

Bat survey report for Ty Ucha, Glascwm, Meifod, Powys, SY22 5LU

Oakwood Ecology

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Summary

This report presents an assessment of the activity of bats at Ty Ucha, Glascwm, Meifod, Powys, SY22 5LU, and includes the results of a desk-study, a building inspection, and activity surveys. The proposed development involves the construction of a two-storey extension. Industry-standard survey methodologies were followed.

There is one statutorily designated site within 2 km of the development site: Allt-y-main mine (SSSI and SAC), notified because it is a hibernaculum for lesser horseshoe bats. There are 669 historical records of bats within the search area, the closest record being the mine mentioned above.

Ty Ucha is surrounded by woodland and pastoral farmland and connectivity with the surrounding countryside is good. The habitats present significant potential for roosting, commuting and foraging bats. The building inspection revealed no evidence of bats roosting in the building and low potential for them.

Two activity surveys were carried out and the following species of bat were heard and/or seen: common and soprano pipistrelle, noctule, whiskered bat, Daubenton's bat, indeterminate *Myotis* species, brown long-eared bat, lesser horseshoe bat and indeterminate bat species. No consistent flight-lines related to the building were observed during the surveys.

A single common pipistrelle was recorded roosting in the house, and this is considered to be either a solitary male or non-breeding female. Given the numbers of bats involved and the common and widespread nature of this species in this area, the roost is deemed to be of only local value. The surrounding land-use fabric is common in the region, and so these habitats are also of only local value.

In the absence of any mitigation measures, the roost will be lost as a result of the proposed development, and bats may be physically harmed during this process. A mitigation strategy is proposed that would allow the development to go ahead with negligible adverse impact through a mixture of careful timing and specific working methods, along with compensation in the form of additional new roosts integrated into the new extension. The legally protected status of all bat species and their roosts means that a development licence must be granted before any works can take place. No post-construction monitoring is proposed.

1 Introduction

1.1 Background

- 1.1.1 This bat survey report was commissioned by Mr Dean Evans to inform a planning application at Ty Ucha, Glascwm, Meifod, Powys, SY22 5LU (grid reference SJ17001573, **Figures 1 & 2**).

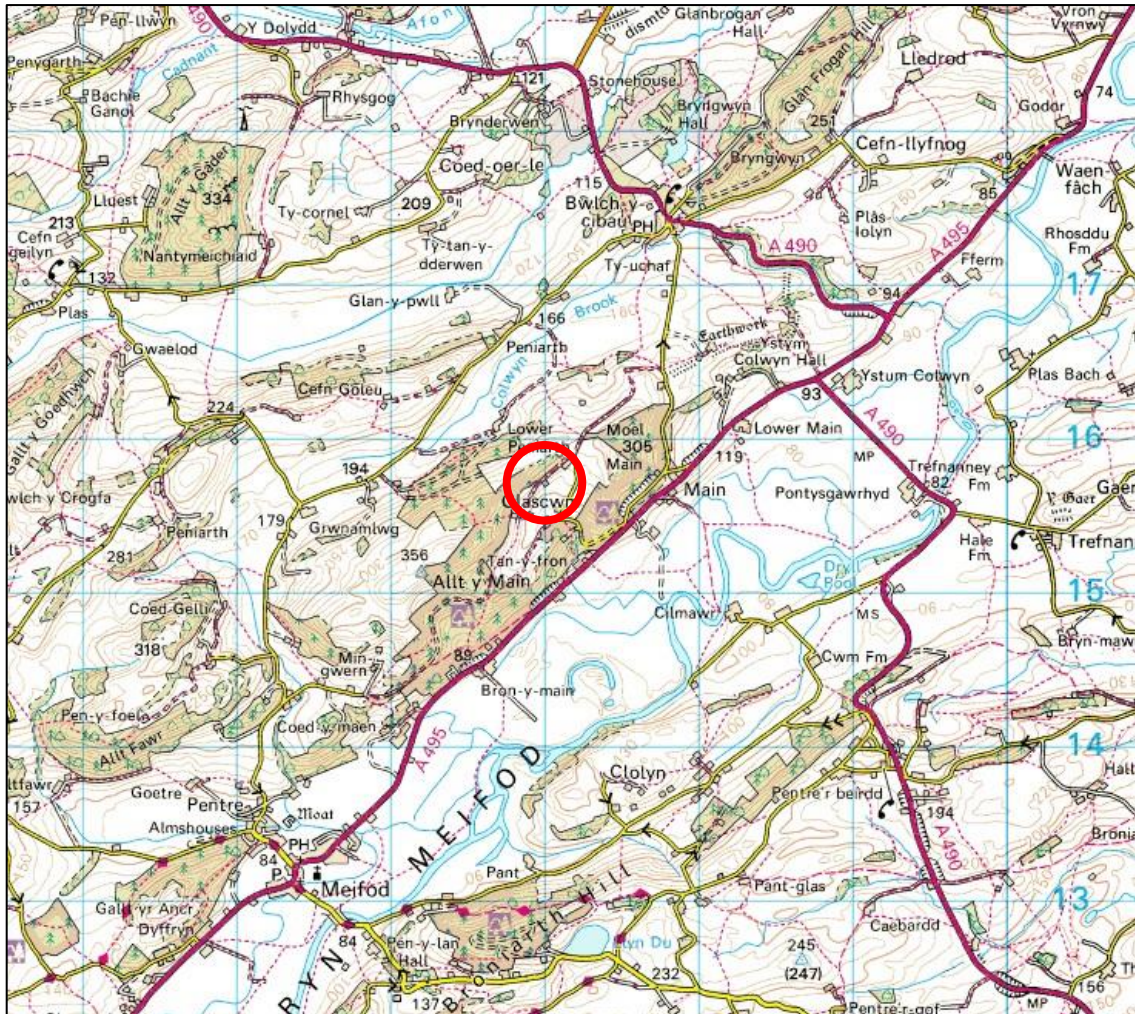


Figure 1. Location map of the development site at Ty Ucha (circled red).

(Reproduced under licence from Ordnance Survey, Licence No. 100056340).

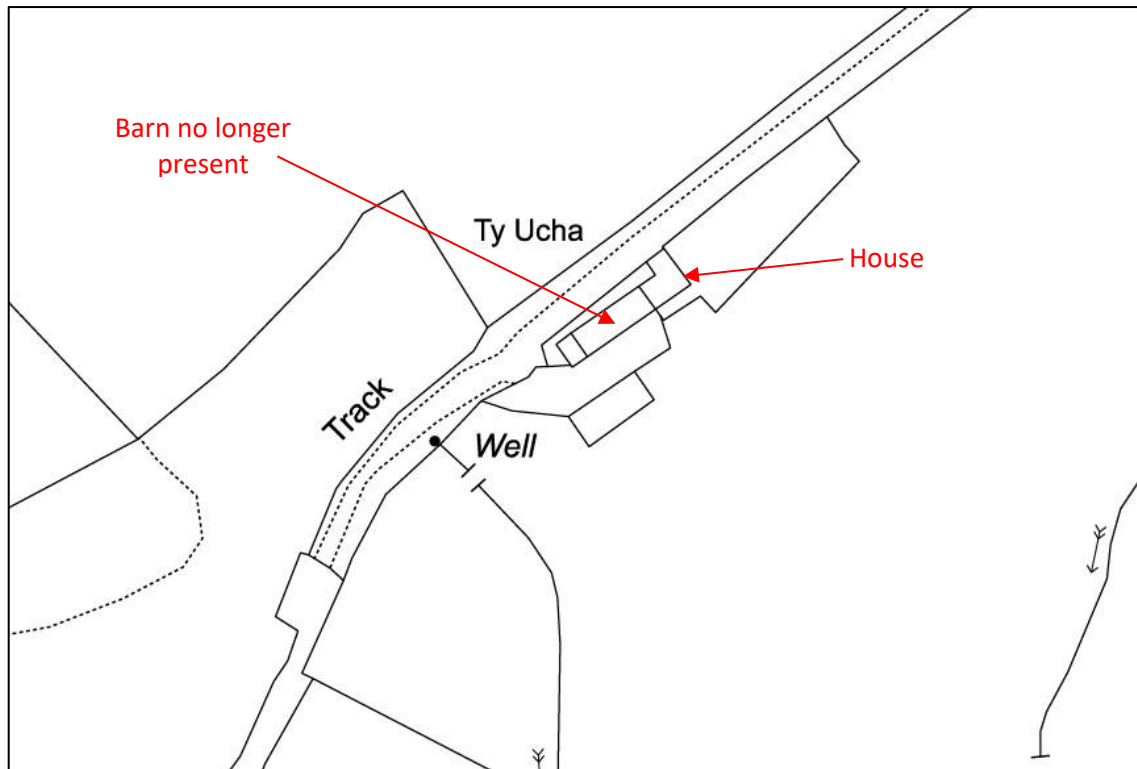


Figure 2. Map showing the layout of buildings at Ty Ucha.

(Reproduced under licence from Ordnance Survey, Licence No. 100056340).

1.1.2 The proposed development involves the construction of an extension to improve the standard of living accommodation in the house. No detailed plans are available at this stage.

1.2 Aims of study

1.2.1 The aims of these surveys were:

- To establish the presence or likely absence of bats (Order Chiroptera) on the site, and;
- If they are found to be present, to carry out further survey work to determine the types of use, so that a suitable management strategy can be implemented, i.e., mitigation and/or compensation measures.

1.3 Authors qualifications

1.3.1 My formal qualifications include an MSc in Biological Recording from Birmingham University. I have attended many relevant short courses as part of my programme of Continuing Professional Development (including survey techniques, difficult sonogram analysis, ecological impact assessment and mitigation).

1.3.2 I am an active member of the Montgomeryshire and Shropshire Bat Groups, I am a licensed surveyor in Wales and England (NRW Bat Survey Licence no. S086636/1)

and I have been a self-employed Ecological Consultant since 2004, having worked with a wide range of habitats and species.

- 1.3.3 It is the policy of Oakwood Ecology, in accordance with the CIEEM Code of Professional Conduct and in compliance with the legal requirements of EPS survey licences, that all biological records collected during these surveys are submitted to the relevant local biological records centre.

2 Legislation and policy guidance

2.1 Legislation overview

2.1.1 All British bat species are protected by statutory law. Historically, national laws such as the Wildlife and Countryside Act (1981) (as amended) and the CRoW Act (2000) have provided partial protection, but the most wide-ranging and comprehensive legislation in Wales now stems from European legislation (retained wholesale after leaving the EU under The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019).

2.1.2 Under these regulations, it is an offence to: deliberately capture, injure, kill or disturb any bat; damage or destroy a breeding site or resting place of a bat; be in possession of, or to control, transport, sell or exchange or to offer for sale or exchange any bat (living or dead) or part of a bat. With regard to bats, the term 'disturb' includes any roost, whether occupied or not, where the disturbance will a) impair their ability to survive, reproduce or rear their young, or to hibernate, and b) affect significantly the local distribution or abundance of that species.

2.1.3 With regards to the Local Authority policy, the presence of a protected species is a 'material consideration' in the planning process. It is, therefore, essential that the presence or otherwise of a protected species, the extent to which they will be affected by the development, and any mitigation and compensation measures are established before planning permission is granted.

2.2 Licensing

2.2.1 In order to carry out work which may affect any European Protected Species (EPS) in the ways outlined above, an EPS License is required. For an ecological surveyor in Wales, this means a Survey Licence. For a particular development, a project-specific derogation must be granted in the form of a development licence from Natural Resources Wales (NRW).

2.2.2 In order to qualify for a development licence, the development must meet the 'three tests':

- It must preserve public health or public safety or satisfy other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment (Reg. 55 (2) (e));
- There is no satisfactory alternative (Reg. 55 (9) (a)), and;
- The action authorised will not be detrimental to the maintenance of the species concerned at a favourable conservation status in their natural range (Reg. 55 (9) (b)).

3 Methodology

3.1 Desk study

3.1.1 Bats are highly mobile species, so the desk-study search area covers a two-kilometre radius from the development site and includes all records of these species and all designated sites.

3.1.2 The following sources were consulted:

- Powys Biodiversity Information Service (BIS) (www.bis.org.uk)
- Section 7 of the Environment (Wales) Act (species of principal importance)
- The MAGIC GIS website (<http://www.magic.gov.uk/MagicMap.aspx>)

3.2 Field surveys

3.2.1 All landscape-scale habitat features in the immediate vicinity that may be used by bats are identified, including any habitats suitable for foraging, commuting, or roosting.

3.2.2 The preliminary roost assessment and dusk/dawn activity survey methodologies follow the guidelines published in Mitchell-Jones & McLeish (2004) and Collins (2016). The materials used in building construction can influence which species may be present, and specific design details can provide opportunities for a range of British bat species, so these features are noted as part of the survey.

3.2.3 This survey involves an external and internal examination of the whole building to check for bats and the field signs that they produce, and an assessment of the habitats in the immediate vicinity to assess their suitability for commuting and foraging bats.

3.2.4 Field signs can include: live bats present, bat corpses, droppings, feeding remains, oil and/or urine staining, or a distinctive smell, all of which, by virtue of their location or other characteristics, can be species-specific. The presence of suitable holes and crevices is also noted, although, by themselves, these are not evidence of occupation.

3.2.5 Various items of specialist equipment are used to aid the building inspection, including: ladders, powerful torches (1 million candlepower), an endoscope and mirrors for investigating crevices and inaccessible nooks and crannies, close-focussing binoculars, a measuring tape, a compass and a camera.

3.2.6 Based on the findings of the preliminary roost assessment, a proportionate number of activity surveys were carried out to ascertain the species and number of bats present on the site, and the specific features used by them. Dusk surveys run from

15 minutes before sunset for two hours 15 minutes, and dawn survey run from two hours before sunrise until sunrise. A suitable number of surveyors were used to provide effective coverage of each building, with most attention being directed towards the areas deemed most likely to harbour bats, as highlighted by the building inspection. If applicable, a bat detector was also left inside the building overnight to passively record bat activity.

- 3.2.7 Specialist equipment used during these surveys includes: Anabat Walkabout, SD2 and Wildlife Acoustics Echometer Touch 2 Pro bat detectors (with real-time sonogram display), Elekon Batscanner heterodyne bat detectors, Yukon 1x24 Night Vision Goggles with infra-red torches, a Yukon Exelon 3 x 50 night-vision scope, a set of Binatone Walkie-Talkies to assist in tracking bats between surveyors, and, if applicable, a CCTV camera.
- 3.2.8 All of the full spectrum bat detectors are capable of recording sonograms, and these were analysed using specialist computer software (Anabat Insight and AnaloookW) to identify individuals to species level where possible. Each of the bat species found in the UK can have significantly different requirements, so this determination may be important when considering appropriate mitigation measures.
- 3.2.9 The sonograms recorded on these surveys have been identified using the criteria given in Russ (2012), Middleton *et al.* (2014) and from information imparted on training courses (S. Sowler, G. Billington & M. Worsfold pers. comm's.).
- 3.2.10 Different bat species produce sonograms of varying distinctiveness. The Pipistrelles, and Noctules recorded during these surveys are usually relatively straightforward to identify from a sonogram. The different Myotis species can be difficult to distinguish even when a high-quality sonogram is recorded because they are so similar. Natterer's and Daubenton's bats can sometimes be identified with a reasonably high degree of confidence (80%), whereas Whiskered and Brandt's Bats are less easy to separate (approx. 60% confidence, i.e., the bat is slightly more likely to be a Whiskered than a Brandt's).
- 3.2.11 A recording on the bat detectors is triggered by an individual bat call (or other similar ultrasound noise). For the purposes of this report, a bat pass is defined as a series of calls which emanate from a bat as it flies past, or the duration of a 15 second Anabat file, whichever is the shorter. The frequency of calls is categorised on a subjective scale ranging from Constant, through Frequent and Occasional to Rare. Continuous calls do not necessarily indicate a steady stream of bats, as all the calls may be emanating from one bat repeatedly passing within range.

4 Results

4.0.1 Representative photographs of the site and salient features are included in **Appendix 1**; **Appendix 2** tabulates the raw survey data; and **Appendix 3** presents some representative sonograms of bat calls recorded during the activity surveys. The results of the historical records search contain some sensitive information and is only available to third parties after gaining permission from the local records centre.

4.1 Desk study

Designated sites

4.1.1 There is one designated site within the 2km search radius around Ty Ucha: Allt-y-main Mine (**Figure 3**), which is notified as a Site of Special Scientific Interest and part of the Tanat and Vyrnwy Bat Sites Special Area of Conservation because it hosts a significant lesser horseshoe bat (*Rhinolophus hipposideros*) hibernaculum.

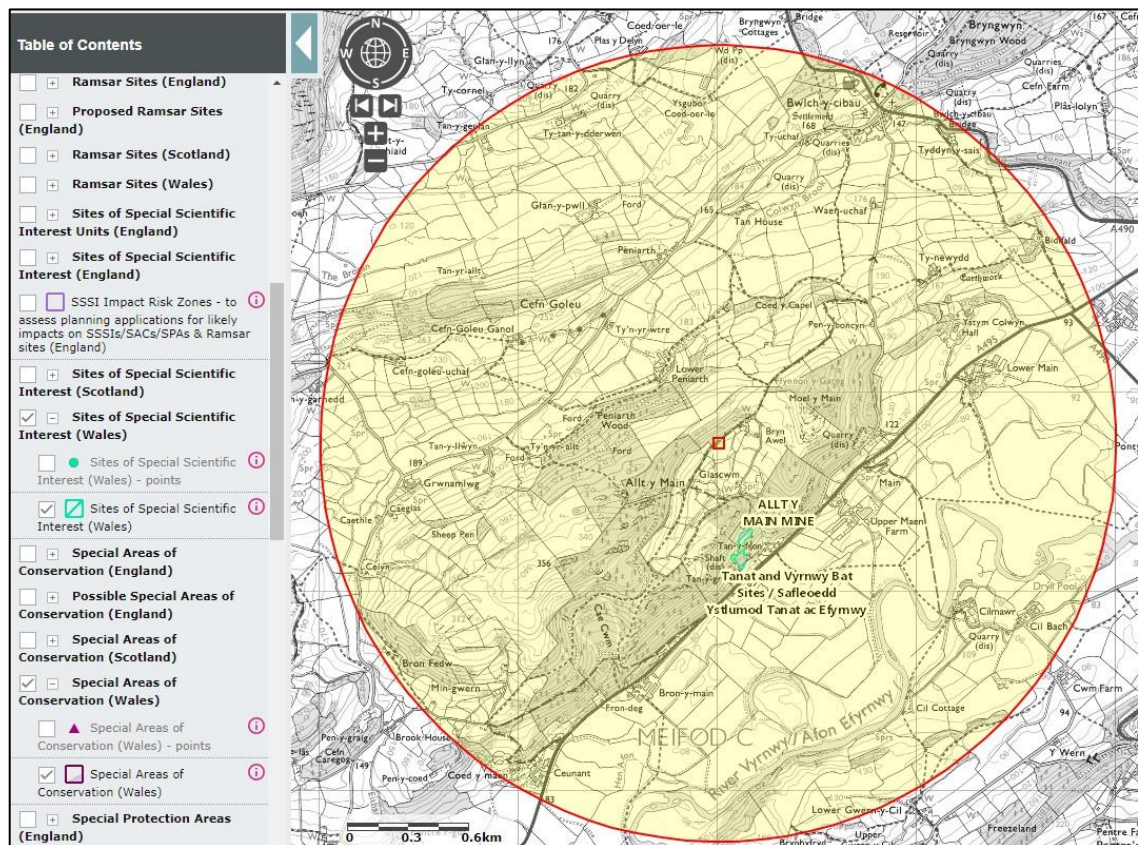


Figure 3. Map showing designated sites within the 2km search radius. (Imagery from MAGIC website).

Historical records

- 4.1.2 There are 669 historical records of bats within the 2km search radius, comprising a mixture of roost counts and roving records. They include common pipistrelle (*Pipistrellus pipistrellus*), soprano pipistrelle (*P. pygmaeus*), undifferentiated pipistrelle species, Daubenton's Bat (*Myotis daubentonii*), Natterer's Bat (*M. nattereri*), whiskered Bat (*M. mystacinus*), undifferentiated myotid species, noctule (*Nyctalus noctula*), brown long-eared bat (*Plecotus auritus*), lesser horseshoe bat, and indeterminate bats. The closest record is of the lesser horseshoe hibernacula in the SSSI mentioned above.

4.2 Field surveys

Habitat description

- 4.2.1 Ty Ucha is surrounded by woodland and pastoral farmland, and the habitats in the immediate vicinity include broadleaved and coniferous woodland, semi-improved neutral grassland, reasonably intact hedgerows with some mature trees, and other rural buildings which provide potential roosting opportunities. There are numerous small streams immediately to the south of the buildings (**Figure 4**), which flow via a network of drainage ditches into the River Vyrnwy just over 1km to the south-east.

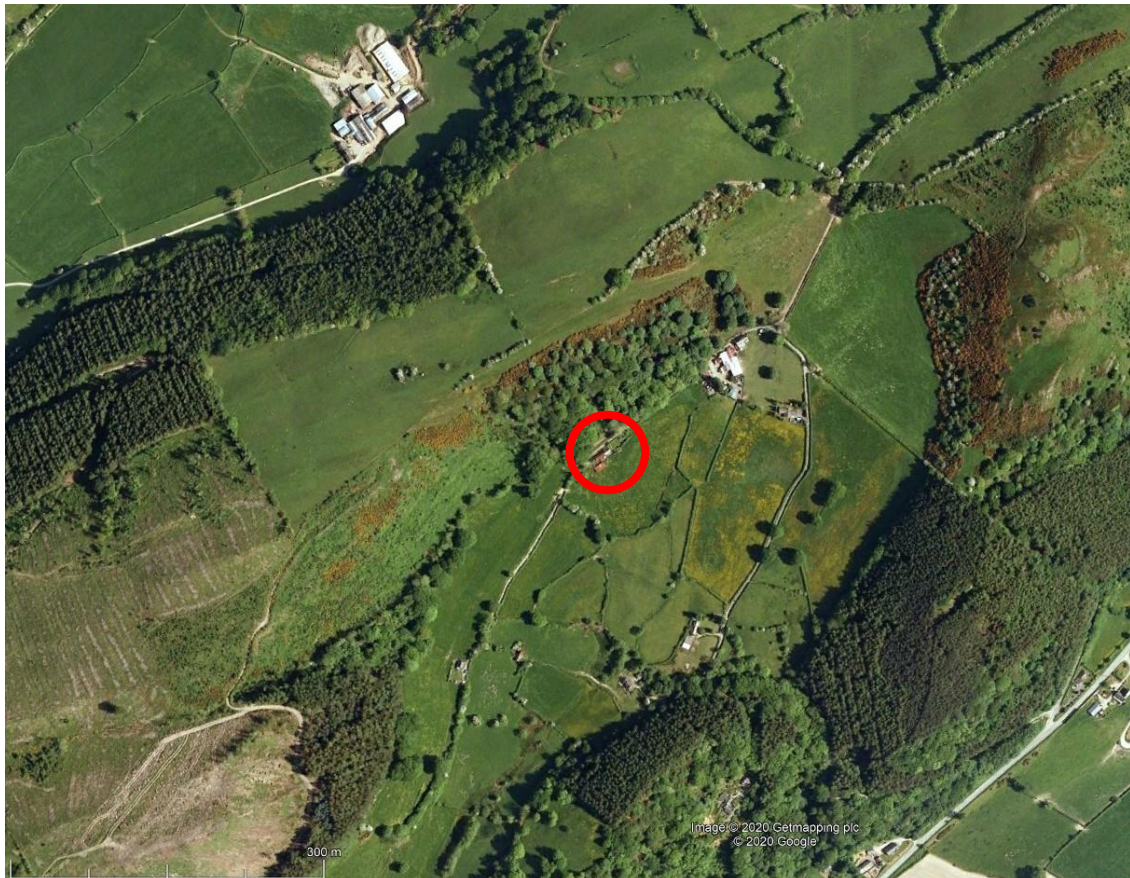


Figure 4. Aerial photograph showing the habitats in the vicinity of Ty Ucha.
(Imagery dates from 2009, courtesy of Google Earth)

- 4.2.2 Connectivity with the surrounding countryside is good, and this mixture of habitats presents significant potential for roosting, foraging and commuting bats.

Preliminary roost assessment

- 4.2.3 The buildings and surrounding habitats were surveyed on the 18th of August 2020. Only the house was surveyed in detail; the attached barn that used to stand partly within the footprint of the proposed extension, as shown on aerial photographs and maps, had already been taken down at some point.
- 4.2.4 The oldest part of the house is of pre-20th century construction, and has walls made of rough field stone and rubble infill, with no cavity. A single storey extension has been added on the north-west side of the building.
- 4.2.5 The roof of the original part of the house is pitched to a central ridge and is composed of wall-plates, purlins, and rafters, covered with battens and slate, and lined with bituminous roofing felt. The eaves were originally open but have more recently been covered with narrow-gauge wire mesh. A ceiling above the purlins on the first floor creates a small loft that runs the length of the original house. This had rockwool insulation laid on the floor and was accessed through a hatch in one of the bedrooms. The extension roof was also covered with slates, presumably supported on timber framing – the internal ceiling was vaulted, with no loft.
- 4.2.6 In terms of potential to support bats, all the walls have intact pointing, the slates and ridge tiles were all tightly fitted, with no potential bat access points. The open eaves were covered by wire mesh that is impenetrable to bats, and the render and mortar on the gable walls extends right up to the barge boards / end rafters, effectively excluding bats from the batten space and internal parts of the roof. No evidence of bats was found inside the loft, or anywhere else on the property.
- 4.2.7 There was a gap in the mortar around an exposed timber on the south corner, and some gaps under the leadwork around the chimney on the north end.

Bat activity surveys

- 4.2.8 One dusk emergence survey and one dawn re-entry survey were carried out and the physical parameters of these are presented in **Table 1**, along with a summary of bat activity levels. A full list of sonograms recorded is presented in **Appendix 2** and sample sonograms are presented in **Appendix 3**. The locations of the vantage points are shown on **Figure 5**; these were chosen to provide effective coverage of the parts of the building that offered significant potential for roosting sites, and the surveyors included Simon Cope and Nicola Wheeler (licence no. S086637/1).
- 4.2.9 The species recorded during the dusk and dawn surveys included common and soprano pipistrelle (Ppip and Ppyg respectively in the table below), indeterminate pipistrelle species (Pip), noctule (Nn), whiskered bat (Mmys), Daubenton's Bat (Md), Natterer's Bat (Mn), indeterminate myotis species (Myotis), brown long-eared bat

(Paur), lesser horseshoe bat (Rhip) and indeterminate bat species (Unknown; usually due to an indistinct sonogram).

Survey #1: 18 th August 2020, Start: 20:17, Finish: 22:32		
Weather: Dry, no wind, 1/3 cloud cover		
Temperature: 17.5 – 16.0°C		
Recorder	Location	Activity observed
Simon Cope	VP1 (N corner)	No bats emerged Frequent passes by Ppip and Ppyg Occasional passes by Nn Rare passes by Pip, Rhip and Mmys
Nicola Wheeler	VP2 (S corner)	One Ppip emerged from hole next to timber under eaves at south end of south-east side Frequent passes by Ppyg Occasional passes by Ppip, Nn and Pip Rare passes by Myotis and Paur

Survey #2: 12 th September 2020, Start: 04:43, Finish: 06:43		
Weather: 2 light 10-minute showers, no wind, 2/3 cloud cover		
Temperature: 10.7 – 9.3°C		
Recorder	Location	Activity observed
Simon Cope	VP1 (N corner)	No bats entered Occasional passes by Ppyg Rare passes by Nn, Ppip, and Rhip
Nicola Wheeler	VP2 (S corner)	One Ppip entered hole next to timber under eaves at south end of south-east side Occasional passes by Ppip Rare passes by Ppyg, Pip, Nn, Md and Rhip

Table 1. Survey parameters recorded, and roosting bats and activity levels observed during the activity surveys.

4.2.10 Over the two activity surveys, a total of two common pipistrelles (one per survey, highly likely to be the same bat) were recorded using one roost access points (**Figure 6**). No consistent flight-lines were recorded around the house, although the lesser horseshoe bat was following the hedgerow between the house and the adjacent road.

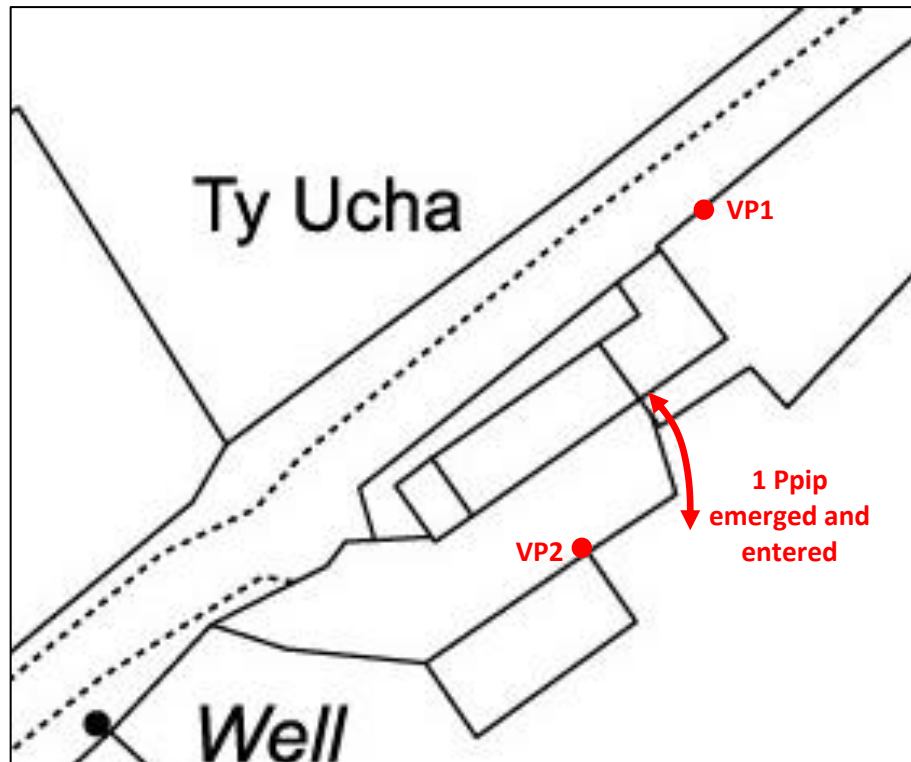


Figure 5. Map showing the location of the vantage points used, and the roost access point observed during the activity surveys (also see photographs in **Appendix 1**).

4.3 Roost characterisation

- 4.3.1 The single roost was occupied by a solitary bat and is considered to be a day roost occupied by a solitary male or non-breeding female; no obvious maternity roosts were recorded.
- 4.3.2 It is likely that the access point leads directly into a small crevice between the timber (which is a severed piece of the wall plate of the barn that used to be attached to the house) and the surrounding stone wall.
- 4.3.3 There was no artificial lighting directly illuminating the roost access point.

5 Assessment

5.0.1 The principles of this assessment are based on best practice guidelines published by the Chartered Institute of Ecology and Environmental Management (CIEEM, 2019).

5.1 Constraints

Survey information

5.1.1 All parts of the building were open to inspection and weather conditions were good during the activity surveys.

5.1.2 Both of the surveyors (Simon Cope and Nicola Wheeler) were licensed bat workers with 10 years experience of professional bat work.

Equipment used

5.1.3 There were no constraints with regards to equipment.

5.2 Current Value of the site

Designated sites

5.2.1 The development site does not lie within, and is not immediately adjacent to, any designated sites. The only designated site within 2km of the proposed development site is a lesser horseshoe hibernaculum.

Bat roosts

5.2.2 A single common pipistrelle was observed roosting at Ty Ucha. This individual is considered to be a solitary male or non-breeding female occupying a day roost.

5.2.3 All bat species are protected by European legislation. At a national (UK and Wales-only) level, the population of common pipistrelles is increasing (Bat Conservation Trust, 2019). There are no available data on the regional or local population numbers and trends.

5.2.4 Given the relatively common and widespread nature of common pipistrelles, and the small number present, the roost is deemed to be of only local value.

Foraging and commuting habitat

5.2.5 The amount of semi-natural grassland, woodland, and hedgerow near to the site, and the proximity of flowing water, qualifies this area as high-quality foraging habitat for a wide range of bat species. The nearby hedgerows and streams are also suitable as linear commuting routes. This land-use fabric is common in the region, and so these habitats are of only local value. None will be affected by the proposed development.

5.3 Impact assessment

5.3.1 The potential impacts of the development at Ty Ucha comprise those felt in both the short- and long-term, and include any impacts that may continue to be felt after the development has been completed. In the absence of any mitigation measures, the following impacts can be predicted:

- **Disturbance, and risk of injury and/or death** - it is certain that individual bats could be disturbed and/or physically harmed during the development, especially when roofing materials are removed from the house to facilitate tying-in with the new extension. This would be a temporary, reversible impact only, during the development phase;
- **Roost loss** –it is certain that the roost observed during the surveys will be destroyed during the construction of the extension. Given the number of bats involved, this is likely to have a permanent, irreversible minor impact at a local level.
- **Fragmentation and isolation** – there will be no modification of the semi-natural habitats in the immediate vicinity of the building as part of the proposed development.
- **Post-development interference** - in the long-term, any increase in external artificial light levels around the property will curtail the foraging and commuting activities of light-avoiding species that were recorded in low numbers during the surveys (i.e., lesser horseshoe bats, long-eared bats and *Myotis* species).

5.3.2 Overall, the proposed development will have a minor negative ecological impact at a local level. Given the relatively low ecological value of the roost at a regional or national level, the overall conservation status of the species involved will not be significantly affected.

6 Recommendations and mitigation

6.1 Further survey work

6.1.1 No further survey work is required. The surveys undertaken to date are proportionate to the development and allow the usage of the site by bats to be described adequately.

6.2 Mitigation measures

6.2.1 The principle of mitigation in the broad sense involves a hierarchy of desirable outcomes designed to maintain or promote the conservation status of the species concerned, as follows:

- Avoidance – can the development be designed so that there will be no negative impacts?
- Mitigation – can the development be designed to reduce the negative impacts?
- Compensation – can the unavoidable impacts be compensated for?

Avoidance

6.2.2 There is no scope within the curtilage of the proposed development for avoidance. Given the shape of the curtilage, the extension must be attached to the southern end of the cottage, and the requirement for two storeys means that the roof line of the southern gable wall will unavoidably be impacted.

Mitigation for bat roosts

6.2.3 The construction of the extension at Ty Ucha will necessitate the destruction of the bat roost contained within the house. The loss of this roost will be compensated for by the provision of new purpose-made roosts, and the negative impact of this loss, and the possibility of harm and/or disturbance to the bats, can be mitigated by the following recommendations (based on guidance given in Mitchell-Jones, 2004):

- A suitably qualified ecologist will be appointed as the Ecological Clerk of Works (ECoW), and he/she will attend and supervise the crucial phases of the development so that any bats that are found can be preserved.
- One bat box will be erected in a suitable place (under the advice of the ECoW) in the vicinity of the building at least two months before work commences. A suitable proprietary bat box is the Schwegler 1FD B bat box (bat boxes that are also used by birds are not suitable; the presence of internal baffles prevents this), or a home-made box along the lines of the 'Kent Bat Box' is also suitable (**Appendix 4**).

- All site workers will receive a tool-box talk from the ECoW on the legal protection of bats and how to proceed if a bat is encountered – namely, re-cover the bat if possible without causing harm, stop all work and notify the ECoW.
- The destructive parts of the works will be timed to avoid the possibility of disturbing hibernating bats, i.e., it will be carried out in the active season between March and November.
- The existing roost will be dismantled gently by hand. The ECoW will be on hand to deal with any bats that are found, and these will be captured and detained during daylight hours in a suitable container, to be released at the point of capture at dusk on the same day. The current roost will be made unsuitable in one day so that the bat cannot return to it. In general, the guidelines presented in the 'Rescue and Collection' section of the Bat Care Guidelines (Miller, 2016) will be followed for the care of any captured bats.

Compensation for the loss of bat roosts

6.2.4 Bats currently use the building for day roosting in. To compensate for the loss of these functions, the following will be implemented:

- Replacement roosts will be integrated within the new extension. In the spirit of a 'like-for-like' provision, these will be small crevices that replicate those previously occupied by single individuals (**Figure 6**), formed by gaps behind all fascia and barge boards. All timber that could come into contact with bats, i.e., in and around roosts, will be rough-sawn and untreated (or treated with suitable bat-friendly preservatives (detailed advice and a list of suitable products can be found at <https://www.gov.uk/guidance/bat-roosts-use-of-chemical-pest-control-products-and-timber-treatments-in-or-near-them>)).

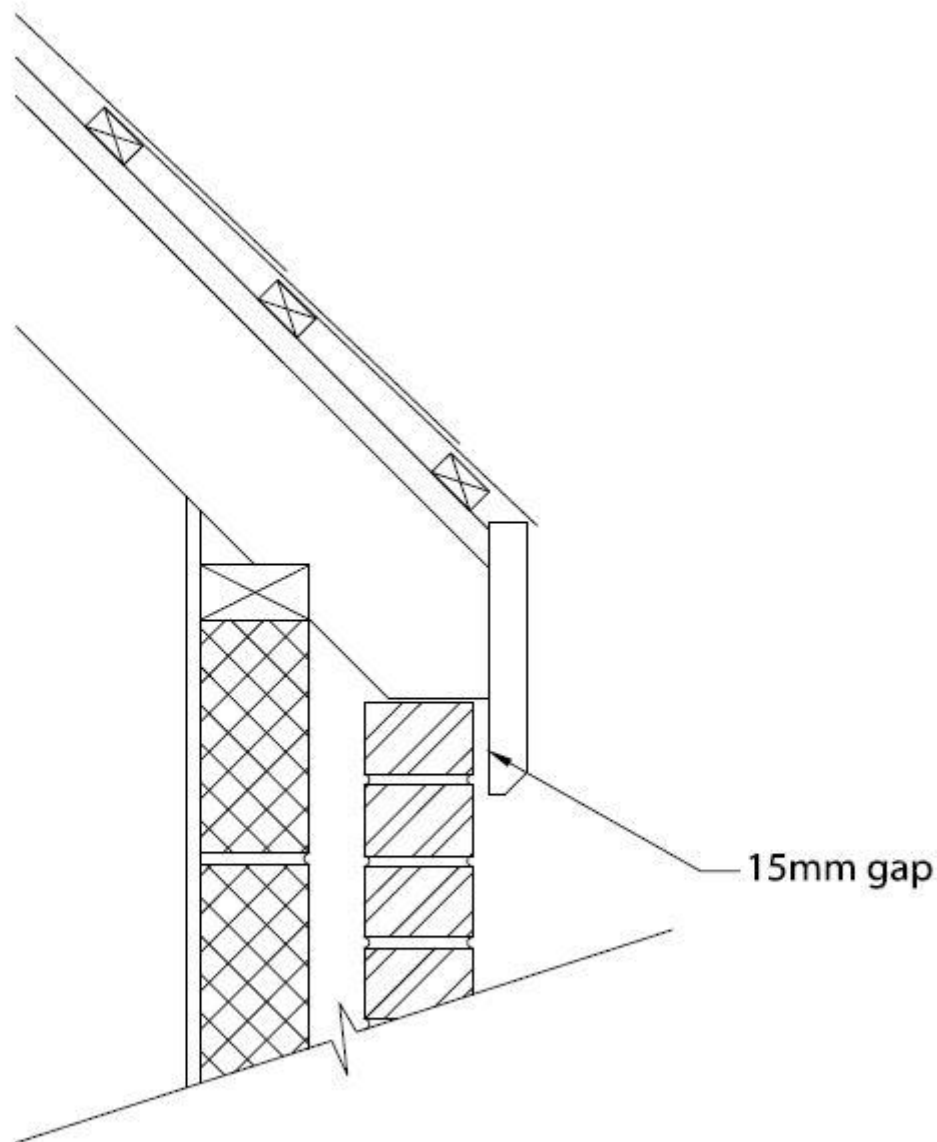


Figure 6. Generic diagram of replacement crevice roosts behind all fascia boards and/or barge boards.

- No non-bitumen-coated roofing membranes will be used in the renovated building where they will come into contact with bats; all membranes in bat roosts will be hessian-backed bitumen roofing felt (type 1F). It is a common misconception that bitumen roofing felt is no longer allowed by Building Regulations, but this is not true. The regulations that apply to this situation are parts L1B (domestic) and Part C (condensation and ventilation). Part L1B states that contractors must “assess the condensation risk within the roof space and make appropriate provisions in line with part C relating to the control of condensation”. Part C then goes on to recommend meeting the recommendations made in BS 5250:2011. In this document, it is made

clear that both High resistance (bitumen) and Low resistance (BRM) underlays are acceptable if appropriate ventilation is provided. The materials must comply with British standards, national technical certificate, or another acceptable EU certificate (which bitumen felt does).

- The entrances to roosts will not be directly illuminated by artificial lighting. All external artificial lighting will be installed at as low a height, intensity and spacing as practicable; it will be directed towards the ground by cowling and movement-activated by Passive Infra-Red (PIR) sensors on a short period timer (≤ 1 minute). 'Warm white' (long-wavelength ($>510\text{nm}$)) bulbs with reduced UV output will be used, blue/white bulbs will be avoided. There will be no external lighting that is permanently left on.

Mitigation for foraging and commuting habitat

- 6.2.5 There will be a negligible impact on the surrounding habitats, so no mitigation for this will be necessary.

Post-construction monitoring

- 6.2.6 No post-construction monitoring will be carried out.

Requirement for Habitats Regulations (EPS) licences

- 6.2.7 It is thought that all the adverse impacts can be overcome if the mitigation and compensation measures outlined above are adopted in full. However, a proven bat roost will be destroyed, and bats may be disturbed, so a site-specific EPS Licence will be necessary after planning permission is granted.

6.3 Schedule of work

	Timing	Action
1	As soon as possible (but definitely before Step 2)	Installation of new bat box
2	March - November 2021	Destruction of existing roost (under supervision of ECoW)
3	Following Step 2	Construction of new extension

7 References

Bat Conservation Trust (2019) '*The National Bat Monitoring Programme Annual Report 2018.*' Bat Conservation Trust, London.

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Appendix 1: Photographs



Photo 1. View from VP1.



Photo 2. View from VP2, indicating the bat roost access point and flight-line used by a single common pipistrelle.



Photo's 3 & 4. Views of the loft inside the house. No evidence of roosting bats was found during the preliminary roost assessment.





Photo 5. The only bat roost recorded during the activity surveys was entered via a hole between a piece of redundant timber and the stone wall.

Appendix 2: Raw survey data

Vantage point	Date	Time	Species	Number of passes
VP1	2020/08/18	20:33	Nn	1
VP1	2020/08/18	20:34	Nn	1
VP1	2020/08/18	20:40	Nn	2
VP1	2020/08/18	20:43	Nn	3
VP1	2020/08/18	20:44	Nn	1
VP1	2020/08/18	20:48	Ppyg	1
VP1	2020/08/18	20:49	Ppyg	7
VP1	2020/08/18	20:51	Ppyg	1
VP1	2020/08/18	20:52	Ppyg	1
VP1	2020/08/18	20:54	Ppyg	2
VP1	2020/08/18	20:57	Ppyg	1
VP1	2020/08/18	20:58	Nn	1
VP1	2020/08/18	20:59	Ppyg	2
VP1	2020/08/18	21:00	Nn	2
VP1	2020/08/18	21:01	Nn	1
VP1	2020/08/18	21:02	Nn	1
VP1	2020/08/18	21:02	Ppip	1
VP1	2020/08/18	21:03	Ppip	1
VP1	2020/08/18	21:04	Ppyg	1
VP1	2020/08/18	21:06	Ppyg	2
VP1	2020/08/18	21:09	Nn	1
VP1	2020/08/18	21:10	Ppip	1
VP1	2020/08/18	21:11	Ppip	1
VP1	2020/08/18	21:12	Nn	2
VP1	2020/08/18	21:13	Ppip	1
VP1	2020/08/18	21:14	Ppip	1
VP1	2020/08/18	21:16	Nn	1
VP1	2020/08/18	21:18	Nn	1
VP1	2020/08/18	21:20	Ppip	1
VP1	2020/08/18	21:22	Ppip	1
VP1	2020/08/18	21:30	Ppip	1
VP1	2020/08/18	21:31	Ppip	2
VP1	2020/08/18	21:34	Ppyg	1
VP1	2020/08/18	21:36	Ppip	2
VP1	2020/08/18	21:38	Ppip	3
VP1	2020/08/18	21:39	Ppip	2
VP1	2020/08/18	21:40	Ppip	3
VP1	2020/08/18	21:41	Ppip	1
VP1	2020/08/18	21:43	Ppip	1
VP1	2020/08/18	21:51	Nn	2
VP1	2020/08/18	21:54	Ppip	3
VP1	2020/08/18	21:54	Ppyg	2
VP1	2020/08/18	21:59	Ppip	1
VP1	2020/08/18	22:00	Rhip	1
VP1	2020/08/18	22:01	Ppyg	1
VP1	2020/08/18	22:02	Ppyg	2
VP1	2020/08/18	22:10	Ppyg	1
VP1	2020/08/18	22:15	Ppip	1
VP1	2020/08/18	22:16	Ppip	3
VP1	2020/08/18	22:16	Ppyg	2
VP1	2020/08/18	22:17	Pip	1

Vantage point	Date	Time	Species	Number of passes
VP1	2020/08/18	22:17	Ppip	1
VP1	2020/08/18	22:17	Ppyg	2
VP1	2020/08/18	22:18	Ppip	1
VP1	2020/08/18	22:18	Ppyg	3
VP1	2020/08/18	22:19	Nn	1
VP1	2020/08/18	22:19	Ppyg	1
VP1	2020/08/18	22:20	Ppyg	4
VP1	2020/08/18	22:21	Ppip	2
VP1	2020/08/18	22:22	Nn	1
VP1	2020/08/18	22:22	Ppip	1
VP1	2020/08/18	22:23	Pip	1
VP1	2020/08/18	22:23	Ppip	4
VP1	2020/08/18	22:23	Ppyg	1
VP1	2020/08/18	22:24	Mmys	1
VP1	2020/08/18	22:24	Ppip	1
VP1	2020/08/18	22:25	Ppip	4
VP1	2020/08/18	22:26	Ppip	4
VP1	2020/08/18	22:27	Ppip	4
VP1	2020/08/18	22:28	Ppip	2
VP1	2020/08/18	22:29	Ppip	1
VP1	2020/08/18	22:30	Ppyg	2
VP1	2020/08/18	22:31	Ppip	1
VP1	2020/08/18	22:31	Ppyg	2
VP1	2020/08/18	22:32	Ppip	1
VP1	2020/08/18	22:32	Ppyg	1
VP1	2020/09/12	05:23	Ppyg	1
VP1	2020/09/12	05:29	Rhip	1
VP1	2020/09/12	05:54	Nn	1
VP2	2020/08/18	20:33	Nn	1
VP2	2020/08/18	20:34	Nn	1
VP2	2020/08/18	20:39	Ppip	2
VP2	2020/08/18	20:40	Nn	1
VP2	2020/08/18	20:42	Nn	1
VP2	2020/08/18	20:43	Nn	3
VP2	2020/08/18	20:44	Nn	1
VP2	2020/08/18	20:45	Nn	2
VP2	2020/08/18	20:48	Ppyg	1
VP2	2020/08/18	20:54	Ppyg	1
VP2	2020/08/18	20:55	Ppyg	1
VP2	2020/08/18	20:58	Nn	2
VP2	2020/08/18	21:00	Nn	2
VP2	2020/08/18	21:01	Nn	1
VP2	2020/08/18	21:02	Nn	1
VP2	2020/08/18	21:02	Ppip	4
VP2	2020/08/18	21:03	Ppip	5
VP2	2020/08/18	21:04	Ppip	4
VP2	2020/08/18	21:05	Ppip	4
VP2	2020/08/18	21:07	Ppip	1
VP2	2020/08/18	21:08	Nn	1
VP2	2020/08/18	21:09	Nn	1
VP2	2020/08/18	21:10	Nn	1

Vantage point	Date	Time	Species	Number of passes
VP2	2020/08/18	21:10	Ppip	3
VP2	2020/08/18	21:11	Ppip	4
VP2	2020/08/18	21:12	Nn	2
VP2	2020/08/18	21:12	Ppip	1
VP2	2020/08/18	21:14	Ppyg	1
VP2	2020/08/18	21:16	Nn	1
VP2	2020/08/18	21:18	Nn	1
VP2	2020/08/18	21:19	Ppip	1
VP2	2020/08/18	21:21	Ppip	1
VP2	2020/08/18	21:22	Ppip	1
VP2	2020/08/18	21:30	Ppip	1
VP2	2020/08/18	21:31	Ppip	1
VP2	2020/08/18	21:32	Ppip	1
VP2	2020/08/18	21:37	Ppip	1
VP2	2020/08/18	21:38	Ppip	2
VP2	2020/08/18	21:39	Ppip	2
VP2	2020/08/18	21:40	Ppip	3
VP2	2020/08/18	21:41	Ppip	2
VP2	2020/08/18	21:44	Ppip	1
VP2	2020/08/18	21:50	Nn	2
VP2	2020/08/18	21:50	Paur	1
VP2	2020/08/18	21:50	Ppip	1
VP2	2020/08/18	21:51	Nn	1
VP2	2020/08/18	21:52	Myotis	1
VP2	2020/08/18	21:54	Ppip	1
VP2	2020/08/18	21:54	Ppyg	1
VP2	2020/08/18	21:55	Ppip	1
VP2	2020/08/18	21:59	Ppip	1
VP2	2020/08/18	22:05	Ppip	1
VP2	2020/08/18	22:09	Ppip	2
VP2	2020/08/18	22:10	Ppip	2
VP2	2020/08/18	22:11	Ppip	1
VP2	2020/08/18	22:14	Pip	2
VP2	2020/08/18	22:15	Ppip	1
VP2	2020/08/18	22:16	Pip	1
VP2	2020/08/18	22:16	Ppip	1
VP2	2020/08/18	22:16	Ppyg	2
VP2	2020/08/18	22:17	Ppip	6
VP2	2020/08/18	22:18	Nn	1
VP2	2020/08/18	22:18	Pip	2
VP2	2020/08/18	22:18	Ppip	3
VP2	2020/08/18	22:19	Nn	1
VP2	2020/08/18	22:19	Pip	1
VP2	2020/08/18	22:20	Pip	3
VP2	2020/08/18	22:21	Ppip	4
VP2	2020/08/18	22:22	Ppip	2
VP2	2020/08/18	22:23	Ppip	4
VP2	2020/08/18	22:24	Ppip	2
VP2	2020/08/18	22:25	Ppip	4
VP2	2020/08/18	22:26	Ppip	3
VP2	2020/08/18	22:27	Ppip	4

Vantage point	Date	Time	Species	Number of passes
VP2	2020/08/18	22:28	Ppip	2
VP2	2020/08/18	22:29	Ppip	1
VP2	2020/08/18	22:30	Pip	2
VP2	2020/08/18	22:31	Pip	1
VP2	2020/08/18	22:31	Ppip	1
VP2	2020/08/18	22:32	Ppip	1
VP2	2020/08/18	22:33	Pip	3
VP2	2020/08/18	22:33	Ppip	1
VP2	2020/09/12	05:01	Md	1
VP2	2020/09/12	05:20	Unknown	1
VP2	2020/09/12	05:22	Pip	1
VP2	2020/09/12	05:22	Ppip	1
VP2	2020/09/12	05:23	Ppip	1
VP2	2020/09/12	05:29	Rhip	1
VP2	2020/09/12	05:30	Ppip	1
VP2	2020/09/12	05:32	Ppip	1
VP2	2020/09/12	05:40	Pip	1
VP2	2020/09/12	05:43	Ppip	1
VP2	2020/09/12	05:45	Ppyg	2
VP2	2020/09/12	05:47	Ppyg	1
VP2	2020/09/12	05:53	Nn	1
VP2	2020/09/12	06:12	Ppip	2
VP2	2020/09/12	06:13	Ppip	2
VP2	2020/09/12	06:25	Nn	2

Appendix 3: Sample sonograms

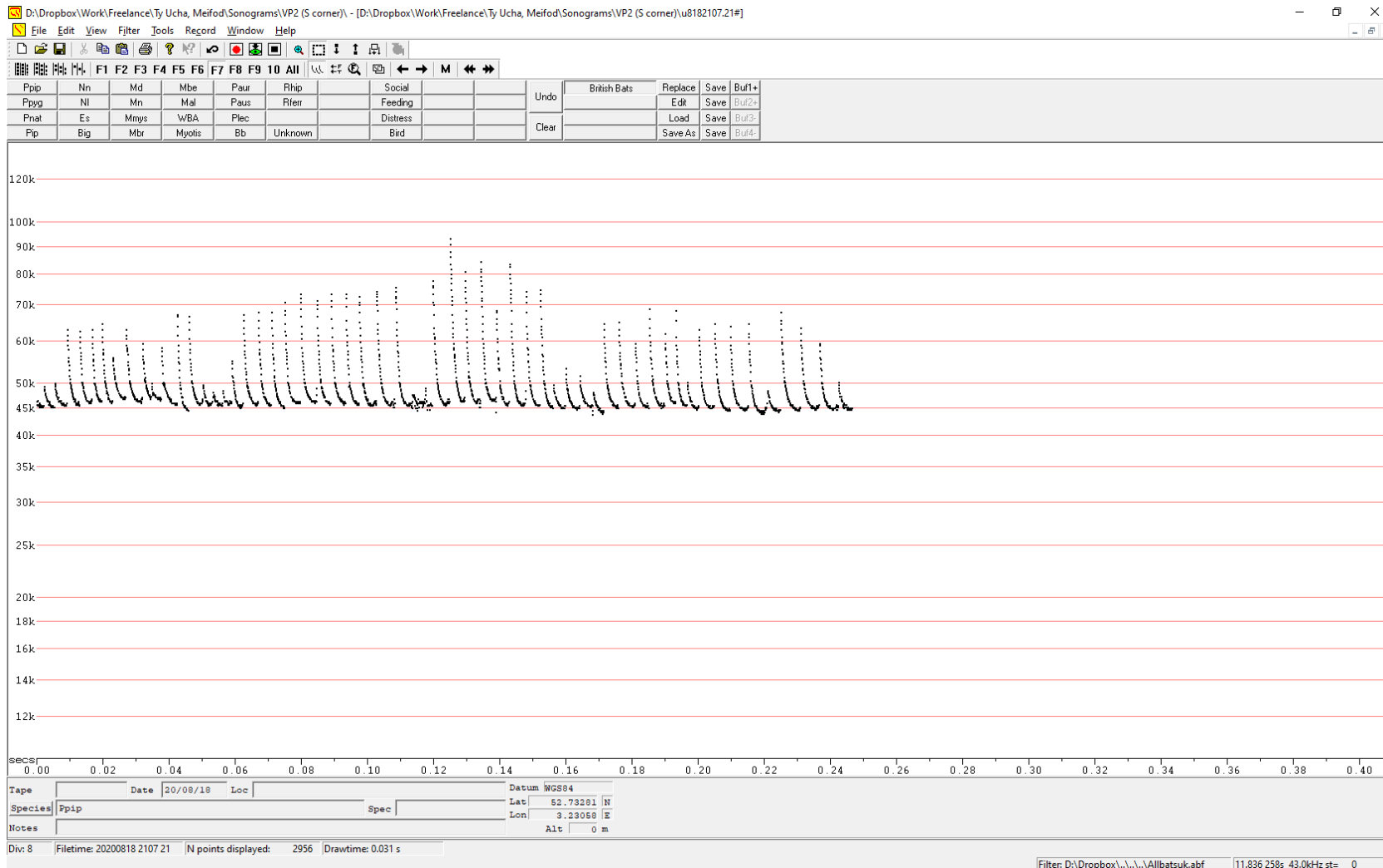


Figure 7. Screenshot of a sonogram, with frequency on the vertical axis and time along the horizontal axis. The hockey stick shaped calls are diagnostic of all pipistrelle species, and the flutter (qCF) part of the call at around 45 kHz indicates a common pipistrelle (expansion scale: F7, compressed to remove spaces between calls, filtered to remove non-bat noise).

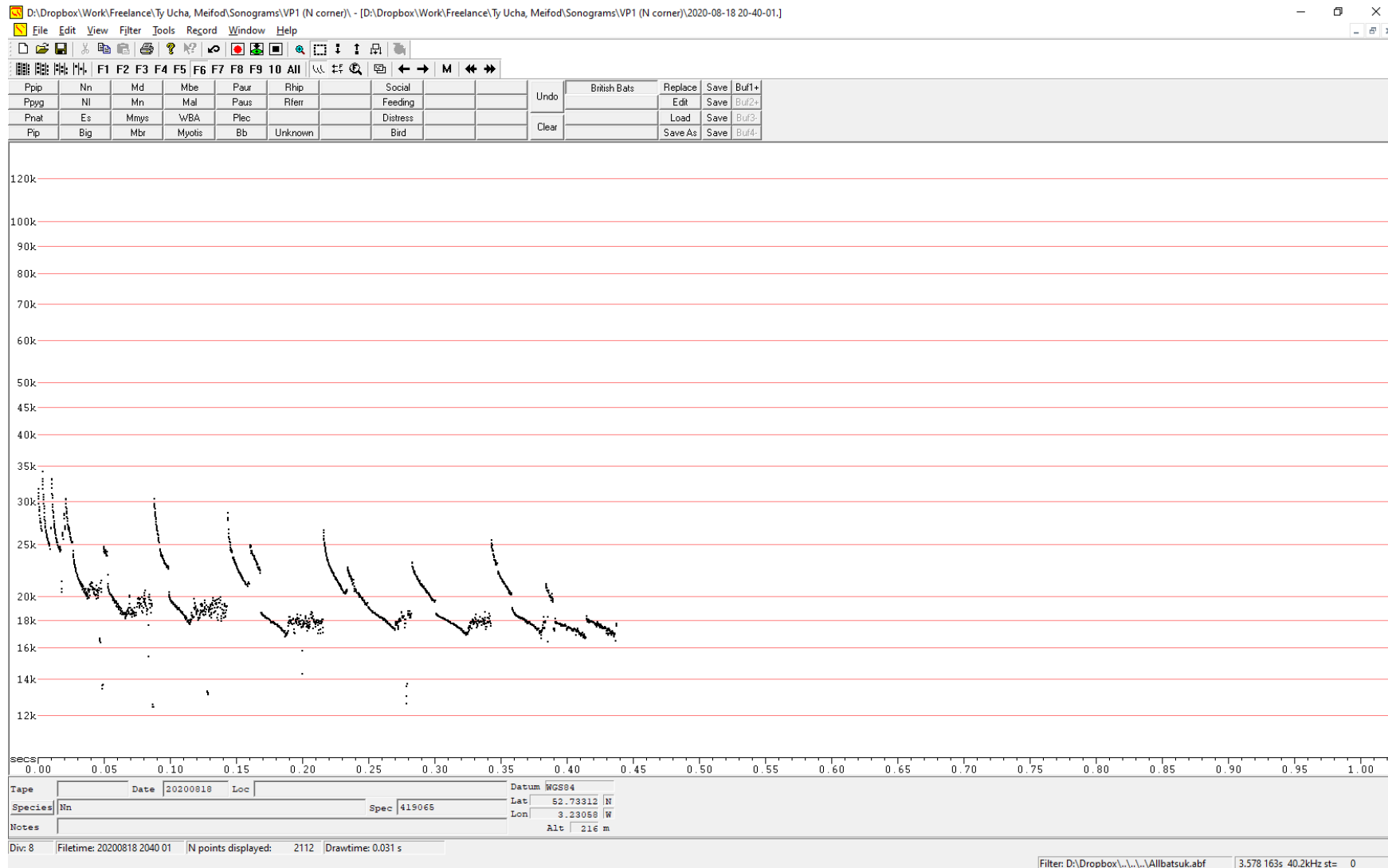


Figure 8. The distinctive two-part call of a noctule, with the lower component extending below 20 kHz. This is a high-flying species that rarely roosts in buildings - they were seen at a distance during both activity surveys (F6, compressed, filtered).

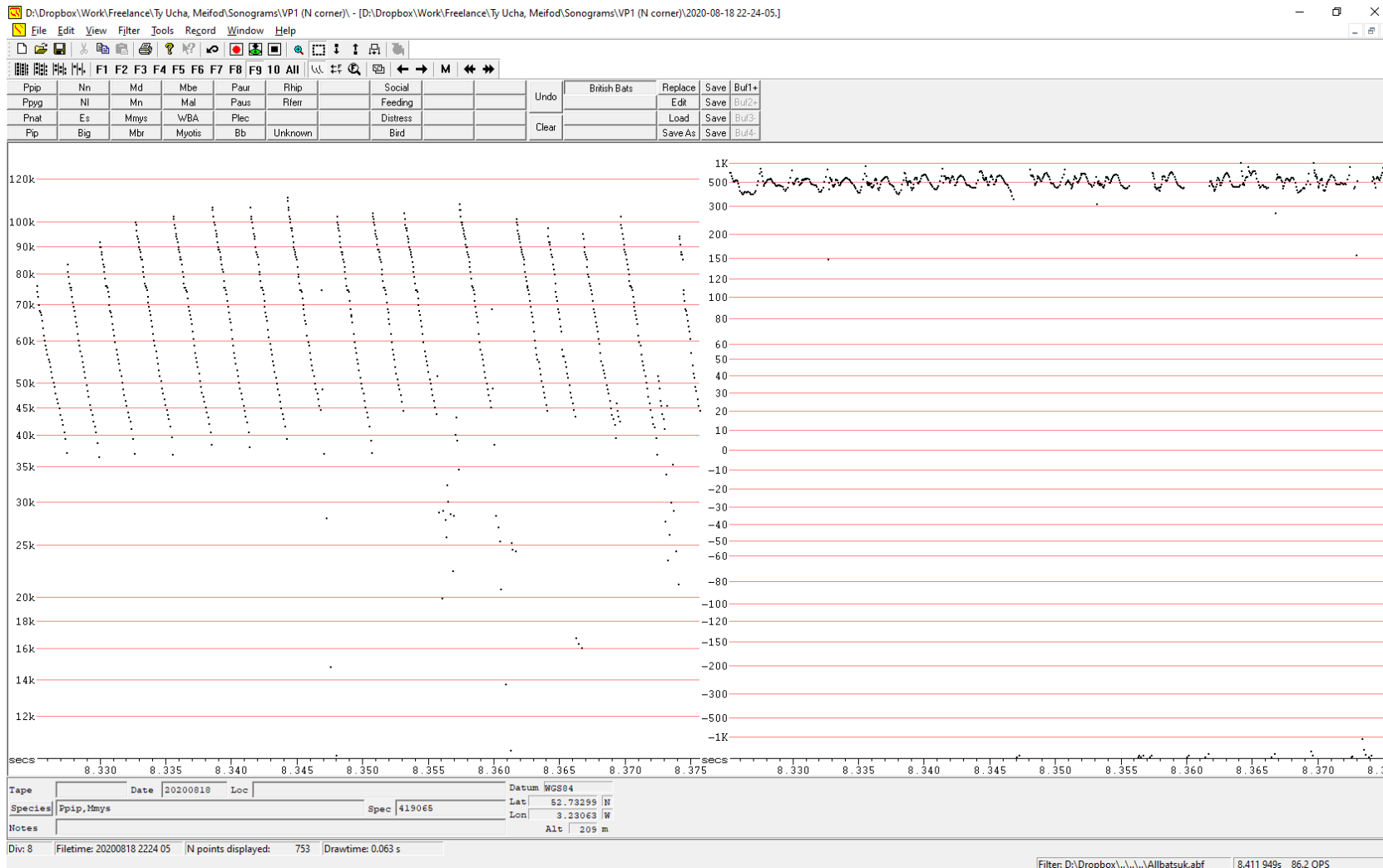


Figure 9. Sonogram of a whiskered Bat. The near-vertical (FM) sweeps on the left-hand side are indicative of a Myotis species; the split-screen on the right-hand side is an analysis of the rate of change in frequency (slope) of the corresponding calls on the left-hand side. A slope between 300 and 1000 octaves per second with many small-scale kinks indicates the likely species. (F9, compressed, filtered).

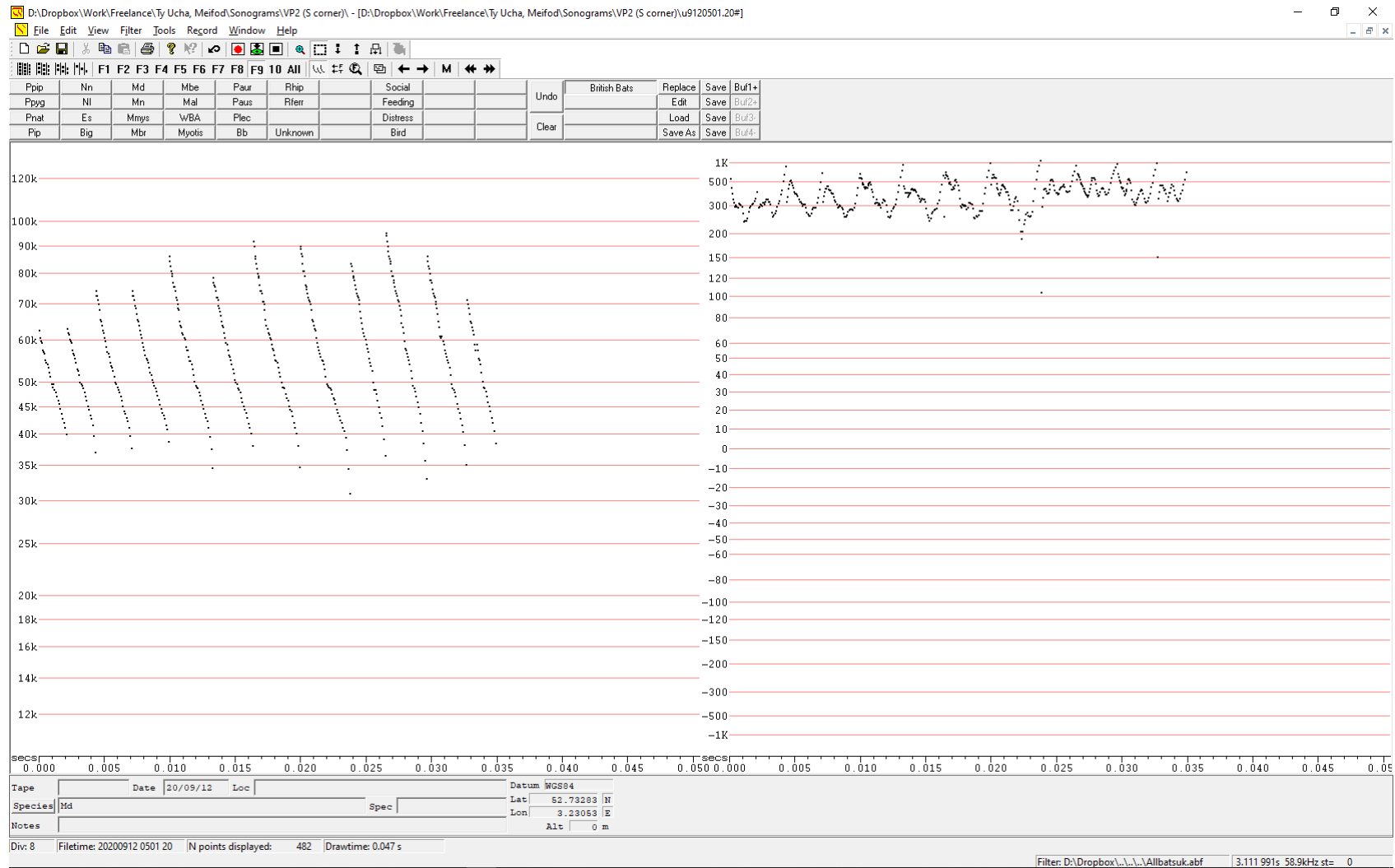


Figure 10. Sonogram of a Daubenton's Bat. The range of octaves per second (120 - 1000 OPS) coupled with the sigmoidal call shape (represented by the single large-scale V-shape of the slope line) is diagnostic of the species (F9, compressed, filtered).

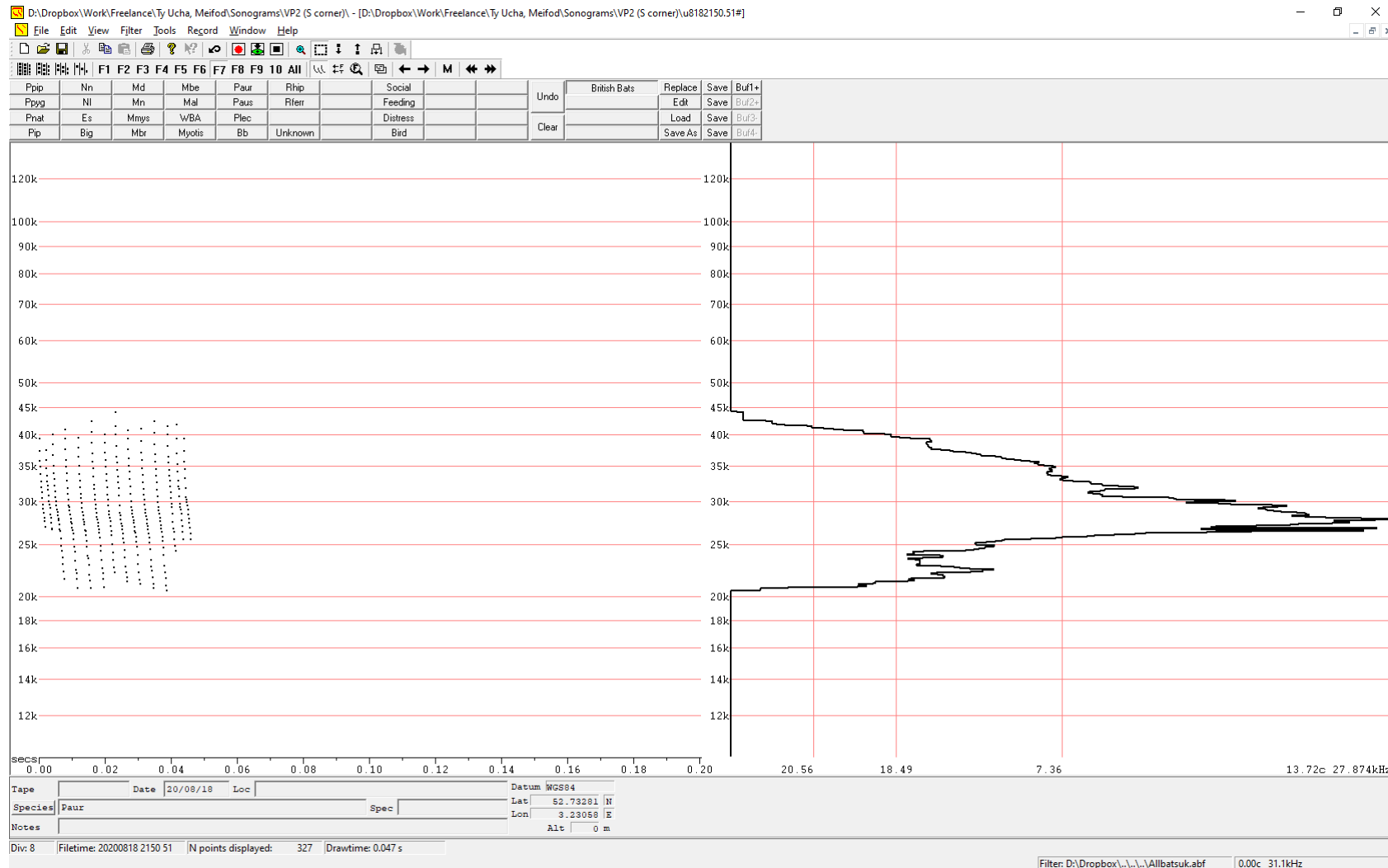


Figure 11. Sonogram of a brown long-eared bat. The calls are similar in shape to some Myotid echolocation calls in that they are entirely FM, but the peak energy (shown on the right-hand split-screen) is around 30 cycles per second, which is too low for a Myotid (F7, compressed, filtered).

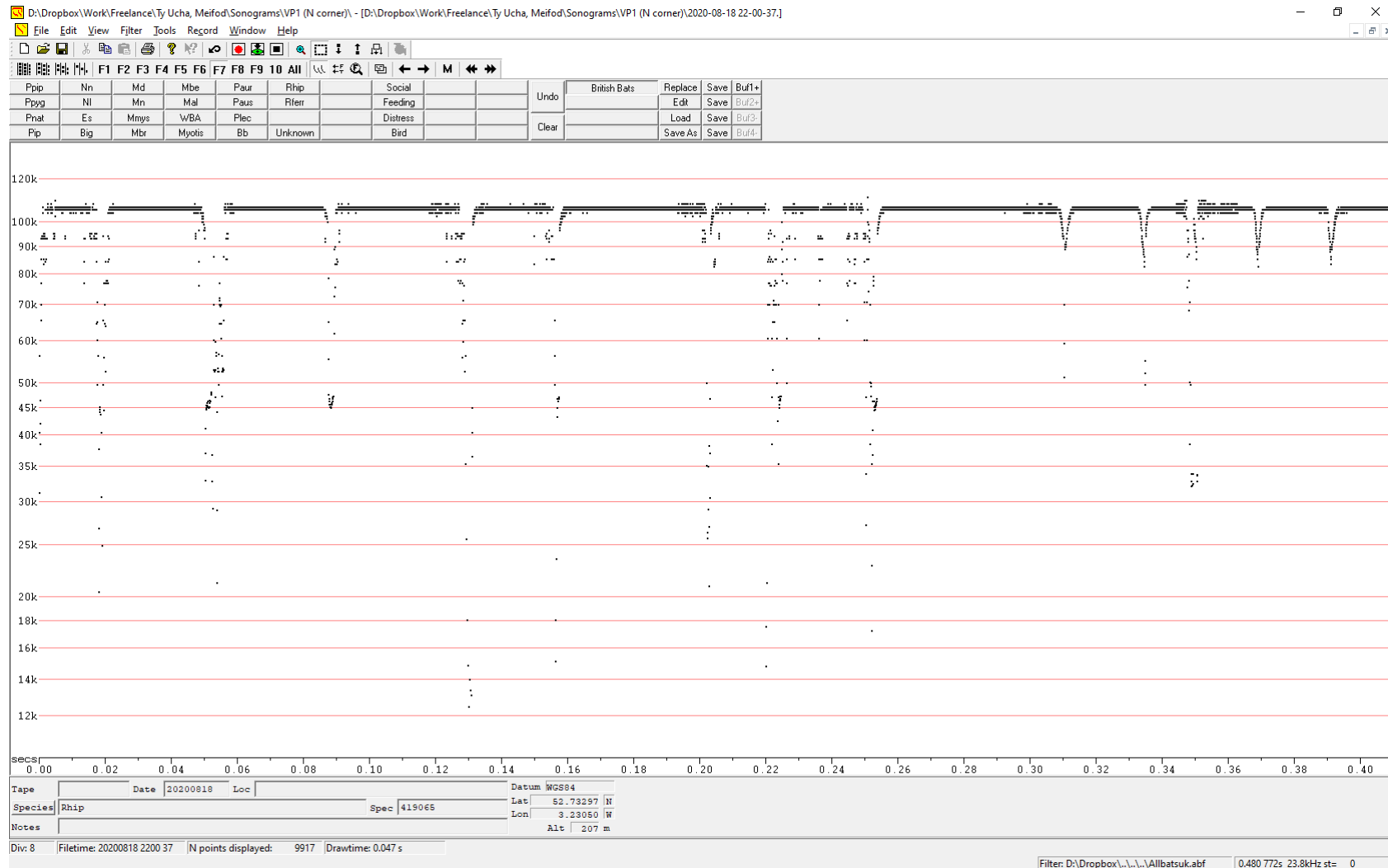


Figure 12. The unmistakable constant frequency call of a Lesser Horseshoe Bat, with the first harmonic at around 110 kHz (F7, compressed, filtered).

Appendix 4: Construction of Kent Bat Box

The Kent bat box

Simple to construct, self-cleaning and low maintenance.

The only critical measurement is the width of the crevices—these should be no larger than suggested. Other measurements are approximate.

Materials and construction

Box to be made from untreated rough-sawn timbers
Timber should be c.20mm thick

The box should be rainproof and draught-free

Crevices can be between 15 and 25 mm wide

Fixing may be by use of brackets, durable bands or wires

Location

Boxes are best fixed as high as possible in a sheltered wind-free position, exposed to the sun for part of the day.

They can be fitted to walls, other flat surfaces or trees

A clear flight line to the entrance is important

