Acoustic Survey at Ethy Wood and Orchard 2019

Survey summary report by Sonia Reveley (BCT)

Background information

Passive acoustic monitoring was set up at Ethy Wood and Ethy Orchard in Cornwall. The wood and orchard can be found adjacent to the estuary of the River Fowey and its tributaries.

The aim of the monitoring was to collect bat data for the Back from the Brink Ancients of the Future primary target species, the barbastelle and the noctule and for the project's secondary target species, the brown long-eared bat, lesser horseshoe bat, greater horseshoe bat and the soprano pipistrelle. The Bechstein's bat is also an Ancients of the Future primary target species but is difficult to identify from its echolocation calls alone because its calls are similar to other *Myotis* bat species.

Survey monitoring

At Ethy Wood and Ethy Orchard, three nights of passive acoustic monitoring utilising the latest development in acoustic sensor design was carried out by volunteers during 2019. A similar survey methodology and recording schedule to the 2019 British Bat Survey and Forestry England Bat Survey was used.

Surveyors deployed AudioMoths, (the size of a credit card) at four different survey location points (Table 4) each month in a range of wood pasture and orchard habitats within Ethy Wood and Ethy Orchard.

The AudioMoths were deployed once a month sometime in June, July and August, giving a snapshot of activity from one evening per deployment over three months.

The AudioMoths were configured to start 30 minutes before sunset and continued recording until 30 minutes after sunrise, on a quasi-continuous recording schedule of 58 seconds recording and 2 seconds sleep, at a sample rate of 384 kHz. Each sensor was fixed to a pole 2 m high which was then pushed into the ground securely. As the sensors were not waterproof, they were placed into a plastic bag to prevent moisture from entering the sensor microphone and circuitry.

Surveys were limited to one night and were not carried out on consecutive nights, as the size of the micro-SD card limited the amount of data that could be collected. The quasi-continuous recording schedule uses approximately 26 GB of the 32 GB storage provided by the micro-SD card. Together with limited capacity and resources to process and analyse the data, it was decided that one night per deployment would be sufficient for this project.

Equipment used, auto-ID software and manual verification.

An AudioMoth (https://www.openacousticdevices.info/), a full spectrum, low cost, still in development sensor was used to help monitor bat activity for this survey.

Due to the large volume of recordings collected, manual classification was not possible. Recordings were processed through Tadarida (https://github.com/YvesBas), an open-sourced software toolbox that automatically classified recordings to species and provided a classification probability. Recordings were split into five-second files segments using Kaleidoscope Pro software (Wildlife Acoustic) before they were processed through Tadarida. Five-second files containing three or more pulses identified to species/genus were considered a pass. As a call sequence can be over five seconds, where a call sequence was split over two five-second files, they were merged.

Manual checks were then carried out on recordings classifieds as our target bat species, using the Wildlife Acoustic Kaleidoscope Pro Free sonogram viewer (https://www.wildlifeacoustics.com/products/kaleidoscope-pro) and were reclassified if needed. Recordings identified by the classifier as Alcathoe bat, Natterer's bat, Bechstein's bat, Daubenton's bat, whiskered bat and Brandt's bat were manually checked then reclassified as the genus *Myotis* where the suggested species ID was uncertain. This is because we didn't have the resources or capacity to confirm to species, as *Myotis* bat calls are very similar in shape and therefore difficult to differentiate through sound analysis alone. Extra time to analyse the recordings would be needed. As pipistrelle calls can account for 95% of recordings collected, a random sample of soprano pipistrelle recordings were manually checked to confirm that the Auto-ID classification was correct. Recordings classified as noctule were reclassified as Big Bat species if uncertain, as they can have similar calls to serotine and Leisler's bat when recorded in a cluttered environment. Other species were not manually checked.

Summary of survey findings

Three evening surveys were successfully carried out by volunteers during June, July and August 2019 at Ethy Wood and Ethy Orchard.

Seven species of bats (barbastelle, brown long-eared bat, Leisler's bat, lesser horseshoe bat, noctule, common and soprano pipistrelle) and one species group *Myotis* were detected in Ethy Orchard. Five species of bats (barbastelle, lesser horseshoe bat, noctule, common pipistrelle and soprano pipistrelle) and one species group *Myotis* were detected in Ethy Wood. The tables below (1 to 3) are a summary of bat passes.

Table 1. Ethy Orchard 2019 (AM) 27/06/2019 *Passive Acoustic Monitoring*	Number of bat passes			
Species	**Point 1**	**Point 2**	**Point 3**	**Point 4**
Barbastelle	0	1	0	0
Noctule	3	4	0	1
Common Pipistrelle	45	27	6	15
Soprano Pipistrelle	0	1	1	0
Total	**48**	**33**	**7**	**16**

Table 2. Ethy Wood 2019 (AM) 31/07/2019 *Passive Acoustic Monitoring*	Number of bat passes			
Species	**Point 1**	**Point 2**	**Point 3**	**Point 4**
Barbastelle	0	0	1	0
Noctule	6	12	8	44
Myotis spp.	86	1	1	39
Common Pipistrelle	292	103	208	49
Soprano Pipistrelle	12	3	7	29
Lesser horseshoe bat	1	0	0	0
Total	**397**	**119**	**225**	**161**

Table 3. Ethy Orchard 2019 (AM) 29/08/2019 *Passive Acoustic Monitoring*	Number of bat passes			
Species	**Point 1**	**Point 2**	**Point 3**	**Point 4**
Barbastelle	2	1	0	0
Noctule	6	5	10	1
Leisler's bat	0	0	1	0
Myotis spp.	3	1	1	0
Common Pipistrelle	26	59	103	141
Soprano Pipistrelle	4	17	18	152
Lesser horseshoe bat	0	0	1	0
Brown long-eared bat	1	3	0	0
Total	**42**	**86**	**134**	**294**

The majority of calls detected at both sites were common pipistrelles. Only four barbastelle passes were detected at Points 1 and 2 during June and August at Ethy Orchards. At Ethy Wood, only one barbastelle pass was detected at Point 3. A reasonable level of noctule activity was detected during July at the survey locations selected across Ethy Wood, especially at Point 4.

It is possible that Ethy Wood is supporting the noctule roosting needs and both Ethy Orchards and Ethy Wood are providing suitable foraging grounds. Noctules predominantly roost in trees and are associated with woodlands that have a high proportion of standing deadwood or trees that support tree holes that are used as roosts. They forage over open countryside and will benefit from open parkland and wood pasture. They also forage over large waterbodies and broadleaved woodlands because of the abundance and diversity of insects supported by these habitats.

One lesser horseshoe bat pass was also detected at Ethy Wood and at Ethy Orchard. Lesser horseshoe bats will feed amongst wood pasture vegetation, so it is possible Ethy Wood and Ethy Orchard may be foraging sites for this secondary target species.

Maps showing where the bats were detected can be found in Appendix A and graphs showing activity through the night can be found in Appendix B. These can be used to identify hotspots of activity for future surveys, such as trapping to collect information about condition and breeding status of the bats.

Future survey recommendations

This survey provides a snapshot of activity from one night per deployment. If a better understanding of bat activity and the species using the site is required, further consecutive nights of passive acoustic monitoring are options to consider.

Some recordings are difficult to classify with certainty to species from echolocations calls alone. This includes *Myotis* species (Alcathoe bat, Daubenton's bat, Natterer's bat, whiskered bat, Bechstein's bat and Brandt's bat). In some cases, big bat species (serotine, noctule and Leisler's bat) can have similar calls when recorded in a cluttered environment. If National Trust would like to determine what species of *Myotis* bats are using the reserve, further surveys under a licence with experienced bat workers to catch the bats and identify these species in the hand would need to be carried out.

BCT is developing new survey protocols using static detectors that are left onsite for a few nights, which requires minimal surveyor effort and little or no previous experience of bat monitoring. Passive Acoustic Surveys under NightWatch and the British Bat Survey will be rolled out during the summer of 2022 as part of the National Bat Monitoring Programme. As data from this site has been

collected using a passive acoustic monitoring survey protocol, taking part in a monitoring scheme like the National Bat Monitoring Programme is recommended. Taking part long term will feed into a national dataset that is used to produce robust population trends

Managing for barbastelle and noctule

These surveys provided a snapshot of three nights of activity over three months and show us that barbastelles and noctules are using Ethy Wood and Ethy Orchard (Appendix A & B).

Habitat management for barbastelle

The conservation of barbastelle requires consideration of both the woodland surrounding tree roosts and the wider landscape.

Woodland – woodland management should seek to encourage characteristics of ancient or semi-natural broadleaved woodland with high numbers of mature and over-mature trees, particularly if the woodland is within a known roost area. It should also retain standing deadwood, canopy cover, dense understorey and areas of minimum intervention especially in proximity to roost trees, streams or other water bodies. Oak trees are of particular value, providing thick plates of defoliating bark. However, such features are often short-lived, so a number of trees of varying ages, species and states of decay are required for the long-term provision of potential roosts within a woodland block.

Wood pasture – Ancient and veteran trees will support many potential roost features and are likely to be used by our target bat species as roosting habitat, so work on these trees should be avoided. Within a wood pasture environment, mature and veteran trees should be left alone to age and decline naturally so they continue to provide a range of potential roost features. Other trees should be allowed to mature and develop old-growth naturally. Tree surgery on trees found in wood pastures should be a last resort i.e. to reduce the collapse of a tree or to reduce the weight of the crown. If possible consider other methods like erecting fencing around the tree to protect the public from any falling branches. If work cannot be avoided, appropriate bat surveys should be undertaken by a professional ecologist.

Beyond the woodland, general advice – management should focus on promoting moth-rich foraging habitats within a range of 7km but the nearer the roost woodland the better. This will support the bats in accessing those habitats quickly and easily.

Wildflower-rich meadows and other unimproved grasslands should be maintained or restored.

Arable margins – These can enhance the productivity of moths.

Hedgerows – Maintain a network of tall, bushy hedgerows. These are important for feeding and for providing cover as the bats head out from their roost woodland.

Other types of habitats - Increase the availability and quality of wetland habitats, including ponds, streams, marshes and reedbeds. Increase riparian habitat alongside rivers and streams with native shrubs and broadleaved trees. These will be commuting corridors and foraging grounds. Landscape connectivity is of importance to barbastelles; to commute to key foraging sites barbastelles will make use of sheltered flight lines like shaded tracks, woodland edges, bushy hedgerows, and tree-lined watercourses.

A lot of what is recommended for the barbastelle will also be beneficial to many other UK bat species, especially those that share similar ecological requirements.

Habitat management for noctule

Woodland management for the conservation of noctule requires retention of a high proportion of standing deadwood or trees that support tree holes as well as the provision of wood pasture and parkland in the wider landscape.

Woodland – woodland management should seek to encourage characteristics of ancient or semi-natural broadleaved woodland with high numbers of mature and over-mature trees, particularly if the woodland is within a known roost area. Trees favoured include oak and beech but any mature, deciduous tree can support a suitable roost hole. In managed woodlands sites that are actively logged, it is important to retain small patches of old-growth woodland connected by wildlife corridors. These old-growth patches will provide suitable roosting opportunities for the noctule. In addition, keep standing and fallen deadwood which will provide both roosting and foraging opportunities. Maintain open areas in woodlands for the noctule to forage in.

Woodland rides and glades – manage rides, glades, and woodland edges in a way that will improve insect diversity and activity. Consider using rotational cutting of these areas so that herb-rich layers are encouraged. Ensure pinch points and scalloped edges are incorporated into the management of rides and glades to encourage greater insect diversity and provide connection to adjacent woodland blocks.

Wood pasture – within a wood pasture environment, mature and veteran trees should be left alone to age and decline naturally so they continue to provide a range of potential roost features. Other trees should be allowed to mature and develop old-growth naturally and a diverse age structure across the pasture should be encouraged. Tree surgery on trees found in wood pastures should be a last resort i.e. to reduce the collapse of a tree or to reduce the weight of the crown. If possible consider other methods like erecting fencing around the tree to protect the public from any falling branches. If work cannot be avoided, appropriate bat surveys should be undertaken by a professional ecologist. Wood pastures are important foraging grounds for the noctule, particularly if grazed by livestock, so maintaining pastoral areas and retaining areas of permanent grassland with livestock would be beneficial.

Beyond the woodland, general advice – management should focus on protecting networks of mature hedgerows, tree lines, woodlands, wood pasture, parkland meadows and wetlands, particularly within a 2 km radius of any known roost site. This will support the bats in accessing those habitats quickly and easily.

Wildflower-rich meadows and other unimproved grasslands should be maintained or restored.

Arable margins – consider expanding unsprayed field margins and minimising the use of pesticides. These can enhance the productivity of moths and support cockchafer beetles.

***Hedgerow*s** – Maintain a network of tall, bushy hedgerows. Hedgerow trees can provide suitable roosts and a foraging resource as the bats head out from their roost woodland to feed.

Other types of habitats - Increase the availability and quality of wetland habitats, including waterbodies like ponds, streams, rivers and lakes. Increase riparian habitat alongside rivers and streams with native shrubs and broadleaved trees. These will be commuting corridors and foraging grounds.

Onsite management recommendations

Within an orchard environment, mature trees should be left alone to age and decline naturally so they continue to provide a range of potential roost features. Old orchards close to woodland can be insect rich feeding grounds for bats and the woodpeckers who create the cavities that the bats use to shelter in and should be retained, with insecticide use restricted.

Retain larger, older mature trees to become roost trees for the future and retain woodland areas of dense understorey and closed canopy if there are any onsite. The best management prescriptions to consider would be minimum intervention where possible, so trees with potential are retained for many years, allowed to age undisturbed by any management and the area is allowed to develop old-growth habitat naturally - great for bat roosts and will provide feeding opportunities.

Any haloing around mature trees (including young trees exhibiting roost potential) should be done sympathetically and be phased. This is because an abrupt change to the environmental conditions around the tree, could mean it becomes unsuitable for bats and if they are roosting in the trees, they may abandon the roost. Any abrupt change to the environmental conditions may also stress the trees, causing them to decline. Ensure appropriate bat surveys are undertaken before any work starts, to assess whether bats could be present and the potential risk to them from any tree/woodland work.

Improve connectivity to the wider landscape. This will ensure good links with key foraging areas and other suitable foraging sites.

For additional information about wildlife management the Woodland Wildlife Toolkit, an online toolkit has advice and guidance on managing woodlands for wildlife, (in particular rare and declining species that are dependent on woodland habitats). The toolkit was developed by the following partners: Bat Conservation Trust, Butterfly Conservation, Forestry Commission, Natural England, Plantlife, RSPB, Sylva Foundation, and the Woodland Trust.

Ancients of the Future have also created species information guides containing habitat management recommendations for its three primary target species, which can be downloaded from the Back from the Brink website. The barbastelle guide can be downloaded from here, the noctule guide can be downloaded from here and the Bechstein's bat guide can be downloaded from here.

Appendix A – Maps showing the acoustic survey results
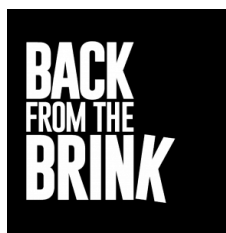
Ethy Orchard Acoustic Survey (Static)
27th June 2019 (1 night)
Bat species (and number of bat passes)
Survey start time: 21:04   Survey finish time: 05:37

Point 1 - Noctule (3)
Point 1 - Common Pipistrelle (45)
Point 2 - Common Pipistrelle (27)
Point 2 - Barbastelle (1)
Point 2 - Noctule (4)
Point 2 - Soprano pipistrelle (1)
Point 3 - Lesser Horseshoe bat (1)
Point 3 - Common Pipistrelle (6)
Point 4 - Noctule (1)
Point 4 - Common Pipistrelle (15)

Ethy Orchard Acoustic Survey (Static)
27th June 2019 (1 night)

Barbastelle bat passes per hour

Ethy Orchard Acoustic Survey (Static)
27th June 2019 (1 night)
Noctule bat passes per hour

Appendix A – Maps showing the acoustic survey results

Ethy Wood Acoustic Survey (Static)
31st July 2019 (1 night)
Bat species (and number of bat passes)
Survey start time: 20:34   Survey finish time: 06:14

Point 1 - Noctule (6)
Point 1 - Common Pipistrelle (292)
Point 1 - Soprano pipistrelle (12)
Point 1 - Lesser horseshoe bat (1)
Point 1 - Myotis species (86)
Point 2 - Common Pipistrelle (103)
Point 2 - Myotis species (1)
Point 2 - Soprano pipistrelle (3)
Point 2 - Noctule (12)
Point 3 - Bat species (1)
Point 3 - Common Pipistrelle (208)
Point 3 - Myotis species (1)
Point 3 - Soprano pipistrelle (7)
Point 3 - Barbastelle bat (1)
Point 3 - Noctule (8)
Point 4 - Common Pipistrelle (49)
Point 4 -Noctule (44)
Point 4 -Soprano pipistrelle (29)
Point 4 -Myotis species (39)

Bat passes per hour
30

Appendix A – Maps showing the acoustic survey results

Ethy Wood Acoustic Survey (Static)
31st July 2019 (1 night)

Barbastelle bat passes per hour

Appendix A – Maps showing the acoustic survey results

Ethy Wood Acoustic Survey (Static)
31st July 2019 (1 night)

Noctule bat passes per hour

Point 1

Point 3

Point 4

Point 2

Noctule bat passes per hour

3

N

0   100   200   400 Meters

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
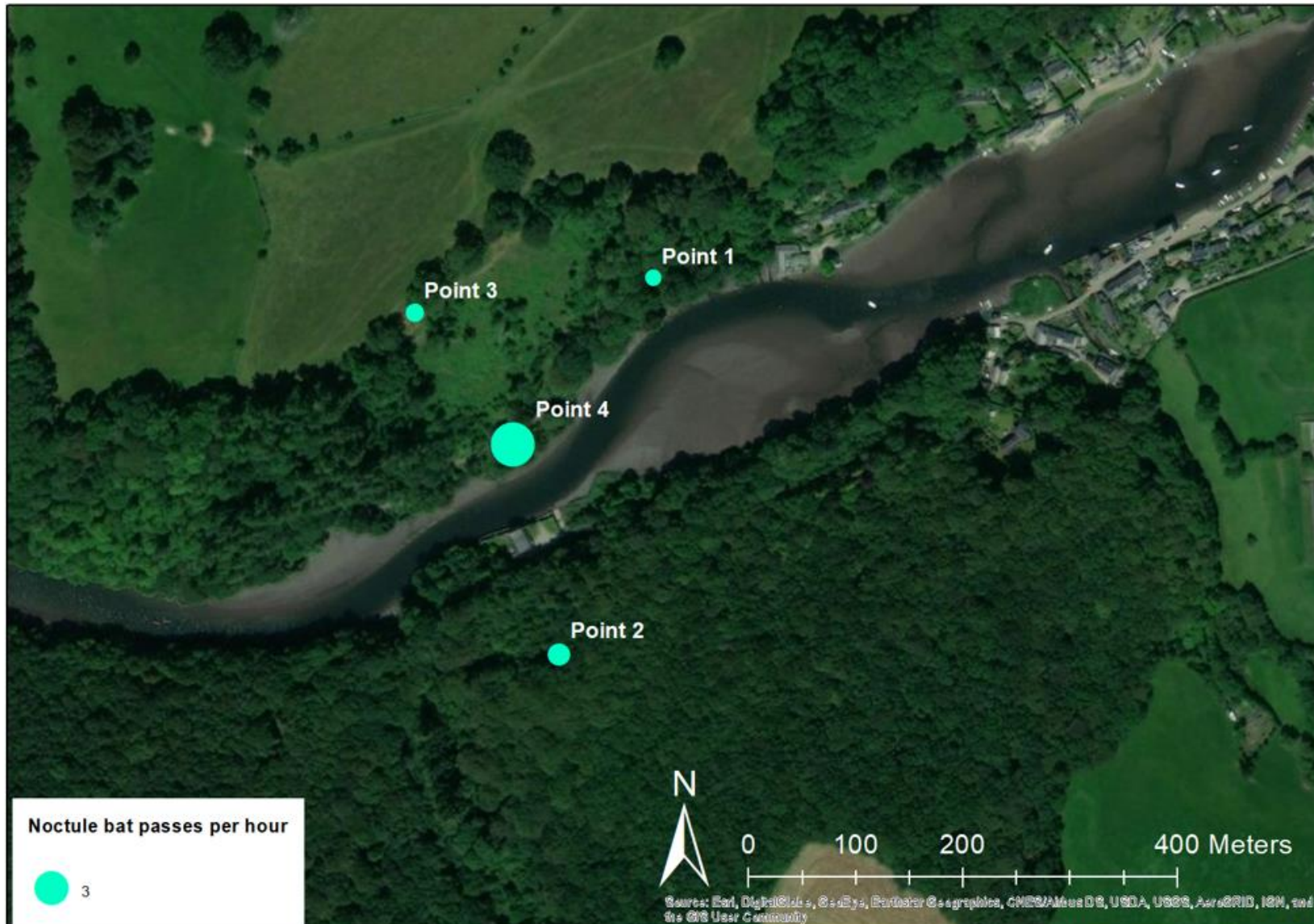
Ethy Orchard Acoustic Survey (Static)
29ᵗʰ August 2019 (1 night)
Bat species (and number of bat passes)
Survey start time: 19:40   **Survey finish time:** 05:58

Point 1 - Noctule (6)
Point 1 - Barbastelle bat (2)
Point 1 - Soprano pipistrelle (4)
Point 1 - Common Pipistrelle (26)
Point 1 - Brown long-eared bat (1)
Point 1 - Myotis species (3)
Point 2 - Barbastelle bat (1)
Point 2 - Big bat species (1)
Point 2 - Brown long-eared bat (3)
Point 2 - Myotis species (1)
Point 2 - Common Pipistrelle (59)
Point 2 - Noctule (5)
Point 2 - Soprano pipistrelle (17)
Point 3 - Leisler's bat (1)
Point 3 - Lesser Horseshoe bat (1)
Point 3 - Noctule (10)
Point 3 - Soprano pipistrelle, 18
Point 3 - Common Pipistrelle (103)
Point 3 - Myotis species (1)
Point 3 - Horseshoe bat species (1)
Point 4 - Noctule (1)
Point 4 - Soprano pipistrelle (152)
Point 4 - Common Pipistrelle (141)

Appendix A – Maps showing the acoustic survey results

Ethy Orchard Acoustic Survey (Static)
29th August 2019 (1 night)

Barbastelle bat passes per hour

Appendix A – Maps showing the acoustic survey results

Ethy Orchard Acoustic Survey (Static)
29th August 2019 (1 night)

Noctule bat passes per hour

Appendix B – Graphs showing bat activity.

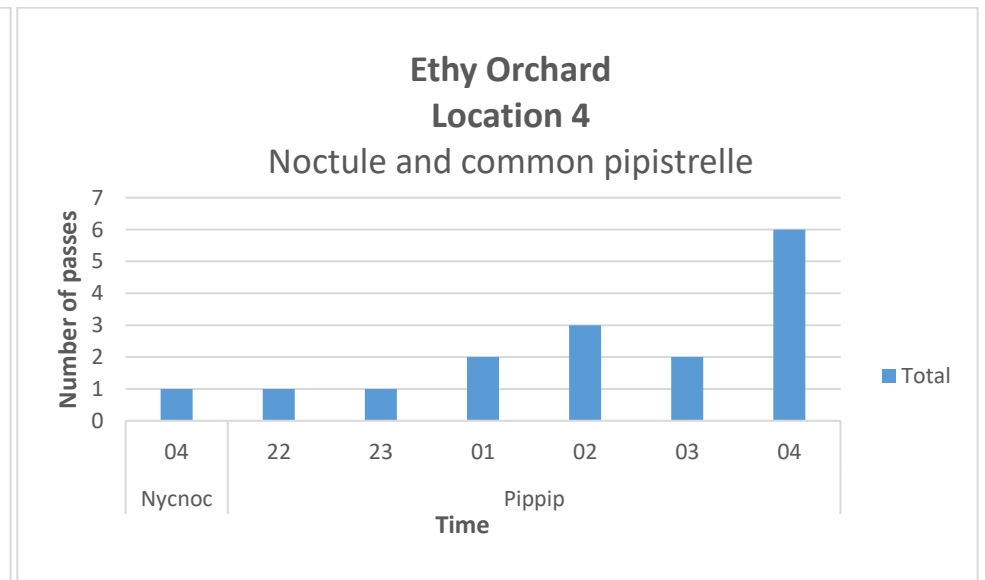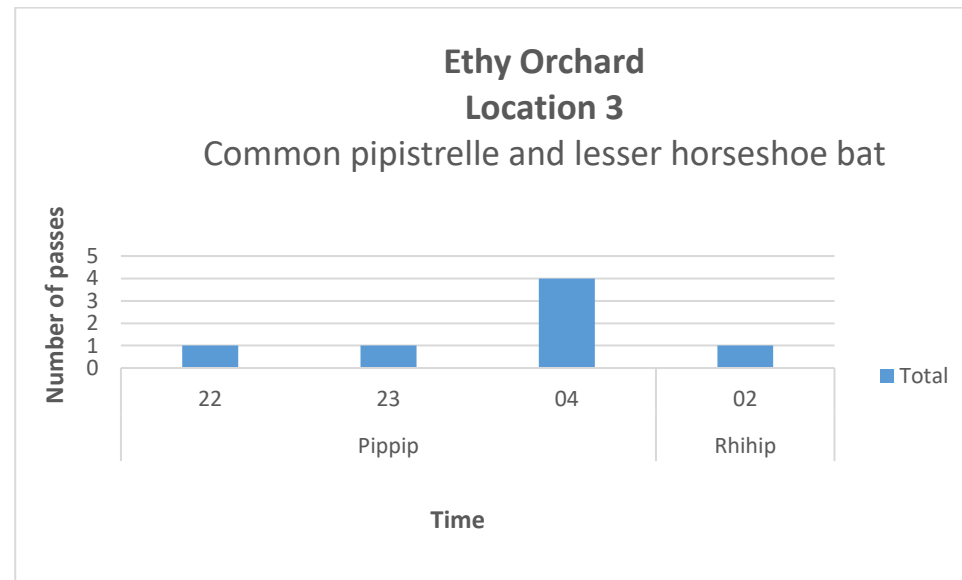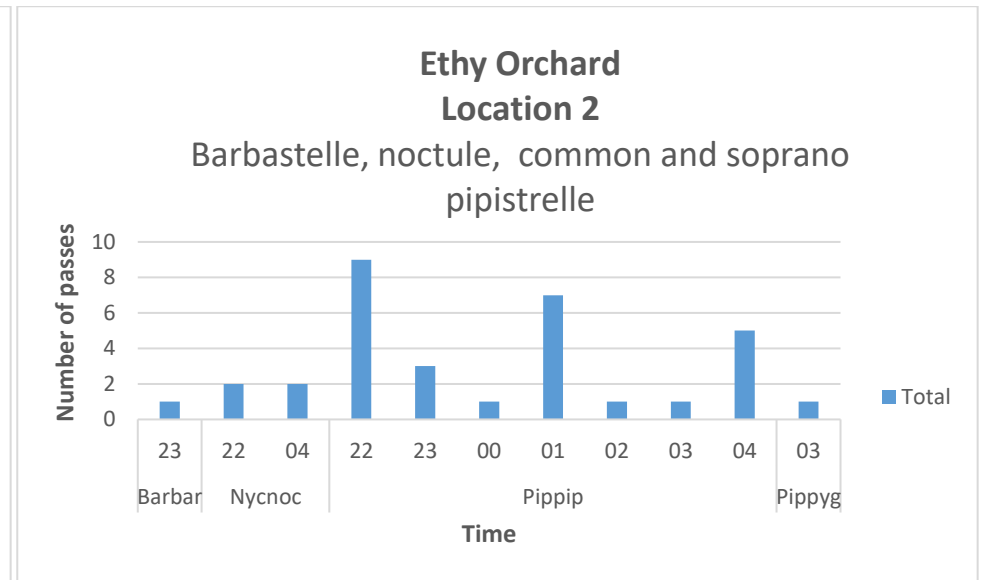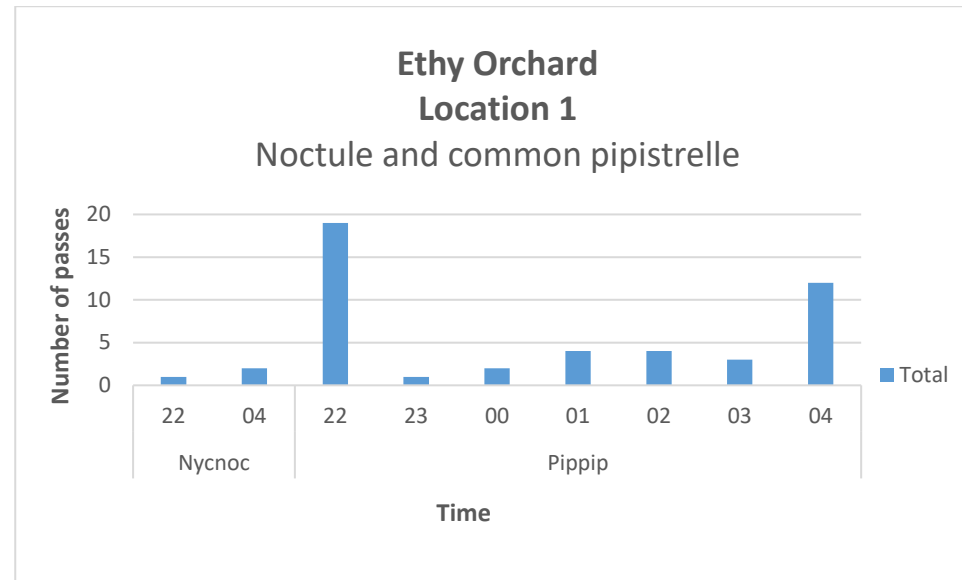**Table 4. Point Location Habitat Descriptions**

Point location	Habitat Description – 27th June 2019	Grid Reference
1	Top of the orchard. More established mature apple trees. Sweet chestnut/ash on hedges	SX 13504 57340
2	Similar to Point 1 (Opposite side). More established mature apple trees. Sweet Chestnut/ash on hedges. Some standing deadwood on the hedge.	SX 13509 57381
3	Bottom left of the orchard. More open space. Younger apple trees. Dense scrub along the hedge, some deadwood	SX 13606 57411
4	Similar to Point 3. Open space/scrubby hedge line. Rank grass. Large hawthorn/sycamore 15m in front	SX 13619 57361

Point location	Habitat Description – 31st July 2019	Grid Reference
1	Bottom of wood pasture, the bottom side of patch 5m from the creek edge	SX 1355456918
2	Open space near field gate into the top of wood pasture. Some standing deadwood and mature oak	SX 1349056696
3	Under mature oak along the top path of wood pasture looking downhill 3m from field fence.	SX 13411 56902
4	Bottom of pasture near the start of plantation wood. Between creek and path. Mature veteran oak trees. Some young beech and hazel	SX 13467 56822

Point location	Habitat Description – 29th August 2019	Grid Reference
1	Bottom of orchard slope. Open space. Young fruit. 5 m off low hedge into the park. No hedgerow trees.	SX 1363957392
2	Open area. The left-hand side of the orchard is parallel to the hedge. 10m from large veteran beech. 5 m from fruit trees	SX 1356457394
3	The right-hand side of the orchard. 10m from hedge close to medium size sycamores x 3. Some smaller hedgerow trees (beech/alder/holly)	SX 1354857347
4	Top of orchard slope. Mature apple trees. 10m from the hedge. Large hawthorn. Standing deadwood 15 m away.	SX 1350257369

Appendix B – Graphs showing bat activity.

27th June 2019

Ethy Orchard
Location 1
Noctule and common pipistrelle

Ethy Orchard
Location 2
Barbastelle, noctule, common and soprano pipistrelle

Ethy Orchard
Location 3
Common pipistrelle and lesser horseshoe bat

Ethy Orchard
Location 4
Noctule and common pipistrelle

Appendix B – Graphs showing bat activity.

31st July 2019

Ethy Wood Location 1 — Noctule, common and soprano pipistrelle, lesserhorseshoe bat and *Myotis* species

Ethy Wood Location 2 — *Myotis* species, noctule, common and soprano pipistrelle

Ethy Wood Location 3 — Myotis species, common and soprano pipistrelle, noctule and barbastelle

Ethy Wood Location 4 — Noctule, common and soprano pipistrelle and *Myotis* species
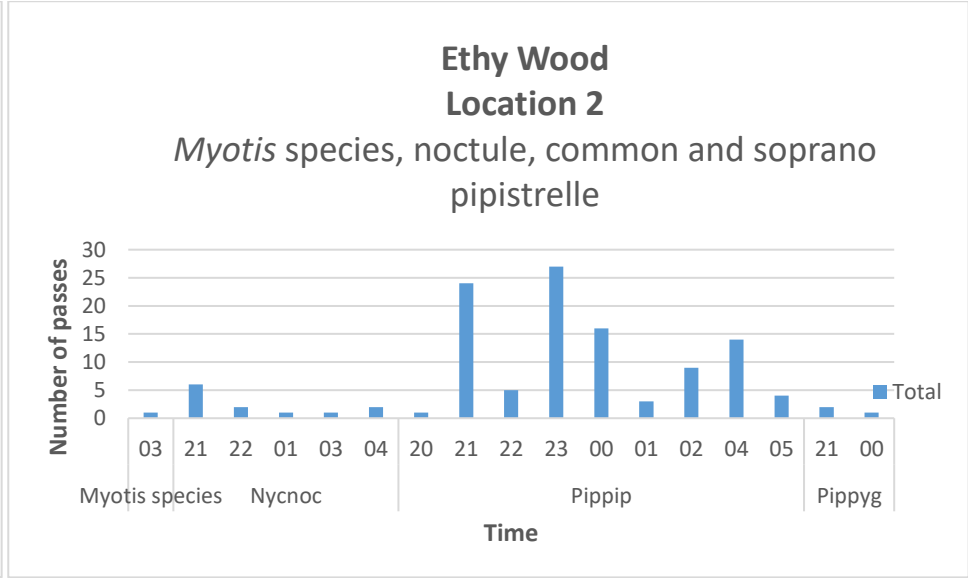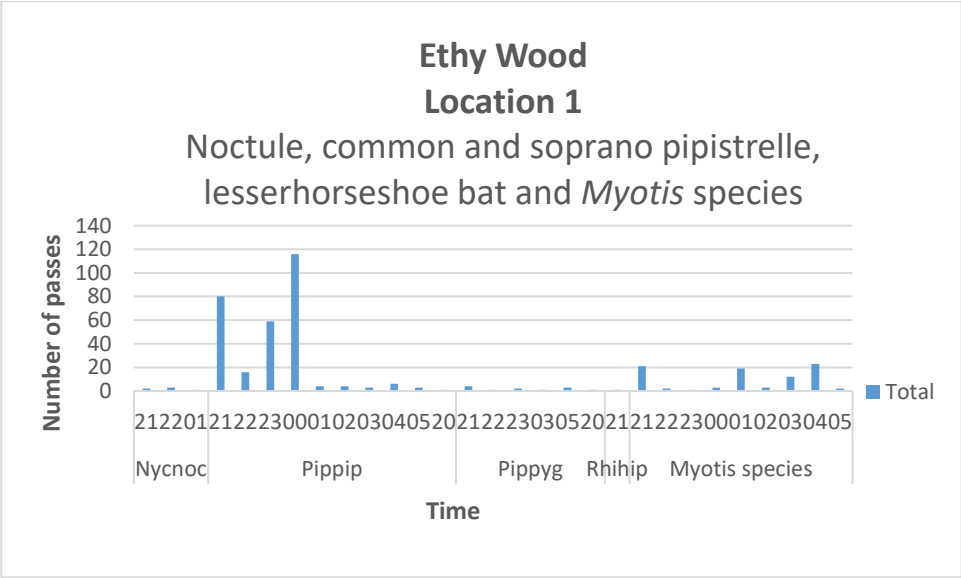
Appendix B – Graphs showing bat activity.

29th August 2019

Ethy Orchard
Location 1
Myotis species, barbastelle, noctule, brown long-eared bat, common and soprano pipistrelle

Ethy Orchard
Location 2
Barbastelle, noctule, common and soprano pipistrelle and brown long-eared bat

Ethy Orchard
Location 3
Noctule, common and soprano pipistrelle and lesser horseshoe bat

Ethy Orchard
Location 4
Noctule, common and soprano pipistrelle