

Bailiwick Bat Survey: 2022 Report

Newson, S.E., Allez, S.L., Coule, E.K., Guille, A., Henney, J.M., Higgins, L., McLellan, G.D., Simmons, M.C., Sweet, E., Whitelegg, D. & Atkinson, P.W.



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Graphs and mapping by S. Gillings

Cover design by M.P. Toms

SUMMARY

- Background** Working with a network of fieldworkers, static acoustic bat detectors were deployed over a 7-month survey season, to provide a second year of baseline data for bats for Guernsey, Alderney, Herm and Sark. This report provides an overview of the survey coverage and main results from 2022.
- Coverage** During 2022, 622 different locations across the Bailiwick of Guernsey were surveyed. Recording was undertaken on 209 different nights mainly between April and the end of October, amounting to a total of 2,416 nights of recording effort across sites. Sound recordings (wav files) were uploaded by volunteers to the BTO Acoustic Pipeline, where a first automated analysis was carried out and provisional results returned. Recordings were then moved to deep glacial storage for later auditing. At the end of the survey season, a copy of the recordings was pulled back, and manual auditing of the results / recordings carried out.
- Results** Overall, 3,389,138 recordings were collected which, following analyses and validation, were found to include 872,126 bat recordings, and 8,587 small terrestrial mammal recordings. Over 2 million recordings of bush-crickets and audible moth species were also recorded as 'by-catch', for which we report species presence on a site and night basis. Following validation, the study confirmed the presence of 13 bat species, 5 small mammal species, 5 species of bush-crickets, and 2 audible moth species. This includes the first records of Serotine *Eptesicus serotinus* for Jethou, the first Leisler's Bat *Nyctalus leisleri* for Herm, and the first Common Noctule *Nyctalus noctula* for Alderney. More generally, we have a better understanding now of the status of all species of bats across the Bailiwick of Guernsey, and of the relative importance of different areas. In addition, the bush-cricket Large Conehead *Ruspolia nitidula* was recorded for the first time on Herm, with records from two new locations on Guernsey, which follows the first records for Alderney, Guernsey and Lihou in 2021. Lastly, the project provides the first large-scale data on the distribution and activity of several species of small terrestrial mammals for the Bailiwick of Guernsey. The report includes a full species-by-species breakdown of spatial, seasonal, and through-the-night patterns of activity.

1. BACKGROUND

1.1 Bailiwick Bat Survey

Since 2021, the Bailiwick Bat Survey (BBS) has set out to document the distribution and activity of the different bat species that occur in Guernsey, Herm, Alderney and Sark. Using a citizen science-based approach, over 200 volunteers, many of whom were new to biological recording, chose one or more 500 x 500-m squares to survey. Volunteers reserved a bat detector from one of the centres hosting bat detectors across the islands, and then placed the detector in their chosen square(s) for 4 consecutive nights. On completion of the survey they, or the Bat Survey Coordinator, uploaded recordings to the BTO Acoustic Pipeline where an initial automated analysis was carried out to identify the species present. This was followed with verification after the end of the survey season.

In 2022, over 90% of the available squares were surveyed (up slightly from 2021) and the presence of 13 bat species, 5 small mammal species, 5 species of bush-cricket, and 2 audible moth species were confirmed. This includes the first records of Serotine *Eptesicus serotinus* for Jethou, the first Leisler's Bat *Nyctalus leisleri* for Herm, and the first Common Noctule *Nyctalus noctula* for Alderney. In 2022, we also recorded Soprano Pipistrelle *Pipistrellus pygmaeus* for the first time in this survey in Alderney, although it had been recorded there previously. This year's data has contributed towards a better understanding of the status of all species of bats across the Bailiwick of Guernsey, and of the relative importance of different areas.

Two of the bat detectors set up in Herm in October 2022 (Image credit: Sarah Allez).



In addition to the bat recording, we recorded small mammals and the presence of bush crickets and two species of moth that emit ultrasound. During the 2021 survey, the bush-cricket Large Conehead *Ruspolia nitidula* was recorded for the first time on Alderney, Guernsey and Lihou, which represented the first records of Large Conehead for the Channel Islands and this was again recorded in 2022. In 2021 we recorded Short-winged Conehead *Conocephalus dorsalis* in two wetland sites, but it was not found in 2022. One of the most interesting outputs has been a map of the distribution of the Greater White-toothed Shrew *Crocidura russula* on Guernsey, Alderney and Herm (but not Burhou, Lihou or Jethou) and the Lesser White-toothed Shrew *Crocidura suaveolens* on Sark. It showed the Greater White-toothed Shrew to be extremely widespread across the islands where it occurs, and was recorded in gardens, farmland and in semi-natural habitats.

1.2 The importance of robust baseline data

This project is supported and funded by the Agriculture, Countryside and Land Management Services (ACLMS) of the States of Guernsey. Bats are poorly understood, despite making up more than half of the terrestrial mammals that occur in the Bailiwick. They are a key indicator species of the islands' environment and Guernsey's Strategy for Nature provides a clear direction to establish baselines for key biodiversity groups to provide government, other policy makers and practitioners the information required for good decision making (www.gov.gg/strategyfornature). Part of the Strategy also emphasises the need to increase community awareness of, and involvement in nature, and its health and wellbeing benefits. The Bailiwick Bat Survey was devised with this in mind and relies on the interest and goodwill of citizen scientists to help survey the islands' bats and identify the species that are present on the islands, and the important areas and habitats for them throughout the year.

Good decision making on managing the built and natural environment is enabled by identifying key areas and habitats for different species. This requires surveys and analyses that provide a robust understanding of large-scale patterns in species' distributions and abundance (Pereira & Cooper, 2006; Jones, 2011). This is particularly challenging for bats, because most species are nocturnal, wide-ranging and difficult to identify. As a consequence, the majority of published studies on bats have used presence-only data (i.e. where there is no direct information collected about either real absence or non-detection), collected through unstructured opportunistic sampling. Working with our network of volunteers, we repeated the 2021 survey and static acoustic bat detectors were deployed over a 7-month long survey season.

1.3 Other activities in 2022 associated with the BBS

One of the benefits of the very public face of the BBS is to stimulate more interest in bats among the wider public and to encourage biological recording on the island. The take up has shown that there is a lot of local interest in bats, and to support this, we added updated information pages on <https://bats.org.gg/> about the species of bats that occur on the islands and their ecology and requirements.

1.3.1 Masters research using BBS data

This year, Emily Coule, part of the Bailiwick Bat Survey team, undertook her Master's degree research project using 2021 survey's data. Emily's thesis which was entitled '*A sound observation: using bioacoustics to understand seasonal habitat selection of bats within the Bailiwick*', looked at the habitats preferentially used by bats. Over the past few decades, the Bailiwick of Guernsey has seen major changes in land use and management through urbanisation and loss of traditional agricultural practices and the move from the traditional mixed farming approach (a mix of originally grass and hay-based livestock and arable farming) to a more intensive silage-based system dominated by a monoculture of Perennial Ryegrass *Lolium perenne*. This has reduced the diversity of plants and insects available in the wider countryside. Bats act as indicators of changes to biodiversity through their reliance on multiple factors throughout their lifecycle. Emily used acoustic data from the first year of the Bailiwick Bat Survey (www.bats.org.gg), to analyse the seasonal habitat selection in the four most common species of bat. The BBS which took place between April and October 2021, was split into 2 seasons, with the 15th July marking the split between them. Bat activity was then assessed in relation to landscape characteristics such as habitat, artificial light at night (ALAN), urban cover, distance to coast and distance to open water.

After removing data collected during unfavourable weather, woodland was the most selected habitat by all species, although the association was particularly strong in Natterer's Bat *Myotis nattereri*, and scrub was the least selected habitat. Both Natterer's Bat and Brown Long-eared Bat *Plecotus auritus* showed avoidance of areas with higher levels of ALAN. In the late season, all species except Natterer's Bat showed avoidance of semi-natural grasslands, which was particularly strong in the two common pipistrelle species. Understanding habitat use is vital for effective conservation management and data from the Bailiwick Bat Survey will provide a baseline for our understanding of bats' habitat use in the Bailiwick.

1.3.2 Upskilling bat workers in Guernsey

The Bailiwick Bat Survey is also meant to be a first step towards encouraging and enabling other projects

studying/researching bats in the islands. In early 2022, La Société received a grant from the Strategy for Nature fund to deliver a Bat Upskilling Course. The aim of the course was to increase both the number of, and the skills of bat workers on island to allow the islands' bats to be better and more effectively monitored. This course was delivered across 4 weekends throughout the year, whereby experts from Sangan Island Conservation in Jersey came over to share their expertise and provide the training. This course was delivered through a series of lectures, surveys, demonstrations, and harp trapping sessions which were undertaken under licence from the States of Guernsey Veterinary Officers. Our thanks go to Dr Amy Hall and Piers Sangan from Sangan Island Conservation, for giving up their time to deliver this training course.

The surveys used BBS data to identify potential roosts. Looking at the data, the key thing to look for is peaks of bat activity shortly after dusk as bats emerge and before dawn as bats return to roost. As a result, a number of bat roosts were found, e.g., on 28 May a total of 17 Common Pipistrelles *Pipistrellus pipistrellus* were observed emerging from the residential care and nursing home at Saumarez Park, and a maternity roost for Grey Long-eared Bat was discovered at St Paul's Church in the Vale when 31 Grey Long-eared Bats *Plecotus austriacus* were observed emerging on 29th May.

Harp traps set up for capturing bats at the German Underground Hospital and at Jerbourg (Image credit: Sarah Allez).



Between 30th July and 19th September 2022, a total of 31 bats were caught from eight sites across Guernsey, with bats being caught at six of the eight sites. The most common were Common Pipistrelle with a total of 21 of captures, and the remaining 10 were made up of Nathusius' Pipistrelle *Pipistrellus nathusii*, Grey Long-eared Bat, Brown Long-eared Bat and Natterer's Bat. There has been some uncertainty about the status of Nathusius' Pipistrelle in Guernsey. Nathusius' Pipistrelle is a well-known long-distance migrant with individuals to the northeast of Guernsey (e.g. in and around the Baltic States) undertaking long migrations southwest in to western Europe in winter. The past distribution of records in Guernsey are all between September and April indicating that this is a migrant and winter visitor. The individual trapped on 28 August 2022 was a juvenile and, given the date, may well have been a migrant or could have possibly been an individual that was born in the island – more mid-summer catching is required. Another significant result from the course was the capture of four Brown Long-eared Bats, which is the first in hand records for Guernsey. This supports the results from the 2021 acoustic monitoring that showed that this cryptic species occurs at a low level, but is fairly widespread across Guernsey and Alderney and not as rare as previously believed.

Brown Long-eared Bat. Trapping was licenced by the States Veterinary Officers. (Image credit: Emily Coule).



1.3.3 Winter roost surveys

Throughout the year, bats use different roost 'types' and will move between roosts to those that will best support their life cycle requirements at the time, for example maternity roosts, satellite roosts and winter roosts. Different species of bats use different kinds of winter roosts. Greater Horseshoe *Rhinolophus ferrumequinum* and Lesser Horseshoe Bats *Rhinolophus hipposideros* always require underground structures to hibernate in, and winter roosts of Natterer's, Whiskered *Myotis mystacinus* and Brandt's Bat *Myotis brandtii* are also mainly underground. Other species, such as pipistrelles, will roost in crevices or recesses in buildings, trees or underground structures which provide the stable conditions required. They are very specific in their requirements around temperature and humidity, as well as social requirements.

Underground structures are important for hibernation but, in late summer/early autumn, large numbers of bats also gather around the entrances of underground sites to swarm. Swarming is poorly understood but almost certainly has mating elements and involves information transfer about suitable wintering sites.

In Guernsey, winter roosts are poorly known for most species, except for Greater Horseshoe Bat whose affinity for underground structures has been known since the early 1900s where it was described as 'not uncommon' in Guernsey and a roost containing many specimens was discovered in the cellar of an old house in St Peter Port. Joseph Sinel wrote in the Transactions of the Guernsey Society of Natural Science and Local Research "*The Greater Horseshoe Bat comes out rather early in the evening and flies high. It frequents caves and old houses during the day. When I was in Guernsey, I was shown a number of specimens that had been taken from a wine cellar somewhere in the Bordage. Some of these are now in the Guille-Allés Museum*".

In the UK underground structures are also known to be important for Brandt's and Whiskered Bat, Natterer's Bat and Brown Long-eared Bat. In the Bailiwick, natural underground structures are limited to a small number of sea caves, but there are a number of man-made structures underground (e.g. military bunkers, Napoleonic towers, tunnels etc). The most extensive are tunnels that were built during the German Occupation.

The Bailiwick Bat Survey has provided information on bat activity in spring, summer and autumn in the islands, however this survey doesn't cover the winter period. Therefore, in February and March 2022 the Bailiwick Bat Survey team and the La Société Bat Section undertook a pilot survey of tunnels and found new sites for Greater Horseshoe Bat, Brandt's/Whiskered Bat and a new large roost or winter swarming site for Natterer's Bat. Underground sites, although poorly known, are very important for many of Guernsey's rarer species of bats, and 1-2 sites could potentially hold the most or all of a population of a particular species of bat in winter.

Brown Long-eared Bat, Natterer's Bat, Whiskered/Brandt's Bat and Greater Horseshoe Bat which were rare in the main bat survey were strongly over-represented in the winter surveys showing strong 'preference' for overwintering in the tunnels. Grey Long-eared Bat, Common Pipistrelle and Kuhl's *Pipistrellus kuhlii*/Nathusius' were under-represented, fitting in with what is known about each species' ecology and their preference for winter roosts. Brown Long-eared Bat, Natterer's Bat, Whiskered/Brandt's Bat and Greater Horseshoe Bat are all known to be strongly associated with underground structures in winter.

There are clear gaps in knowledge about how the bats use the underground sites, and we are pleased to say that La Société's Bat Section has received a grant from the Strategy for Nature fund to carry out further studies in 2022/2023. The Bailiwick Bat Survey team and BTO will be assisting with this project and placing detectors at some of the known winter roost sites.

2. AIMS AND OBJECTIVES

The Bailiwick Bat Survey capitalises on the interest and enthusiasm of volunteers to participate in biodiversity monitoring to systematically collect bat distribution and activity data across Guernsey, Alderney, Herm and Sark through a project that will run over four years (2021-2024), of which we present here the results from 2022. The aim is to provide a robust dataset for increasing knowledge and understanding of bat distribution and activity across Bailiwick of Guernsey.

Whilst the focus of this work is bats, results for small terrestrial mammals, bush-crickets and audible moths which are recorded as 'by-catch' during bat surveys are also returned (Newson *et al.*, 2017b; Newson *et al.*, 2021).

In addition to the above, the project has the following objectives:

- Improve our understanding of the status, distribution and timing of occurrence of bat, bush-cricket and small mammal species that occur in the Bailiwick of Guernsey.
- Involve and inspire a large section of the wider community to connect and engage with an aspect of nature that is poorly known and understood.
- Help develop a community awareness of what bats do for us, what they require, why it is important to conserve them and how landowners and householders can enhance their properties for bats.

Map of the Bailiwick of Guernsey, comprising the islands of Guernsey, Herm, Sark, Alderney, and their associated smaller islands. The aim will be to achieve survey coverage for all islands.



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3. METHODS

3.1 Static detector protocol

Our survey approach is based on the Norfolk Bat Survey and Southern Scotland Bat Survey (Newson *et al.*, 2015; Newson *et al.*, 2017a) which was set up to assess the season-wide status of bat species throughout large regions. Our protocol enables members of the public to have access to passive real-time bat detectors which they leave outside to automatically trigger and record the calls to a memory card every time a bat passes throughout a night.

Bat detectors (the Song Meter Mini Bat), were placed out to record for a minimum of four consecutive nights at each location. The recommendation of four nights follows analyses of bat data carried out by ourselves as part of a Defra funded project to inform the most cost-effective sampling regime for detecting the effect of local land-use and land management (BTO, unpublished data). Multiple nights of recording are likely to smooth over stochastic and weather related variation, whilst also being easy to implement logistically (once a detector is on site, it is easy to leave it in situ for multiple nights).

Volunteers were directed to an online square sign-up tool, showing survey coverage (available 500-m x 500-m squares), through which they sign-up and reserved a square or squares for survey. The survey map was updated throughout the survey season allowing uptake and coverage during the survey season to be assessed. After reserving a 500-m x 500-m square for the survey, volunteers were automatically emailed a web link through which they reserved out a bat detector from the most convenient 'bat monitoring centre', and received details on how to set up a BTO Acoustic Pipeline account (see below). In this project, in 2022, the Priaulx Library, Sir Charles Frossard House, the Guille-Allés library, La Société Guernesiaise, Alderney Wildlife Trust and Société Sercquaise hosted bat detectors.

The bat detectors were set to record with a sample rate of 256 kHz and to use a high pass filter of 12 kHz which defined the lower threshold of the frequencies of interest for the triggering mechanism. Recording was set to continue until no trigger is detected for a 2 second period up to a maximum of 5 seconds. Detectors were deployed before sunset and detectors set to switch on and record 30 minutes before sunset until 30 minutes after sunrise the following day. The detector was mounted on 2-m poles to avoid ground noise and reduce recordings of reflected calls. Guidance was provided to volunteers on the placement of microphones which were to be deployed at least 1.5-m in any direction from vegetation, water or other obstructions.

3.2 Survey effort and timing

The survey period ran from the beginning of April to the end of October, but with a small amount of recording outside this period. A long survey season covers the main period of bat activity, and maximises the use of the equipment during the year. Volunteers were encouraged to choose specific 500-m squares to survey, but some flexibility was allowed to encourage volunteer uptake.

3.3 Processing recordings and species identification

Automated passive real-time detectors are triggered when they detect sound within a certain frequency range. Monitoring on this scale can generate a very large volume of recordings, efficient processing of which is greatly aided by a semi-automated approach for assigning recordings to species.

At the end of a four-day recording session, the files recorded by the bat detector (uncompressed wav format), were uploaded by the volunteer to the BTO's Acoustic Pipeline <http://bto.org/pipeline> for processing. Volunteers have their own online user account, and desktop software through which they, or the local project organiser if needed, can upload recordings directly to the cloud-based BTO Acoustic Pipeline for processing. This system captures the metadata (name and email address of the person taking part, the survey dates, and locations at which the detectors were left out to record), which are matched automatically to the bat results. Once a batch of recordings is processed, the user is emailed automatically, and the raw results are then downloadable through the user account as a csv file. These first results are provided with the caveat that additional auditing of the results and recordings is carried out at the end of the survey season.



Because the cost of cloud processing and storage is expensive, and there is a significant cost every time data is pulled out or moved, particularly if it is in the most accessible storage tier, recordings were automatically moved to deep glacial storage after processing. The recordings were then not easily accessible during the survey season itself, but a complete copy of the recordings was pulled back at the end of the survey season for auditing.

The BTO Acoustic Pipeline applies machine learning algorithms to classify sound events in the uploaded recordings. The classifier allows up to four different “identities” to be assigned to a single recording, according to probability distributions between detected and classified sound events. From these, species identities are assigned by the classifier, along with an estimated probability of correct classification. Specifically this is the false positive rate, which is the probability that the Pipeline has assigned an identification to the wrong species. However, we scale the probability, so that the higher the probability, the lower the false positive rate. To give an example, given a species identification with a probability of 0.9, there is a 10% chance that the identification is wrong.

Our recommendation, which is supported in Barré *et al.* (2019), is that identifications with a probability of less than 0.5 (50%) are discarded. However, manually auditing of a sample of recordings (wav files) that are below this threshold, was carried out to be confident that we were losing very little by doing this.

For bats and small mammals where we were interested in producing a measure of activity, we manually checked all the recordings of a species. For most common species, Common Pipistrelle, we checked a random sample of 1,000 recordings to quantify the error rate for these species in the dataset. For this species 0 (0%) recordings were assigned to the wrong species. For bush-crickets and audible moths where there can be a large number of recordings, often of the same individual is recorded over a night, we instead focus on producing an inventory of species presence only instead, where the three recordings with the highest probability for each site and night were selected for auditing.

Verification of species identification was carried out through the manual checking of spectrograms using software SonoBat (<http://sonobat.com/>) which was used as an independent check of the original species identities assigned by pipeline. The spectrograms shown in this report, were also produced using SonoBat. All subsequent analyses use final identities upon completion of the above inspection and (where necessary) correction steps.

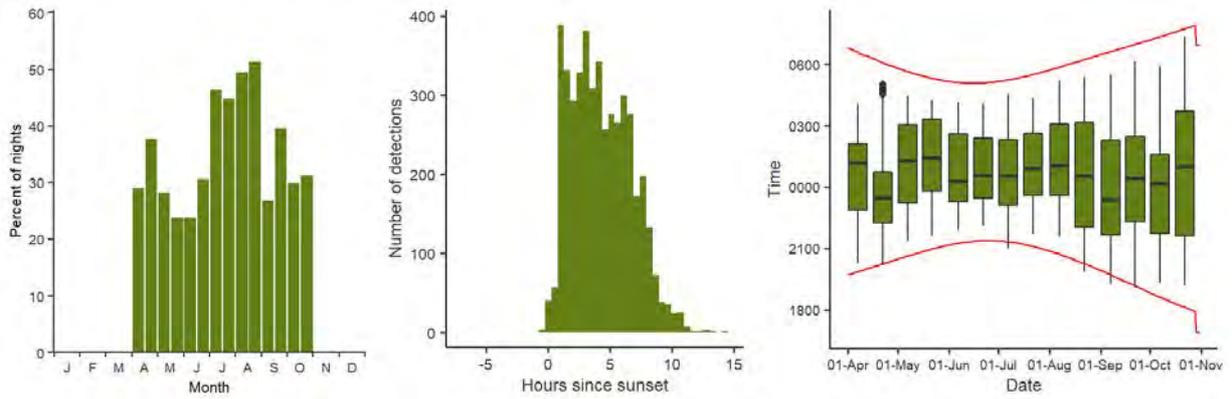
It is important to note that the criteria for distinguishing Whiskered Bat and Brandt’s Bat are very subtle and poorly defined. For this reason, until further ground-truthing of the identification can be carried out, we treat these two species as a species pair.

The echolocation calls of Kuhl’s Pipistrelle and Nathusius’ Pipistrelle are also extremely similar, but these two species produce social calls which can be assigned to species with confidence. For this reason, we treat recordings where there are only echolocation calls as “Kuhl’s Pipistrelle or Nathusius’ Pipistrelle”, and present the results separately where there are social calls in recordings i.e., where we can be confident with the identification.

3.4 Seasonal and nightly patterns of activity

Important for improving our understanding of the species present, we examine how bat activity varied by time of night and by season. Nightly activity was determined for each half-month period and presented according to the percentage of survey nights on which each bat species was detected. Activity through the night was analysed by first converting all bat pass times to time since sunset based on the location and date and calculated using the R package *suncalc* (Thieurmél & Elmarhraoui, 2019) and then assessing the frequency distribution of passes relative to sunset for the whole season and in half-month periods. By looking at nightly activity in this way, it allows us to visualise general patterns in activity for a species according to time of night and season, accepting that activity on any given night will be influenced by weather and potentially other factors.

To explain the figures in the following results section, we show an example below for Natterer’s Bat. The left plot shows the percentage of nights on which the species was detected every half-month through the season, showing the periods of main activity for this species. The middle plot shows the overall spread of recordings with respect to sunset time, calculated over the whole season. The right plot shows the spread of recordings with respect to sunset and sunrise times (red lines) summarised for each half-month through the season. For this last seasonal plot, the individual boxplots show quartiles (lower, median and upper) with lines extended to 1.5 times the interquartile range, and small dots show outliers. For the latter plot only, we exclude the small number of records before the 1st April.



3.5 Spatial patterns of activity and distribution

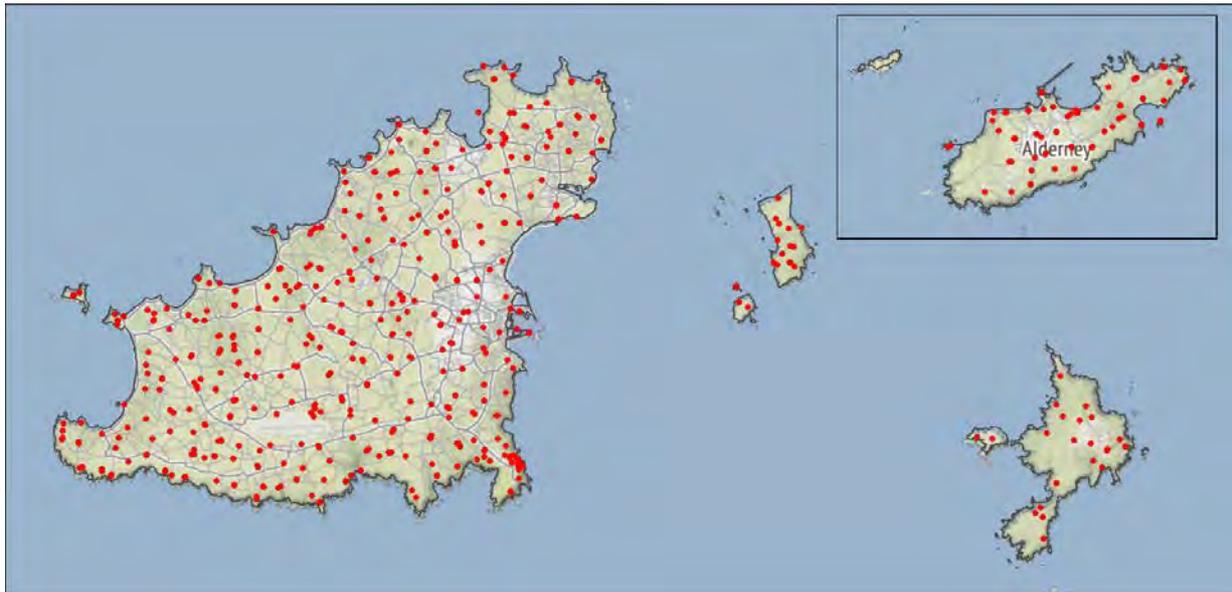
We produce maps of bat and small mammal activity. With these, dots are scaled according to the total number of recordings of this species at each location. Activity here represents usage of an area, which will be a combination of species abundance, and time spent in the area. For bush-crickets and audible moths, the results focus instead on species presence.

4. RESULTS

4.1 Survey coverage

During 2022, 622 different locations were surveyed for bats, with all recordings uploaded and processed through the BTO Acoustic Pipeline. The distribution of these locations is shown below. Collectively across all these sites, 2,416 complete nights of recording effort was conducted. The recording effort spanned 209 different nights and 8 months. The seasonal pattern of recording effort is shown in the bottom figure.

Map of the study area showing locations where detectors were deployed in 2022.



Number of locations surveyed.



4.2 General results

Overall, 3,389,138 recordings were collected which, following analyses and validation, were found to include 872,126 bat recordings, and 8,587 small terrestrial mammal recordings. In addition, several species of bush-crickets and audible moth species were recorded (see table below). Following validation, the presence of at least 13 bat species, 5 small mammal species, 5 bush-cricket species and 2 audible moth species can be confirmed.

Species detected, number of recordings of each species following validation and a summary of the scale of recording.

Bats

Species (/call type)	No. of recordings following validation	No. of different locations (% of total)
Serotine, <i>Eptesicus serotinus</i>	7	4 (0.6%)
Whiskered or Brandt's Bat, <i>Myotis mystacinus</i> or <i>M. brandtii</i>	210	10 (1.6%)
Natterer's Bat, <i>Myotis nattereri</i>	4553	378 (60.8%)
Natterer's Bat social calls, <i>Myotis nattereri</i>	35	18 (2.9%)
Leisler's Bat, <i>Nyctalus leisleri</i>	22	11 (1.8%)
Common Noctule, <i>Nyctalus noctula</i>	9	2 (0.3%)
Kuhl's Pipistrelle or Nathusius' Pipistrelle, <i>Pipistrellus kuhlii</i> or <i>P. nathusii</i>	16045	454 (73%)
Kuhl's Pipistrelle social calls, <i>Pipistrellus kuhlii</i>	2421	103 (16.6%)
Nathusius' Pipistrelle social calls, <i>Pipistrellus nathusii</i>	4	2 (0.3%)
Common Pipistrelle, <i>Pipistrellus pipistrellus</i>	824898	617 (99.2%)
Soprano Pipistrelle, <i>Pipistrellus pygmaeus</i>	10	1 (0.2%)
Brown Long-eared Bat, <i>Plecotus auritus</i>	327	102 (16.4%)
Grey Long-eared Bat, <i>Plecotus austriacus</i>	23359	527 (84.7%)
Greater Horseshoe Bat, <i>Rhinolophus ferrumequinum</i>	221	19 (3.1%)
Lesser Horseshoe Bat, <i>Rhinolophus hipposideros</i>	5	5 (0.8%)

Small mammals

Species	No. of recordings following validation	No. of different locations (% of total)
Wood Mouse, <i>Apodemus sylvaticus</i>	8	3 (0.5%)
Greater White-toothed Shrew, <i>Crocidura russula</i>	1437	217 (34.9%)
Lesser White-toothed Shrew, <i>Crocidura suaveolens</i>	36	11 (1.8%)
Brown Rat, <i>Rattus norvegicus</i>	7058	138 (22.2%)
Black Rat, <i>Rattus rattus</i>	48	2 (0.3%)

Bush-crickets

Species	No. of different locations (% of total)
Long-winged Conehead, <i>Conocephalus fuscus</i>	75 (12.1%)
Speckled Bush-cricket, <i>Leptophyes punctatissima</i>	151 (24.3%)
Grey Bush-cricket, <i>Platycleis albopunctata</i>	92 (14.8%)
Large Conehead, <i>Ruspolia nitidula</i>	3 (0.5%)
Great Green Bush-cricket, <i>Tettigonia viridissima</i>	205 (33%)

Moths

Species	No. of different locations (% of total)
Green Silver-lines, <i>Pseudoips prasinana</i>	21 (3.4%)
Bird Cherry Ermine, <i>Yponomeuta evonymella</i>	43 (6.9%)

4.3 Species and call-type results

The following sections provide results for each species and/or call type.

4.3.1 Bat species

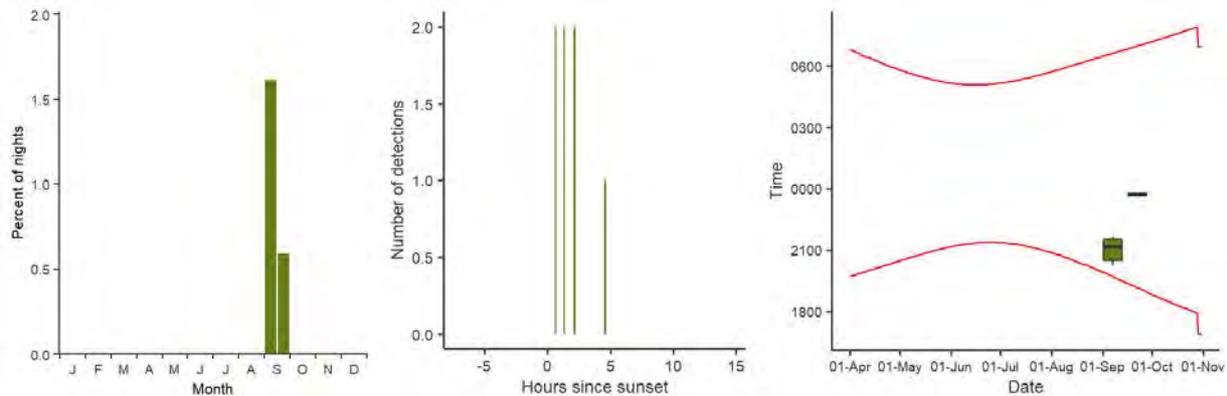
Serotine

Serotine *Eptesicus serotinus* was recorded on four nights, from four locations, giving a total of 7 recordings.

Spatial pattern of activity



Seasonal and nightly activity

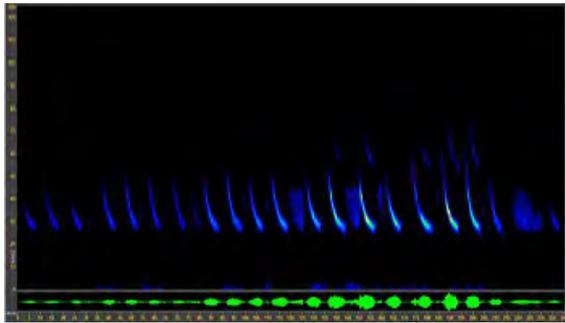


Serotine - new species for Jethou Compared with 2021, when Serotine was recorded across Guernsey and Alderney from the second half of May until the end of September (33 nights, 31 locations), Serotine was very scarce in 2022 and was only recorded from 4 locations over 4 nights in 2022. A single recording from Jethou on the 22nd September comprises the first record of this species for the island. On Guernsey, Serotine was only recorded at Le Creux ès Faïes on the Fort Saumarez headland on the 7th September (two recordings from one location), and on Alderney, Serotine was recorded from two locations (Tourgis and near the junction of the Rue de Beaumont and Newtown Road) on the 10th and 12th September respectively. In last year's report, we noted that Serotine may be a rare resident or possibly a migrant. With the only records of Serotine in 2022 from September, it provides support for the idea that this species may not be resident on the islands.

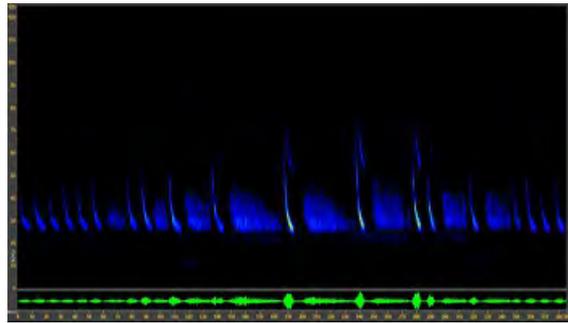
Serotine is scarce in Jersey, and present on the adjacent coasts of France. Below, we show spectrograms from six example recordings to show examples across a range of call durations. Spectrograms in this report provide a visual representation of the spectrum of frequencies (in kHz) produced by an animal as they vary with time.

Acoustically, it is normally straightforward to distinguish Serotine from *Nyctalus* species, of which Common Noctule and Leisler's Bat are the most likely confusion species here. In contrast to Serotine, *Nyctalus* species often show strong alternating frequencies in the calls within a sequence. Leisler's Bat often shows sharp frequency changes within a sequence of over 2 kHz, where such changes would be unusual for Serotine. One situation where it can be

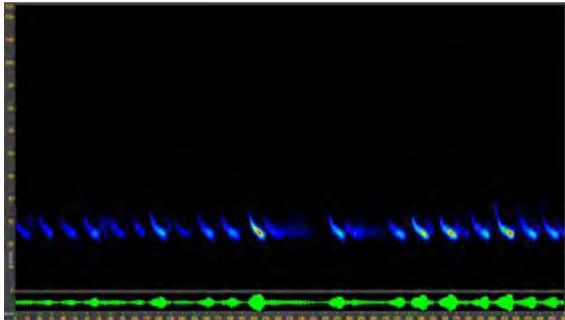
more difficult to distinguish Serotine/*Nyctalus* is in high clutter, but *Nyctalus* normally do not stay long in high clutter, so it would be exceptional to find consecutive steep calls of these species. For a visual comparison of the calls of Serotine and Leisler's Bat see Identification Appendix 1.



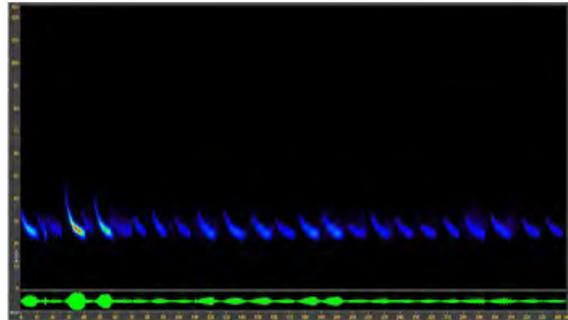
Serotine - Jethou, 7th September



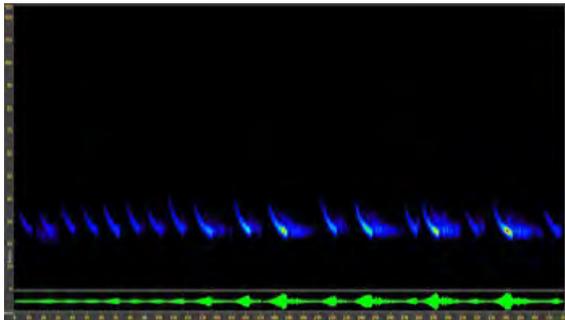
Serotine - Guernsey, 22nd September



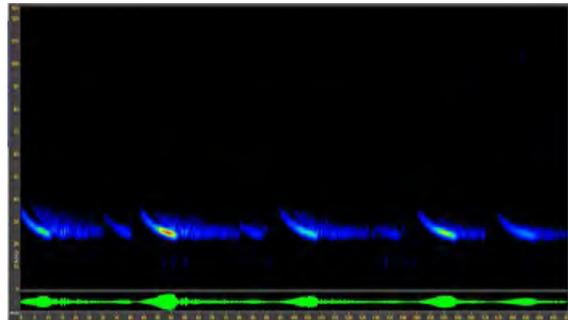
Serotine - Alderney, 12th September



Serotine - Alderney, 12th September



Serotine - Alderney, 10th September



Serotine - Alderney, 10th September

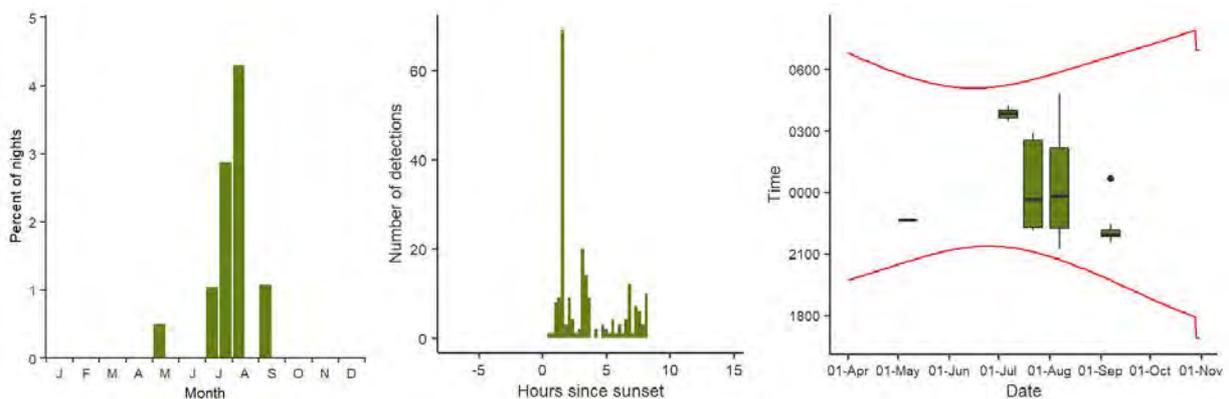
Whiskered or Brandt's Bat

Whiskered or Brandt's Bat *Myotis mystacinus* or *M. brandtii* was recorded on 14 nights, from 10 locations, giving a total of 210 recordings.

Spatial pattern of activity



Seasonal and nightly activity

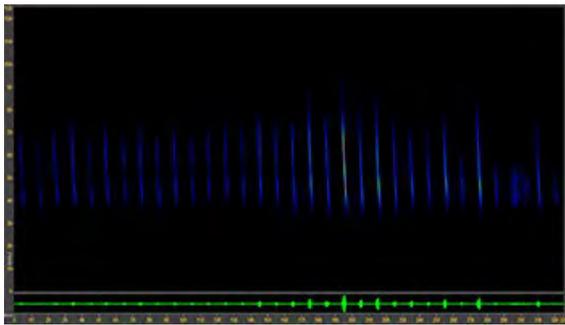


Whiskered or Brandt's Bat At the current time, there are no good, clear criteria for distinguishing Whiskered and Brandt's Bat acoustically with confidence (see Identification Appendix 2). We found this species pair on Guernsey for the first time in 2021 and also Alderney where this species pair, or Alcatheo Bat *M. alcathoe* has been recorded previously. The pattern of records in the Bailiwick Bat Survey, along with the discovery of a winter roost in Guernsey and a previously known roost in Alderney, show that this is a rare resident in the two largest islands in the Bailiwick.

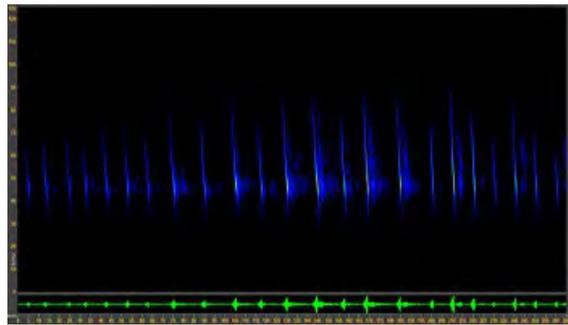
In 2022, we assigned 210 recordings to Whiskered or Brandt's Bat. Four of these locations were from Alderney (three locations in August or early September). There were two locations with many dozens of recordings in Alderney, both in wooded areas just to the east of the road leading up from the harbour to St Annes and at Val de Saou in the west of the island. The remaining ten recordings were from separate and widespread locations on Guernsey. In 2022, there was one recording from the south-east corner of Guernsey where, in 2021 there was a series of records that spanned a number of months (June, August and September), which perhaps suggested that this species was an extremely rare resident confined to this small area. However, in 2022, single recordings of Whiskered or Brandt's bat were made from several other areas of Guernsey. In early 2022 a winter roost containing this species pair was discovered in an underground structure in the north of the island.

As discussed in the 2021 report, Brandt's Bat is extremely rare or a vagrant in Jersey, while Whiskered Bat is considered to be very rare. In neighbouring France, Brandt's Bat is absent from Normandy and rare in Brittany. Whiskered Bat is much more common in both neighbouring areas and, based on this evidence, the recordings may

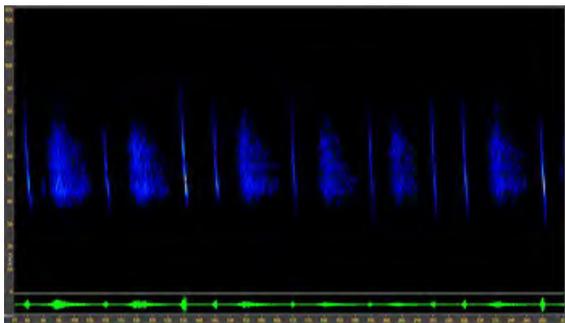
well be of this species, but this needs to be proven by some other means (e.g. DNA evidence or trapping). The discovery of a winter roost in Guernsey may allow collection of droppings to clarify which species has been recorded.



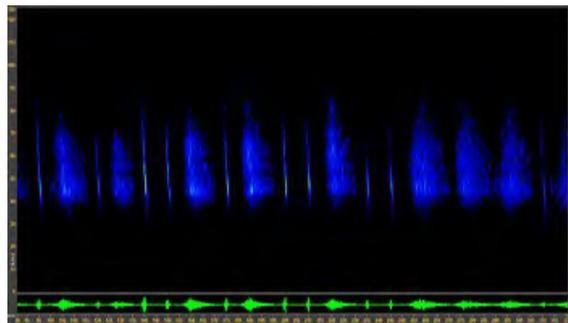
Whiskered or Brandt's Bat - Guernsey, 27th July



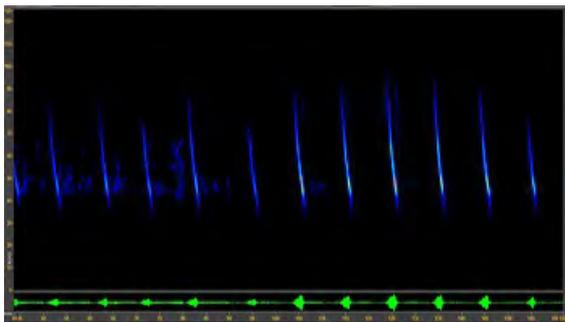
Whiskered or Brandt's Bat - Alderney, 12th August



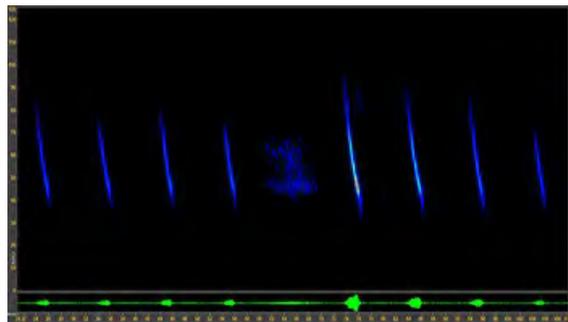
Whiskered or Brandt's Bat - Alderney, 12th August



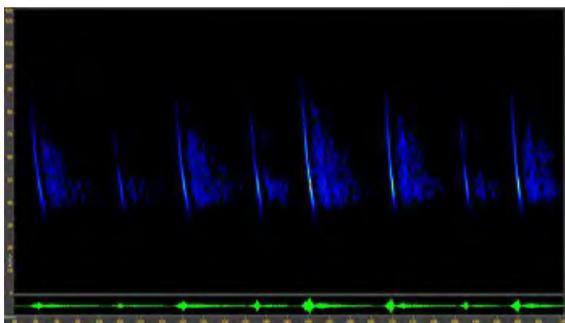
Whiskered or Brandt's Bat - Guernsey 19th July



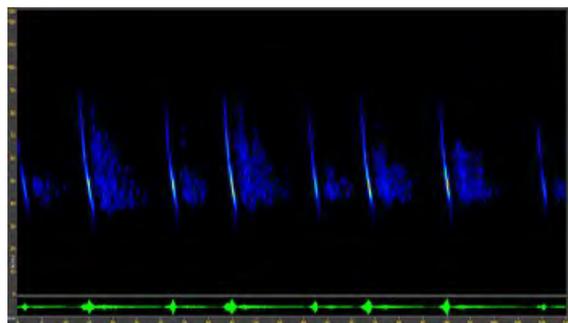
Whiskered or Brandt's Bat - Alderney, 9th August



Whiskered or Brandt's Bat - Alderney, 9th August



Whiskered or Brandt's Bat - Alderney, 9th August

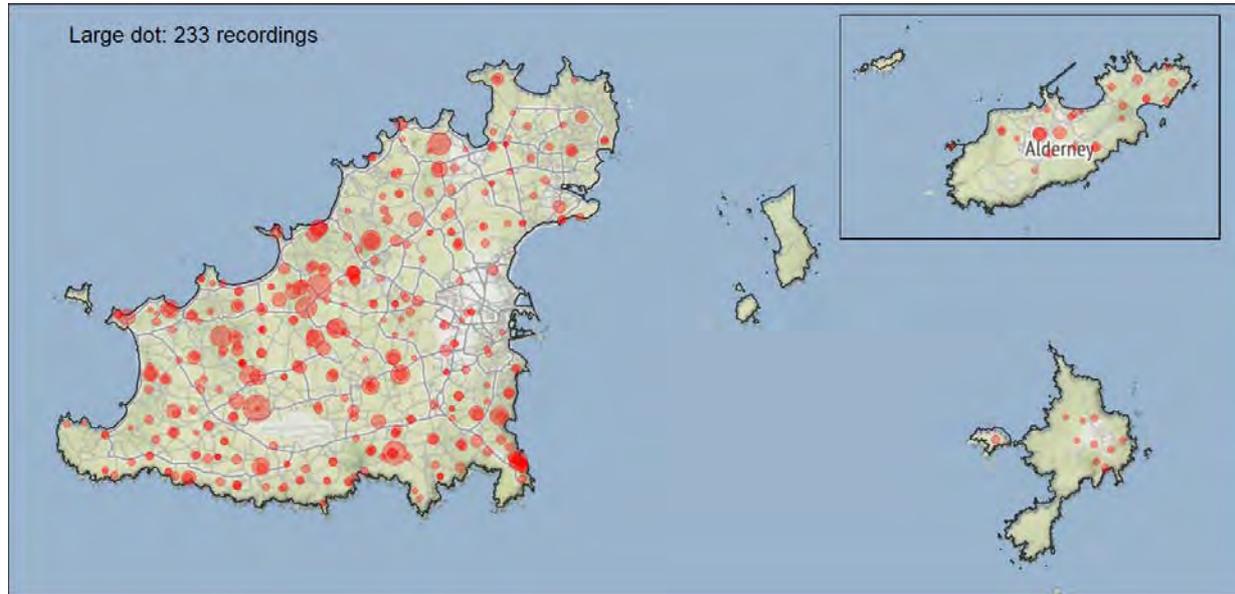


Whiskered or Brandt's Bat - Alderney, 9th August

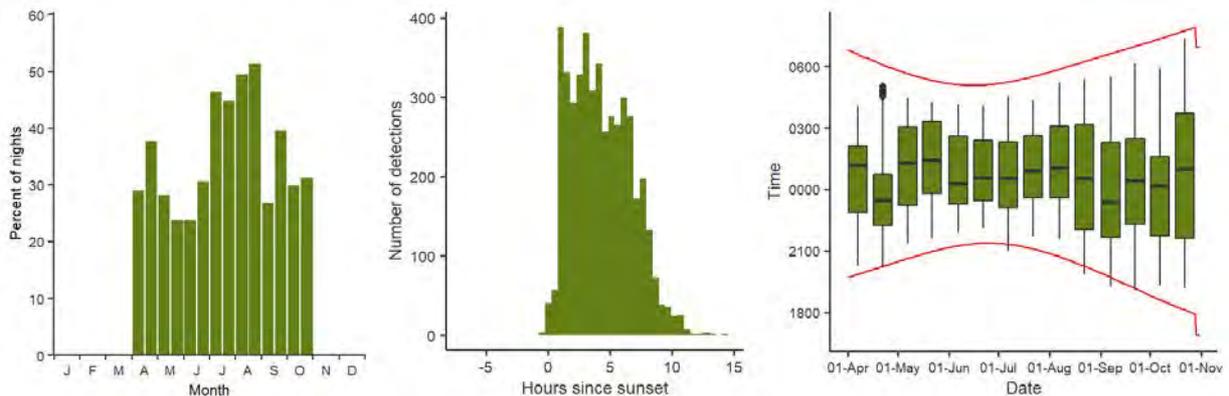
Natterer's Bat

Natterer's Bat *Myotis nattereri* was recorded on 197 nights, from 378 locations, giving a total of 4,553 recordings.

Spatial pattern of activity



Seasonal and nightly activity



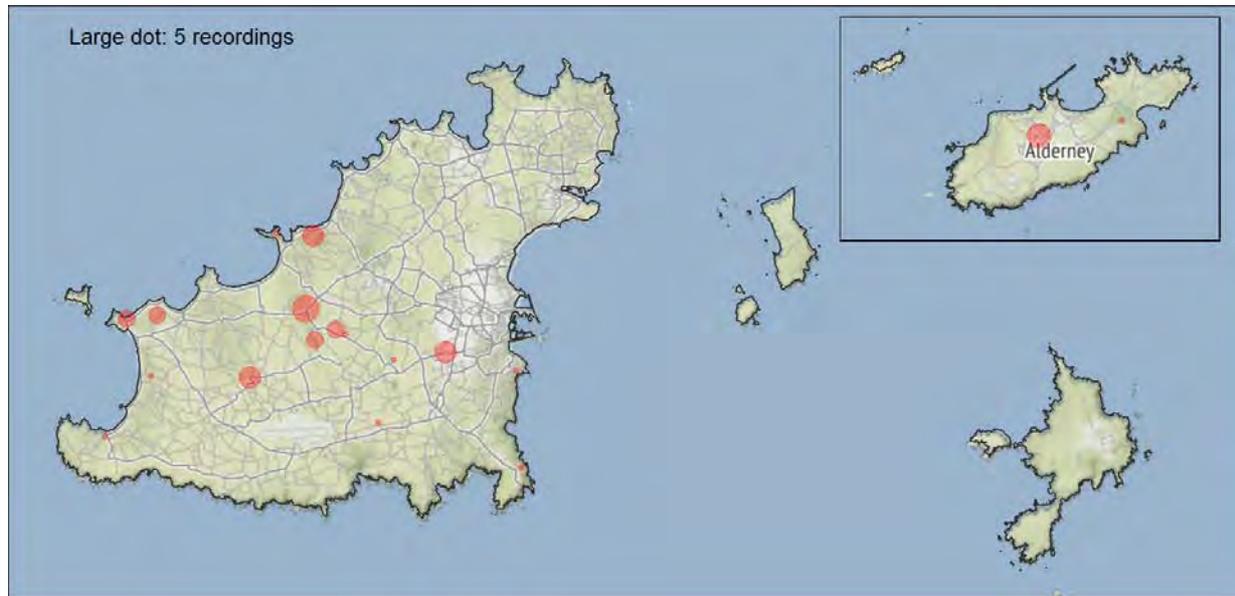
Similarly to 2021, **Natterer's Bat** was widely recorded in 2022, with records from Guernsey, Sark and Alderney, but it was absent from the smaller islands. The pattern of abundance was similar to 2021, with large numbers of recordings in the south-east corner of Guernsey and along a line going south-west from the Saumarez Nature Trail/Saumarez Park to the Reservoir and then down to an area along St Peter's church and an area at the top of the Quanteraine Valley. Natterer's Bat will forage around semi-natural broad-leaved woodland and open water sheltered by tree cover although they will use grassland too. This is reflected in the higher activity in areas with woodland and parkland as well as around the Reservoir. In Alderney it was widespread, but larger numbers of recordings were obtained in and around the Community Woodland. It is becoming clear from the two year's surveys that well-lit areas tend to be avoided - in Guernsey this means areas around St Peter Port, the Vale and around the airport.

One interesting observation from the winter roost surveys was the very large numbers of Natterer's Bat recordings around the German Underground Hospital and the St Saviour's tunnels. We recorded for only a few weeks at these two sites but had more recordings than in the whole of the Bailiwick Bat Survey. It does suggest that these underground sites are extremely important for swarming or use as a hibernation roost. See Identification Appendix 3 for more information on the sound identification of Natterer's Bat.

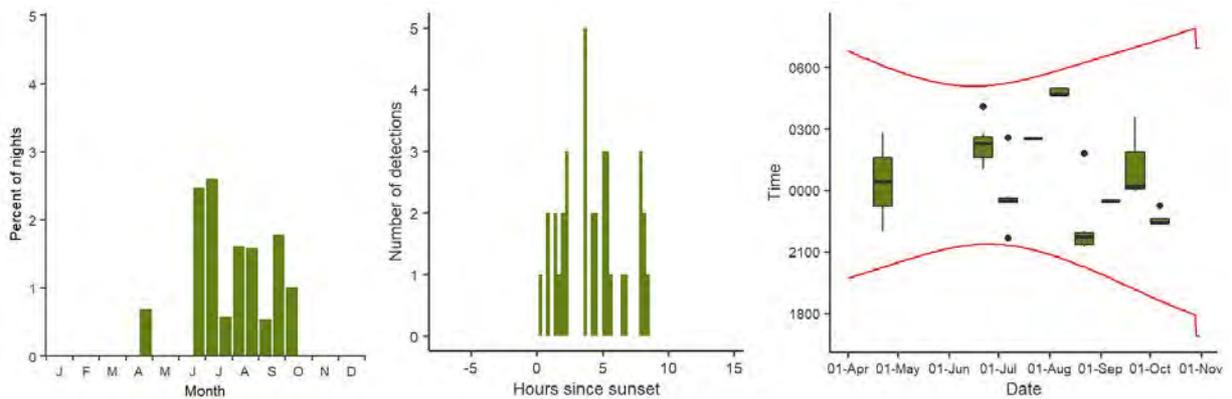
Natterer's Bat social calls

Natterer's Bat social calls *Myotis nattereri* were recorded on 20 nights, from 18 locations, giving a total of 35 recordings.

Spatial pattern of activity



Seasonal and nightly activity

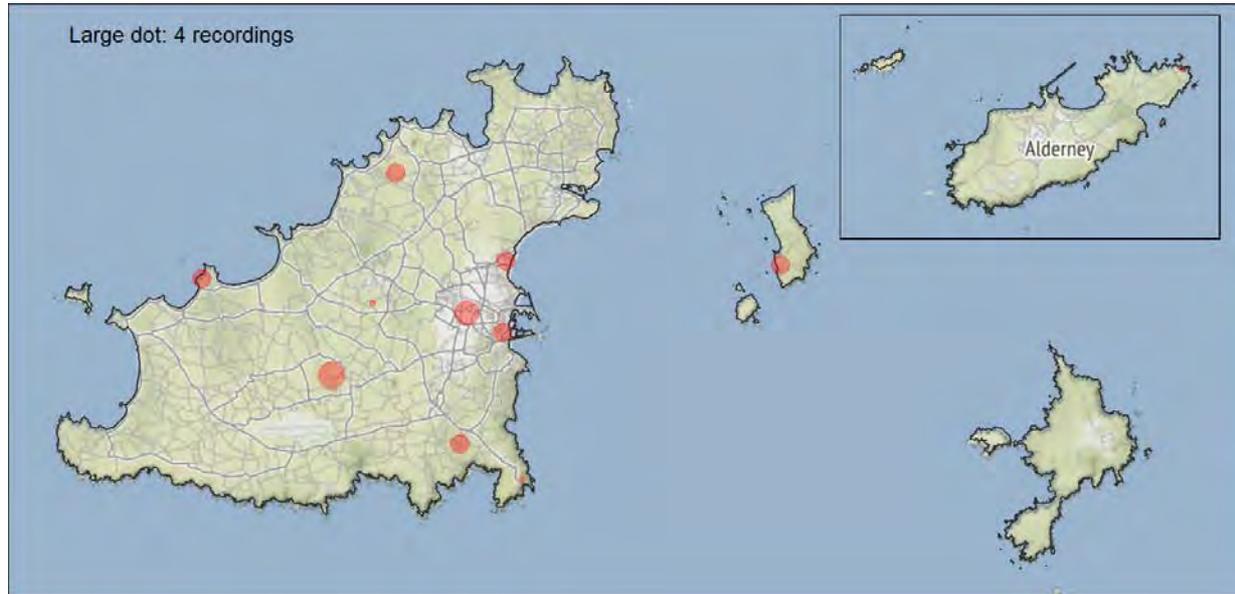


Social calls of bats are different from echolocation calls, which they use to navigate their way around the landscape, in that they are often used when bats interact with one another. Natterer's Bat social calls in October or November may be associated with swarming in the vicinity of roost sites. The largest number of social calls were recorded close to St. Saviour's parish church (an area suspected to be a swarming site) and in the area above Princess Elizabeth Hospital. Locations recording Natterer's Bat social calls tended to be in or next to areas of broad-leaved woodland.

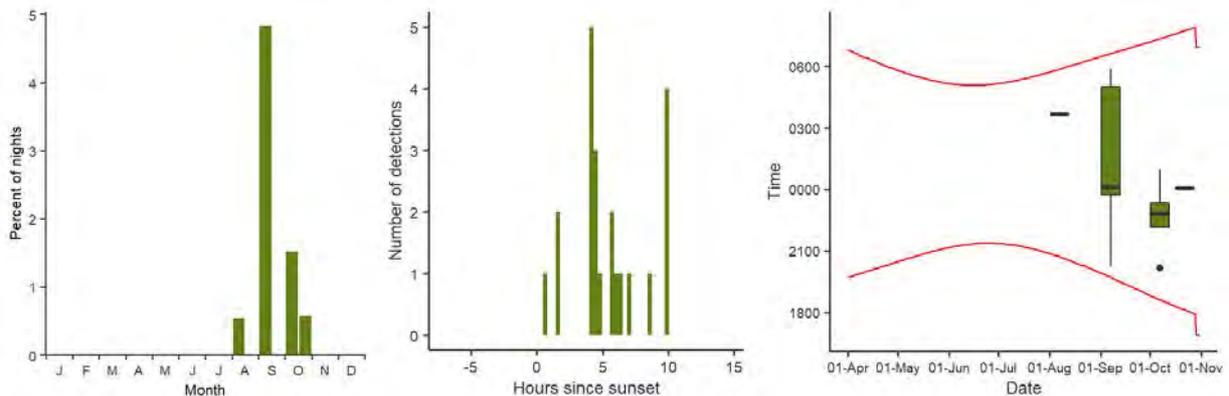
Leisler's Bat

Leisler's Bat *Nyctalus leisleri* was recorded on nine nights, from 11 locations, giving a total of 22 recordings.

Spatial pattern of activity

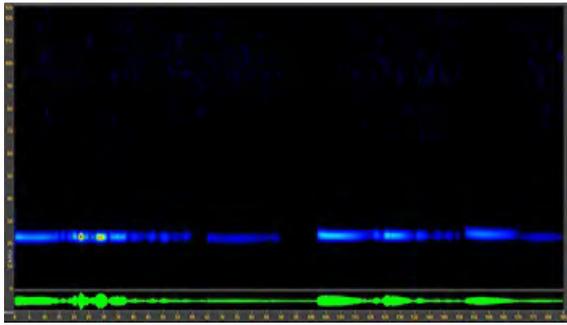


Seasonal and nightly activity

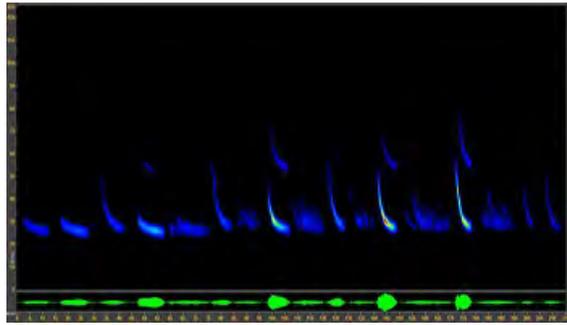


Leisler's Bat - new species for Herm. Two recordings of Leisler's Bat from Herm from the 11th October comprised the first record of this species for the island. As in 2021, the remaining records of Leisler's Bat were from Guernsey (10 locations, 20 recordings) from September or October, with the exception of a single early record of Leisler's Bat from the 10th August from close to Le Preel in the centre of Guernsey. All of these areas were fairly open, and were either in gardens or in areas of pasture and all consisted of one, or two recordings a few seconds apart, probably indicating that a single bat was passing through the area. It is very rare in Jersey and very localised on the nearby coasts of France. Leisler's Bat are known to be migratory and the pattern of records (all in autumn) does indicate that it is a rare, but regular migrant to the islands.

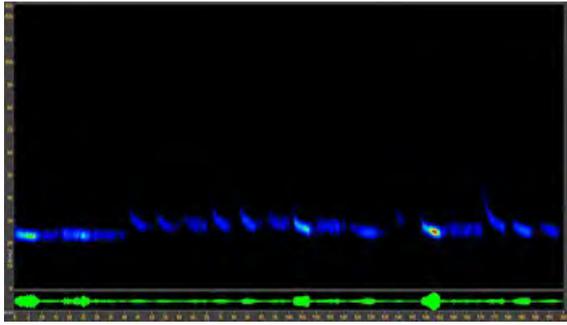
In most of the recordings, there are alternating call frequencies, which is typical for *Nyctalus*. Such alternating calls would be unexpected for Serotine, but also unlikely to be produced by Parti-coloured Bat *Vespertilio murinus*, which should probably be considered as a possible vagrant to the Channel Islands and produces calls which are otherwise extremely similar to Leisler's Bat. Narrowing down the identification further, given the call durations in the presumed Leisler's Bat recordings, it is clear the frequency of the calls, is higher than would be expected for Noctule given the flat call shape. For more information on the sound identification of Leisler's Bat see Identification Appendix 4.



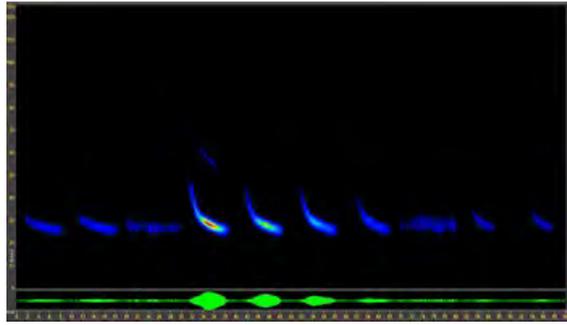
Leisler's Bat - Guernsey, 1st September



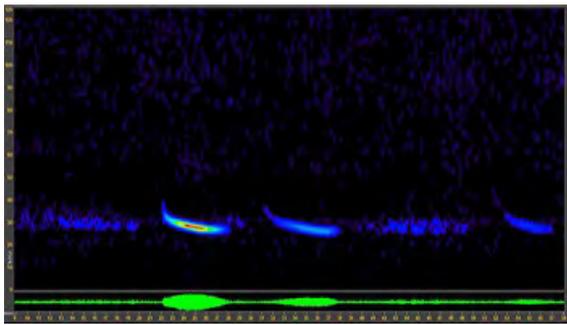
Leisler's Bat - Guernsey, 12th September



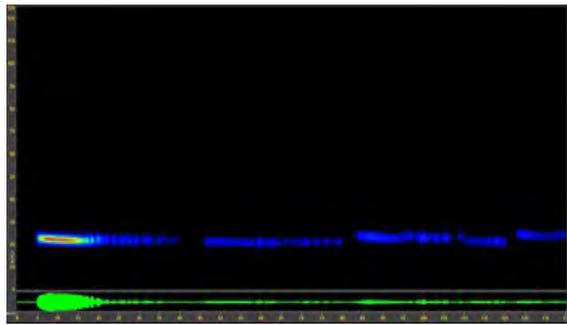
Leisler's Bat - Guernsey, 11th September



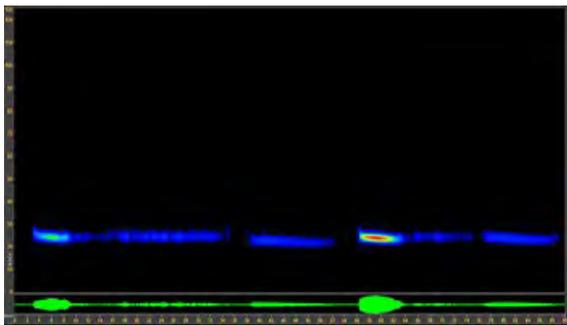
Leisler's Bat - Herm, 11th September



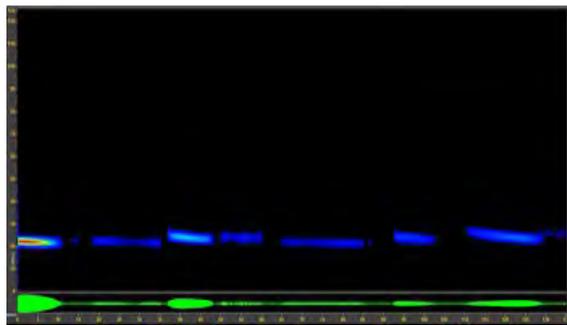
Leisler's Bat - Herm, 11th September



Leisler's Bat - Guernsey, 18th October



Leisler's Bat - Guernsey, 11th September



Leisler's Bat - Alderney, 13th October

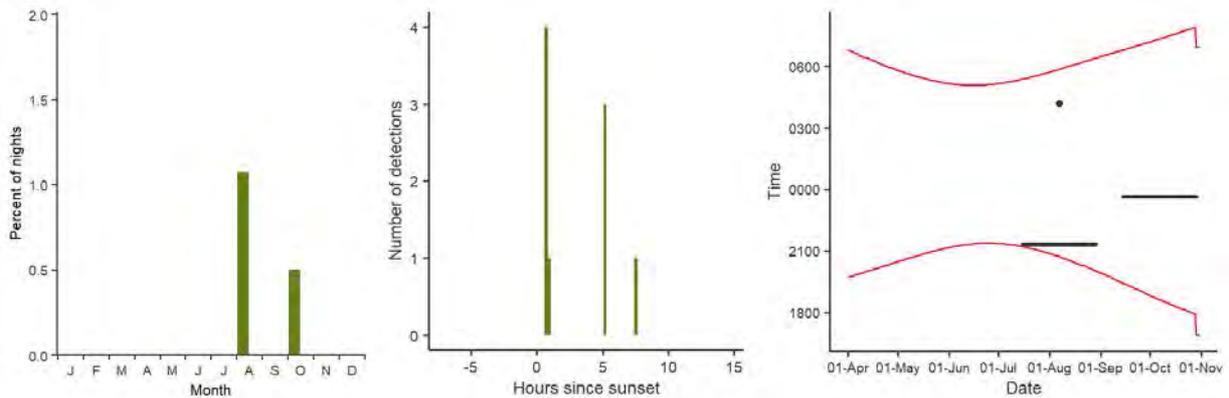
Common Noctule

Common Noctule *Nyctalus noctula* was recorded on three nights, from two locations, giving a total of 9 recordings.

Spatial pattern of activity



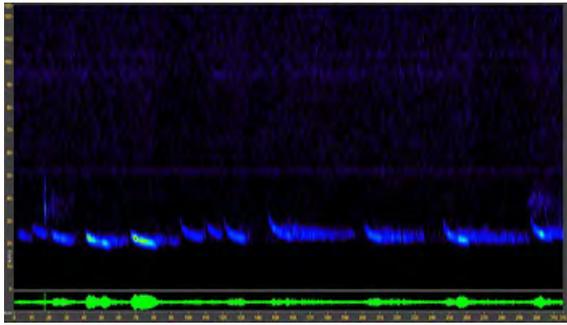
Seasonal and nightly activity



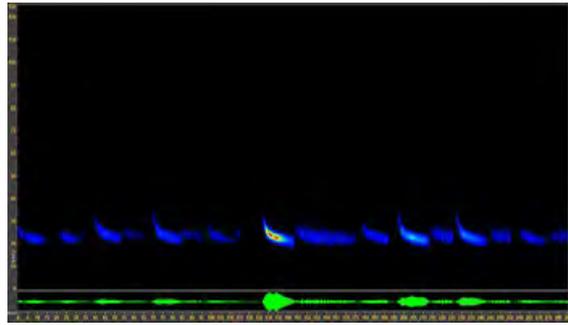
Common Noctule - new species for Alderney was first recorded on Alderney in a wooded area south-east of Newtown on the night of the 11th August (1 recording) and presumably the same individual was recorded again from the same location on the 12th August (5 recordings). The only other record from 2022 was also from Alderney on the 9th October (3 recordings) again from a wooded area in the Val du Saou part of the island.

Common Noctule are rare in Normandy and Brittany and data deficient in Jersey, with only a few acoustic recordings. Combined with the data from 2021 (likely a record of a single bat over 2 nights in Guernsey), it is likely that this is a very rare migrant in the Bailiwick.

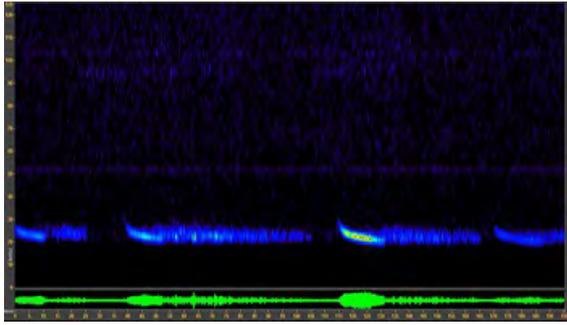
In the spectrograms below, we show spectrograms of some of the better quality Noctule calls. The calls here are very typical for Noctule and are too low in frequency for Leisler's Bat to be likely.



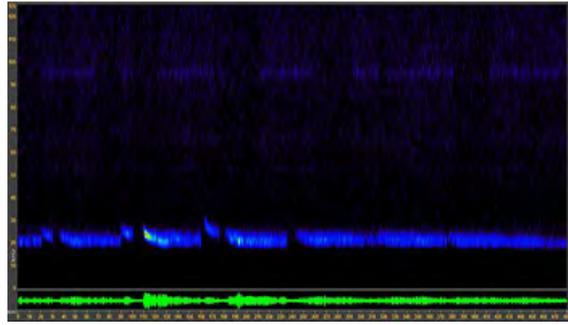
Noctule - Alderney, 9th October



Noctule - Alderney, 9th October



Noctule - Alderney, 9th October

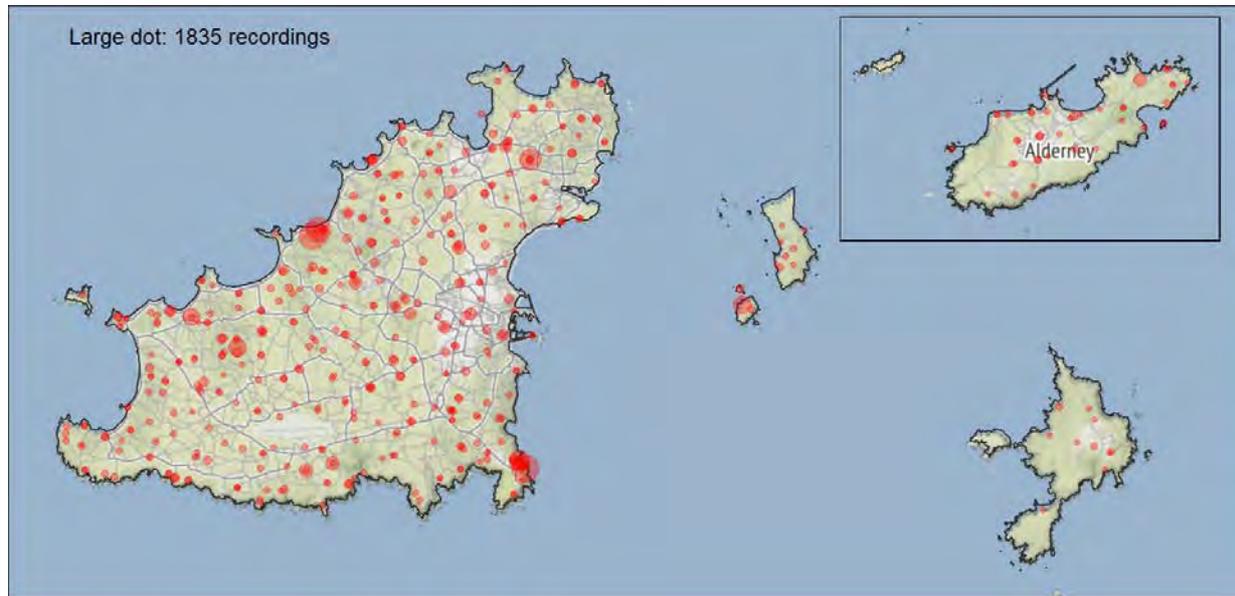


Noctule - Alderney, 12th August

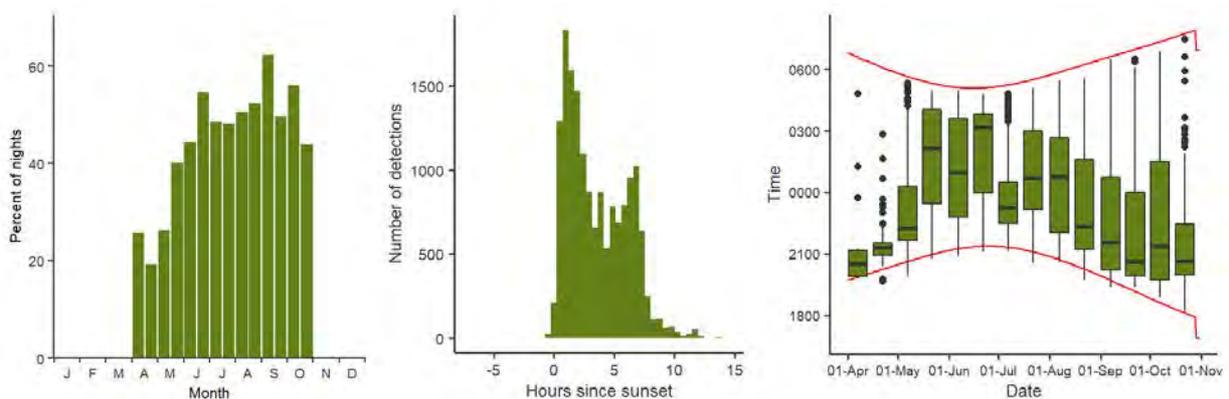
Kuhl's Pipistrelle or Nathusius' Pipistrelle

Kuhl's Pipistrelle or Nathusius' Pipistrelle *Pipistrellus kuhlii* or *P. nathusii* was recorded on 191 nights, from 454 locations, giving a total of 16,045 recordings.

Spatial pattern of activity



Seasonal and nightly activity



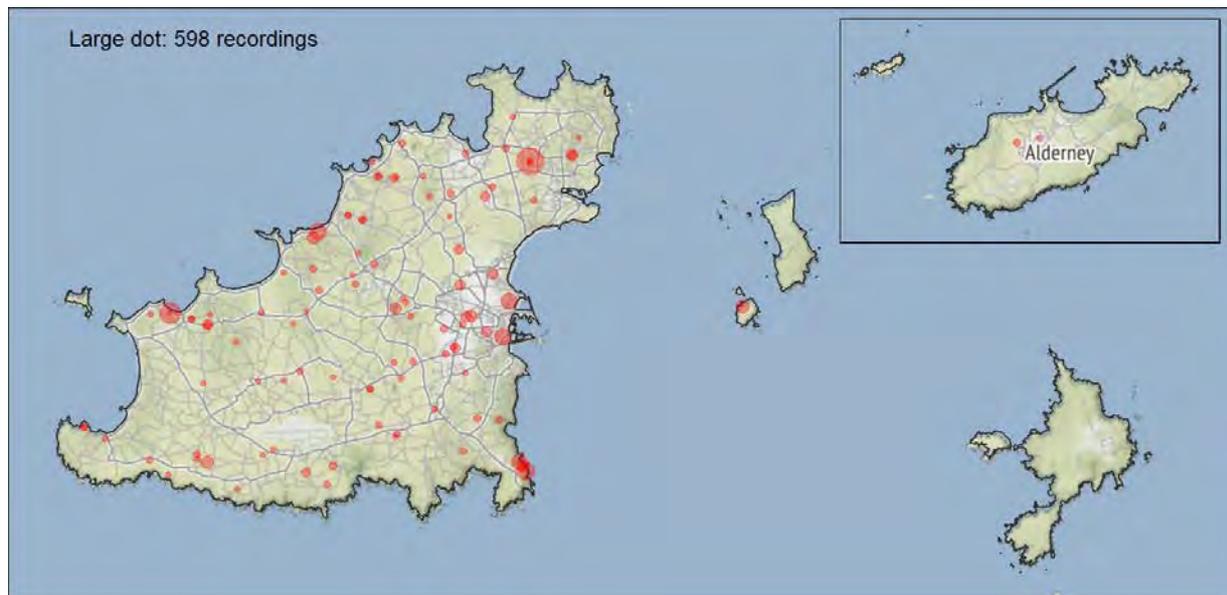
Nathusius' or Kuhl's Pipistrelle. We present here results for Kuhl's Pipistrelle and Nathusius' Pipistrelle combined. These two species are extremely difficult to distinguish from their echolocation calls (see Identification Appendix 5) and are best treated as a species pair, although social calls are clearly different and are reliably identified (see separate section below on social calls). Testing of the current BTO Acoustic Pipeline classifier for the Channel Islands with independent known species recordings, suggests that a relatively low error rate for echolocation calls is in the region of about 10% for both species, but more work is needed to look at this. The classifier initially assigned over 90% of Kuhl's Pipistrelle or Nathusius' Pipistrelle recordings to Kuhl's Pipistrelle.

This species pair have been recorded on every island where detectors were placed. It was extremely widespread with generally low numbers of recordings (95% of the detections at a site involved fewer than c. 40 recordings per site), although some sites such as at Le Guet and Jerbourg in Guernsey held much larger numbers exceeding 1,800 in one case.

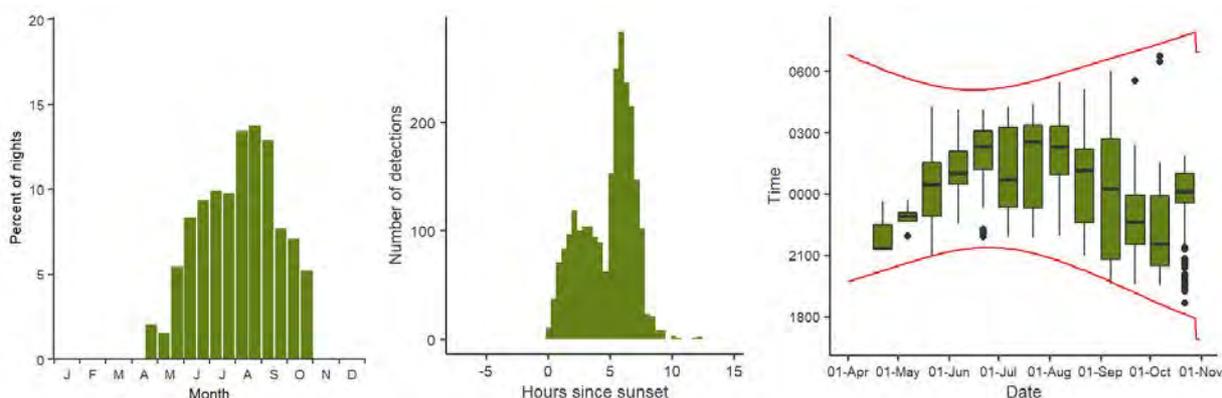
Kuhl's Pipistrelle social calls

Kuhl's Pipistrelle social calls *Pipistrellus kuhlii* were recorded on 126 nights, from 103 locations, giving a total of 2,421 recordings.

Spatial pattern of activity



Seasonal and nightly activity



Kuhl's Pipistrelle These social calls are very different from echolocation calls of Nathusius' Pipistrelle so we can assign these calls to Kuhl's Pipistrelle with confidence (see Identification Appendix 4).

Social calls were recorded from approximately twice the number of nights and locations compared with the 2021 survey. Kuhl's Pipistrelle social calls were recorded across the survey season (late April to October), across multiple sites, whereas Nathusius' Pipistrelle social calls were only recorded from October at two sites, one at the reservoir behind Corblets beach in Alderney on 3-4 October, and in the Monnaie/Talbots Valley area in Guernsey (single call on 8 October).

It is clear that Kuhl's Pipistrelle is a common and widespread breeding species on all the major islands in the Bailiwick. This builds on evidence from Guernsey, where in 2018, three juvenile Kuhl's Pipistrelle's were caught, and one radio-tracked to a roost on Guernsey (Binet & Walsh, 2020).

As in 2021, there was a tendency for Kuhl's Pipistrelle social calls to be produced late in the night between June until September, but there appears to be a change in behaviour between about mid-September and November, when social calls were produced early in the night. This change in behaviour fits with Russ et al., (2021), which suggests that the function of social calls of Kuhl's Pipistrelle earlier in the season is often associated with the defence of resources, but later in the season, social calls may relate to mating activity.

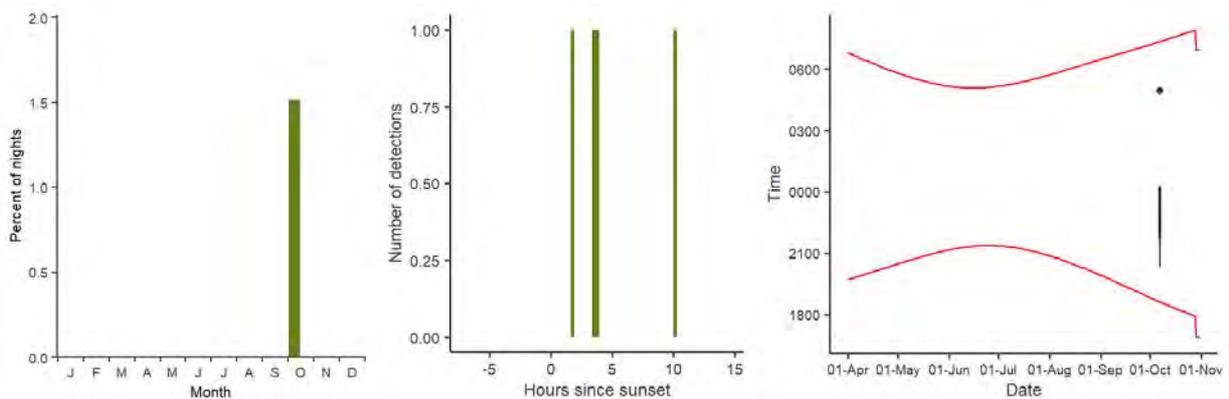
Nathusius' Pipistrelle social calls

Nathusius' Pipistrelle social calls *Pipistrellus nathusii* were recorded on three nights, from two locations, giving a total of 4 recordings.

Spatial pattern of activity



Seasonal and nightly activity



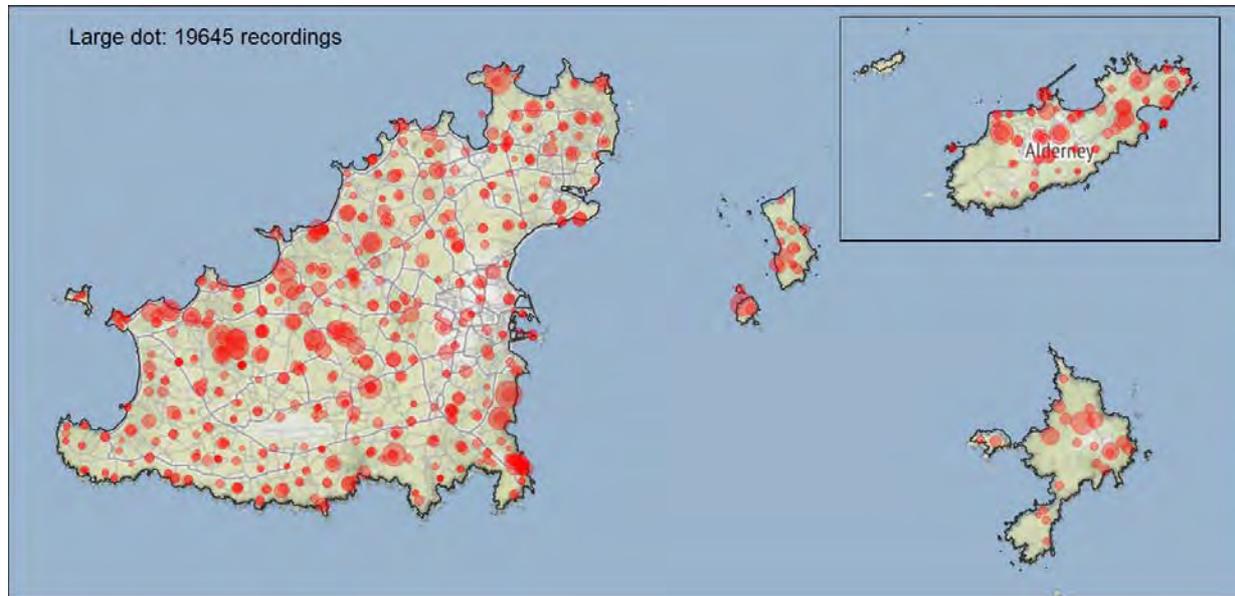
Nathusius' Pipistrelle In contrast to echolocation calls, social calls of Nathusius' Pipistrelle can be assigned to species with confidence (see Identification Appendix 4). The social calls recorded, have mainly comprised of male advertisement calls (i.e. they are calling for a female). In 2021 they were recorded on 14 nights from 12 locations with a total of 123 recordings. In stark contrast, in 2022, these calls were only recorded from one location in Guernsey and from a second location on Alderney, both in early October. Quite why there were so scarce in 2022 is unknown.

The timing of the male advertisement calls fits in with what is known about when Nathusius' Pipistrelles mate, and the question is whether these are newly arrived migrants setting up territories to attract females, or whether they are individuals that are resident, but are being overlooked because they have not given out social calls prior to this. The distribution of social calls is much more restricted compared to Kuhl's, both spatially (12 vs 53 locations in 2021; 2 vs 103 locations in 2022) and temporally (Kuhl's: April to October; Nathusius': September-October only). All previous records found and reported on in the *Transactions of La Société Guernesaise* have been from September to April, which perhaps points to this being migrant and winter visitor. Intriguingly a juvenile Nathusius' Pipistrelle was trapped on 28th August 2022. Although early, this could still be a migrant and further work is needed to understand the status of this species better, i.e. is it a rare resident or solely a migrant and winter visitor.

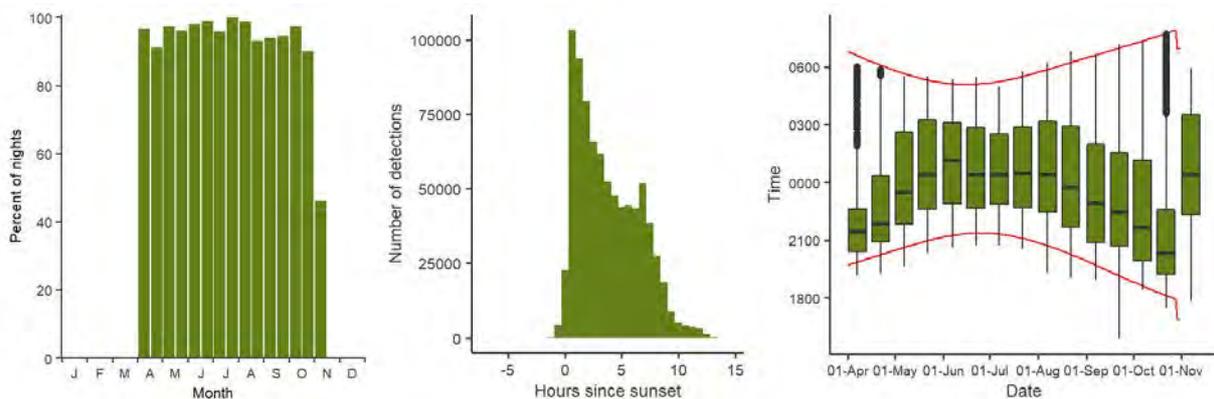
Common Pipistrelle

Common Pipistrelle *Pipistrellus pipistrellus* was recorded on 208 nights, from 617 locations, giving a total of 824,898 recordings.

Spatial pattern of activity



Seasonal and nightly activity



As in 2021, **Common Pipistrelle** was by far the most common and widely recorded bat species, with 824,898 recordings from 617 different locations (99% of survey locations) and a maximum of 5,735 recordings per night at an individual site. It was the only species of bat to be recorded on every island surveyed. As with several other bat species, there were concentrations in the southeast and in the centre-west region of Guernsey, but it was common in each island that was surveyed. There is an indication that built up and well-lit areas were associated with fewer recordings, with areas around St Peter Port and the airport on Guernsey having the lowest number of recordings.

In the winter roost surveys, it was under-represented in the tunnel surveys compared with the results we are getting from the wider spring-summer survey and the rarer species predominated showing the importance of underground structures for these species. Common Pipistrelles tend to hibernate more in buildings, often in roofs, or behind soffits and sympathetic building techniques are recommended when re-roofing or improving houses to allow them to roost.

Common Pipistrelle is normally straightforward to identify acoustically, but particular care is needed given calls at the low or high frequency end of the range for this species, which could be mis-identified as Nathusius' Pipistrelle or Soprano Pipistrelle respectively. For these it is important to consider the call duration, and not just the peak or end frequency of the calls. In addition, where there are multiple individuals of the same species present, there can be frequency shifting as one or both individuals 'shift' their frequencies to avoid acoustic interference, which again can result in some calls in a sequence that are higher in frequency than would be typical for the species.

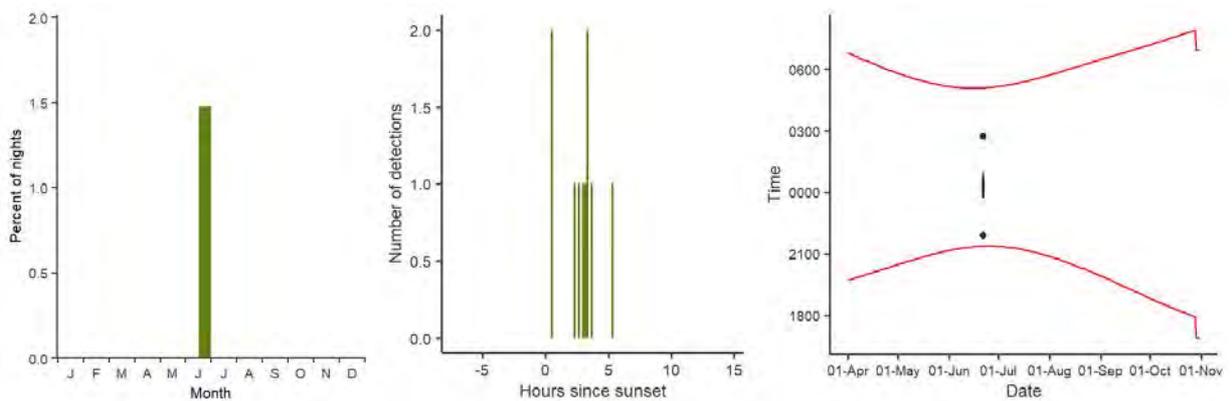
Soprano Pipistrelle

Soprano Pipistrelle *Pipistrellus pygmaeus* was recorded on three nights, from one location, giving a total of 10 recordings.

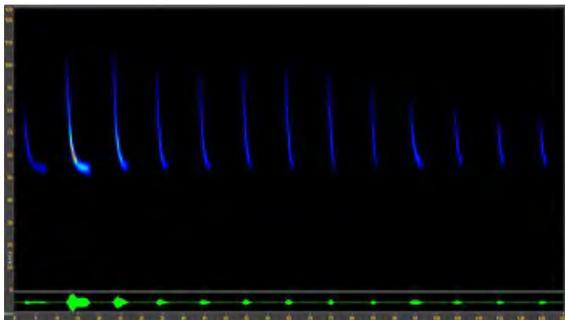
Spatial pattern of activity



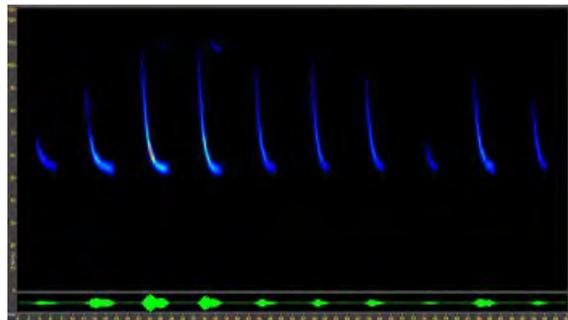
Seasonal and nightly activity



Soprano Pipistrelle - new species for Alderney for the project. Whilst there are previous records of Soprano Pipistrelle from Alderney, the ten recordings over three nights in June 2022 (22nd, 23rd and 26th June) are the first records of Soprano Pipistrelle for the project. They are all from the same location in a residential area in the southern edge of St Annes. The timing of the records suggests that Soprano Pipistrelle could be a resident species on Alderney.



Soprano Pipistrelle - Alderney, 23rd June

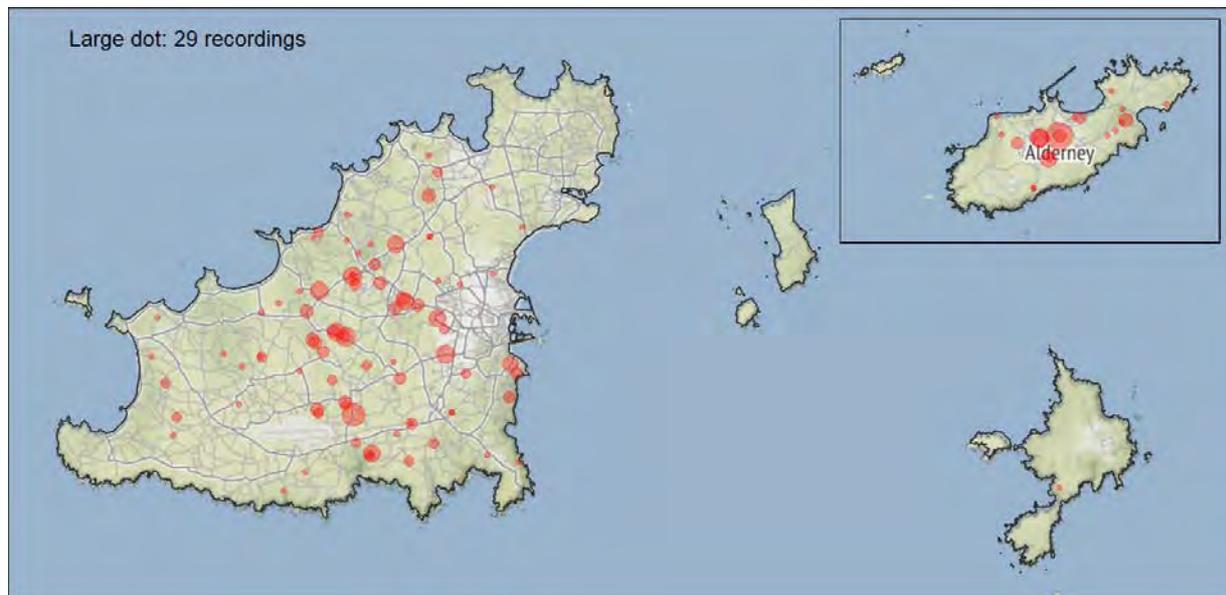


Soprano Pipistrelle - Alderney, 23rd June

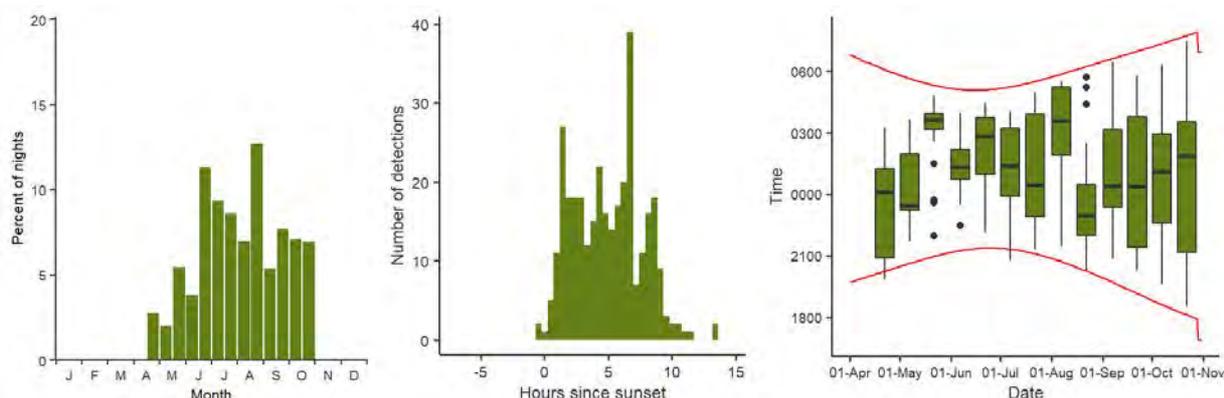
Brown Long-eared Bat

Brown Long-eared Bat *Plecotus auritus* was recorded on 112 nights, from 102 locations, giving a total of 327 recordings.

Spatial pattern of activity



Seasonal and nightly activity



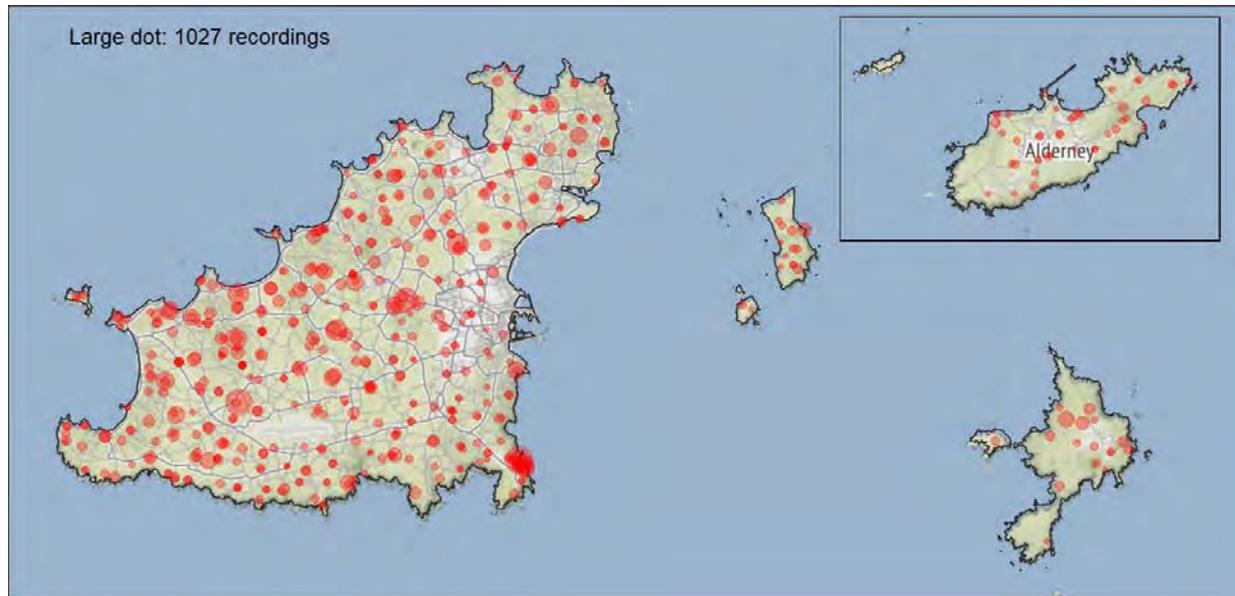
Brown Long-eared Bat was recorded from Guernsey and Alderney only, matching our findings in 2021. A similar number of recordings was obtained (313 in 2021, 327 in 2022), but it was found in more places and nights in 2022 (79 nights/75 locations in 2021; 112 nights/102 locations in 2022). In 2021, we found that Brown Long-eared Bat was recorded more widely between mid-September and the end of October than earlier in the season, and suggested that this could be related to a habitat shift away from a close association with woodland in summer to more open habitats in autumn, but this pattern did not hold in 2022 and the records were very much clustered in the interior of Guernsey, with few records away from wooded areas. In 2021, there were also records from wooded south coast valleys and areas like Bluebell Wood on the southeast coast of Guernsey.

Brown Long-eared Bat is common in neighbouring France, but it is considered rare in Jersey (Binet & Walsh, 2020; Hall, 2021). Jersey Bat Group indicate that Brown Long-eared Bat is possibly under-recorded on Jersey (Hall, 2021).

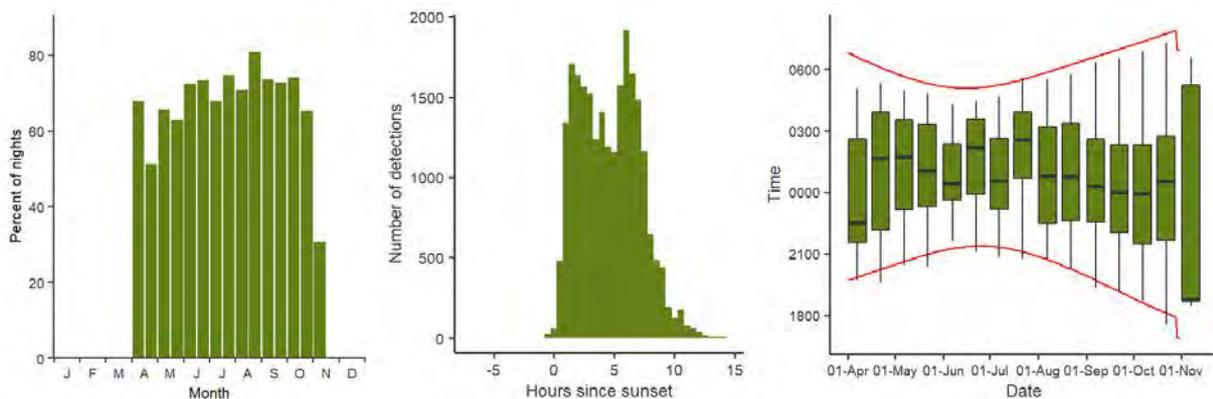
Grey Long-eared Bat

Grey Long-eared Bat *Plecotus austriacus* was recorded on 208 nights, from 527 locations, giving a total of 23,359 recordings.

Spatial pattern of activity



Seasonal and nightly activity



Grey Long-eared Bat. In contrast to the UK, Grey Long-eared Bat is the most common and widespread long-eared bat species on the islands. Of 23,686 *Plecotus* recordings which we assigned to species (where a recording was of sufficient quality, and where we were sufficiently confident to assign the recording to species), 23,359 recordings (98.6%) were assigned to Grey Long-eared Bat. Grey Long-eared Bat was recorded from 527 locations (85% of surveyed locations), and included recordings from Guernsey & Lihou, Alderney, Herm & Jethou and Sark & Brecqhou. Burhou is the only significant island in the Bailiwick on which it has not been recorded.

During 2022, a maternity roost was discovered in a church in the Vale in Guernsey. A total of 31 Grey Long-eared Bats were observed emerging at dusk on 29th May 2022. Bats have the ability to use even the smallest opening or crack in a building to enter and form a roost. Sympathetic construction techniques are important to enable bats to continue using our buildings.

For a visual comparison of the calls of Brown Long-eared Bat and Grey Long-eared Bat of the same call duration (i.e. comparing like with like) see Identification Appendix 6.

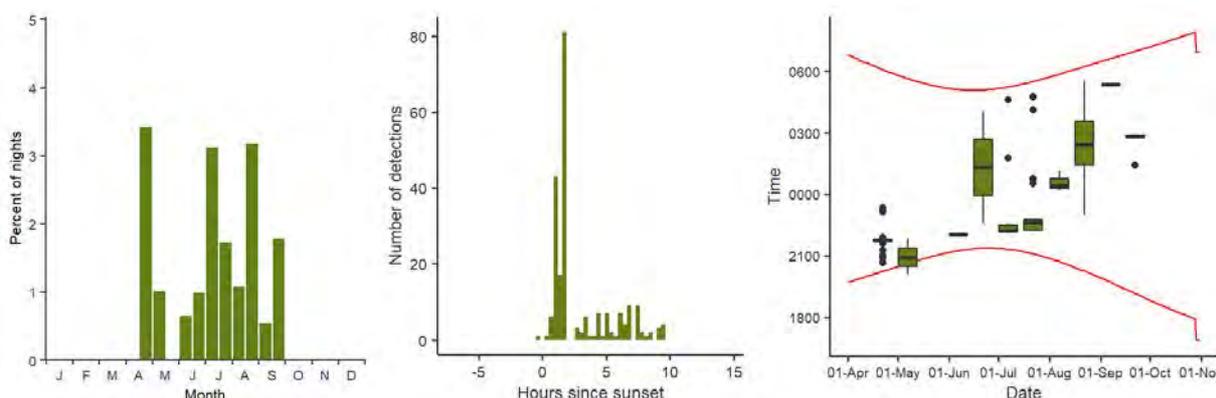
Greater Horseshoe Bat

Greater Horseshoe Bat *Rhinolophus ferrumequinum* was recorded on 30 nights, from 19 locations, giving a total of 221 recordings.

Spatial pattern of activity



Seasonal and nightly activity

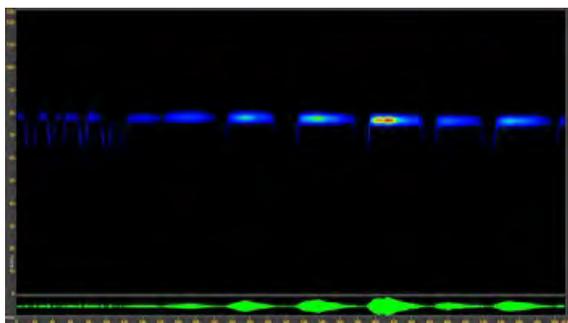


Greater Horseshoe Bat is an iconic bat species that is often used as a flagship for bat conservation. It is a rare resident in Guernsey. Compared with 2021, we received records from approximately twice the number of sites and had many more recordings – 25 (2021) vs 221 (2022) recordings. In 2021, the majority of records comprised a single recording from a location a night up to five recordings. In 2022, we had a large number of recordings from the Jerbourg area and had up to 69 recordings in an area of pine trees where the bats were likely to be foraging. Similar large numbers of recordings were obtained at two other sites which were known winter roosts. Six recordings were obtained from the Shingle Bank/Colin Best Nature Reserve area in April 2022 over two nights confirming a pattern also seen in 2021. Although this seems like an odd place for a Horseshoe Bat to be, it might suggest that there is a roost nearby and that this individual was transiting the area.

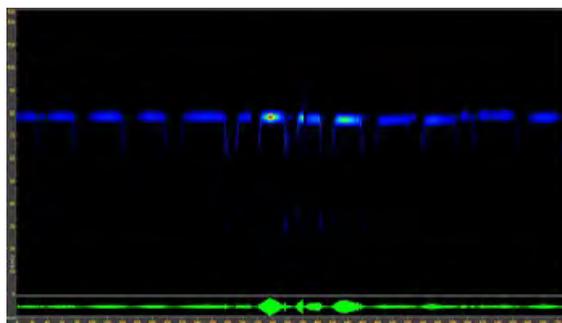
Still no breeding sites have been found in Guernsey and we ask volunteers to remain vigilant, but if found to not touch or otherwise disturb the bats. Horseshoe bats are obvious when roosting – they hang freely from the ceiling and wrap their wings around themselves. Other species will hide away in cracks in buildings and old trees. In other areas where they occur, they breed in old buildings, such as quiet undisturbed barns and require free access to the space as they will fly straight in and not alight and crawl into cracks as other species do. A gap the size of a large letter box is sufficient.

During the winter they hibernate or spend time in ‘torpor’ in caves, old cellars and cold, damp places which are dark and undisturbed. Last winter, we surveyed a number of German tunnels and found Greater Horseshoe Bats in one

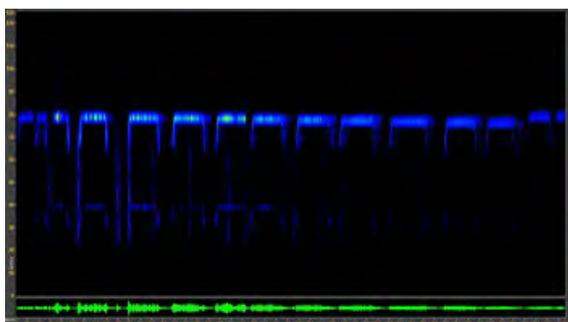
known site and in another newly surveyed tunnel complex. There are clearly a number of Greater Horseshoe Bats present on the island year-round and while the number of hibernation sites is limited and reasonably well known, there are a lot of buildings which might be suitable for maternity colonies. Given what was most likely foraging activity recorded in the Jerbourg area, a more systematic search of the area in summer might provide evidence of breeding colonies. Females form maternity colonies in buildings which remain dark, undisturbed and warm throughout the summer – old barns with slate roofs are ideal. They give birth in late June up until the end of July and pups are weaned c. 6-7 weeks later. In 2021, we did not record Greater Horseshoe Bat in July or August, but in 2022, there were a number of recordings from three main areas in Jerbourg (100 recordings), close to St. Saviour’s parish church (40 recordings), and Le Guet (59 recordings).



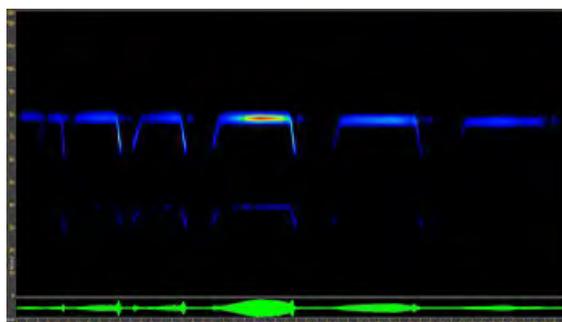
Greater Horseshoe Bat - Guernsey, 17th April



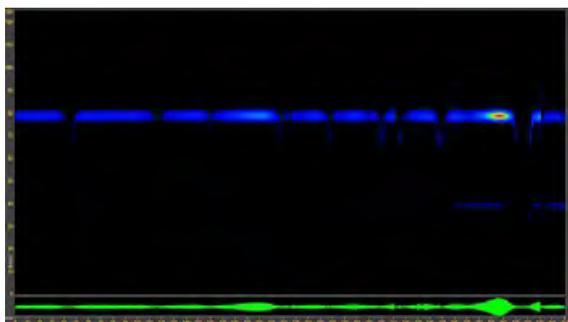
Greater Horseshoe Bat - Guernsey, 18th September



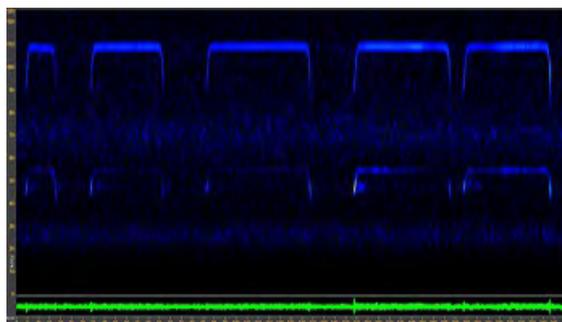
Greater Horseshoe Bat - Guernsey, 21st August



Greater Horseshoe Bat - Guernsey, 21st August



Greater Horseshoe Bat - Guernsey, 24th April



Lesser Horseshoe Bat (comparison), Guernsey, 7th May

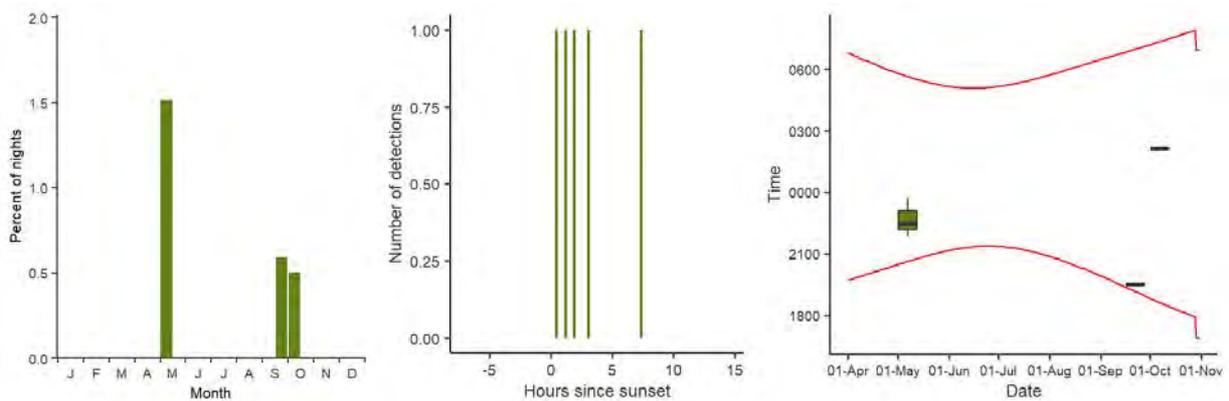
Lesser Horseshoe Bat

Lesser Horseshoe Bat *Rhinolophus hipposideros* was recorded on four nights, from five locations, giving a total of 5 recordings.

Spatial pattern of activity



Seasonal and nightly activity



Lesser Horseshoe Bat was recorded as a new species for Guernsey in 2021 (two recordings in April in St Martins). It was perhaps not unexpected as, although very rare, it has been recorded in Jersey and is present in neighbouring France. In 2022, Lesser Horseshoe Bat was recorded on five occasions (single recordings) between April and October, all from the Jerbourg area. This is arguably one of the most frustrating of species to survey on Guernsey. The record from 2021 was in the same area as the five locations recorded in 2022 so clearly there is at least one Lesser Horseshoe Bat in the area. The timing is intriguing, with a gap in mid-summer. Across the two years, it has been recorded in April-May and September-October. This may be a product of survey effort but surveyors did operate in the area in summer as well. More focused surveys in mid-summer to pick up this species and narrow down any possible maternity roosts of Lesser Horseshoe Bat would be a priority for the 2023 survey season.

This species produces echolocation calls where the maximum (peak) energy is in the range of 107-114 kHz. The only likely confusion species is Greater Horseshoe Bat, but this produces calls with maximum energy in the range of 77-84 kHz.

4.3.2 Small terrestrial mammal species

In this section we look at the recordings that we can assign to small terrestrial mammals.

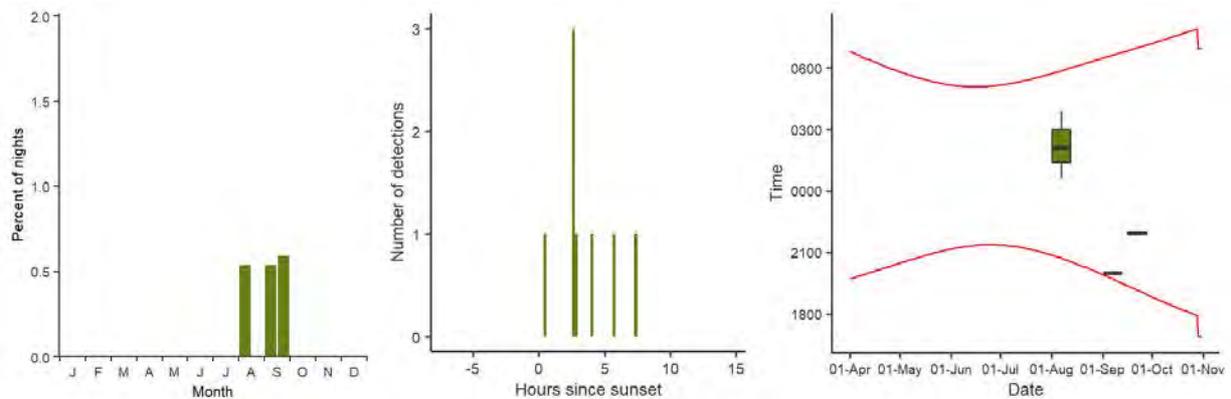
Wood Mouse

Wood Mouse *Apodemus sylvaticus* was recorded on three nights, from three locations, giving a total of 8 recordings.

Spatial pattern of activity



Seasonal and nightly activity

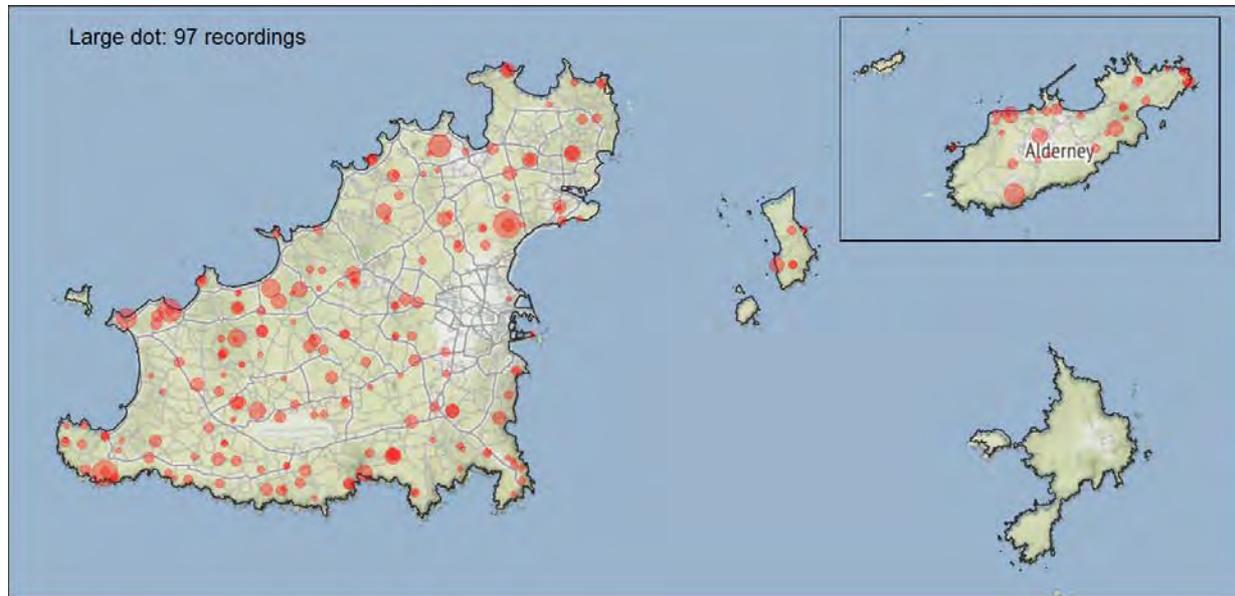


Wood Mouse Compared with the other small terrestrial mammal species here, the calls of Wood Mouse are not as loud, and so are likely to be under-recorded compared with shrews and rats. The detection distance of Wood Mouse is only about 1.5-m and so mounting the detector high on a pole, whilst ideal for bats, is likely to under-record this species (Newson *et al.* 2022). For more information on the sound identification of Wood Mouse see Newson *et al.*, (2021).

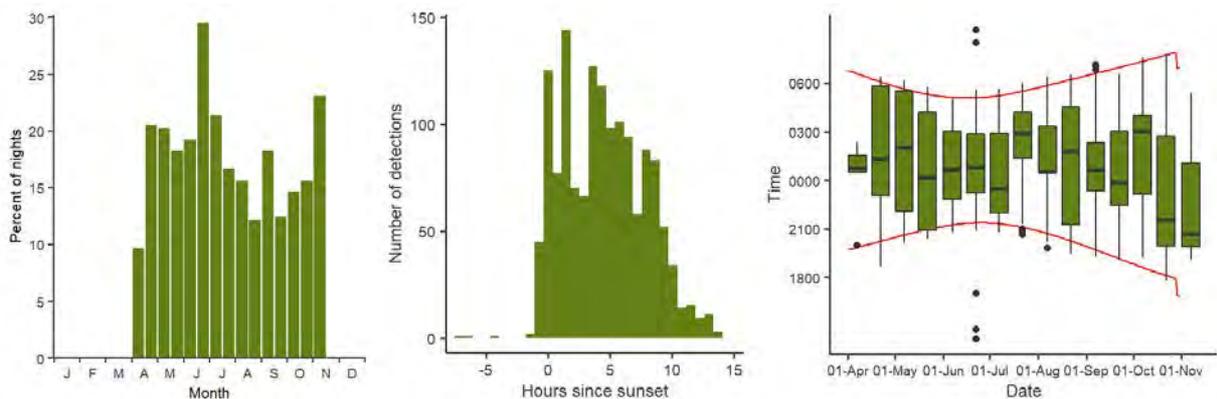
Greater White-toothed Shrew

Greater White-toothed Shrew *Crocidura russula* was recorded on 181 nights, from 217 locations, giving a total of 1,437 recordings.

Spatial pattern of activity

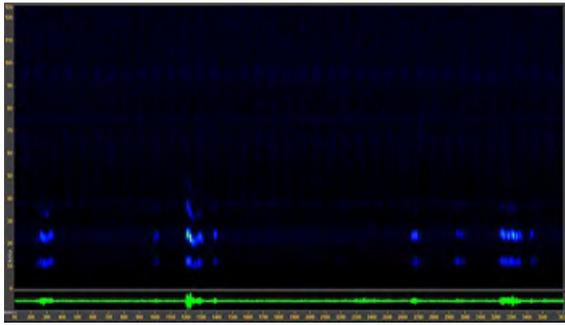


Seasonal and nightly activity

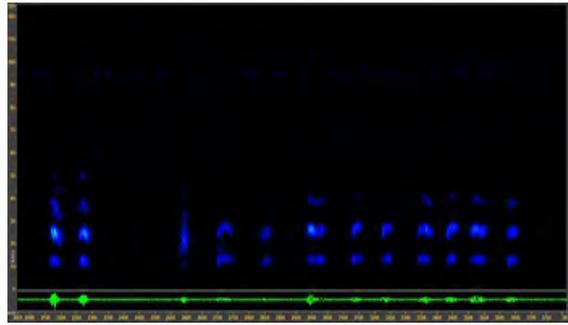


Greater White-toothed Shrew was recorded on Guernsey, Alderney and Herm and it is not present on the smaller islands. Lesser White-toothed Shrew replaces this species on Sark. They were extremely widespread and were present on three islands, being associated with farmland and gardens. In 2021, the reporting rate increased from 15-20% of nights from April to August to c. 35% in September and October, but a similar pattern was not seen in 2022. This is the first time that such a comprehensive map of small mammal activity has been made for the islands, and with so much data it provides an ideal opportunity to look at habitat use of this poorly known species.

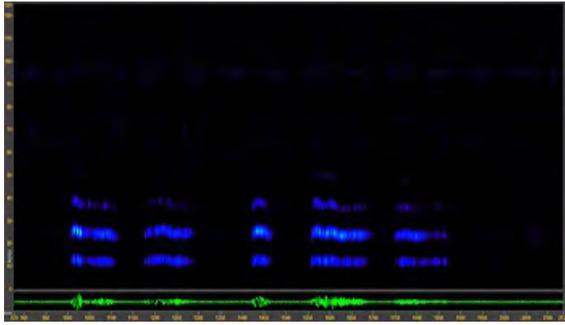
The calls sound quite different from those of Common Shrew *Sorex araneus*, Pygmy Shrew *Sorex minutus* and Water Shrew *Neomys fodiens* found on mainland UK and described in Newson *et al.*, (2021). In particular, the calls are shorter in duration, which makes the calls sound more abrupt.



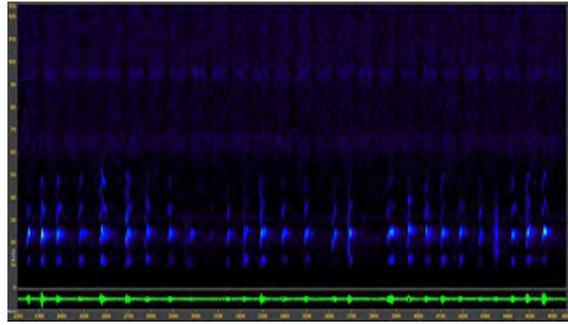
Greater White-toothed Shrew - Guernsey, 11th June



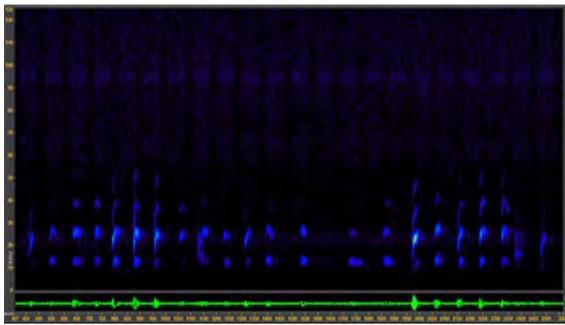
Greater White-toothed Shrew - Guernsey, 11th June



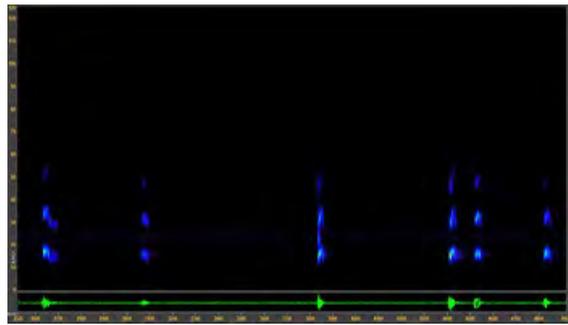
Greater White-toothed Shrew - Guernsey, 11th June



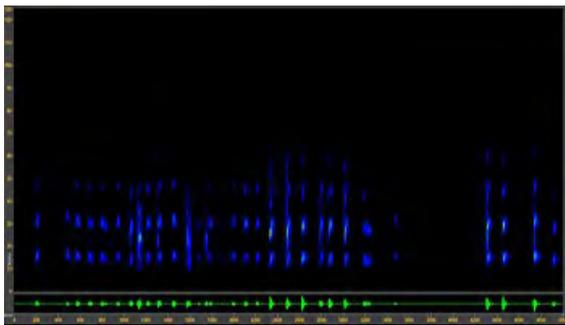
Greater White-toothed Shrew - Guernsey, 23rd June



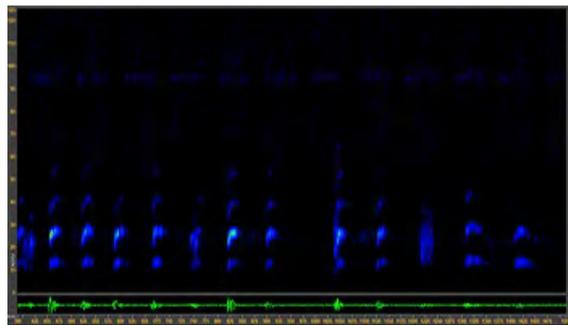
Greater White-toothed Shrew - Guernsey, 21st April



Greater White-toothed Shrew - Guernsey, 1st June



Greater White-toothed Shrew - Guernsey, 1st June



Greater White-toothed Shrew - Guernsey, 21st May

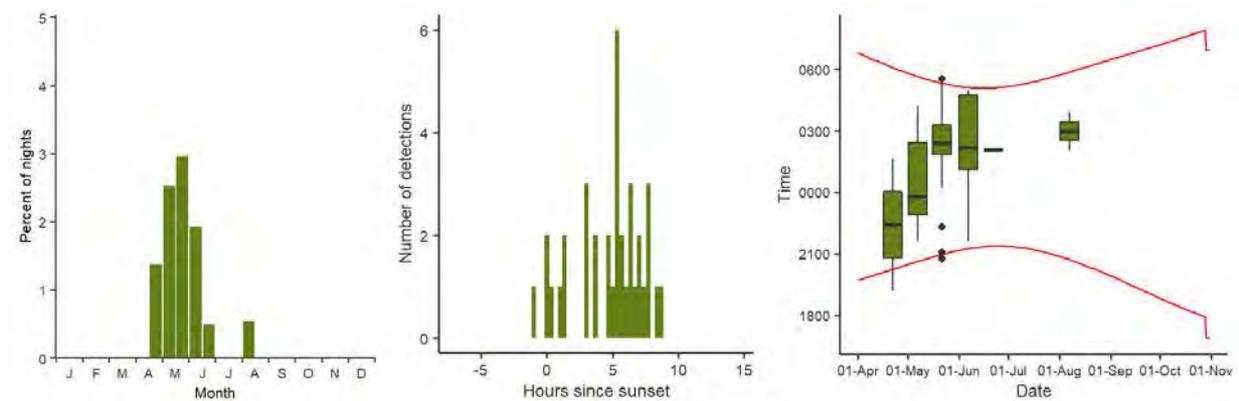
Lesser White-toothed Shrew

Lesser White-toothed Shrew *Crocidura suaveolens* was recorded on 17 nights, from 11 locations, giving a total of 36 recordings.

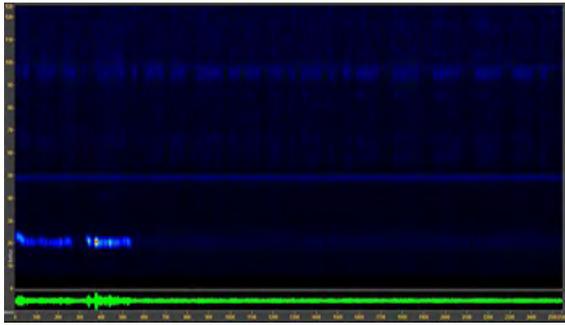
Spatial pattern of activity



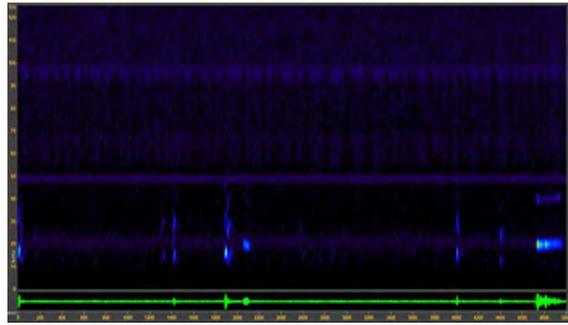
Seasonal and nightly activity



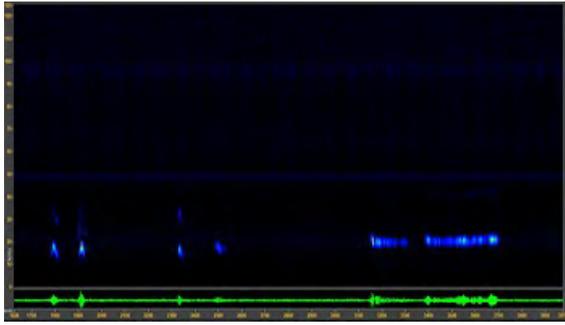
Lesser White-toothed Shrew was only recorded on Sark, where Lesser White-toothed Shrew is the only shrew species present. Last season, based on only seven recordings from Sark, we believed that the calls of Lesser White-toothed shrew were higher in frequency than the calls of Greater White-toothed Shrew which we can now confirm. Having collected further recordings of Lesser White-toothed Shrew from Sark this season, combined with the collection of over 400 recordings of Lesser White-toothed Shrew from the Isles of Scilly where Lesser White-toothed Shrew is the only shrew species present (thanks to Darren Hart from the Isles of Scilly Wildlife Trust), we now know that in most situations it should be straightforward to distinguish these species acoustically. Whilst the two shrew species do not occur together on any island in the Channel Islands for there to be a chance of misidentifying these species here, it may be useful to be able to distinguish these species acoustically on the continent.



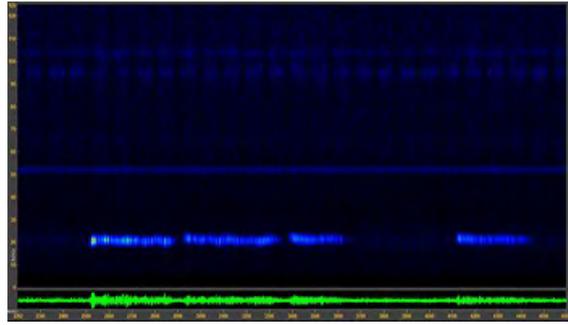
Lesser White-toothed Shrew - Sark, 25th May



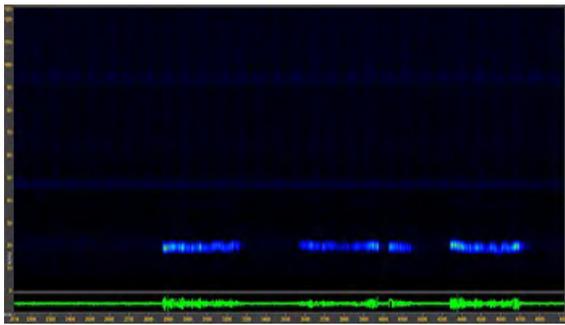
Lesser White-toothed Shrew - Sark, 25th May



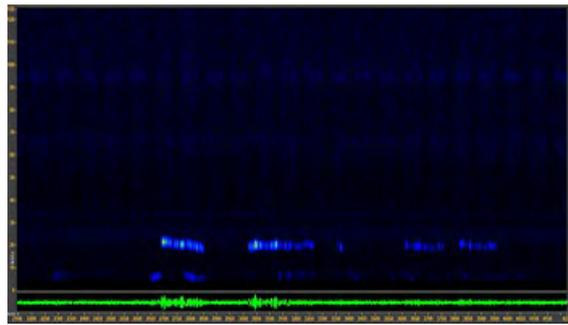
Lesser White-toothed Shrew - Sark, 25th May



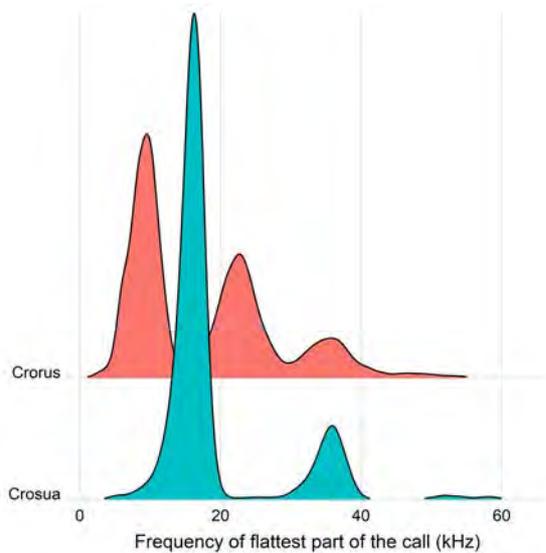
Lesser White-toothed Shrew - Sark, 10th May



Lesser White-toothed Shrew - Sark, 28th April



Lesser White-toothed Shrew - Sark, 10th June

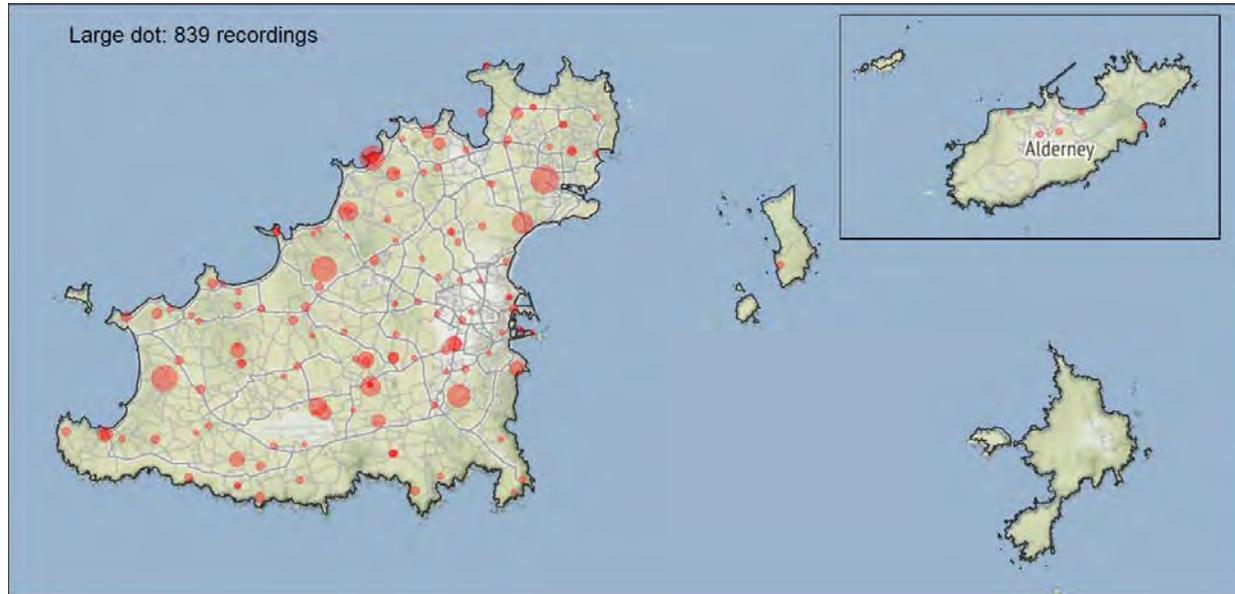


Frequency distribution of calls of Greater White-toothed Shrew (Crosus) and Lesser White-toothed Shrew (Crosua)

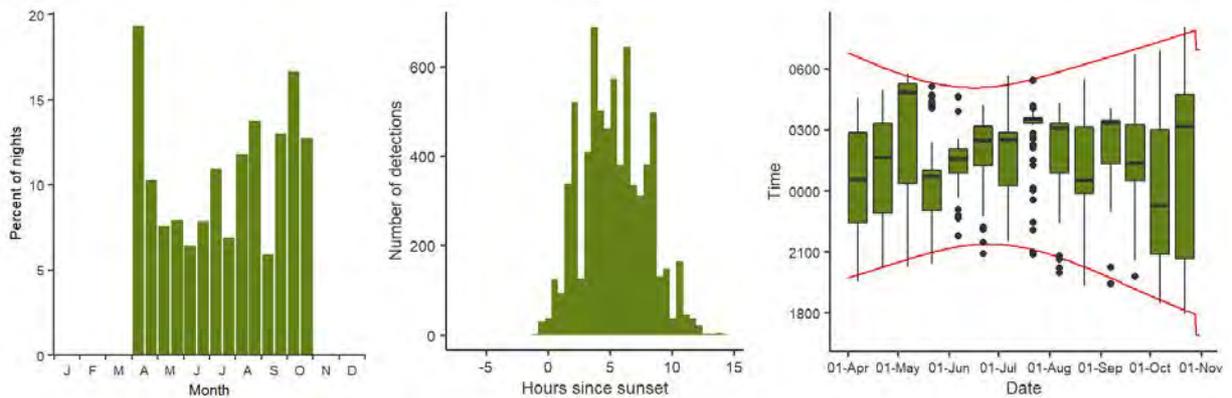
Brown Rat

Brown Rat *Rattus norvegicus* was recorded on 138 nights, from 138 locations, giving a total of 7,058 recordings.

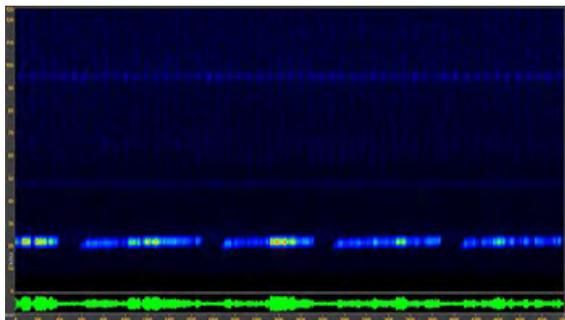
Spatial pattern of activity



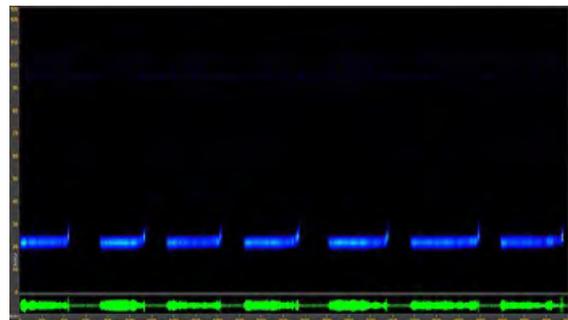
Seasonal and nightly activity



Brown Rat was recorded on Guernsey, Alderney and Herm. Brown Rat is extremely similar acoustically to Black Rat (see Newson *et al.*, 2021). As would be expected, it was extremely widespread in Guernsey, but less so on the other islands. Unlike most bat species where we recorded more activity from a larger number of locations in 2022, the opposite was true for this rat species. We recorded it on 171 nights at 172 locations in 2021, compared to 138 nights from 138 locations in 2022.



Brown Rat - Guernsey, 3rd August



Brown Rat - Guernsey, 16th May

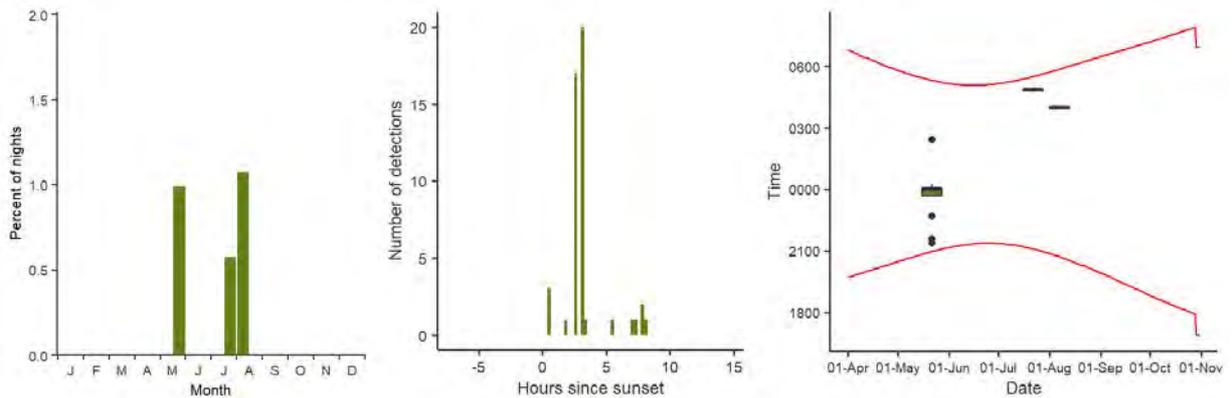
Black Rat

Black Rat *Rattus rattus* was recorded on five nights, from two locations, giving a total of 48 recordings.

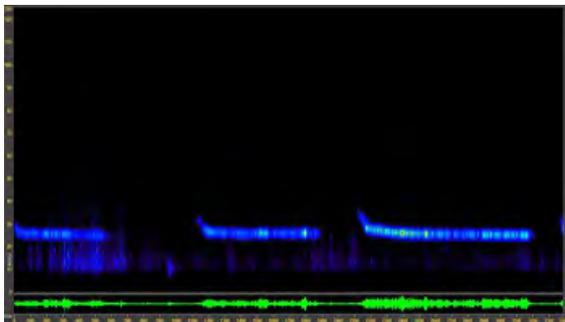
Spatial pattern of activity



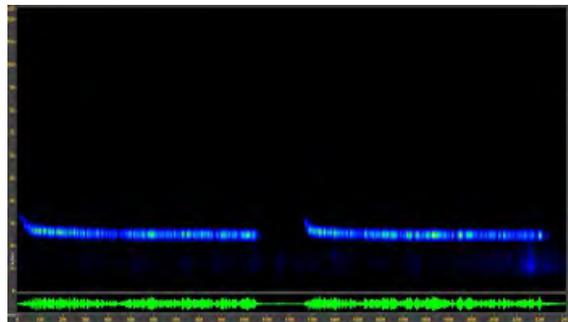
Seasonal and nightly activity



Black Rat is extremely similar acoustically to Brown Rat (see Newson *et al.*, 2021). Based on conversations with Sark residents, Black Rat is thought to be the only species of rat present on Sark, so all *Rattus* calls on Sark have assumed to be Black Rat.



Black Rat - Sark, 25th May



Black Rat - Sark, 25th May

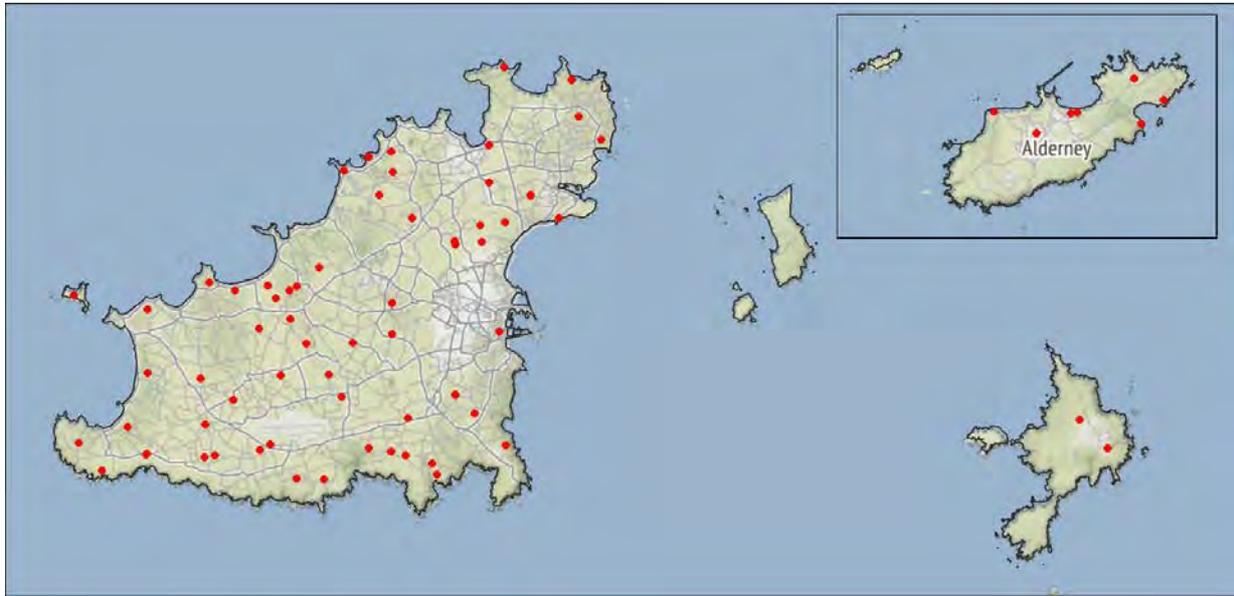
4.3.3 Bush-crickets

Being stationary, and calling for long periods, the number of recordings is not an informative measure of abundance. For this reason, bush-cricket data are shown as presence information rather than activity information.

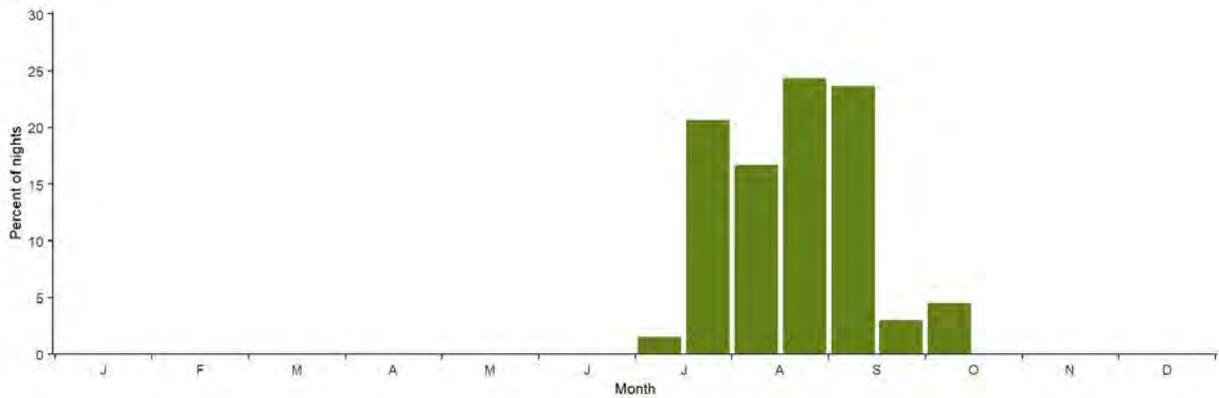
Long-winged Conehead

Long-winged Conehead *Conocephalus fuscus* was recorded on 69 nights, from 75 locations.

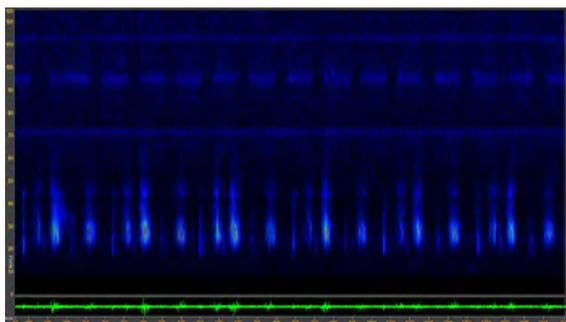
Spatial pattern of detections



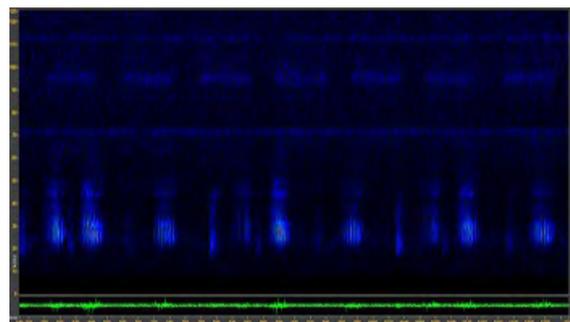
Seasonality



Long-winged Conehead were recorded from 59 locations between July and the end of October with records from Guernsey, Alderney and Sark. Long-winged Conehead produces ‘calls’ with a peak frequency about 26 kHz. It is most similar acoustically to Short-winged Conehead which was not recorded in 2022, but it produces three-syllable calls (two short calls, pause, followed by one longer duration call).



Long-winged Conehead - Guernsey, 16th September

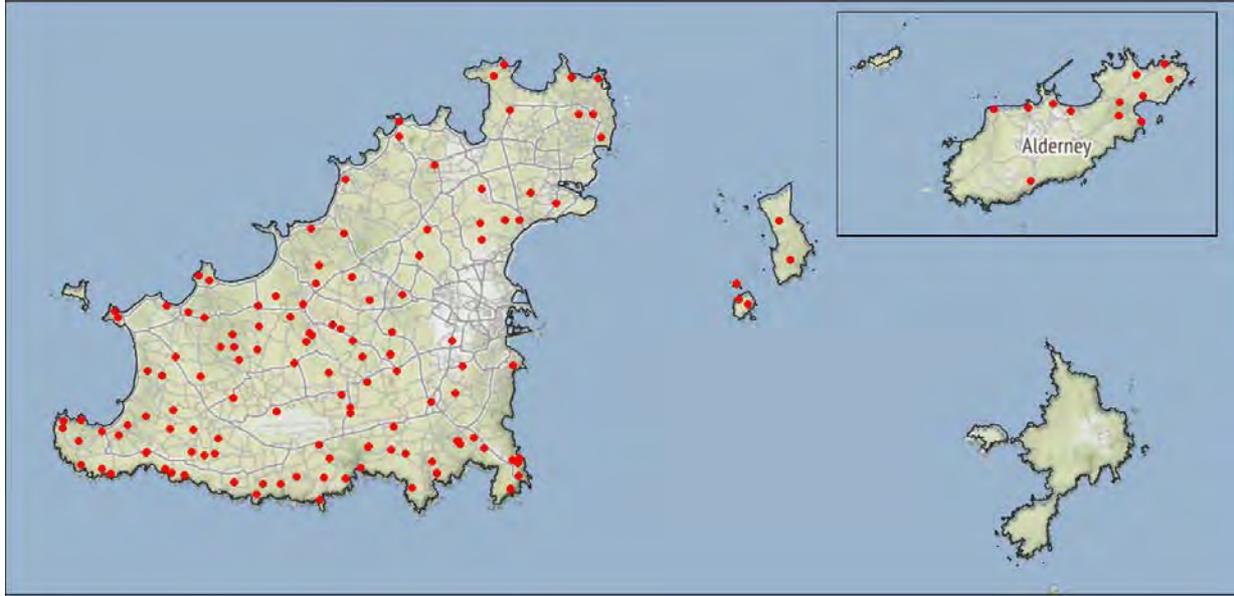


Long-winged Conehead (as left, different scale)

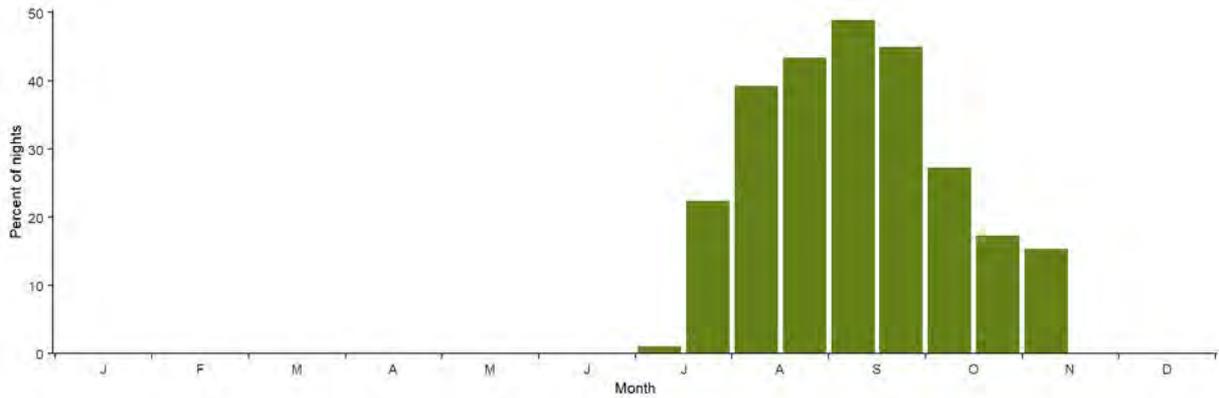
Speckled Bush-cricket

Speckled Bush-cricket *Leptophyes punctatissima* was recorded on 107 nights, from 151 locations.

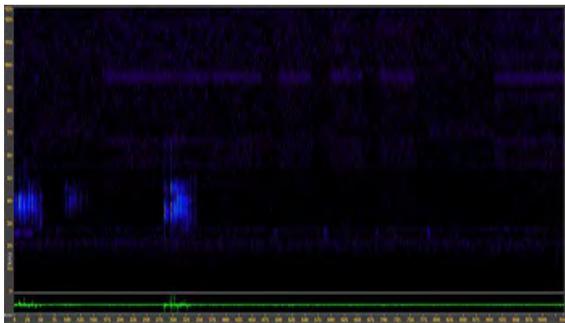
Spatial pattern of detections



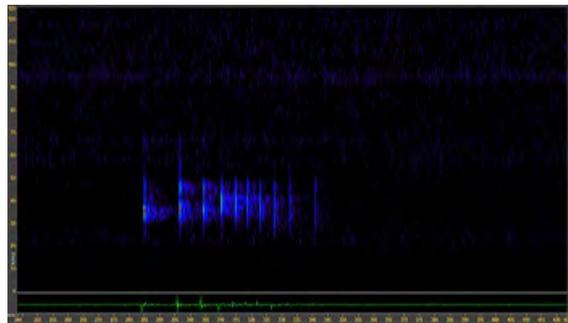
Seasonality



Speckled Bush-cricket were recorded from 141 locations between July and mid-November, which included locations on Guernsey, Alderney, Herm and Jethou. Speckled Bush-cricket produces distinctive multiple syllable calls. There are normally at least five of these, which are isolated, short and are at high frequency, 30-40 kHz. In this species, the female also calls in response to the male, but the calls normally comprise a shorter call sequence.



Speckled Bush-cricket - Guernsey, 17th September

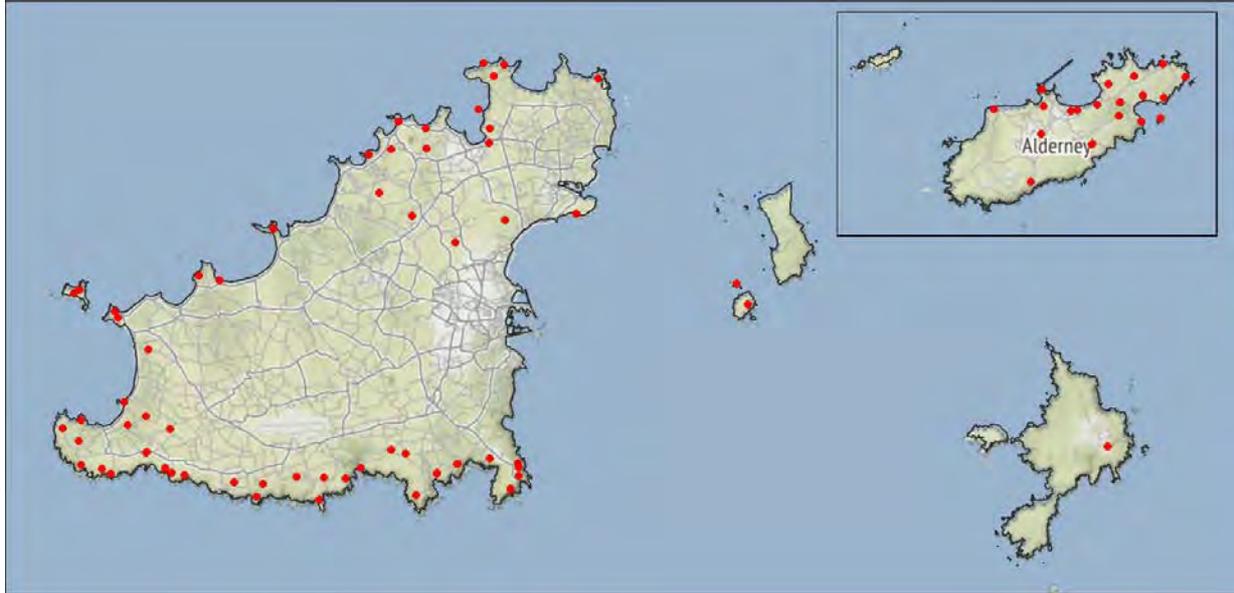


Speckled Bush-cricket (as left, different scale)

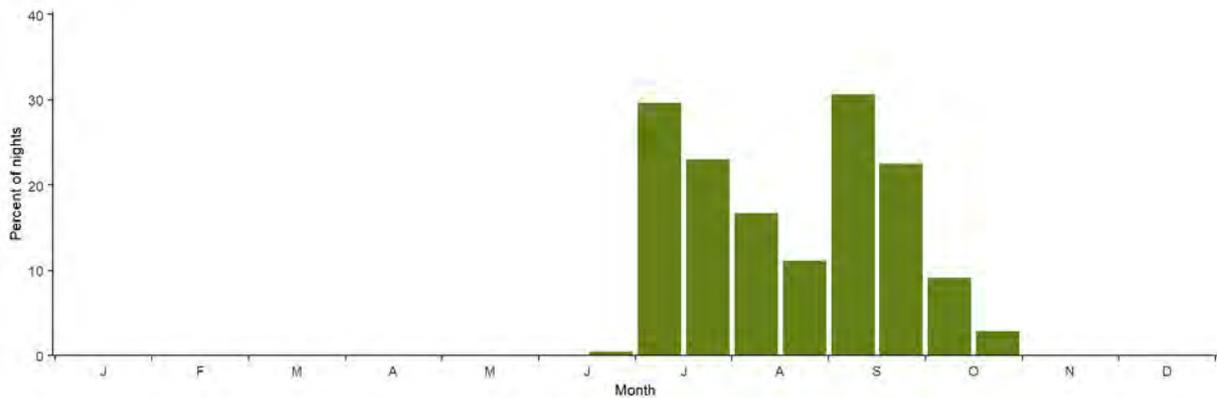
Grey Bush-cricket

Grey Bush-cricket *Platycleis albopunctata* was recorded on 99 nights, from 92 locations.

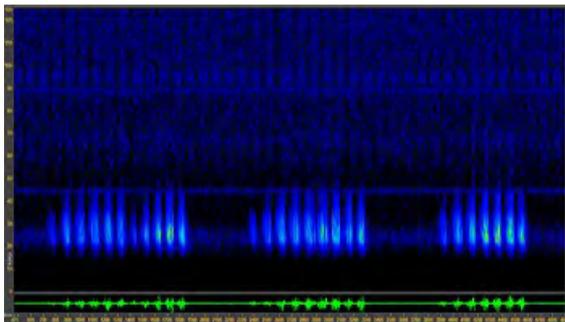
Spatial pattern of detections



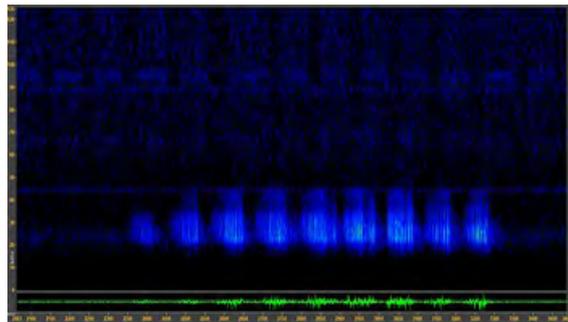
Seasonality



Grey Bush-cricket were recorded from 101 locations between the beginning of July and the end of October, which included locations on Guernsey, Alderney, Sark and Jethou. As in 2021, this species favours coastal areas on Guernsey, particularly the south coast cliffs, but there were also some records from inland low-lying areas in the northern third of Guernsey. In Alderney, it was mainly found at the northeast end of the island. Grey Bush-cricket produces 'calls' with a peak frequency of about 23 kHz. There are normally four or five grouped syllables, followed by a pause in a repeated sequence, where the syllables tend to show an increasing intensity across the sequence.



Grey Bush-cricket - Guernsey, 30th July

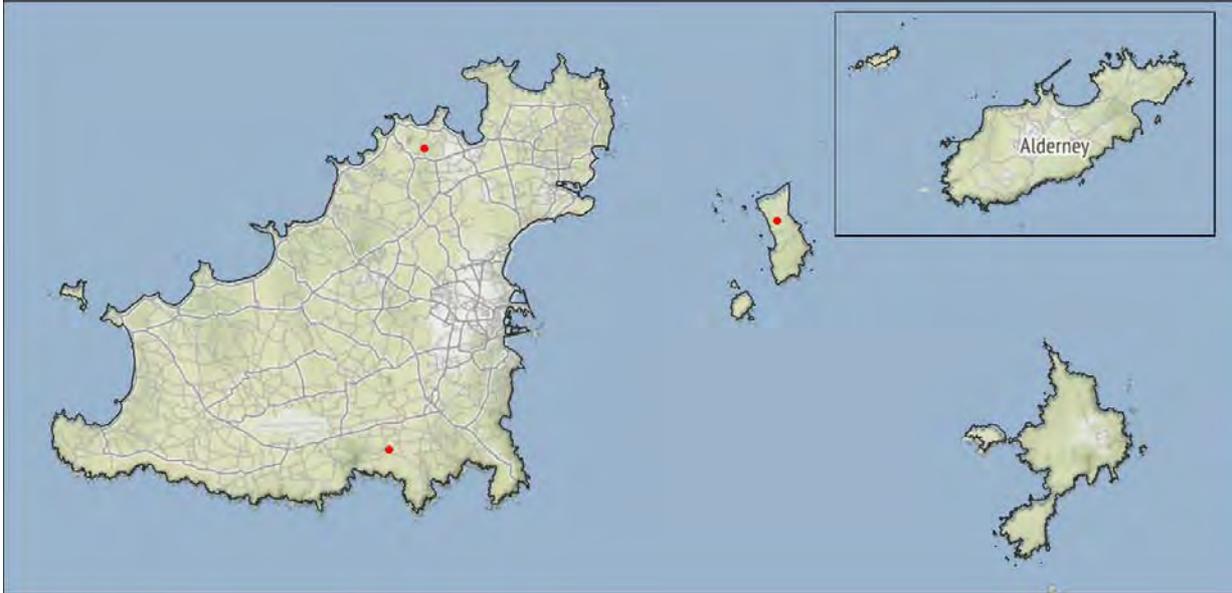


Grey Bush-cricket (as left, different scale)

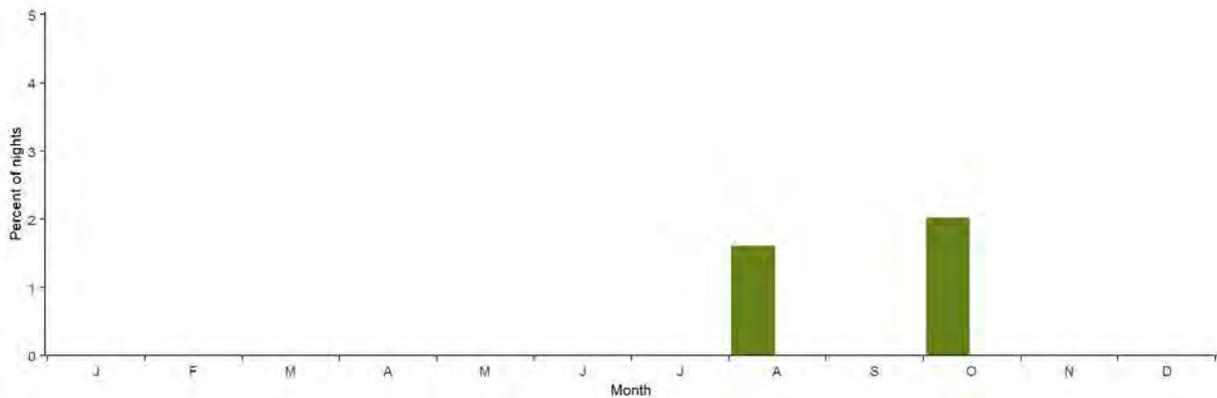
Large Conehead

Large Conehead *Ruspolia nitidula* was recorded on seven nights, from three locations.

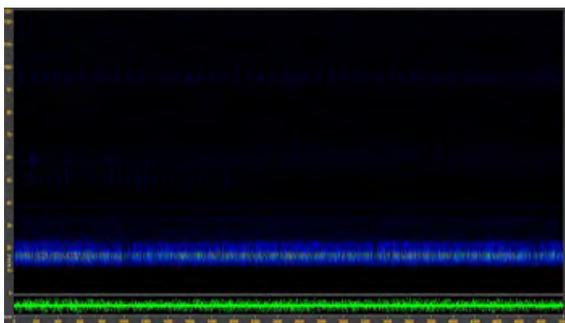
Spatial pattern of detections



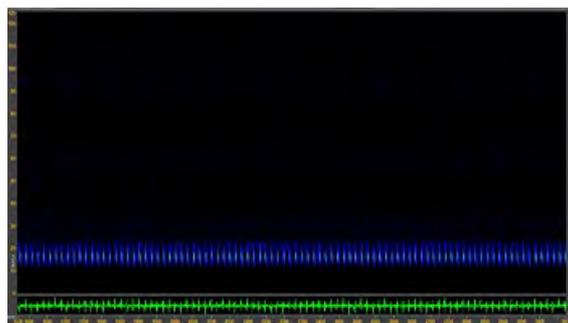
Seasonality



Large Conehead - new species for Herm This species was recorded in 2021 as a new species for the Channel Islands, with records from Alderney, Guernsey and Lihou. In 2022, Large Conehead was recorded for the first time on Herm on four nights (12th-15th October), and from Guernsey for the second year from two new locations, spaced widely apart. This is a continental species that is spreading northwards. Previously an occasional migrant to the UK, breeding colonies were discovered in 2020 at Dungeness and it is likely to become more widespread in the Channel Islands as its colonisation northwards continues.



Large Conehead - Herm, 14th October

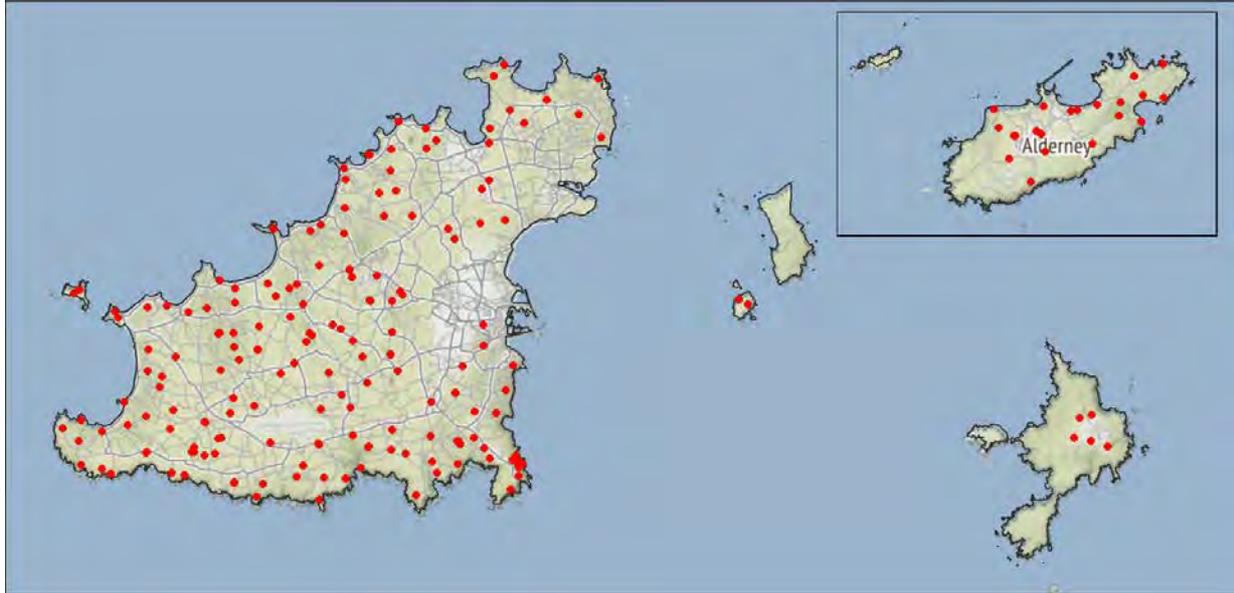


Large Conehead - Herm (as left, different scale)

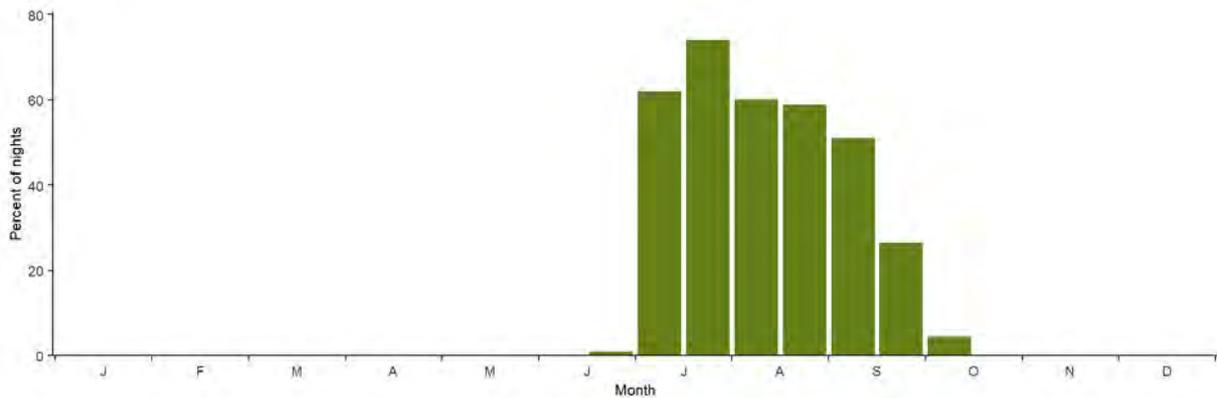
Great Green Bush-cricket

Great Green Bush-cricket *Tettigonia viridissima* was recorded on 96 nights, from 205 locations.

Spatial pattern of detections

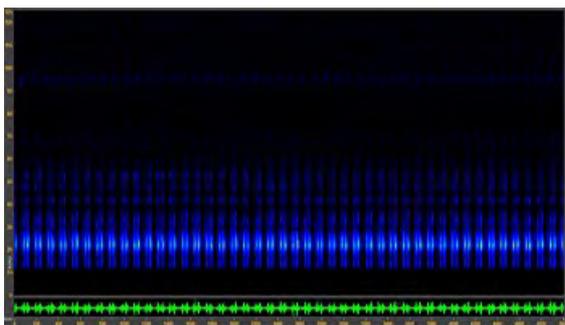


Seasonality

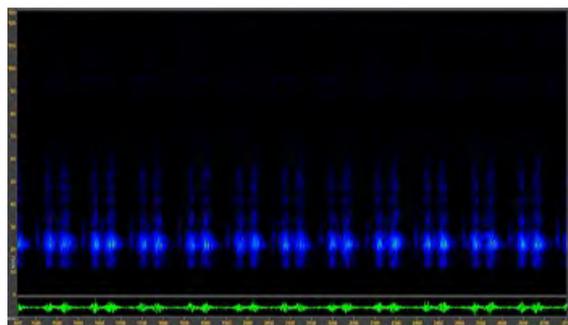


Great Green Bush-cricket were recorded from 205 locations between the beginning of July and mid-October, which includes records from Guernsey, Alderney, Sark, Jethou and Lihou. This is the most ubiquitous bush-cricket species present on the islands. Great Green Bush-cricket produces 'calls' with a peak frequency of about 10 kHz. The call syllables for this species are grouped into twos.

Despite looking carefully through recordings for these species, we did not find any evidence that Dark Bush-cricket *Pholidoptera griseoptera* or Roesel's Bush-cricket *Roeseliana roeselii* were detected in 2022. We are unsure whether the presence of these species has been confirmed on the islands.



Great Green Bush-cricket - Guernsey, 13th July



Great Green Bush-cricket (as left, different scale)

4.3.4 Audible moth species

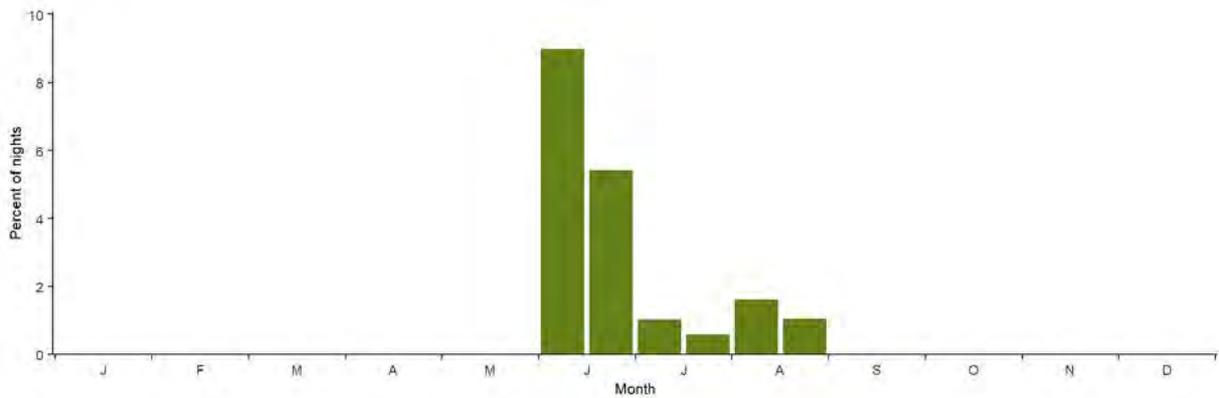
Green Silver-lines

Green Silver-lines *Pseudoips prasinana* was recorded on 23 nights, from 21 locations.

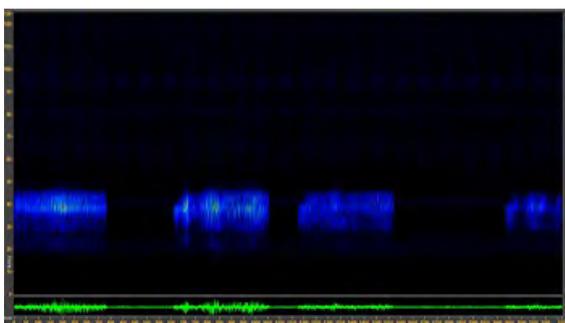
Spatial pattern of detections



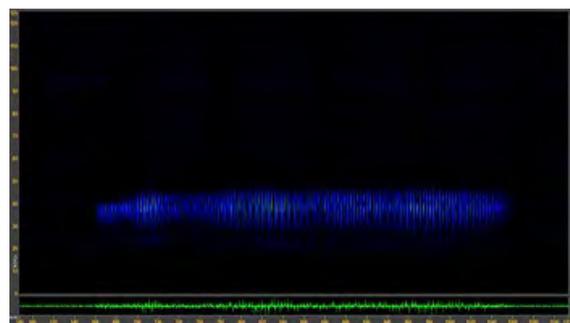
Seasonality



Green Silver-lines was recorded from 21 locations, which included records from Guernsey and from two locations on Sark. Green Silver-lines produce 'calls' that form a very distinctive shape. See Barataud & Skals, (2018) for a description of the sound identification of Green Silver-lines.



Green Silver-lines - Guernsey, 9th June

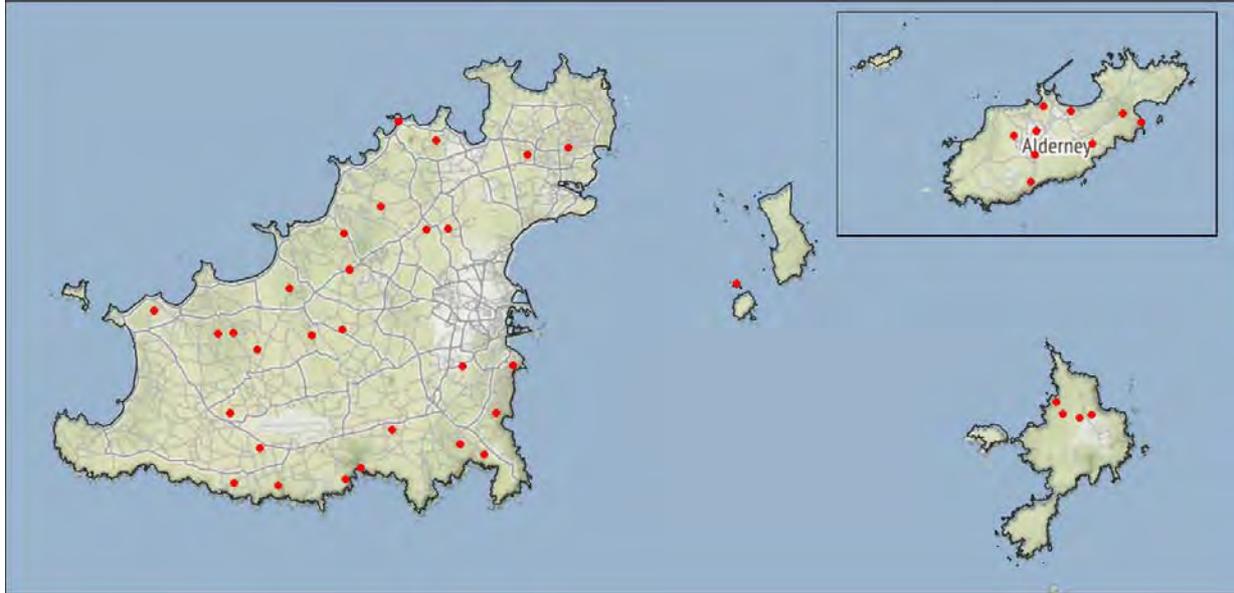


Green Silver-lines - Guernsey (as left, different scale)

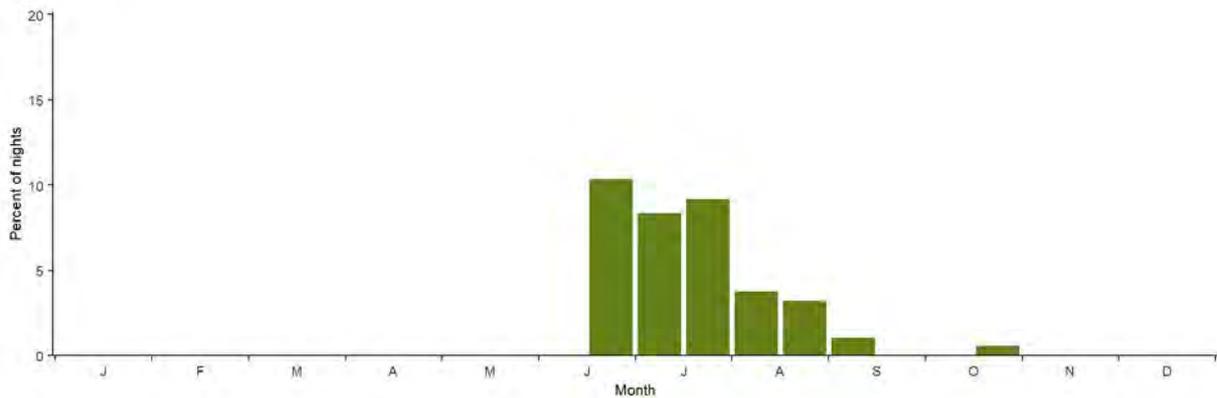
Bird Cherry Ermine

Bird Cherry Ermine *Yponomeuta evonymella* was recorded on 47 nights, from 43 locations.

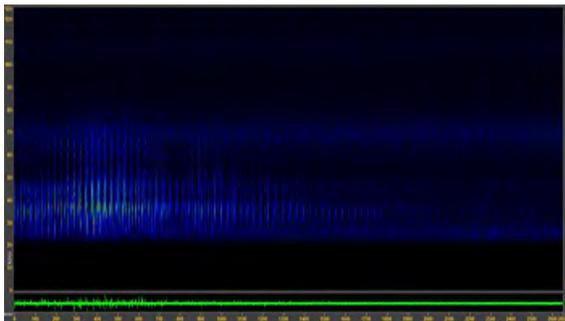
Spatial pattern of detections



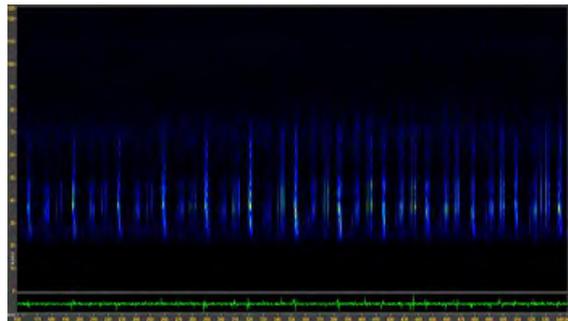
Seasonality



Bird Cherry Ermine was recorded on Guernsey, Alderney, Sark and from an island off Jethou. The micro-moth Bird Cherry Ermine was also recorded from 43 locations. This species of moth is deaf itself, but it produces ultrasonic clicks when it flies, to interfere with the echolocation of bats and reduce predation. The sound produced by the Bird Cherry Ermine is very different from Green Silver-lines. Whilst we have assigned all recordings like this to this species, we cannot exclude the possibility that other closely related species produce similar sounds. In addition to recordings that we have assigned to the two moth species here, we believe that several other currently unidentifiable insect species (probably moths or beetle species), were also recorded in 2022.



Bird Cherry Ermine - Guernsey, 9th July



Bird Cherry Ermine - Guernsey (as left, different scale)

5. DISCUSSION

The current 2022 dataset of 872,126, plus the 710,260 bat recordings from 2021, has been very valuable in adding to our understanding of patterns of occurrence and activity of bats across the Bailiwick of Guernsey, but it also adds to our understanding of some other species groups that were recorded as 'by-catch' during bat surveys. The results from this season include the first records of Serotine for Jethou, the first Leisler's Bat for Herm, and the first Common Noctule for Jethou. Soprano Pipistrelle was also recorded for the first time for this project, on Alderney. More generally, we have a better understanding now of the status of all species of bats across the Bailiwick of Guernsey, and of the relative importance of different areas. In addition, the bush-cricket Large Conehead *Ruspolia nitidula* was recorded for the first time on Herm, with records from two new locations on Guernsey and Lihou in 2021.

6. ACKNOWLEDGEMENTS

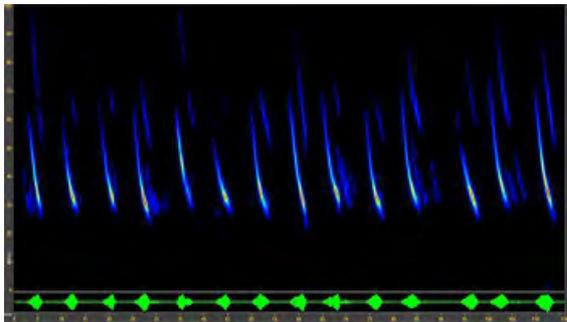
We would like to thank all the fieldworkers who took part in the Bailiwick Bat Survey in 2022 and the landowners that gave volunteers access to their land. We would also like to thank the Priaux Library, the Guille-Allés library, Sir Charles Frossard House reception staff, La Société Guernesiaise, Alderney Wildlife Trust and La Société Sercquaise for hosting bat detectors for the project. We are also very grateful to Daniel Whitelegg (Alderney), Roland Gauvain (Alderney), Lynda Higgins (Sark), Roger Thresher (Herm), Bill Bayley (Jethou), Aidan Monaghan (Brecqhou) and Steve Sarre (Lihou), Piers Sangan, Amy Hall and the Bat Section of La Société Guernesiaise for their help and support of this project. We would also like to thank Matt Baxter, Steve Pritchard from the BTO IS team for development and support of the online systems that were used in this project. Lastly, we would like to thank the States of Guernsey for funding this project.

7. REFERENCES

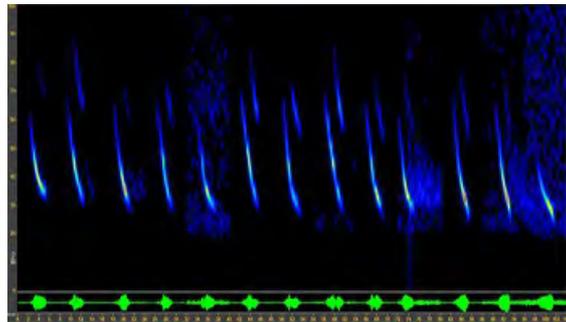
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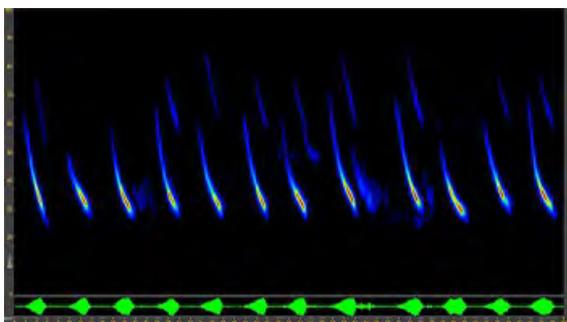
Identification appendix 1: Serotine *Eptesicus serotinus* and Leisler's Bat *Nyctalus leisleri*



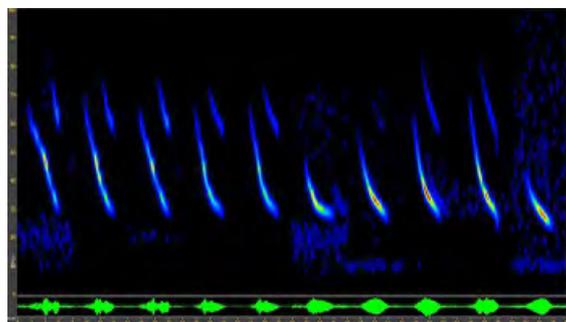
Serotine - call duration 2.7-3.0 ms



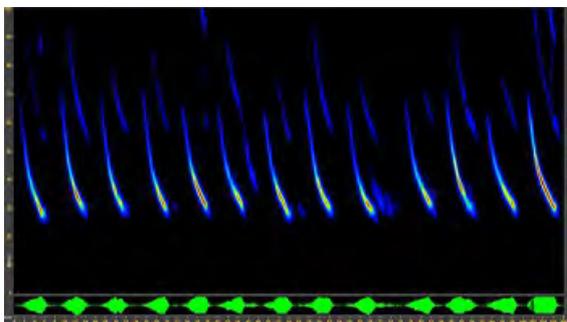
Leisler's Bat - call duration 2.7-3.0 ms



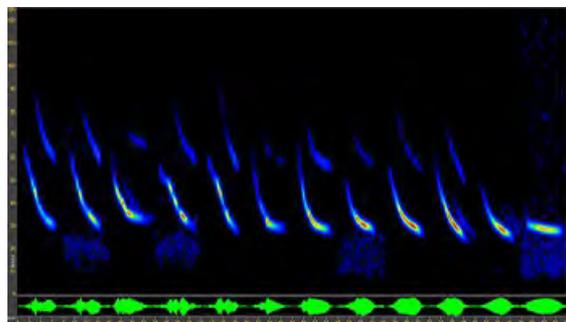
Serotine - call duration 4.0 ms



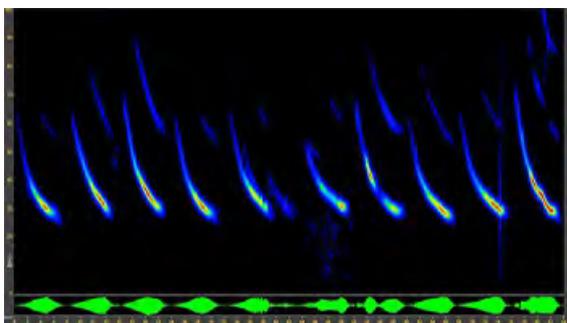
Leisler's Bat - call duration 4.0 ms



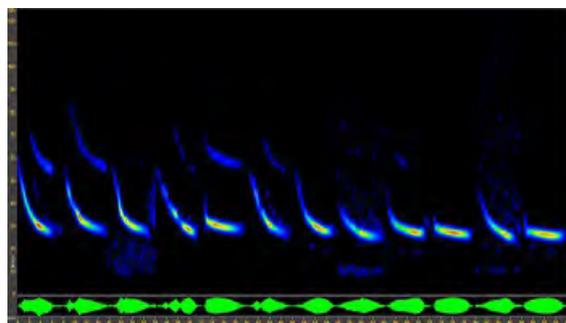
Serotine - call duration 5.0 ms



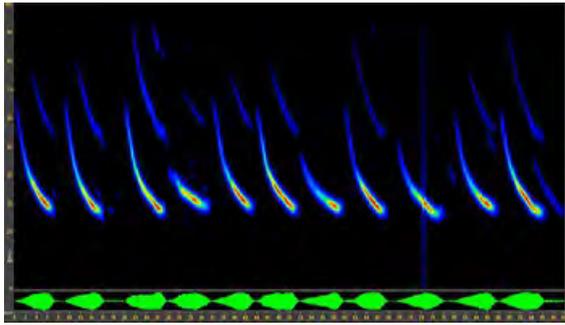
Leisler's Bat - call duration 5.0 ms



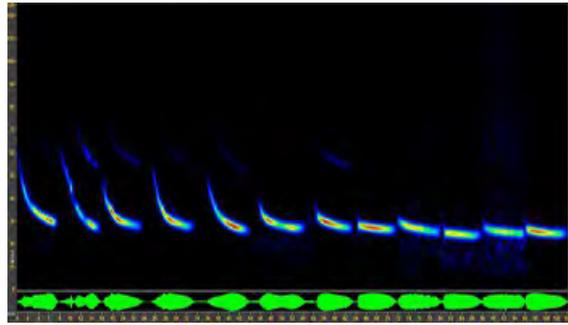
Serotine - call duration 6.0 ms



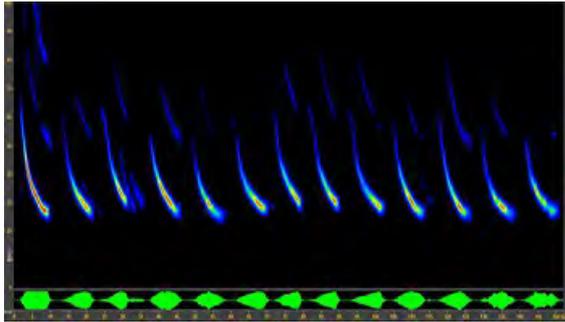
Leisler's Bat - call duration 6.0 ms



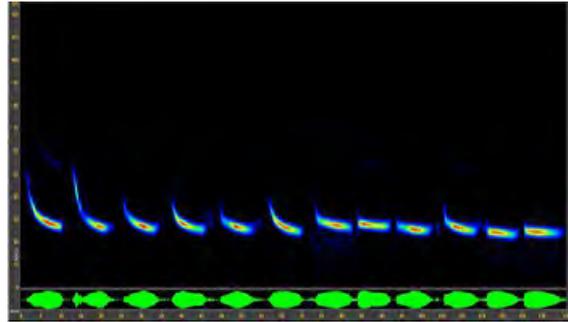
Serotine - call duration 7.0 ms



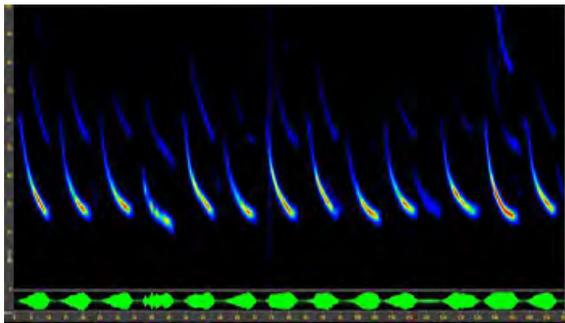
Leisler's Bat - call duration 7.0 ms



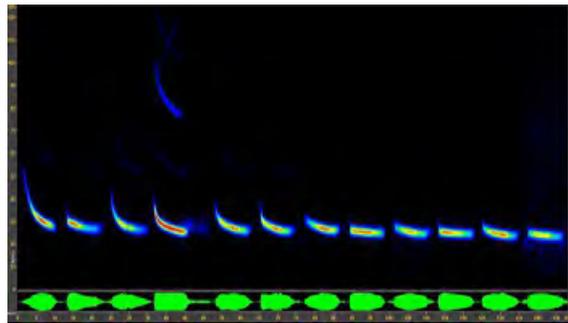
Serotine - call duration 8.0 ms



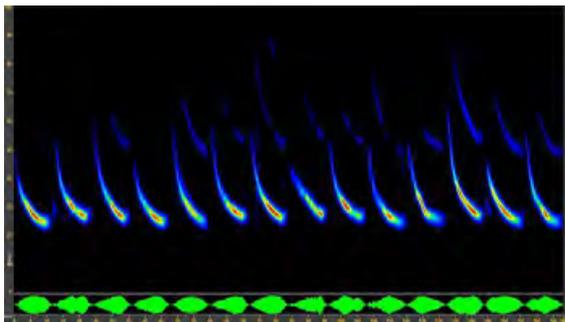
Leisler's Bat - call duration 8.0 ms



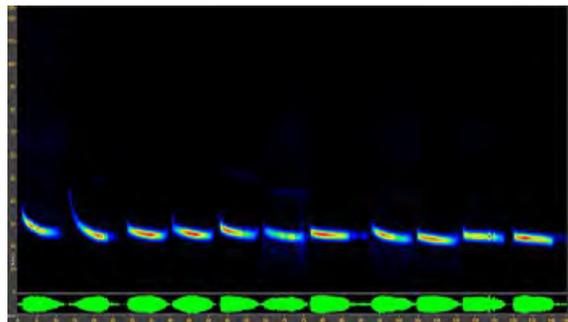
Serotine - call duration 9.0 ms



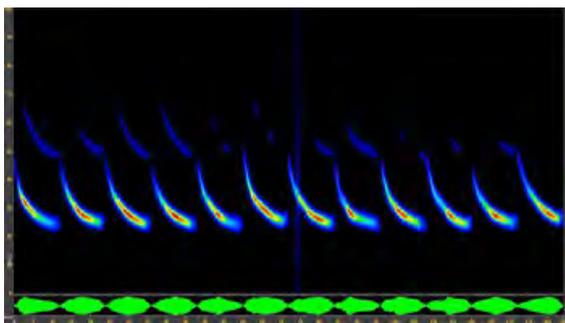
Leisler's Bat - call duration 9.0 ms



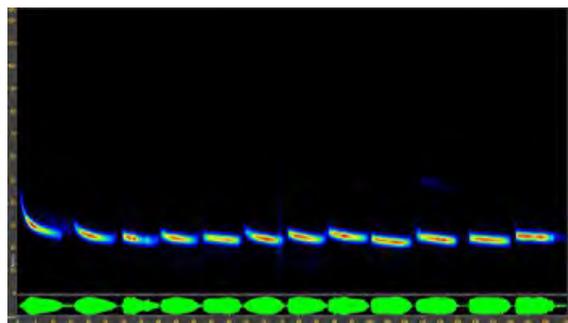
Serotine - call duration 10.0 ms



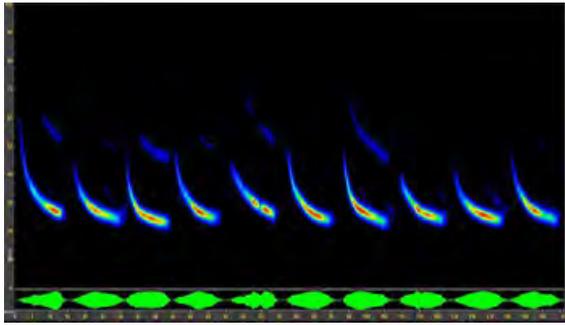
Leisler's Bat - call duration 10.0 ms



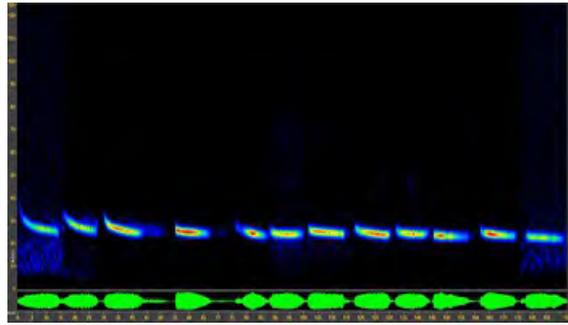
Serotine - call duration 11.0 ms



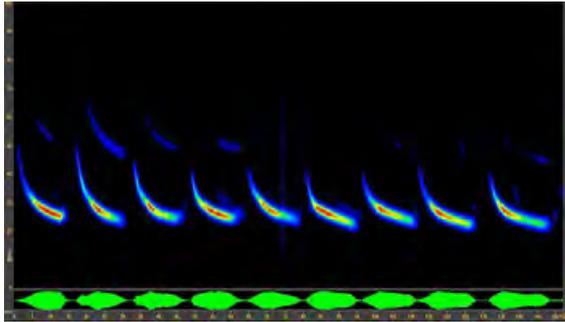
Leisler's Bat - call duration 11.0 ms



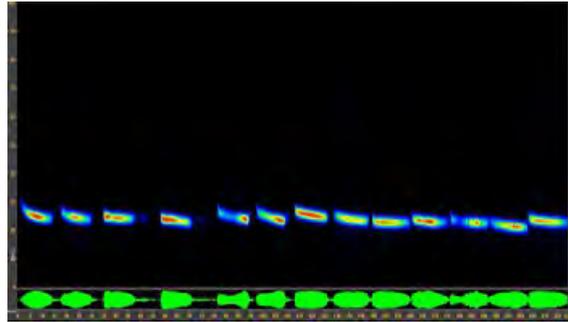
Serotine - call duration 12.0 ms



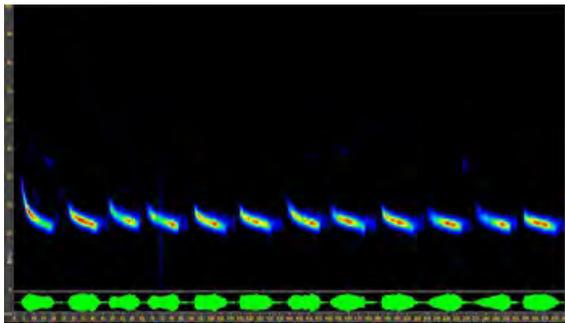
Leisler's Bat - call duration 12.0 ms



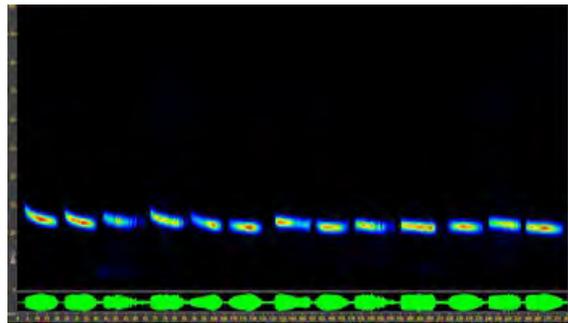
Serotine - call duration 13.0-16.0 ms



Leisler's Bat - call duration 13-16 ms

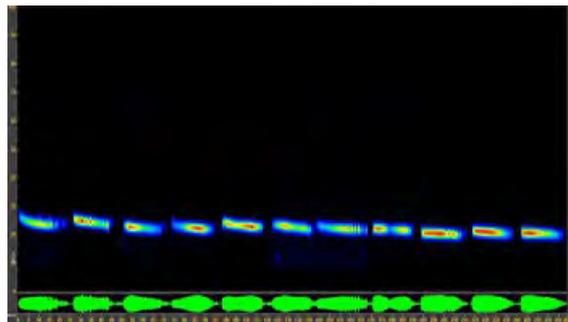


Serotine - call duration 17.0-18.0 ms



Leisler's Bat - call duration 17-18 ms

Serotine - no examples for this call duration



Leisler's bat - call duration 19-24 ms

Identification appendix 2: Whiskered Bat *Myotis mystacinus* and Brandt's Bat *Myotis brandtii*

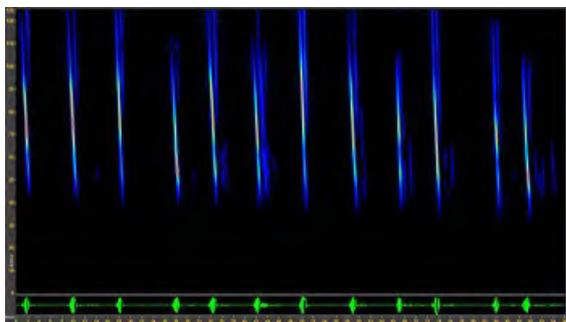
In the below we provide a visual comparison of echolocation calls of the same call duration of Whiskered Bat *Myotis mystacinus* and Brandt's Bat *Myotis brandtii* alongside each other. In producing these comparisons, we would like to explore whether there are any patterns of differences between the calls of these species that could be useful for species identification (e.g. differences in frequency or shape).

We do this by mining known recordings of *M. mystacinus* and *M. brandtii* to look for examples of individual echolocation calls that cover the range of observed call durations, and then putting calls of similar duration together into 'compiled' recordings for a given range of call durations. For example, a compiled recording, may just contain examples of calls of between 3.5 and 3.6 ms.

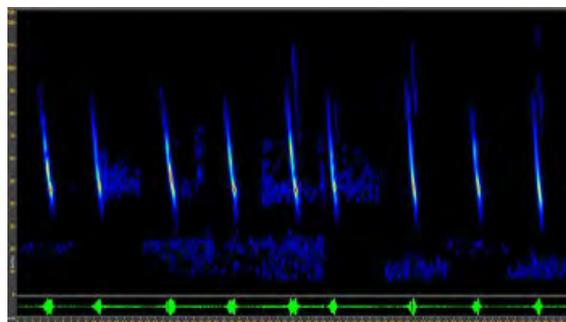
M. mystacinus and *M. brandtii* are two of the most difficult bat species in Europe to distinguish from their echolocation calls. For a given call duration, the echolocation calls of these species are visually extremely similar in frequency and shape.

Looking at the visualisations below, there is perhaps an indication here that for a given call duration, the calls of *M. mystacinus* are more likely to have a lower end frequency than *M. brandtii*.

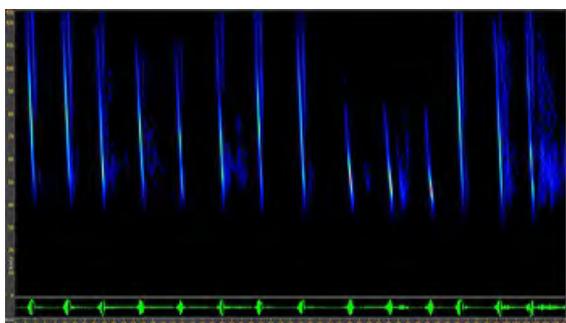
It is difficult to be sure that the recordings here are completely representative of *M. mystacinus* and *M. brandtii* to infer too much from this, but it was easy to find recordings of *M. mystacinus* of less 1.7 ms, but hard to find similar short duration calls of *M. brandtii*. This may suggest that *M. mystacinus* is more likely to produce shorter duration calls than *M. brandtii*. Conversely, it was easy to find long duration calls of greater than 5.0 ms of *M. brandtii* (up to 6.5 ms), but it was difficult to find calls of *M. mystacinus* of greater than 5.0 ms, perhaps suggesting that *M. brandtii* is more likely to produce long duration calls than *M. mystacinus*. Potentially supporting this, Lefevre & Van de Sijpe (in Russ, 2021) made a comment that under comparable conditions, the calls of *M. mystacinus* are higher with shorter calls than those of *M. brandtii*.



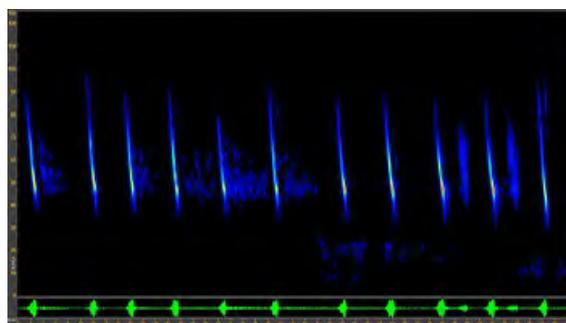
Whiskered Bat - call duration up to 1.3 ms



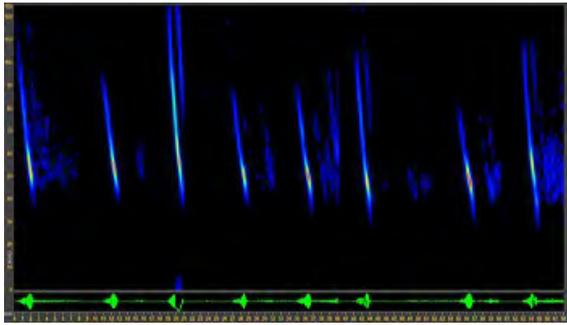
Brandt's Bat - call duration up to 1.3 ms



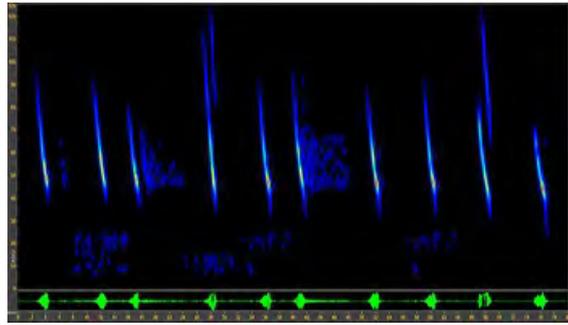
Whiskered Bat - call duration 1.4-1.5 ms



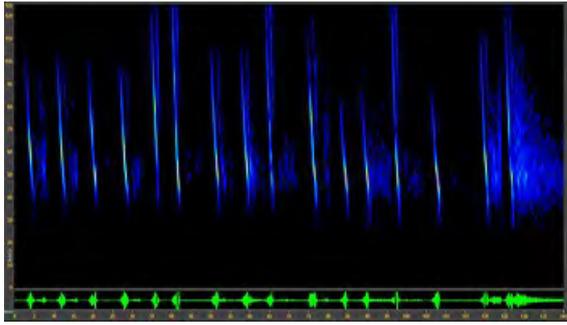
Brandt's Bat - call duration 1.4-1.5 ms



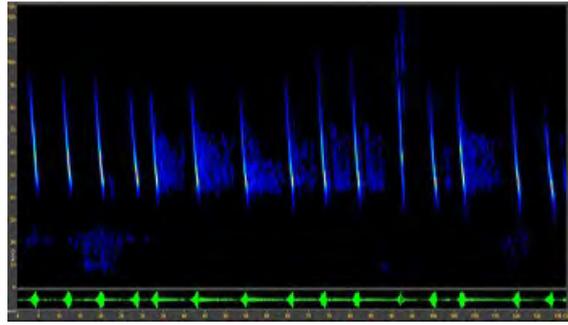
Whiskered Bat - call duration 1.6-1.7 ms



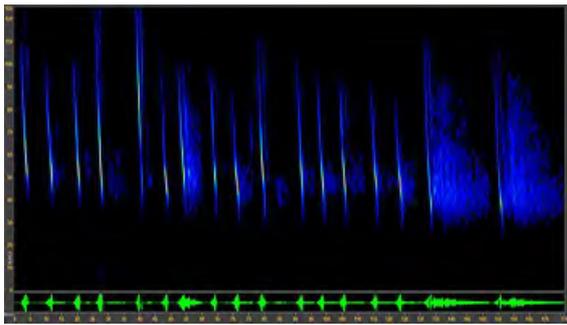
Brandt's Bat - call duration 1.6-1.7 ms



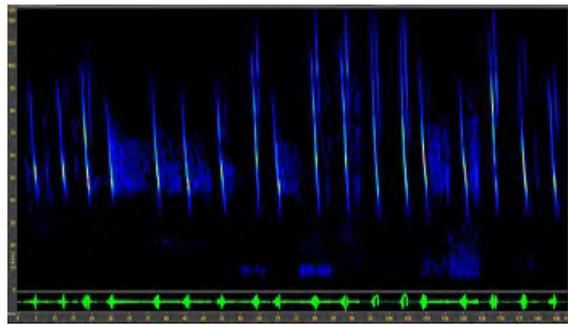
Whiskered Bat - call duration 1.8-1.9 ms



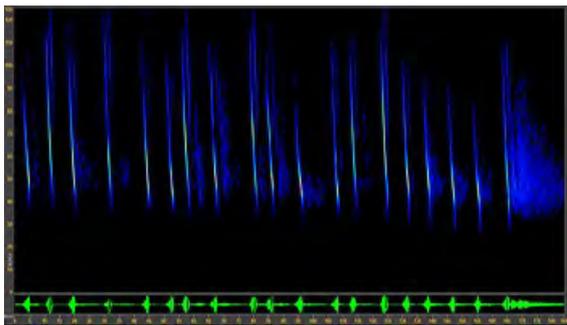
Brandt's Bat - call duration 1.8-1.9 ms



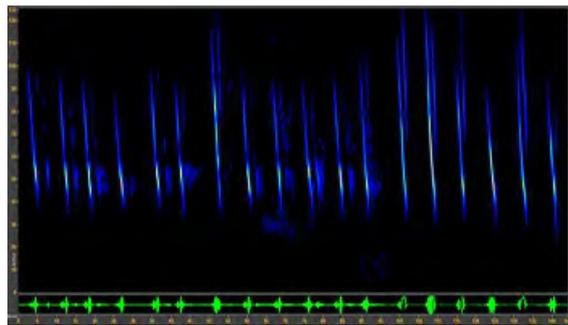
Whiskered Bat - call duration 2.0-2.1 ms



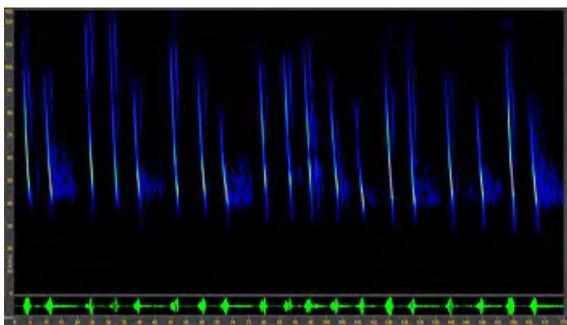
Brandt's Bat - call duration 2.0-2.1 ms



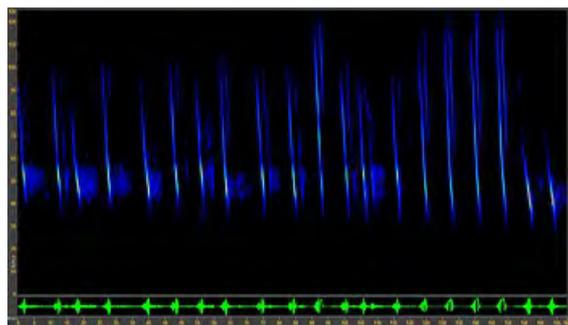
Whiskered Bat - call duration 2.2-2.3 ms



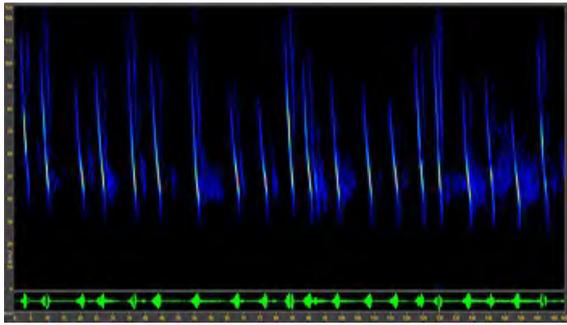
Brandt's Bat - call duration 2.2-2.3 ms



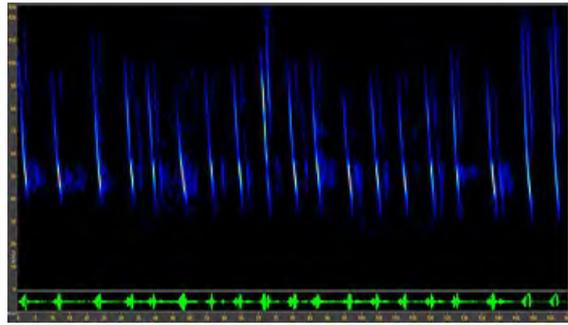
Whiskered Bat - call duration 2.4-2.5 ms



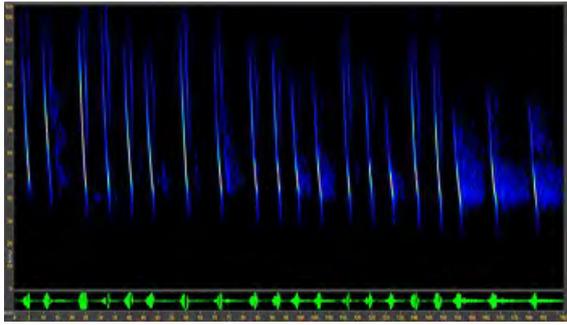
Brandt's Bat - call duration 2.4-2.5 ms



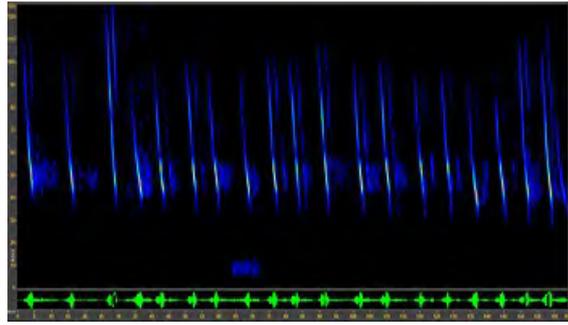
Whiskered Bat - call duration 2.6-2.7 ms



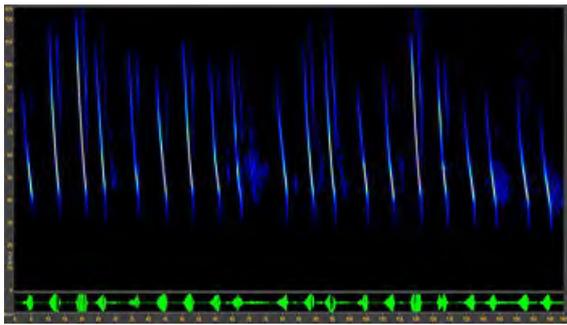
Brandt's Bat - call duration 2.6-2.7 ms



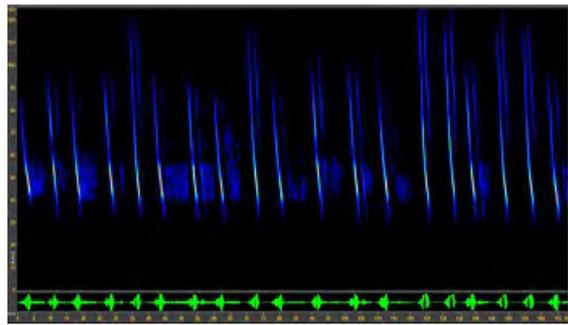
Whiskered Bat - call duration 2.8-2.9 ms



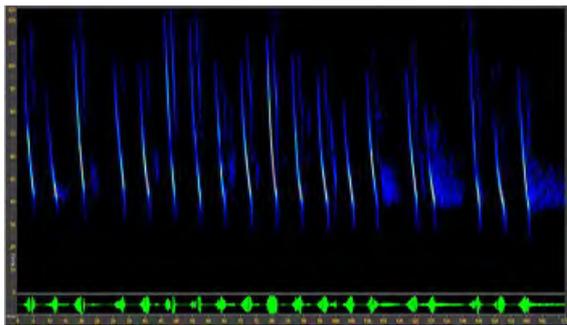
Brandt's Bat - call duration 2.8-2.9 ms



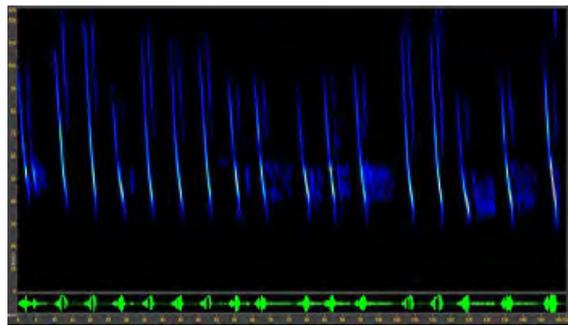
Whiskered Bat - call duration 3.0-3.1 ms



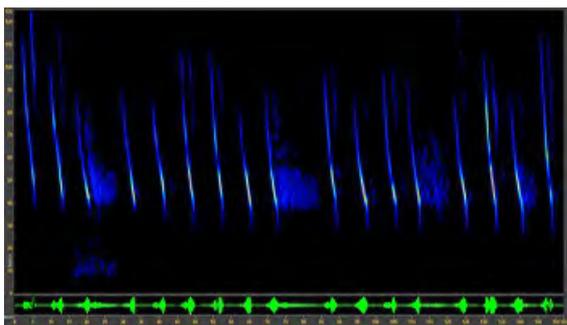
Brandt's Bat - call duration 3.0-3.1 ms



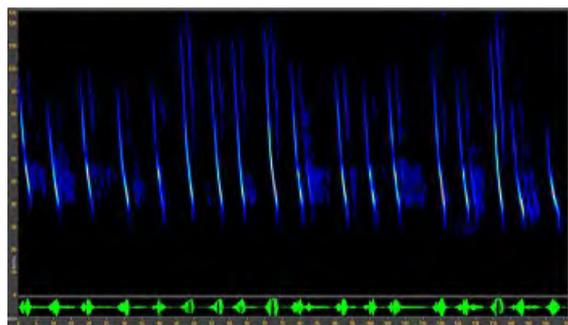
Whiskered Bat - call duration 3.2-3.3 ms



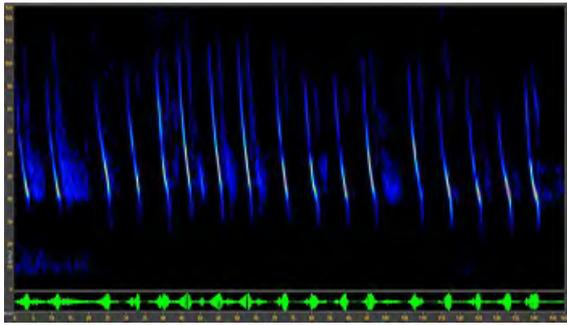
Brandt's Bat - call duration 3.2-3.3 ms



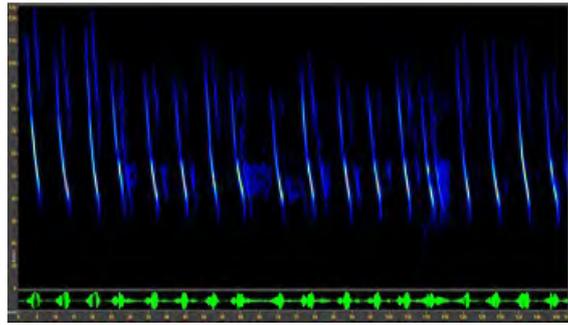
Whiskered Bat - call duration 3.4-3.5 ms



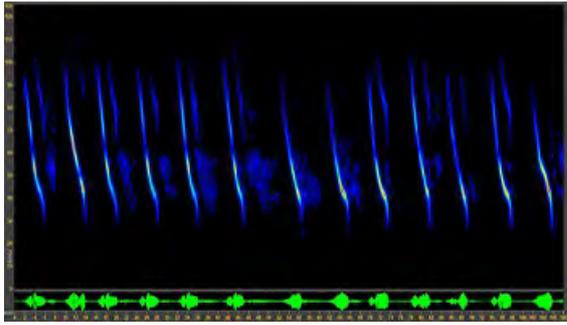
Brandt's Bat - call duration 3.4-3.5 ms



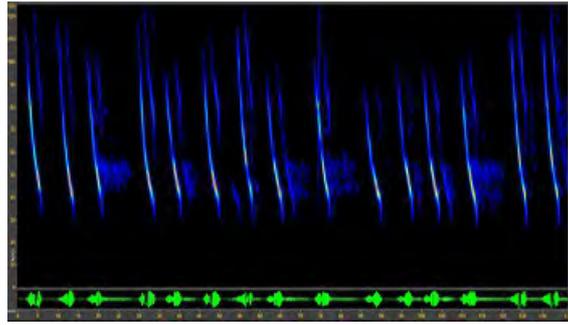
Whiskered Bat - call duration 3.6-3.7 ms



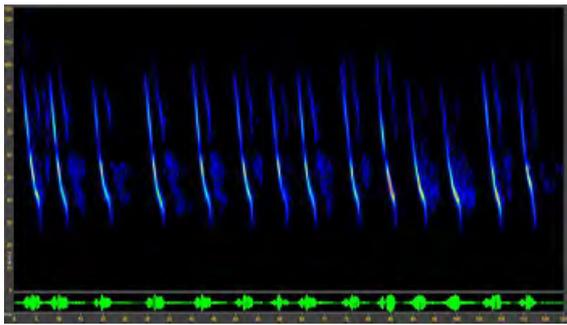
Brandt's Bat - call duration 3.6-3.7 ms



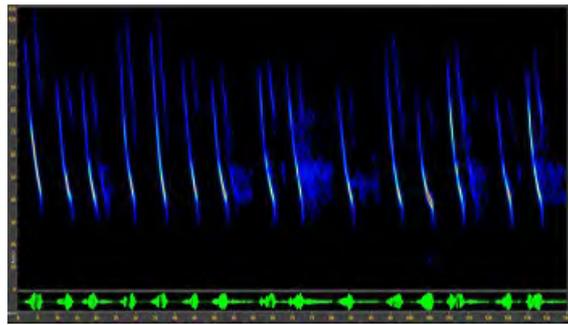
Whiskered Bat - call duration 3.8-3.9 ms



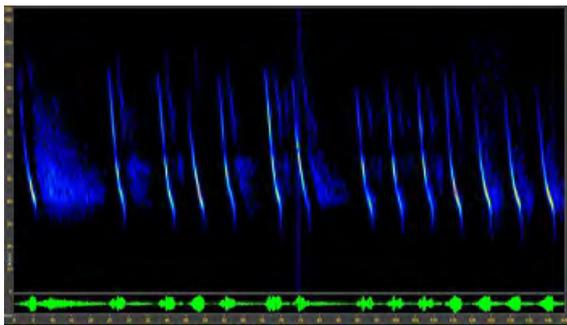
Brandt's Bat - call duration 3.8-3.9 ms



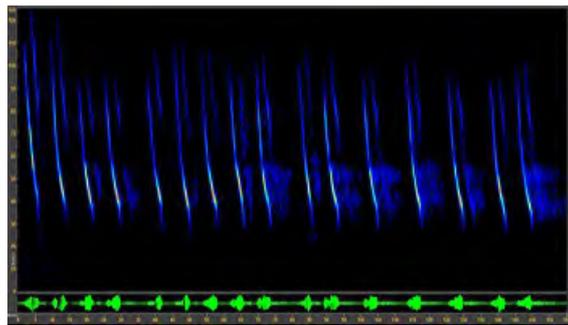
Whiskered Bat - call duration 4.0-4.1 ms



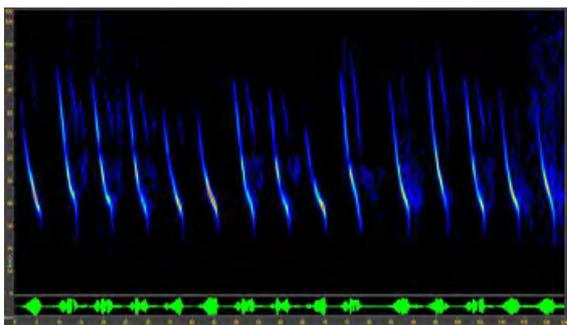
Brandt's Bat - call duration 4.0-4.1 ms



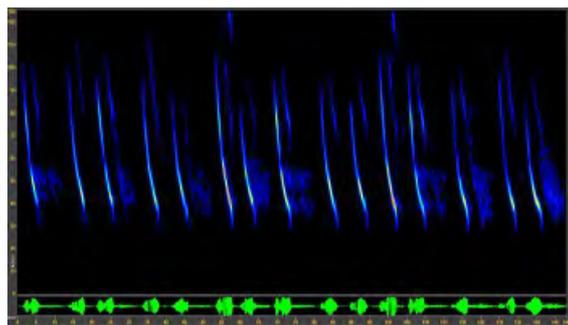
Whiskered Bat - call duration 4.2-4.3 ms



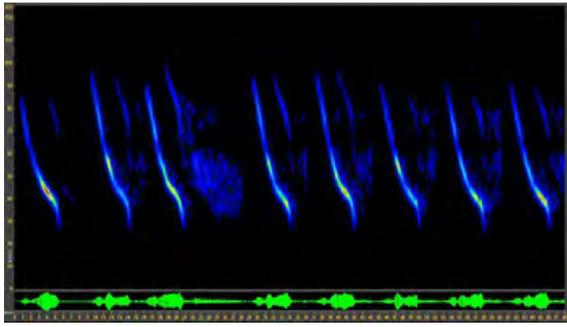
Brandt's Bat - call duration 4.2-4.3 ms



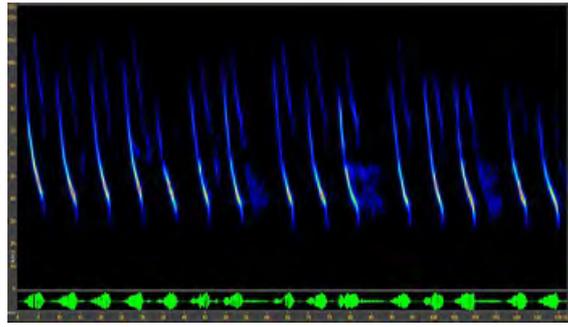
Whiskered Bat - call duration 4.4-4.5 ms



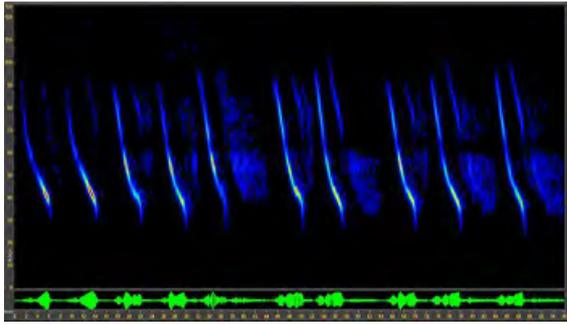
Brandt's Bat - call duration 4.4-4.5 ms



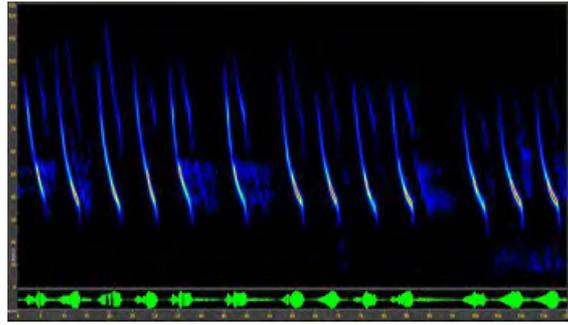
Whiskered Bat - call duration 4.6-4.7 ms



Brandt's Bat - call duration 4.6-4.7 ms

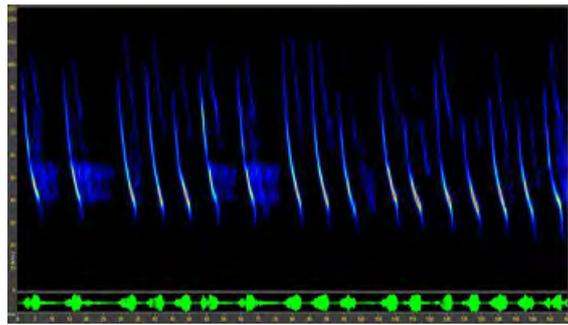


Whiskered Bat - call duration 4.8-5.1 ms



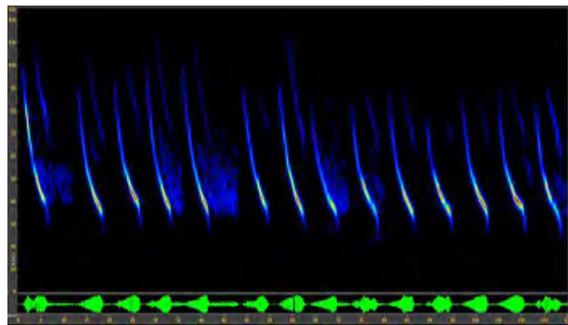
Brandt's Bat - call duration 4.8-5.1 ms

Whiskered Bat call duration 5.2-5.3 ms no examples



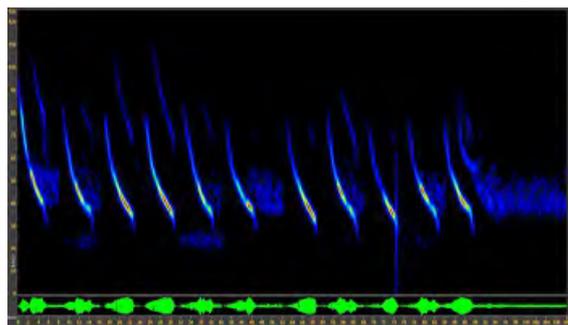
Brandt's Bat - call duration 5.2-5.3 ms

Whiskered Bat call duration 5.4-5.5 ms no examples



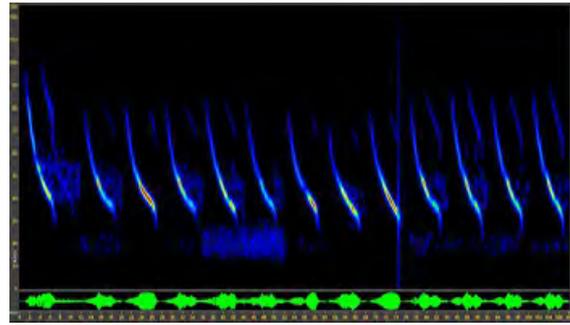
Brandt's Bat - call duration 5.4-5.5 ms

Whiskered Bat call duration 5.6-5.7 ms no examples



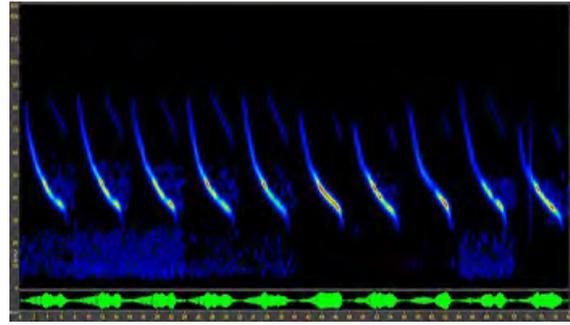
Brandt's Bat - call duration 5.6-5.7 ms

Whiskered Bat call duration 5.8-5.9 ms no examples



Brandt's Bat - call duration 5.8-5.9 ms

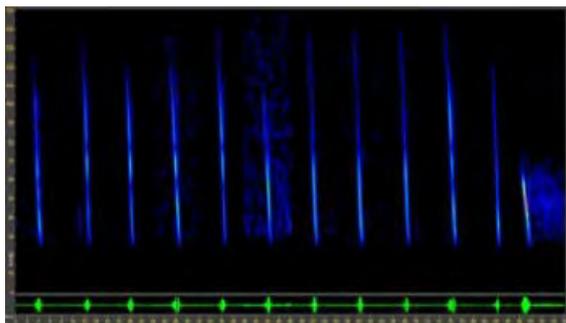
Whiskered Bat call duration 6.0-6.5 ms no examples



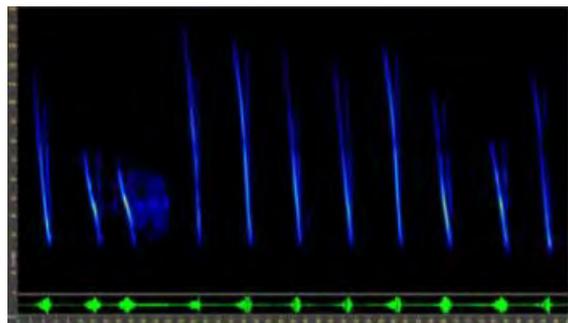
Brandt's Bat - call duration 6.0-6.5 ms

Identification appendix 3: Natterer's Bat *Myotis nattereri*

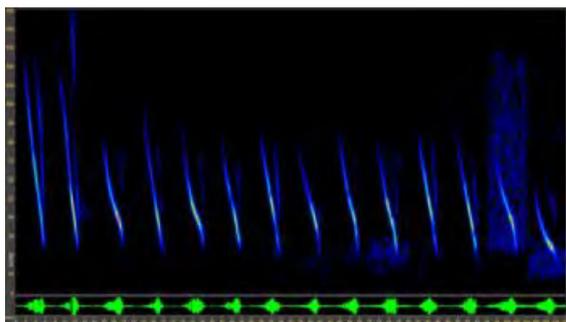
As with Whiskered and Brandt's Bat, the first consideration when looking at recordings is the quality of the recording, to consider whether the quality is good enough to try to assign the recording to species. Given a good recording, Natterer's Bat can occasionally produce atypical calls that could be mistaken for other *Myotis* species, however, such unusual calls rarely continue for long. Where neighbouring recordings are present, these can provide context to understand what is going on. By carefully considering the atypical calls in a recording in relation to the calls in neighbouring recordings, it should be possible to assign most of these still to species with confidence. In the below, we illustrate some of the range of variation in calls of Natterer's Bat from very short calls produced when flying in extreme clutter (a very closed habitat or environment) to long duration calls produced when flying in the open.



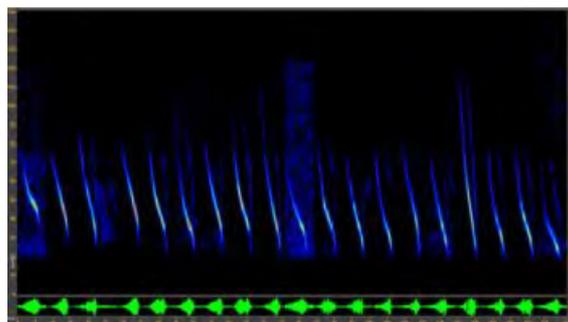
Natterer's Bat - call duration up to 1.2 ms



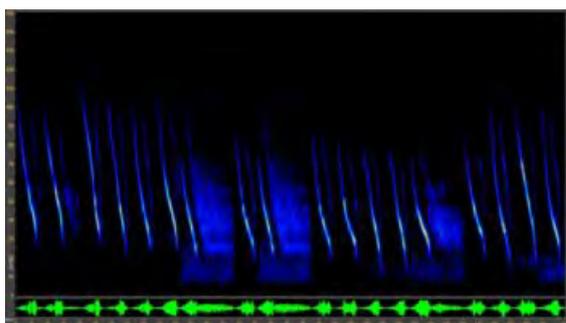
Natterer's Bat - call duration 2.7-2.8 ms



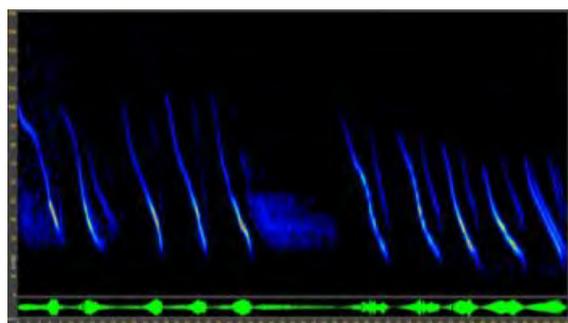
Natterer's Bat - call duration 3.9-4.0 ms



Natterer's Bat - call duration 4.9-5.0 ms

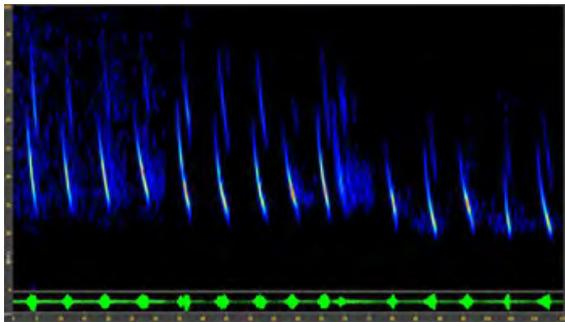


Natterer's Bat - call duration 5.9-6.0 ms

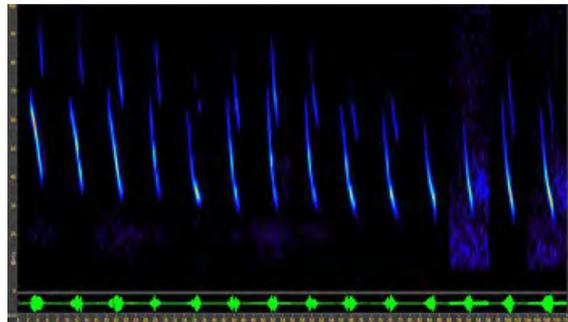


Natterer's Bat - call duration 7.1-9.4 ms

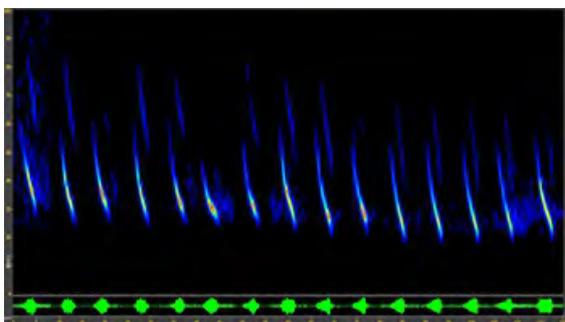
Identification appendix 4: Common Noctule *Nyctalus noctula* and Leisler's Bat *Nyctalus leisleri*



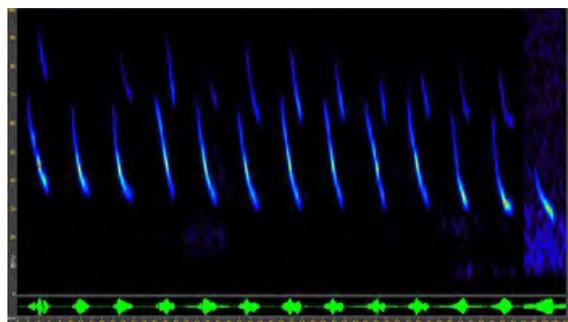
Common Noctule - call duration 1.4-3.0 ms



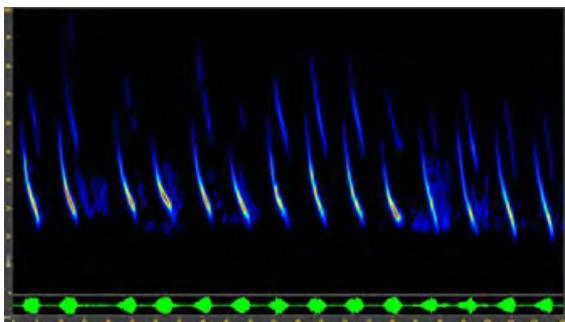
Leisler's Bat - call duration 1.4-3.0 ms



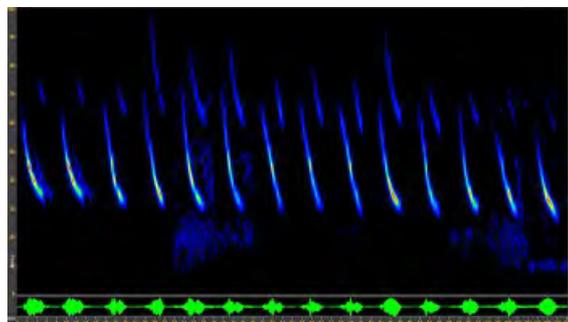
Common Noctule - call duration 3.1-3.7 ms



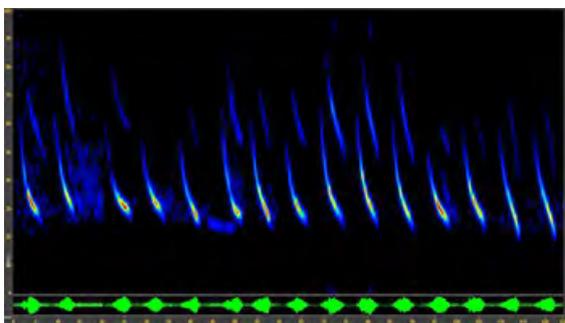
Leisler's Bat - call duration 3.1-3.7 ms



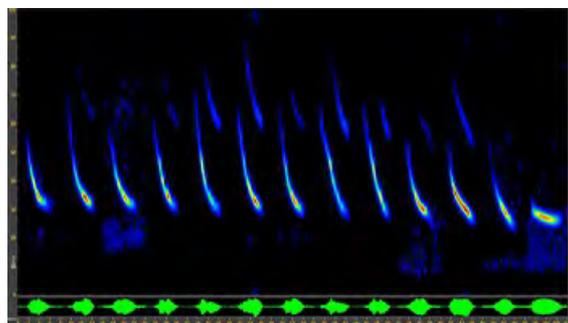
Common Noctule - call duration 3.8-4.3 ms



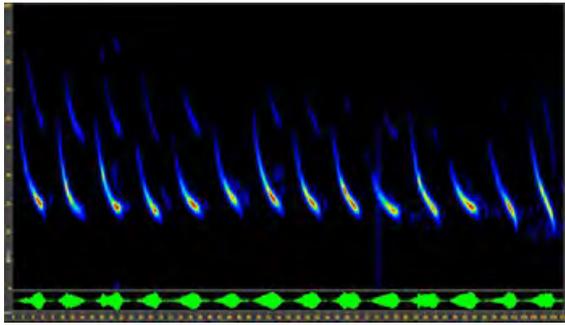
Leisler's Bat - call duration 3.8-4.3 ms



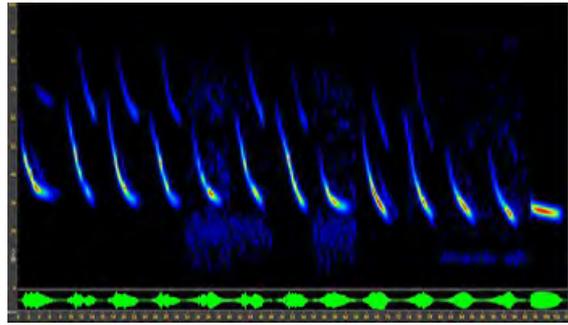
Common Noctule - call duration 4.4-4.9 ms



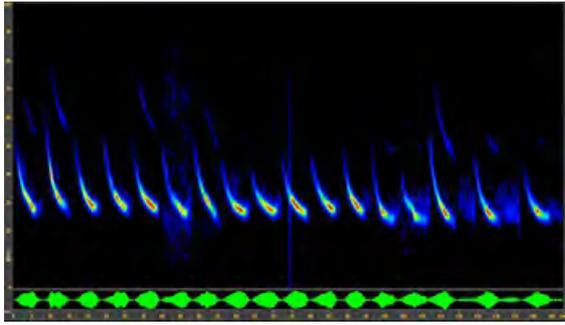
Leisler's Bat - call duration 4.4-4.9 ms



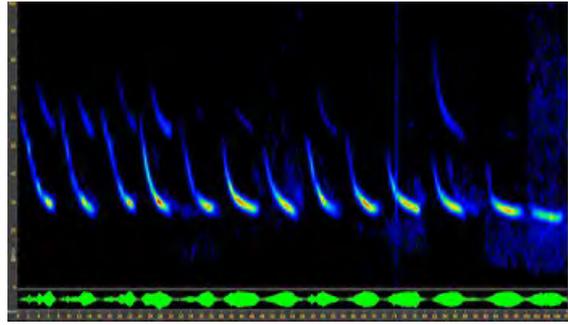
Common Noctule - call duration 5.0-5.9 ms



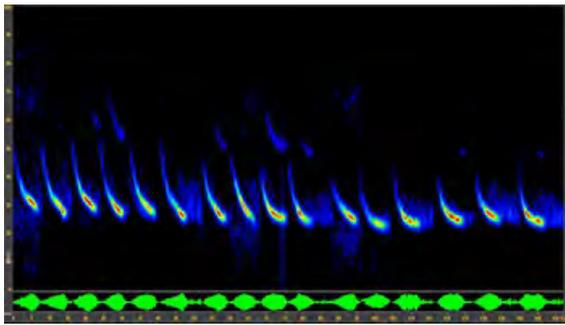
Leisler's Bat - call duration 5.0-5.9 ms



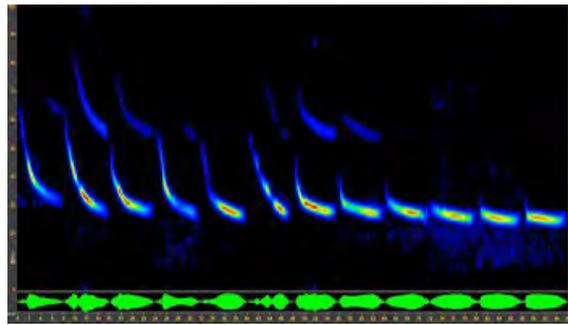
Common Noctule - call duration 6.0-6.8 ms



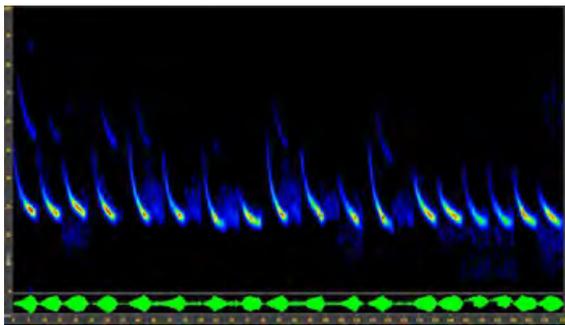
Leisler's Bat - call duration 6.0-6.8 ms



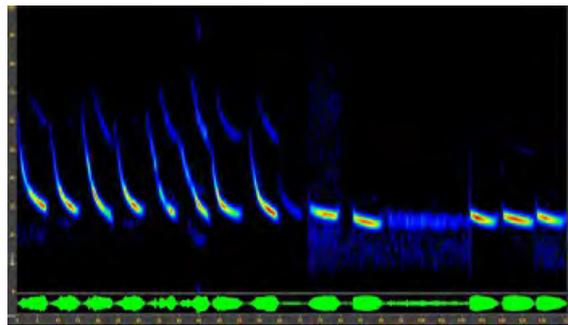
Common Noctule - call duration 6.9-7.2 ms



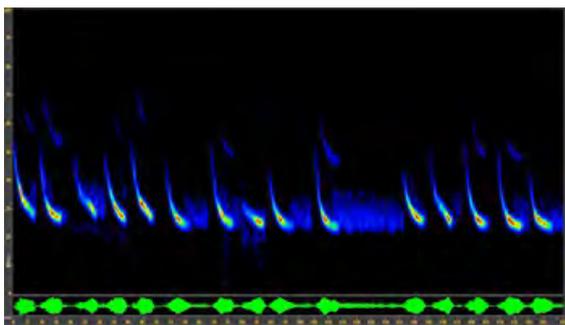
Leisler's Bat - call duration 6.9-7.2 ms



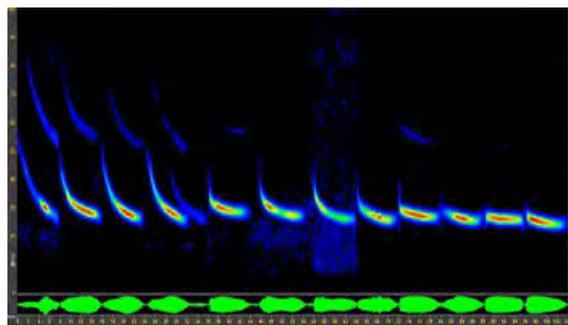
Common Noctule - call duration 7.3-7.6 ms



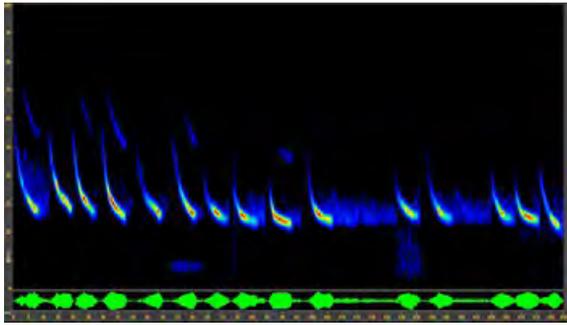
Leisler's Bat - call duration 7.3-7.6 ms



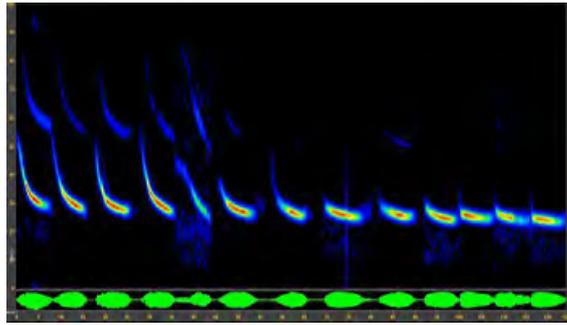
Common Noctule - call duration 7.7-7.8 ms



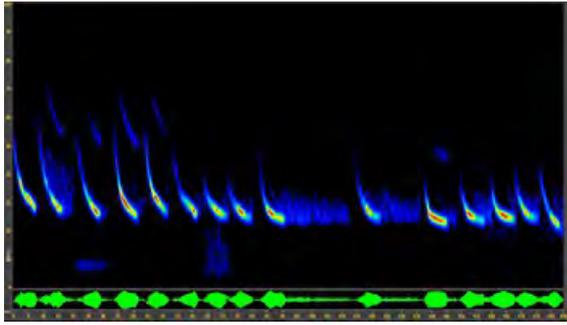
Leisler's Bat - call duration 7.7-7.8 ms



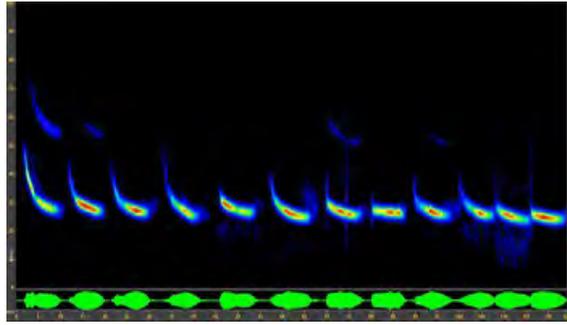
Common Noctule - call duration 7.9-8.0 ms



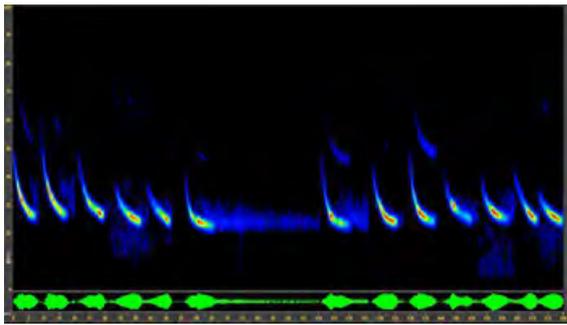
Leisler's Bat - call duration 7.9-8.0 ms



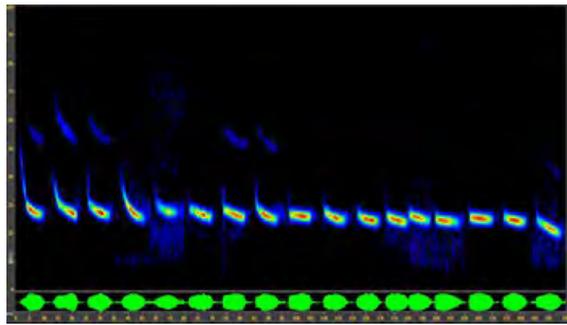
Common Noctule - call duration 8.1-8.3 ms



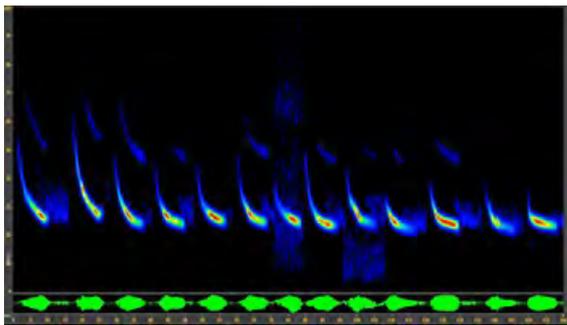
Leisler's Bat - call duration 8.1-8.3 ms



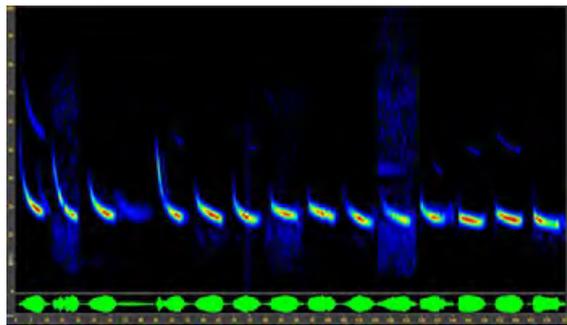
Common Noctule - call duration 8.4-8.5 ms



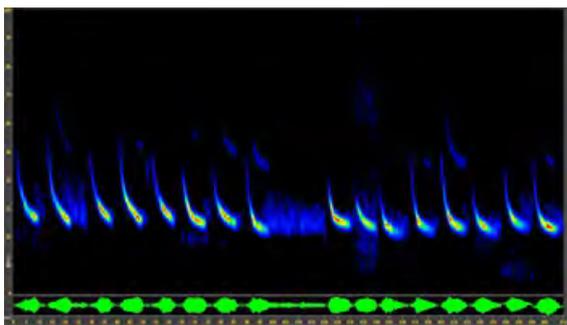
Leisler's Bat - call duration 8.4-8.5 ms



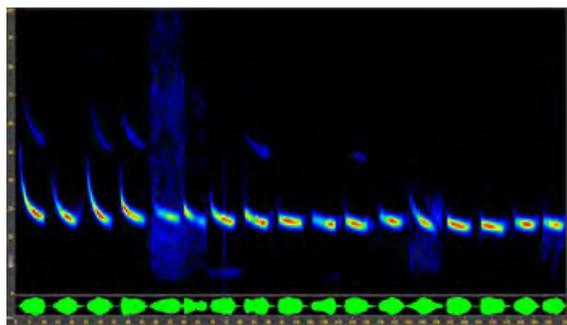
Common Noctule - call duration 8.6-8.7 ms



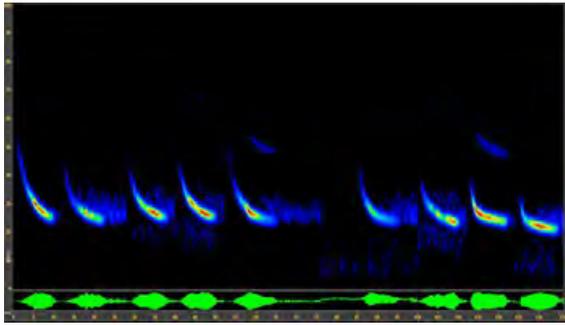
Leisler's Bat - call duration 8.6-8.7 ms



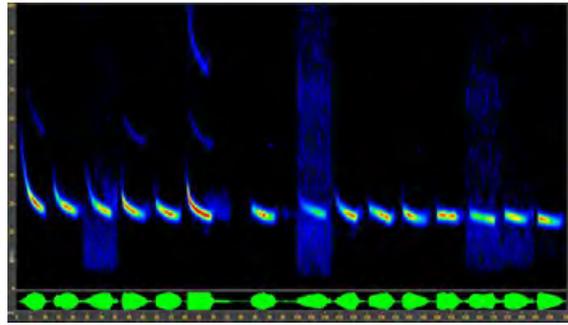
Common Noctule - call duration 8.8-8.9 ms



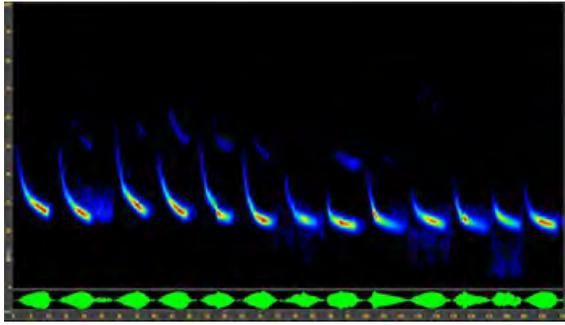
Leisler's Bat - call duration 8.8-8.9 ms



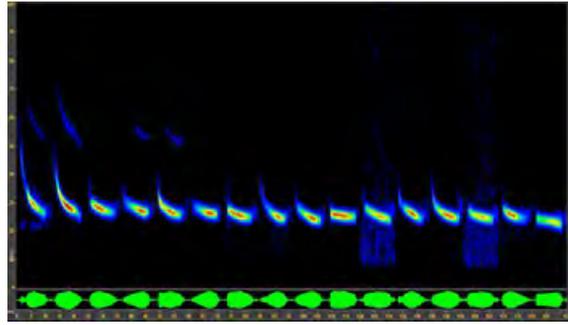
Common Noctule - call duration 9.0-9.1 ms



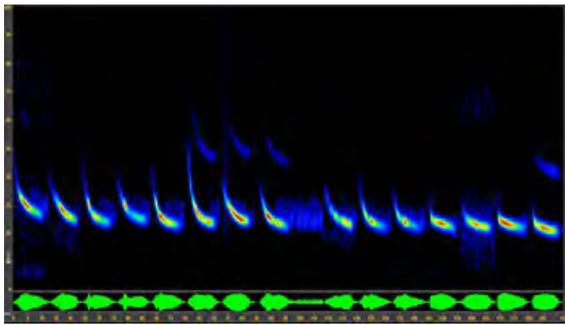
Leisler's Bat - call duration 9.0-9.1 ms



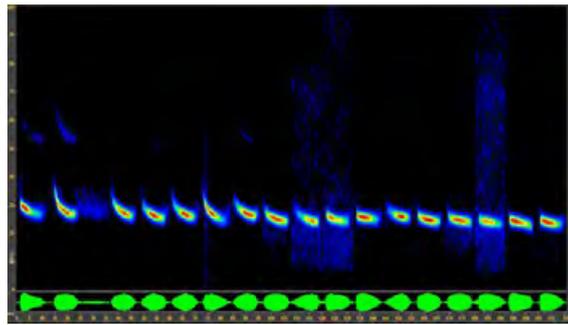
Common Noctule - call duration 9.2-9.3 ms



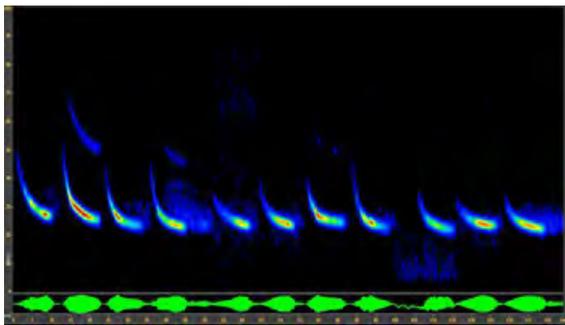
Leisler's Bat - call duration 9.2-9.3 ms



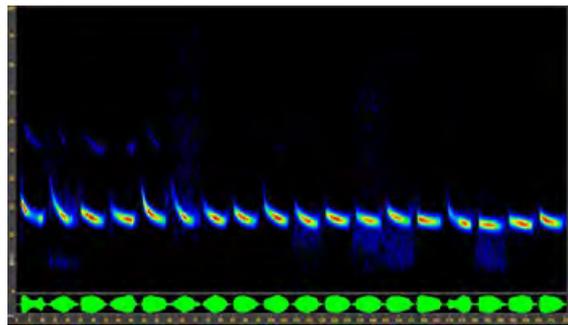
Common Noctule - call duration 9.4-9.5 ms



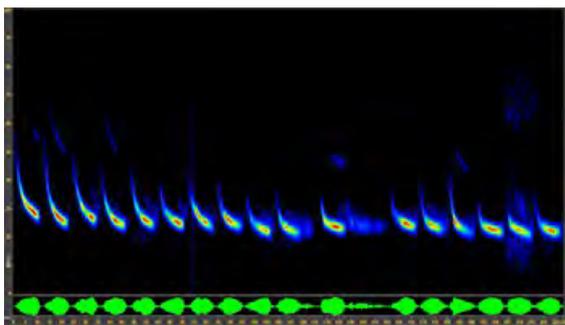
Leisler's Bat - call duration 9.4-9.5 ms



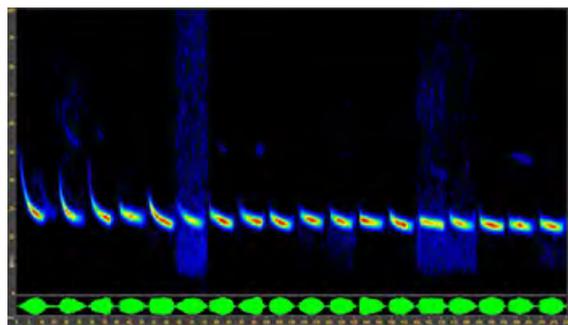
Common Noctule - call duration 9.6-9.7 ms



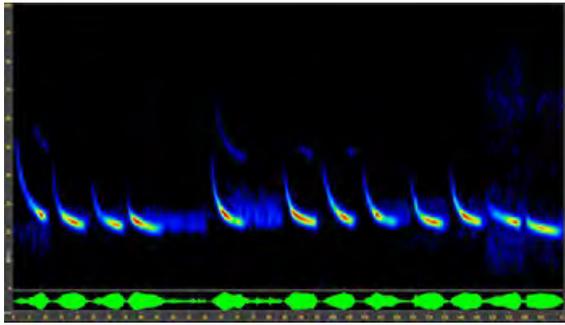
Leisler's Bat - call duration 9.6-9.7 ms



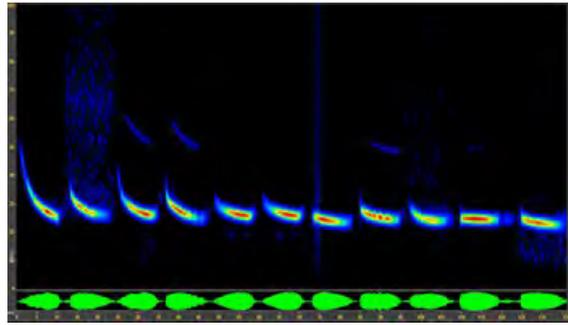
Common Noctule - call duration 9.8-9.9 ms



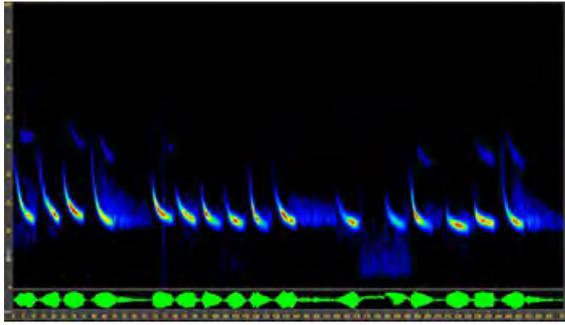
Leisler's Bat - call duration 9.8-9.9 ms



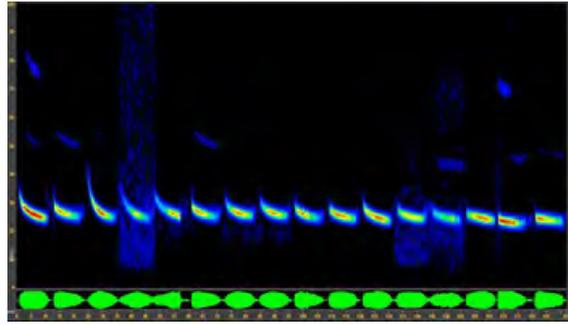
Common Noctule - call duration 10.0-10.1 ms



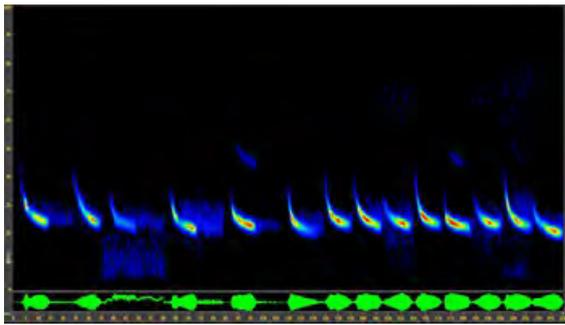
Leisler's Bat - call duration 10.0-10.1 ms



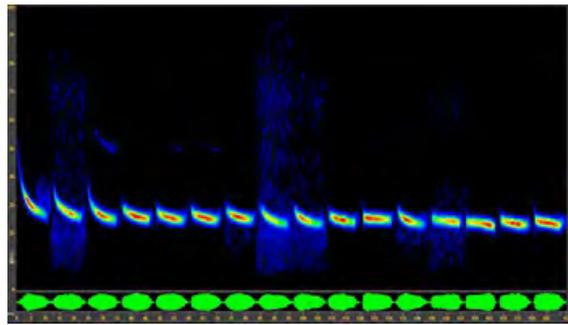
Common Noctule - call duration 10.2-10.3 ms



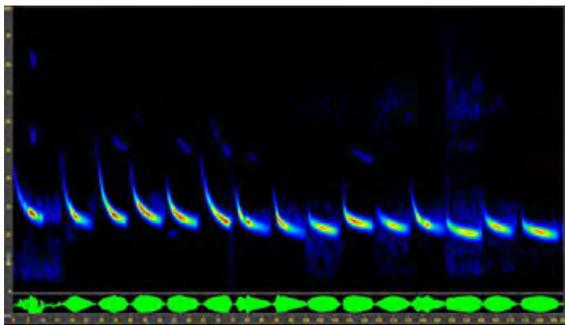
Leisler's Bat - call duration 10.2-10.3 ms



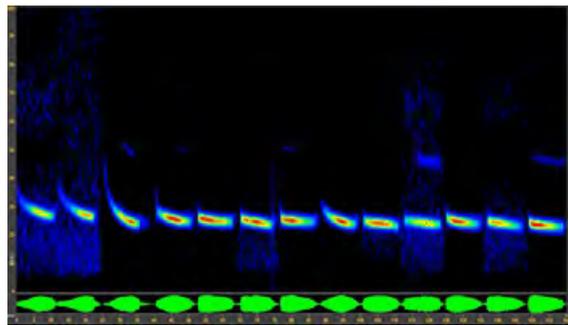
Common Noctule - call duration 10.4-10.5 ms



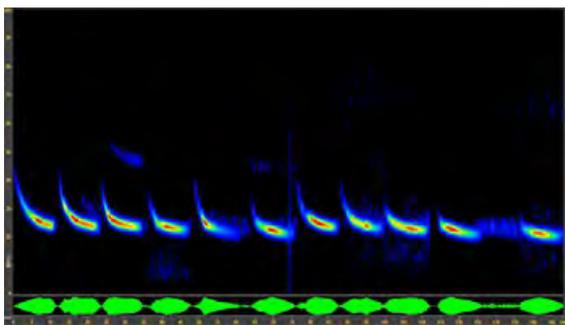
Leisler's Bat - call duration 10.4-10.5 ms



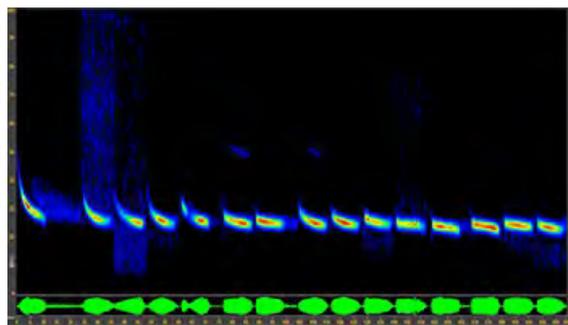
Common Noctule - call duration 10.6-10.7 ms



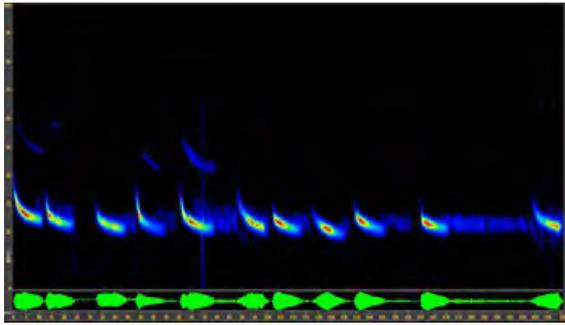
Leisler's Bat - call duration 10.6-10.7 ms



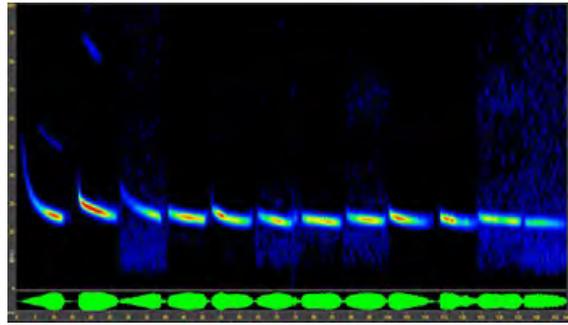
Common Noctule - call duration 10.8-10.9 ms



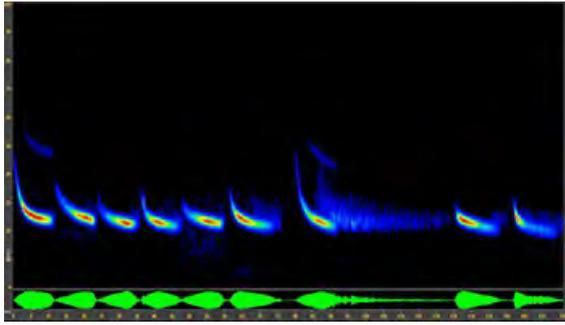
Leisler's Bat - call duration 10.8-10.9 ms



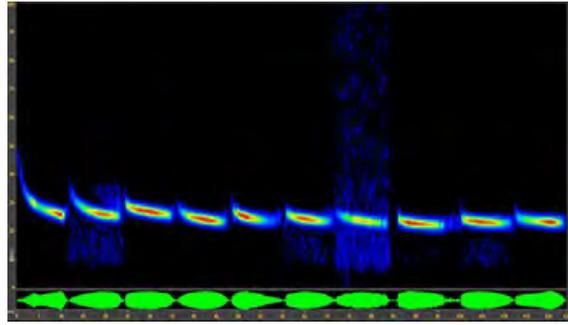
Common Noctule - call duration 11.0-11.1 ms



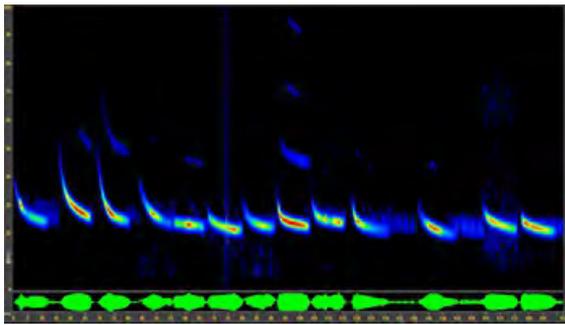
Leisler's Bat - call duration 11.0-11.1 ms



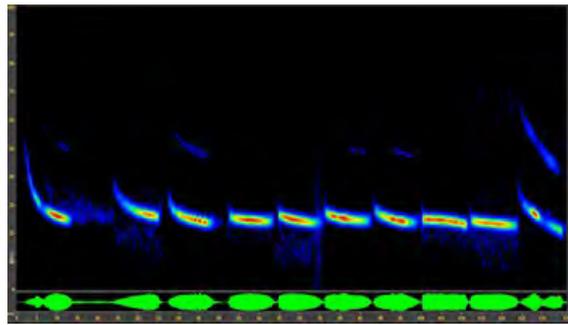
Common Noctule - call duration 11.2-11.3 ms



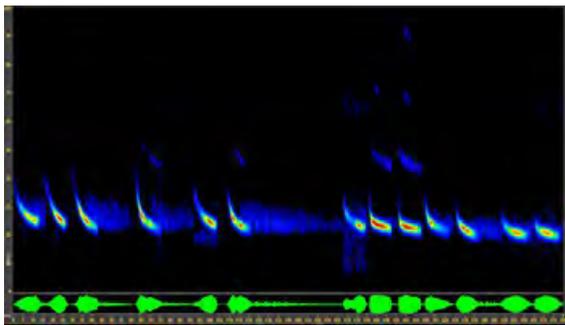
Leisler's Bat - call duration 11.2-11.3 ms



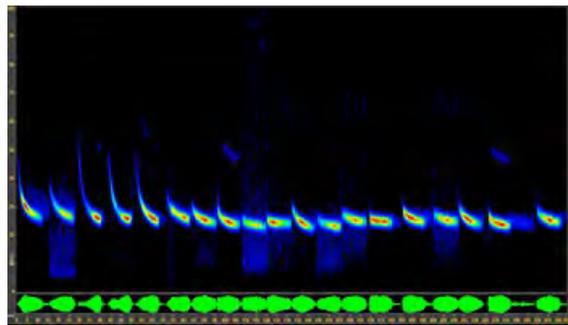
Common Noctule - call duration 11.4-11.5 ms



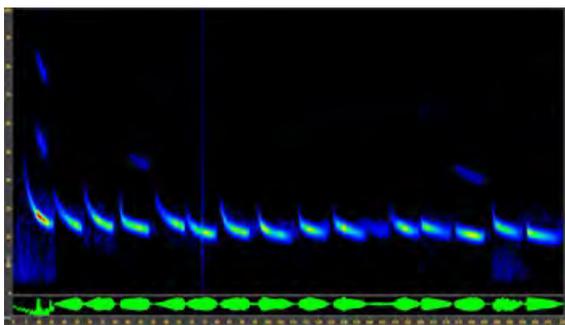
Leisler's Bat - call duration 11.4-11.5 ms



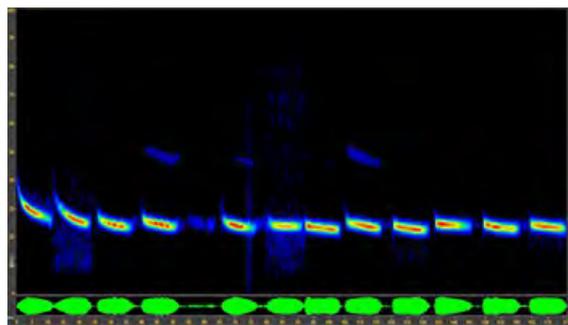
Common Noctule - call duration 11.6-11.7 ms



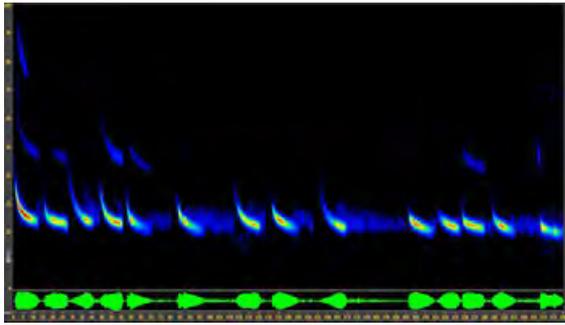
Leisler's Bat - call duration 11.6-11.7 ms



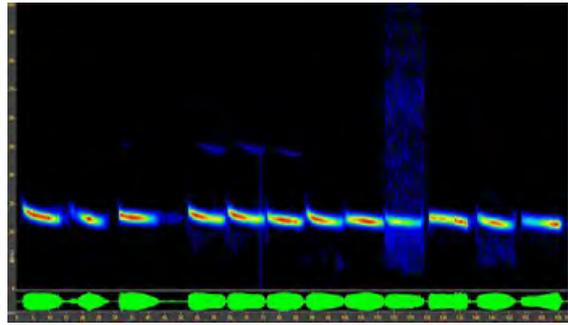
Common Noctule - call duration 11.8-11.9 ms



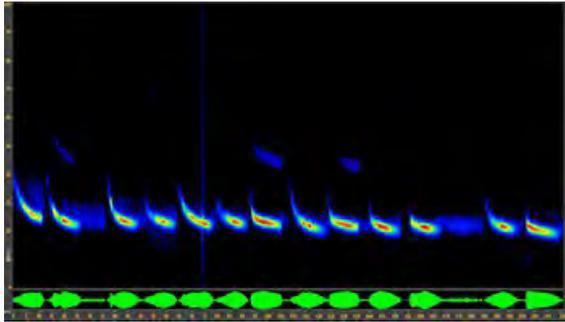
Leisler's Bat - call duration 11.8-11.9 ms



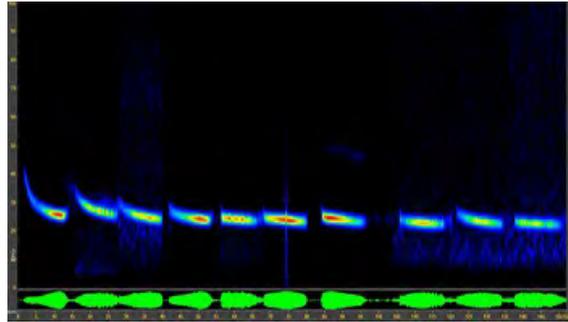
Common Noctule - call duration 12.0-12.2 ms



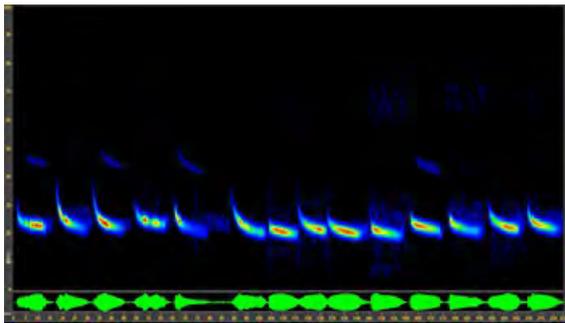
Leisler's Bat - call duration 12.0-12.2 ms



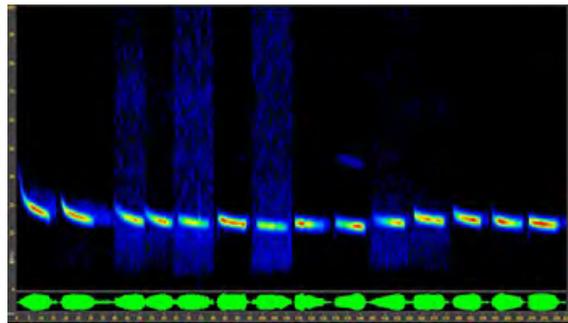
Common Noctule - call duration 12.3-12.4 ms



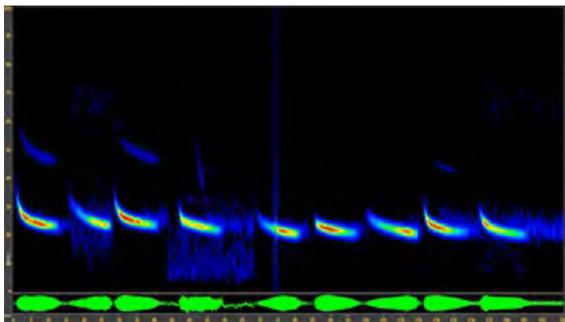
Leisler's Bat - call duration 12.3-12.4 ms



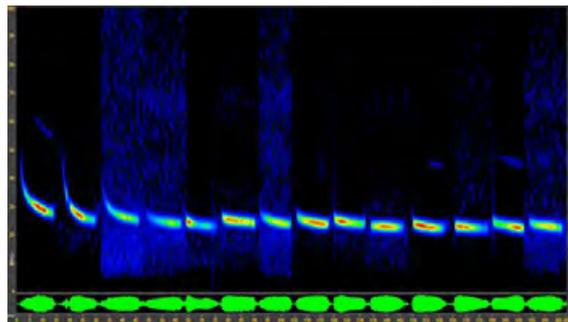
Common Noctule - call duration 12.5-12.7 ms



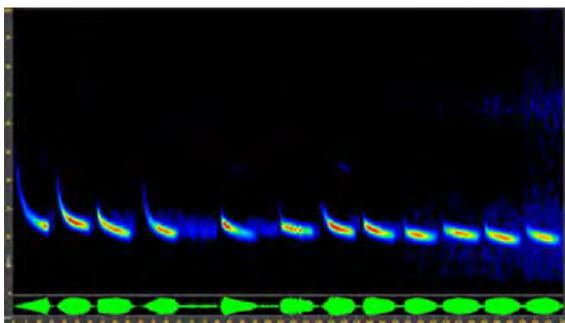
Leisler's Bat - call duration 12.5-12.7 ms



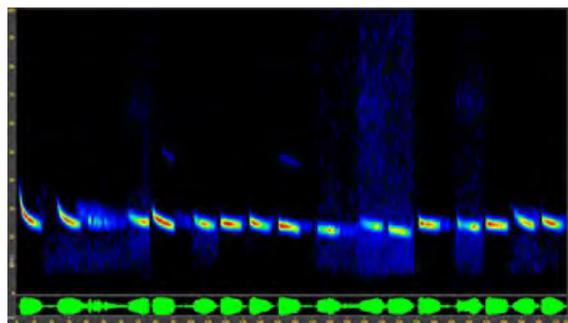
Common Noctule - call duration 12.8-12.9 ms



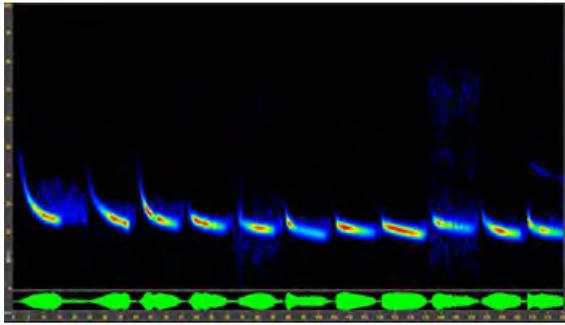
Leisler's Bat - call duration 12.8-12.9 ms



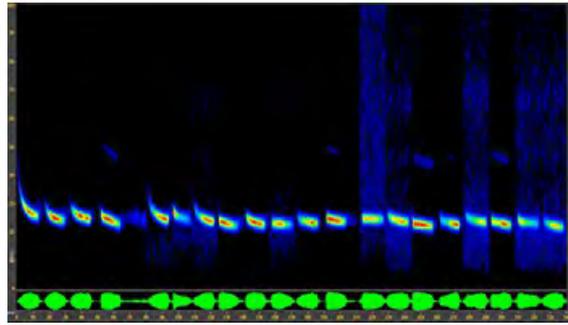
Common Noctule - call duration 13.0-13.1 ms



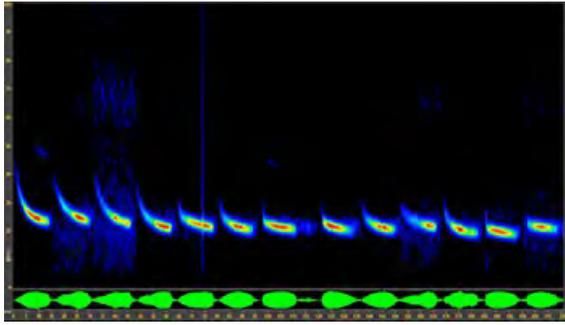
Leisler's Bat - call duration 13.0-13.1 ms



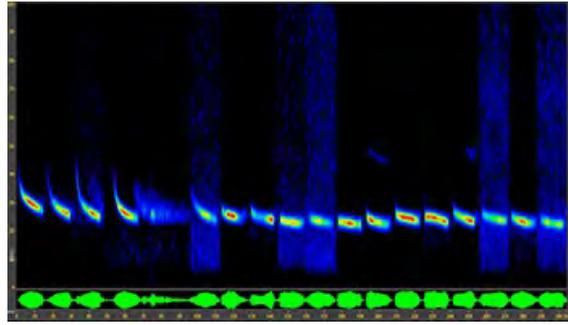
Common Noctule - call duration 13.2-13.3 ms



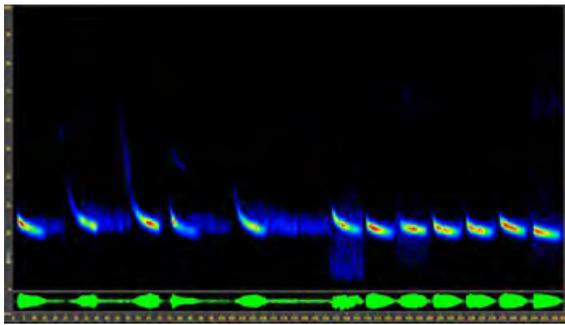
Leisler's Bat - call duration 13.2-13.3 ms



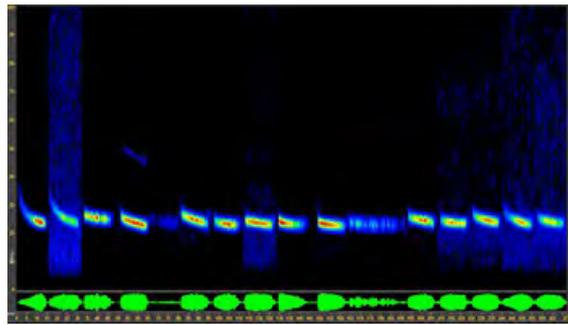
Common Noctule - call duration 13.4-13.5 ms



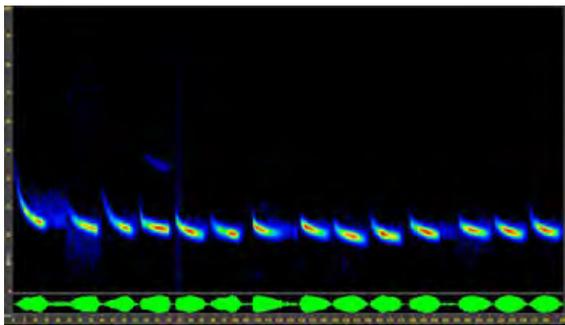
Leisler's Bat - call duration 13.4-13.5 ms



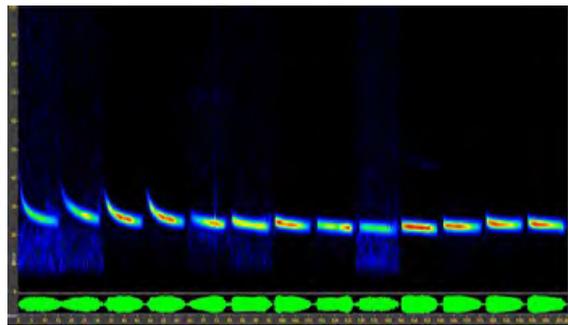
Common Noctule - call duration 13.6-13.7 ms



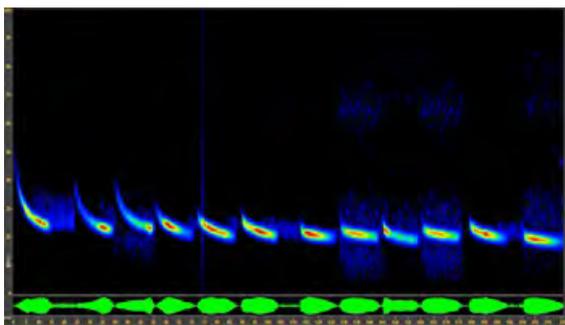
Leisler's Bat - call duration 13.6-13.7 ms



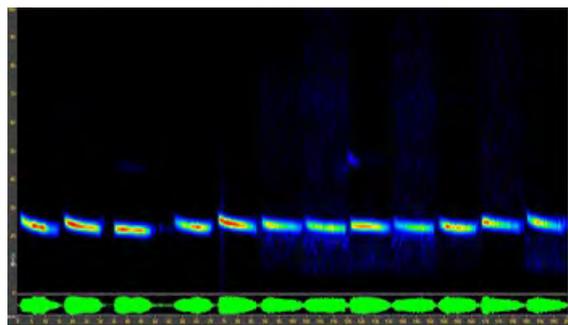
Common Noctule - call duration 13.8-14.0 ms



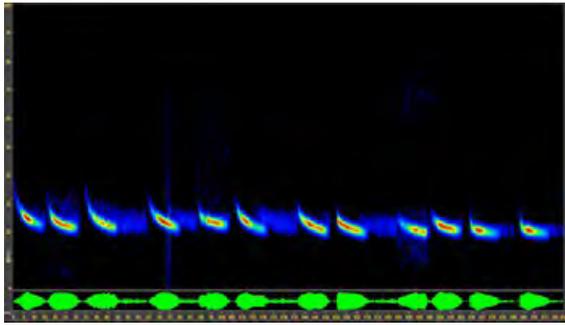
Leisler's Bat - call duration 13.8-14.0 ms



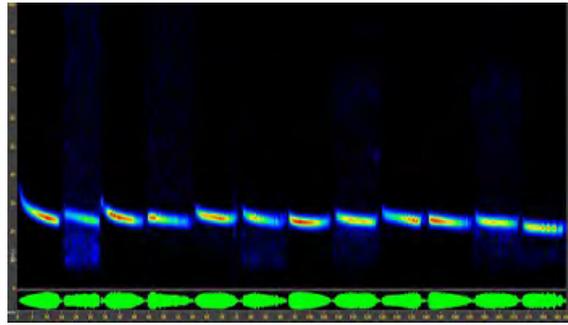
Common Noctule - call duration 14.1-14.3 ms



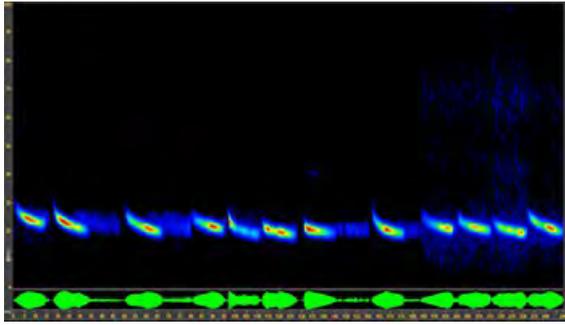
Leisler's Bat - call duration 14.1-14.3 ms



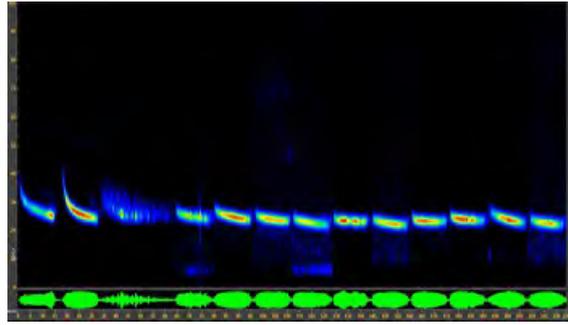
Common Noctule - call duration 14.4-14.5 ms



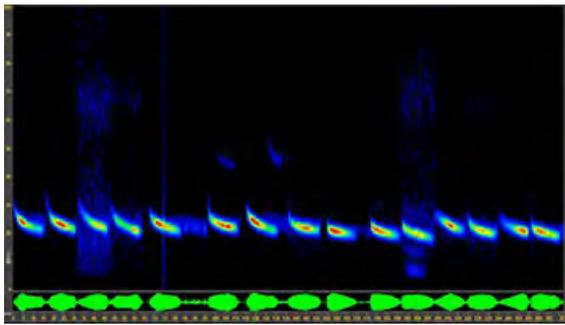
Leisler's Bat - call duration 14.4-14.5 ms



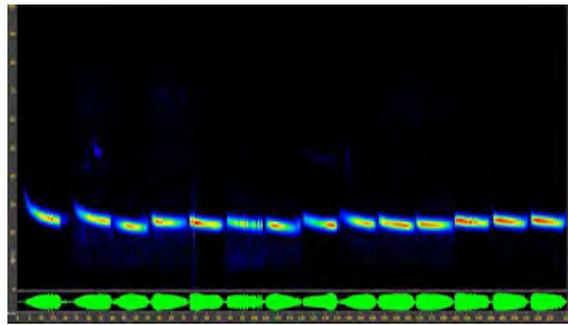
Common Noctule - call duration 14.6-14.8 ms



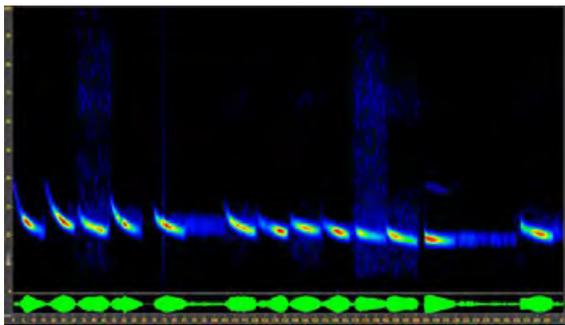
Leisler's Bat - call duration 14.6-14.8 ms



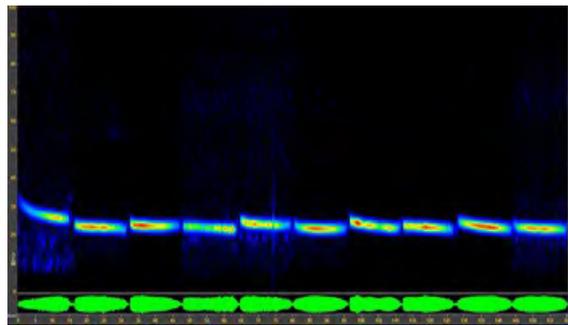
Common Noctule - call duration 14.9-15.1 ms



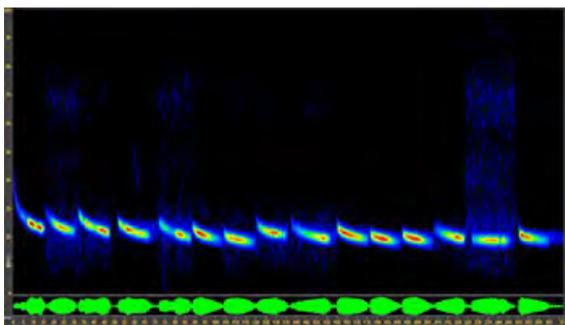
Leisler's Bat - call duration 14.9-15.1 ms



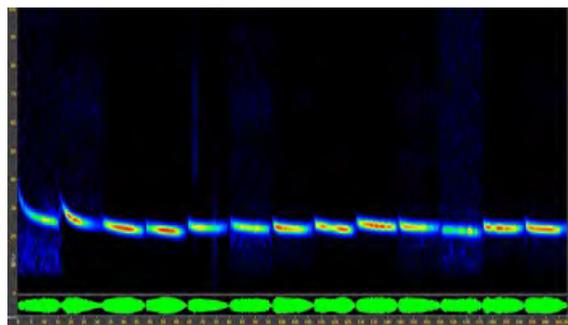
Common Noctule - call duration 15.2-15.3 ms



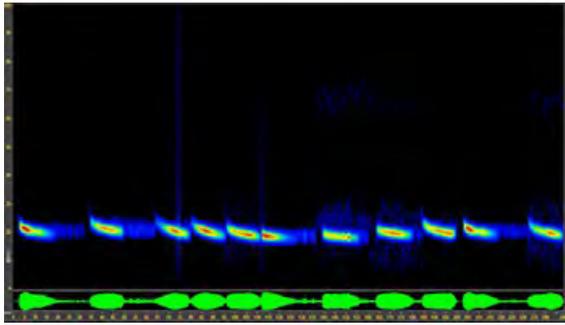
Leisler's Bat - call duration 15.2-15.3 ms



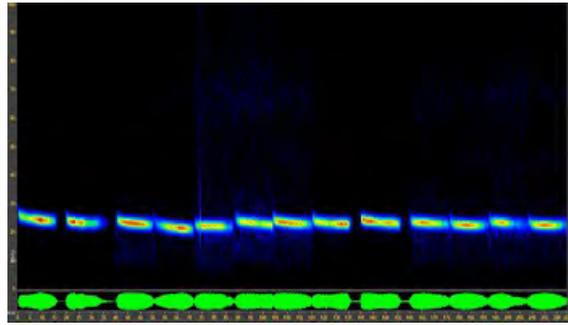
Common Noctule - call duration 15.4-15.7 ms



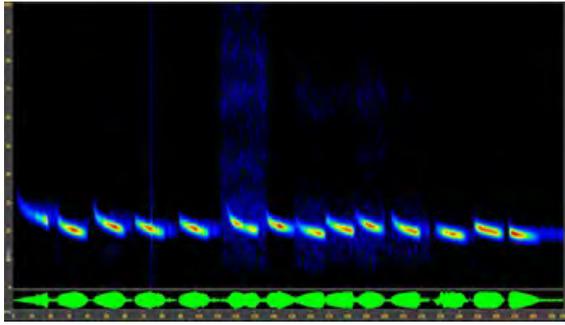
Leisler's Bat - call duration 15.4-15.7 ms



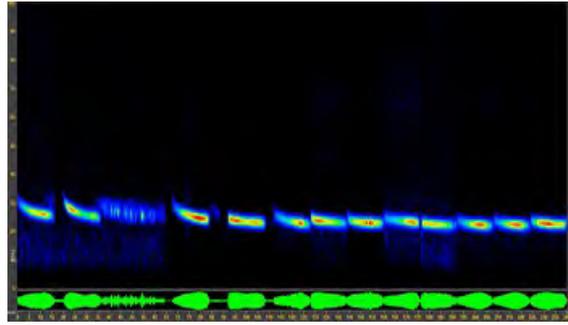
Common Noctule - call duration 15.8-16.0 ms



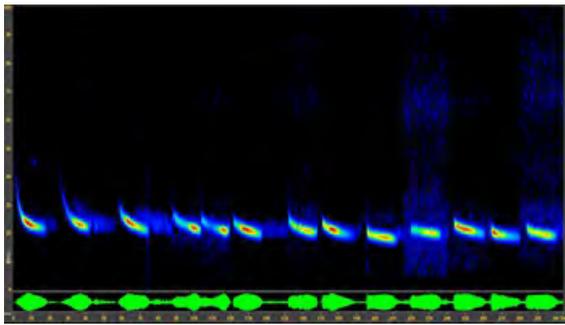
Leisler's Bat - call duration 15.8-16.0 ms



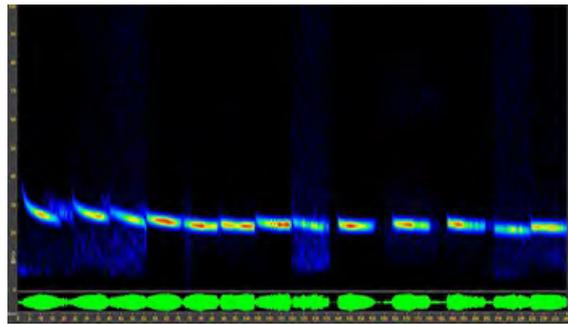
Common Noctule - call duration 16.1-16.3 ms



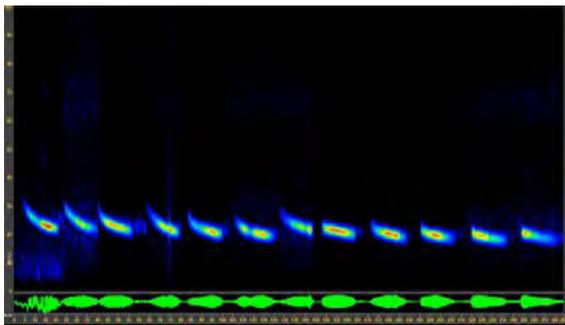
Leisler's Bat - call duration 16.1-16.3 ms



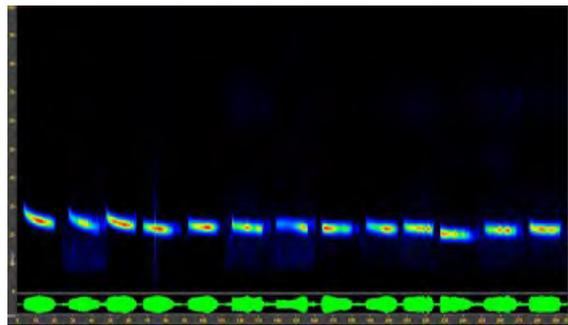
Common Noctule - call duration 16.4-16.6 ms



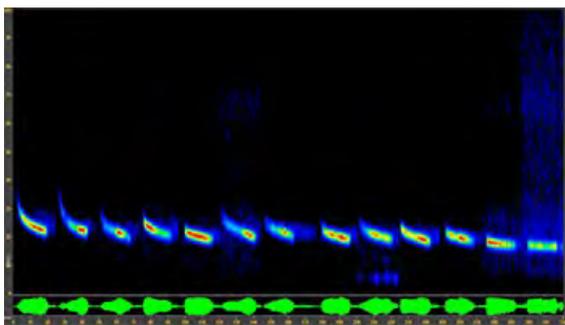
Leisler's Bat - call duration 16.4-16.6 ms



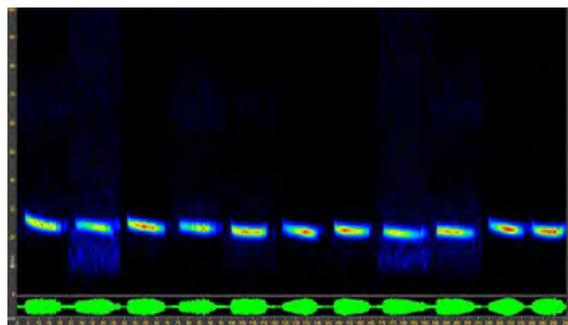
Common Noctule - call duration 16.7-17.0 ms



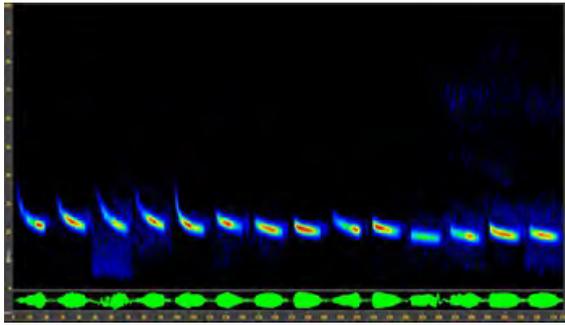
Leisler's Bat - call duration 16.7-17.0 ms



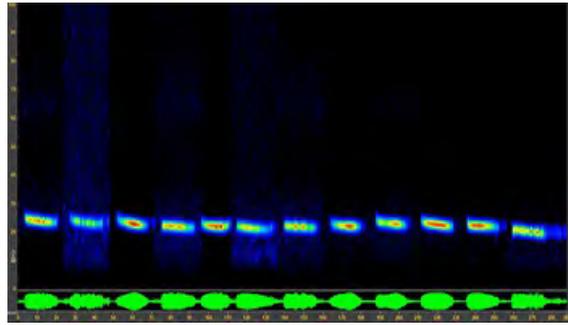
Common Noctule - call duration 17.1-17.2 ms



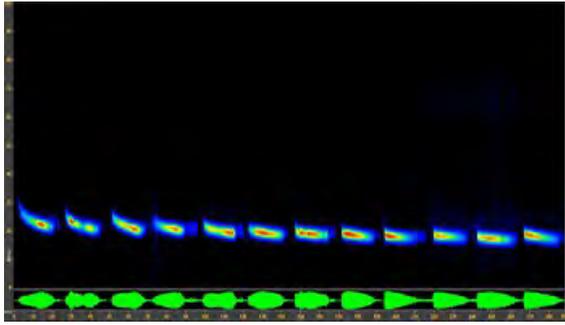
Leisler's Bat - call duration 17.1-17.2 ms



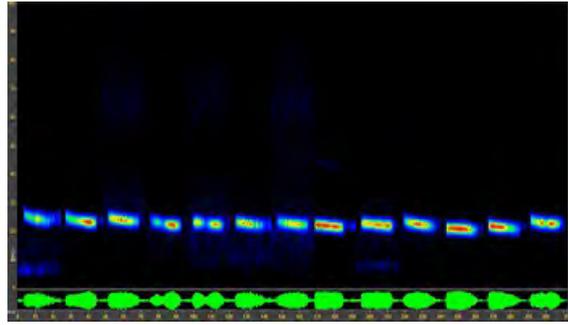
Common Noctule - call duration 17.3-17.4 ms



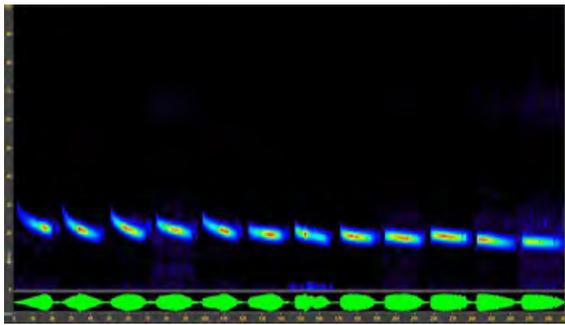
Leisler's Bat - call duration 17.3-17.4 ms



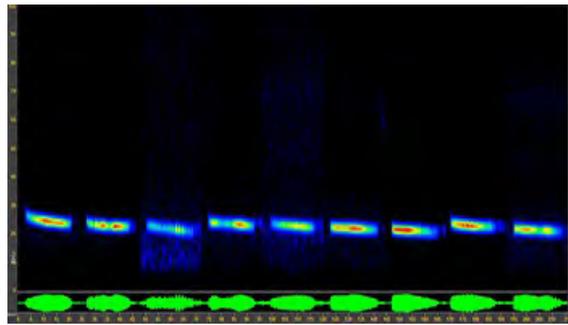
Common Noctule - call duration 17.5-18.2 ms



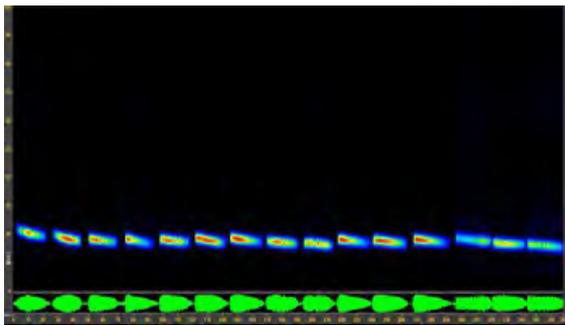
Leisler's Bat - call duration 17.5-18.2 ms



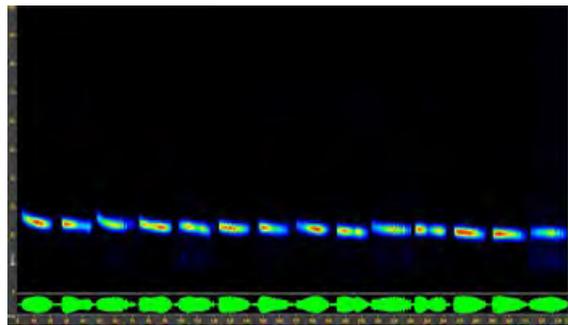
Common Noctule - call duration 18.3-18.7 ms



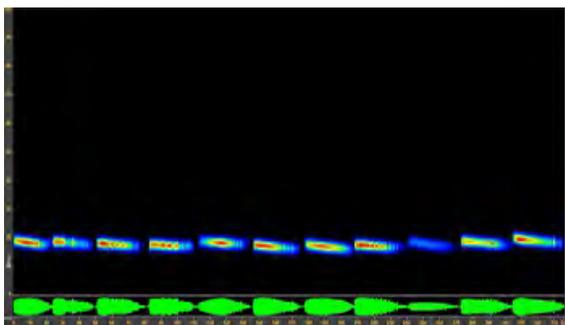
Leisler's Bat - call duration 18.3-18.7 ms



Common Noctule - call duration 18.8-24.0 ms



Leisler's Bat - call duration 18.8-24.0 ms

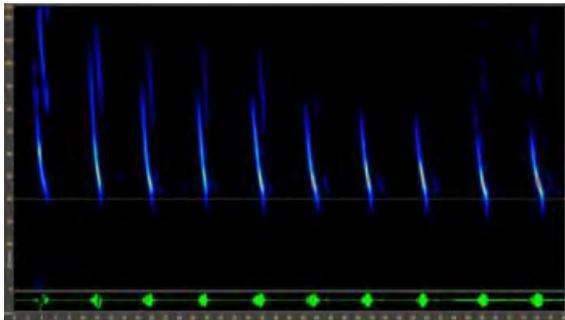


Common Noctule - call duration 24.1-31.7 ms

Leisler's Bat - no examples for this call duration

Identification appendix 5: Kuhl's Pipistrelle *Pipistrellus kuhlii* and Nathusius' Pipistrelle *Pipistrellus nathusii*

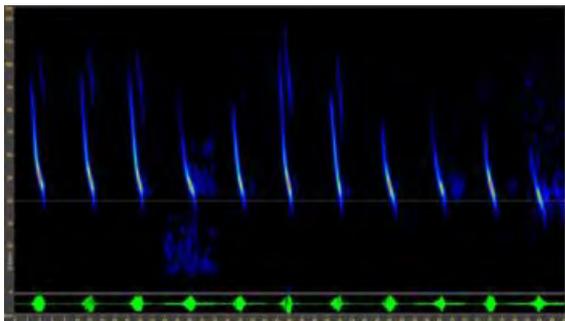
Nathusius' Pipistrelle and Kuhl's Pipistrelle are two of the most difficult species in Europe to identify acoustically from their echolocation calls. Here we provide a comparison of known Nathusius' Pipistrelle and Kuhl's Pipistrelle calls of the same call duration alongside each other to illustrate this. However, for a given call duration, Kuhl's Pipistrelle calls tend to be lower in frequency and Kuhl's Pipistrelle calls also often have a downward hook, with a larger bandwidth that can be larger than 5 kHz, which is not seen in Nathusius' Pipistrelle. This highlights that there is scope to look across recordings to get an idea of the likely proportion of Nathusius' Pipistrelle and Kuhl's Pipistrelle. For the time being, we take a cautious approach and present the number of recordings of Nathusius' Pipistrelle and Kuhl's Pipistrelle combined.



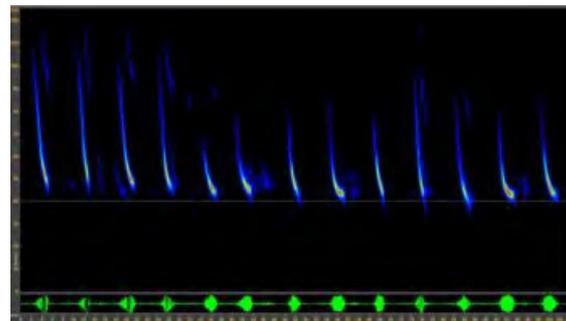
Kuhl's Pipistrelle - call duration 1.1-1.7 ms



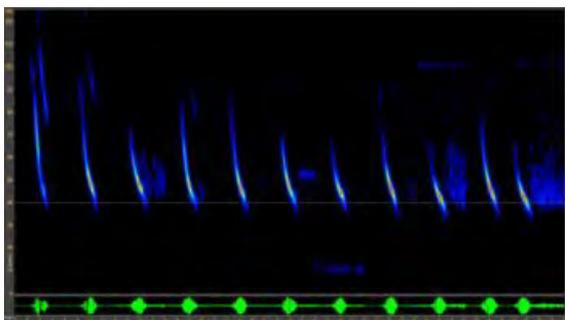
Nathusius' Pipistrelle - fewer examples for this call duration



Kuhl's Pipistrelle - call duration 1.8-2.2 ms



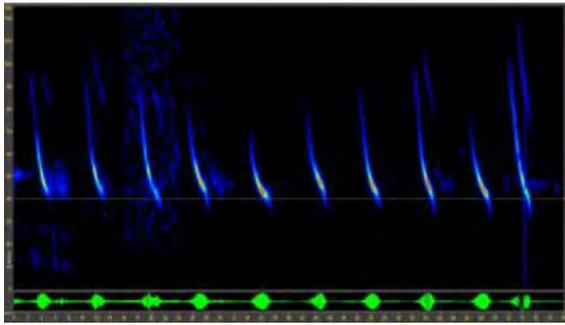
Nathusius' Pipistrelle - call duration 1.8-3.0 ms



Kuhl's Pipistrelle - call duration 2.3-2.6 ms

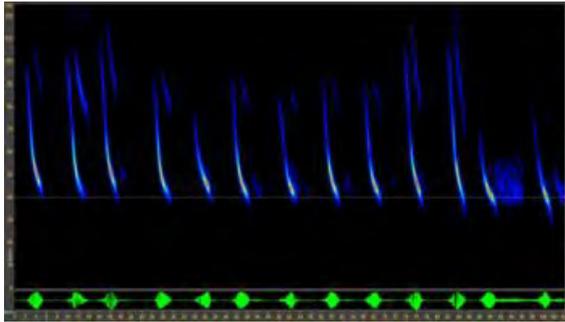


Nathusius' Pipistrelle - fewer examples for this call duration



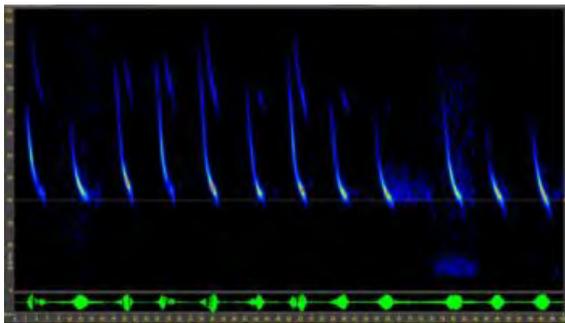
Kuhl's Pipistrelle - call duration 2.7-2.9 ms

Nathusius' Pipistrelle - fewer examples for this call duration

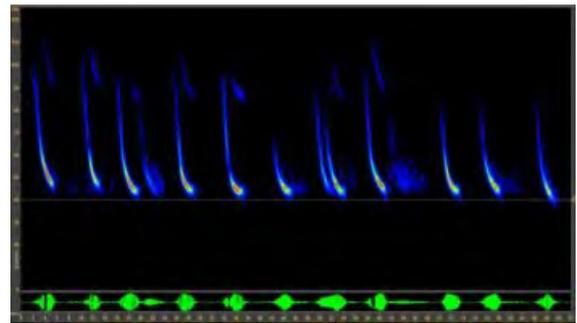


Kuhl's Pipistrelle - call duration 3.0-3.1 ms

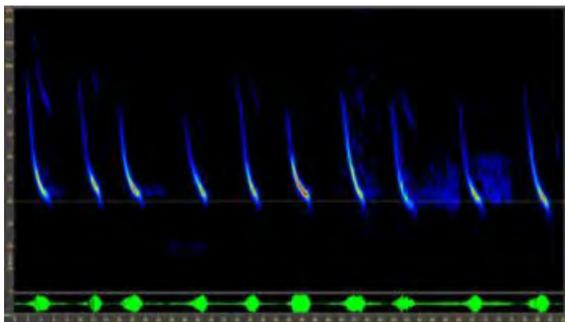
Nathusius' Pipistrelle - fewer examples for this call duration



Kuhl's Pipistrelle - call duration 3.2-3.3 ms

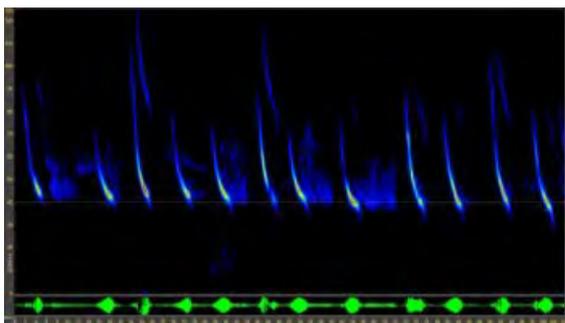


Nathusius' Pipistrelle - call duration 3.1-3.6 ms



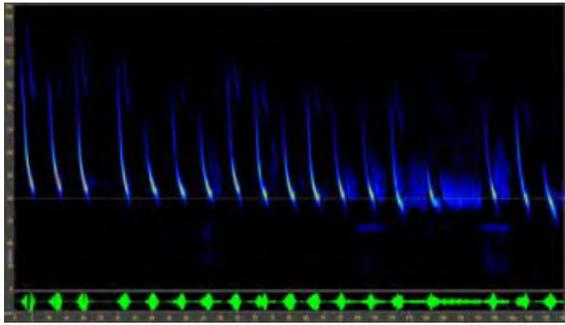
Kuhl's Pipistrelle - call duration 3.4-3.5 ms

Nathusius' Pipistrelle - fewer examples for this call duration

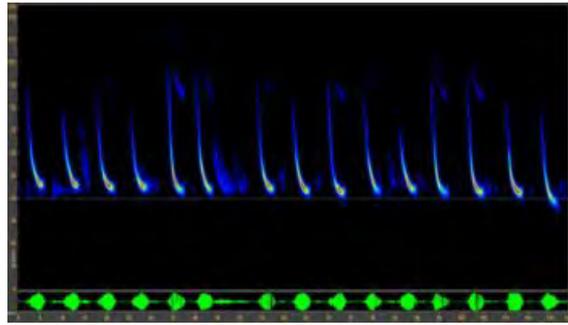


Kuhl's Pipistrelle - call duration 3.6-3.7 ms

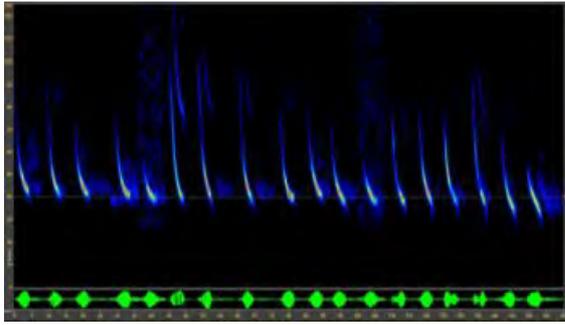
Nathusius' Pipistrelle - fewer examples for this call duration



Kuhl's Pipistrelle - call duration 3.8-3.9 ms



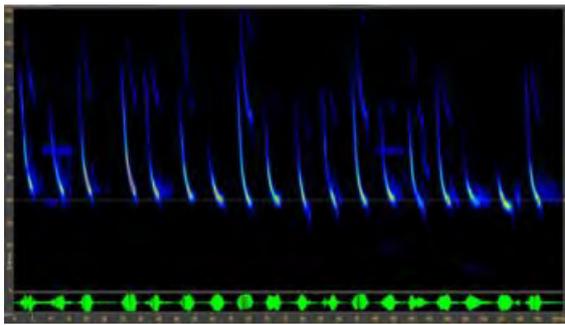
Nathusius' Pipistrelle - call duration 3.7-4.0 ms



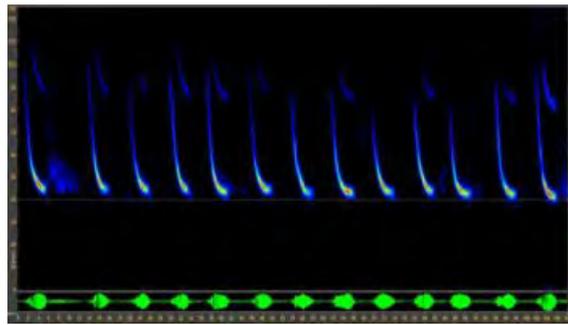
Kuhl's Pipistrelle - call duration 4.0-4.1 ms



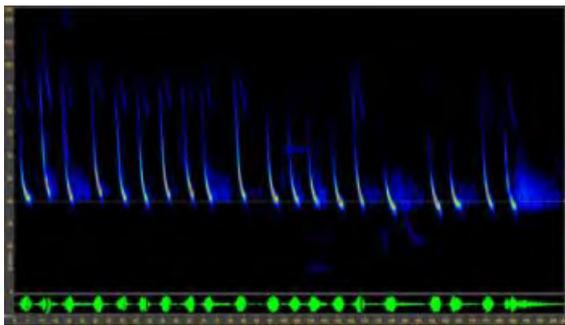
Nathusius' Pipistrelle - fewer examples for this call duration



Kuhl's Pipistrelle - call duration 4.2-4.3 ms



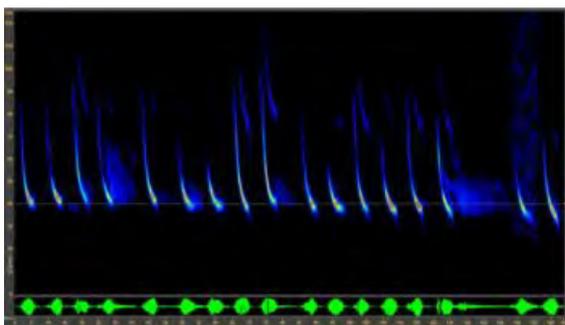
Nathusius' Pipistrelle - call duration 4.1-4.4 ms



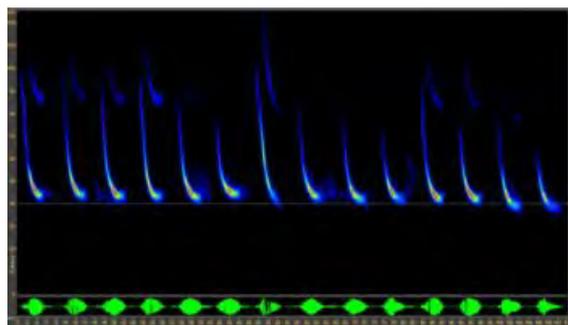
Kuhl's Pipistrelle - call duration 4.4-4.5 ms



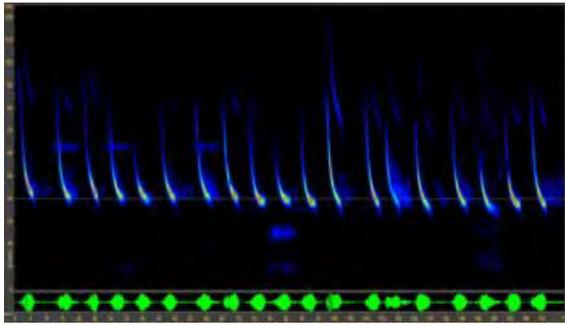
Nathusius' Pipistrelle - fewer examples for this call duration



Kuhl's Pipistrelle - call duration 4.6-4.7 ms

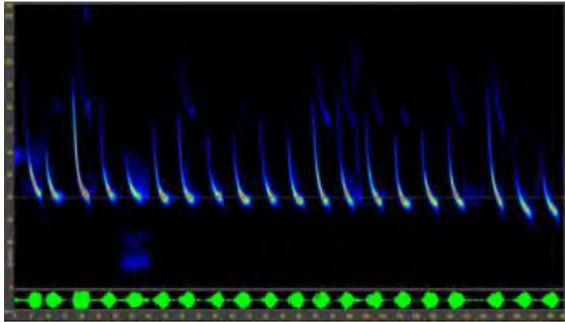


Nathusius' Pipistrelle - call duration 4.5-4.8 ms

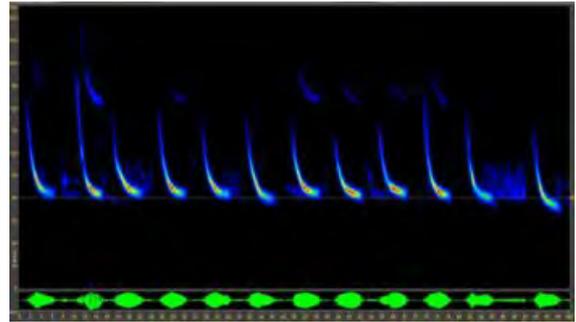


Kuhl's Pipistrelle - call duration 4.8-4.9 ms

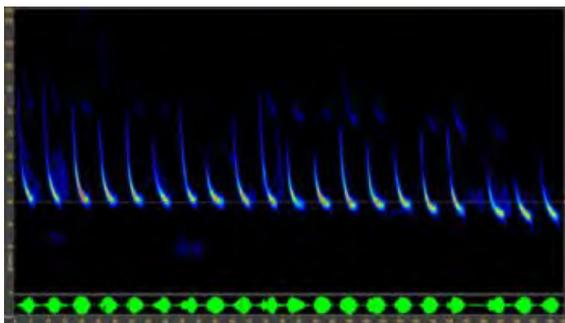
Nathusius' Pipistrelle - fewer examples for this call duration



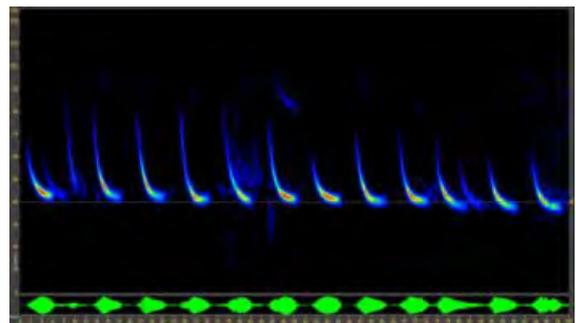
Kuhl's Pipistrelle - call duration 5.0-5.1 ms



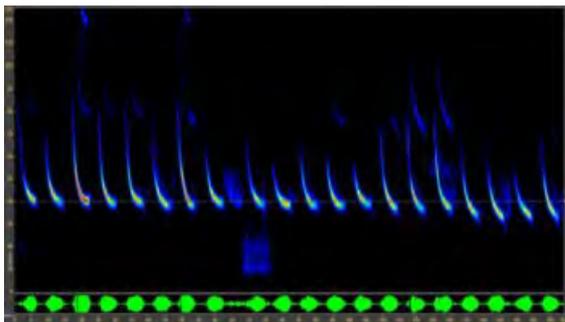
Nathusius' Pipistrelle - call duration 4.9-5.1 ms



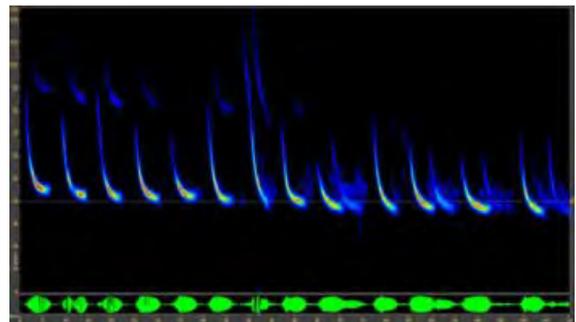
Kuhl's Pipistrelle - call duration 5.2-5.3 ms



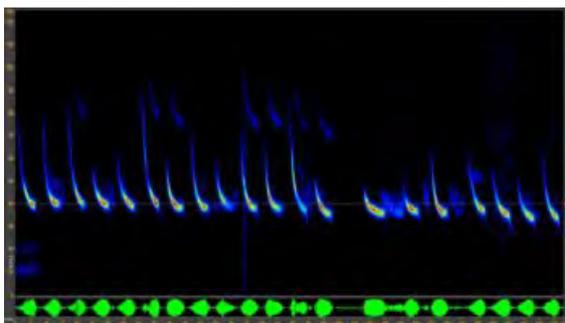
Nathusius' Pipistrelle - call duration 5.2-5.3 ms



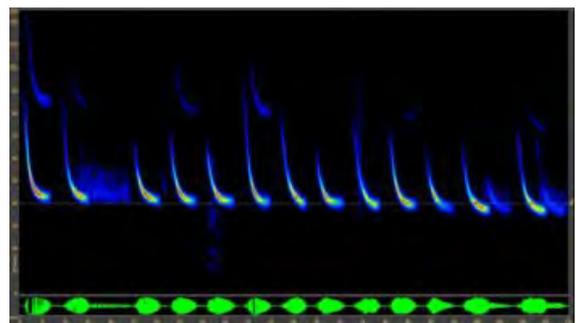
Kuhl's Pipistrelle - call duration 5.4-5.5 ms



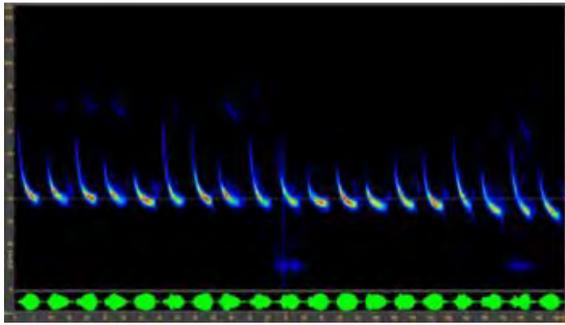
Nathusius' Pipistrelle - call duration 5.4-5.5 ms



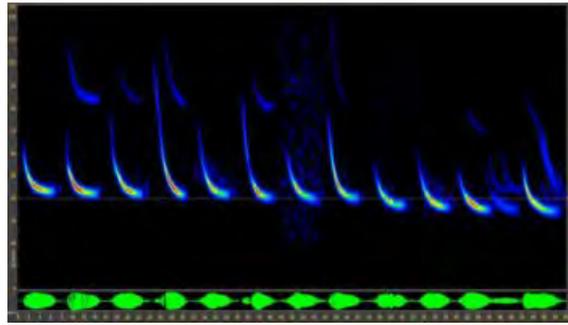
Kuhl's Pipistrelle - call duration 5.6-5.7 ms



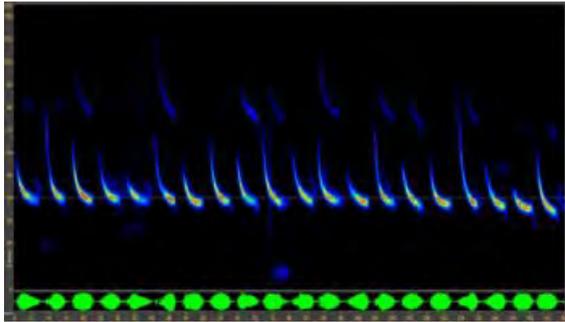
Nathusius' Pipistrelle - call duration 5.6-5.7 ms



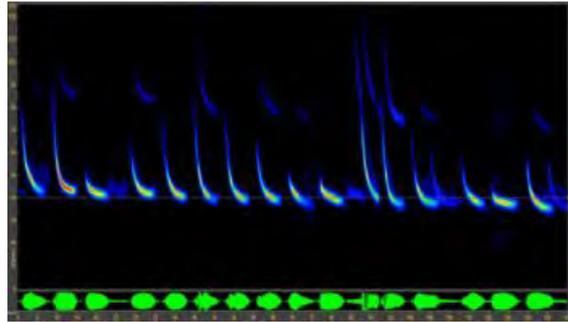
Kuhl's Pipistrelle - call duration 5.8-5.9 ms



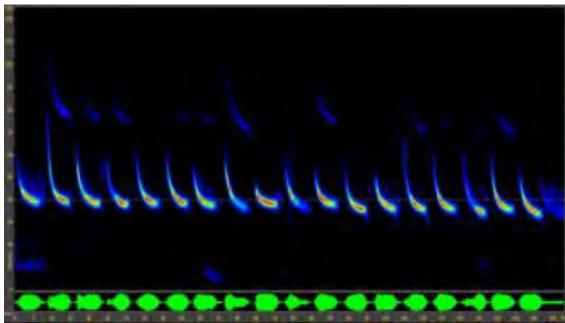
Nathusius' Pipistrelle - call duration 5.8-5.9 ms



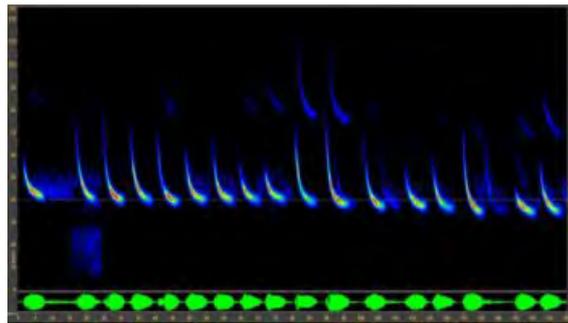
Kuhl's Pipistrelle - call duration 6.0-6.1 ms



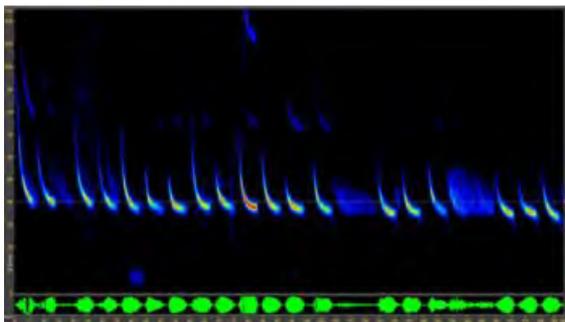
Nathusius' Pipistrelle - call duration 6.0-6.1 ms



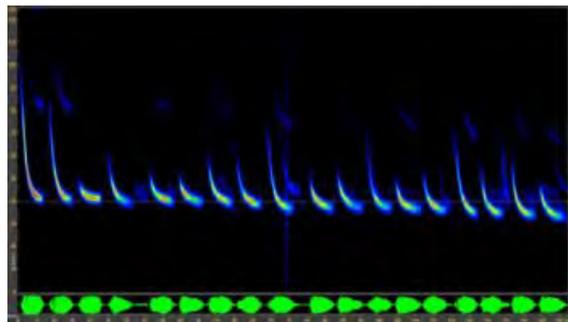
Kuhl's Pipistrelle - call duration 6.2-6.3 ms



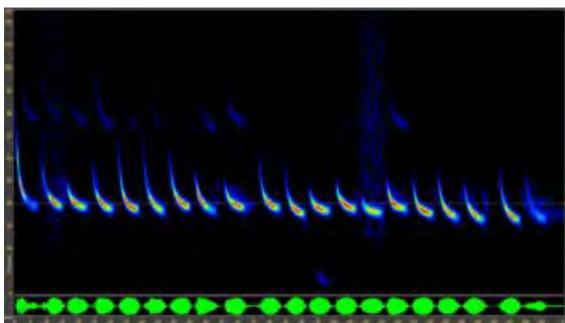
Nathusius' Pipistrelle - call duration 6.2-6.3 ms



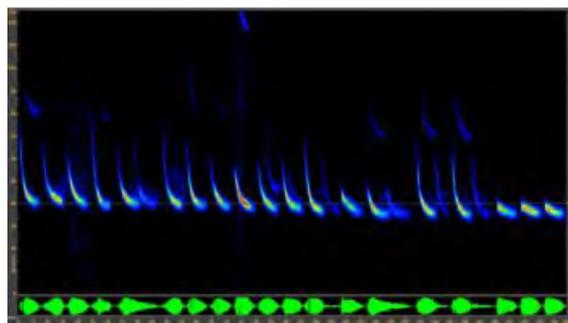
Kuhl's Pipistrelle - call duration 6.4-6.5 ms



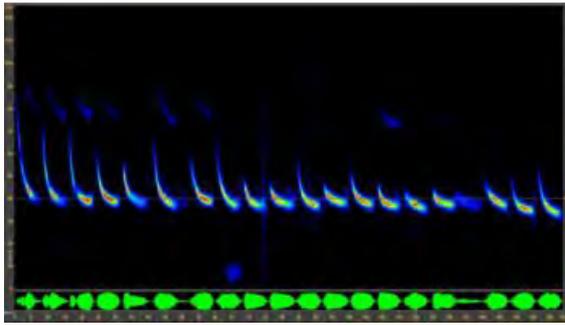
Nathusius' Pipistrelle - call duration 6.4-6.5 ms



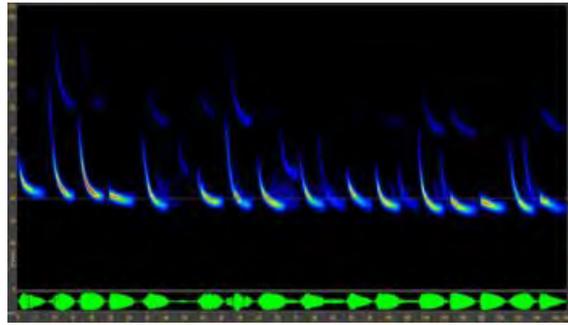
Kuhl's Pipistrelle - call duration 6.6-6.7 ms



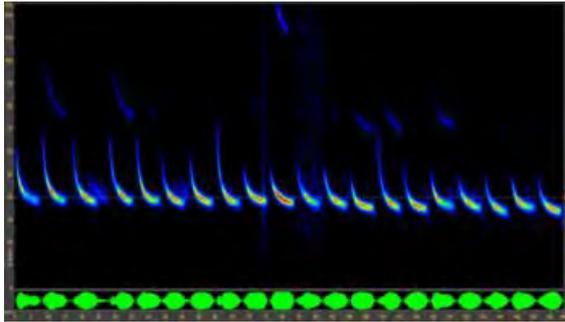
Nathusius' Pipistrelle - call duration 6.6-6.7 ms



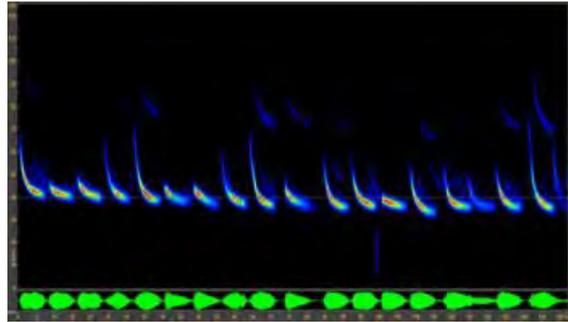
Kuhl's Pipistrelle - call duration 6.8-6.9 ms



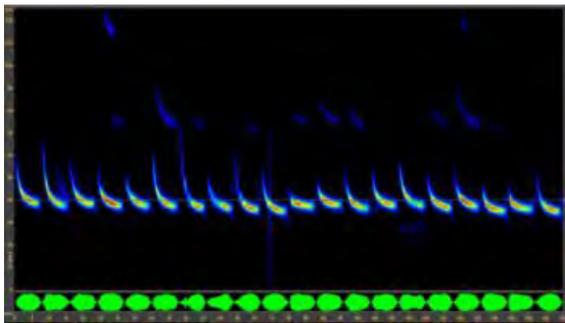
Nathusius' Pipistrelle - call duration 6.8-6.9 ms



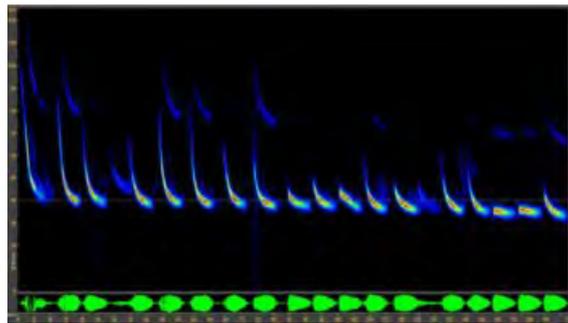
Kuhl's Pipistrelle - call duration 7.0-7.1 ms



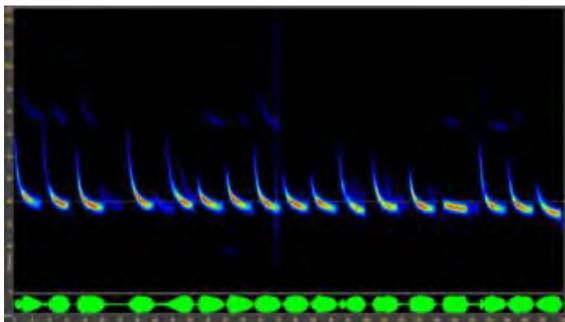
Nathusius' Pipistrelle - call duration 7.0-7.1 ms



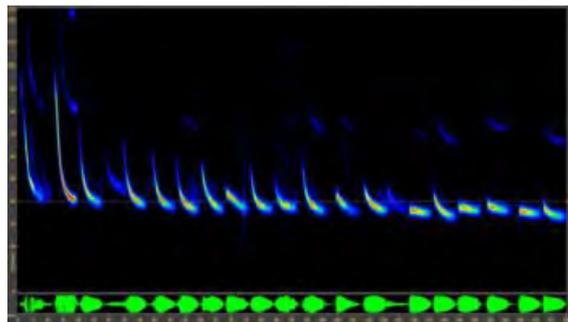
Kuhl's Pipistrelle - call duration 7.2-7.3 ms



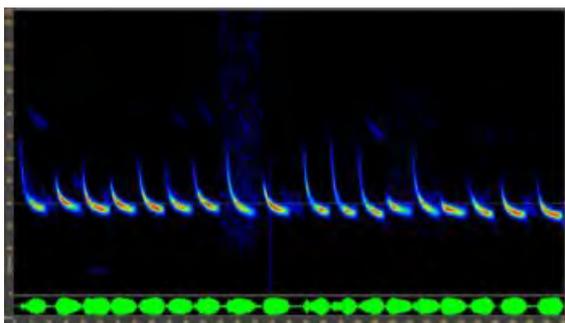
Nathusius' Pipistrelle - call duration 7.2-7.3 ms



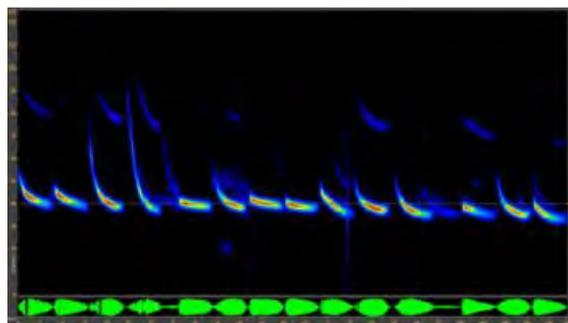
Kuhl's Pipistrelle - call duration 7.4-7.5 ms



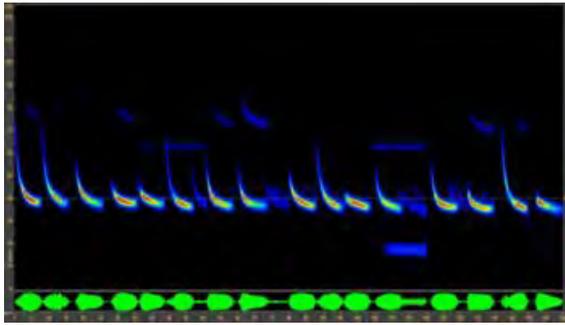
Nathusius' Pipistrelle - call duration 7.4-7.5 ms



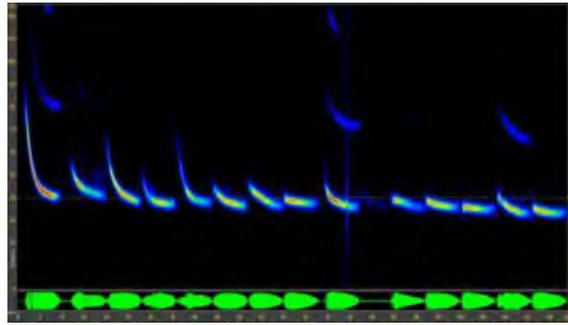
Kuhl's Pipistrelle - call duration 7.6-7.7 ms



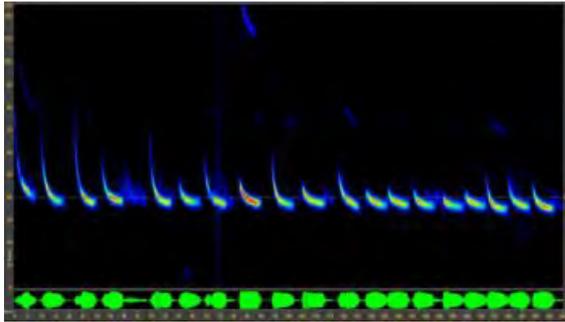
Nathusius' Pipistrelle - call duration 7.6-7.7 ms



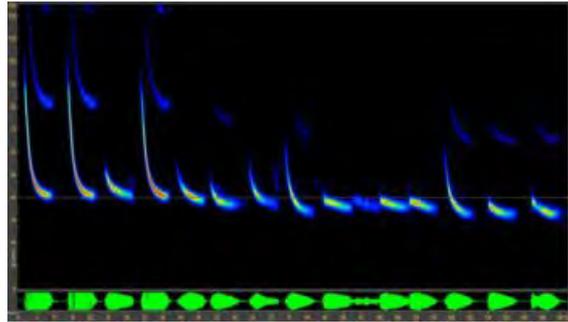
Kuhl's Pipistrelle - call duration 7.8-7.9 ms



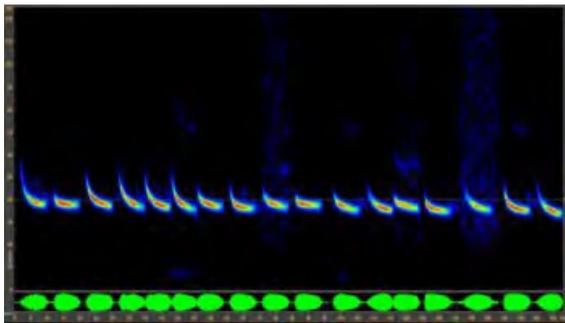
Nathusius' Pipistrelle - call duration 7.8-7.9 ms



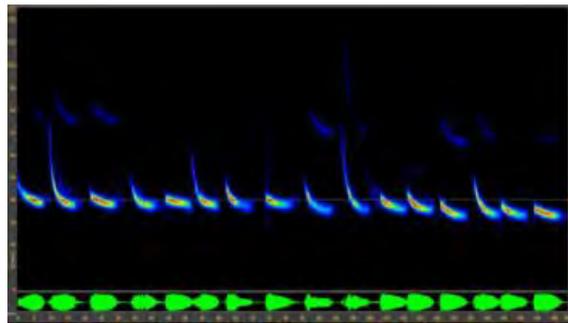
Kuhl's Pipistrelle - call duration 8.0-8.1 ms



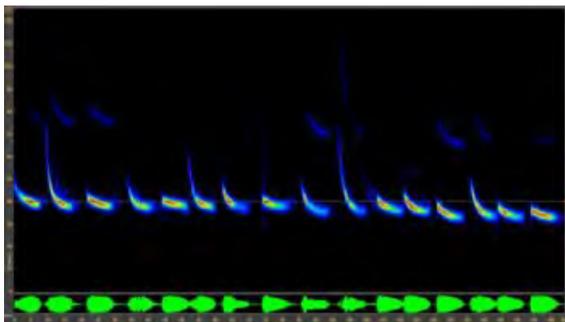
Nathusius' Pipistrelle - call duration 8.0-8.1 ms



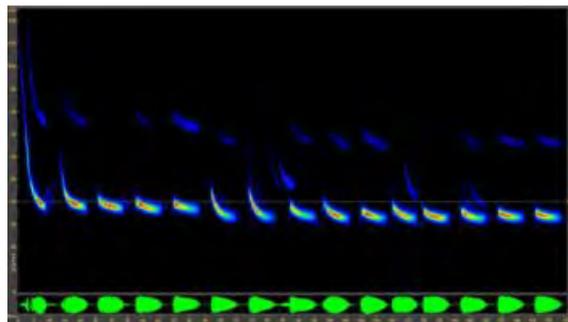
Kuhl's Pipistrelle - call duration 8.2-8.3 ms



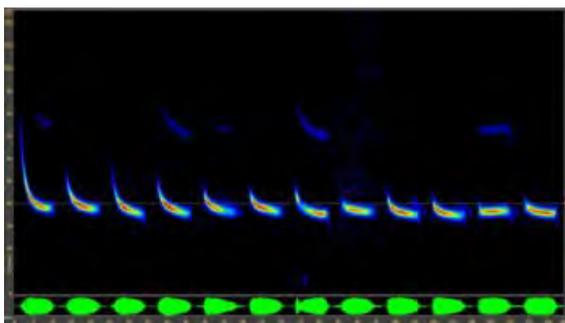
Nathusius' Pipistrelle - call duration 8.2-8.3 ms



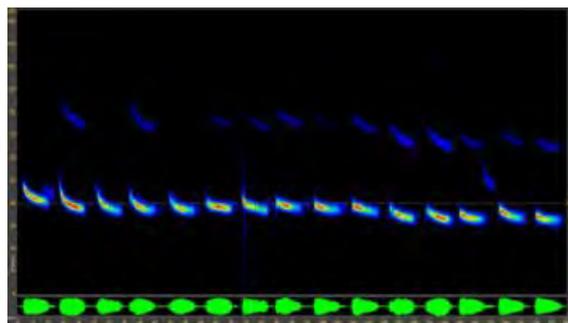
Kuhl's Pipistrelle - call duration 8.4-8.5 ms



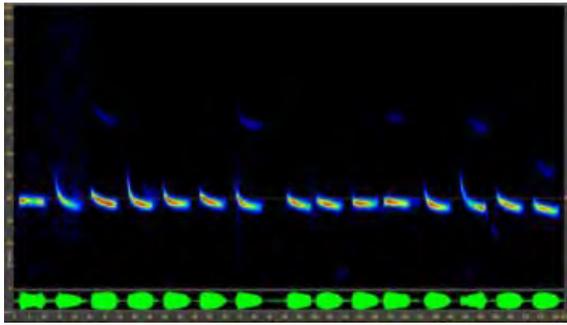
Nathusius' Pipistrelle - call duration 8.4-8.5 ms



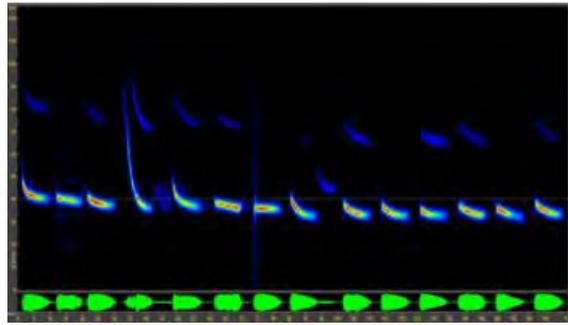
Kuhl's Pipistrelle - call duration 8.6-8.7 ms



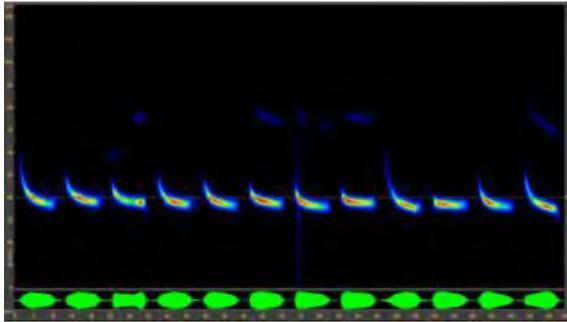
Nathusius' Pipistrelle - call duration 8.6-8.7 ms



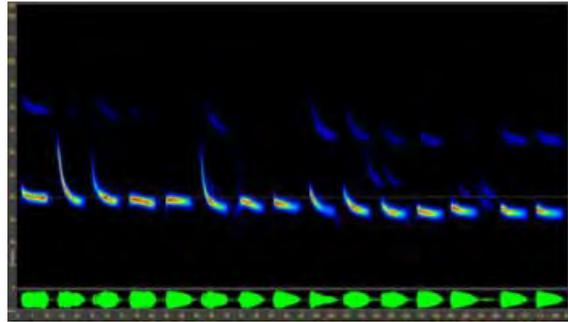
Kuhl's Pipistrelle - call duration 8.8-8.9 ms



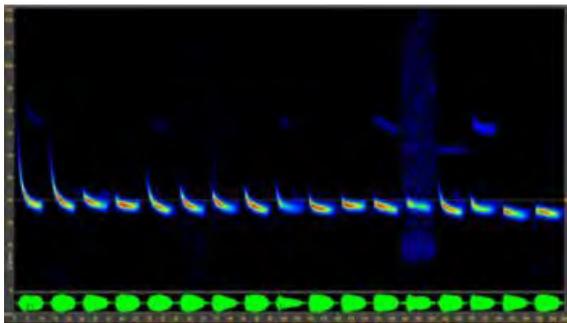
Nathusius' Pipistrelle - call duration 8.8-8.9 ms



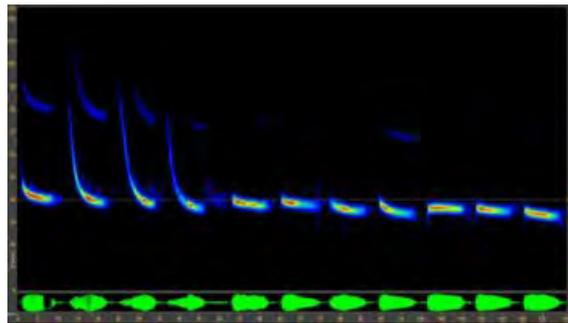
Kuhl's Pipistrelle - call duration 9.0-9.1 ms



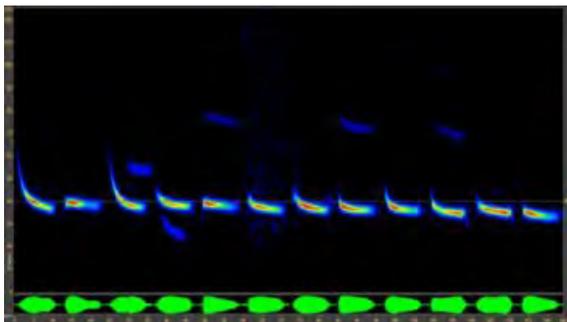
Nathusius' Pipistrelle - call duration 9.0-9.1 ms



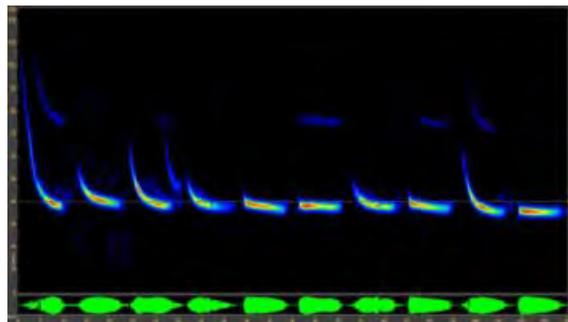
Kuhl's Pipistrelle - call duration 9.2-9.3 ms



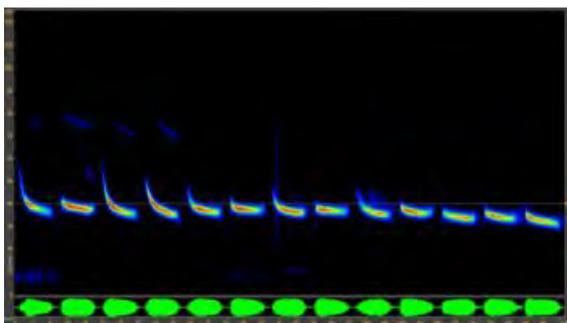
Nathusius' Pipistrelle - call duration 9.2-9.3 ms



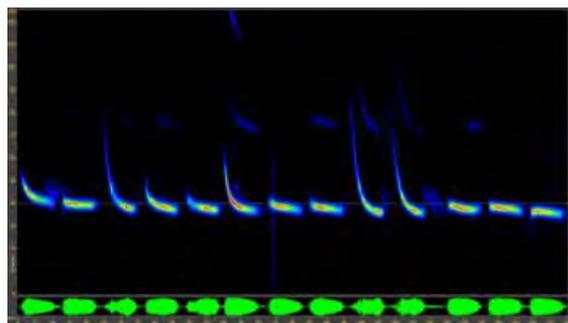
Kuhl's Pipistrelle - call duration 9.4-9.5 ms



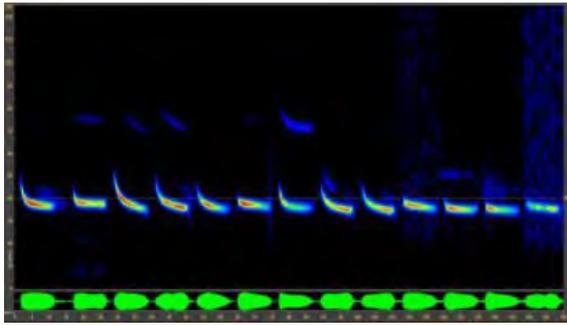
Nathusius' Pipistrelle - call duration 9.4-9.5 ms



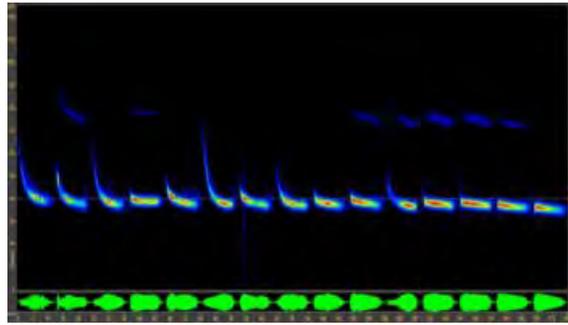
Kuhl's Pipistrelle - call duration 9.6-9.8 ms



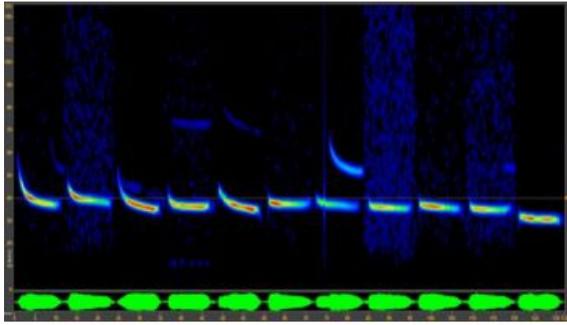
Nathusius' Pipistrelle - call duration 9.6-9.8 ms



Kuhl's Pipistrelle - call duration 9.9-10.1 ms



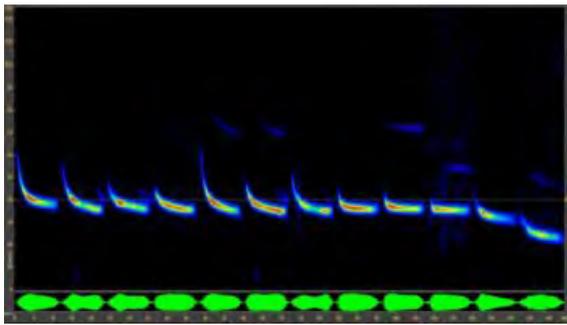
Nathusius' Pipistrelle - call duration 9.9-10.2 ms



Kuhl's Pipistrelle - call duration 10.2-10.4 ms



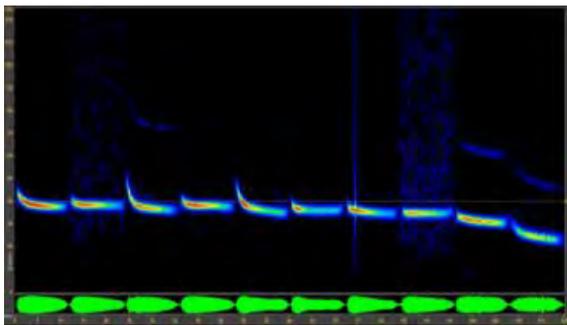
Nathusius' Pipistrelle - fewer examples for this call duration



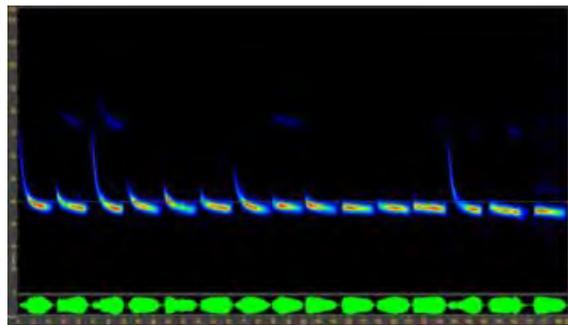
Kuhl's Pipistrelle - call duration 10.5-10.9 ms



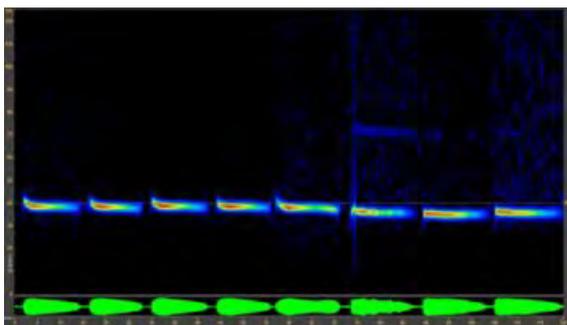
Nathusius' Pipistrelle - fewer examples for this call duration



Kuhl's Pipistrelle - call duration 11.0-11.7 ms



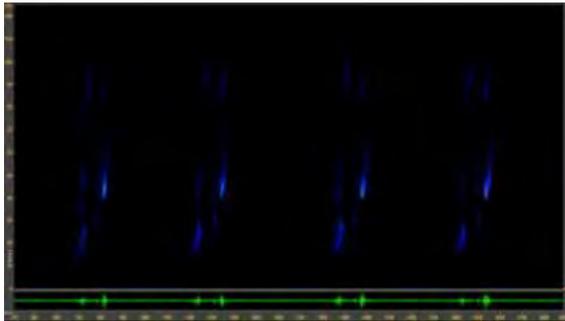
Nathusius' Pipistrelle - call duration 10.3-12.3 ms



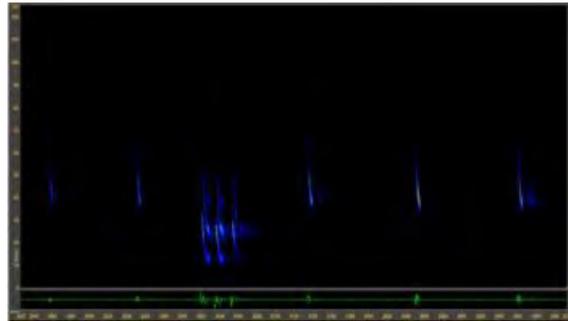
Kuhl's Pipistrelle - call duration 11.8-14.7 ms

Identification appendix 6: Kuhl's Pipistrelle *Pipistrellus kuhlii* and Nathusius' Pipistrelle *Pipistrellus nathusii* social calls

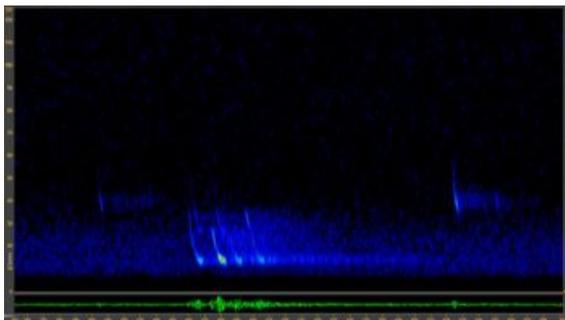
In addition to echolocation calls Kuhl's Pipistrelle and Nathusius' Pipistrelle also produce a range of social calls which can be assigned to species with confidence (observed variation in social calls shown below). Most of the observed social calls of Nathusius' Pipistrelle and Kuhl's Pipistrelle shown below are documented in Middleton *et al.*, (2014), Russ, (2021). Some of the more unusual social calls of Kuhl's Pipistrelle below are described at http://ecologieacoustique.fr/wp-content/uploads/Edition3_Addendum1_janvier2019_P-kuhlii_signaux-sigmoïdes.pdf



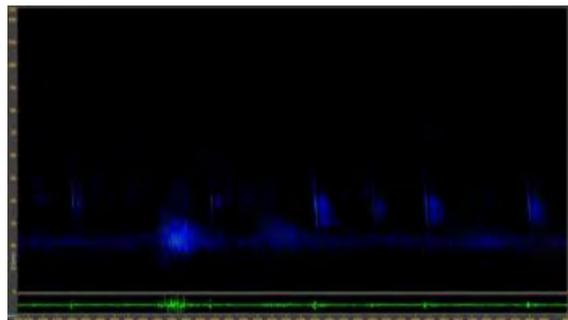
Nathusius' Pipistrelle male advertisement calls



Kuhl's Pipistrelle - three-component social call



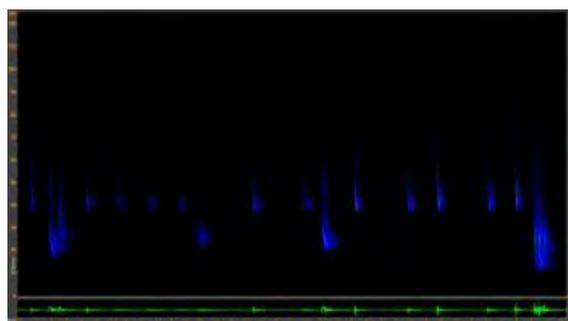
Kuhl's Pipistrelle - four-component social call



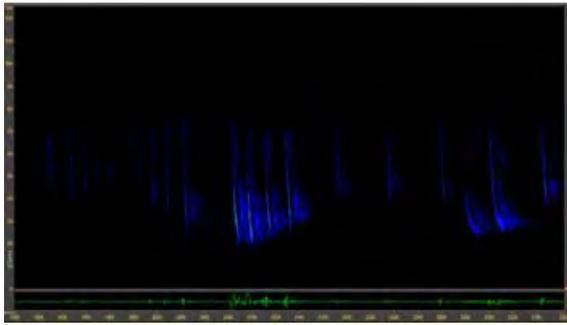
Kuhl's Pipistrelle - trills and low frequency 'myotis-like' echolocation calls with social function



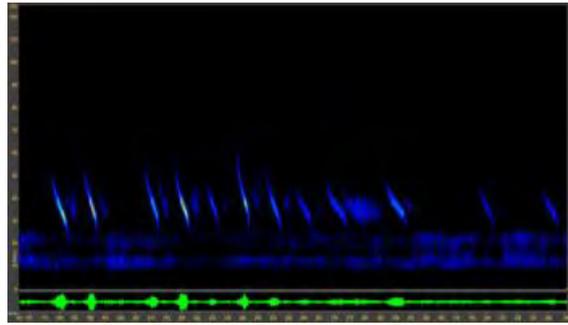
Kuhl's Pipistrelle - one-component social call



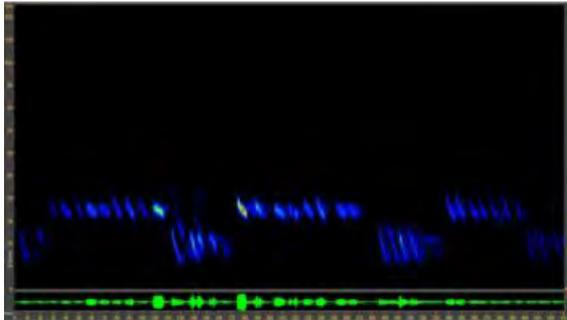
Kuhl's Pipistrelle - variation in social calls with different end frequency



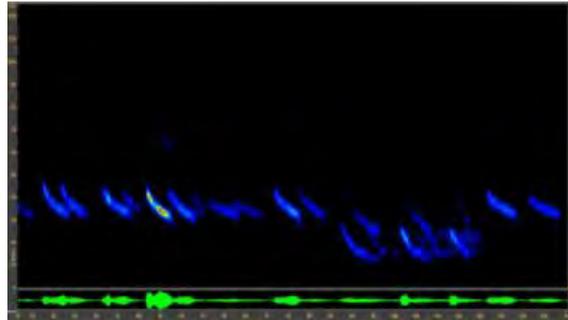
Kuhl's Pipistrelle - variation in social calls with different frequency



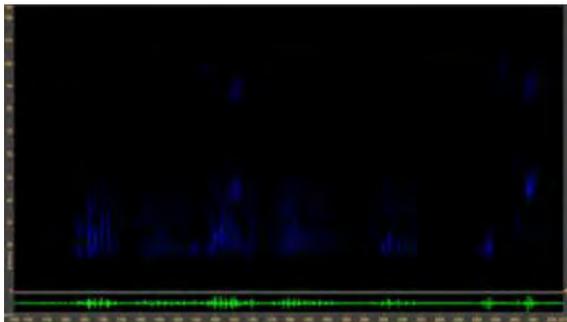
Kuhl's Pipistrelle - low frequency 'barbastelle-like' echolocation calls with social function



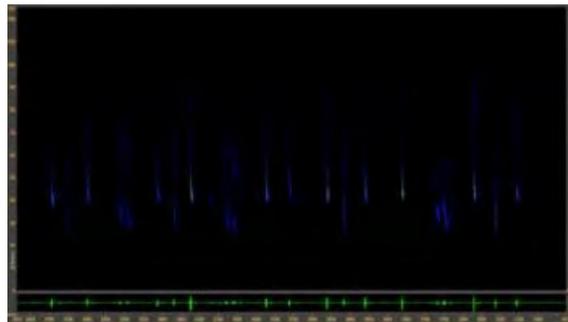
Kuhl's Pipistrelle - low frequency echolocation calls with social function and trills



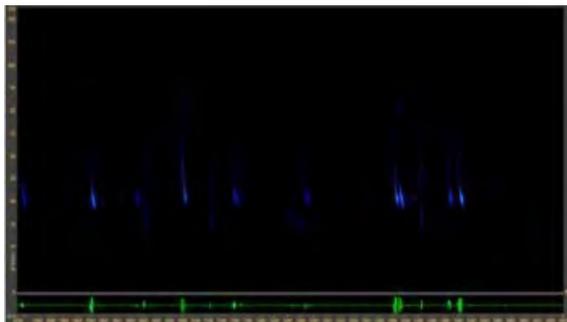
Kuhl's Pipistrelle - low frequency echolocation calls with social function and trills



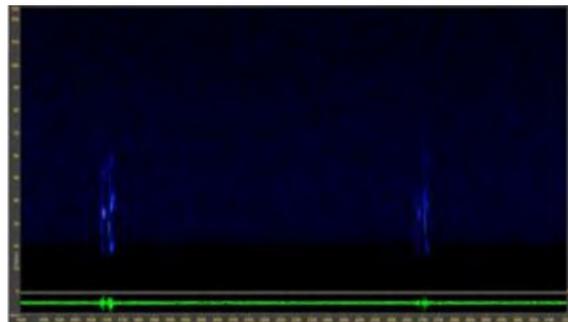
Nathusius' Pipistrelle - male advertisement calls and other social calls



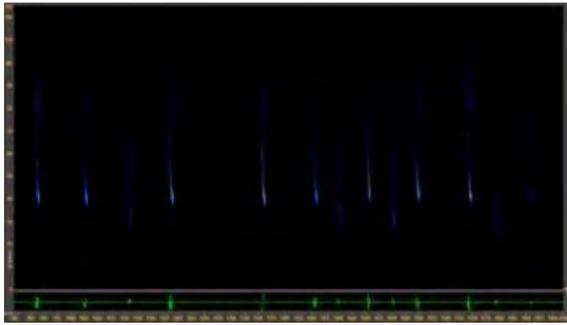
Nathusius' Pipistrelle - variation in social calls, including Plecotus-like calls



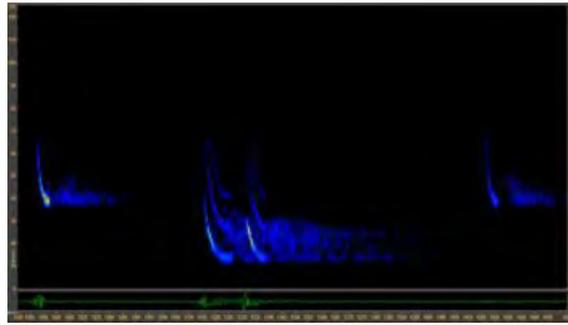
Nathusius' Pipistrelle - Plecotus-like social calls



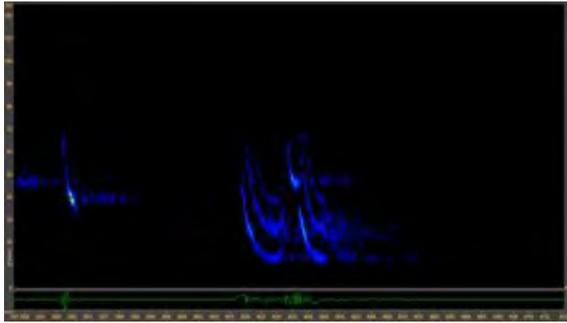
Nathusius' Pipistrelle - variation in social calls - potential confusion with Kuhl's Pipistrelle



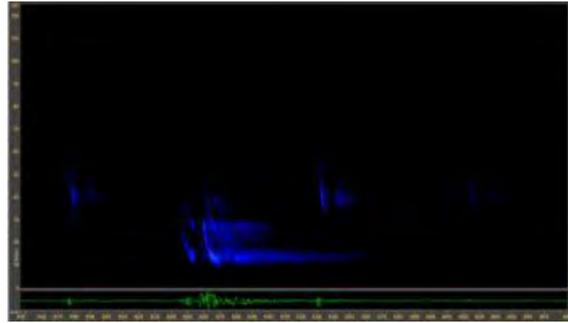
Nathusius' Pipistrelle - Plecotus-like social calls



Kuhl's Pipistrelle - most common two-component social calls



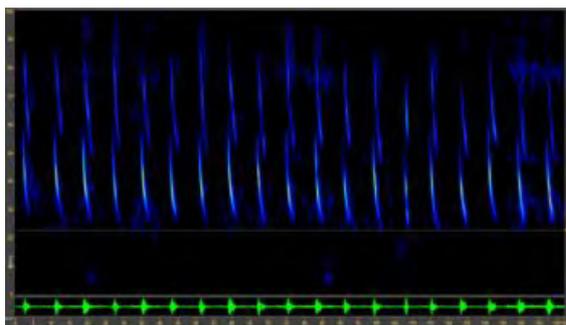
Kuhl's Pipistrelle - variation in two-component social calls



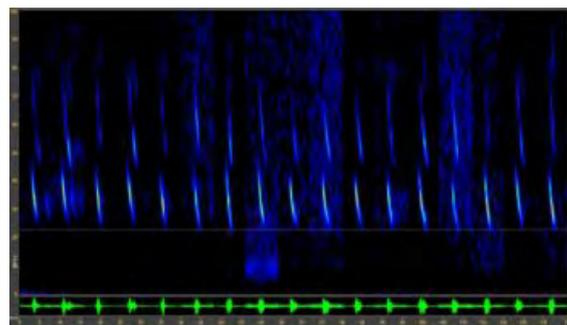
Kuhl's Pipistrelle - variation in two-component social call

Identification appendix 7: Grey Long-eared Bat *Plecotus austriacus* and Brown Long-eared Bat *Plecotus auritus*

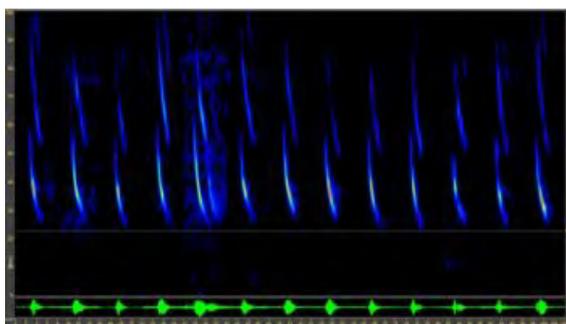
The echolocation and social calls of Grey Long-eared Bat are very similar to Brown Long-eared Bat, but given good recordings and an understanding of what the calls of the two species should look like given the call duration, it should be possible to assign a majority of recordings to species. To illustrate we provide a visual comparison below of similar duration echolocation and type c social calls of known Grey Long-eared Bat and Brown Long-eared Bat (Middleton *et al.* 2022). Despite this, it is very possible that a small number of Brown Long-eared Bat recordings will be missed, either in recordings not assigned to species (for example assigned instead to *Plecotus* species, and not considered in this report), or potentially to Grey Long-eared Bat in error. The latter is most likely where there is attenuation of the weaker ends of the calls of Brown Long-eared Bat, making the calls look less broadband than they really are, but in most cases, it should be clear where there are problems with the quality of a recording, so we expect that the error will be small. Some, but not all social calls of Brown Long-eared Bat, can also look very similar those of Grey Long-eared Bat. Where an identification is not clear, we take a cautious approach and do not assign these to a species. As a general point, the chance of misidentifying of Grey Long-eared Bat as Brown Long-eared is less likely. Whilst Grey Long-eared Bat is not an obvious confusion species for *Nyctalus*, it is worth noting that this species commonly produces long duration calls of 7-10ms in open areas, which are longer than have been documented elsewhere (Barataud, 2015; Russ, 2021).



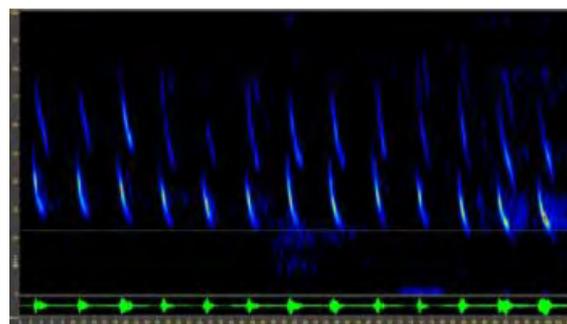
Brown Long-eared Bat - call duration 1.0-1.8 ms



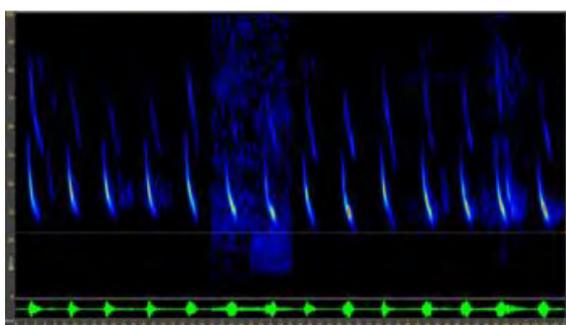
Grey Long-eared Bat - call duration 1.2-1.6 ms



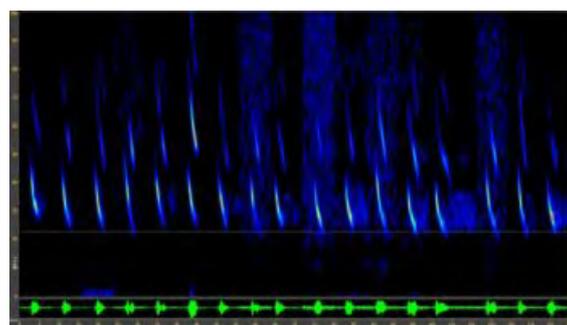
Brown Long-eared Bat - call duration 1.9-2.0 ms



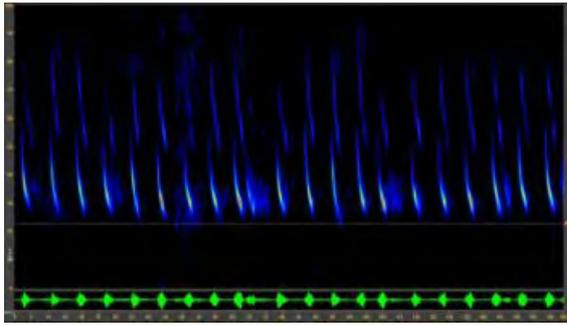
Grey Long-eared Bat - call duration 1.9-2.0 ms



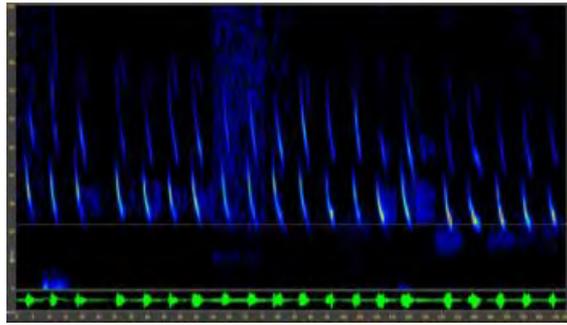
Brown Long-eared Bat - call duration 2.1-2.2 ms



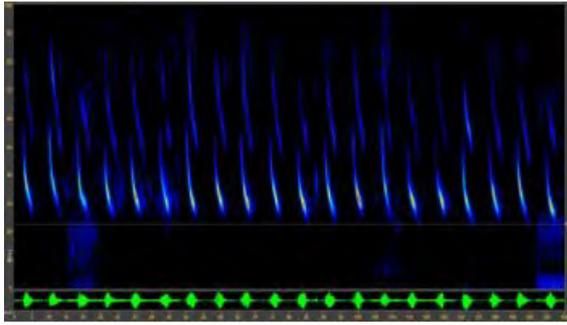
Grey Long-eared Bat - call duration 2.1-2.2 ms



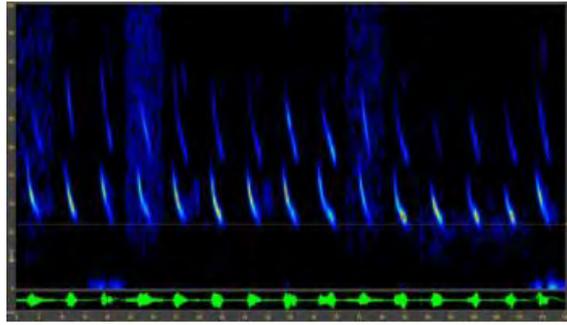
Brown Long-eared Bat - call duration 2.5-2.6 ms



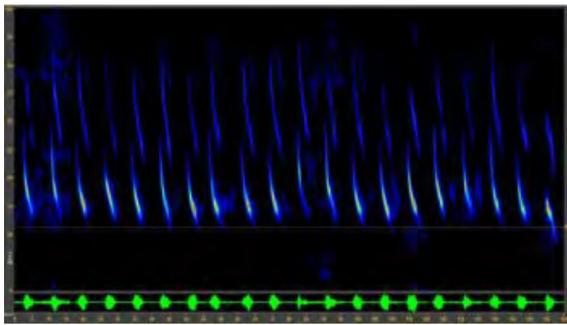
Grey Long-eared Bat - call duration 2.3-2.6 ms



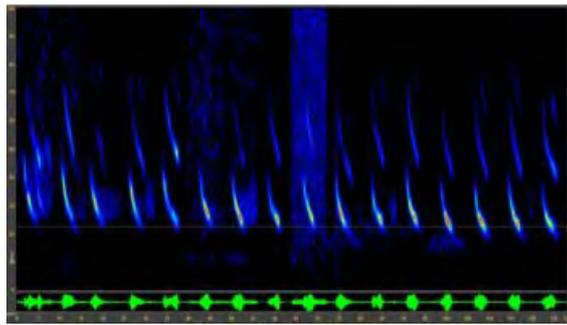
Brown Long-eared Bat - call duration 2.7-2.8 ms



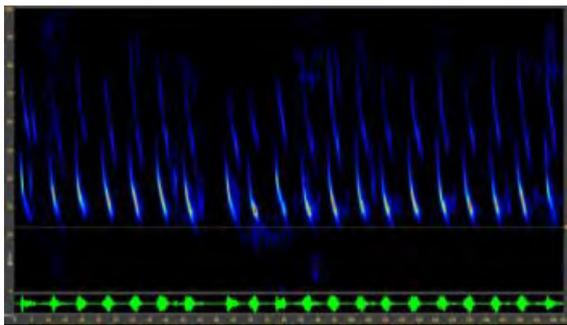
Grey Long-eared Bat - call duration 2.7-2.8 ms



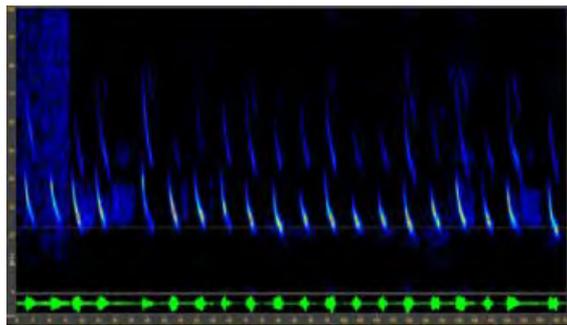
Brown Long-eared Bat - call duration 2.9-3.0 ms



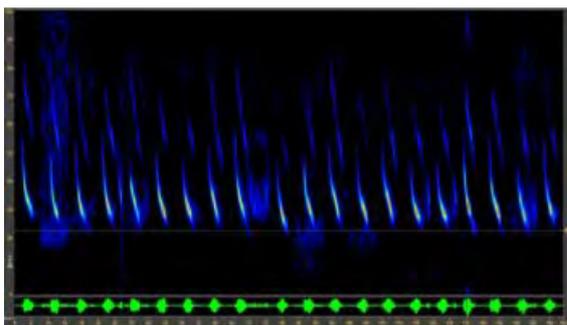
Grey Long-eared Bat - call duration 2.9-3.0 ms



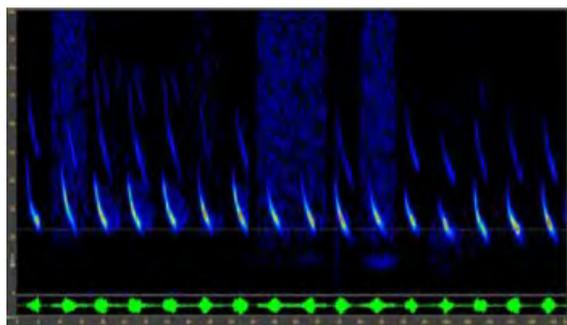
Brown Long-eared Bat - call duration 3.1-3.2 ms



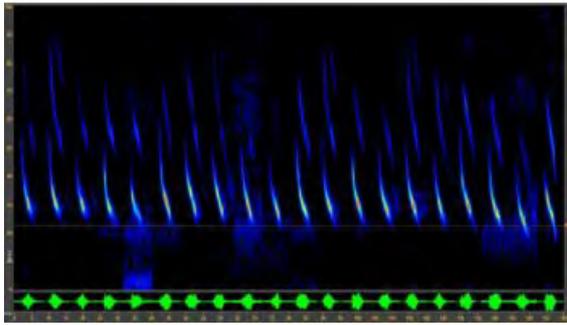
Grey Long-eared Bat - call duration 3.1-3.2 ms



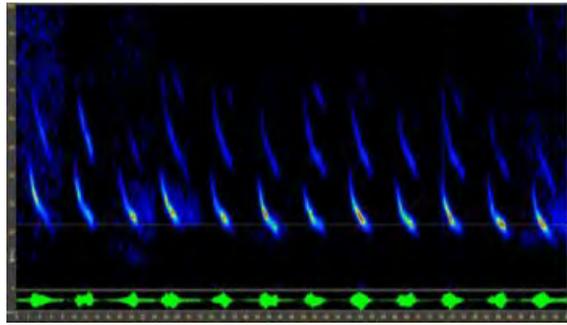
Brown Long-eared Bat - call duration 3.3-3.4 ms



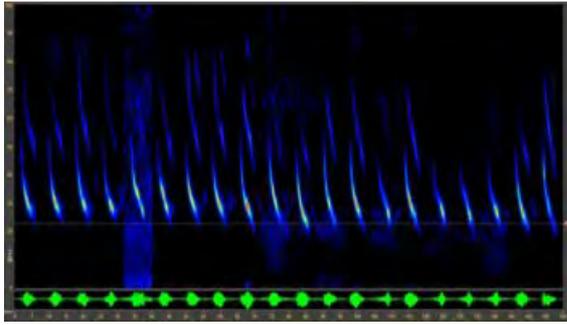
Grey Long-eared Bat - call duration 3.3-3.4 ms



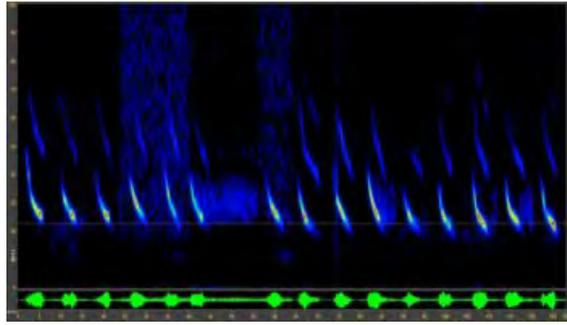
Brown Long-eared Bat - call duration 3.5-3.6 ms



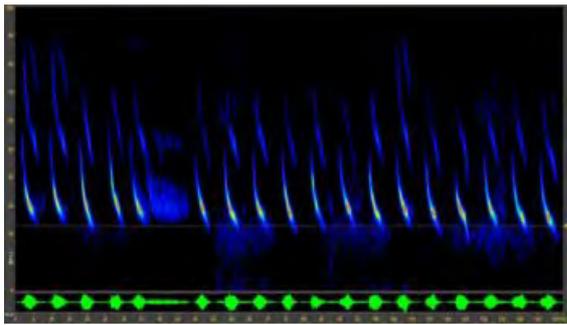
Grey Long-eared Bat - call duration 3.5-3.6 ms



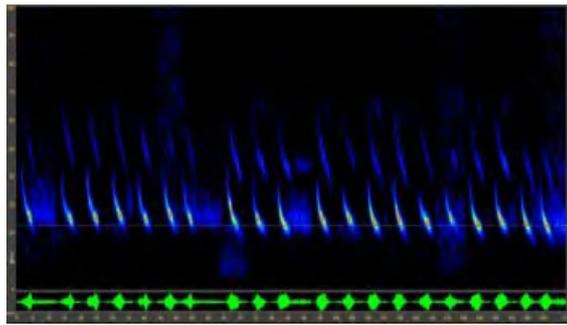
Brown Long-eared Bat - call duration 3.7-3.8 ms



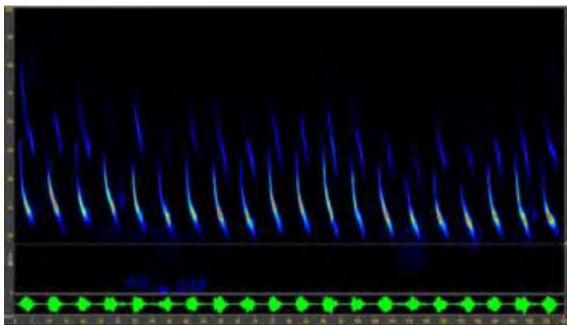
Grey Long-eared Bat - call duration 3.7-3.8 ms



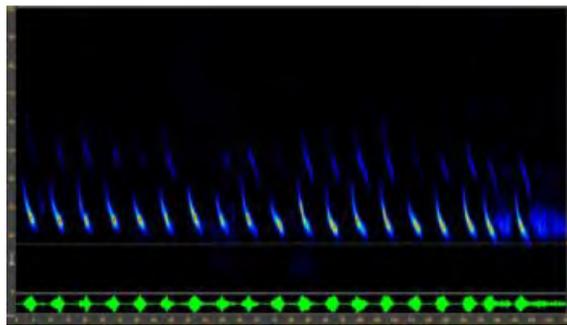
Brown Long-eared Bat - call duration 3.9-4.0 ms



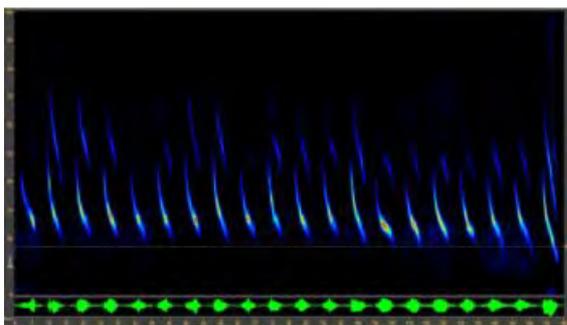
Grey Long-eared Bat - call duration 3.9-4.0 ms



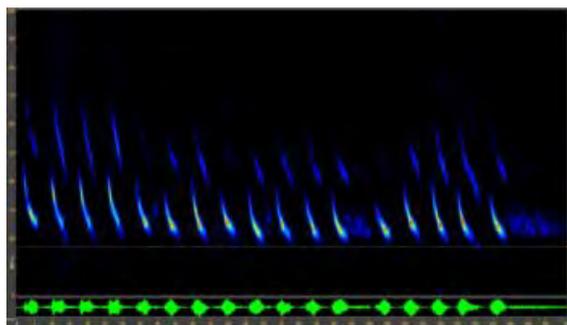
Brown Long-eared Bat - call duration 4.1-4.2 ms



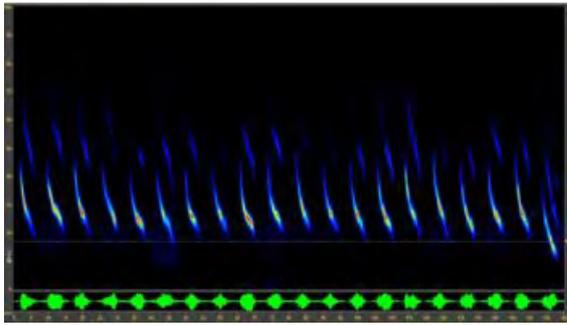
Grey Long-eared Bat - call duration 4.1-4.2 ms



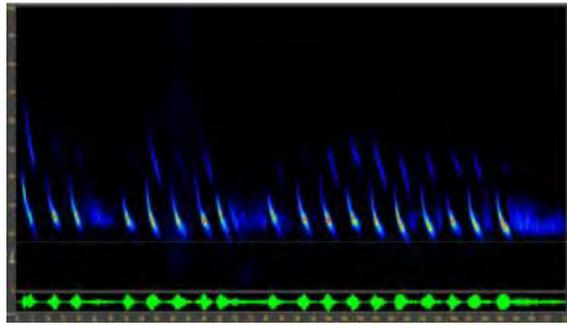
Brown Long-eared Bat - call duration 4.3-4.4 ms



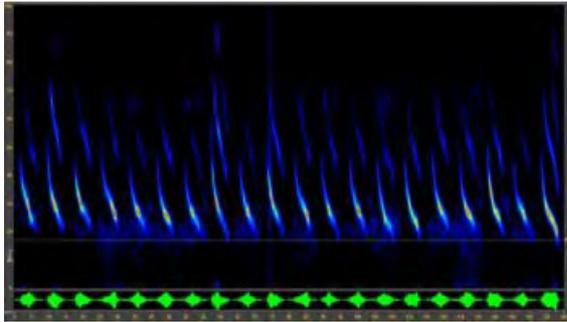
Grey Long-eared Bat - call duration 4.3-4.4 ms



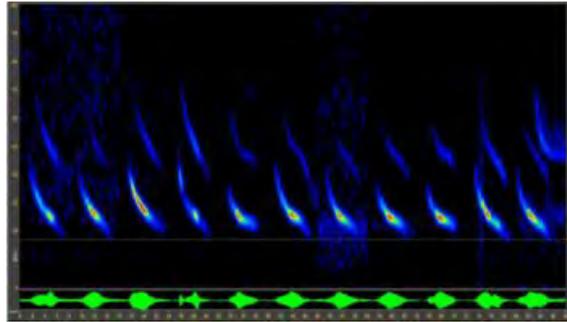
Brown Long-eared Bat - call duration 4.5-4.6 ms



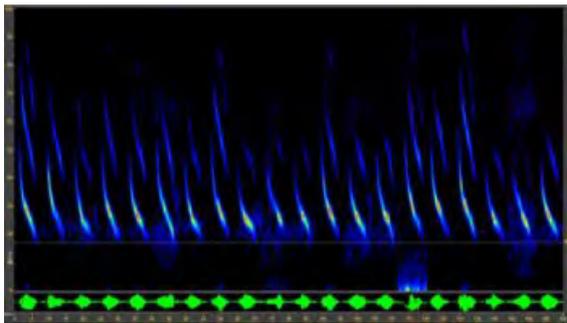
Grey Long-eared Bat - call duration 4.5-4.6 ms



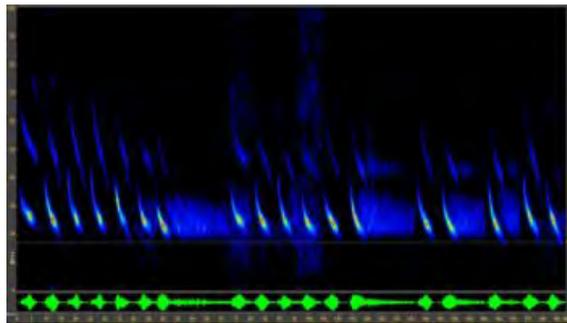
Brown Long-eared Bat - call duration 4.7-4.8 ms



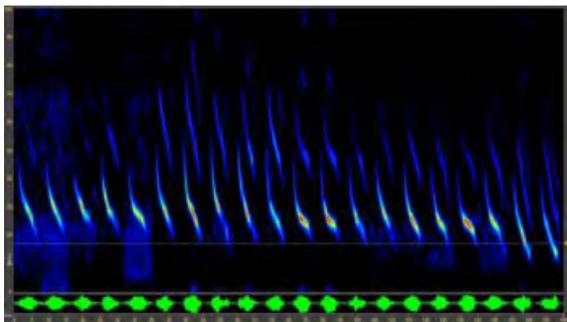
Grey Long-eared Bat - call duration 4.7-4.8 ms



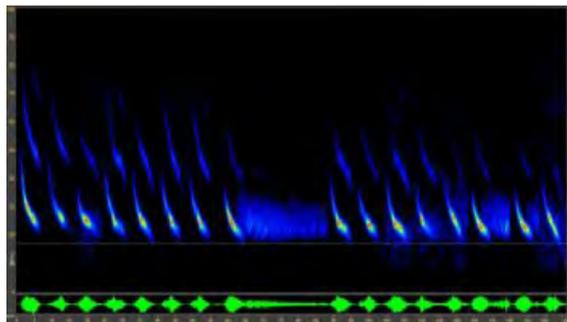
Brown Long-eared Bat - call duration 4.9-5.0 ms



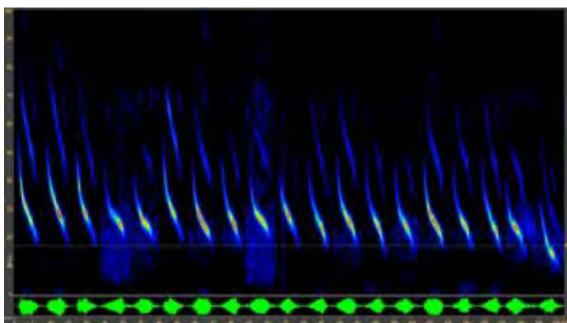
Grey Long-eared Bat - call duration 4.9-5.0 ms



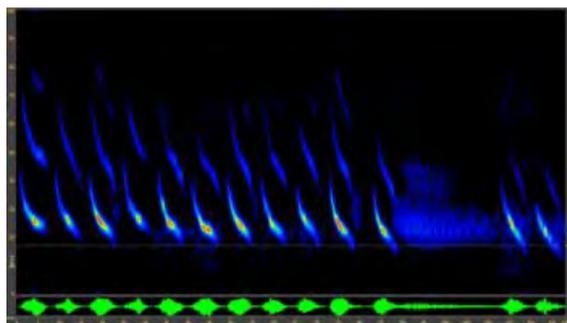
Brown Long-eared Bat - call duration 5.1-5.2 ms



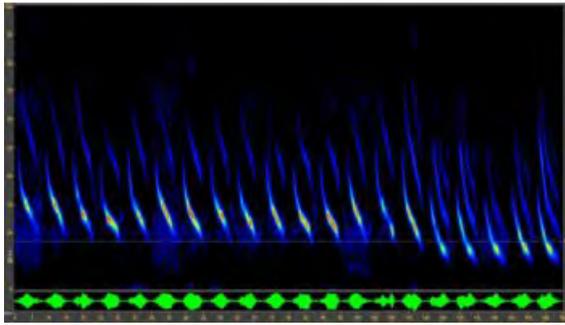
Grey Long-eared Bat - call duration 5.1-5.2 ms



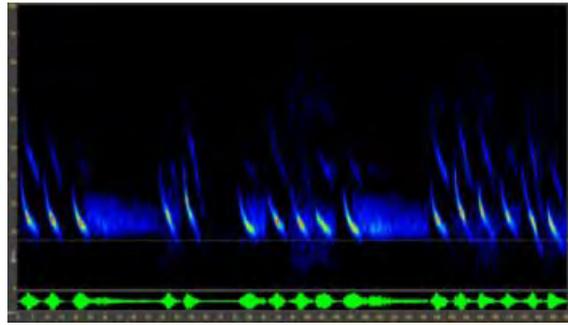
Brown Long-eared Bat - call duration 5.3-5.4 ms



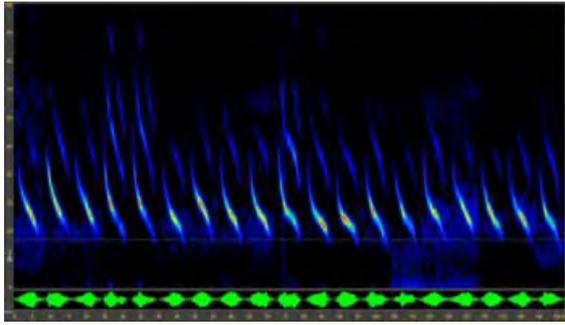
Grey Long-eared Bat - call duration 5.3-5.5 ms



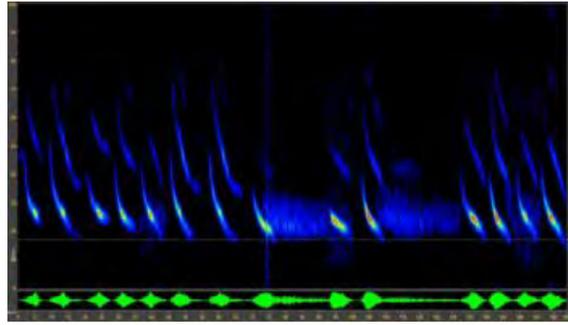
Brown Long-eared Bat - call duration 5.5-5.8 ms



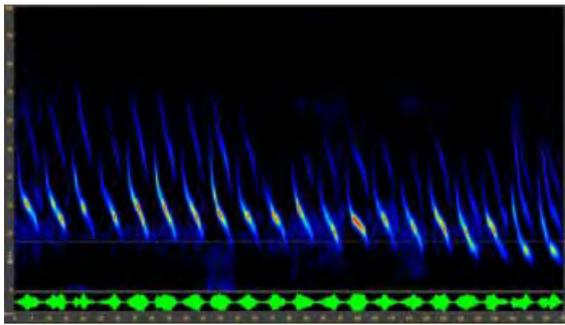
Grey Long-eared Bat - call duration 5.6-5.8 ms



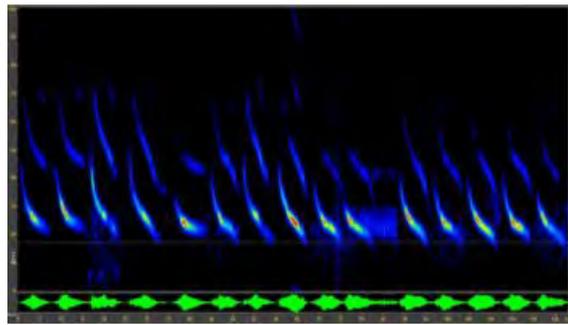
Brown Long-eared Bat - call duration 5.9-6.2 ms



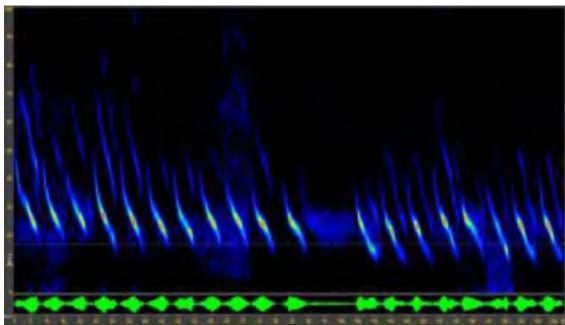
Grey Long-eared Bat - call duration 5.9-6.2 ms



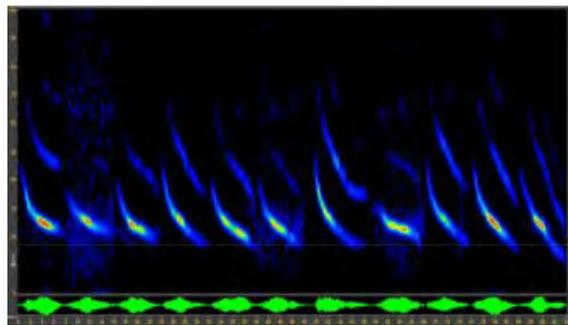
Brown Long-eared Bat - call duration 6.3-6.4 ms



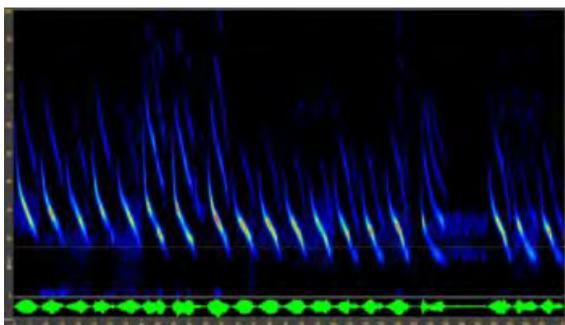
Grey Long-eared Bat - call duration 6.3-6.5 ms



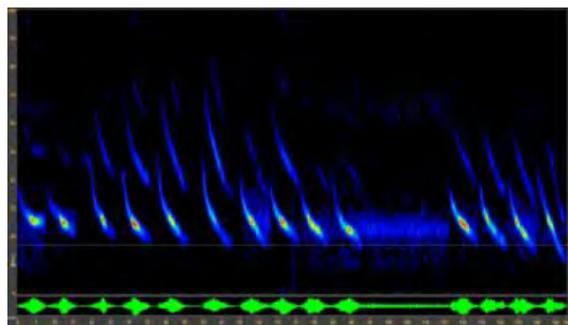
Brown Long-eared Bat - call duration 6.7-6.8 ms



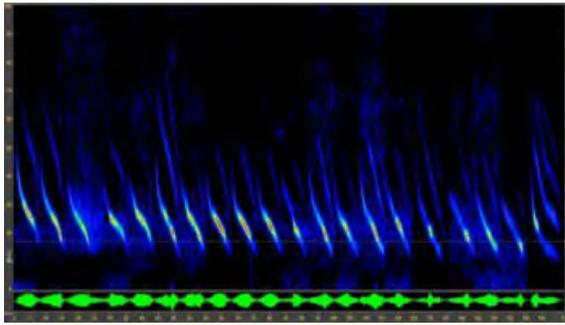
Grey Long-eared Bat - call duration 6.6-6.8 ms



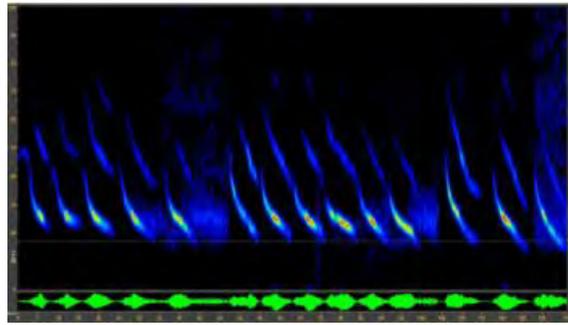
Brown Long-eared Bat - call duration 6.9-7.0 ms



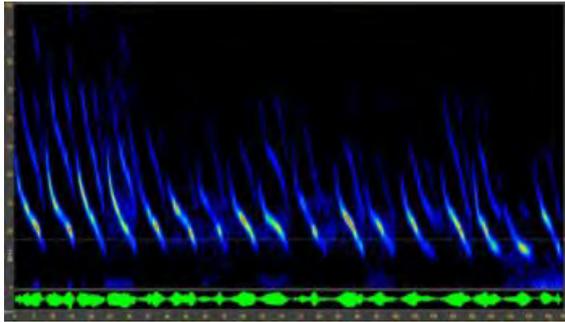
Grey Long-eared Bat - call duration 6.9-7.1 ms



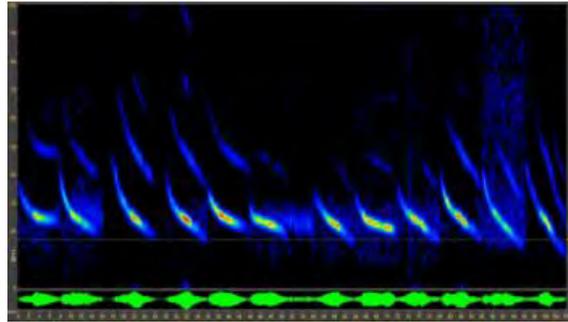
Brown Long-eared Bat - call duration 7.3-7.4 ms



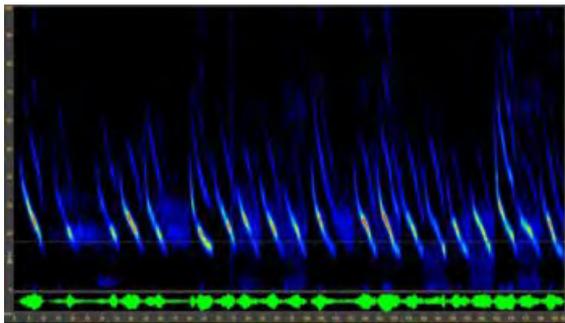
Grey Long-eared Bat - call duration 7.2-7.4 ms



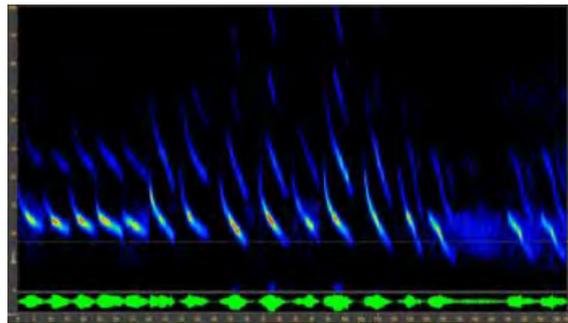
Brown Long-eared Bat - call duration 7.5-7.6 ms



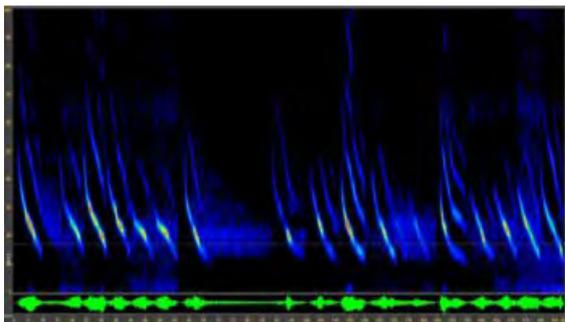
Grey Long-eared Bat - call duration 7.5-7.6 ms



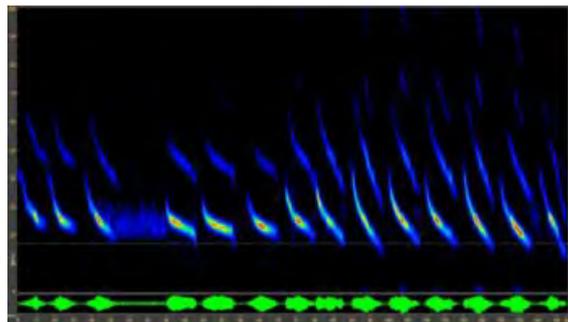
Brown Long-eared Bat - call duration 7.7-7.8 ms



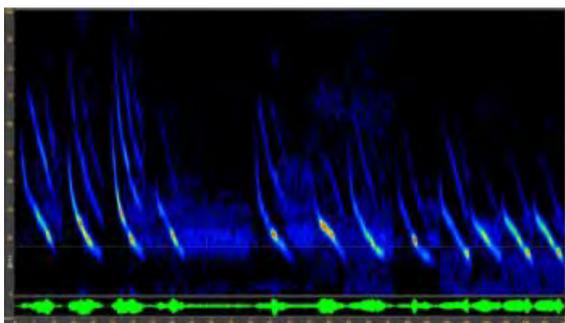
Grey Long-eared Bat - call duration 7.7-7.8 ms



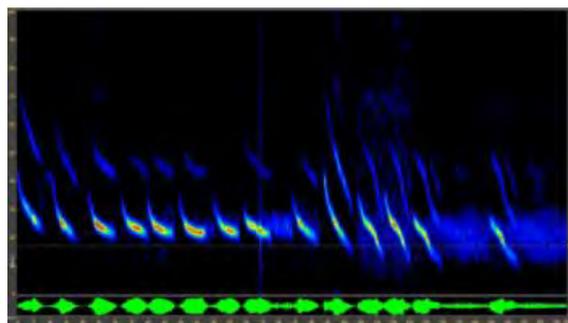
Brown Long-eared Bat - call duration 7.9-8.1 ms



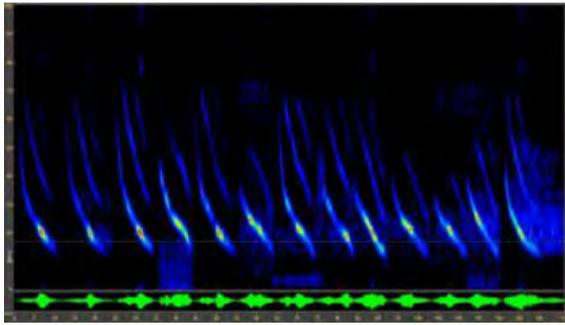
Grey Long-eared Bat - call duration 7.9-8.1 ms



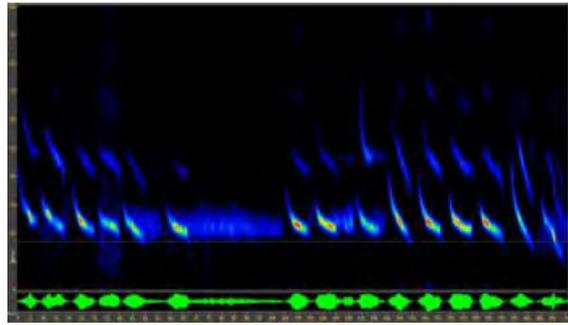
Brown Long-eared Bat - call duration 8.2-8.3 ms



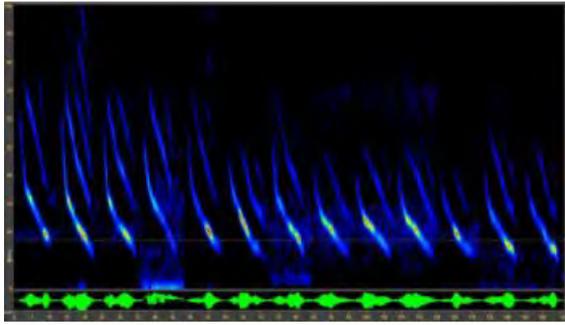
Grey Long-eared Bat - call duration 8.2-8.3 ms



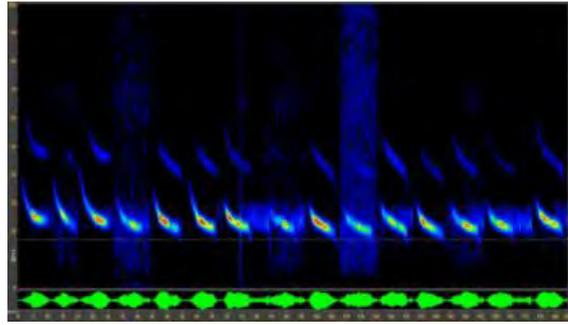
Brown Long-eared Bat - call duration 8.4-8.6 ms



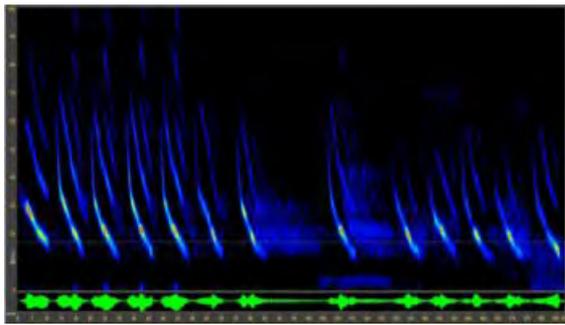
Grey Long-eared Bat - call duration 8.4-8.7 ms



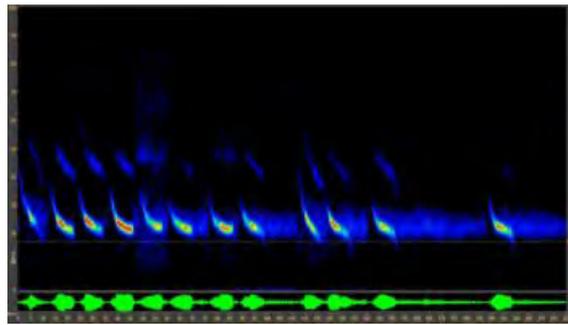
Brown Long-eared Bat - call duration 8.7-9.0 ms



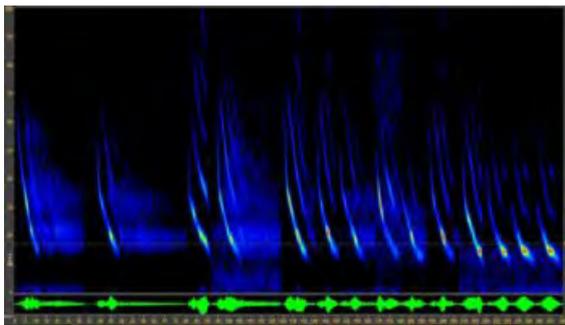
Grey Long-eared Bat - call duration 8.8-9.1 ms



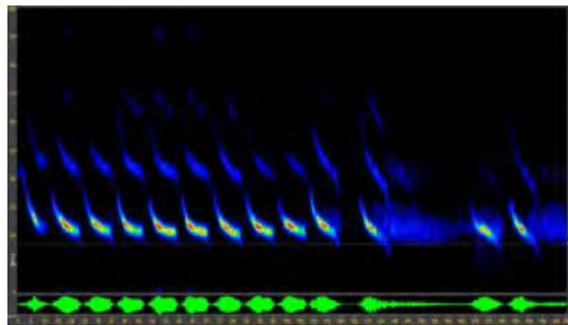
Brown Long-eared Bat - call duration 9.1-9.5 ms



Grey Long-eared Bat - call duration 9.2-9.6 ms



Brown Long-eared Bat - call duration 9.6-11.4 ms



Grey Long-eared Bat - call duration 9.7-10.5 ms



Images: Common Pipistrelle by John Black, Wood Mouse by Moss Taylor, Speckled Bush-cricket by Mike Toms, Green silver-lines by Andy Musgrove. Cover image: Sarah Allez

Bailiwick Bat Survey: 2022 Report

This report presents the main findings from survey work delivered using passive acoustic monitoring devices deployed across the Bailiwick of Guernsey. Through the surveys that we support we aim to improve knowledge and understanding of species distribution and activity, covering a range of taxonomic groups, including bats, small terrestrial mammals and insects. Through this approach we provide robust datasets that can be used to inform better decision-making processes.

The use of acoustic monitoring can be particularly useful for species that are rare or unexpected in the survey area, or that are traditionally regarded as too difficult to identify (such as bats in the genera *Myotis*, *Plecotus* or *Nyctalus/Eptesicus*). Where such species are recorded, we provide additional information to support their identification. A secondary aim of our work is to improve the wider understanding of species identification, inspiring a culture of critical thinking and the use of emerging technologies to improve the current knowledge base.

Newson, S.E., Allez, S.L., Coule, E.K., Guille, A., Henney, J.M., Higgins, L., McLellan, G.D., Simmons, M.C., Sweet, E., Whitelegg, D. & Atkinson, P.W. (2023). Bailiwick Bat Survey: 2022 Report. *BTO Research Report 750*, BTO, Thetford, UK.



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