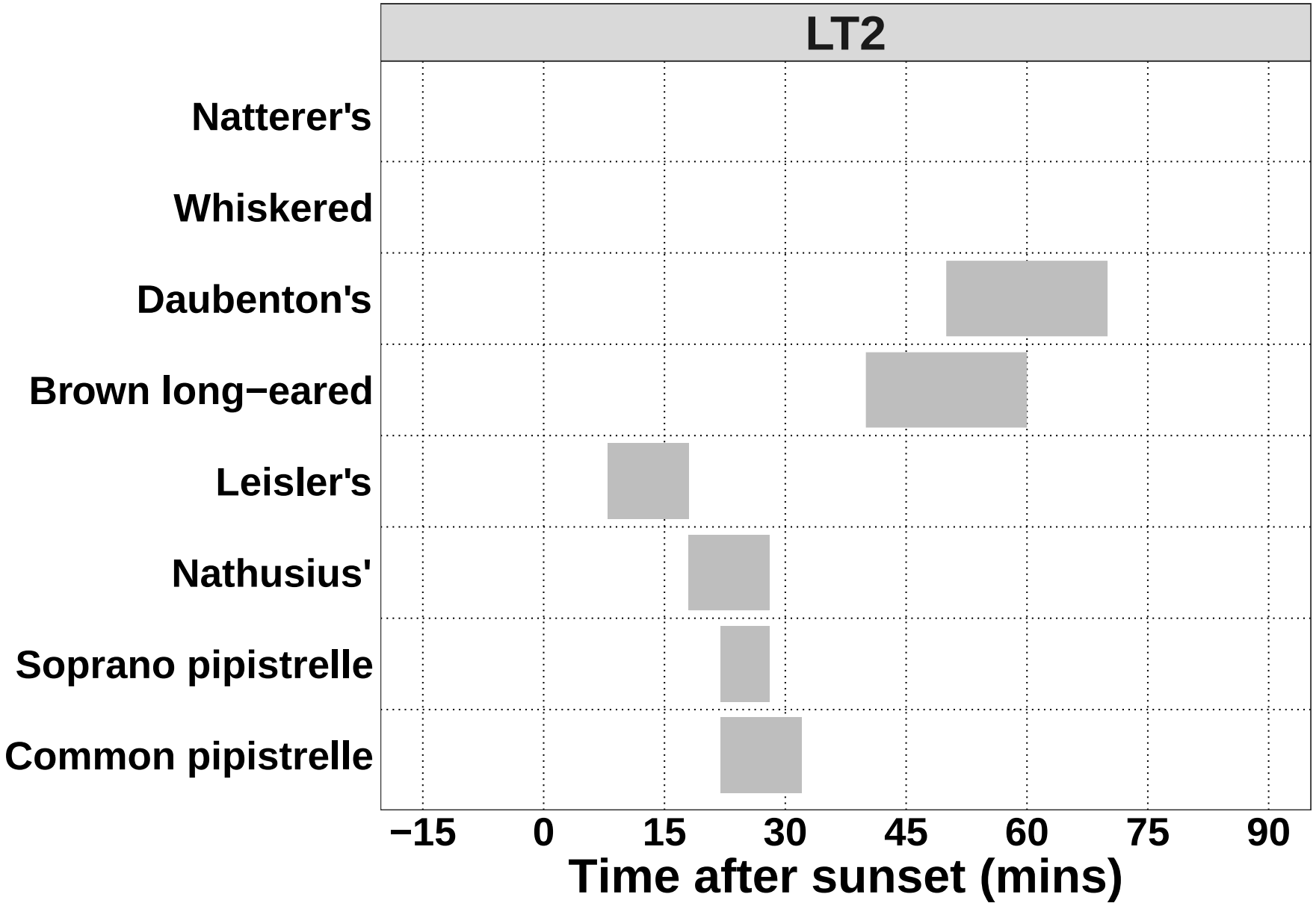
Species	Detector ID	2025-06-02
Brown long-eared	L10	1

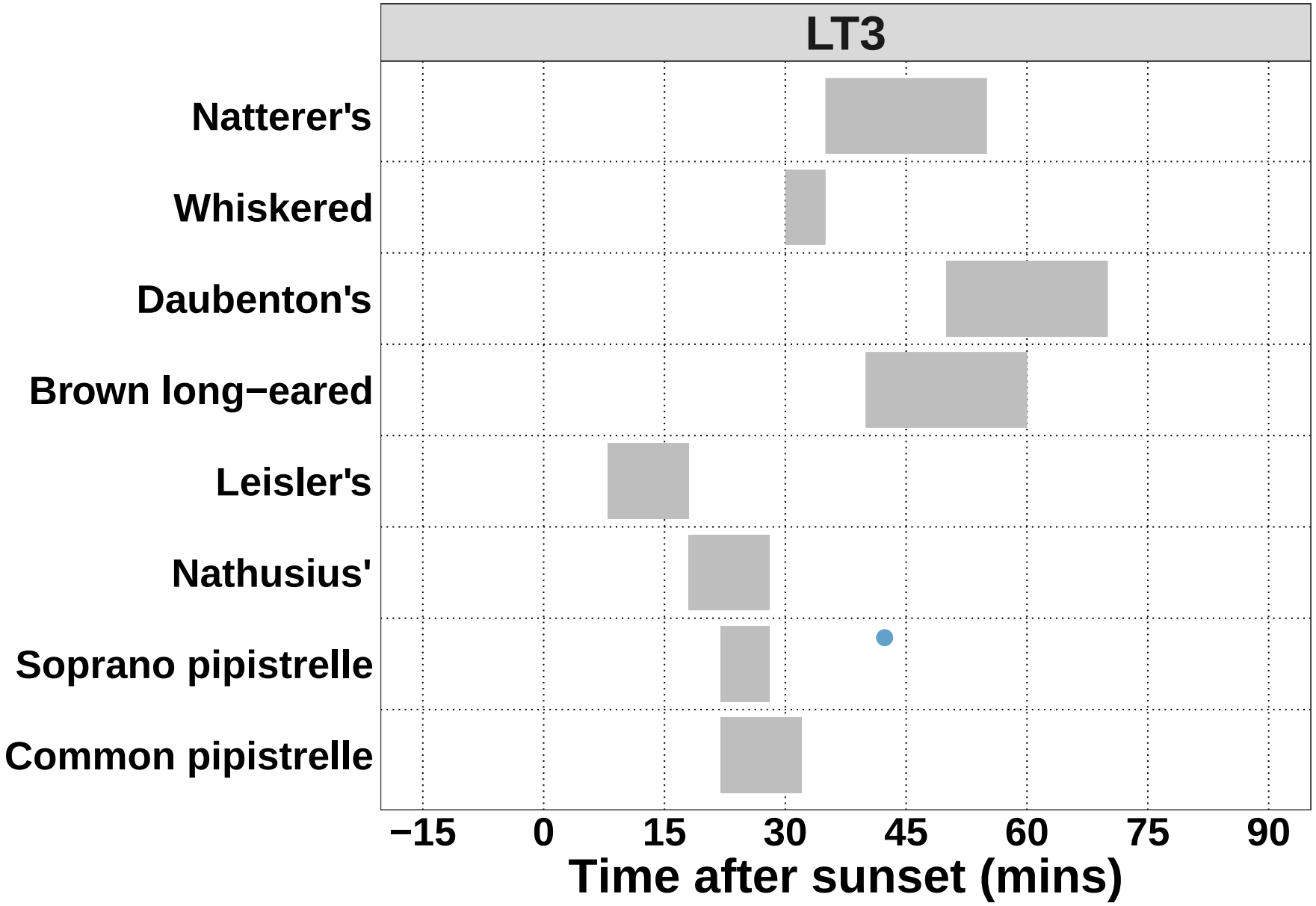
Bat Passes Potentially Indicating Close Proximity to a Roost (Russ 2012)

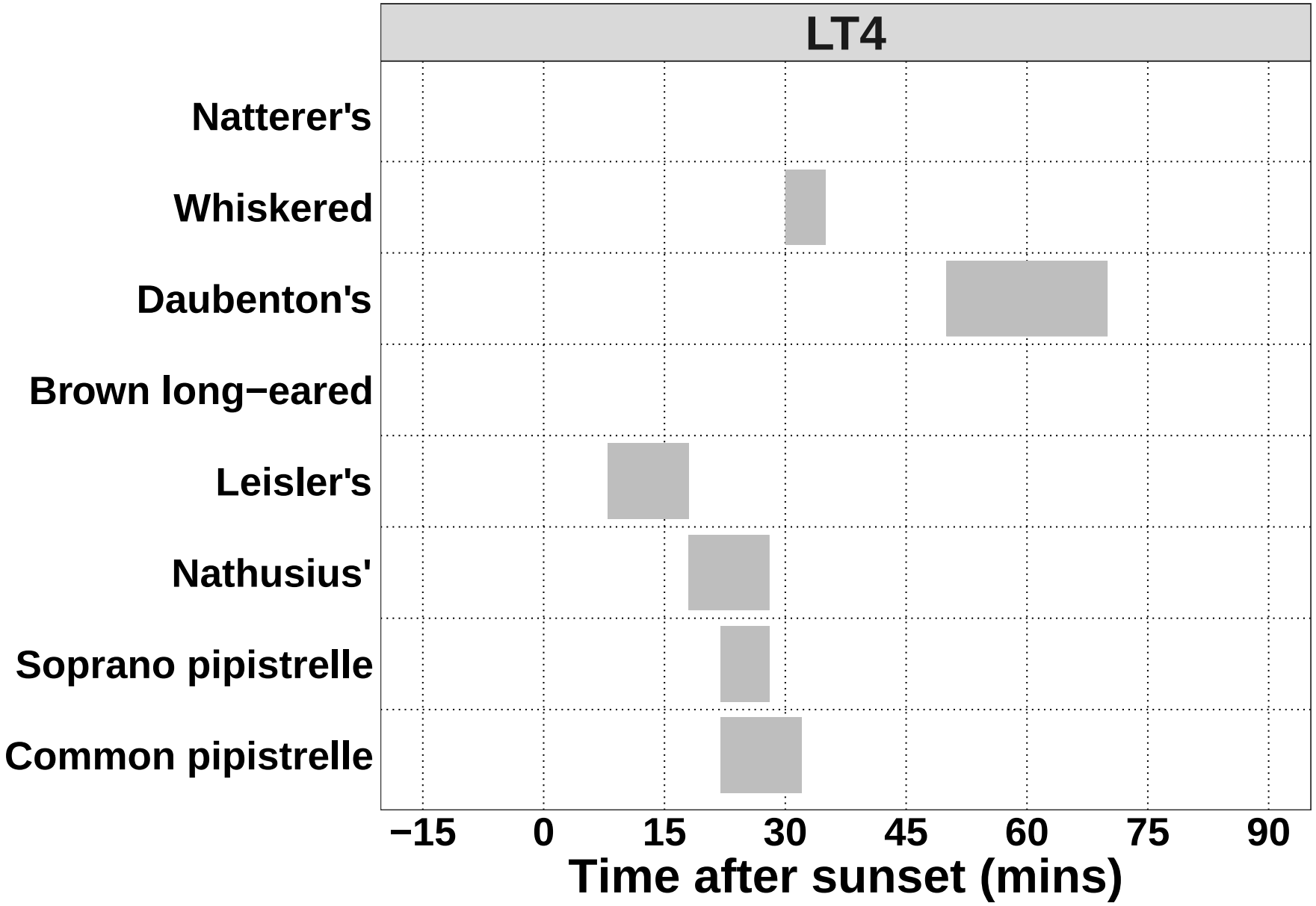
Figure 8. Time from 15 minutes before to 90 minutes after sunset. Species-specific emergence time ranges are shown as grey bars. Bat passes overlapping species-specific grey bars, or occuring earlier than this time range, may potentially indicate the presence of a nearby roost.

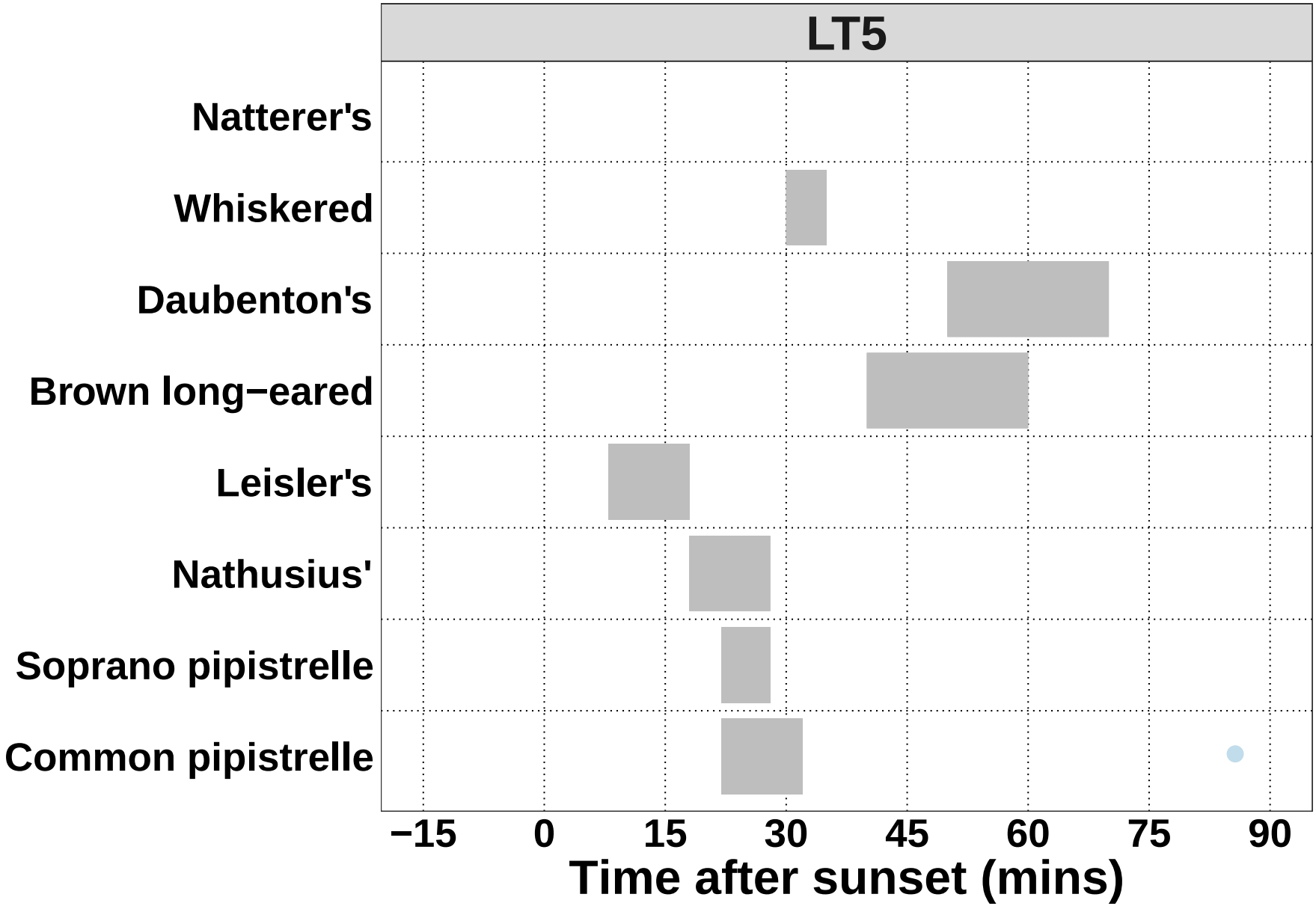

L10
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

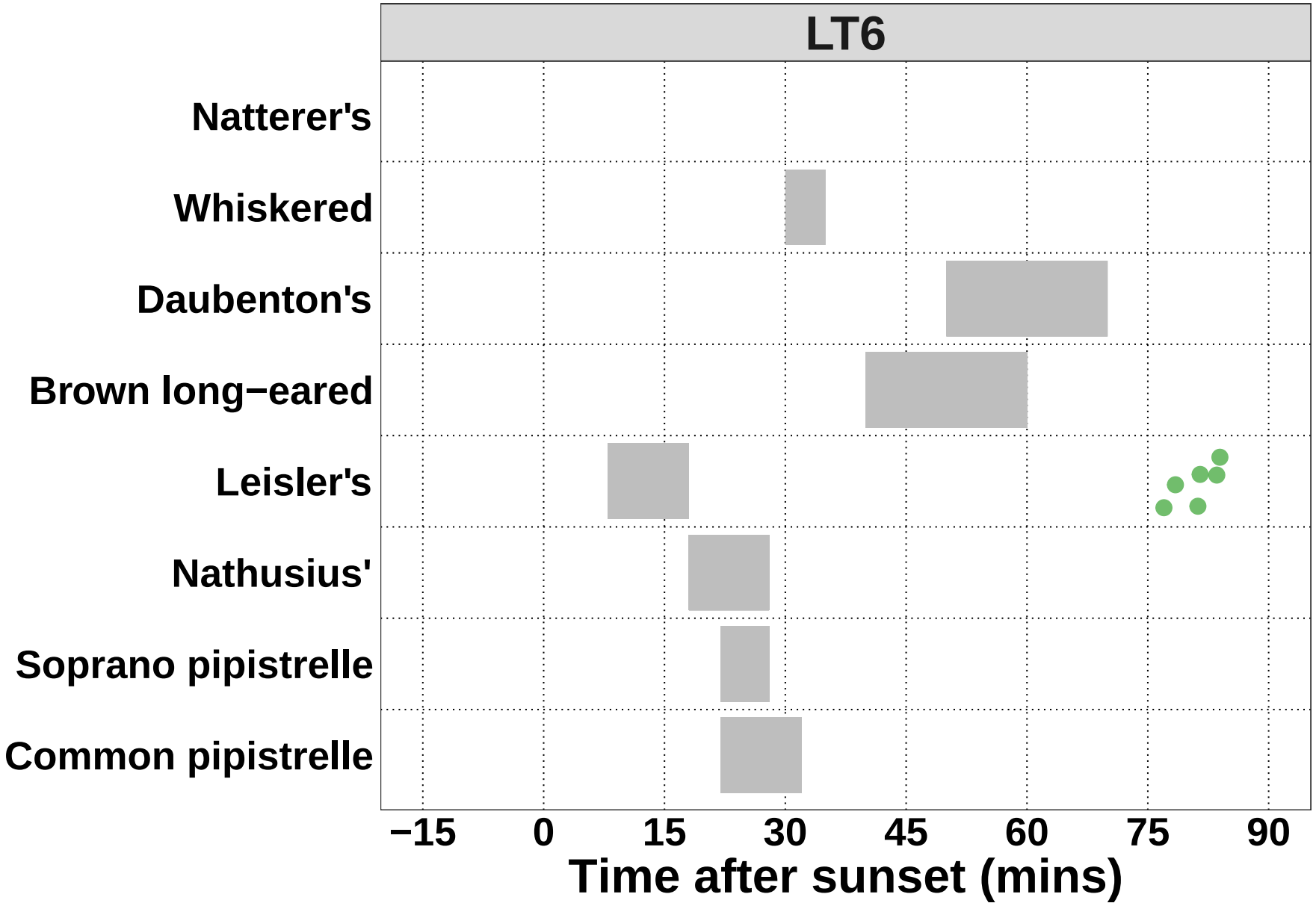

LT1
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

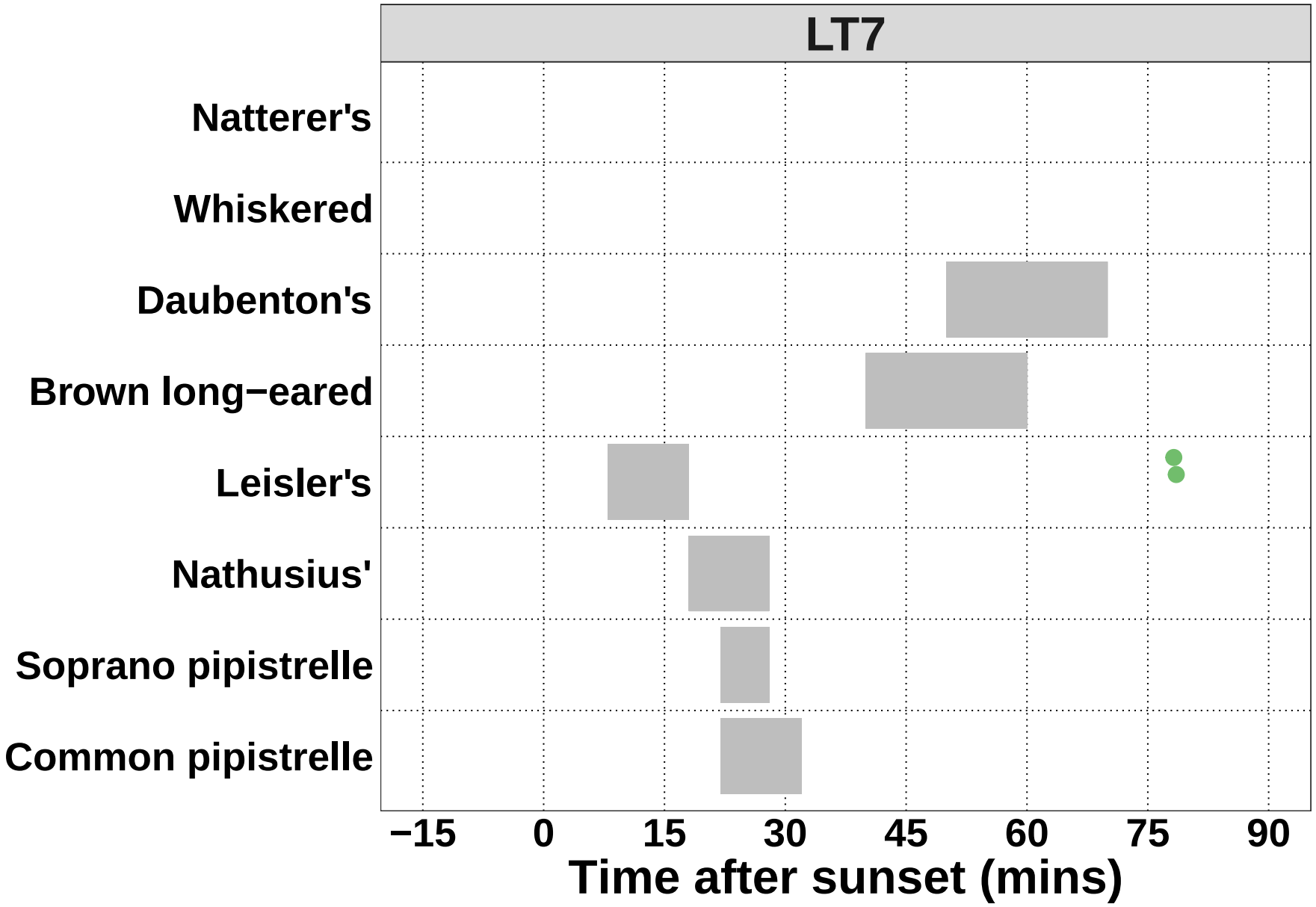

LT2
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

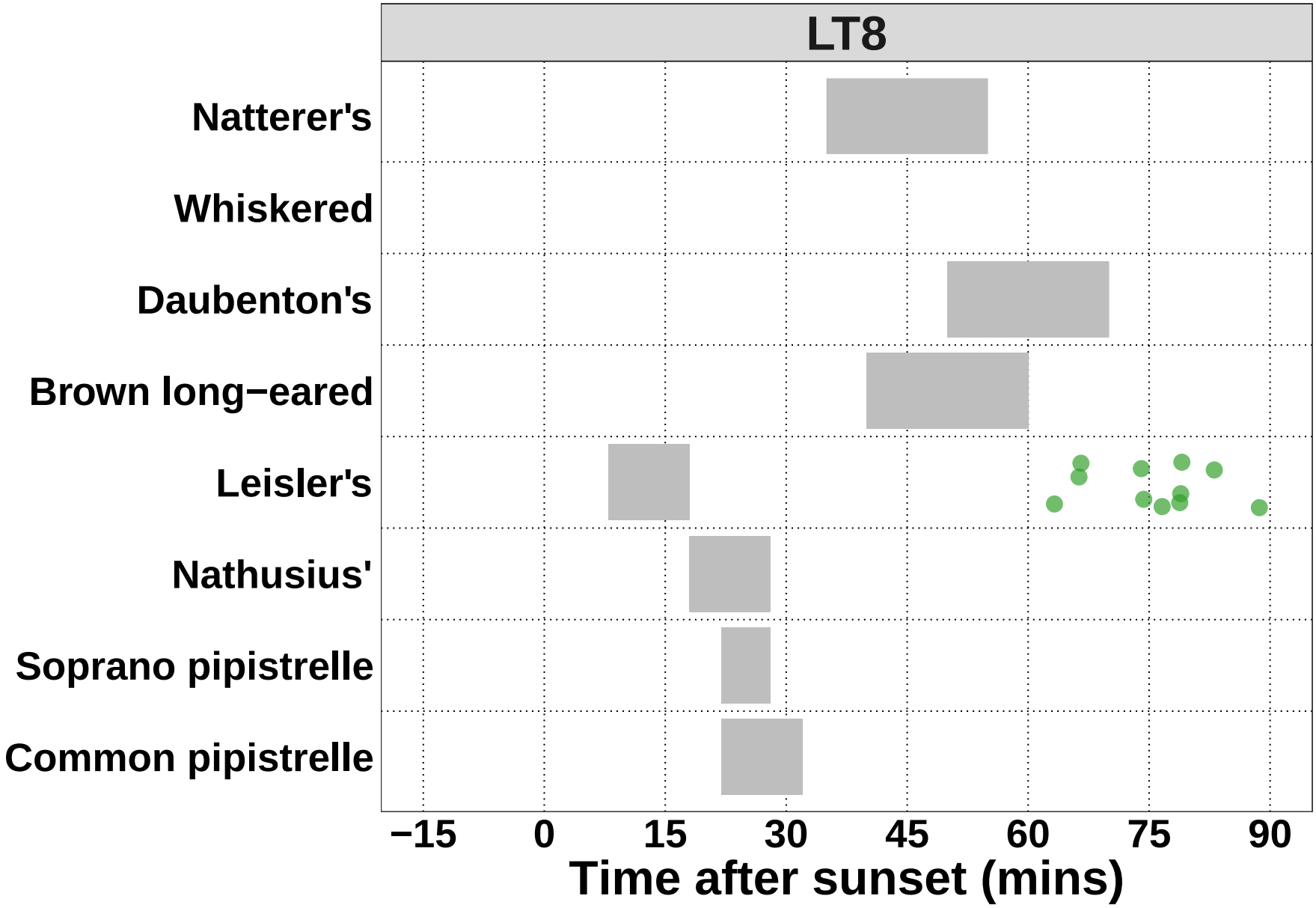

LT3
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

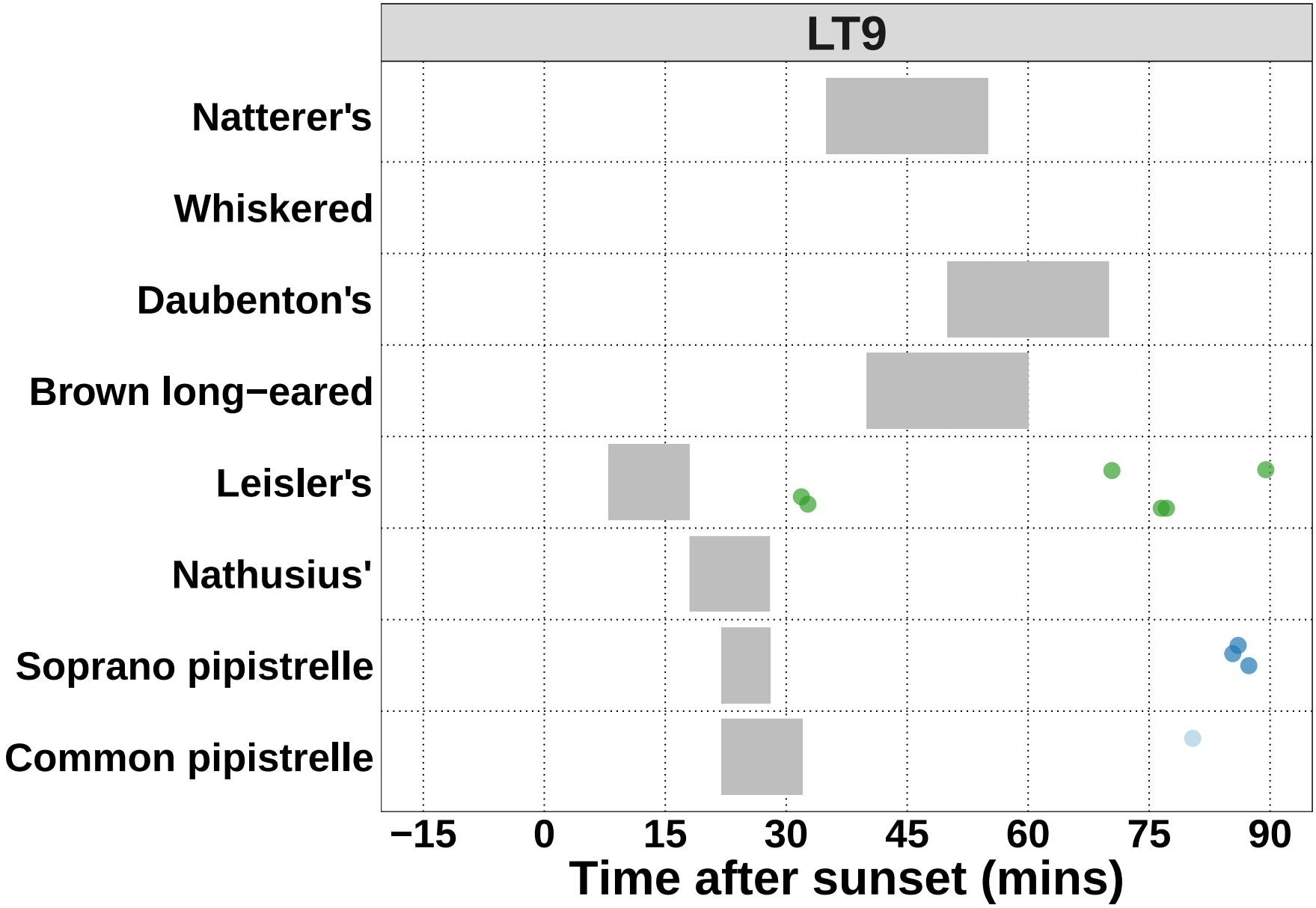

LT4
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)


LT5
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)


LT6
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)


LT7
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)


LT8
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)


LT9
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)

Count 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 (%)
Myotis daubentonii	118	1.0
Myotis mystacinus	20	0.2
Myotis nattereri	58	0.5
Nyctalus leisleri	1899	16.4
Pipistrellus nathusii	195	1.7
Pipistrellus pipistrellus	6909	59.8
Pipistrellus pygmaeus	2264	19.6
Plecotus auritus	96	0.8
Total	11559	100.0

Per Detector

The number of passes recorded for each species at each detector.

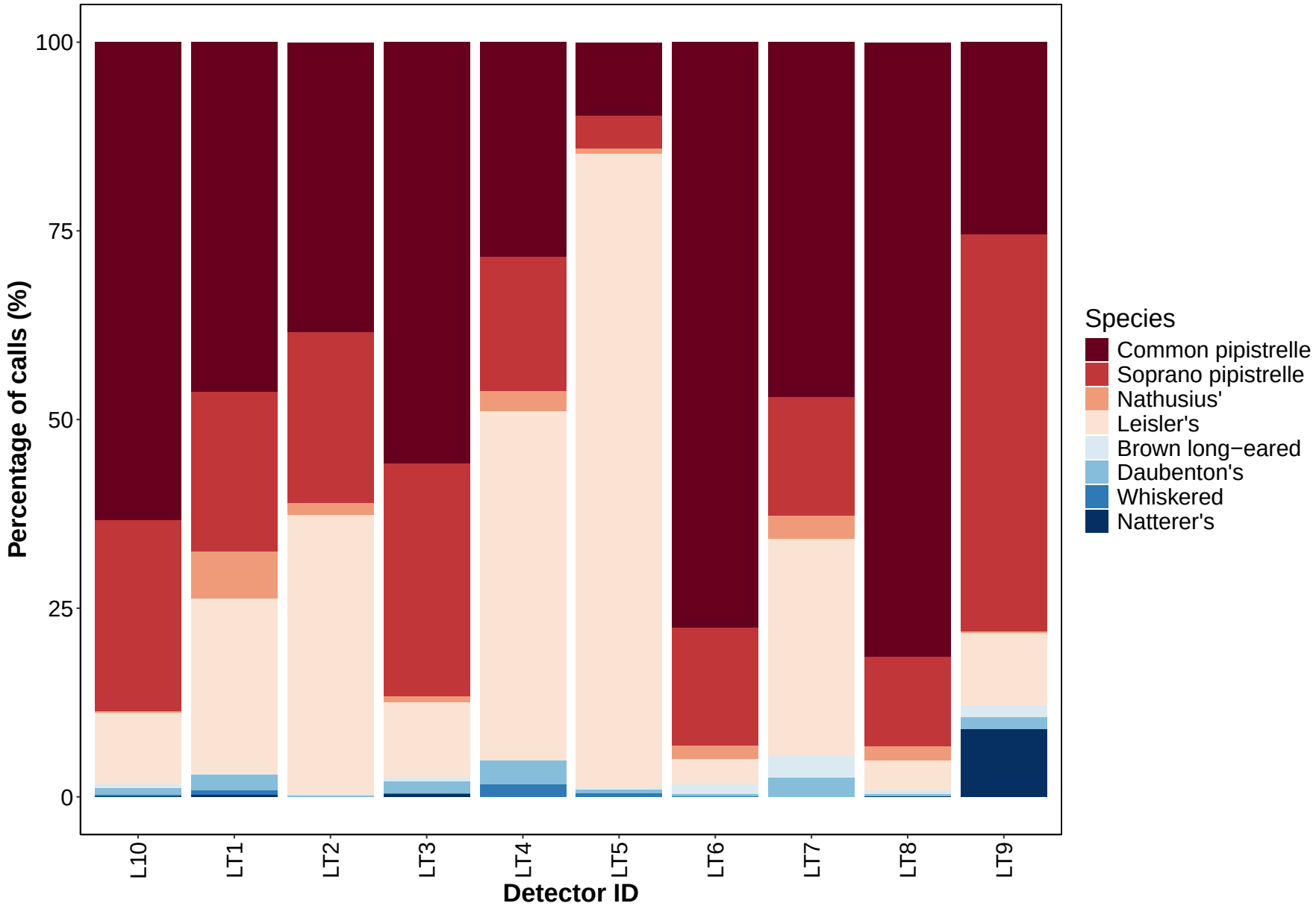
Species	Detector ID	Count (no.)	Percentage by Detector (%)
Common pipistrelle	L10	1012	62.3921085
Common pipistrelle	LT1	306	48.1132075
Common pipistrelle	LT2	175	38.2932166
Common pipistrelle	LT3	388	49.0518331
Common pipistrelle	LT4	47	26.1111111
Common pipistrelle	LT5	119	12.0202020
Common pipistrelle	LT6	1977	74.9431387
Common pipistrelle	LT7	211	41.4538310
Common pipistrelle	LT8	2510	79.1548407
Common pipistrelle	LT9	164	29.0265487
Soprano pipistrelle	L10	443	27.3119605
Soprano pipistrelle	LT1	131	20.5974843
Soprano pipistrelle	LT2	114	24.9452954
Soprano pipistrelle	LT3	280	35.3982301
Soprano pipistrelle	LT4	32	17.7777778
Soprano pipistrelle	LT5	54	5.4545455
Soprano pipistrelle	LT6	443	16.7930250
Soprano pipistrelle	LT7	89	17.4852652
Soprano pipistrelle	LT8	407	12.8350678
Soprano pipistrelle	LT9	271	47.9646018
Nathusius’	L10	2	0.1233046
Nathusius’	LT1	34	5.3459119
Nathusius’	LT2	9	1.9693654
Nathusius’	LT3	7	0.8849558
Nathusius’	LT4	5	2.7777778
Nathusius’	LT5	6	0.6060606
Nathusius’	LT6	48	1.8195603
Nathusius’	LT7	17	3.3398821
Nathusius’	LT8	66	2.0813623
Nathusius’	LT9	1	0.1769912
Leisler’s	L10	132	8.1381011
Leisler’s	LT1	143	22.4842767

Species	Detector ID	Count (no.)	Percentage by Detector (%)
Leisler's	LT2	156	34.1356674
Leisler's	LT3	92	11.6308470
Leisler's	LT4	89	49.4444444
Leisler's	LT5	796	80.4040404
Leisler's	LT6	122	4.6247157
Leisler's	LT7	163	32.0235756
Leisler's	LT8	150	4.7303690
Leisler's	LT9	56	9.9115044
Brown long-eared	L10	9	0.5548705
Brown long-eared	LT1	2	0.3144654
Brown long-eared	LT2	1	0.2188184
Brown long-eared	LT3	4	0.5056890
Brown long-eared	LT5	3	0.3030303
Brown long-eared	LT6	35	1.3267627
Brown long-eared	LT7	11	2.1611002
Brown long-eared	LT8	20	0.6307159
Brown long-eared	LT9	11	1.9469027
Daubenton's	L10	19	1.1713933
Daubenton's	LT1	14	2.2012579
Daubenton's	LT2	2	0.4376368
Daubenton's	LT3	16	2.0227560
Daubenton's	LT4	4	2.2222222
Daubenton's	LT5	6	0.6060606
Daubenton's	LT6	11	0.4169826
Daubenton's	LT7	18	3.5363458
Daubenton's	LT8	16	0.5045727
Daubenton's	LT9	12	2.1238938
Whiskered	L10	4	0.2466091
Whiskered	LT1	4	0.6289308
Whiskered	LT3	1	0.1264223
Whiskered	LT4	3	1.6666667
Whiskered	LT5	6	0.6060606
Whiskered	LT6	2	0.0758150
Natterer's	L10	1	0.0616523
Natterer's	LT1	2	0.3144654
Natterer's	LT3	3	0.3792668

Species	Detector ID	Count (no.)	Percentage by Detector (%)
Natterer's	LT8	2	0.0630716
Natterer's	LT9	50	8.8495575

Species Composition

Figure 10. Percentage species composition of passes at each detector.


100
75
50
25
0
Percentage of calls (%)
L10
LT1
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID
Species
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Brown long−eared
Daubenton's
Whiskered
Natterer's

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.

Nighlty 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	L10	9.6
Common pipistrelle	LT1	2.2
Common pipistrelle	LT2	1.4
Common pipistrelle	LT3	3.0
Common pipistrelle	LT4	0.7
Common pipistrelle	LT5	0.7
Common pipistrelle	LT6	12.2
Common pipistrelle	LT7	5.3
Common pipistrelle	LT8	20.3
Common pipistrelle	LT9	1.0
Soprano pipistrelle	L10	3.7
Soprano pipistrelle	LT1	1.1
Soprano pipistrelle	LT2	1.3
Soprano pipistrelle	LT3	1.4
Soprano pipistrelle	LT4	0.4
Soprano pipistrelle	LT5	0.7
Soprano pipistrelle	LT6	3.1
Soprano pipistrelle	LT7	1.3
Soprano pipistrelle	LT8	2.8
Soprano pipistrelle	LT9	2.9
Nathusius'	L10	0.2
Nathusius'	LT1	0.4
Nathusius'	LT2	0.3
Nathusius'	LT3	0.1
Nathusius'	LT4	0.3
Nathusius'	LT5	0.5
Nathusius'	LT6	1.0
Nathusius'	LT7	0.3
Nathusius'	LT8	1.1
Nathusius'	LT9	0.1
Leisler's	L10	1.3
Leisler's	LT1	0.8
Leisler's	LT2	0.5
Leisler's	LT3	0.5
Leisler's	LT4	0.4
Leisler's	LT5	5.0

Species	Detector ID	Median Pass Rate
Leisler's	LT6	1.1
Leisler's	LT7	1.2
Leisler's	LT8	1.6
Leisler's	LT9	0.6
Brown long-eared	L10	0.2
Brown long-eared	LT1	0.3
Brown long-eared	LT2	0.1
Brown long-eared	LT3	0.2
Brown long-eared	LT5	0.1
Brown long-eared	LT6	0.5
Brown long-eared	LT7	0.3
Brown long-eared	LT8	0.6
Brown long-eared	LT9	0.2
Daubenton's	L10	0.3
Daubenton's	LT1	0.3
Daubenton's	LT2	0.1
Daubenton's	LT3	0.2
Daubenton's	LT4	0.4
Daubenton's	LT5	0.3
Daubenton's	LT6	0.1
Daubenton's	LT7	0.2
Daubenton's	LT8	0.1
Daubenton's	LT9	0.1
Whiskered	L10	0.3
Whiskered	LT1	0.1
Whiskered	LT3	0.1
Whiskered	LT4	0.2
Whiskered	LT5	0.1
Whiskered	LT6	0.1
Natterer's	L10	0.1
Natterer's	LT1	0.1
Natterer's	LT3	0.1
Natterer's	LT8	0.1
Natterer's	LT9	0.5

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.

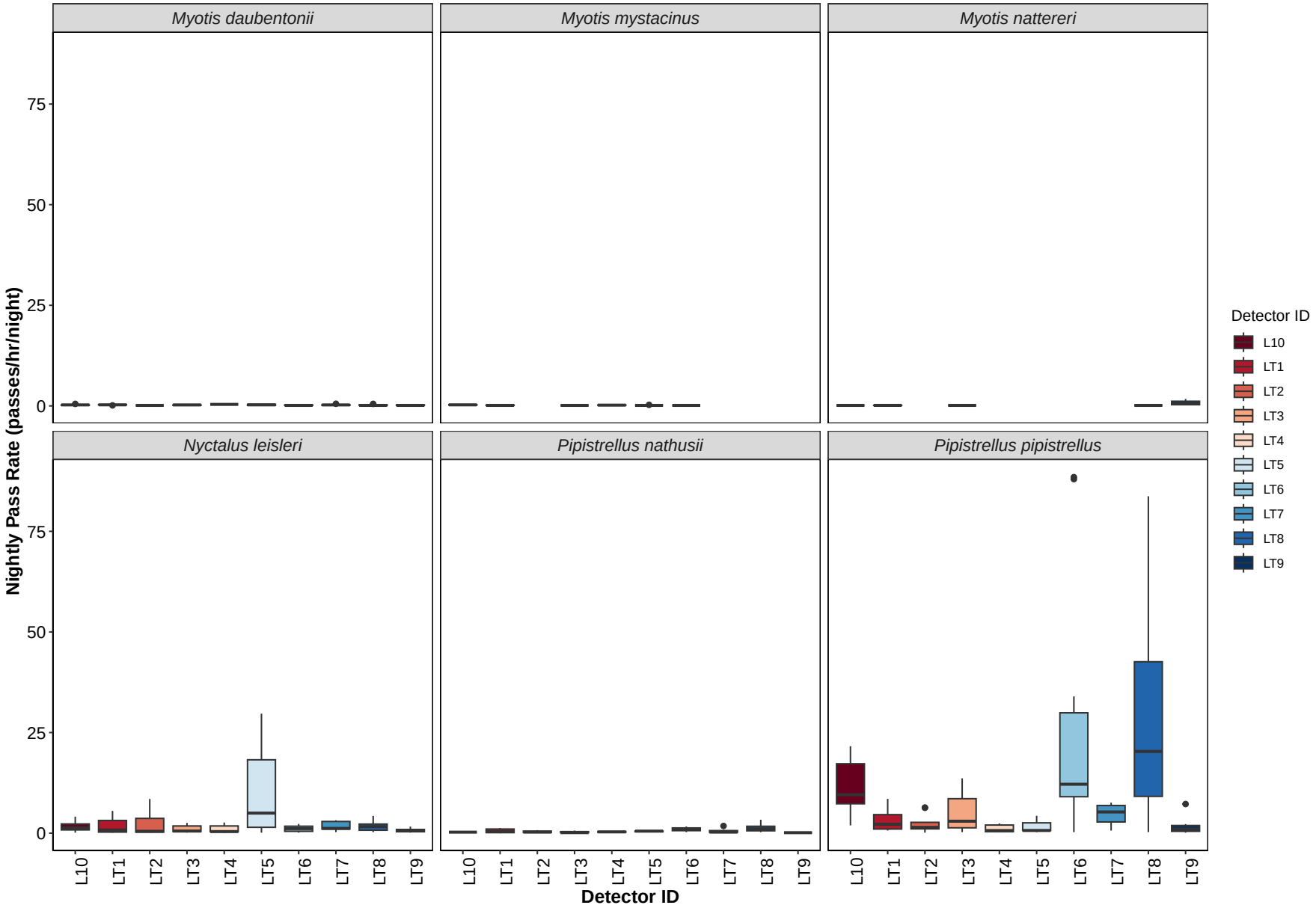
Species	Detector ID	Mean Pass Rate
Common pipistrelle	L10	11.2
Common pipistrelle	LT1	3.1
Common pipistrelle	LT2	2.2
Common pipistrelle	LT3	5.1
Common pipistrelle	LT4	1.1
Common pipistrelle	LT5	1.6
Common pipistrelle	LT6	23.2
Common pipistrelle	LT7	4.8
Common pipistrelle	LT8	30.4
Common pipistrelle	LT9	1.4
Soprano pipistrelle	L10	4.2
Soprano pipistrelle	LT1	1.4
Soprano pipistrelle	LT2	1.3
Soprano pipistrelle	LT3	2.7
Soprano pipistrelle	LT4	0.5
Soprano pipistrelle	LT5	0.7
Soprano pipistrelle	LT6	5.0
Soprano pipistrelle	LT7	1.2
Soprano pipistrelle	LT8	4.4
Soprano pipistrelle	LT9	3.0
Nathusius'	L10	0.2
Nathusius'	LT1	0.6
Nathusius'	LT2	0.4
Nathusius'	LT3	0.3
Nathusius'	LT4	0.3
Nathusius'	LT5	0.4
Nathusius'	LT6	1.0
Nathusius'	LT7	0.6
Nathusius'	LT8	1.4
Nathusius'	LT9	0.1

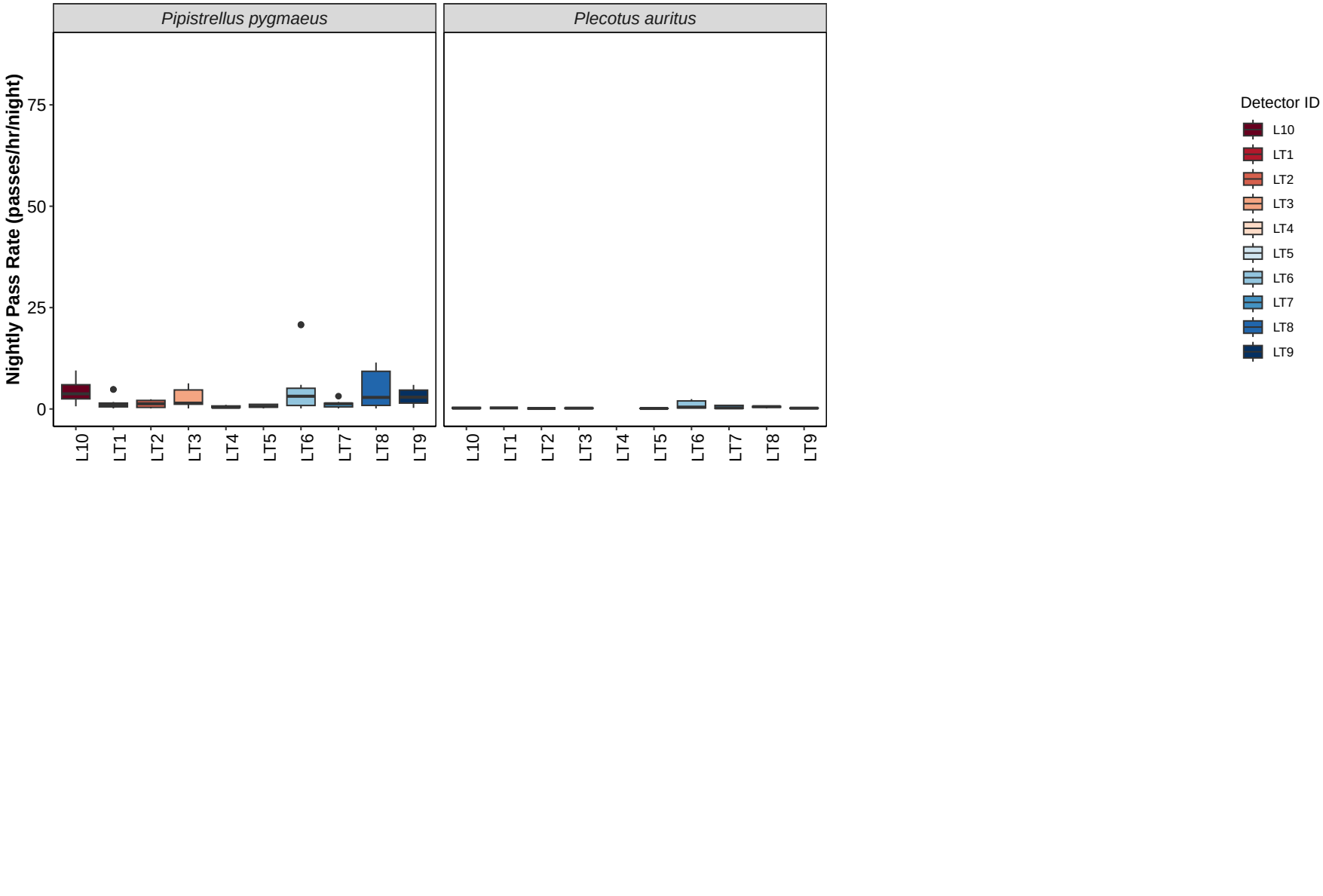
Species	Detector ID	Mean Pass Rate
Leisler's	L10	1.7
Leisler's	LT1	1.7
Leisler's	LT2	2.3
Leisler's	LT3	1.0
Leisler's	LT4	1.0
Leisler's	LT5	9.6
Leisler's	LT6	1.2
Leisler's	LT7	1.8
Leisler's	LT8	1.7
Leisler's	LT9	0.7
Brown long-eared	L10	0.2
Brown long-eared	LT1	0.3
Brown long-eared	LT2	0.1
Brown long-eared	LT3	0.2
Brown long-eared	LT5	0.1
Brown long-eared	LT6	1.0
Brown long-eared	LT7	0.5
Brown long-eared	LT8	0.5
Brown long-eared	LT9	0.2
Daubenton's	L10	0.2
Daubenton's	LT1	0.3
Daubenton's	LT2	0.1
Daubenton's	LT3	0.2
Daubenton's	LT4	0.4
Daubenton's	LT5	0.3
Daubenton's	LT6	0.2
Daubenton's	LT7	0.3
Daubenton's	LT8	0.2
Daubenton's	LT9	0.2
Whiskered	L10	0.3
Whiskered	LT1	0.2
Whiskered	LT3	0.1
Whiskered	LT4	0.2
Whiskered	LT5	0.2
Whiskered	LT6	0.1
Natterer's	L10	0.1

Species	Detector ID	Mean Pass Rate
Natterer's	LT1	0.1
Natterer's	LT3	0.1
Natterer's	LT8	0.1
Natterer's	LT9	0.8

Per Detector

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)
0
25
50
75
L10
LT1
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID
Detector ID


Pipistrellus pygmaeus
Plecotus auritus
Nightly Pass Rate (passes/hr/night)
0
25
50
75
L10
LT1
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID
Detector ID
L10
LT1
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9

Split by Month

Total Bat Passes per Detector each Month

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	May	Jun
Common pipistrelle	L10	937	355
Common pipistrelle	LT1	310	27
Common pipistrelle	LT2	218	3
Common pipistrelle	LT3	548	8
Common pipistrelle	LT4	53	0
Common pipistrelle	LT5	131	7
Common pipistrelle	LT6	2853	31
Common pipistrelle	LT7	297	0
Common pipistrelle	LT8	3735	24
Common pipistrelle	LT9	160	9
Soprano pipistrelle	L10	447	69
Soprano pipistrelle	LT1	133	20
Soprano pipistrelle	LT2	123	8
Soprano pipistrelle	LT3	285	23
Soprano pipistrelle	LT4	32	1
Soprano pipistrelle	LT5	61	0
Soprano pipistrelle	LT6	581	3
Soprano pipistrelle	LT7	99	1
Soprano pipistrelle	LT8	535	12
Soprano pipistrelle	LT9	337	11
Nathusius'	L10	4	0
Nathusius'	LT1	45	0
Nathusius'	LT2	9	0
Nathusius'	LT3	7	0
Nathusius'	LT4	5	0
Nathusius'	LT5	10	0
Nathusius'	LT6	63	0
Nathusius'	LT7	19	0
Nathusius'	LT8	88	0
Nathusius'	LT9	1	0
Leisler's	L10	174	19
Leisler's	LT1	165	3
Leisler's	LT2	211	2
Leisler's	LT3	96	3
Leisler's	LT4	85	1
Leisler's	LT5	1139	45

Species	Detector ID	May	Jun
Leisler's	LT6	116	10
Leisler's	LT7	180	2
Leisler's	LT8	176	4
Leisler's	LT9	58	6
Brown long-eared	L10	3	8
Brown long-eared	LT1	2	0
Brown long-eared	LT2	1	0
Brown long-eared	LT3	6	0
Brown long-eared	LT5	2	1
Brown long-eared	LT6	47	1
Brown long-eared	LT7	18	0
Brown long-eared	LT8	23	1
Brown long-eared	LT9	9	1
Daubenton's	L10	13	5
Daubenton's	LT1	11	4
Daubenton's	LT2	1	0
Daubenton's	LT3	12	4
Daubenton's	LT4	6	0
Daubenton's	LT5	5	3
Daubenton's	LT6	7	4
Daubenton's	LT7	12	4
Daubenton's	LT8	10	3
Daubenton's	LT9	6	5
Whiskered	L10	1	3
Whiskered	LT1	4	0
Whiskered	LT3	1	0
Whiskered	LT4	3	0
Whiskered	LT5	4	2
Whiskered	LT6	2	0
Natterer's	L10	1	0
Natterer's	LT1	1	1
Natterer's	LT3	3	0
Natterer's	LT8	2	0
Natterer's	LT9	47	12

Survey Effort

Table 19. The number of survey nights per month per detector.

month	Detector ID	No. of Survey Nights
May	L10	13
May	LT1	12
May	LT2	11
May	LT3	13
May	LT4	11
May	LT5	13
May	LT6	13
May	LT7	12
May	LT8	13
May	LT9	12
Jun	L10	4
Jun	LT1	3
Jun	LT2	3
Jun	LT3	4
Jun	LT4	1
Jun	LT5	3
Jun	LT6	4
Jun	LT7	2
Jun	LT8	4
Jun	LT9	4

Nightly Bat Passes 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	May	Jun
Common pipistrelle	L10	9.5	19.2
Common pipistrelle	LT1	2.4	1.1
Common pipistrelle	LT2	2.2	0.2
Common pipistrelle	LT3	5.0	0.5
Common pipistrelle	LT4	0.7	NA
Common pipistrelle	LT5	0.7	0.5
Common pipistrelle	LT6	15.0	0.8
Common pipistrelle	LT7	5.3	NA
Common pipistrelle	LT8	21.8	0.5
Common pipistrelle	LT9	1.2	0.4
Soprano pipistrelle	L10	4.5	3.5
Soprano pipistrelle	LT1	1.0	1.1
Soprano pipistrelle	LT2	1.9	0.1
Soprano pipistrelle	LT3	2.9	1.2
Soprano pipistrelle	LT4	0.4	0.1
Soprano pipistrelle	LT5	0.7	NA
Soprano pipistrelle	LT6	4.0	0.1
Soprano pipistrelle	LT7	1.3	0.1
Soprano pipistrelle	LT8	3.3	0.1
Soprano pipistrelle	LT9	3.4	0.3
Nathusius'	L10	0.2	NA
Nathusius'	LT1	0.4	NA
Nathusius'	LT2	0.3	NA
Nathusius'	LT3	0.1	NA
Nathusius'	LT4	0.3	NA
Nathusius'	LT5	0.5	NA
Nathusius'	LT6	1.0	NA
Nathusius'	LT7	0.3	NA
Nathusius'	LT8	1.1	NA
Nathusius'	LT9	0.1	NA
Leisler's	L10	1.8	0.8
Leisler's	LT1	0.9	0.2
Leisler's	LT2	0.5	0.3
Leisler's	LT3	0.5	0.2
Leisler's	LT4	0.6	0.1
Leisler's	LT5	5.2	0.7

Species	Detector ID	May	Jun
Leisler's	LT6	1.4	0.3
Leisler's	LT7	1.8	0.3
Leisler's	LT8	1.8	0.3
Leisler's	LT9	0.7	0.4
Brown long-eared	L10	0.1	0.4
Brown long-eared	LT1	0.3	NA
Brown long-eared	LT2	0.1	NA
Brown long-eared	LT3	0.2	NA
Brown long-eared	LT5	0.1	0.1
Brown long-eared	LT6	0.7	0.1
Brown long-eared	LT7	0.3	NA
Brown long-eared	LT8	0.6	0.1
Brown long-eared	LT9	0.3	0.1
Daubenton's	L10	0.2	0.3
Daubenton's	LT1	0.3	0.3
Daubenton's	LT2	0.1	NA
Daubenton's	LT3	0.2	0.1
Daubenton's	LT4	0.4	NA
Daubenton's	LT5	0.1	0.4
Daubenton's	LT6	0.1	0.3
Daubenton's	LT7	0.2	0.5
Daubenton's	LT8	0.1	0.2
Daubenton's	LT9	0.1	0.3
Whiskered	L10	0.1	0.4
Whiskered	LT1	0.1	NA
Whiskered	LT3	0.1	NA
Whiskered	LT4	0.2	NA
Whiskered	LT5	0.1	0.1
Whiskered	LT6	0.1	NA
Natterer's	L10	0.1	NA
Natterer's	LT1	0.1	0.1
Natterer's	LT3	0.1	NA
Natterer's	LT8	0.1	NA
Natterer's	LT9	0.7	0.3

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.

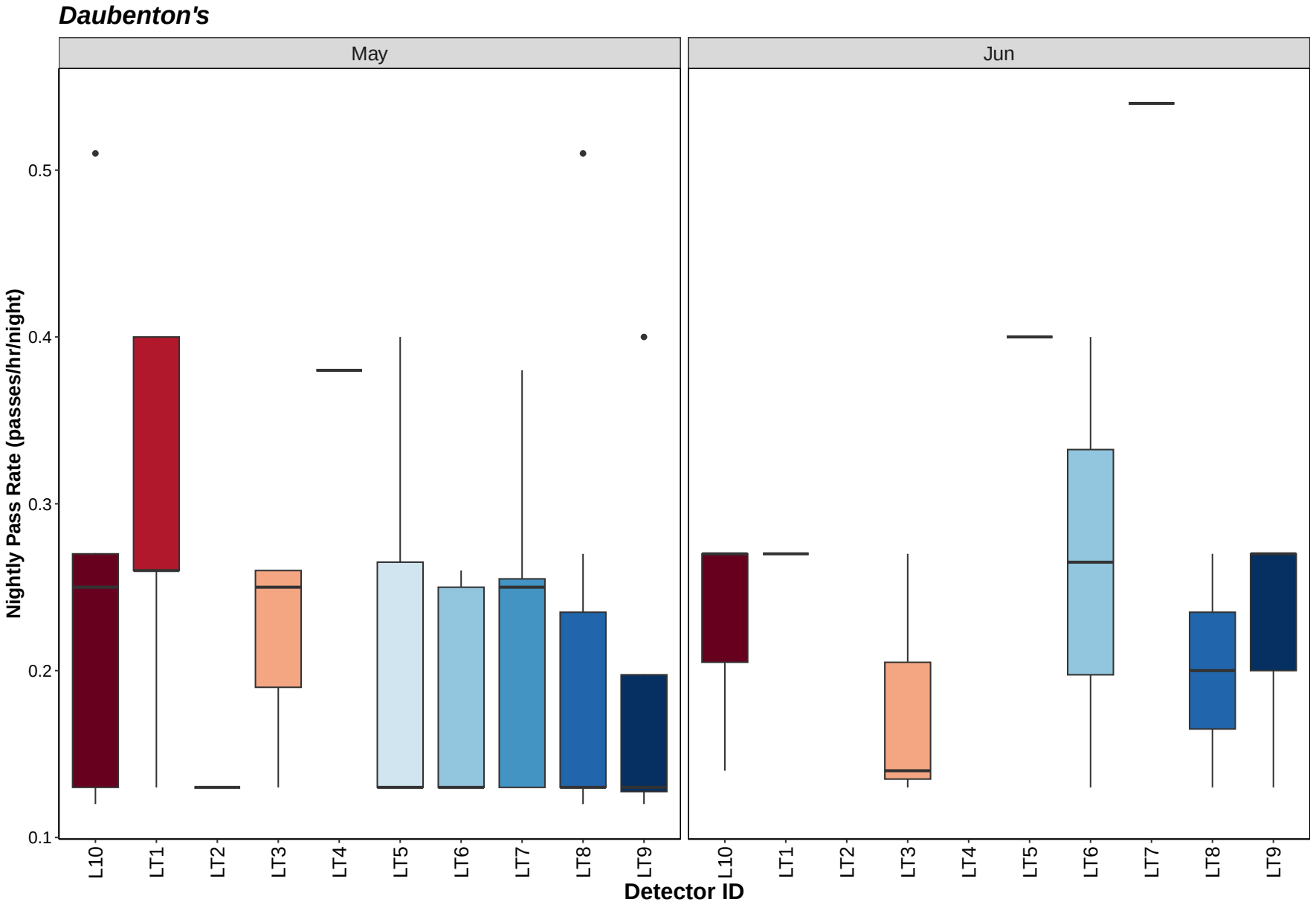
Species	Detector ID	May	Jun
Common pipistrelle	L10	10.0	16.0
Common pipistrelle	LT1	3.6	1.2
Common pipistrelle	LT2	2.5	0.2
Common pipistrelle	LT3	5.9	0.5
Common pipistrelle	LT4	1.1	NA
Common pipistrelle	LT5	1.9	0.5
Common pipistrelle	LT6	28.2	1.4
Common pipistrelle	LT7	4.8	NA
Common pipistrelle	LT8	37.1	1.1
Common pipistrelle	LT9	1.7	0.4
Soprano pipistrelle	L10	4.4	3.1
Soprano pipistrelle	LT1	1.6	0.9
Soprano pipistrelle	LT2	1.6	0.4
Soprano pipistrelle	LT3	3.1	1.0
Soprano pipistrelle	LT4	0.6	0.1
Soprano pipistrelle	LT5	0.7	NA
Soprano pipistrelle	LT6	6.2	0.1
Soprano pipistrelle	LT7	1.3	0.1
Soprano pipistrelle	LT8	5.3	0.5
Soprano pipistrelle	LT9	3.7	0.5
Nathusius'	L10	0.2	NA
Nathusius'	LT1	0.6	NA
Nathusius'	LT2	0.4	NA
Nathusius'	LT3	0.3	NA
Nathusius'	LT4	0.3	NA
Nathusius'	LT5	0.4	NA
Nathusius'	LT6	1.0	NA
Nathusius'	LT7	0.6	NA
Nathusius'	LT8	1.4	NA
Nathusius'	LT9	0.1	NA

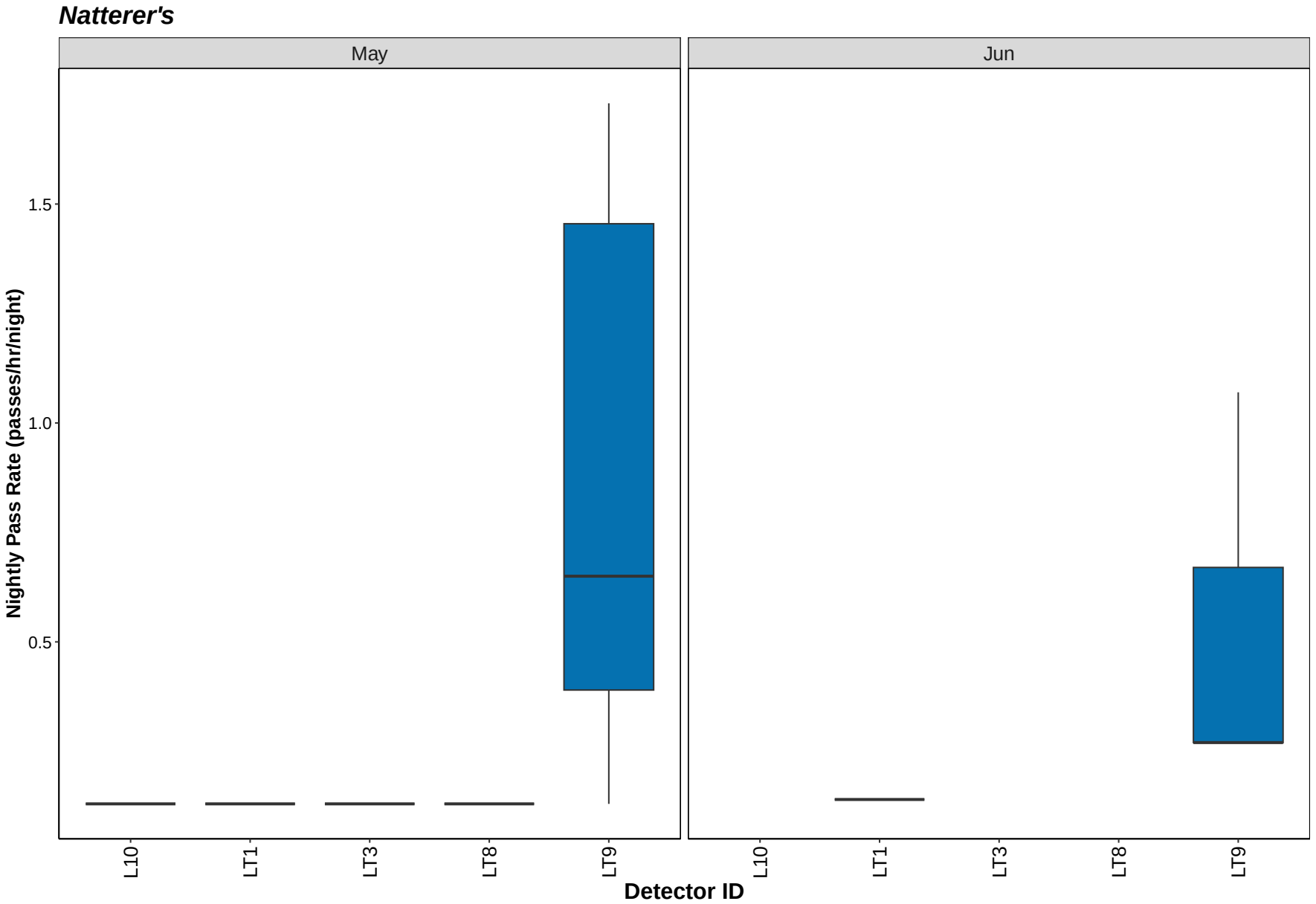
Species	Detector ID	May	Jun
Leisler's	L10	2.1	0.6
Leisler's	LT1	1.9	0.2
Leisler's	LT2	2.5	0.3
Leisler's	LT3	1.1	0.2
Leisler's	LT4	1.1	0.1
Leisler's	LT5	11.3	2.0
Leisler's	LT6	1.4	0.4
Leisler's	LT7	1.9	0.3
Leisler's	LT8	1.9	0.3
Leisler's	LT9	0.7	0.4
Brown long-eared	L10	0.1	0.4
Brown long-eared	LT1	0.3	NA
Brown long-eared	LT2	0.1	NA
Brown long-eared	LT3	0.2	NA
Brown long-eared	LT5	0.1	0.1
Brown long-eared	LT6	1.2	0.1
Brown long-eared	LT7	0.5	NA
Brown long-eared	LT8	0.6	0.1
Brown long-eared	LT9	0.2	0.1
Daubenton's	L10	0.2	0.2
Daubenton's	LT1	0.3	0.3
Daubenton's	LT2	0.1	NA
Daubenton's	LT3	0.2	0.2
Daubenton's	LT4	0.4	NA
Daubenton's	LT5	0.2	0.4
Daubenton's	LT6	0.2	0.3
Daubenton's	LT7	0.2	0.5
Daubenton's	LT8	0.2	0.2
Daubenton's	LT9	0.2	0.2
Whiskered	L10	0.1	0.4
Whiskered	LT1	0.2	NA
Whiskered	LT3	0.1	NA
Whiskered	LT4	0.2	NA
Whiskered	LT5	0.2	0.1
Whiskered	LT6	0.1	NA
Natterer's	L10	0.1	NA

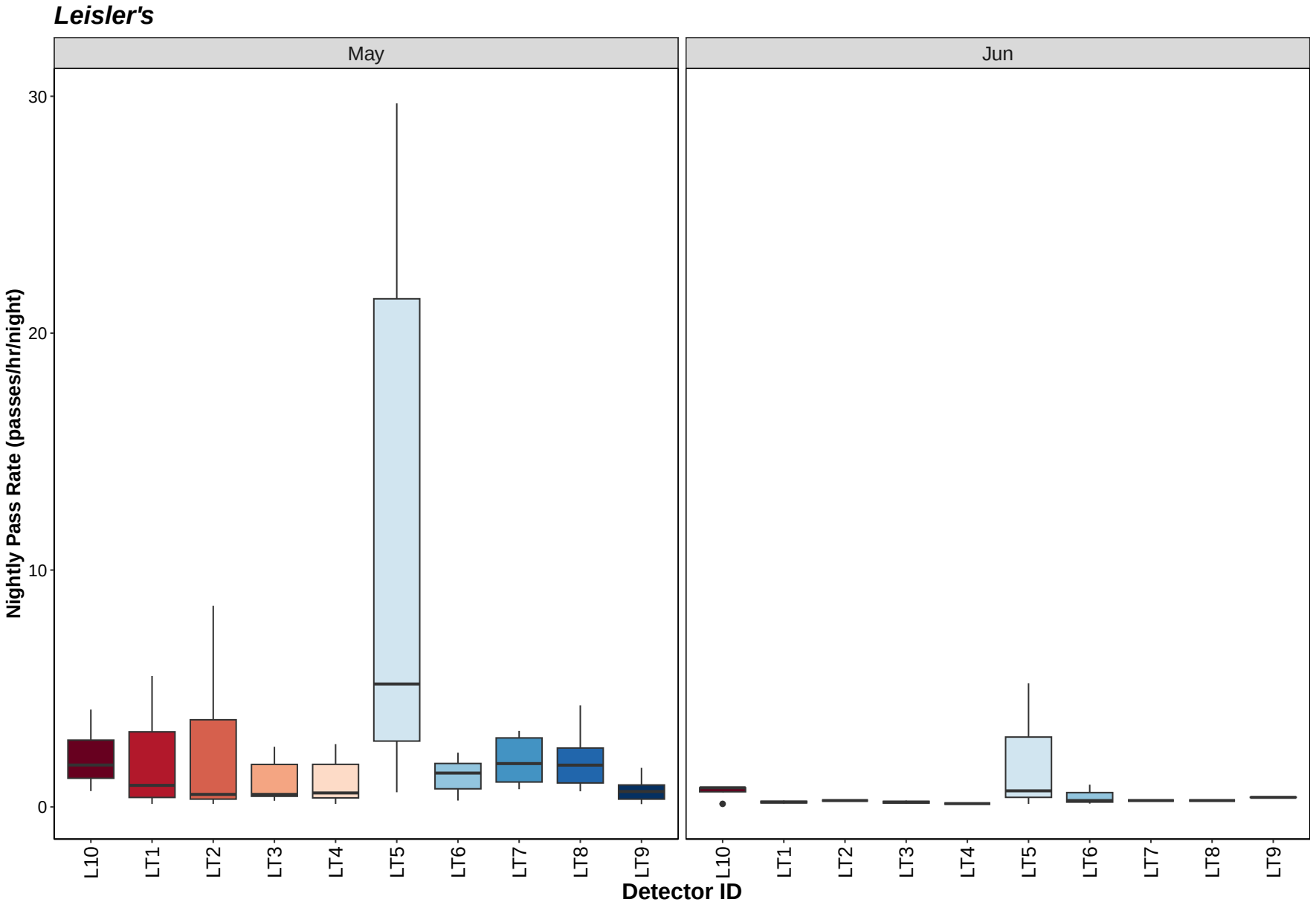
Species	Detector ID	May	Jun
Natterer's	LT1	0.1	0.1
Natterer's	LT3	0.1	NA
Natterer's	LT8	0.1	NA
Natterer's	LT9	0.9	0.5

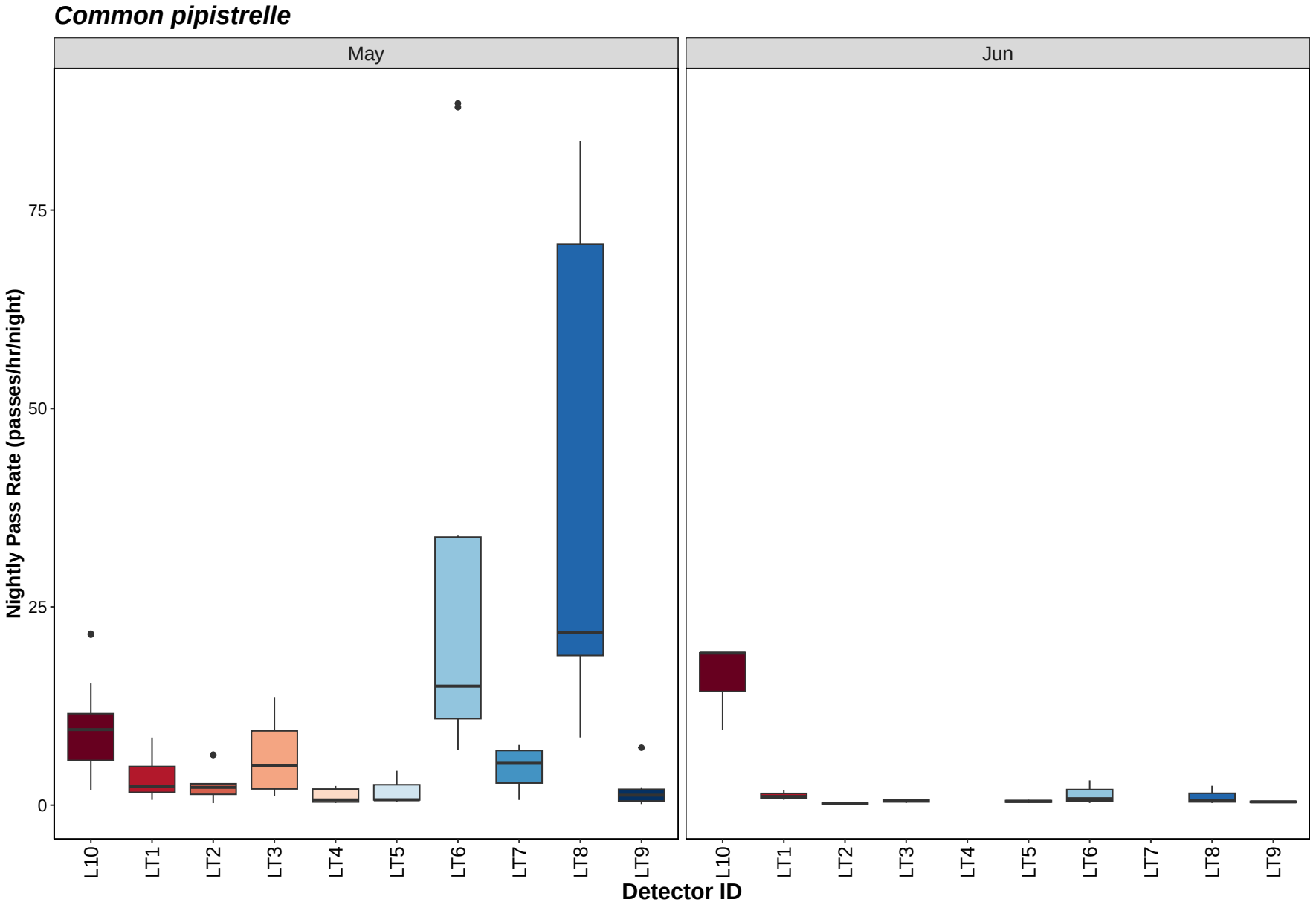
Per Detector

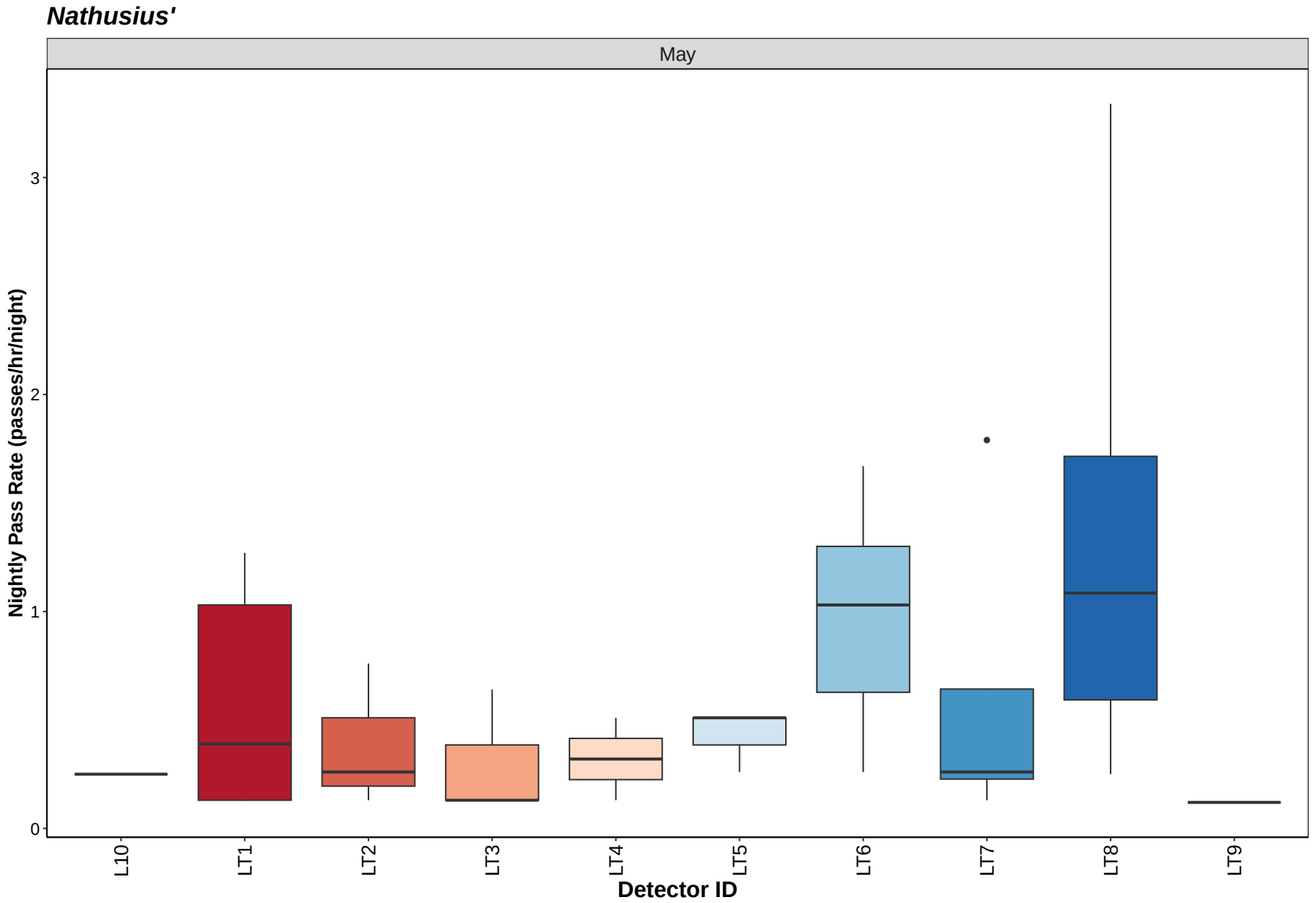
Figure 12. Figures show boxplots for the number of bat passes per hour by detector, for each month. The ‘box’ shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The ‘whiskers’ extend from the box and represent 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.

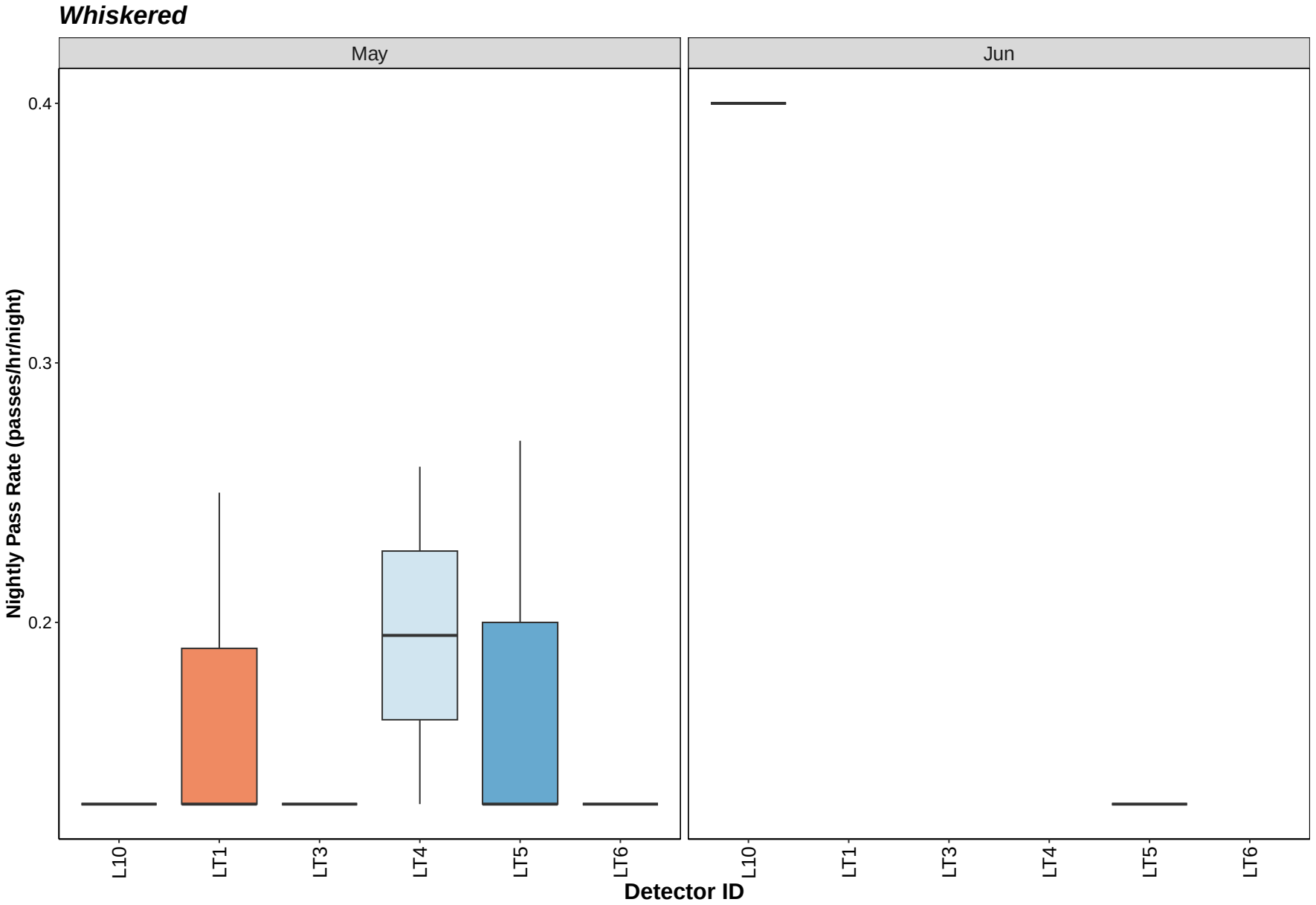

Daubenton's
May
Jun
Nightly Pass Rate (passes/hr/night)
0.1
0.2
0.3
0.4
0.5
L10
LT1
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID

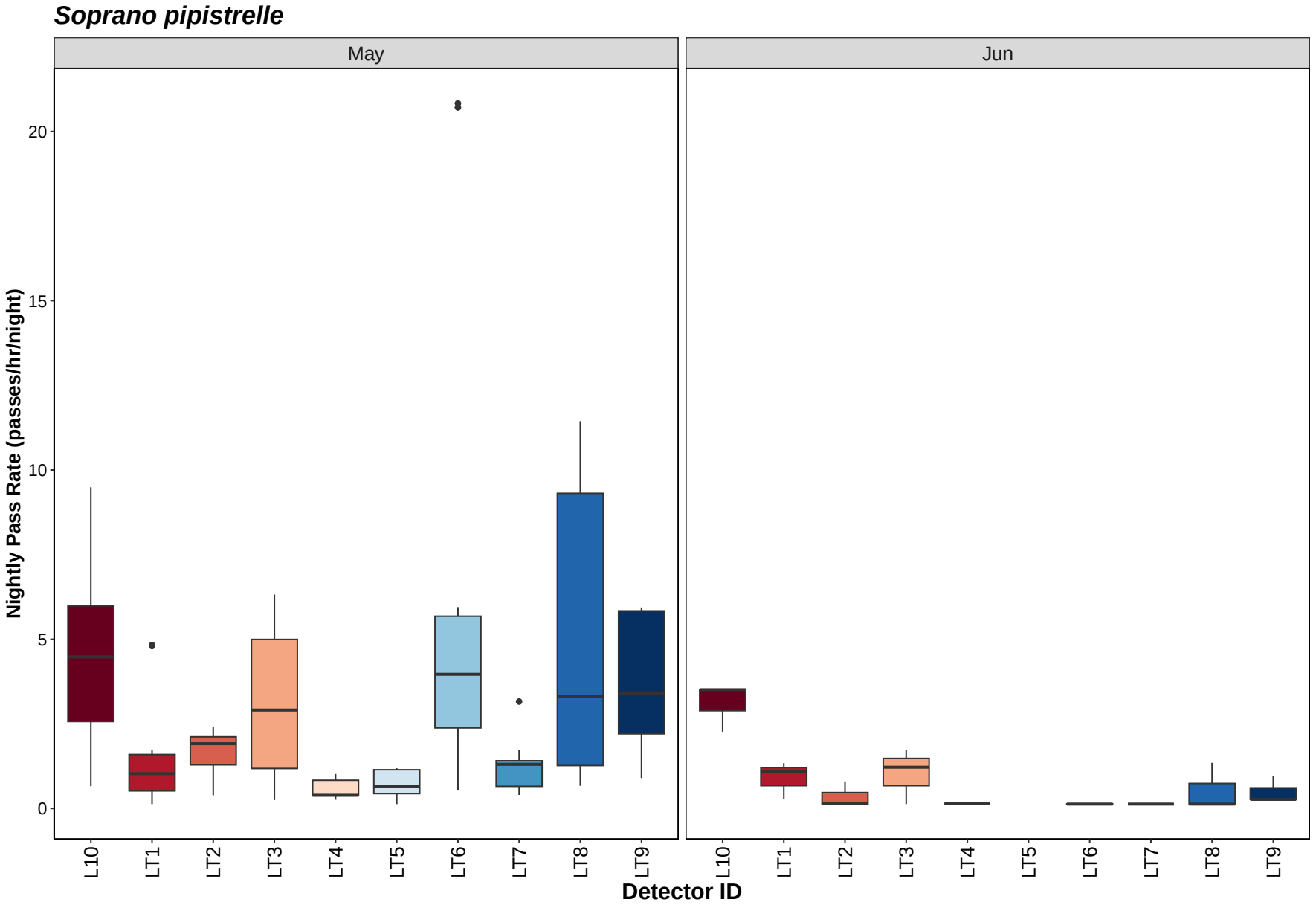

Natterer's
May
Jun
Nightly Pass Rate (passes/hr/night)
1.5
1.0
0.5
L10
LT1
LT3
LT8
LT9
Detector ID

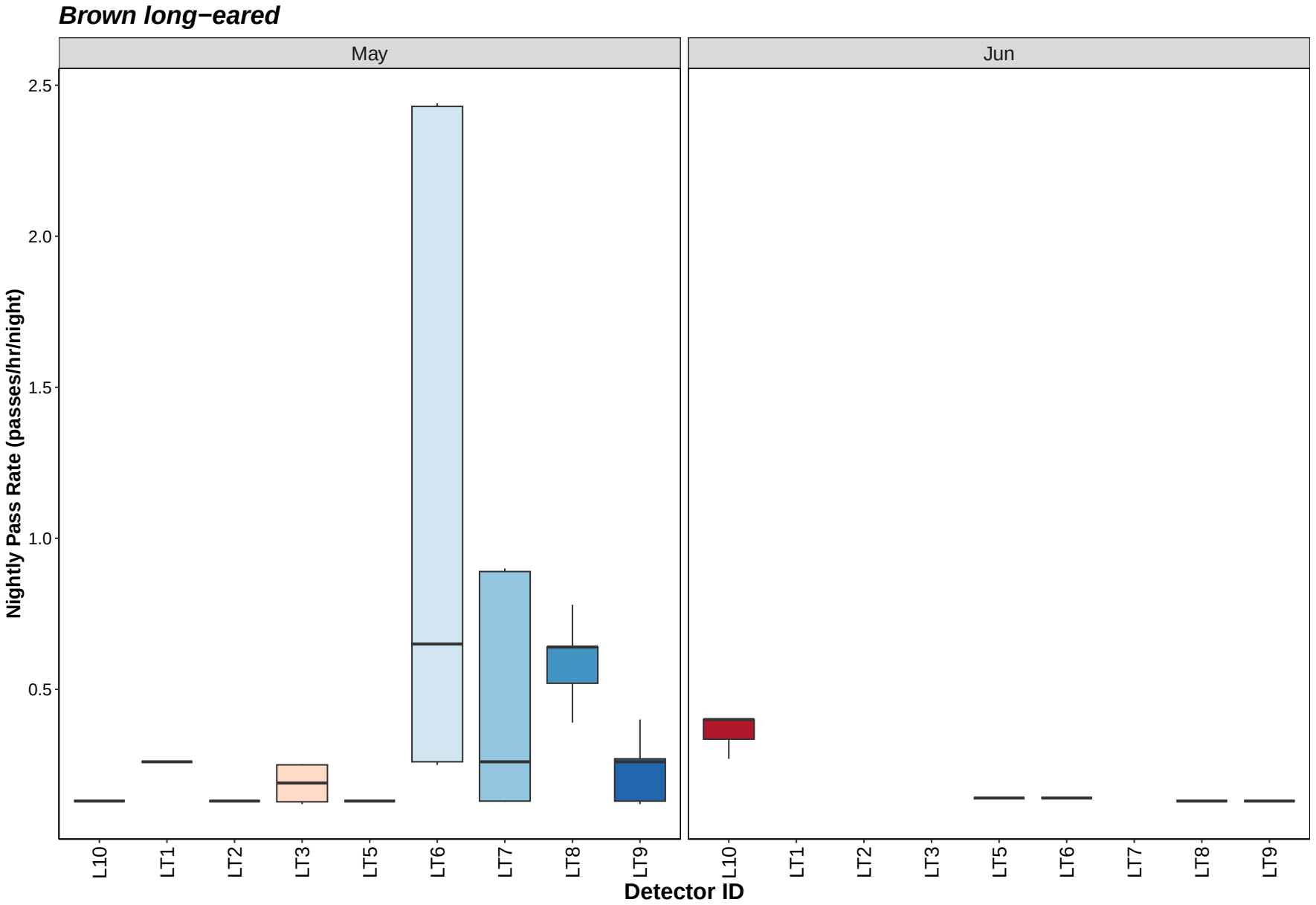

Leisler's
May
Jun
Nightly Pass Rate (passes/hr/night)
30
20
10
0
L10
LT1
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID


Common pipistrelle
May
Jun
Nightly Pass Rate (passes/hr/night)
0
25
50
75
L10
LT1
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID


Nathusius'
May
Nightly Pass Rate (passes/hr/night)
0
1
2
3
L10
LT1
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID


Whiskered
May
Jun
0.4
0.3
0.2
Nightly Pass Rate (passes/hr/night)
L10
LT1
LT3
LT4
LT5
LT6
Detector ID


Soprano pipistrelle
May
Jun
Nightly Pass Rate (passes/hr/night)
0
5
10
15
20
L10
LT1
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID


Brown long−eared
May
Jun
Nightly Pass Rate (passes/hr/night)
2.5
2.0
1.5
1.0
0.5
L10
LT1
LT2
LT3
LT5
LT6
LT7
LT8
LT9
Detector ID

Bat Activity per Detector Location

Figure 13. Detector ID reference:

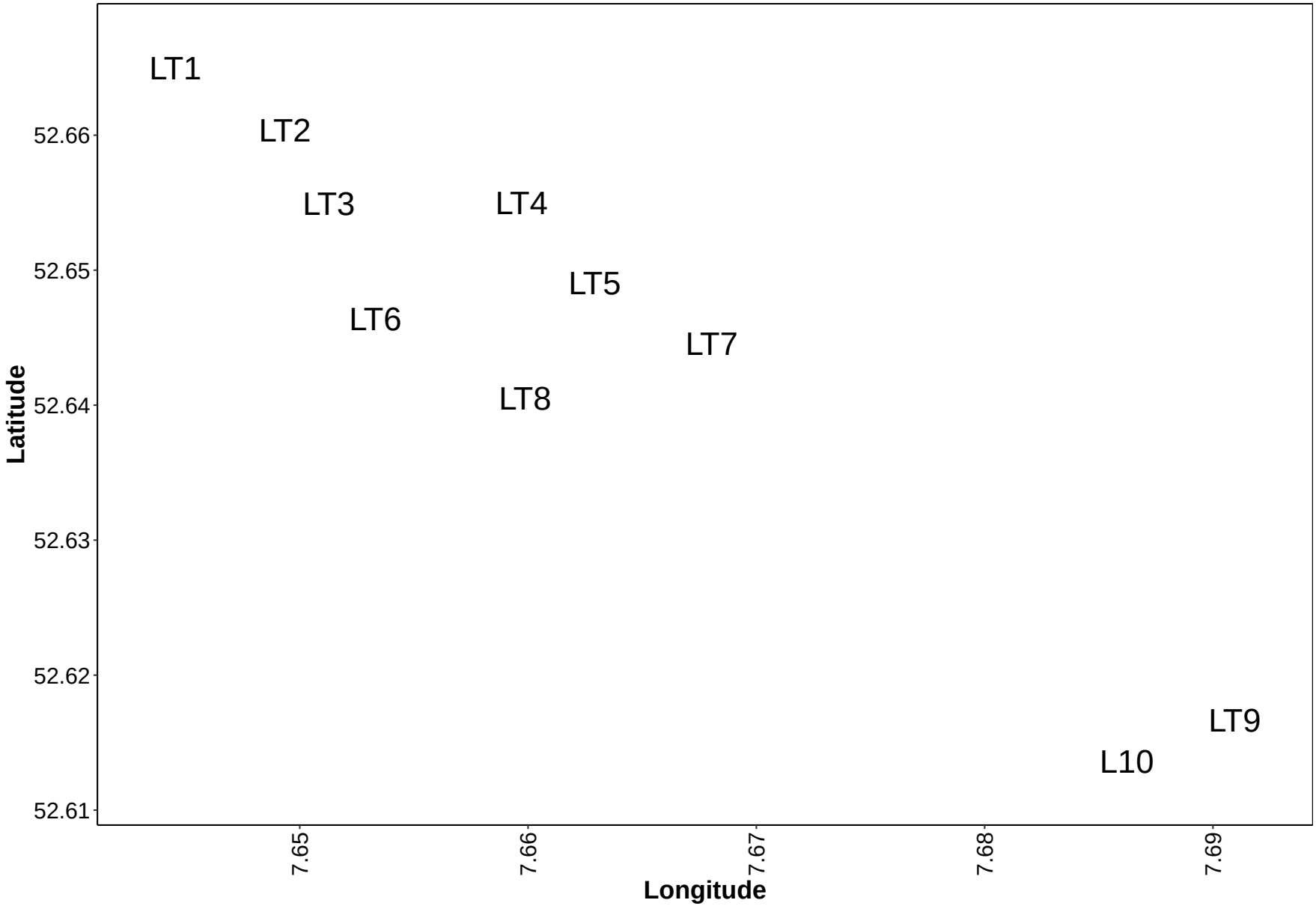
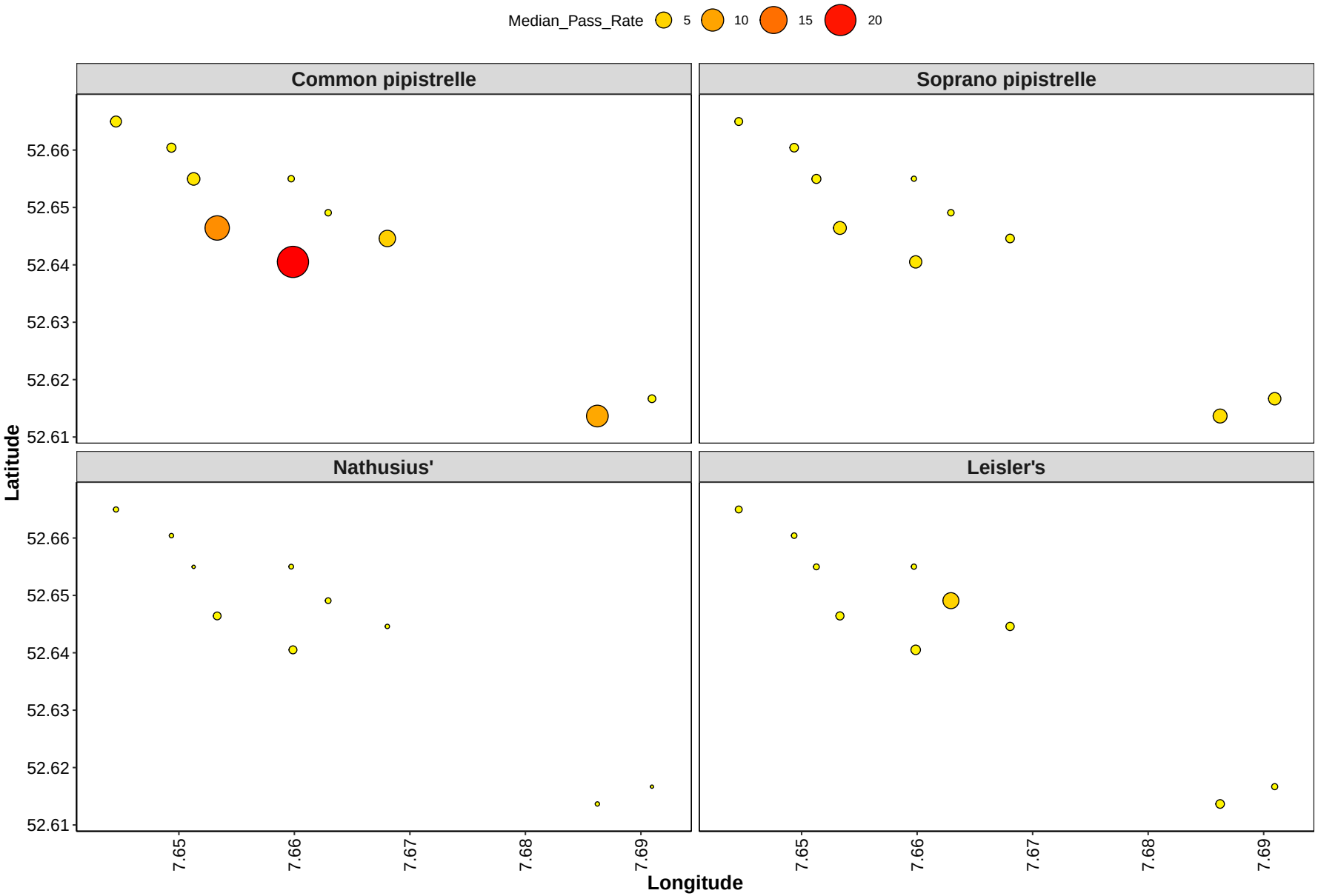

LT1
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
L10
52.66
52.65
52.64
52.63
52.62
52.61
Latitude
7.65
7.66
7.67
7.68
7.69
Longitude

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
5
10
15
20
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
Longitude
7.65
7.66
7.67
7.68
7.69

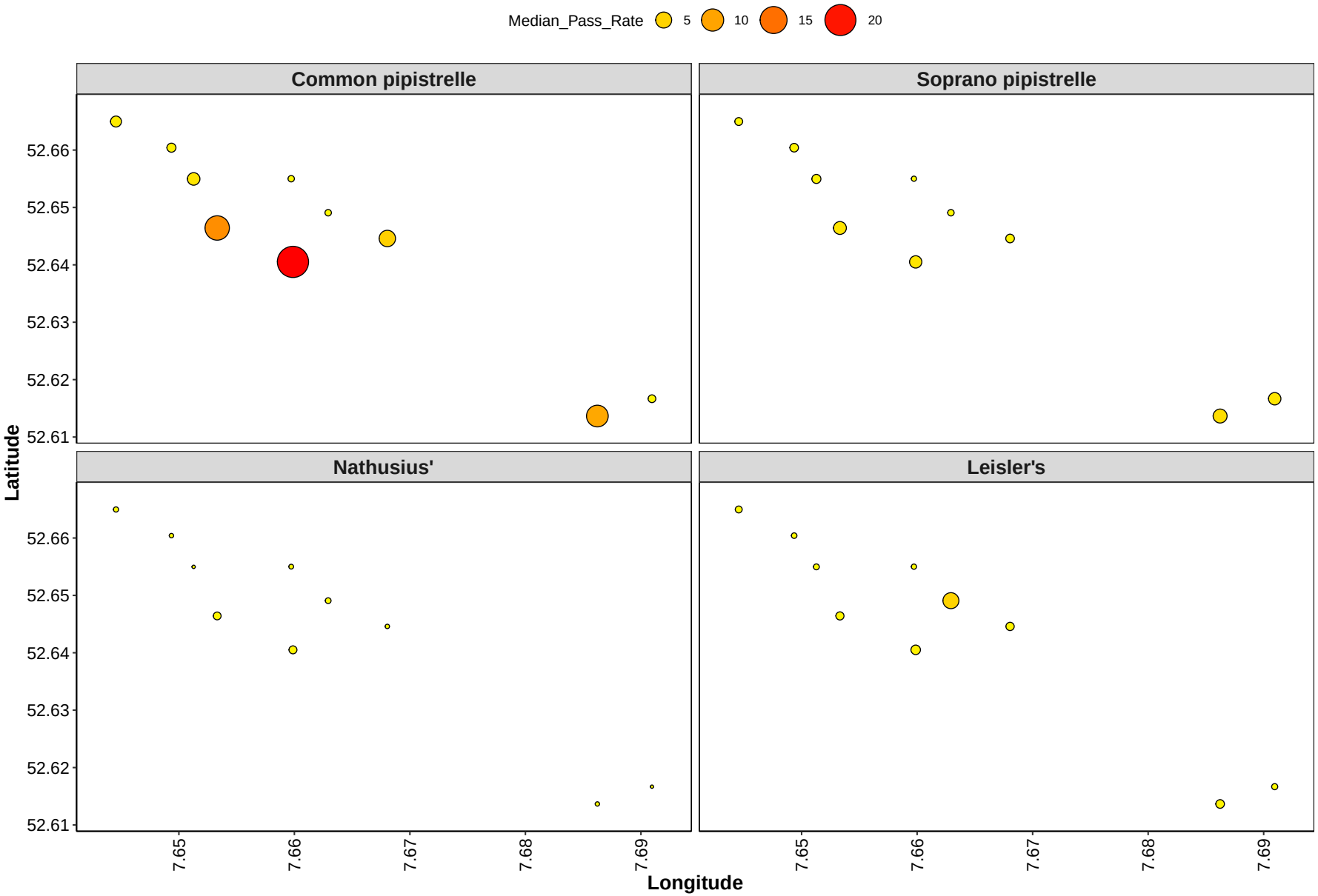
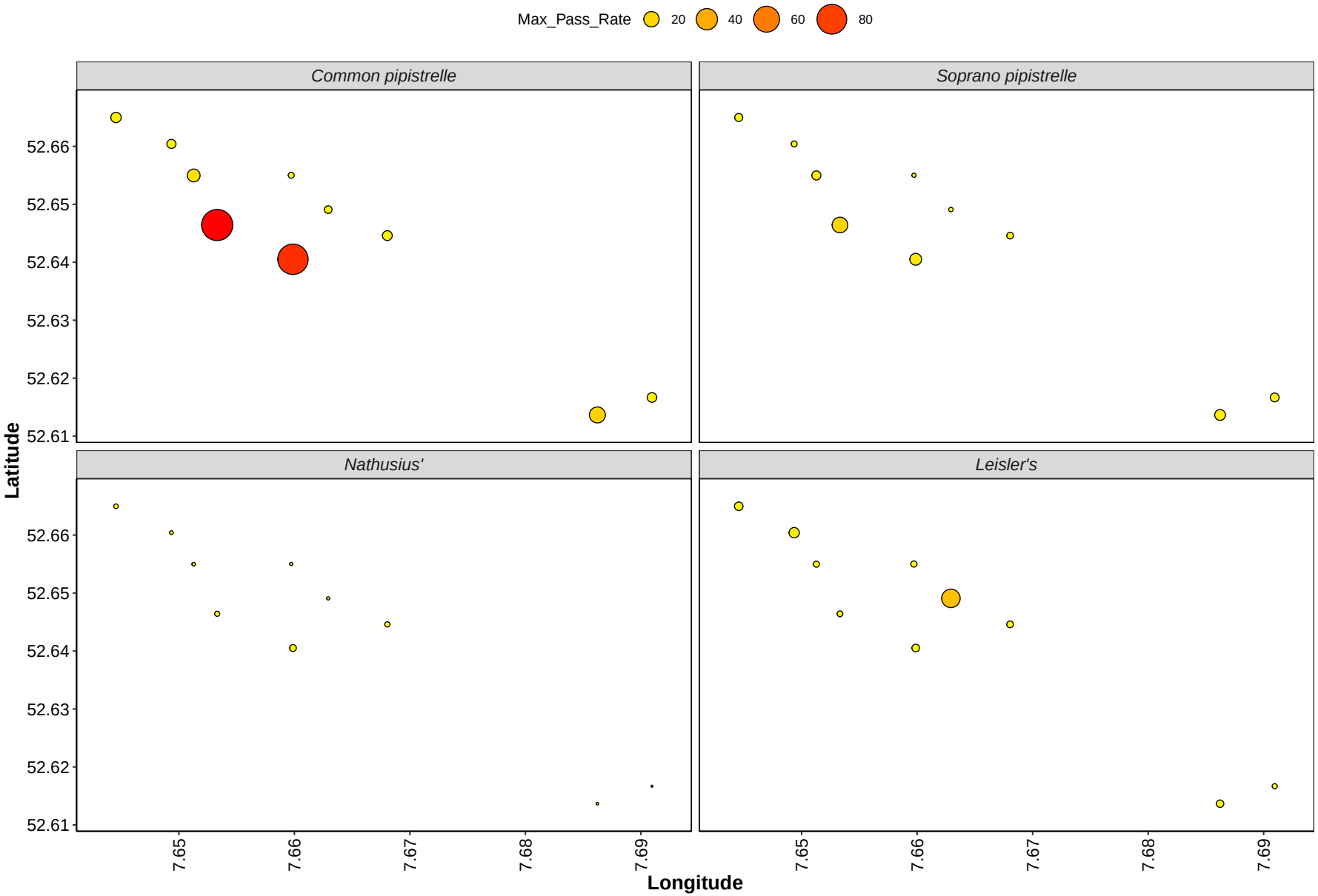
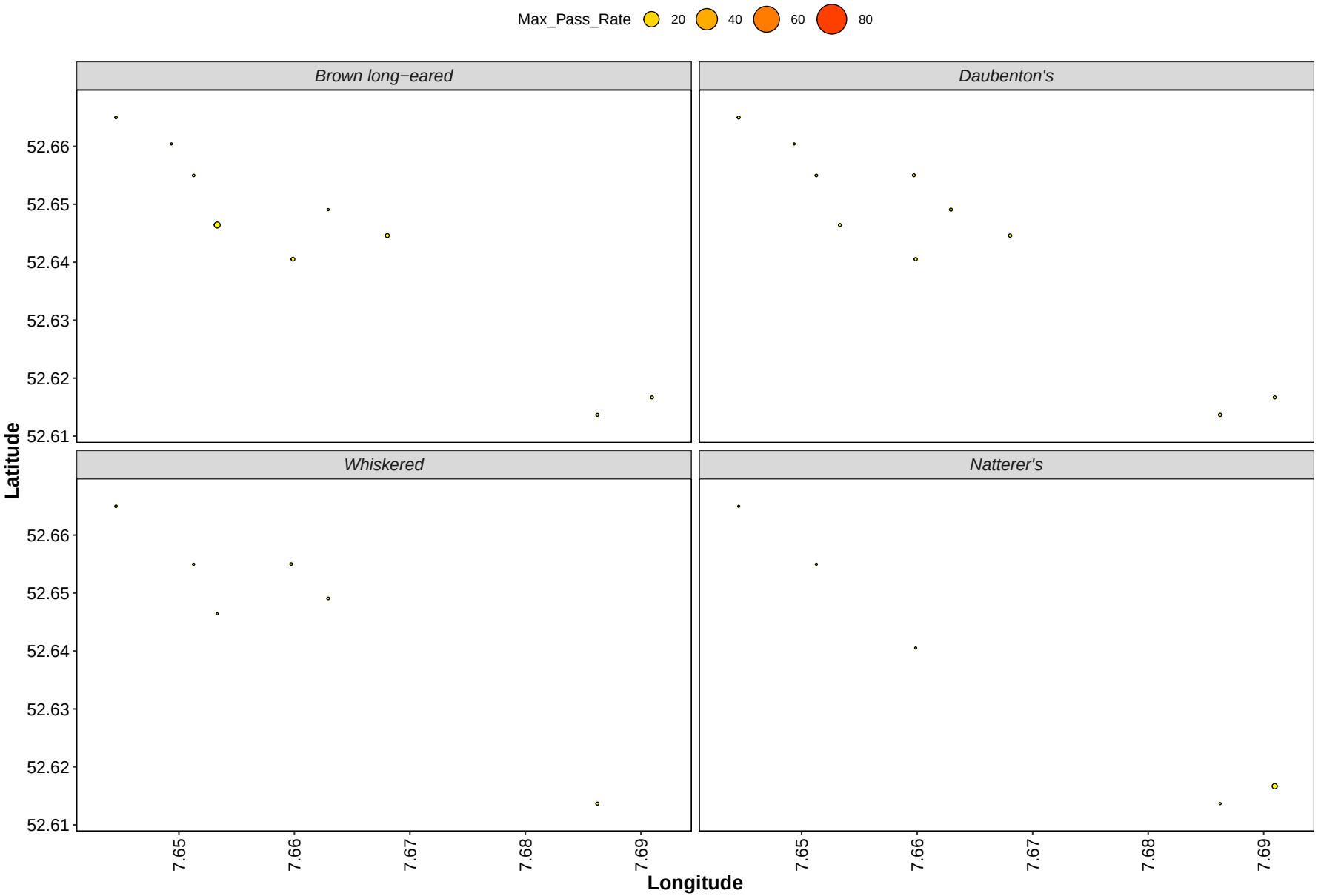

Median_Pass_Rate
5
10
15
20
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
Longitude
7.65
7.66
7.67
7.68
7.69

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
20
40
60
80
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
7.65
7.66
7.67
7.68
7.69
Longitude


Max_Pass_Rate
20
40
60
80
Brown long−eared
Daubenton's
Whiskered
Natterer's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
Longitude
7.65
7.66
7.67
7.68
7.69

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

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	L10	0.0
Brown long-eared	LT1	0.0
Brown long-eared	LT2	0.0
Brown long-eared	LT3	0.0
Brown long-eared	LT4	0.0
Brown long-eared	LT5	0.0
Brown long-eared	LT6	0.0
Brown long-eared	LT7	0.0
Brown long-eared	LT8	0.0
Brown long-eared	LT9	0.0
Common pipistrelle	L10	9.5
Common pipistrelle	LT1	2.2
Common pipistrelle	LT2	1.4
Common pipistrelle	LT3	2.1
Common pipistrelle	LT4	0.1
Common pipistrelle	LT5	0.7
Common pipistrelle	LT6	12.1
Common pipistrelle	LT7	1.5
Common pipistrelle	LT8	19.0
Common pipistrelle	LT9	0.8
Daubenton's	L10	0.1
Daubenton's	LT1	0.0
Daubenton's	LT2	0.0
Daubenton's	LT3	0.1
Daubenton's	LT4	0.0
Daubenton's	LT5	0.0
Daubenton's	LT6	0.0
Daubenton's	LT7	0.1
Daubenton's	LT8	0.0
Daubenton's	LT9	0.0
Leisler's	L10	1.1
Leisler's	LT1	0.5
Leisler's	LT2	0.4
Leisler's	LT3	0.4
Leisler's	LT4	0.4
Leisler's	LT5	5.0

Species	Detector ID	Median Pass Rate
Leisler's	LT6	0.9
Leisler's	LT7	1.1
Leisler's	LT8	1.0
Leisler's	LT9	0.4
Nathusius'	L10	0.0
Nathusius'	LT1	0.1
Nathusius'	LT2	0.0
Nathusius'	LT3	0.0
Nathusius'	LT4	0.0
Nathusius'	LT5	0.0
Nathusius'	LT6	0.0
Nathusius'	LT7	0.0
Nathusius'	LT8	0.0
Nathusius'	LT9	0.0
Natterer's	L10	0.0
Natterer's	LT1	0.0
Natterer's	LT2	0.0
Natterer's	LT3	0.0
Natterer's	LT4	0.0
Natterer's	LT5	0.0
Natterer's	LT6	0.0
Natterer's	LT7	0.0
Natterer's	LT8	0.0
Natterer's	LT9	0.3
Soprano pipistrelle	L10	3.5
Soprano pipistrelle	LT1	1.0
Soprano pipistrelle	LT2	1.3
Soprano pipistrelle	LT3	1.4
Soprano pipistrelle	LT4	0.3
Soprano pipistrelle	LT5	0.4
Soprano pipistrelle	LT6	2.8
Soprano pipistrelle	LT7	0.8
Soprano pipistrelle	LT8	2.4
Soprano pipistrelle	LT9	2.6
Whiskered	L10	0.0
Whiskered	LT1	0.0

Species	Detector ID	Median Pass Rate
Whiskered	LT2	0.0
Whiskered	LT3	0.0
Whiskered	LT4	0.0
Whiskered	LT5	0.0
Whiskered	LT6	0.0
Whiskered	LT7	0.0
Whiskered	LT8	0.0
Whiskered	LT9	0.0

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.

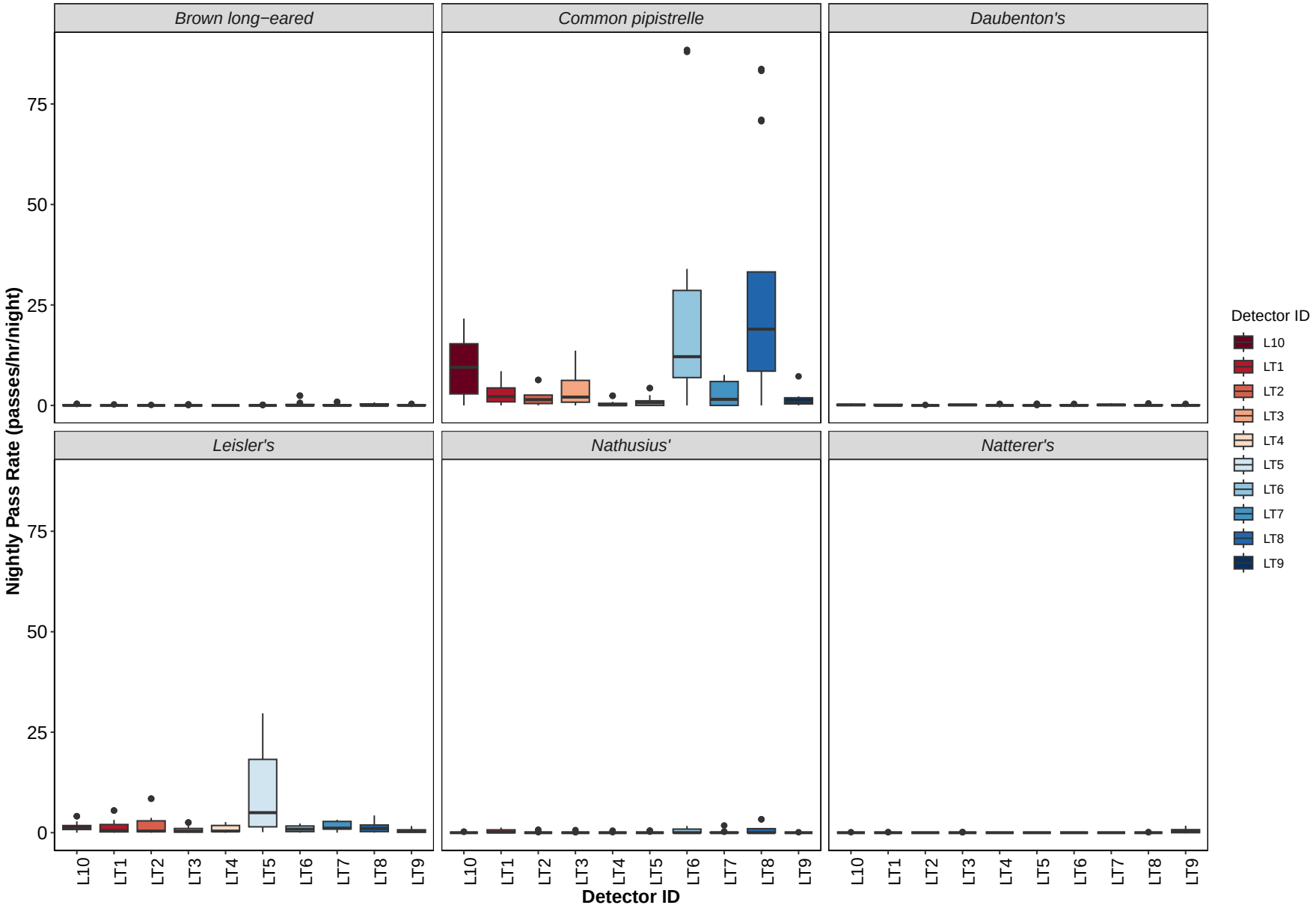
Species	Detector ID	Mean Pass Rate
Brown long-eared	L10	0.1
Brown long-eared	LT1	0.0
Brown long-eared	LT2	0.0
Brown long-eared	LT3	0.0
Brown long-eared	LT4	0.0
Brown long-eared	LT5	0.0
Brown long-eared	LT6	0.4
Brown long-eared	LT7	0.2
Brown long-eared	LT8	0.2
Brown long-eared	LT9	0.1
Common pipistrelle	L10	9.9
Common pipistrelle	LT1	2.9
Common pipistrelle	LT2	2.0
Common pipistrelle	LT3	4.2
Common pipistrelle	LT4	0.6
Common pipistrelle	LT5	1.1
Common pipistrelle	LT6	21.8
Common pipistrelle	LT7	2.7
Common pipistrelle	LT8	28.6
Common pipistrelle	LT9	1.4
Daubenton's	L10	0.1
Daubenton's	LT1	0.1
Daubenton's	LT2	0.0
Daubenton's	LT3	0.1
Daubenton's	LT4	0.1
Daubenton's	LT5	0.1
Daubenton's	LT6	0.1
Daubenton's	LT7	0.1
Daubenton's	LT8	0.1
Daubenton's	LT9	0.1
Leisler's	L10	1.5
Leisler's	LT1	1.4
Leisler's	LT2	2.0
Leisler's	LT3	0.7
Leisler's	LT4	0.9
Leisler's	LT5	9.6

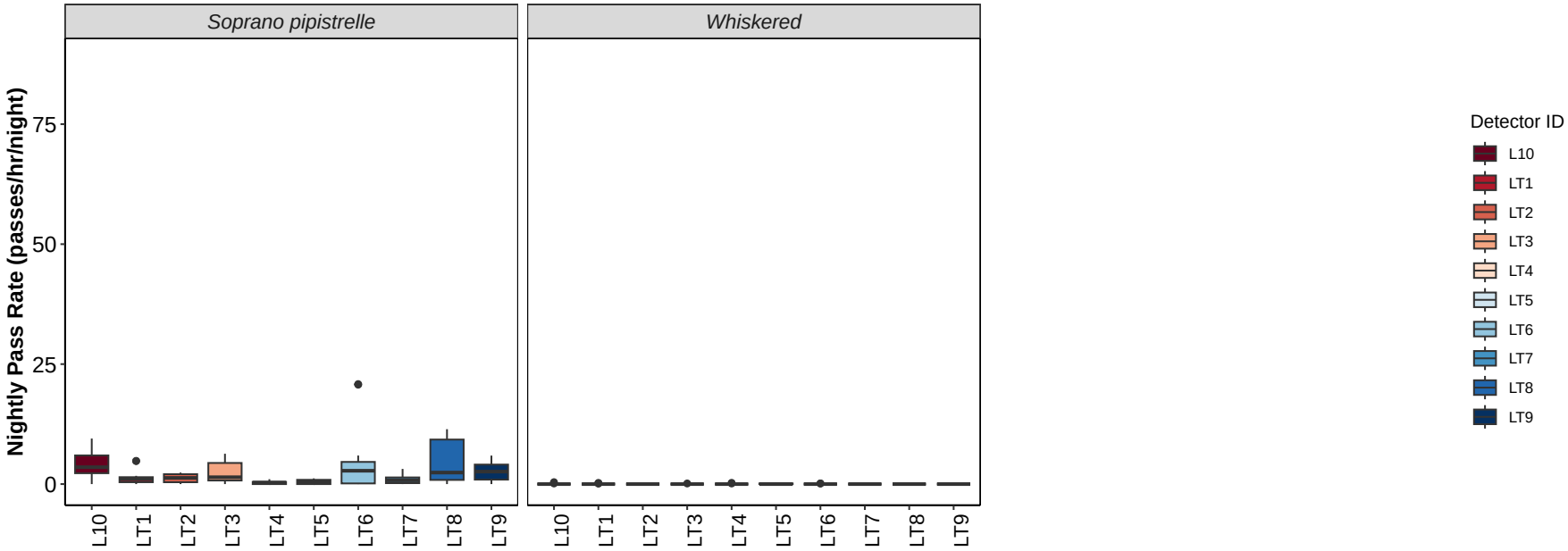
Species	Detector ID	Mean Pass Rate
Leisler's	LT6	1.0
Leisler's	LT7	1.7
Leisler's	LT8	1.4
Leisler's	LT9	0.5
Nathusius'	L10	0.0
Nathusius'	LT1	0.4
Nathusius'	LT2	0.1
Nathusius'	LT3	0.1
Nathusius'	LT4	0.1
Nathusius'	LT5	0.1
Nathusius'	LT6	0.5
Nathusius'	LT7	0.2
Nathusius'	LT8	0.7
Nathusius'	LT9	0.0
Natterer's	L10	0.0
Natterer's	LT1	0.0
Natterer's	LT2	0.0
Natterer's	LT3	0.0
Natterer's	LT4	0.0
Natterer's	LT5	0.0
Natterer's	LT6	0.0
Natterer's	LT7	0.0
Natterer's	LT8	0.0
Natterer's	LT9	0.5
Soprano pipistrelle	L10	3.9
Soprano pipistrelle	LT1	1.3
Soprano pipistrelle	LT2	1.2
Soprano pipistrelle	LT3	2.3
Soprano pipistrelle	LT4	0.4
Soprano pipistrelle	LT5	0.5
Soprano pipistrelle	LT6	4.4
Soprano pipistrelle	LT7	0.9
Soprano pipistrelle	LT8	4.2
Soprano pipistrelle	LT9	2.8
Whiskered	L10	0.0
Whiskered	LT1	0.0

Species	Detector ID	Mean Pass Rate
Whiskered	LT2	0.0
Whiskered	LT3	0.0
Whiskered	LT4	0.0
Whiskered	LT5	0.0
Whiskered	LT6	0.0
Whiskered	LT7	0.0
Whiskered	LT8	0.0
Whiskered	LT9	0.0

Per Detector

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.


Brown long−eared
Common pipistrelle
Daubenton's
Leisler's
Nathusius'
Natterer's
Nightly Pass Rate (passes/hr/night)
0
25
50
75
L10
LT1
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID
Detector ID
L10
LT1
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9


Soprano pipistrelle
Whiskered
Nightly Pass Rate (passes/hr/night)
0
25
50
75
L10
LT1
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID

Survey Effort

Table 24. The number of nights bats were detected per month per detector.

month	Detector ID	No. of Survey Nights
May	L10	13
May	LT1	12
May	LT2	11
May	LT3	13
May	LT4	11
May	LT5	13
May	LT6	13
May	LT7	12
May	LT8	13
May	LT9	12
Jun	L10	4
Jun	LT1	3
Jun	LT2	3
Jun	LT3	4
Jun	LT4	1
Jun	LT5	3
Jun	LT6	4
Jun	LT7	2
Jun	LT8	4
Jun	LT9	4

Nighlty 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	Jun	May
Brown long-eared	L10	0.3	0.0
Brown long-eared	LT1	0.0	0.0
Brown long-eared	LT2	0.0	0.0
Brown long-eared	LT3	0.0	0.0
Brown long-eared	LT4	0.0	0.0
Brown long-eared	LT5	0.0	0.0
Brown long-eared	LT6	0.0	0.0
Brown long-eared	LT7	0.0	0.0
Brown long-eared	LT8	0.0	0.0
Brown long-eared	LT9	0.0	0.0
Common pipistrelle	L10	14.3	9.5
Common pipistrelle	LT1	1.1	2.3
Common pipistrelle	LT2	0.1	2.2
Common pipistrelle	LT3	0.1	3.9
Common pipistrelle	LT4	0.0	0.3
Common pipistrelle	LT5	0.3	0.7
Common pipistrelle	LT6	0.5	15.0
Common pipistrelle	LT7	0.0	2.7
Common pipistrelle	LT8	0.4	21.8
Common pipistrelle	LT9	0.3	1.2
Daubenton's	L10	0.2	0.1
Daubenton's	LT1	0.3	0.0
Daubenton's	LT2	0.0	0.0
Daubenton's	LT3	0.1	0.1
Daubenton's	LT4	0.0	0.0
Daubenton's	LT5	0.0	0.0
Daubenton's	LT6	0.1	0.0
Daubenton's	LT7	0.3	0.1
Daubenton's	LT8	0.1	0.0
Daubenton's	LT9	0.2	0.0
Leisler's	L10	0.8	1.3
Leisler's	LT1	0.1	0.8
Leisler's	LT2	0.0	0.5
Leisler's	LT3	0.1	0.5
Leisler's	LT4	0.1	0.4
Leisler's	LT5	0.7	5.2

Species	Detector ID	Jun	May
Leisler's	LT6	0.2	1.3
Leisler's	LT7	0.1	1.8
Leisler's	LT8	0.1	1.6
Leisler's	LT9	0.2	0.6
Nathusius'	L10	0.0	0.0
Nathusius'	LT1	0.0	0.3
Nathusius'	LT2	0.0	0.0
Nathusius'	LT3	0.0	0.0
Nathusius'	LT4	0.0	0.0
Nathusius'	LT5	0.0	0.0
Nathusius'	LT6	0.0	0.6
Nathusius'	LT7	0.0	0.0
Nathusius'	LT8	0.0	0.4
Nathusius'	LT9	0.0	0.0
Natterer's	L10	0.0	0.0
Natterer's	LT1	0.0	0.0
Natterer's	LT2	0.0	0.0
Natterer's	LT3	0.0	0.0
Natterer's	LT4	0.0	0.0
Natterer's	LT5	0.0	0.0
Natterer's	LT6	0.0	0.0
Natterer's	LT7	0.0	0.0
Natterer's	LT8	0.0	0.0
Natterer's	LT9	0.3	0.3
Soprano pipistrelle	L10	2.9	4.5
Soprano pipistrelle	LT1	1.1	0.8
Soprano pipistrelle	LT2	0.1	1.9
Soprano pipistrelle	LT3	0.7	1.4
Soprano pipistrelle	LT4	0.1	0.4
Soprano pipistrelle	LT5	0.0	0.5
Soprano pipistrelle	LT6	0.1	3.8
Soprano pipistrelle	LT7	0.1	1.2
Soprano pipistrelle	LT8	0.1	3.3
Soprano pipistrelle	LT9	0.3	3.4
Whiskered	L10	0.0	0.0
Whiskered	LT1	0.0	0.0

Species	Detector ID	Jun	May
Whiskered	LT2	0.0	0.0
Whiskered	LT3	0.0	0.0
Whiskered	LT4	0.0	0.0
Whiskered	LT5	0.1	0.0
Whiskered	LT6	0.0	0.0
Whiskered	LT7	0.0	0.0
Whiskered	LT8	0.0	0.0
Whiskered	LT9	0.0	0.0

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.

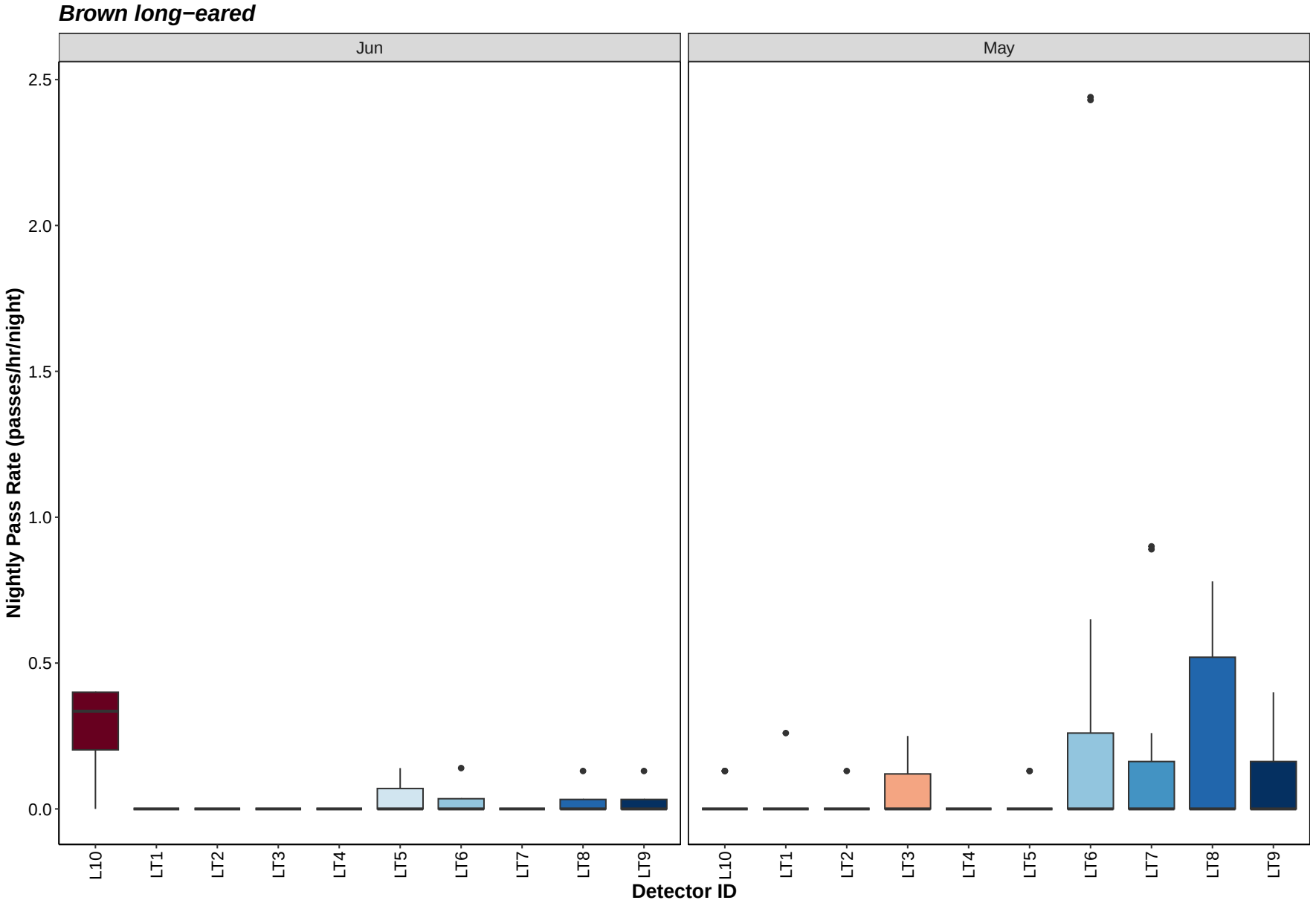
Species	Detector ID	Jun	May
Brown long-eared	L10	0.3	0.0
Brown long-eared	LT1	0.0	0.0
Brown long-eared	LT2	0.0	0.0
Brown long-eared	LT3	0.0	0.1
Brown long-eared	LT4	0.0	0.0
Brown long-eared	LT5	0.0	0.0
Brown long-eared	LT6	0.0	0.5
Brown long-eared	LT7	0.0	0.2
Brown long-eared	LT8	0.0	0.2
Brown long-eared	LT9	0.0	0.1
Common pipistrelle	L10	12.0	9.2
Common pipistrelle	LT1	1.2	3.3
Common pipistrelle	LT2	0.1	2.5
Common pipistrelle	LT3	0.3	5.4
Common pipistrelle	LT4	0.0	0.6
Common pipistrelle	LT5	0.3	1.3
Common pipistrelle	LT6	1.0	28.2
Common pipistrelle	LT7	0.0	3.2
Common pipistrelle	LT8	0.8	37.1
Common pipistrelle	LT9	0.3	1.7
Daubenton's	L10	0.2	0.1
Daubenton's	LT1	0.2	0.1
Daubenton's	LT2	0.0	0.0
Daubenton's	LT3	0.1	0.1
Daubenton's	LT4	0.0	0.1
Daubenton's	LT5	0.1	0.1
Daubenton's	LT6	0.1	0.1
Daubenton's	LT7	0.3	0.1
Daubenton's	LT8	0.1	0.1
Daubenton's	LT9	0.2	0.1
Leisler's	L10	0.6	1.7
Leisler's	LT1	0.1	1.8
Leisler's	LT2	0.1	2.5
Leisler's	LT3	0.1	0.9
Leisler's	LT4	0.1	1.0
Leisler's	LT5	2.0	11.3

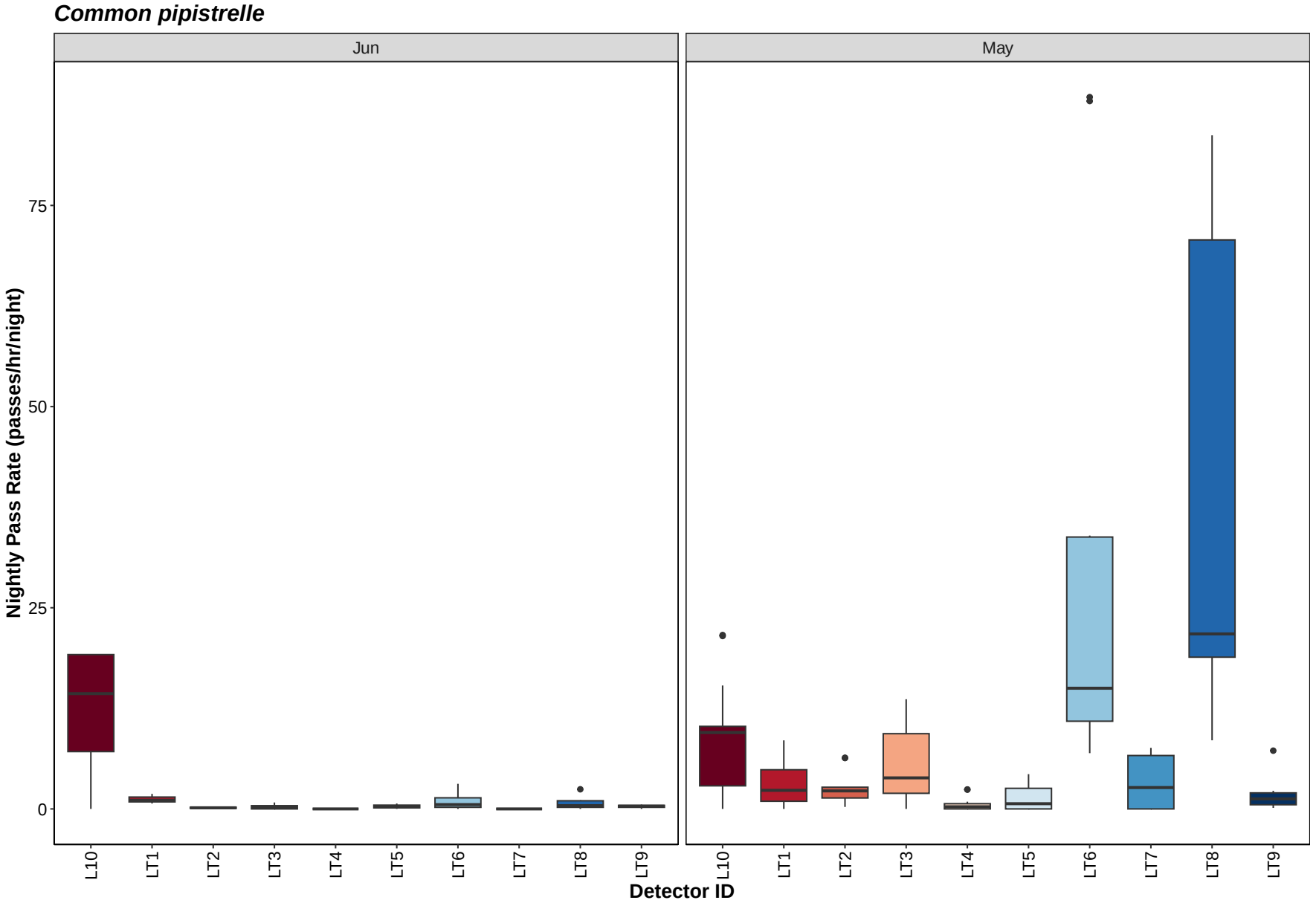
Species	Detector ID	Jun	May
Leisler's	LT6	0.3	1.1
Leisler's	LT7	0.1	1.9
Leisler's	LT8	0.1	1.7
Leisler's	LT9	0.2	0.6
Nathusius'	L10	0.0	0.0
Nathusius'	LT1	0.0	0.5
Nathusius'	LT2	0.0	0.1
Nathusius'	LT3	0.0	0.1
Nathusius'	LT4	0.0	0.1
Nathusius'	LT5	0.0	0.1
Nathusius'	LT6	0.0	0.6
Nathusius'	LT7	0.0	0.2
Nathusius'	LT8	0.0	0.9
Nathusius'	LT9	0.0	0.0
Natterer's	L10	0.0	0.0
Natterer's	LT1	0.0	0.0
Natterer's	LT2	0.0	0.0
Natterer's	LT3	0.0	0.0
Natterer's	LT4	0.0	0.0
Natterer's	LT5	0.0	0.0
Natterer's	LT6	0.0	0.0
Natterer's	LT7	0.0	0.0
Natterer's	LT8	0.0	0.0
Natterer's	LT9	0.4	0.5
Soprano pipistrelle	L10	2.3	4.4
Soprano pipistrelle	LT1	0.9	1.4
Soprano pipistrelle	LT2	0.4	1.4
Soprano pipistrelle	LT3	0.8	2.8
Soprano pipistrelle	LT4	0.1	0.4
Soprano pipistrelle	LT5	0.0	0.6
Soprano pipistrelle	LT6	0.1	5.7
Soprano pipistrelle	LT7	0.1	1.1
Soprano pipistrelle	LT8	0.4	5.3
Soprano pipistrelle	LT9	0.4	3.7
Whiskered	L10	0.1	0.0
Whiskered	LT1	0.0	0.0

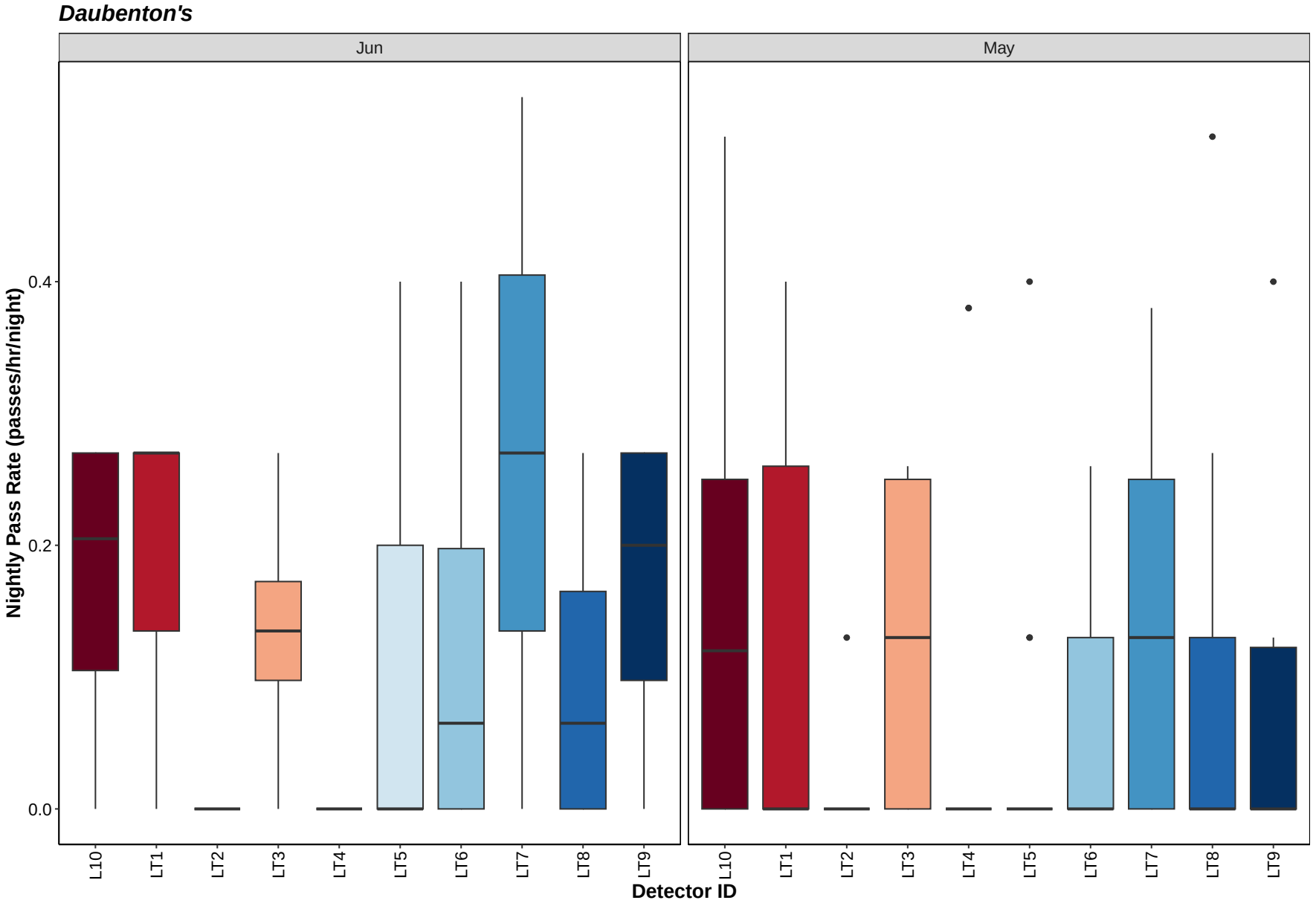
Species	Detector ID	Jun	May
Whiskered	LT2	0.0	0.0
Whiskered	LT3	0.0	0.0
Whiskered	LT4	0.0	0.0
Whiskered	LT5	0.1	0.0
Whiskered	LT6	0.0	0.0
Whiskered	LT7	0.0	0.0
Whiskered	LT8	0.0	0.0
Whiskered	LT9	0.0	0.0

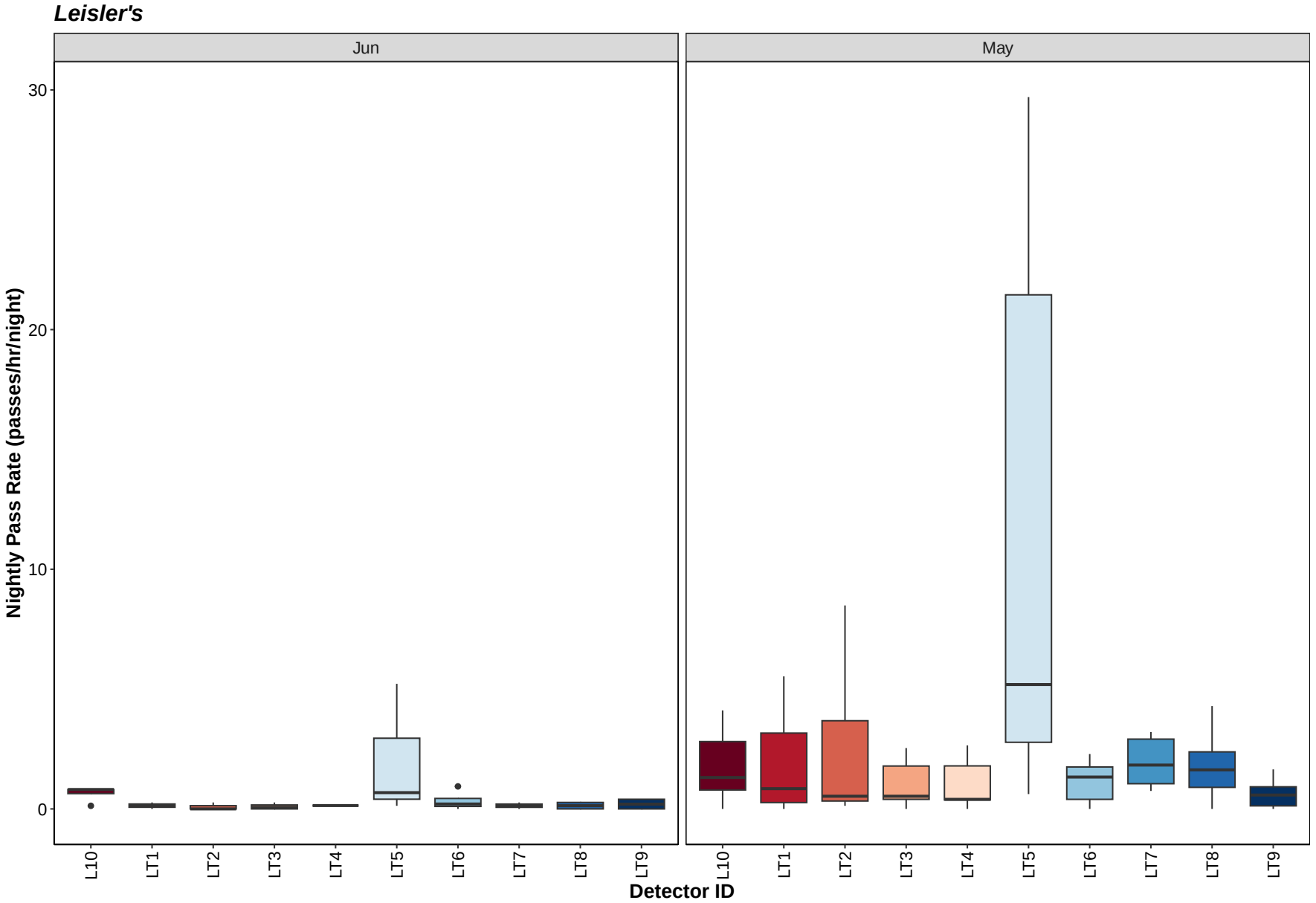
Per Detector

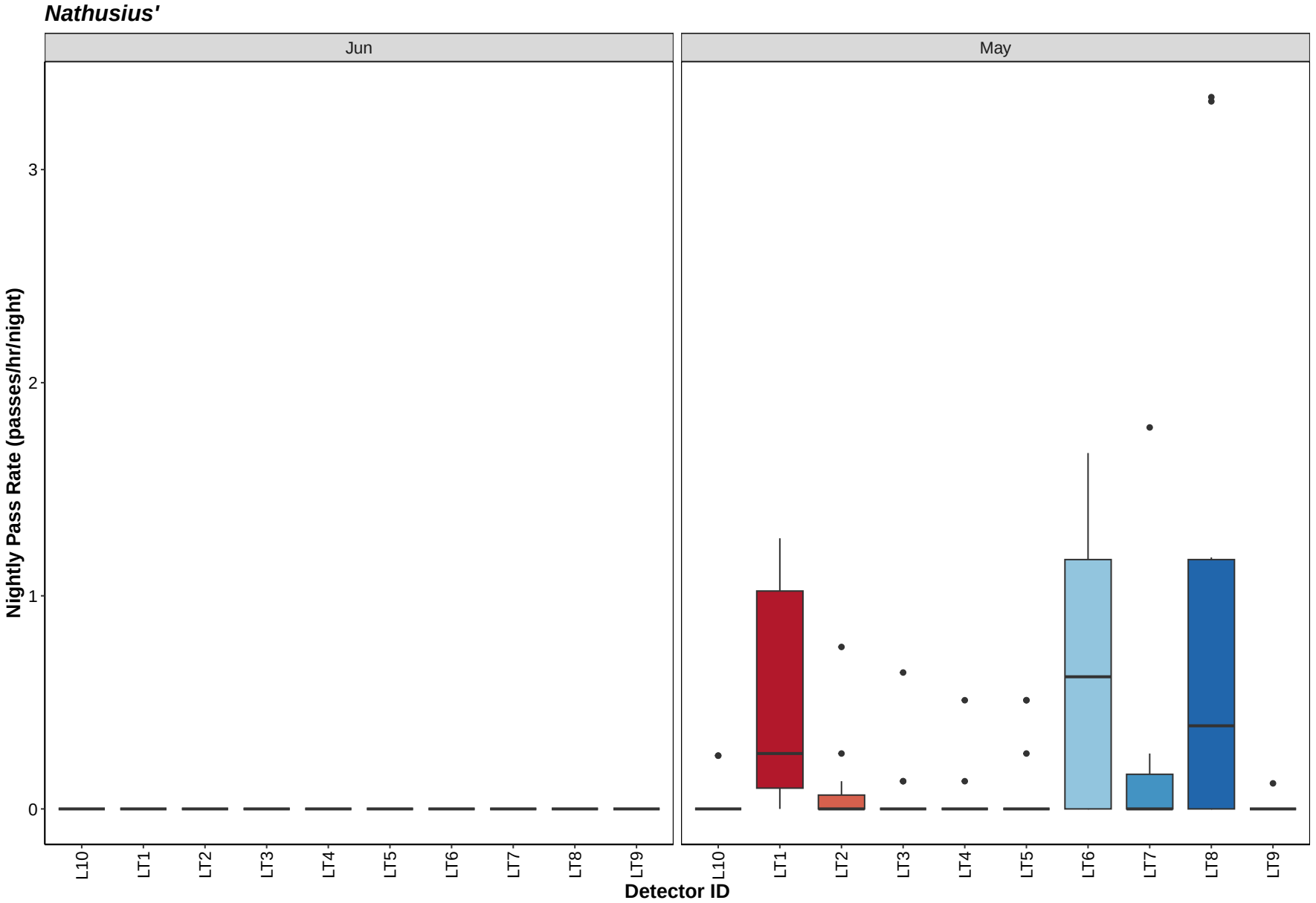
Figure 17. Figures show boxplots for the number of bat passes per hour by detector, for each month. The ‘box’ shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The ‘whiskers’ extend from the box and represent 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.

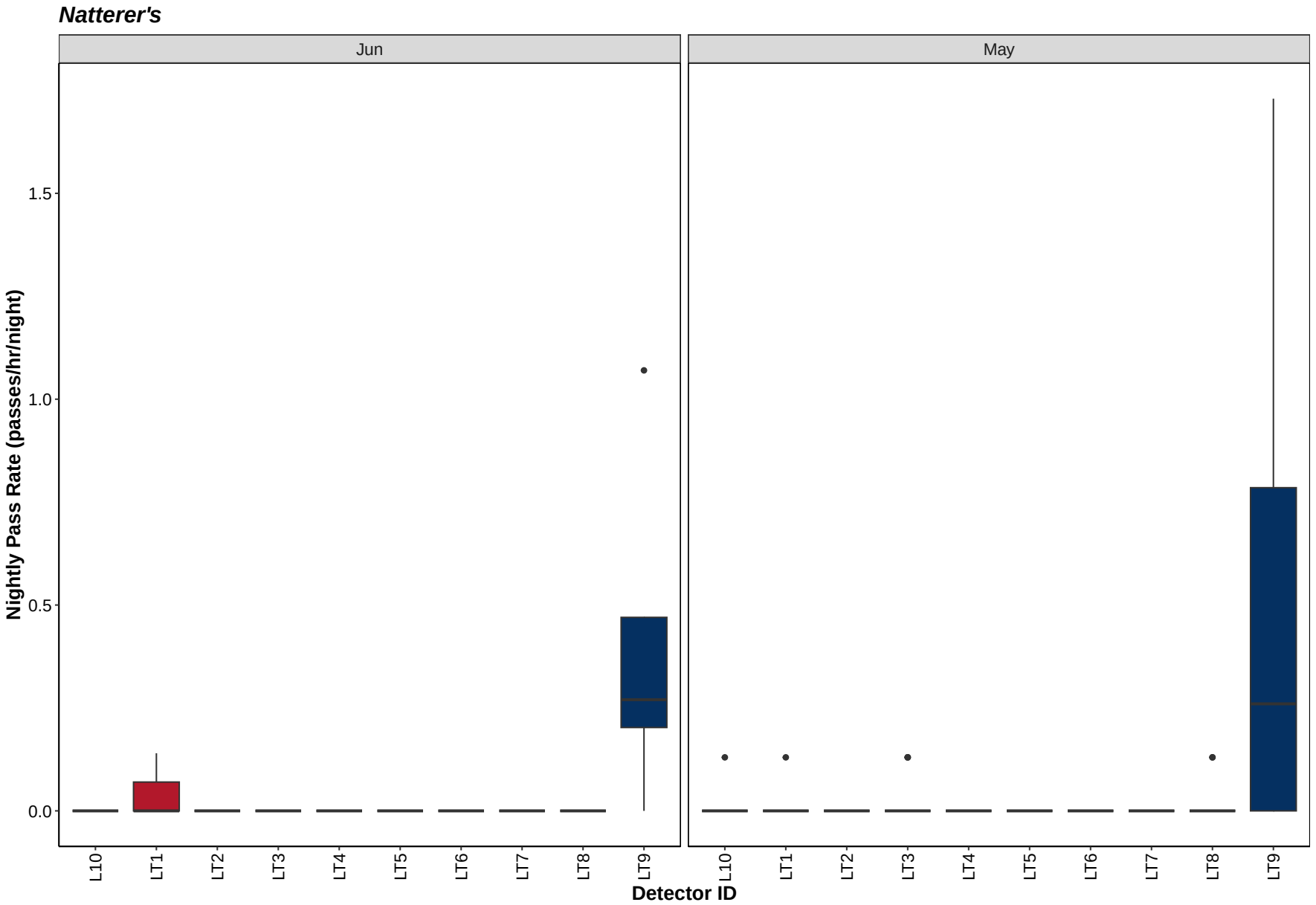

Brown long−eared
Jun
May
Nightly Pass Rate (passes/hr/night)
2.5
2.0
1.5
1.0
0.5
0.0
L10
LT1
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID

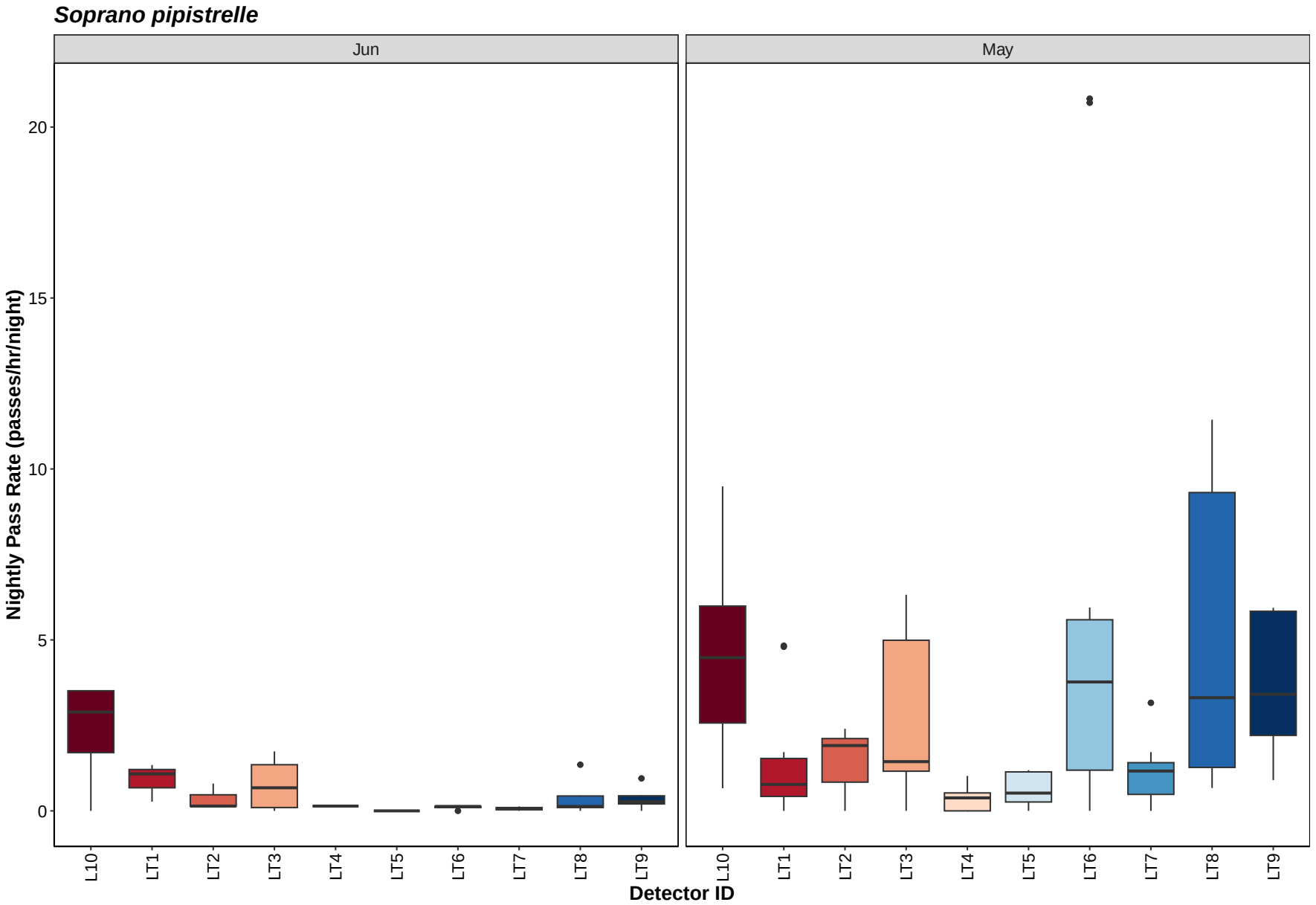

Common pipistrelle
Jun
May
Nightly Pass Rate (passes/hr/night)
0
25
50
75
L10
LT1
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID

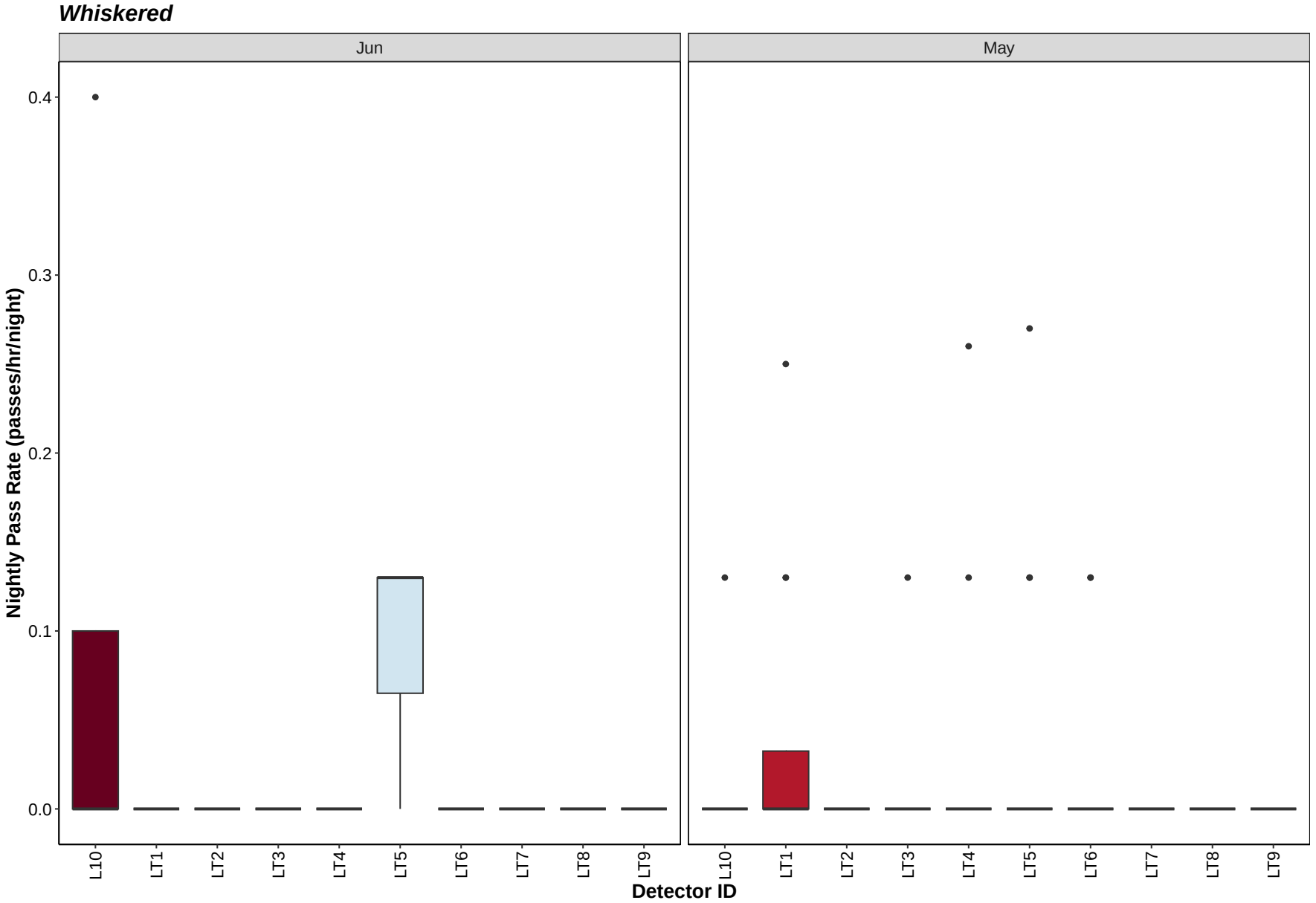

Daubenton's
Jun
May
Nightly Pass Rate (passes/hr/night)
0.0
0.2
0.4
L10
LT1
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID


Leisler's
Jun
May
Nightly Pass Rate (passes/hr/night)
30
20
10
0
L10
LT1
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID


Nathusius'
Jun
May
Nightly Pass Rate (passes/hr/night)
0
1
2
3
L10
LT1
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID


Natterer's
Jun
May
Nightly Pass Rate (passes/hr/night)
0.0
0.5
1.0
1.5
L10
LT1
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID


Soprano pipistrelle
Jun
May
Nightly Pass Rate (passes/hr/night)
0
5
10
15
20
L10
LT1
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID


Whiskered
Jun
May
Nightly Pass Rate (passes/hr/night)
0.4
0.3
0.2
0.1
0.0
L10
LT1
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID

Bat Activity per Detector Location

Figure 18. Detector ID reference:

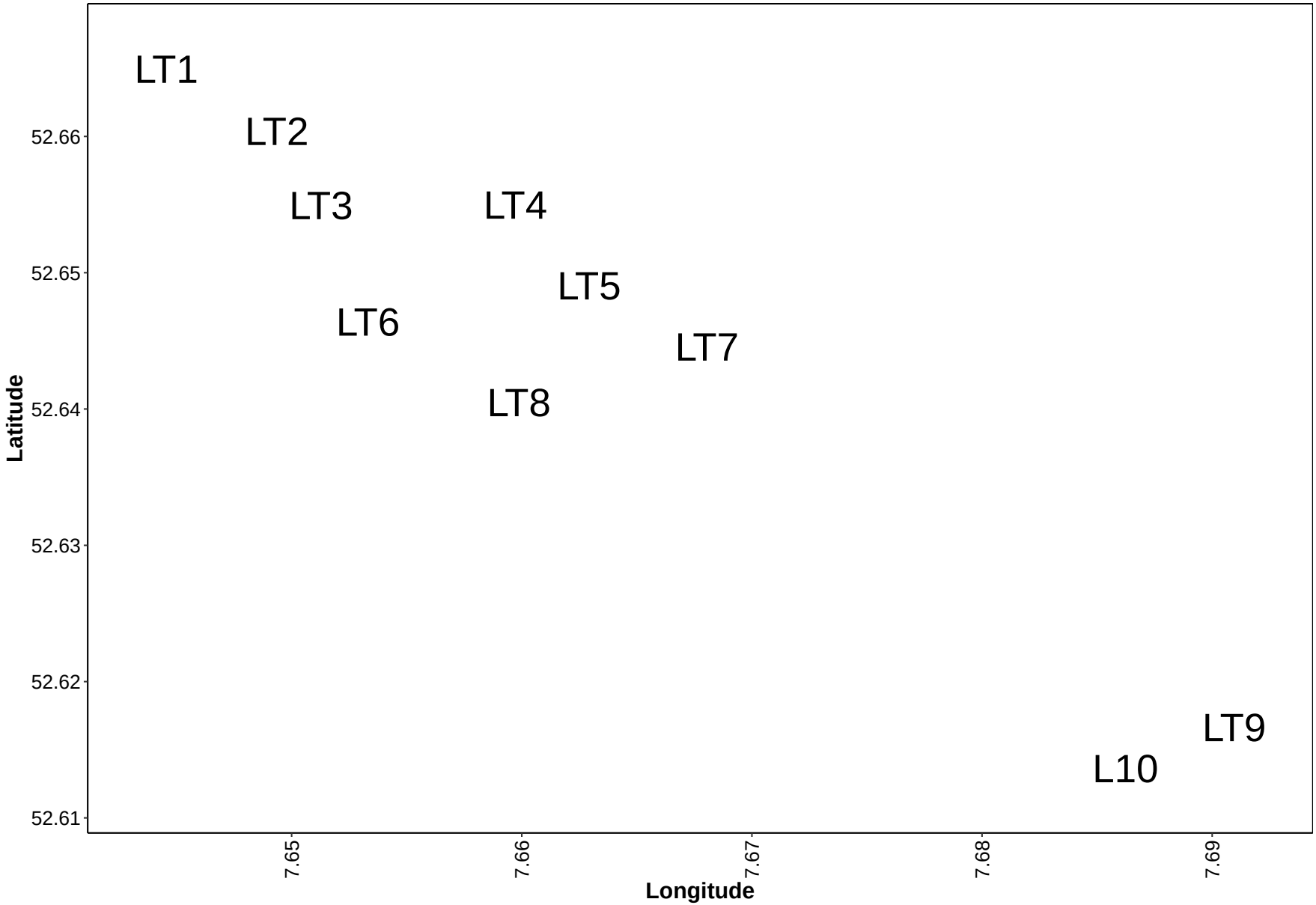
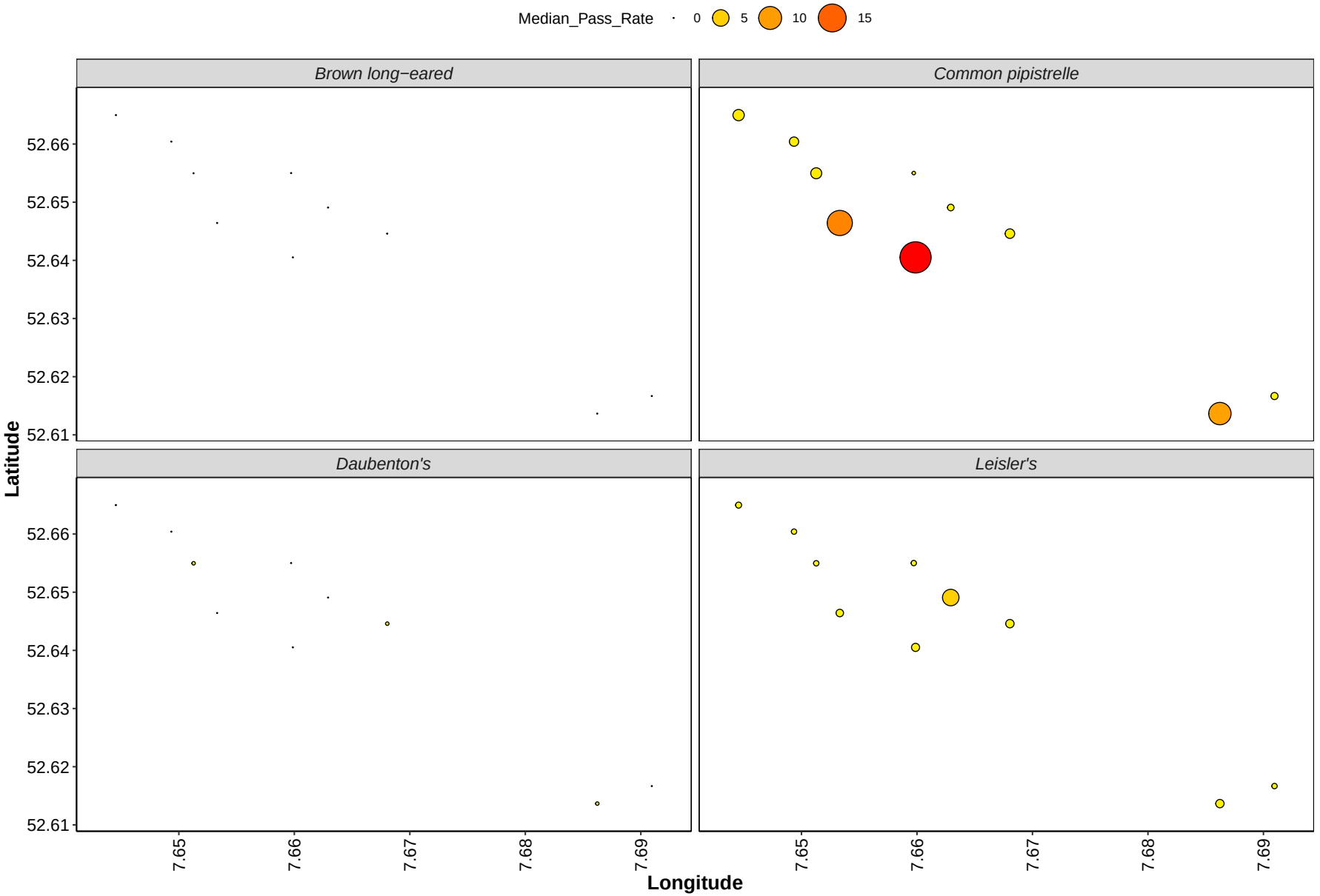

LT1
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
L10
52.66
52.65
52.64
52.63
52.62
52.61
Latitude
7.65
7.66
7.67
7.68
7.69
Longitude

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
Brown long−eared
Common pipistrelle
Daubenton's
Leisler's
52.66
52.65
52.64
52.63
52.62
52.61
Latitude
7.65
7.66
7.67
7.68
7.69
Longitude

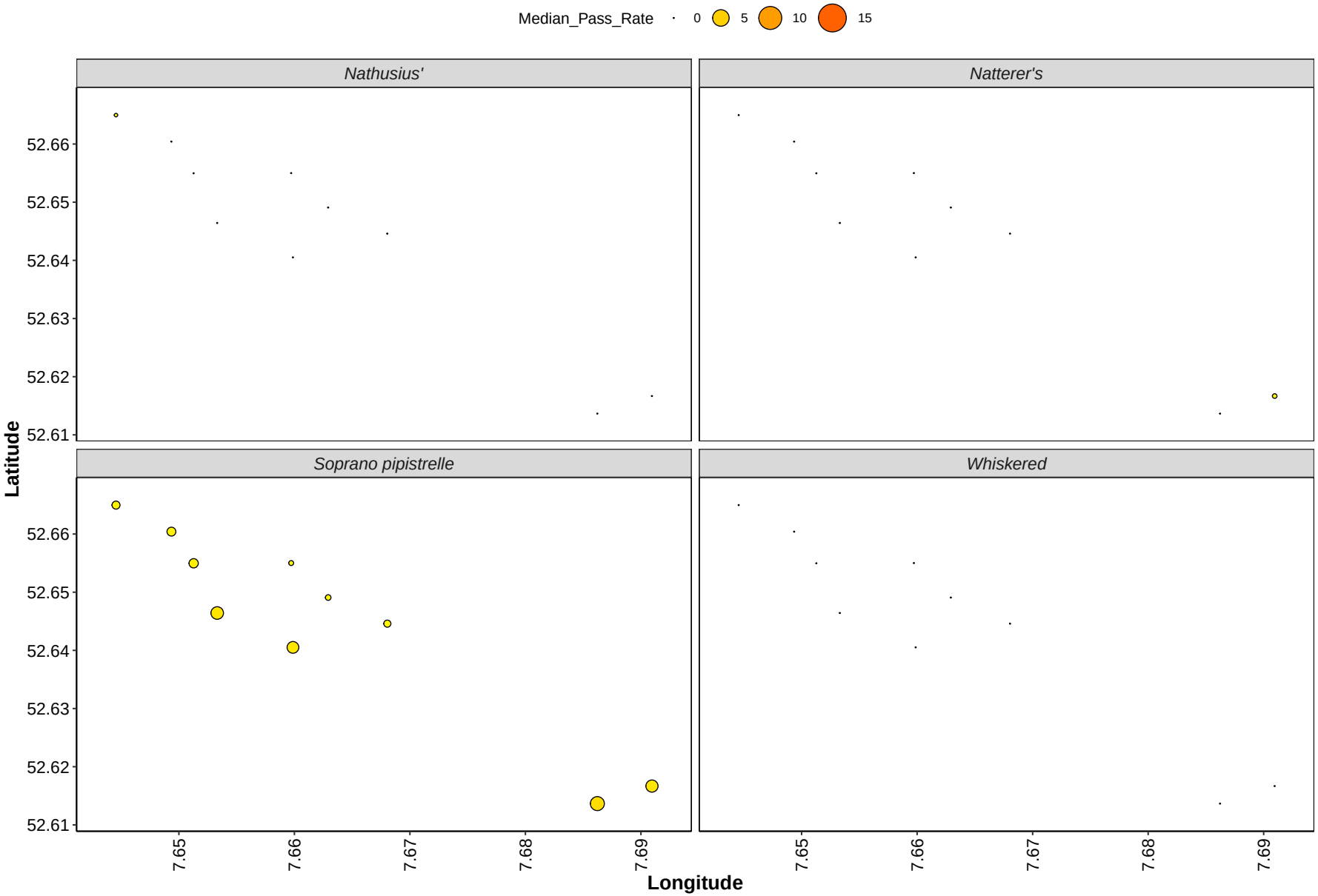
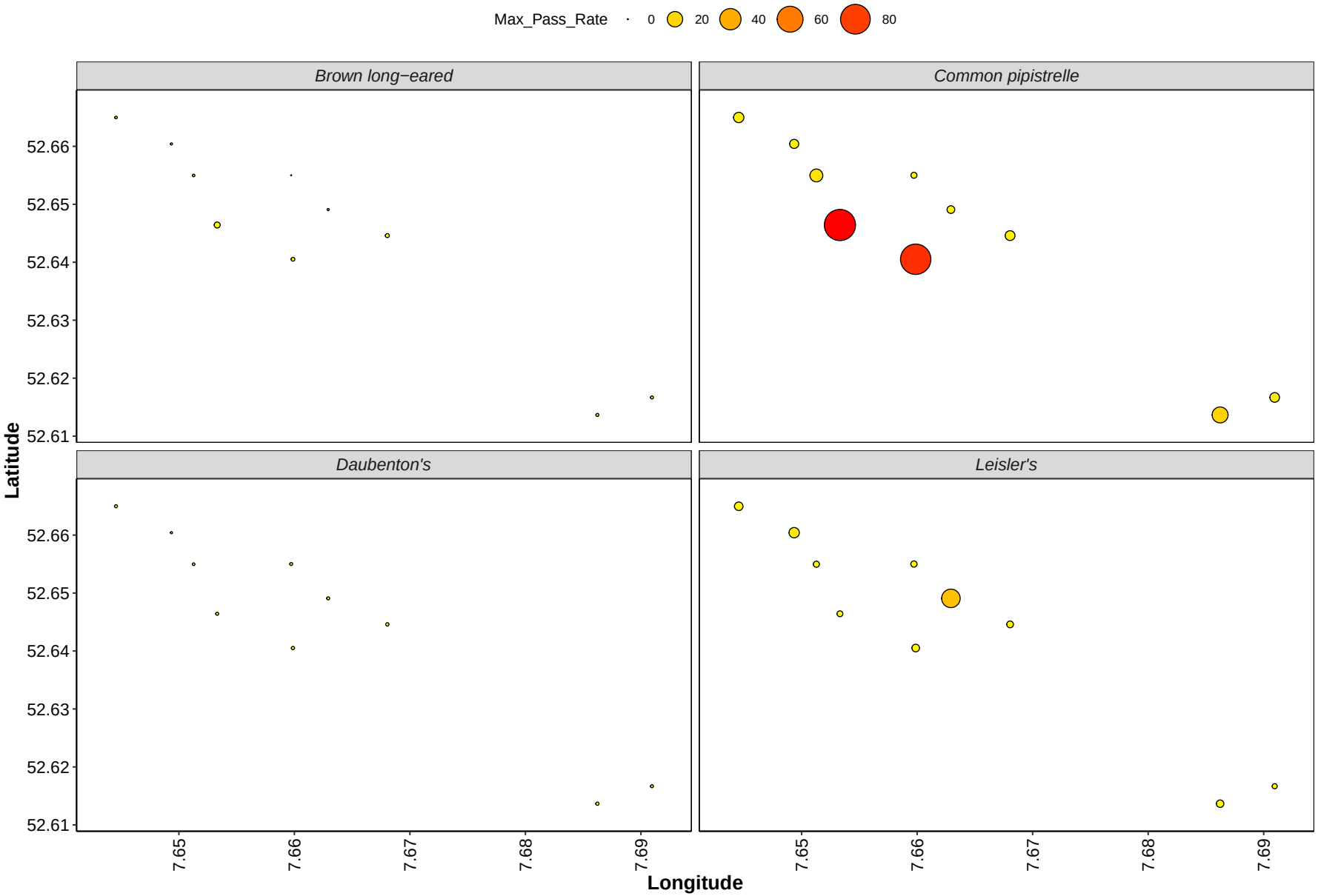
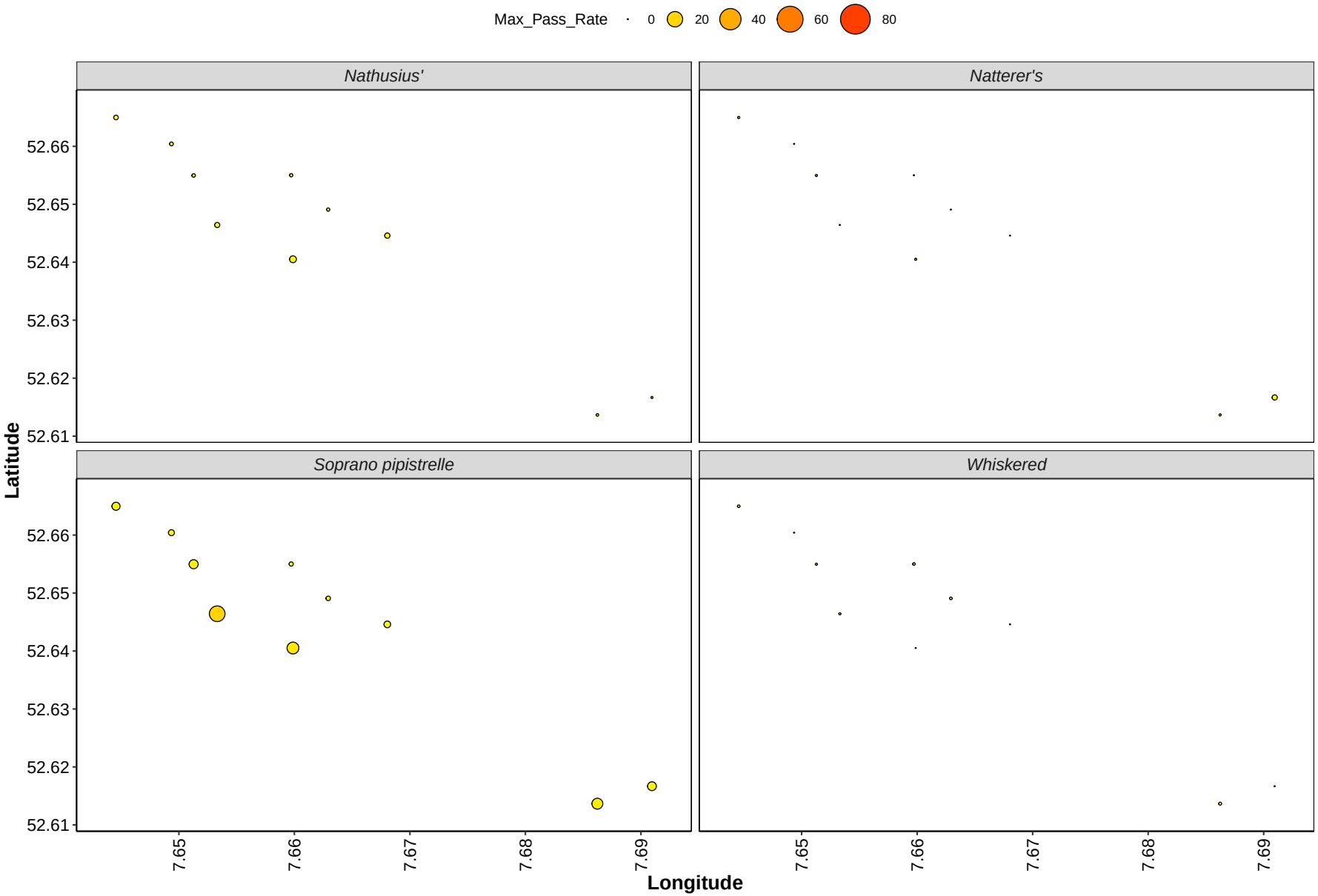

Median_Pass_Rate
0
5
10
15
Nathusius'
Natterer's
Soprano pipistrelle
Whiskered
52.66
52.65
52.64
52.63
52.62
52.61
Latitude
Longitude

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
20
40
60
80
Brown long−eared
Common pipistrelle
Daubenton's
Leisler's
52.66
52.65
52.64
52.63
52.62
52.61
Latitude
7.65
7.66
7.67
7.68
7.69
Longitude


Max_Pass_Rate
0
20
40
60
80
Nathusius'
Natterer's
Soprano pipistrelle
Whiskered
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
Longitude
7.65
7.66
7.67
7.68
7.69

Thank you for using Ecobat!

Ecobat Report

2026-01-19

Geo filter: all, Time filter: all

Summary

Bats were detected on **58** nights between **24/07/2025** and **24/08/2026**, using **11** static bat detectors. Throughout this period, **8** species were recorded. **Table 1.** Detectors were placed at the following locations:

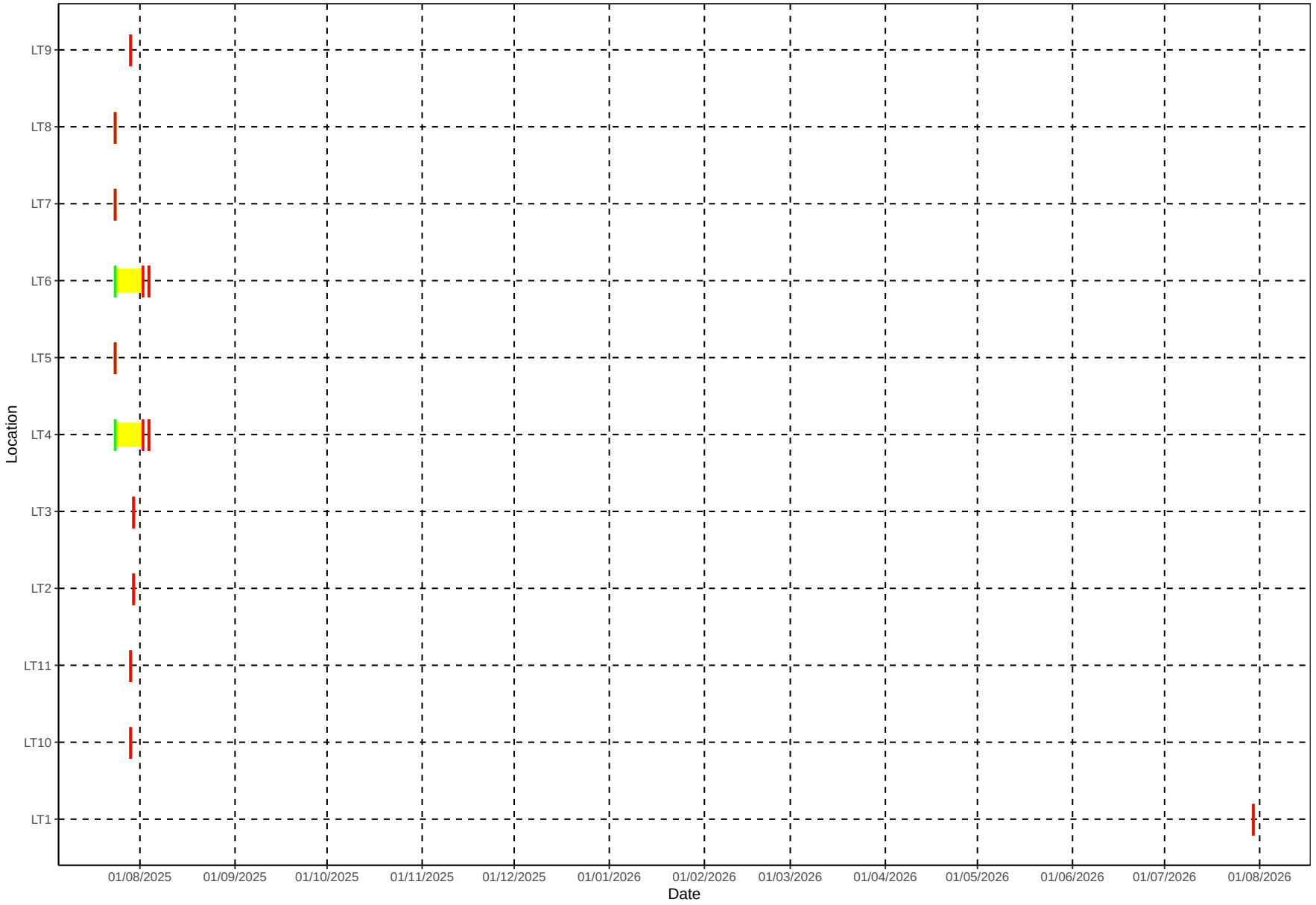
Detector ID	Latitude	Longitude
LT1	52.66497	7.644556
LT2	52.66041	7.649355
LT3	52.65497	7.651278
LT4	52.65501	7.659723
LT5	52.64908	7.662925
LT6	52.64642	7.653317
LT7	52.64459	7.668046
LT8	52.64051	7.659876
LT9	52.61667	7.690955
LT10	52.61366	7.686230
LT11	52.60997	7.683222

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
LT1	26
LT10	27
LT11	27
LT2	26
LT3	26
LT4	27
LT5	28
LT6	21
LT7	28
LT8	28
LT9	27

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


LT9
LT8
LT7
LT6
LT5
LT4
LT3
LT2
LT11
LT10
LT1
Location
01/08/2025
01/09/2025
01/10/2025
01/11/2025
01/12/2025
01/01/2026
01/02/2026
01/03/2026
01/04/2026
01/05/2026
01/06/2026
01/07/2026
01/08/2026
Date

Part 1: Percentile 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.

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 Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT1	Myotis daubentonii	0	0	0	0	0	21
LT1	Myotis mystacinus	0	0	0	0	0	15
LT1	Myotis nattereri	0	0	0	0	0	3
LT1	Nyctalus leisleri	0	0	0	0	0	26
LT1	Pipistrellus nathusii	0	0	0	0	0	1
LT1	Pipistrellus pipistrellus	0	0	0	0	0	26
LT1	Pipistrellus pygmaeus	0	0	0	0	0	26
LT1	Plecotus auritus	0	0	0	0	0	12
LT10	Myotis daubentonii	0	0	0	0	0	21
LT10	Myotis mystacinus	0	0	0	0	0	13
LT10	Myotis nattereri	0	0	0	0	2	14
LT10	Nyctalus leisleri	0	0	0	0	0	25
LT10	Pipistrellus pipistrellus	0	0	0	0	0	24
LT10	Pipistrellus pygmaeus	0	0	0	0	10	17
LT10	Plecotus auritus	0	0	0	0	0	12
LT11	Myotis daubentonii	0	0	0	0	2	23
LT11	Myotis mystacinus	0	0	0	0	0	6
LT11	Myotis nattereri	0	0	0	0	10	12
LT11	Nyctalus leisleri	0	0	0	0	0	27

Detector ID	Species/Species Group	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT11	Pipistrellus nathusii	0	0	0	0	0	4
LT11	Pipistrellus pipistrellus	0	0	0	0	0	26
LT11	Pipistrellus pygmaeus	0	0	0	0	9	18
LT11	Plecotus auritus	0	0	0	0	1	23
LT2	Myotis daubentonii	0	0	0	0	0	15
LT2	Myotis mystacinus	0	0	0	0	0	14
LT2	Myotis nattereri	0	0	0	0	3	7
LT2	Nyctalus leisleri	0	0	0	0	2	24
LT2	Pipistrellus nathusii	0	0	0	0	0	2
LT2	Pipistrellus pipistrellus	0	0	0	0	0	25
LT2	Pipistrellus pygmaeus	0	0	0	0	0	26
LT2	Plecotus auritus	0	0	0	0	0	17
LT3	Myotis daubentonii	0	0	0	0	0	24
LT3	Myotis mystacinus	0	0	0	0	0	5
LT3	Myotis nattereri	0	0	0	0	0	9
LT3	Nyctalus leisleri	0	0	0	0	0	26
LT3	Pipistrellus pipistrellus	0	0	0	0	0	26
LT3	Pipistrellus pygmaeus	0	0	0	0	0	26
LT3	Plecotus auritus	0	0	0	0	0	13
LT4	Myotis daubentonii	0	0	0	0	0	15

Detector ID	Species/Species Group	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT4	Myotis mystacinus	0	0	0	0	0	12
LT4	Myotis nattereri	0	0	0	0	0	7
LT4	Nyctalus leisleri	0	0	0	0	2	25
LT4	Pipistrellus pipistrellus	0	0	0	0	0	25
LT4	Pipistrellus pygmaeus	0	0	0	0	0	27
LT4	Plecotus auritus	0	0	0	0	0	9
LT5	Myotis daubentonii	0	0	0	0	0	18
LT5	Myotis mystacinus	0	0	0	0	0	10
LT5	Myotis nattereri	0	0	0	0	0	14
LT5	Nyctalus leisleri	0	0	0	0	0	28
LT5	Pipistrellus nathusii	0	0	0	0	0	6
LT5	Pipistrellus pipistrellus	0	0	0	0	0	27
LT5	Pipistrellus pygmaeus	0	0	0	0	0	27
LT5	Plecotus auritus	0	0	0	0	0	18
LT6	Myotis daubentonii	0	0	0	0	0	13
LT6	Myotis mystacinus	0	0	0	0	0	8
LT6	Myotis nattereri	0	0	0	0	0	9
LT6	Nyctalus leisleri	0	0	0	0	0	19
LT6	Pipistrellus pipistrellus	0	0	0	0	0	18
LT6	Pipistrellus pygmaeus	0	0	0	0	0	20
LT6	Plecotus auritus	0	0	0	0	0	7

Detector ID	Species/Species Group	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT7	Myotis daubentonii	0	0	0	0	0	17
LT7	Myotis mystacinus	0	0	0	0	0	10
LT7	Myotis nattereri	0	0	0	0	0	13
LT7	Nyctalus leisleri	0	0	0	0	2	26
LT7	Pipistrellus nathusii	0	0	0	0	0	4
LT7	Pipistrellus pipistrellus	0	0	0	0	0	28
LT7	Pipistrellus pygmaeus	0	0	0	0	2	26
LT7	Plecotus auritus	0	0	0	0	0	24
LT8	Myotis daubentonii	0	0	0	0	0	25
LT8	Myotis mystacinus	0	0	0	0	0	8
LT8	Myotis nattereri	0	0	0	0	4	10
LT8	Nyctalus leisleri	0	0	0	0	2	26
LT8	Pipistrellus pipistrellus	0	0	0	0	0	26
LT8	Pipistrellus pygmaeus	0	0	0	0	0	28
LT8	Plecotus auritus	0	0	0	0	0	19
LT9	Myotis daubentonii	0	0	0	0	2	18
LT9	Myotis mystacinus	0	0	0	0	0	3
LT9	Myotis nattereri	0	0	2	2	19	1
LT9	Nyctalus leisleri	0	0	0	0	0	26
LT9	Pipistrellus nathusii	0	0	0	0	0	4
LT9	Pipistrellus pipistrellus	0	0	0	0	0	27

Detector ID	Species/Species Group	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT9	Pipistrellus pygmaeus	0	0	0	0	2	25
LT9	Plecotus auritus	0	0	0	0	2	16

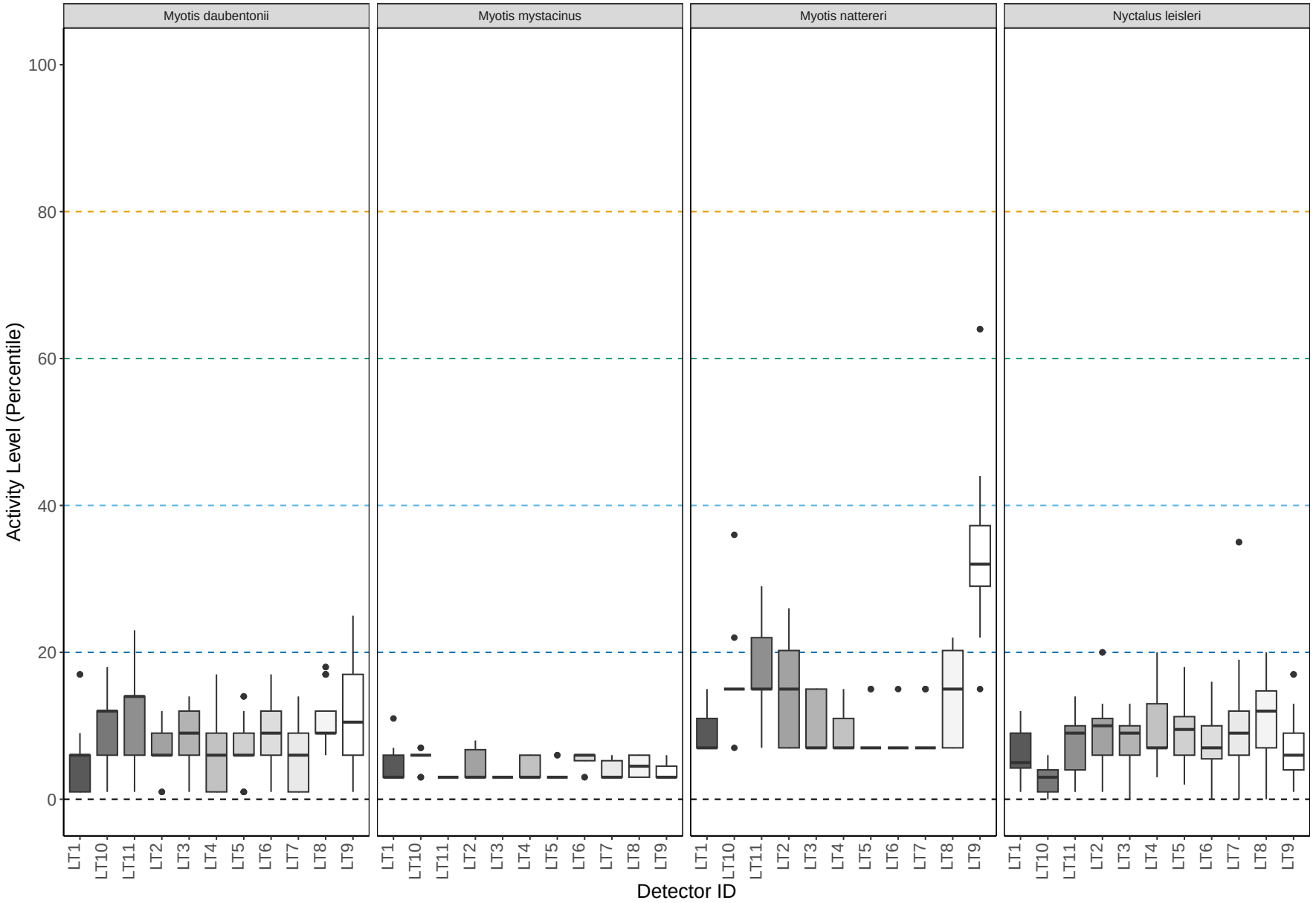
Table 4. Summary table showing key metrics for each species recorded. The reference range is the number of nights for each species that your data were compared to. We recommend a Reference Range of 200+ to be confident in the relative activity level.

Detector ID	Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded	Reference Range
LT1	Myotis daubentonii	6	3.5 - 7.5	17	21	6886
LT1	Myotis mystacinus	3	3 - 6	11	15	2818
LT1	Myotis nattereri	7	7 - 7	15	3	2036
LT1	Nyctalus leisleri	5	5 - 7.5	12	26	62907
LT1	Pipistrellus nathusii	9	0	9	1	3167
LT1	Pipistrellus pipistrellus	0	1 - 1	2	26	1538084
LT1	Pipistrellus pygmaeus	13	11.5 - 13.5	19	26	416126
LT1	Plecotus auritus	7	2.5 - 9	13	12	23469
LT10	Myotis daubentonii	12	6.5 - 12	18	21	6886
LT10	Myotis mystacinus	6	4.5 - 6.5	7	13	2818
LT10	Myotis nattereri	15	15 - 15	36	16	2036
LT10	Nyctalus leisleri	3	2 - 3.5	6	25	62907
LT10	Pipistrellus pipistrellus	0	0 - 0	1	24	1538084
LT10	Pipistrellus pygmaeus	16	15 - 19	26	27	416126
LT10	Plecotus auritus	4	1 - 4	17	12	23469
LT11	Myotis daubentonii	14	10 - 14	23	25	6886
LT11	Myotis mystacinus	3	3 - 3	3	6	2818
LT11	Myotis nattereri	15	14.5 - 22	29	22	2036
LT11	Nyctalus leisleri	9	5.5 - 9	14	27	62907
LT11	Pipistrellus nathusii	9	9 - 9	9	4	3167
LT11	Pipistrellus pipistrellus	0	0 - 0	1	26	1538084
LT11	Pipistrellus pygmaeus	14	12.5 - 18.5	32	27	416126
LT11	Plecotus auritus	9	8 - 12	23	24	23469
LT2	Myotis daubentonii	6	6 - 9	12	15	6886
LT2	Myotis mystacinus	3	3 - 5.5	8	14	2818
LT2	Myotis nattereri	15	7 - 20.5	26	10	2036
LT2	Nyctalus leisleri	10	7.5 - 11	20	26	62907
LT2	Pipistrellus nathusii	9	9 - 9	9	2	3167
LT2	Pipistrellus pipistrellus	0	1 - 1.5	2	25	1538084
LT2	Pipistrellus pygmaeus	9	7.5 - 10	12	26	416126
LT2	Plecotus auritus	4	2.5 - 6.5	9	17	23469
LT3	Myotis daubentonii	9	7.5 - 10.5	14	24	6886
LT3	Myotis mystacinus	3	3 - 3	3	5	2818

Detector ID	Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded	Reference Range
LT3	Myotis nattereri	7	7 - 11	15	9	2036
LT3	Nyctalus leisleri	9	7.5 - 10	13	26	62907
LT3	Pipistrellus pipistrellus	0	0 - 0	1	26	1538084
LT3	Pipistrellus pygmaeus	8	6.5 - 8.5	16	26	416126
LT3	Plecotus auritus	4	2.5 - 6.5	9	13	23469
LT4	Myotis daubentonii	6	1 - 9	17	15	6886
LT4	Myotis mystacinus	3	3 - 4.5	6	12	2818
LT4	Myotis nattereri	7	7 - 11	15	7	2036
LT4	Nyctalus leisleri	7	7 - 11.5	20	27	62907
LT4	Pipistrellus pipistrellus	0	0 - 0	1	25	1538084
LT4	Pipistrellus pygmaeus	6	5.5 - 7.5	11	27	416126
LT4	Plecotus auritus	1	1 - 7	13	9	23469
LT5	Myotis daubentonii	6	3.5 - 9	14	18	6886
LT5	Myotis mystacinus	3	3 - 3	6	10	2818
LT5	Myotis nattereri	7	7 - 7	15	14	2036
LT5	Nyctalus leisleri	10	7 - 11	18	28	62907
LT5	Pipistrellus nathusii	9	9 - 9	9	6	3167
LT5	Pipistrellus pipistrellus	0	0 - 0	1	27	1538084
LT5	Pipistrellus pygmaeus	4	3.5 - 7	17	27	416126
LT5	Plecotus auritus	7	2.5 - 11	18	18	23469
LT6	Myotis daubentonii	9	6 - 12	17	13	6886
LT6	Myotis mystacinus	6	4.5 - 6	6	8	2818
LT6	Myotis nattereri	7	7 - 7	15	9	2036
LT6	Nyctalus leisleri	7	5.5 - 9.5	16	19	62907
LT6	Pipistrellus pipistrellus	0	0 - 0	1	18	1538084
LT6	Pipistrellus pygmaeus	3	2 - 4	6	20	416126
LT6	Plecotus auritus	1	1 - 5	9	7	23469
LT7	Myotis daubentonii	6	3.5 - 9	14	17	6886
LT7	Myotis mystacinus	3	3 - 4.5	6	10	2818
LT7	Myotis nattereri	7	7 - 11	15	13	2036
LT7	Nyctalus leisleri	9	7.5 - 12.5	35	28	62907
LT7	Pipistrellus nathusii	9	9 - 9	9	4	3167
LT7	Pipistrellus pipistrellus	1	1 - 3	7	28	1538084
LT7	Pipistrellus pygmaeus	7	5 - 9	20	28	416126
LT7	Plecotus auritus	4	4 - 8.5	13	24	23469
LT8	Myotis daubentonii	9	9 - 13	18	25	6886

Detector ID	Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded	Reference Range
LT8	Myotis mystacinus	5	3 - 6	6	8	2818
LT8	Myotis nattereri	15	11 - 18.5	22	14	2036
LT8	Nyctalus leisleri	12	9.5 - 14	20	28	62907
LT8	Pipistrellus pipistrellus	0	1 - 1	2	26	1538084
LT8	Pipistrellus pygmaeus	9	6.5 - 9.5	13	28	416126
LT8	Plecotus auritus	4	2.5 - 8	15	19	23469
LT9	Myotis daubentonii	11	7.5 - 15.5	25	20	6886
LT9	Myotis mystacinus	3	3 - 3	6	3	2818
LT9	Myotis nattereri	32	30.5 - 37.5	64	24	2036
LT9	Nyctalus leisleri	6	4.5 - 8	17	26	62907
LT9	Pipistrellus nathusii	9	9 - 9	9	4	3167
LT9	Pipistrellus pipistrellus	0	1 - 2	2	27	1538084
LT9	Pipistrellus pygmaeus	9	7.5 - 11.5	27	27	416126
LT9	Plecotus auritus	7	4 - 12	28	18	23469

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).


Myotis daubentonii
Myotis mystacinus
Myotis nattereri
Nyctalus leisleri
Activity Level (Percentile)
100
80
60
40
20
0
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID

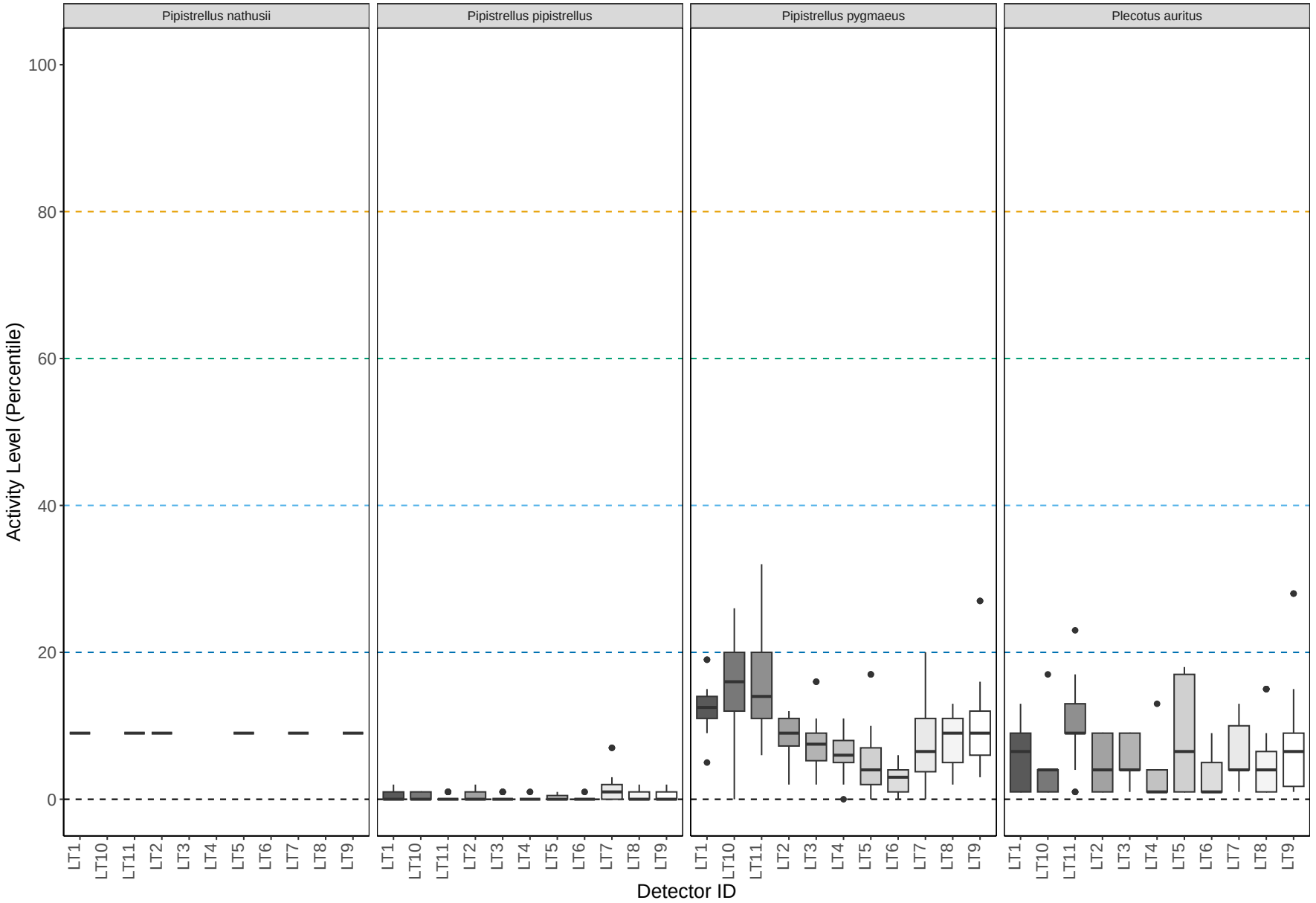
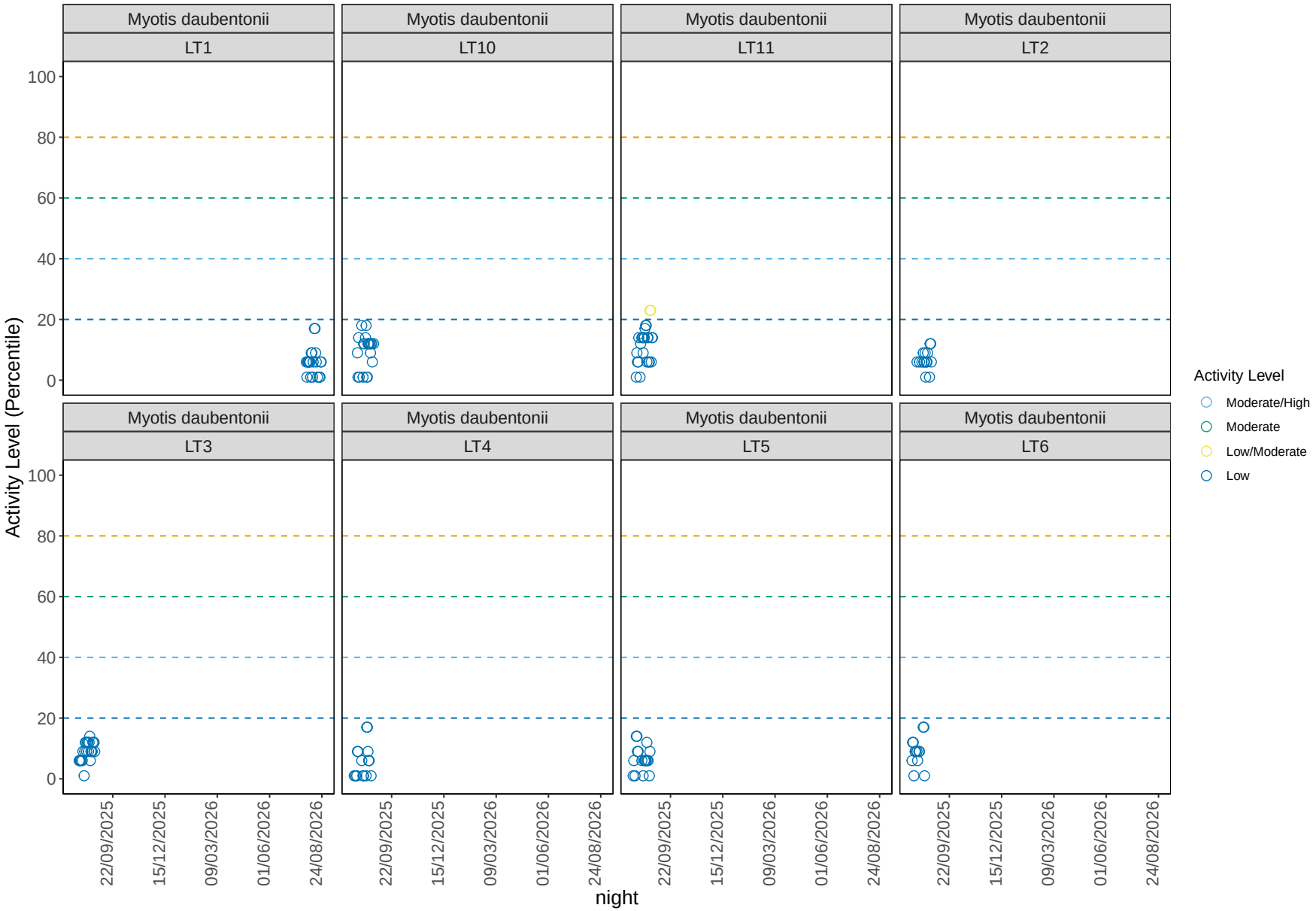
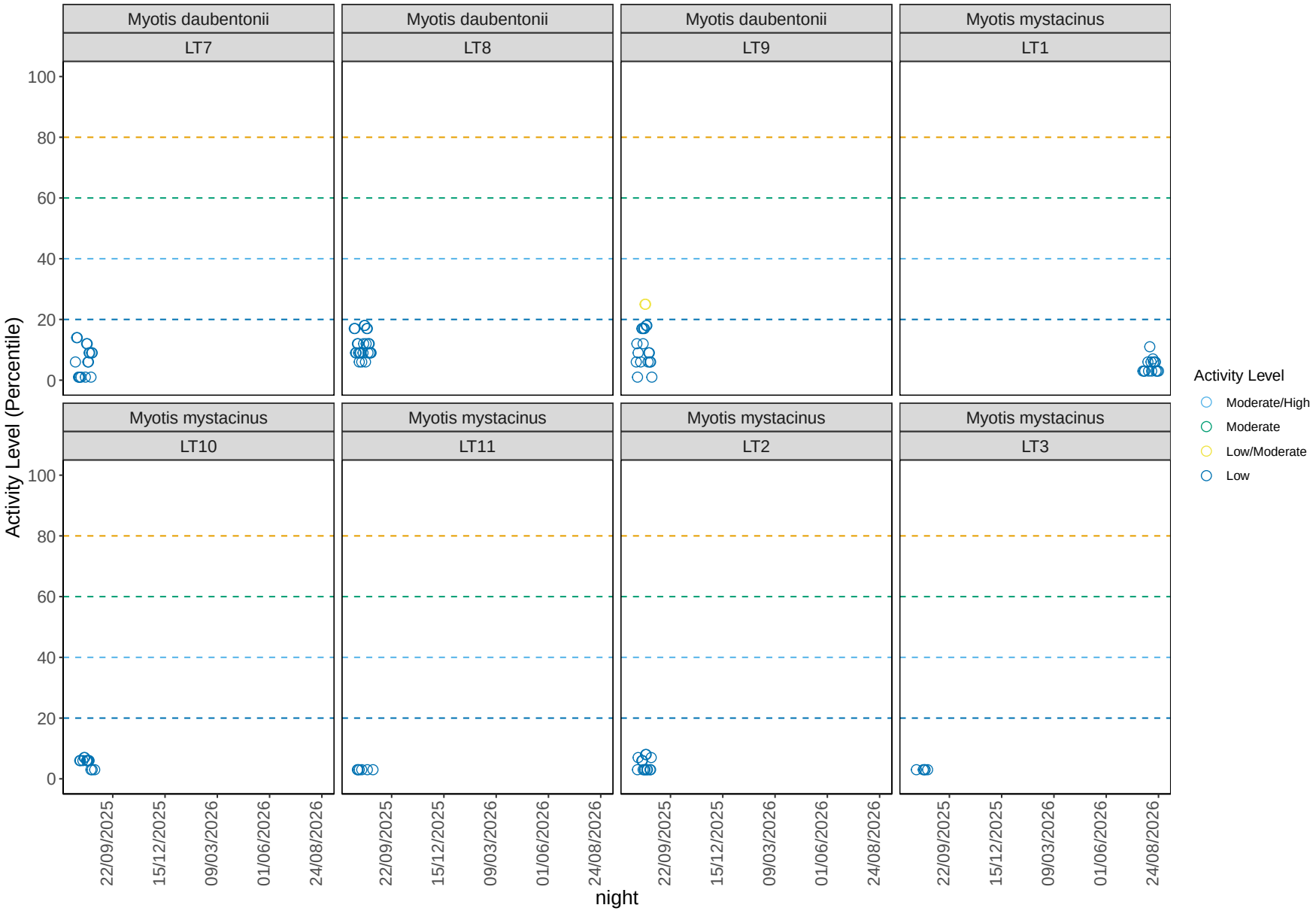
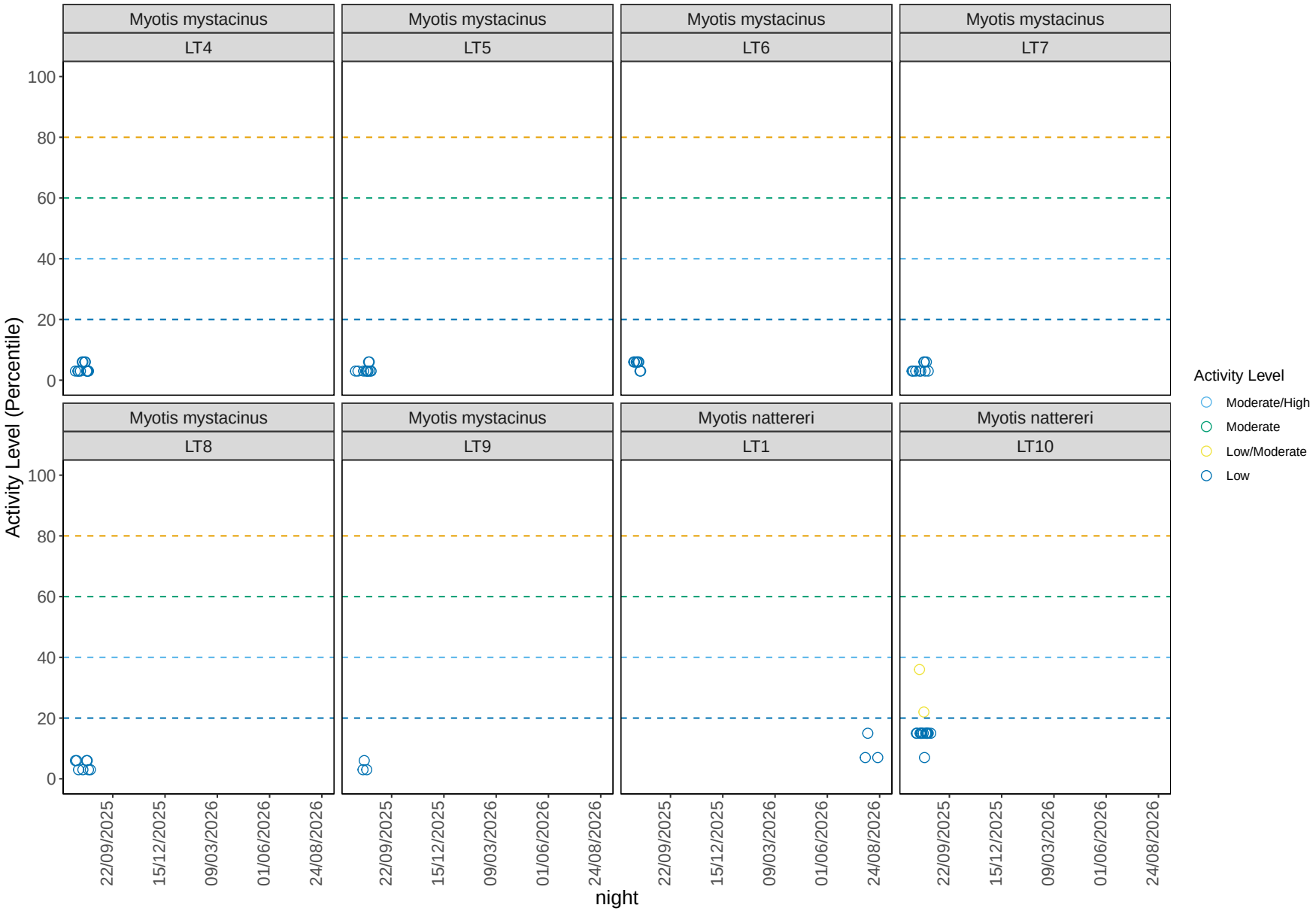
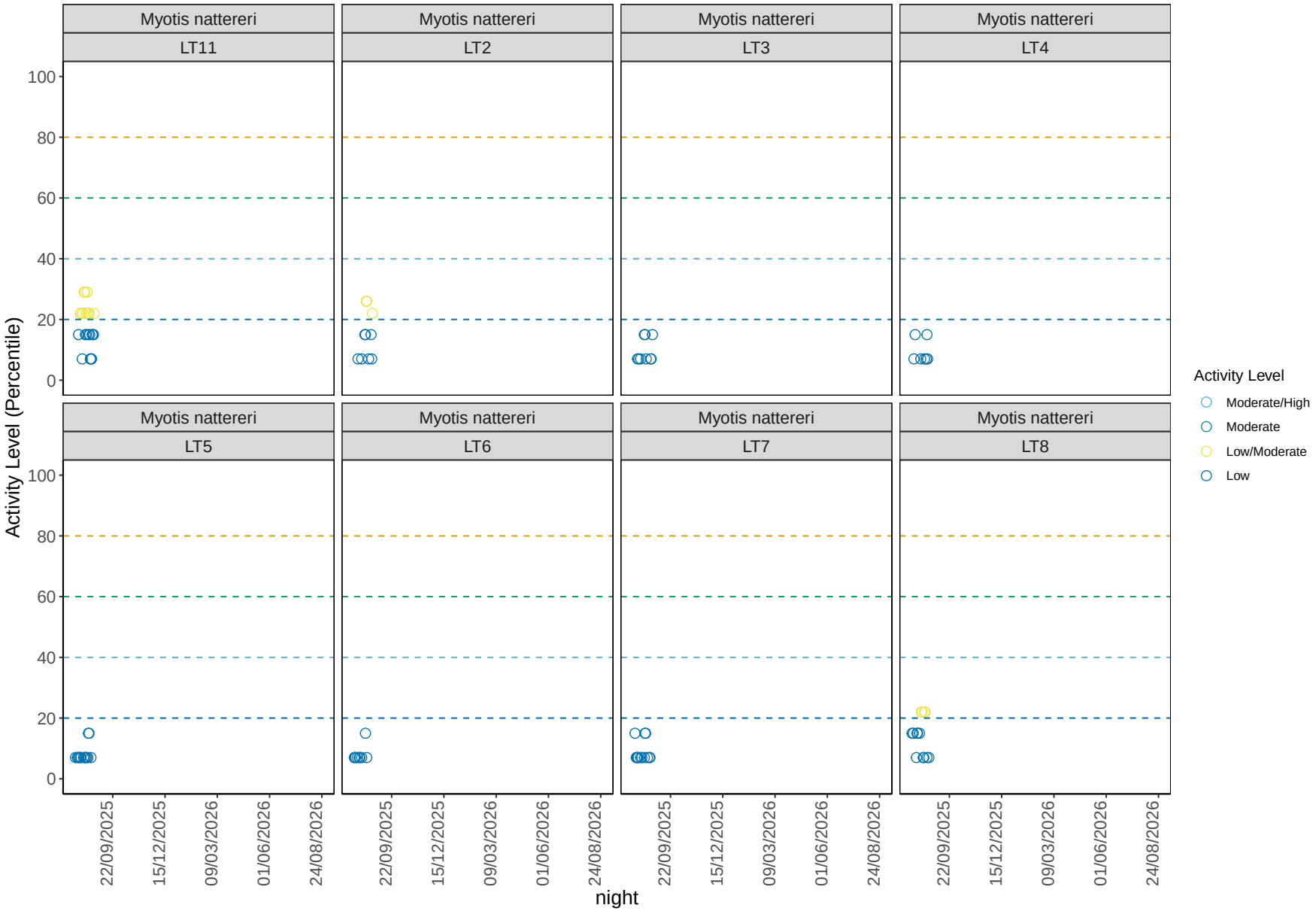

Pipistrellus nathusii
Pipistrellus pipistrellus
Pipistrellus pygmaeus
Plecotus auritus
Activity Level (Percentile)
100
80
60
40
20
0
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID

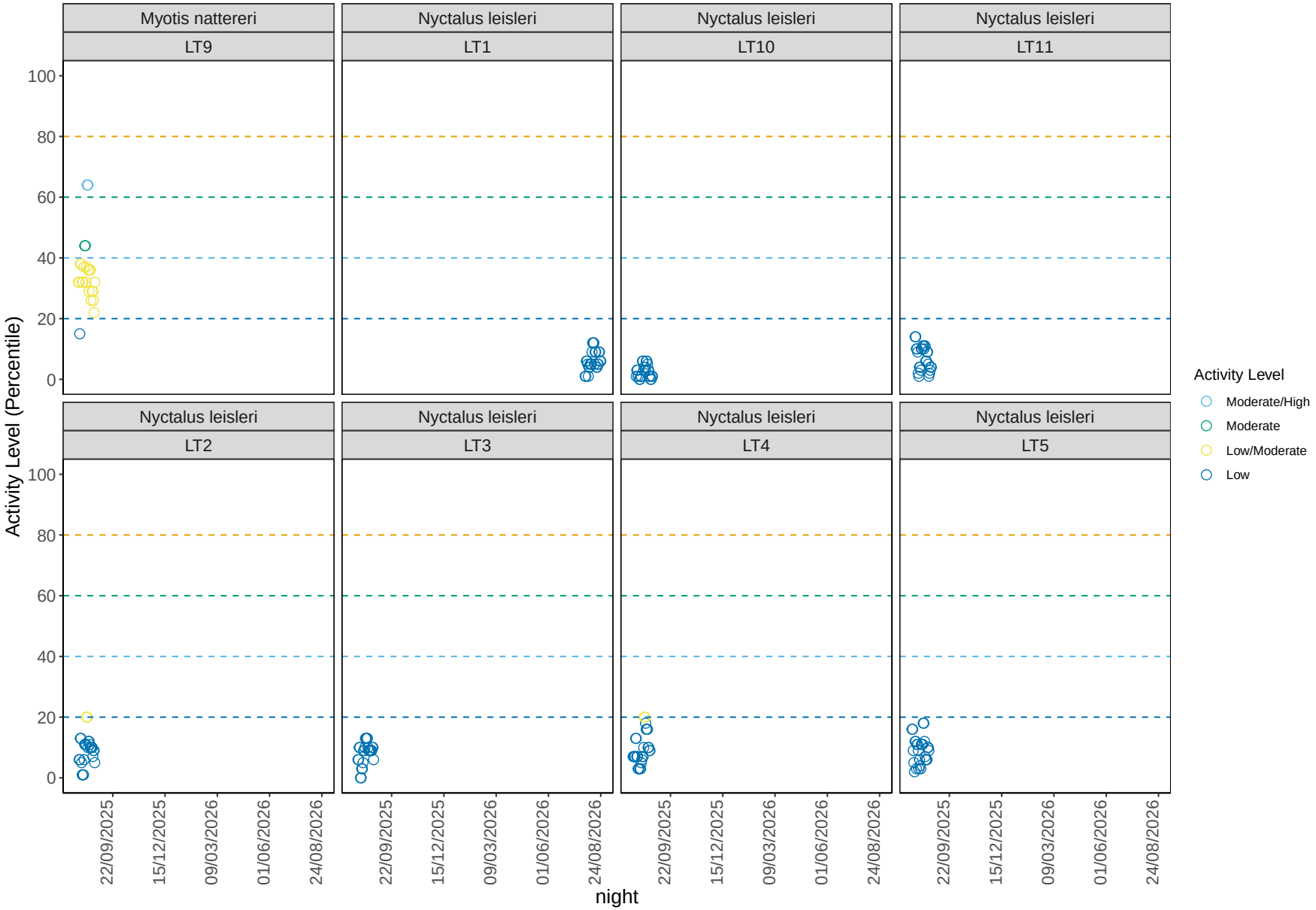
Figure 3. The activity level (percentile) of bats recorded across each night of the bat survey.

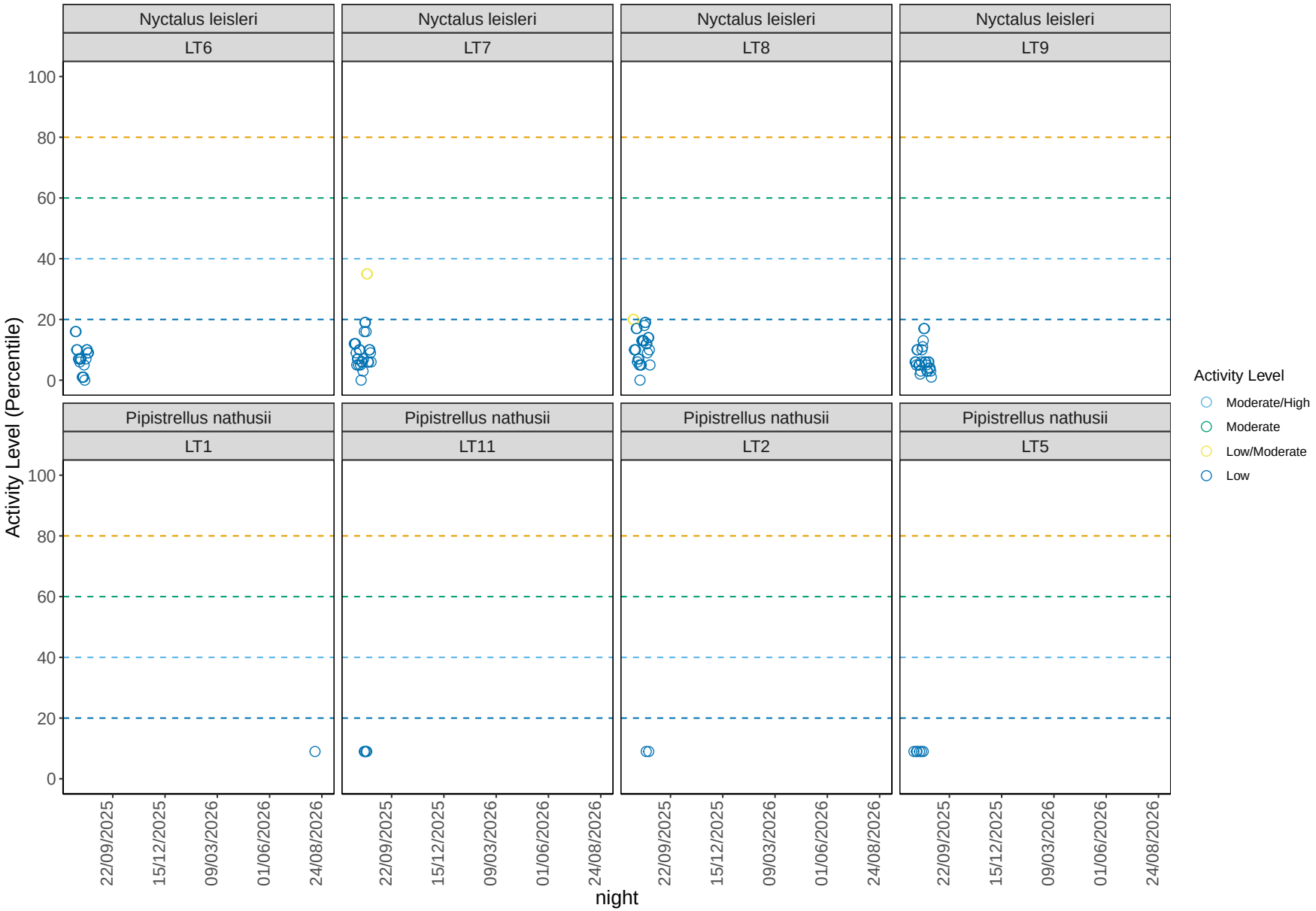

Myotis daubentonii
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
Activity Level (Percentile)
100
80
60
40
20
0
22/09/2025
15/12/2025
09/03/2026
01/06/2026
24/08/2026
night
Activity Level
Moderate/High
Moderate
Low/Moderate
Low

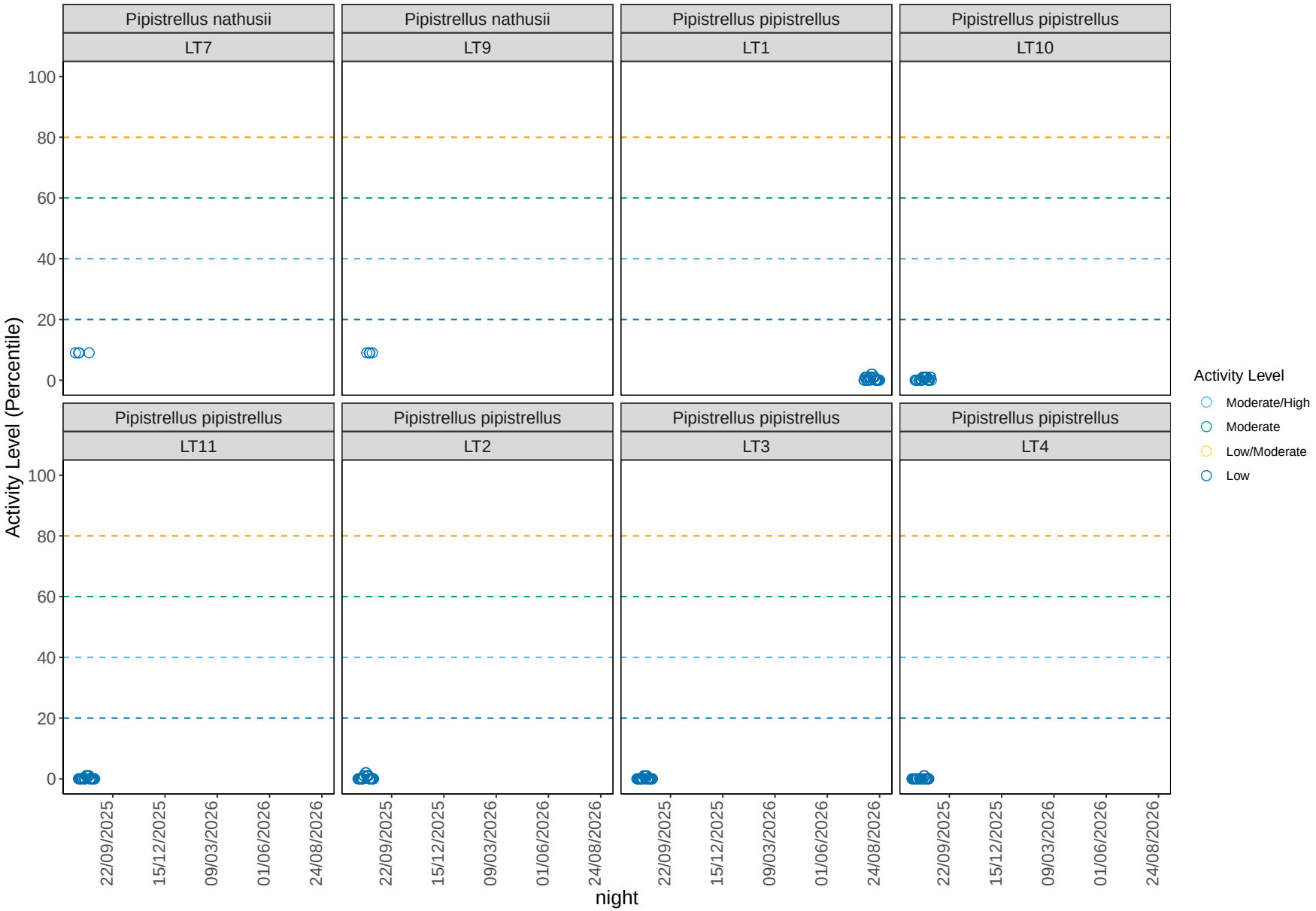

Myotis daubentonii
LT7
Myotis daubentonii
LT8
Myotis daubentonii
LT9
Myotis mystacinus
LT1
Myotis mystacinus
LT10
Myotis mystacinus
LT11
Myotis mystacinus
LT2
Myotis mystacinus
LT3
Activity Level (Percentile)
100
80
60
40
20
0
22/09/2025
15/12/2025
09/03/2026
01/06/2026
24/08/2026
night
Activity Level
Moderate/High
Moderate
Low/Moderate
Low

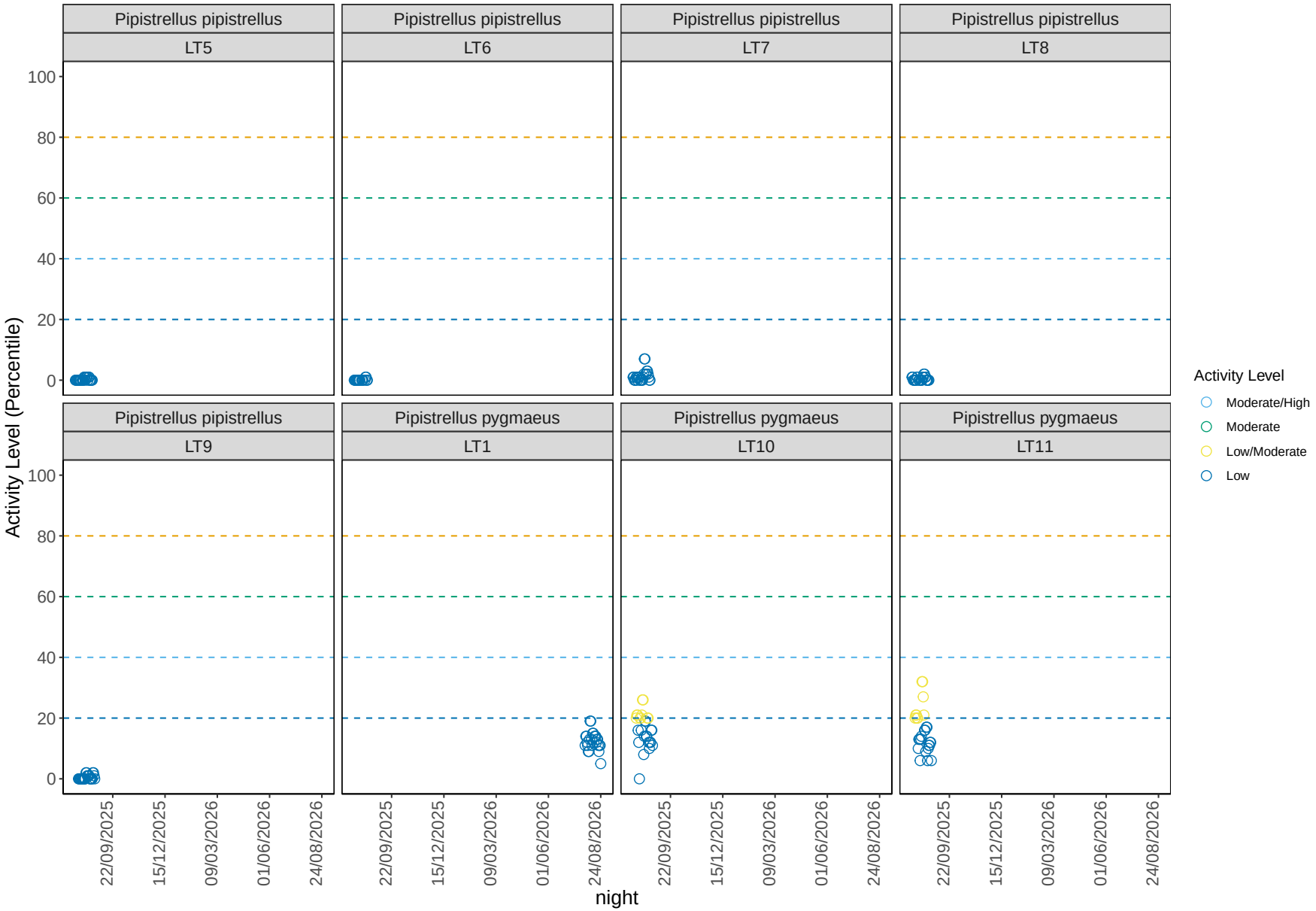

Myotis mystacinus
LT4
Myotis mystacinus
LT5
Myotis mystacinus
LT6
Myotis mystacinus
LT7
Myotis mystacinus
LT8
Myotis mystacinus
LT9
Myotis nattereri
LT1
Myotis nattereri
LT10
Activity Level (Percentile)
100
80
60
40
20
0
22/09/2025
15/12/2025
09/03/2026
01/06/2026
24/08/2026
night
Activity Level
Moderate/High
Moderate
Low/Moderate
Low

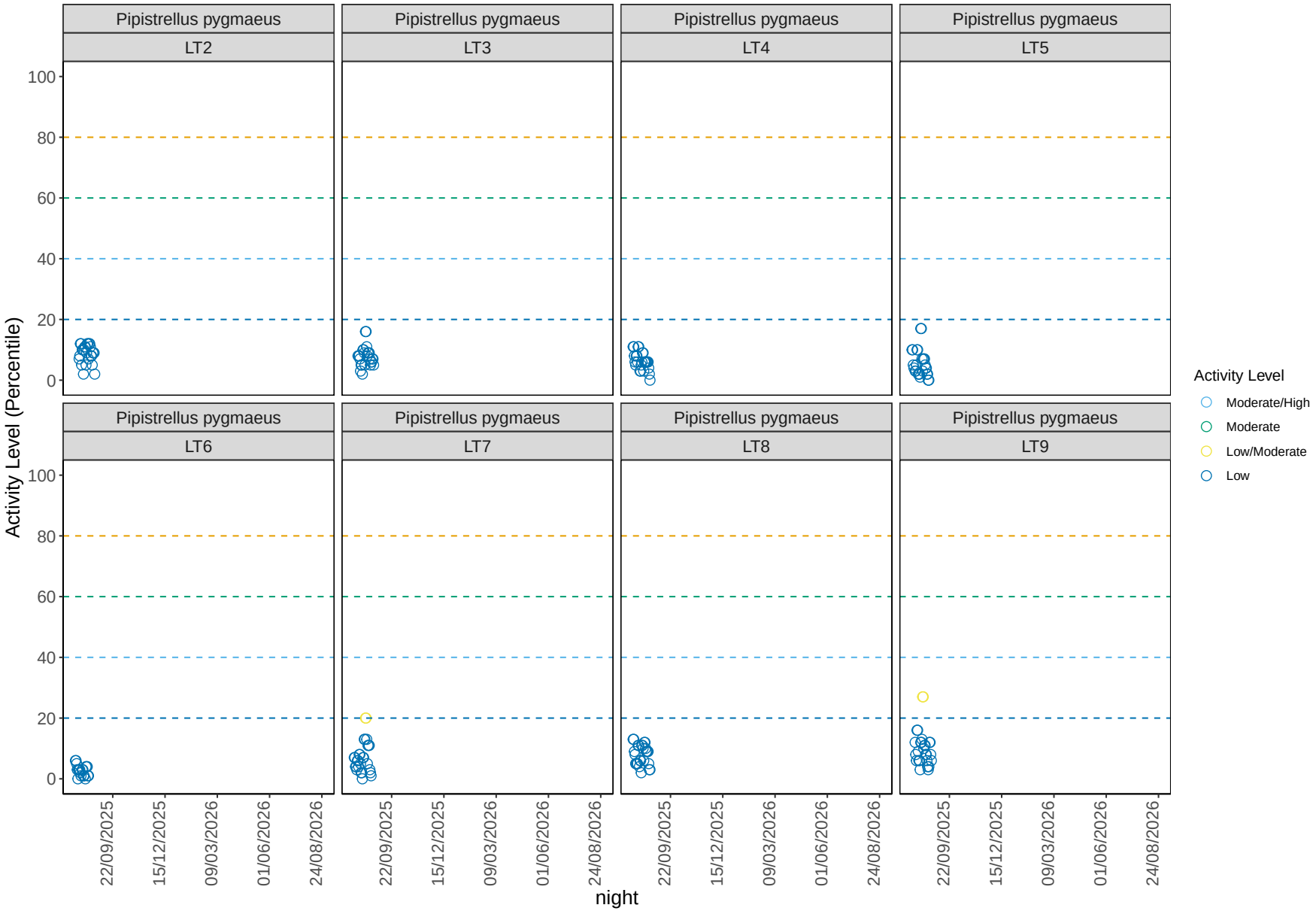

Myotis nattereri
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
Activity Level (Percentile)
0
20
40
60
80
100
22/09/2025
15/12/2025
09/03/2026
01/06/2026
24/08/2026
night
Activity Level
Moderate/High
Moderate
Low/Moderate
Low

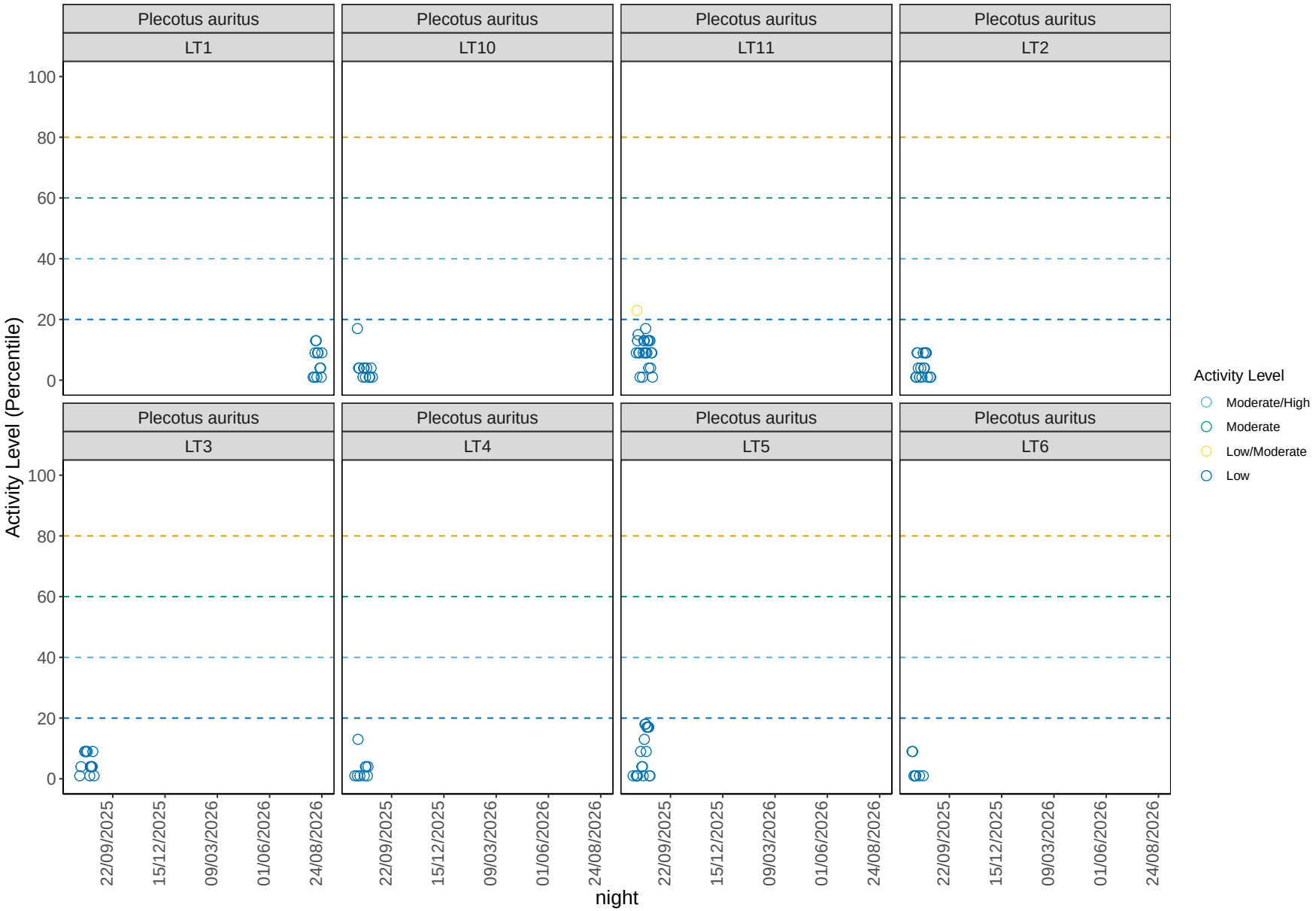

Myotis nattereri
LT9
Nyctalus leisleri
LT1
Nyctalus leisleri
LT10
Nyctalus leisleri
LT11
Nyctalus leisleri
LT2
Nyctalus leisleri
LT3
Nyctalus leisleri
LT4
Nyctalus leisleri
LT5
Activity Level (Percentile)
100
80
60
40
20
0
22/09/2025
15/12/2025
09/03/2026
01/06/2026
24/08/2026
night
Activity Level
Moderate/High
Moderate
Low/Moderate
Low

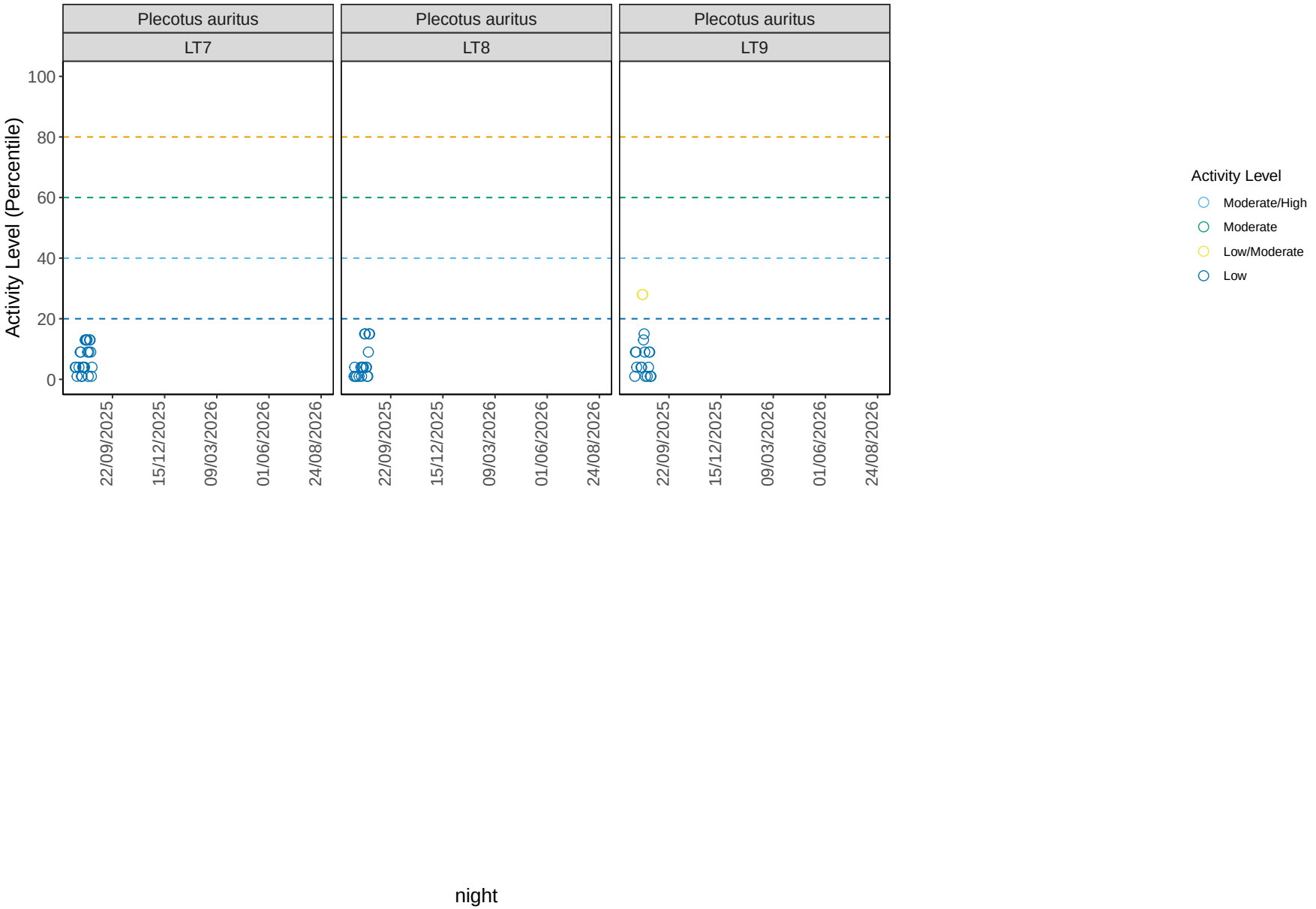

Nyctalus leisleri
LT6
Nyctalus leisleri
LT7
Nyctalus leisleri
LT8
Nyctalus leisleri
LT9
Pipistrellus nathusii
LT1
Pipistrellus nathusii
LT11
Pipistrellus nathusii
LT2
Pipistrellus nathusii
LT5
Activity Level (Percentile)
100
80
60
40
20
0
22/09/2025
15/12/2025
09/03/2026
01/06/2026
24/08/2026
night
Activity Level
Moderate/High
Moderate
Low/Moderate
Low


Pipistrellus nathusii
LT7
Pipistrellus nathusii
LT9
Pipistrellus pipistrellus
LT1
Pipistrellus pipistrellus
LT10
Pipistrellus pipistrellus
LT11
Pipistrellus pipistrellus
LT2
Pipistrellus pipistrellus
LT3
Pipistrellus pipistrellus
LT4
Activity Level (Percentile)
100
80
60
40
20
0
22/09/2025
15/12/2025
09/03/2026
01/06/2026
24/08/2026
night
Activity Level
Moderate/High
Moderate
Low/Moderate
Low


Pipistrellus pipistrellus
LT5
Pipistrellus pipistrellus
LT6
Pipistrellus pipistrellus
LT7
Pipistrellus pipistrellus
LT8
Pipistrellus pipistrellus
LT9
Pipistrellus pygmaeus
LT1
Pipistrellus pygmaeus
LT10
Pipistrellus pygmaeus
LT11
Activity Level (Percentile)
100
80
60
40
20
0
22/09/2025
15/12/2025
09/03/2026
01/06/2026
24/08/2026
night
Activity Level
Moderate/High
Moderate
Low/Moderate
Low


Pipistrellus pygmaeus
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Activity Level (Percentile)
100
80
60
40
20
0
22/09/2025
15/12/2025
09/03/2026
01/06/2026
24/08/2026
night
Activity Level
Moderate/High
Moderate
Low/Moderate
Low


Plecotus auritus
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
Activity Level (Percentile)
100
80
60
40
20
0
22/09/2025
15/12/2025
09/03/2026
01/06/2026
24/08/2026
night
Activity Level
Moderate/High
Moderate
Low/Moderate
Low


Plecotus auritus
Plecotus auritus
Plecotus auritus
LT7
LT8
LT9
Activity Level (Percentile)
100
80
60
40
20
0
22/09/2025
15/12/2025
09/03/2026
01/06/2026
24/08/2026
Activity Level
Moderate/High
Moderate
Low/Moderate
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 Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT1	Myotis daubentonii	Jul	0	0	0	0	0	2
LT1	Myotis daubentonii	Aug	0	0	0	0	0	19
LT1	Myotis mystacinus	Jul	0	0	0	0	0	1
LT1	Myotis mystacinus	Aug	0	0	0	0	0	14
LT1	Myotis nattereri	Aug	0	0	0	0	0	3
LT1	Nyctalus leisleri	Jul	0	0	0	0	0	2
LT1	Nyctalus leisleri	Aug	0	0	0	0	0	24
LT1	Pipistrellus nathusii	Aug	0	0	0	0	0	1
LT1	Pipistrellus pipistrellus	Jul	0	0	0	0	0	2
LT1	Pipistrellus pipistrellus	Aug	0	0	0	0	0	24
LT1	Pipistrellus pygmaeus	Jul	0	0	0	0	0	2
LT1	Pipistrellus pygmaeus	Aug	0	0	0	0	0	24
LT1	Plecotus auritus	Aug	0	0	0	0	0	12
LT10	Myotis daubentonii	Jul	0	0	0	0	0	3
LT10	Myotis daubentonii	Aug	0	0	0	0	0	18
LT10	Myotis mystacinus	Jul	0	0	0	0	0	1
LT10	Myotis mystacinus	Aug	0	0	0	0	0	12

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT10	Myotis nattereri	Jul	0	0	0	0	0	1
LT10	Myotis nattereri	Aug	0	0	0	0	2	13
LT10	Nyctalus leisleri	Jul	0	0	0	0	0	3
LT10	Nyctalus leisleri	Aug	0	0	0	0	0	22
LT10	Pipistrellus pipistrellus	Jul	0	0	0	0	0	3
LT10	Pipistrellus pipistrellus	Aug	0	0	0	0	0	21
LT10	Pipistrellus pygmaeus	Jul	0	0	0	0	3	0
LT10	Pipistrellus pygmaeus	Aug	0	0	0	0	7	17
LT10	Plecotus auritus	Jul	0	0	0	0	0	2
LT10	Plecotus auritus	Aug	0	0	0	0	0	10
LT11	Myotis daubentonii	Jul	0	0	0	0	0	3
LT11	Myotis daubentonii	Aug	0	0	0	0	2	20
LT11	Myotis mystacinus	Jul	0	0	0	0	0	2
LT11	Myotis mystacinus	Aug	0	0	0	0	0	4
LT11	Myotis nattereri	Jul	0	0	0	0	0	1
LT11	Myotis nattereri	Aug	0	0	0	0	10	11
LT11	Nyctalus leisleri	Jul	0	0	0	0	0	3
LT11	Nyctalus leisleri	Aug	0	0	0	0	0	24
LT11	Pipistrellus nathusii	Aug	0	0	0	0	0	4
LT11	Pipistrellus pipistrellus	Jul	0	0	0	0	0	3
LT11	Pipistrellus pipistrellus	Aug	0	0	0	0	0	23
LT11	Pipistrellus pygmaeus	Jul	0	0	0	0	3	0

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT11	Pipistrellus pygmaeus	Aug	0	0	0	0	6	18
LT11	Plecotus auritus	Jul	0	0	0	0	1	2
LT11	Plecotus auritus	Aug	0	0	0	0	0	21
LT2	Myotis daubentonii	Aug	0	0	0	0	0	15
LT2	Myotis mystacinus	Jul	0	0	0	0	0	1
LT2	Myotis mystacinus	Aug	0	0	0	0	0	13
LT2	Myotis nattereri	Jul	0	0	0	0	0	1
LT2	Myotis nattereri	Aug	0	0	0	0	3	6
LT2	Nyctalus leisleri	Jul	0	0	0	0	0	2
LT2	Nyctalus leisleri	Aug	0	0	0	0	2	22
LT2	Pipistrellus nathusii	Aug	0	0	0	0	0	2
LT2	Pipistrellus pipistrellus	Jul	0	0	0	0	0	2
LT2	Pipistrellus pipistrellus	Aug	0	0	0	0	0	23
LT2	Pipistrellus pygmaeus	Jul	0	0	0	0	0	2
LT2	Pipistrellus pygmaeus	Aug	0	0	0	0	0	24
LT2	Plecotus auritus	Jul	0	0	0	0	0	2
LT2	Plecotus auritus	Aug	0	0	0	0	0	15
LT3	Myotis daubentonii	Jul	0	0	0	0	0	2
LT3	Myotis daubentonii	Aug	0	0	0	0	0	22
LT3	Myotis mystacinus	Jul	0	0	0	0	0	1
LT3	Myotis mystacinus	Aug	0	0	0	0	0	4

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT3	Myotis nattereri	Jul	0	0	0	0	0	1
LT3	Myotis nattereri	Aug	0	0	0	0	0	8
LT3	Nyctalus leisleri	Jul	0	0	0	0	0	2
LT3	Nyctalus leisleri	Aug	0	0	0	0	0	24
LT3	Pipistrellus pipistrellus	Jul	0	0	0	0	0	2
LT3	Pipistrellus pipistrellus	Aug	0	0	0	0	0	24
LT3	Pipistrellus pygmaeus	Jul	0	0	0	0	0	2
LT3	Pipistrellus pygmaeus	Aug	0	0	0	0	0	24
LT3	Plecotus auritus	Jul	0	0	0	0	0	1
LT3	Plecotus auritus	Aug	0	0	0	0	0	12
LT4	Myotis daubentonii	Jul	0	0	0	0	0	5
LT4	Myotis daubentonii	Aug	0	0	0	0	0	10
LT4	Myotis mystacinus	Jul	0	0	0	0	0	3
LT4	Myotis mystacinus	Aug	0	0	0	0	0	9
LT4	Myotis nattereri	Jul	0	0	0	0	0	2
LT4	Myotis nattereri	Aug	0	0	0	0	0	5
LT4	Nyctalus leisleri	Jul	0	0	0	0	0	8
LT4	Nyctalus leisleri	Aug	0	0	0	0	2	17
LT4	Pipistrellus pipistrellus	Jul	0	0	0	0	0	8
LT4	Pipistrellus pipistrellus	Aug	0	0	0	0	0	17
LT4	Pipistrellus pygmaeus	Jul	0	0	0	0	0	8
LT4	Pipistrellus pygmaeus	Aug	0	0	0	0	0	19

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT4	Plecotus auritus	Jul	0	0	0	0	0	3
LT4	Plecotus auritus	Aug	0	0	0	0	0	6
LT5	Myotis daubentonii	Jul	0	0	0	0	0	6
LT5	Myotis daubentonii	Aug	0	0	0	0	0	12
LT5	Myotis mystacinus	Jul	0	0	0	0	0	2
LT5	Myotis mystacinus	Aug	0	0	0	0	0	8
LT5	Myotis nattereri	Jul	0	0	0	0	0	4
LT5	Myotis nattereri	Aug	0	0	0	0	0	10
LT5	Nyctalus leisleri	Jul	0	0	0	0	0	8
LT5	Nyctalus leisleri	Aug	0	0	0	0	0	20
LT5	Pipistrellus nathusii	Jul	0	0	0	0	0	2
LT5	Pipistrellus nathusii	Aug	0	0	0	0	0	4
LT5	Pipistrellus pipistrellus	Jul	0	0	0	0	0	8
LT5	Pipistrellus pipistrellus	Aug	0	0	0	0	0	19
LT5	Pipistrellus pygmaeus	Jul	0	0	0	0	0	7
LT5	Pipistrellus pygmaeus	Aug	0	0	0	0	0	20
LT5	Plecotus auritus	Jul	0	0	0	0	0	4
LT5	Plecotus auritus	Aug	0	0	0	0	0	14
LT6	Myotis daubentonii	Jul	0	0	0	0	0	6
LT6	Myotis daubentonii	Aug	0	0	0	0	0	7
LT6	Myotis mystacinus	Jul	0	0	0	0	0	4

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT6	Myotis mystacinus	Aug	0	0	0	0	0	4
LT6	Myotis nattereri	Jul	0	0	0	0	0	4
LT6	Myotis nattereri	Aug	0	0	0	0	0	5
LT6	Nyctalus leisleri	Jul	0	0	0	0	0	7
LT6	Nyctalus leisleri	Aug	0	0	0	0	0	12
LT6	Pipistrellus pipistrellus	Jul	0	0	0	0	0	8
LT6	Pipistrellus pipistrellus	Aug	0	0	0	0	0	10
LT6	Pipistrellus pygmaeus	Jul	0	0	0	0	0	8
LT6	Pipistrellus pygmaeus	Aug	0	0	0	0	0	12
LT6	Plecotus auritus	Jul	0	0	0	0	0	5
LT6	Plecotus auritus	Aug	0	0	0	0	0	2
LT7	Myotis daubentonii	Jul	0	0	0	0	0	6
LT7	Myotis daubentonii	Aug	0	0	0	0	0	11
LT7	Myotis mystacinus	Jul	0	0	0	0	0	3
LT7	Myotis mystacinus	Aug	0	0	0	0	0	7
LT7	Myotis nattereri	Jul	0	0	0	0	0	4
LT7	Myotis nattereri	Aug	0	0	0	0	0	9
LT7	Nyctalus leisleri	Jul	0	0	0	0	0	8
LT7	Nyctalus leisleri	Aug	0	0	0	0	2	18
LT7	Pipistrellus nathusii	Jul	0	0	0	0	0	3
LT7	Pipistrellus nathusii	Aug	0	0	0	0	0	1
LT7	Pipistrellus pipistrellus	Jul	0	0	0	0	0	8

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT7	Pipistrellus pipistrellus	Aug	0	0	0	0	0	20
LT7	Pipistrellus pygmaeus	Jul	0	0	0	0	0	8
LT7	Pipistrellus pygmaeus	Aug	0	0	0	0	2	18
LT7	Plecotus auritus	Jul	0	0	0	0	0	4
LT7	Plecotus auritus	Aug	0	0	0	0	0	20
LT8	Myotis daubentonii	Jul	0	0	0	0	0	7
LT8	Myotis daubentonii	Aug	0	0	0	0	0	18
LT8	Myotis mystacinus	Jul	0	0	0	0	0	3
LT8	Myotis mystacinus	Aug	0	0	0	0	0	5
LT8	Myotis nattereri	Jul	0	0	0	0	0	3
LT8	Myotis nattereri	Aug	0	0	0	0	4	7
LT8	Nyctalus leisleri	Jul	0	0	0	0	2	6
LT8	Nyctalus leisleri	Aug	0	0	0	0	0	20
LT8	Pipistrellus pipistrellus	Jul	0	0	0	0	0	8
LT8	Pipistrellus pipistrellus	Aug	0	0	0	0	0	18
LT8	Pipistrellus pygmaeus	Jul	0	0	0	0	0	8
LT8	Pipistrellus pygmaeus	Aug	0	0	0	0	0	20
LT8	Plecotus auritus	Jul	0	0	0	0	0	4
LT8	Plecotus auritus	Aug	0	0	0	0	0	15
LT9	Myotis daubentonii	Jul	0	0	0	0	0	3
LT9	Myotis daubentonii	Aug	0	0	0	0	2	15

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT9	Myotis mystacinus	Aug	0	0	0	0	0	3
LT9	Myotis nattereri	Jul	0	0	0	0	2	1
LT9	Myotis nattereri	Aug	0	0	2	2	17	0
LT9	Nyctalus leisleri	Jul	0	0	0	0	0	3
LT9	Nyctalus leisleri	Aug	0	0	0	0	0	23
LT9	Pipistrellus nathusii	Aug	0	0	0	0	0	4
LT9	Pipistrellus pipistrellus	Jul	0	0	0	0	0	3
LT9	Pipistrellus pipistrellus	Aug	0	0	0	0	0	24
LT9	Pipistrellus pygmaeus	Jul	0	0	0	0	0	3
LT9	Pipistrellus pygmaeus	Aug	0	0	0	0	2	22
LT9	Plecotus auritus	Jul	0	0	0	0	0	3
LT9	Plecotus auritus	Aug	0	0	0	0	2	13

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
LT1	Myotis daubentonii	Jul	4	3.5 - 7.5	6	2
LT1	Myotis daubentonii	Aug	6	3.5 - 7.5	17	19
LT1	Myotis mystacinus	Jul	3	3 - 6	3	1
LT1	Myotis mystacinus	Aug	5	3 - 6	11	14
LT1	Myotis nattereri	Aug	7	7 - 7	15	3
LT1	Nyctalus leisleri	Jul	1	5 - 7.5	1	2
LT1	Nyctalus leisleri	Aug	6	5 - 7.5	12	24
LT1	Pipistrellus nathusii	Aug	9	0	9	1
LT1	Pipistrellus pipistrellus	Jul	0	1 - 1	0	2
LT1	Pipistrellus pipistrellus	Aug	1	1 - 1	2	24
LT1	Pipistrellus pygmaeus	Jul	13	11.5 - 13.5	14	2
LT1	Pipistrellus pygmaeus	Aug	13	11.5 - 13.5	19	24
LT1	Plecotus auritus	Aug	7	2.5 - 9	13	12
LT10	Myotis daubentonii	Jul	9	6.5 - 12	14	3
LT10	Myotis daubentonii	Aug	12	6.5 - 12	18	18
LT10	Myotis mystacinus	Jul	6	4.5 - 6.5	6	1
LT10	Myotis mystacinus	Aug	6	4.5 - 6.5	7	12
LT10	Myotis nattereri	Jul	15	15 - 15	15	1
LT10	Myotis nattereri	Aug	15	15 - 15	36	15
LT10	Nyctalus leisleri	Jul	3	2 - 3.5	3	3
LT10	Nyctalus leisleri	Aug	2	2 - 3.5	6	22
LT10	Pipistrellus pipistrellus	Jul	0	0 - 0	0	3
LT10	Pipistrellus pipistrellus	Aug	0	0 - 0	1	21
LT10	Pipistrellus pygmaeus	Jul	21	15 - 19	21	3
LT10	Pipistrellus pygmaeus	Aug	16	15 - 19	26	24
LT10	Plecotus auritus	Jul	11	1 - 4	17	2
LT10	Plecotus auritus	Aug	3	1 - 4	4	10
LT11	Myotis daubentonii	Jul	6	10 - 14	9	3
LT11	Myotis daubentonii	Aug	14	10 - 14	23	22
LT11	Myotis mystacinus	Jul	3	3 - 3	3	2
LT11	Myotis mystacinus	Aug	3	3 - 3	3	4
LT11	Myotis nattereri	Jul	15	14.5 - 22	15	1
LT11	Myotis nattereri	Aug	15	14.5 - 22	29	21

Detector ID	Species/Species Group	month	Median Percentile	95% CIs	Max. Percentile	Nights Recorded
LT11	Nyctalus leisleri	Jul	14	5.5 - 9	14	3
LT11	Nyctalus leisleri	Aug	6	5.5 - 9	11	24
LT11	Pipistrellus nathusii	Aug	9	9 - 9	9	4
LT11	Pipistrellus pipistrellus	Jul	0	0 - 0	0	3
LT11	Pipistrellus pipistrellus	Aug	0	0 - 0	1	23
LT11	Pipistrellus pygmaeus	Jul	21	12.5 - 18.5	21	3
LT11	Pipistrellus pygmaeus	Aug	13	12.5 - 18.5	32	24
LT11	Plecotus auritus	Jul	13	8 - 12	23	3
LT11	Plecotus auritus	Aug	9	8 - 12	17	21
LT2	Myotis daubentonii	Aug	6	6 - 9	12	15
LT2	Myotis mystacinus	Jul	3	3 - 5.5	3	1
LT2	Myotis mystacinus	Aug	3	3 - 5.5	8	13
LT2	Myotis nattereri	Jul	7	7 - 20.5	7	1
LT2	Myotis nattereri	Aug	15	7 - 20.5	26	9
LT2	Nyctalus leisleri	Jul	6	7.5 - 11	6	2
LT2	Nyctalus leisleri	Aug	10	7.5 - 11	20	24
LT2	Pipistrellus nathusii	Aug	9	9 - 9	9	2
LT2	Pipistrellus pipistrellus	Jul	0	1 - 1.5	0	2
LT2	Pipistrellus pipistrellus	Aug	0	1 - 1.5	2	23
LT2	Pipistrellus pygmaeus	Jul	8	7.5 - 10	8	2
LT2	Pipistrellus pygmaeus	Aug	10	7.5 - 10	12	24
LT2	Plecotus auritus	Jul	1	2.5 - 6.5	1	2
LT2	Plecotus auritus	Aug	4	2.5 - 6.5	9	15
LT3	Myotis daubentonii	Jul	6	7.5 - 10.5	6	2
LT3	Myotis daubentonii	Aug	9	7.5 - 10.5	14	22
LT3	Myotis mystacinus	Jul	3	3 - 3	3	1
LT3	Myotis mystacinus	Aug	3	3 - 3	3	4
LT3	Myotis nattereri	Jul	7	7 - 11	7	1
LT3	Myotis nattereri	Aug	7	7 - 11	15	8
LT3	Nyctalus leisleri	Jul	6	7.5 - 10	6	2
LT3	Nyctalus leisleri	Aug	9	7.5 - 10	13	24
LT3	Pipistrellus pipistrellus	Jul	0	0 - 0	0	2
LT3	Pipistrellus pipistrellus	Aug	0	0 - 0	1	24
LT3	Pipistrellus pygmaeus	Jul	8	6.5 - 8.5	8	2
LT3	Pipistrellus pygmaeus	Aug	7	6.5 - 8.5	16	24
LT3	Plecotus auritus	Jul	1	2.5 - 6.5	1	1

Detector ID	Species/Species Group	month	Median Percentile	95% CIs	Max. Percentile	Nights Recorded
LT3	Plecotus auritus	Aug	4	2.5 - 6.5	9	12
LT4	Myotis daubentonii	Jul	1	1 - 9	9	5
LT4	Myotis daubentonii	Aug	6	1 - 9	17	10
LT4	Myotis mystacinus	Jul	3	3 - 4.5	3	3
LT4	Myotis mystacinus	Aug	3	3 - 4.5	6	9
LT4	Myotis nattereri	Jul	11	7 - 11	15	2
LT4	Myotis nattereri	Aug	7	7 - 11	15	5
LT4	Nyctalus leisleri	Jul	7	7 - 11.5	13	8
LT4	Nyctalus leisleri	Aug	9	7 - 11.5	20	19
LT4	Pipistrellus pipistrellus	Jul	0	0 - 0	0	8
LT4	Pipistrellus pipistrellus	Aug	0	0 - 0	1	17
LT4	Pipistrellus pygmaeus	Jul	8	5.5 - 7.5	11	8
LT4	Pipistrellus pygmaeus	Aug	6	5.5 - 7.5	11	19
LT4	Plecotus auritus	Jul	1	1 - 7	13	3
LT4	Plecotus auritus	Aug	3	1 - 7	4	6
LT5	Myotis daubentonii	Jul	8	3.5 - 9	14	6
LT5	Myotis daubentonii	Aug	6	3.5 - 9	12	12
LT5	Myotis mystacinus	Jul	3	3 - 3	3	2
LT5	Myotis mystacinus	Aug	3	3 - 3	6	8
LT5	Myotis nattereri	Jul	7	7 - 7	7	4
LT5	Myotis nattereri	Aug	7	7 - 7	15	10
LT5	Nyctalus leisleri	Jul	11	7 - 11	16	8
LT5	Nyctalus leisleri	Aug	10	7 - 11	18	20
LT5	Pipistrellus nathusii	Jul	9	9 - 9	9	2
LT5	Pipistrellus nathusii	Aug	9	9 - 9	9	4
LT5	Pipistrellus pipistrellus	Jul	0	0 - 0	0	8
LT5	Pipistrellus pipistrellus	Aug	0	0 - 0	1	19
LT5	Pipistrellus pygmaeus	Jul	5	3.5 - 7	10	7
LT5	Pipistrellus pygmaeus	Aug	4	3.5 - 7	17	20
LT5	Plecotus auritus	Jul	1	2.5 - 11	1	4
LT5	Plecotus auritus	Aug	11	2.5 - 11	18	14
LT6	Myotis daubentonii	Jul	9	6 - 12	12	6
LT6	Myotis daubentonii	Aug	9	6 - 12	17	7
LT6	Myotis mystacinus	Jul	6	4.5 - 6	6	4
LT6	Myotis mystacinus	Aug	5	4.5 - 6	6	4
LT6	Myotis nattereri	Jul	7	7 - 7	7	4

Detector ID	Species/Species Group	month	Median Percentile	95% CIs	Max. Percentile	Nights Recorded
LT6	Myotis nattereri	Aug	7	7 - 7	15	5
LT6	Nyctalus leisleri	Jul	10	5.5 - 9.5	16	7
LT6	Nyctalus leisleri	Aug	7	5.5 - 9.5	10	12
LT6	Pipistrellus pipistrellus	Jul	0	0 - 0	0	8
LT6	Pipistrellus pipistrellus	Aug	0	0 - 0	1	10
LT6	Pipistrellus pygmaeus	Jul	3	2 - 4	6	8
LT6	Pipistrellus pygmaeus	Aug	2	2 - 4	4	12
LT6	Plecotus auritus	Jul	1	1 - 5	9	5
LT6	Plecotus auritus	Aug	1	1 - 5	1	2
LT7	Myotis daubentonii	Jul	4	3.5 - 9	14	6
LT7	Myotis daubentonii	Aug	9	3.5 - 9	12	11
LT7	Myotis mystacinus	Jul	3	3 - 4.5	3	3
LT7	Myotis mystacinus	Aug	3	3 - 4.5	6	7
LT7	Myotis nattereri	Jul	7	7 - 11	15	4
LT7	Myotis nattereri	Aug	7	7 - 11	15	9
LT7	Nyctalus leisleri	Jul	8	7.5 - 12.5	12	8
LT7	Nyctalus leisleri	Aug	10	7.5 - 12.5	35	20
LT7	Pipistrellus nathusii	Jul	9	9 - 9	9	3
LT7	Pipistrellus nathusii	Aug	9	9 - 9	9	1
LT7	Pipistrellus pipistrellus	Jul	1	1 - 3	1	8
LT7	Pipistrellus pipistrellus	Aug	1	1 - 3	7	20
LT7	Pipistrellus pygmaeus	Jul	5	5 - 9	7	8
LT7	Pipistrellus pygmaeus	Aug	8	5 - 9	20	20
LT7	Plecotus auritus	Jul	4	4 - 8.5	4	4
LT7	Plecotus auritus	Aug	9	4 - 8.5	13	20
LT8	Myotis daubentonii	Jul	12	9 - 13	17	7
LT8	Myotis daubentonii	Aug	9	9 - 13	18	18
LT8	Myotis mystacinus	Jul	6	3 - 6	6	3
LT8	Myotis mystacinus	Aug	3	3 - 6	6	5
LT8	Myotis nattereri	Jul	15	11 - 18.5	15	3
LT8	Myotis nattereri	Aug	15	11 - 18.5	22	11
LT8	Nyctalus leisleri	Jul	14	9.5 - 14	20	8
LT8	Nyctalus leisleri	Aug	12	9.5 - 14	19	20
LT8	Pipistrellus pipistrellus	Jul	0	1 - 1	1	8
LT8	Pipistrellus pipistrellus	Aug	0	1 - 1	2	18
LT8	Pipistrellus pygmaeus	Jul	7	6.5 - 9.5	13	8

Detector ID	Species/Species Group	month	Median Percentile	95% CIs	Max. Percentile	Nights Recorded
LT8	Pipistrellus pygmaeus	Aug	9	6.5 - 9.5	12	20
LT8	Plecotus auritus	Jul	1	2.5 - 8	4	4
LT8	Plecotus auritus	Aug	4	2.5 - 8	15	15
LT9	Myotis daubentonii	Jul	6	7.5 - 15.5	12	3
LT9	Myotis daubentonii	Aug	12	7.5 - 15.5	25	17
LT9	Myotis mystacinus	Aug	3	3 - 3	6	3
LT9	Myotis nattereri	Jul	32	30.5 - 37.5	32	3
LT9	Myotis nattereri	Aug	36	30.5 - 37.5	64	21
LT9	Nyctalus leisleri	Jul	6	4.5 - 8	6	3
LT9	Nyctalus leisleri	Aug	6	4.5 - 8	17	23
LT9	Pipistrellus nathusii	Aug	9	9 - 9	9	4
LT9	Pipistrellus pipistrellus	Jul	0	1 - 2	0	3
LT9	Pipistrellus pipistrellus	Aug	0	1 - 2	2	24
LT9	Pipistrellus pygmaeus	Jul	8	7.5 - 11.5	12	3
LT9	Pipistrellus pygmaeus	Aug	10	7.5 - 11.5	27	24
LT9	Plecotus auritus	Jul	9	4 - 12	9	3
LT9	Plecotus auritus	Aug	4	4 - 12	28	15

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 Exceptional Activity	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	0	0	0	4	210
Myotis mystacinus	0	0	0	0	0	104
Myotis nattereri	0	0	2	2	38	99
Nyctalus leisleri	0	0	0	0	8	278
Pipistrellus nathusii	0	0	0	0	0	21
Pipistrellus pipistrellus	0	0	0	0	0	278
Pipistrellus pygmaeus	0	0	0	0	23	266
Plecotus auritus	0	0	0	0	3	170

Table 8. Summary table showing key metrics for each species recorded.

Species/Species Group	Median Percentile	95% CIs	Max. Percentile	Nights Recorded
Myotis daubentonii	9	9 - 13	25	214
Myotis mystacinus	3	4.5 - 6.5	11	104
Myotis nattereri	15	7 - 7	64	141
Nyctalus leisleri	7	9.5 - 14	35	286
Pipistrellus nathusii	9	9 - 9	9	21
Pipistrellus pipistrellus	0	1 - 3	7	278
Pipistrellus pygmaeus	9	7.5 - 11.5	32	289
Plecotus auritus	4	8 - 12	28	173

Figure 4. The activity level (percentile) of bats recorded across each night of the bat survey for the **entire site**.

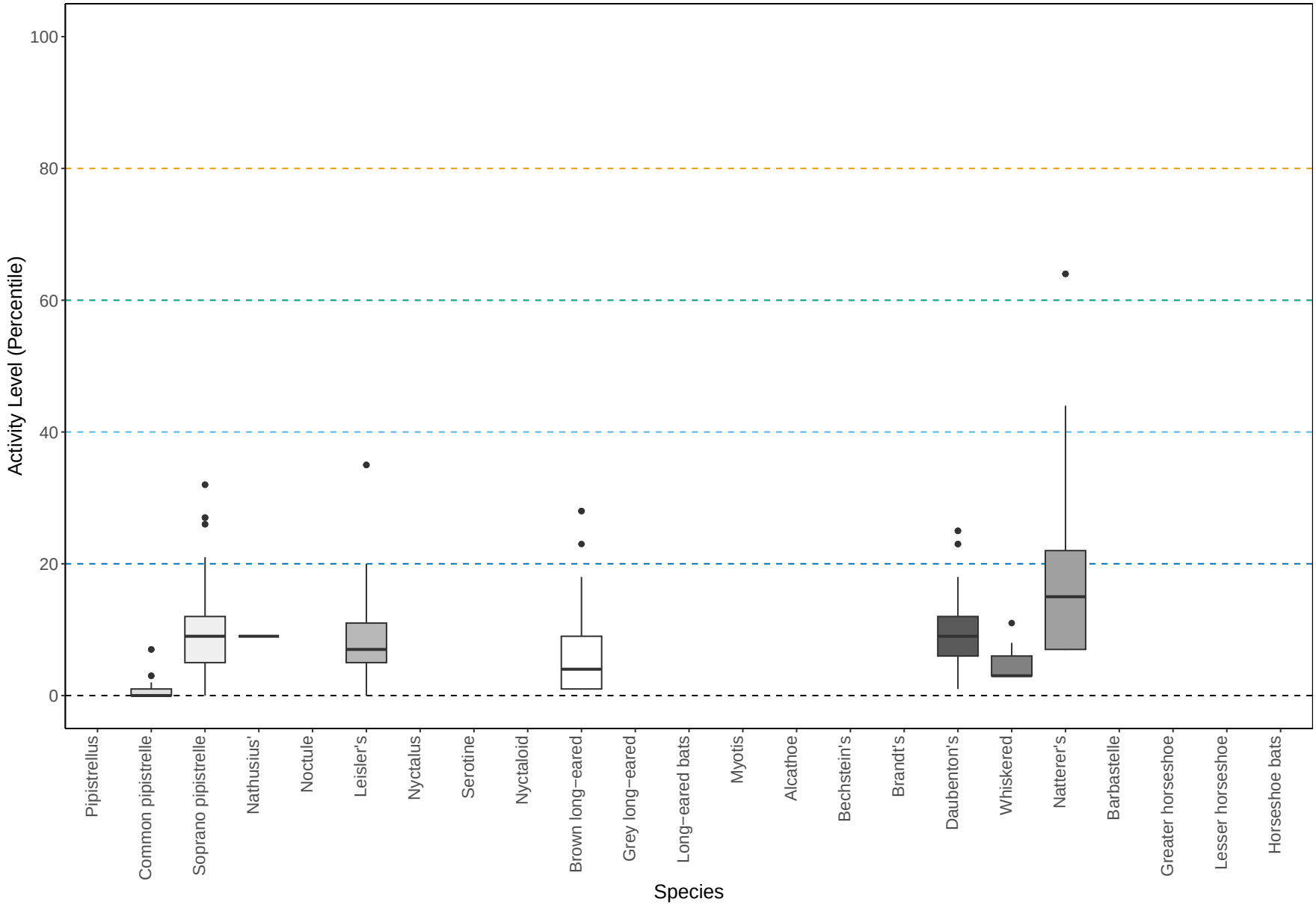
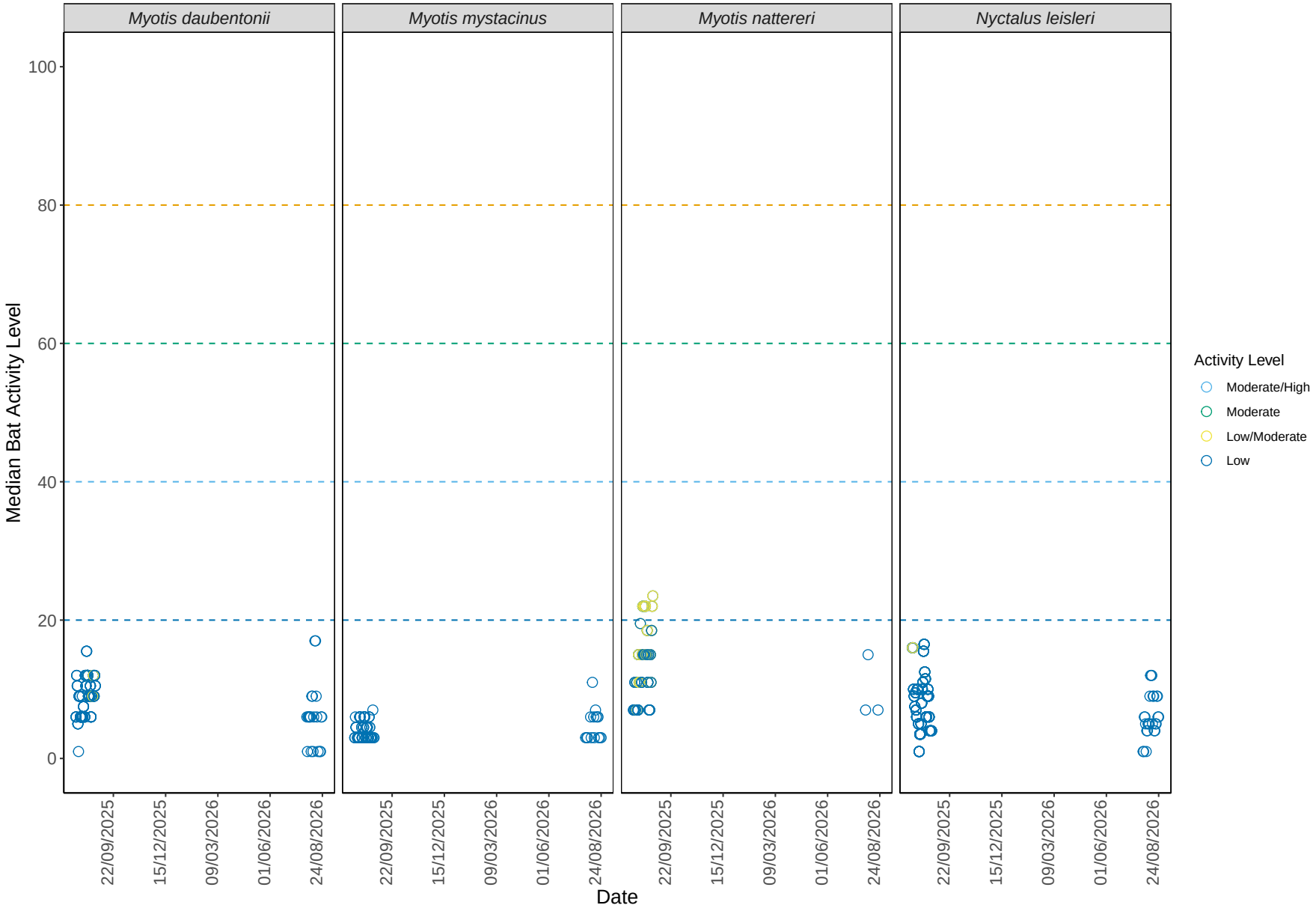
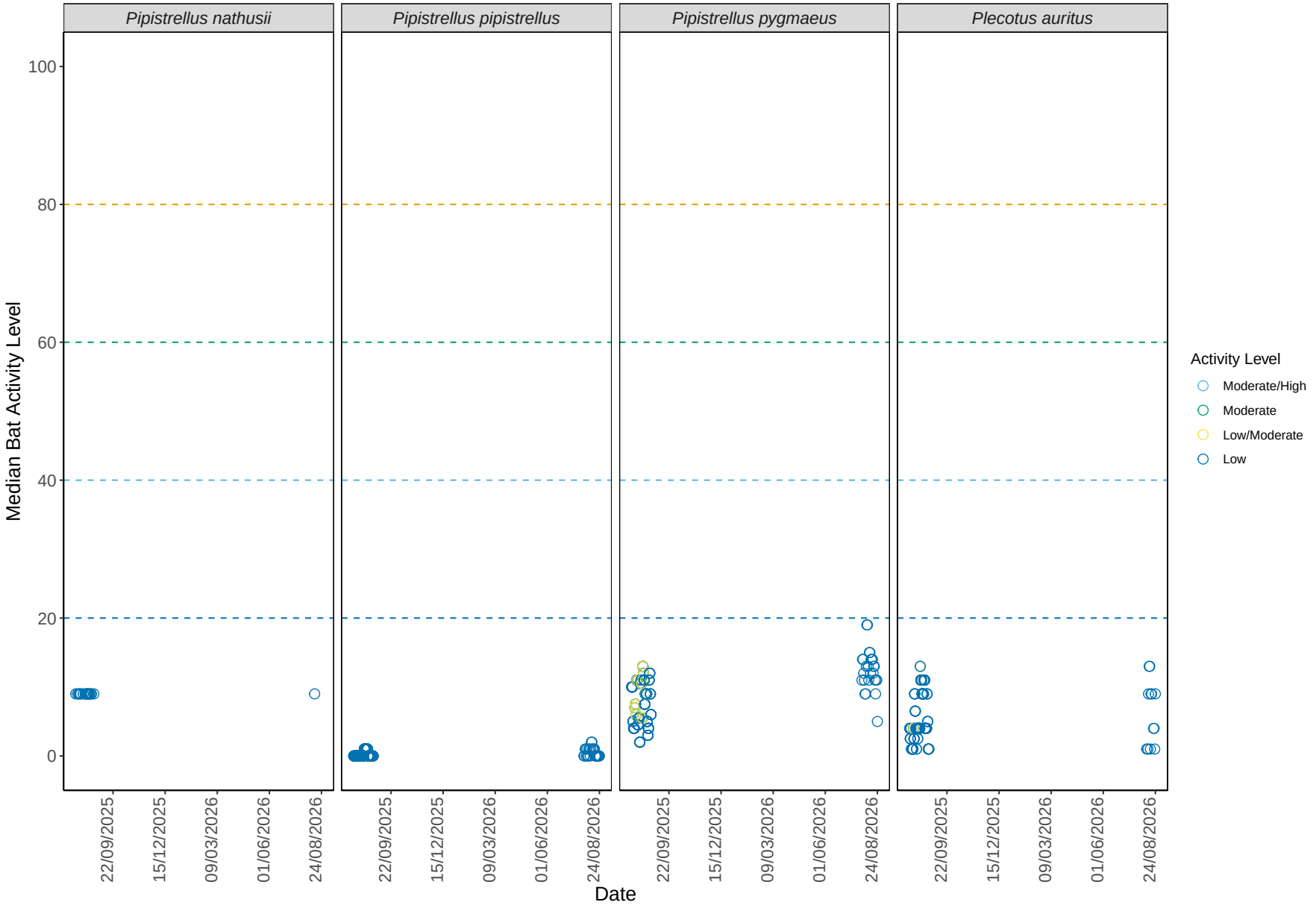

Activity Level (Percentile)
100
80
60
40
20
0
Pipistrellus
Common pipistrelle
Soprano pipistrelle
Nathusius'
Noctule
Leisler's
Nyctalus
Serotine
Nyctaloid
Brown long−eared
Grey long−eared
Long−eared bats
Myotis
Alcathoe
Bechstein's
Brandt's
Daubenton's
Whiskered
Natterer's
Barbastelle
Greater horseshoe
Lesser horseshoe
Horseshoe bats
Species

Figure 5. The median activity levels of bats recorded across all detectors each night.


Myotis daubentonii
Myotis mystacinus
Myotis nattereri
Nyctalus leisleri
Median Bat Activity Level
100
80
60
40
20
0
22/09/2025
15/12/2025
09/03/2026
01/06/2026
24/08/2026
Date
Activity Level
Moderate/High
Moderate
Low/Moderate
Low


Pipistrellus nathusii
Pipistrellus pipistrellus
Pipistrellus pygmaeus
Plecotus auritus
Median Bat Activity Level
100
80
60
40
20
0
22/09/2025
15/12/2025
09/03/2026
01/06/2026
24/08/2026
Date
Activity Level
Moderate/High
Moderate
Low/Moderate
Low

Per Site, Per Month

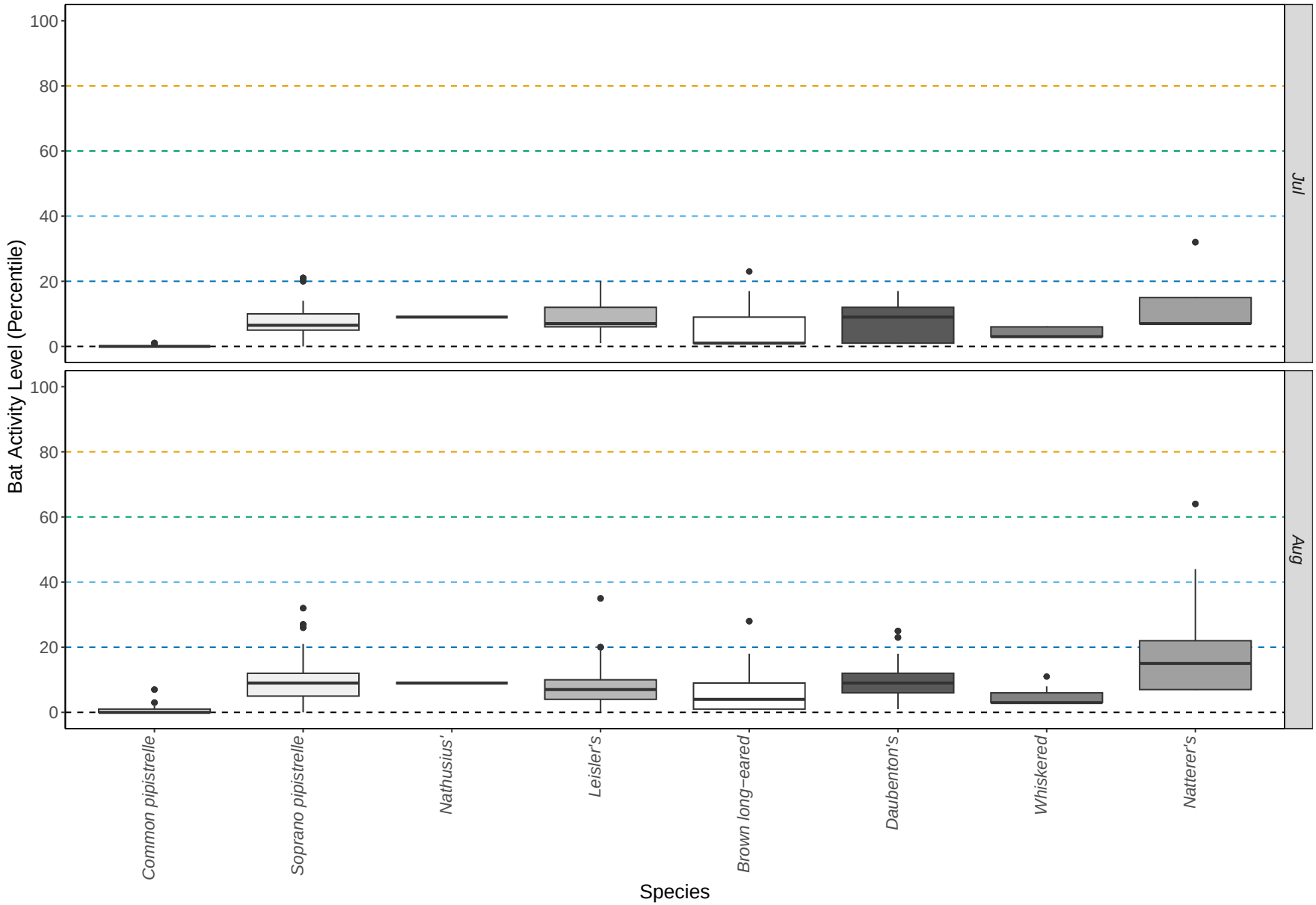
Table 9. Summary table showing the number of nights recorded bat activity fell into each activity band for each species during each month.

Species/Species Group	month	Nights of Exceptional Activity	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	0	0	0	0	43
Myotis daubentonii	Aug	0	0	0	0	4	167
Myotis mystacinus	Jul	0	0	0	0	0	21
Myotis mystacinus	Aug	0	0	0	0	0	83
Myotis nattereri	Jul	0	0	0	0	2	22
Myotis nattereri	Aug	0	0	2	2	36	77
Nyctalus leisleri	Jul	0	0	0	0	2	52
Nyctalus leisleri	Aug	0	0	0	0	6	226
Pipistrellus nathusii	Jul	0	0	0	0	0	5
Pipistrellus nathusii	Aug	0	0	0	0	0	16
Pipistrellus pipistrellus	Jul	0	0	0	0	0	55
Pipistrellus pipistrellus	Aug	0	0	0	0	0	223
Pipistrellus pygmaeus	Jul	0	0	0	0	6	48
Pipistrellus pygmaeus	Aug	0	0	0	0	17	218
Plecotus auritus	Jul	0	0	0	0	1	30
Plecotus auritus	Aug	0	0	0	0	2	140

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	9	9 - 13	17	43
Myotis daubentonii	Aug	9	9 - 13	25	171
Myotis mystacinus	Jul	3	4.5 - 6.5	6	21
Myotis mystacinus	Aug	3	4.5 - 6.5	11	83
Myotis nattereri	Jul	7	7 - 7	32	24
Myotis nattereri	Aug	15	7 - 7	64	117
Nyctalus leisleri	Jul	7	9.5 - 14	20	54
Nyctalus leisleri	Aug	7	9.5 - 14	35	232
Pipistrellus nathusii	Jul	9	9 - 9	9	5
Pipistrellus nathusii	Aug	9	9 - 9	9	16
Pipistrellus pipistrellus	Jul	0	1 - 3	1	55
Pipistrellus pipistrellus	Aug	0	1 - 3	7	223
Pipistrellus pygmaeus	Jul	7	7.5 - 11.5	21	54
Pipistrellus pygmaeus	Aug	9	7.5 - 11.5	32	235
Plecotus auritus	Jul	1	8 - 12	23	31
Plecotus auritus	Aug	4	8 - 12	28	142

Figure 6. The activity level (percentile) of bats recorded across each night of the bat survey for the entire site, split between months.


Bat Activity Level (Percentile)
100
80
60
40
20
0
Jul
Aug
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Brown long−eared
Daubenton's
Whiskered
Natterer's
Species

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.

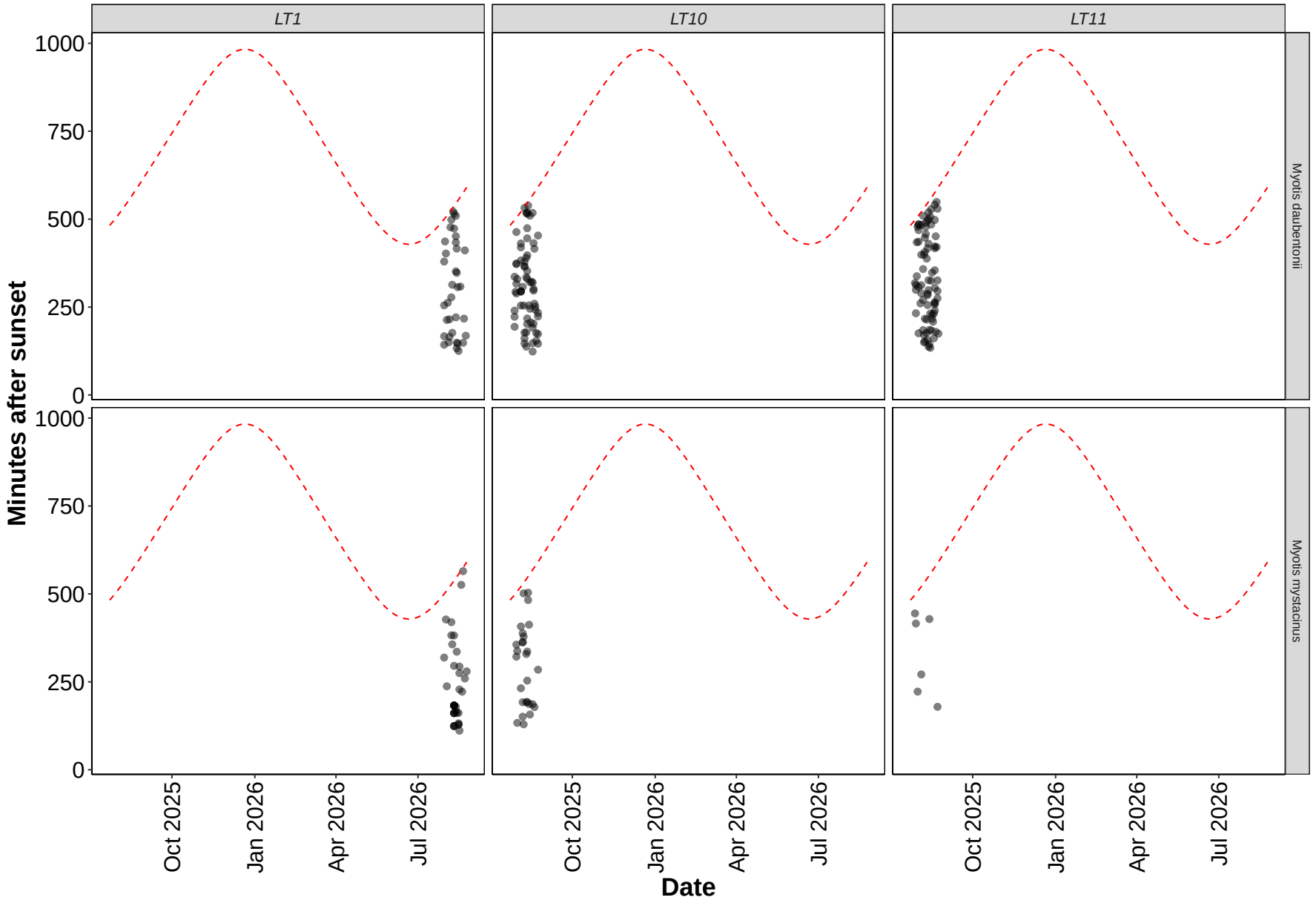
Night (y-m-d)	Sunset (h:m)	Sunrise (h:m)	Night Length (hours)
2025-07-24	20:36	04:38	8.0
2025-07-25	20:35	04:40	8.1
2025-07-26	20:33	04:41	8.1
2025-07-27	20:32	04:43	8.2
2025-07-28	20:30	04:45	8.2
2025-07-29	20:29	04:46	8.3
2025-07-30	20:27	04:48	8.3
2025-07-31	20:25	04:49	8.4
2025-08-01	20:24	04:51	8.5
2025-08-02	20:22	04:52	8.5
2025-08-03	20:20	04:54	8.6
2025-08-04	20:18	04:56	8.6
2025-08-05	20:17	04:57	8.7
2025-08-06	20:15	04:59	8.7
2025-08-07	20:13	05:01	8.8
2025-08-08	20:11	05:02	8.9
2025-08-09	20:09	05:04	8.9
2025-08-10	20:07	05:06	9.0
2025-08-11	20:05	05:07	9.0
2025-08-12	20:03	05:09	9.1
2025-08-13	20:01	05:11	9.2
2025-08-14	19:59	05:12	9.2
2025-08-15	19:57	05:14	9.3
2025-08-16	19:55	05:16	9.3
2025-08-17	19:53	05:17	9.4
2025-08-18	19:51	05:19	9.5
2025-08-19	19:49	05:21	9.5
2025-08-20	19:47	05:22	9.6

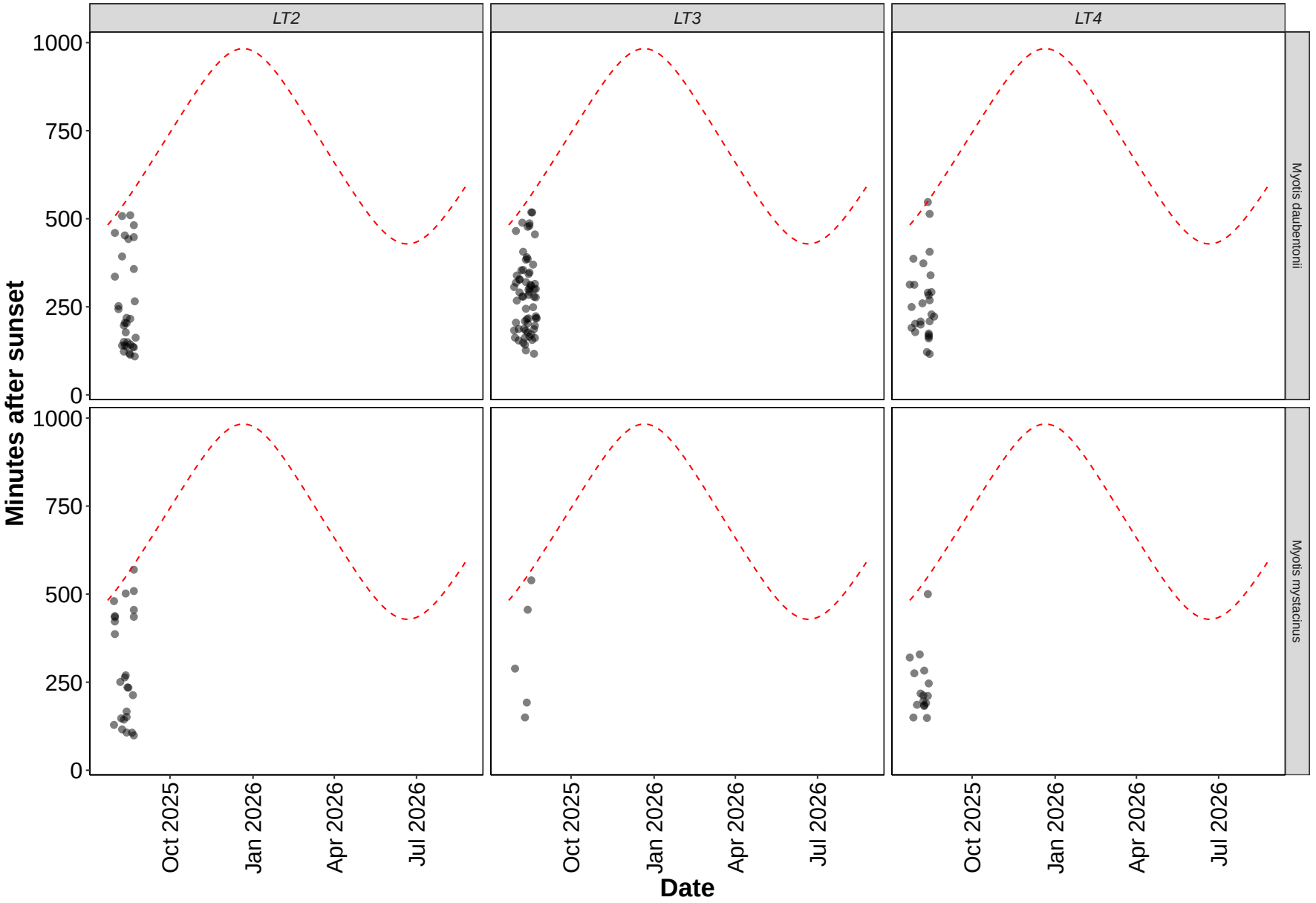
Night (y-m-d)	Sunset (h:m)	Sunrise (h:m)	Night Length (hours)
2025-08-21	19:45	05:24	9.7
2025-08-22	19:42	05:26	9.7
2025-08-23	19:40	05:27	9.8
2025-08-24	19:38	05:29	9.9
2026-07-30	20:27	04:47	8.3
2026-07-31	20:26	04:49	8.4
2026-08-01	20:24	04:50	8.4
2026-08-02	20:22	04:52	8.5
2026-08-03	20:21	04:54	8.6
2026-08-04	20:19	04:55	8.6
2026-08-05	20:17	04:57	8.7
2026-08-06	20:15	04:59	8.7
2026-08-07	20:13	05:00	8.8
2026-08-08	20:11	05:02	8.8
2026-08-09	20:10	05:04	8.9
2026-08-10	20:08	05:05	9.0
2026-08-11	20:06	05:07	9.0
2026-08-12	20:04	05:09	9.1
2026-08-13	20:02	05:10	9.1
2026-08-14	20:00	05:12	9.2
2026-08-15	19:58	05:14	9.3
2026-08-16	19:56	05:15	9.3
2026-08-17	19:54	05:17	9.4
2026-08-18	19:51	05:19	9.5
2026-08-19	19:49	05:20	9.5
2026-08-20	19:47	05:22	9.6
2026-08-21	19:45	05:24	9.6
2026-08-22	19:43	05:25	9.7
2026-08-23	19:41	05:27	9.8
2026-08-24	19:39	05:29	9.8

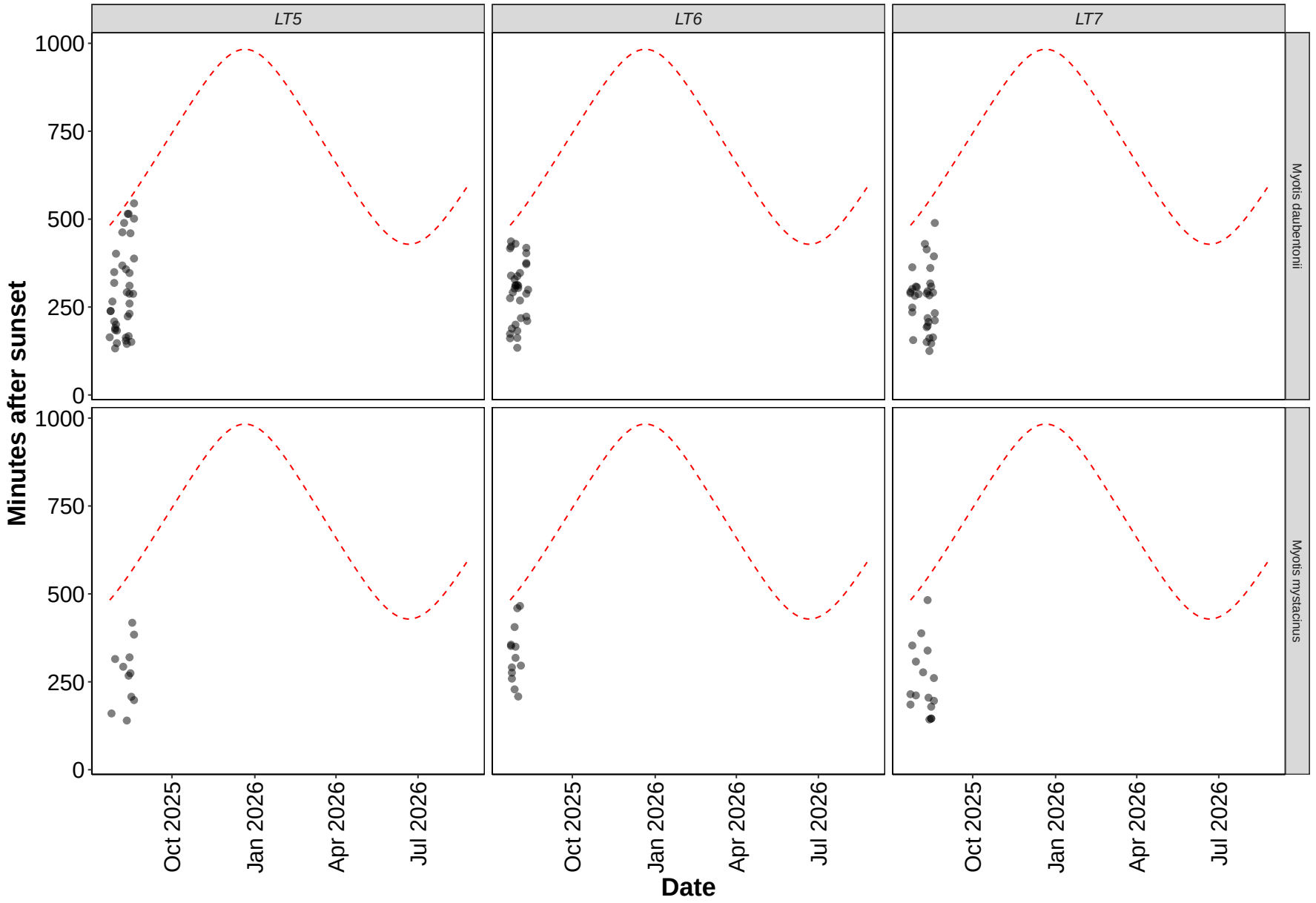
Distribution of Bat Activity Across the Night through Time

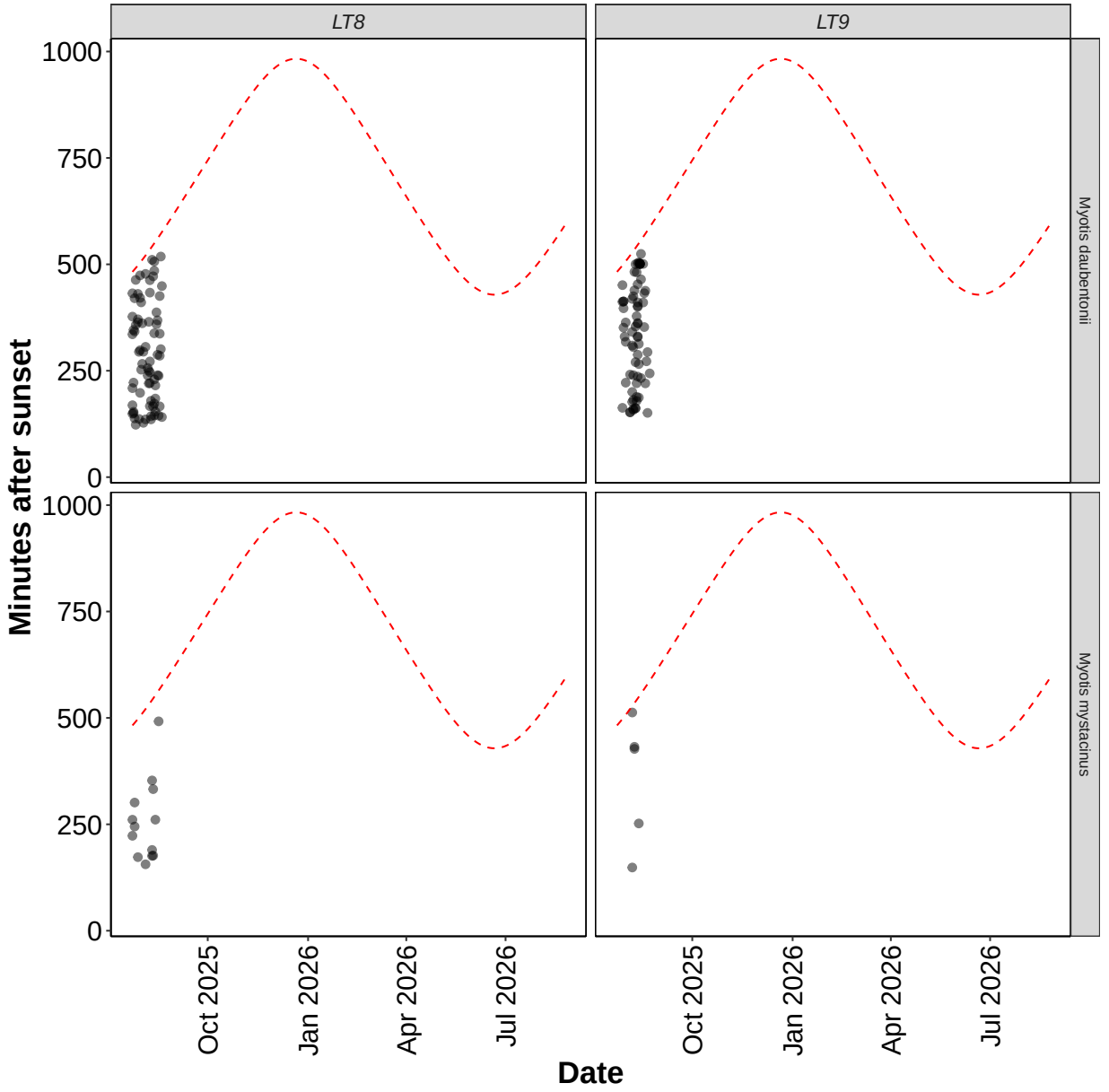
Per Detector

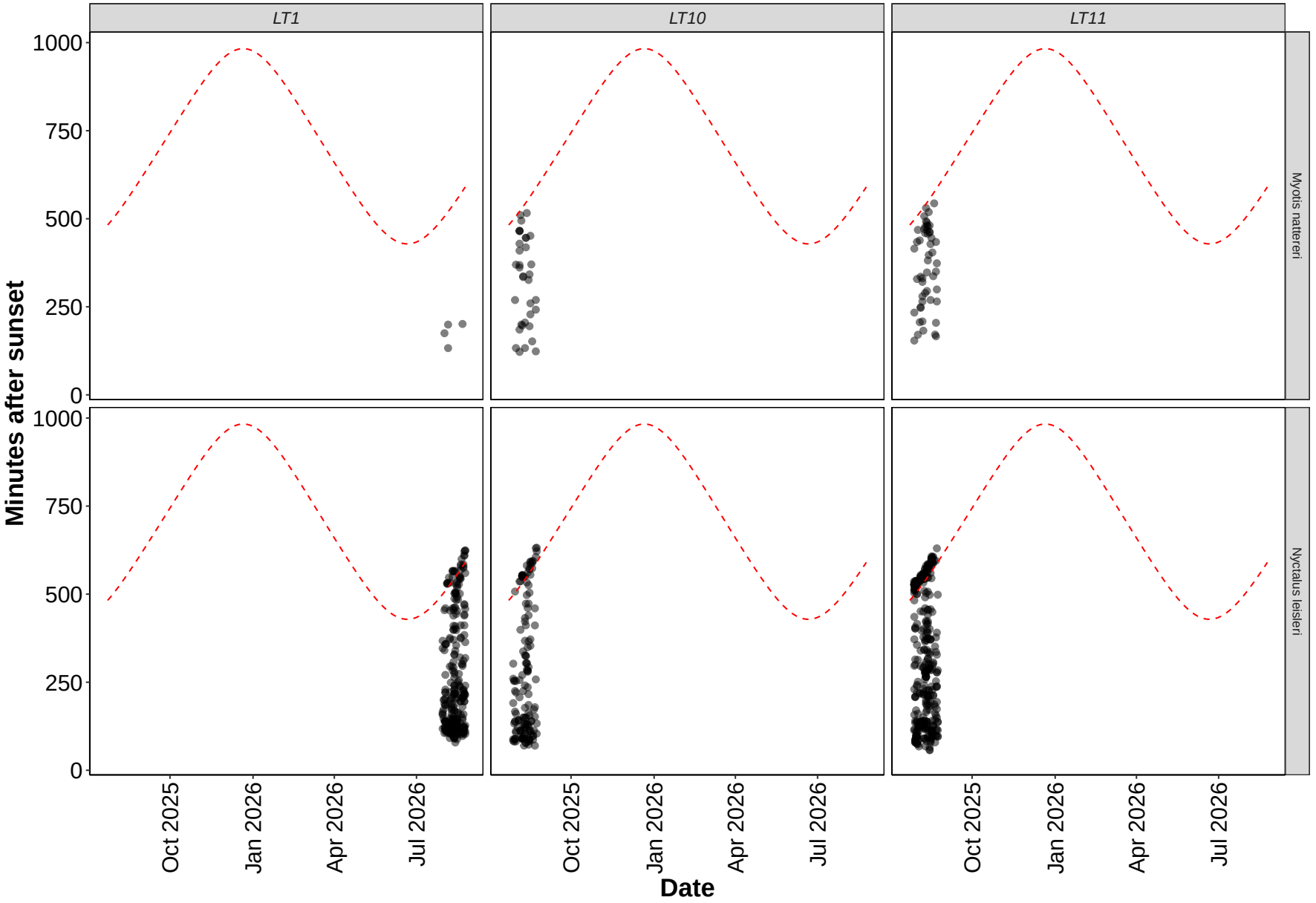
Figure 7. Timing of bat calls plotted as minutes before/after sunset, whereby 0 on the y axis represents sunset. Sunrise throughout the survey period is depicted as the red dashed line. Colours indicate kernel densities, with darkest colours showing peaks of activity. These colours are comparative only within each plot, and do not account for overall activity.

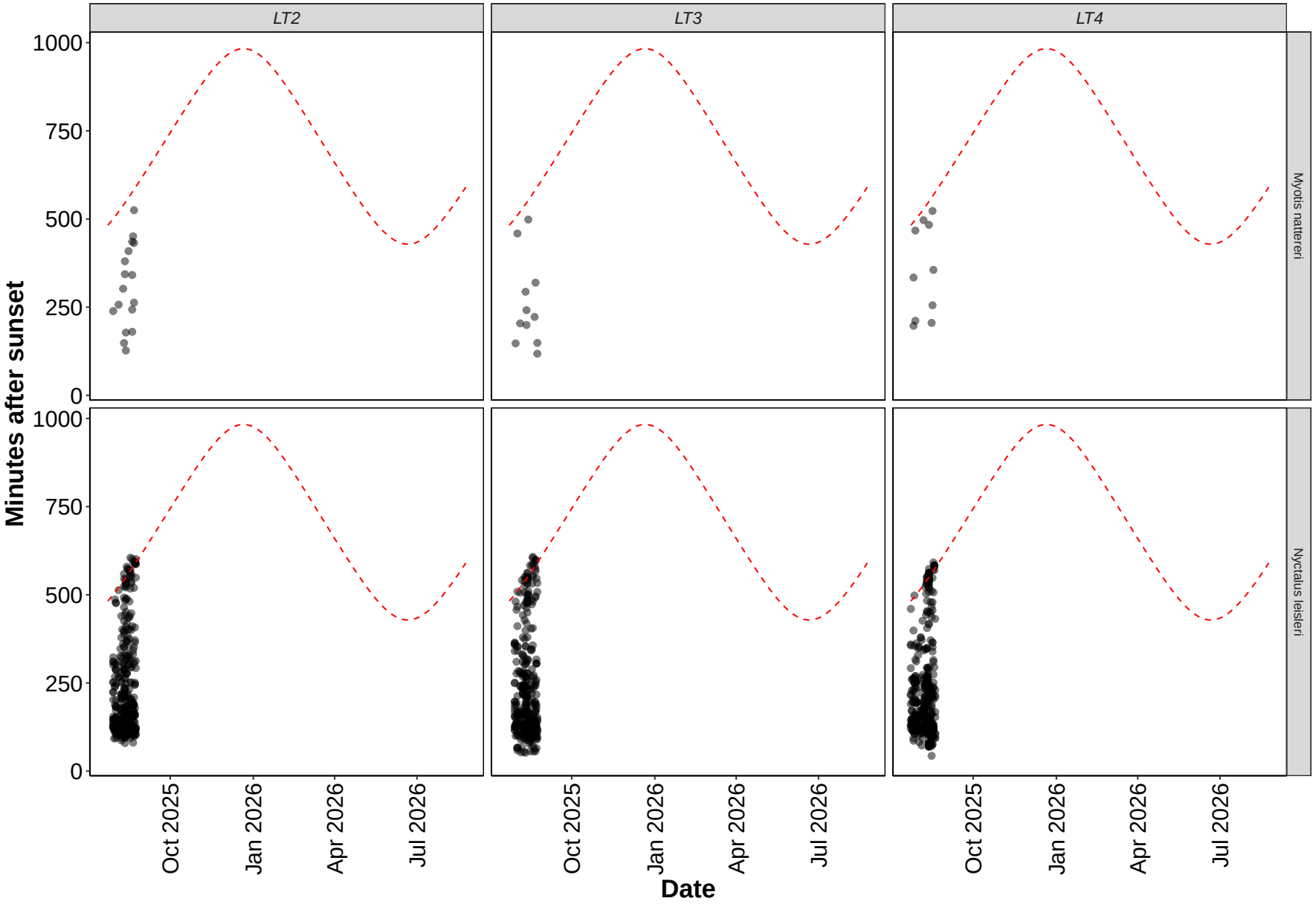

LT1
LT10
LT11
Myotis daubentonii
Myotis mystacinus
Minutes after sunset
0
250
500
750
1000
Oct 2025
Jan 2026
Apr 2026
Jul 2026
Date

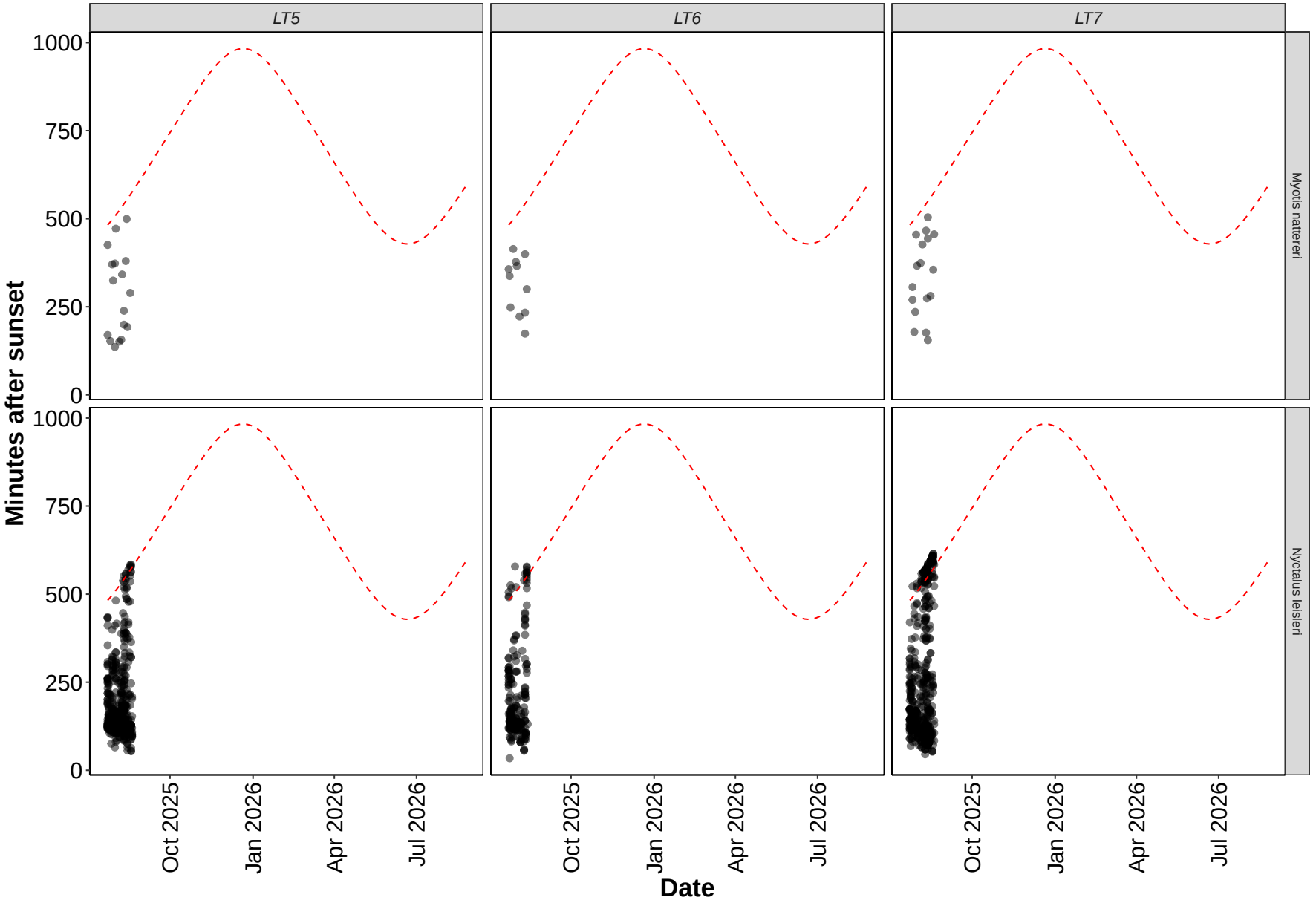

LT2
LT3
LT4
Myotis daubentonii
Myotis mystacinus
Minutes after sunset
0
250
500
750
1000
Oct 2025
Jan 2026
Apr 2026
Jul 2026
Date

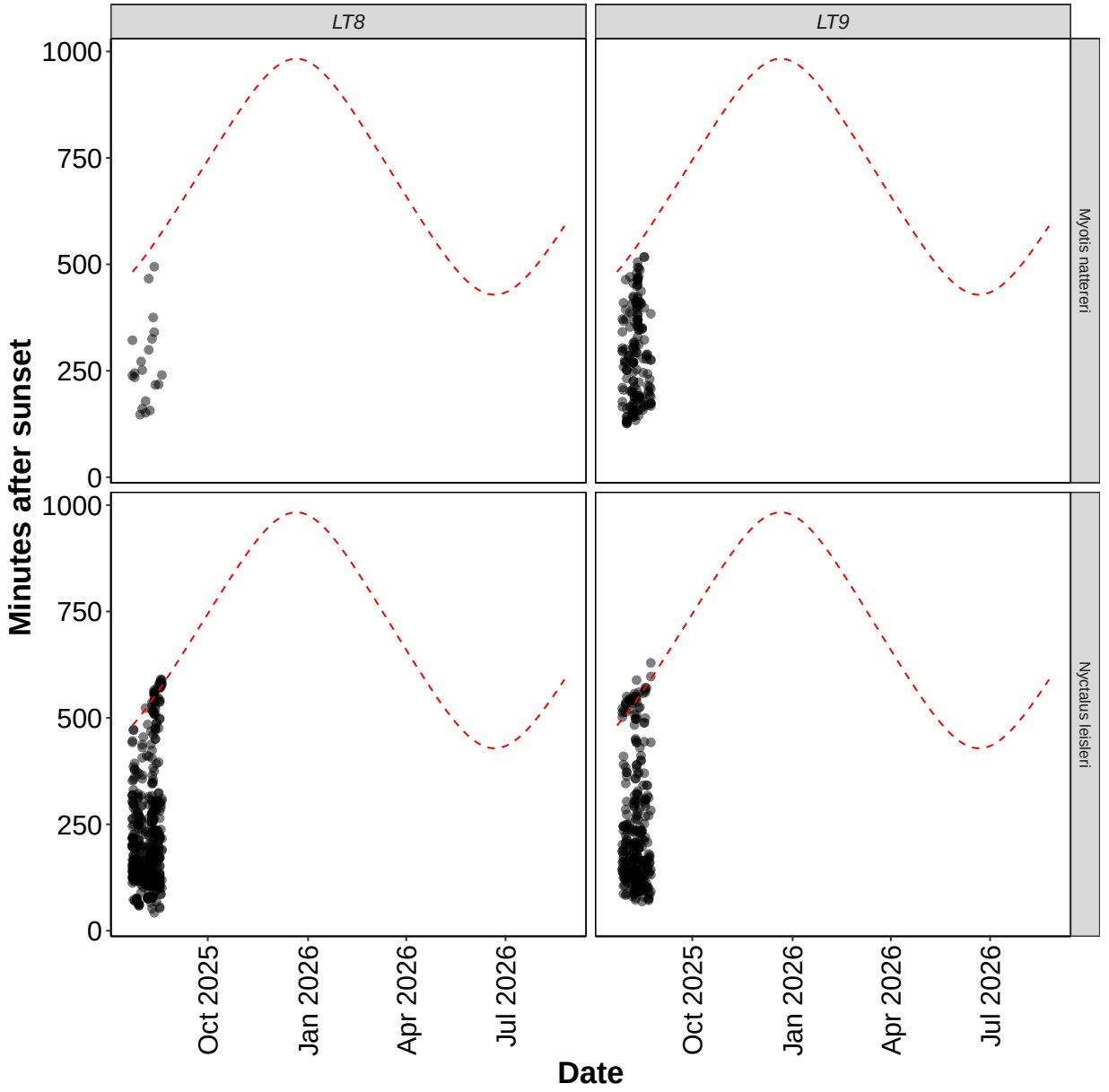

LT5
LT6
LT7
Myotis daubentonii
Myotis mystacinus
Minutes after sunset
1000
750
500
250
0
Oct 2025
Jan 2026
Apr 2026
Jul 2026
Date

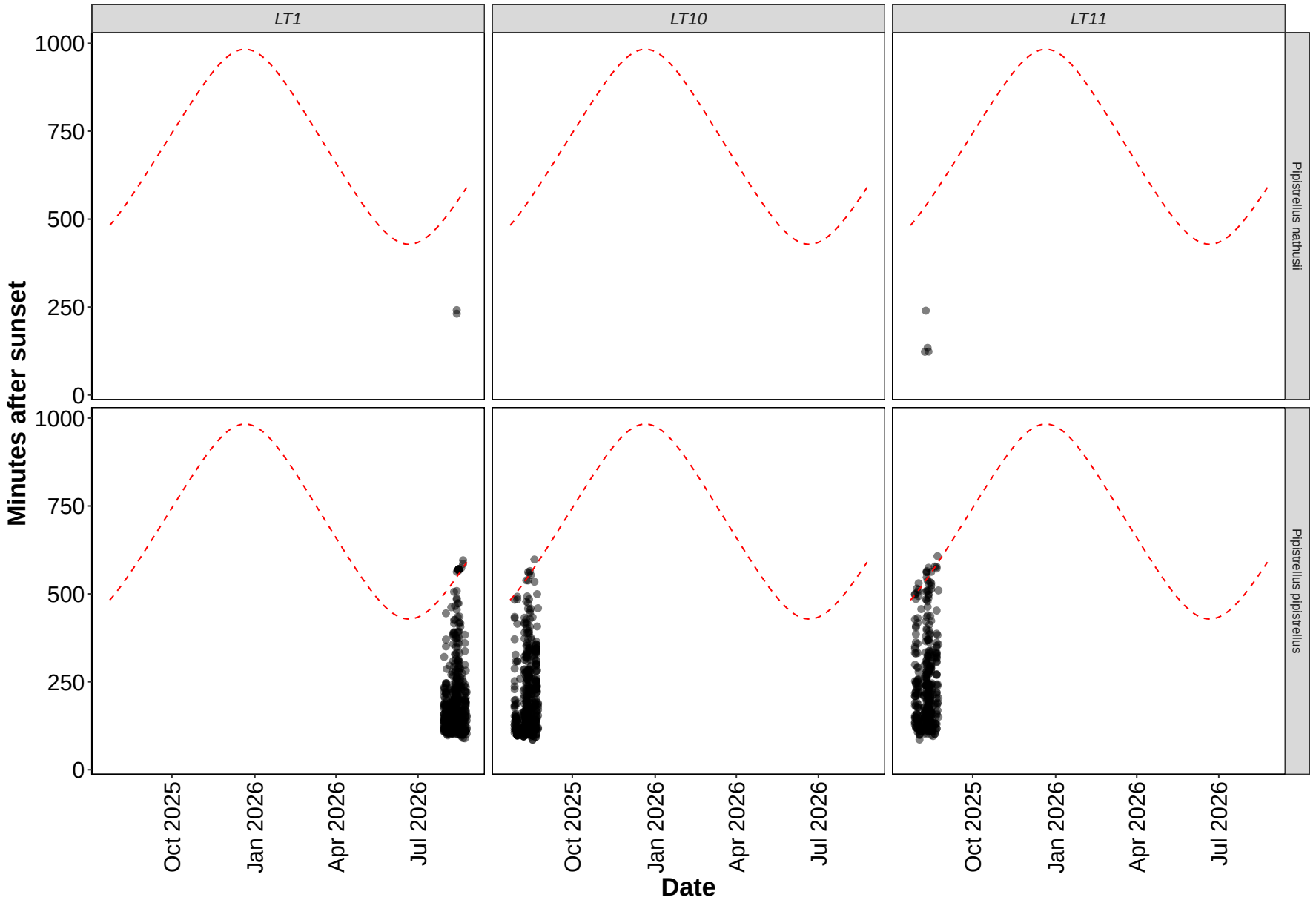

LT8
LT9
Myotis daubentonii
Myotis mystacinus
Minutes after sunset
1000
750
500
250
0
Oct 2025
Jan 2026
Apr 2026
Jul 2026
Date

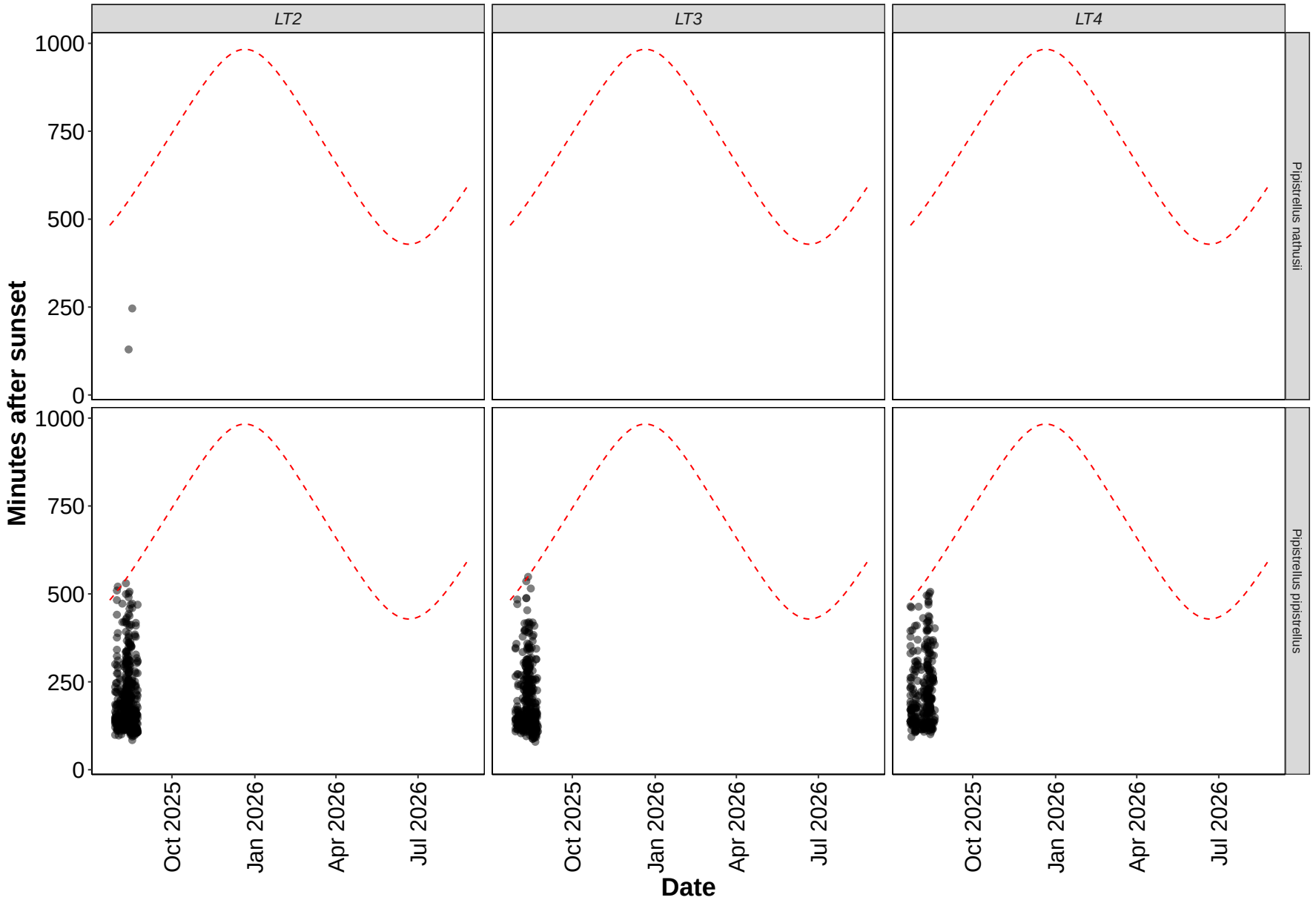

LT1
LT10
LT11
Myotis nattereri
Nyctalus leisleri
Minutes after sunset
0
250
500
750
1000
Oct 2025
Jan 2026
Apr 2026
Jul 2026
Date

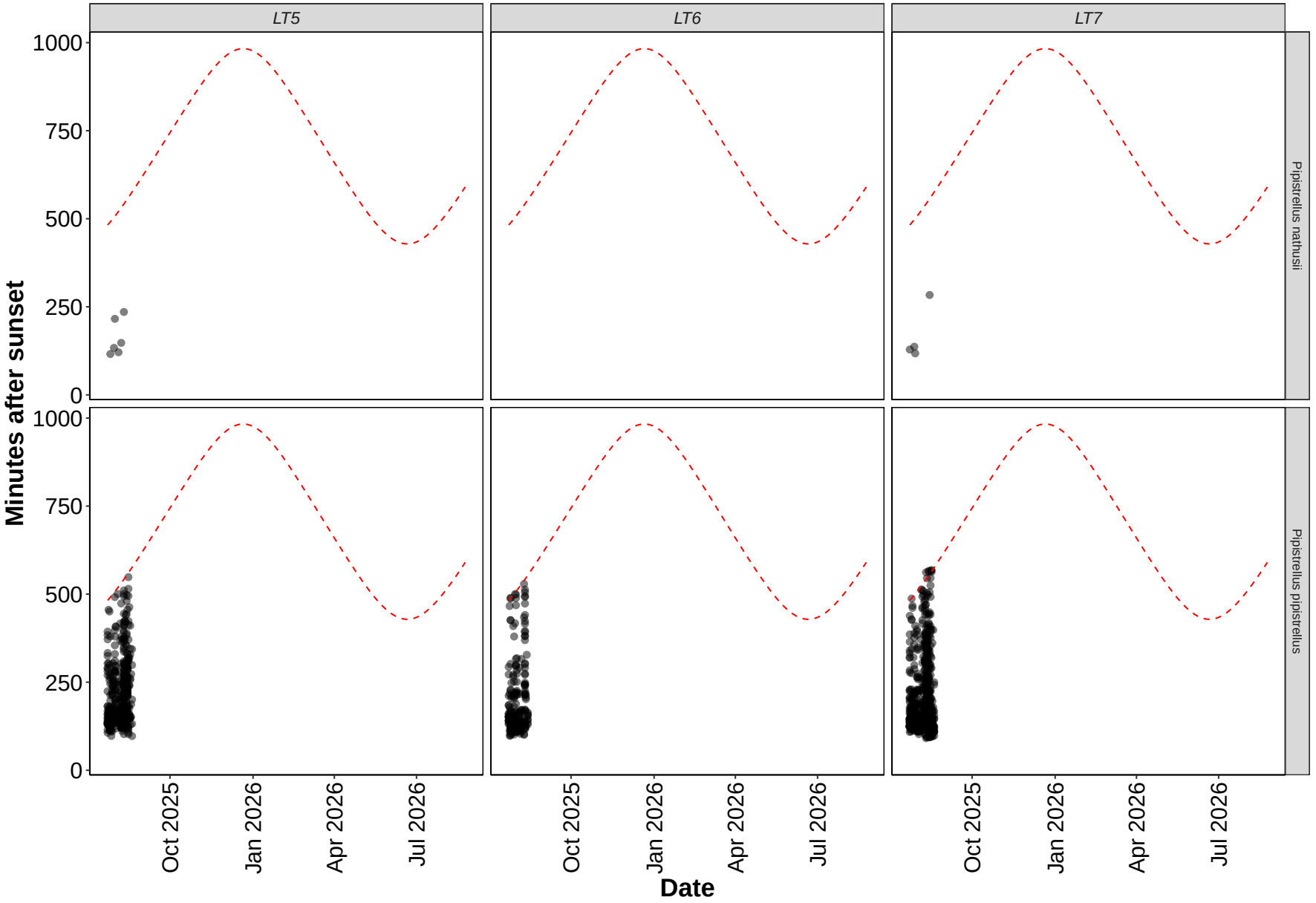

LT2
LT3
LT4
Myotis nattereri
Nyctalus leisleri
Minutes after sunset
0
250
500
750
1000
Oct 2025
Jan 2026
Apr 2026
Jul 2026
Date

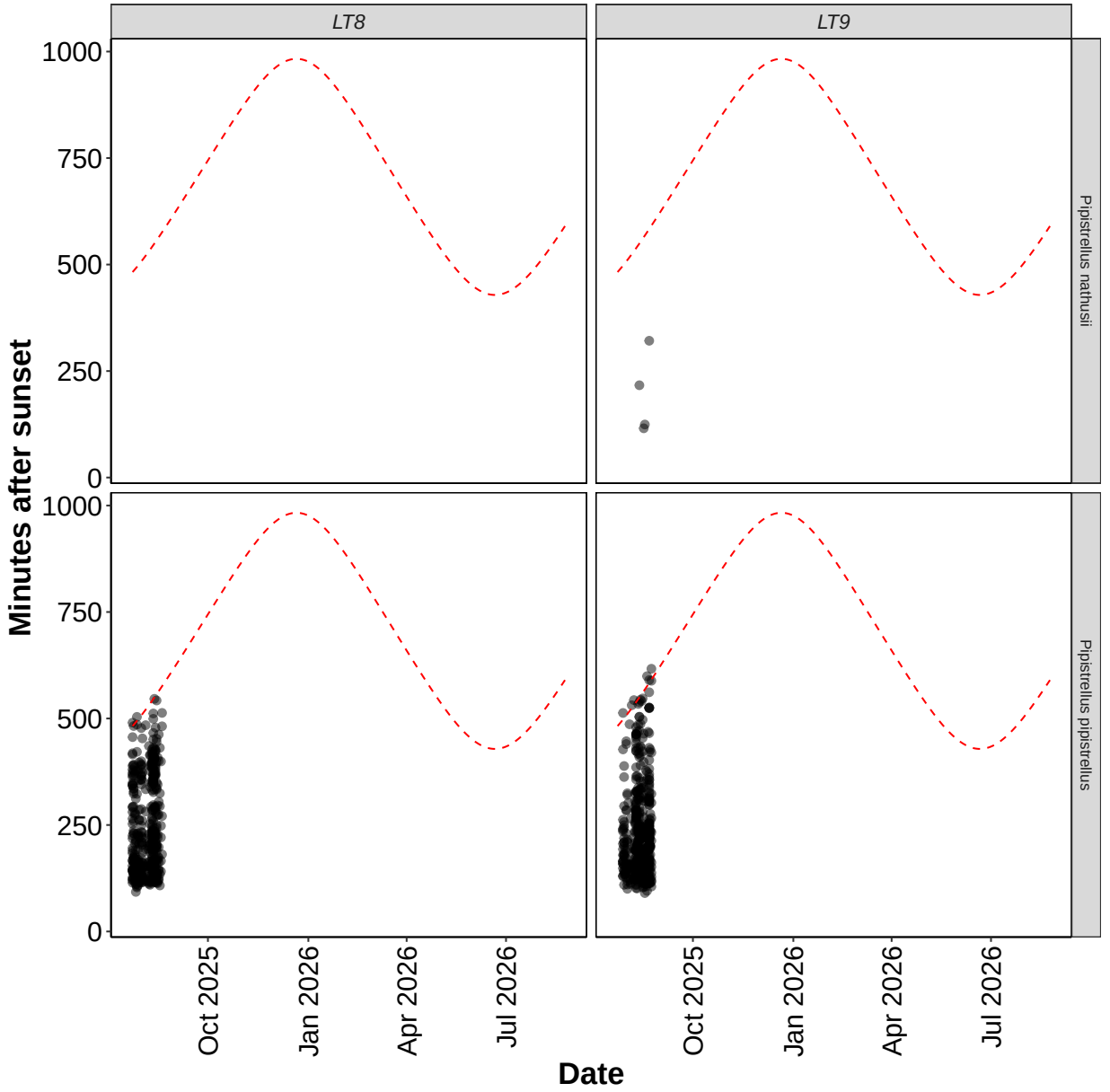

LT5
LT6
LT7
Myotis nattereri
Nyctalus leisleri
Minutes after sunset
0
250
500
750
1000
Oct 2025
Jan 2026
Apr 2026
Jul 2026
Date

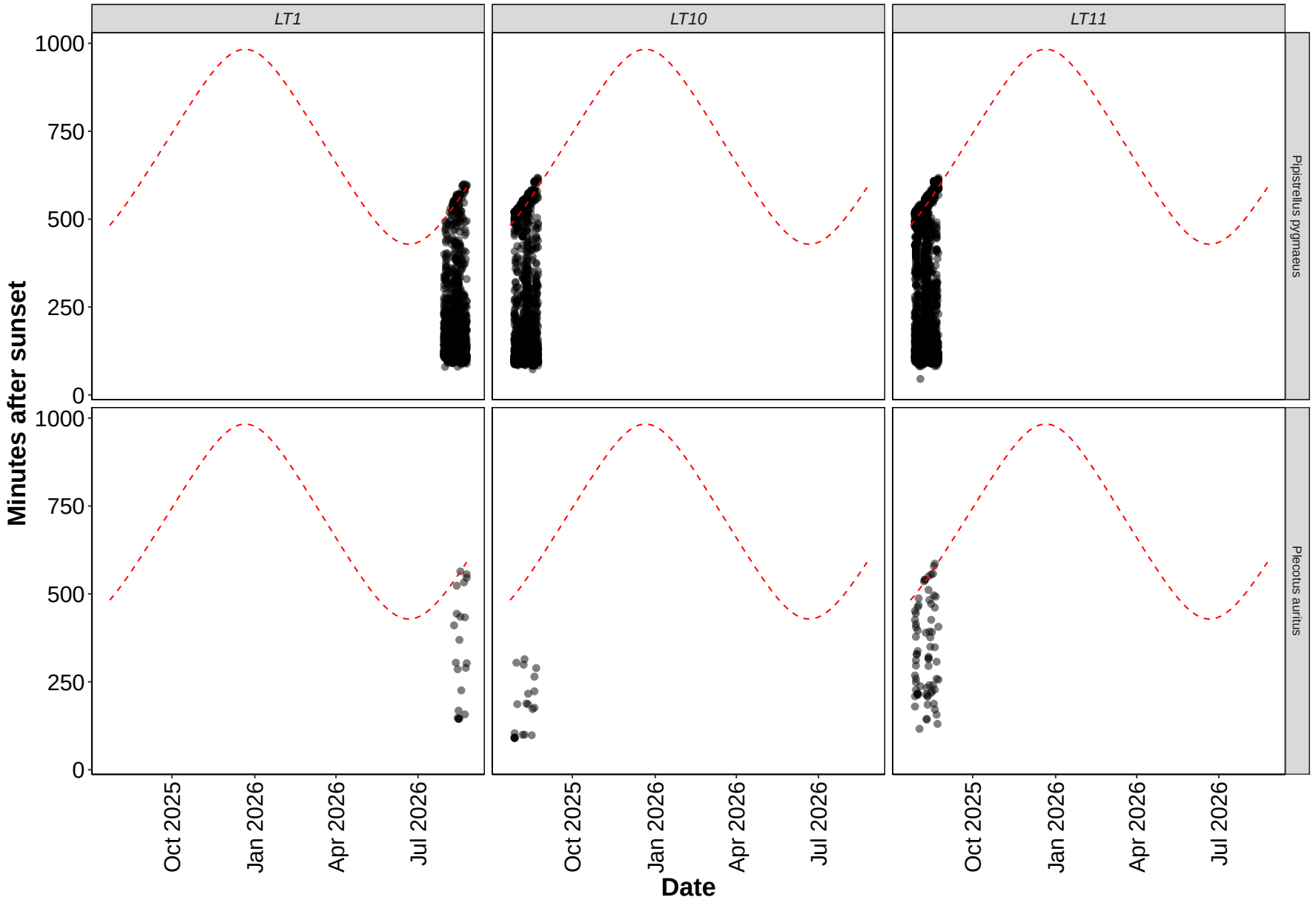

LT8
LT9
Myotis nattereri
Nyctalus leisleri
Minutes after sunset
1000
750
500
250
0
Oct 2025
Jan 2026
Apr 2026
Jul 2026
Date

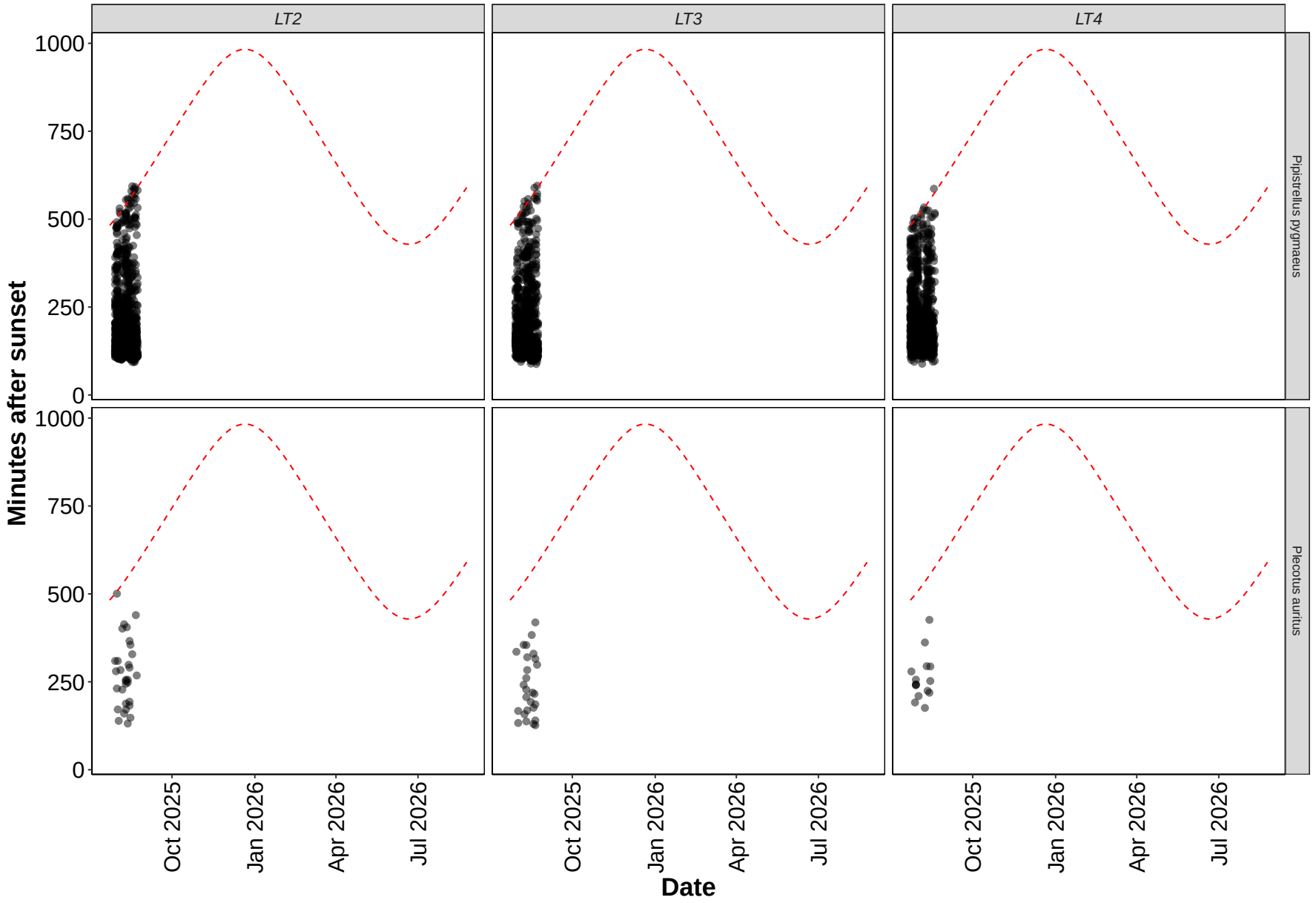

LT1
LT10
LT11
Pipistrellus nathusii
Pipistrellus pipistrellus
Minutes after sunset
0
250
500
750
1000
Oct 2025
Jan 2026
Apr 2026
Jul 2026
Date


LT2
LT3
LT4
Pipistrellus nathusii
Pipistrellus pipistrellus
Minutes after sunset
0
250
500
750
1000
Oct 2025
Jan 2026
Apr 2026
Jul 2026
Date


LT5
LT6
LT7
Pipistrellus nathusii
Pipistrellus pipistrellus
Minutes after sunset
0
250
500
750
1000
Oct 2025
Jan 2026
Apr 2026
Jul 2026
Date


LT8
LT9
Pipistrellus nathusii
Pipistrellus pipistrellus
Minutes after sunset
1000
750
500
250
0
Oct 2025
Jan 2026
Apr 2026
Jul 2026
Date


LT1
LT10
LT11
Pipistrellus pygmaeus
Plecotus auritus
Minutes after sunset
0
250
500
750
1000
Oct 2025
Jan 2026
Apr 2026
Jul 2026
Date


LT2
LT3
LT4
Pipistrellus pygmaeus
Plecotus auritus
Minutes after sunset
0
250
500
750
1000
Oct 2025
Jan 2026
Apr 2026
Jul 2026
Date

Roost Emergence Time and Bat Observation

Based on: Russ, Jon. 2012. British Bat Calls a Guide to species Identification. Pelagic Publishing.

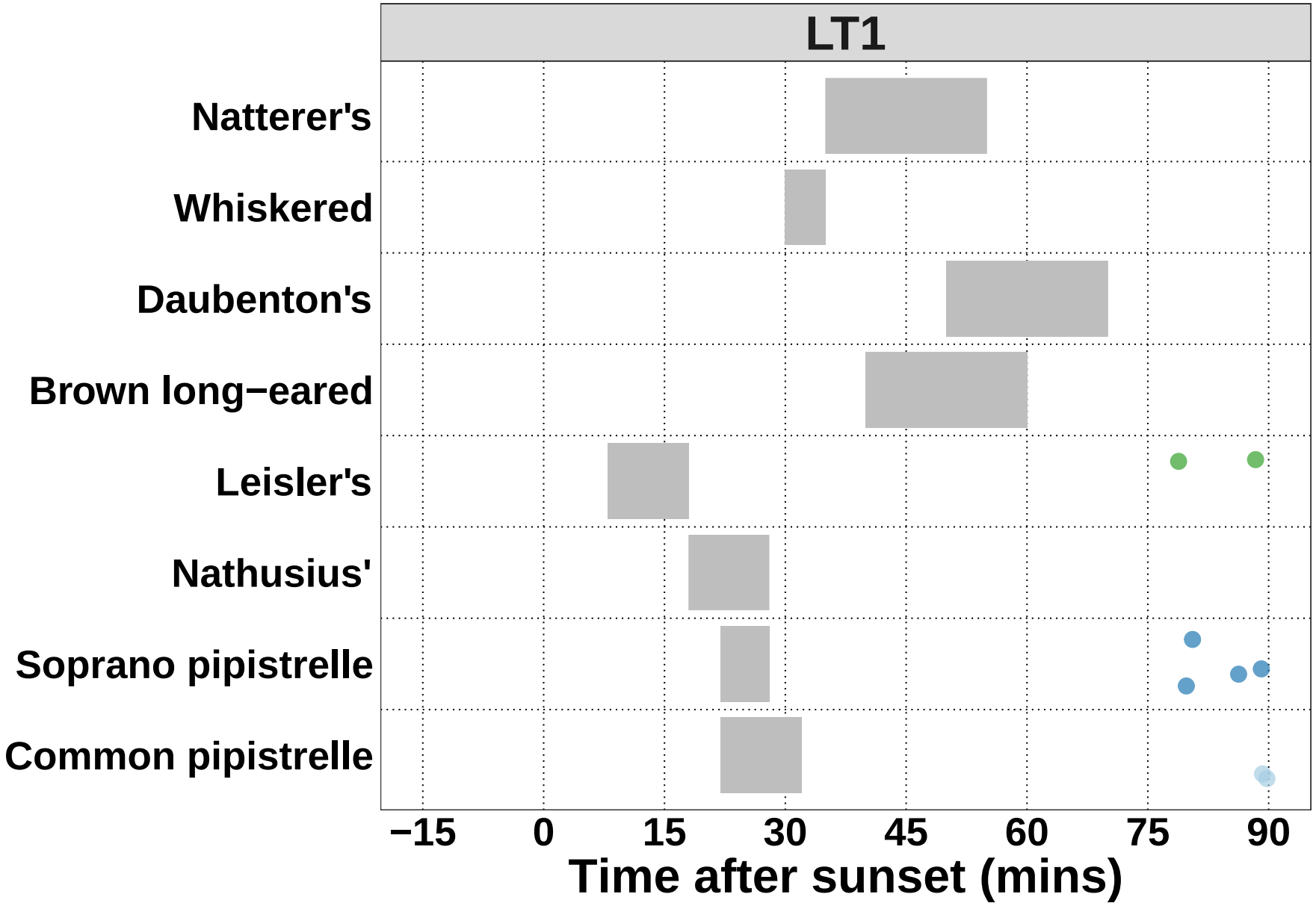
Bat Passes Potentially Indicating Close Proximity to a Roost (Russ 2012)

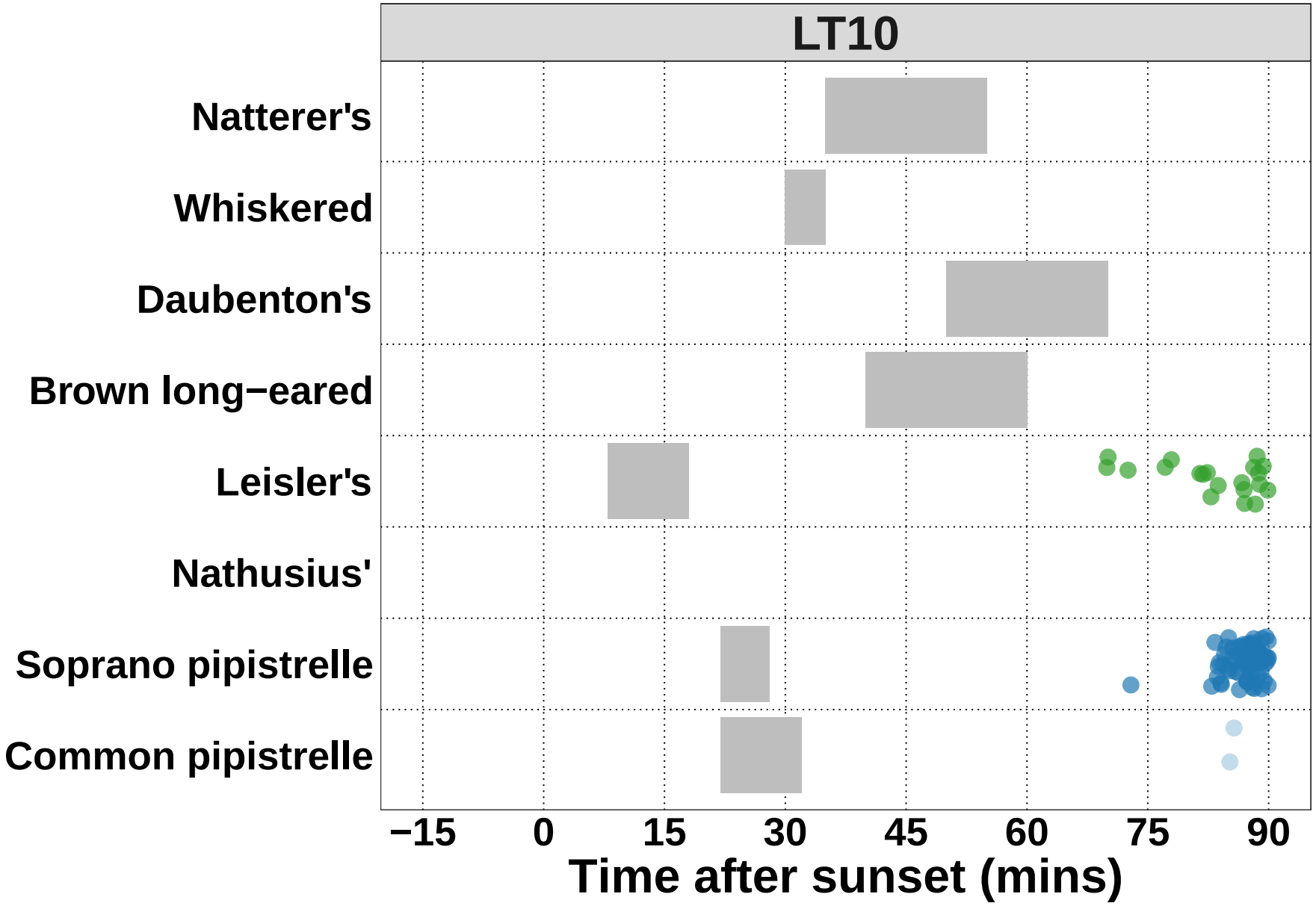
Table 12. Number of bat calls recorded before the upper time of the species-specific emergence time range, and which therefore may potentially indicate the presence of a nearby roost.

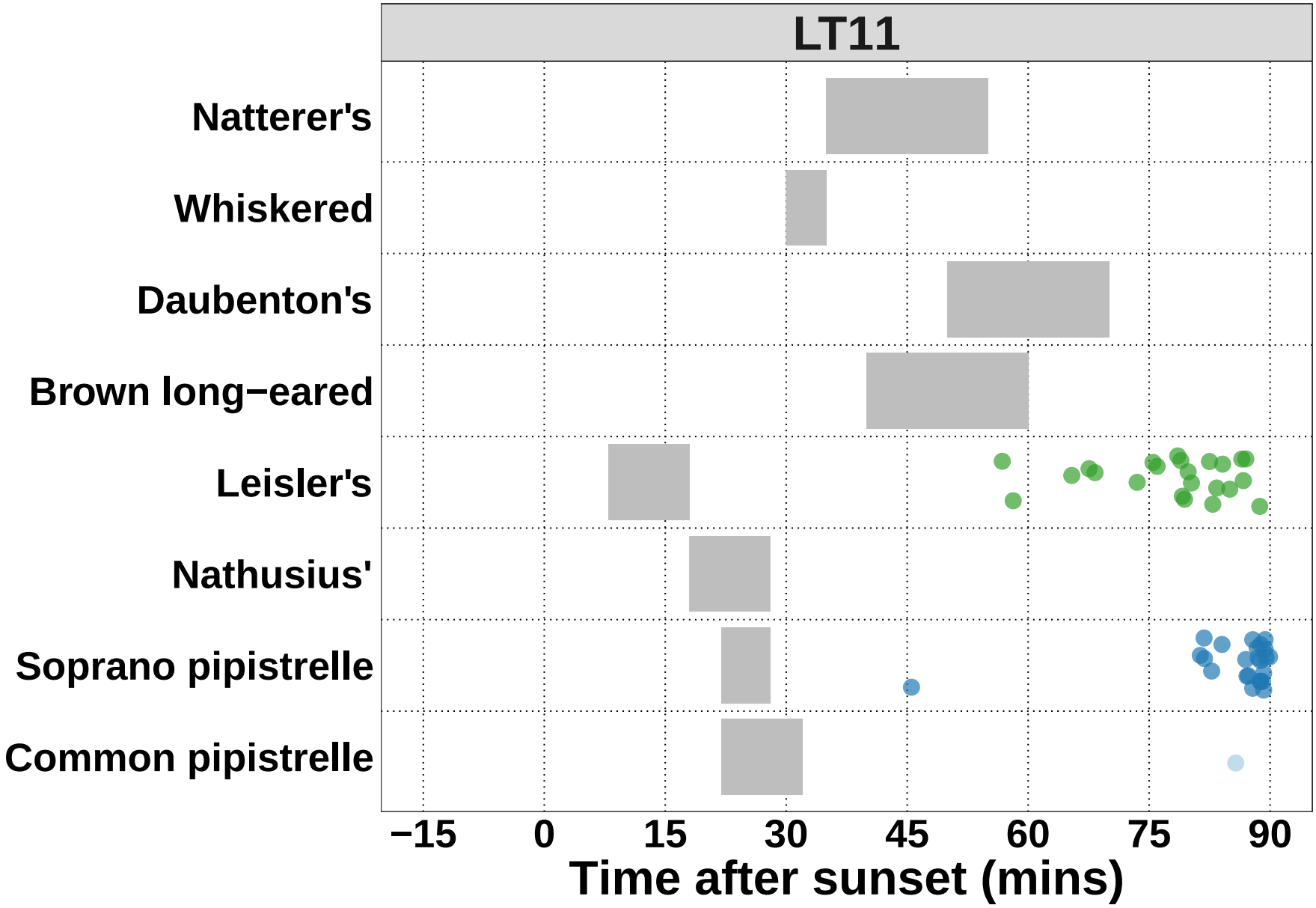
Species	Detector ID

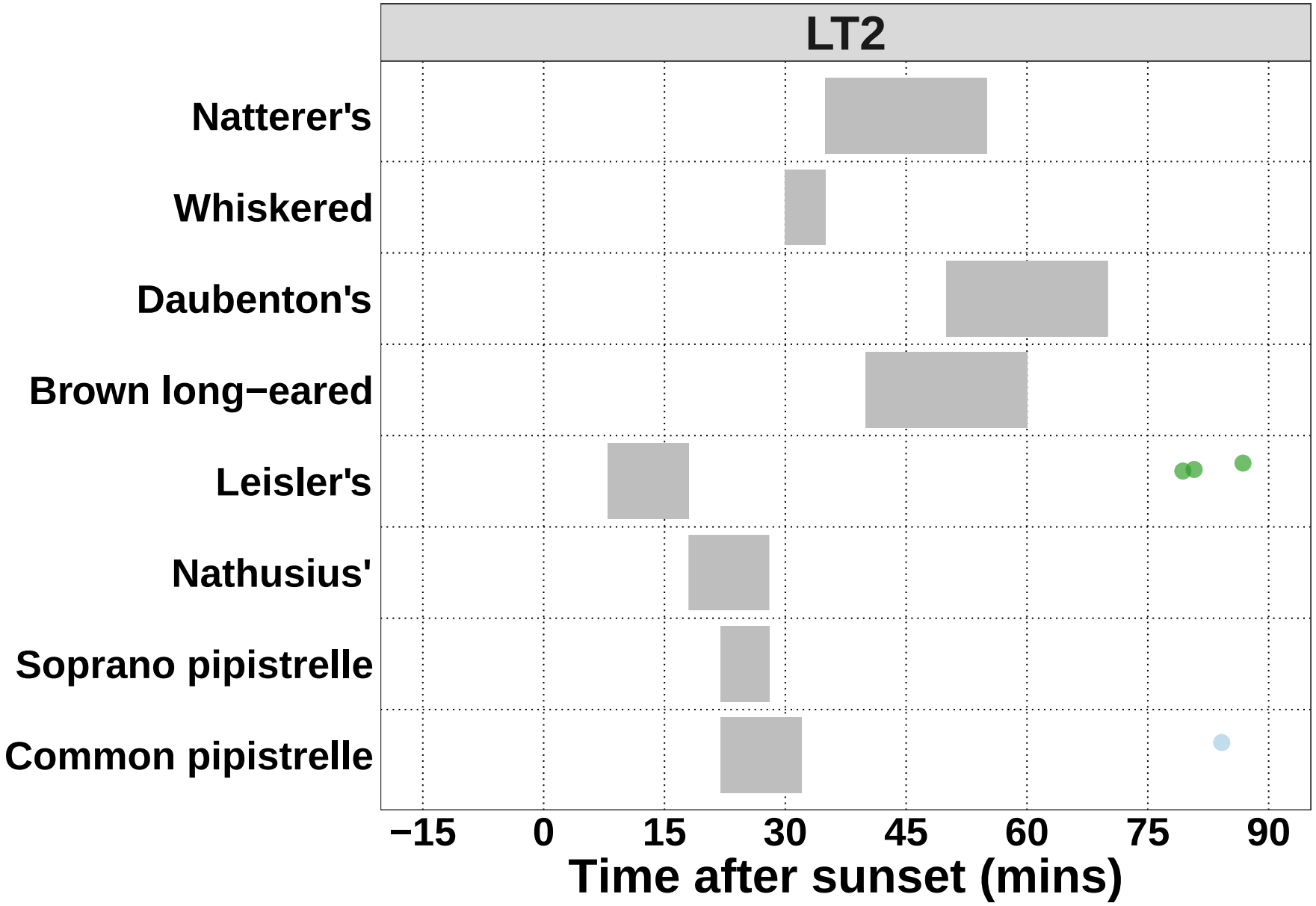
Bat Passes Potentially Indicating Close Proximity to a Roost (Russ 2012)

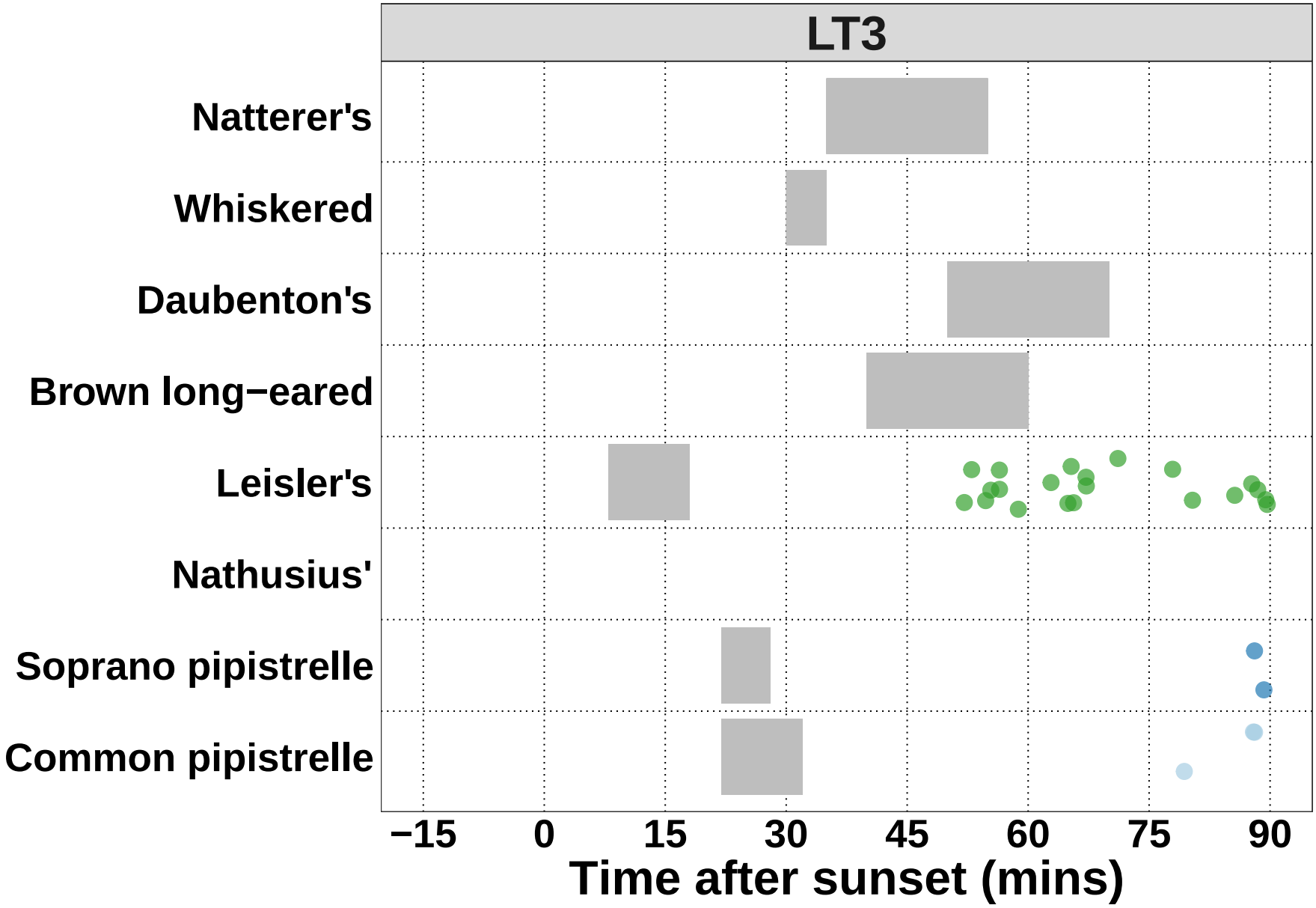
Figure 8. Time from 15 minutes before to 90 minutes after sunset. Species-specific emergence time ranges are shown as grey bars. Bat passes overlapping species-specific grey bars, or occuring earlier than this time range, may potentially indicate the presence of a nearby roost.

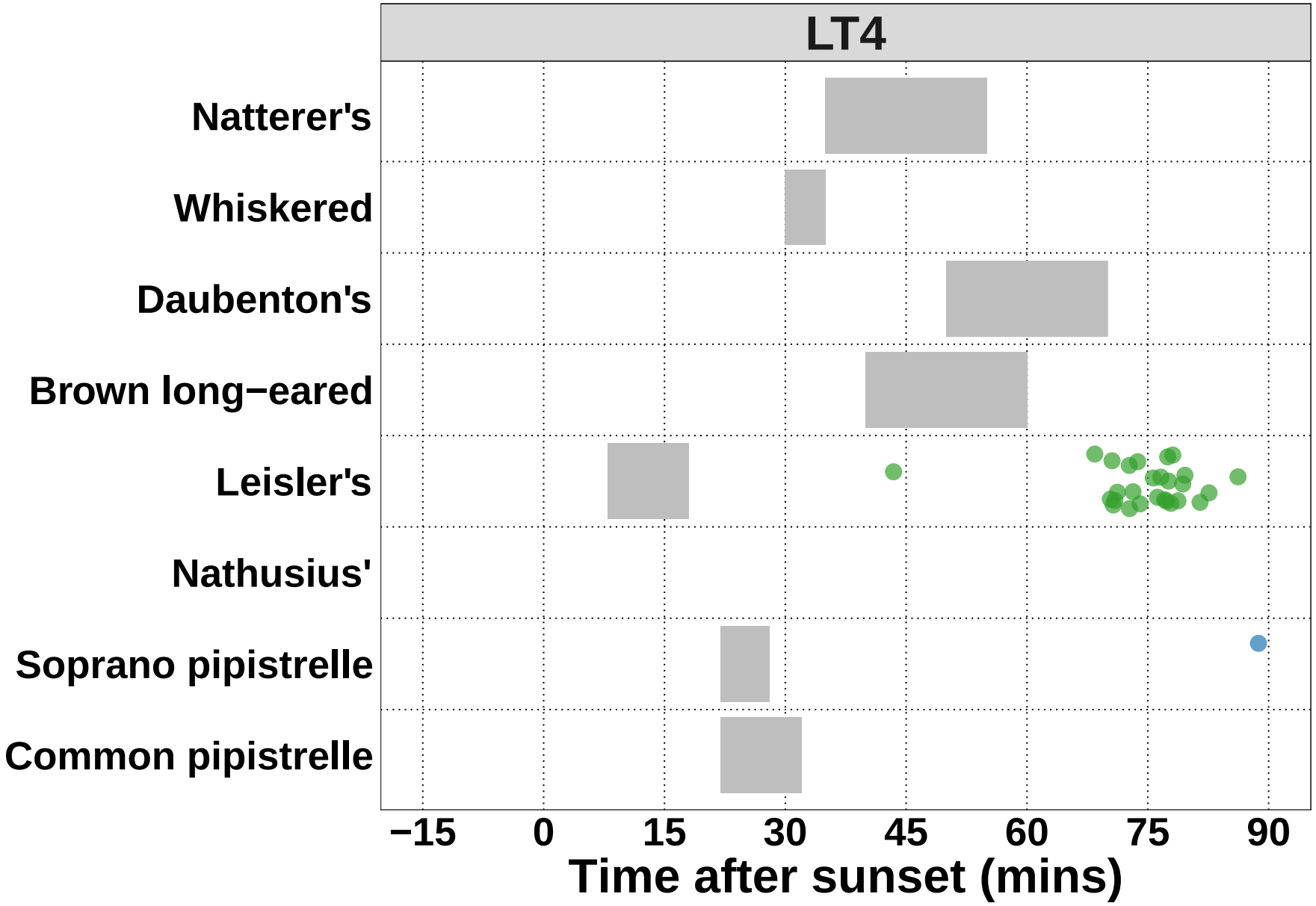

LT1
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

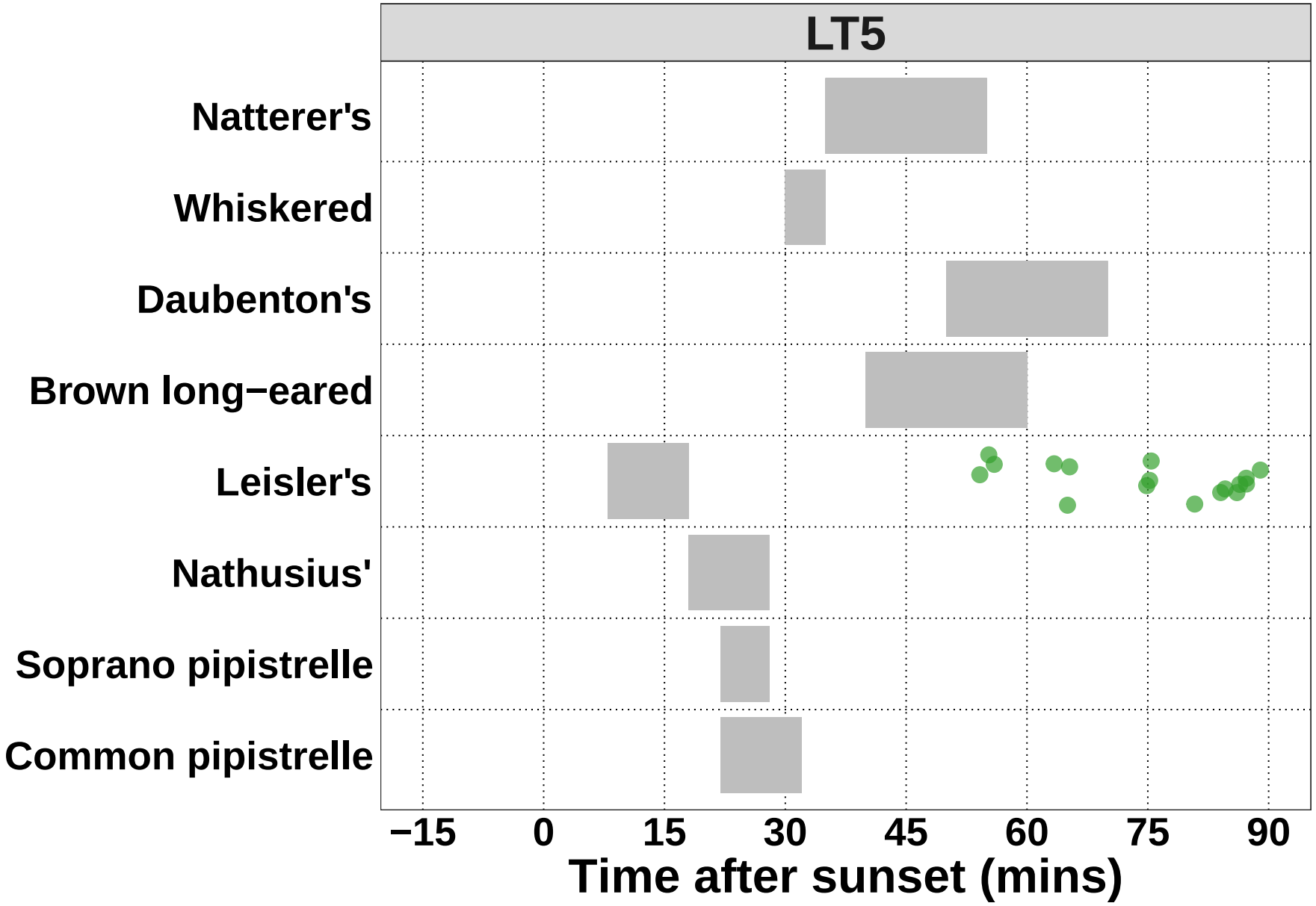

LT10
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

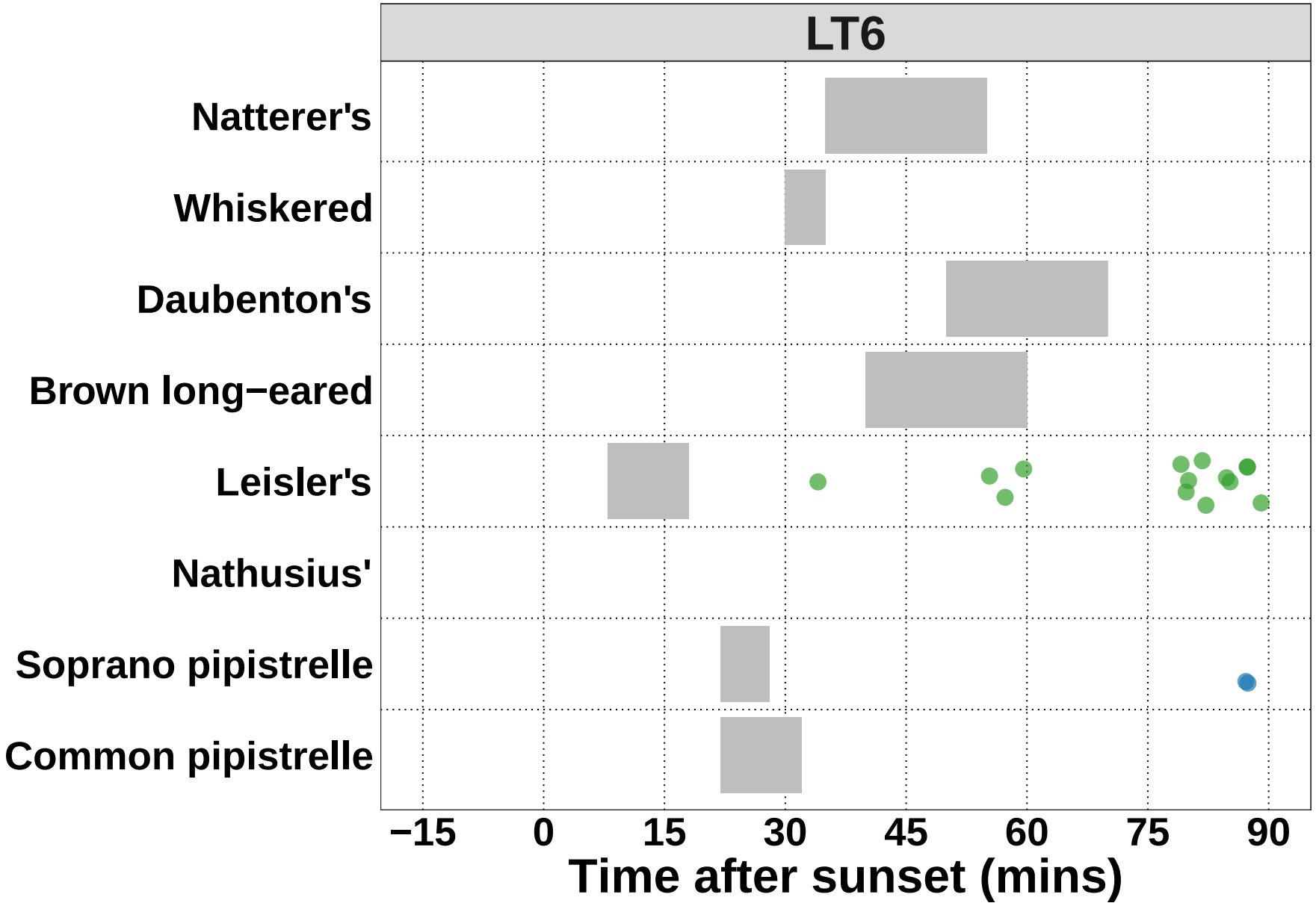

LT11
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

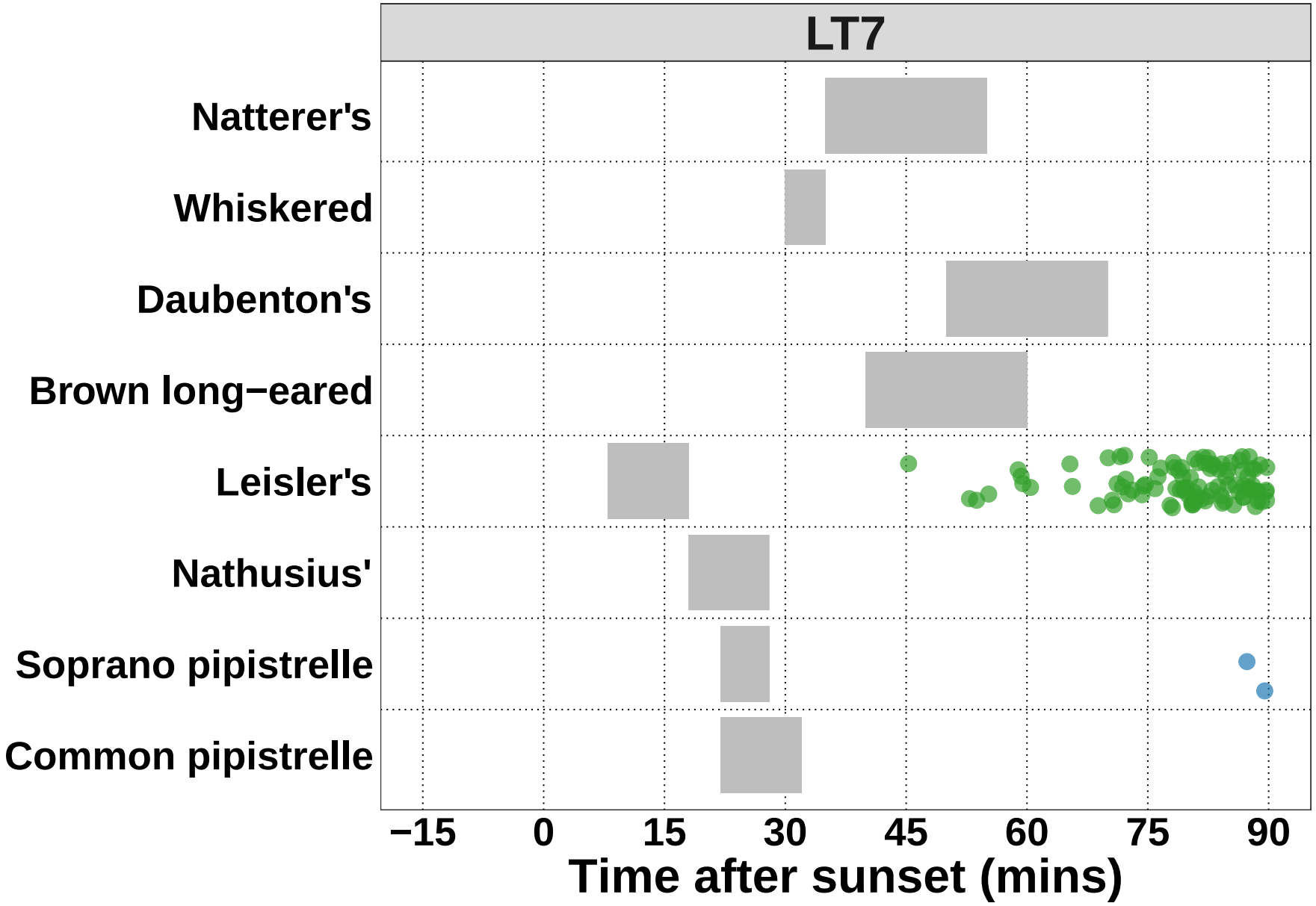

LT2
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

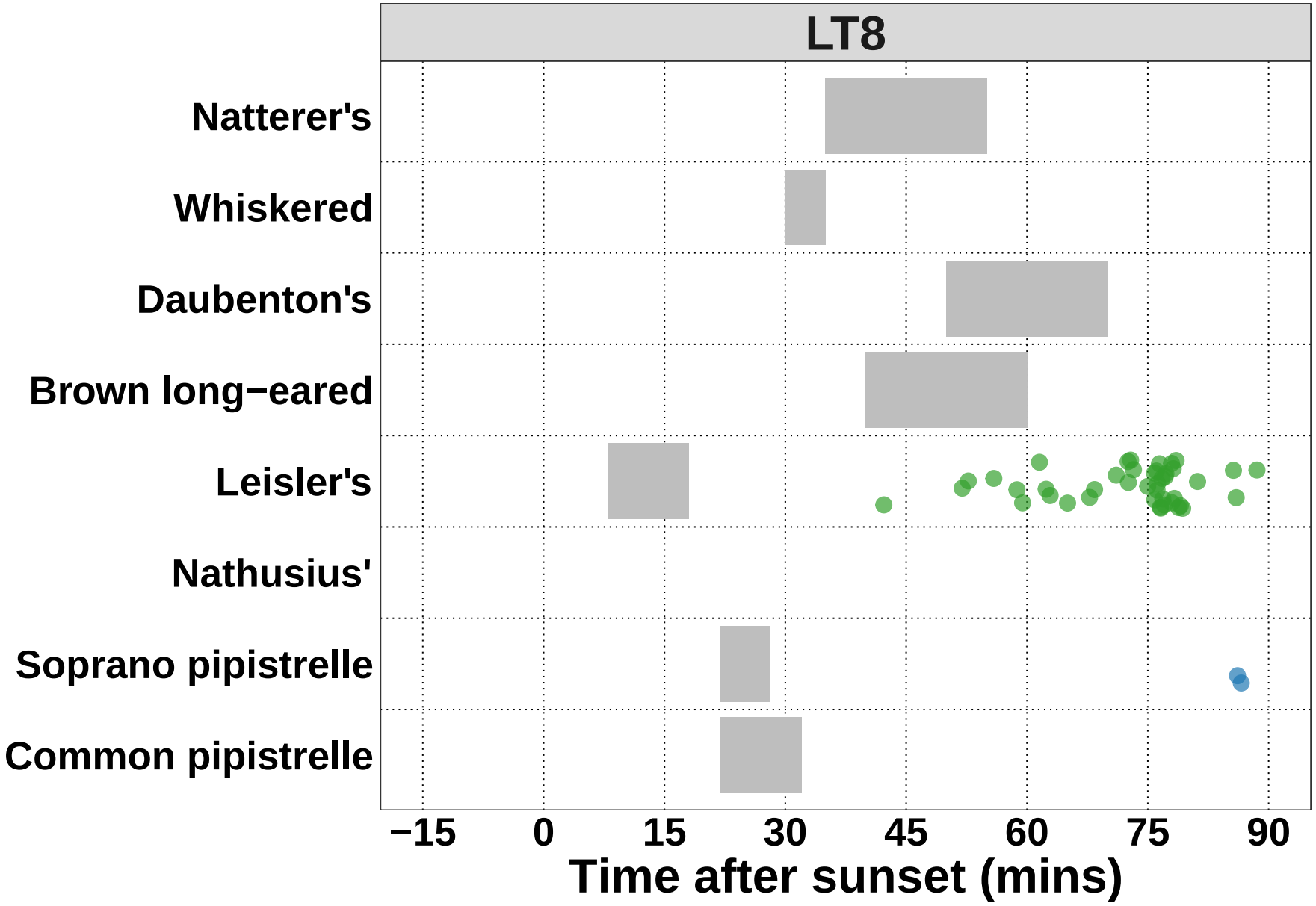

LT3
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

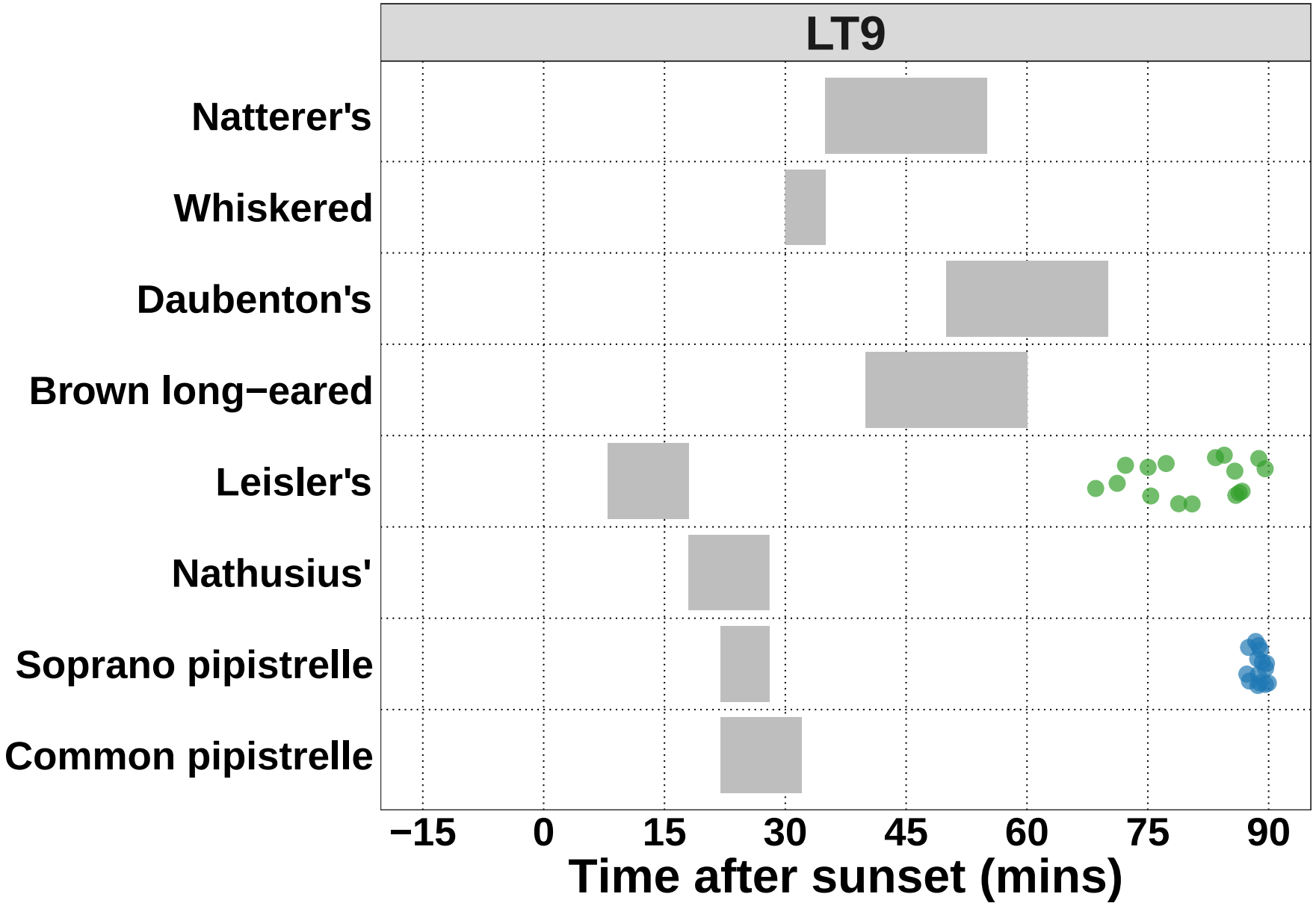

LT4
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)


LT5
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)


LT6
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)


LT7
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)

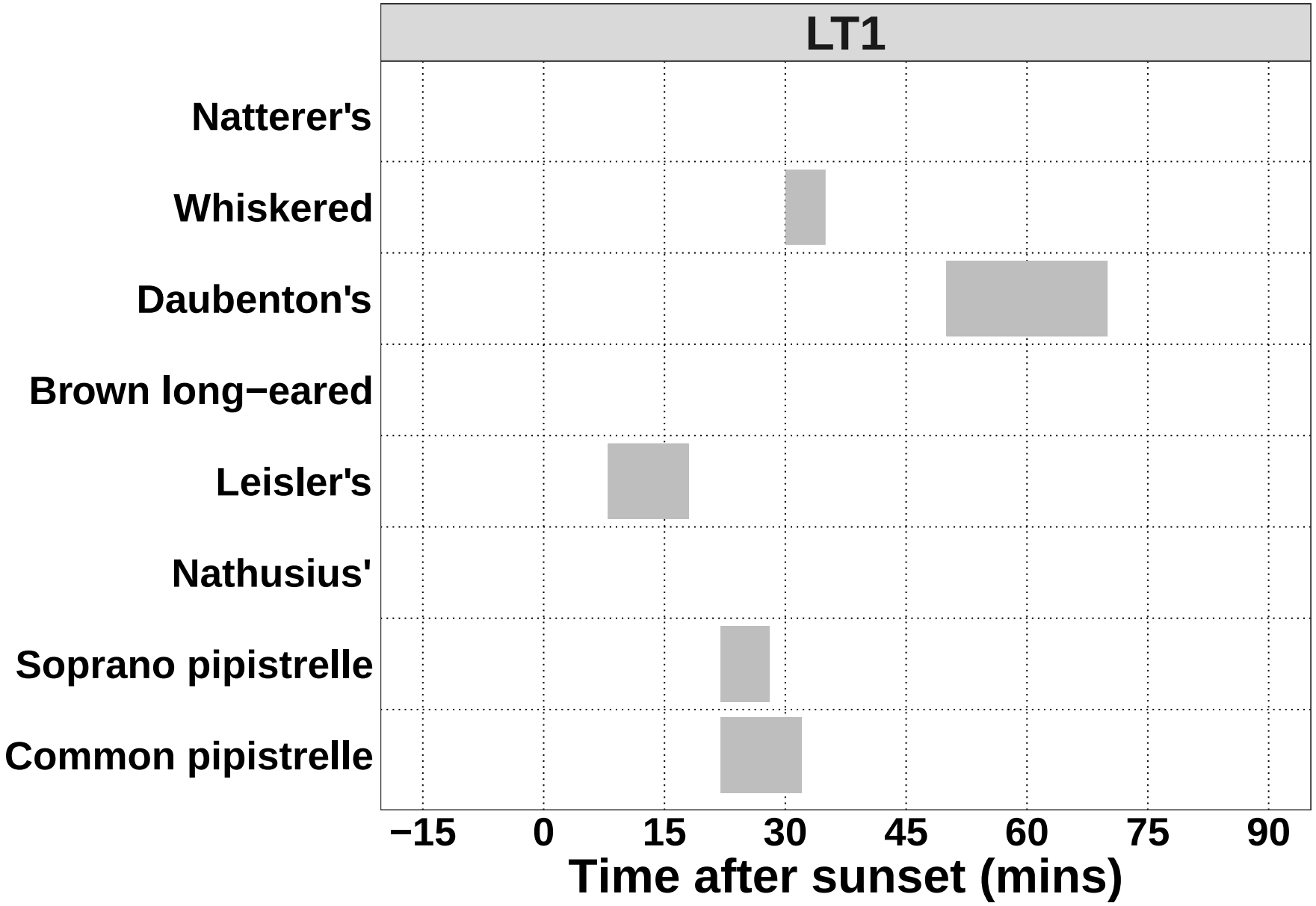

LT8
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

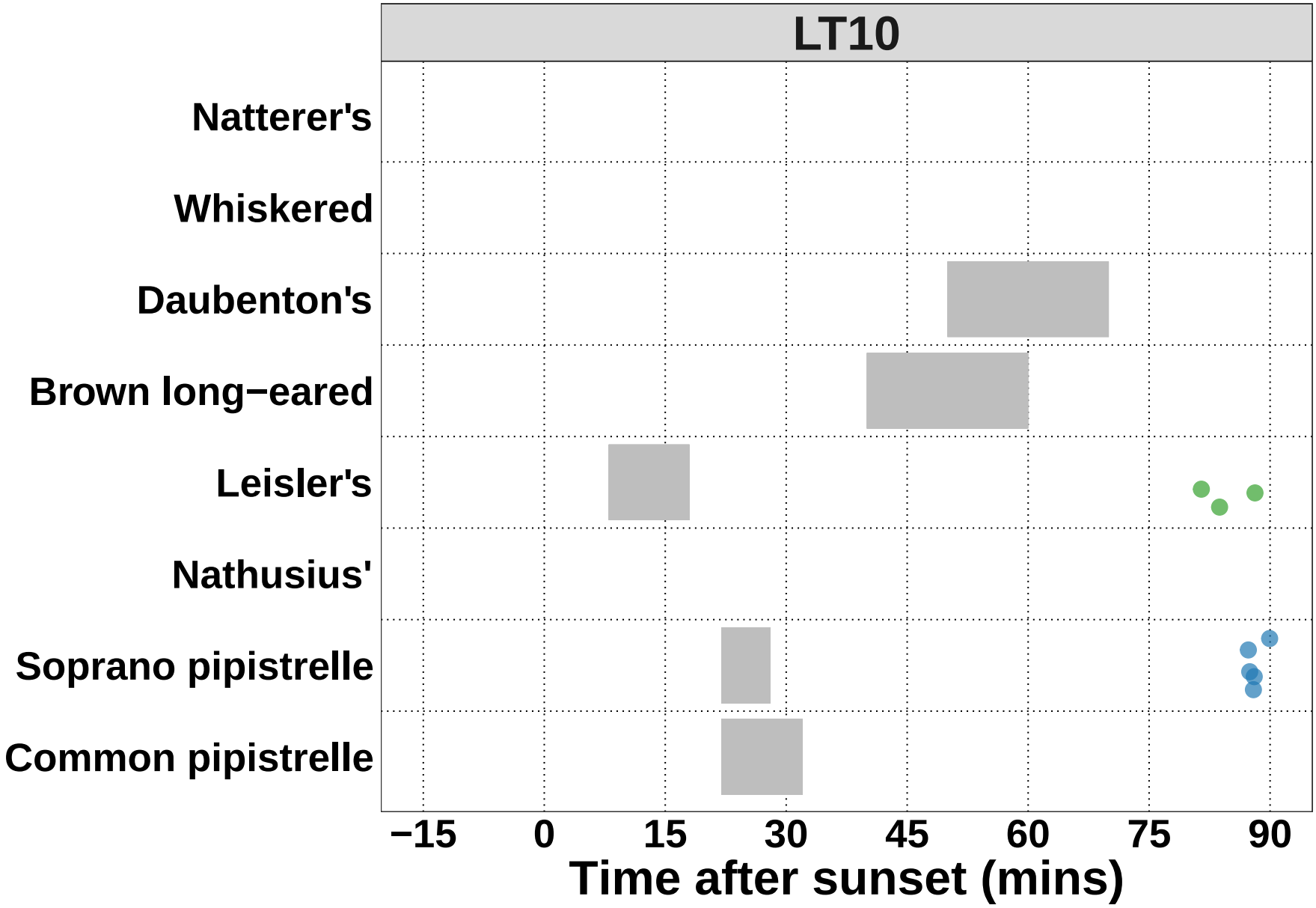

LT9
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

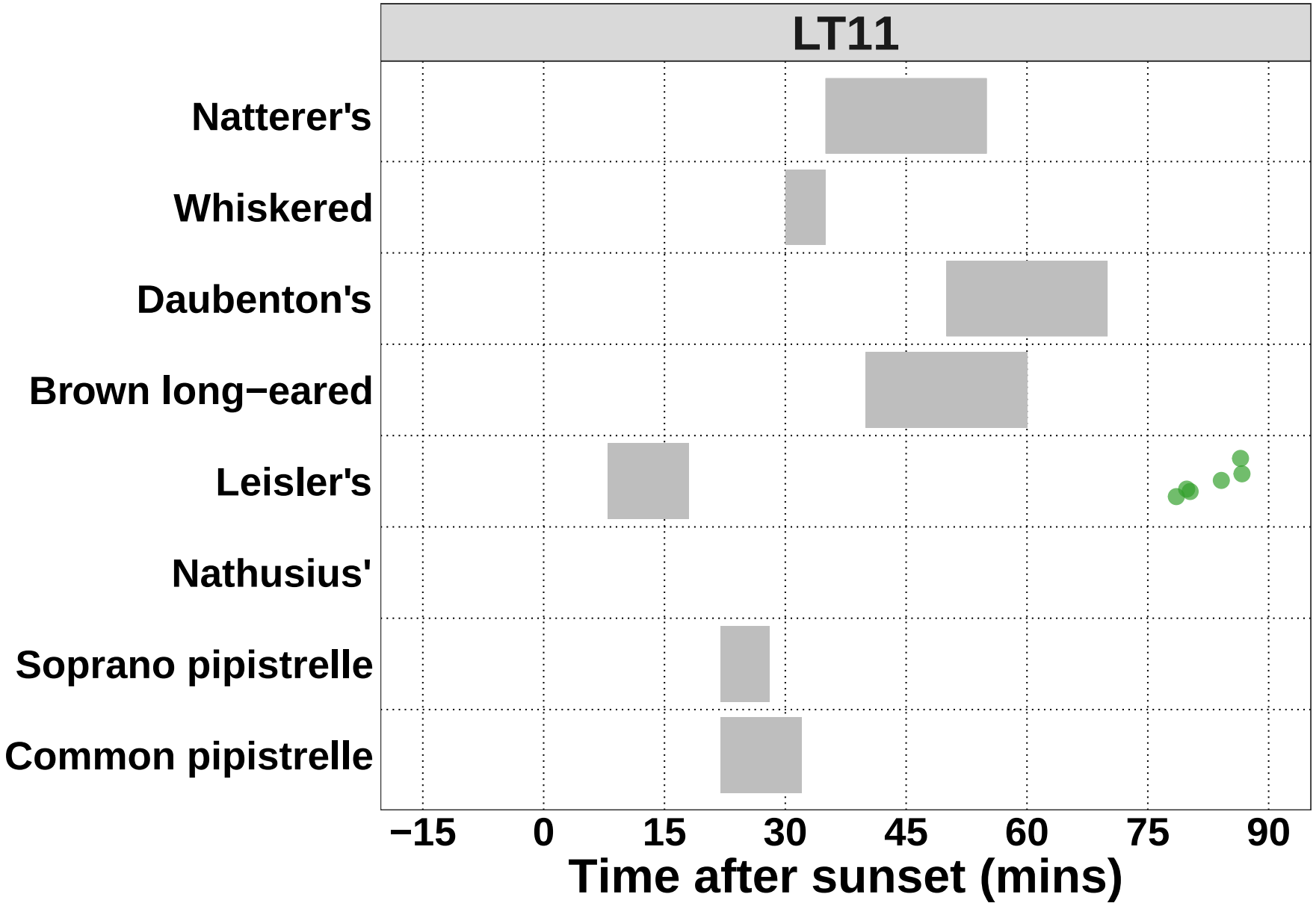
Bat Passes Potentially Indicating Close Proximity to a Roost (Maternity Period Only) - *Maternity period defined as 15th June - 30th July.

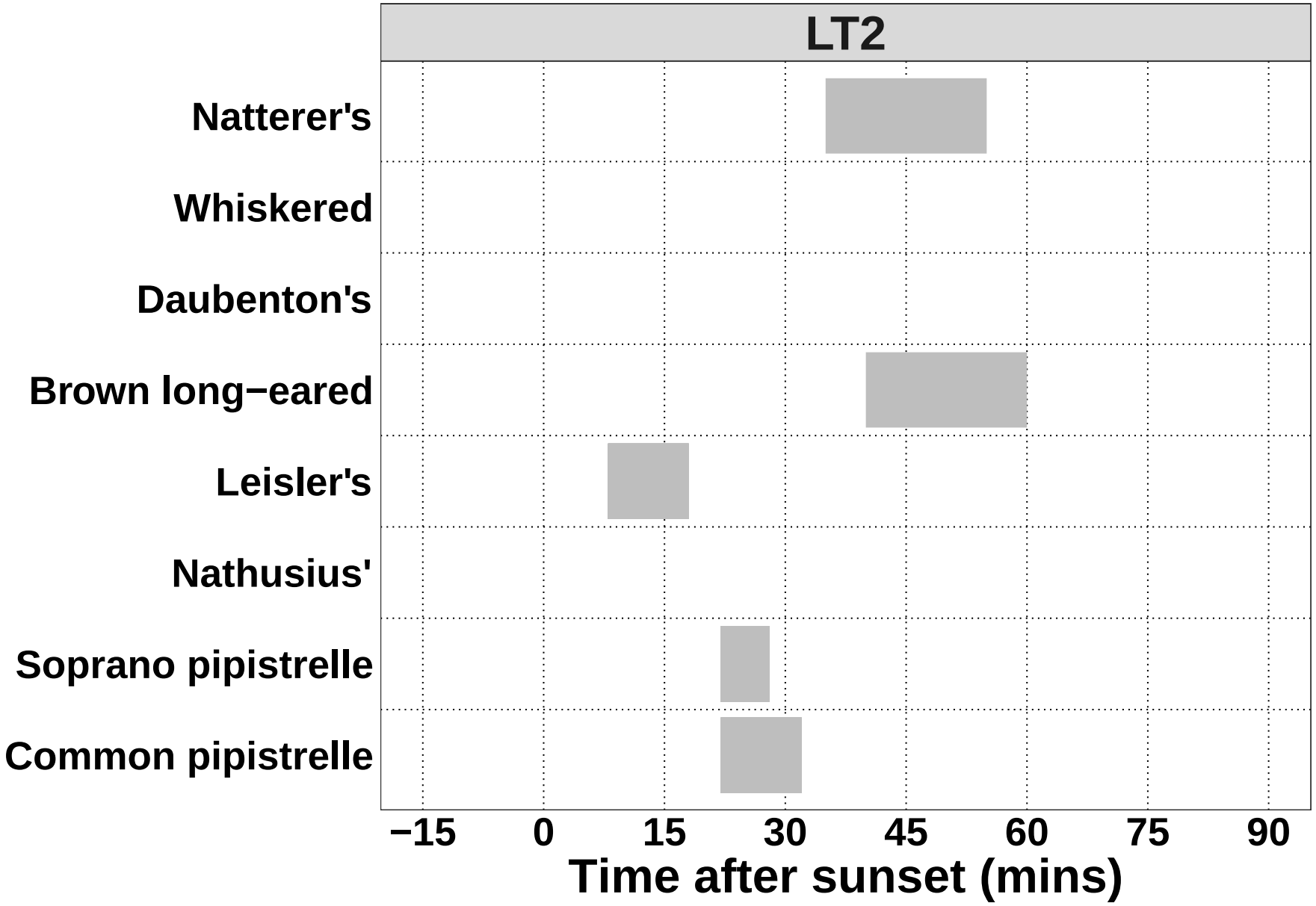
Species	Detector ID

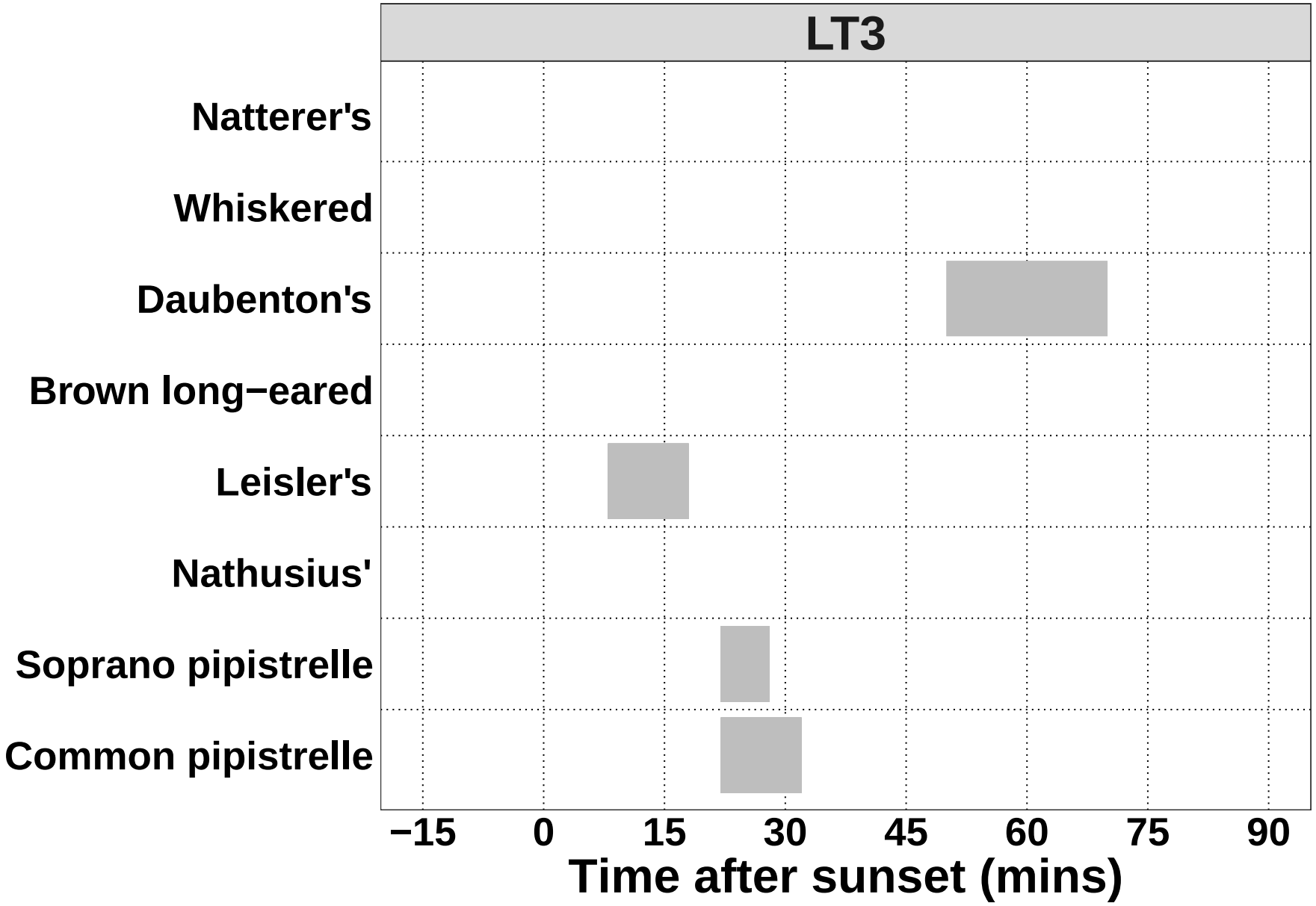
Bat Passes Potentially Indicating Close Proximity to a Roost (Maternity Period Only) - Maternity period defined as 15th June - 30th July.

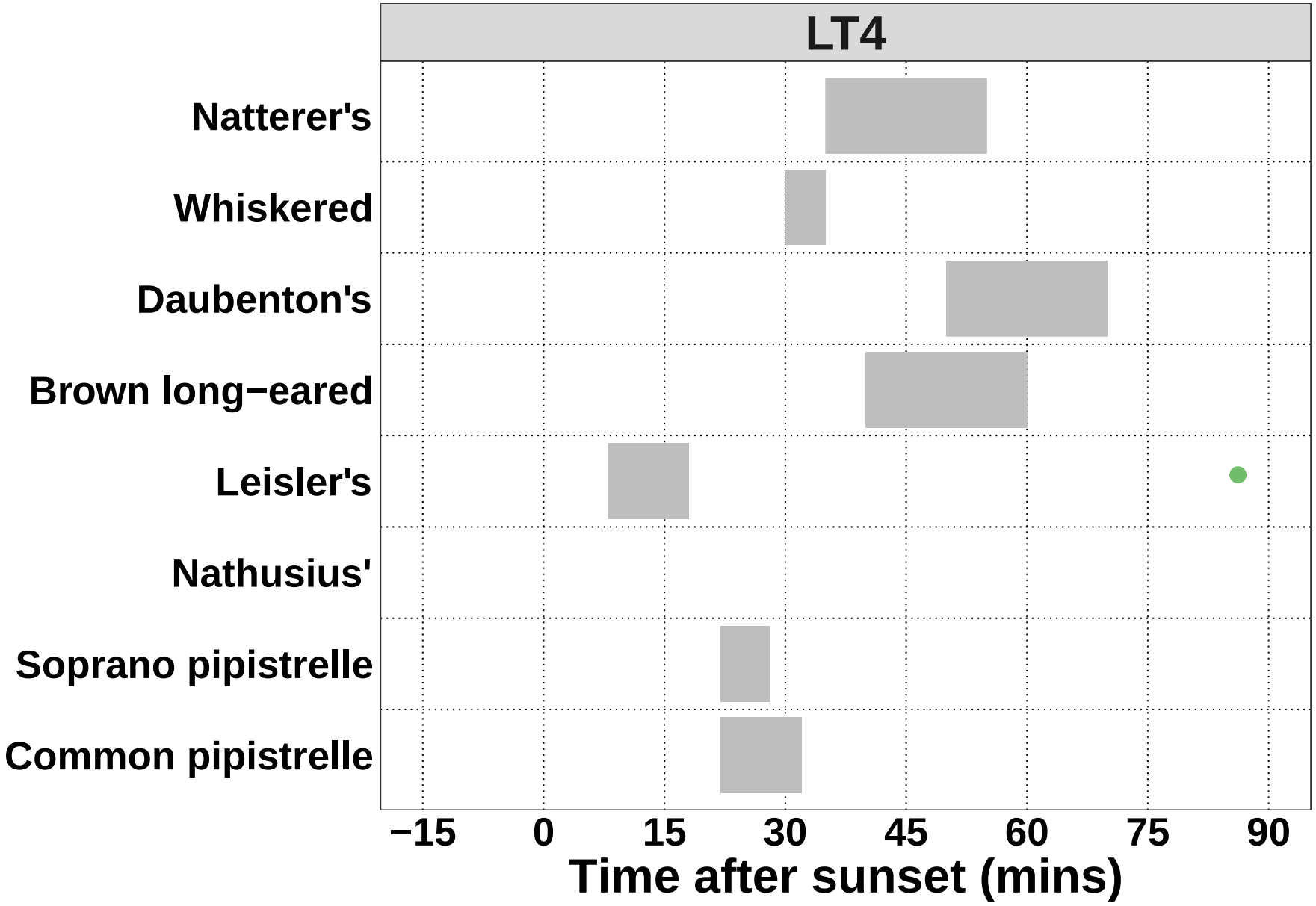

LT1
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

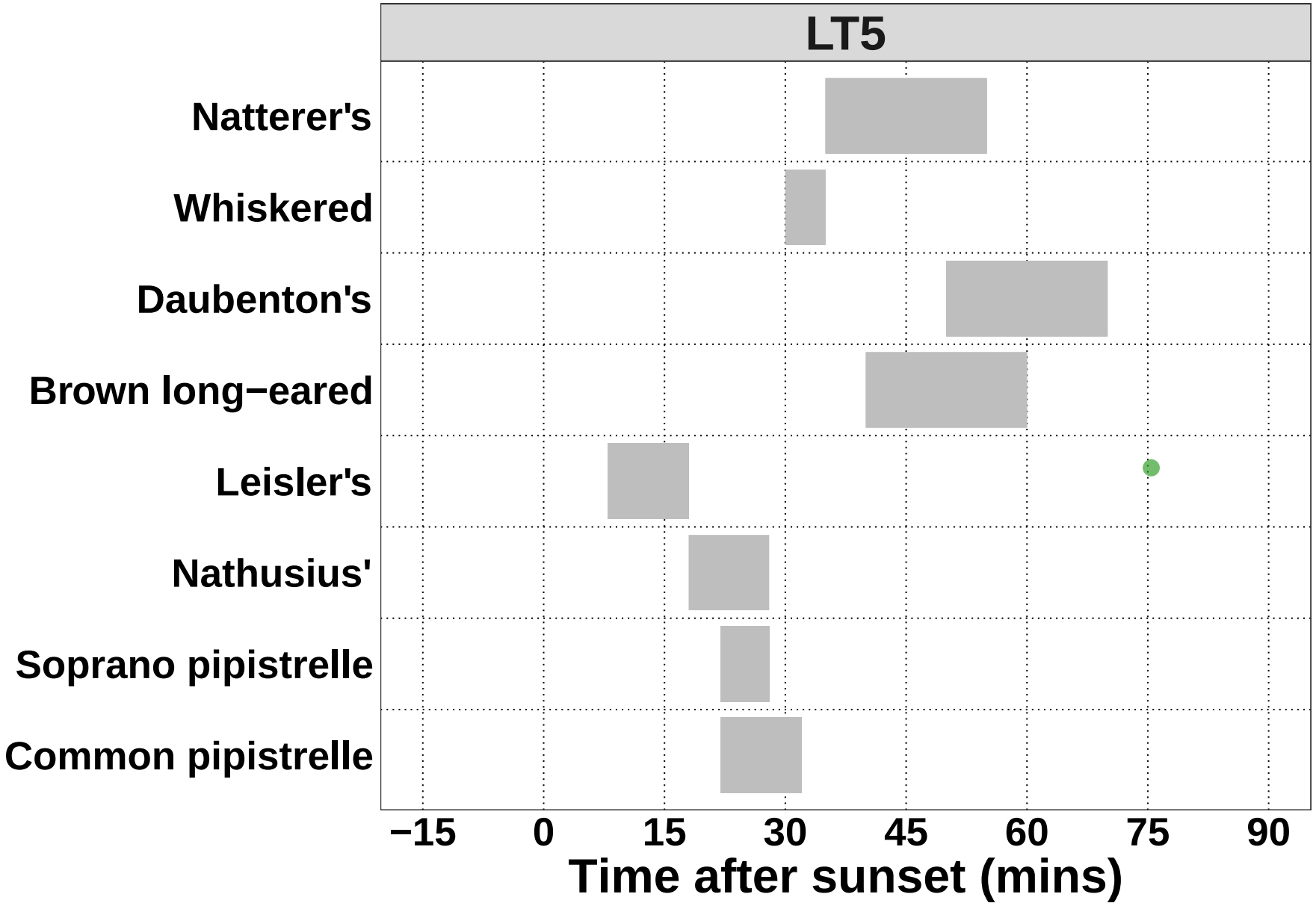

LT10
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

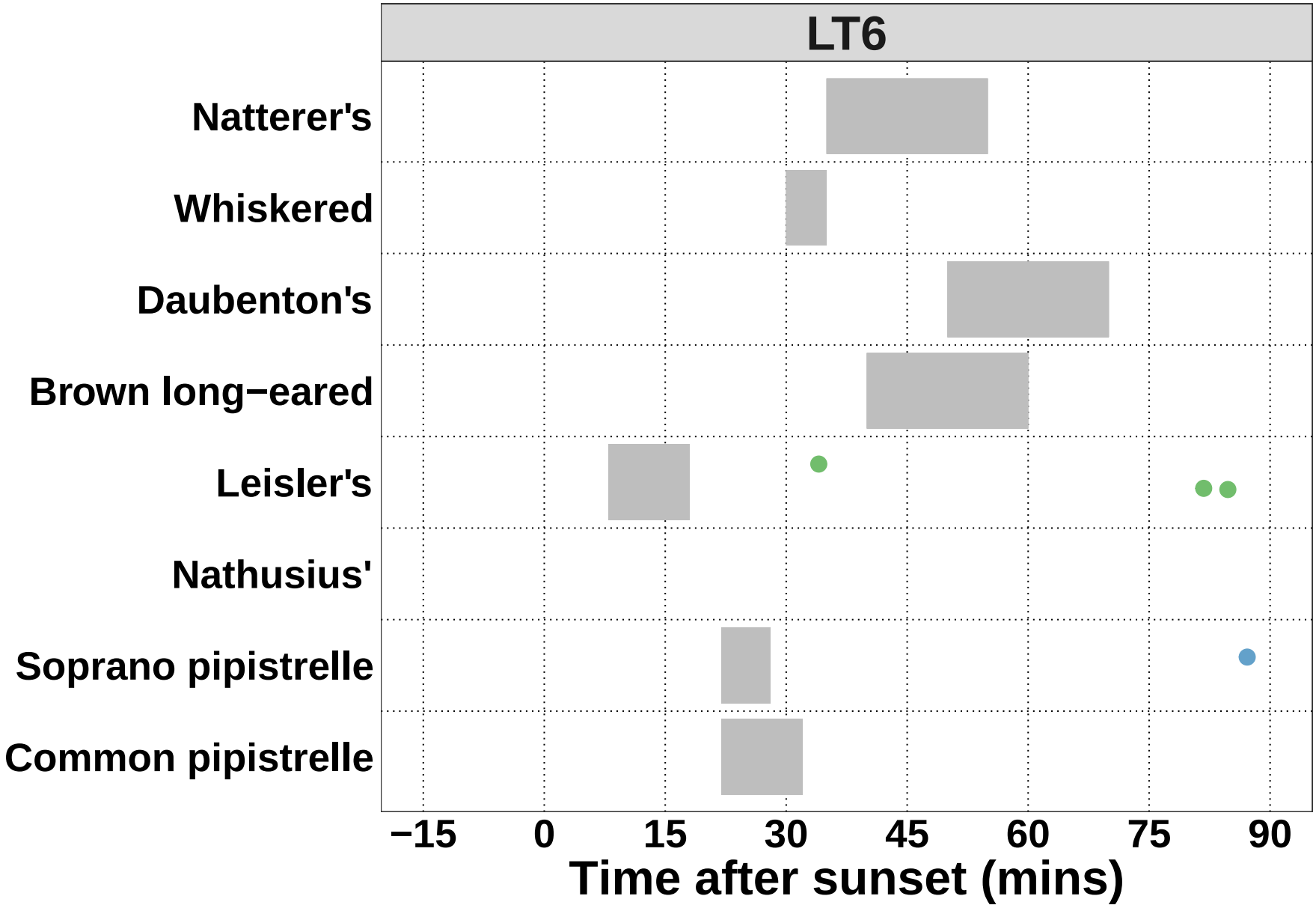

LT11
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

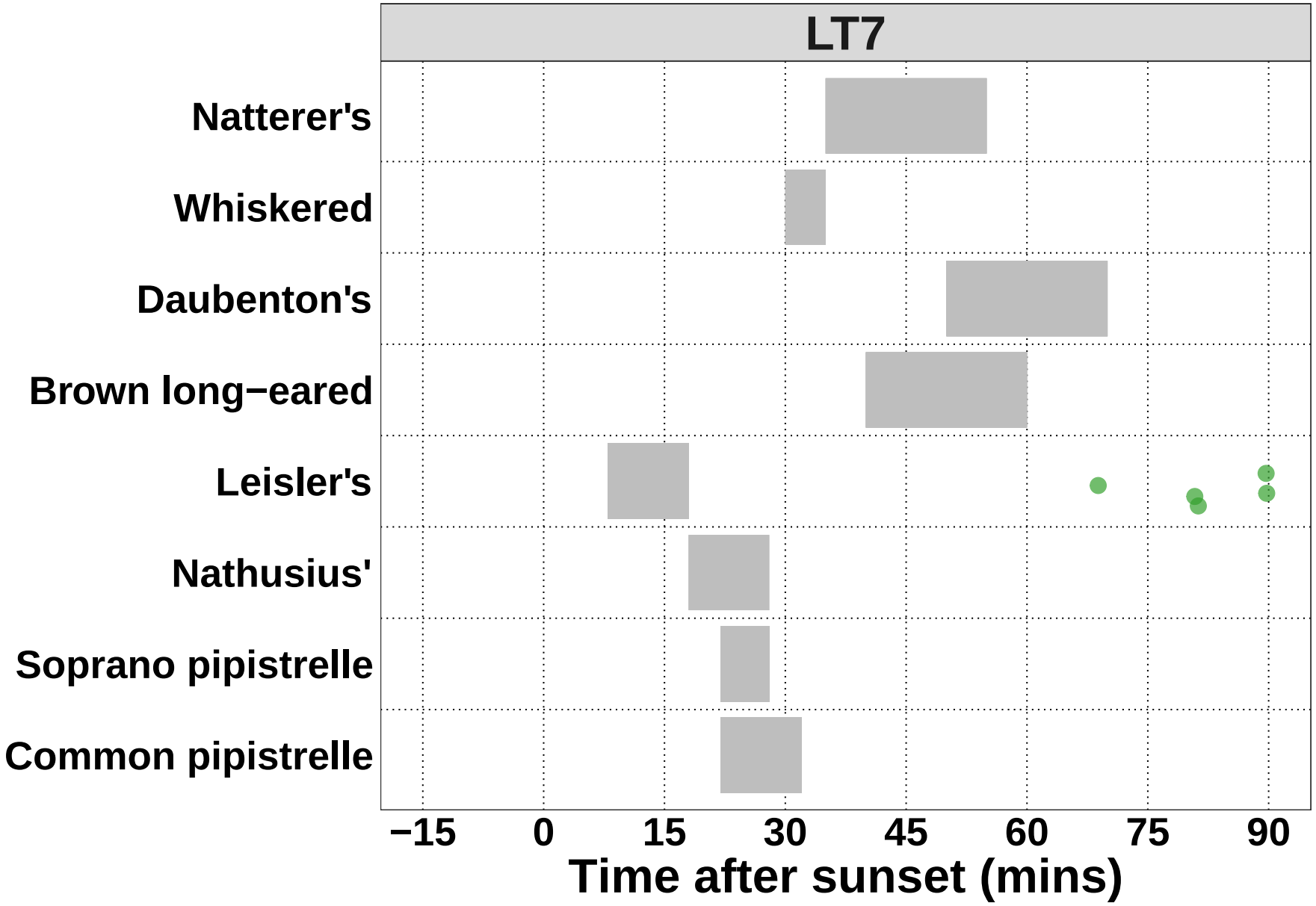

LT2
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

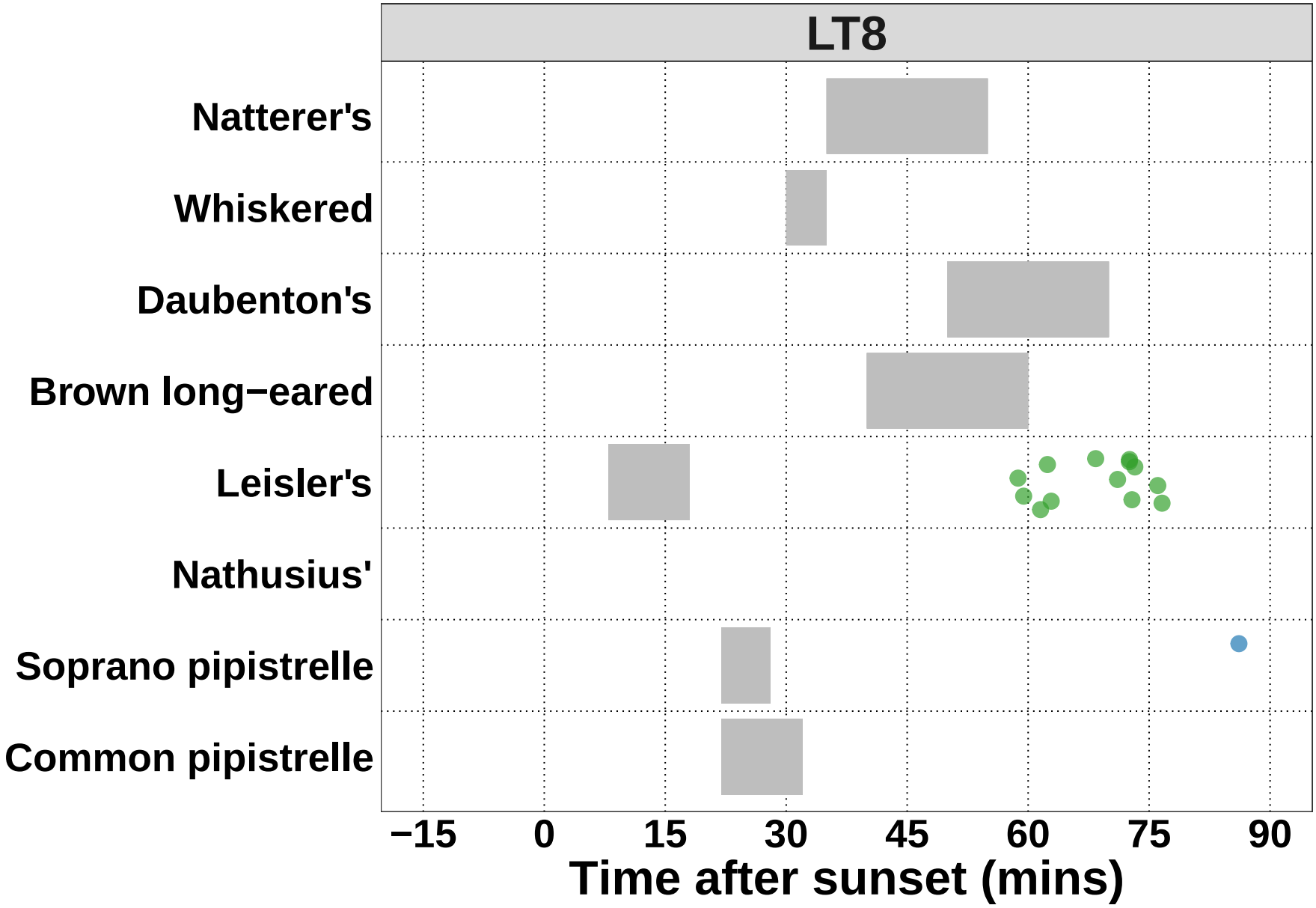

LT3
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

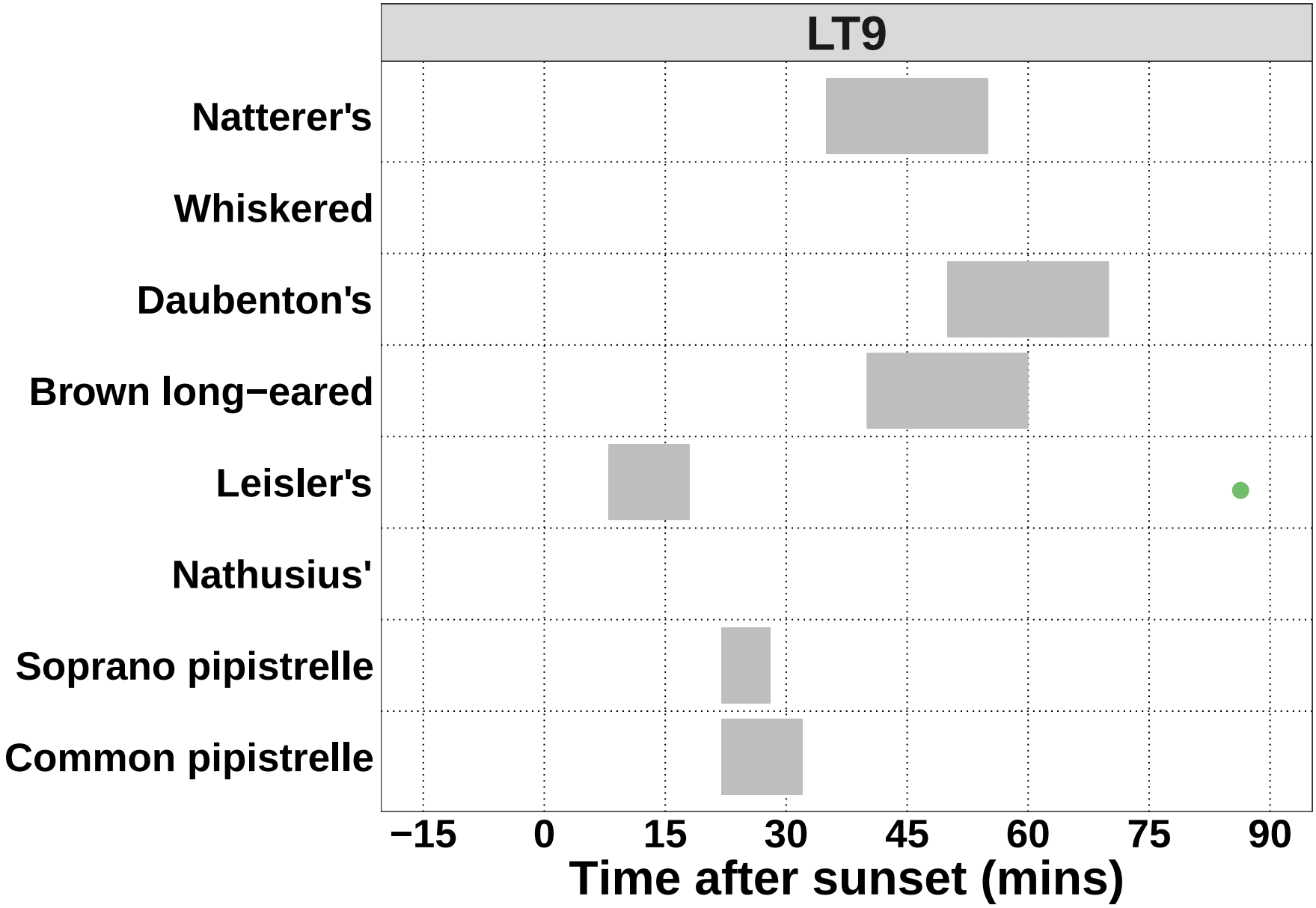

LT4
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)


LT5
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)


LT6
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)


LT7
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)


LT8
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)


LT9
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)

Count 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 (%)
Myotis daubentonii	560	2.5
Myotis mystacinus	173	0.8
Myotis nattereri	371	1.7
Nyctalus leisleri	3946	17.7
Pipistrellus nathusii	22	0.1
Pipistrellus pipistrellus	4959	22.3
Pipistrellus pygmaeus	11880	53.3
Plecotus auritus	370	1.7
Total	22281	100.1

Per Detector

The number of passes recorded for each species at each detector.

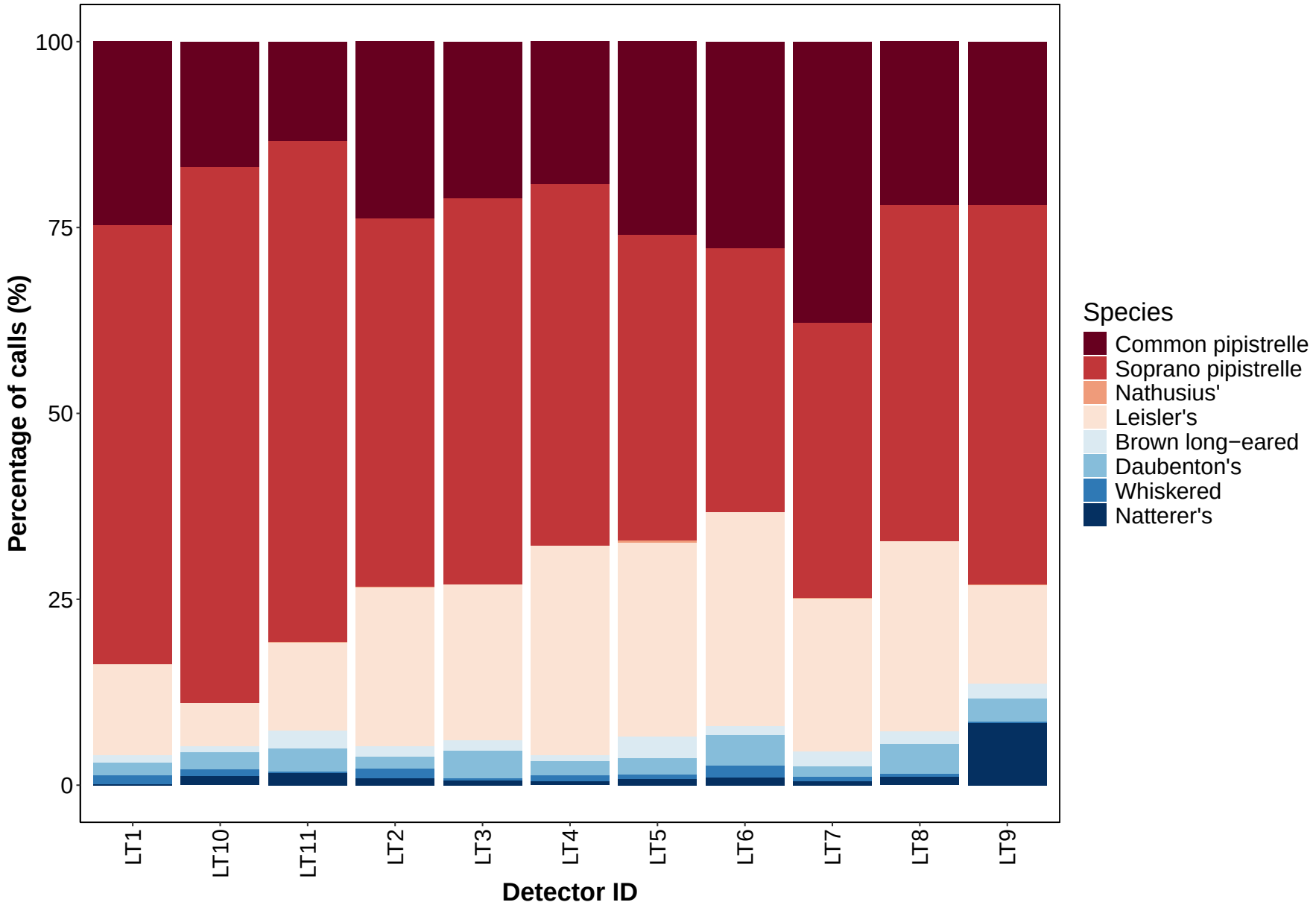
Species	Detector ID	Count (no.)	Percentage by Detector (%)
Common pipistrelle	LT1	601	24.4806517
Common pipistrelle	LT10	477	17.2700941
Common pipistrelle	LT11	383	13.5479307
Common pipistrelle	LT2	450	23.6344538
Common pipistrelle	LT3	343	20.6129808
Common pipistrelle	LT4	292	19.1349934
Common pipistrelle	LT5	391	24.1060419
Common pipistrelle	LT6	217	27.6081425
Common pipistrelle	LT7	869	36.4513423
Common pipistrelle	LT8	451	21.7140106
Common pipistrelle	LT9	485	21.3280563
Soprano pipistrelle	LT1	1468	59.7963340
Soprano pipistrelle	LT10	1982	71.7595945
Soprano pipistrelle	LT11	1897	67.1029360
Soprano pipistrelle	LT2	958	50.3151261
Soprano pipistrelle	LT3	865	51.9831731
Soprano pipistrelle	LT4	751	49.2136304
Soprano pipistrelle	LT5	670	41.3070284
Soprano pipistrelle	LT6	285	36.2595420
Soprano pipistrelle	LT7	880	36.9127517
Soprano pipistrelle	LT8	951	45.7871931
Soprano pipistrelle	LT9	1173	51.5831135
Nathusius'	LT1	2	0.0814664
Nathusius'	LT11	4	0.1414927
Nathusius'	LT2	2	0.1050420
Nathusius'	LT5	6	0.3699137
Nathusius'	LT7	4	0.1677852
Nathusius'	LT9	4	0.1759015
Leisler's	LT1	287	11.6904277
Leisler's	LT10	152	5.5032585
Leisler's	LT11	332	11.7438981
Leisler's	LT2	389	20.4306723

Species	Detector ID	Count (no.)	Percentage by Detector (%)
Leisler's	LT3	347	20.8533654
Leisler's	LT4	414	27.1297510
Leisler's	LT5	444	27.3736128
Leisler's	LT6	219	27.8625954
Leisler's	LT7	515	21.6023490
Leisler's	LT8	529	25.4694271
Leisler's	LT9	318	13.9841689
Brown long-eared	LT1	21	0.8553971
Brown long-eared	LT10	21	0.7603186
Brown long-eared	LT11	72	2.5468695
Brown long-eared	LT2	31	1.6281513
Brown long-eared	LT3	27	1.6225962
Brown long-eared	LT4	15	0.9829620
Brown long-eared	LT5	46	2.8360049
Brown long-eared	LT6	8	1.0178117
Brown long-eared	LT7	50	2.0973154
Brown long-eared	LT8	38	1.8295619
Brown long-eared	LT9	41	1.8029903
Daubenton's	LT1	36	1.4663951
Daubenton's	LT10	68	2.4619841
Daubenton's	LT11	81	2.8652282
Daubenton's	LT2	32	1.6806723
Daubenton's	LT3	66	3.9663462
Daubenton's	LT4	28	1.8348624
Daubenton's	LT5	37	2.2811344
Daubenton's	LT6	33	4.1984733
Daubenton's	LT7	33	1.3842282
Daubenton's	LT8	75	3.6109774
Daubenton's	LT9	71	3.1222515
Whiskered	LT1	36	1.4663951
Whiskered	LT10	27	0.9775525
Whiskered	LT11	6	0.2122391
Whiskered	LT2	25	1.3130252
Whiskered	LT3	5	0.3004808
Whiskered	LT4	16	1.0484928
Whiskered	LT5	11	0.6781751

Species	Detector ID	Count (no.)	Percentage by Detector (%)
Whiskered	LT6	13	1.6539440
Whiskered	LT7	16	0.6711409
Whiskered	LT8	13	0.6259027
Whiskered	LT9	5	0.2198769
Natterer's	LT1	4	0.1629328
Natterer's	LT10	35	1.2671977
Natterer's	LT11	52	1.8394057
Natterer's	LT2	17	0.8928571
Natterer's	LT3	11	0.6610577
Natterer's	LT4	10	0.6553080
Natterer's	LT5	17	1.0480888
Natterer's	LT6	11	1.3994911
Natterer's	LT7	17	0.7130872
Natterer's	LT8	20	0.9629273
Natterer's	LT9	177	7.7836412

Species Composition

Figure 10. Percentage species composition of passes at each detector.


100
75
50
25
0
Percentage of calls (%)
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID
Species
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Brown long−eared
Daubenton's
Whiskered
Natterer's

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.

Nighlty 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	LT1	2.9
Common pipistrelle	LT10	2.2
Common pipistrelle	LT11	2.1
Common pipistrelle	LT2	2.2
Common pipistrelle	LT3	1.7
Common pipistrelle	LT4	1.5
Common pipistrelle	LT5	1.8
Common pipistrelle	LT6	2.0
Common pipistrelle	LT7	3.8
Common pipistrelle	LT8	2.7
Common pipistrelle	LT9	1.9
Soprano pipistrelle	LT1	7.0
Soprano pipistrelle	LT10	9.4
Soprano pipistrelle	LT11	8.2
Soprano pipistrelle	LT2	4.6
Soprano pipistrelle	LT3	4.3
Soprano pipistrelle	LT4	3.6
Soprano pipistrelle	LT5	2.7
Soprano pipistrelle	LT6	2.1
Soprano pipistrelle	LT7	3.9
Soprano pipistrelle	LT8	4.6
Soprano pipistrelle	LT9	4.9
Nathusius'	LT1	0.1
Nathusius'	LT11	0.1
Nathusius'	LT2	0.1
Nathusius'	LT5	0.1
Nathusius'	LT7	0.1
Nathusius'	LT9	0.1
Leisler's	LT1	1.4
Leisler's	LT10	0.9
Leisler's	LT11	1.8
Leisler's	LT2	1.9
Leisler's	LT3	1.8
Leisler's	LT4	1.8
Leisler's	LT5	2.0
Leisler's	LT6	1.8

Species	Detector ID	Median Pass Rate
Leisler's	LT7	1.9
Leisler's	LT8	2.6
Leisler's	LT9	1.4
Brown long-eared	LT1	0.3
Brown long-eared	LT10	0.2
Brown long-eared	LT11	0.3
Brown long-eared	LT2	0.2
Brown long-eared	LT3	0.2
Brown long-eared	LT4	0.1
Brown long-eared	LT5	0.3
Brown long-eared	LT6	0.1
Brown long-eared	LT7	0.2
Brown long-eared	LT8	0.2
Brown long-eared	LT9	0.3
Daubenton's	LT1	0.2
Daubenton's	LT10	0.4
Daubenton's	LT11	0.5
Daubenton's	LT2	0.2
Daubenton's	LT3	0.3
Daubenton's	LT4	0.2
Daubenton's	LT5	0.2
Daubenton's	LT6	0.3
Daubenton's	LT7	0.2
Daubenton's	LT8	0.4
Daubenton's	LT9	0.4
Whiskered	LT1	0.1
Whiskered	LT10	0.2
Whiskered	LT11	0.1
Whiskered	LT2	0.1
Whiskered	LT3	0.1
Whiskered	LT4	0.1
Whiskered	LT5	0.1
Whiskered	LT6	0.2
Whiskered	LT7	0.1
Whiskered	LT8	0.2
Whiskered	LT9	0.1

Species	Detector ID	Median Pass Rate
Natterer's	LT1	0.1
Natterer's	LT10	0.2
Natterer's	LT11	0.2
Natterer's	LT2	0.2
Natterer's	LT3	0.1
Natterer's	LT4	0.1
Natterer's	LT5	0.1
Natterer's	LT6	0.1
Natterer's	LT7	0.1
Natterer's	LT8	0.2
Natterer's	LT9	0.7

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.

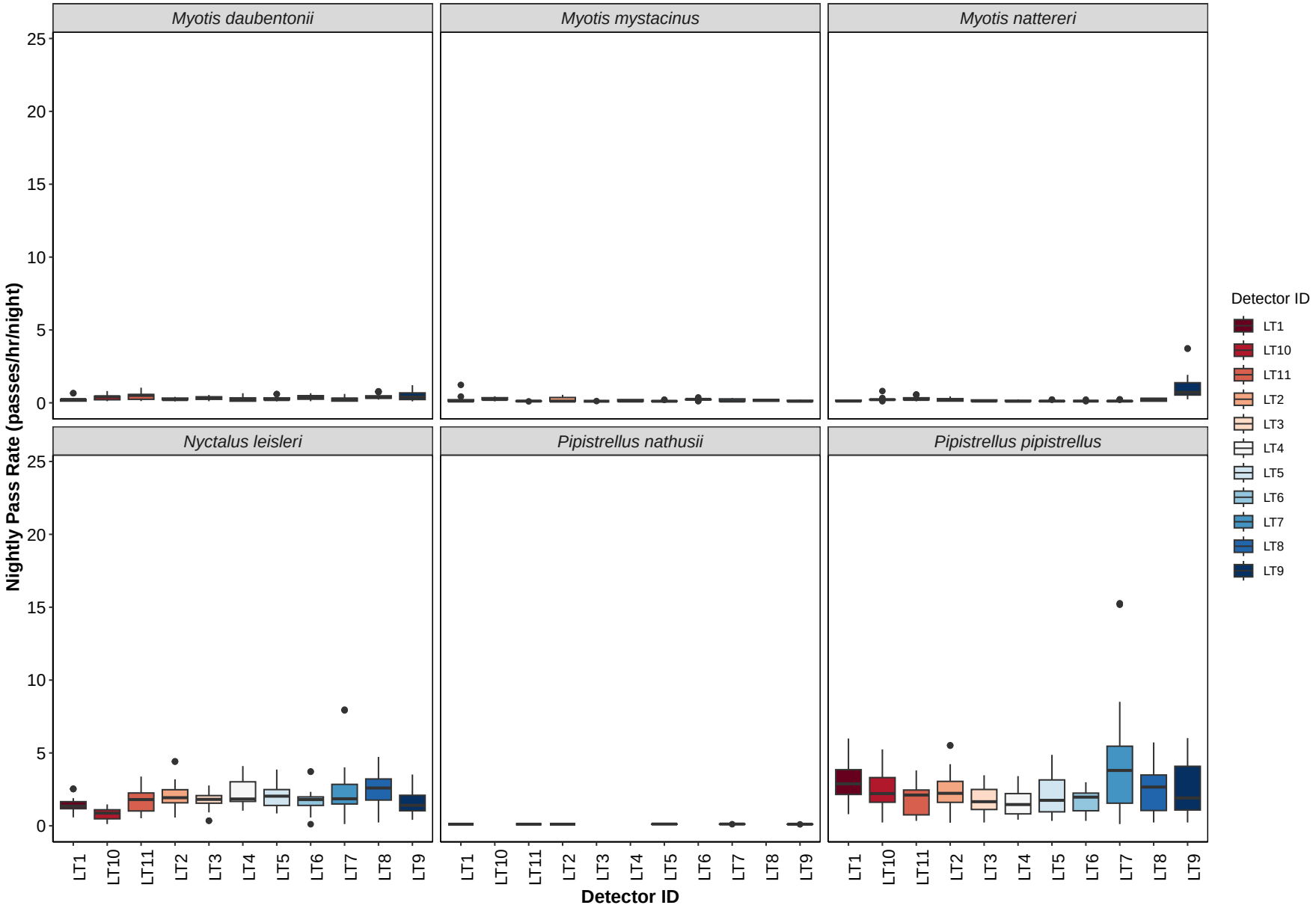
Species	Detector ID	Mean Pass Rate
Common pipistrelle	LT1	3.0
Common pipistrelle	LT10	2.4
Common pipistrelle	LT11	2.0
Common pipistrelle	LT2	2.4
Common pipistrelle	LT3	1.8
Common pipistrelle	LT4	1.6
Common pipistrelle	LT5	2.2
Common pipistrelle	LT6	1.8
Common pipistrelle	LT7	4.5
Common pipistrelle	LT8	2.4
Common pipistrelle	LT9	2.5
Soprano pipistrelle	LT1	7.1
Soprano pipistrelle	LT10	9.4
Soprano pipistrelle	LT11	9.6
Soprano pipistrelle	LT2	4.8
Soprano pipistrelle	LT3	4.4
Soprano pipistrelle	LT4	3.8
Soprano pipistrelle	LT5	3.5
Soprano pipistrelle	LT6	2.0
Soprano pipistrelle	LT7	4.4
Soprano pipistrelle	LT8	4.6
Soprano pipistrelle	LT9	6.0
Nathusius'	LT1	0.1
Nathusius'	LT11	0.1
Nathusius'	LT2	0.1
Nathusius'	LT5	0.1
Nathusius'	LT7	0.1
Nathusius'	LT9	0.1
Leisler's	LT1	1.4
Leisler's	LT10	0.8

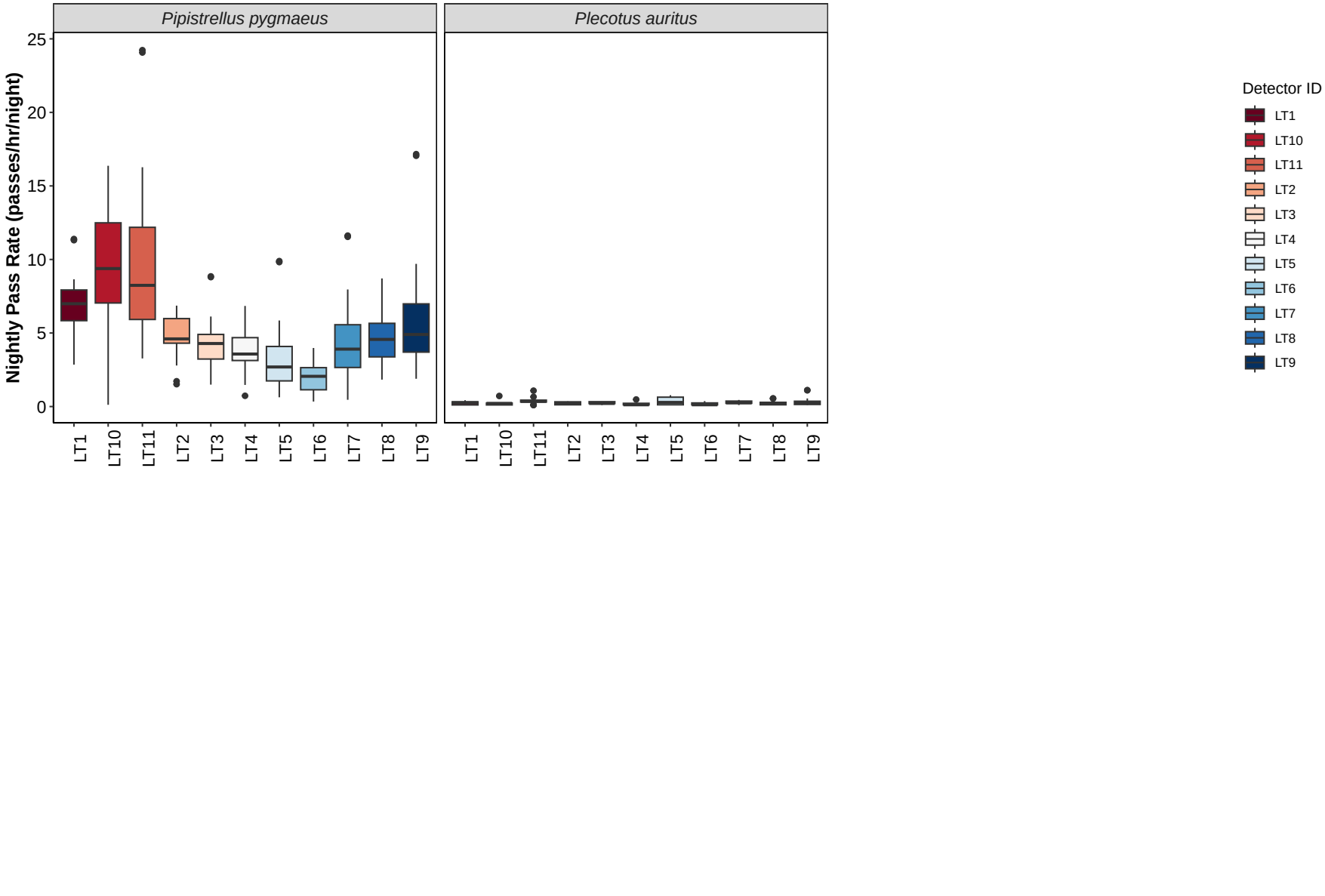
Species	Detector ID	Mean Pass Rate
Leisler's	LT11	1.7
Leisler's	LT2	2.1
Leisler's	LT3	1.8
Leisler's	LT4	2.2
Leisler's	LT5	2.1
Leisler's	LT6	1.7
Leisler's	LT7	2.5
Leisler's	LT8	2.6
Leisler's	LT9	1.6
Brown long-eared	LT1	0.2
Brown long-eared	LT10	0.2
Brown long-eared	LT11	0.4
Brown long-eared	LT2	0.2
Brown long-eared	LT3	0.2
Brown long-eared	LT4	0.2
Brown long-eared	LT5	0.4
Brown long-eared	LT6	0.2
Brown long-eared	LT7	0.3
Brown long-eared	LT8	0.3
Brown long-eared	LT9	0.4
Daubenton's	LT1	0.2
Daubenton's	LT10	0.4
Daubenton's	LT11	0.5
Daubenton's	LT2	0.3
Daubenton's	LT3	0.3
Daubenton's	LT4	0.3
Daubenton's	LT5	0.3
Daubenton's	LT6	0.4
Daubenton's	LT7	0.3
Daubenton's	LT8	0.4
Daubenton's	LT9	0.5
Whiskered	LT1	0.2
Whiskered	LT10	0.3
Whiskered	LT11	0.1
Whiskered	LT2	0.2
Whiskered	LT3	0.1

Species	Detector ID	Mean Pass Rate
Whiskered	LT4	0.2
Whiskered	LT5	0.1
Whiskered	LT6	0.2
Whiskered	LT7	0.2
Whiskered	LT8	0.2
Whiskered	LT9	0.1
Natterer's	LT1	0.1
Natterer's	LT10	0.3
Natterer's	LT11	0.3
Natterer's	LT2	0.2
Natterer's	LT3	0.1
Natterer's	LT4	0.1
Natterer's	LT5	0.1
Natterer's	LT6	0.1
Natterer's	LT7	0.1
Natterer's	LT8	0.2
Natterer's	LT9	1.1

Per Detector

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)
0
5
10
15
20
25
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID


Pipistrellus pygmaeus
Plecotus auritus
Nightly Pass Rate (passes/hr/night)
0
5
10
15
20
25
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID

Split by Month

Total Bat Passes per Detector each Month

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	LT1	49	644
Common pipistrelle	LT10	48	488
Common pipistrelle	LT11	50	411
Common pipistrelle	LT2	25	519
Common pipistrelle	LT3	19	400
Common pipistrelle	LT4	110	243
Common pipistrelle	LT5	106	410
Common pipistrelle	LT6	121	151
Common pipistrelle	LT7	174	949
Common pipistrelle	LT8	180	369
Common pipistrelle	LT9	48	574
Soprano pipistrelle	LT1	126	1532
Soprano pipistrelle	LT10	333	1949
Soprano pipistrelle	LT11	333	1989
Soprano pipistrelle	LT2	75	1060
Soprano pipistrelle	LT3	82	946
Soprano pipistrelle	LT4	318	579
Soprano pipistrelle	LT5	208	608
Soprano pipistrelle	LT6	173	174
Soprano pipistrelle	LT7	227	871
Soprano pipistrelle	LT8	333	799
Soprano pipistrelle	LT9	135	1314
Nathusius'	LT1	0	1
Nathusius'	LT11	0	4
Nathusius'	LT2	0	2
Nathusius'	LT5	2	4
Nathusius'	LT7	3	1
Nathusius'	LT9	0	4
Leisler's	LT1	10	333
Leisler's	LT10	20	165
Leisler's	LT11	75	332
Leisler's	LT2	28	461
Leisler's	LT3	26	391
Leisler's	LT4	140	379
Leisler's	LT5	154	363
Leisler's	LT6	140	142

Species	Detector ID	Jul	Aug
Leisler's	LT7	138	471
Leisler's	LT8	208	430
Leisler's	LT9	39	334
Brown long-eared	LT1	0	28
Brown long-eared	LT10	8	15
Brown long-eared	LT11	16	66
Brown long-eared	LT2	2	31
Brown long-eared	LT3	1	27
Brown long-eared	LT4	6	9
Brown long-eared	LT5	4	55
Brown long-eared	LT6	9	2
Brown long-eared	LT7	7	53
Brown long-eared	LT8	5	39
Brown long-eared	LT9	7	50
Daubenton's	LT1	3	44
Daubenton's	LT10	9	64
Daubenton's	LT11	6	103
Daubenton's	LT2	0	35
Daubenton's	LT3	4	70
Daubenton's	LT4	9	25
Daubenton's	LT5	17	26
Daubenton's	LT6	17	24
Daubenton's	LT7	15	27
Daubenton's	LT8	29	69
Daubenton's	LT9	7	82
Whiskered	LT1	1	32
Whiskered	LT10	3	28
Whiskered	LT11	2	4
Whiskered	LT2	1	29
Whiskered	LT3	1	4
Whiskered	LT4	3	13
Whiskered	LT5	2	10
Whiskered	LT6	9	6
Whiskered	LT7	3	13
Whiskered	LT8	5	7
Whiskered	LT9	0	4

Species	Detector ID	Jul	Aug
Natterer's	LT1	0	4
Natterer's	LT10	2	35
Natterer's	LT11	2	54
Natterer's	LT2	1	20
Natterer's	LT3	1	11
Natterer's	LT4	3	6
Natterer's	LT5	4	12
Natterer's	LT6	4	6
Natterer's	LT7	5	11
Natterer's	LT8	5	22
Natterer's	LT9	14	223

Survey Effort

Table 19. The number of survey nights per month per detector.

month	Detector ID	No. of Survey Nights
Jul	LT1	2
Jul	LT10	3
Jul	LT11	3
Jul	LT2	2
Jul	LT3	2
Jul	LT4	8
Jul	LT5	8
Jul	LT6	8
Jul	LT7	8
Jul	LT8	8
Jul	LT9	3
Aug	LT1	24
Aug	LT10	24
Aug	LT11	24
Aug	LT2	24
Aug	LT3	24
Aug	LT4	19
Aug	LT5	20
Aug	LT6	13
Aug	LT7	20
Aug	LT8	20
Aug	LT9	24

Nightly Bat Passes 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	LT1	2.9	2.9
Common pipistrelle	LT10	2.2	2.4
Common pipistrelle	LT11	2.1	2.1
Common pipistrelle	LT2	1.5	2.2
Common pipistrelle	LT3	1.1	1.7
Common pipistrelle	LT4	1.6	1.2
Common pipistrelle	LT5	1.6	2.4
Common pipistrelle	LT6	2.1	1.8
Common pipistrelle	LT7	2.5	4.6
Common pipistrelle	LT8	2.7	1.7
Common pipistrelle	LT9	2.2	1.9
Soprano pipistrelle	LT1	7.5	7.0
Soprano pipistrelle	LT10	13.7	8.5
Soprano pipistrelle	LT11	13.6	8.1
Soprano pipistrelle	LT2	4.5	5.0
Soprano pipistrelle	LT3	4.9	4.0
Soprano pipistrelle	LT4	4.7	3.3
Soprano pipistrelle	LT5	3.0	2.5
Soprano pipistrelle	LT6	2.4	1.6
Soprano pipistrelle	LT7	3.3	4.4
Soprano pipistrelle	LT8	4.2	4.6
Soprano pipistrelle	LT9	4.7	5.0
Nathusius'	LT1	NA	0.1
Nathusius'	LT11	NA	0.1
Nathusius'	LT2	NA	0.1
Nathusius'	LT5	0.1	0.1
Nathusius'	LT7	0.1	0.1
Nathusius'	LT9	NA	0.1
Leisler's	LT1	0.6	1.4
Leisler's	LT10	0.9	0.8
Leisler's	LT11	3.4	1.4
Leisler's	LT2	1.7	2.0
Leisler's	LT3	1.6	1.8
Leisler's	LT4	1.8	1.7
Leisler's	LT5	2.4	2.0
Leisler's	LT6	2.2	1.7

Species	Detector ID	Jul	Aug
Leisler's	LT7	1.9	1.8
Leisler's	LT8	3.1	2.6
Leisler's	LT9	1.7	1.4
Brown long-eared	LT1	NA	0.3
Brown long-eared	LT10	0.5	0.2
Brown long-eared	LT11	0.5	0.3
Brown long-eared	LT2	0.1	0.2
Brown long-eared	LT3	0.1	0.2
Brown long-eared	LT4	0.1	0.2
Brown long-eared	LT5	0.1	0.4
Brown long-eared	LT6	0.1	0.1
Brown long-eared	LT7	0.2	0.3
Brown long-eared	LT8	0.1	0.2
Brown long-eared	LT9	0.4	0.2
Daubenton's	LT1	0.2	0.2
Daubenton's	LT10	0.4	0.4
Daubenton's	LT11	0.2	0.5
Daubenton's	LT2	NA	0.2
Daubenton's	LT3	0.2	0.3
Daubenton's	LT4	0.1	0.2
Daubenton's	LT5	0.3	0.2
Daubenton's	LT6	0.4	0.3
Daubenton's	LT7	0.2	0.3
Daubenton's	LT8	0.5	0.3
Daubenton's	LT9	0.2	0.4
Whiskered	LT1	0.1	0.2
Whiskered	LT10	0.4	0.2
Whiskered	LT11	0.1	0.1
Whiskered	LT2	0.1	0.1
Whiskered	LT3	0.1	0.1
Whiskered	LT4	0.1	0.1
Whiskered	LT5	0.1	0.1
Whiskered	LT6	0.2	0.2
Whiskered	LT7	0.1	0.1
Whiskered	LT8	0.2	0.1
Whiskered	LT9	NA	0.1

Species	Detector ID	Jul	Aug
Natterer's	LT1	NA	0.1
Natterer's	LT10	0.2	0.2
Natterer's	LT11	0.2	0.2
Natterer's	LT2	0.1	0.2
Natterer's	LT3	0.1	0.1
Natterer's	LT4	0.2	0.1
Natterer's	LT5	0.1	0.1
Natterer's	LT6	0.1	0.1
Natterer's	LT7	0.1	0.1
Natterer's	LT8	0.2	0.2
Natterer's	LT9	0.7	0.7

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.

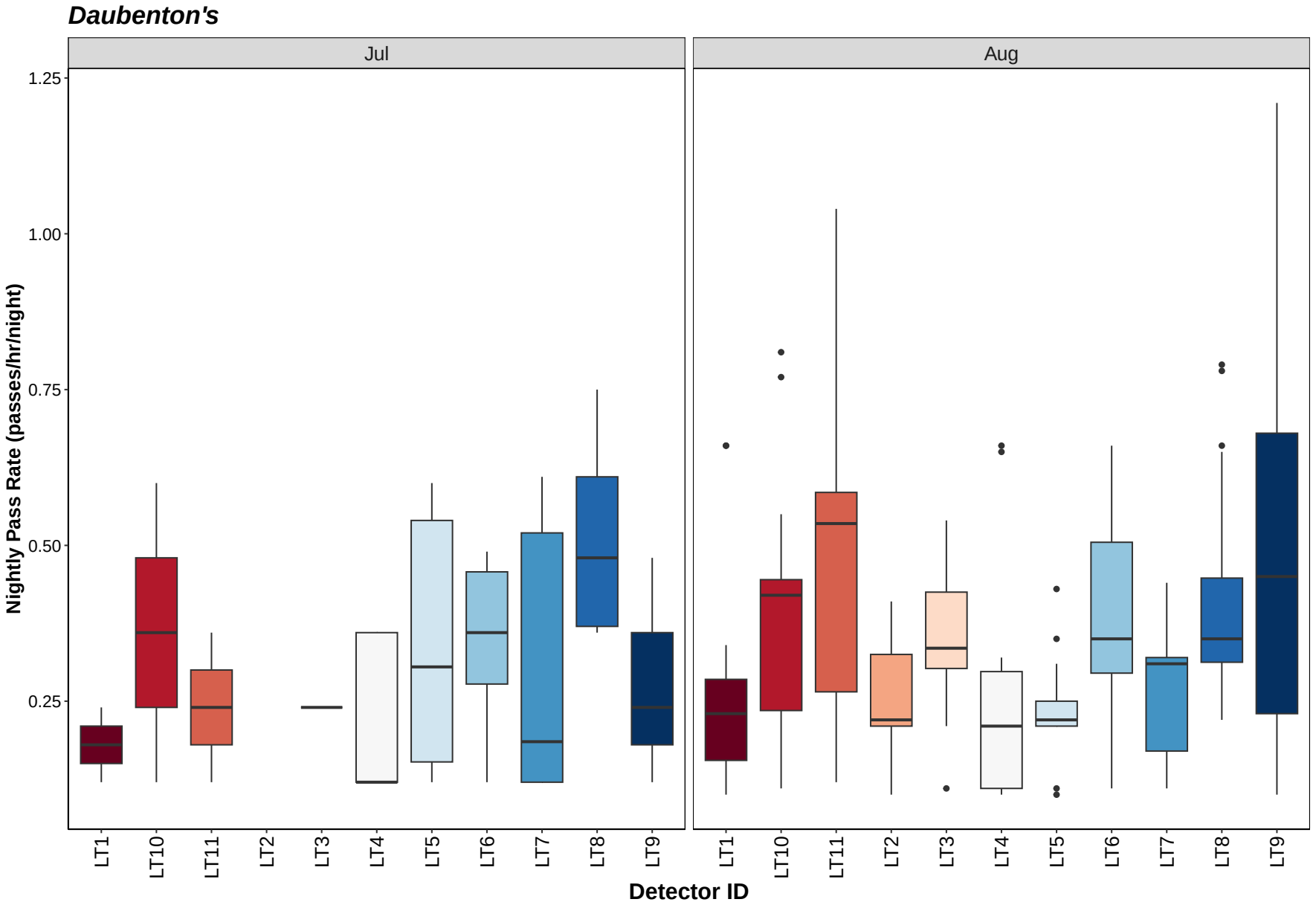
Species	Detector ID	Jul	Aug
Common pipistrelle	LT1	2.9	3.0
Common pipistrelle	LT10	1.9	2.5
Common pipistrelle	LT11	2.0	2.0
Common pipistrelle	LT2	1.5	2.5
Common pipistrelle	LT3	1.1	1.8
Common pipistrelle	LT4	1.7	1.6
Common pipistrelle	LT5	1.6	2.4
Common pipistrelle	LT6	1.8	1.7
Common pipistrelle	LT7	2.7	5.2
Common pipistrelle	LT8	2.7	2.3
Common pipistrelle	LT9	1.9	2.6
Soprano pipistrelle	LT1	7.5	7.0
Soprano pipistrelle	LT10	13.3	8.9
Soprano pipistrelle	LT11	13.3	9.2
Soprano pipistrelle	LT2	4.5	4.9
Soprano pipistrelle	LT3	4.9	4.3
Soprano pipistrelle	LT4	4.8	3.4
Soprano pipistrelle	LT5	3.6	3.4
Soprano pipistrelle	LT6	2.6	1.6
Soprano pipistrelle	LT7	3.5	4.8
Soprano pipistrelle	LT8	5.1	4.5
Soprano pipistrelle	LT9	5.4	6.1
Nathusius'	LT1	NA	0.1
Nathusius'	LT11	NA	0.1
Nathusius'	LT2	NA	0.1
Nathusius'	LT5	0.1	0.1
Nathusius'	LT7	0.1	0.1
Nathusius'	LT9	NA	0.1
Leisler's	LT1	0.6	1.5
Leisler's	LT10	0.8	0.8

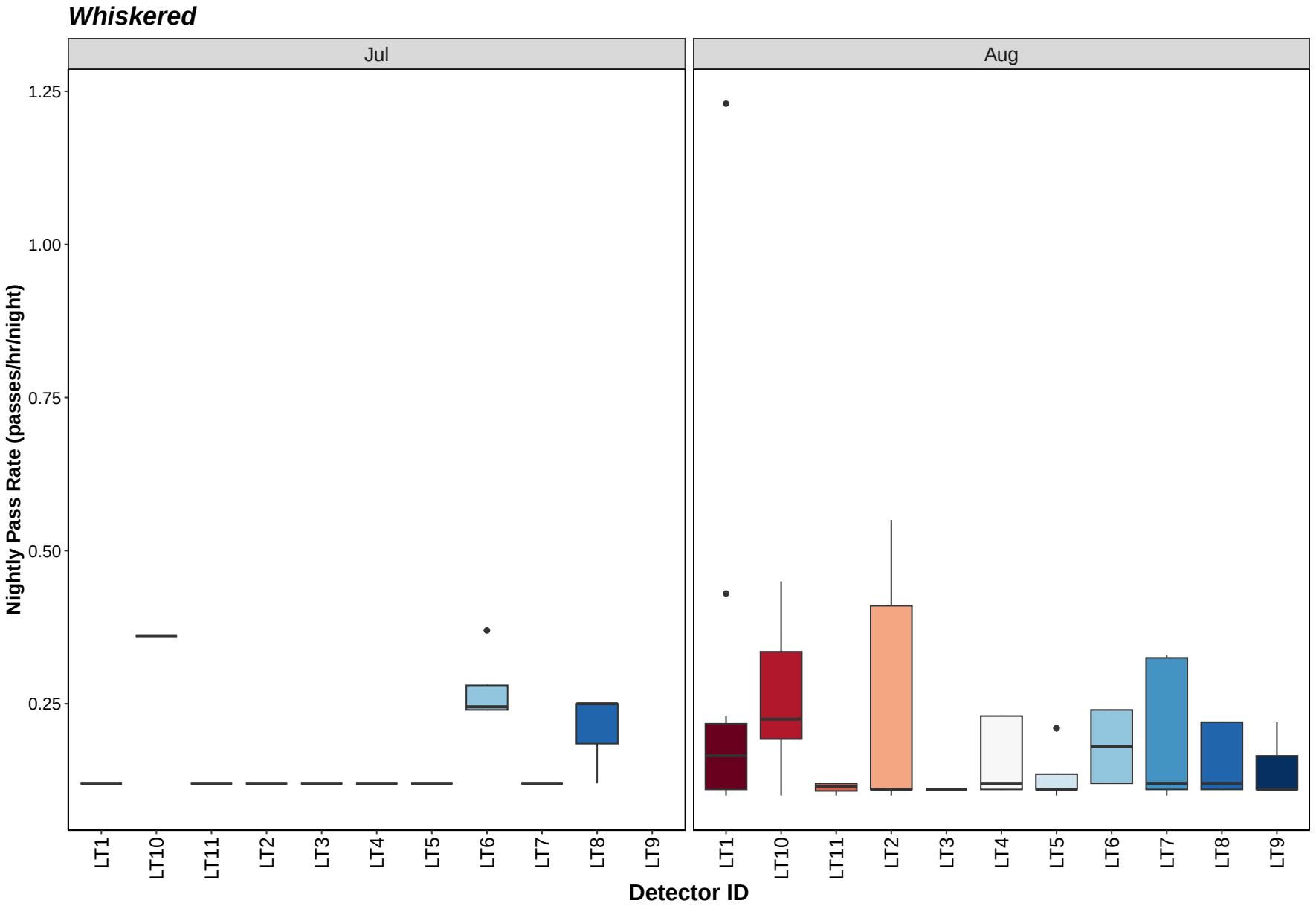
Species	Detector ID	Jul	Aug
Leisler's	LT11	3.0	1.5
Leisler's	LT2	1.7	2.1
Leisler's	LT3	1.6	1.8
Leisler's	LT4	2.1	2.2
Leisler's	LT5	2.4	2.0
Leisler's	LT6	2.4	1.3
Leisler's	LT7	2.1	2.6
Leisler's	LT8	3.2	2.4
Leisler's	LT9	1.6	1.6
Brown long-eared	LT1	NA	0.2
Brown long-eared	LT10	0.5	0.2
Brown long-eared	LT11	0.6	0.3
Brown long-eared	LT2	0.1	0.2
Brown long-eared	LT3	0.1	0.2
Brown long-eared	LT4	0.2	0.2
Brown long-eared	LT5	0.1	0.4
Brown long-eared	LT6	0.2	0.1
Brown long-eared	LT7	0.2	0.3
Brown long-eared	LT8	0.2	0.3
Brown long-eared	LT9	0.3	0.4
Daubenton's	LT1	0.2	0.3
Daubenton's	LT10	0.4	0.4
Daubenton's	LT11	0.2	0.5
Daubenton's	LT2	NA	0.3
Daubenton's	LT3	0.2	0.3
Daubenton's	LT4	0.2	0.3
Daubenton's	LT5	0.3	0.2
Daubenton's	LT6	0.3	0.4
Daubenton's	LT7	0.3	0.3
Daubenton's	LT8	0.5	0.4
Daubenton's	LT9	0.3	0.5
Whiskered	LT1	0.1	0.2
Whiskered	LT10	0.4	0.3
Whiskered	LT11	0.1	0.1
Whiskered	LT2	0.1	0.2
Whiskered	LT3	0.1	0.1

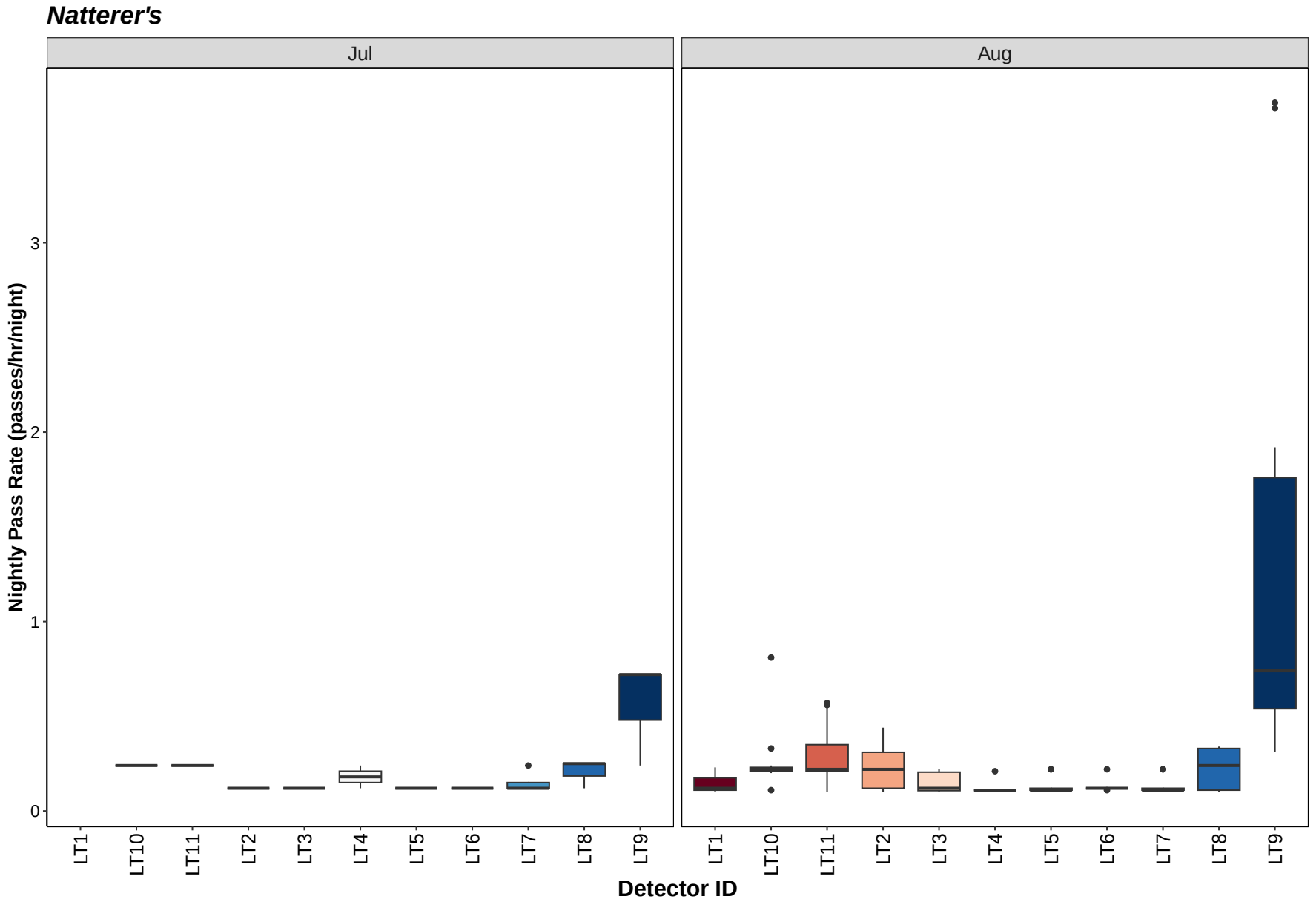
Species	Detector ID	Jul	Aug
Whiskered	LT4	0.1	0.2
Whiskered	LT5	0.1	0.1
Whiskered	LT6	0.3	0.2
Whiskered	LT7	0.1	0.2
Whiskered	LT8	0.2	0.2
Whiskered	LT9	NA	0.1
Natterer's	LT1	NA	0.1
Natterer's	LT10	0.2	0.3
Natterer's	LT11	0.2	0.3
Natterer's	LT2	0.1	0.2
Natterer's	LT3	0.1	0.1
Natterer's	LT4	0.2	0.1
Natterer's	LT5	0.1	0.1
Natterer's	LT6	0.1	0.1
Natterer's	LT7	0.1	0.1
Natterer's	LT8	0.2	0.2
Natterer's	LT9	0.6	1.2

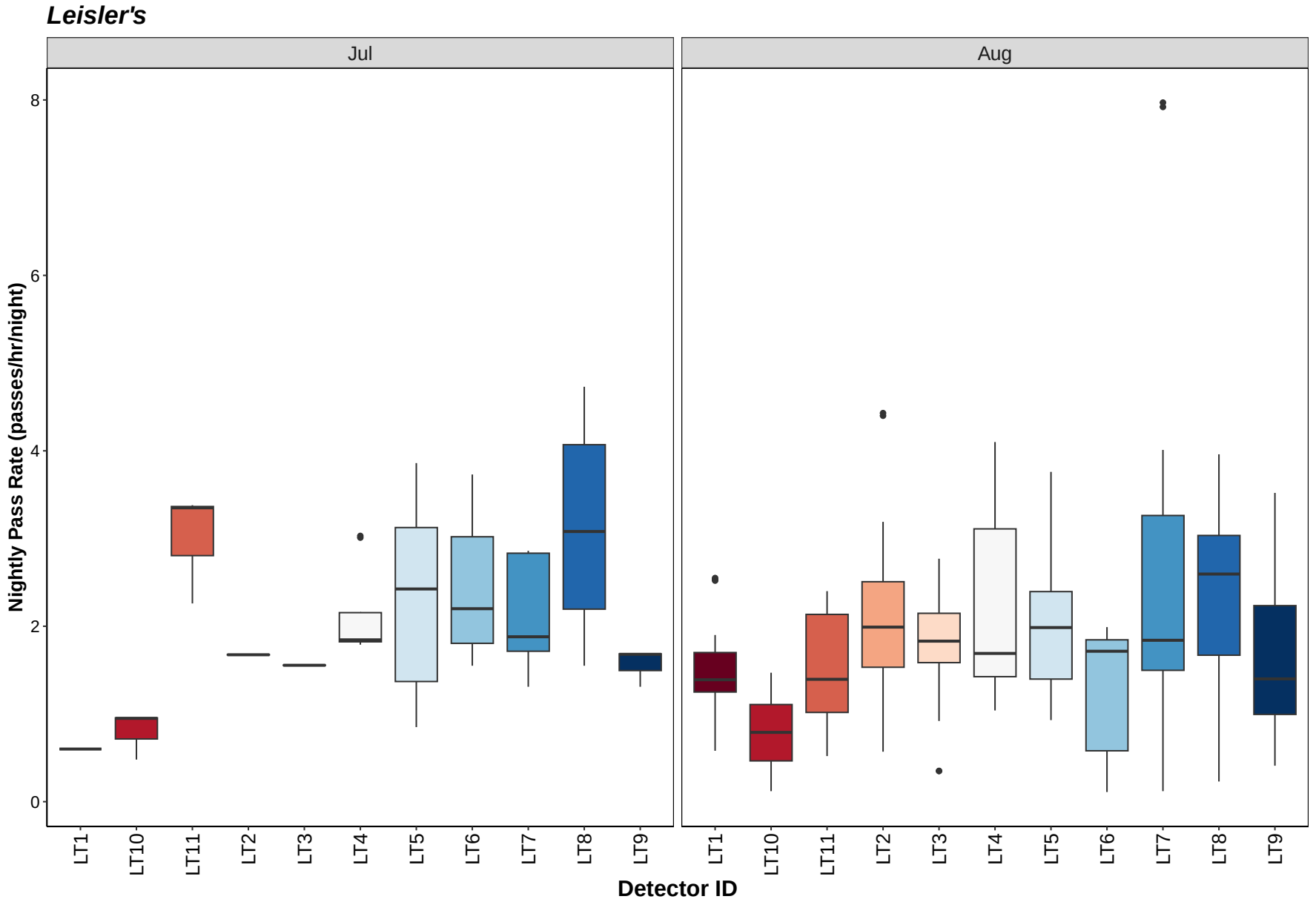
Per Detector

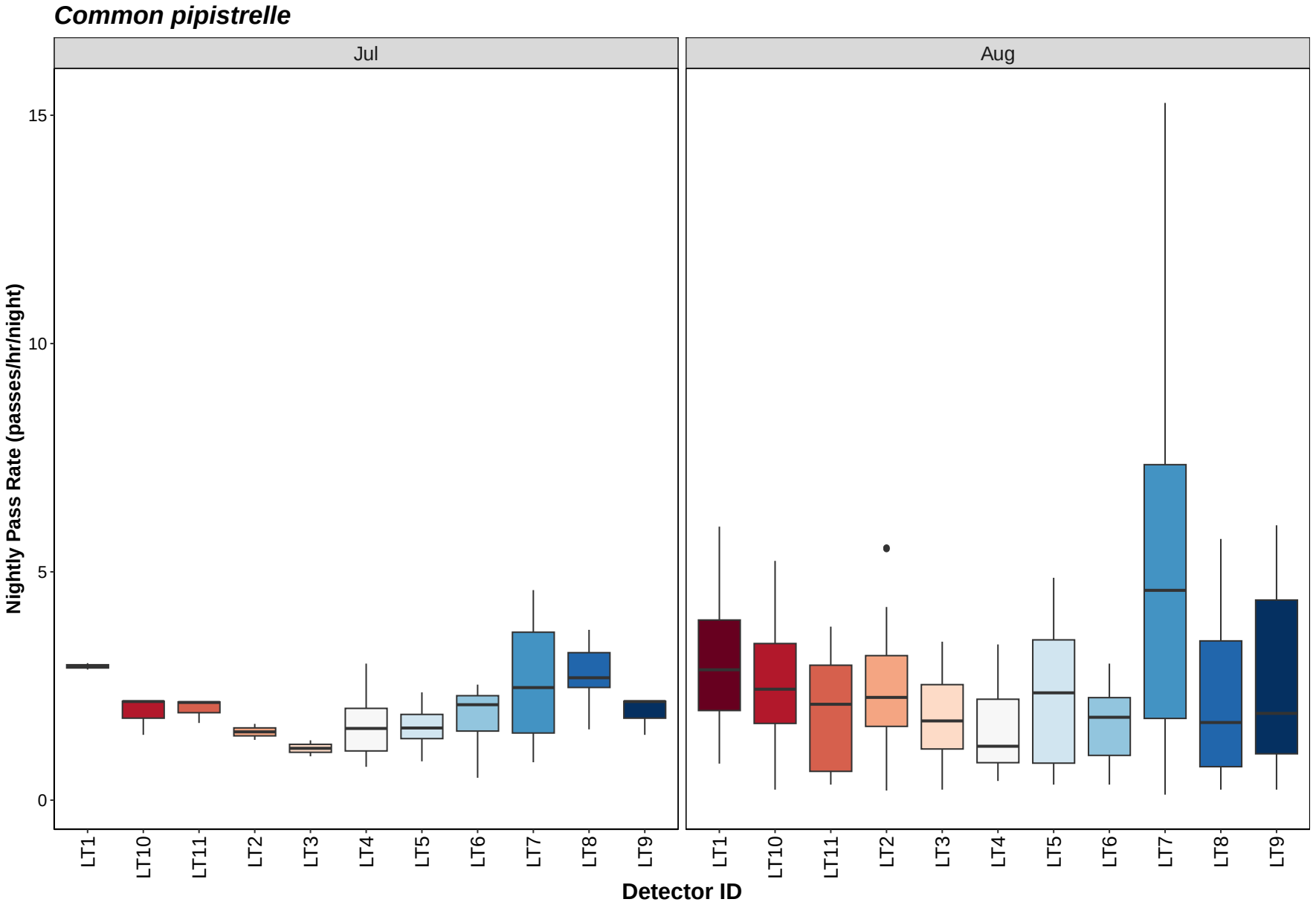
Figure 12. Figures show boxplots for the number of bat passes per hour by detector, for each month. The ‘box’ shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The ‘whiskers’ extend from the box and represent 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.

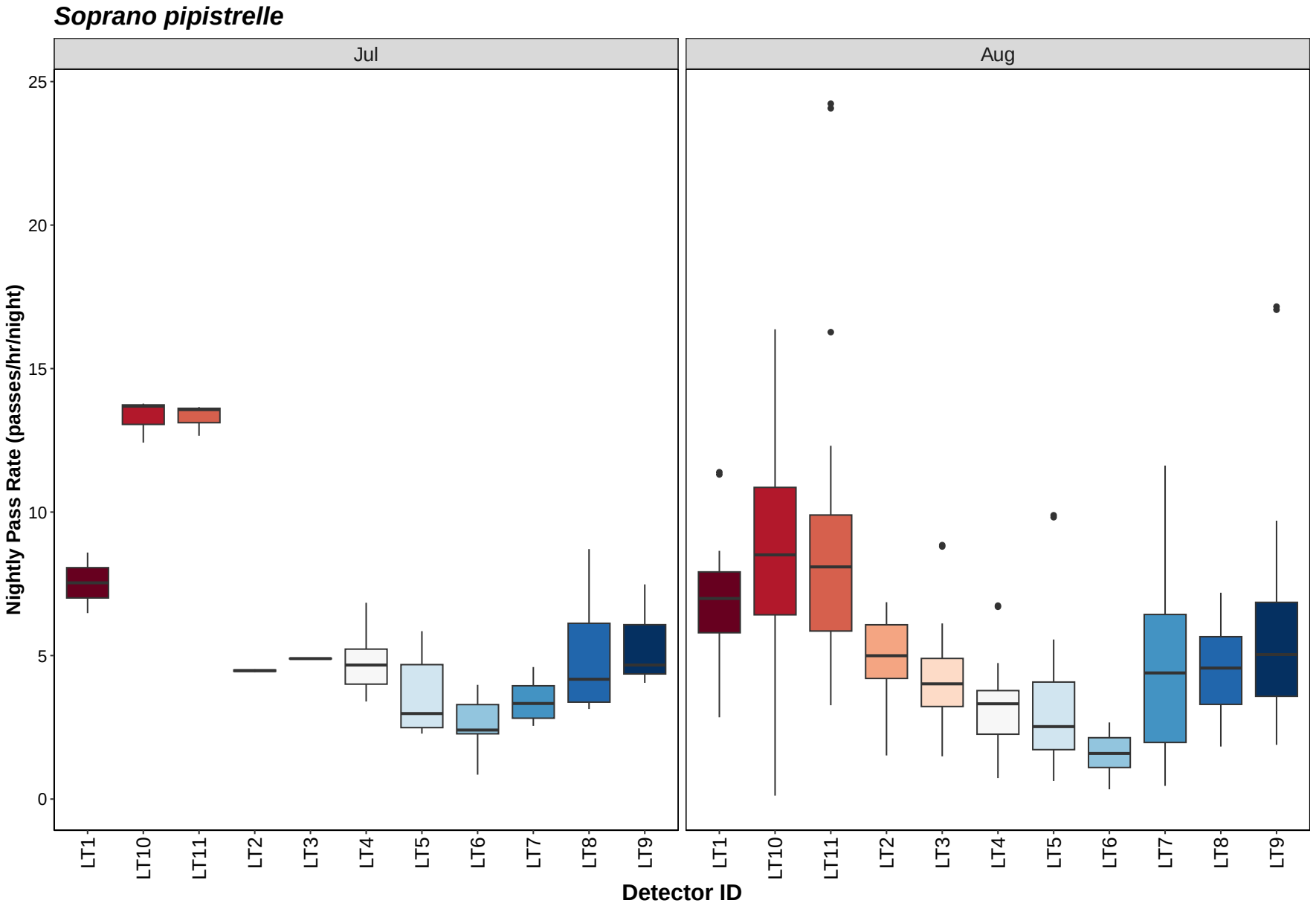

Daubenton's
Jul
Aug
Nightly Pass Rate (passes/hr/night)
1.25
1.00
0.75
0.50
0.25
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID

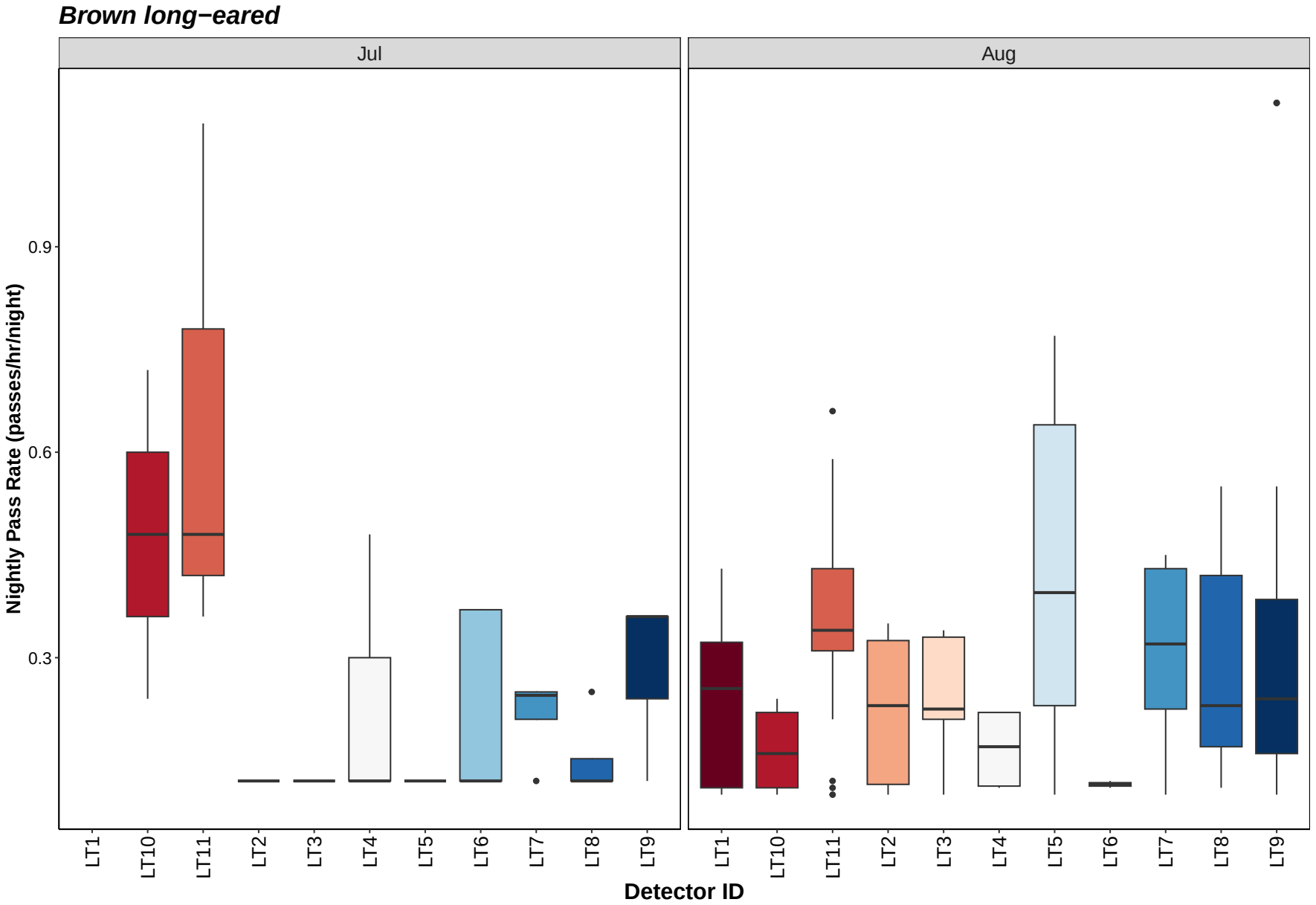

Whiskered
Jul
Aug
Nightly Pass Rate (passes/hr/night)
1.25
1.00
0.75
0.50
0.25
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID


Natterer's
Jul
Aug
Nightly Pass Rate (passes/hr/night)
0
1
2
3
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID

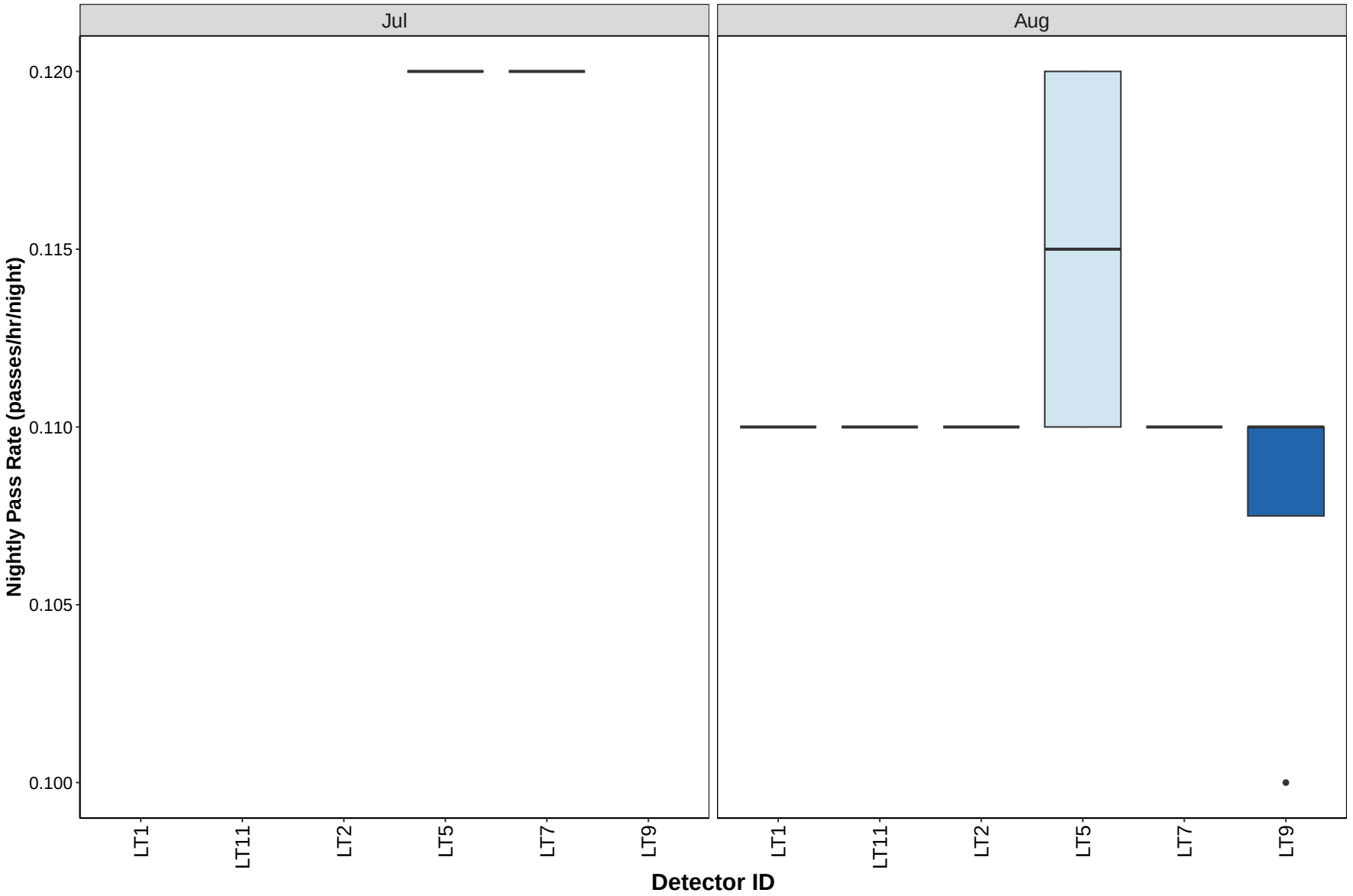

Leisler's
Jul
Aug
Nightly Pass Rate (passes/hr/night)
0
2
4
6
8
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID


Common pipistrelle
Jul
Aug
Nightly Pass Rate (passes/hr/night)
0
5
10
15
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID


Soprano pipistrelle
Jul
Aug
Nightly Pass Rate (passes/hr/night)
0
5
10
15
20
25
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID


Brown long−eared
Jul
Aug
Nightly Pass Rate (passes/hr/night)
0.9
0.6
0.3
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID

Nathusius'


Jul
Aug
0.120
0.115
0.110
0.105
0.100
Nightly Pass Rate (passes/hr/night)
LT1
LT11
LT2
LT5
LT7
LT9
Detector ID

Bat Activity per Detector Location

Figure 13. Detector ID reference:

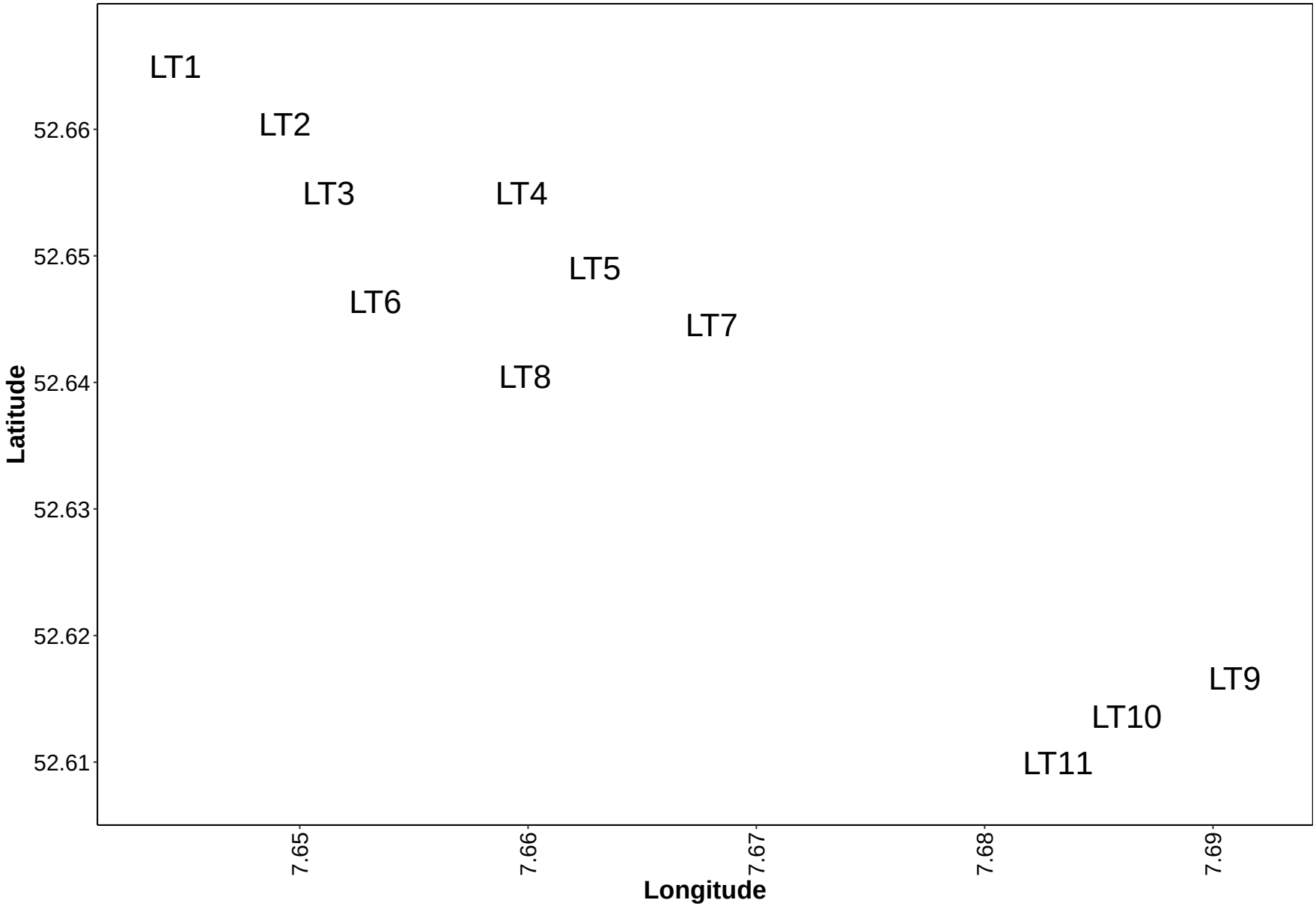
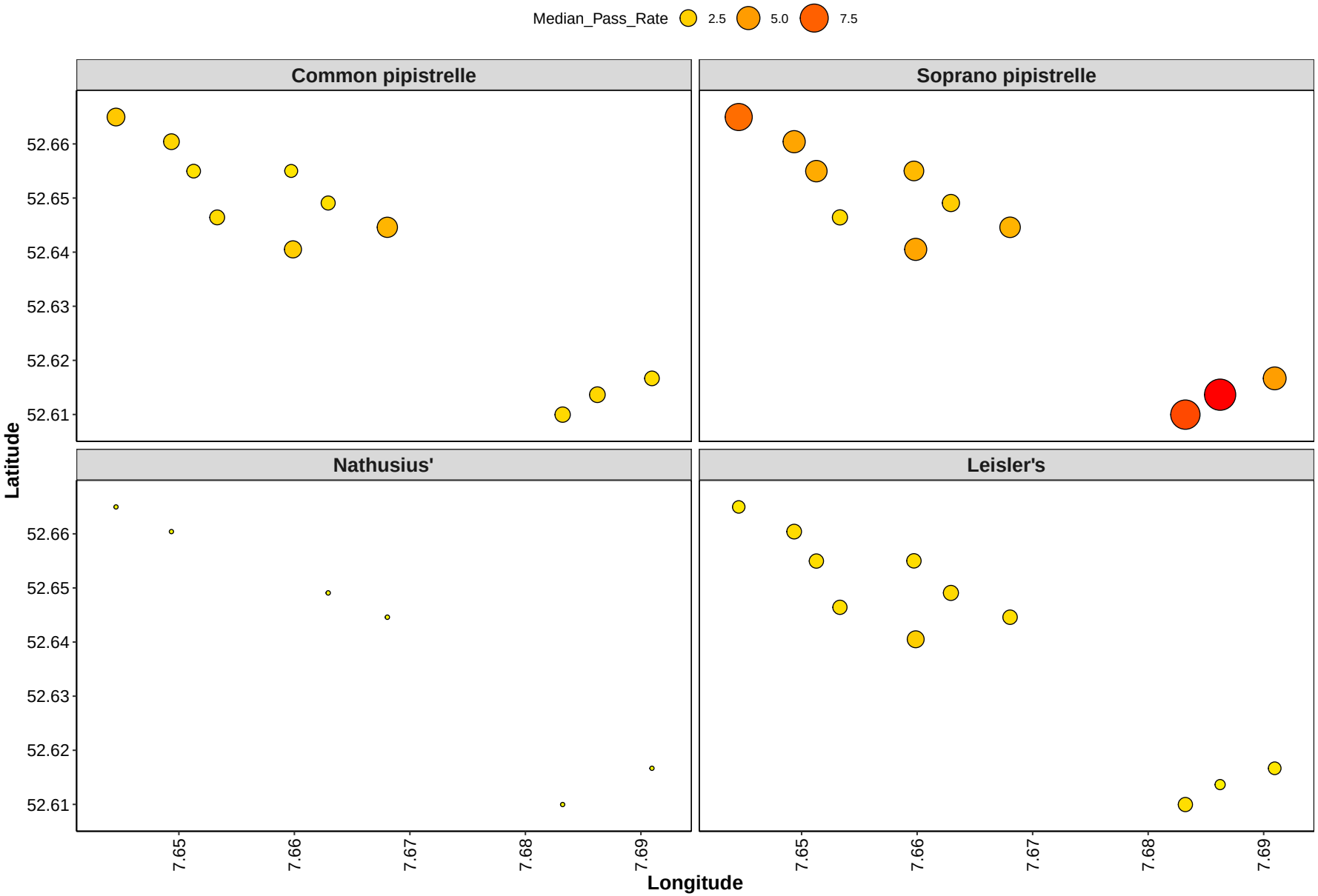

LT1
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
LT10
LT11
52.66
52.65
52.64
52.63
52.62
52.61
Latitude
7.65
7.66
7.67
7.68
7.69
Longitude

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
2.5
5.0
7.5
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
7.65
7.66
7.67
7.68
7.69
Longitude

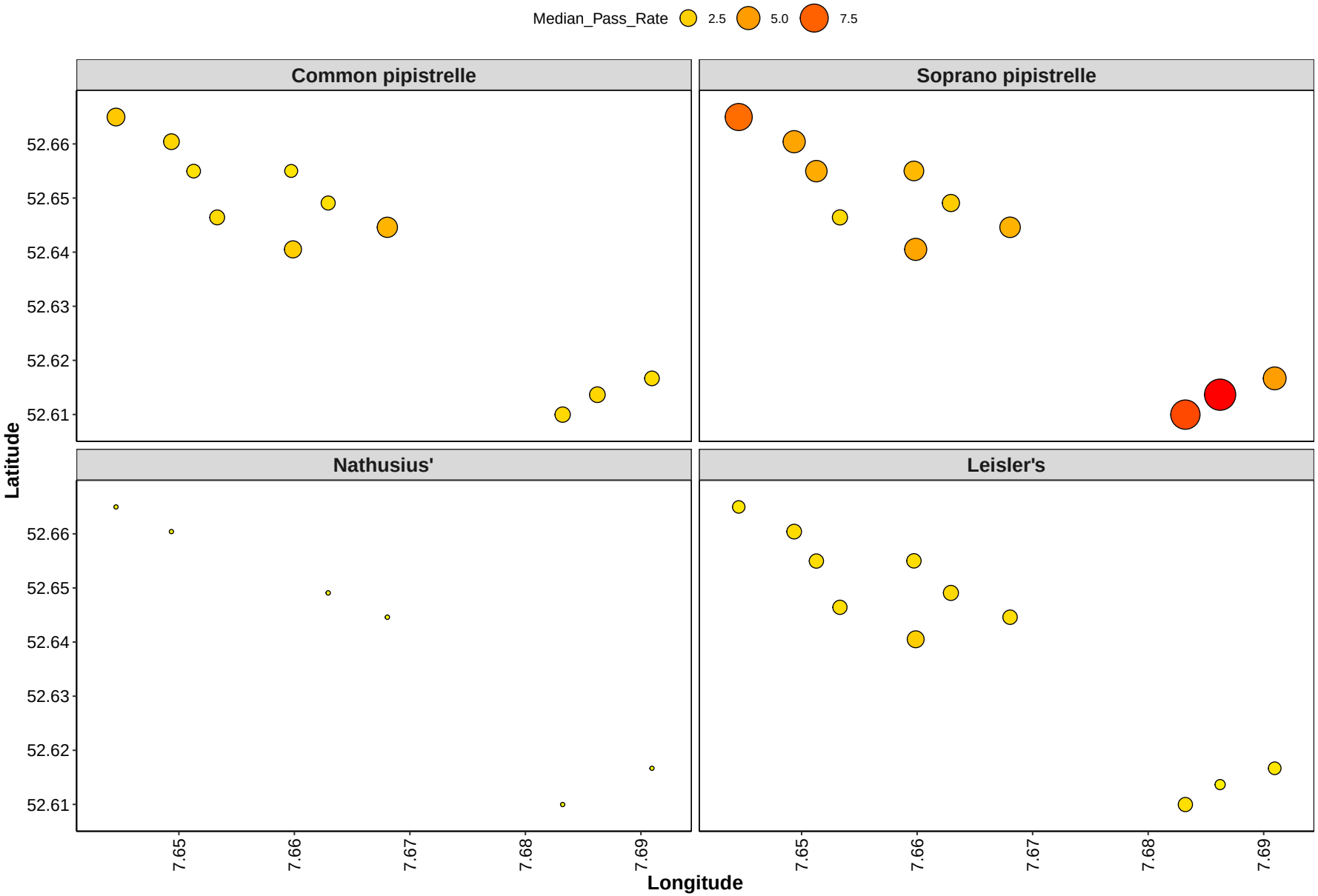
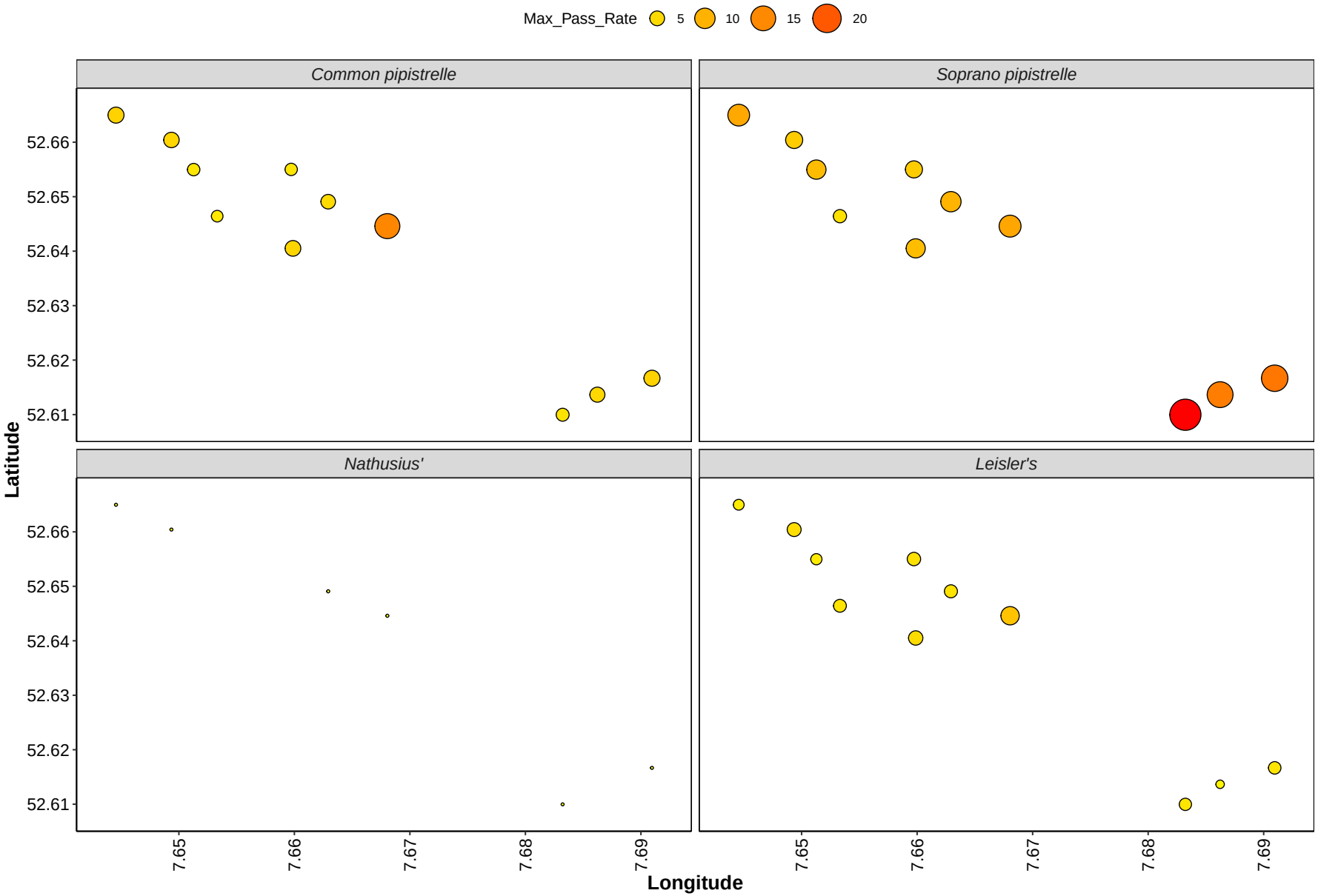
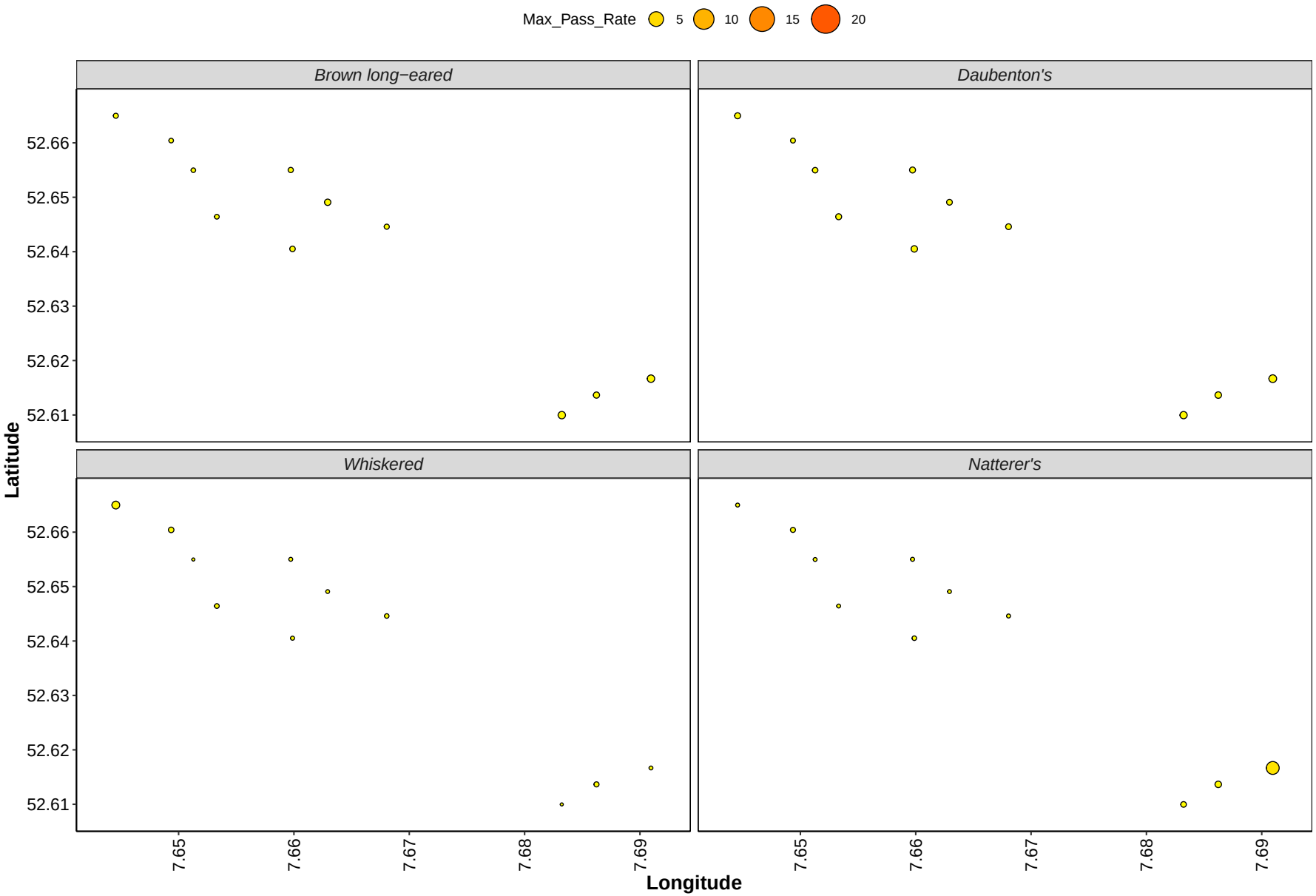

Median_Pass_Rate
2.5
5.0
7.5
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
Longitude
7.65
7.66
7.67
7.68
7.69

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
5
10
15
20
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
7.65
7.66
7.67
7.68
7.69
Longitude


Max_Pass_Rate
5
10
15
20
Brown long−eared
Daubenton's
Whiskered
Natterer's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
Longitude
7.65
7.66
7.67
7.68
7.69

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

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	LT1	0.0
Brown long-eared	LT10	0.0
Brown long-eared	LT11	0.3
Brown long-eared	LT2	0.1
Brown long-eared	LT3	0.0
Brown long-eared	LT4	0.0
Brown long-eared	LT5	0.1
Brown long-eared	LT6	0.0
Brown long-eared	LT7	0.2
Brown long-eared	LT8	0.1
Brown long-eared	LT9	0.1
Common pipistrelle	LT1	2.9
Common pipistrelle	LT10	2.2
Common pipistrelle	LT11	2.1
Common pipistrelle	LT2	2.1
Common pipistrelle	LT3	1.7
Common pipistrelle	LT4	1.2
Common pipistrelle	LT5	1.7
Common pipistrelle	LT6	1.7
Common pipistrelle	LT7	3.8
Common pipistrelle	LT8	2.3
Common pipistrelle	LT9	1.9
Daubenton's	LT1	0.2
Daubenton's	LT10	0.4
Daubenton's	LT11	0.5
Daubenton's	LT2	0.2
Daubenton's	LT3	0.3
Daubenton's	LT4	0.1
Daubenton's	LT5	0.2
Daubenton's	LT6	0.2
Daubenton's	LT7	0.1
Daubenton's	LT8	0.4
Daubenton's	LT9	0.2
Leisler's	LT1	1.4
Leisler's	LT10	0.7
Leisler's	LT11	1.8

Species	Detector ID	Median Pass Rate
Leisler's	LT2	1.9
Leisler's	LT3	1.8
Leisler's	LT4	1.8
Leisler's	LT5	2.0
Leisler's	LT6	1.8
Leisler's	LT7	1.9
Leisler's	LT8	2.6
Leisler's	LT9	1.4
Nathusius'	LT1	0.0
Nathusius'	LT10	0.0
Nathusius'	LT11	0.0
Nathusius'	LT2	0.0
Nathusius'	LT3	0.0
Nathusius'	LT4	0.0
Nathusius'	LT5	0.0
Nathusius'	LT6	0.0
Nathusius'	LT7	0.0
Nathusius'	LT8	0.0
Nathusius'	LT9	0.0
Natterer's	LT1	0.0
Natterer's	LT10	0.2
Natterer's	LT11	0.2
Natterer's	LT2	0.0
Natterer's	LT3	0.0
Natterer's	LT4	0.0
Natterer's	LT5	0.1
Natterer's	LT6	0.0
Natterer's	LT7	0.0
Natterer's	LT8	0.0
Natterer's	LT9	0.7
Soprano pipistrelle	LT1	7.0
Soprano pipistrelle	LT10	9.4
Soprano pipistrelle	LT11	8.2
Soprano pipistrelle	LT2	4.6
Soprano pipistrelle	LT3	4.3
Soprano pipistrelle	LT4	3.6

Species	Detector ID	Median Pass Rate
Soprano pipistrelle	LT5	2.6
Soprano pipistrelle	LT6	2.0
Soprano pipistrelle	LT7	3.9
Soprano pipistrelle	LT8	4.6
Soprano pipistrelle	LT9	4.9
Whiskered	LT1	0.1
Whiskered	LT10	0.0
Whiskered	LT11	0.0
Whiskered	LT2	0.1
Whiskered	LT3	0.0
Whiskered	LT4	0.0
Whiskered	LT5	0.0
Whiskered	LT6	0.0
Whiskered	LT7	0.0
Whiskered	LT8	0.0
Whiskered	LT9	0.0

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.

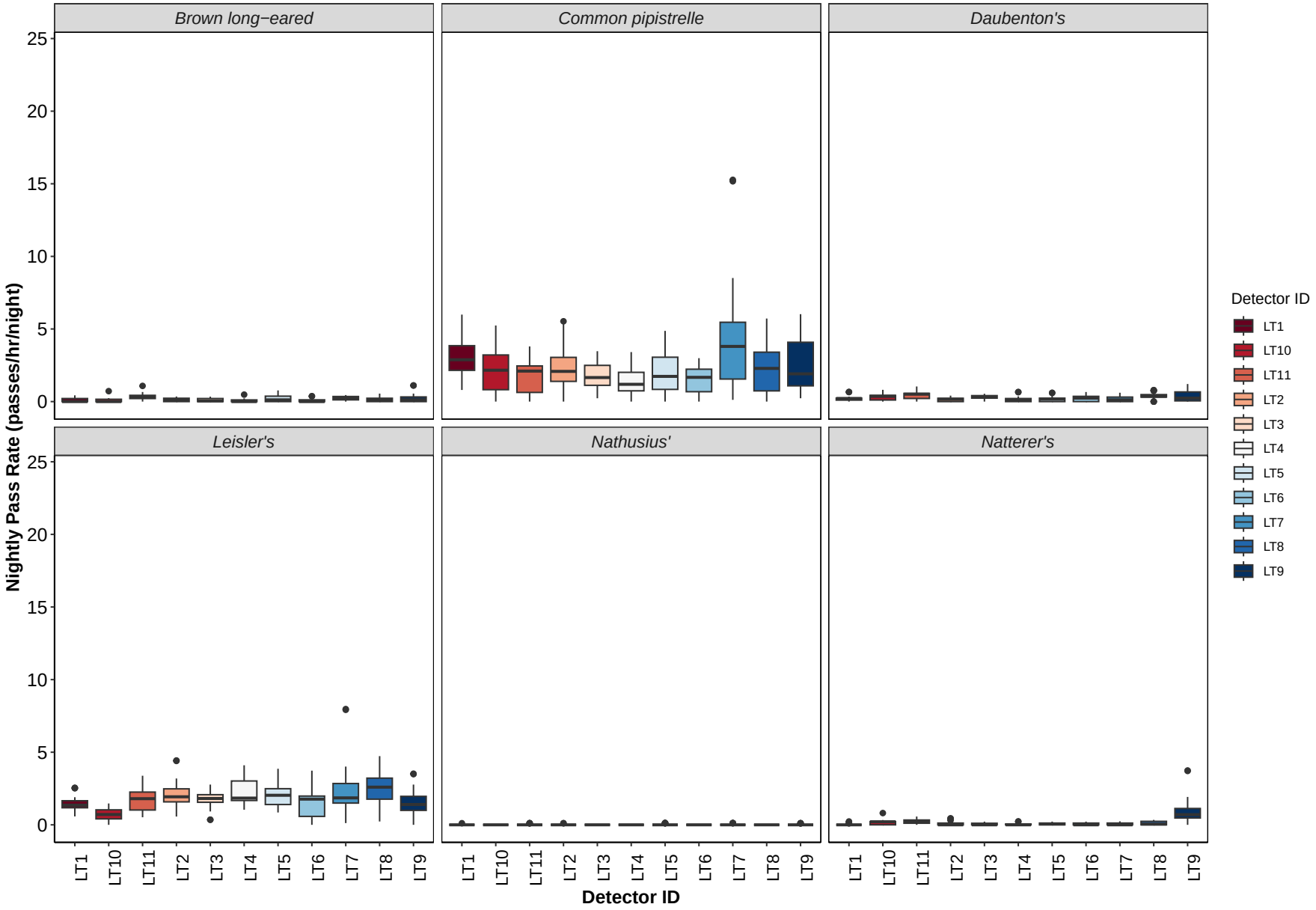
Species	Detector ID	Mean Pass Rate
Brown long-eared	LT1	0.1
Brown long-eared	LT10	0.1
Brown long-eared	LT11	0.3
Brown long-eared	LT2	0.1
Brown long-eared	LT3	0.1
Brown long-eared	LT4	0.1
Brown long-eared	LT5	0.2
Brown long-eared	LT6	0.1
Brown long-eared	LT7	0.2
Brown long-eared	LT8	0.2
Brown long-eared	LT9	0.2
Common pipistrelle	LT1	3.0
Common pipistrelle	LT10	2.2
Common pipistrelle	LT11	1.9
Common pipistrelle	LT2	2.3
Common pipistrelle	LT3	1.8
Common pipistrelle	LT4	1.5
Common pipistrelle	LT5	2.1
Common pipistrelle	LT6	1.5
Common pipistrelle	LT7	4.5
Common pipistrelle	LT8	2.2
Common pipistrelle	LT9	2.5
Daubenton's	LT1	0.2
Daubenton's	LT10	0.3
Daubenton's	LT11	0.4
Daubenton's	LT2	0.1
Daubenton's	LT3	0.3
Daubenton's	LT4	0.1
Daubenton's	LT5	0.2
Daubenton's	LT6	0.2
Daubenton's	LT7	0.2
Daubenton's	LT8	0.4
Daubenton's	LT9	0.4
Leisler's	LT1	1.4
Leisler's	LT10	0.8
Leisler's	LT11	1.7

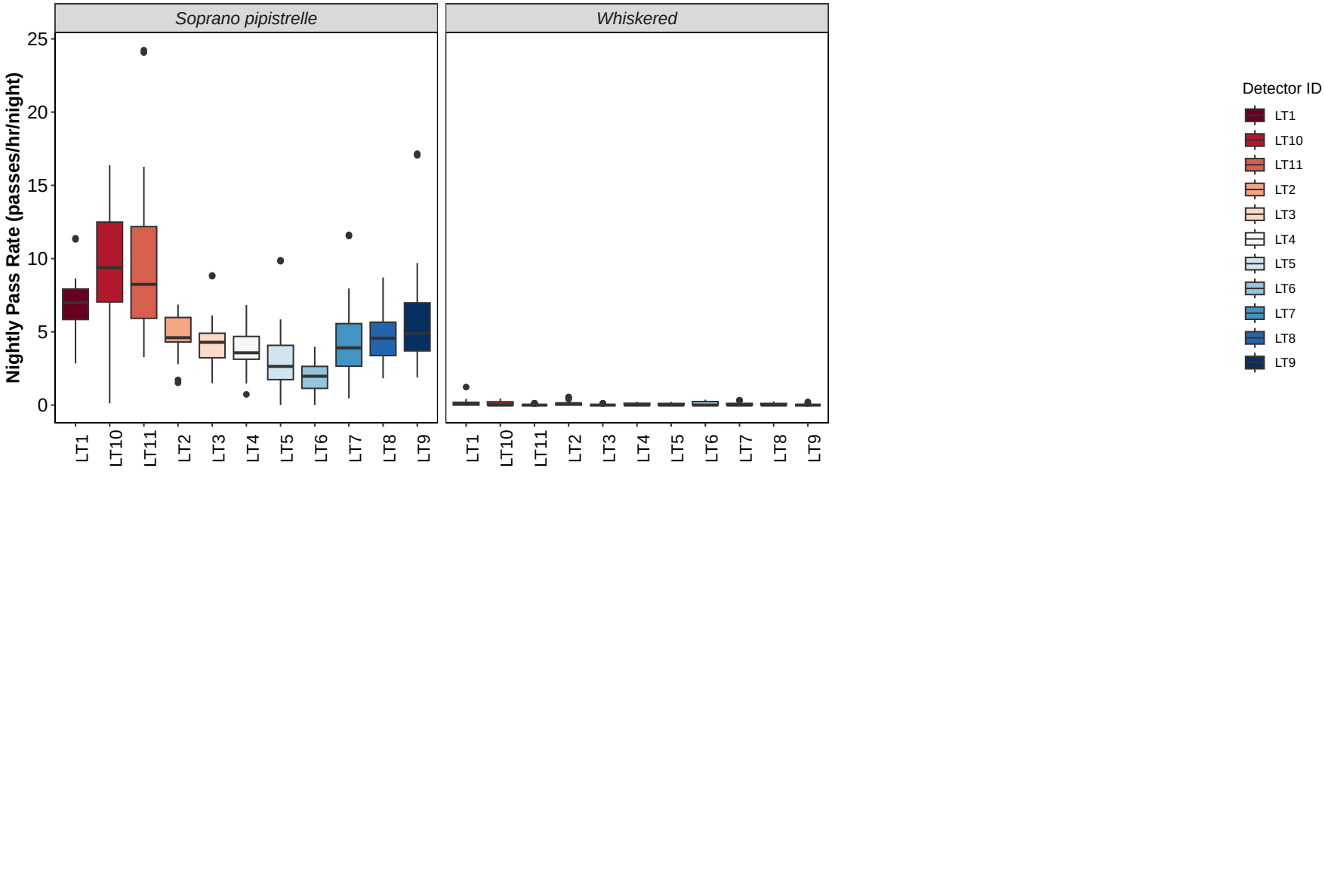
Species	Detector ID	Mean Pass Rate
Leisler's	LT2	2.1
Leisler's	LT3	1.8
Leisler's	LT4	2.2
Leisler's	LT5	2.1
Leisler's	LT6	1.6
Leisler's	LT7	2.5
Leisler's	LT8	2.6
Leisler's	LT9	1.5
Nathusius'	LT1	0.0
Nathusius'	LT10	0.0
Nathusius'	LT11	0.0
Nathusius'	LT2	0.0
Nathusius'	LT3	0.0
Nathusius'	LT4	0.0
Nathusius'	LT5	0.0
Nathusius'	LT6	0.0
Nathusius'	LT7	0.0
Nathusius'	LT8	0.0
Nathusius'	LT9	0.0
Natterer's	LT1	0.0
Natterer's	LT10	0.2
Natterer's	LT11	0.2
Natterer's	LT2	0.1
Natterer's	LT3	0.1
Natterer's	LT4	0.0
Natterer's	LT5	0.1
Natterer's	LT6	0.1
Natterer's	LT7	0.1
Natterer's	LT8	0.1
Natterer's	LT9	1.0
Soprano pipistrelle	LT1	7.1
Soprano pipistrelle	LT10	9.4
Soprano pipistrelle	LT11	9.6
Soprano pipistrelle	LT2	4.8
Soprano pipistrelle	LT3	4.4
Soprano pipistrelle	LT4	3.8

Species	Detector ID	Mean Pass Rate
Soprano pipistrelle	LT5	3.3
Soprano pipistrelle	LT6	1.9
Soprano pipistrelle	LT7	4.4
Soprano pipistrelle	LT8	4.6
Soprano pipistrelle	LT9	6.0
Whiskered	LT1	0.1
Whiskered	LT10	0.1
Whiskered	LT11	0.0
Whiskered	LT2	0.1
Whiskered	LT3	0.0
Whiskered	LT4	0.1
Whiskered	LT5	0.0
Whiskered	LT6	0.1
Whiskered	LT7	0.1
Whiskered	LT8	0.0
Whiskered	LT9	0.0

Per Detector

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.


Brown long−eared
Common pipistrelle
Daubenton's
Leisler's
Nathusius'
Natterer's
Nightly Pass Rate (passes/hr/night)
0
5
10
15
20
25
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID
Detector ID
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9


Soprano pipistrelle
Whiskered
Nightly Pass Rate (passes/hr/night)
0
5
10
15
20
25
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9

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	LT1	2
Jul	LT10	3
Jul	LT11	3
Jul	LT2	2
Jul	LT3	2
Jul	LT4	8
Jul	LT5	8
Jul	LT6	8
Jul	LT7	8
Jul	LT8	8
Jul	LT9	3
Aug	LT1	24
Aug	LT10	24
Aug	LT11	24
Aug	LT2	24
Aug	LT3	24
Aug	LT4	19
Aug	LT5	20
Aug	LT6	13
Aug	LT7	20
Aug	LT8	20
Aug	LT9	24

Nighlty 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	LT1	0.0	0.0
Brown long-eared	LT10	0.0	0.2
Brown long-eared	LT11	0.3	0.5
Brown long-eared	LT2	0.1	0.1
Brown long-eared	LT3	0.0	0.1
Brown long-eared	LT4	0.0	0.0
Brown long-eared	LT5	0.2	0.1
Brown long-eared	LT6	0.0	0.1
Brown long-eared	LT7	0.3	0.1
Brown long-eared	LT8	0.2	0.1
Brown long-eared	LT9	0.1	0.4
Common pipistrelle	LT1	2.9	2.9
Common pipistrelle	LT10	2.2	2.2
Common pipistrelle	LT11	2.1	2.1
Common pipistrelle	LT2	2.2	1.5
Common pipistrelle	LT3	1.7	1.1
Common pipistrelle	LT4	1.2	1.6
Common pipistrelle	LT5	2.3	1.6
Common pipistrelle	LT6	1.0	2.1
Common pipistrelle	LT7	4.6	2.5
Common pipistrelle	LT8	1.4	2.7
Common pipistrelle	LT9	1.9	2.2
Daubenton's	LT1	0.2	0.2
Daubenton's	LT10	0.4	0.4
Daubenton's	LT11	0.5	0.2
Daubenton's	LT2	0.2	0.0
Daubenton's	LT3	0.3	0.2
Daubenton's	LT4	0.1	0.1
Daubenton's	LT5	0.2	0.2
Daubenton's	LT6	0.1	0.3
Daubenton's	LT7	0.1	0.1
Daubenton's	LT8	0.3	0.4
Daubenton's	LT9	0.3	0.2
Leisler's	LT1	1.4	0.6
Leisler's	LT10	0.7	0.9
Leisler's	LT11	1.4	3.4

Species	Detector ID	Aug	Jul
Leisler's	LT2	2.0	1.7
Leisler's	LT3	1.8	1.6
Leisler's	LT4	1.7	1.8
Leisler's	LT5	2.0	2.4
Leisler's	LT6	1.7	2.0
Leisler's	LT7	1.8	1.9
Leisler's	LT8	2.6	3.1
Leisler's	LT9	1.3	1.7
Nathusius'	LT1	0.0	0.0
Nathusius'	LT10	0.0	0.0
Nathusius'	LT11	0.0	0.0
Nathusius'	LT2	0.0	0.0
Nathusius'	LT3	0.0	0.0
Nathusius'	LT4	0.0	0.0
Nathusius'	LT5	0.0	0.0
Nathusius'	LT6	0.0	0.0
Nathusius'	LT7	0.0	0.0
Nathusius'	LT8	0.0	0.0
Nathusius'	LT9	0.0	0.0
Natterer's	LT1	0.0	0.0
Natterer's	LT10	0.2	0.0
Natterer's	LT11	0.2	0.0
Natterer's	LT2	0.0	0.1
Natterer's	LT3	0.0	0.1
Natterer's	LT4	0.0	0.0
Natterer's	LT5	0.1	0.1
Natterer's	LT6	0.0	0.1
Natterer's	LT7	0.0	0.1
Natterer's	LT8	0.1	0.0
Natterer's	LT9	0.7	0.7
Soprano pipistrelle	LT1	7.0	7.5
Soprano pipistrelle	LT10	8.5	13.7
Soprano pipistrelle	LT11	8.1	13.6
Soprano pipistrelle	LT2	5.0	4.5
Soprano pipistrelle	LT3	4.0	4.9
Soprano pipistrelle	LT4	3.3	4.7

Species	Detector ID	Aug	Jul
Soprano pipistrelle	LT5	2.5	2.8
Soprano pipistrelle	LT6	1.3	2.4
Soprano pipistrelle	LT7	4.4	3.3
Soprano pipistrelle	LT8	4.6	4.2
Soprano pipistrelle	LT9	5.0	4.7
Whiskered	LT1	0.1	0.1
Whiskered	LT10	0.0	0.0
Whiskered	LT11	0.0	0.1
Whiskered	LT2	0.1	0.1
Whiskered	LT3	0.0	0.1
Whiskered	LT4	0.0	0.0
Whiskered	LT5	0.0	0.0
Whiskered	LT6	0.0	0.1
Whiskered	LT7	0.0	0.0
Whiskered	LT8	0.0	0.0
Whiskered	LT9	0.0	0.0

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.

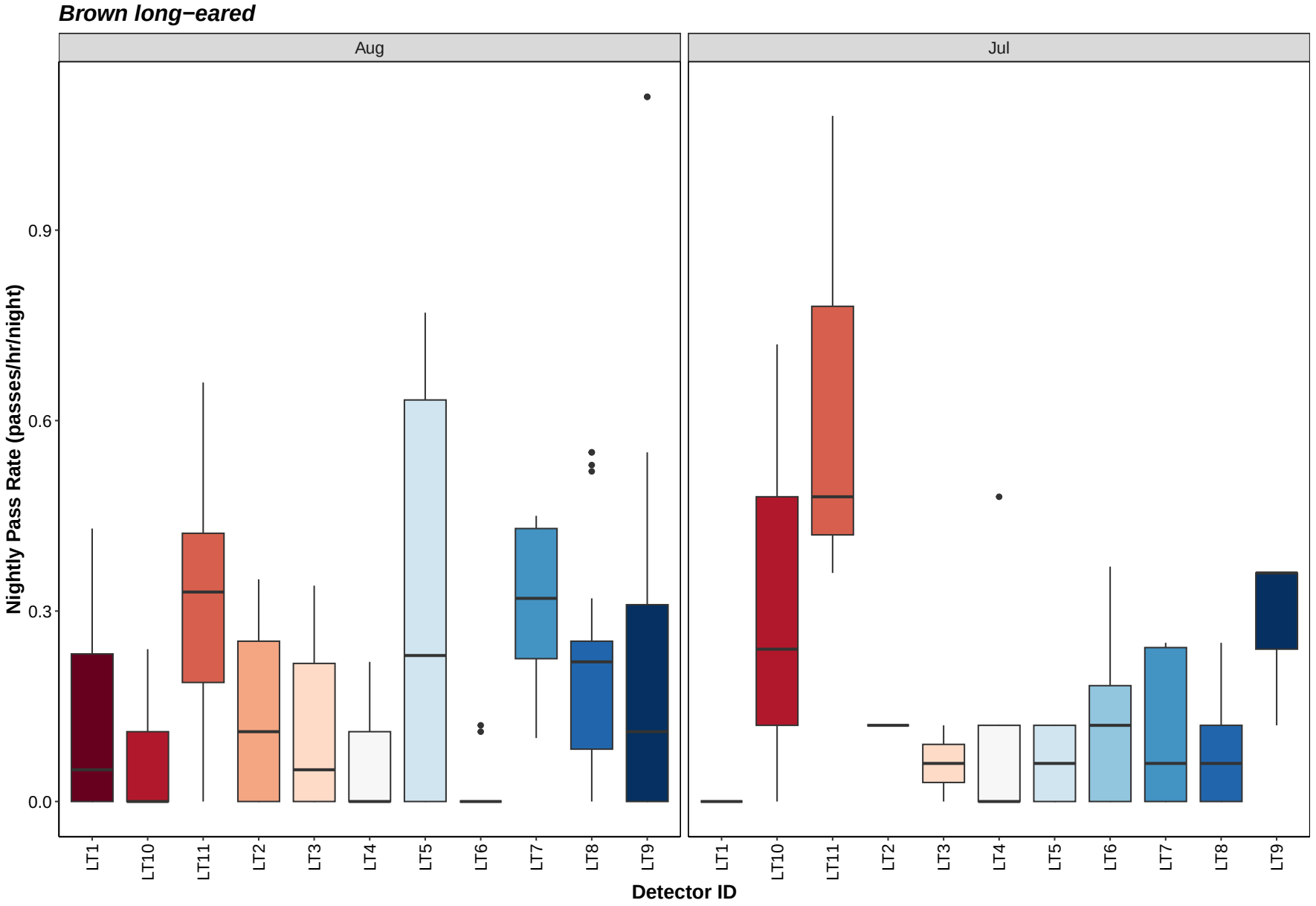
Species	Detector ID	Aug	Jul
Brown long-eared	LT1	0.1	0.0
Brown long-eared	LT10	0.1	0.3
Brown long-eared	LT11	0.3	0.6
Brown long-eared	LT2	0.1	0.1
Brown long-eared	LT3	0.1	0.1
Brown long-eared	LT4	0.1	0.1
Brown long-eared	LT5	0.3	0.1
Brown long-eared	LT6	0.0	0.1
Brown long-eared	LT7	0.3	0.1
Brown long-eared	LT8	0.2	0.1
Brown long-eared	LT9	0.2	0.3
Common pipistrelle	LT1	3.0	2.9
Common pipistrelle	LT10	2.2	1.9
Common pipistrelle	LT11	1.9	2.0
Common pipistrelle	LT2	2.4	1.5
Common pipistrelle	LT3	1.8	1.1
Common pipistrelle	LT4	1.4	1.7
Common pipistrelle	LT5	2.3	1.6
Common pipistrelle	LT6	1.3	1.8
Common pipistrelle	LT7	5.2	2.7
Common pipistrelle	LT8	2.0	2.7
Common pipistrelle	LT9	2.6	1.9
Daubenton's	LT1	0.2	0.2
Daubenton's	LT10	0.3	0.4
Daubenton's	LT11	0.5	0.2
Daubenton's	LT2	0.2	0.0
Daubenton's	LT3	0.3	0.2
Daubenton's	LT4	0.1	0.1
Daubenton's	LT5	0.1	0.3
Daubenton's	LT6	0.2	0.3
Daubenton's	LT7	0.1	0.2
Daubenton's	LT8	0.4	0.4
Daubenton's	LT9	0.4	0.3
Leisler's	LT1	1.5	0.6
Leisler's	LT10	0.8	0.8
Leisler's	LT11	1.5	3.0

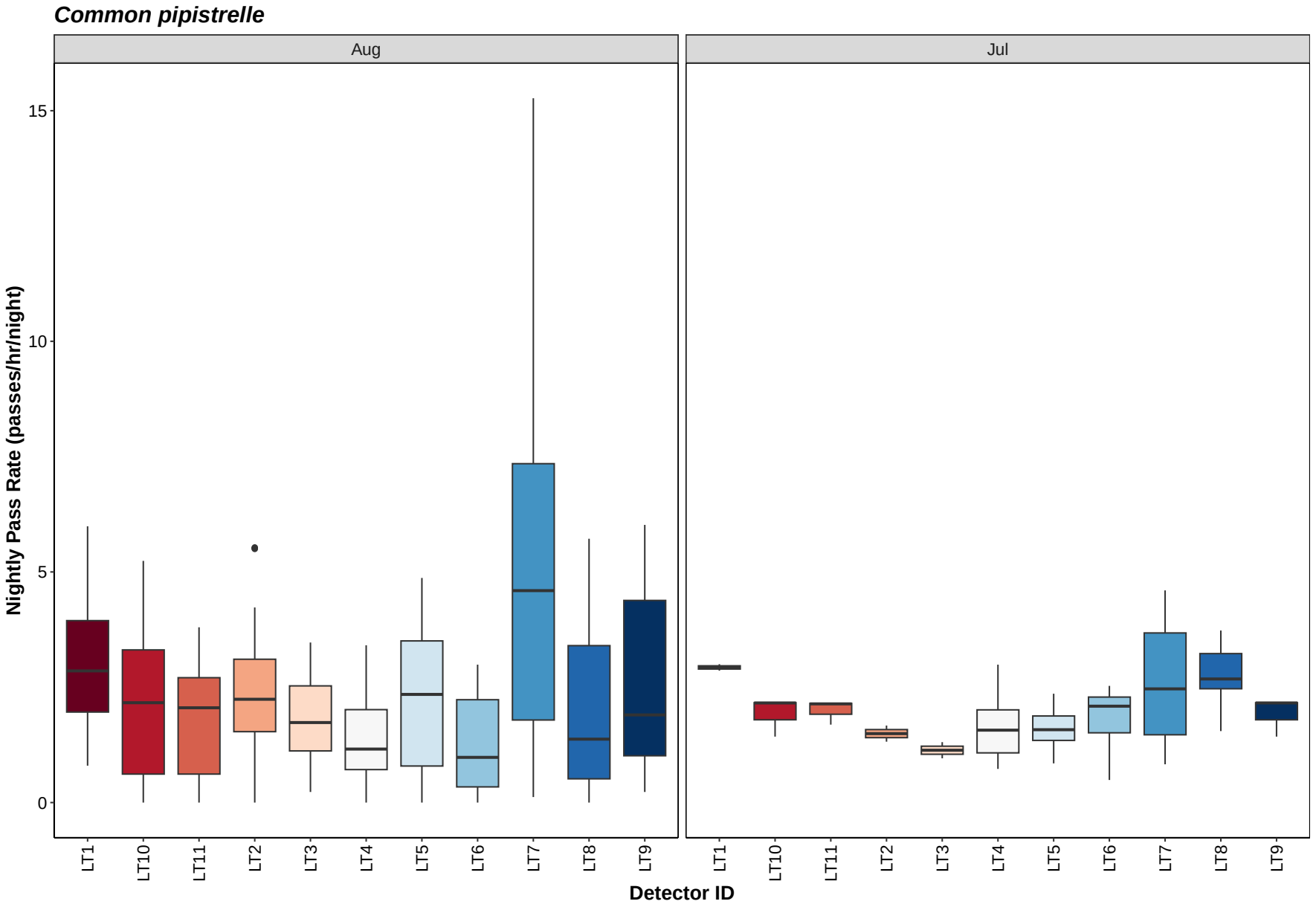
Species	Detector ID	Aug	Jul
Leisler's	LT2	2.1	1.7
Leisler's	LT3	1.8	1.6
Leisler's	LT4	2.2	2.1
Leisler's	LT5	2.0	2.4
Leisler's	LT6	1.2	2.1
Leisler's	LT7	2.6	2.1
Leisler's	LT8	2.4	3.2
Leisler's	LT9	1.5	1.6
Nathusius'	LT1	0.0	0.0
Nathusius'	LT10	0.0	0.0
Nathusius'	LT11	0.0	0.0
Nathusius'	LT2	0.0	0.0
Nathusius'	LT3	0.0	0.0
Nathusius'	LT4	0.0	0.0
Nathusius'	LT5	0.0	0.0
Nathusius'	LT6	0.0	0.0
Nathusius'	LT7	0.0	0.0
Nathusius'	LT8	0.0	0.0
Nathusius'	LT9	0.0	0.0
Natterer's	LT1	0.0	0.0
Natterer's	LT10	0.2	0.1
Natterer's	LT11	0.2	0.1
Natterer's	LT2	0.1	0.1
Natterer's	LT3	0.0	0.1
Natterer's	LT4	0.0	0.0
Natterer's	LT5	0.1	0.1
Natterer's	LT6	0.1	0.1
Natterer's	LT7	0.1	0.1
Natterer's	LT8	0.1	0.1
Natterer's	LT9	1.0	0.6
Soprano pipistrelle	LT1	7.0	7.5
Soprano pipistrelle	LT10	8.9	13.3
Soprano pipistrelle	LT11	9.2	13.3
Soprano pipistrelle	LT2	4.9	4.5
Soprano pipistrelle	LT3	4.3	4.9
Soprano pipistrelle	LT4	3.4	4.8

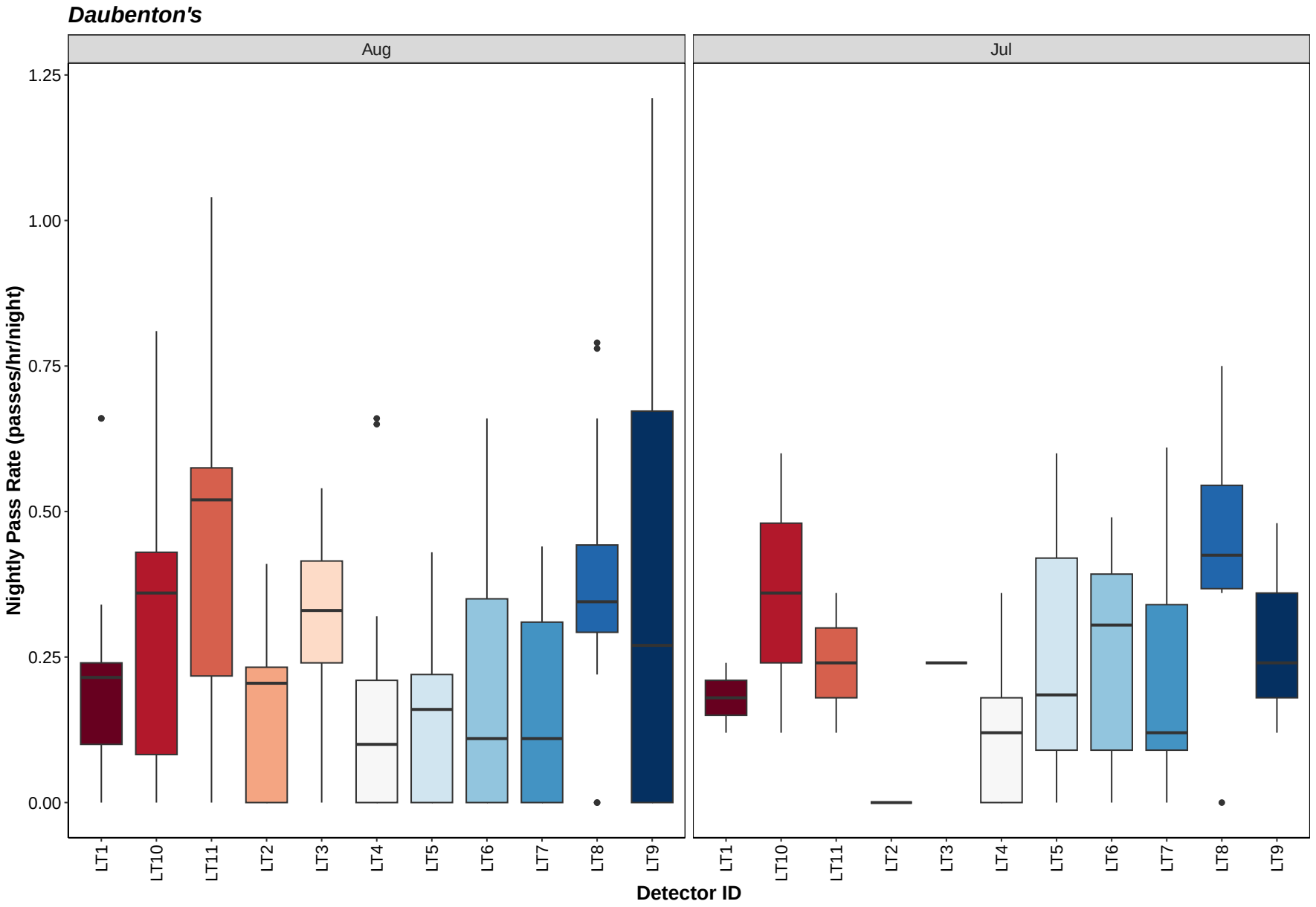
Species	Detector ID	Aug	Jul
Soprano pipistrelle	LT5	3.4	3.2
Soprano pipistrelle	LT6	1.5	2.6
Soprano pipistrelle	LT7	4.8	3.5
Soprano pipistrelle	LT8	4.5	5.1
Soprano pipistrelle	LT9	6.1	5.4
Whiskered	LT1	0.1	0.1
Whiskered	LT10	0.1	0.1
Whiskered	LT11	0.0	0.1
Whiskered	LT2	0.1	0.1
Whiskered	LT3	0.0	0.1
Whiskered	LT4	0.1	0.0
Whiskered	LT5	0.1	0.0
Whiskered	LT6	0.1	0.1
Whiskered	LT7	0.1	0.0
Whiskered	LT8	0.0	0.1
Whiskered	LT9	0.0	0.0

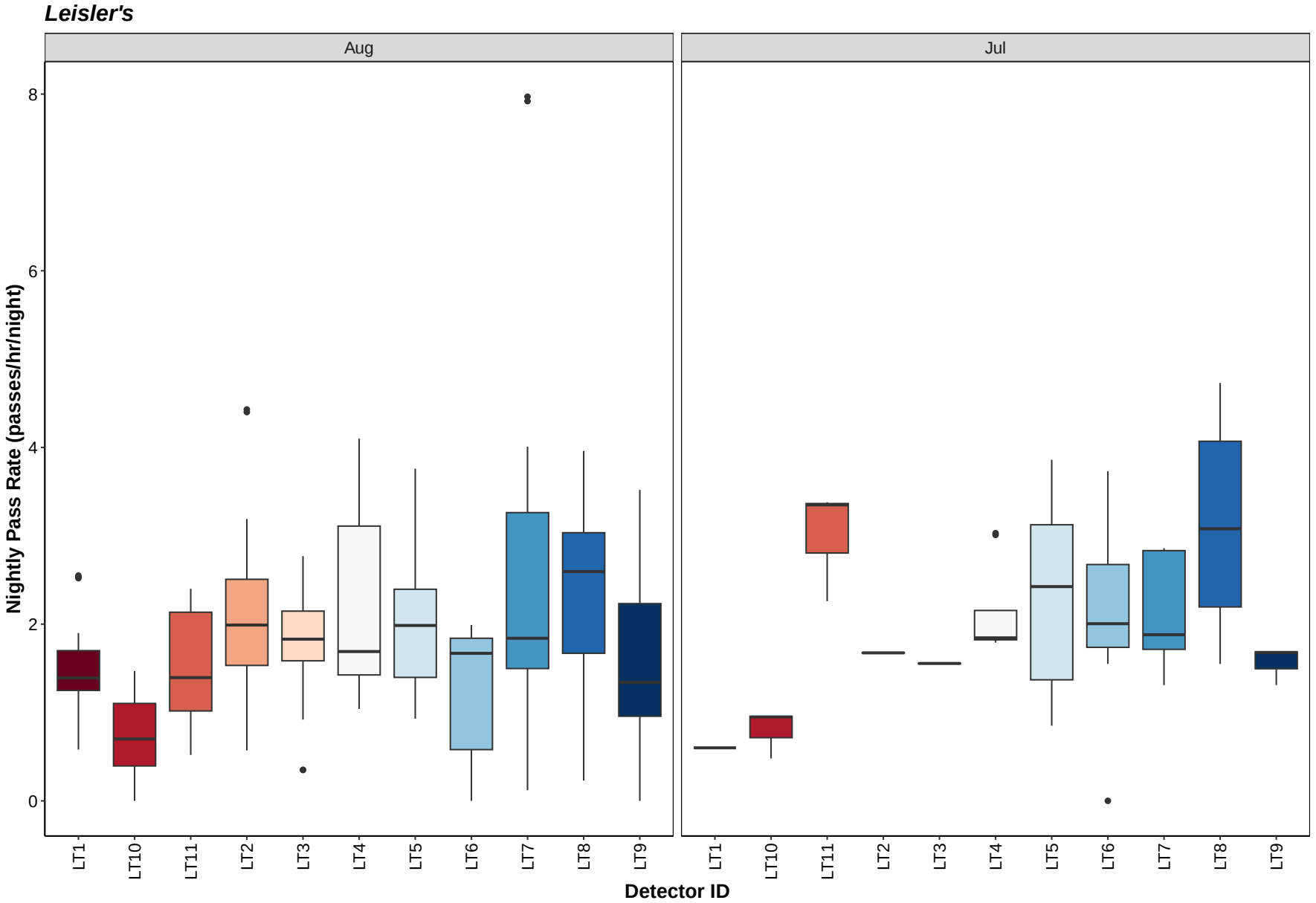
Per Detector

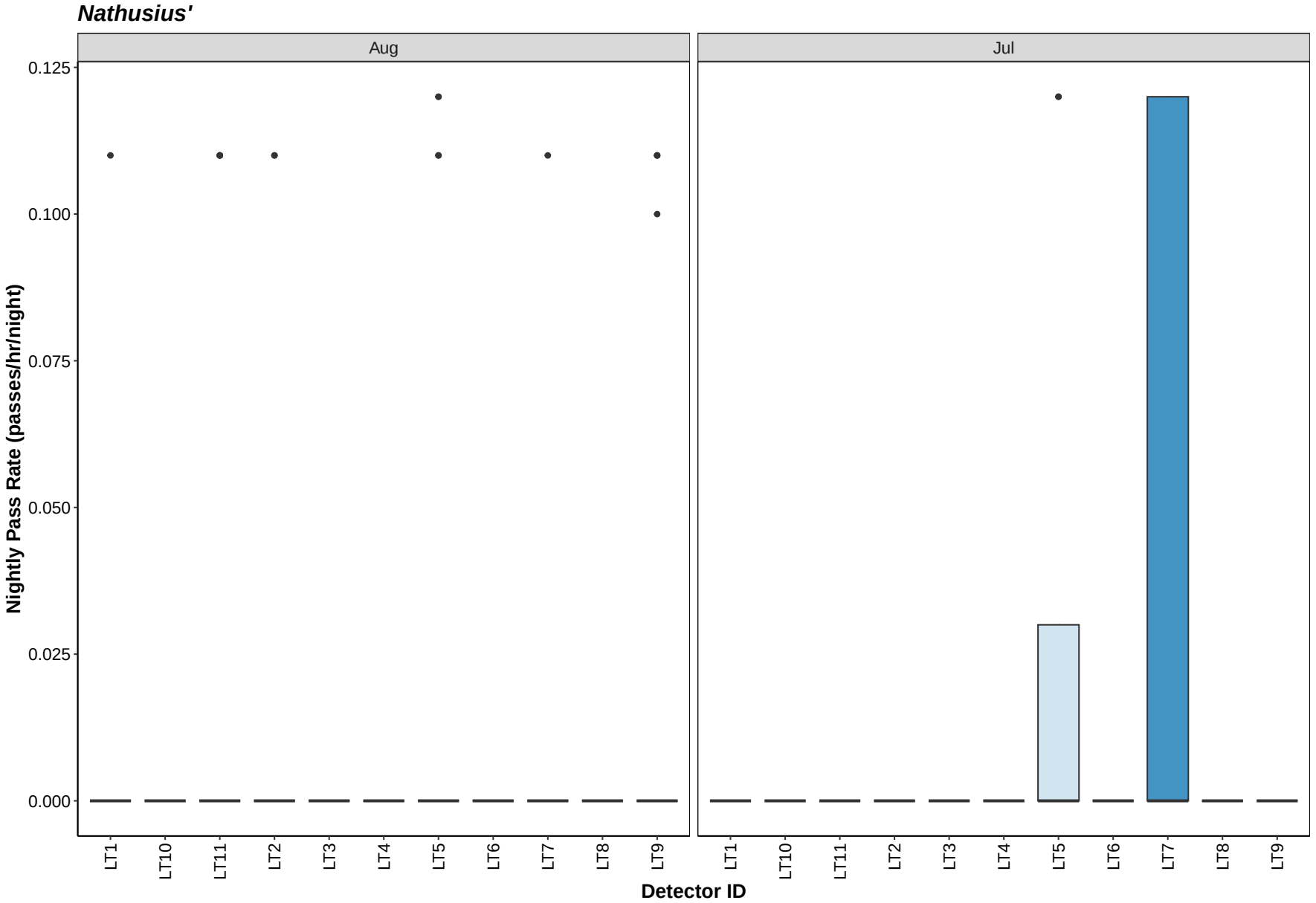
Figure 17. Figures show boxplots for the number of bat passes per hour by detector, for each month. The ‘box’ shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The ‘whiskers’ extend from the box and represent 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.

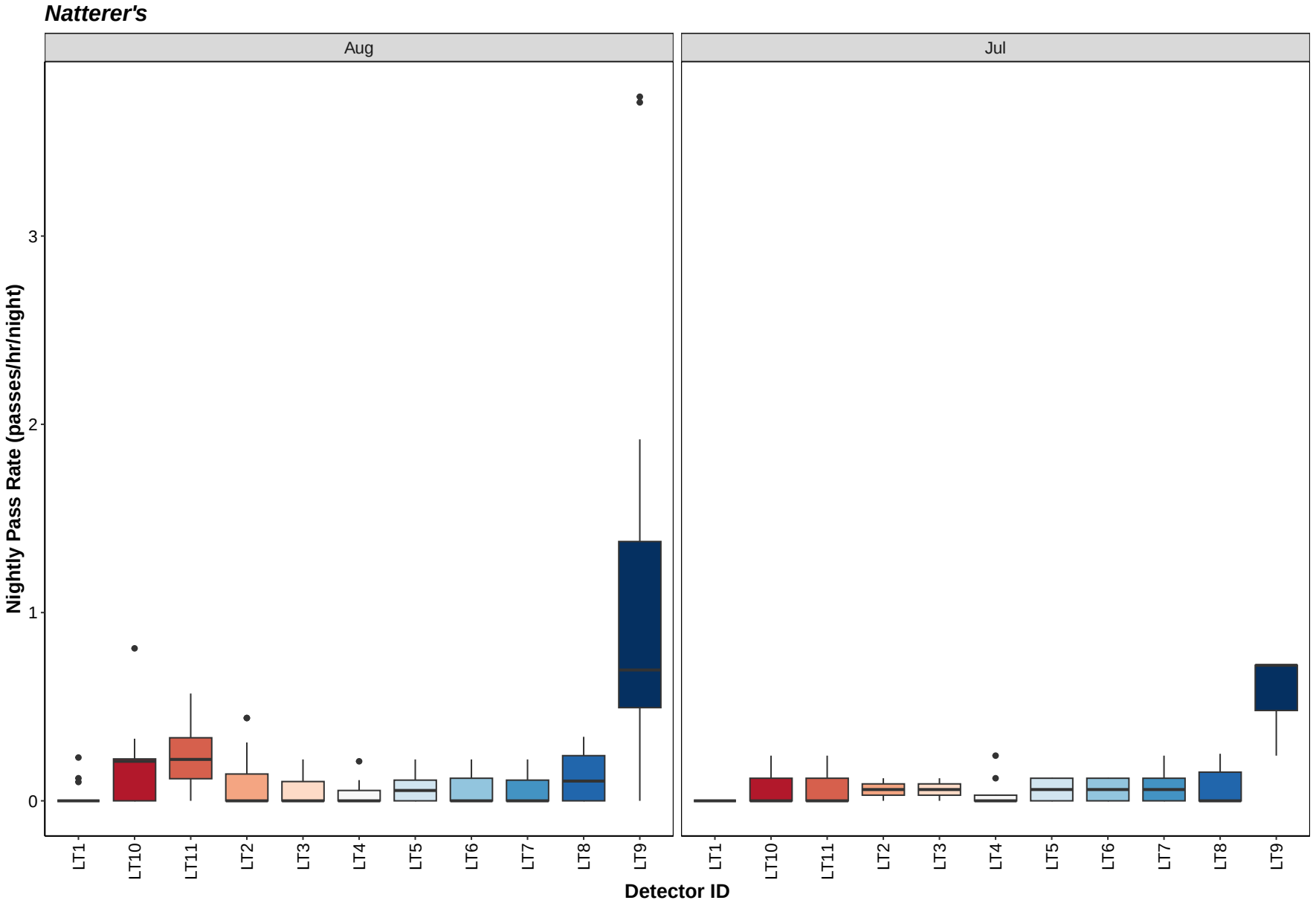

Brown long−eared
Aug
Jul
Nightly Pass Rate (passes/hr/night)
0.0
0.3
0.6
0.9
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID

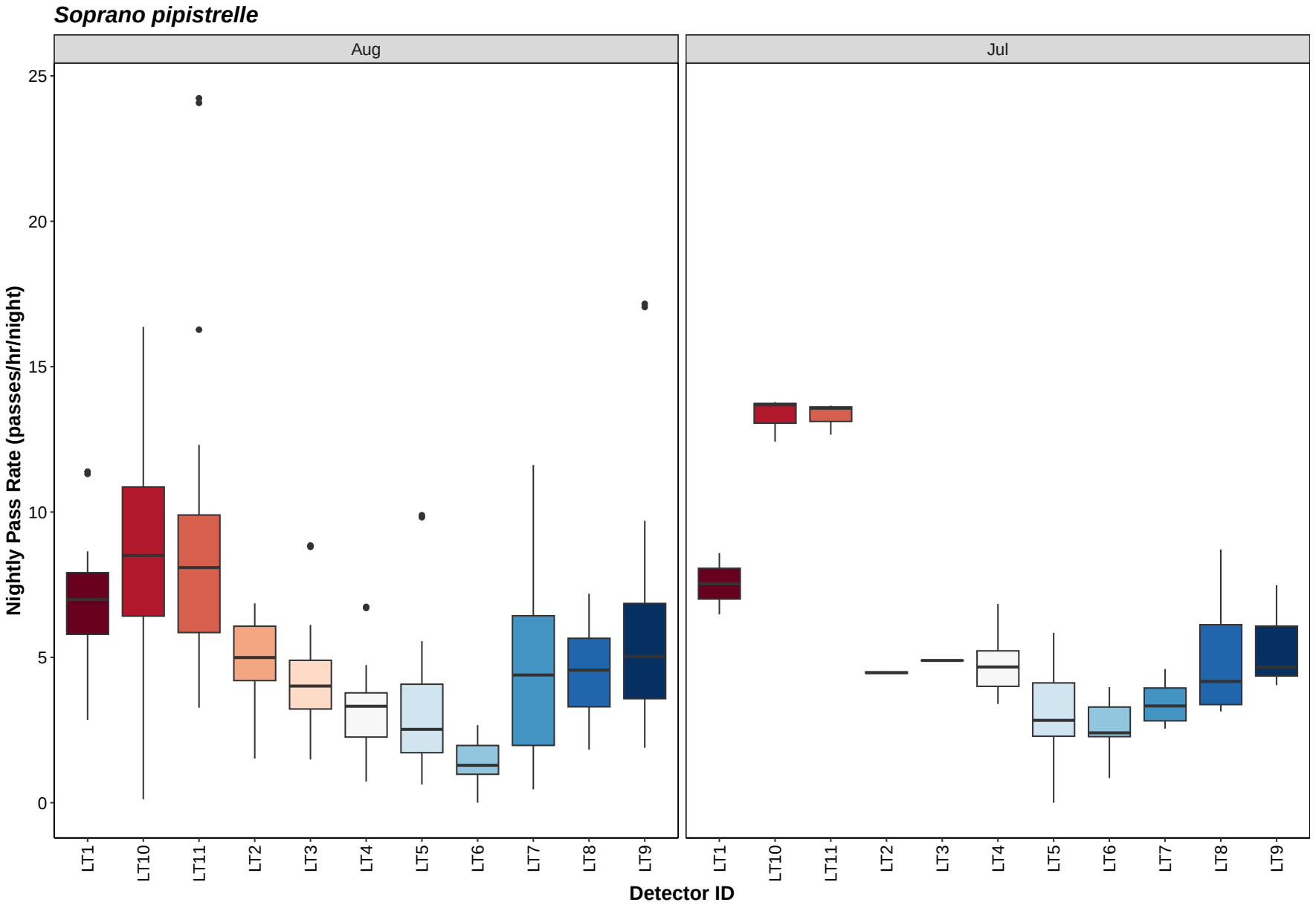

Common pipistrelle
Aug
Jul
Nightly Pass Rate (passes/hr/night)
0
5
10
15
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID

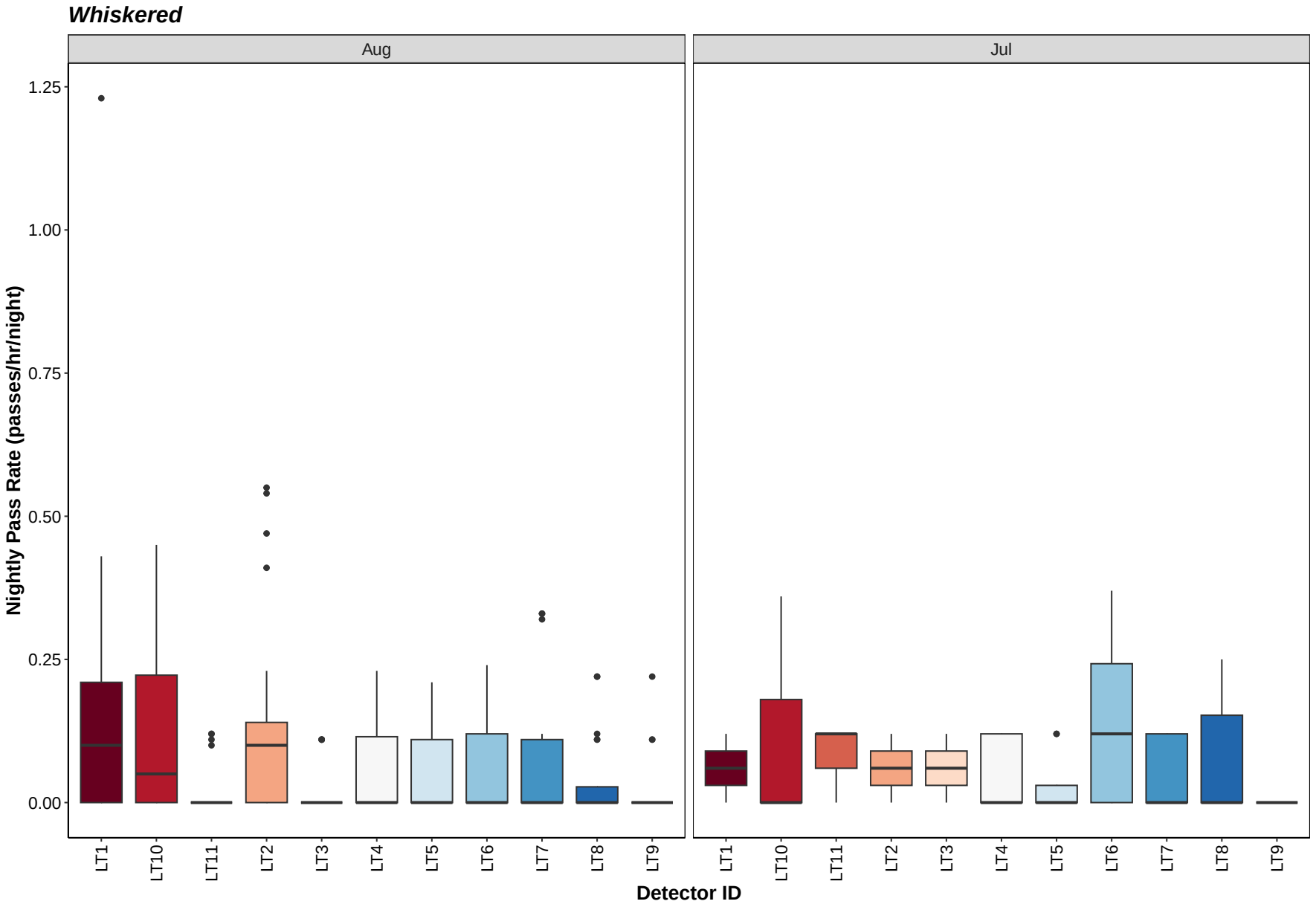

Daubenton's
Aug
Jul
Nightly Pass Rate (passes/hr/night)
1.25
1.00
0.75
0.50
0.25
0.00
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID


Leisler's
Aug
Jul
Nightly Pass Rate (passes/hr/night)
0
2
4
6
8
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID


Nathusius'
Aug
Jul
0.125
0.100
0.075
0.050
0.025
0.000
Nightly Pass Rate (passes/hr/night)
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID


Natterer's
Aug
Jul
Nightly Pass Rate (passes/hr/night)
0
1
2
3
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID


Soprano pipistrelle
Aug
Jul
Nightly Pass Rate (passes/hr/night)
0
5
10
15
20
25
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID


Whiskered
Aug
Jul
Nightly Pass Rate (passes/hr/night)
1.25
1.00
0.75
0.50
0.25
0.00
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID

Bat Activity per Detector Location

Figure 18. Detector ID reference:

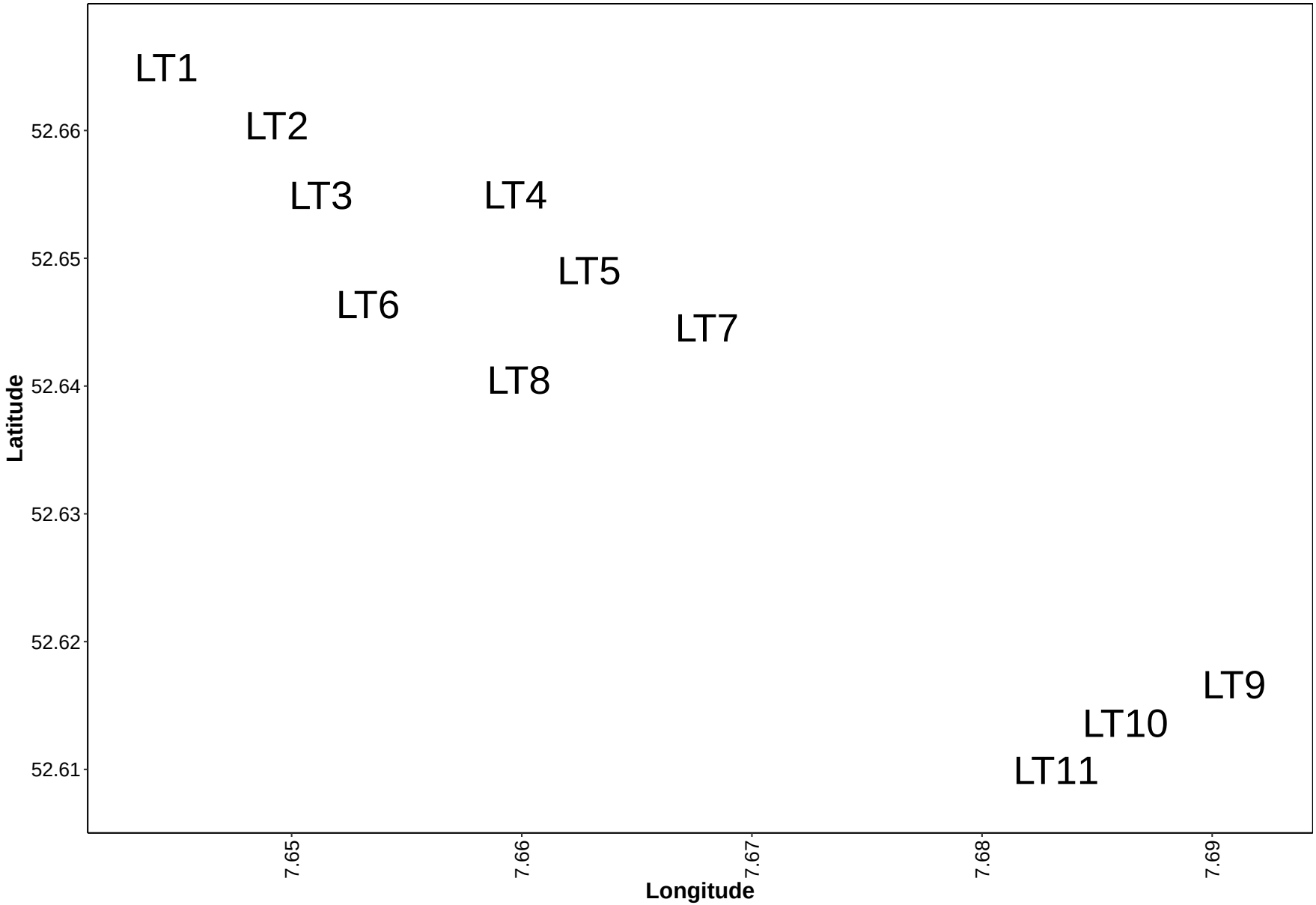
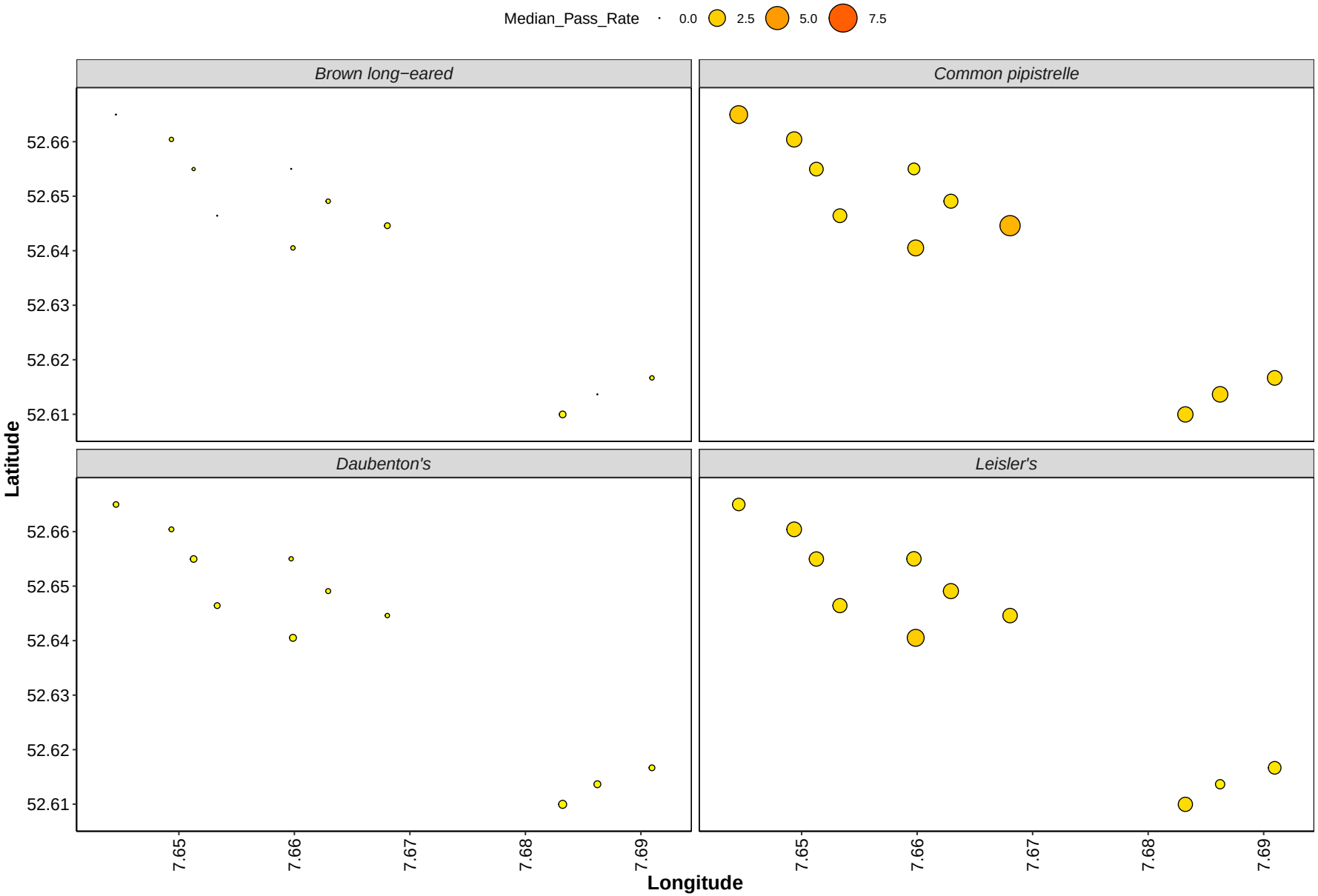

LT1
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
LT10
LT11
52.66
52.65
52.64
52.63
52.62
52.61
Latitude
7.65
7.66
7.67
7.68
7.69
Longitude

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
Brown long−eared
Common pipistrelle
Daubenton's
Leisler's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
7.65
7.66
7.67
7.68
7.69
Longitude

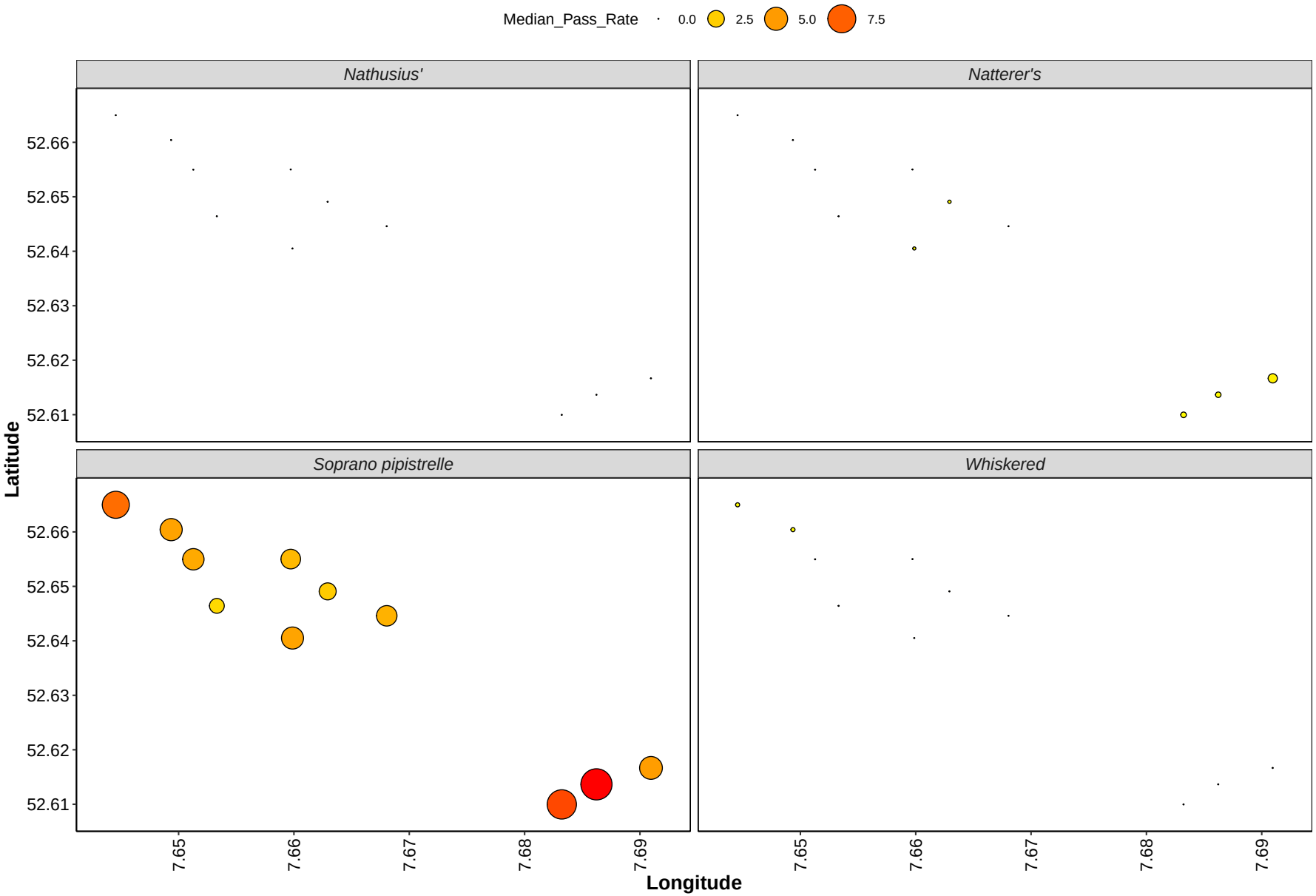
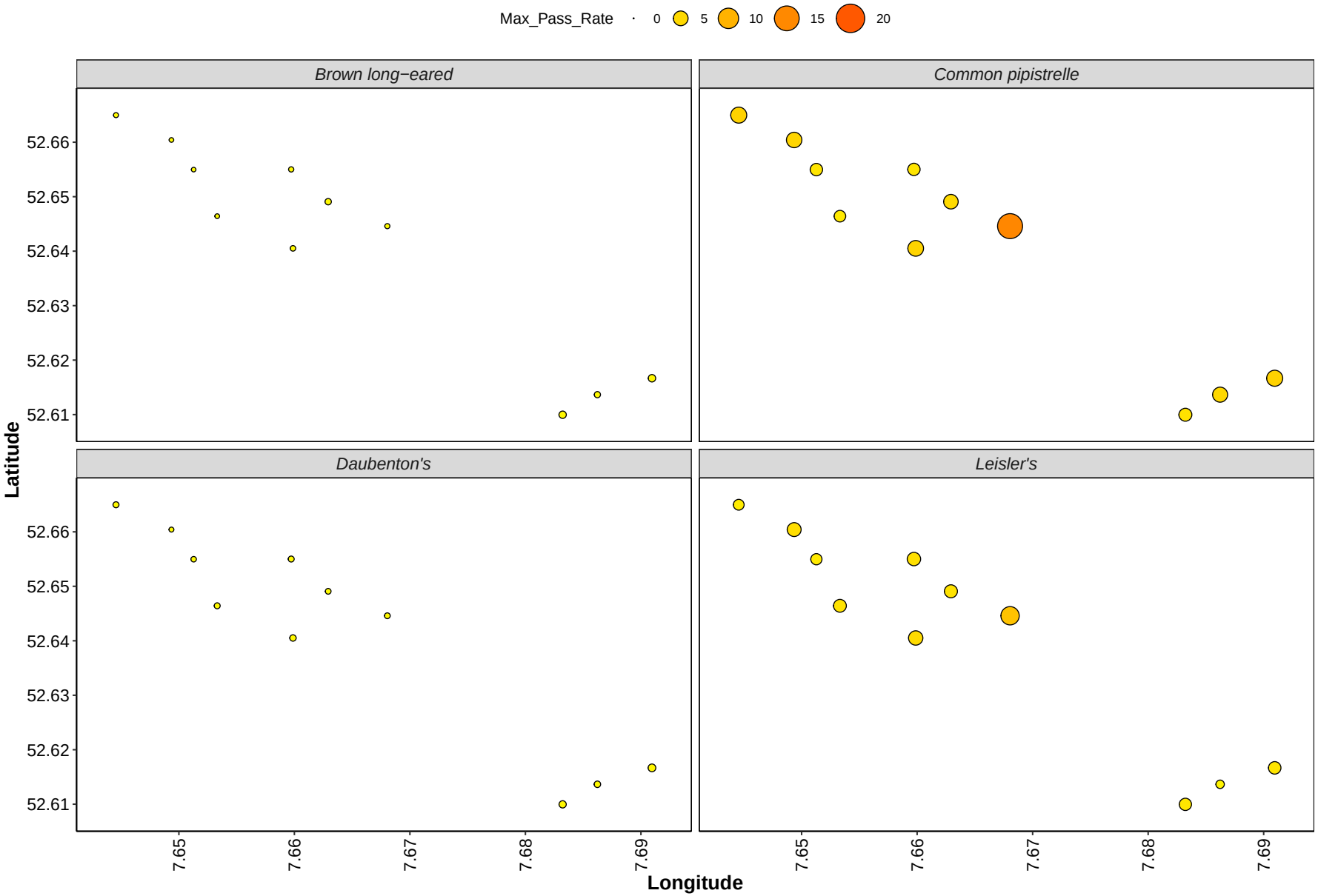
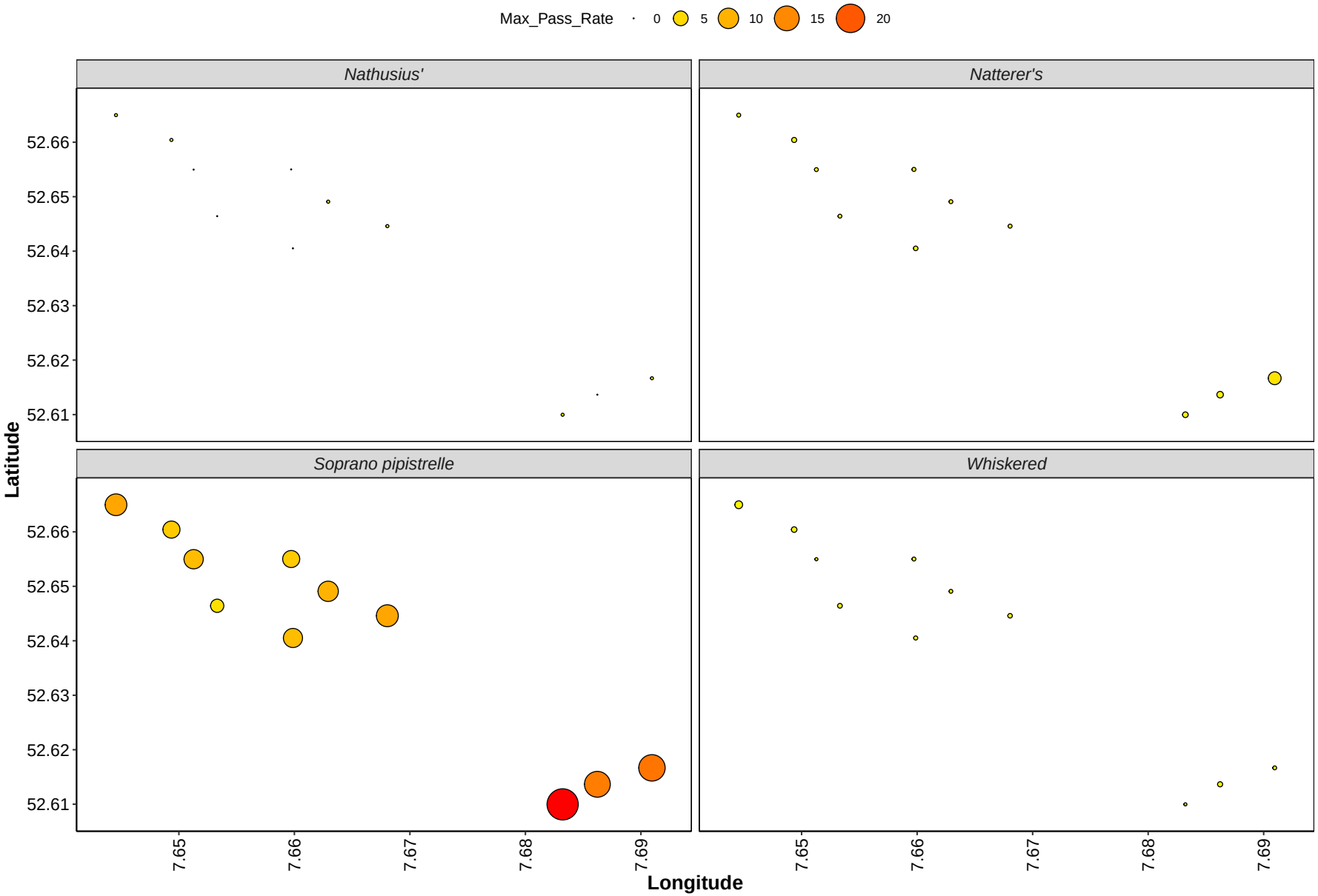

Median_Pass_Rate
0.0
2.5
5.0
7.5
Nathusius'
Natterer's
Soprano pipistrelle
Whiskered
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
Longitude
7.65
7.66
7.67
7.68
7.69

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
5
10
15
20
Brown long−eared
Common pipistrelle
Daubenton's
Leisler's
52.66
52.65
52.64
52.63
52.62
52.61
Latitude
7.65
7.66
7.67
7.68
7.69
Longitude


Max_Pass_Rate
0
5
10
15
20
Nathusius'
Natterer's
Soprano pipistrelle
Whiskered
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
Longitude
7.65
7.66
7.67
7.68
7.69

Thank you for using Ecobat!

Ecobat Report
2025-10-31

Geo filter: all, Time filter: all

Summary

Bats were detected on **28** nights between **21/08/2025** and **17/09/2025**, using **11** static bat detectors. Throughout this period, **8** species were recorded. **Table 1.** Detectors were placed at the following locations:

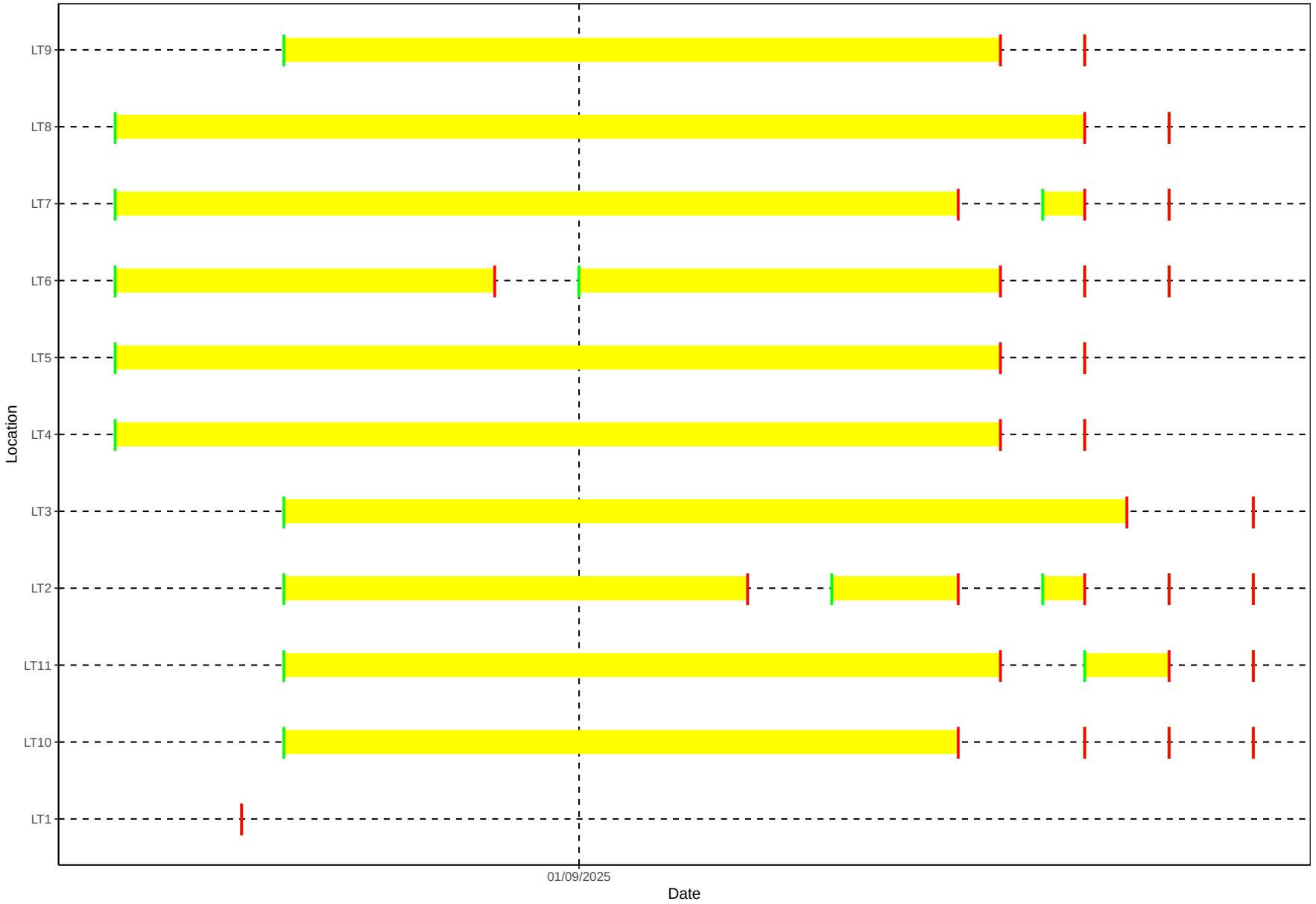
Detector ID	Latitude	Longitude
LT1	52.66497	7.644556
LT2	52.66041	7.649355
LT3	52.65497	7.651278
LT4	52.65501	7.659723
LT5	52.64908	7.662925
LT6	52.64642	7.653317
LT7	52.64459	7.668046
LT8	52.64051	7.659876
LT9	52.61667	7.690955
LT10	52.61366	7.686230
LT11	52.60997	7.683222

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
LT1	25
LT10	20
LT11	22
LT2	20
LT3	22
LT4	26
LT5	26
LT6	23
LT7	24
LT8	26
LT9	23

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


LT9
LT8
LT7
LT6
LT5
LT4
LT3
LT2
LT11
LT10
LT1
Location
01/09/2025
Date

Part 1: Percentile 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.

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 Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT1	Myotis daubentonii	0	0	0	0	0	16
LT1	Myotis nattereri	0	0	0	0	0	5
LT1	Nyctalus leisleri	0	0	0	0	0	25
LT1	Pipistrellus pipistrellus	0	0	0	0	0	20
LT1	Pipistrellus pygmaeus	0	0	0	0	0	21
LT1	Plecotus auritus	0	0	0	0	0	13
LT10	Myotis daubentonii	0	0	0	0	0	10
LT10	Myotis mystacinus	0	0	0	0	0	2
LT10	Myotis nattereri	0	0	0	0	0	6
LT10	Nyctalus leisleri	0	0	0	0	0	13
LT10	Pipistrellus pipistrellus	0	0	0	0	0	11
LT10	Pipistrellus pygmaeus	0	0	0	0	0	17
LT10	Plecotus auritus	0	0	0	0	0	7
LT11	Myotis daubentonii	0	0	0	0	0	16
LT11	Myotis nattereri	0	0	0	0	0	11
LT11	Nyctalus leisleri	0	0	0	0	0	17
LT11	Pipistrellus nathusii	0	0	0	0	0	2
LT11	Pipistrellus pipistrellus	0	0	0	0	0	13
LT11	Pipistrellus pygmaeus	0	0	0	0	0	19

Detector ID	Species/Species Group	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT11	Plecotus auritus	0	0	0	0	0	13
LT2	Myotis daubentonii	0	0	0	0	0	11
LT2	Nyctalus leisleri	0	0	0	0	0	18
LT2	Pipistrellus pipistrellus	0	0	0	0	0	14
LT2	Pipistrellus pygmaeus	0	0	0	0	0	18
LT2	Plecotus auritus	0	0	0	0	0	4
LT3	Myotis daubentonii	0	0	0	0	0	9
LT3	Myotis mystacinus	0	0	0	0	0	9
LT3	Myotis nattereri	0	0	0	0	0	2
LT3	Nyctalus leisleri	0	0	0	0	0	21
LT3	Pipistrellus pipistrellus	0	0	0	0	0	13
LT3	Pipistrellus pygmaeus	0	0	0	0	0	19
LT3	Plecotus auritus	0	0	0	0	0	7
LT4	Myotis daubentonii	0	0	0	0	0	12
LT4	Myotis nattereri	0	0	0	0	0	9
LT4	Nyctalus leisleri	0	0	0	0	0	26
LT4	Pipistrellus pipistrellus	0	0	0	0	0	11
LT4	Pipistrellus pygmaeus	0	0	0	0	0	20
LT4	Plecotus auritus	0	0	0	0	2	12
LT5	Myotis daubentonii	0	0	0	0	0	9
LT5	Myotis mystacinus	0	0	0	0	0	1
LT5	Myotis nattereri	0	0	0	0	0	7

Detector ID	Species/Species Group	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT5	Nyctalus leisleri	0	0	0	0	0	26
LT5	Pipistrellus nathusii	0	0	0	0	0	1
LT5	Pipistrellus pipistrellus	0	0	0	0	0	11
LT5	Pipistrellus pygmaeus	0	0	0	0	0	20
LT5	Plecotus auritus	0	0	0	0	1	14
LT6	Myotis daubentonii	0	0	0	0	0	13
LT6	Myotis nattereri	0	0	0	0	0	9
LT6	Nyctalus leisleri	0	0	0	0	0	23
LT6	Pipistrellus pipistrellus	0	0	0	0	0	16
LT6	Pipistrellus pygmaeus	0	0	0	0	0	21
LT6	Plecotus auritus	0	0	0	0	0	11
LT7	Myotis daubentonii	0	0	0	0	0	16
LT7	Myotis nattereri	0	0	0	0	1	6
LT7	Nyctalus leisleri	0	0	0	0	0	24
LT7	Pipistrellus pipistrellus	0	0	0	0	0	16
LT7	Pipistrellus pygmaeus	0	0	0	0	0	22
LT7	Plecotus auritus	0	0	0	0	0	12
LT8	Myotis daubentonii	0	0	0	0	0	12
LT8	Myotis mystacinus	0	0	0	0	0	7
LT8	Myotis nattereri	0	0	0	0	0	7
LT8	Nyctalus leisleri	0	0	0	0	4	22
LT8	Pipistrellus pipistrellus	0	0	0	0	0	20

Detector ID	Species/Species Group	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT8	Pipistrellus pygmaeus	0	0	0	0	0	20
LT8	Plecotus auritus	0	0	0	0	0	13
LT9	Myotis daubentonii	0	0	0	0	9	8
LT9	Myotis mystacinus	0	0	0	0	0	6
LT9	Myotis nattereri	0	0	1	2	9	3
LT9	Nyctalus leisleri	0	0	0	0	0	21
LT9	Pipistrellus nathusii	0	0	0	0	0	3
LT9	Pipistrellus pipistrellus	0	0	0	0	0	16
LT9	Pipistrellus pygmaeus	0	0	0	0	0	19
LT9	Plecotus auritus	0	0	0	2	6	8

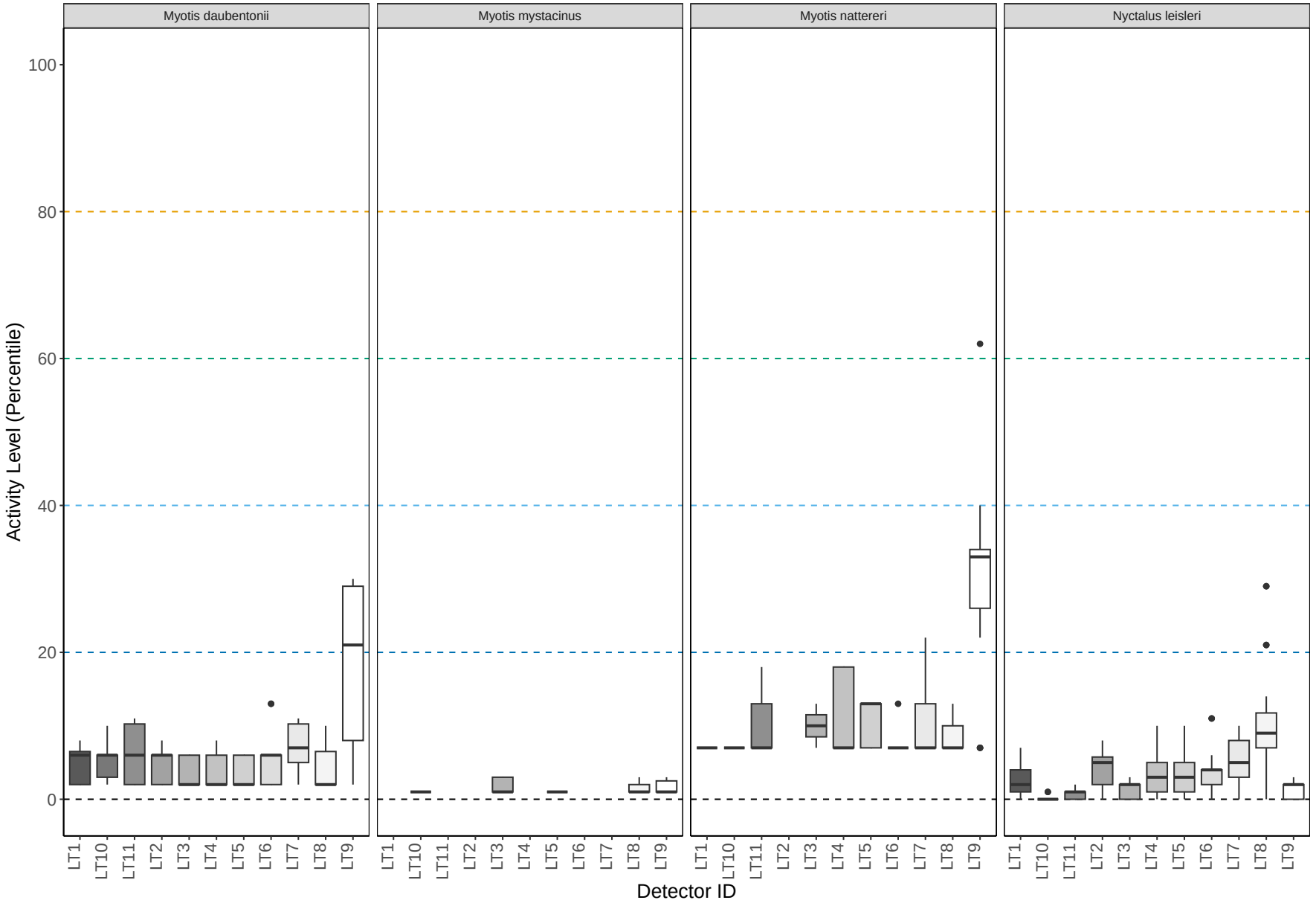
Table 4. Summary table showing key metrics for each species recorded. The reference range is the number of nights for each species that your data were compared to. We recommend a Reference Range of 200+ to be confident in the relative activity level.

Detector ID	Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded	Reference Range
LT1	Myotis daubentonii	6	4 - 7	8	16	6724
LT1	Myotis nattereri	7	7 - 7	7	5	1914
LT1	Nyctalus leisleri	2	2 - 4	7	25	60815
LT1	Pipistrellus pipistrellus	0	0 - 0	0	20	1534004
LT1	Pipistrellus pygmaeus	7	6 - 9	12	21	407082
LT1	Plecotus auritus	4	2.5 - 8.5	13	13	23418
LT10	Myotis daubentonii	6	4 - 7	10	10	6724
LT10	Myotis mystacinus	1	1 - 1	1	2	2677
LT10	Myotis nattereri	7	7 - 7	7	6	1914
LT10	Nyctalus leisleri	0	0 - 0	1	13	60815
LT10	Pipistrellus pipistrellus	0	0 - 0	0	11	1534004
LT10	Pipistrellus pygmaeus	3	3 - 9	17	17	407082
LT10	Plecotus auritus	1	1 - 1	4	7	23418
LT11	Myotis daubentonii	6	4 - 8.5	11	16	6724
LT11	Myotis nattereri	7	7 - 13	18	11	1914
LT11	Nyctalus leisleri	1	1 - 1	2	17	60815
LT11	Pipistrellus nathusii	8	8 - 8	8	2	3152
LT11	Pipistrellus pipistrellus	0	0 - 0	0	13	1534004
LT11	Pipistrellus pygmaeus	2	2 - 3.5	5	19	407082
LT11	Plecotus auritus	1	1 - 7	13	13	23418
LT2	Myotis daubentonii	6	2 - 6	8	11	6724
LT2	Nyctalus leisleri	5	3 - 6	8	18	60815
LT2	Pipistrellus pipistrellus	0	0 - 0	0	14	1534004
LT2	Pipistrellus pygmaeus	3	2.5 - 4	5	18	407082
LT2	Plecotus auritus	1	1 - 1	4	4	23418
LT3	Myotis daubentonii	2	2 - 4	6	9	6724
LT3	Myotis mystacinus	1	1 - 3	3	9	2677
LT3	Myotis nattereri	10	10 - 10	13	2	1914
LT3	Nyctalus leisleri	2	1.5 - 2.5	3	21	60815
LT3	Pipistrellus pipistrellus	0	0 - 0	0	13	1534004
LT3	Pipistrellus pygmaeus	1	1.5 - 3	4	19	407082
LT3	Plecotus auritus	1	1 - 2.5	4	7	23418
LT4	Myotis daubentonii	2	2 - 4	8	12	6724

Detector ID	Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded	Reference Range
LT4	Myotis nattereri	7	7 - 15.5	18	9	1914
LT4	Nyctalus leisleri	3	3 - 5.5	10	26	60815
LT4	Pipistrellus pipistrellus	0	0 - 0	0	11	1534004
LT4	Pipistrellus pygmaeus	0	1.5 - 2	2	20	407082
LT4	Plecotus auritus	9	5 - 14.5	28	14	23418
LT5	Myotis daubentonii	2	2 - 6	6	9	6724
LT5	Myotis mystacinus	1	0	1	1	2677
LT5	Myotis nattereri	13	10 - 13	13	7	1914
LT5	Nyctalus leisleri	3	2.5 - 5.5	10	26	60815
LT5	Pipistrellus nathusii	8	0	8	1	3152
LT5	Pipistrellus pipistrellus	0	0 - 0	0	11	1534004
LT5	Pipistrellus pygmaeus	0	1 - 2.5	3	20	407082
LT5	Plecotus auritus	9	4 - 9	28	15	23418
LT6	Myotis daubentonii	6	2 - 7.5	13	13	6724
LT6	Myotis nattereri	7	7 - 7	13	9	1914
LT6	Nyctalus leisleri	4	2.5 - 4	11	23	60815
LT6	Pipistrellus pipistrellus	0	0 - 0	0	16	1534004
LT6	Pipistrellus pygmaeus	1	1 - 2.5	4	21	407082
LT6	Plecotus auritus	1	1 - 2.5	4	11	23418
LT7	Myotis daubentonii	7	5 - 9	11	16	6724
LT7	Myotis nattereri	7	7 - 14.5	22	7	1914
LT7	Nyctalus leisleri	5	4 - 6.5	10	24	60815
LT7	Pipistrellus pipistrellus	0	0 - 0	0	16	1534004
LT7	Pipistrellus pygmaeus	2	2 - 4.5	6	22	407082
LT7	Plecotus auritus	3	1 - 8.5	16	12	23418
LT8	Myotis daubentonii	2	2 - 6	10	12	6724
LT8	Myotis mystacinus	1	1 - 2	3	7	2677
LT8	Myotis nattereri	7	7 - 10	13	7	1914
LT8	Nyctalus leisleri	9	8 - 14	29	26	60815
LT8	Pipistrellus pipistrellus	0	1 - 2	2	20	1534004
LT8	Pipistrellus pygmaeus	1	1 - 3	5	20	407082
LT8	Plecotus auritus	9	4 - 11	15	13	23418
LT9	Myotis daubentonii	21	12.5 - 25.5	30	17	6724
LT9	Myotis mystacinus	1	1 - 2	3	6	2677
LT9	Myotis nattereri	33	20.5 - 36.5	62	15	1914
LT9	Nyctalus leisleri	2	1.5 - 2.5	3	21	60815

Detector ID	Species/Species Group	Median Percentile	95% CIs	Max Percentile	Nights Recorded	Reference Range
LT9	Pipistrellus nathusii	8	8 - 8	13	3	3152
LT9	Pipistrellus pipistrellus	0	0 - 0	0	16	1534004
LT9	Pipistrellus pygmaeus	2	2 - 7	12	19	407082
LT9	Plecotus auritus	18	10 - 26	44	16	23418

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).


Myotis daubentonii
Myotis mystacinus
Myotis nattereri
Nyctalus leisleri
Activity Level (Percentile)
100
80
60
40
20
0
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID

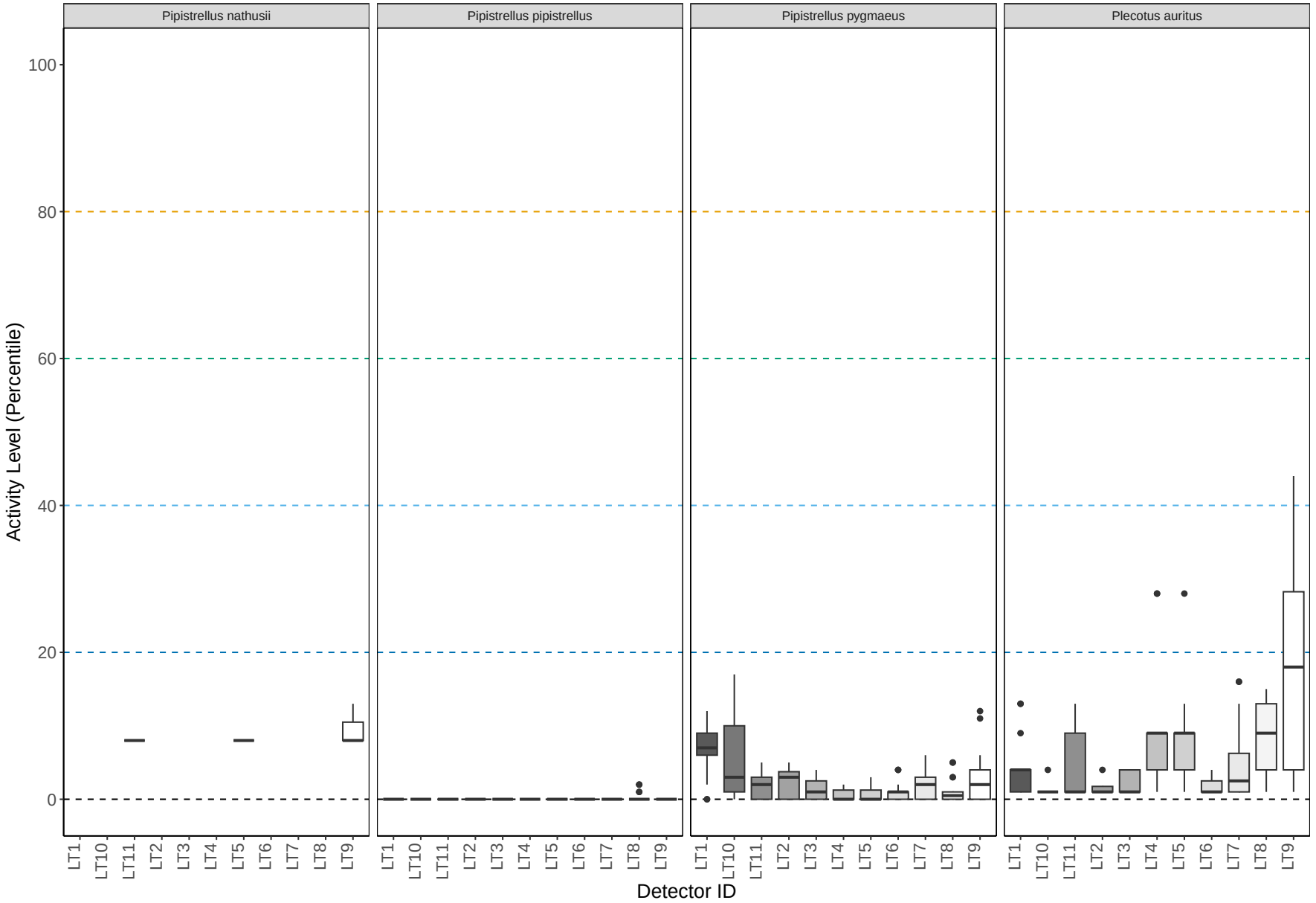
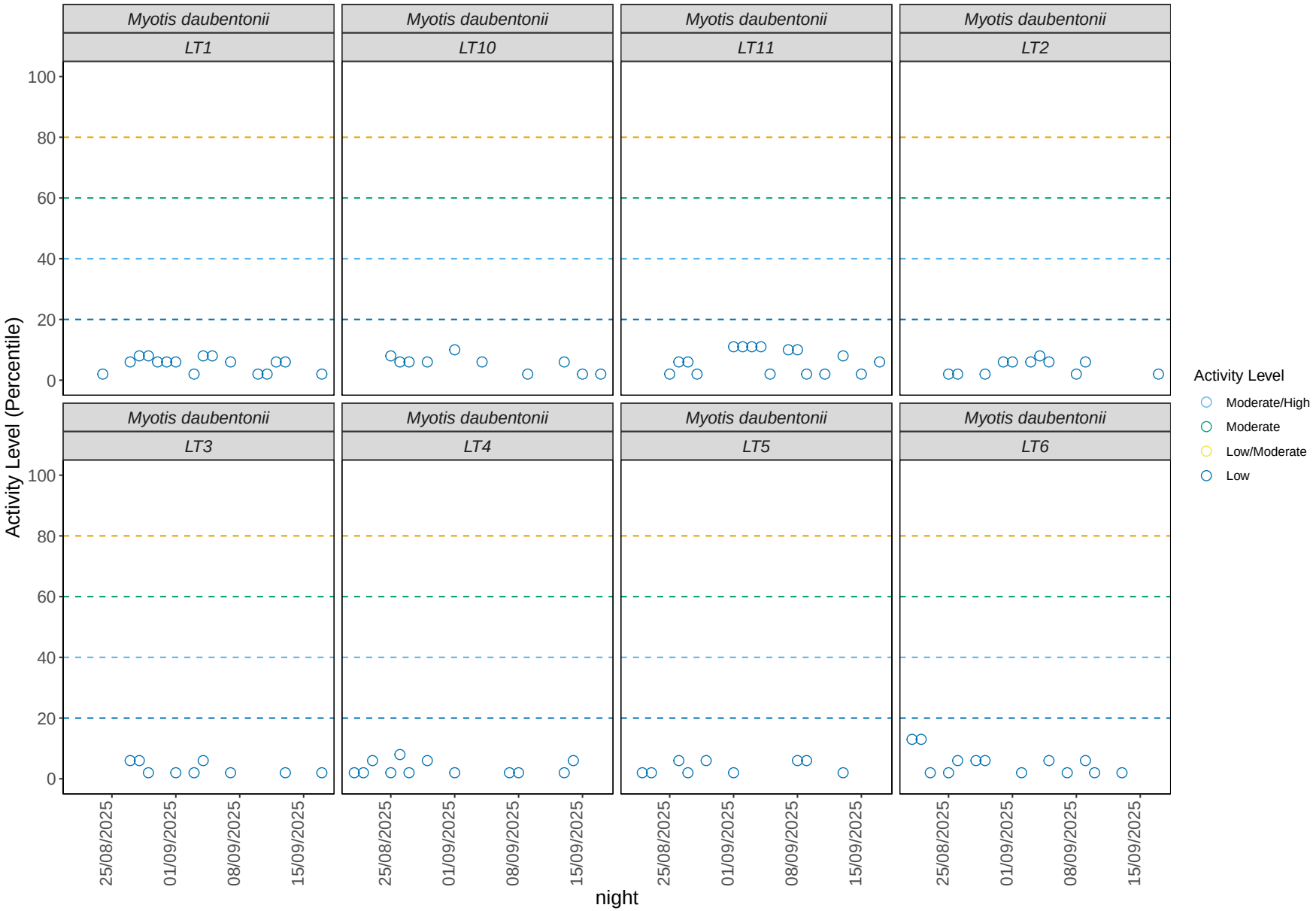
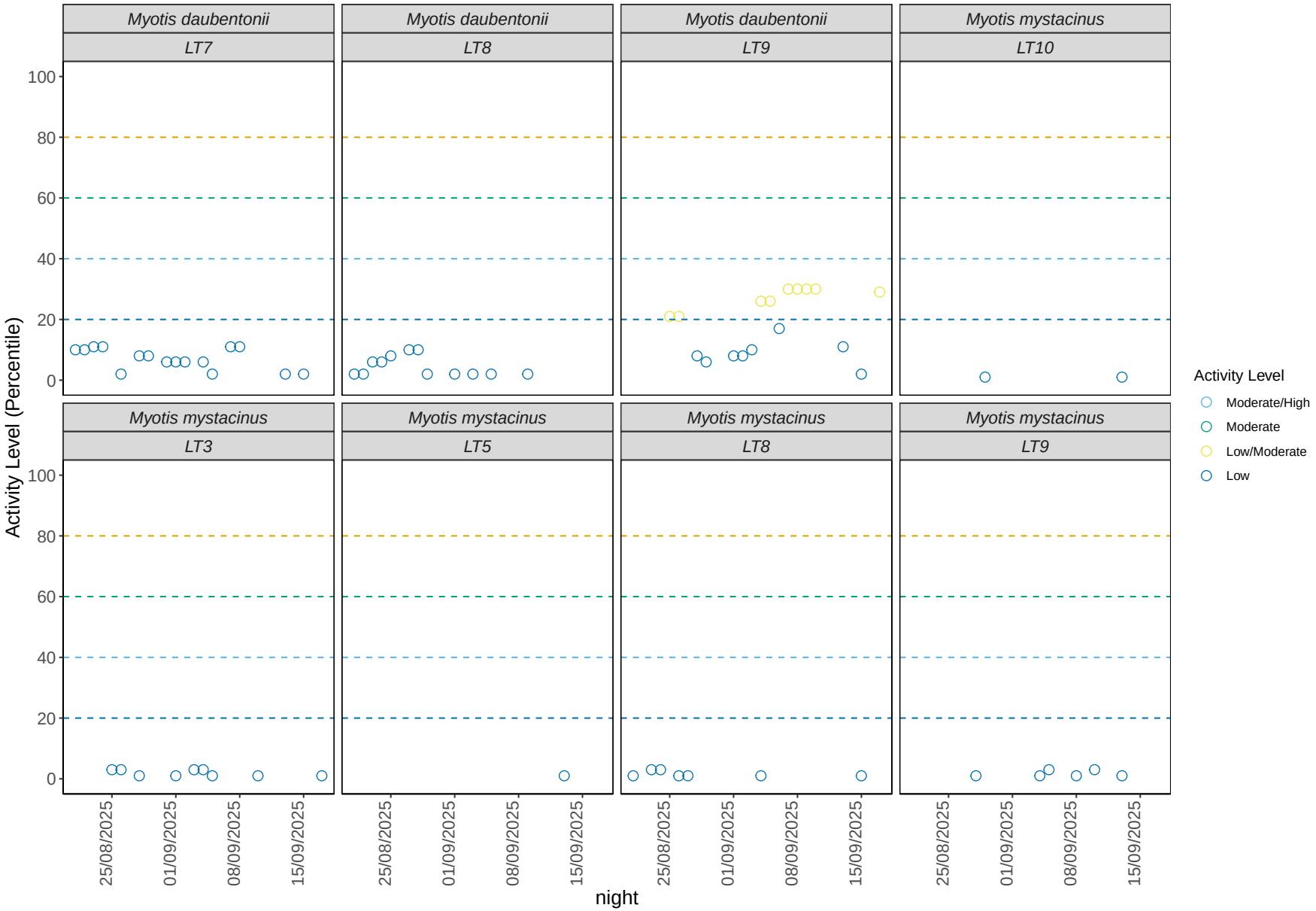
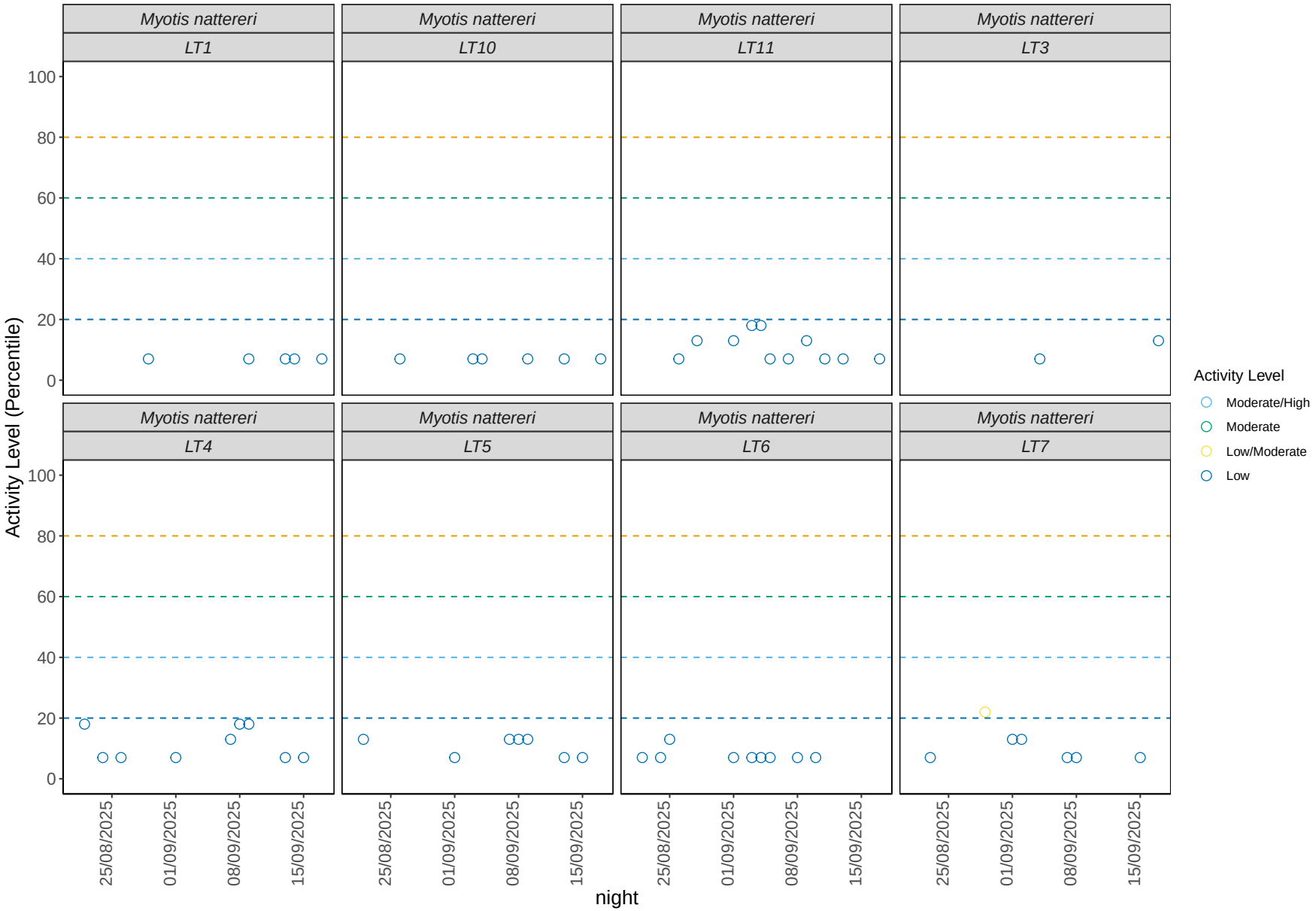
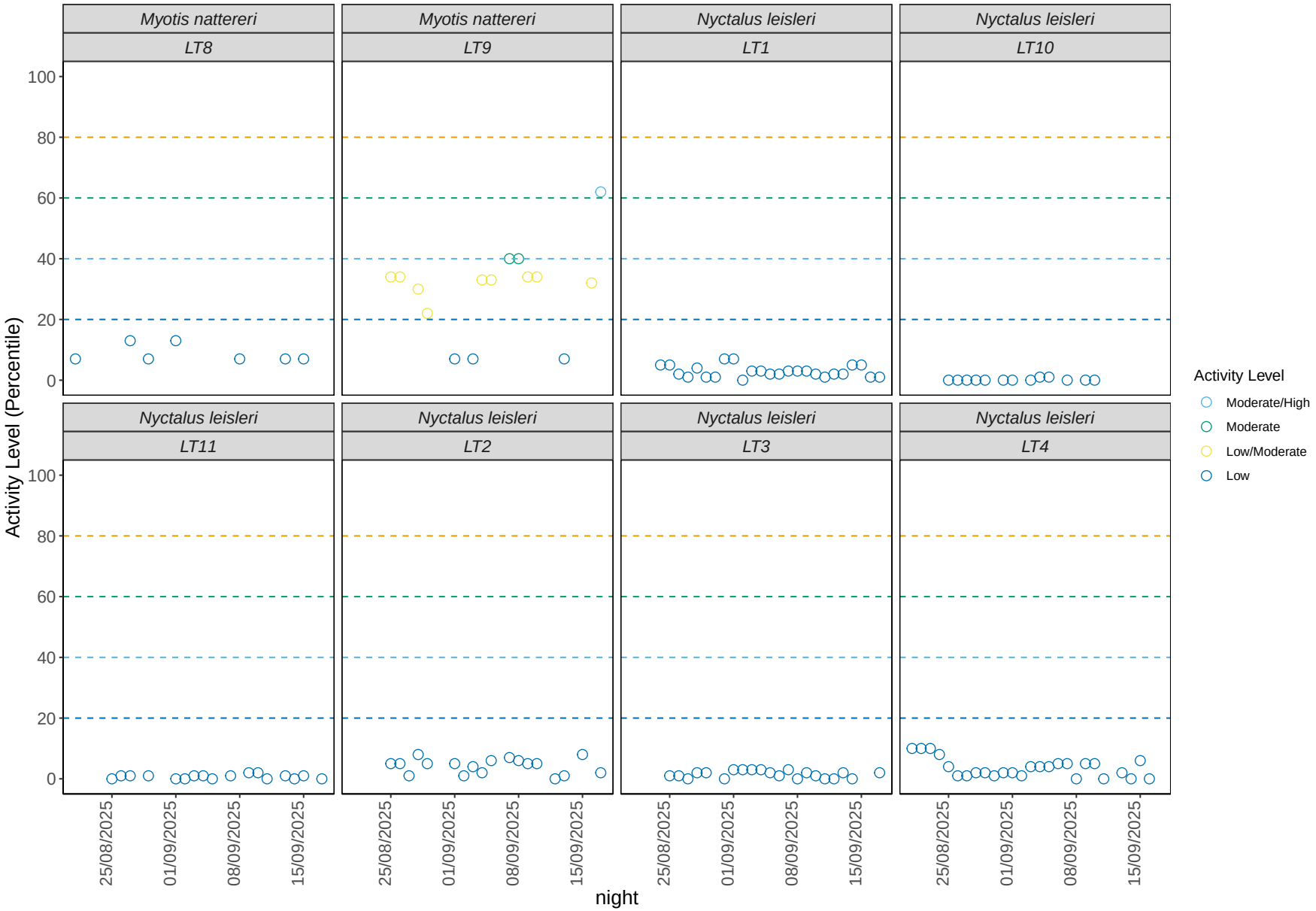

Pipistrellus nathusii
Pipistrellus pipistrellus
Pipistrellus pygmaeus
Plecotus auritus
Activity Level (Percentile)
100
80
60
40
20
0
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID

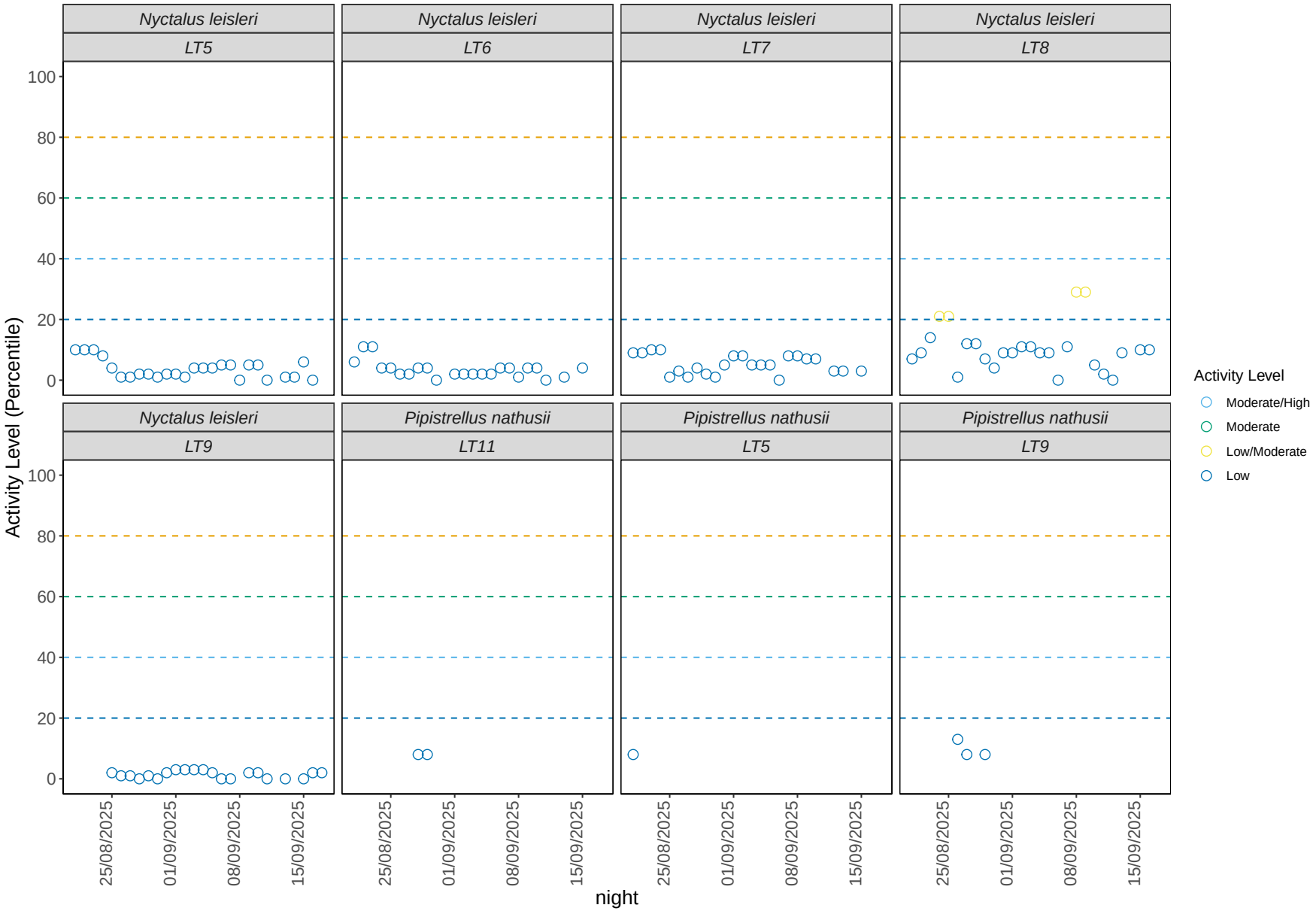
Figure 3. The activity level (percentile) of bats recorded across each night of the bat survey.

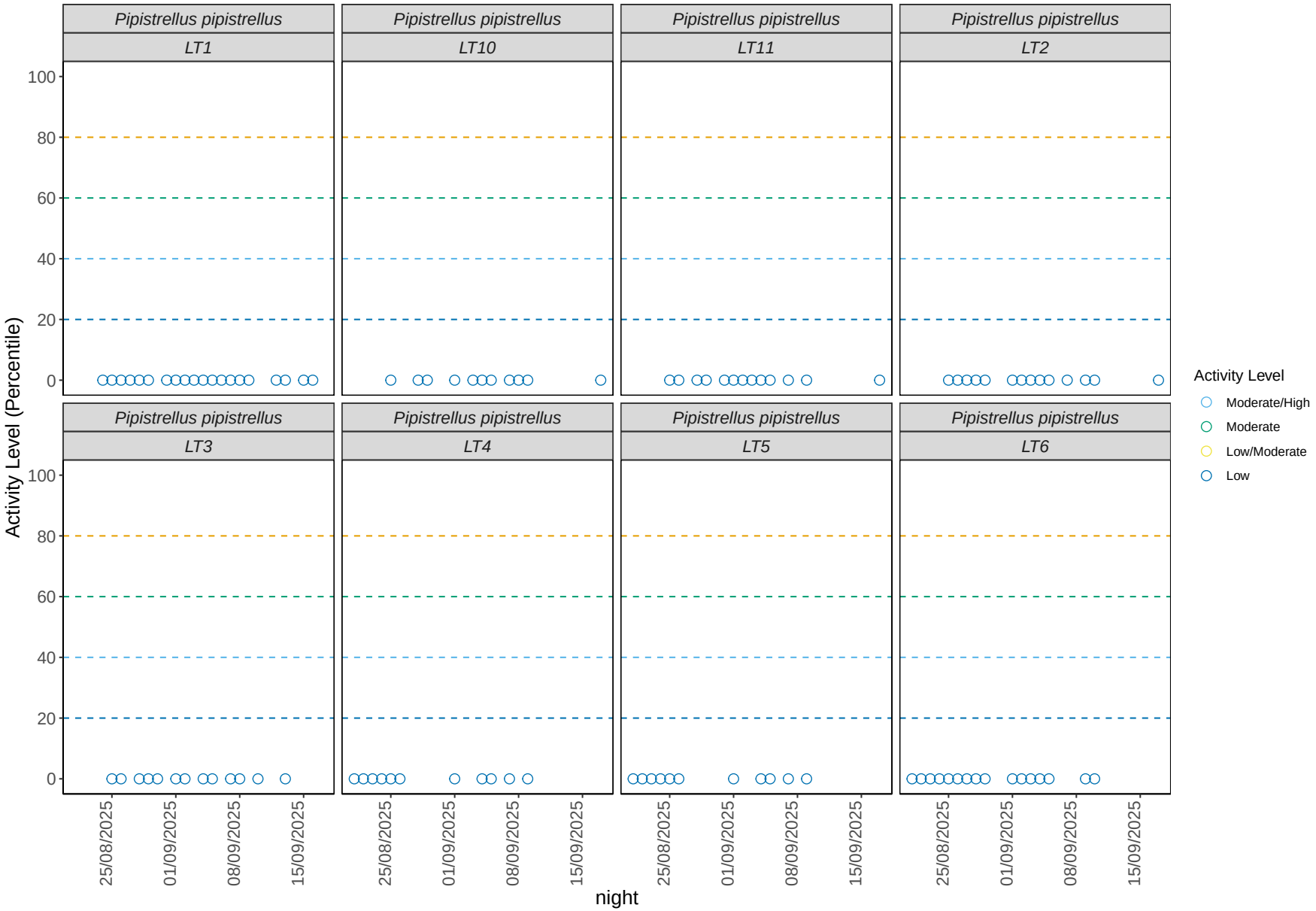

Myotis daubentonii
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
Activity Level (Percentile)
100
80
60
40
20
0
25/08/2025
01/09/2025
08/09/2025
15/09/2025
night
Activity Level
Moderate/High
Moderate
Low/Moderate
Low

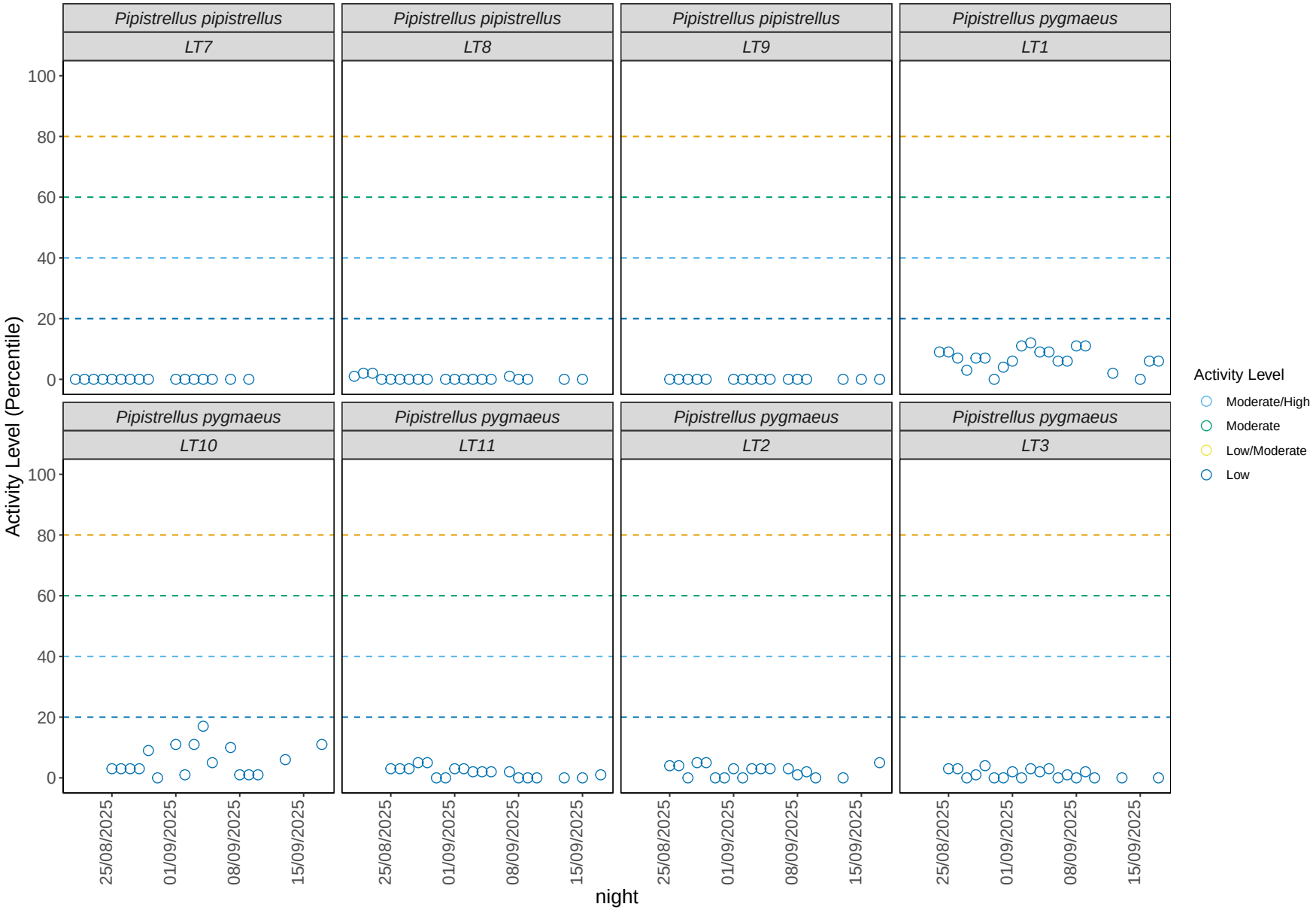

Myotis daubentonii
LT7
Myotis daubentonii
LT8
Myotis daubentonii
LT9
Myotis mystacinus
LT10
Myotis mystacinus
LT3
Myotis mystacinus
LT5
Myotis mystacinus
LT8
Myotis mystacinus
LT9
Activity Level (Percentile)
100
80
60
40
20
0
25/08/2025
01/09/2025
08/09/2025
15/09/2025
night
Activity Level
Moderate/High
Moderate
Low/Moderate
Low

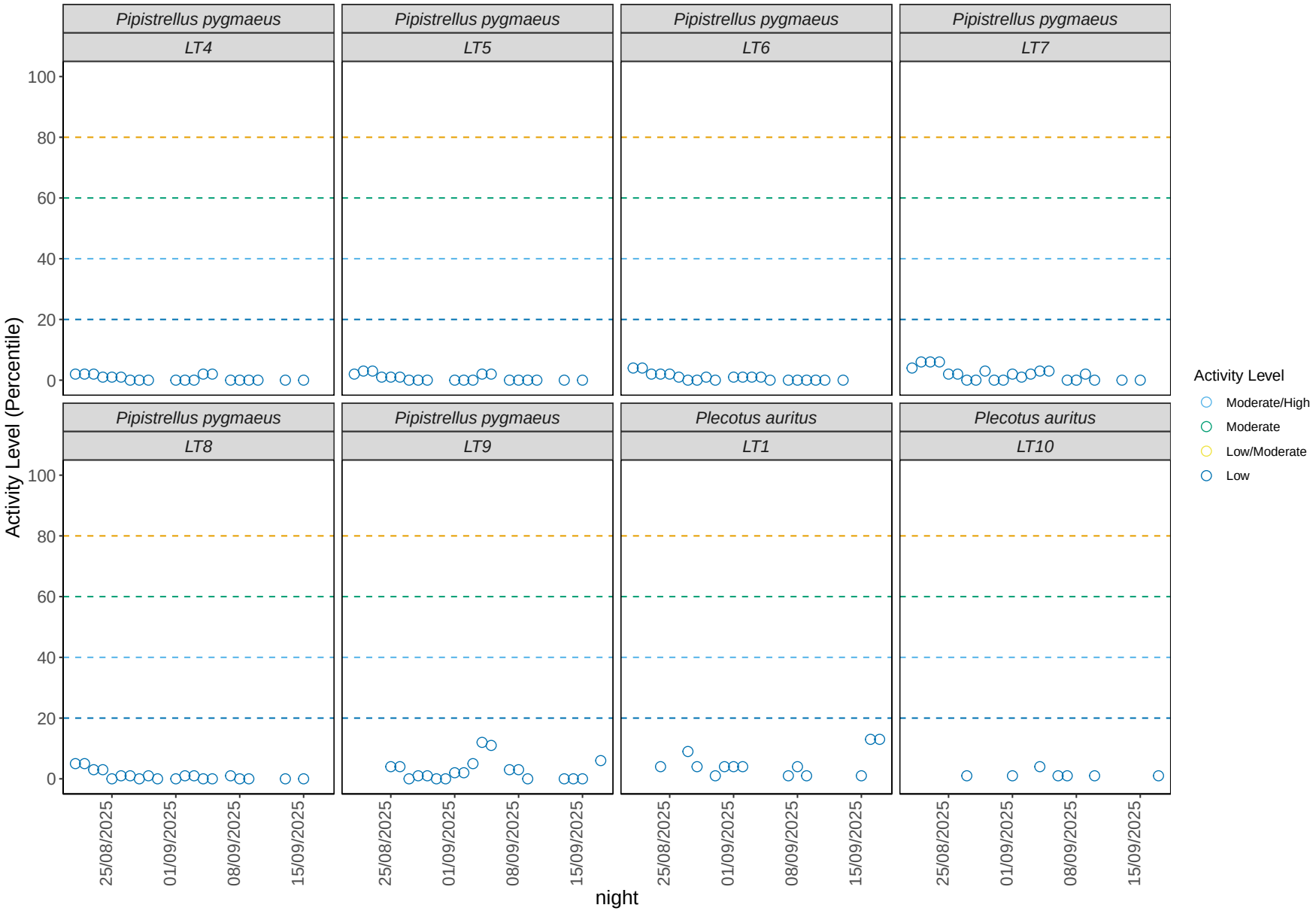

Myotis nattereri
LT1
LT10
LT11
LT3
LT4
LT5
LT6
LT7
Activity Level (Percentile)
0
20
40
60
80
100
25/08/2025
01/09/2025
08/09/2025
15/09/2025
night
Activity Level
Moderate/High
Moderate
Low/Moderate
Low

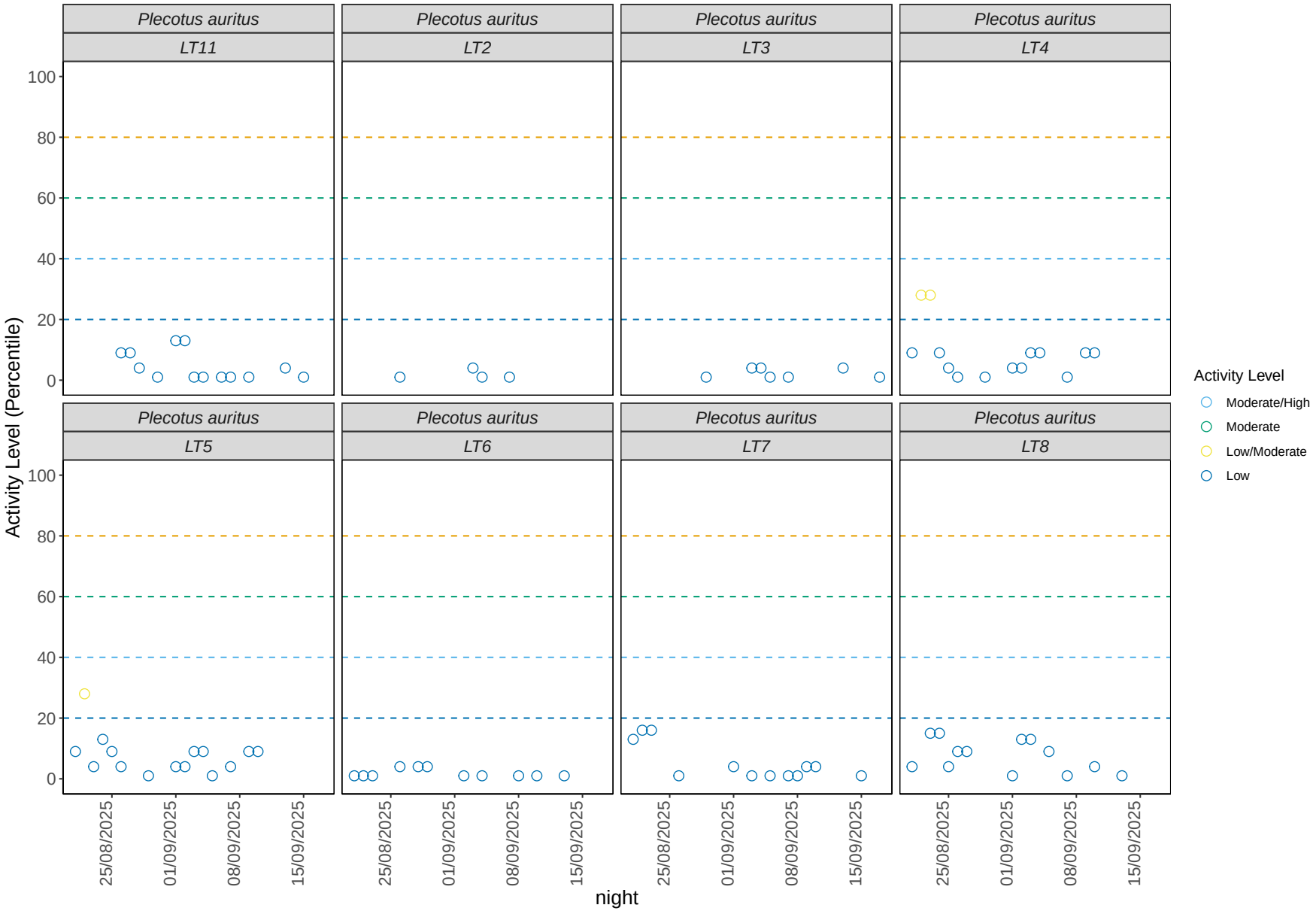

Myotis nattereri
LT8
Myotis nattereri
LT9
Nyctalus leisleri
LT1
Nyctalus leisleri
LT10
Nyctalus leisleri
LT11
Nyctalus leisleri
LT2
Nyctalus leisleri
LT3
Nyctalus leisleri
LT4
Activity Level (Percentile)
100
80
60
40
20
0
25/08/2025
01/09/2025
08/09/2025
15/09/2025
night
Activity Level
Moderate/High
Moderate
Low/Moderate
Low

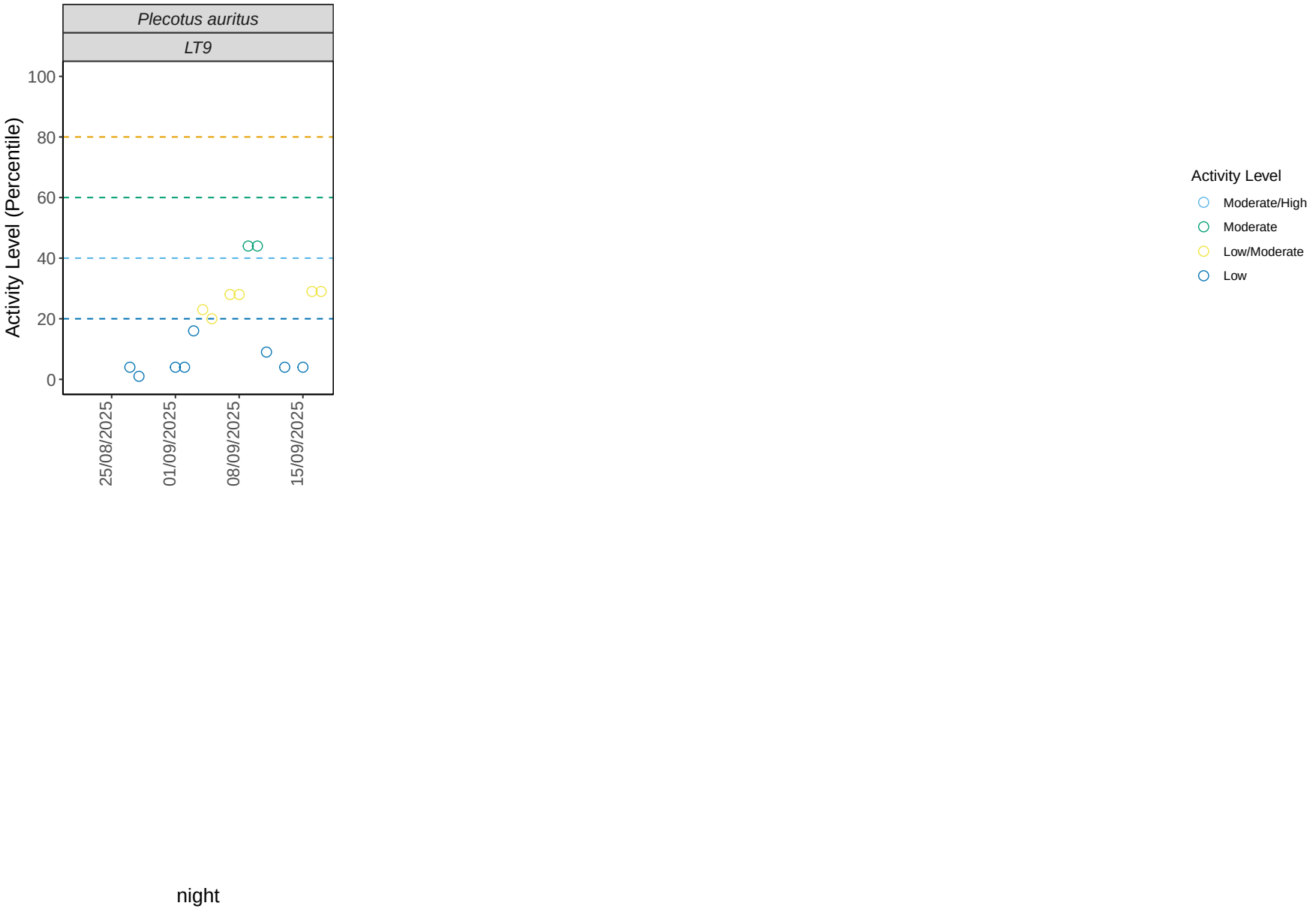

Nyctalus leisleri
LT5
Nyctalus leisleri
LT6
Nyctalus leisleri
LT7
Nyctalus leisleri
LT8
Nyctalus leisleri
LT9
Pipistrellus nathusii
LT11
Pipistrellus nathusii
LT5
Pipistrellus nathusii
LT9
Activity Level (Percentile)
100
80
60
40
20
0
25/08/2025
01/09/2025
08/09/2025
15/09/2025
night
Activity Level
Moderate/High
Moderate
Low/Moderate
Low


Pipistrellus pipistrellus
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
Activity Level (Percentile)
100
80
60
40
20
0
25/08/2025
01/09/2025
08/09/2025
15/09/2025
night
Activity Level
Moderate/High
Moderate
Low/Moderate
Low


Pipistrellus pipistrellus
LT7
Pipistrellus pipistrellus
LT8
Pipistrellus pipistrellus
LT9
Pipistrellus pygmaeus
LT1
Pipistrellus pygmaeus
LT10
Pipistrellus pygmaeus
LT11
Pipistrellus pygmaeus
LT2
Pipistrellus pygmaeus
LT3
Activity Level (Percentile)
100
80
60
40
20
0
25/08/2025
01/09/2025
08/09/2025
15/09/2025
night
Activity Level
Moderate/High
Moderate
Low/Moderate
Low


Pipistrellus pygmaeus
LT4
Pipistrellus pygmaeus
LT5
Pipistrellus pygmaeus
LT6
Pipistrellus pygmaeus
LT7
Pipistrellus pygmaeus
LT8
Pipistrellus pygmaeus
LT9
Plecotus auritus
LT1
Plecotus auritus
LT10
Activity Level (Percentile)
100
80
60
40
20
0
25/08/2025
01/09/2025
08/09/2025
15/09/2025
night
Activity Level
Moderate/High
Moderate
Low/Moderate
Low


Plecotus auritus
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
Activity Level (Percentile)
100
80
60
40
20
0
25/08/2025
01/09/2025
08/09/2025
15/09/2025
night
Activity Level
Moderate/High
Moderate
Low/Moderate
Low


Plecotus auritus
LT9
Activity Level (Percentile)
100
80
60
40
20
0
25/08/2025
01/09/2025
08/09/2025
15/09/2025
night
Activity Level
Moderate/High
Moderate
Low/Moderate
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 Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT1	Myotis daubentonii	Aug	0	0	0	0	0	6
LT1	Myotis daubentonii	Sep	0	0	0	0	0	10
LT1	Myotis nattereri	Aug	0	0	0	0	0	1
LT1	Myotis nattereri	Sep	0	0	0	0	0	4
LT1	Nyctalus leisleri	Aug	0	0	0	0	0	8
LT1	Nyctalus leisleri	Sep	0	0	0	0	0	17
LT1	Pipistrellus pipistrellus	Aug	0	0	0	0	0	7
LT1	Pipistrellus pipistrellus	Sep	0	0	0	0	0	13
LT1	Pipistrellus pygmaeus	Aug	0	0	0	0	0	8
LT1	Pipistrellus pygmaeus	Sep	0	0	0	0	0	13
LT1	Plecotus auritus	Aug	0	0	0	0	0	5
LT1	Plecotus auritus	Sep	0	0	0	0	0	8
LT10	Myotis daubentonii	Aug	0	0	0	0	0	4
LT10	Myotis daubentonii	Sep	0	0	0	0	0	6
LT10	Myotis mystacinus	Aug	0	0	0	0	0	1
LT10	Myotis mystacinus	Sep	0	0	0	0	0	1
LT10	Myotis nattereri	Aug	0	0	0	0	0	1
LT10	Myotis nattereri	Sep	0	0	0	0	0	5
LT10	Nyctalus leisleri	Aug	0	0	0	0	0	6
LT10	Nyctalus leisleri	Sep	0	0	0	0	0	7

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT10	Pipistrellus pipistrellus	Aug	0	0	0	0	0	3
LT10	Pipistrellus pipistrellus	Sep	0	0	0	0	0	8
LT10	Pipistrellus pygmaeus	Aug	0	0	0	0	0	6
LT10	Pipistrellus pygmaeus	Sep	0	0	0	0	0	11
LT10	Plecotus auritus	Aug	0	0	0	0	0	1
LT10	Plecotus auritus	Sep	0	0	0	0	0	6
LT11	Myotis daubentonii	Aug	0	0	0	0	0	4
LT11	Myotis daubentonii	Sep	0	0	0	0	0	12
LT11	Myotis nattereri	Aug	0	0	0	0	0	2
LT11	Myotis nattereri	Sep	0	0	0	0	0	9
LT11	Nyctalus leisleri	Aug	0	0	0	0	0	4
LT11	Nyctalus leisleri	Sep	0	0	0	0	0	13
LT11	Pipistrellus nathusii	Aug	0	0	0	0	0	2
LT11	Pipistrellus pipistrellus	Aug	0	0	0	0	0	5
LT11	Pipistrellus pipistrellus	Sep	0	0	0	0	0	8
LT11	Pipistrellus pygmaeus	Aug	0	0	0	0	0	7
LT11	Pipistrellus pygmaeus	Sep	0	0	0	0	0	12
LT11	Plecotus auritus	Aug	0	0	0	0	0	4
LT11	Plecotus auritus	Sep	0	0	0	0	0	9
LT2	Myotis daubentonii	Aug	0	0	0	0	0	4
LT2	Myotis daubentonii	Sep	0	0	0	0	0	7

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT2	Nyctalus leisleri	Aug	0	0	0	0	0	5
LT2	Nyctalus leisleri	Sep	0	0	0	0	0	13
LT2	Pipistrellus pipistrellus	Aug	0	0	0	0	0	5
LT2	Pipistrellus pipistrellus	Sep	0	0	0	0	0	9
LT2	Pipistrellus pygmaeus	Aug	0	0	0	0	0	7
LT2	Pipistrellus pygmaeus	Sep	0	0	0	0	0	11
LT2	Plecotus auritus	Aug	0	0	0	0	0	1
LT2	Plecotus auritus	Sep	0	0	0	0	0	3
LT3	Myotis daubentonii	Aug	0	0	0	0	0	3
LT3	Myotis daubentonii	Sep	0	0	0	0	0	6
LT3	Myotis mystacinus	Aug	0	0	0	0	0	3
LT3	Myotis mystacinus	Sep	0	0	0	0	0	6
LT3	Myotis nattereri	Sep	0	0	0	0	0	2
LT3	Nyctalus leisleri	Aug	0	0	0	0	0	6
LT3	Nyctalus leisleri	Sep	0	0	0	0	0	15
LT3	Pipistrellus pipistrellus	Aug	0	0	0	0	0	5
LT3	Pipistrellus pipistrellus	Sep	0	0	0	0	0	8
LT3	Pipistrellus pygmaeus	Aug	0	0	0	0	0	7
LT3	Pipistrellus pygmaeus	Sep	0	0	0	0	0	12
LT3	Plecotus auritus	Aug	0	0	0	0	0	1
LT3	Plecotus auritus	Sep	0	0	0	0	0	6

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT4	Myotis daubentonii	Aug	0	0	0	0	0	7
LT4	Myotis daubentonii	Sep	0	0	0	0	0	5
LT4	Myotis nattereri	Aug	0	0	0	0	0	3
LT4	Myotis nattereri	Sep	0	0	0	0	0	6
LT4	Nyctalus leisleri	Aug	0	0	0	0	0	11
LT4	Nyctalus leisleri	Sep	0	0	0	0	0	15
LT4	Pipistrellus pipistrellus	Aug	0	0	0	0	0	6
LT4	Pipistrellus pipistrellus	Sep	0	0	0	0	0	5
LT4	Pipistrellus pygmaeus	Aug	0	0	0	0	0	9
LT4	Pipistrellus pygmaeus	Sep	0	0	0	0	0	11
LT4	Plecotus auritus	Aug	0	0	0	0	2	5
LT4	Plecotus auritus	Sep	0	0	0	0	0	7
LT5	Myotis daubentonii	Aug	0	0	0	0	0	5
LT5	Myotis daubentonii	Sep	0	0	0	0	0	4
LT5	Myotis mystacinus	Sep	0	0	0	0	0	1
LT5	Myotis nattereri	Aug	0	0	0	0	0	1
LT5	Myotis nattereri	Sep	0	0	0	0	0	6
LT5	Nyctalus leisleri	Aug	0	0	0	0	0	11
LT5	Nyctalus leisleri	Sep	0	0	0	0	0	15
LT5	Pipistrellus nathusii	Aug	0	0	0	0	0	1
LT5	Pipistrellus pipistrellus	Aug	0	0	0	0	0	6
LT5	Pipistrellus pipistrellus	Sep	0	0	0	0	0	5

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT5	Pipistrellus pygmaeus	Aug	0	0	0	0	0	9
LT5	Pipistrellus pygmaeus	Sep	0	0	0	0	0	11
LT5	Plecotus auritus	Aug	0	0	0	0	1	6
LT5	Plecotus auritus	Sep	0	0	0	0	0	8
LT6	Myotis daubentonii	Aug	0	0	0	0	0	7
LT6	Myotis daubentonii	Sep	0	0	0	0	0	6
LT6	Myotis nattereri	Aug	0	0	0	0	0	3
LT6	Myotis nattereri	Sep	0	0	0	0	0	6
LT6	Nyctalus leisleri	Aug	0	0	0	0	0	10
LT6	Nyctalus leisleri	Sep	0	0	0	0	0	13
LT6	Pipistrellus pipistrellus	Aug	0	0	0	0	0	9
LT6	Pipistrellus pipistrellus	Sep	0	0	0	0	0	7
LT6	Pipistrellus pygmaeus	Aug	0	0	0	0	0	10
LT6	Pipistrellus pygmaeus	Sep	0	0	0	0	0	11
LT6	Plecotus auritus	Aug	0	0	0	0	0	6
LT6	Plecotus auritus	Sep	0	0	0	0	0	5
LT7	Myotis daubentonii	Aug	0	0	0	0	0	8
LT7	Myotis daubentonii	Sep	0	0	0	0	0	8
LT7	Myotis nattereri	Aug	0	0	0	0	1	1
LT7	Myotis nattereri	Sep	0	0	0	0	0	5
LT7	Nyctalus leisleri	Aug	0	0	0	0	0	11
LT7	Nyctalus leisleri	Sep	0	0	0	0	0	13
LT7	Pipistrellus pipistrellus	Aug	0	0	0	0	0	9

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT7	Pipistrellus pipistrellus	Sep	0	0	0	0	0	7
LT7	Pipistrellus pygmaeus	Aug	0	0	0	0	0	11
LT7	Pipistrellus pygmaeus	Sep	0	0	0	0	0	11
LT7	Plecotus auritus	Aug	0	0	0	0	0	4
LT7	Plecotus auritus	Sep	0	0	0	0	0	8
LT8	Myotis daubentonii	Aug	0	0	0	0	0	8
LT8	Myotis daubentonii	Sep	0	0	0	0	0	4
LT8	Myotis mystacinus	Aug	0	0	0	0	0	5
LT8	Myotis mystacinus	Sep	0	0	0	0	0	2
LT8	Myotis nattereri	Aug	0	0	0	0	0	3
LT8	Myotis nattereri	Sep	0	0	0	0	0	4
LT8	Nyctalus leisleri	Aug	0	0	0	0	2	9
LT8	Nyctalus leisleri	Sep	0	0	0	0	2	13
LT8	Pipistrellus pipistrellus	Aug	0	0	0	0	0	10
LT8	Pipistrellus pipistrellus	Sep	0	0	0	0	0	10
LT8	Pipistrellus pygmaeus	Aug	0	0	0	0	0	10
LT8	Pipistrellus pygmaeus	Sep	0	0	0	0	0	10
LT8	Plecotus auritus	Aug	0	0	0	0	0	6
LT8	Plecotus auritus	Sep	0	0	0	0	0	7
LT9	Myotis daubentonii	Aug	0	0	0	0	2	2
LT9	Myotis daubentonii	Sep	0	0	0	0	7	6

Detector ID	Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
LT9	Myotis mystacinus	Aug	0	0	0	0	0	1
LT9	Myotis mystacinus	Sep	0	0	0	0	0	5
LT9	Myotis nattereri	Aug	0	0	0	0	4	0
LT9	Myotis nattereri	Sep	0	0	1	2	5	3
LT9	Nyctalus leisleri	Aug	0	0	0	0	0	7
LT9	Nyctalus leisleri	Sep	0	0	0	0	0	14
LT9	Pipistrellus nathusii	Aug	0	0	0	0	0	3
LT9	Pipistrellus pipistrellus	Aug	0	0	0	0	0	5
LT9	Pipistrellus pipistrellus	Sep	0	0	0	0	0	11
LT9	Pipistrellus pygmaeus	Aug	0	0	0	0	0	7
LT9	Pipistrellus pygmaeus	Sep	0	0	0	0	0	12
LT9	Plecotus auritus	Aug	0	0	0	0	0	2
LT9	Plecotus auritus	Sep	0	0	0	2	6	6

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
LT1	Myotis daubentonii	Aug	6	4 - 7	8	6
LT1	Myotis daubentonii	Sep	6	4 - 7	8	10
LT1	Myotis nattereri	Aug	7	7 - 7	7	1
LT1	Myotis nattereri	Sep	7	7 - 7	7	4
LT1	Nyctalus leisleri	Aug	3	2 - 4	7	8
LT1	Nyctalus leisleri	Sep	2	2 - 4	7	17
LT1	Pipistrellus pipistrellus	Aug	0	0 - 0	0	7
LT1	Pipistrellus pipistrellus	Sep	0	0 - 0	0	13
LT1	Pipistrellus pygmaeus	Aug	7	6 - 9	9	8
LT1	Pipistrellus pygmaeus	Sep	6	6 - 9	12	13
LT1	Plecotus auritus	Aug	4	2.5 - 8.5	9	5
LT1	Plecotus auritus	Sep	4	2.5 - 8.5	13	8
LT10	Myotis daubentonii	Aug	6	4 - 7	8	4
LT10	Myotis daubentonii	Sep	4	4 - 7	10	6
LT10	Myotis mystacinus	Aug	1	1 - 1	1	1
LT10	Myotis mystacinus	Sep	1	1 - 1	1	1
LT10	Myotis nattereri	Aug	7	7 - 7	7	1
LT10	Myotis nattereri	Sep	7	7 - 7	7	5
LT10	Nyctalus leisleri	Aug	0	0 - 0	0	6
LT10	Nyctalus leisleri	Sep	0	0 - 0	1	7
LT10	Pipistrellus pipistrellus	Aug	0	0 - 0	0	3
LT10	Pipistrellus pipistrellus	Sep	0	0 - 0	0	8
LT10	Pipistrellus pygmaeus	Aug	3	3 - 9	9	6
LT10	Pipistrellus pygmaeus	Sep	6	3 - 9	17	11
LT10	Plecotus auritus	Aug	1	1 - 1	1	1
LT10	Plecotus auritus	Sep	1	1 - 1	4	6
LT11	Myotis daubentonii	Aug	4	4 - 8.5	6	4
LT11	Myotis daubentonii	Sep	9	4 - 8.5	11	12
LT11	Myotis nattereri	Aug	10	7 - 13	13	2
LT11	Myotis nattereri	Sep	7	7 - 13	18	9
LT11	Nyctalus leisleri	Aug	1	1 - 1	1	4
LT11	Nyctalus leisleri	Sep	1	1 - 1	2	13
LT11	Pipistrellus nathusii	Aug	8	8 - 8	8	2

Detector ID	Species/Species Group	month	Median Percentile	95% CIs	Max. Percentile	Nights Recorded
LT11	Pipistrellus pipistrellus	Aug	0	0 - 0	0	5
LT11	Pipistrellus pipistrellus	Sep	0	0 - 0	0	8
LT11	Pipistrellus pygmaeus	Aug	3	2 - 3.5	5	7
LT11	Pipistrellus pygmaeus	Sep	2	2 - 3.5	3	12
LT11	Plecotus auritus	Aug	7	1 - 7	9	4
LT11	Plecotus auritus	Sep	1	1 - 7	13	9
LT2	Myotis daubentonii	Aug	2	2 - 6	6	4
LT2	Myotis daubentonii	Sep	6	2 - 6	8	7
LT2	Nyctalus leisleri	Aug	5	3 - 6	8	5
LT2	Nyctalus leisleri	Sep	5	3 - 6	8	13
LT2	Pipistrellus pipistrellus	Aug	0	0 - 0	0	5
LT2	Pipistrellus pipistrellus	Sep	0	0 - 0	0	9
LT2	Pipistrellus pygmaeus	Aug	4	2.5 - 4	5	7
LT2	Pipistrellus pygmaeus	Sep	3	2.5 - 4	5	11
LT2	Plecotus auritus	Aug	1	1 - 1	1	1
LT2	Plecotus auritus	Sep	1	1 - 1	4	3
LT3	Myotis daubentonii	Aug	6	2 - 4	6	3
LT3	Myotis daubentonii	Sep	2	2 - 4	6	6
LT3	Myotis mystacinus	Aug	3	1 - 3	3	3
LT3	Myotis mystacinus	Sep	1	1 - 3	3	6
LT3	Myotis nattereri	Sep	10	10 - 10	13	2
LT3	Nyctalus leisleri	Aug	1	1.5 - 2.5	2	6
LT3	Nyctalus leisleri	Sep	2	1.5 - 2.5	3	15
LT3	Pipistrellus pipistrellus	Aug	0	0 - 0	0	5
LT3	Pipistrellus pipistrellus	Sep	0	0 - 0	0	8
LT3	Pipistrellus pygmaeus	Aug	1	1.5 - 3	4	7
LT3	Pipistrellus pygmaeus	Sep	1	1.5 - 3	3	12
LT3	Plecotus auritus	Aug	1	1 - 2.5	1	1
LT3	Plecotus auritus	Sep	3	1 - 2.5	4	6
LT4	Myotis daubentonii	Aug	2	2 - 4	8	7
LT4	Myotis daubentonii	Sep	2	2 - 4	6	5
LT4	Myotis nattereri	Aug	7	7 - 15.5	18	3
LT4	Myotis nattereri	Sep	10	7 - 15.5	18	6
LT4	Nyctalus leisleri	Aug	2	3 - 5.5	10	11
LT4	Nyctalus leisleri	Sep	4	3 - 5.5	6	15
LT4	Pipistrellus pipistrellus	Aug	0	0 - 0	0	6

Detector ID	Species/Species Group	month	Median Percentile	95% CIs	Max. Percentile	Nights Recorded
LT4	Pipistrellus pipistrellus	Sep	0	0 - 0	0	5
LT4	Pipistrellus pygmaeus	Aug	1	1.5 - 2	2	9
LT4	Pipistrellus pygmaeus	Sep	0	1.5 - 2	2	11
LT4	Plecotus auritus	Aug	9	5 - 14.5	28	7
LT4	Plecotus auritus	Sep	9	5 - 14.5	9	7
LT5	Myotis daubentonii	Aug	2	2 - 6	6	5
LT5	Myotis daubentonii	Sep	4	2 - 6	6	4
LT5	Myotis mystacinus	Sep	1	0	1	1
LT5	Myotis nattereri	Aug	13	10 - 13	13	1
LT5	Myotis nattereri	Sep	10	10 - 13	13	6
LT5	Nyctalus leisleri	Aug	2	2.5 - 5.5	10	11
LT5	Nyctalus leisleri	Sep	4	2.5 - 5.5	6	15
LT5	Pipistrellus nathusii	Aug	8	0	8	1
LT5	Pipistrellus pipistrellus	Aug	0	0 - 0	0	6
LT5	Pipistrellus pipistrellus	Sep	0	0 - 0	0	5
LT5	Pipistrellus pygmaeus	Aug	1	1 - 2.5	3	9
LT5	Pipistrellus pygmaeus	Sep	0	1 - 2.5	2	11
LT5	Plecotus auritus	Aug	9	4 - 9	28	7
LT5	Plecotus auritus	Sep	7	4 - 9	9	8
LT6	Myotis daubentonii	Aug	6	2 - 7.5	13	7
LT6	Myotis daubentonii	Sep	2	2 - 7.5	6	6
LT6	Myotis nattereri	Aug	7	7 - 7	13	3
LT6	Myotis nattereri	Sep	7	7 - 7	7	6
LT6	Nyctalus leisleri	Aug	4	2.5 - 4	11	10
LT6	Nyctalus leisleri	Sep	2	2.5 - 4	4	13
LT6	Pipistrellus pipistrellus	Aug	0	0 - 0	0	9
LT6	Pipistrellus pipistrellus	Sep	0	0 - 0	0	7
LT6	Pipistrellus pygmaeus	Aug	2	1 - 2.5	4	10
LT6	Pipistrellus pygmaeus	Sep	0	1 - 2.5	1	11
LT6	Plecotus auritus	Aug	3	1 - 2.5	4	6
LT6	Plecotus auritus	Sep	1	1 - 2.5	1	5
LT7	Myotis daubentonii	Aug	9	5 - 9	11	8
LT7	Myotis daubentonii	Sep	6	5 - 9	11	8
LT7	Myotis nattereri	Aug	15	7 - 14.5	22	2
LT7	Myotis nattereri	Sep	7	7 - 14.5	13	5
LT7	Nyctalus leisleri	Aug	4	4 - 6.5	10	11

Detector ID	Species/Species Group	month	Median Percentile	95% CIs	Max. Percentile	Nights Recorded
LT7	Nyctalus leisleri	Sep	5	4 - 6.5	8	13
LT7	Pipistrellus pipistrellus	Aug	0	0 - 0	0	9
LT7	Pipistrellus pipistrellus	Sep	0	0 - 0	0	7
LT7	Pipistrellus pygmaeus	Aug	2	2 - 4.5	6	11
LT7	Pipistrellus pygmaeus	Sep	1	2 - 4.5	3	11
LT7	Plecotus auritus	Aug	15	1 - 8.5	16	4
LT7	Plecotus auritus	Sep	1	1 - 8.5	4	8
LT8	Myotis daubentonii	Aug	6	2 - 6	10	8
LT8	Myotis daubentonii	Sep	2	2 - 6	2	4
LT8	Myotis mystacinus	Aug	1	1 - 2	3	5
LT8	Myotis mystacinus	Sep	1	1 - 2	1	2
LT8	Myotis nattereri	Aug	7	7 - 10	13	3
LT8	Myotis nattereri	Sep	7	7 - 10	13	4
LT8	Nyctalus leisleri	Aug	9	8 - 14	21	11
LT8	Nyctalus leisleri	Sep	9	8 - 14	29	15
LT8	Pipistrellus pipistrellus	Aug	0	1 - 2	2	10
LT8	Pipistrellus pipistrellus	Sep	0	1 - 2	1	10
LT8	Pipistrellus pygmaeus	Aug	1	1 - 3	5	10
LT8	Pipistrellus pygmaeus	Sep	0	1 - 3	1	10
LT8	Plecotus auritus	Aug	9	4 - 11	15	6
LT8	Plecotus auritus	Sep	4	4 - 11	13	7
LT9	Myotis daubentonii	Aug	15	12.5 - 25.5	21	4
LT9	Myotis daubentonii	Sep	26	12.5 - 25.5	30	13
LT9	Myotis mystacinus	Aug	1	1 - 2	1	1
LT9	Myotis mystacinus	Sep	1	1 - 2	3	5
LT9	Myotis nattereri	Aug	32	20.5 - 36.5	34	4
LT9	Myotis nattereri	Sep	33	20.5 - 36.5	62	11
LT9	Nyctalus leisleri	Aug	1	1.5 - 2.5	2	7
LT9	Nyctalus leisleri	Sep	2	1.5 - 2.5	3	14
LT9	Pipistrellus nathusii	Aug	8	8 - 8	13	3
LT9	Pipistrellus pipistrellus	Aug	0	0 - 0	0	5
LT9	Pipistrellus pipistrellus	Sep	0	0 - 0	0	11
LT9	Pipistrellus pygmaeus	Aug	1	2 - 7	4	7
LT9	Pipistrellus pygmaeus	Sep	3	2 - 7	12	12
LT9	Plecotus auritus	Aug	3	10 - 26	4	2

LT9	Plecotus auritus	Sep	22	10 - 26	44	14

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 Exceptional Activity	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	0	0	0	9	132
Myotis mystacinus	0	0	0	0	0	25
Myotis nattereri	0	0	1	2	10	65
Nyctalus leisleri	0	0	0	0	4	236
Pipistrellus nathusii	0	0	0	0	0	6
Pipistrellus pipistrellus	0	0	0	0	0	161
Pipistrellus pygmaeus	0	0	0	0	0	216
Plecotus auritus	0	0	0	2	9	114

Table 8. Summary table showing key metrics for each species recorded.

Species/Species Group	Median Percentile	95% CIs	Max. Percentile	Nights Recorded
Myotis daubentonii	6	5 - 9	30	141
Myotis mystacinus	1	1 - 3	3	25
Myotis nattereri	7	7 - 7	62	78
Nyctalus leisleri	2	8 - 14	29	240
Pipistrellus nathusii	8	8 - 8	13	6
Pipistrellus pipistrellus	0	1 - 2	2	161
Pipistrellus pygmaeus	1	6 - 9	17	216
Plecotus auritus	4	5 - 14.5	44	125

Figure 4. The activity level (percentile) of bats recorded across each night of the bat survey for the **entire site**.

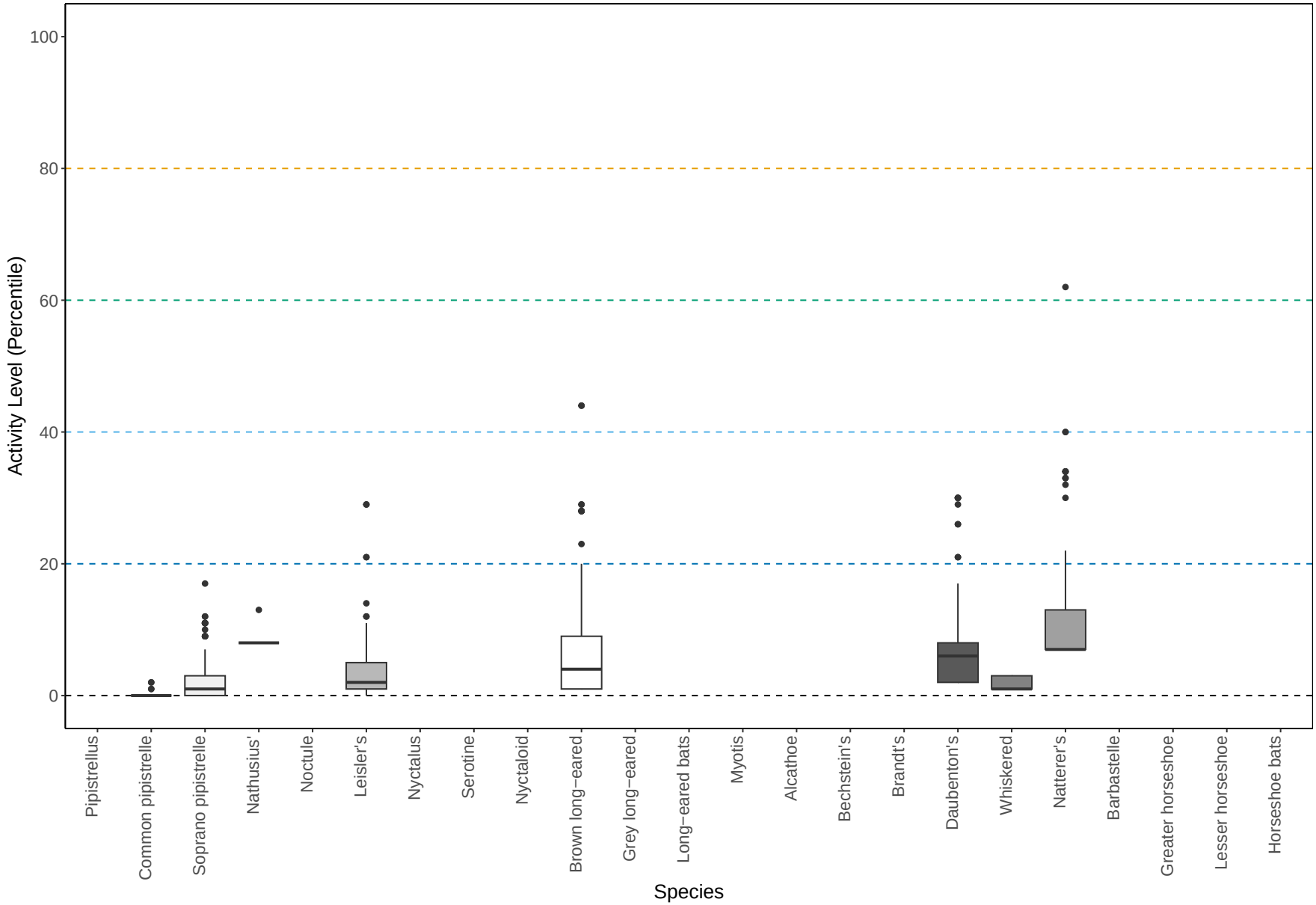
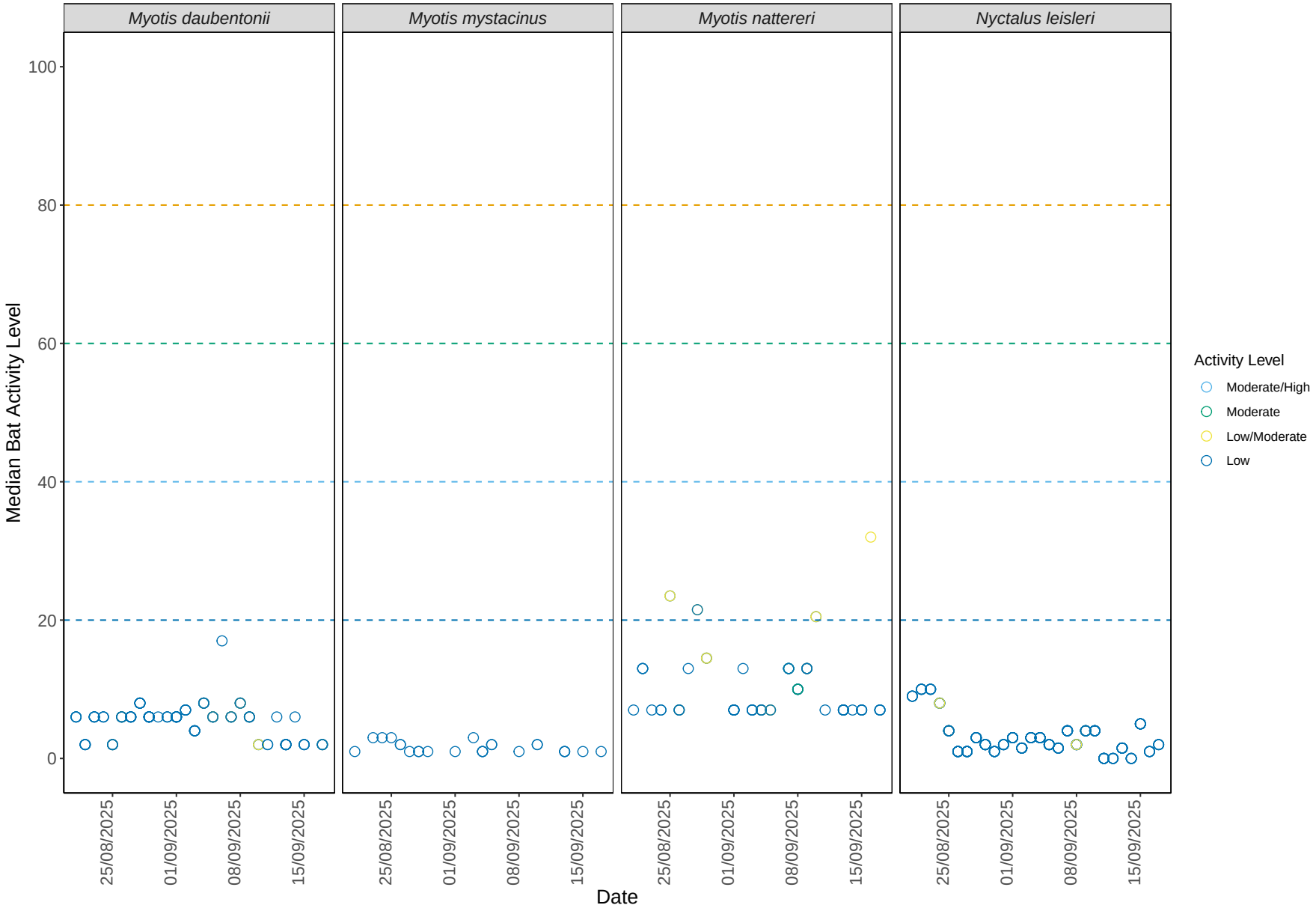
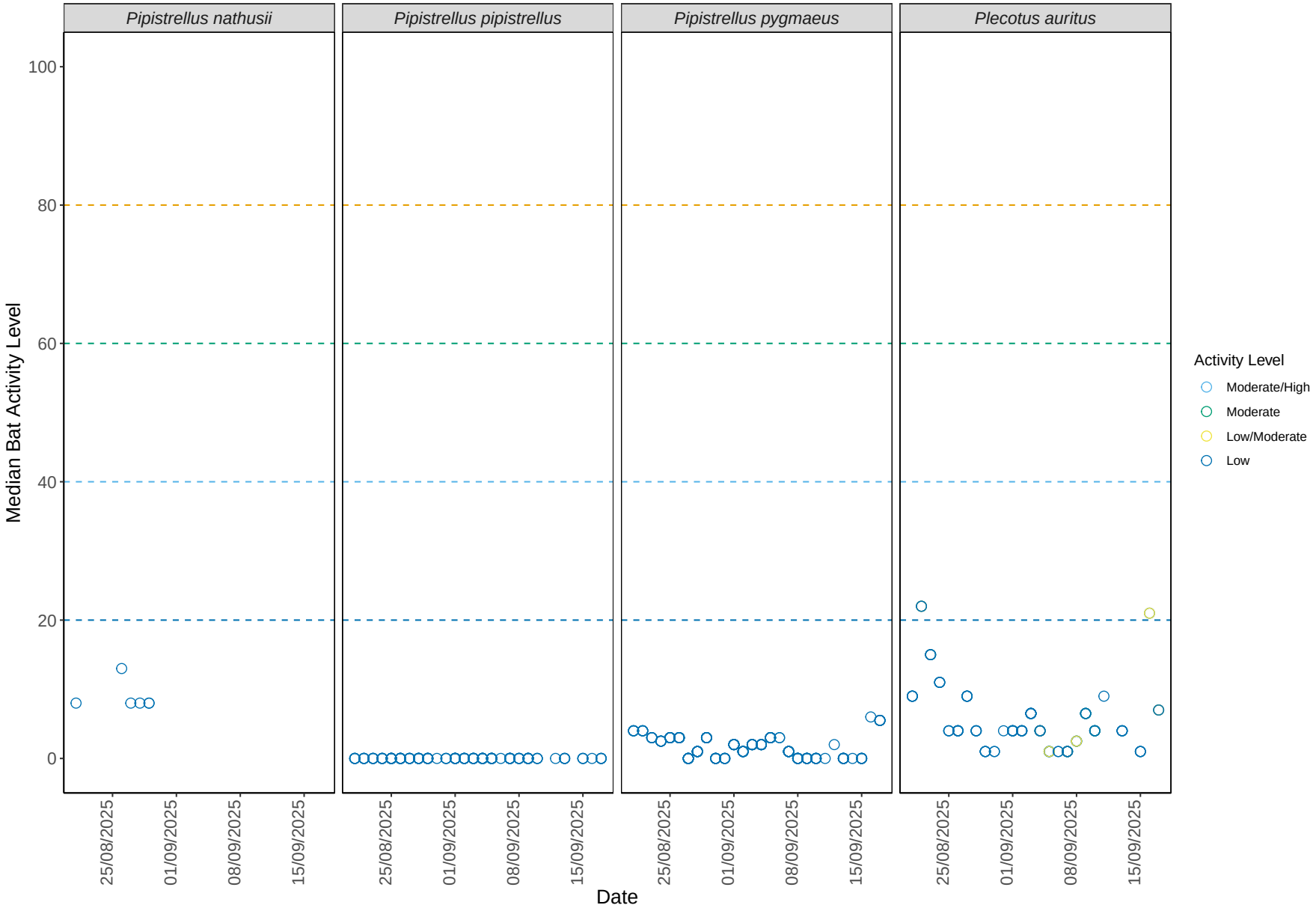

Activity Level (Percentile)
100
80
60
40
20
0
Pipistrellus
Common pipistrelle
Soprano pipistrelle
Nathusius'
Noctule
Leisler's
Nyctalus
Serotine
Nyctaloid
Brown long−eared
Grey long−eared
Long−eared bats
Myotis
Alcathoe
Bechstein's
Brandt's
Daubenton's
Whiskered
Natterer's
Barbastelle
Greater horseshoe
Lesser horseshoe
Horseshoe bats
Species

Figure 5. The median activity levels of bats recorded across all detectors each night.


Myotis daubentonii
Myotis mystacinus
Myotis nattereri
Nyctalus leisleri
Median Bat Activity Level
100
80
60
40
20
0
25/08/2025
01/09/2025
08/09/2025
15/09/2025
Date
Activity Level
Moderate/High
Moderate
Low/Moderate
Low


Pipistrellus nathusii
Pipistrellus pipistrellus
Pipistrellus pygmaeus
Plecotus auritus
Median Bat Activity Level
100
80
60
40
20
0
25/08/2025
01/09/2025
08/09/2025
15/09/2025
Date
Activity Level
Moderate/High
Moderate
Low/Moderate
Low

Per Site, Per Month

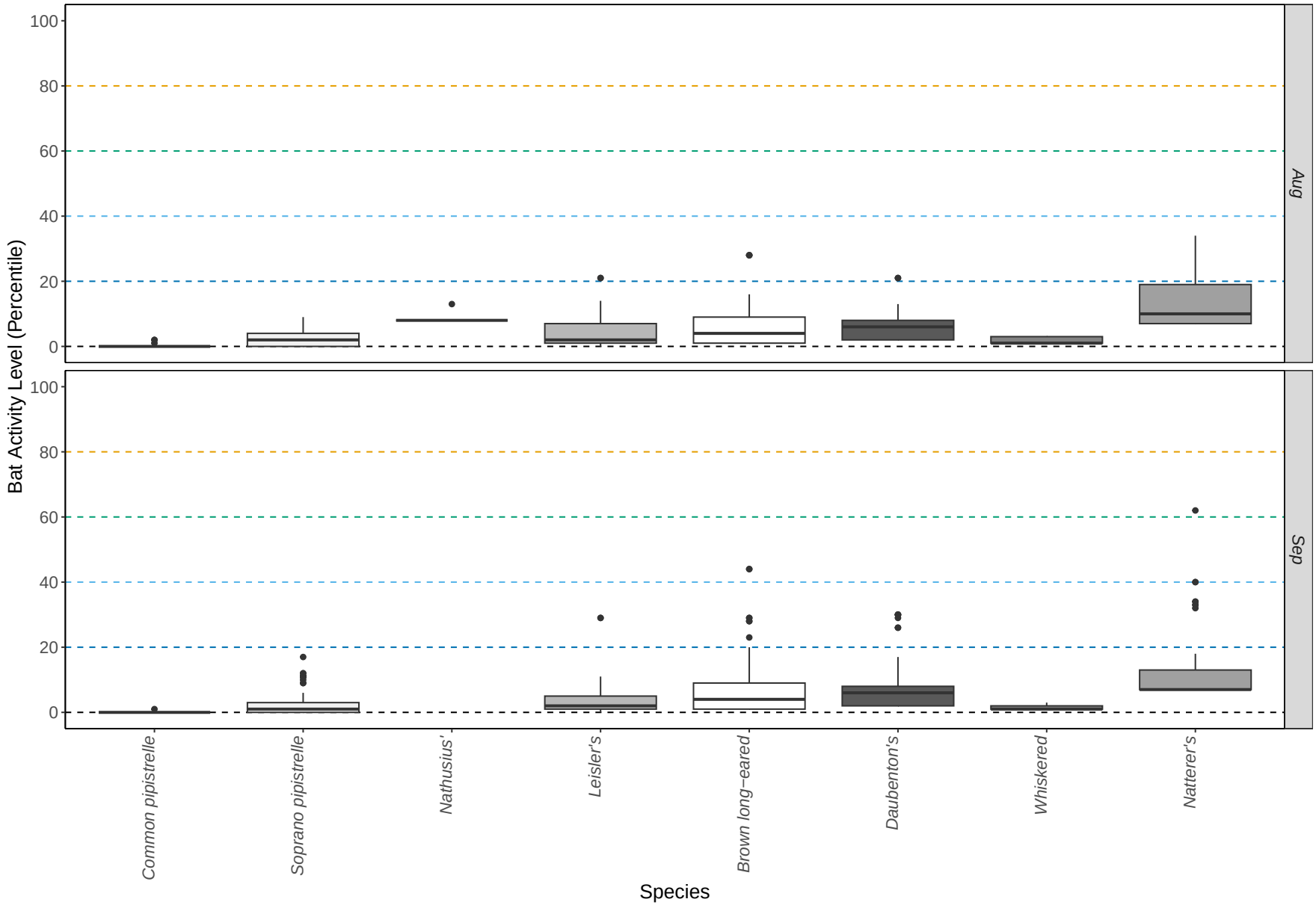
Table 9. Summary table showing the number of nights recorded bat activity fell into each activity band for each species during each month.

Species/Species Group	month	Nights of Exceptional Activity	Nights of High Activity	Nights of Moderate/High Activity	Nights of Moderate Activity	Nights of Low/Moderate Activity	Nights of Low Activity
Myotis daubentonii	Aug	0	0	0	0	2	58
Myotis daubentonii	Sep	0	0	0	0	7	74
Myotis mystacinus	Aug	0	0	0	0	0	10
Myotis mystacinus	Sep	0	0	0	0	0	15
Myotis nattereri	Aug	0	0	0	0	5	15
Myotis nattereri	Sep	0	0	1	2	5	50
Nyctalus leisleri	Aug	0	0	0	0	2	88
Nyctalus leisleri	Sep	0	0	0	0	2	148
Pipistrellus nathusii	Aug	0	0	0	0	0	6
Pipistrellus pipistrellus	Aug	0	0	0	0	0	70
Pipistrellus pipistrellus	Sep	0	0	0	0	0	91
Pipistrellus pygmaeus	Aug	0	0	0	0	0	91
Pipistrellus pygmaeus	Sep	0	0	0	0	0	125
Plecotus auritus	Aug	0	0	0	0	3	41
Plecotus auritus	Sep	0	0	0	2	6	73

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	Aug	6	5 - 9	21	60
Myotis daubentonii	Sep	6	5 - 9	30	81
Myotis mystacinus	Aug	1	1 - 3	3	10
Myotis mystacinus	Sep	1	1 - 3	3	15
Myotis nattereri	Aug	10	7 - 7	34	20
Myotis nattereri	Sep	7	7 - 7	62	58
Nyctalus leisleri	Aug	2	8 - 14	21	90
Nyctalus leisleri	Sep	2	8 - 14	29	150
Pipistrellus nathusii	Aug	8	8 - 8	13	6
Pipistrellus pipistrellus	Aug	0	1 - 2	2	70
Pipistrellus pipistrellus	Sep	0	1 - 2	1	91
Pipistrellus pygmaeus	Aug	2	6 - 9	9	91
Pipistrellus pygmaeus	Sep	1	6 - 9	17	125
Plecotus auritus	Aug	4	5 - 14.5	28	44
Plecotus auritus	Sep	4	5 - 14.5	44	81

Figure 6. The activity level (percentile) of bats recorded across each night of the bat survey for the entire site, split between months.


Bat Activity Level (Percentile)
100
80
60
40
20
0
Aug
Sep
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Brown long−eared
Daubenton's
Whiskered
Natterer's
Species

Part 2: Nightly Analysis

Entire Survey Period

Sunrise and Sunset Times

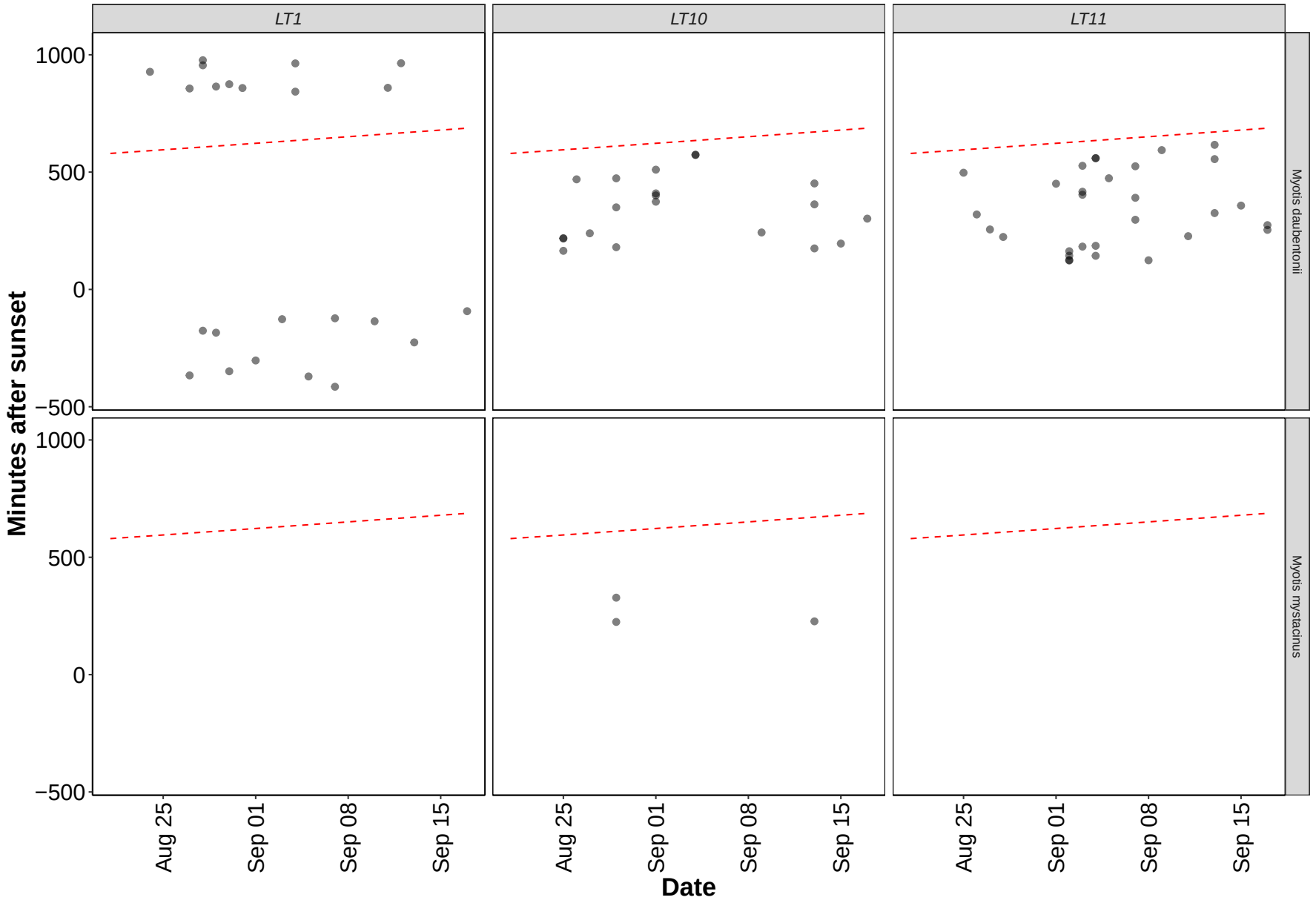
Table 11. The times of sunset and sunrise the following morning for surveys beginning on the date shown.

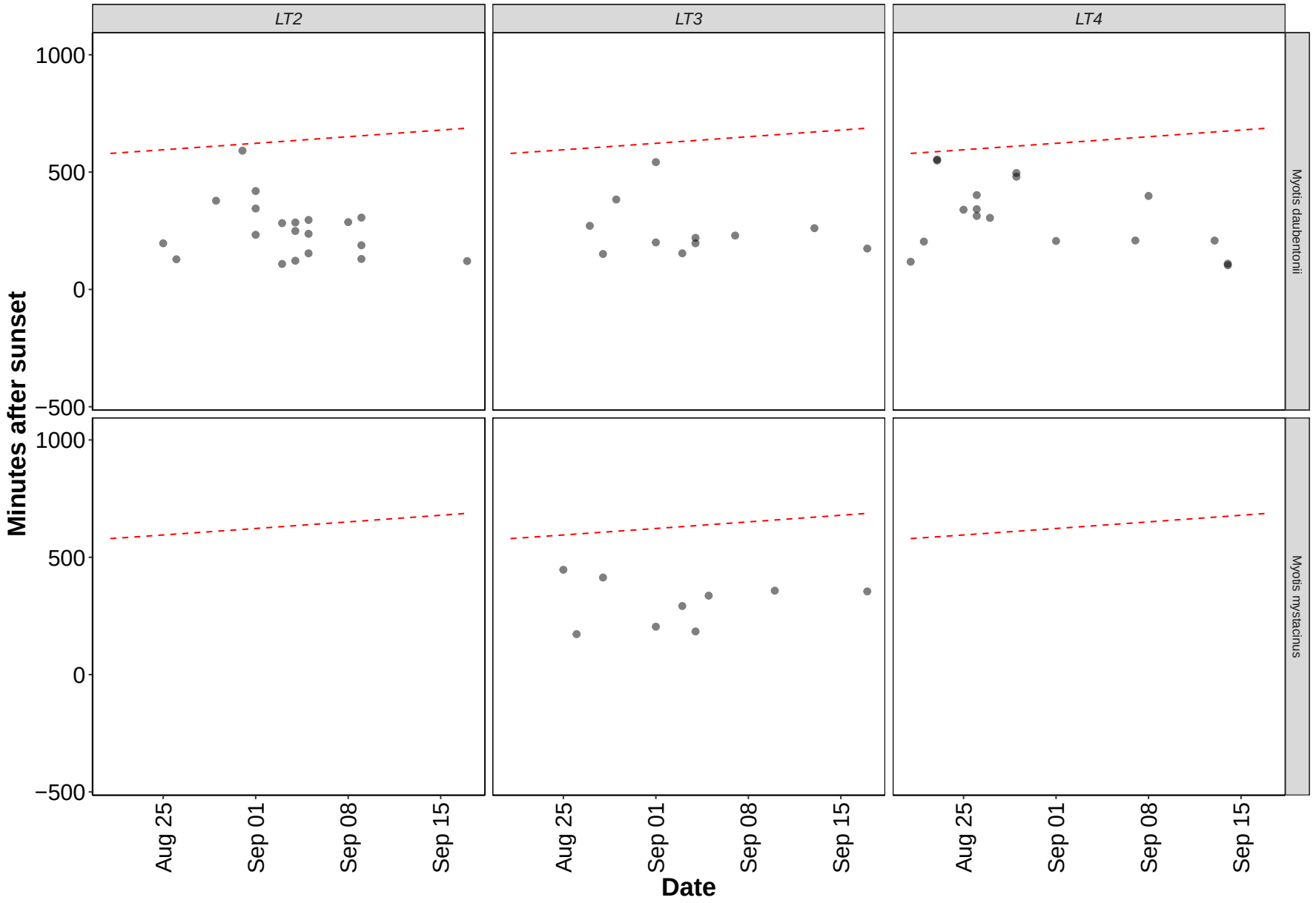
Night (y-m-d)	Sunset (h:m)	Sunrise (h:m)	Night Length (hours)
2025-08-21	19:45	05:24	9.7
2025-08-22	19:42	05:26	9.7
2025-08-23	19:40	05:28	9.8
2025-08-24	19:38	05:29	9.9
2025-08-25	19:36	05:31	9.9
2025-08-26	19:34	05:33	10.0
2025-08-27	19:31	05:34	10.0
2025-08-28	19:29	05:36	10.1
2025-08-29	19:27	05:38	10.2
2025-08-30	19:24	05:39	10.2
2025-08-31	19:22	05:41	10.3
2025-09-01	19:20	05:43	10.4
2025-09-02	19:18	05:44	10.4
2025-09-03	19:15	05:46	10.5
2025-09-04	19:13	05:48	10.6
2025-09-05	19:11	05:49	10.6
2025-09-06	19:08	05:51	10.7
2025-09-07	19:06	05:53	10.8
2025-09-08	19:03	05:54	10.8
2025-09-09	19:01	05:56	10.9
2025-09-10	18:59	05:58	11.0
2025-09-11	18:56	05:59	11.0
2025-09-12	18:54	06:01	11.1
2025-09-13	18:52	06:03	11.2
2025-09-14	18:49	06:04	11.3
2025-09-15	18:47	06:06	11.3
2025-09-16	18:44	06:08	11.4
2025-09-17	18:42	06:09	11.5

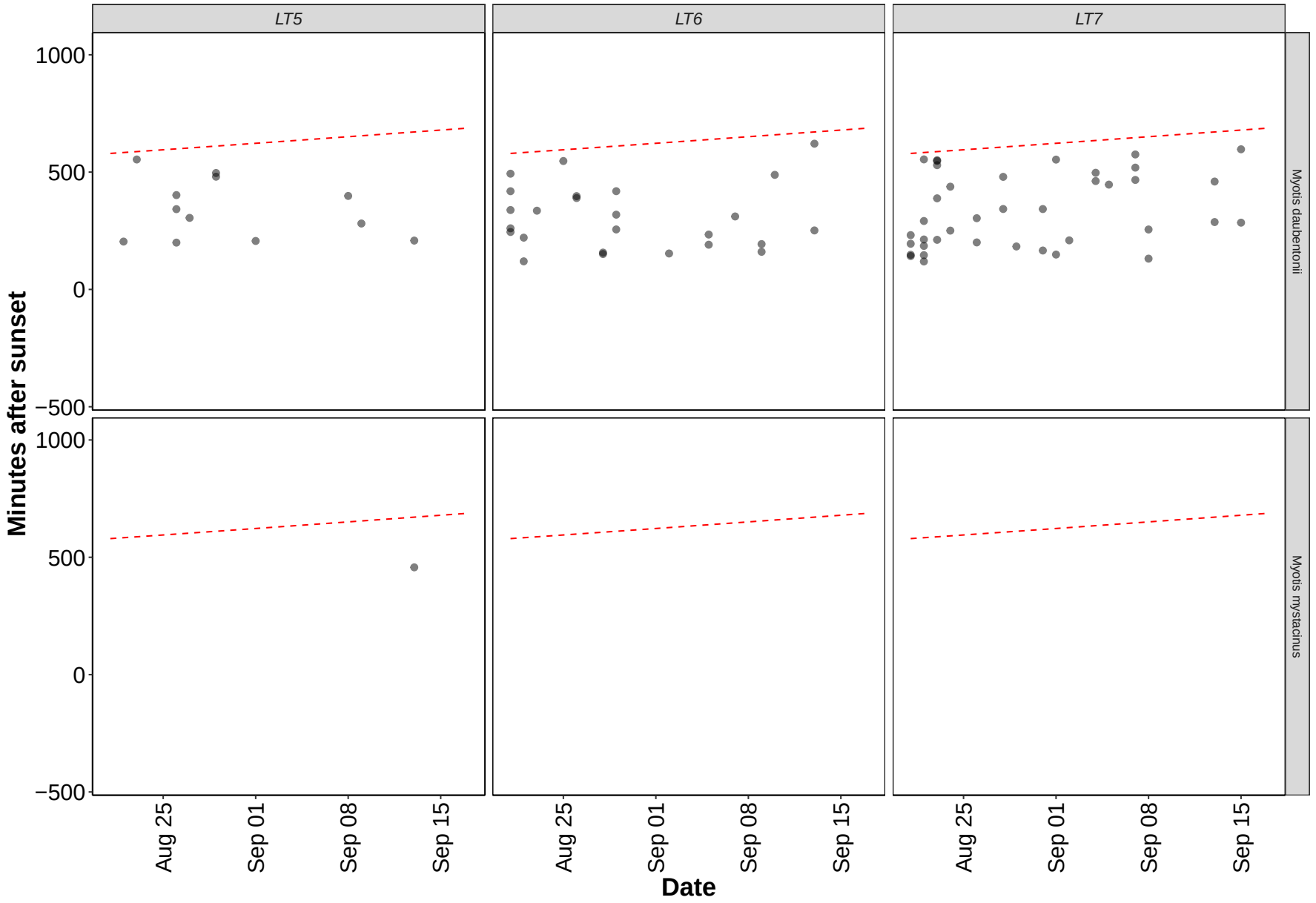
Distribution of Bat Activity Across the Night through Time

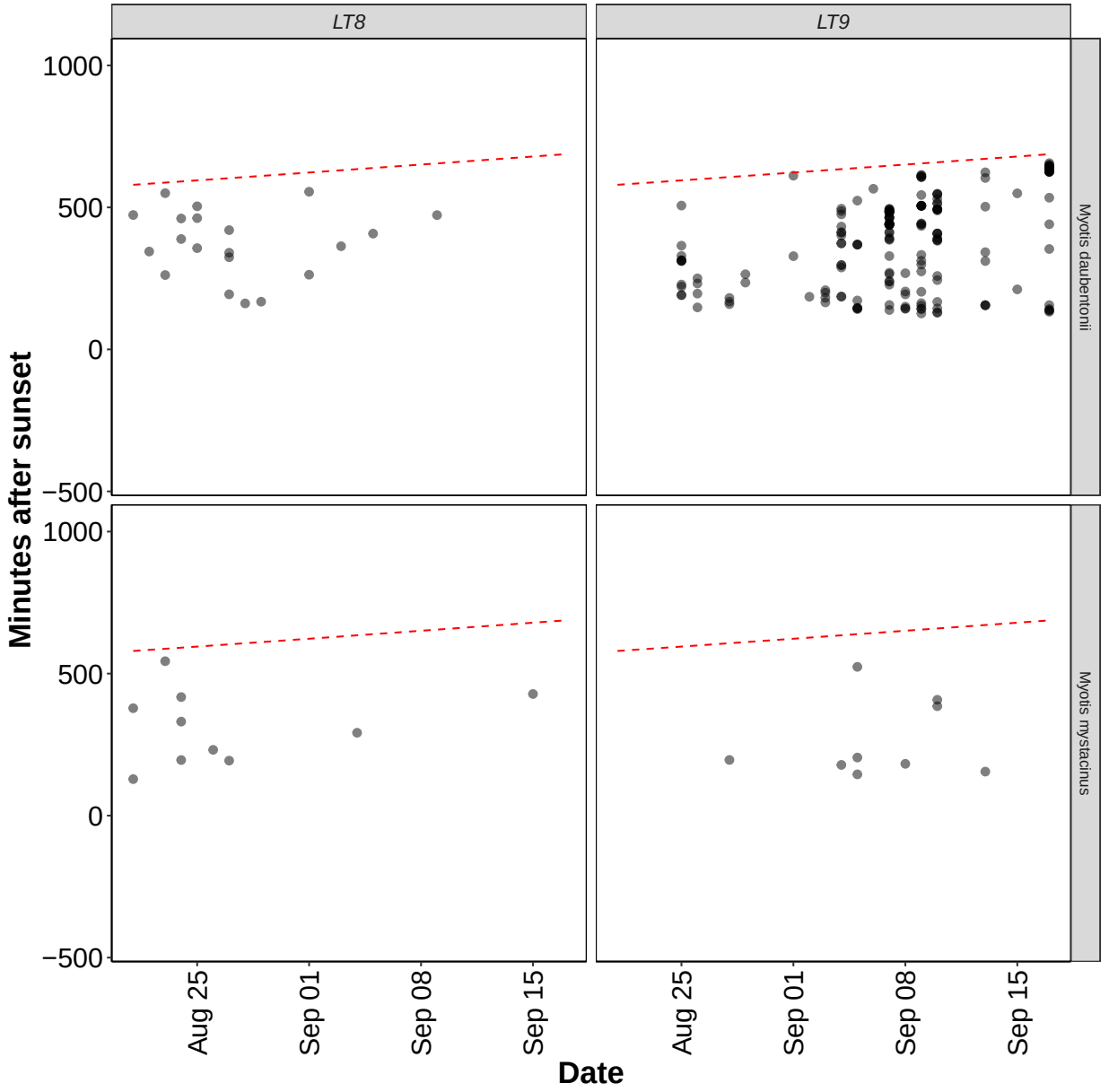
Per Detector

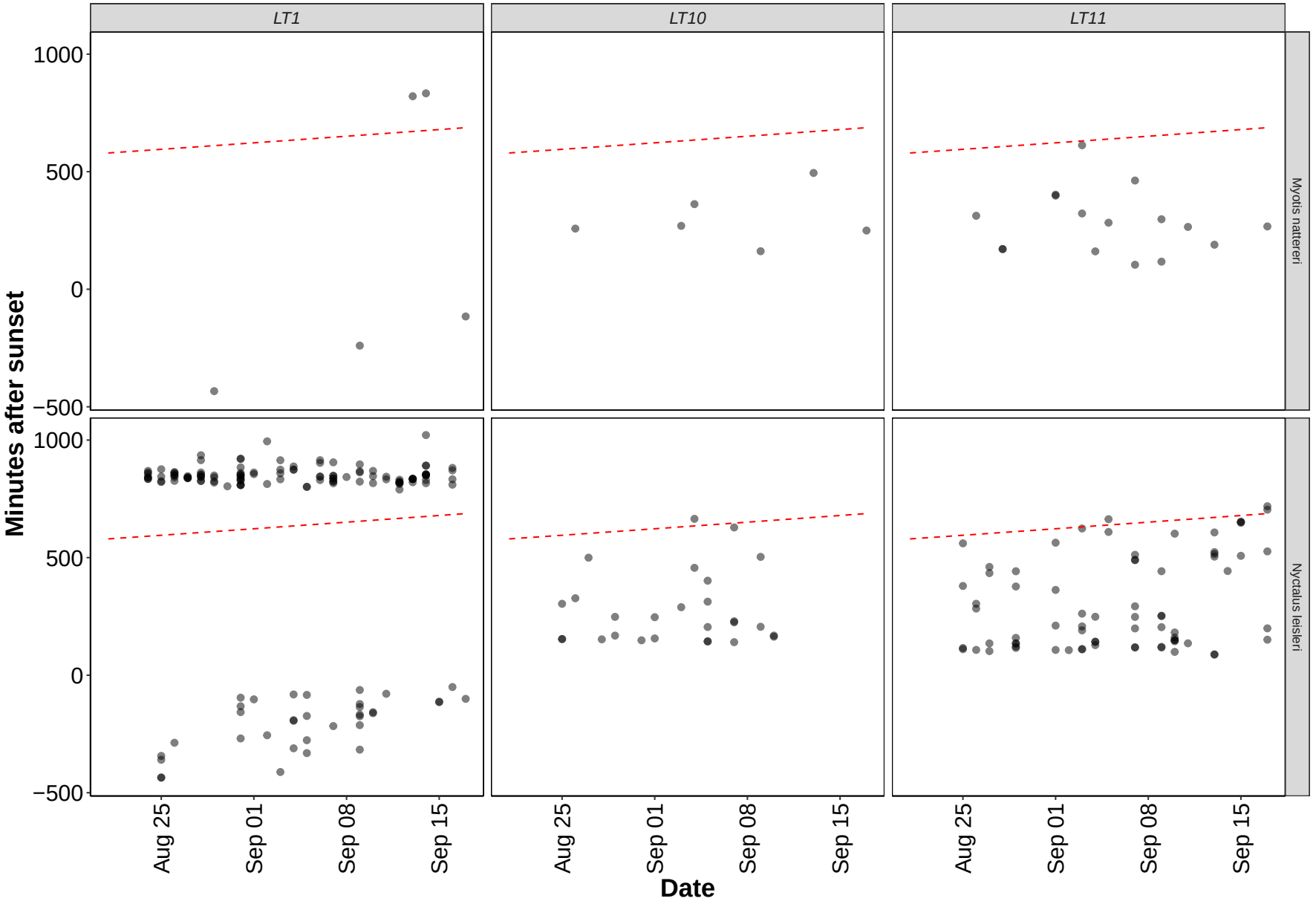
Figure 7. Timing of bat calls plotted as minutes before/after sunset, whereby 0 on the y axis represents sunset. Sunrise throughout the survey period is depicted as the red dashed line. Colours indicate kernel densities, with darkest colours showing peaks of activity. These colours are comparative only within each plot, and do not account for overall activity.

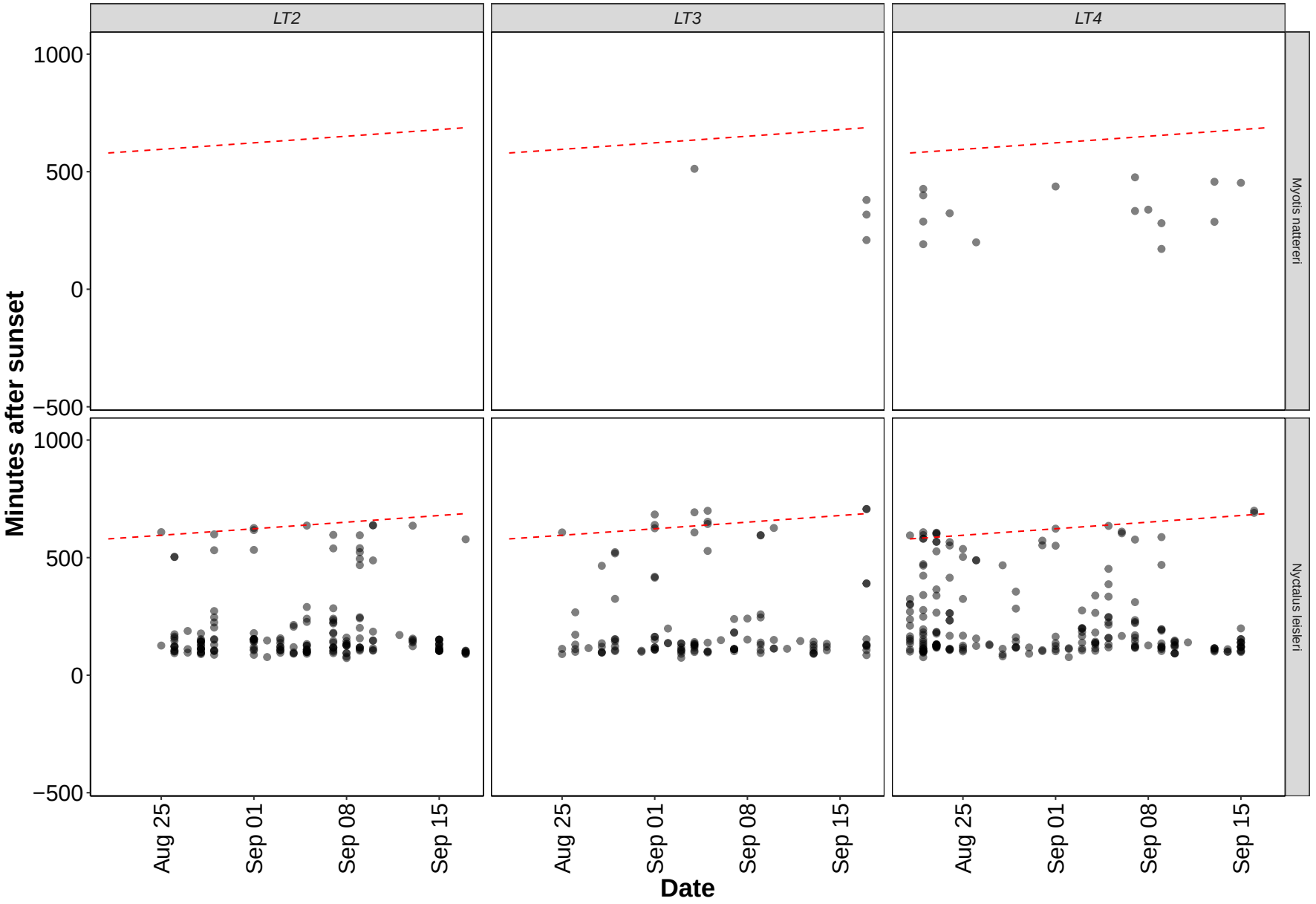

LT1
LT10
LT11
Myotis daubentonii
Myotis mystacinus
Minutes after sunset
1000
500
0
−500
Aug 25
Sep 01
Sep 08
Sep 15
Date

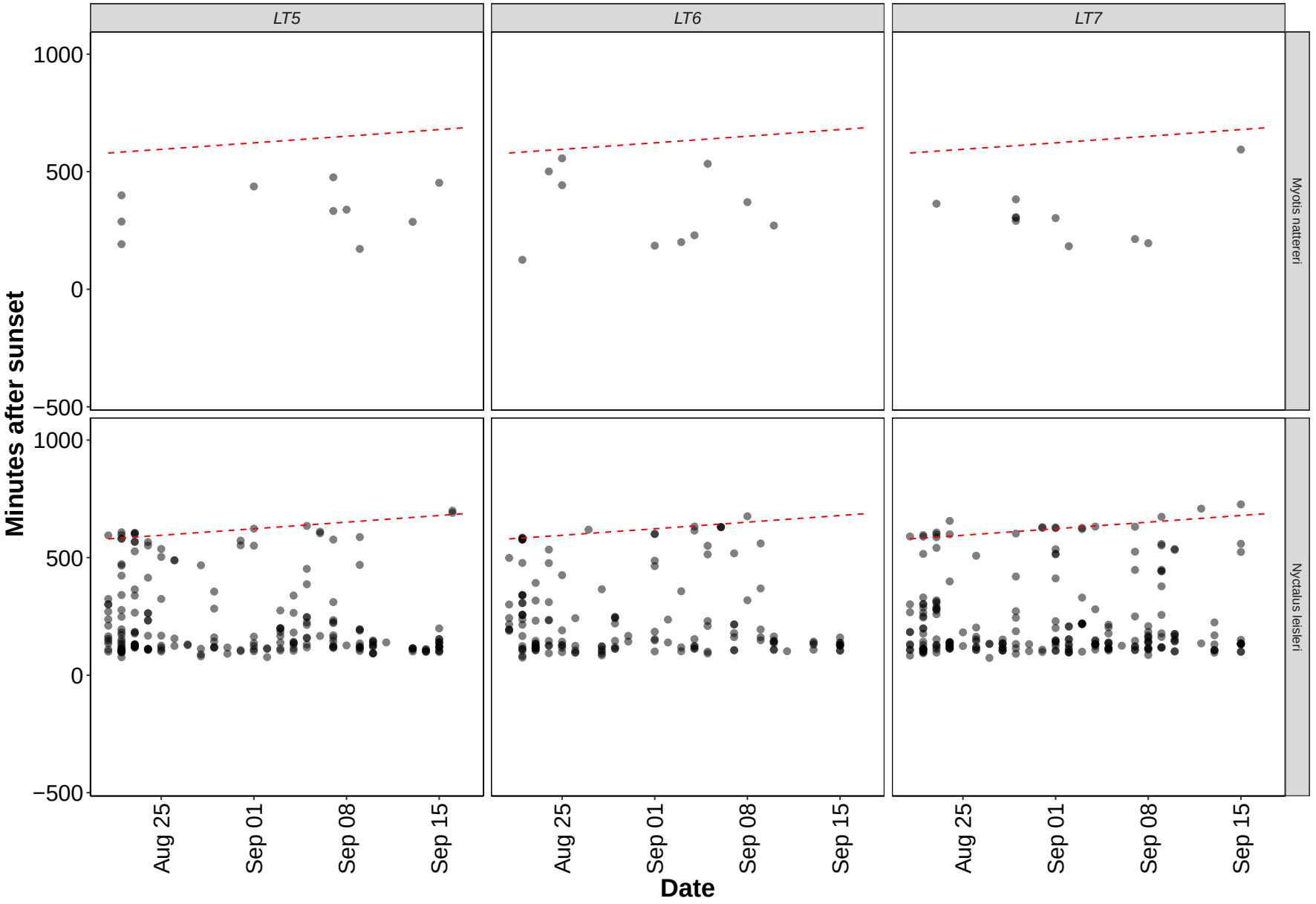

LT2
LT3
LT4
Myotis daubentonii
Myotis mystacinus
Minutes after sunset
1000
500
0
−500
Aug 25
Sep 01
Sep 08
Sep 15
Date

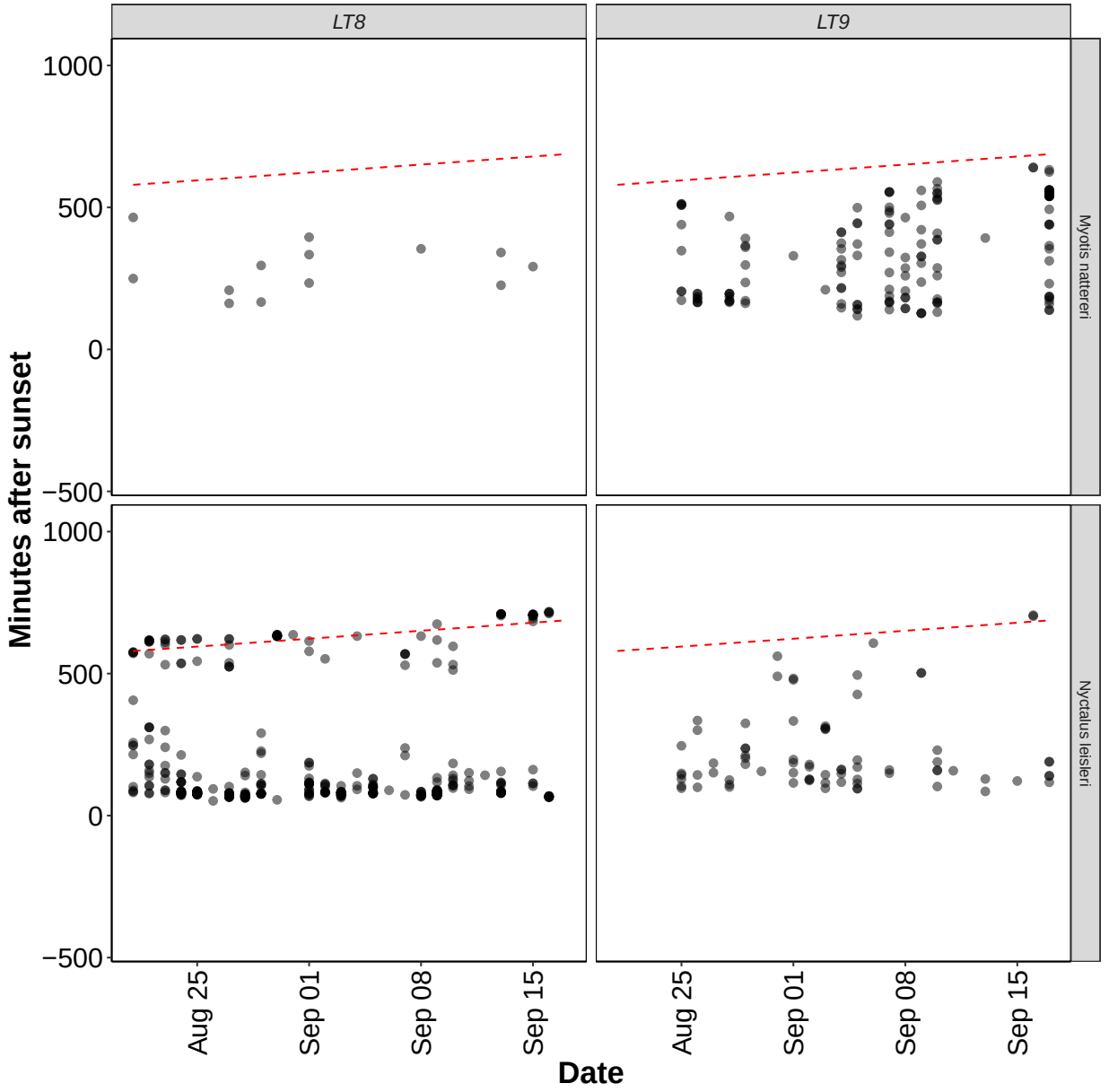

LT5
LT6
LT7
Myotis daubentonii
Myotis mystacinus
Minutes after sunset
1000
500
0
−500
Aug 25
Sep 01
Sep 08
Sep 15
Date

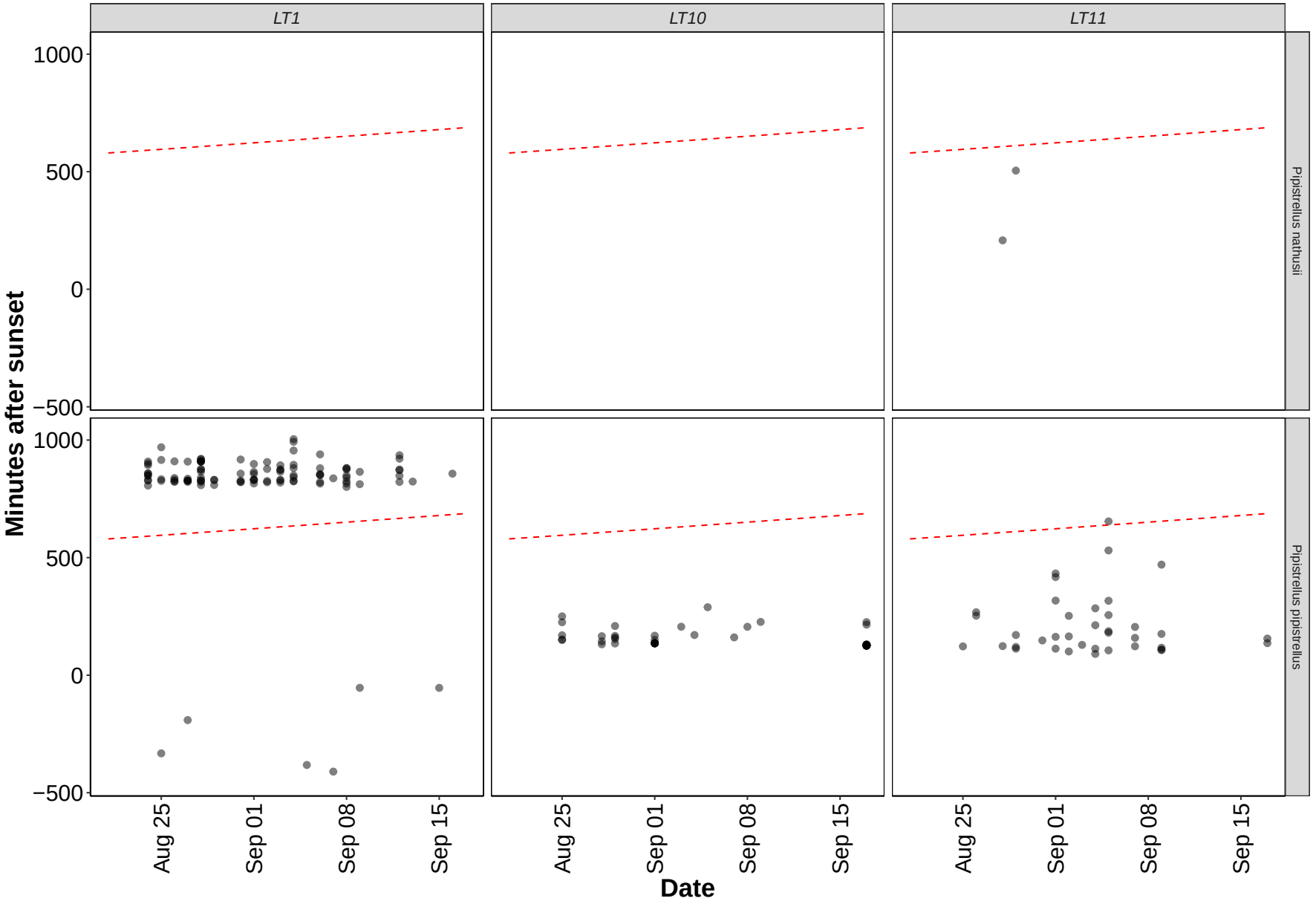

LT8
LT9
Myotis daubentonii
Myotis mystacinus
Minutes after sunset
1000
500
0
−500
Aug 25
Sep 01
Sep 08
Sep 15
Date

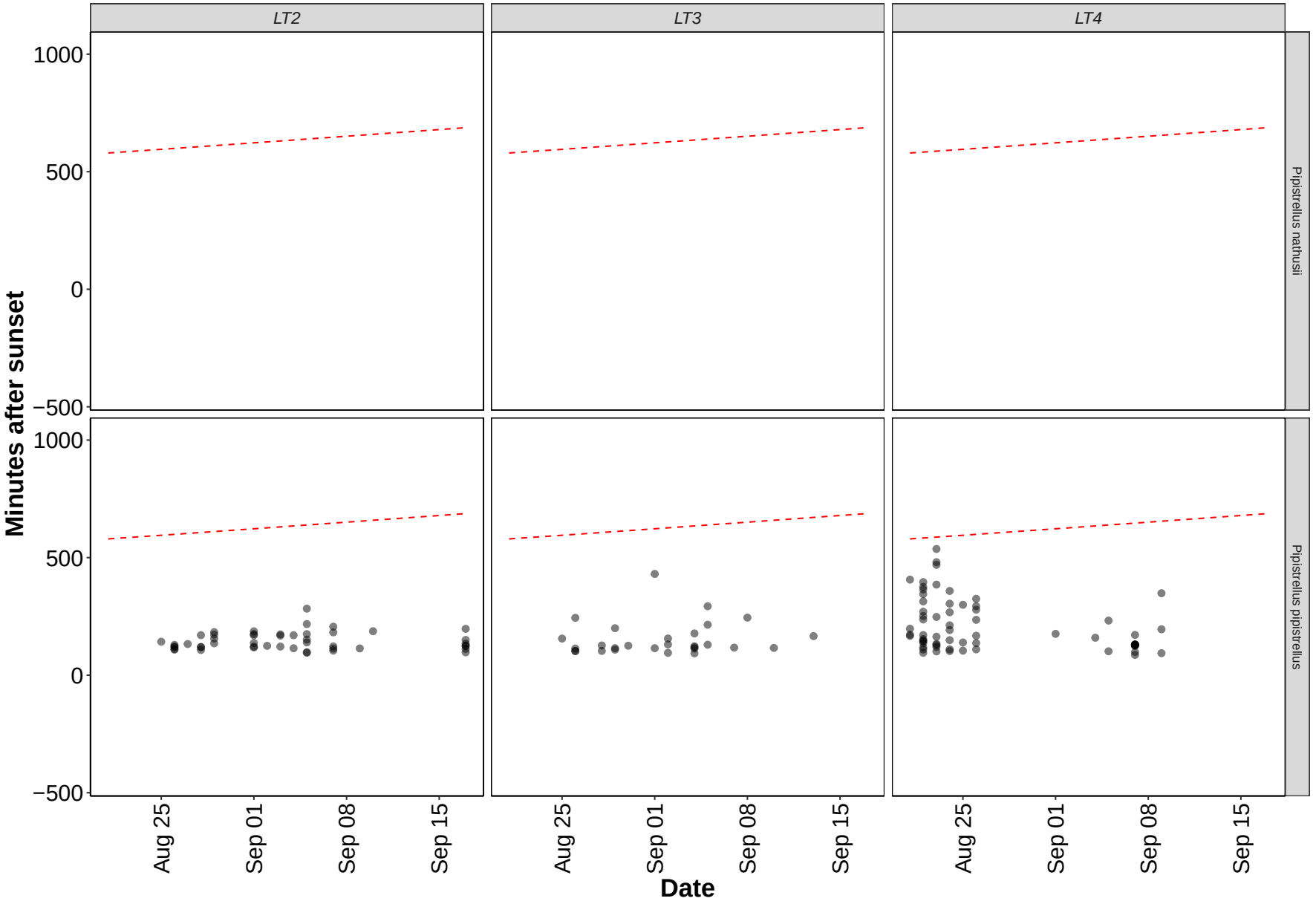

LT1
LT10
LT11
Myotis nattereri
Nyctalus leisleri
Minutes after sunset
1000
500
0
−500
Aug 25
Sep 01
Sep 08
Sep 15
Date

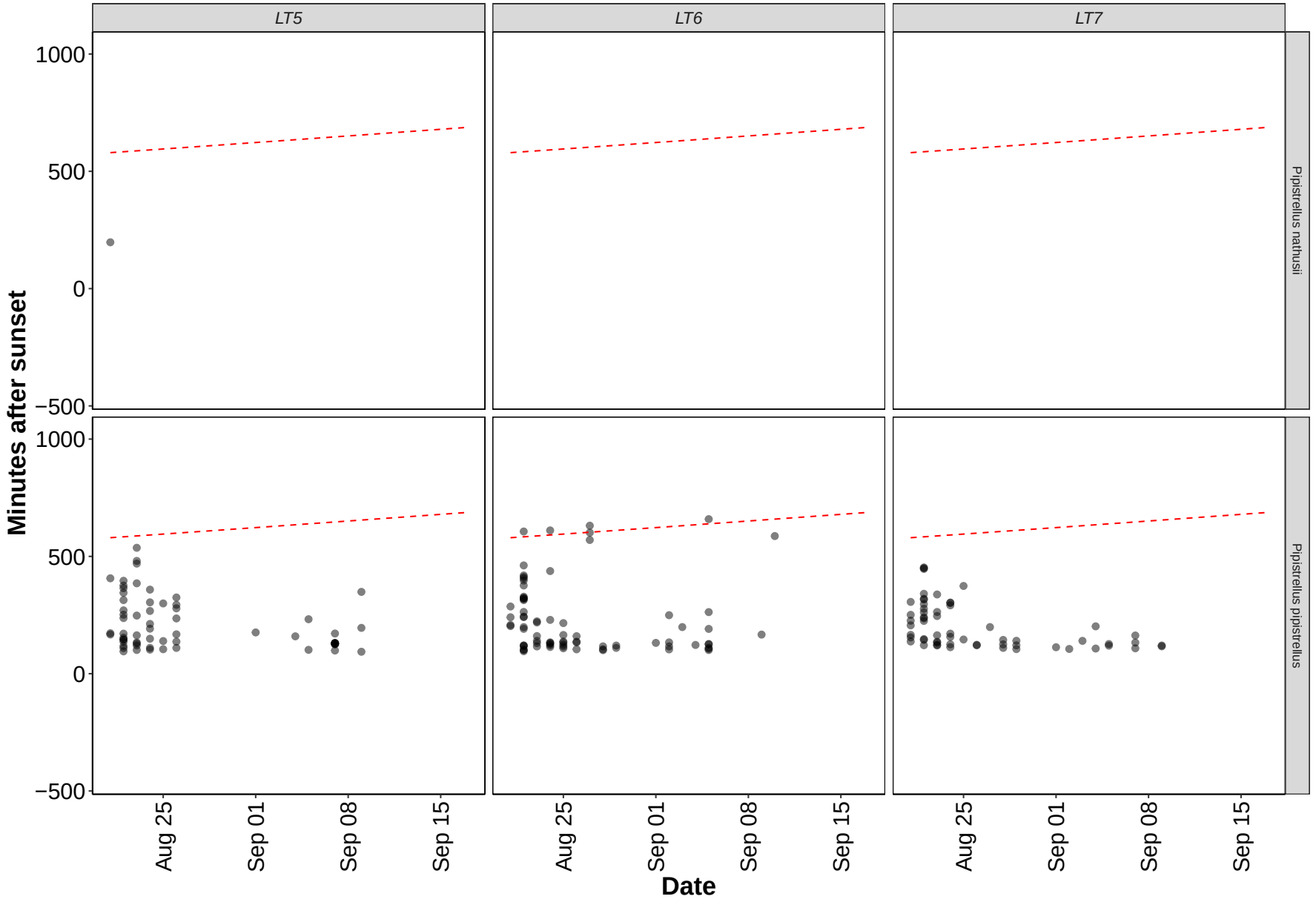

LT2
LT3
LT4
Myotis nattereri
Nyctalus leisleri
Minutes after sunset
1000
500
0
−500
Aug 25
Sep 01
Sep 08
Sep 15
Date

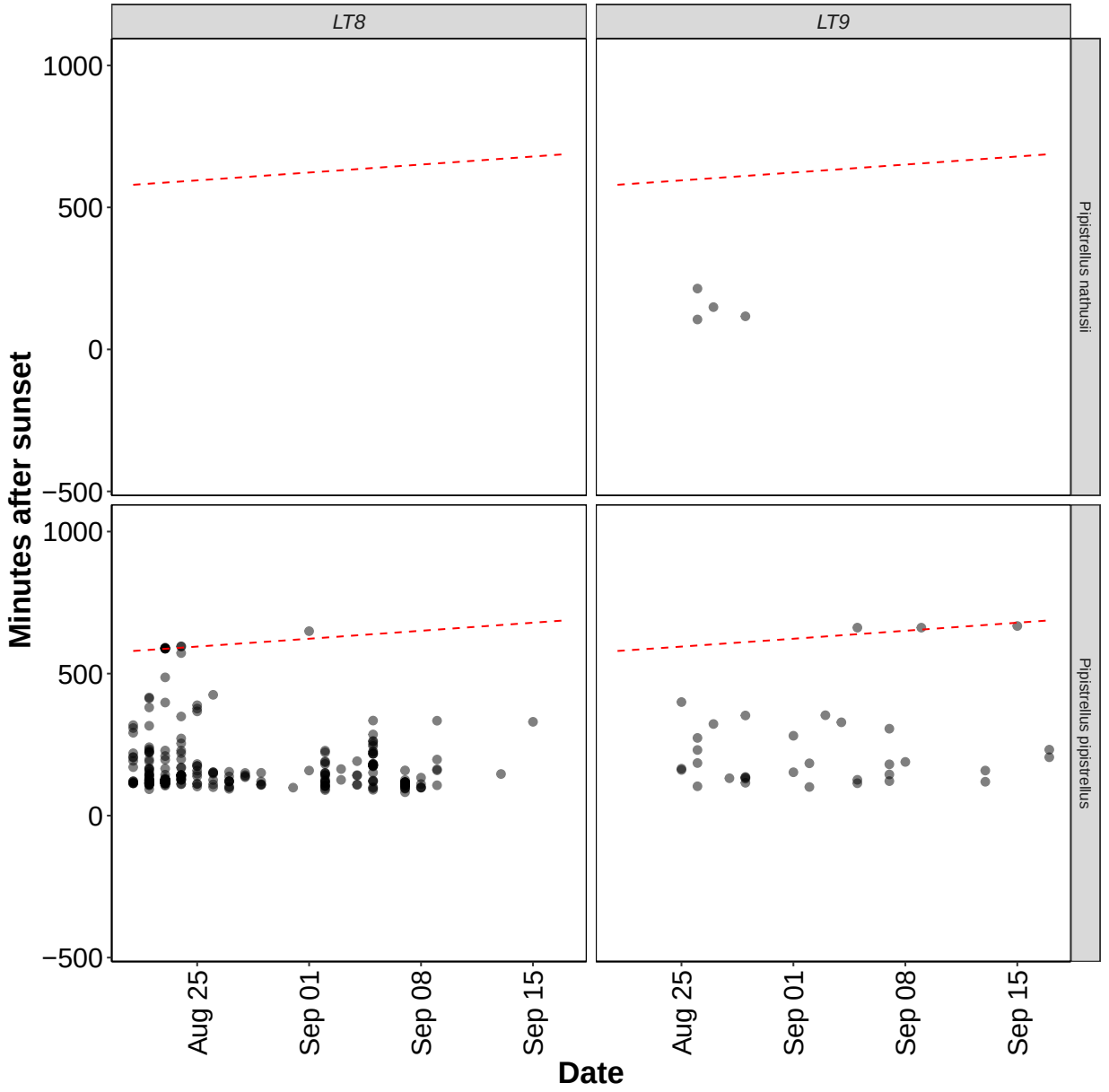

LT5
LT6
LT7
Myotis nattereri
Nyctalus leisleri
Minutes after sunset
1000
500
0
−500
Aug 25
Sep 01
Sep 08
Sep 15
Date

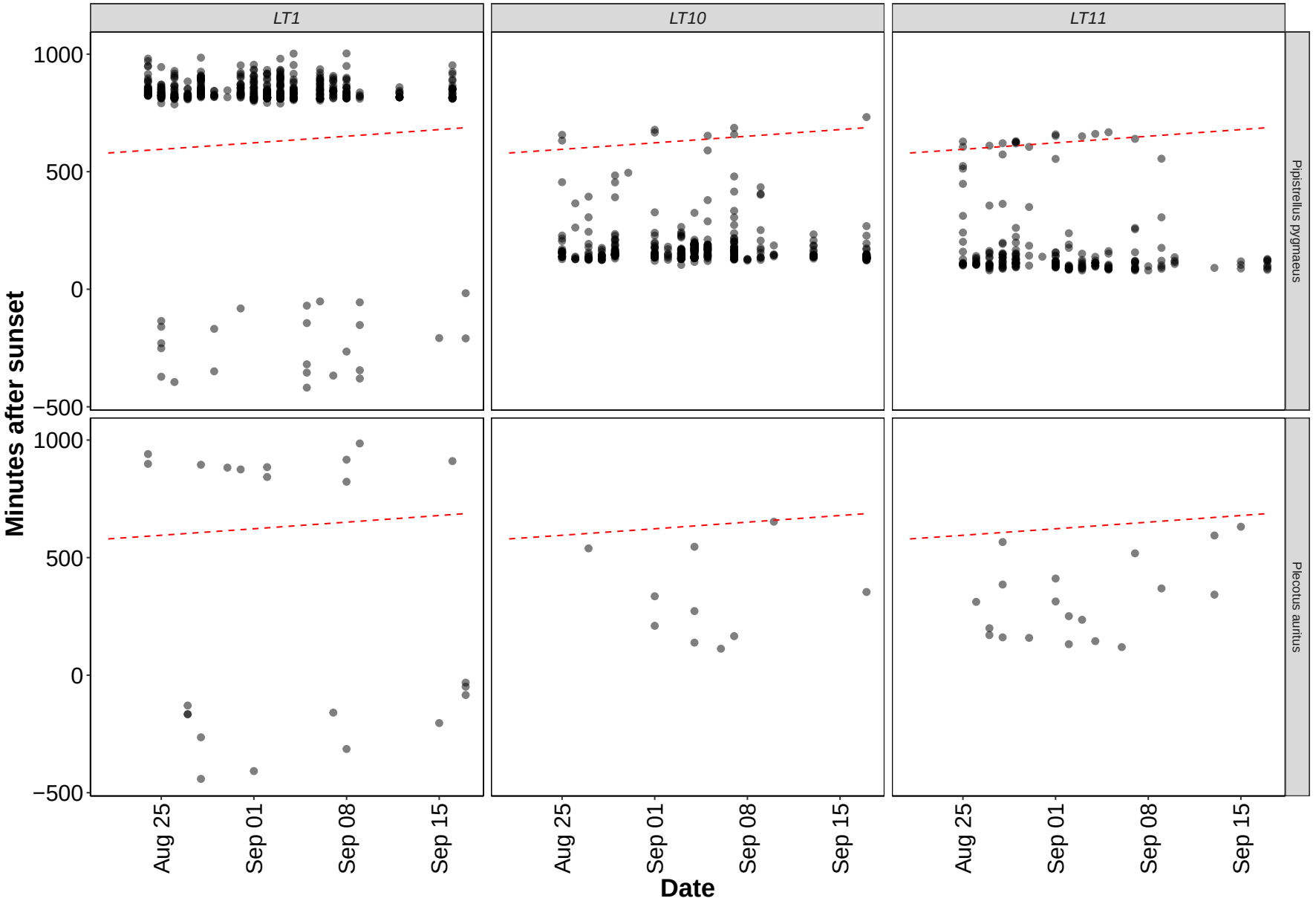

LT8
LT9
Myotis nattereri
Nyctalus leisleri
Minutes after sunset
1000
500
0
−500
Aug 25
Sep 01
Sep 08
Sep 15
Date


LT1
LT10
LT11
Pipistrellus nathusii
Pipistrellus pipistrellus
Minutes after sunset
1000
500
0
−500
Aug 25
Sep 01
Sep 08
Sep 15
Date


LT2
LT3
LT4
Pipistrellus nathusii
Pipistrellus pipistrellus
Minutes after sunset
1000
500
0
−500
Aug 25
Sep 01
Sep 08
Sep 15
Date


LT5
LT6
LT7
Pipistrellus nathusii
Pipistrellus pipistrellus
Minutes after sunset
1000
500
0
−500
Aug 25
Sep 01
Sep 08
Sep 15
Date


LT8
LT9
Pipistrellus nathusi
Pipistrellus pipistrellus
Minutes after sunset
1000
500
0
−500
Aug 25
Sep 01
Sep 08
Sep 15
Date


LT1
LT10
LT11
Pipistrellus pygmaeus
Plecotus auritus
Minutes after sunset
1000
500
0
−500
Aug 25
Sep 01
Sep 08
Sep 15
Date

Roost Emergence Time and Bat Observation

Based on: Russ, Jon. 2012. British Bat Calls a Guide to species Identification. Pelagic Publishing.

Bat Passes Potentially Indicating Close Proximity to a Roost (Russ 2012)

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 12: Table continues below

Species	Detector ID	2025-08-25	2025-08-26	2025-08-27	2025-08-28	2025-08-29
Common pipistrelle	LT1	1	0	1	0	0
Soprano pipistrelle	LT1	5	1	0	0	2
Leisler's	LT1	4	1	0	0	0
Brown long-eared	LT1	0	0	3	2	0
Daubenton's	LT1	0	0	1	1	1
Natterer's	LT1	0	0	0	0	1

Table 13: Table continues below

2025-08-30	2025-08-31	2025-09-01	2025-09-02	2025-09-03	2025-09-04	2025-09-05
0	0	0	0	0	0	1
0	1	0	0	0	0	5
0	4	1	1	1	4	4
0	0	1	0	0	0	0
1	0	1	0	1	0	1
0	0	0	0	0	0	0

Table 14: Table continues below

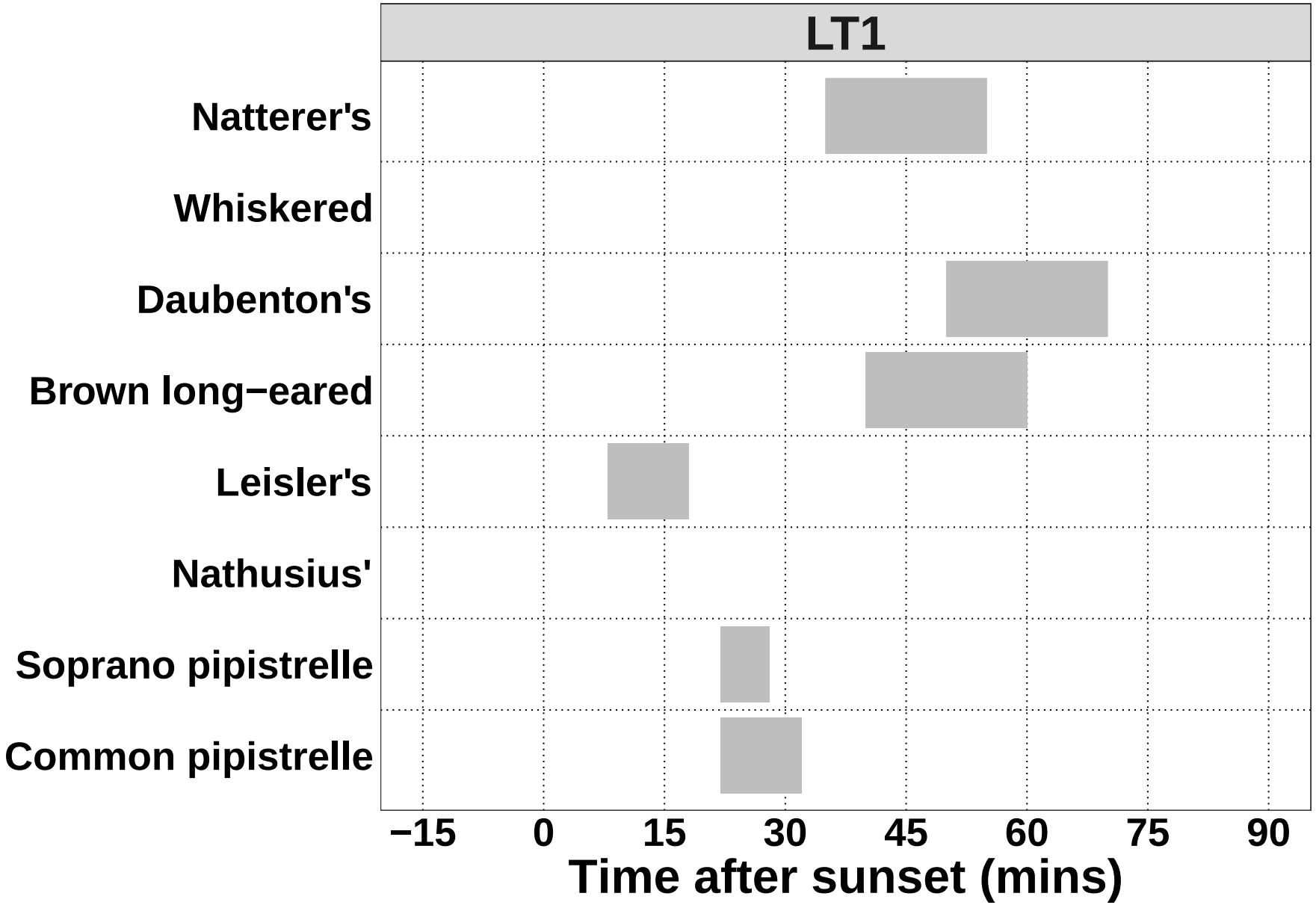
2025-09-06	2025-09-07	2025-09-08	2025-09-09	2025-09-10	2025-09-11	2025-09-13
0	1	0	1	0	0	0
1	1	1	4	0	0	0

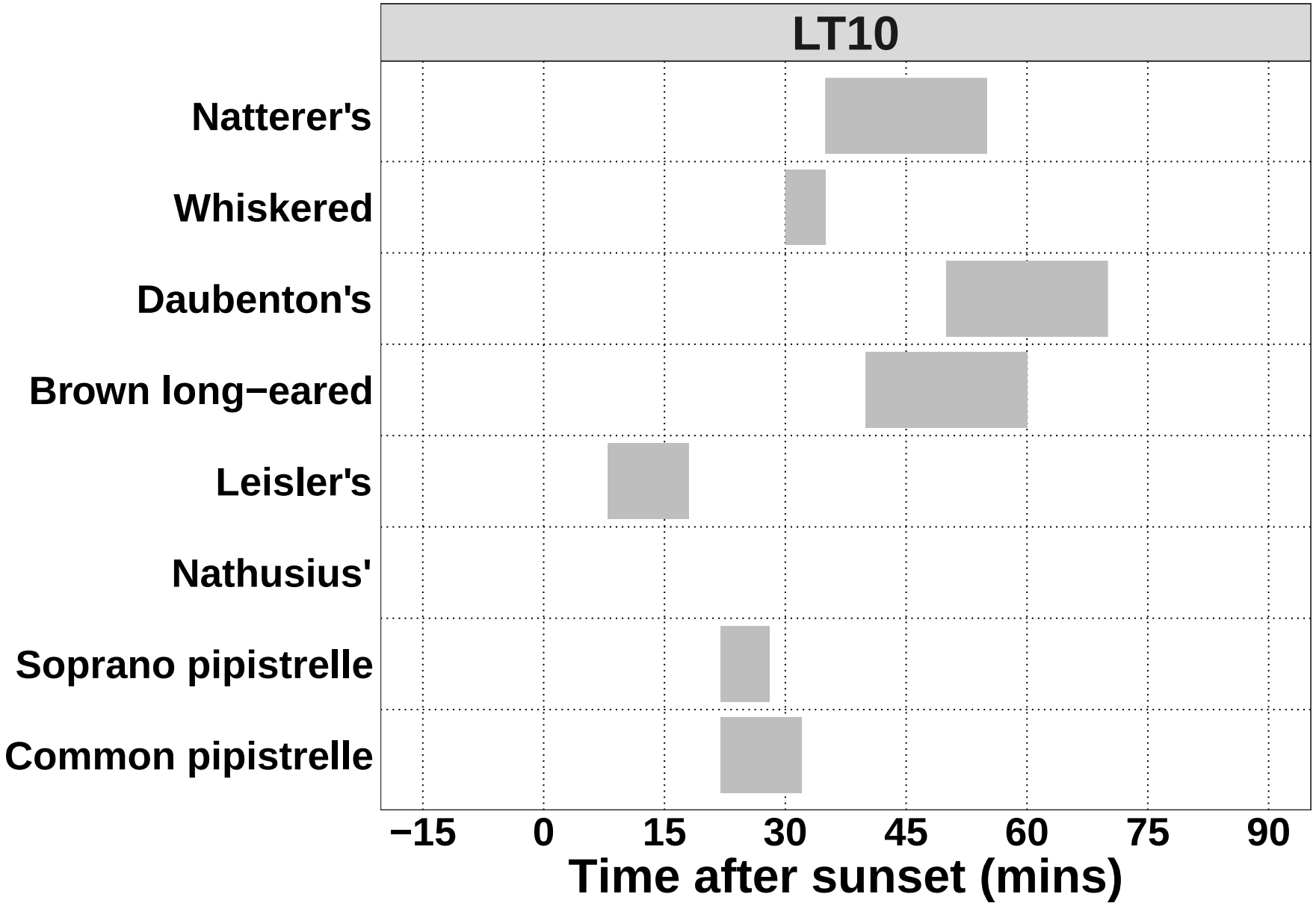
2025-09-06	2025-09-07	2025-09-08	2025-09-09	2025-09-10	2025-09-11	2025-09-13
0	1	0	7	2	1	0
0	1	1	0	0	0	0
0	2	0	0	1	0	1
0	0	0	1	0	0	0

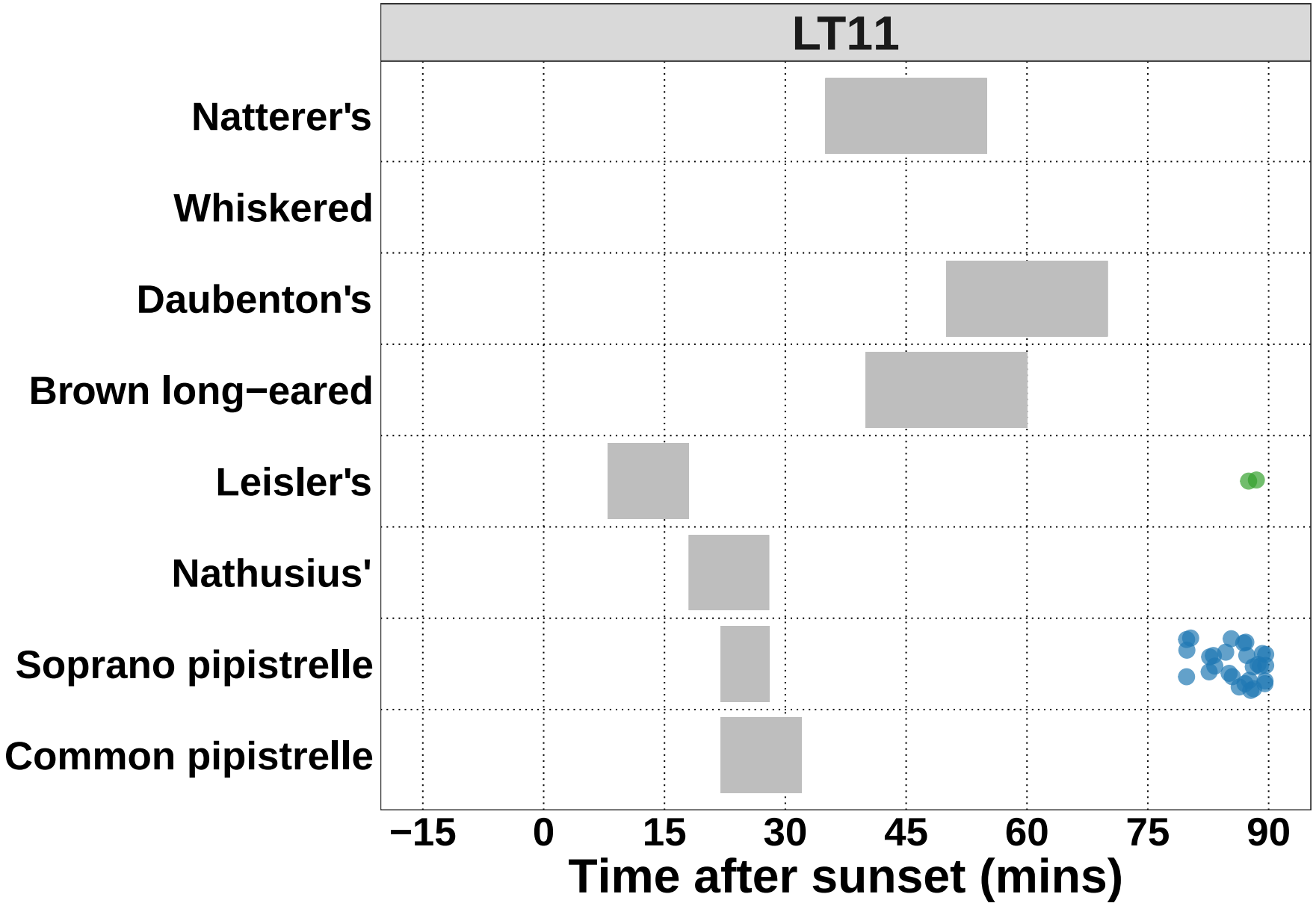
2025-09-15	2025-09-16	2025-09-17
1	0	0
1	0	2
2	1	1
1	0	3
0	0	1
0	0	1

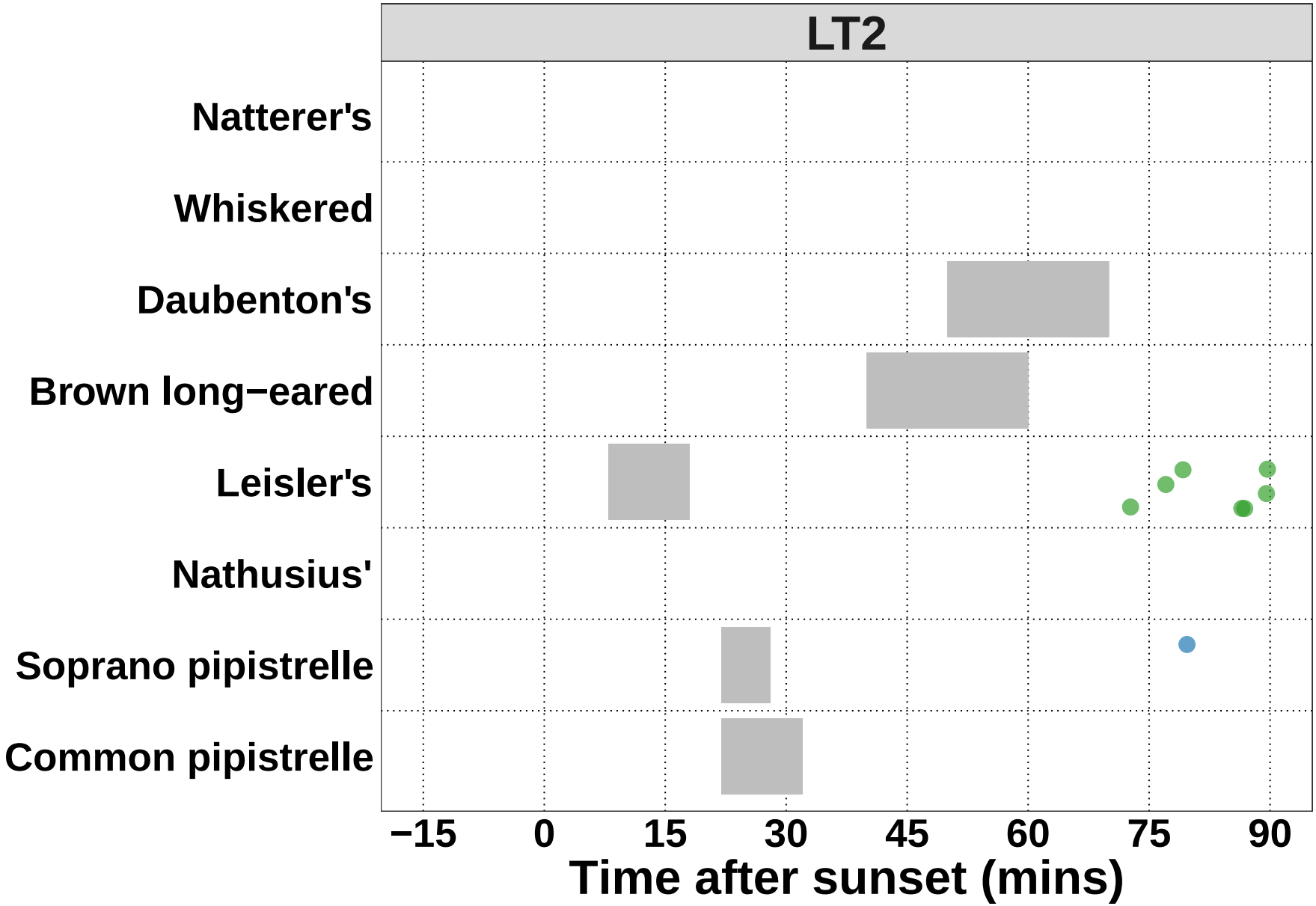
Bat Passes Potentially Indicating Close Proximity to a Roost (Russ 2012)

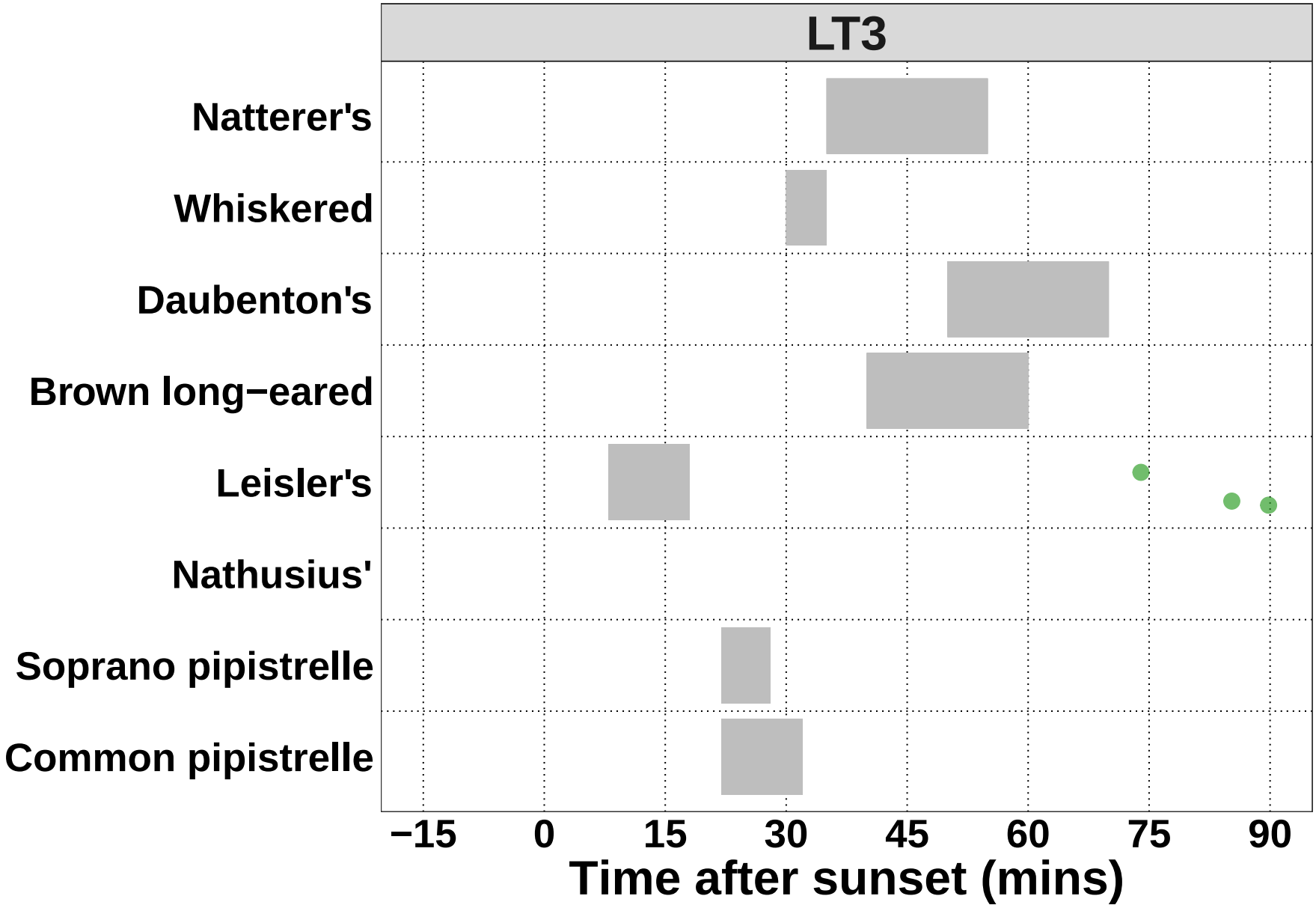
Figure 8. Time from 15 minutes before to 90 minutes after sunset. Species-specific emergence time ranges are shown as grey bars. Bat passes overlapping species-specific grey bars, or occuring earlier than this time range, may potentially indicate the presence of a nearby roost.

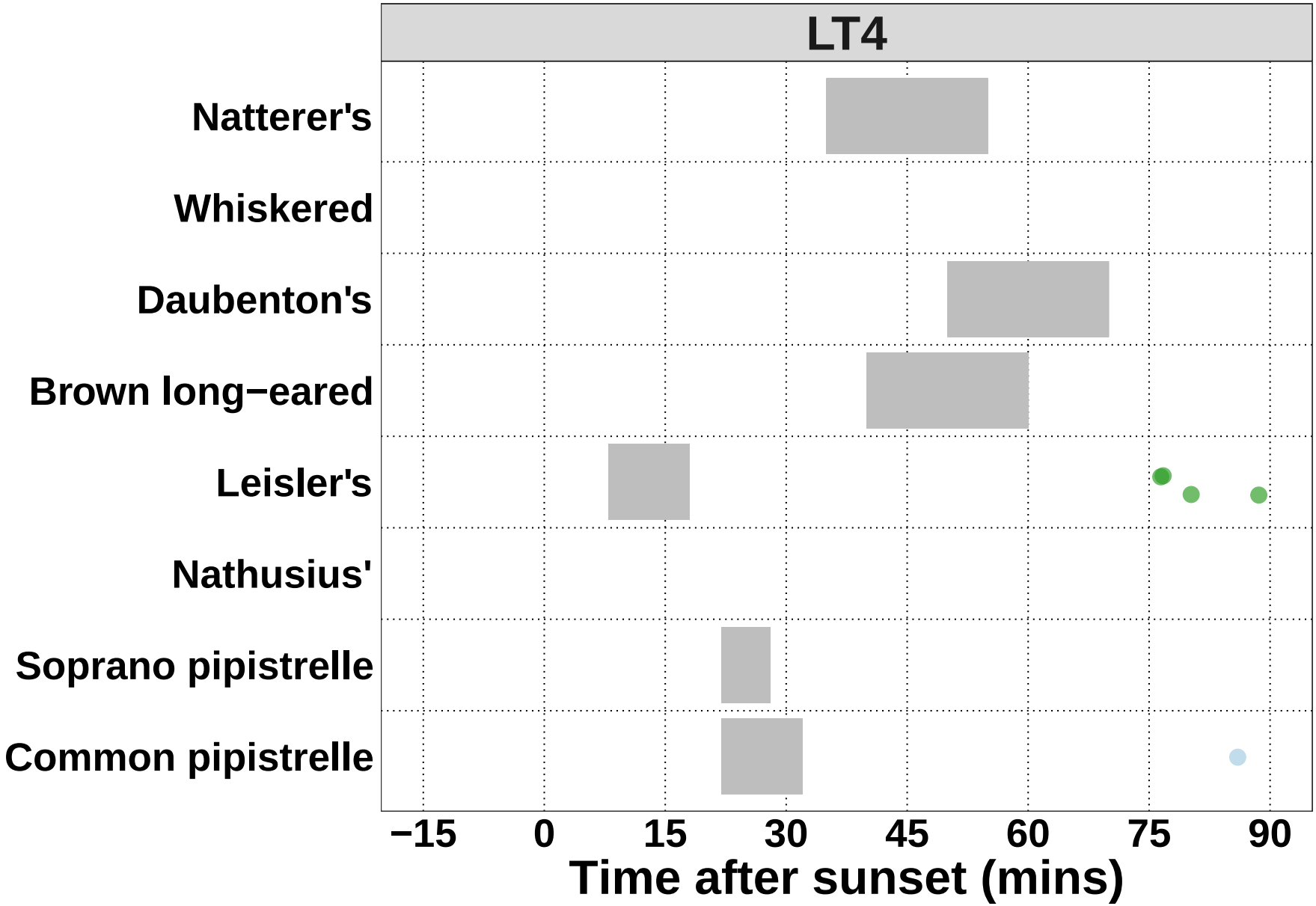

LT1
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

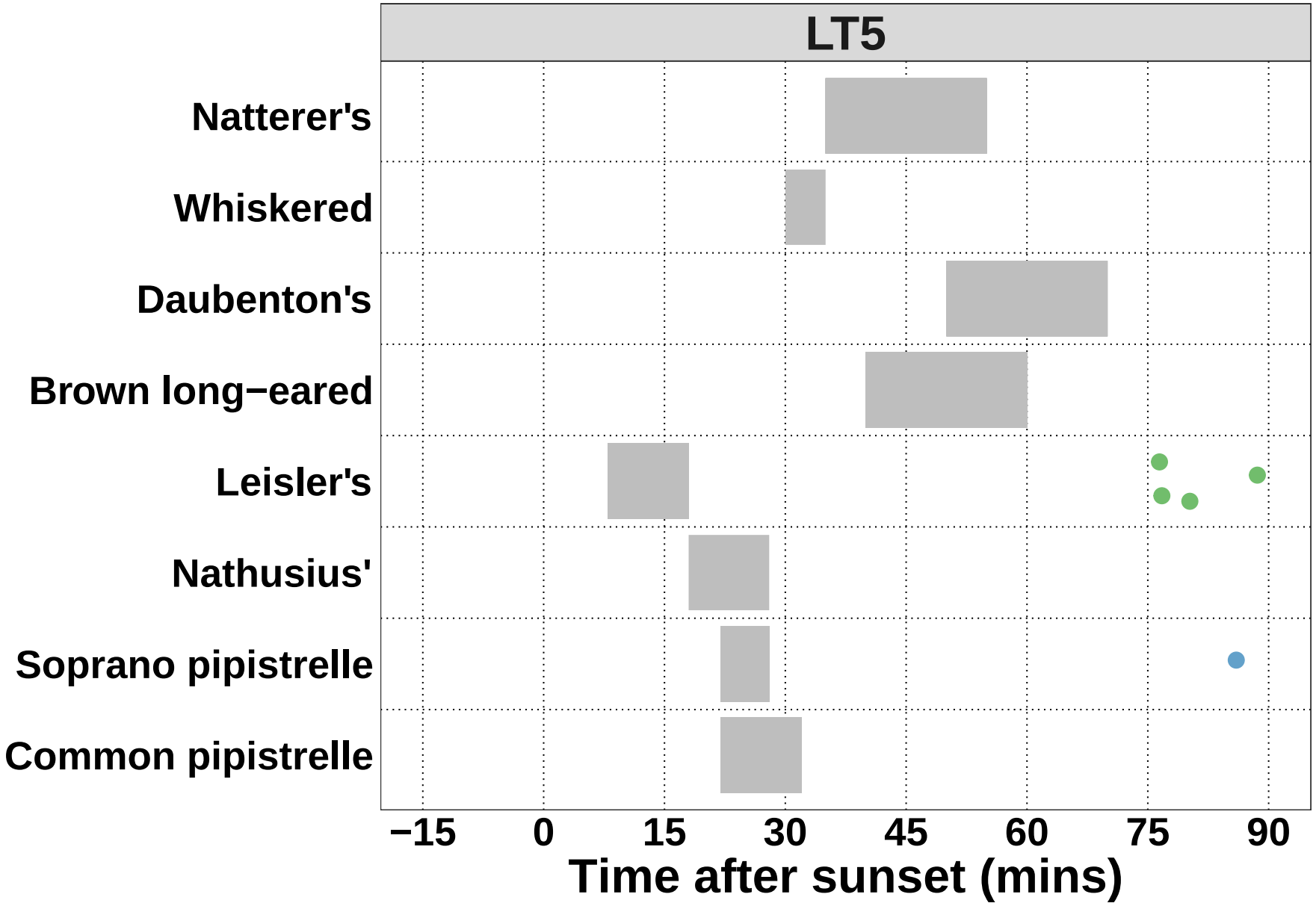

LT10
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

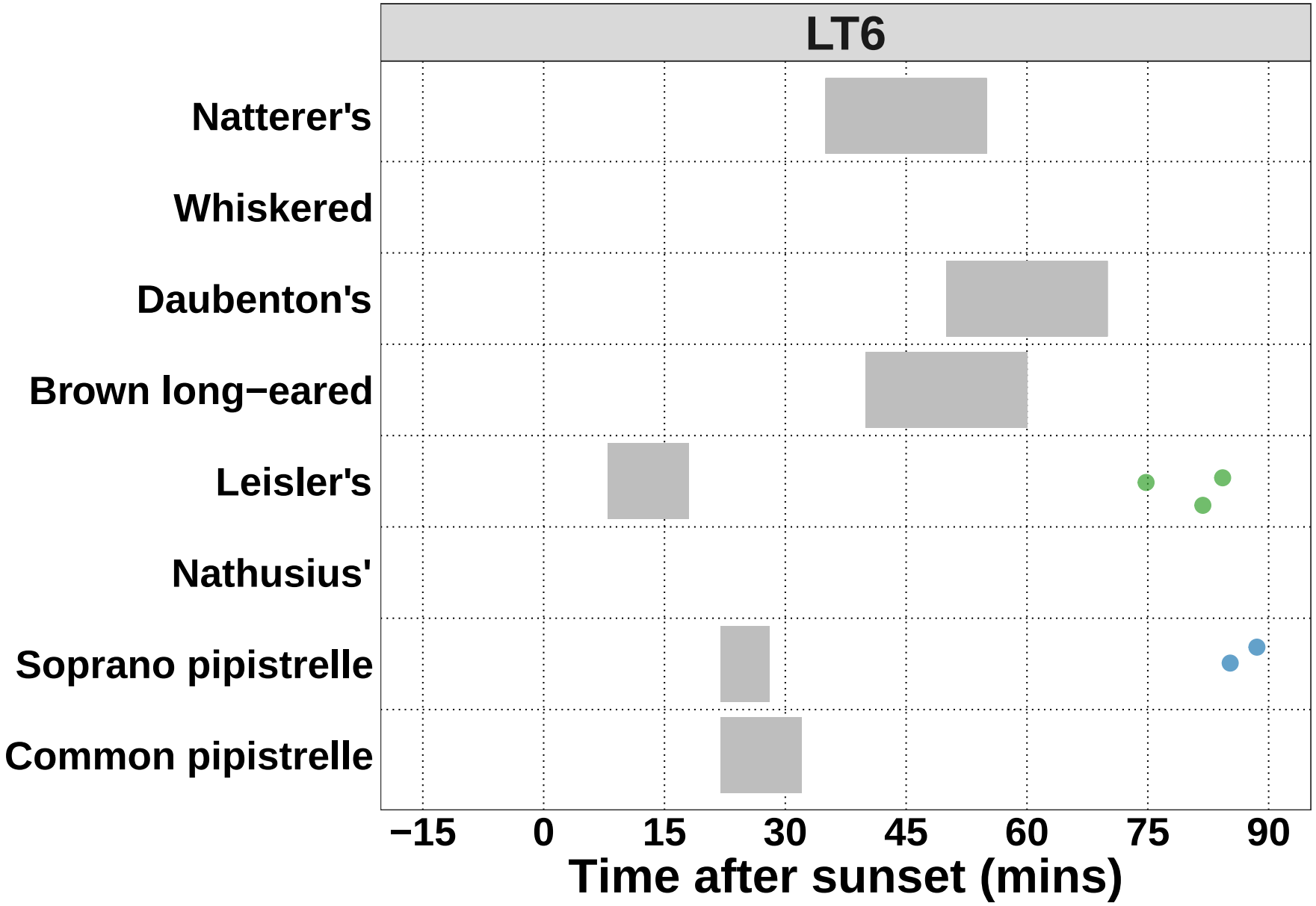

LT11
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

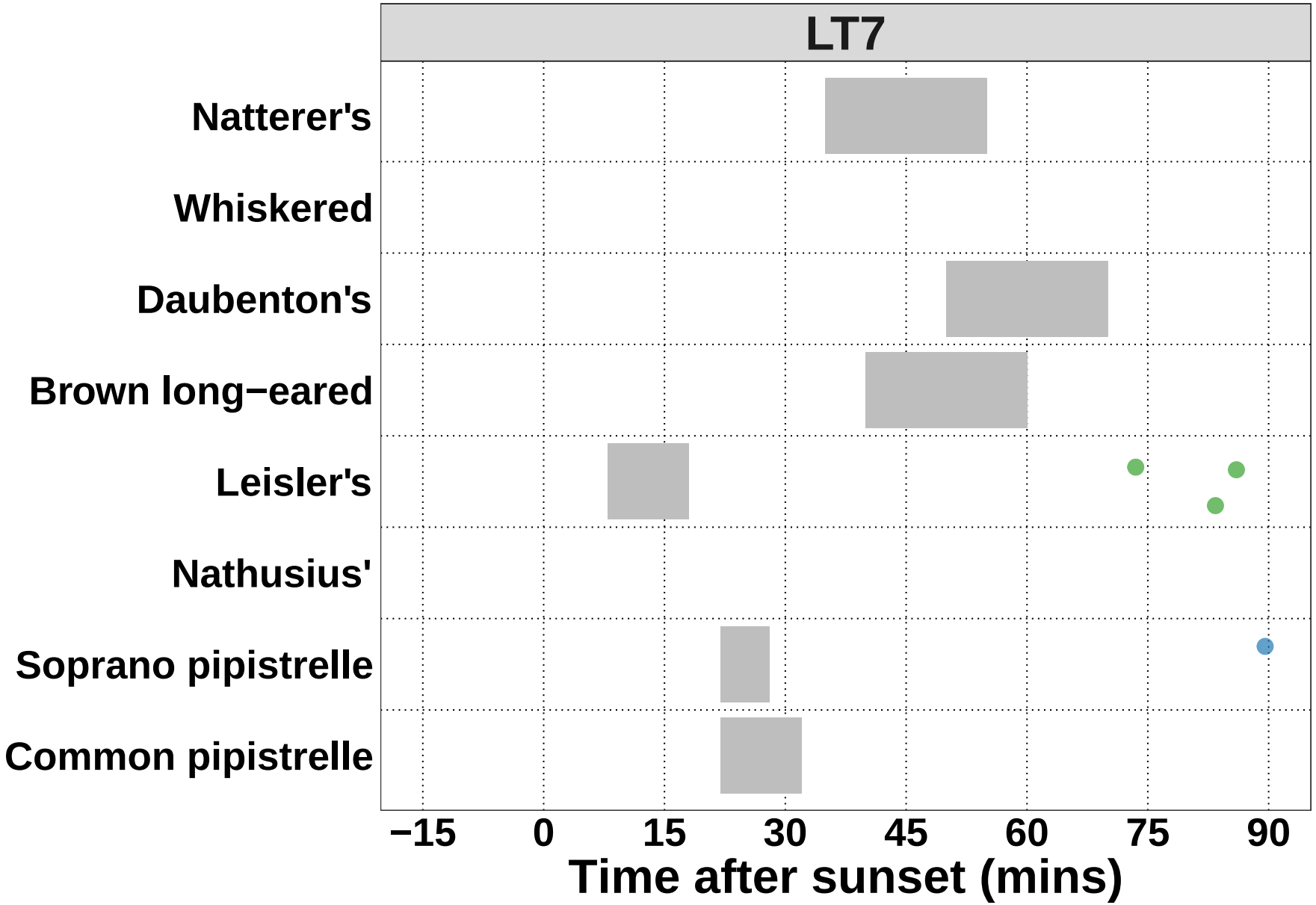

LT2
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

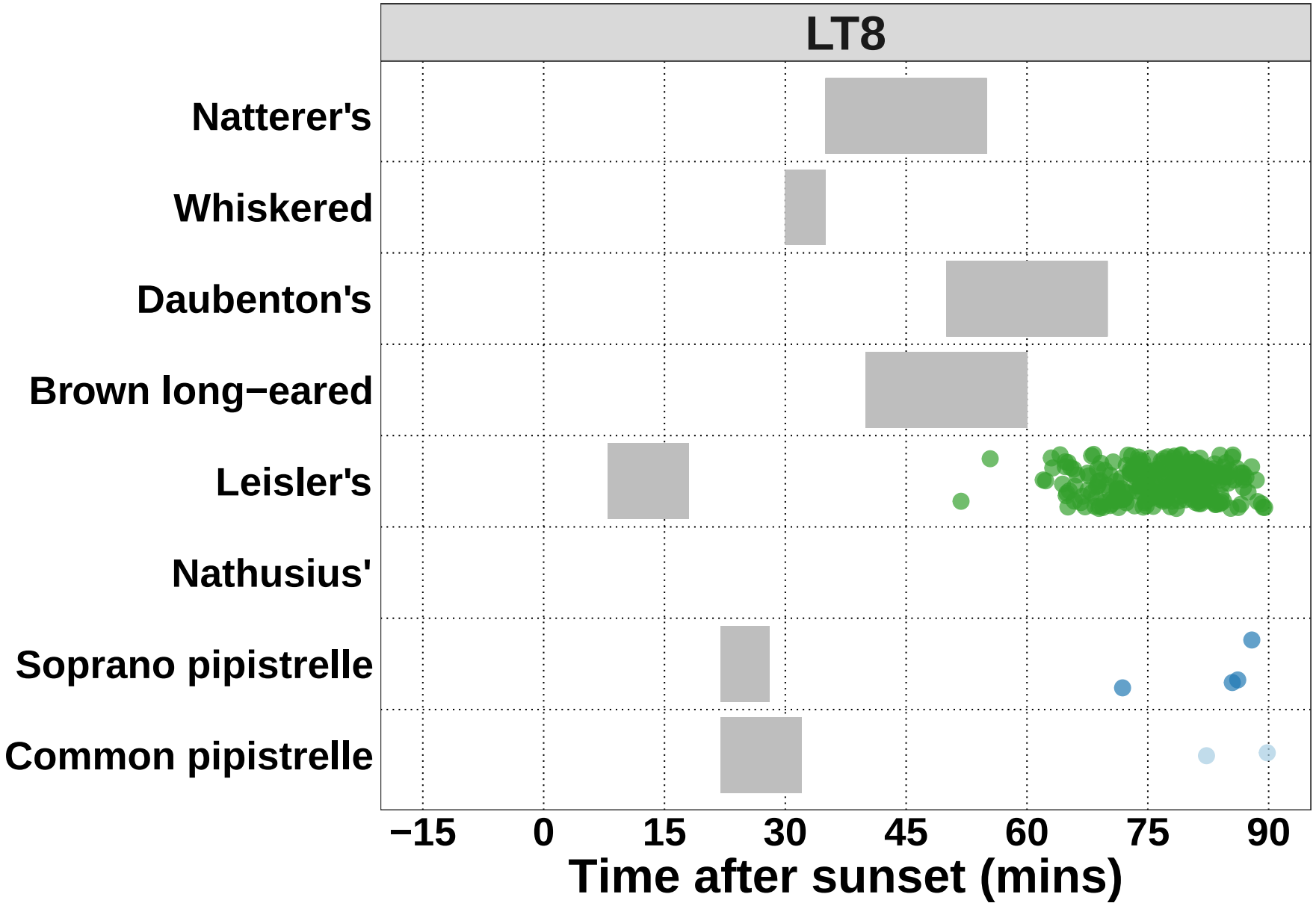

LT3
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)

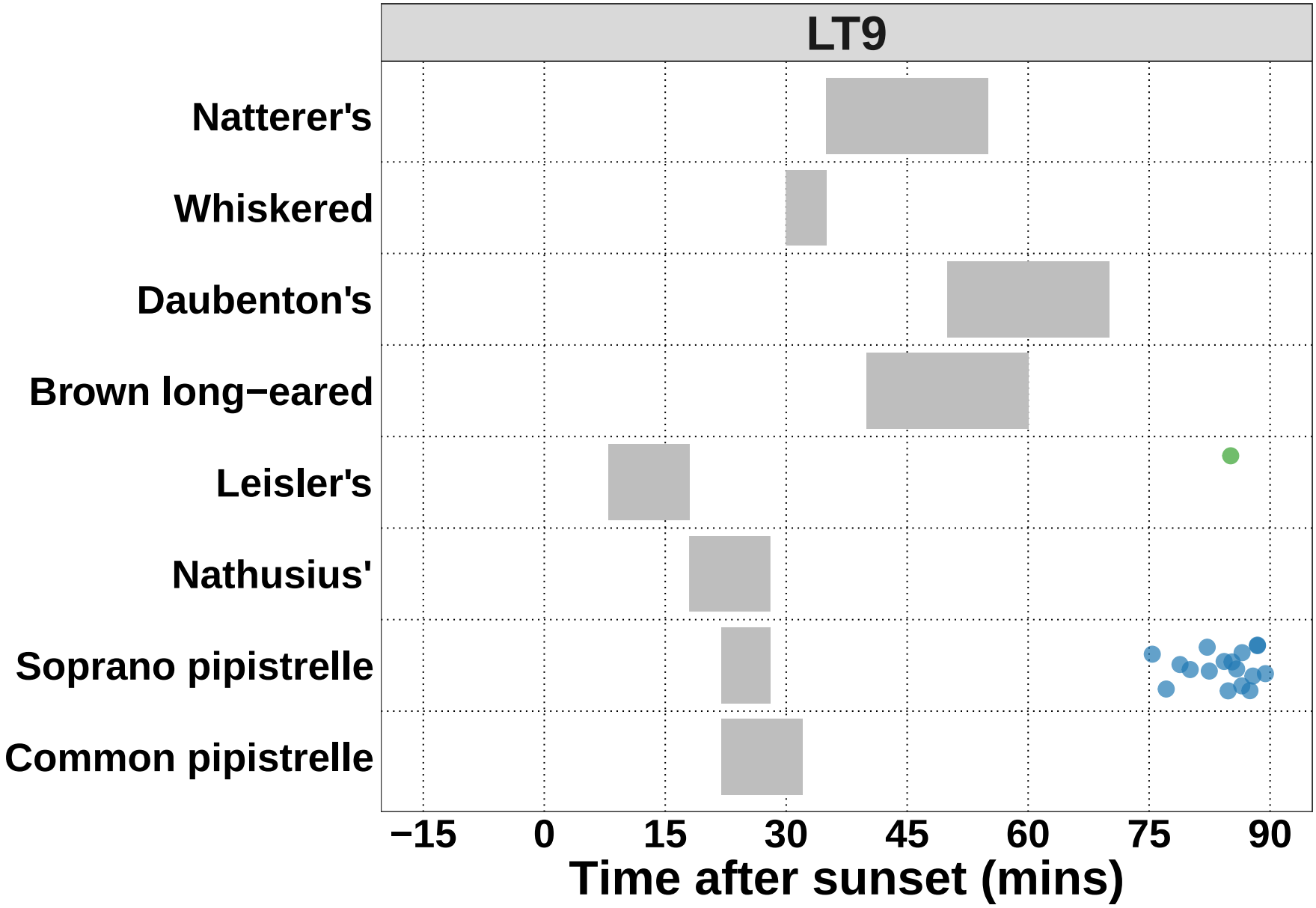

LT4
Natterer's
Whiskered
Daubenton's
Brown long−eared
Leisler's
Nathusius'
Soprano pipistrelle
Common pipistrelle
−15
0
15
30
45
60
75
90
Time after sunset (mins)


LT5
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)


LT6
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)


LT7
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)


LT8
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)


LT9
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)

Count 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 (%)
Myotis daubentonii	398	6.1
Myotis mystacinus	32	0.5
Myotis nattereri	249	3.8
Nyctalus leisleri	1854	28.2
Pipistrellus nathusii	7	0.1
Pipistrellus pipistrellus	879	13.4
Pipistrellus pygmaeus	2836	43.1
Plecotus auritus	319	4.9
Total	6574	100.1

Per Detector

The number of passes recorded for each species at each detector.

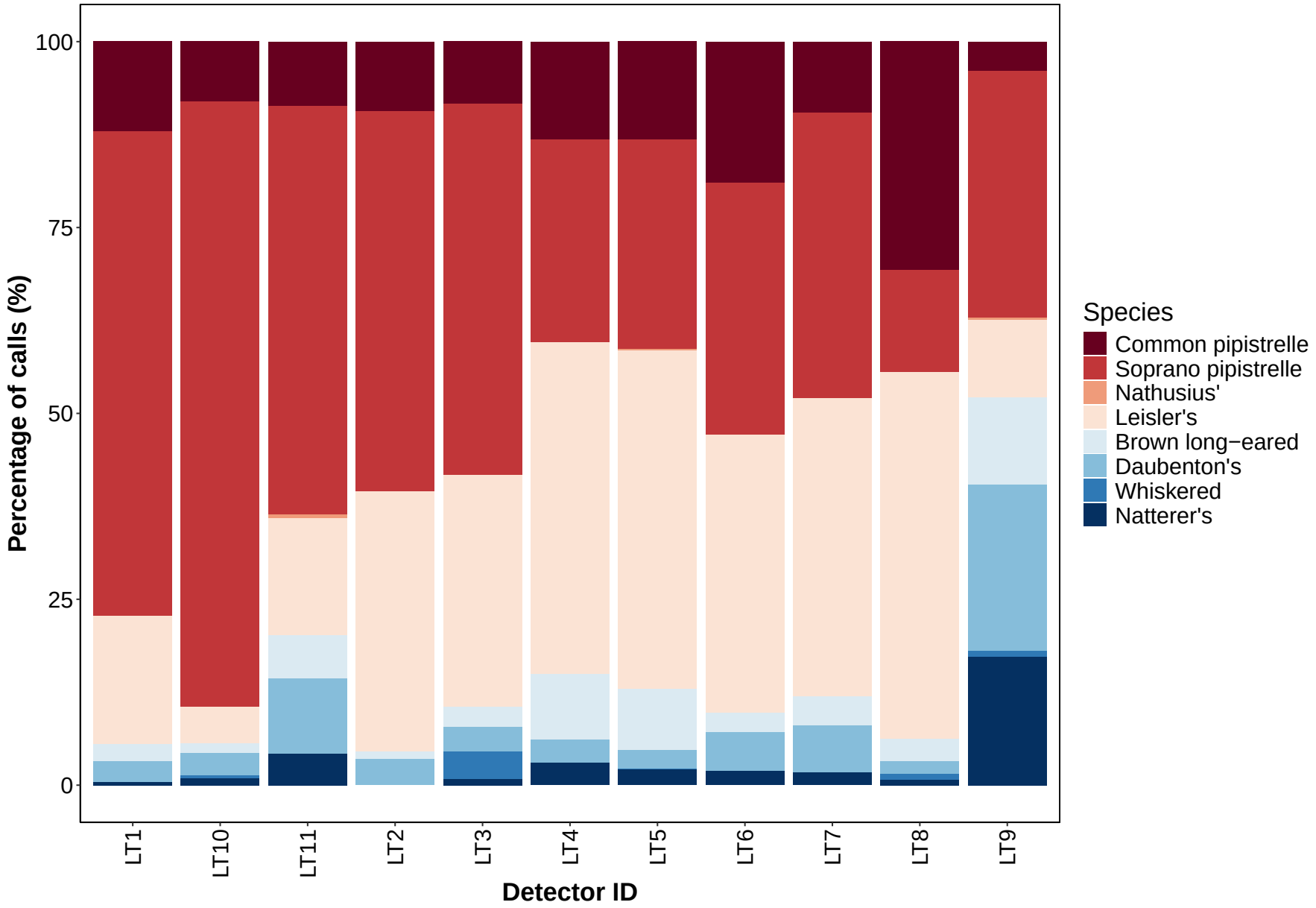
Species	Detector ID	Count (no.)	Percentage by Detector (%)
Common pipistrelle	LT1	106	12.3112660
Common pipistrelle	LT10	52	8.0620155
Common pipistrelle	LT11	38	9.7435897
Common pipistrelle	LT2	48	9.7759674
Common pipistrelle	LT3	28	8.2111437
Common pipistrelle	LT4	66	14.1630901
Common pipistrelle	LT5	64	13.7044968
Common pipistrelle	LT6	77	18.0327869
Common pipistrelle	LT7	60	9.8522167
Common pipistrelle	LT8	306	31.0030395
Common pipistrelle	LT9	34	3.8202247
Soprano pipistrelle	LT1	555	64.4599303
Soprano pipistrelle	LT10	527	81.7054264
Soprano pipistrelle	LT11	212	54.3589744
Soprano pipistrelle	LT2	242	49.2871690
Soprano pipistrelle	LT3	166	48.6803519
Soprano pipistrelle	LT4	126	27.0386266
Soprano pipistrelle	LT5	129	27.6231263
Soprano pipistrelle	LT6	153	35.8313817
Soprano pipistrelle	LT7	250	41.0509031
Soprano pipistrelle	LT8	150	15.1975684
Soprano pipistrelle	LT9	326	36.6292135
Nathusius'	LT11	2	0.5128205
Nathusius'	LT5	1	0.2141328
Nathusius'	LT9	4	0.4494382
Leisler's	LT1	149	17.3054588
Leisler's	LT10	27	4.1860465
Leisler's	LT11	73	18.7179487
Leisler's	LT2	176	35.8452138
Leisler's	LT3	114	33.4310850
Leisler's	LT4	207	44.4206009
Leisler's	LT5	208	44.5396146

Species	Detector ID	Count (no.)	Percentage by Detector (%)
Leisler's	LT6	148	34.6604215
Leisler's	LT7	226	37.1100164
Leisler's	LT8	450	45.5927052
Leisler's	LT9	76	8.5393258
Brown long-eared	LT1	23	2.6713124
Brown long-eared	LT10	10	1.5503876
Brown long-eared	LT11	19	4.8717949
Brown long-eared	LT2	5	1.0183299
Brown long-eared	LT3	9	2.6392962
Brown long-eared	LT4	35	7.5107296
Brown long-eared	LT5	42	8.9935760
Brown long-eared	LT6	14	3.2786885
Brown long-eared	LT7	24	3.9408867
Brown long-eared	LT8	38	3.8500507
Brown long-eared	LT9	100	11.2359551
Daubenton's	LT1	23	2.6713124
Daubenton's	LT10	20	3.1007752
Daubenton's	LT11	30	7.6923077
Daubenton's	LT2	20	4.0733198
Daubenton's	LT3	11	3.2258065
Daubenton's	LT4	17	3.6480687
Daubenton's	LT5	12	2.5695931
Daubenton's	LT6	25	5.8548009
Daubenton's	LT7	39	6.4039409
Daubenton's	LT8	20	2.0263425
Daubenton's	LT9	181	20.3370787
Whiskered	LT10	3	0.4651163
Whiskered	LT3	9	2.6392962
Whiskered	LT5	1	0.2141328
Whiskered	LT8	10	1.0131712
Whiskered	LT9	9	1.0112360
Natterer's	LT1	5	0.5807201
Natterer's	LT10	6	0.9302326
Natterer's	LT11	16	4.1025641
Natterer's	LT3	4	1.1730205
Natterer's	LT4	15	3.2188841

Species	Detector ID	Count (no.)	Percentage by Detector (%)
Natterer's	LT5	10	2.1413276
Natterer's	LT6	10	2.3419204
Natterer's	LT7	10	1.6420361
Natterer's	LT8	13	1.3171226
Natterer's	LT9	160	17.9775281

Species Composition

Figure 10. Percentage species composition of passes at each detector.


100
75
50
25
0
Percentage of calls (%)
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID
Species
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Brown long−eared
Daubenton's
Whiskered
Natterer's

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.

Nighlty 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	LT1	0.7
Common pipistrelle	LT10	0.1
Common pipistrelle	LT11	0.3
Common pipistrelle	LT2	0.3
Common pipistrelle	LT3	0.2
Common pipistrelle	LT4	0.5
Common pipistrelle	LT5	0.5
Common pipistrelle	LT6	0.5
Common pipistrelle	LT7	0.3
Common pipistrelle	LT8	1.0
Common pipistrelle	LT9	0.2
Soprano pipistrelle	LT1	3.5
Soprano pipistrelle	LT10	1.8
Soprano pipistrelle	LT11	1.2
Soprano pipistrelle	LT2	1.6
Soprano pipistrelle	LT3	0.7
Soprano pipistrelle	LT4	0.6
Soprano pipistrelle	LT5	0.6
Soprano pipistrelle	LT6	0.8
Soprano pipistrelle	LT7	1.1
Soprano pipistrelle	LT8	0.7
Soprano pipistrelle	LT9	1.3
Nathusius'	LT11	0.1
Nathusius'	LT5	0.1
Nathusius'	LT9	0.1
Leisler's	LT1	0.7
Leisler's	LT10	0.2
Leisler's	LT11	0.4
Leisler's	LT2	1.0
Leisler's	LT3	0.6
Leisler's	LT4	0.8
Leisler's	LT5	0.8
Leisler's	LT6	0.8
Leisler's	LT7	1.1
Leisler's	LT8	2.0
Leisler's	LT9	0.6

Species	Detector ID	Median Pass Rate
Brown long-eared	LT1	0.2
Brown long-eared	LT10	0.1
Brown long-eared	LT11	0.1
Brown long-eared	LT2	0.1
Brown long-eared	LT3	0.1
Brown long-eared	LT4	0.3
Brown long-eared	LT5	0.3
Brown long-eared	LT6	0.1
Brown long-eared	LT7	0.1
Brown long-eared	LT8	0.3
Brown long-eared	LT9	0.7
Daubenton's	LT1	0.2
Daubenton's	LT10	0.2
Daubenton's	LT11	0.2
Daubenton's	LT2	0.2
Daubenton's	LT3	0.1
Daubenton's	LT4	0.1
Daubenton's	LT5	0.1
Daubenton's	LT6	0.2
Daubenton's	LT7	0.2
Daubenton's	LT8	0.1
Daubenton's	LT9	1.1
Whiskered	LT10	0.1
Whiskered	LT3	0.1
Whiskered	LT5	0.1
Whiskered	LT8	0.1
Whiskered	LT9	0.1
Natterer's	LT1	0.1
Natterer's	LT10	0.1
Natterer's	LT11	0.1
Natterer's	LT3	0.1
Natterer's	LT4	0.1
Natterer's	LT5	0.2
Natterer's	LT6	0.1
Natterer's	LT7	0.1
Natterer's	LT8	0.1

Species	Detector ID	Median Pass Rate
Natterer's	LT9	1.1

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.

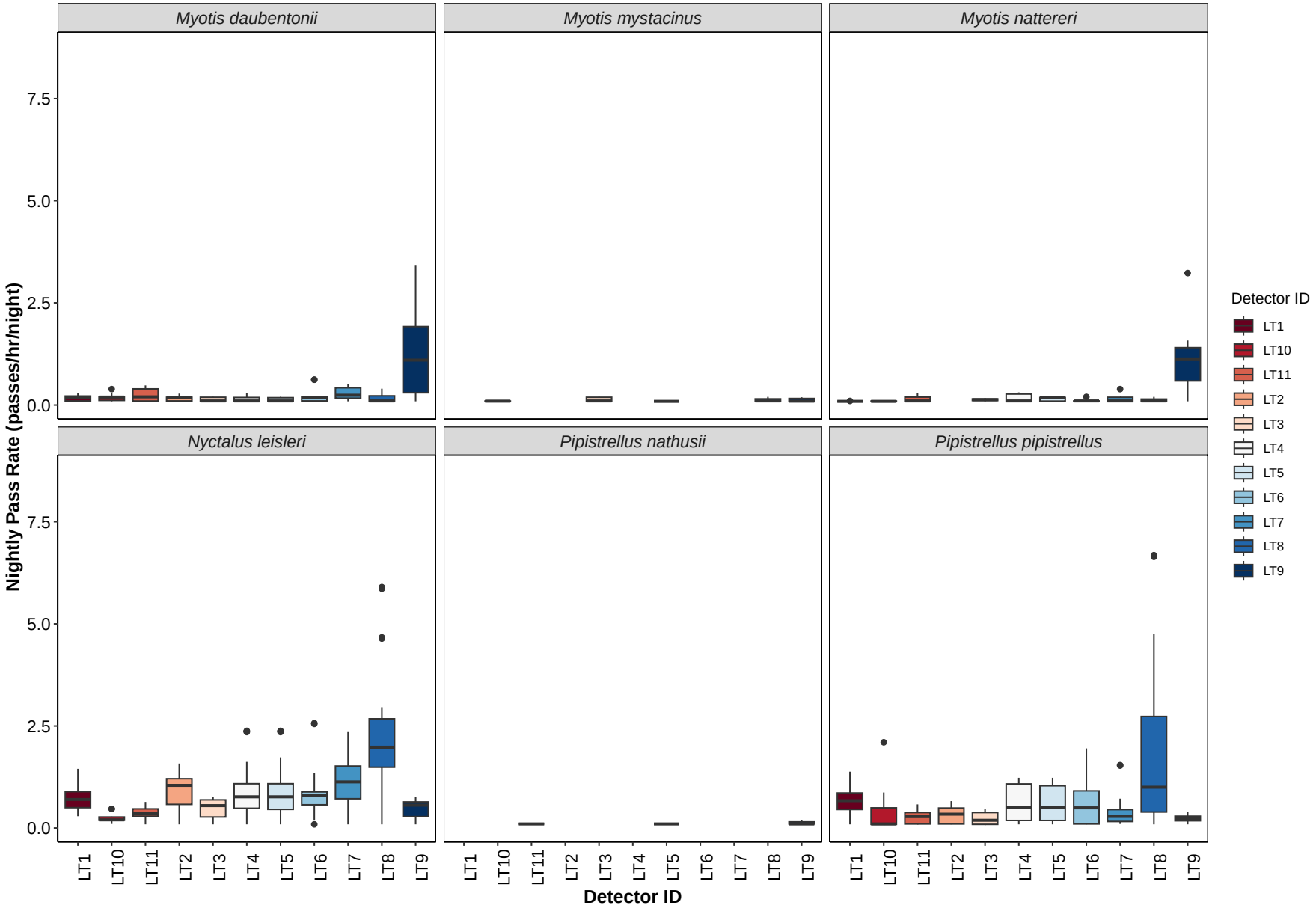
Species	Detector ID	Mean Pass Rate
Common pipistrelle	LT1	0.7
Common pipistrelle	LT10	0.4
Common pipistrelle	LT11	0.3
Common pipistrelle	LT2	0.3
Common pipistrelle	LT3	0.2
Common pipistrelle	LT4	0.6
Common pipistrelle	LT5	0.6
Common pipistrelle	LT6	0.6
Common pipistrelle	LT7	0.4
Common pipistrelle	LT8	1.9
Common pipistrelle	LT9	0.2
Soprano pipistrelle	LT1	3.4
Soprano pipistrelle	LT10	2.9
Soprano pipistrelle	LT11	1.2
Soprano pipistrelle	LT2	1.4
Soprano pipistrelle	LT3	0.9
Soprano pipistrelle	LT4	0.7
Soprano pipistrelle	LT5	0.7
Soprano pipistrelle	LT6	0.9
Soprano pipistrelle	LT7	1.2
Soprano pipistrelle	LT8	0.8
Soprano pipistrelle	LT9	1.7
Nathusius'	LT11	0.1
Nathusius'	LT5	0.1
Nathusius'	LT9	0.1
Leisler's	LT1	0.7
Leisler's	LT10	0.2
Leisler's	LT11	0.4
Leisler's	LT2	0.9
Leisler's	LT3	0.5

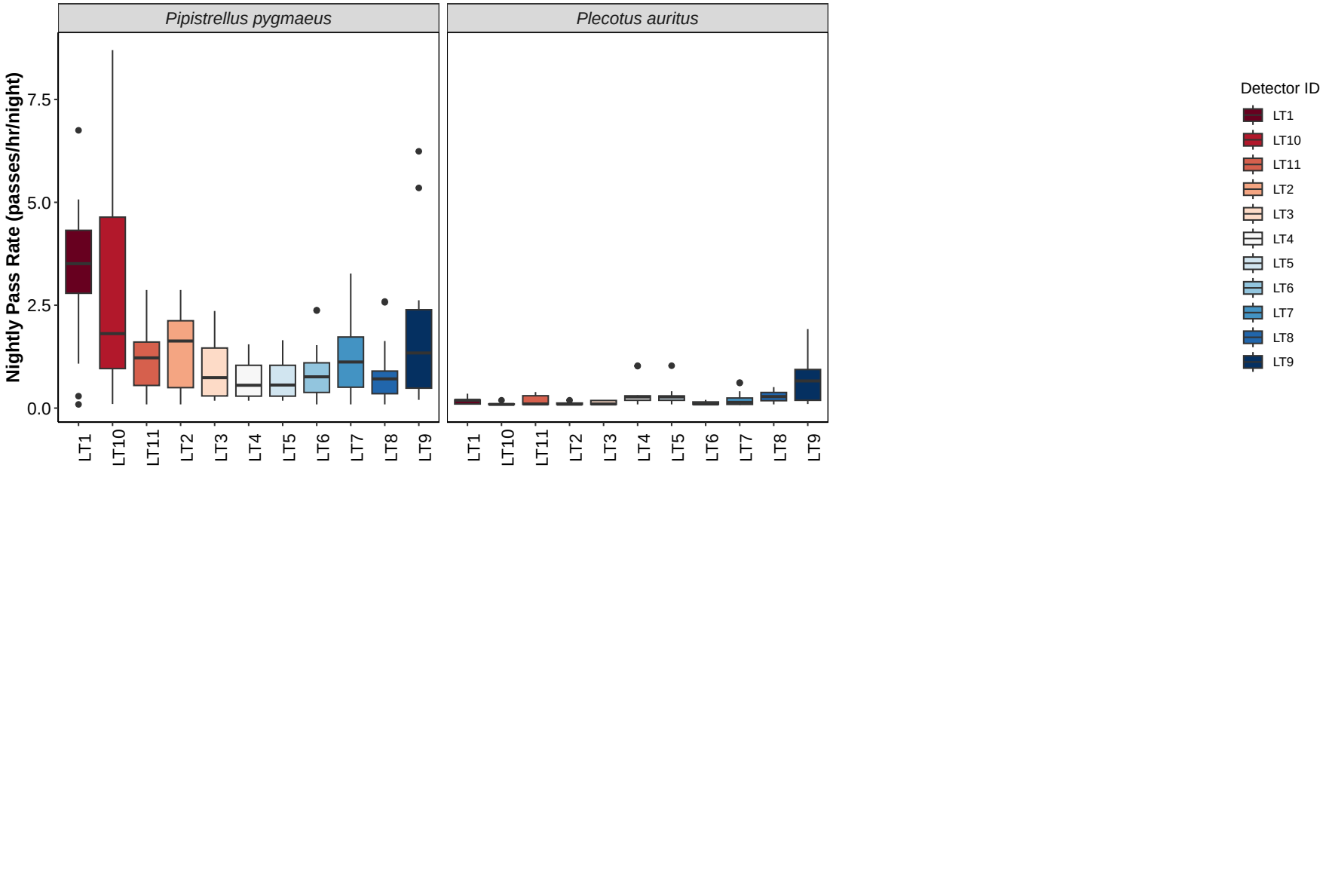
Species	Detector ID	Mean Pass Rate
Leisler's	LT4	0.9
Leisler's	LT5	0.9
Leisler's	LT6	0.8
Leisler's	LT7	1.2
Leisler's	LT8	2.2
Leisler's	LT9	0.5
Brown long-eared	LT1	0.2
Brown long-eared	LT10	0.1
Brown long-eared	LT11	0.2
Brown long-eared	LT2	0.1
Brown long-eared	LT3	0.1
Brown long-eared	LT4	0.3
Brown long-eared	LT5	0.3
Brown long-eared	LT6	0.1
Brown long-eared	LT7	0.2
Brown long-eared	LT8	0.3
Brown long-eared	LT9	0.7
Daubenton's	LT1	0.2
Daubenton's	LT10	0.2
Daubenton's	LT11	0.3
Daubenton's	LT2	0.2
Daubenton's	LT3	0.1
Daubenton's	LT4	0.1
Daubenton's	LT5	0.1
Daubenton's	LT6	0.2
Daubenton's	LT7	0.3
Daubenton's	LT8	0.2
Daubenton's	LT9	1.3
Whiskered	LT10	0.1
Whiskered	LT3	0.1
Whiskered	LT5	0.1
Whiskered	LT8	0.1
Whiskered	LT9	0.1
Natterer's	LT1	0.1
Natterer's	LT10	0.1
Natterer's	LT11	0.2

Species	Detector ID	Mean Pass Rate
Natterer's	LT3	0.1
Natterer's	LT4	0.2
Natterer's	LT5	0.1
Natterer's	LT6	0.1
Natterer's	LT7	0.2
Natterer's	LT8	0.1
Natterer's	LT9	1.1

Per Detector

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)
0.0
2.5
5.0
7.5
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID


Pipistrellus pygmaeus
Plecotus auritus
Nightly Pass Rate (passes/hr/night)
7.5
5.0
2.5
0.0
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID

Split by Month

Total Bat Passes per Detector each Month

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	Aug	Sep
Common pipistrelle	LT1	56	81
Common pipistrelle	LT10	13	39
Common pipistrelle	LT11	7	30
Common pipistrelle	LT2	15	33
Common pipistrelle	LT3	11	19
Common pipistrelle	LT4	54	17
Common pipistrelle	LT5	54	16
Common pipistrelle	LT6	85	16
Common pipistrelle	LT7	57	12
Common pipistrelle	LT8	250	128
Common pipistrelle	LT9	16	24
Soprano pipistrelle	LT1	239	502
Soprano pipistrelle	LT10	113	415
Soprano pipistrelle	LT11	120	114
Soprano pipistrelle	LT2	110	152
Soprano pipistrelle	LT3	73	107
Soprano pipistrelle	LT4	84	62
Soprano pipistrelle	LT5	86	64
Soprano pipistrelle	LT6	123	58
Soprano pipistrelle	LT7	168	108
Soprano pipistrelle	LT8	115	55
Soprano pipistrelle	LT9	79	261
Nathusius'	LT11	2	0
Nathusius'	LT5	1	0
Nathusius'	LT9	4	0
Leisler's	LT1	67	128
Leisler's	LT10	10	22
Leisler's	LT11	16	51
Leisler's	LT2	56	124
Leisler's	LT3	28	84
Leisler's	LT4	127	113
Leisler's	LT5	128	114
Leisler's	LT6	114	85
Leisler's	LT7	131	157
Leisler's	LT8	263	345
Leisler's	LT9	30	76

Species	Detector ID	Aug	Sep
Brown long-eared	LT1	10	17
Brown long-eared	LT10	1	7
Brown long-eared	LT11	9	16
Brown long-eared	LT2	1	4
Brown long-eared	LT3	1	9
Brown long-eared	LT4	30	17
Brown long-eared	LT5	25	19
Brown long-eared	LT6	9	5
Brown long-eared	LT7	17	11
Brown long-eared	LT8	20	16
Brown long-eared	LT9	3	118
Daubenton's	LT1	13	18
Daubenton's	LT10	9	11
Daubenton's	LT11	6	37
Daubenton's	LT2	5	13
Daubenton's	LT3	5	7
Daubenton's	LT4	11	6
Daubenton's	LT5	7	6
Daubenton's	LT6	20	8
Daubenton's	LT7	27	19
Daubenton's	LT8	18	4
Daubenton's	LT9	27	202
Whiskered	LT10	1	1
Whiskered	LT3	5	8
Whiskered	LT5	0	1
Whiskered	LT8	7	2
Whiskered	LT9	1	7
Natterer's	LT1	1	4
Natterer's	LT10	1	5
Natterer's	LT11	3	15
Natterer's	LT3	0	3
Natterer's	LT4	5	11
Natterer's	LT5	2	9
Natterer's	LT6	4	6
Natterer's	LT7	5	7
Natterer's	LT8	4	5

Species	Detector ID	Aug	Sep
Natterer's	LT9	40	137

Survey Effort

Table 19. The number of survey nights per month per detector.

month	Detector ID	No. of Survey Nights
Aug	LT1	8
Aug	LT10	7
Aug	LT11	7
Aug	LT2	7
Aug	LT3	7
Aug	LT4	11
Aug	LT5	11
Aug	LT6	10
Aug	LT7	11
Aug	LT8	11
Aug	LT9	7
Sep	LT1	17
Sep	LT10	13
Sep	LT11	15
Sep	LT2	13
Sep	LT3	15
Sep	LT4	15
Sep	LT5	15
Sep	LT6	13
Sep	LT7	13
Sep	LT8	15
Sep	LT9	16

Nightly Bat Passes 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	Aug	Sep
Common pipistrelle	LT1	0.6	0.7
Common pipistrelle	LT10	0.5	0.1
Common pipistrelle	LT11	0.1	0.4
Common pipistrelle	LT2	0.4	0.3
Common pipistrelle	LT3	0.2	0.1
Common pipistrelle	LT4	1.0	0.2
Common pipistrelle	LT5	1.0	0.2
Common pipistrelle	LT6	0.9	0.1
Common pipistrelle	LT7	0.4	0.2
Common pipistrelle	LT8	1.2	0.5
Common pipistrelle	LT9	0.4	0.2
Soprano pipistrelle	LT1	3.6	3.2
Soprano pipistrelle	LT10	1.7	2.7
Soprano pipistrelle	LT11	1.6	0.9
Soprano pipistrelle	LT2	2.2	1.6
Soprano pipistrelle	LT3	0.9	0.7
Soprano pipistrelle	LT4	1.0	0.6
Soprano pipistrelle	LT5	1.0	0.6
Soprano pipistrelle	LT6	1.3	0.5
Soprano pipistrelle	LT7	1.2	0.9
Soprano pipistrelle	LT8	0.9	0.6
Soprano pipistrelle	LT9	0.8	1.6
Nathusius'	LT11	0.1	NA
Nathusius'	LT5	0.1	NA
Nathusius'	LT9	0.1	NA
Leisler's	LT1	0.8	0.7
Leisler's	LT10	0.2	0.3
Leisler's	LT11	0.4	0.3
Leisler's	LT2	1.2	1.0
Leisler's	LT3	0.5	0.6
Leisler's	LT4	0.7	0.8
Leisler's	LT5	0.7	0.8
Leisler's	LT6	0.9	0.6
Leisler's	LT7	0.9	1.1
Leisler's	LT8	2.1	1.9
Leisler's	LT9	0.4	0.6

Species	Detector ID	Aug	Sep
Brown long-eared	LT1	0.2	0.2
Brown long-eared	LT10	0.1	0.1
Brown long-eared	LT11	0.2	0.1
Brown long-eared	LT2	0.1	0.1
Brown long-eared	LT3	0.1	0.1
Brown long-eared	LT4	0.3	0.3
Brown long-eared	LT5	0.3	0.2
Brown long-eared	LT6	0.2	0.1
Brown long-eared	LT7	0.5	0.1
Brown long-eared	LT8	0.3	0.2
Brown long-eared	LT9	0.2	0.8
Daubenton's	LT1	0.2	0.2
Daubenton's	LT10	0.2	0.1
Daubenton's	LT11	0.2	0.3
Daubenton's	LT2	0.1	0.2
Daubenton's	LT3	0.2	0.1
Daubenton's	LT4	0.1	0.1
Daubenton's	LT5	0.1	0.1
Daubenton's	LT6	0.2	0.1
Daubenton's	LT7	0.4	0.2
Daubenton's	LT8	0.2	0.1
Daubenton's	LT9	0.7	1.6
Whiskered	LT10	0.1	0.1
Whiskered	LT3	0.2	0.1
Whiskered	LT5	NA	0.1
Whiskered	LT8	0.1	0.1
Whiskered	LT9	0.1	0.1
Natterer's	LT1	0.1	0.1
Natterer's	LT10	0.1	0.1
Natterer's	LT11	0.2	0.1
Natterer's	LT3	NA	0.1
Natterer's	LT4	0.1	0.1
Natterer's	LT5	0.2	0.1
Natterer's	LT6	0.1	0.1
Natterer's	LT7	0.2	0.1
Natterer's	LT8	0.1	0.1

Species	Detector ID	Aug	Sep
Natterer's	LT9	1.1	1.1

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.

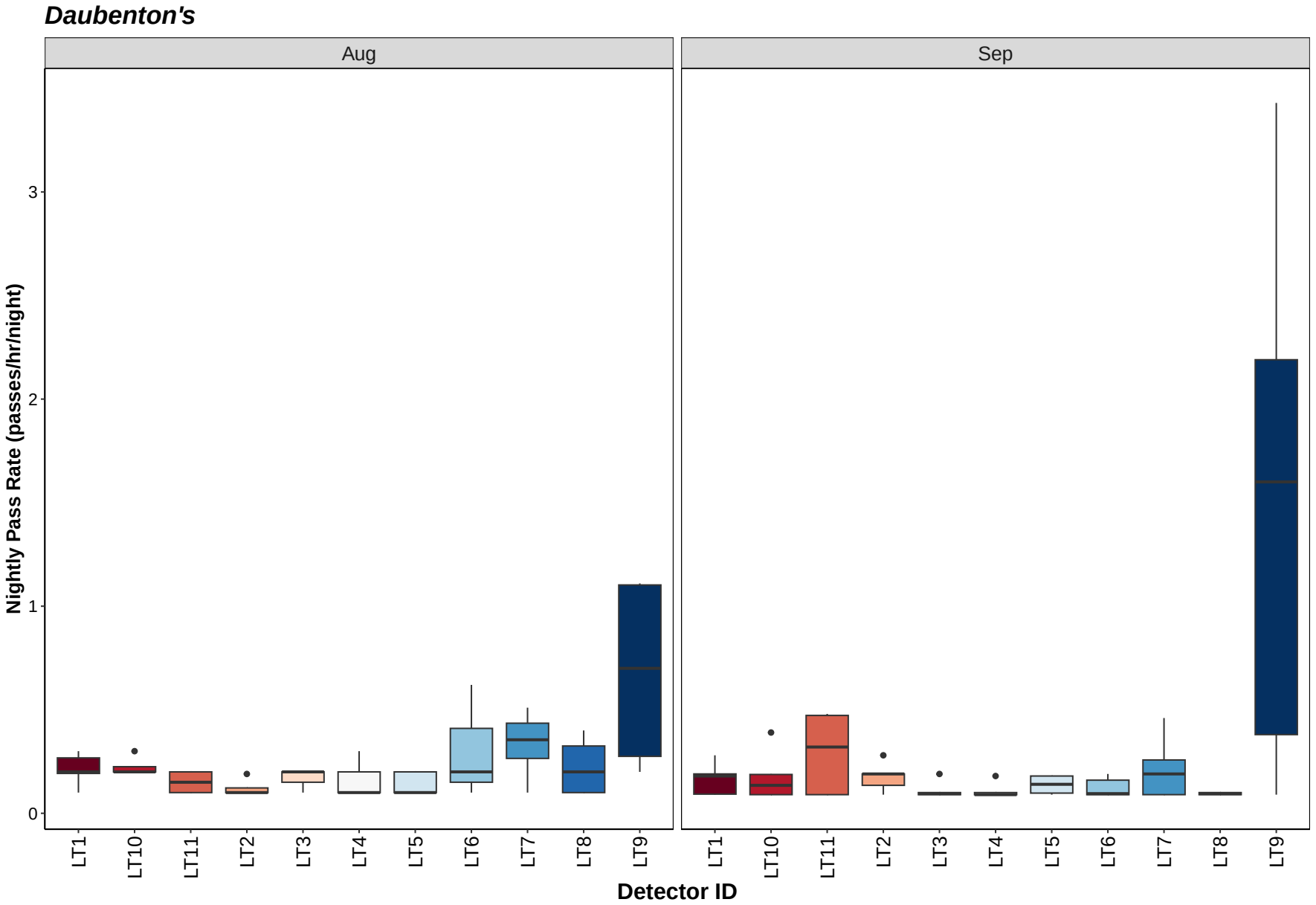
Species	Detector ID	Aug	Sep
Common pipistrelle	LT1	0.8	0.6
Common pipistrelle	LT10	0.4	0.4
Common pipistrelle	LT11	0.1	0.4
Common pipistrelle	LT2	0.3	0.3
Common pipistrelle	LT3	0.2	0.2
Common pipistrelle	LT4	0.9	0.3
Common pipistrelle	LT5	0.9	0.3
Common pipistrelle	LT6	1.0	0.2
Common pipistrelle	LT7	0.6	0.2
Common pipistrelle	LT8	2.6	1.2
Common pipistrelle	LT9	0.3	0.2
Soprano pipistrelle	LT1	3.0	3.6
Soprano pipistrelle	LT10	1.9	3.5
Soprano pipistrelle	LT11	1.7	0.9
Soprano pipistrelle	LT2	1.6	1.3
Soprano pipistrelle	LT3	1.0	0.8
Soprano pipistrelle	LT4	0.9	0.5
Soprano pipistrelle	LT5	1.0	0.5
Soprano pipistrelle	LT6	1.2	0.5
Soprano pipistrelle	LT7	1.6	0.9
Soprano pipistrelle	LT8	1.2	0.5
Soprano pipistrelle	LT9	1.1	2.0
Nathusius'	LT11	0.1	NA
Nathusius'	LT5	0.1	NA
Nathusius'	LT9	0.1	NA
Leisler's	LT1	0.8	0.7
Leisler's	LT10	0.2	0.3
Leisler's	LT11	0.4	0.4
Leisler's	LT2	1.1	0.9
Leisler's	LT3	0.5	0.5

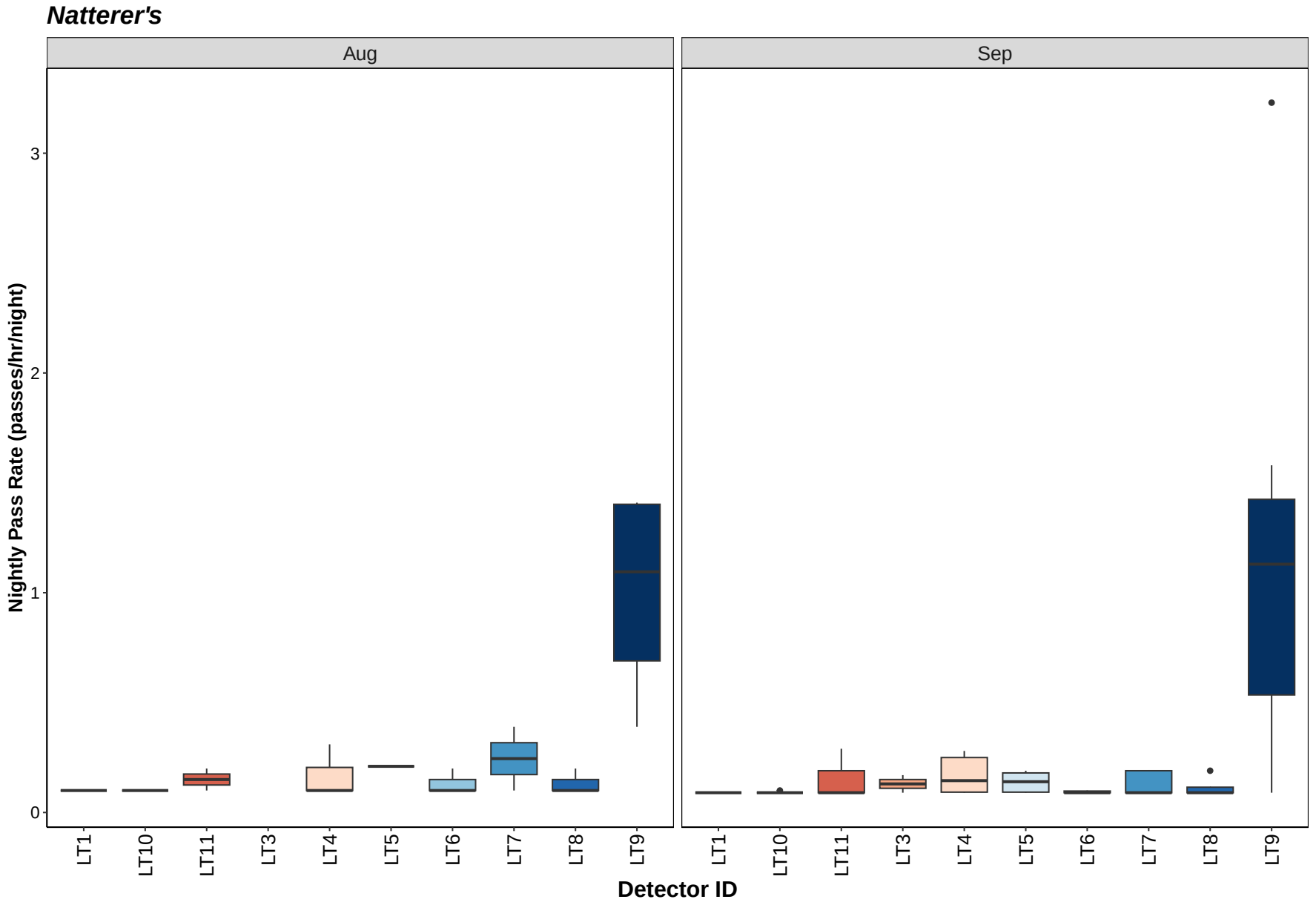
Species	Detector ID	Aug	Sep
Leisler's	LT4	1.2	0.7
Leisler's	LT5	1.2	0.7
Leisler's	LT6	1.2	0.6
Leisler's	LT7	1.2	1.1
Leisler's	LT8	2.4	2.1
Leisler's	LT9	0.4	0.5
Brown long-eared	LT1	0.2	0.2
Brown long-eared	LT10	0.1	0.1
Brown long-eared	LT11	0.2	0.2
Brown long-eared	LT2	0.1	0.1
Brown long-eared	LT3	0.1	0.1
Brown long-eared	LT4	0.4	0.2
Brown long-eared	LT5	0.4	0.2
Brown long-eared	LT6	0.2	0.1
Brown long-eared	LT7	0.4	0.1
Brown long-eared	LT8	0.3	0.2
Brown long-eared	LT9	0.2	0.8
Daubenton's	LT1	0.2	0.2
Daubenton's	LT10	0.2	0.2
Daubenton's	LT11	0.2	0.3
Daubenton's	LT2	0.1	0.2
Daubenton's	LT3	0.2	0.1
Daubenton's	LT4	0.2	0.1
Daubenton's	LT5	0.1	0.1
Daubenton's	LT6	0.3	0.1
Daubenton's	LT7	0.3	0.2
Daubenton's	LT8	0.2	0.1
Daubenton's	LT9	0.7	1.4
Whiskered	LT10	0.1	0.1
Whiskered	LT3	0.2	0.1
Whiskered	LT5	NA	0.1
Whiskered	LT8	0.1	0.1
Whiskered	LT9	0.1	0.1
Natterer's	LT1	0.1	0.1
Natterer's	LT10	0.1	0.1
Natterer's	LT11	0.2	0.2

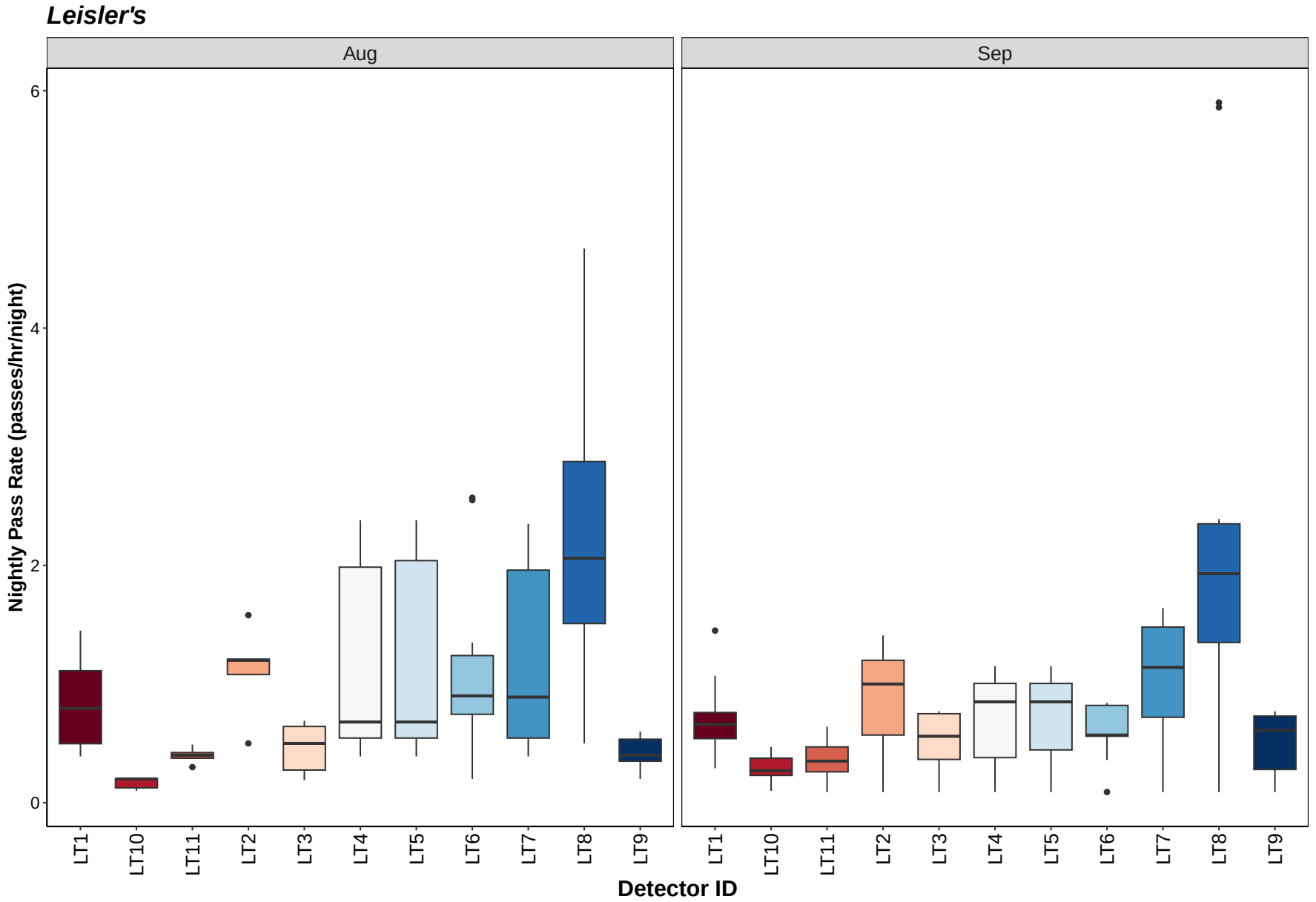
Species	Detector ID	Aug	Sep
Natterer's	LT3	NA	0.1
Natterer's	LT4	0.2	0.2
Natterer's	LT5	0.2	0.1
Natterer's	LT6	0.1	0.1
Natterer's	LT7	0.2	0.1
Natterer's	LT8	0.1	0.1
Natterer's	LT9	1.0	1.1

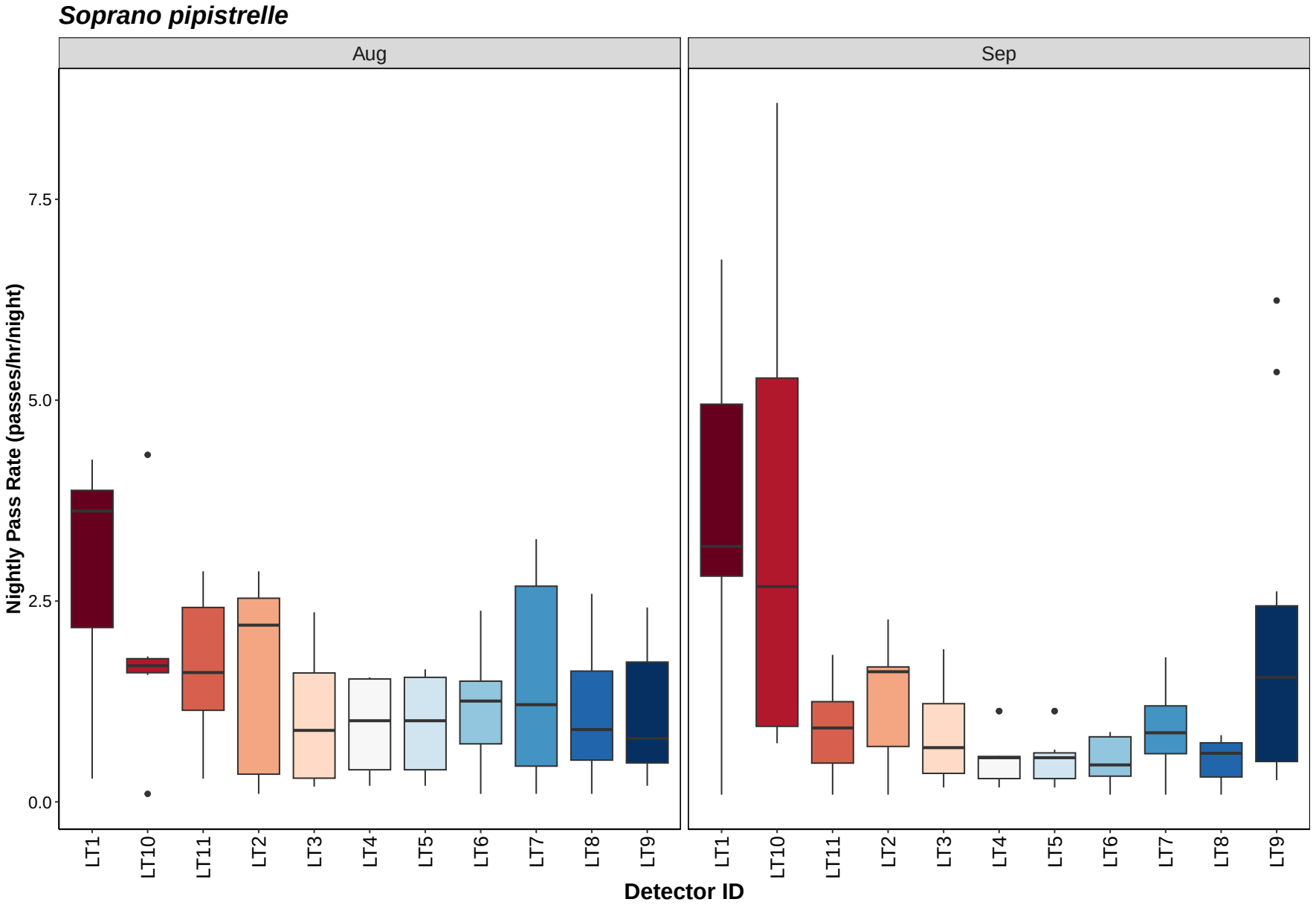
Per Detector

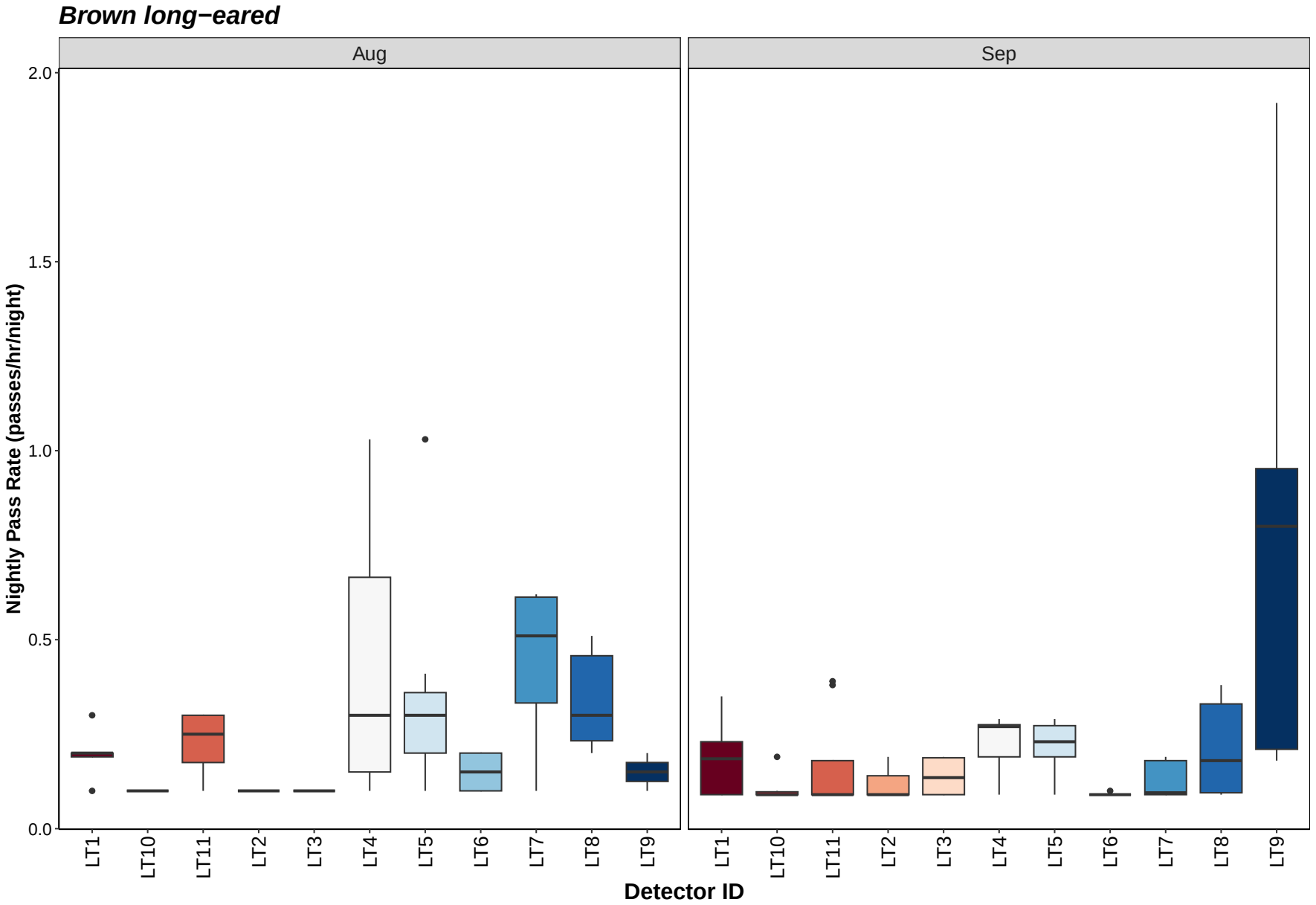
Figure 12. Figures show boxplots for the number of bat passes per hour by detector, for each month. The ‘box’ shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The ‘whiskers’ extend from the box and represent 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.


Daubenton's
Aug
Sep
Nightly Pass Rate (passes/hr/night)
0
1
2
3
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID

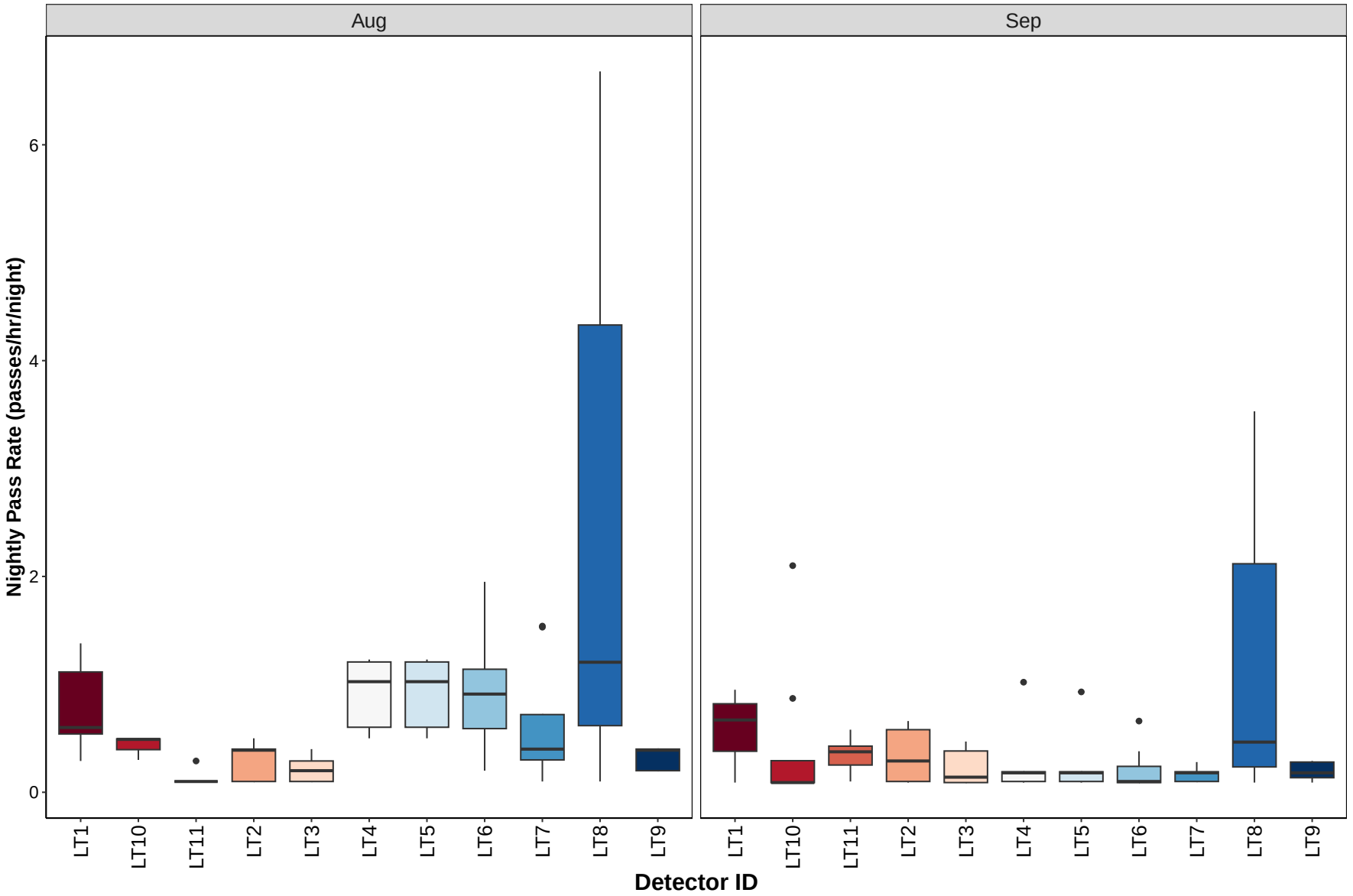

Natterer's
Aug
Sep
Nightly Pass Rate (passes/hr/night)
0
1
2
3
LT1
LT10
LT11
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID

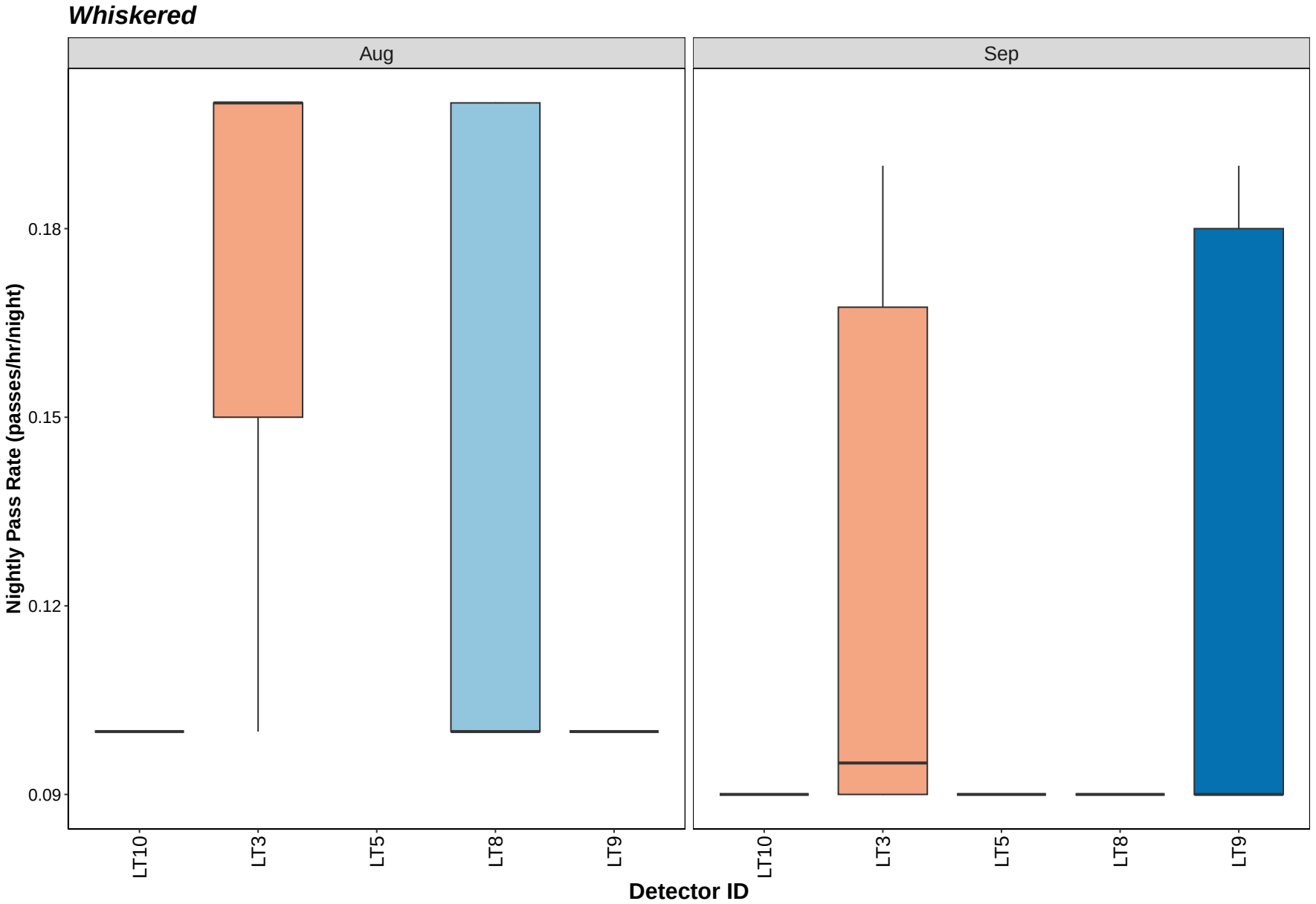

Leisler's
Aug
Sep
Nightly Pass Rate (passes/hr/night)
0
2
4
6
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID

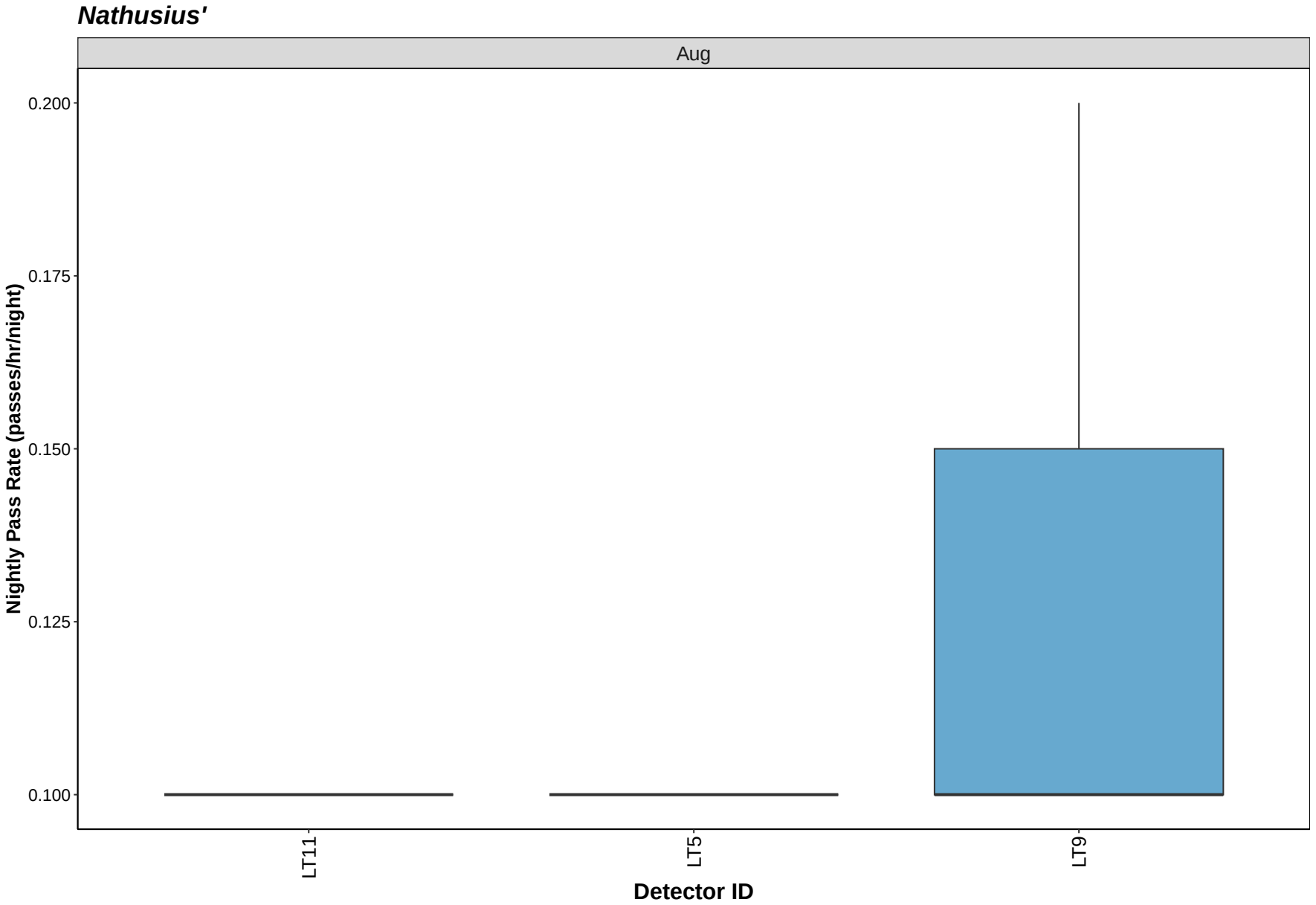

Soprano pipistrelle
Aug
Sep
Nightly Pass Rate (passes/hr/night)
7.5
5.0
2.5
0.0
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID


Brown long−eared
Aug
Sep
Nightly Pass Rate (passes/hr/night)
2.0
1.5
1.0
0.5
0.0
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID

Common pipistrelle




Whiskered
Aug
Sep
Nightly Pass Rate (passes/hr/night)
0.18
0.15
0.12
0.09
LT10
LT3
LT5
LT8
LT9
Detector ID


Nathusius'
Aug
0.200
0.175
0.150
0.125
0.100
Nightly Pass Rate (passes/hr/night)
LT11
LT5
LT9
Detector ID

Bat Activity per Detector Location

Figure 13. Detector ID reference:

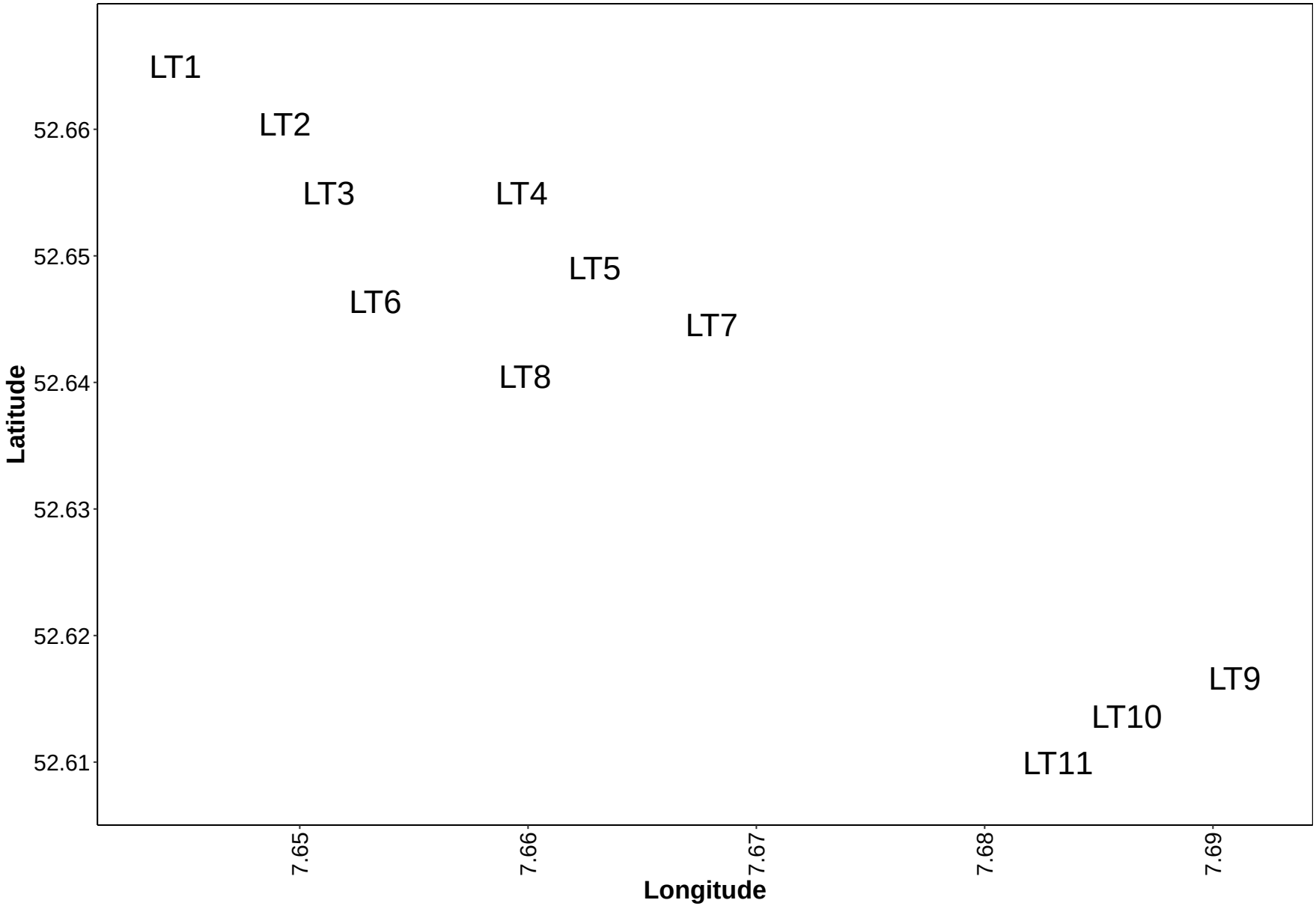
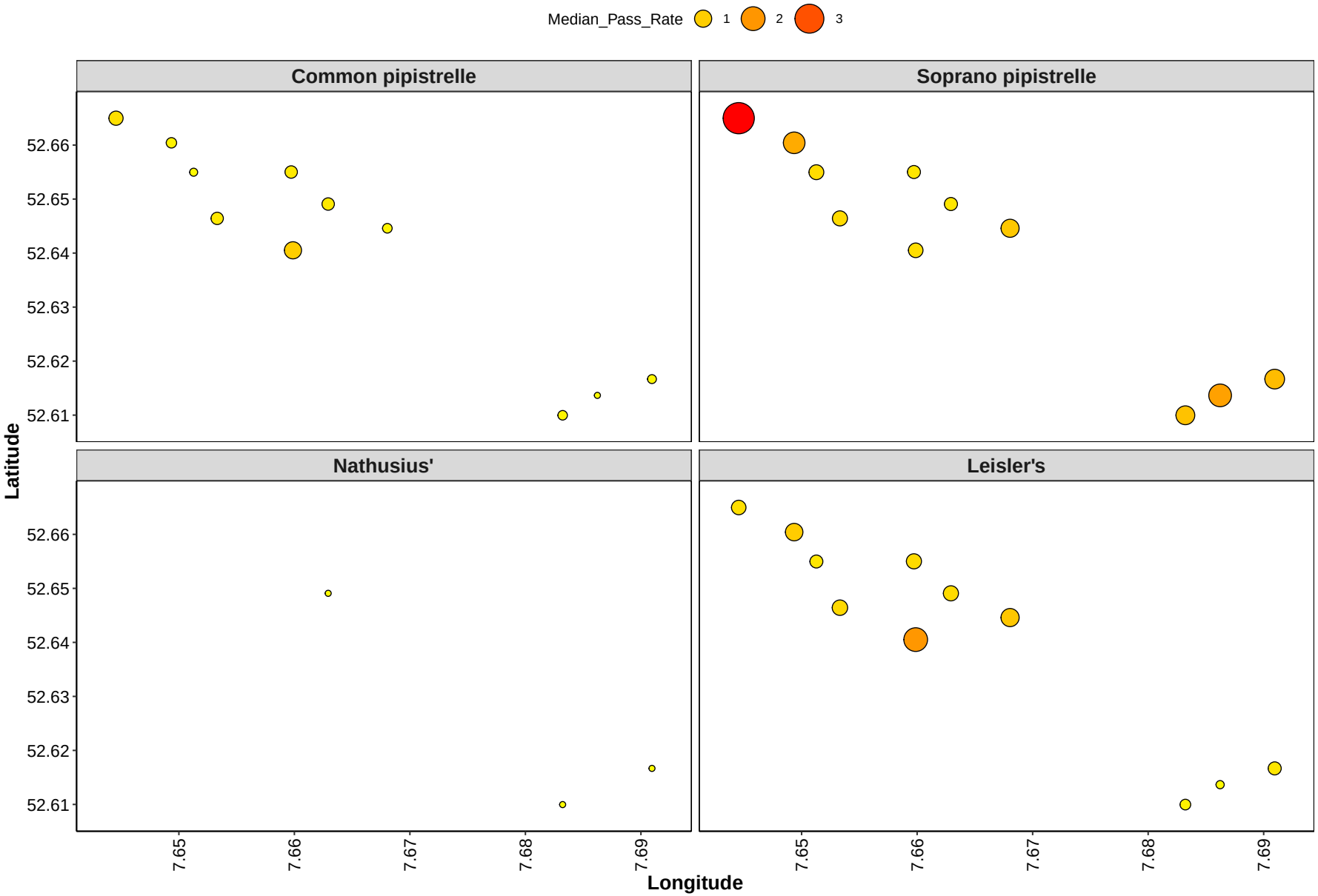

LT1
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
LT10
LT11
52.66
52.65
52.64
52.63
52.62
52.61
Latitude
7.65
7.66
7.67
7.68
7.69
Longitude

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
1
2
3
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
7.65
7.66
7.67
7.68
7.69
Longitude

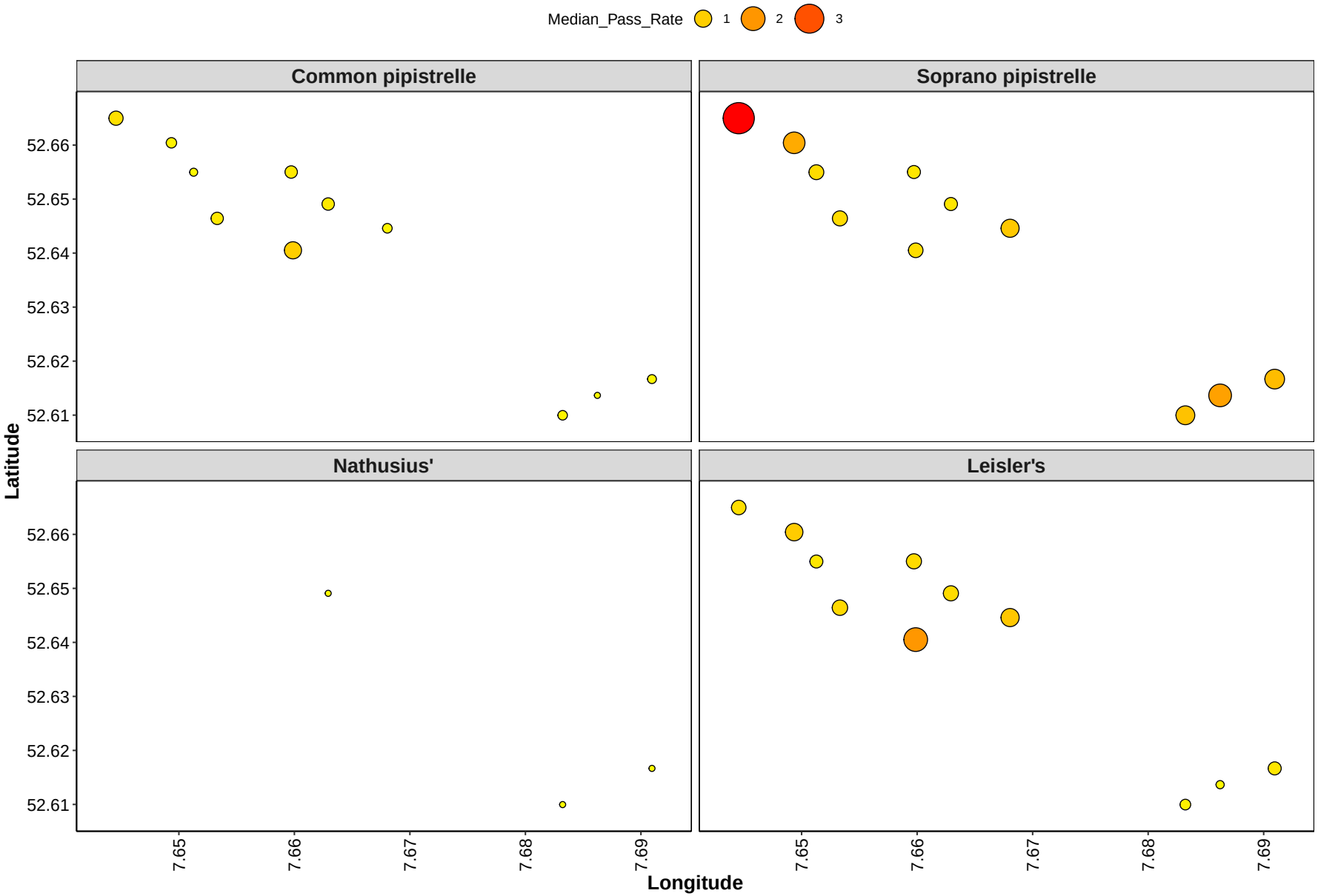
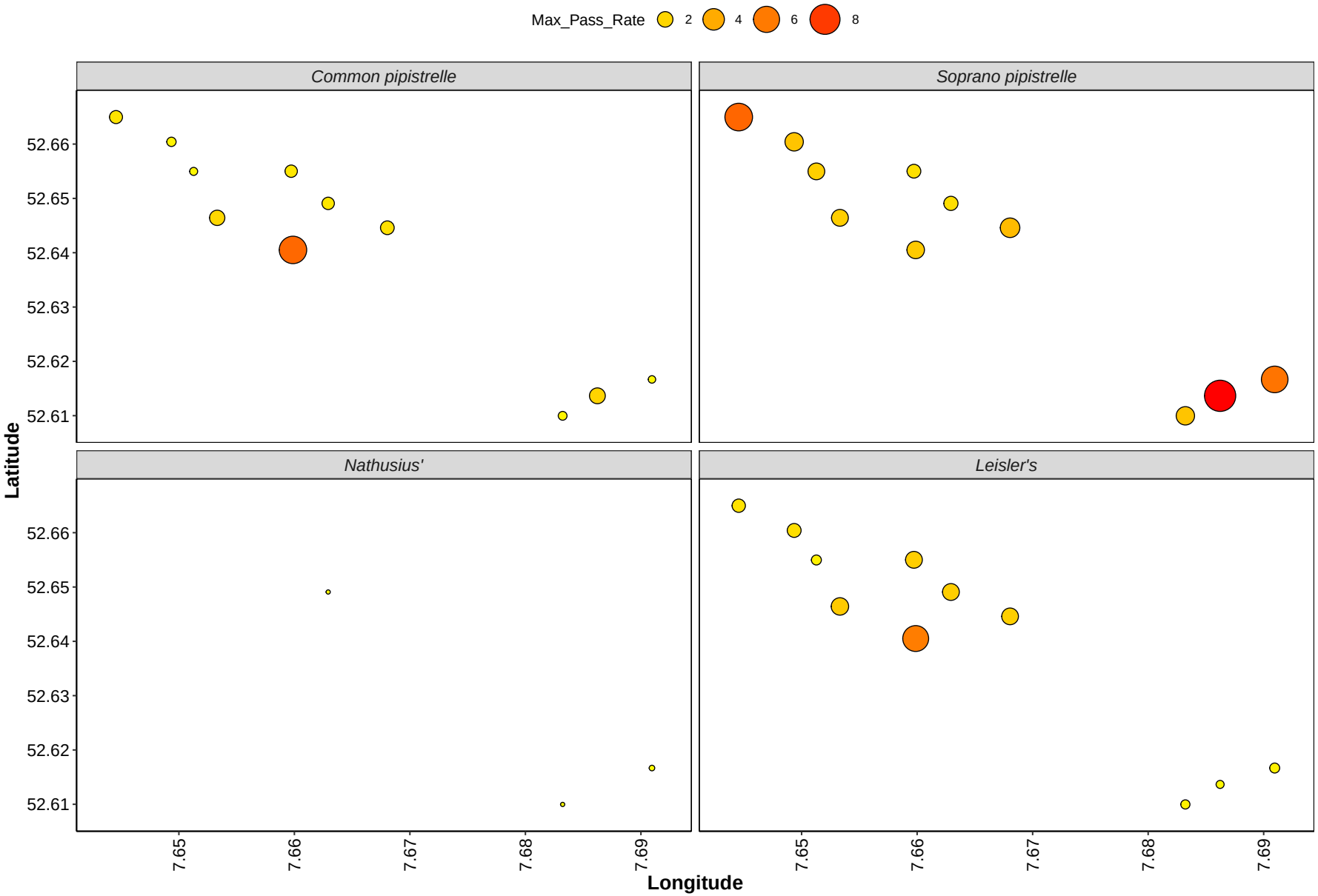
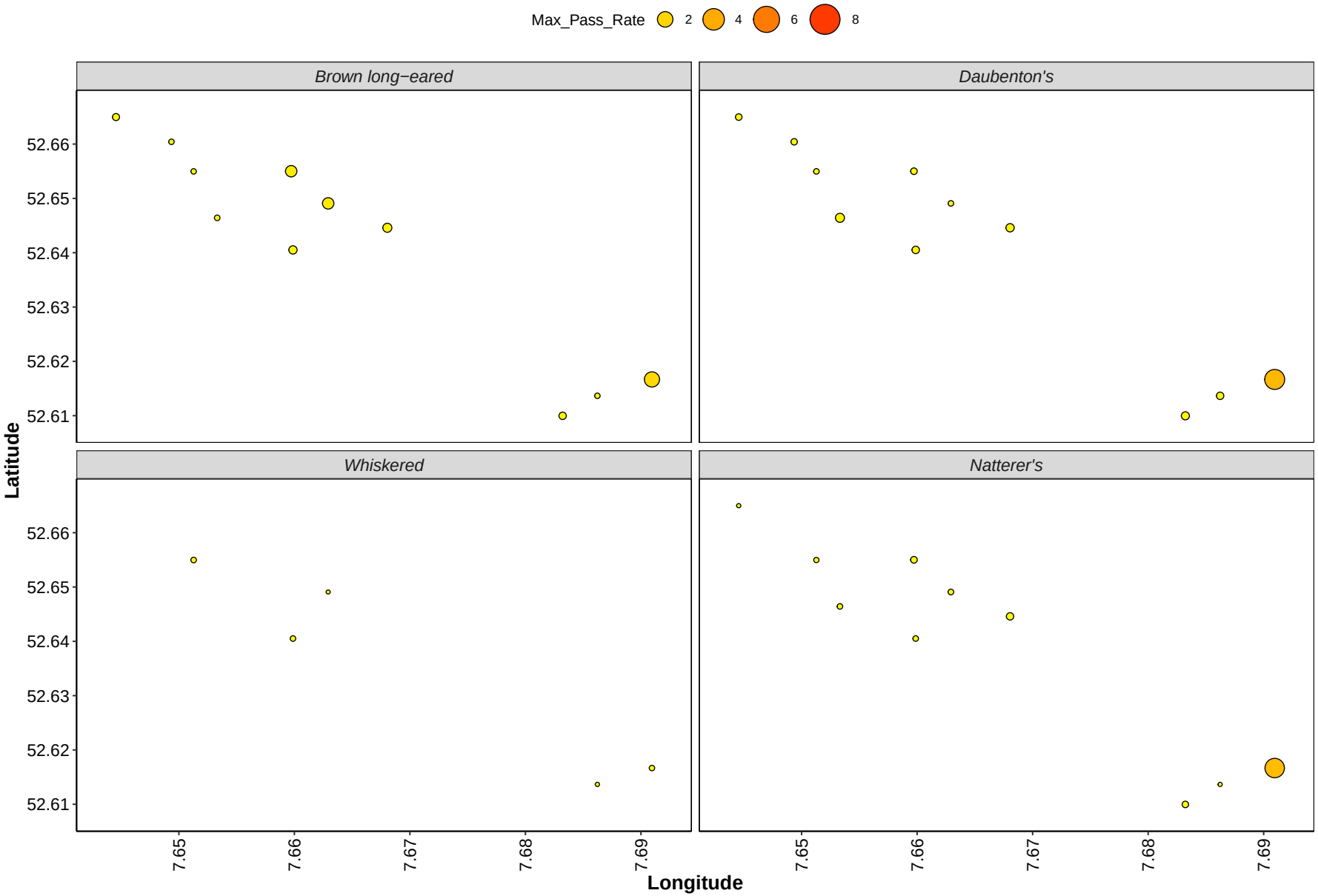

Median_Pass_Rate
1
2
3
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
7.65
7.66
7.67
7.68
7.69
Longitude

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
2
4
6
8
Common pipistrelle
Soprano pipistrelle
Nathusius'
Leisler's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
7.65
7.66
7.67
7.68
7.69
Longitude


Max_Pass_Rate
2
4
6
8
Brown long−eared
Daubenton's
Whiskered
Natterer's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
Longitude
7.65
7.66
7.67
7.68
7.69

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

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	LT1	0.1
Brown long-eared	LT10	0.0
Brown long-eared	LT11	0.1
Brown long-eared	LT2	0.0
Brown long-eared	LT3	0.0
Brown long-eared	LT4	0.1
Brown long-eared	LT5	0.1
Brown long-eared	LT6	0.0
Brown long-eared	LT7	0.0
Brown long-eared	LT8	0.0
Brown long-eared	LT9	0.2
Common pipistrelle	LT1	0.6
Common pipistrelle	LT10	0.1
Common pipistrelle	LT11	0.1
Common pipistrelle	LT2	0.1
Common pipistrelle	LT3	0.1
Common pipistrelle	LT4	0.0
Common pipistrelle	LT5	0.0
Common pipistrelle	LT6	0.1
Common pipistrelle	LT7	0.1
Common pipistrelle	LT8	0.5
Common pipistrelle	LT9	0.2
Daubenton's	LT1	0.1
Daubenton's	LT10	0.0
Daubenton's	LT11	0.1
Daubenton's	LT2	0.1
Daubenton's	LT3	0.0
Daubenton's	LT4	0.0
Daubenton's	LT5	0.0
Daubenton's	LT6	0.1
Daubenton's	LT7	0.1
Daubenton's	LT8	0.0
Daubenton's	LT9	0.4
Leisler's	LT1	0.7
Leisler's	LT10	0.1
Leisler's	LT11	0.3

Species	Detector ID	Median Pass Rate
Leisler's	LT2	1.0
Leisler's	LT3	0.5
Leisler's	LT4	0.8
Leisler's	LT5	0.8
Leisler's	LT6	0.8
Leisler's	LT7	1.1
Leisler's	LT8	2.0
Leisler's	LT9	0.5
Nathusius'	LT1	0.0
Nathusius'	LT10	0.0
Nathusius'	LT11	0.0
Nathusius'	LT2	0.0
Nathusius'	LT3	0.0
Nathusius'	LT4	0.0
Nathusius'	LT5	0.0
Nathusius'	LT6	0.0
Nathusius'	LT7	0.0
Nathusius'	LT8	0.0
Nathusius'	LT9	0.0
Natterer's	LT1	0.0
Natterer's	LT10	0.0
Natterer's	LT11	0.0
Natterer's	LT2	0.0
Natterer's	LT3	0.0
Natterer's	LT4	0.0
Natterer's	LT5	0.0
Natterer's	LT6	0.0
Natterer's	LT7	0.0
Natterer's	LT8	0.0
Natterer's	LT9	0.4
Soprano pipistrelle	LT1	3.2
Soprano pipistrelle	LT10	1.7
Soprano pipistrelle	LT11	0.9
Soprano pipistrelle	LT2	1.5
Soprano pipistrelle	LT3	0.5
Soprano pipistrelle	LT4	0.4

Species	Detector ID	Median Pass Rate
Soprano pipistrelle	LT5	0.4
Soprano pipistrelle	LT6	0.7
Soprano pipistrelle	LT7	1.0
Soprano pipistrelle	LT8	0.5
Soprano pipistrelle	LT9	0.8
Whiskered	LT1	0.0
Whiskered	LT10	0.0
Whiskered	LT11	0.0
Whiskered	LT2	0.0
Whiskered	LT3	0.0
Whiskered	LT4	0.0
Whiskered	LT5	0.0
Whiskered	LT6	0.0
Whiskered	LT7	0.0
Whiskered	LT8	0.0
Whiskered	LT9	0.0

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.

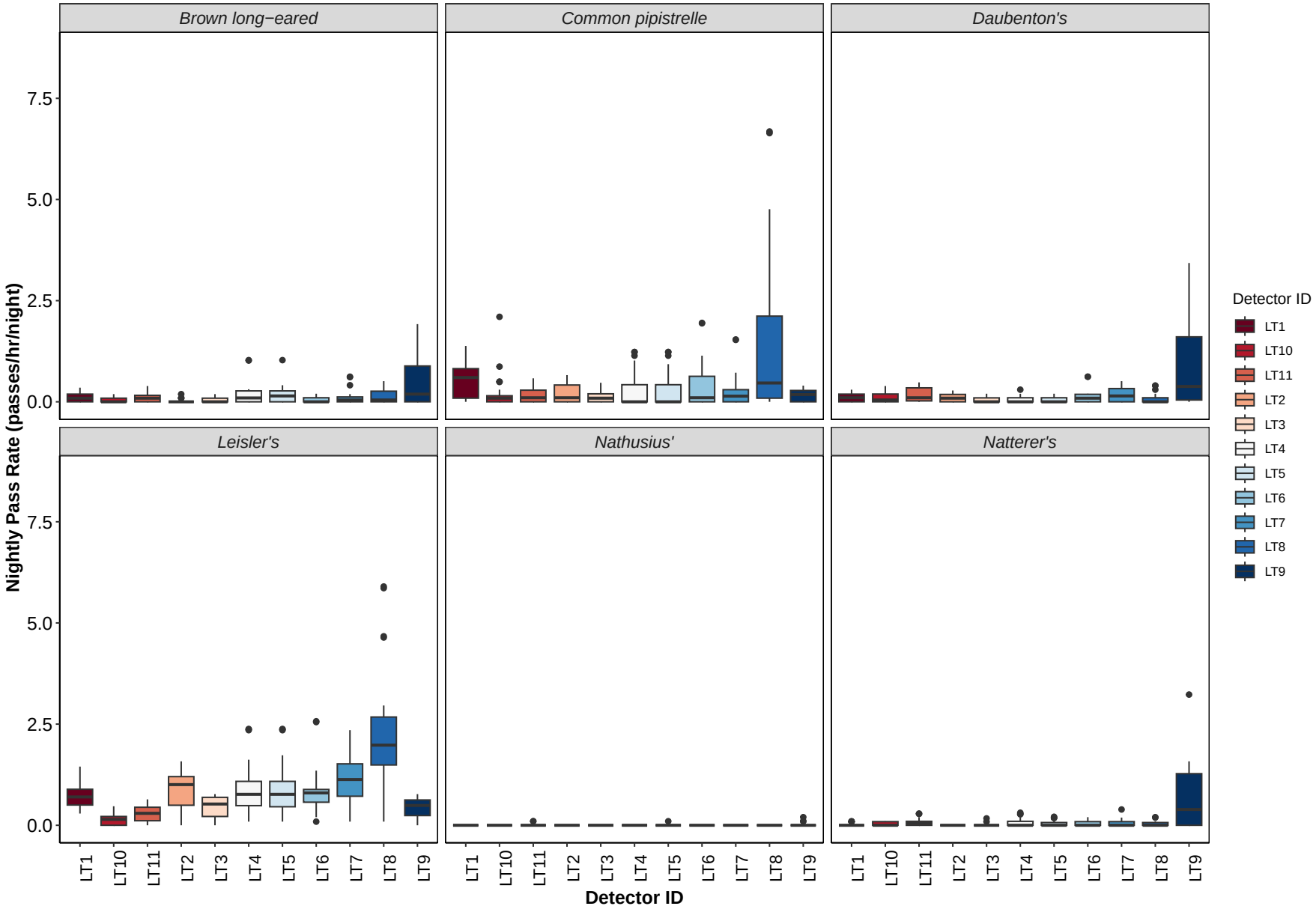
Species	Detector ID	Mean Pass Rate
Brown long-eared	LT1	0.1
Brown long-eared	LT10	0.0
Brown long-eared	LT11	0.1
Brown long-eared	LT2	0.0
Brown long-eared	LT3	0.0
Brown long-eared	LT4	0.2
Brown long-eared	LT5	0.2
Brown long-eared	LT6	0.1
Brown long-eared	LT7	0.1
Brown long-eared	LT8	0.1
Brown long-eared	LT9	0.5
Common pipistrelle	LT1	0.5
Common pipistrelle	LT10	0.2
Common pipistrelle	LT11	0.2
Common pipistrelle	LT2	0.2
Common pipistrelle	LT3	0.1
Common pipistrelle	LT4	0.3
Common pipistrelle	LT5	0.3
Common pipistrelle	LT6	0.4
Common pipistrelle	LT7	0.3
Common pipistrelle	LT8	1.4
Common pipistrelle	LT9	0.2
Daubenton's	LT1	0.1
Daubenton's	LT10	0.1
Daubenton's	LT11	0.2
Daubenton's	LT2	0.1
Daubenton's	LT3	0.1
Daubenton's	LT4	0.1
Daubenton's	LT5	0.0
Daubenton's	LT6	0.1
Daubenton's	LT7	0.2
Daubenton's	LT8	0.1
Daubenton's	LT9	0.9
Leisler's	LT1	0.7
Leisler's	LT10	0.2
Leisler's	LT11	0.3

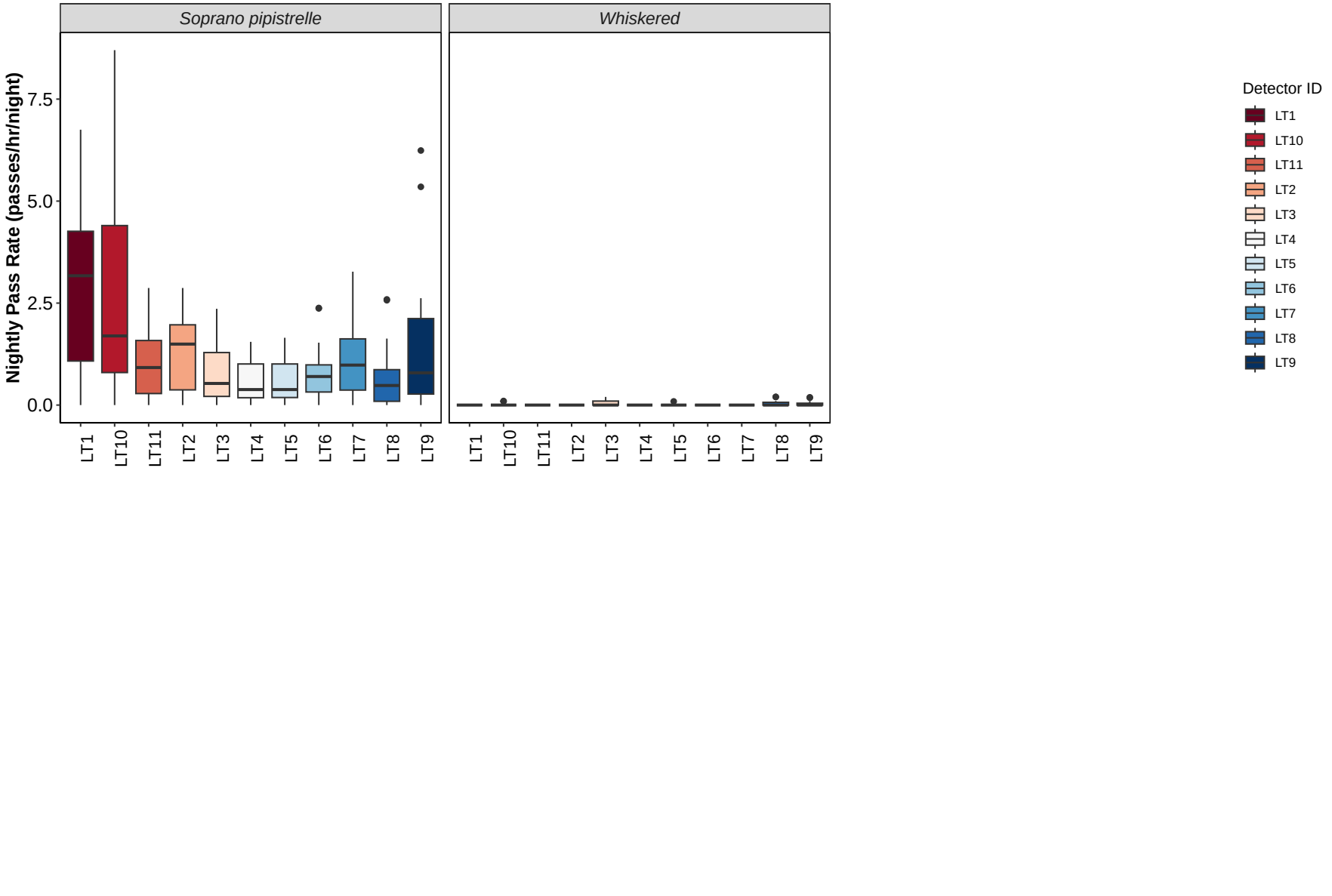
Species	Detector ID	Mean Pass Rate
Leisler's	LT2	0.9
Leisler's	LT3	0.5
Leisler's	LT4	0.9
Leisler's	LT5	0.9
Leisler's	LT6	0.8
Leisler's	LT7	1.2
Leisler's	LT8	2.2
Leisler's	LT9	0.4
Nathusius'	LT1	0.0
Nathusius'	LT10	0.0
Nathusius'	LT11	0.0
Nathusius'	LT2	0.0
Nathusius'	LT3	0.0
Nathusius'	LT4	0.0
Nathusius'	LT5	0.0
Nathusius'	LT6	0.0
Nathusius'	LT7	0.0
Nathusius'	LT8	0.0
Nathusius'	LT9	0.0
Natterer's	LT1	0.0
Natterer's	LT10	0.0
Natterer's	LT11	0.1
Natterer's	LT2	0.0
Natterer's	LT3	0.0
Natterer's	LT4	0.1
Natterer's	LT5	0.0
Natterer's	LT6	0.0
Natterer's	LT7	0.0
Natterer's	LT8	0.0
Natterer's	LT9	0.7
Soprano pipistrelle	LT1	2.8
Soprano pipistrelle	LT10	2.5
Soprano pipistrelle	LT11	1.0
Soprano pipistrelle	LT2	1.3
Soprano pipistrelle	LT3	0.8
Soprano pipistrelle	LT4	0.6

Species	Detector ID	Mean Pass Rate
Soprano pipistrelle	LT5	0.6
Soprano pipistrelle	LT6	0.8
Soprano pipistrelle	LT7	1.1
Soprano pipistrelle	LT8	0.6
Soprano pipistrelle	LT9	1.4
Whiskered	LT1	0.0
Whiskered	LT10	0.0
Whiskered	LT11	0.0
Whiskered	LT2	0.0
Whiskered	LT3	0.1
Whiskered	LT4	0.0
Whiskered	LT5	0.0
Whiskered	LT6	0.0
Whiskered	LT7	0.0
Whiskered	LT8	0.0
Whiskered	LT9	0.0

Per Detector

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.


Brown long−eared
Common pipistrelle
Daubenton's
Leisler's
Nathusius'
Natterer's
Nightly Pass Rate (passes/hr/night)
0.0
2.5
5.0
7.5
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID
Detector ID
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9


Soprano pipistrelle
Whiskered
Nightly Pass Rate (passes/hr/night)
7.5
5.0
2.5
0.0
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID
Detector ID
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9

Survey Effort

Table 24. The number of nights bats were detected per month per detector.

month	Detector ID	No. of Survey Nights
Aug	LT1	8
Aug	LT10	7
Aug	LT11	7
Aug	LT2	7
Aug	LT3	7
Aug	LT4	11
Aug	LT5	11
Aug	LT6	10
Aug	LT7	11
Aug	LT8	11
Aug	LT9	7
Sep	LT1	17
Sep	LT10	13
Sep	LT11	15
Sep	LT2	13
Sep	LT3	15
Sep	LT4	15
Sep	LT5	15
Sep	LT6	13
Sep	LT7	13
Sep	LT8	15
Sep	LT9	16

Nighlty 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	Sep
Brown long-eared	LT1	0.1	0.0
Brown long-eared	LT10	0.0	0.0
Brown long-eared	LT11	0.1	0.1
Brown long-eared	LT2	0.0	0.0
Brown long-eared	LT3	0.0	0.0
Brown long-eared	LT4	0.1	0.0
Brown long-eared	LT5	0.2	0.1
Brown long-eared	LT6	0.1	0.0
Brown long-eared	LT7	0.0	0.1
Brown long-eared	LT8	0.2	0.0
Brown long-eared	LT9	0.0	0.7
Common pipistrelle	LT1	0.6	0.5
Common pipistrelle	LT10	0.0	0.1
Common pipistrelle	LT11	0.1	0.1
Common pipistrelle	LT2	0.1	0.1
Common pipistrelle	LT3	0.1	0.1
Common pipistrelle	LT4	0.5	0.0
Common pipistrelle	LT5	0.5	0.0
Common pipistrelle	LT6	0.8	0.1
Common pipistrelle	LT7	0.3	0.1
Common pipistrelle	LT8	1.0	0.2
Common pipistrelle	LT9	0.2	0.1
Daubenton's	LT1	0.2	0.1
Daubenton's	LT10	0.2	0.0
Daubenton's	LT11	0.1	0.2
Daubenton's	LT2	0.1	0.1
Daubenton's	LT3	0.0	0.0
Daubenton's	LT4	0.1	0.0
Daubenton's	LT5	0.0	0.0
Daubenton's	LT6	0.2	0.0
Daubenton's	LT7	0.3	0.1
Daubenton's	LT8	0.1	0.0
Daubenton's	LT9	0.2	0.6
Leisler's	LT1	0.8	0.7
Leisler's	LT10	0.2	0.1
Leisler's	LT11	0.3	0.3

Species	Detector ID	Aug	Sep
Leisler's	LT2	1.1	1.0
Leisler's	LT3	0.5	0.6
Leisler's	LT4	0.7	0.8
Leisler's	LT5	0.7	0.8
Leisler's	LT6	0.9	0.6
Leisler's	LT7	0.9	1.1
Leisler's	LT8	2.1	1.9
Leisler's	LT9	0.4	0.6
Nathusius'	LT1	0.0	0.0
Nathusius'	LT10	0.0	0.0
Nathusius'	LT11	0.0	0.0
Nathusius'	LT2	0.0	0.0
Nathusius'	LT3	0.0	0.0
Nathusius'	LT4	0.0	0.0
Nathusius'	LT5	0.0	0.0
Nathusius'	LT6	0.0	0.0
Nathusius'	LT7	0.0	0.0
Nathusius'	LT8	0.0	0.0
Nathusius'	LT9	0.0	0.0
Natterer's	LT1	0.0	0.0
Natterer's	LT10	0.0	0.0
Natterer's	LT11	0.0	0.1
Natterer's	LT2	0.0	0.0
Natterer's	LT3	0.0	0.0
Natterer's	LT4	0.0	0.0
Natterer's	LT5	0.0	0.0
Natterer's	LT6	0.0	0.0
Natterer's	LT7	0.0	0.0
Natterer's	LT8	0.0	0.0
Natterer's	LT9	0.4	0.5
Soprano pipistrelle	LT1	3.6	3.1
Soprano pipistrelle	LT10	1.7	2.6
Soprano pipistrelle	LT11	1.6	0.6
Soprano pipistrelle	LT2	2.2	1.4
Soprano pipistrelle	LT3	0.9	0.4
Soprano pipistrelle	LT4	1.0	0.3

Species	Detector ID	Aug	Sep
Soprano pipistrelle	LT5	1.0	0.3
Soprano pipistrelle	LT6	1.3	0.4
Soprano pipistrelle	LT7	1.2	0.7
Soprano pipistrelle	LT8	0.9	0.3
Soprano pipistrelle	LT9	0.8	0.9
Whiskered	LT1	0.0	0.0
Whiskered	LT10	0.0	0.0
Whiskered	LT11	0.0	0.0
Whiskered	LT2	0.0	0.0
Whiskered	LT3	0.0	0.0
Whiskered	LT4	0.0	0.0
Whiskered	LT5	0.0	0.0
Whiskered	LT6	0.0	0.0
Whiskered	LT7	0.0	0.0
Whiskered	LT8	0.0	0.0
Whiskered	LT9	0.0	0.0

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.

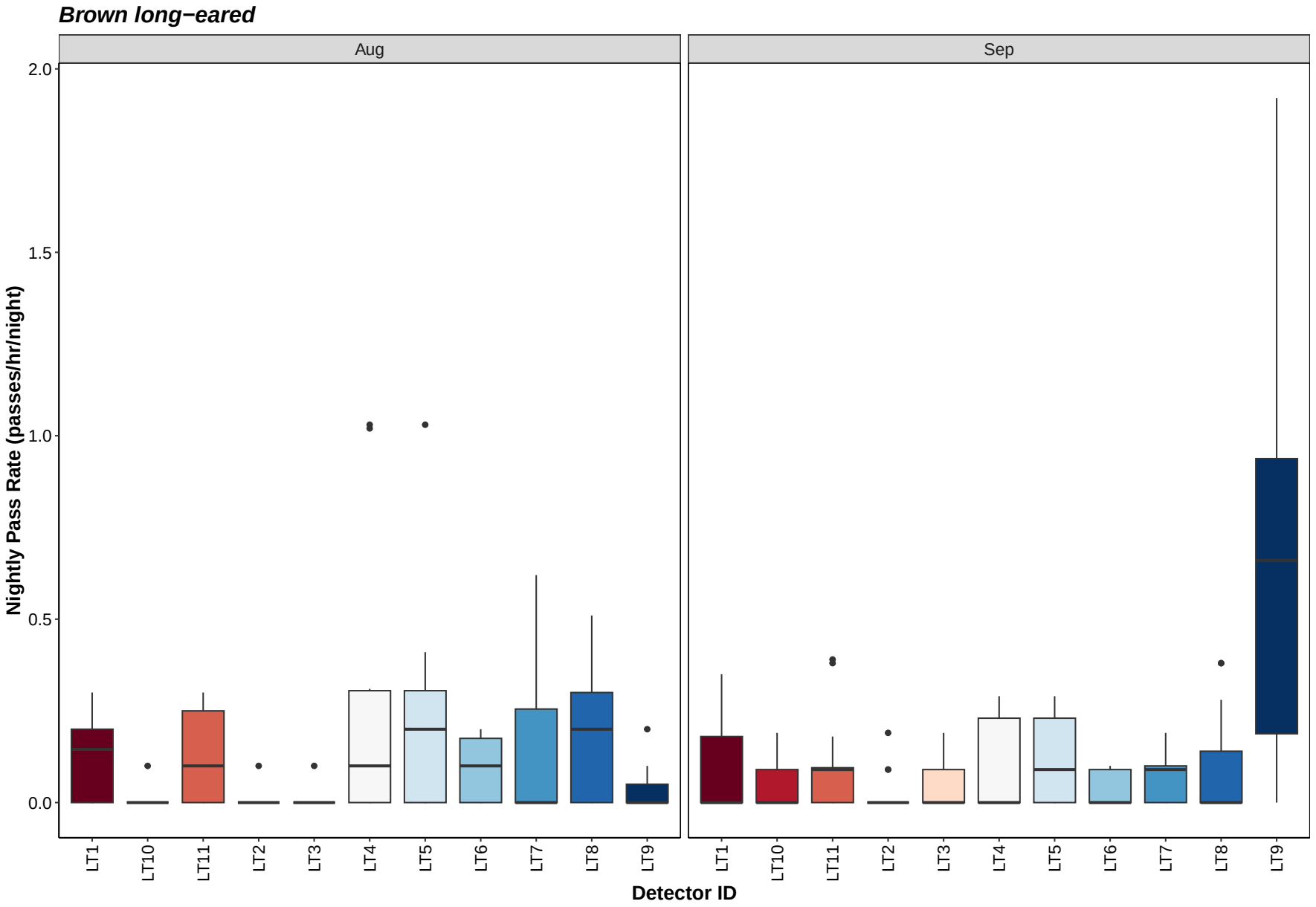
Species	Detector ID	Aug	Sep
Brown long-eared	LT1	0.1	0.1
Brown long-eared	LT10	0.0	0.0
Brown long-eared	LT11	0.1	0.1
Brown long-eared	LT2	0.0	0.0
Brown long-eared	LT3	0.0	0.1
Brown long-eared	LT4	0.3	0.1
Brown long-eared	LT5	0.2	0.1
Brown long-eared	LT6	0.1	0.0
Brown long-eared	LT7	0.2	0.1
Brown long-eared	LT8	0.2	0.1
Brown long-eared	LT9	0.0	0.7
Common pipistrelle	LT1	0.7	0.4
Common pipistrelle	LT10	0.2	0.3
Common pipistrelle	LT11	0.1	0.2
Common pipistrelle	LT2	0.2	0.2
Common pipistrelle	LT3	0.2	0.1
Common pipistrelle	LT4	0.5	0.1
Common pipistrelle	LT5	0.5	0.1
Common pipistrelle	LT6	0.9	0.1
Common pipistrelle	LT7	0.5	0.1
Common pipistrelle	LT8	2.3	0.8
Common pipistrelle	LT9	0.2	0.1
Daubenton's	LT1	0.2	0.1
Daubenton's	LT10	0.1	0.1
Daubenton's	LT11	0.1	0.2
Daubenton's	LT2	0.1	0.1
Daubenton's	LT3	0.1	0.0
Daubenton's	LT4	0.1	0.0
Daubenton's	LT5	0.1	0.0
Daubenton's	LT6	0.2	0.1
Daubenton's	LT7	0.2	0.1
Daubenton's	LT8	0.2	0.0
Daubenton's	LT9	0.4	1.2
Leisler's	LT1	0.8	0.7
Leisler's	LT10	0.1	0.2
Leisler's	LT11	0.2	0.3

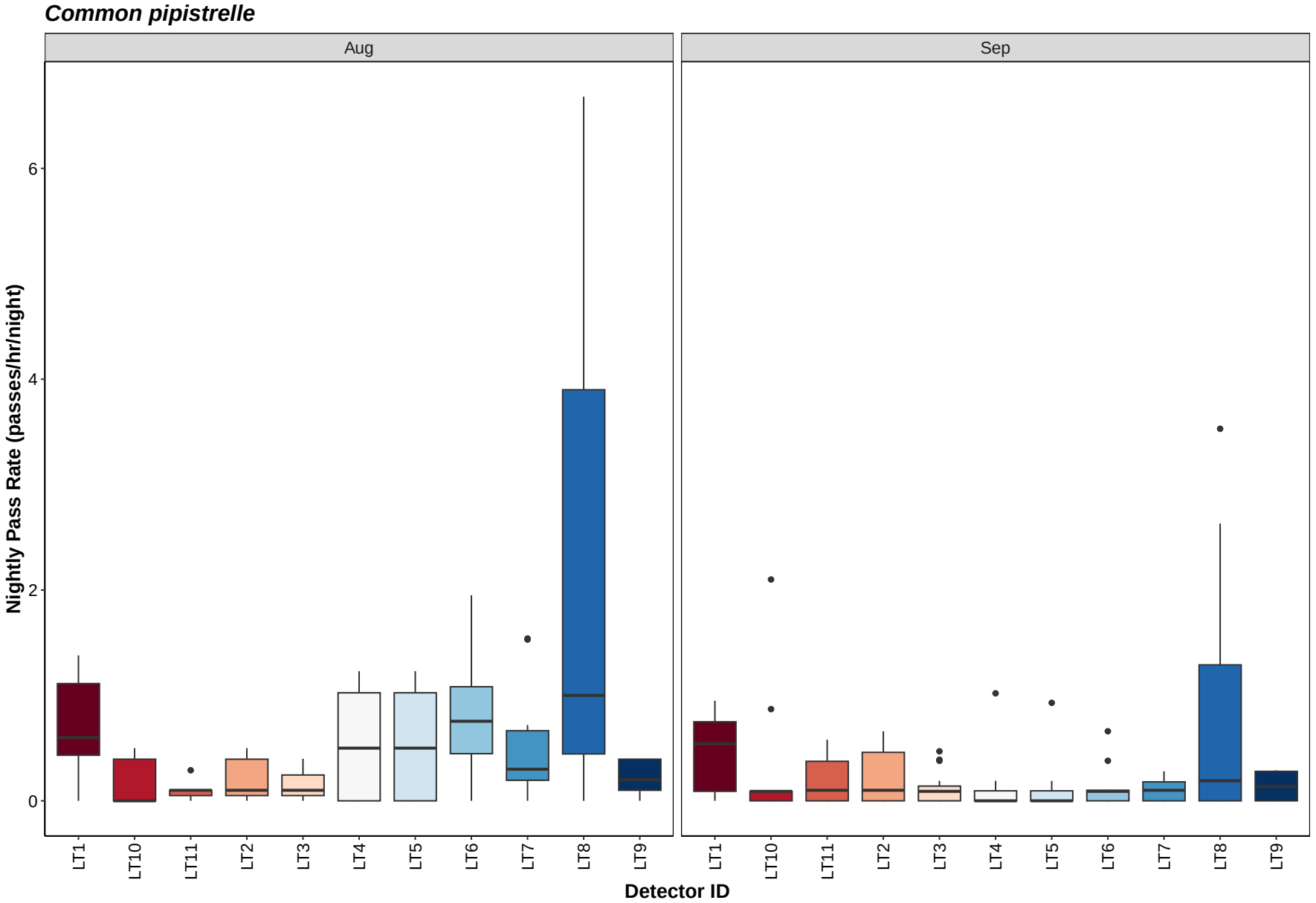
Species	Detector ID	Aug	Sep
Leisler's	LT2	0.8	0.9
Leisler's	LT3	0.4	0.5
Leisler's	LT4	1.2	0.7
Leisler's	LT5	1.2	0.7
Leisler's	LT6	1.2	0.6
Leisler's	LT7	1.2	1.1
Leisler's	LT8	2.4	2.1
Leisler's	LT9	0.4	0.4
Nathusius'	LT1	0.0	0.0
Nathusius'	LT10	0.0	0.0
Nathusius'	LT11	0.0	0.0
Nathusius'	LT2	0.0	0.0
Nathusius'	LT3	0.0	0.0
Nathusius'	LT4	0.0	0.0
Nathusius'	LT5	0.0	0.0
Nathusius'	LT6	0.0	0.0
Nathusius'	LT7	0.0	0.0
Nathusius'	LT8	0.0	0.0
Nathusius'	LT9	0.1	0.0
Natterer's	LT1	0.0	0.0
Natterer's	LT10	0.0	0.0
Natterer's	LT11	0.0	0.1
Natterer's	LT2	0.0	0.0
Natterer's	LT3	0.0	0.0
Natterer's	LT4	0.0	0.1
Natterer's	LT5	0.0	0.1
Natterer's	LT6	0.0	0.0
Natterer's	LT7	0.0	0.0
Natterer's	LT8	0.0	0.0
Natterer's	LT9	0.6	0.8
Soprano pipistrelle	LT1	3.0	2.7
Soprano pipistrelle	LT10	1.6	3.0
Soprano pipistrelle	LT11	1.7	0.7
Soprano pipistrelle	LT2	1.6	1.1
Soprano pipistrelle	LT3	1.0	0.7
Soprano pipistrelle	LT4	0.8	0.4

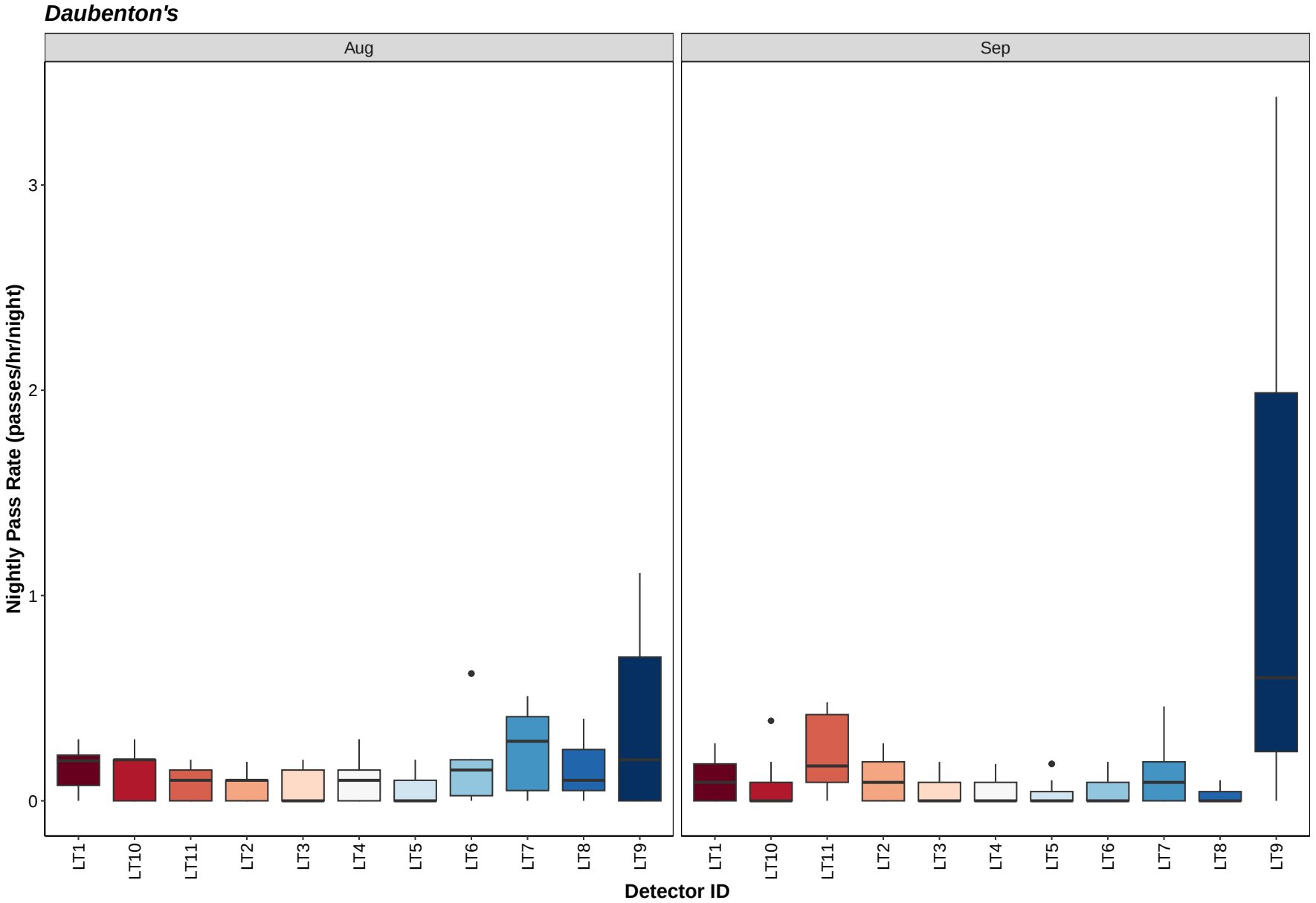
Species	Detector ID	Aug	Sep
Soprano pipistrelle	LT5	0.8	0.4
Soprano pipistrelle	LT6	1.2	0.4
Soprano pipistrelle	LT7	1.6	0.8
Soprano pipistrelle	LT8	1.1	0.3
Soprano pipistrelle	LT9	1.1	1.5
Whiskered	LT1	0.0	0.0
Whiskered	LT10	0.0	0.0
Whiskered	LT11	0.0	0.0
Whiskered	LT2	0.0	0.0
Whiskered	LT3	0.1	0.0
Whiskered	LT4	0.0	0.0
Whiskered	LT5	0.0	0.0
Whiskered	LT6	0.0	0.0
Whiskered	LT7	0.0	0.0
Whiskered	LT8	0.1	0.0
Whiskered	LT9	0.0	0.0

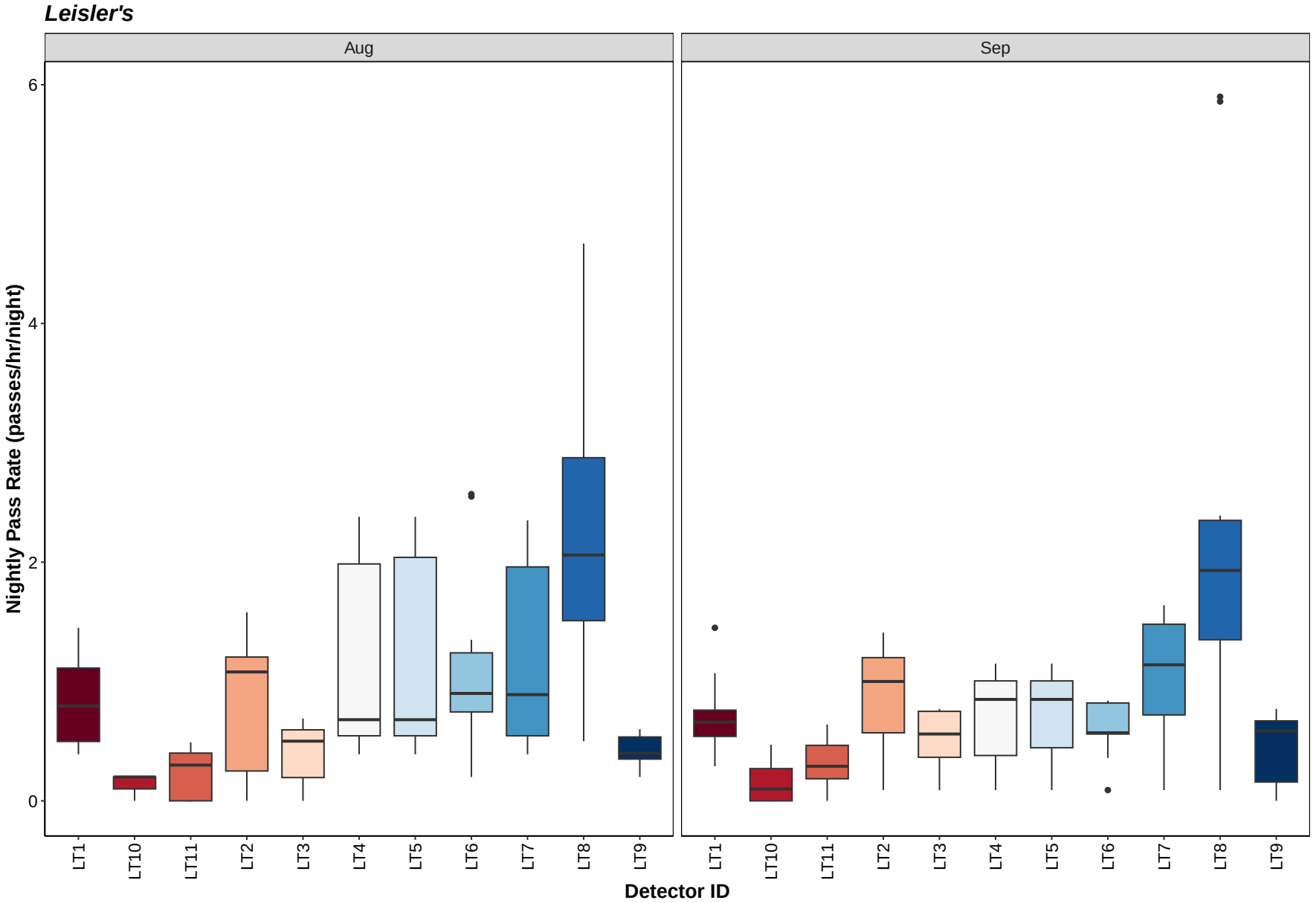
Per Detector

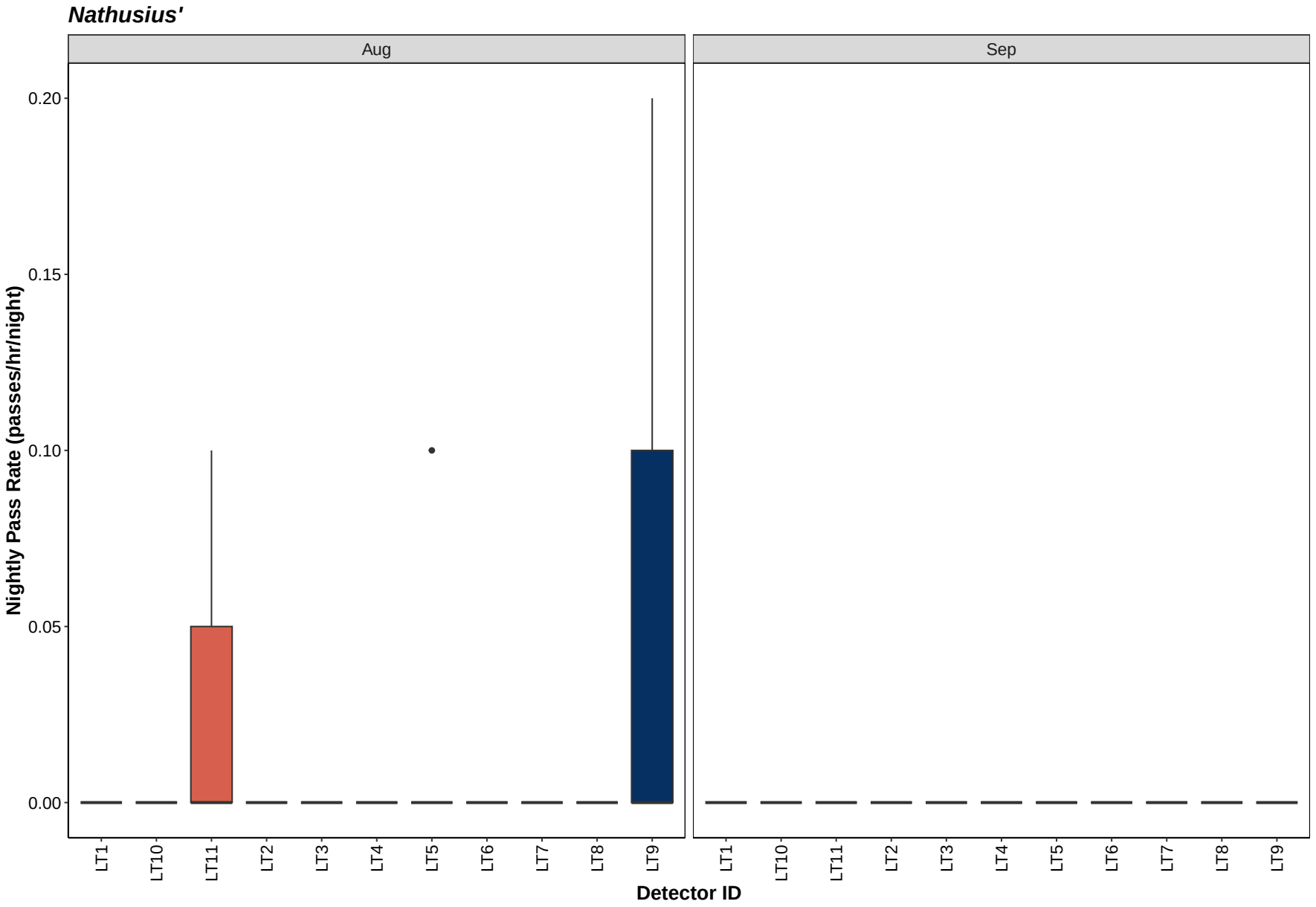
Figure 17. Figures show boxplots for the number of bat passes per hour by detector, for each month. The ‘box’ shows the interquartile range, which is where the middle 50% of the data lie. The line dividing the box is the median, the mid-point of the data. The ‘whiskers’ extend from the box and represent 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.

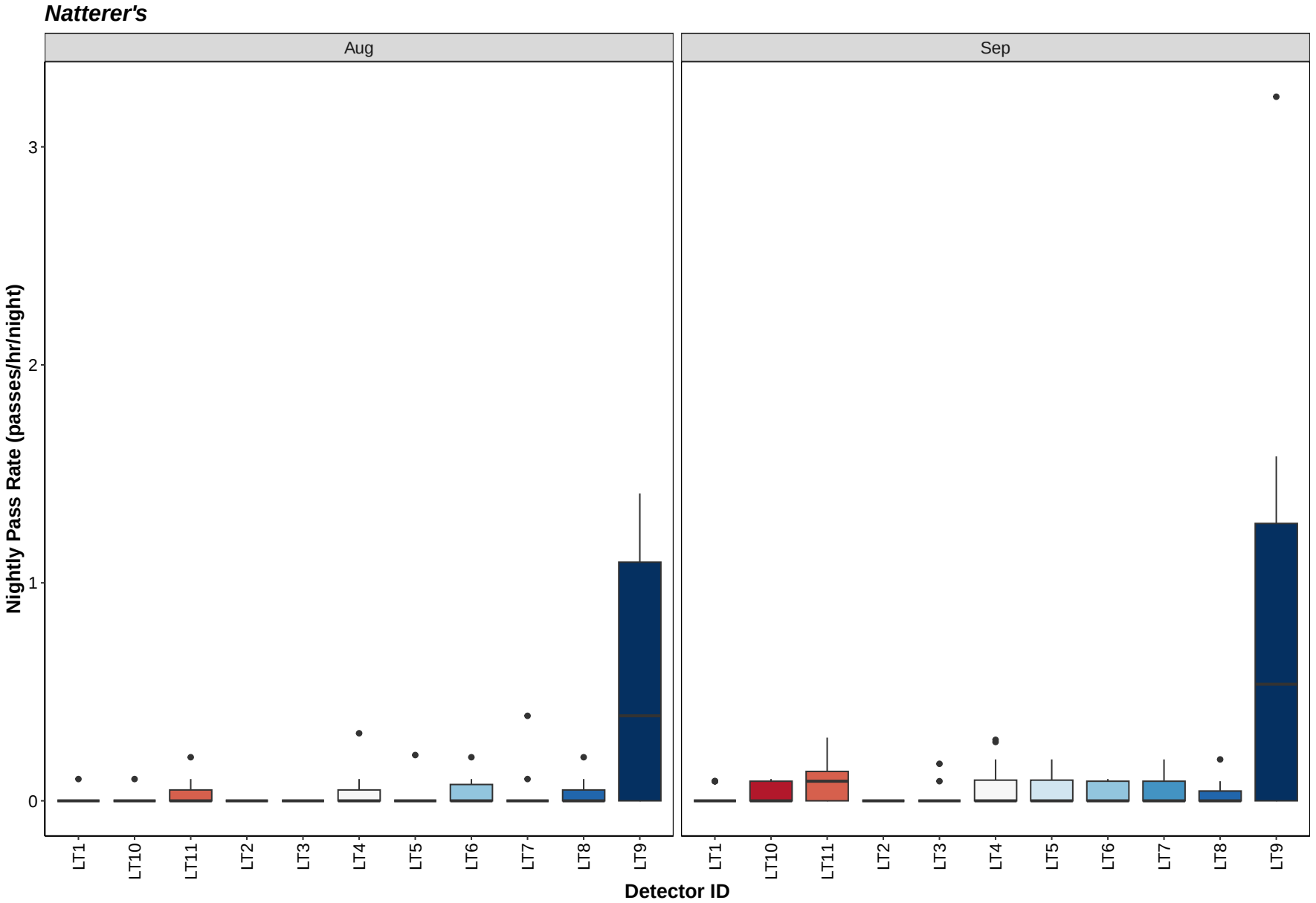

Brown long−eared
Aug
Sep
Nightly Pass Rate (passes/hr/night)
2.0
1.5
1.0
0.5
0.0
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID

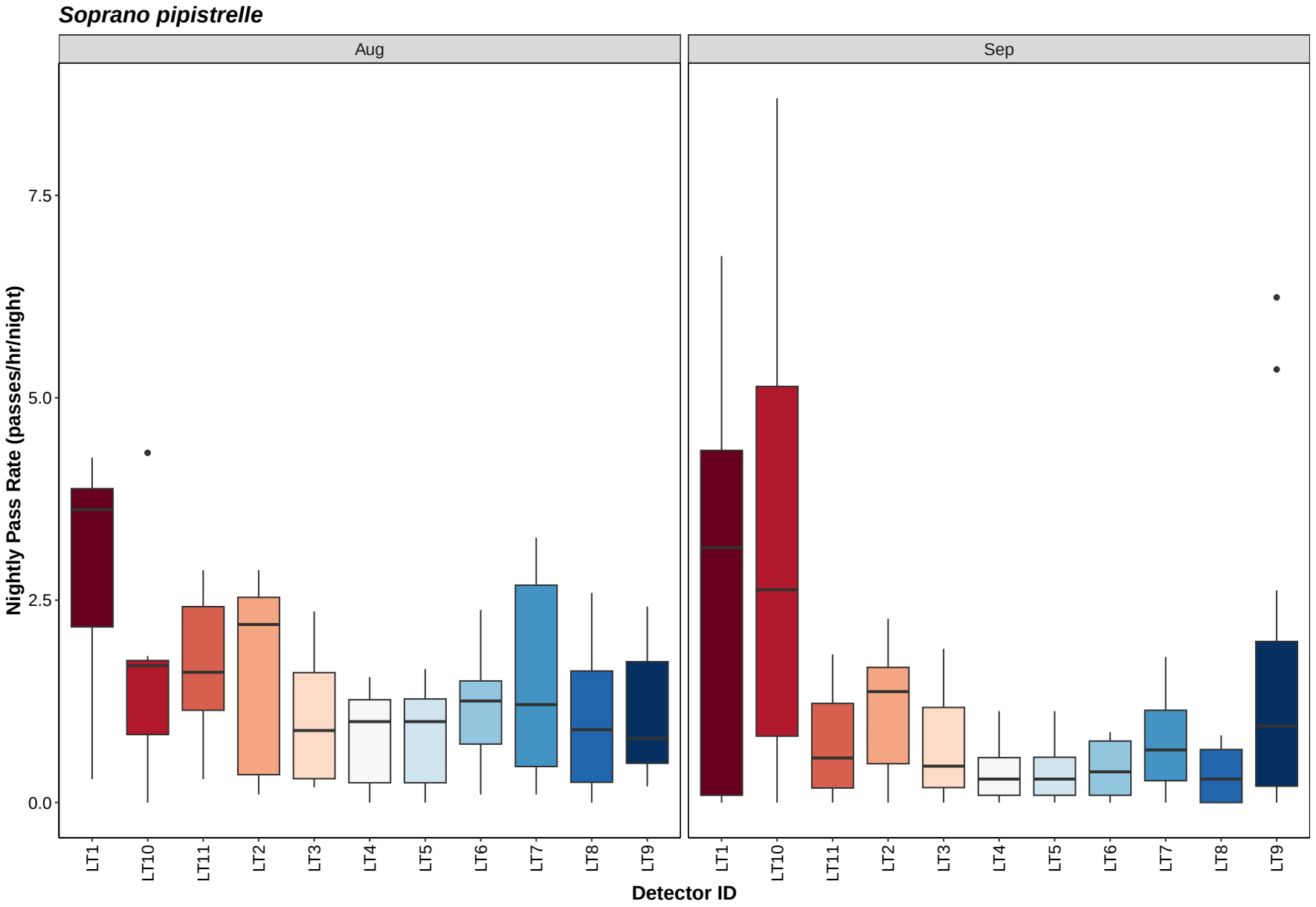

Common pipistrelle
Aug
Sep
Nightly Pass Rate (passes/hr/night)
0
2
4
6
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID

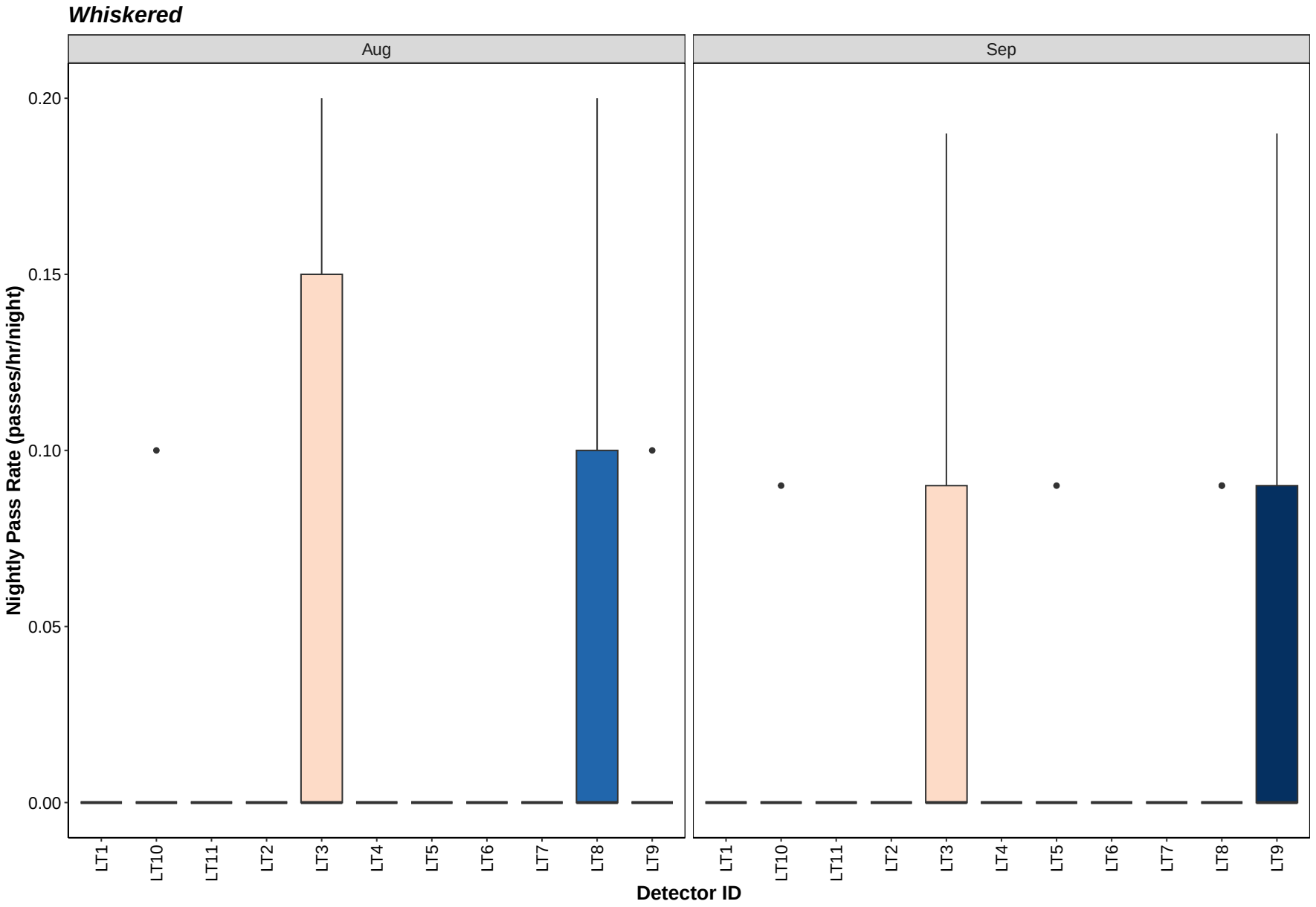

Daubenton's
Aug
Sep
Nightly Pass Rate (passes/hr/night)
0
1
2
3
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID


Leisler's
Aug
Sep
Nightly Pass Rate (passes/hr/night)
0
2
4
6
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID


Nathusius'
Aug
Sep
Nightly Pass Rate (passes/hr/night)
0.20
0.15
0.10
0.05
0.00
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID


Natterer's
Aug
Sep
Nightly Pass Rate (passes/hr/night)
0
1
2
3
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID


Soprano pipistrelle
Aug
Sep
Nightly Pass Rate (passes/hr/night)
7.5
5.0
2.5
0.0
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID


Whiskered
Aug
Sep
Nightly Pass Rate (passes/hr/night)
0.20
0.15
0.10
0.05
0.00
LT1
LT10
LT11
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
Detector ID

Bat Activity per Detector Location

Figure 18. Detector ID reference:

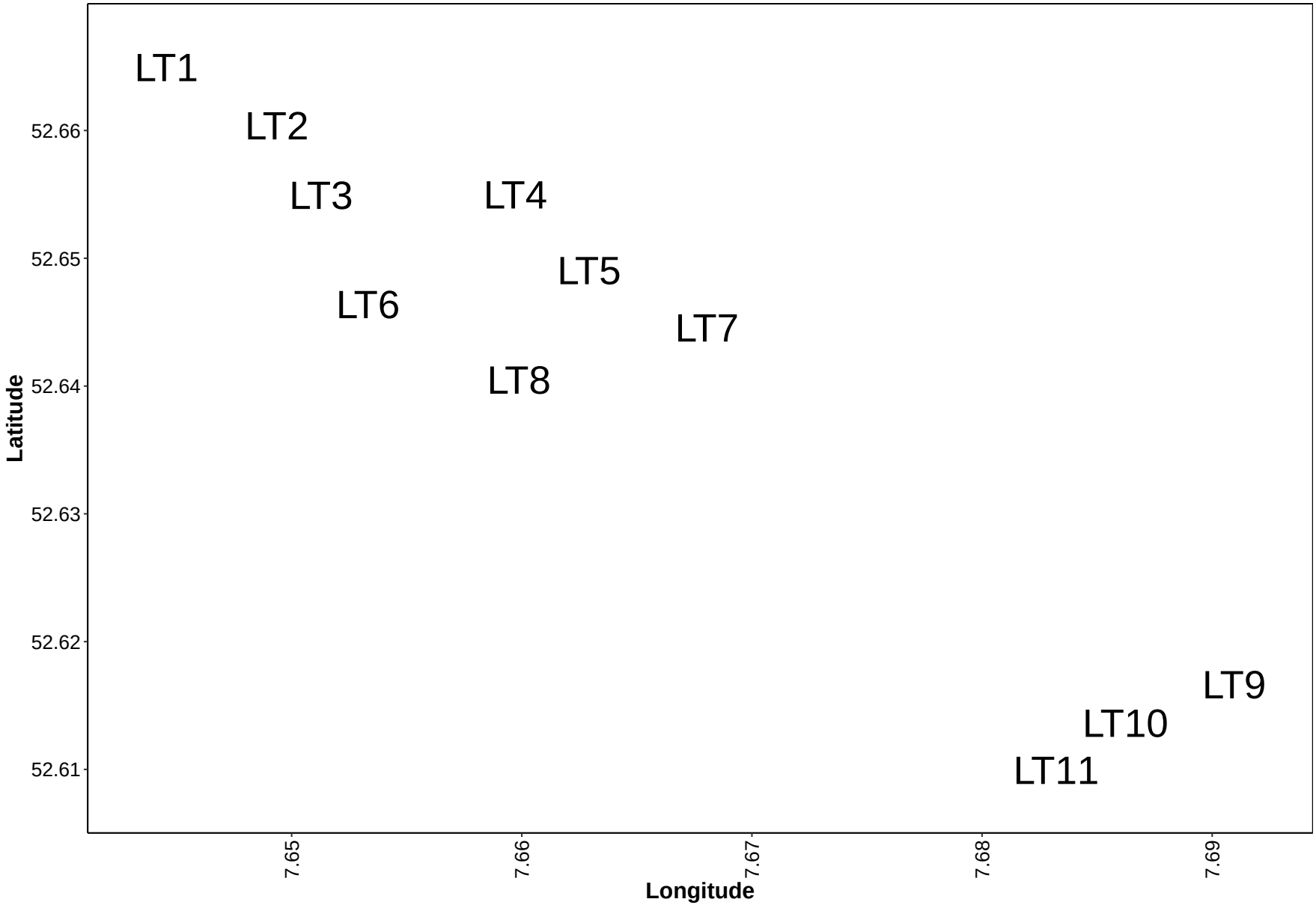
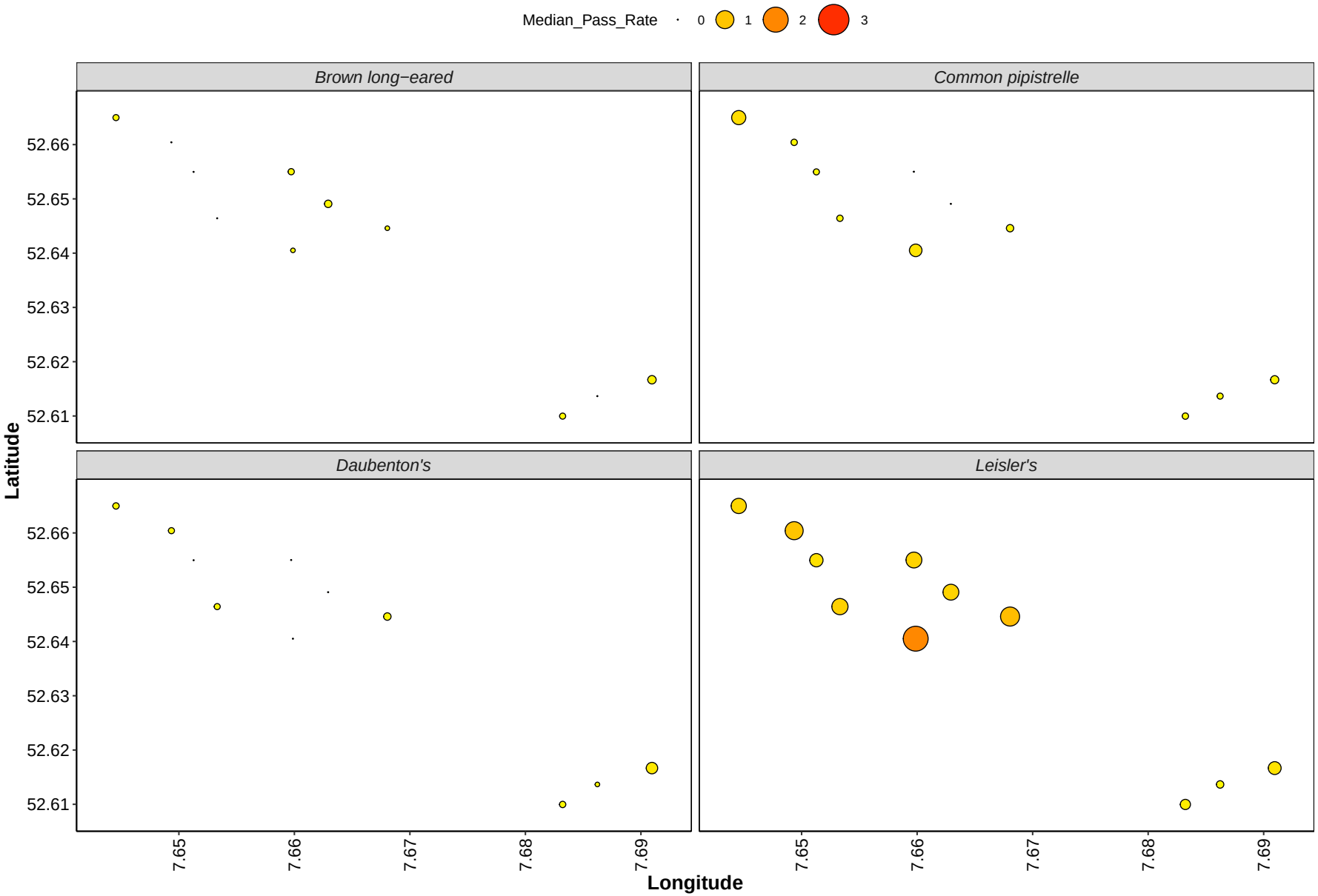

LT1
LT2
LT3
LT4
LT5
LT6
LT7
LT8
LT9
LT10
LT11
52.66
52.65
52.64
52.63
52.62
52.61
Latitude
7.65
7.66
7.67
7.68
7.69
Longitude

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
1
2
3
Brown long−eared
Common pipistrelle
Daubenton's
Leisler's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
Longitude
−7.65
−7.66
−7.67
−7.68
−7.69

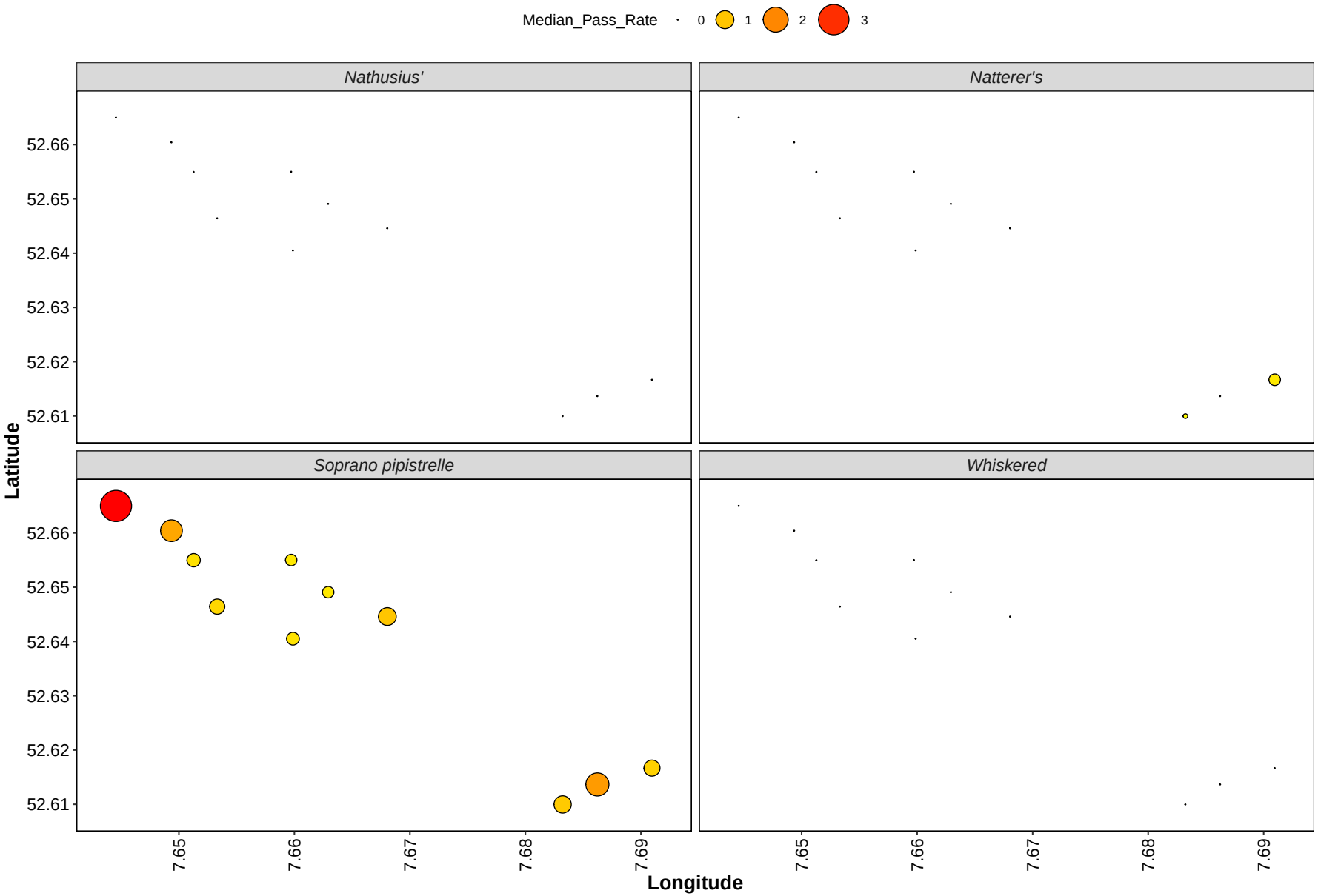
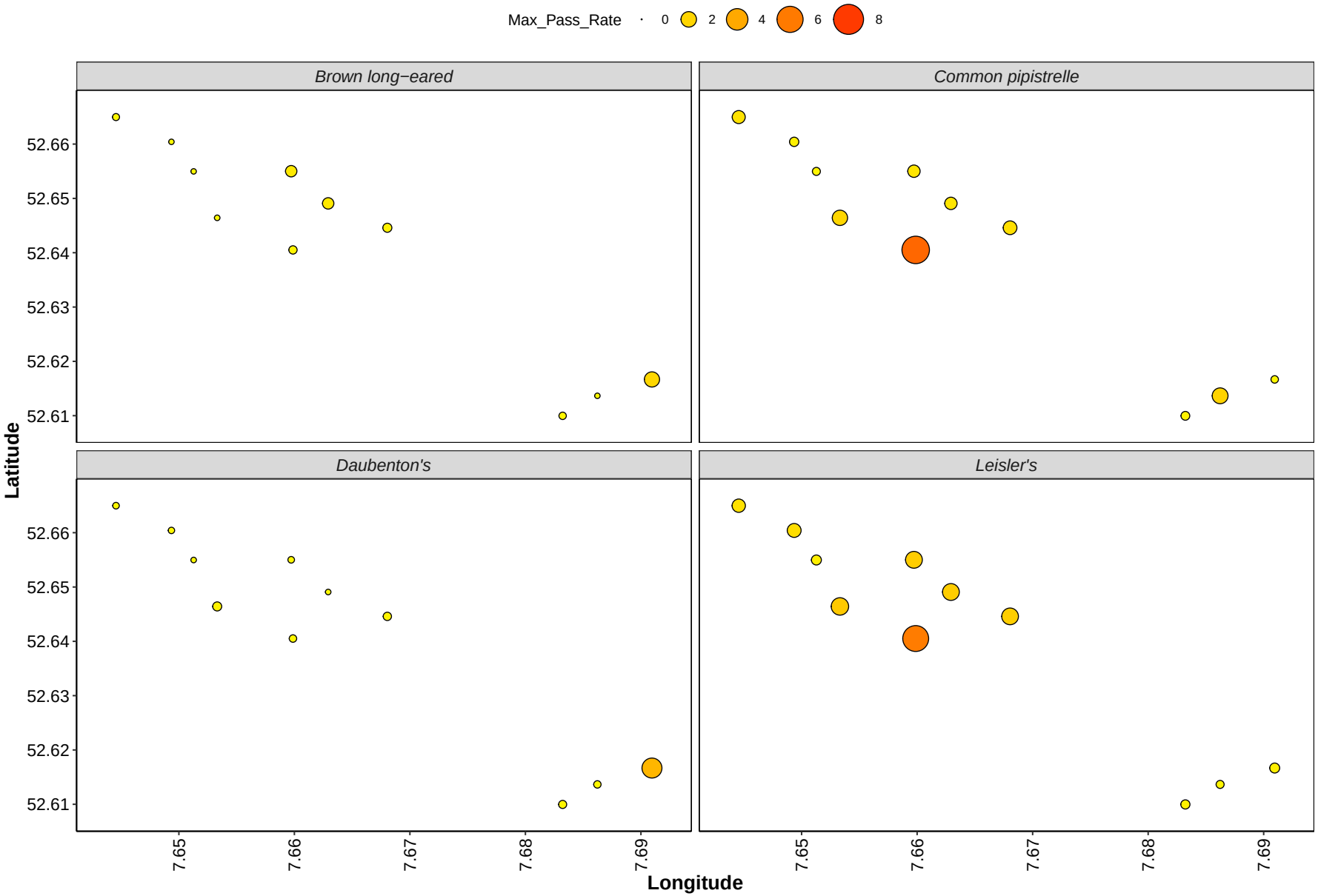
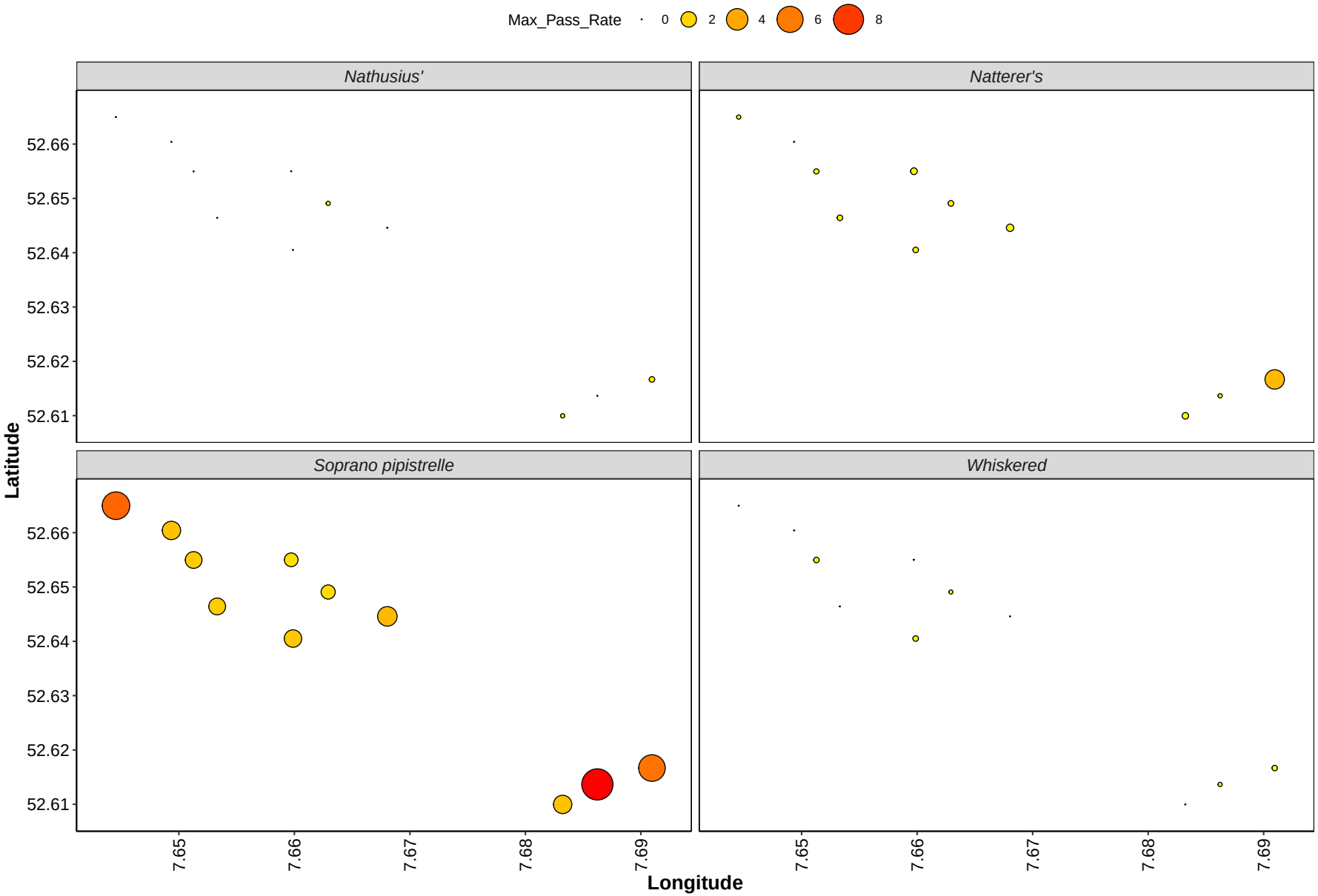

Median_Pass_Rate
0
1
2
3
Nathusius'
Natterer's
Soprano pipistrelle
Whiskered
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
Longitude
-7.65
-7.66
-7.67
-7.68
-7.69

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
2
4
6
8
Brown long−eared
Common pipistrelle
Daubenton's
Leisler's
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
7.65
7.66
7.67
7.68
7.69
Longitude


Max_Pass_Rate
0
2
4
6
8
Nathusius'
Natterer's
Soprano pipistrelle
Whiskered
Latitude
52.66
52.65
52.64
52.63
52.62
52.61
Longitude
7.65
7.66
7.67
7.68
7.69

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APPENDIX 6.4

Invasive Species Management Plan

APPENDIX 6.4

Invasive Species Management Plan

FEHILY TIMONEY

DESIGNING AND DELIVERING
A SUSTAINABLE FUTURE

LITTELTON WIND FARM

Invasive Species Management Plan

Prepared for:
Littleton Wind Farm DAC

Date: **April 2026**

Document No:
P20211-FT-XX-XX-RP-EN-0003

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Invasive Species Management Plan

REVISION CONTROL TABLE, CLIENT, KEYWORDS AND ABSTRACT

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Keywords: Invasive Species, Management, Littleton Wind Farm, Co. Tipperary

Abstract: This document provides an Invasive Species Management Plan to provide guidance and strategies for the management of invasive plant species at the proposed Littleton Wind Farm, Co. Tipperary

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1. INTRODUCTION

Littleton Wind Farm DAC has commissioned Fehily Timoney & Company (FT) to prepare an Invasive Species Management Plan as part of the proposed Littleton Wind Farm. Fehily Timoney & Company (FT) has prepared this Invasive Species Management Plan (ISMP) to comply with Regulations 49 and 50, Schedule III of the European Communities (Birds and Natural Habitats) Regulations 2011 to 2021 (not to cause the spread of non-native invasive plant species listed in the Third Schedule). This report details a programme for the monitoring and control of invasive species at and adjacent to the proposed project.

One species listed in the Third Schedule, Japanese knotweed, is present at the proposed development.

1.1 Legislative Context

In Ireland, the spread and propagation of species listed in the Third Schedule of S.I. No. 477/2011 European Communities (Birds and Natural Habitats) Regulations 2011 to 2021 is an offence. Under Regulation 49 (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. Under Regulation 50 it is an offence to transport a vector material listed in Part 3 of the Third Schedule except under licence.

1.2 Site Description

The proposed development comprises the proposed wind farm (The Site), grid connection (GC) and turbine delivery route (TDR).

The Site is located within Littleton and Lanespark Bogs, within the jurisdiction of Tipperary County Council. The closest settlements to the Site are Urlingford (ca. 5 km to the north-east), Gortnahoe (ca. 2.5 km to the east), Twomileborris (ca. 2 km to the west), Littleton (ca. 2.55 km to the west) and New Birmingham (ca. 2 km to the east) and Horse and Jockey (ca. 4.7 km west). The town of Thurles is located approximately 9 km to the west of the Site.

The proposed GC route will exit north of the Proposed Wind Farm Site along the Local Road L4114 and traverse the following townlands within County Tipperary: Longfordpass East, Graiguepadeen, Longfordpass North, Fennor and Longfordpass South. The cable then enters County Kilkenny, and traverses the following townland within the public road, terminating at the Ballyragget 110kV Substation: Freshford Lots, Borrisnoe, Killawardy, Clomantagh Upper, Acragar, Moneenaun, Urlingford, Kilrush, Glenreagh, Kilduff, Borrisnafarney, Barnane, Sweethill, Ridge, Balief Lower, Bohernarude, Kilmacuddy, Killoskehan, Cloncannon, Grange, Moatpark, Barna, Ballybeg, Parksgrove, Baunaniska, Ballyconra, Stook, Graigueswood, Clone, Borrisbeg, Borrismore, Gortagarry, Clomantagh (Mt. Garret), Mountfinn, Barnagrotty, Balief Upper, Clomantagh Lower, Tobernapeastia, Darbyshill, Monabrika, Aghnameadle and Blakefield.

1.3 Relevant Guidance

The methodology and guidance for this management plan has been devised in consideration of the following relevant guidance:

- 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.
- Property Care Association, (2018). Practical Management of Invasive Non-Native Weeds in Britain and Ireland. Packard Publishing Ltd.
- Kelly et al., (2008). Best Practice Management Guidelines Japanese Knotweed *Fallopia japonica*. Prepared for NIEA and NPWS as part of Invasive Species Ireland.
- Tu, (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.
- AM-SOP-009 Information and Guidance Document on Japanese Knotweed
- RAPID, 2018. Good Practice Management- Japanese Knotweed (*Fallopia japonica*).
- INNSA, 2017. Code of Practice – Managing Japanese Knotweed

1.4 Surveys and Baseline

1.4.1 Invasive and Non-native Species Recorded at the Proposed Development

An invasive alien plant species survey was carried out in parallel with habitat surveys and general ecology site walkovers during July – October 2025 (See EIAR Vol II Chapter 6). Surveys encompassed the Site (including BEMP area), GC and TDR.

One Schedule III non-native invasive plant species requiring control/avoidance measures was recorded near the proposed northern site entrance. This comprises a small growth of Japanese knotweed. It is located >8m from the edge of the proposed access track felling buffer (see Vol. IV Figure 6-16).

Table 1-1: Invasive species recorded at proposed development

Species	Invasiveness Risk	Legal Status
Japanese knotweed (*Fallopia japonica*)	High	Schedule III

A further four non-native species were recorded (one at both\the site and GC, and three along the GC) (see Table 1-2. Due to their non-regulated status and setback from proposed works areas, control/avoidance measures are not required for these species.

Table 1-2: Non-native species recorded at proposed development

Species	Invasiveness Risk	Legal Status	Location
Cherry laurel (*Prunus laurocerasus*)	High	None	GC
Sycamore (*Acer pseudoplatanus*)	Medium	None	GC Site
Traveller's-joy (*Clematis vitalba*)	Medium	None	GC
Wall cotoneaster (*Cotoneaster horizontalis*)	Medium	None	GC

A number of other non-native species Red osier dogwood (*Cornus sericea*), Snowberry (*Symphoricarpos albus*), Winter heliotrope (*Petasites fragrans*) which are not assessed as invasive were also recorded along the GC.

No invasive or non-native species were found at TDR nodes during site walkovers.

1.4.2 Desktop Records

A desktop record of the Schedule III invasive species giant hogweed (Heracleum mantegazzianum) was noted in the vicinity of the grid connection, specifically at Clomantagh Lower within 100m grid square S353633, located c. 450m south of the proposed grid connection. The area in which this plant was recorded in down-gradient of the GC and there is no downstream hydrological connectivity between this area and the GC. The observer noted plants growing along a channel from a groundwater spring to the Nuenna_010 waterbody.

As such, current baseline conditions do not require measures to avoid, contain or eradicate this species. However, due to its high invasiveness risk, legal restriction and human health risks, measures to control this species are provided as a precautionary measure.

2. INVASIVE SPECIES CHRACTERISTICS

The International Union for Conservation of Nature (IUCN) in their 'IUCN Guidelines for the Prevention of Biodiversity Loss Caused by Alien Invasive Species' 2000 report 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".*

Species descriptions for Japanese knotweed (recorded at the Site) and giant hogweed (desktop record c. 450m form GC) are provided in this section.

Accounts of these species, summaries of their ecology, distribution, growth, and management periods are included below.

2.1 Japanese knotweed *Fallopia japonica*

According to the Invasive Species Ireland Project who have carried out a risk assessment of Japanese Knotweed (*Fallopia japonica*), which is distributed throughout the island of Ireland, the species is "one of the highest risk (most unwanted) non-native invasive species in Ireland". The species poses a risk to open and riparian areas where it spreads rapidly to form dense stands, excluding native vegetation and prohibiting regeneration. This process has been known to reduce diversity and alter semi-natural and locally important habitats for wildlife. Once stands become established, they are extremely persistent and difficult to remove. Japanese knotweed can grow through weaknesses in both tarmac and concrete. Population clusters must be completely removed, under appropriate licencing, before site works or specific projects within the site can commence (Kelly et al., 2008).

2.1.1 Species Ecology

Although Japanese knotweed plants flower, all flowers in Ireland and Britain are female, precluding the possibility of sexual reproduction. The means of spread is entirely through the movement of rhizomes or rhizome fragments in soil or cut stems. Japanese knotweed has an extraordinary ability to spread vegetatively from crown, stem and rhizome (underground root) if disturbed. Even tiny amounts of cut stem, crown or rhizome can produce a new plant.

Controlling the spread of the species is therefore dependent on preventing the spread of the stem, crown or rhizome. Japanese knotweed causes numerous impacts, both ecological and economic. It is capable of outcompeting native plants and blocking commuting corridors of native mammals, and damaging buildings, tarmacadam and concrete. In waterways, it can block and reduce water flow, increasing the risk of flooding. In winter, when it dies back, it can leave riverbanks bare and open to erosion.

Red/purple shoots appear early in spring, which in some cases have an asparagus-like appearance but, as the canes grow, the leaves unfurl, and the plant takes its more characteristic appearance. The mature canes are like bamboo, being hollow, and have a characteristic pattern of purple speckles. The leaves are shield-shaped with pointed tips and a flat base, arranged in a zig-zag formation. The plant can grow to over 3m in height. Flowering occurs in late summer/autumn (End July – typically August) and consists of small creamy white flowers. During the winter the leaves die back and reveal orange/brown woody erect stems. Rhizomes are bright orange inside and can extend to a depth of 3m and a width of 7m around the visible growth above ground.



Source: "Expansion of Japanese Knotweed" by U.S Fish and Wildlife Service – Northeast Region is licensed with CC PDM 1.0 (https://www.flickr.com/photos/43322816@N08/5951588772)

Plate 2-1: Characteristic Features of Japanese Knotweed

2.1.2 Timeframe

Japanese Knotweed shoots typically appear between March and April. During this time energy stores from the root system are used to facilitate initial growth. The summer growth period commences in May and lasts until July, typical growth occurs during this time. Flowering begins in August and lasts until October. During this time the pale flowers can be seen.

Plate 2-2 indicates the suitable period for glyphosate herbicide application to treat Japanese Knotweed. It is suitable to use glyphosate herbicide on knotweed between the months of May and October, with August, September and October being the preferred months of use.

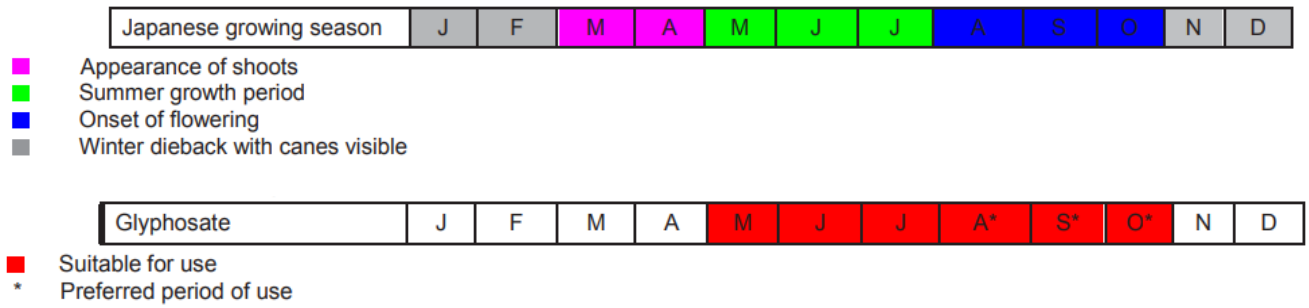


Plate 2-2: Japanese Knotweed Growth season summary (Kelly, et al., 2008).

2.2 Giant hogweed *Heracleum mantegazzianum*

2.2.1 Species Ecology

This is an extremely large (up to 5m tall) perennial herb which lives between 3-5 years. Stems are up to 10cm thick at the base, coloured green with purple blotches; root is pale yellow. Leaves are pinnate (opposite pairs of leaflets with one terminal leaflet) up to 1m length and 2.5m across; 10mm cream-white flowers are borne in umbels (disc-like clusters) up to 50cm in diameter. The mechanism of spread is by seed, with up to 50,000 seeds being produced when the plant reaches maturity (3-5 years), after which it dies. As such the plant may have a low growth form early in the season, as new plants develop from seed.

Giant hogweed produces large seeds which drop from the plant on maturity; they can potentially also be transported by flowing water and wind. The seeds regularly remain dormant in the soil for 1-2 years (5% found to survive 2 years; Nielsen et al., 2005) but may remain viable for up to 15 years (Maguire et al., 2008) and as such removal and eradication efforts must focus on not only the plant itself but also seed banks in the soil.

Its ecological impacts include outcompeting native flora when dense stands produced by prolific seeding colonise areas, and increased riverbank erosion when the plants die back in winter. Seeds usually disperse within the vicinity of the parent plant; there is potential for them to be transported further however by transport on animals, human intervention (e.g. machinery or soil movement) or in flowing water (this species is known to colonise river corridors).

It also poses a serious human health hazard, as contact with the sap can cause a condition called phytophotodermatis, which causes painful blistering of the skin, which can persist for years with exposure to sunlight re-triggering symptoms.

This species has been assessed by the National Biodiversity Data Centre as having a risk of high impact on native Irish species.



"Giant Hogweed (*Heracleum mantegazzianum*)" by Jeremy Halls is licensed under CC BY-SA 2.0.
(https://www.flickr.com/photos/33239614@N02/12704706783)

Plate 2-3: Giant hogweed leaves

2.2.2 Timeframe

The optimum time to control giant hogweed is around April/May, when the first foliage appears and the largest seedlings establish a leaf rosette.

3. PROPOSED MEASURES FOR MANAGEMENT OF INVASIVE SPECIES

3.1 Recommended Measures

While it is extremely important and more efficient to contain invasive species at the point of infestation, care shall also be taken to ensure the management plan (Section 4) is adhered to ensure that invasive species are not spread outside the works area. Furthermore, none of these invasive species will be planted as part of landscaping the proposed project.

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; changing habitats and ultimately threatening ecosystems which impacts on biodiversity as well as economics as they are costly to eradicate.

Through prevention, early detection, rapid response, eradication, and control measures, we can reduce the risk of their introduction, establishment, spread, and impact (Invasives.ie, 2022).

Specific consideration will be given to particular locations, due to their potential for disturbance during 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.

3.1.1 Prevention of spread within the works footprint

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

- The full implementation of the invasive species management plan (Section 4) 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 to site workers via toolbox talks given by a suitably qualified person as part of site inductions; 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 project lands will be allowed.
- Where invasive species have been physically removed and soil disturbed, this soil will be seeded or replanted (including 5cm deep mulch) with native plant species. This will prevent erosion and the easy colonisation of bare soil by invasive species in the area.
- Unwanted material originating from the site (including soil, rhizomes and other material) will immediately be transported off site by an appropriately licensed waste contractor and disposed of properly at a suitably licenced facility, in accordance with the (NRA, 2010) guidelines, i.e., 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 rhizomes, flower heads or seeds will be disposed to licensed landfill. All disposals will be carried out in accordance with the Waste Management Acts.
- Signs will warn people working within the site that there is invasive species contamination.
- Ensure appropriate biosecurity measure are in place; these will include the Check Clean Dry method, along with those outlined below:

- Remove the build-up of soil on equipment
- Keep equipment clean
- Do not move fouled equipment from one site to another
- Footwear and clothing of operatives working near invasive species should be checked for seeds, fruits, knotweed rhizomes or other viable material before exiting invasive species control zones and/or the site
- All vehicles exiting the site will be examined to prevent the transport of rhizomes, seeds and other plant material.
- Follow instructions provided for containment of invasive species (Section 3.2).

3.2 Containment

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

- Importation of infested soil.
- Contamination on vehicles and equipment.
- Illegal dumping.

Containment of invasive species will be achieved by:

- A pre-construction survey to reconfirm the findings of the baseline survey 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 3.4 for treatment methods).
- A licensed invasive species contractor shall be engaged to remove invasive plant species prior to development.
- Cordoning of invasive species outside the works footprint shall include a buffer of 1m the area of infestation. When larger buffers are required this shall be specified in Section 3.4. 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 contaminated soil (soil containing non-native invasive species material) or vegetation shall be removed from site unless proper biosecurity (Refer to Section 3.2 above) is observed and removal to a suitably licenced facility is carried out by an appropriately licensed waste contractor.
- New sightings of the invasive plant species identified at the proposed site shall be relayed to the contractor for invasive species control. These areas shall follow the same protocol as the current infected 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, during May/June, July/August and September/October should be sufficient to catch all regrowth, although a cautionary approach is advisable and pending the outcome of initial visits, further monitoring and control measures may be required.

3.3 Limitations on Herbicide Use

Due to the potential for significant negative effects on the aquatic environment from herbicides, the prioritisation of physical control over chemical methods must guide management strategies.

It is recommended to avoid spraying as an application method unless essential, instead favouring application using 'weed wipers' or direct injection if herbicides are deemed necessary.

Any herbicides used must be DAFM approved.

3.4 Species-Specific Measures

3.4.1 Giant hogweed *Heracleum mantegazzianum*

A historical record of this species is present c. 450m form the GC. As such, the current baseline does not require measures to be implemented for this species. Measures are included here on a precautionary basis, to be deployed in the event that preconstruction surveys indicate any changes in the baseline which may require their implementation.

The following management considerations should be taken into account:

- Seed can remain viable for up to 15 years; however most will persist for only 1-2 years
- Soil within 4m of parent plants is likely to contain a large number of seeds
- Most seeds are found within the top 5cm of soil
- Plants can regenerate from the central crown of the main root
- Giant hogweed produces phytotoxic sap, which poses a serious human health hazard.

These factors result in a number of basic requirements:

- Follow-up monitoring for regrowth (spring - autumn) will be required for several years following implementation of control/eradication measures.
- No machinery or construction operatives shall enter a 5m exclusion zone around plants.
- Soil from the 5m exclusion zone around plants shall only be moved under controlled conditions, if disposal is required.
- A risk assessment shall be carried out in advance of control/eradication works, and all personnel involved will require adequate PPE to prevent contact of plant material with skin.

One key option is proposed for the treatment of giant hogweed:

3.4.1.1 Option 1: Physical Control

- Young plants can be pulled or removed using hand tools.
- Larger plants can be cut back, and the lower stem and main root removed separately.
- The central root crown must be removed to prevent regeneration.

- Ripe seed-heads should be covered with bags and cut separately before digging/cutting to prevent the accidental spread of seed.
- Smaller seedlings should be left to grow for several weeks as larger plants are easier to remove.
- Mechanical cutting devices will not be used, as they can stimulate growth and spray sap onto operators.
- Vector material requiring disposal will be stored in a secure area onsite until it is non-viable or will be transported off site by an appropriately licensed waste contractor to a suitably licenced facility.

3.4.1.2 Additional Option: Chemical Control

- Foliar sprays of glyphosate or 2,4-D can be used for large infestations; broad-spectrum herbicides will also kill off non-target species however. Direct application of herbicide (e.g. using a 'weed wiper' or stem injection) should be used in favour of spraying.
- Foliar application should be undertaken in mid spring during dry mild weather, before the stem has fully elongated. If undertaken later in the year, plants should be cut back to ground level and re-growth treated.
- Due to the presence of sensitive aquatic receptors and semi-natural habitats, herbicide shall only be applied by stem injection or using a ‘weed wiper’.
- Operatives treating giant hogweed require a valid certificate for herbicide application.

Material (soil, vegetation, etc.) contaminated with giant hogweed can only be transported offsite under the conditions of a relevant licence from the National Parks and Wildlife Service (NPWS). The material can only be removed to a prearranged EPA licenced waste transfer/disposal facility by the licenced haulier.

3.4.2 Japanese knotweed *Fallopia japonica*

One small growth (several stems) of Japanese knotweed is present near the proposed bell-mouth site entrance onto the Longfordpass local road (see Figure 6-16). A buffer of > 8m separates this from the nearest proposed site activity (edge of access track felling buffer). A further 7m buffer lies between the edge of the felling buffer and the proposed access track, providing a buffer of > 15m between the current baseline growth and closest proposed construction area.

In addition, two stands of Japanese knotweed have been recorded within 10km grid square S25, at 52°37'55.87" N, 7°41'33.8" W, respectively. It is noted that the latter is outside of the Study Area. The area in which the former is located was surveyed during 2025 site walkovers; no Japanese knotweed was observed within the proposed development footprint or surrounding area at this location.

As such, it is highly unlikely that either construction of felling activities will interact with growths of knotweed.

However, measures to control/eradicate this species are provided to ensure any potential changes to the baseline are mitigated against.

It may also be preferable to eradicate the growth of knotweed at the northern site entrance in order to avoid the requirement for repeated surveys and control measures during the operational phase.

The following measures to prevent the spread of Japanese knotweed can be implemented during the proposed works:

- Japanese knotweed root systems can extend up to 7m in a lateral direction (but usually only up to 5 m), and 2m deep from the over ground parent plant. This 7m buffer zone and infested area will be fenced off prior to and during works to avoid spreading seeds or plant fragments around or off-site.
- Erection of adequate site hygiene signage in relation to the management of non-native invasive material as appropriate and to inform contractors of the risk.
- All staff shall be made aware of nature of threat via toolbox talks as part of site inductions.
- Ensure all site users are aware of measures to be taken and alert them to the presence of the Invasive Species Management Plan.
- Site works will only be allowed within exclusion zones following the removal of Japanese knotweed and contaminated soil.
- All machinery vehicles, equipment, footwear, and clothing operating within area of infestation to be thoroughly checked and cleaned in appropriately contained area prior to leaving the area to protect against further spreading of Japanese knotweed.
- Avoid if possible using machinery with tracks in infested areas.
- No stockpiling of contaminated soil will occur on-site.
- For soil imported to the site for infilling, the contractor will gain documentation from suppliers stating that it is free from invasive species.

Options proposed for the treatment of Japanese knotweed are described below.

3.4.2.1 Herbicide Treatment

Herbicide treatment using glyphosate (Round-up Biactive formulation) has been successfully used by IFI to control Japanese knotweed. This herbicide can be used as a foliar application, through stem injection or as stump cut application where the stems are cut and the herbicide is directly applied immediately after cutting.

Treatment can be carried out between May and October. For best results, it is recommended that foliar treatment is conducted in July, with follow-up treatment in September. For stem injection, treatment is most effective when applied to flowering stems (late summer to October). For stump cut application, treatment is most effective in September / October before senescence occurs.

Stem injection and stump cut application can be used to treat individual knotweed canes when they are interspersed among native vegetation, avoiding effects on non-target species. For stem injection, glyphosate should be injected into the cane between the 1st and 2nd node above the stem base.

For stump cut application, individual stems should be cut 20 cm above their base and 4 cm above a node, and the cut surface should be hollowed out to create a well. The herbicide can then be applied within 15 minutes of cutting with a pipette. For both treatments, a 10 ml dose per stem is recommended (made up of 5 parts water and 1 part glyphosate).

For extensive stands, it may be also necessary to mechanically excavate a 7 m area around the stand to 3 m depth to remove any knotweed rhizomes present. The excavated spoil should be disposed of in a biosecure manner (e.g. removed to a licenced landfill facility). Excavation equipment should be disinfected on site after use to prevent any further spread of the knotweed outside of the treatment area as plants will regenerate from rhizomes fragments remaining in the spoil.

Repeat herbicide treatment will be necessary over a three to four year period to achieve eradication (IFI, 2026).

3.4.2.2 Physical Control

Japanese Knotweed root systems can extend up to 7m in a lateral direction (but usually only up to 5 m), and 2-3m deep from the over ground parent plant. The Japanese knotweed stands, in addition to the 7x3m buffer volume, will be excavated.

Following excavation, two disposal methods can be used:

3.4.2.2.1 Burial Onsite

This is an option used in situations where there is a pressing development need for the site and time constraints would not allow for in-situ herbicide control over a longer period.

Pre-excavation treatment

The Japanese Knotweed infestation must be treated with a non-persistent herbicide before removing. When sufficient time has been allowed for the herbicide to take effect (at least a fortnight) the canes are to be cut and removed and contained for burial.

Herbicides can be applied using a range of suitable applicators, however 'weed wiping' or stem injection are preferable due to reduced potential for non-target plants and surrounding soil to be affected. Herbicide application must be carried out in calm, dry conditions, also allowing for a dry period following application. Control is easier if dead winter stems are tidied over the winter months to assist with access before growth commences i.e., to prevent tripping interfering with the knapsack lance It is advised to leave live canes in situ to reduce the risk of spread to other sites. Care must be taken to avoid spreading Knotweed crowns when tidying dead canes. Application in sensitive vegetation areas is best achieved by stem injection or weed wiper.

Stockpiling Japanese Knotweed infested soil prior to burial

If soil containing Japanese Knotweed is stockpiled, the material must be stored in a manner that will not harm the environment. The stockpile will be on an area of the site that will remain undisturbed. The area will be clearly signed and cordoned to prevent interference.

As a precaution, the stockpiled material must be laid on a root barrier membrane to avoid contaminating the site further and covered fully with the same material to avoid dispersal via wind.

Burying the material

Soil containing Japanese Knotweed material may be buried on the site where it is produced to ensure that it is completely eradicated.

It is advisable to apply a non-persistent herbicide at least once to reduce the growth of infective material. The period during which the herbicide is 'active' is described on the product label. Material cannot be buried during that period of activity.

Material must be buried on-site at least 5m deep. The Japanese Knotweed material must then be covered with a root barrier membrane layer before infilling it to 5m deep with inert fill or topsoil.

Root barrier membranes that may have been used to protect clean ground from vehicles involved in excavating Japanese Knotweed must also be buried. This method relies on the depth of burial as the main Japanese Knotweed treatment, rather than the protection from the root barrier membrane.

Where on-site burial is used, the area of deposition must be accurately mapped and the location recorded to prevent potential disturbance and re-infestation, future owners must be advised of its position. Japanese Knotweed is likely to survive for many years, depending on how effective the treatment was before it was buried. It is essential that it is not buried in a location where landscaping, installing services, building foundations are proposed or erosion from a watercourse is likely.

Where the deep burial of the dead Japanese Knotweed material is the preferred method of disposal, it is recommended to use glyphosate formulations. Other persistent herbicides are not allowed for deep burial under various waste regulations and due to a potential risk of pollution of groundwater.

Material, including contaminated soils, rhizome and the crown at the base of the stem, must be buried:

- at least 5 metres deep
- at least 10 metres from the margins of the site or any engineering features, for example drains or bunds, of the site

It is only acceptable to bury Japanese Knotweed material if the soil is otherwise uncontaminated.

3.4.2.2.2 Moving soil and treated Japanese Knotweed off site

Material (soil, vegetation, etc.) contaminated with Japanese knotweed can only be transported offsite under the conditions of a relevant licence from the National Parks and Wildlife Service (NPWS). The material can only be removed to a prearranged EPA licenced waste transfer/disposal facility by the licenced haulier using a truck fitted with a cover to prevent escape of any vector material. During excavation for off-site disposal, great care needs to be taken to avoid excess waste and ensure the excavated Japanese knotweed does not contaminate surplus soil that is currently free from infestation during excavations. When transporting soil infested with Japanese knotweed, it is essential to carry out strict hygiene measures. If proper standards are not followed, this may lead to Japanese knotweed spreading.

Trucks that transport the material will only be filled up to a maximum of 20cm from the top. The void must be sealed with a well-secured membrane.

There must be enough membrane to seal the soil into a temporary cell for transporting. It is very important that the soil is contained to prevent any material being lost when it is moved. To contain the soil in the short-term, you can use a lower specification of membrane.

The final fate of knotweed material transported off-site would be deep burial or incineration at an appropriately licensed facility.

3.4.2.3 Chemical Pre-treatment

Japanese knotweed is highly invasive and physical methods undertaken together with chemical treatment can prevent re-infestation.

At least two weeks prior to excavation, Japanese knotweed can be treated with a non-persistent herbicide e.g. glyphosate. Extreme caution and only approved herbicides will be used when applying herbicide

4. 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. It is recommended that surveys be carried out periodically at the site to monitor the extent of invasive flora and the success of the control and management measures. These can be carried out by FT, or a contractor specialised in invasive flora treatment. Monitoring shall continue during the construction period and as part of post construction monitoring to ensure successful control has been achieved. All invasive species which occur within the area utilised by people and machinery during the proposed construction works will be controlled/removed from the works area before commencement of works.

4.1 Containment

For the efficient use of resources, namely financial and physical effort, it is important to prevent the further spread of invasive species. Containment will be achieved using measure outlined in Section 3 and those presented below:

- Landholder to be informed of location of the invasive species and the management plan.
- Ensure anyone treating the infestation is a suitably qualified trained 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.

4.2 Schedule

Periodic re-surveying for all invasive species will be required, to ensure that treatment measures were effective, and to trigger further treatment if necessary. Refer to Table 3-2.

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

Table 4-1: Schedule for Management of Invasive Species

Time	Details of Measures
Pre-construction (isolation of invasive species)	• 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. • All invasive species observed shall include a suitable buffer (see Section 3.4) 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 3. • Only once treatment has been completed and invasive species have been removed from within the area of works will works commence. • Toolbox talks on invasive species shall be given to all personnel accessing the site.

Time	Details of Measures
	• 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 be required for the transportation of such matter.
During Construction	• Following treatment, site to be monitored for signs of regrowth/spread to new areas. • Toolbox talks shall be given to all personnel accessing the site, informing them of the locations of the invasive species and instructing them not to enter these areas (unless they are licensed invasive species contractors or ecologists). • Designated curtailment areas will be demarcated for the transport of invasive species offsite. • Machinery to be used in the control of invasive species will be itemised, and only that specific machinery will be used for excavation/control measures. • The build-up of soil on equipment will be removed and fouled equipment will not be moved between sites, or between the curtailment area (demarcated areas with invasive species and for transport of invasives)/clean down area and the rest of the site. • Footwear and clothing of operatives working near invasive species will be checked for rhizomes, seeds, fruits, or other viable material before exiting the site. Boot brushes will also be utilised. • All vehicles exiting the site will be examined to prevent the transport of seeds/rhizomes/plant material. • If re-growth of invasive species is discovered, further treatment/control will be completed using the treatment methods detailed in Section 5. • Site to be monitored during works for signs of regrowth of all invasive species.
Post Construction	For 5 years following construction, site to be monitored annually for signs of regrowth of invasive species, triggering further control measures as required. Any maintenance work requiring clearance of vegetation will require an invasive species survey and if required control/eradication measures for the area being accessed prior to works.

4.3 Mapping, Evaluation and Record Keeping

During the preconstruction and construction phases the following will take place before control measures:

- 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 (including above and below ground rhizome growth) and plot on map
- Evaluate the status/condition of the infestation
- Make sure the above steps are recorded

At the end of each site visit the recorded data should be compared with the findings of this report. Preparation of a short report on the progress of treatment following treatment works, and any subsequent monitoring.

4.4 Appropriate Disposal

4.4.1 Storage

All cut and excavated plant matter will be stored securely in line with the relevant treatment methodology. If invasive species vector material is required to be stored on site, it will be stored in a secure designated area with signage within the site boundary.

4.4.2 Disposal

Disposal of plant matter and infested soil onsite will be undertaken in a manner which ensures no further spread of invasive species occurs.

If transported off site, disposal of plant matter and soil off-site will be completed through an appropriately licenced haulier and waste facility.

5. DISCUSSION AND CONCLUSION

There is a legal obligation not to spread plants listed on the Third Schedule of Regulations 49 and 50 of the European Communities (Birds and Natural Habitats) Regulations 2011 to 2021; the relevant species at the proposed site and therefore the species of principal concern is Japanese knotweed. Additionally, of concern for the invasive species management plan is the presence of a historical record of giant hogweed c. 450m form the GC.

A competent and experienced invasive species management contractor is required to be appointed to treat and control invasive species. A dedicated invasive species survey will be undertaken by the appointed contractor to re-confirm the findings of the previous survey and to identify any new areas of infestation or invasive species.

Both infested and treated areas will be appropriately demarcated and signed to prevent access by unauthorised personnel. Additionally, appropriate biosecurity measures to prevent spread of invasive species are required, as detailed in Section 3.

It is noted that the current baseline poses little or no risk of the spread of invasive species, and measures are primarily included to mitigate against any potential future expansion or invasion of new areas prior to construction. In addition, the eradication of Japanese knotweed is likely to be preferable in order to minimise further survey and control efforts during the operational phase.

5.1 Conclusion

The implementation of this ISMP will prevent the spread of identified non-native invasive species within and from any works areas and reduce the potential risk for the introduction and/or spread of new invasive species within the site prior to, during and after construction.

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