BTO RESEARCH REPORT 764

Bailiwick Bat Survey: 2023 season report

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BTO Birds Science People

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SUMMARY

Background Working with a network of volunteer fieldworkers, static acoustic bat detectors were deployed over an eight month survey season to provide a third 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 2023.

Coverage During 2023, 582 different locations across the Bailiwick of Guernsey were surveyed. Recording was undertaken on 228 different nights mainly between April and the end of October, amounting to a total of 2,260 nights of recording effort across sites. Sound recordings (wav files) were uploaded by fieldworkers 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, 3,825,977 five second triggered recordings were collected which, following analyses and validation, were found to include 994,021 bat identifications, and 7,973 small terrestrial mammal identifications. There were also over 2 million identifications of bush-crickets as 'by-catch', for which we report species presence on a site and night basis. Following validation, the study confirmed the presence of at least 13 bat species, 5 small mammal species, and 6 species of bush-crickets. Through the project, we have a better understanding now of the status of bats across the islands. 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 were asked to place the detector in their chosen square(s) for at least 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 2023, over 90% of the available squares were surveyed and the presence of at least 13 bat species, 5 small mammal species, 5 species of bush-crickets, and 2 audible moth species were confirmed. This includes the first record of Leisler's Bat *Nyctalus leisleri* for Sark. We also recorded Soprano Pipistrelle *Pipistrellus pygmaeus* for the second season running in Alderney. In addition, in 2023 we extend the results to identify social calls for a broader range of bat species, and feeding buzzes where this is possible to provide additional behavioural insights for bats. 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 Guernsey in 2023 (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 2023 survey, the bush-cricket Large Conehead *Ruspolia nitidula* which was recorded as a new species for the Channel Islands through this project in 2021, was recorded from a new location on Alderney. In 2021 we recorded Short-winged Conehead *Conocephalus dorsalis* in two wetland sites, but it was not found in 2022 or 2023. 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 and 2022 survey and static acoustic bat detectors were deployed over a 8-month long survey season.

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. This will result in the production of a robust dataset, which will increase knowledge and understanding of bat distribution and activity across the Bailiwick of Guernsey. Based around 500 x 500-m squares, this project will provide a detailed description of the islands' bat fauna.

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 this report we present results from the survey season of 2023.

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.

All maps in this report use the maptiles R package (Giraud, 2023) with data copyright OpenStreetMap contributors.

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 Wildlife Acoustics 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 centre', and received details on how to set up a BTO Acoustic Pipeline account (see below). In this project, in 2023, the Fort Grey Shipwreck Museum, the Guille-Allés library, Agriculture, Countryside and Land Management Services (ACLMS), Alderney Wildlife Trust and Société Sercquaise were bat centres.

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 from sunset until sunrise the following day. Detectors were 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. For the first time in 2023, we applied an update to the classifiers, which provides separate results for echolocation calls, feeding buzzes and social calls, where these are produced and can be identified.

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 the 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 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.

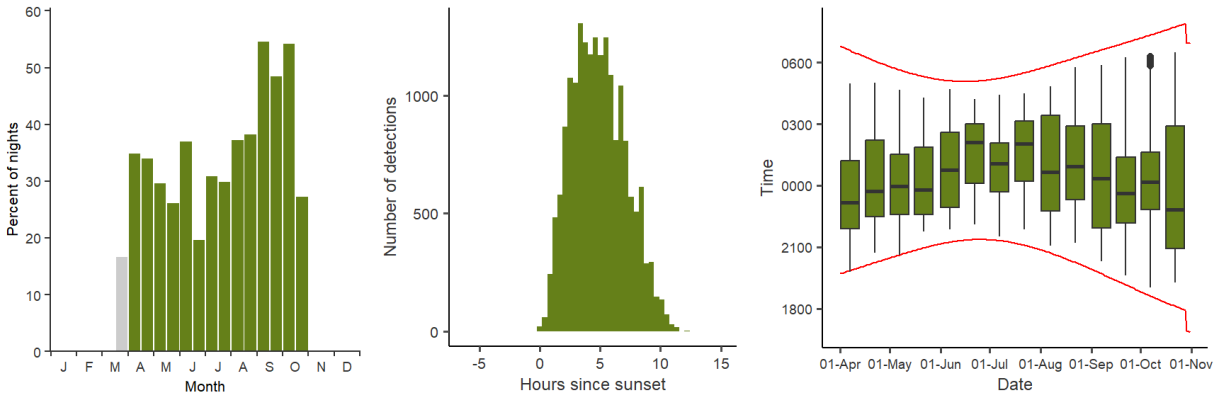
It is important to note that the criteria for distinguishing Whiskered Bat and Brandt's Bat are very subtle and poorly defined. For this reason, until further ground-truthing of the identification can be carried out, we treat these two species as a species pair.

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 (Thieurmel & 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 boxplot 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

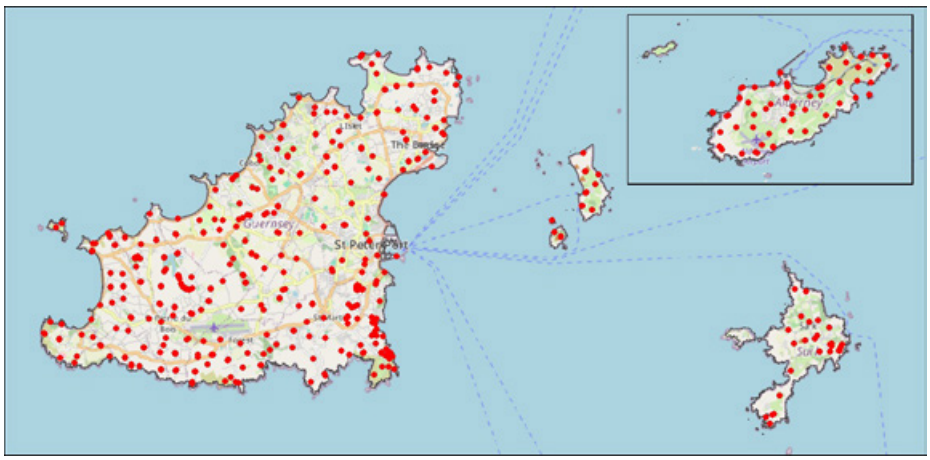
We produce maps of bat and small mammal activity. With these, dots are scaled according to the total number of recordings of this species at each location. Activity here represents usage of an area, which will be a combination of species abundance, and time spent in the area. For bush-crickets and audible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

4. RESULTS

4.1 Survey coverage

During 2023, 582 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, 2,260 complete nights of recording effort was conducted. The recording effort spanned 228 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 2023.



Number of locations surveyed.

4.2 General results

Overall, 3,825,977 recordings were collected which, following analyses and validation, were found to include 994,021 bat identifications, and 7,973 small terrestrial mammal identifications. 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, Eptesicus serotinus	22	9 (1.5%)
Whiskered or Brandt's Bat, Myotis mystacinus or M. brandtii	387	12 (2.1%)
Natterer's Bat, Myotis nattereri	18162	343 (58.9%)
Natterer's Bat Social Calls, Myotis nattereri	954	25 (4.3%)
Leisler's Bat, Nyctalus leisleri	36	17 (2.9%)
Common Noctule, Nyctalus noctula	8	3 (0.5%)
Kuhl's Pipistrelle or Nathusius' Pipistrelle, Pipistrellus kuhlii or P. nathusii	19407	365 (62.7%)
Kuhl's Pipistrelle Social Calls, Pipistrellus kuhlii	1236	89 (15.3%)
Nathusius' Pipistrelle Social Calls, Pipistrellus nathusii	69	11 (1.9%)
Common Pipistrelle, Pipistrellus pipistrellus	787915	576 (99%)
Common Pipistrelle Social Calls, Pipistrellus pipistrellus	80157	458 (78.7%)
Common Pipistrelle Feeding Buzz, Pipistrellus pipistrellus	70127	496 (85.2%)
Soprano Pipistrelle, Pipistrellus pygmaeus	7	4 (0.7%)
Soprano Pipistrelle Social Calls, Pipistrellus pygmaeus	1	1 (0.2%)
Brown Long-eared Bat, Plecotus auritus	370	82 (14.1%)
Brown Long-eared Bat Social Calls, Plecotus auritus	23	6 (1%)
Grey Long-eared Bat, Plecotus austriacus	14651	447 (76.8%)
Grey Long-eared Bat Social Calls, Plecotus austriacus	53	16 (2.7%)
Greater Horseshoe Bat, Rhinolophus ferrumequinum	425	36 (6.2%)
Lesser Horseshoe Bat, Rhinolophus hipposideros	11	5 (0.9%)

Small mammals

Species	No. of recordings following validation	No. of different locations (% of total)
Wood Mouse, Apodemus sylvaticus	10	3 (0.5%)
Greater White-toothed Shrew, Crocidura russula	2093	257 (44.2%)
Lesser White-toothed Shrew, Crocidura suaveolens	84	16 (2.7%)
Brown Rat, Rattus norvegicus	5212	130 (22.3%)
Black Rat, Rattus rattus	574	8 (1.4%)

Bush-crickets

Species	No. of different locations (% of total)
Long-winged Conehead, Conocephalus fuscus	70 (12%)
Speckled Bush-cricket, Leptophyes punctatissima	153 (26.3%)
Grey Bush-cricket, Platycleis albopunctata	83 (14.3%)
Large Conehead, Ruspolia nitidula	1 (0.2%)
Great Green Bush-cricket, Tettigonia viridissima	248 (42.6%)

Moths

Species	No. of different locations (% of total)
Green Silver-lines, Pseudoips prasinana	14 (2.4%)
Bird Cherry Ermine, Yponomeuta evonymella	38 (6.5%)

4.3 Species and call-type results

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

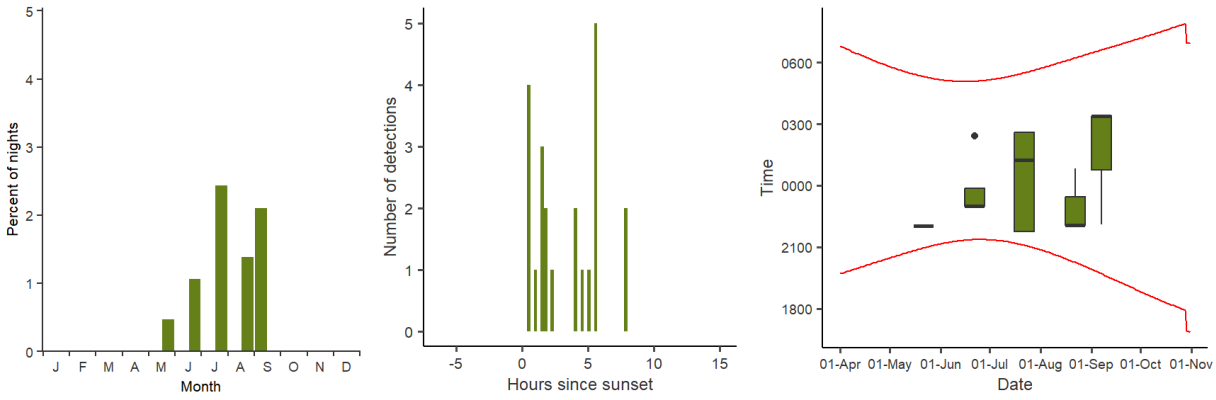
4.3.1 Bat species

Serotine

Serotine *Eptesicus serotinus* was recorded on 12 nights, from nine locations, giving a total of 22 recordings.

Spatial pattern of activity

Seasonal and nightly activity

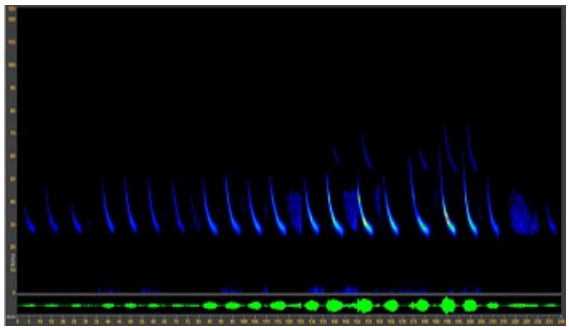


Serotine Compared with 2022, when Serotine was very scarce (4 nights, 4 locations), Serotine was recorded from slightly more locations and nights in 2023 (12 nights, 9 locations).

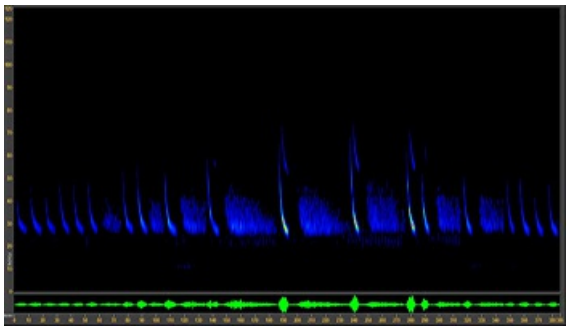
On Guernsey, Serotine was recorded close to Rue des Grands Camps, at St. Sampson, close to the junction of Les Prevosts road and Route du Houguets, and near to St. Saviours parish church. On Alderney, Serotine was recorded from five locations (close to the Roman Fort, the Raz Causeway, Les Rochers, Alderney Bird Observatory, and at a location towards the south-west end of the island) with records between June and September. 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 provided support for the idea that this species may not be resident on the islands. We still consider that Serotine is likely to be a migrant, but in 2023, Serotine was recorded from the second half of May until mid-September.

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.

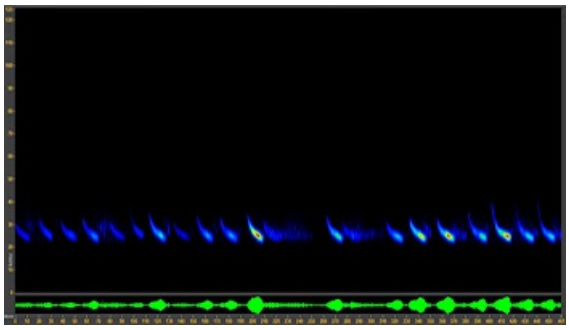
Acoustically, it is normally straightforward to distinguish Serotine from *Nyctalus* species, of which Common Noctule and Leisler's Bat are the most likely confusion species here. In contrast to Serotine, *Nyctalus* species often show strong alternating frequencies in the calls within a sequence. Leisler's 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. See also Appendix 8 for the description and comments on a 'big bat' species, possibly Serotine recorded on Sark in September, but which was not assigned to species.



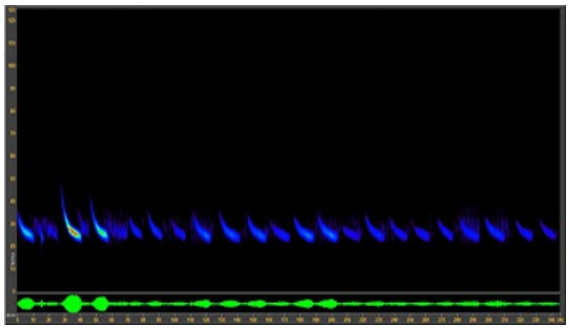
Serotine



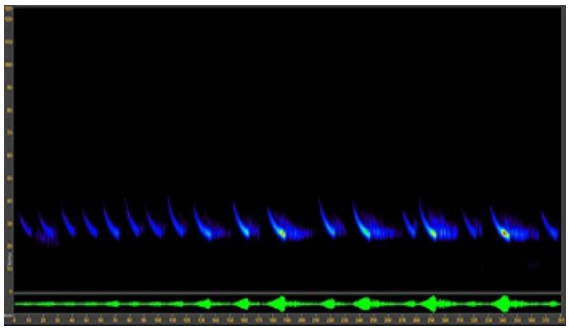
Serotine



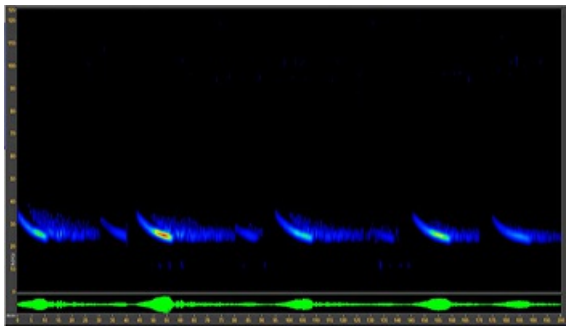
Serotine



Serotine



Serotine



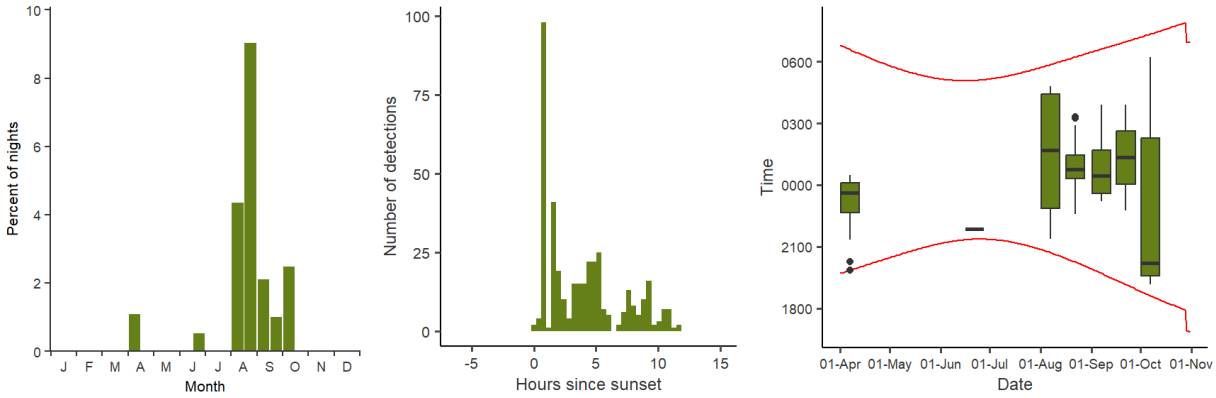
Serotine

Whiskered or Brandt's Bat

Whiskered or Brandt's Bat *Myotis mystacinus or M. brandtii* was recorded on 21 nights, from 12 locations, giving a total of 387 recordings.

Spatial pattern of activity

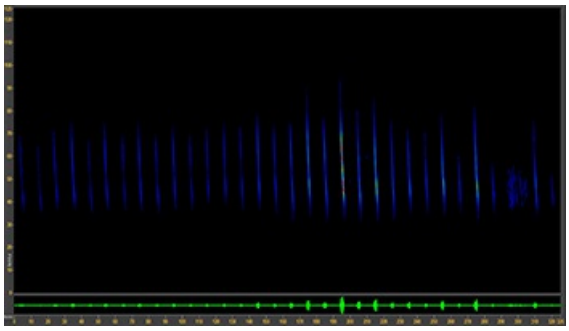
Seasonal and nightly activity



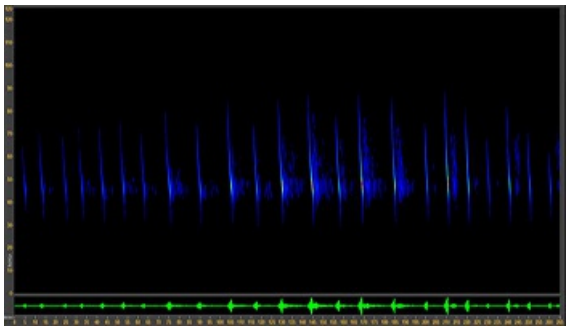
Whiskered or Brandt's Bat At the current time, there are no good, clear criteria for distinguishing Whiskered and Brandt's Bat acoustically with confidence (see Identification Appendix 2). We found this species pair on Guernsey for the first time in 2021 and also Alderney where this species pair, or Alcathoe 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 2023, we assigned 387 recordings to Whiskered or Brandt's Bat. Four of these locations were on Alderney (three locations in September or October). Of particular note, was one location close to Val Reuters road in St. Anne, where there were 181 recordings from one night in October. On Guernsey, the distribution of records reinforces the findings from previous years, with recordings from the south-east corner of Guernsey (mainly in August), perhaps suggesting that this species was an extremely rare resident confined to this small area. However, there were also a number of records from late August and September from the north of the island, where we know from winter roost surveys, that an underground structure in the north of the island is used by this species pair.

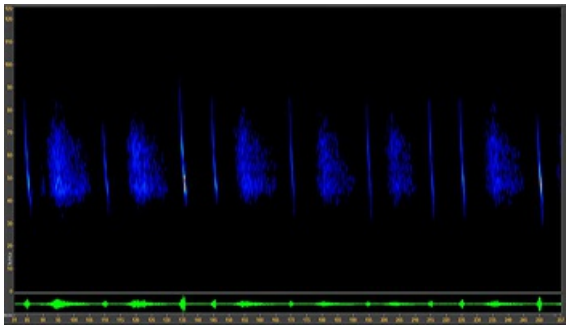
As discussed in the 2021 report, Brandt's Bat is extremely rare or a vagrant in Jersey, while Whiskered Bat is considered to be very rare. In neighbouring France, Brandt's Bat is absent from Normandy and rare in Brittany. Whiskered Bat is much more common in both neighbouring areas and, based on this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



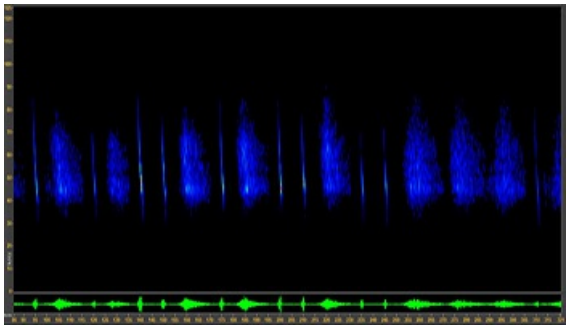
Whiskered or Brandt's Bat



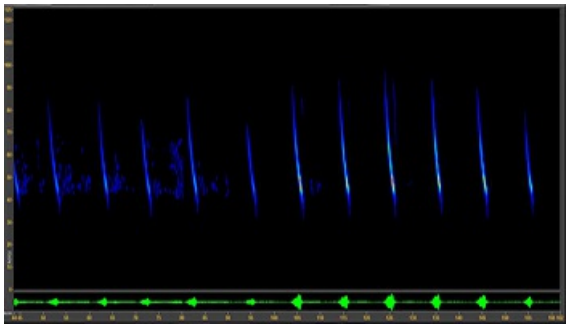
Whiskered or Brandt's Bat



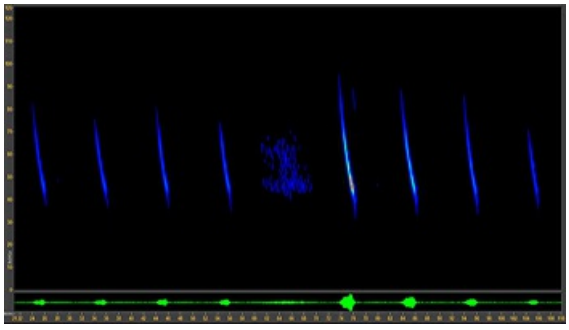
Whiskered or Brandt's Bat



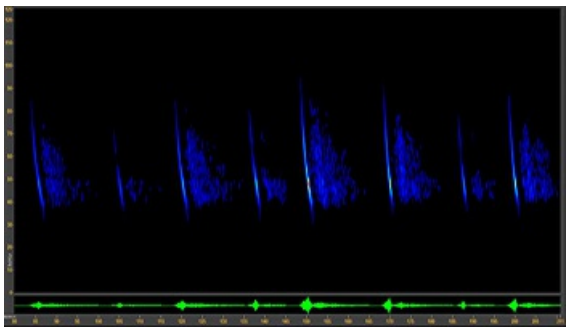
Whiskered or Brandt's Bat



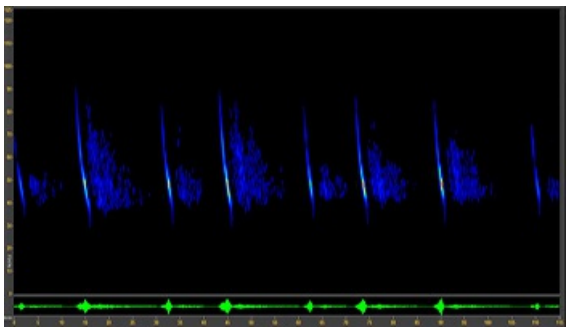
Whiskered or Brandt's Bat



Whiskered or Brandt's Bat



Whiskered or Brandt's Bat

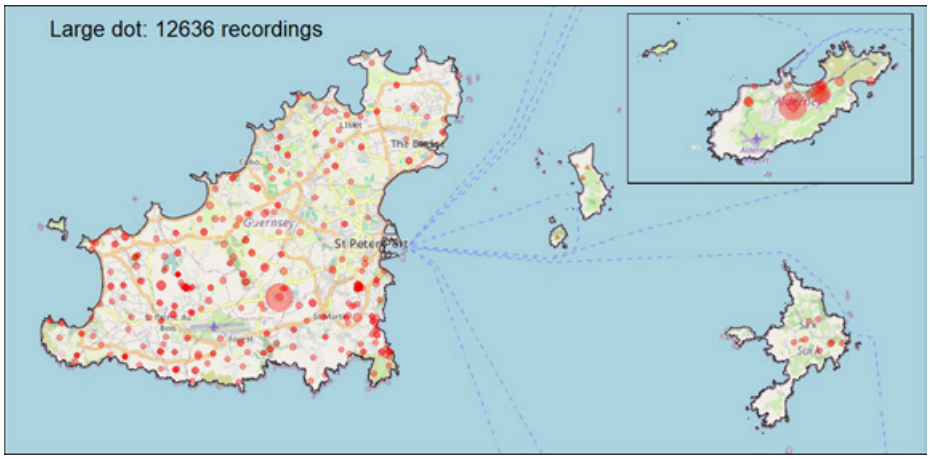


Whiskered or Brandt's Bat

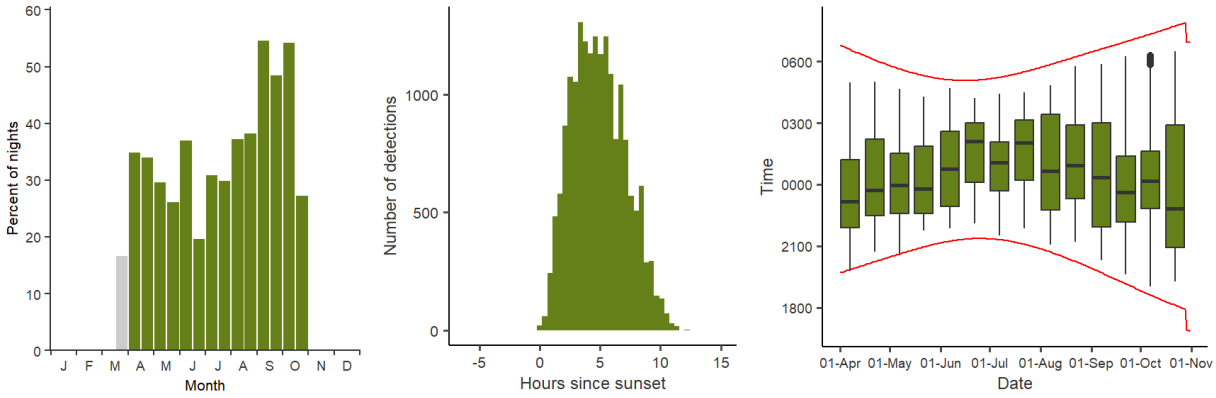
Natterer's Bat

Natterer's Bat *Myotis nattereri* was recorded on 205 nights, from 343 locations, giving a total of 18,162 recordings.

Spatial pattern of activity



Seasonal and nightly activity

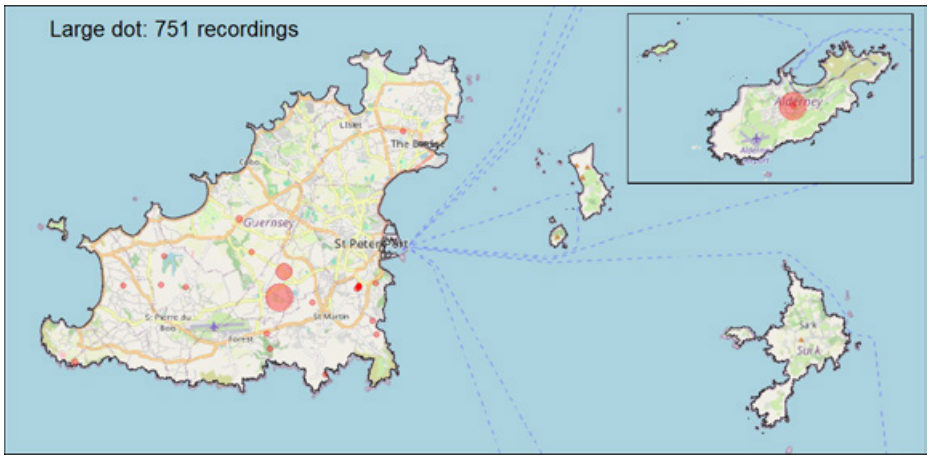


Similar to 2021 and 2022, **Natterer's Bat** was widely recorded in 2023, with records from Guernsey, Sark and Alderney, but it was absent from the smaller islands. The pattern of abundance was similar to 2021 and 2022, with large numbers of recordings in the south-east corner of Guernsey and along a 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. However, it is difficult to see this pattern in the map above, because of the large number of Natterer's Bat recordings (12,636 recordings over 11 nights) that were made outside the German Underground Hospital in late September and October. We know from previous winter roost surveys, that the German Underground Hospital and the St Saviour's tunnels are likely to be extremely important for Natterer's Bat for swarming or use as hibernation roosts. See Identification Appendix 3 for more information on the sound identification of Natterer's Bat.

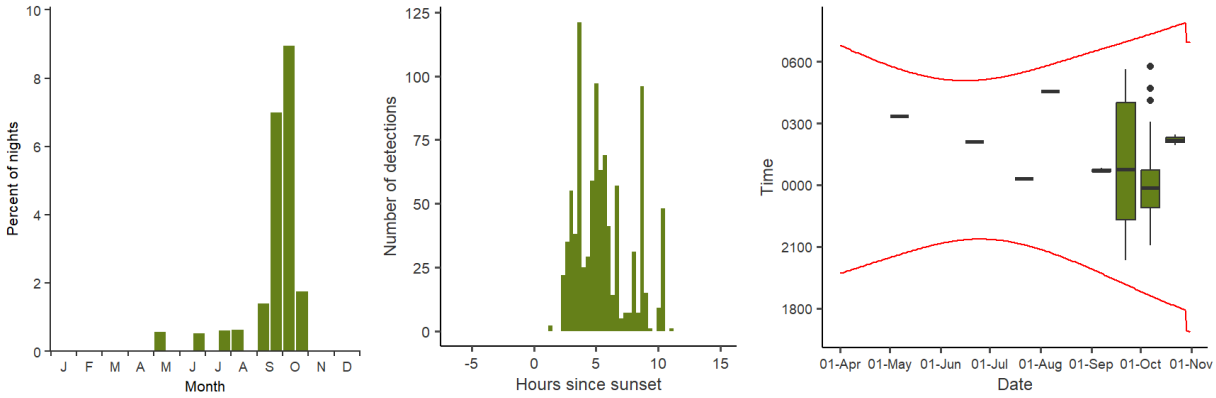
Natterer's Bat Social Calls

Natterer's Bat Social Calls *Myotis nattereri* was recorded on 26 nights, from 25 locations, giving a total of 954 recordings.

Spatial pattern of activity



Seasonal and nightly activity



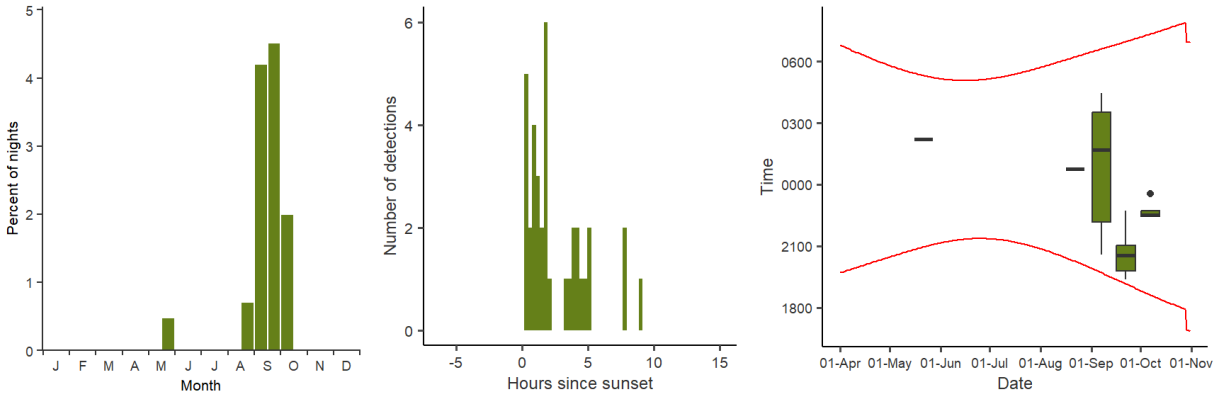
Natterer's Bat social calls Social calls of bats are different from echolocation calls, which they use to navigate their way around the landscape, in that they are often used when bats interact with one another. Natterer's Bat social calls in October or November may be associated with swarming in the vicinity of roost sites. The largest number of social calls were recorded close to the German Underground Hospital and at a location along Route des Talbots close to Le Monnaie Chapel.

Leisler's Bat

Leisler's Bat *Nyctalus leisleri* was recorded on 14 nights, from 17 locations, giving a total of 36 recordings.

Spatial pattern of activity

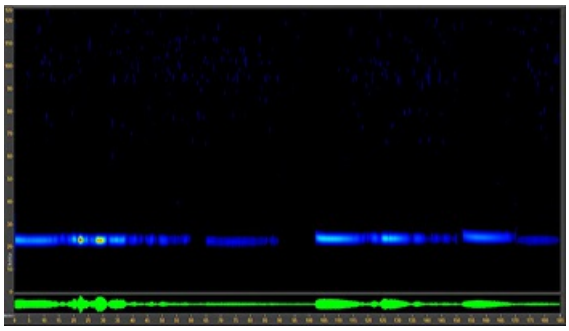
Seasonal and nightly activity

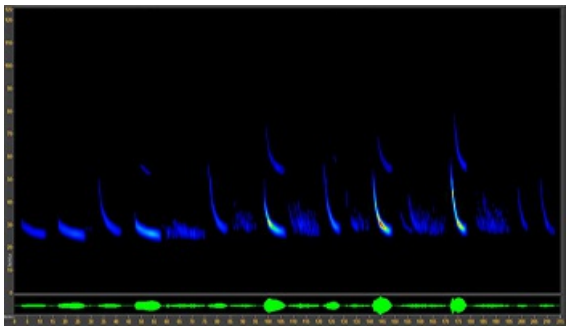


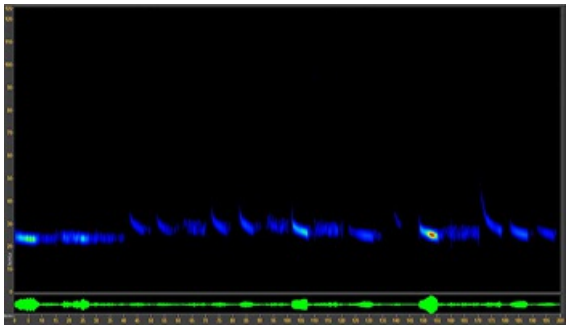
Leisler's Bat - new species for Sark. Two recordings of Leisler's Bat from Sark from the 9th October comprise the first record of this species for the island. As was mainly the case in 2021 and 2022, records of Leisler's Bat from Guernsey (13 locations, 31 recordings) were from September or October, with the exception of a single early record of Leisler's Bat from the 24th May from a coastal location at St. Sampson.

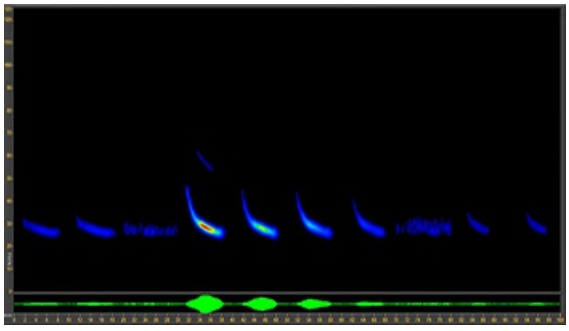
On Alderney, single recordings of Leisler's bat were made from three locations across the island between late August and mid-September. All of these areas were fairly open, and were generally recorded from gardens or in areas of pasture and all consisted of one, or two recordings a few seconds apart, 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 (mainly in autumn) does indicate that it is a rare, but regular migrant to the islands.

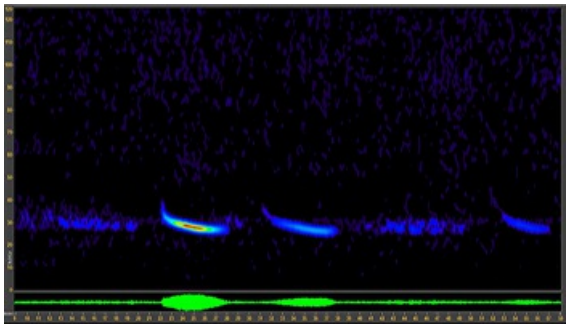
In most of the recordings, there are alternating call frequencies, which is typical for *Nyctalus*. Such alternating calls would be unexpected for Serotine, but also unlikely to be produced by Parti-coloured Bat *Vespertilio murinus*, which should probably be considered as a possible vagrant to the Channel 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. See also Appendix 8 for the description and comments on an additional 'big bat' species, possibly Leisler's Bat recorded on Sark in early September, but which was not assigned to species.

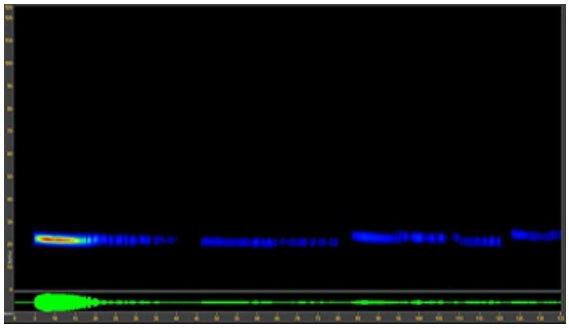

Leisler's Bat

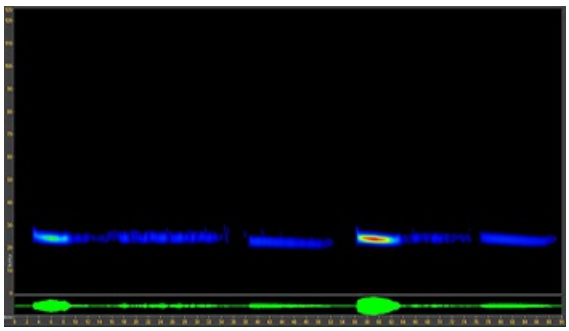

Leisler's Bat

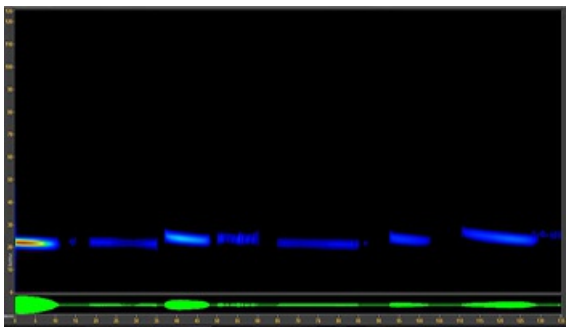

Leisler's Bat


Leisler's Bat


Leisler's Bat


Leisler's Bat


Leisler's Bat

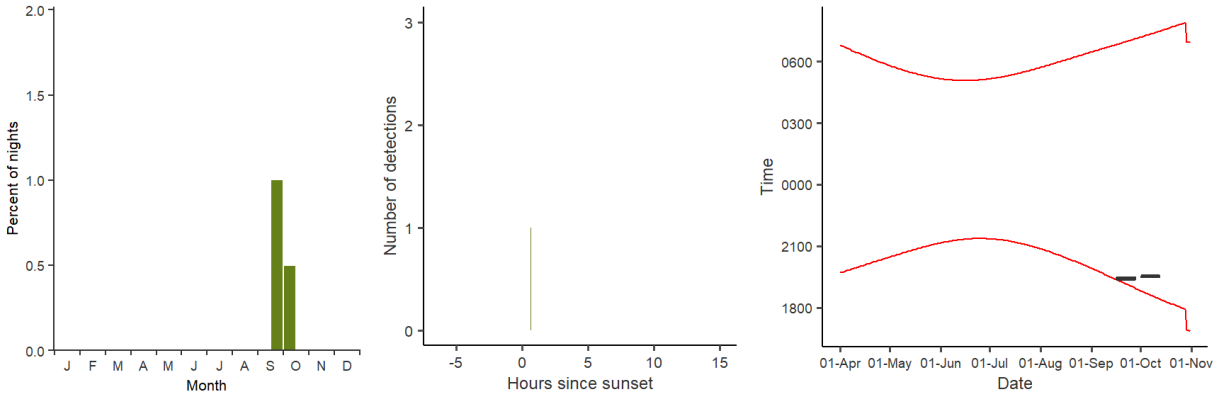

Leisler's Bat

Common Noctule

Common Noctule *Nyctalus noctula* was recorded on three nights, from three locations, giving a total of 8 recordings.

Spatial pattern of activity

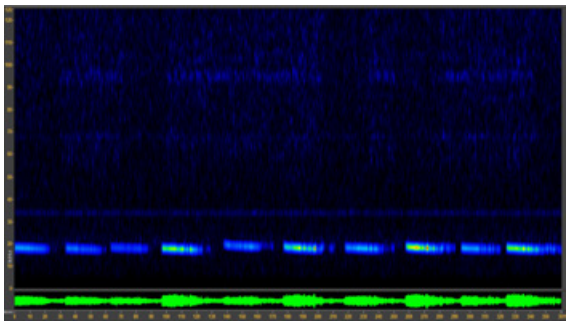
Seasonal and nightly activity



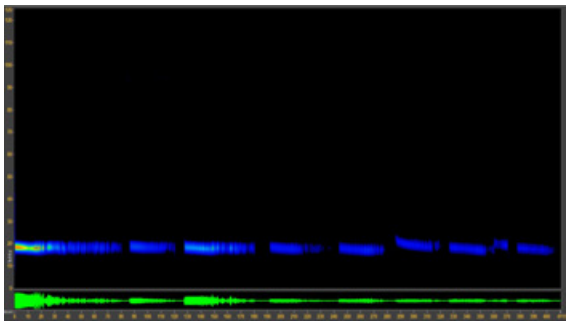
Common Noctule was first recorded from three different locations (3 recordings) on Guernsey between the 25th September and 1st October, which may represent the same individual.

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) and from 2022 where Noctule was recorded as a new species for Alderney (recorded on two dates, in late August and October), it is likely that this is a very rare migrant in the Bailiwick.

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



Noctule

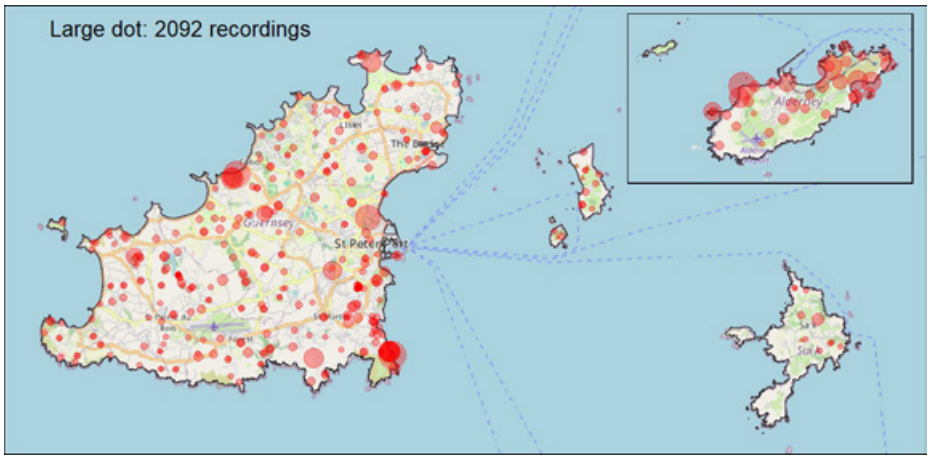


Noctule

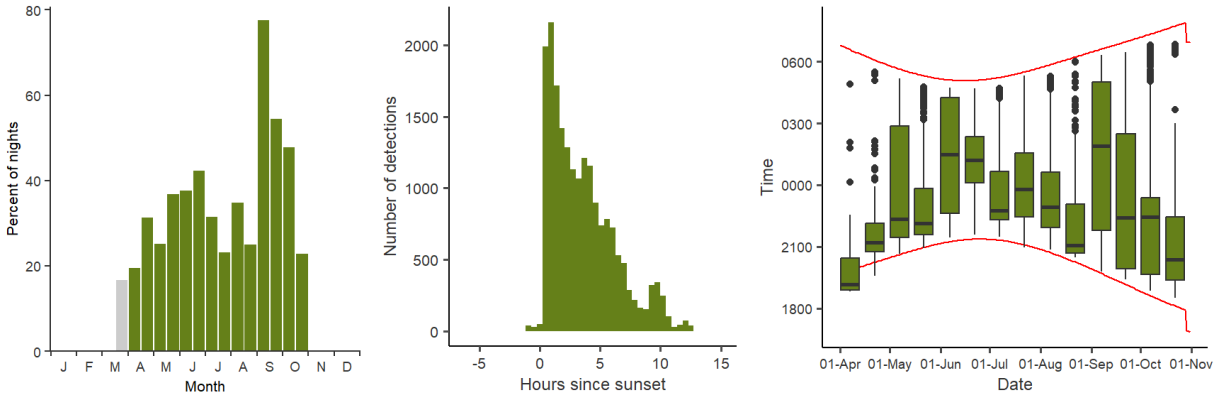
Kuhl's Pipistrelle or Nathusius' Pipistrelle

Kuhl's Pipistrelle or Nathusius' Pipistrelle *Pipistrellus kuhlii or P. nathusii* was recorded on 194 nights, from 365 locations, giving a total of 19,407 recordings.

Spatial pattern of activity



Seasonal and nightly activity



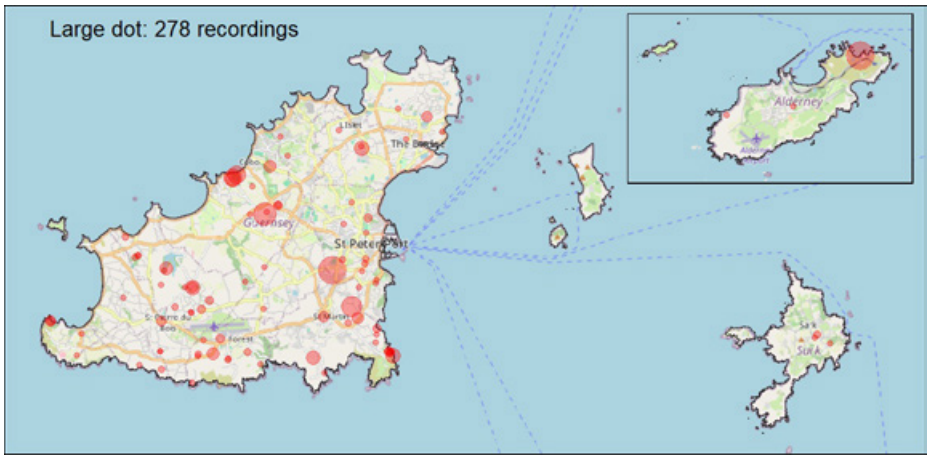
Nathusius' or **Kuhl's Pipistrelle**. We present here results for Kuhl's Pipistrelle and Nathusius' Pipistrelle combined. These two species are extremely difficult to distinguish from their echolocation calls (see Identification Appendix 5) and are best treated as a species pair, although social calls 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 as in 2022 some sites such as at Le Guet and Jerbourg in Guernsey held much larger numbers exceeding 1,900 in one case.

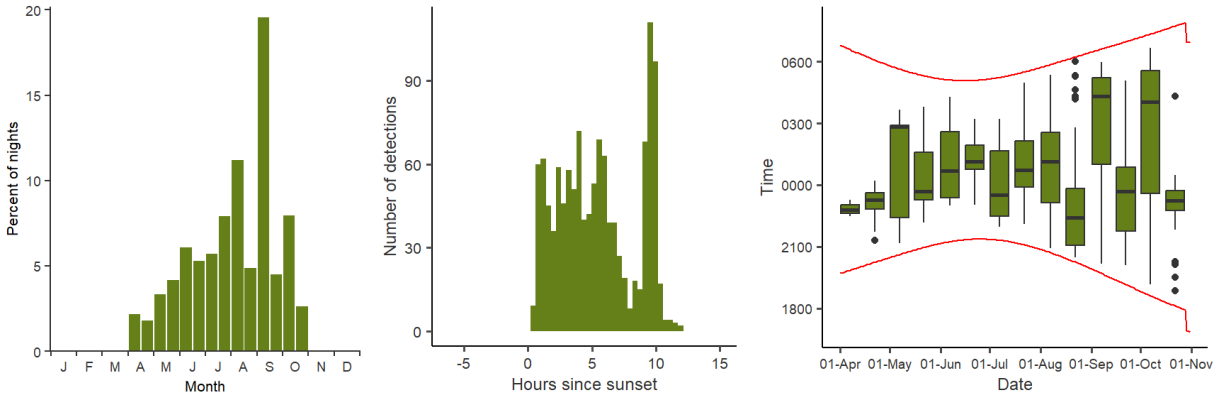
Kuhl's Pipistrelle Social Calls

Kuhl's Pipistrelle Social Calls *Pipistrellus kuhlii* was recorded on 93 nights, from 89 locations, giving a total of 1,236 recordings.

Spatial pattern of activity



Seasonal and nightly activity



Kuhl's Pipistrelle social calls These social calls are very different from the social calls of Nathusius' Pipistrelle so we can assign these calls to Kuhl's Pipistrelle with confidence (see Identification Appendix 6).

Kuhl's Pipistrelle social calls were recorded across the survey season (late April to October), across multiple sites (89 locations), whereas Nathusius' Pipistrelle social calls were only recorded between September and October from 11 locations, including from one location on Alderney and for the first time during this project, from one location on Sark.

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).

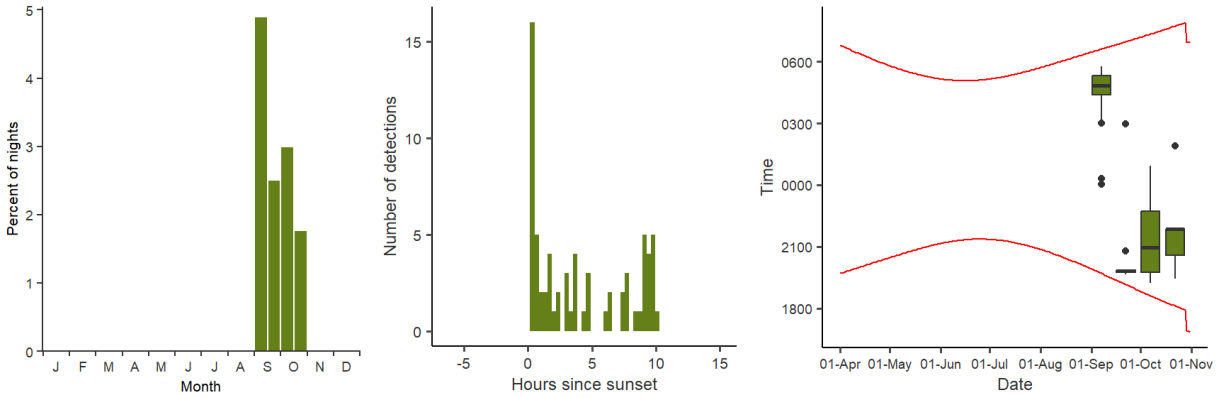
As in 2021 and 2022, there is perhaps continuing support for there being a tendency for Kuhl's Pipistrelle social calls to be produced late in the night between June until September, but there appears to be a change in behaviour between about mid-September and November, when social calls were produced 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* was recorded on 16 nights, from 11 locations, giving a total of 69 recordings.

Spatial pattern of activity

Seasonal and nightly activity



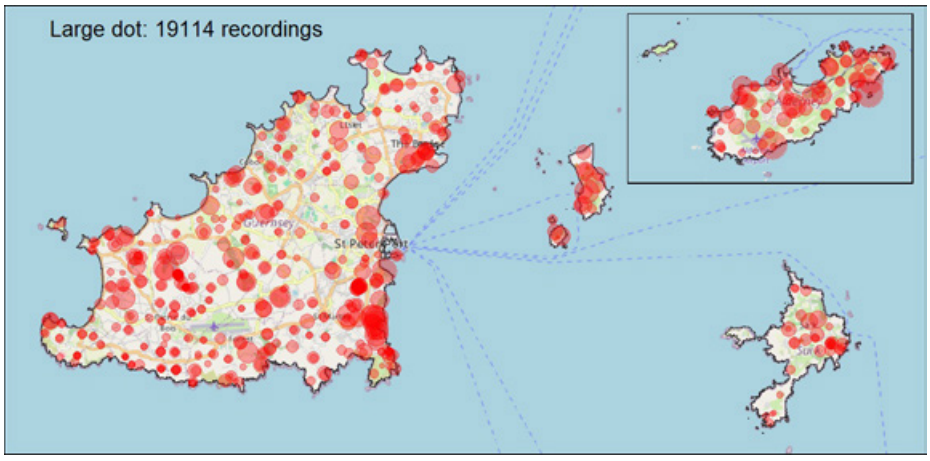
Nathusius' Pipistrelle social calls In contrast to echolocation calls, social calls of Nathusius' Pipistrelle can be assigned to species with confidence (see Identification Appendix 6). The social calls recorded, have mainly comprised of male advertisement calls (i.e. they are calling for a female). 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. However, in 2023, social calls were recorded more widely again on 16 nights from 11 locations with a total of 69 recordings. This included recordings from a single location on Alderney, and social calls of Nathusius' Pipistrelle were recorded for the first time through this project from one location on Sark.

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. As in previous years, the distribution of social calls is much more restricted compared to Kuhl's, both spatially and temporally (Kuhl's: April to October; Nathusius': September-October only). All previous records found and reported on in the *Transactions of La Société Guernesiaise* 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.

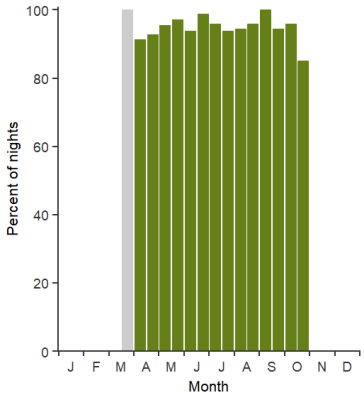
Common Pipistrelle

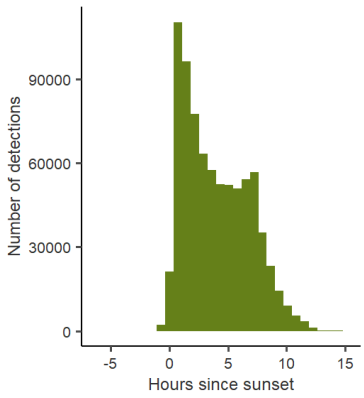
Common Pipistrelle *Pipistrellus pipistrellus* was recorded on 228 nights, from 576 locations, giving a total of 787,915 recordings.

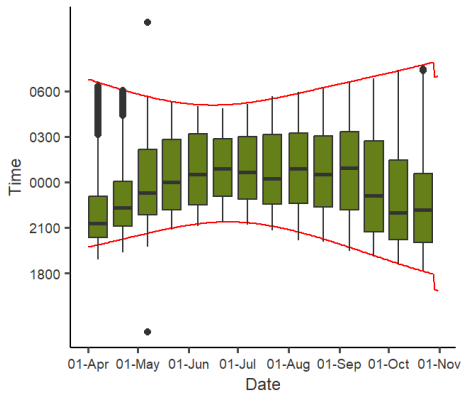
Spatial pattern of activity



Seasonal and nightly activity







As in previous years, **Common Pipistrelle** was by far the most common and widely recorded bat species, with 787,915 recordings from 576 different locations (99% of survey locations) and a maximum of 4,808 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.

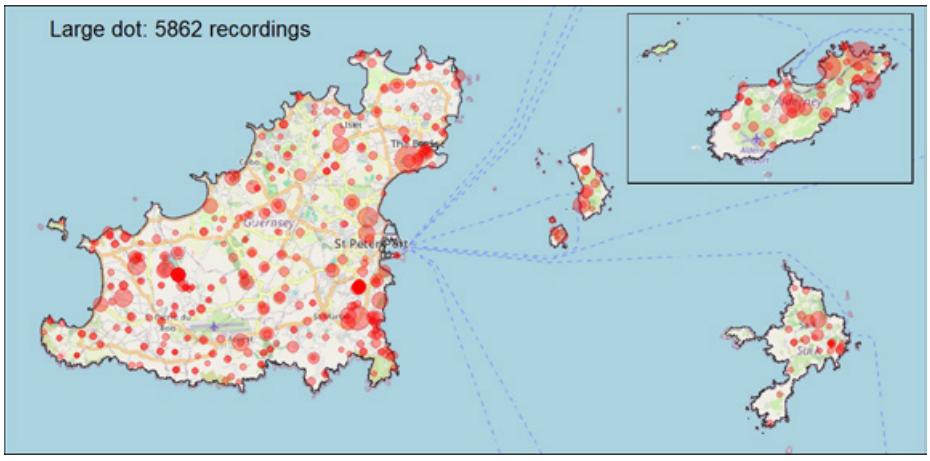
In previous winter roost surveys, it was under-represented in the tunnel surveys compared with the results we are getting from the wider spring-summer survey and the rarer species predominated showing the importance of underground structures for these species. Common Pipistrelles tend to hibernate more 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.

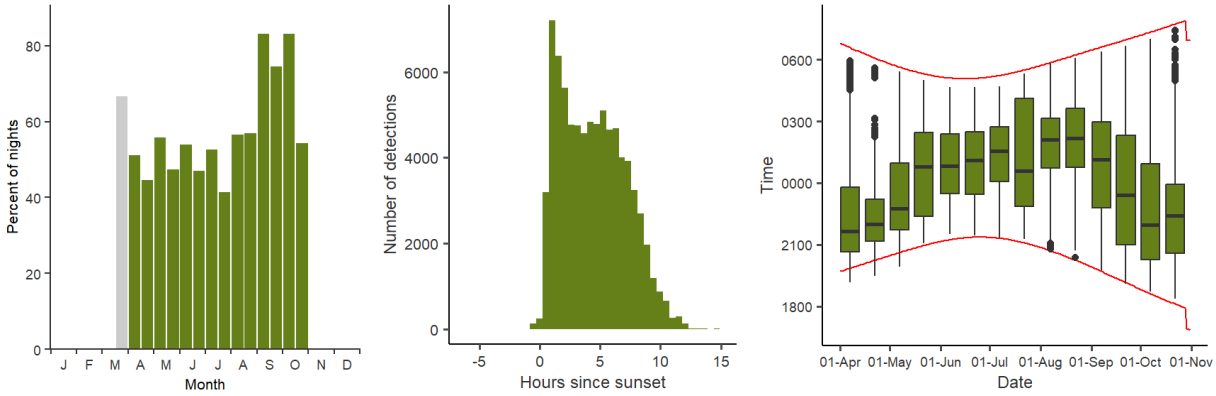
Common Pipistrelle Social Calls

Common Pipistrelle Social Calls *Pipistrellus pipistrellus* was recorded on 214 nights, from 458 locations, giving a total of 80,157 recordings.

Spatial pattern of activity



Seasonal and nightly activity

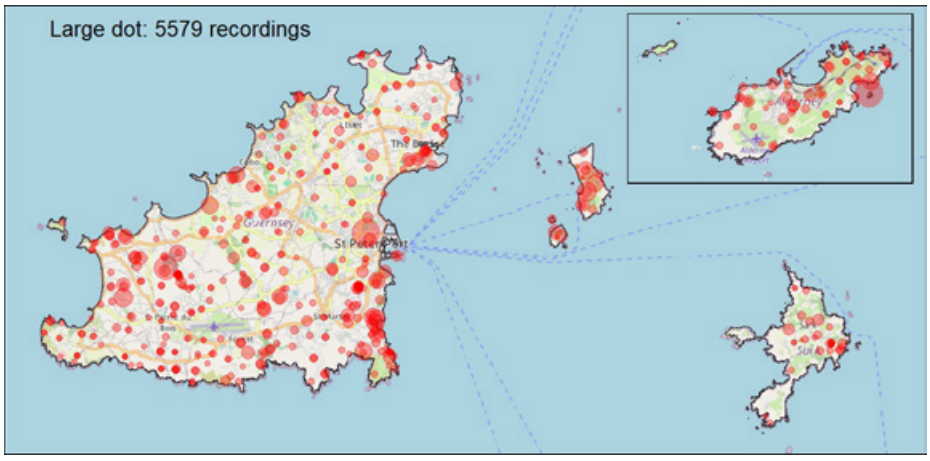


Common Pipistrelle social calls. This is the first year that we have specifically identified Common Pipistrelle social calls. A range of social calls are produced by Common Pipistrelle, but most common are social trills often comprising of four calls. These can be produced in flight at any time of year, but as illustrated above, there is an increase in the percent of nights recording Common Pipistrelle social calls during the late summer / autumn mating period.

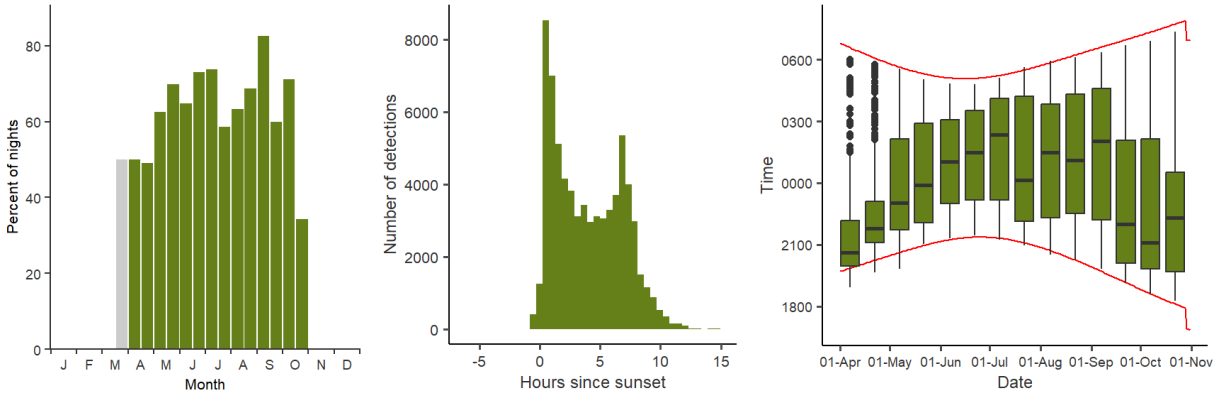
Common Pipistrelle Feeding Buzz

Common Pipistrelle Feeding Buzz *Pipistrellus pipistrellus* was recorded on 218 nights, from 496 locations, giving a total of 70,127 recordings.

Spatial pattern of activity



Seasonal and nightly activity



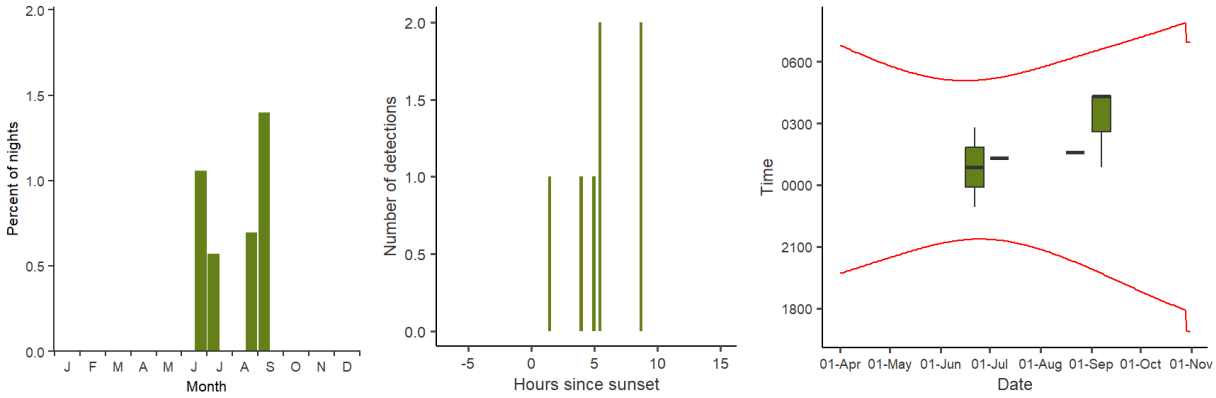
Common Pipistrelle feeding buzzes. This is the first year that we have specifically identified Common Pipistrelle feeding buzzes. As illustrated above, feeding buzzes are produced across the year, with peaks in feeding activity towards the start of the night and a clear increase in feeding activity towards the end of the night before returning to the roost. During the colder start and end of the project, feeding activity is more concentrated towards the early part of the night.

Soprano Pipistrelle

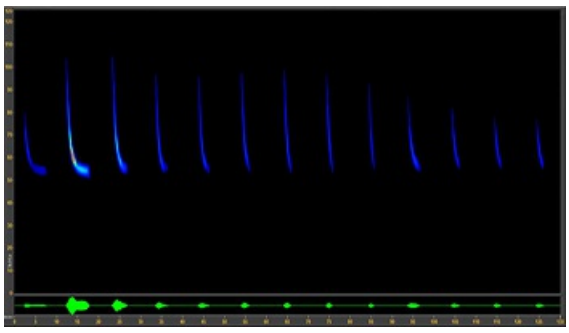
Soprano Pipistrelle *Pipistrellus pygmaeus* was recorded on six nights, from four locations, giving a total of 7 recordings.

Spatial pattern of activity

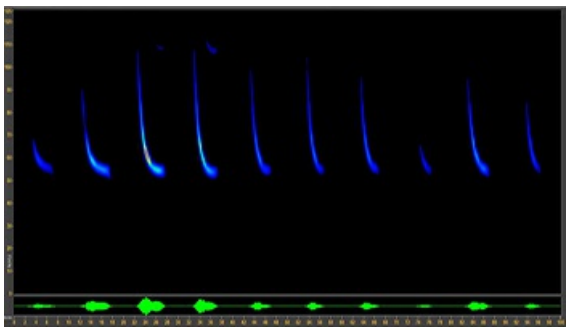
Seasonal and nightly activity



Soprano Pipistrelle. For the second year running, Soprano Pipistrelle was recorded from Alderney. The seven recordings were made between June and September from four locations. The timing of some of these records from June and July suggests that Soprano Pipistrelle could be a resident species on Alderney.



Soprano Pipistrelle



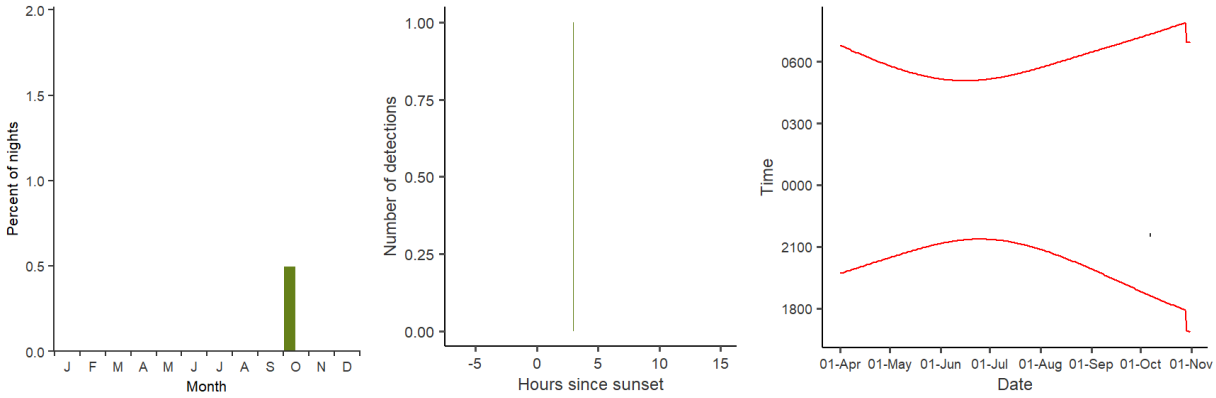
Soprano Pipistrelle

Soprano Pipistrelle Social Calls

Soprano Pipistrelle Social Calls *Pipistrellus pygmaeus* was recorded on one night, from one location, giving a total of 1 recordings.

Spatial pattern of activity

Seasonal and nightly activity

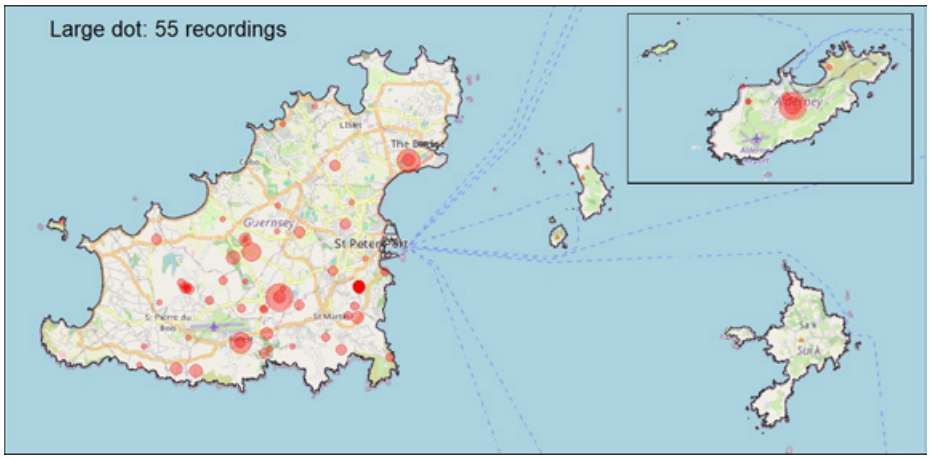


Soprano Pipistrelle social calls. This is the first year that we have specifically identified Soprano Pipistrelle social calls. In 2023, just a single recording from Alderney in October included social calls.

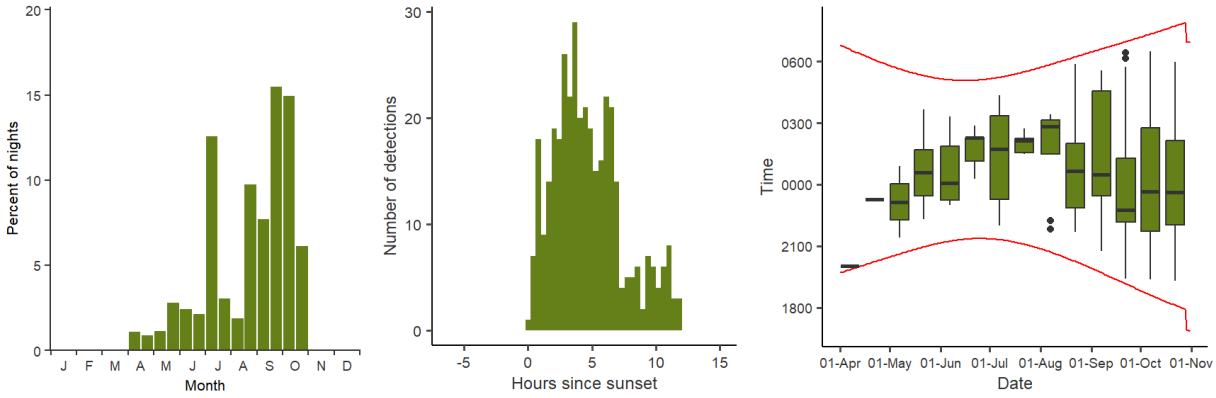
Brown Long-eared Bat

Brown Long-eared Bat *Plecotus auritus* was recorded on 84 nights, from 82 locations, giving a total of 370 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 and 2022. A similar number of recordings was obtained (313 in 2021, 327 in 2022, 370 in 2023), but it was found in fewer places and nights in 2023 compared with 2022, but similar to 2021 (79 nights/75 locations in 2021; 112 nights/102 locations in 2022; 83 nights, 82 locations in 2023).

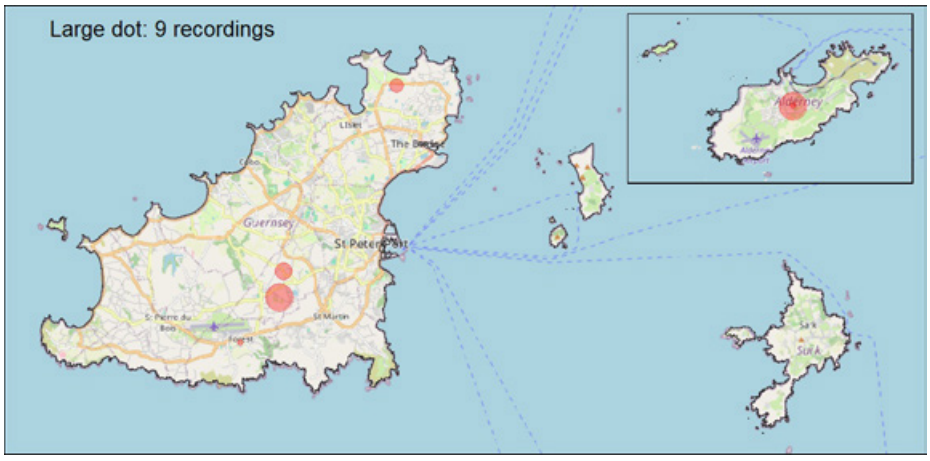
In 2021 and 2023, we found that Brown Long-eared Bat was recorded more widely between mid-September and the end of October than earlier in the season We suggest that this could be related to a habitat shift away from a close association with woodland in summer to more open habitats in autumn, but this pattern did not hold in 2022. The records are clustered in the interior of Guernsey, with few records away from wooded areas.

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).

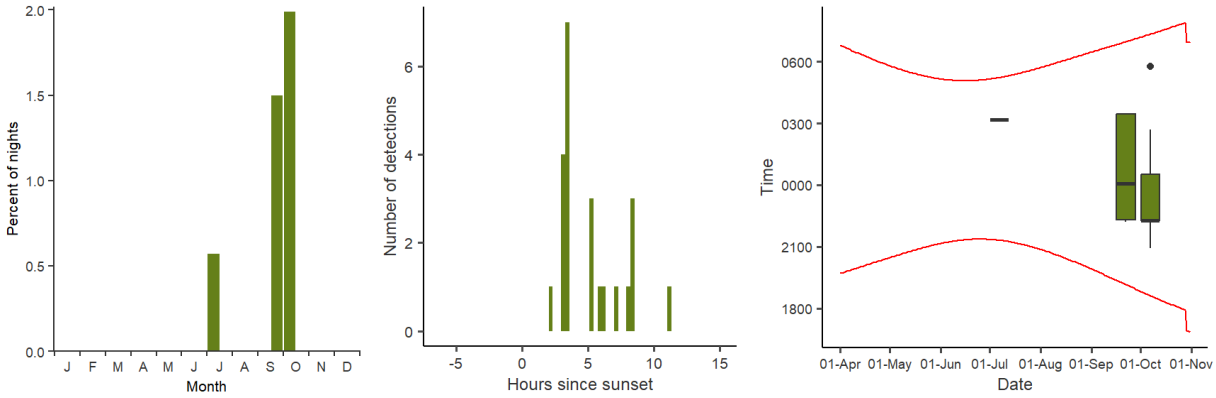
Brown Long-eared Bat Social Calls

Brown Long-eared Bat Social Calls *Plecotus auritus* was recorded on seven nights, from six locations, giving a total of 23 recordings.

Spatial pattern of activity



Seasonal and nightly activity

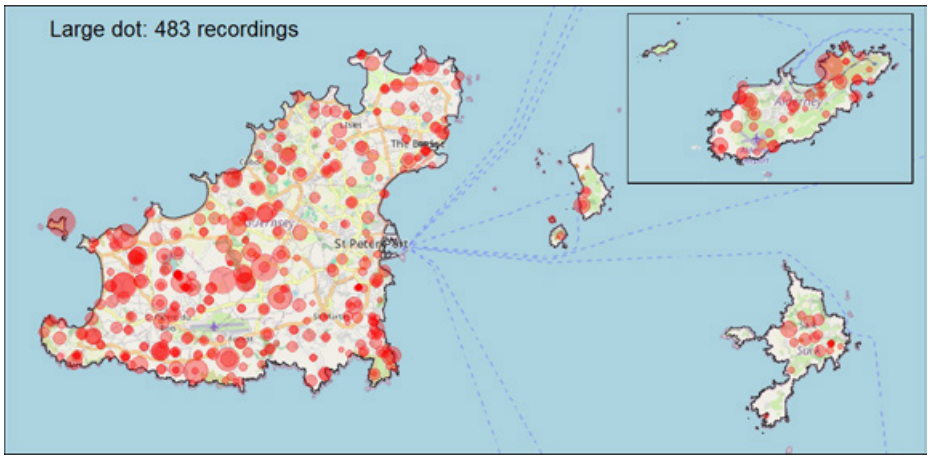


Brown Long-eared Bat social calls. This is the first year that we have specifically identified Brown Long-eared Bat social calls. In our categorisation of social calls for Brown Long-eared Bat, we have not included calls often defined as Type C social calls (Middleton *et al*. 2022) that are likely to have an echolocation and a social function. By excluding Type C social calls, the remaining social calls are more likely (but not exclusively) to be recorded in the vicinity of a roost. Depending on the time of year, a maternity roost, a mating roost or a wintering hibernation site. On Guernsey, the largest number of recordings containing social calls were from close to the German underground hospital, whilst on Alderney, recordings were centered on an area of woodland close to Val Routers.

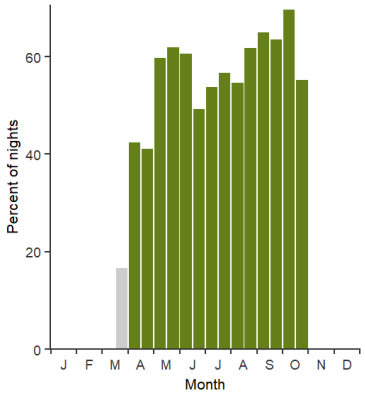
Grey Long-eared Bat

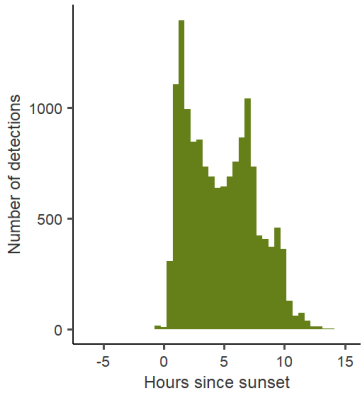
Grey Long-eared Bat *Plecotus austriacus* was recorded on 215 nights, from 447 locations, giving a total of 14,651 recordings.

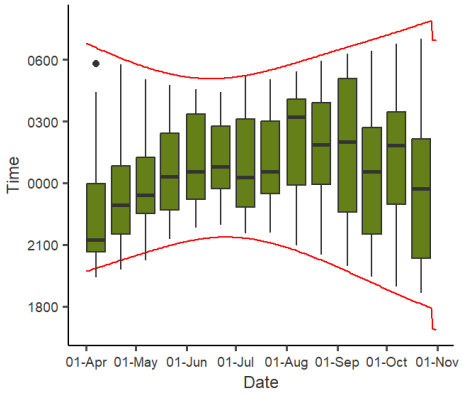
Spatial pattern of activity



Seasonal and nightly activity







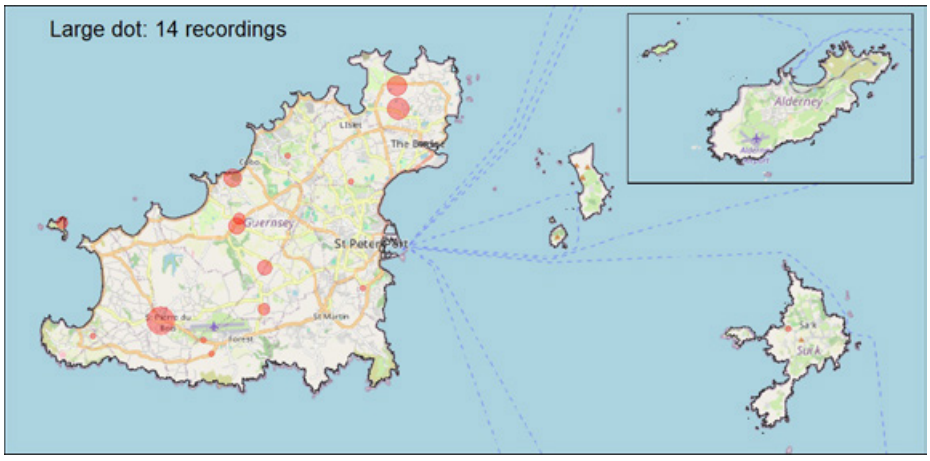
Grey Long-eared Bat. In contrast to the UK, Grey Long-eared Bat is the most common and widespread long-eared bat species on the islands. Of 15,023 *Plecotus* recordings which we assigned to species (where a recording was of sufficient quality, and where we were sufficiently confident to assign the recording to species), 14,651 recordings (97.5%) were assigned to Grey Long-eared Bat from 447 locations (77% of surveyed locations). This is noticeably down from 23,359 recordings from 527 locations recorded in 2022. This includes recordings from Guernsey & Lihou, Alderney, Herm & Jethou and Sark. Burhou is the only significant island in the Bailiwick on which it has not been recorded in any year of the project.

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 7.

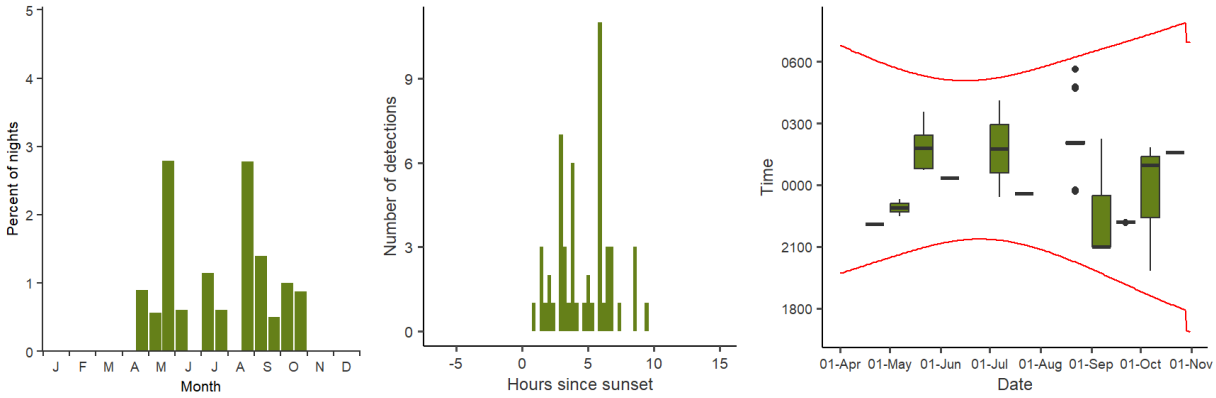
Grey Long-eared Bat Social Calls

Grey Long-eared Bat Social Calls *Plecotus austriacus* was recorded on 19 nights, from 16 locations, giving a total of 53 recordings.

Spatial pattern of activity



Seasonal and nightly activity



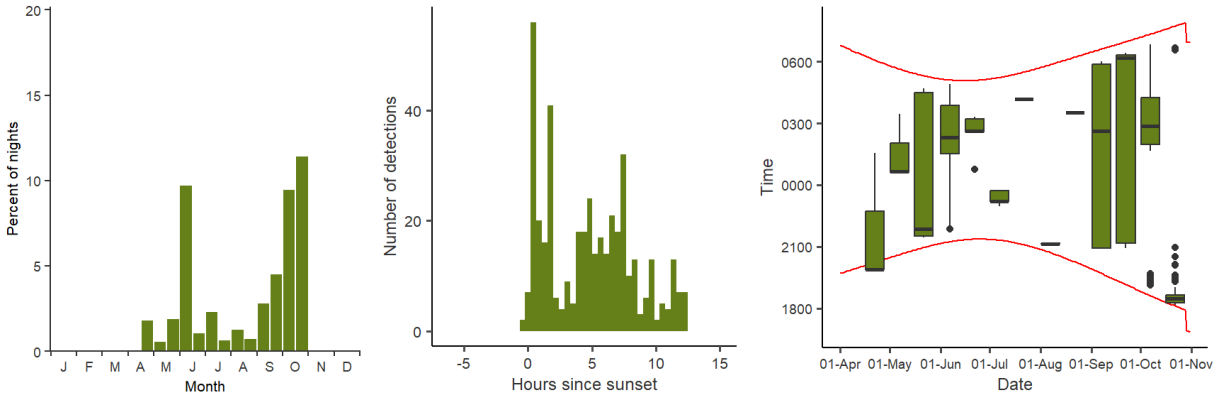
Grey Long-eared Bat social calls. This is the first year that we have specifically identified Grey Long-eared Bat social calls. In our categorisation of social calls for Grey Long-eared Bat, we have not included calls often defined as Type C social calls (Middleton *et al*. 2022) for the same reasons as discussed for Brown Long-eared Bat. Most of the social calls recorded in 2023 were from locations on Guernsey, but with a single recording Grey Long-eared Bat with social calls from a location at Le Port a la Jument on Sark. It may be helpful to follow up with more targeted work at some of the locations on Guernsey, perhaps particularly those from May and June, to see if these are being produced in the vicinity of a maternity roost.

Greater Horseshoe Bat

Greater Horseshoe Bat *Rhinolophus ferrumequinum* was recorded on 58 nights, from 36 locations, giving a total of 425 recordings.

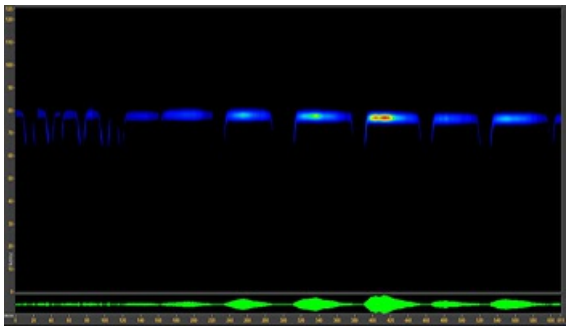
Spatial pattern of activity

Seasonal and nightly activity

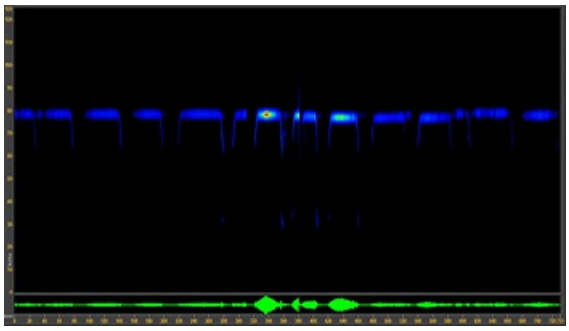


Greater Horseshoe Bat is an iconic bat species that is often used as a flagship for bat conservation. It is a rare resident in Guernsey. Compared with 2021 and 2022, we received records from a larger number of sites and and had many more recordings – 25 (2021) vs 221 (2022) recordings vs 425 (2023) recordings. In 2021, the majority of records comprised a single recording from a location a night up to five recordings. In 2022, we had 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. In 2023, the largest number of recordings were from two main sites, at Havilland Vale and from close to St. Saviour's parish church.

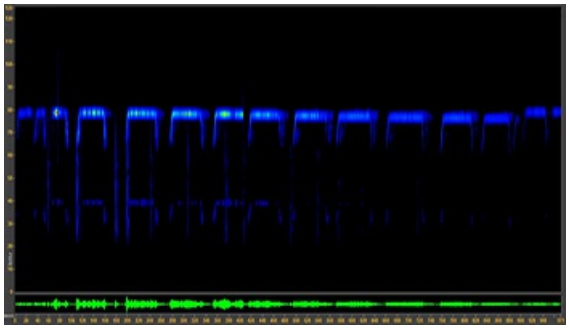
Still no breeding sites have been found in Guernsey and we ask volunteers to remain vigilant, but if found to not touch or otherwise disturb the bats. Horseshoe bats are obvious when roosting – they hang freely from the ceiling and wrap their wings around themselves. Other species will hide away in cracks 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. Over two winters, we have 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. 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.



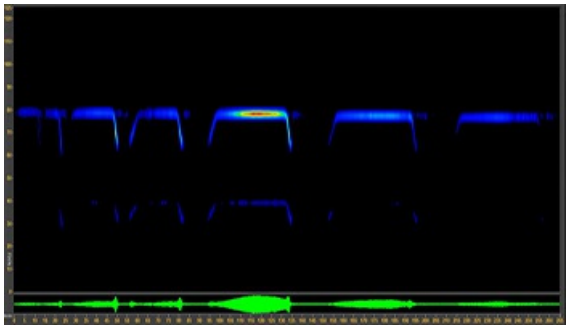
Greater Horseshoe Bat



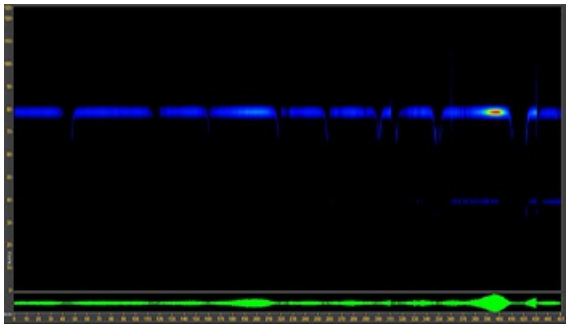
Greater Horseshoe Bat



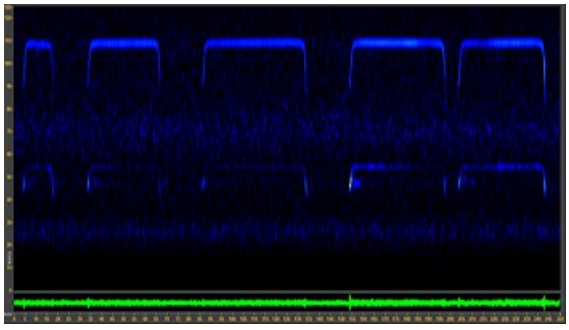
Greater Horseshoe Bat



Greater Horseshoe Bat



Greater Horseshoe Bat

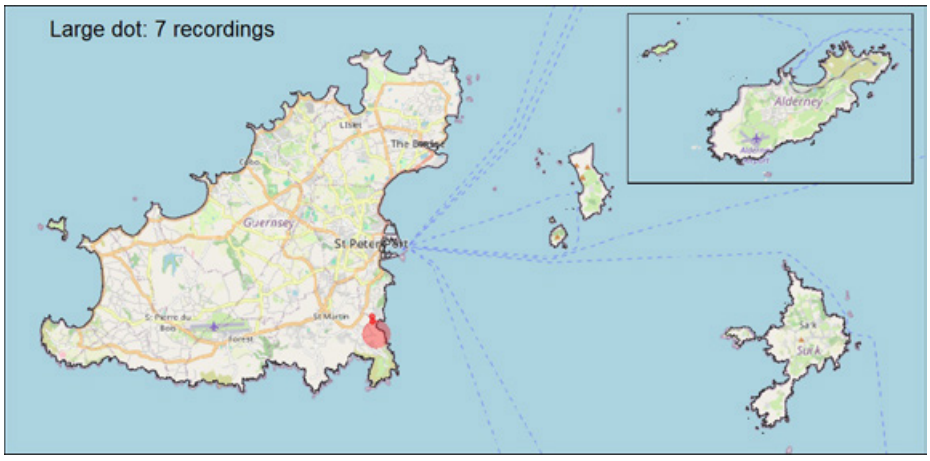


Lesser Horseshoe Bat

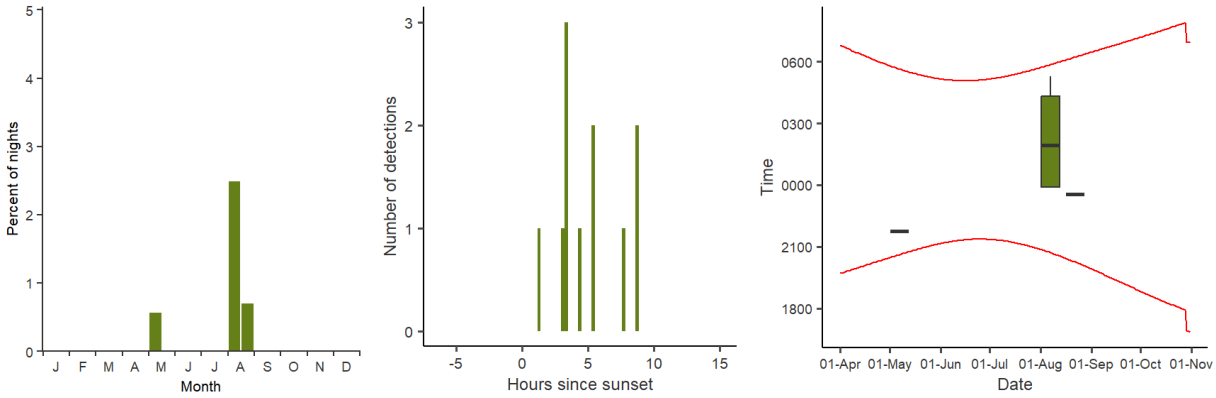
Lesser Horseshoe Bat

Lesser Horseshoe Bat *Rhinolophus hipposideros* was recorded on five nights, from five locations, giving a total of 11 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. Again in 2023, Lesser Horseshoe Bat was recorded from the Jerbourg area on five nights from five locations. Across the three years, it has been recorded in almost all months between April and October.

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

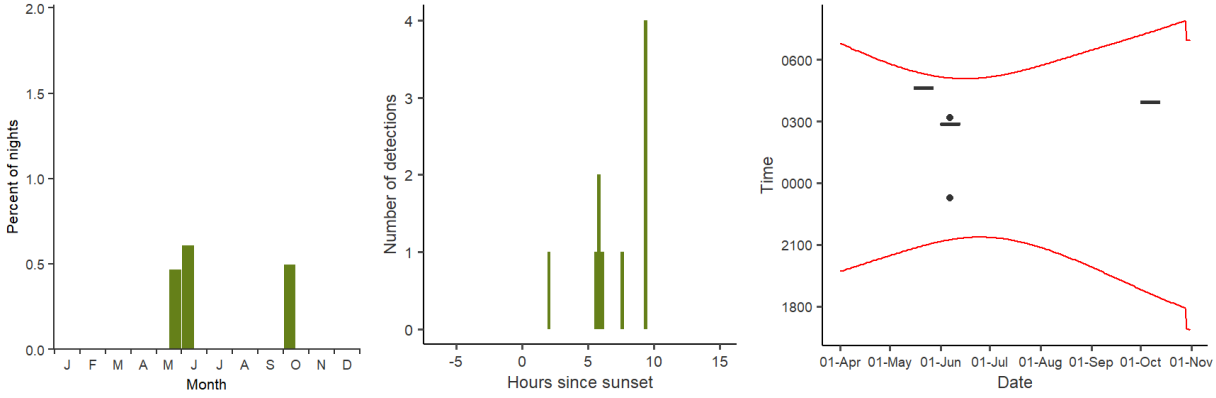
In this section we look at the recordings that we can assign to small terrestrial mammals.

Wood Mouse

Wood Mouse *Apodemus sylvaticus* was recorded on three nights, from three locations, giving a total of 10 recordings.

Spatial pattern of activity

Seasonal and nightly activity

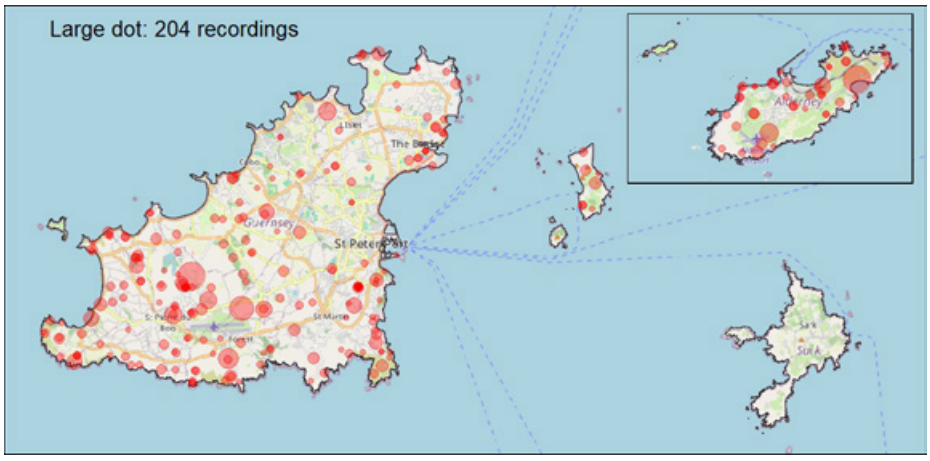


Wood Mouse was recorded from Guernsey and Alderney. Compared with the other small terrestrial mammal species here, the calls of Wood Mouse are not as loud, and so are likely to be under-recorded compared with shrews and rats. The detection distance of Wood Mouse is only about 1.5-m and so mounting the 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) and Middleton *et al*., (2024).

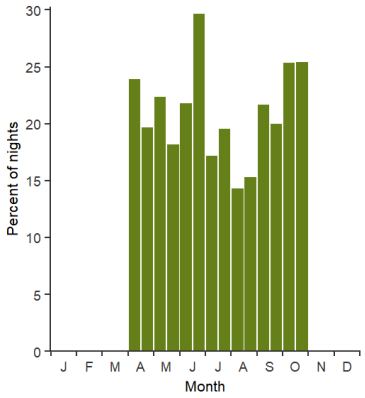
Greater White-toothed Shrew

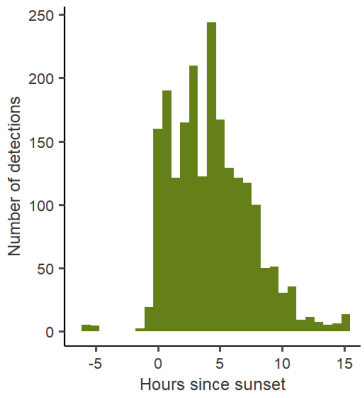
Greater White-toothed Shrew *Crocidura russula* was recorded on 193 nights, from 257 locations, giving a total of 2,093 recordings.

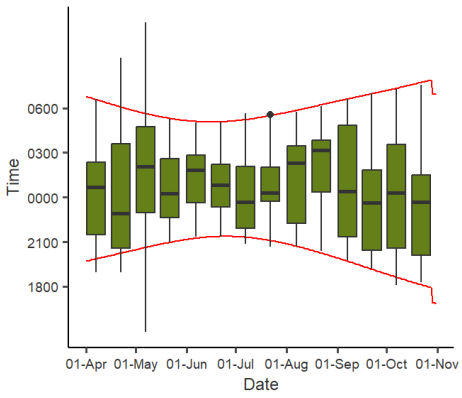
Spatial pattern of activity



Seasonal and nightly activity

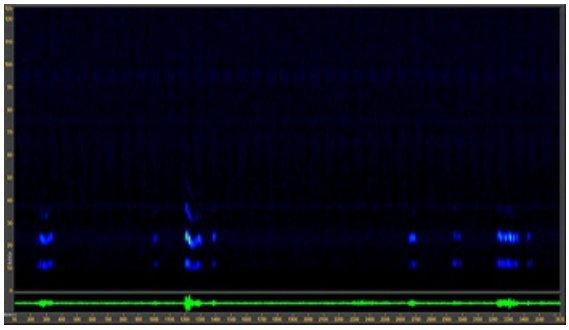




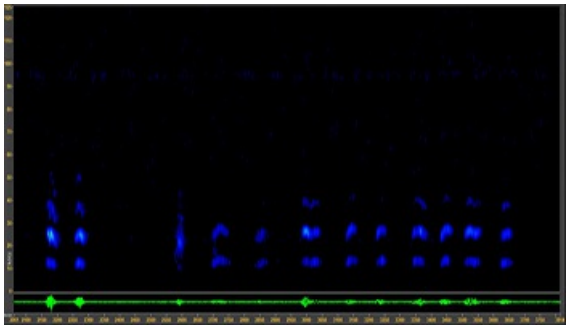


Greater White-toothed Shrew was recorded on Guernsey, Alderney and Herm and it is not present on the smaller islands. Lesser White-toothed Shrew replaces this species on Sark. They were extremely widespread and were present on three islands, being associated with farmland and gardens. This is the first project that has provided such a comprehensive map of small mammal activity for the islands, and with so much data it provides an ideal opportunity to look at habitat use of this poorly known species.

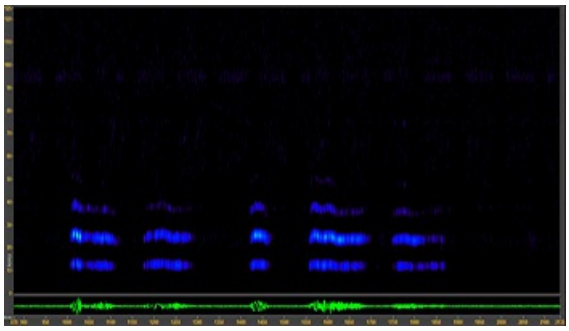
The calls sound quite different from those of Common Shrew *Sorex araneus*, Pygmy Shrew *Sorex minutus* and Water Shrew *Neomys fodiens* found on mainland UK and described in Newson *et al*., (2021). In particular, the calls are shorter in duration, which makes the calls sound more abrupt.



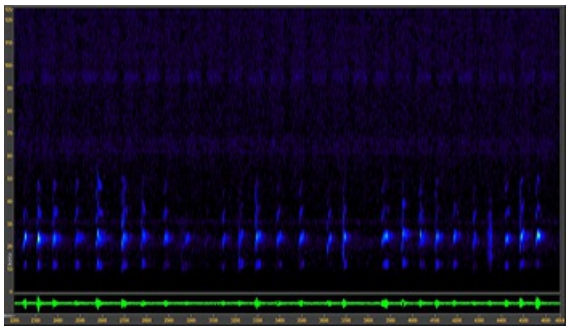
Greater White-toothed Shrew



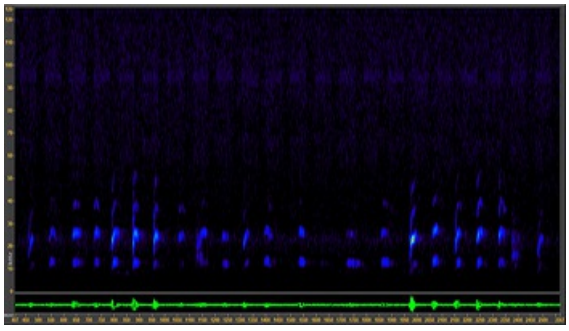
Greater White-toothed Shrew



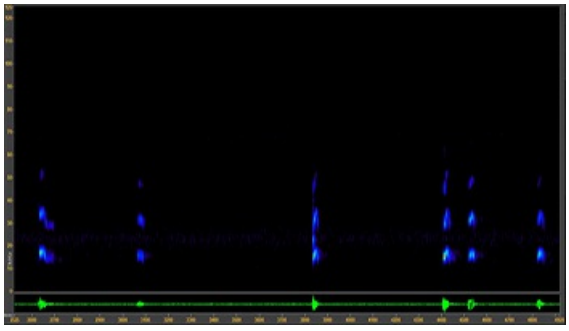
Greater White-toothed Shrew



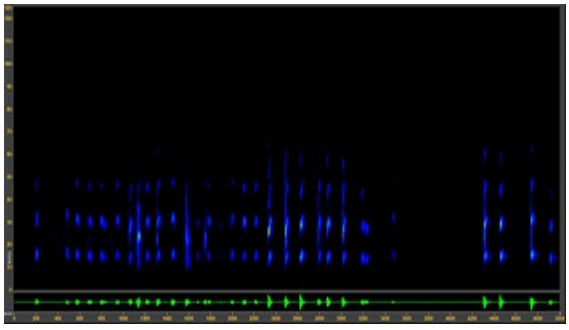
Greater White-toothed Shrew



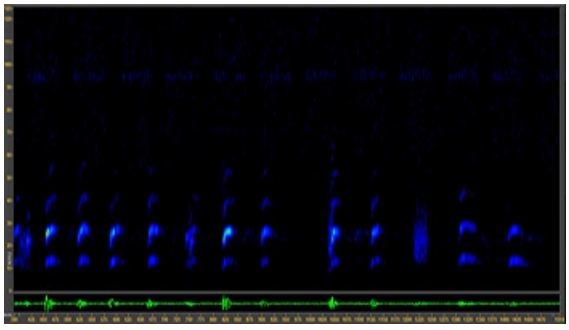
Greater White-toothed Shrew



Greater White-toothed Shrew



Greater White-toothed Shrew



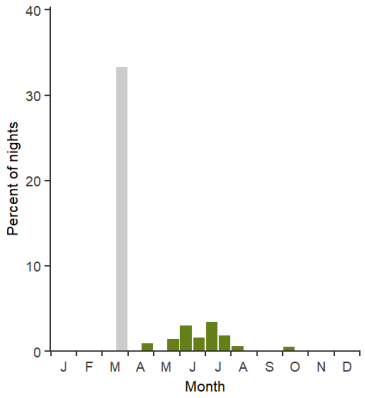
Greater White-toothed Shrew

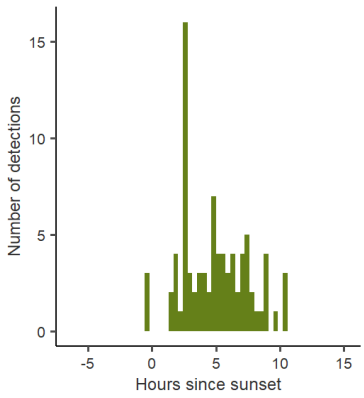
Lesser White-toothed Shrew

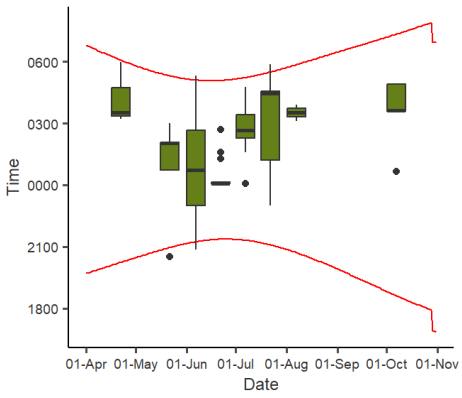
Lesser White-toothed Shrew *Crocidura suaveolens* was recorded on 25 nights, from 16 locations, giving a total of 84 recordings.

Spatial pattern of activity

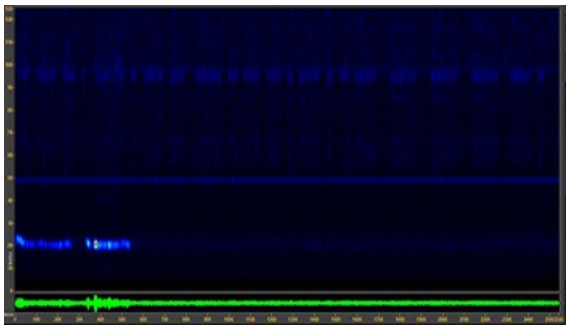
Seasonal and nightly activity



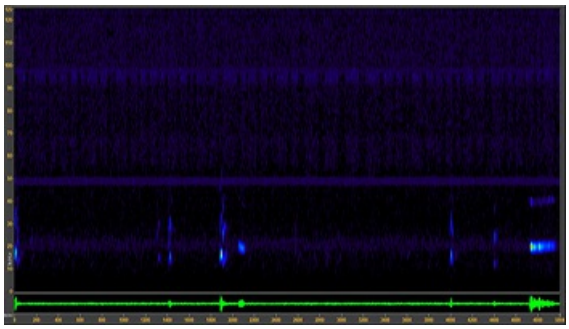




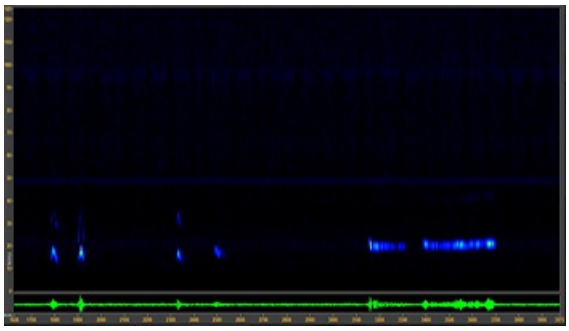
Lesser White-toothed Shrew was only recorded on Sark, where Lesser White-toothed Shrew is the only shrew species present. Thanks to the collection of a large reference library now of sound recordings of Lesser White-toothed Shrew from the Isles of Scilly, we have a good understanding of the range of calls produced by this species (Middleton *et al.*, 2024). Lesser White-toothed Shrew and Greater White-toothed shrew do not occur together on any island in the Channel Islands.



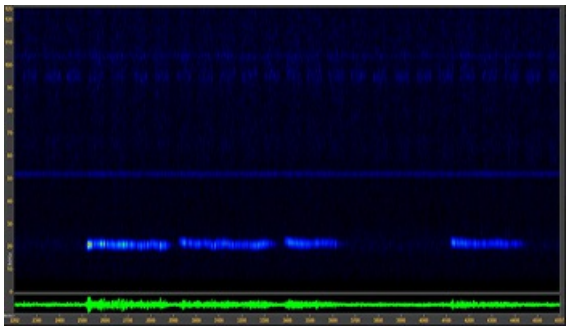
Lesser White-toothed Shrew



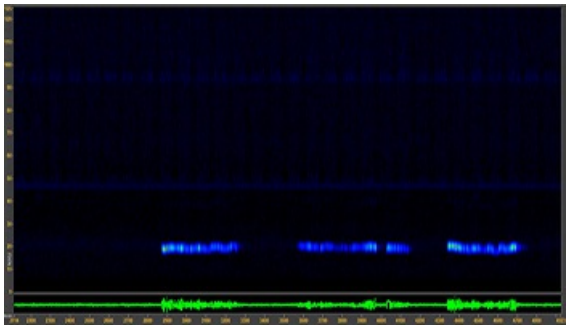
Lesser White-toothed Shrew



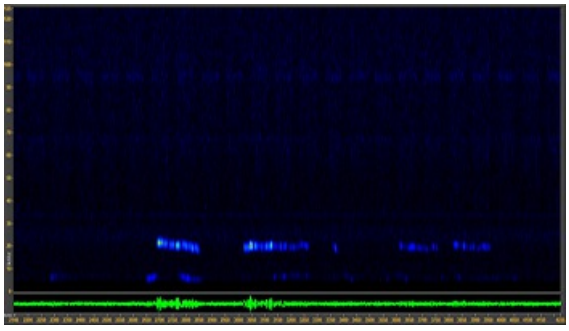
Lesser White-toothed Shrew



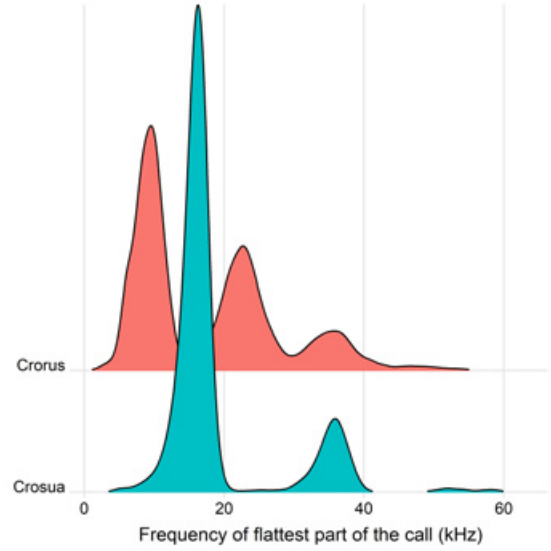
Lesser White-toothed Shrew



Lesser White-toothed Shrew



Lesser White-toothed Shrew

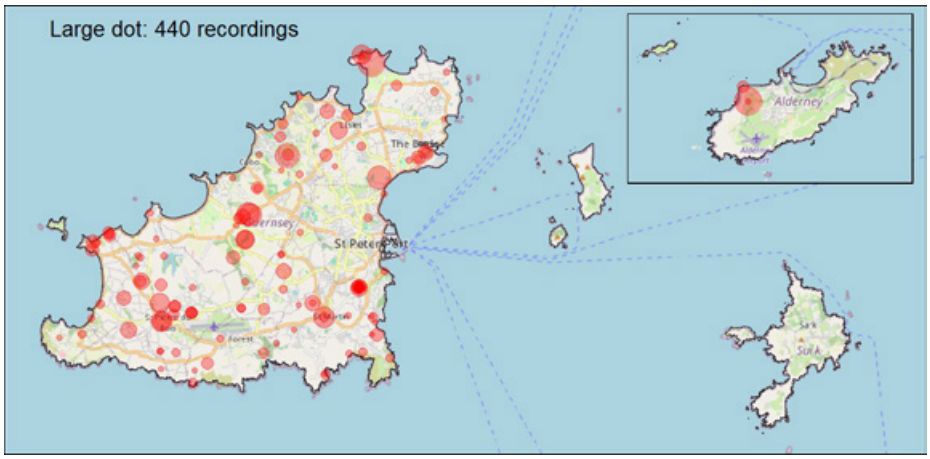


Frequency distribution of calls of Greater White-toothed Shrew (Crorus) and Lesser White-toothed Shrew (Crosua)

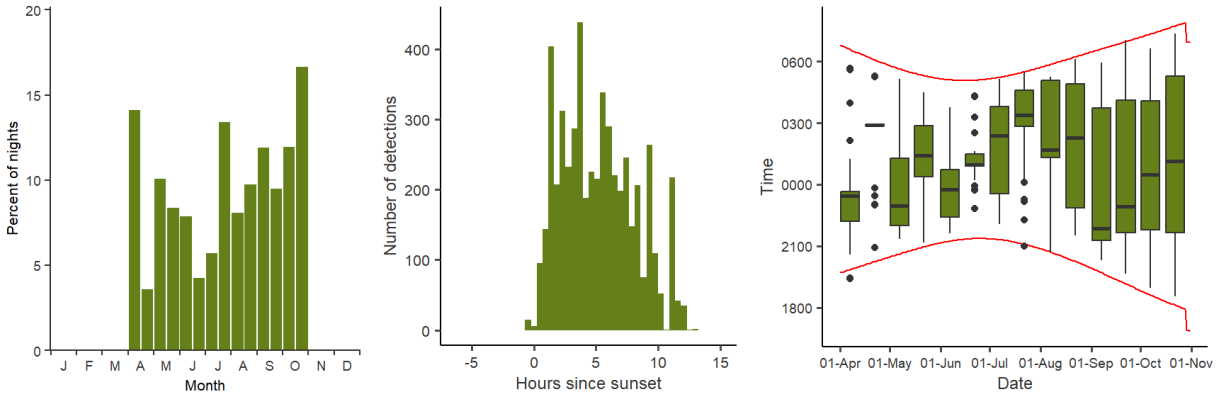
Brown Rat

Brown Rat *Rattus norvegicus* was recorded on 139 nights, from 130 locations, giving a total of 5,212 recordings.

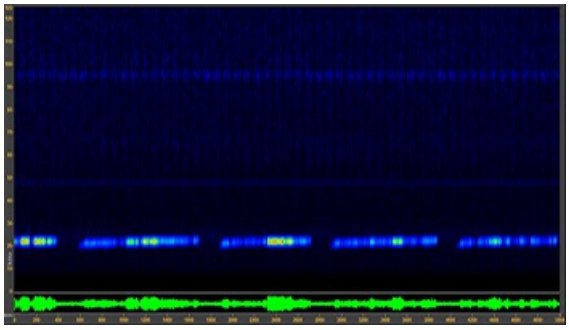
Spatial pattern of activity



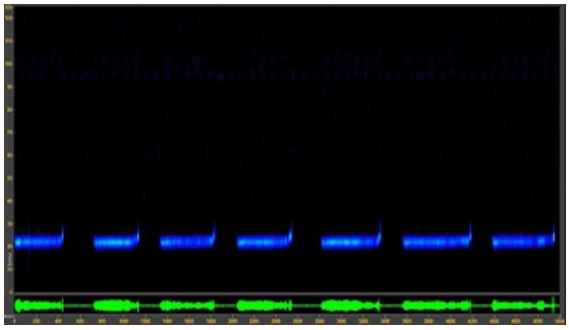
Seasonal and nightly activity



Brown Rat was recorded on Guernsey, Alderney and Herm. Brown Rat is very similar acoustically to Black Rat (see Newson *et al.*, 2021 and Middleton *et al.*, 2024). As would be expected, it was extremely widespread in Guernsey, but was also recorded from Alderney in 2023. We recorded it on 140 nights at 131 locations in 2023, which is very similar to the 138 nights from 138 locations in 2022.



Brown Rat



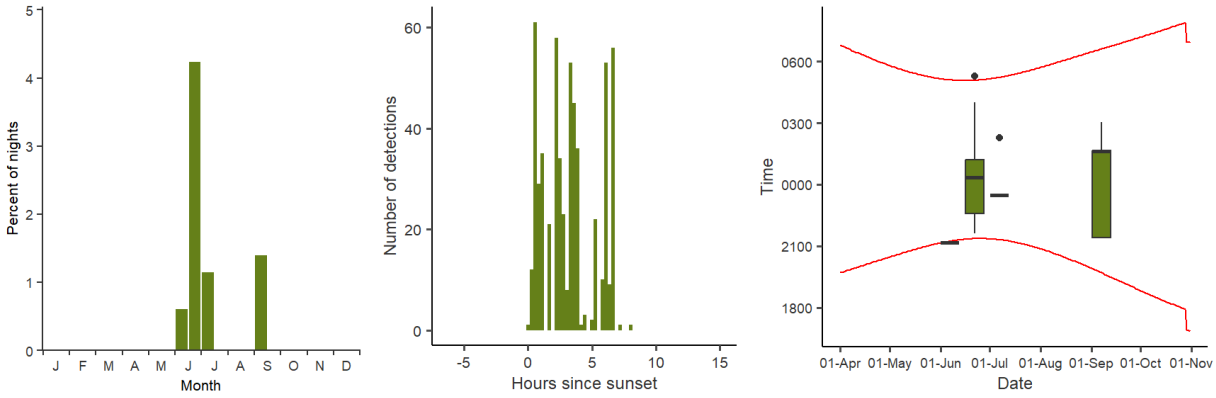
Brown Rat

Black Rat

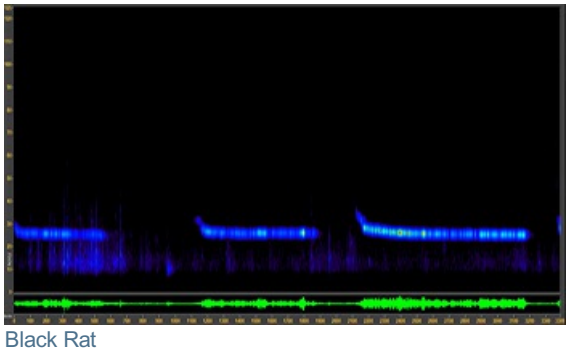
Black Rat *Rattus rattus* was recorded on 12 nights, from eight locations, giving a total of 574 recordings.

Spatial pattern of activity

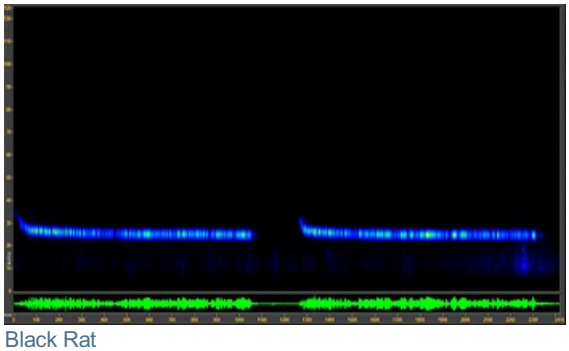
Seasonal and nightly activity



Black Rat is extremely similar acoustically to Brown Rat (see Newson *et al*., 2021 and Middleton *et al*., 2024). 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



Black Rat

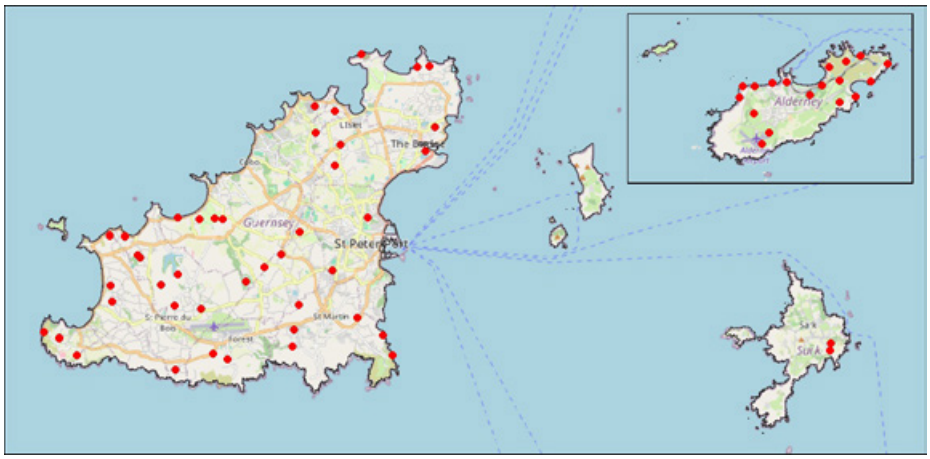
4.3.3 Bush-crickets

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.

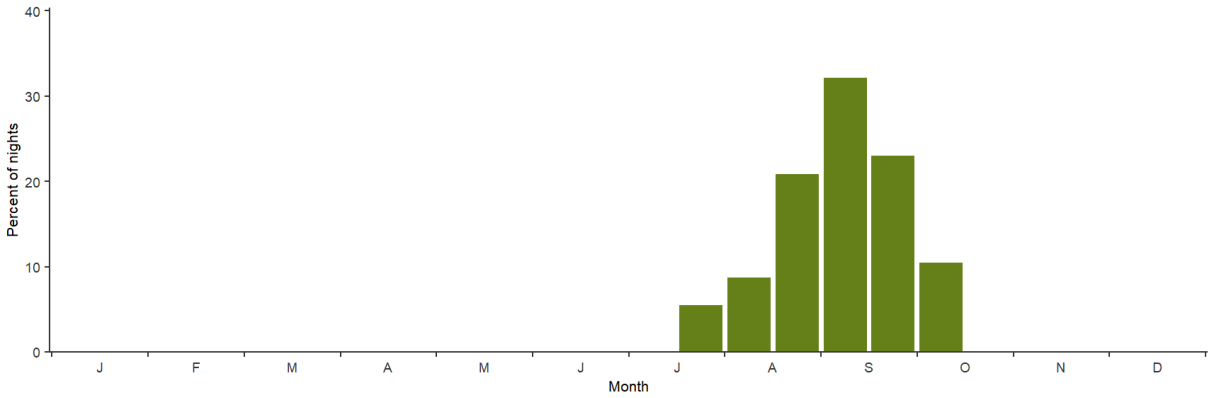
Long-winged Conehead

Long-winged Conehead *Conocephalus fuscus* was recorded on 67 nights, from 70 locations.

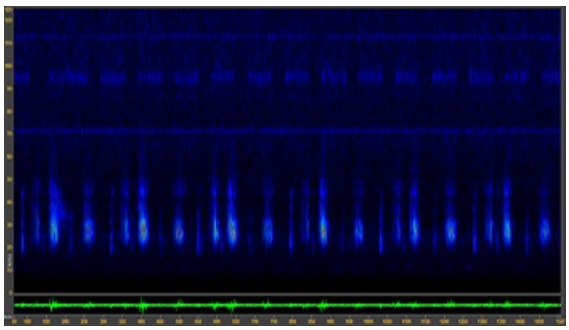
Spatial pattern of detections



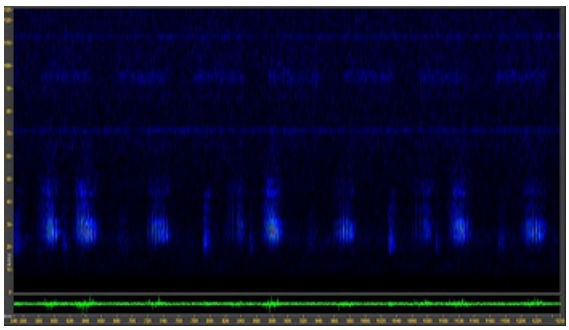
Seasonality



Long-winged Conehead were recorded from 70 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 or 2023, but it produces three-syllable calls (two short calls, pause, followed by one longer duration call).



Long-winged Conehead

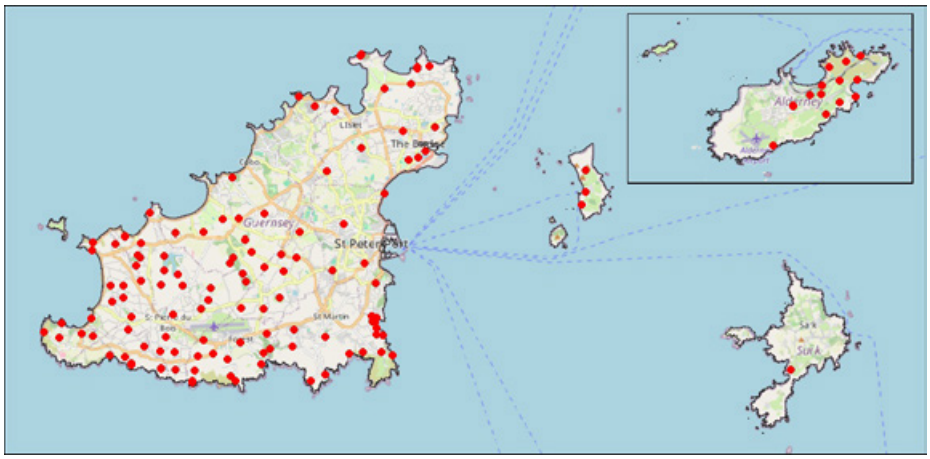


Long-winged Conehead (as left, different scale)

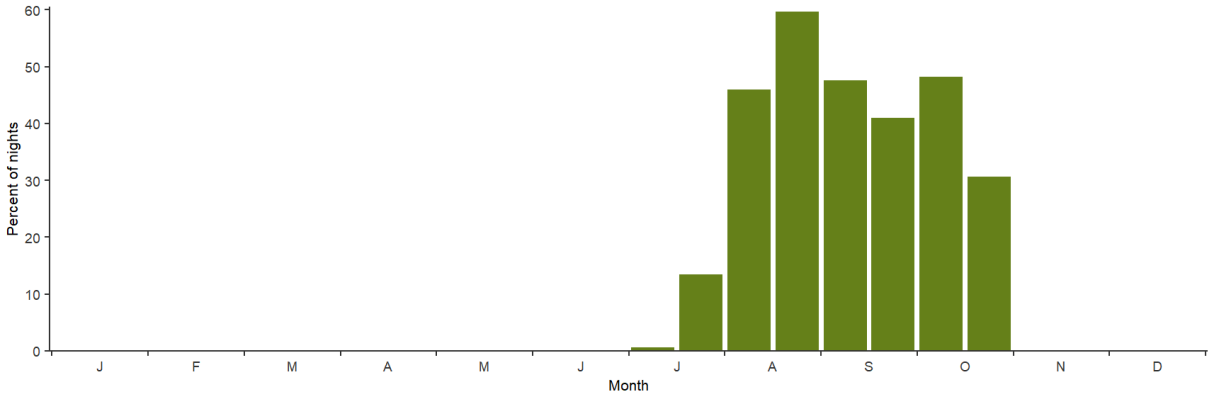
Speckled Bush-cricket

Speckled Bush-cricket *Leptophyes punctatissima* was recorded on 103 nights, from 153 locations.

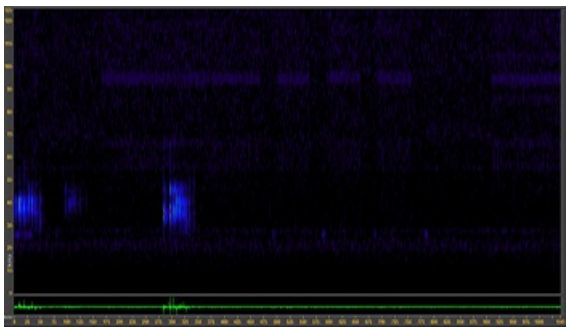
Spatial pattern of detections



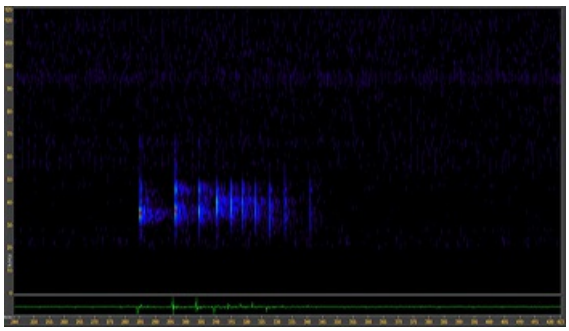
Seasonality



Speckled Bush-cricket were recorded from 153 locations between July and the end of October, which included locations on Guernsey, Alderney, Herm and Sark. 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

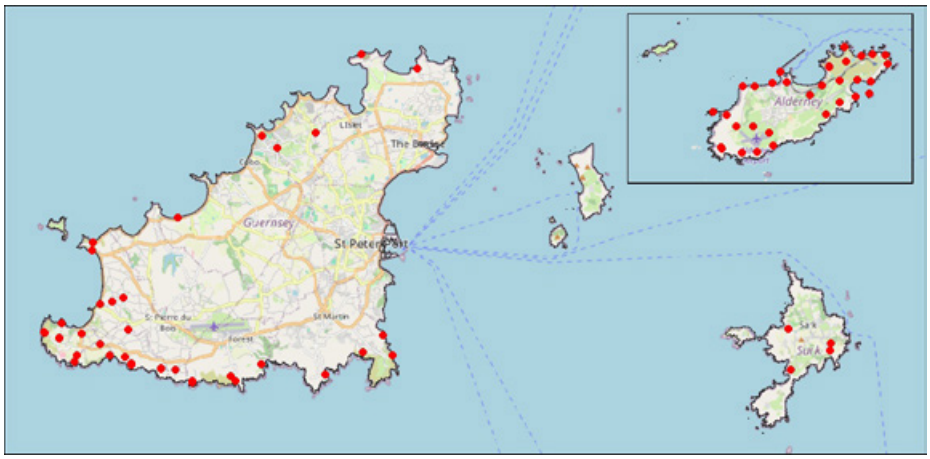


Speckled Bush-cricket (as left, different scale)

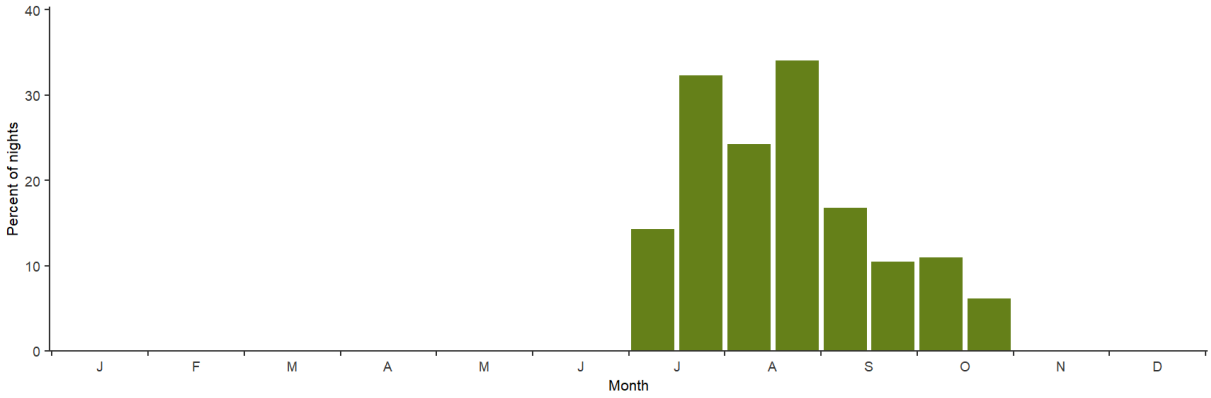
Grey Bush-cricket

Grey Bush-cricket *Platycleis albopunctata* was recorded on 105 nights, from 83 locations.

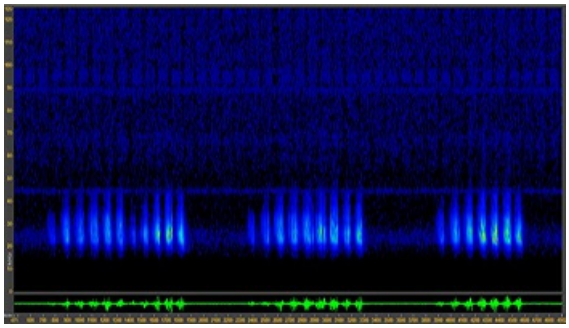
Spatial pattern of detections



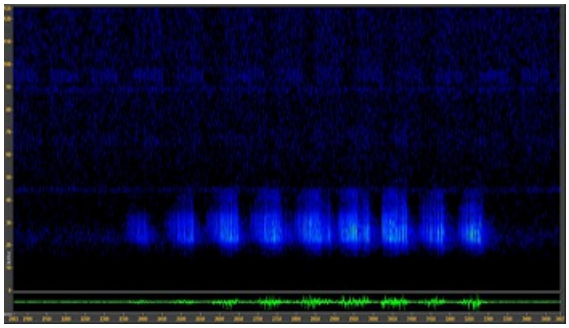
Seasonality



Grey Bush-cricket were recorded from 83 locations between the beginning of July and the end of October, which included locations on Guernsey, Alderney and Sark. As in 2021 and 2022, this species favours coastal areas on Guernsey, particularly the south coast cliffs, but similar to previous years, there were also some records from inland low-lying areas in the northern third of Guernsey. In Alderney, it was distributed quite widely across the island away from the town. 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



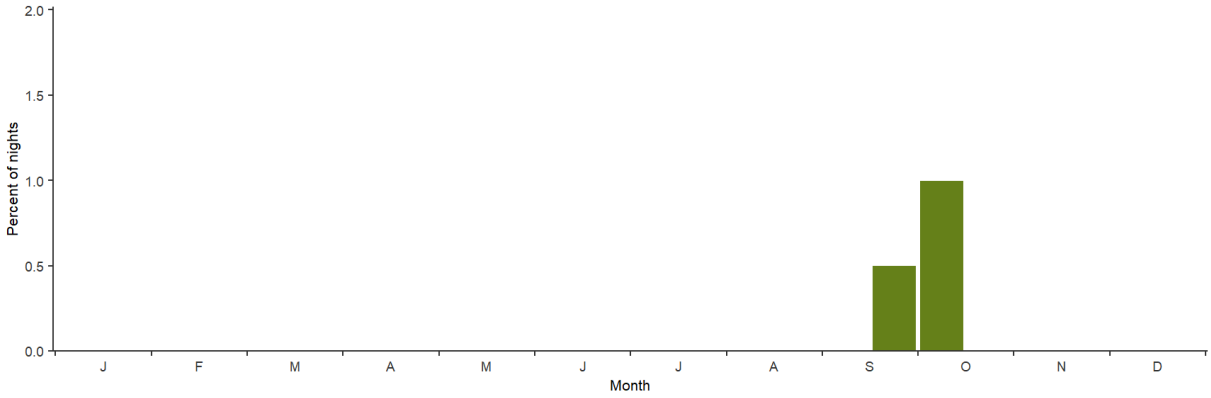
Grey Bush-cricket

Large Conehead

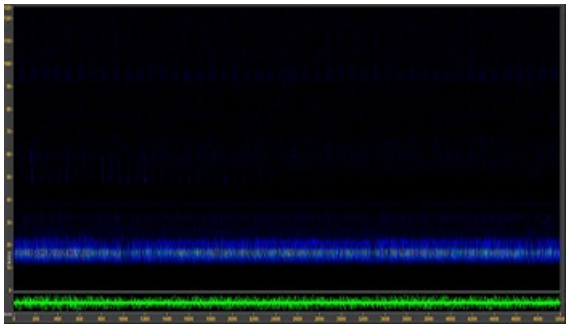
Large Conehead *Ruspolia nitidula* was recorded on three nights, from one location.

Spatial pattern of detections

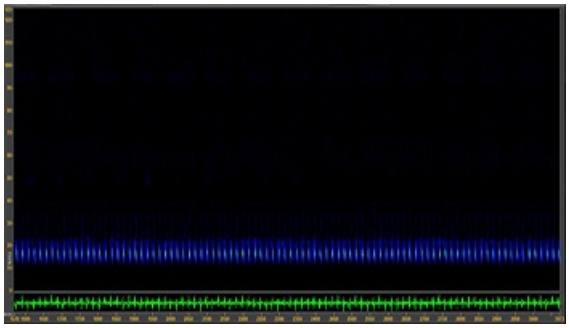
Seasonality



Large Conehead. 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. In 2023, Large Conehead was recorded from just a single, but new location on Alderney, east of the town and just south of the Rue de Beaumont. 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

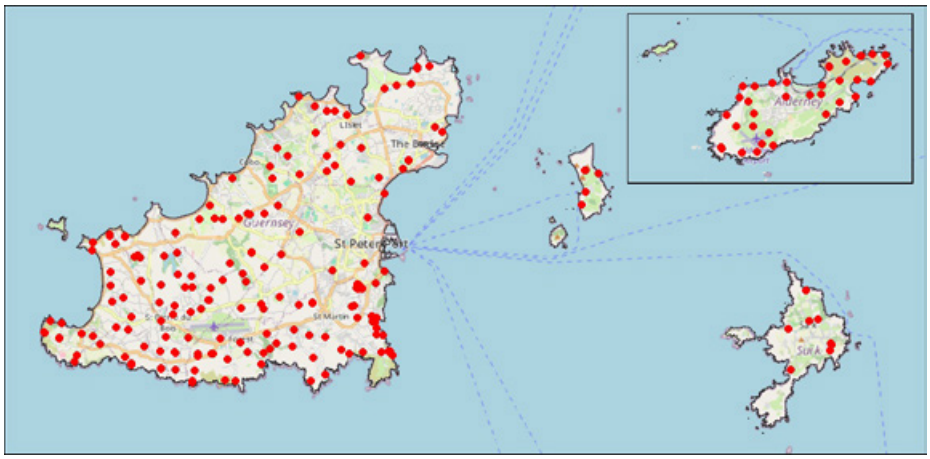


Large Conehead (as left, different scale

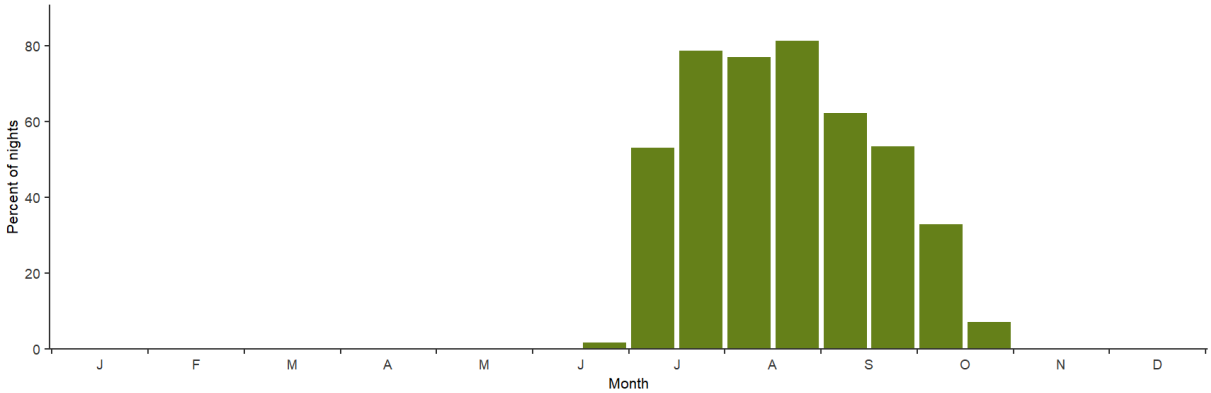
Great Green Bush-cricket

Great Green Bush-cricket *Tettigonia viridissima* was recorded on 122 nights, from 248 locations.

Spatial pattern of detections

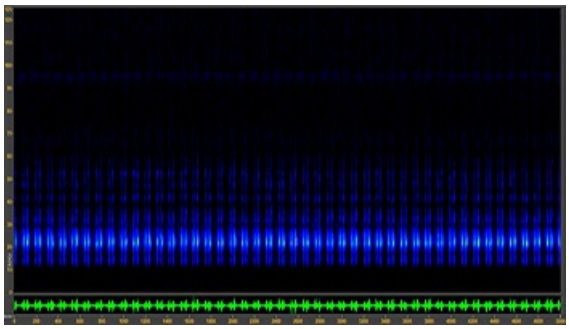


Seasonality

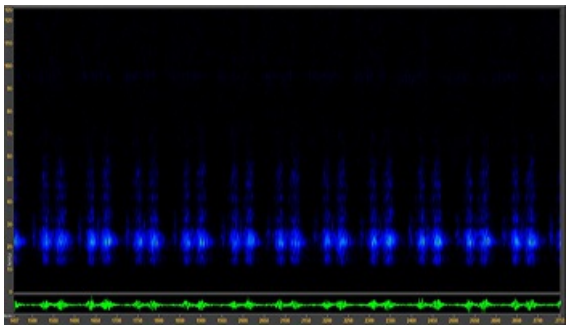


Great Green Bush-cricket were recorded from 248 locations between the beginning of July and mid-October, which includes records from Guernsey, Alderney, Herm and Sark. This is the most ubiquitous bush-cricket species present on the islands. Great Green Bush-cricket produces 'calls' with a peak frequency 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 griseoaptera* or Roesel's Bush-cricket *Roeseliana roeselii* were detected in 2023. We are unsure whether the presence of these species has been confirmed on the islands.



Great Green Bush-cricket



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

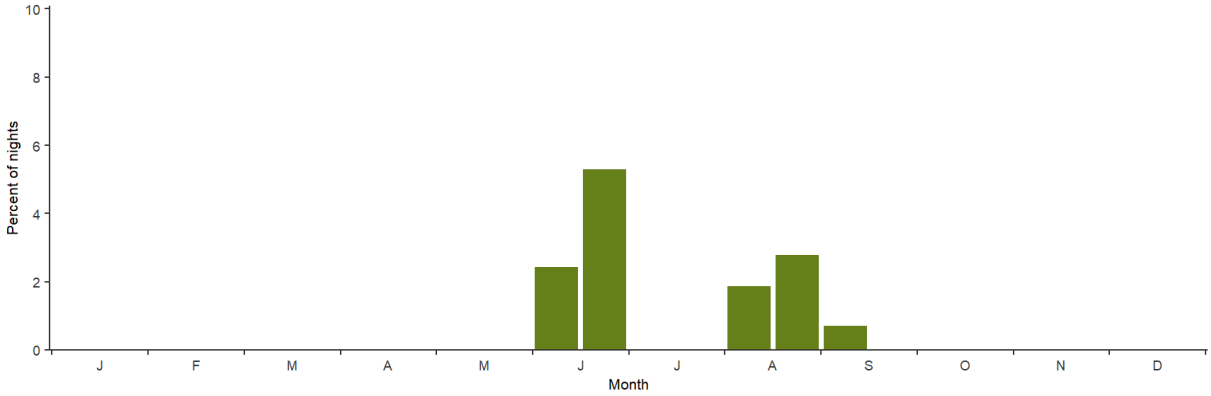
4.3.4 Audible moth species

Green Silver-lines

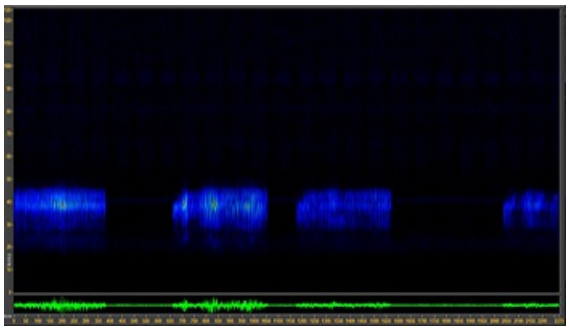
Green Silver-lines *Pseudoips prasinana* was recorded on 19 nights, from 14 locations.

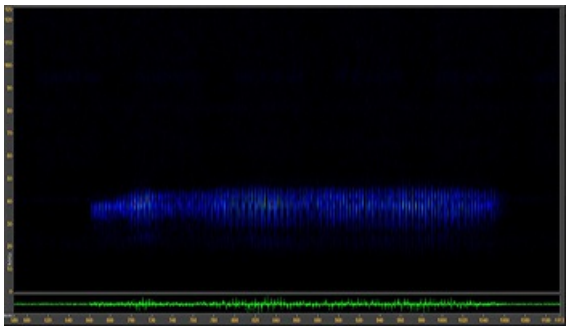
Spatial pattern of detections

Seasonality



Green Silver-lines was recorded from 14 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.

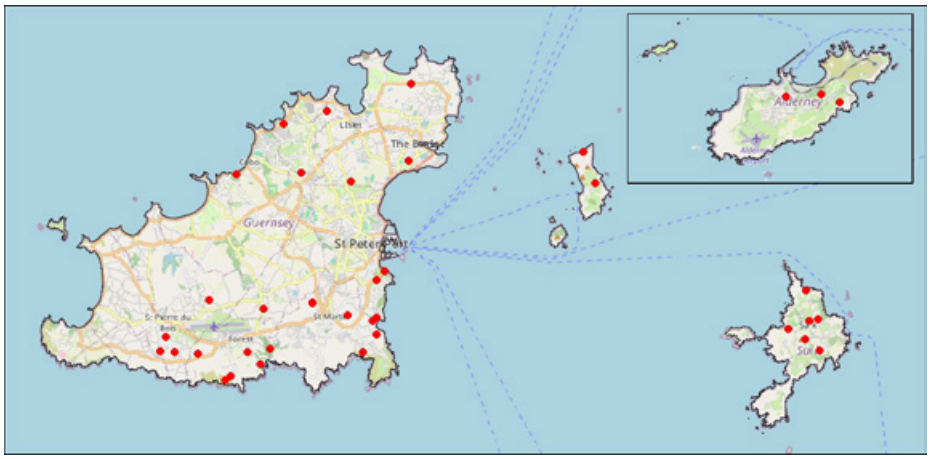

Green Silver-lines


Green Silver-lines

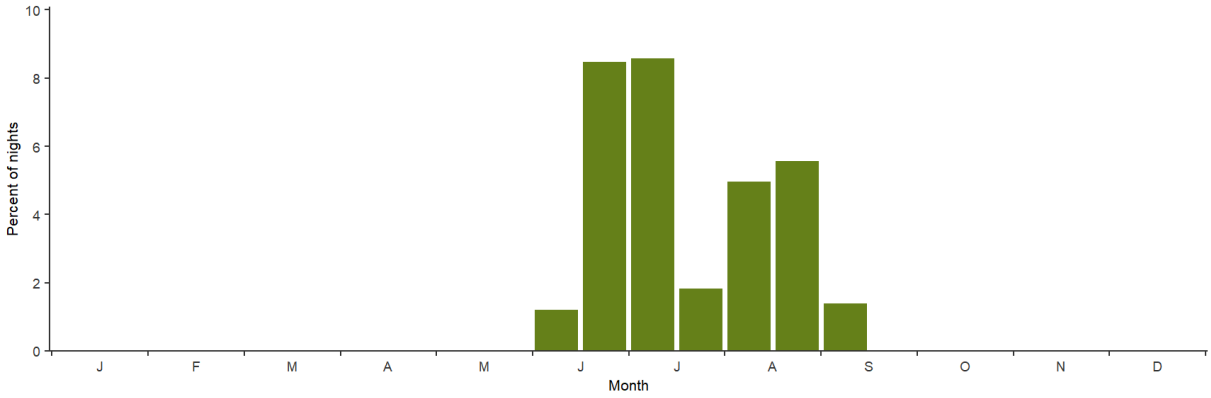
Bird Cherry Ermine

Bird Cherry Ermine *Yponomeuta evonymella* was recorded on 38 nights, from 38 locations.

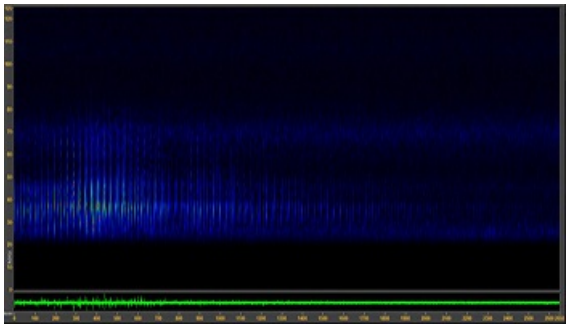
Spatial pattern of detections



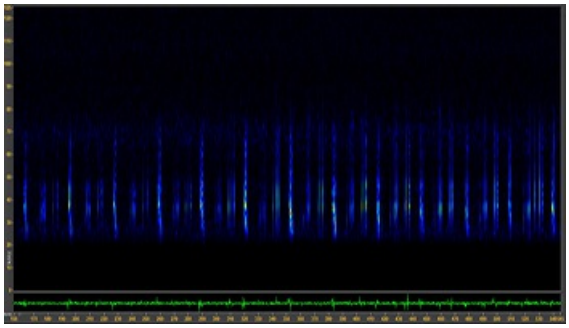
Seasonality



Bird Cherry Ermine was recorded on Guernsey, Alderney, Herm and Sark. The micro-moth Bird Cherry Ermine was also recorded from 38 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 2023.



Bird Cherry Ermine



Bird Cherry Ermine(as left, different scale)

5. DISCUSSION

The current 2023 dataset of 994,034 bat identifications, including the identification of social calls and feeding buzzes for additional species, plus 872,126 bat identifications from 2022, and 710,260 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 record of Leisler's Bat from Sark. Soprano Pipistrelle was also recorded for the second year running 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 was recorded from one new location on Alderney in 2023.

Derrible Head on Sark where Leisler's Bat was recorded for the first time on the island (Image credit: Lynda Higgins).

6. ACKNOWLEDGEMENTS

We would like to thank all the fieldworkers who took part in the Bailiwick Bat Survey in 2023 and the landowners that gave volunteers access to their land. We would also like to thank the Fort Grey Shipwreck Museum, 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, Ollie Barratt, Steve Pritchard and Hazel McCambridge from the BTO for development and support of the online systems that were used in this project. We are also extremely grateful to Marc Van de Sijpe, Alex Lefevre and Chris Corben for providing their thoughts on the identification of a series of 'big bat' recordings from Sark. Lastly, we would like to thank the States of Guernsey for funding this project.

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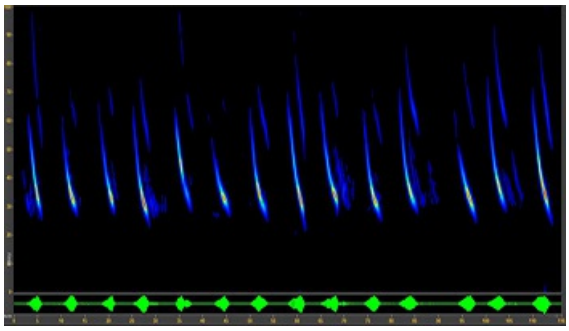
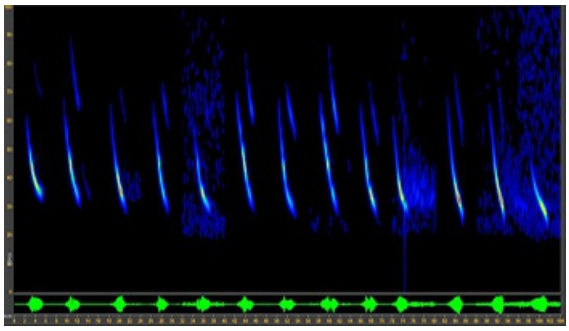
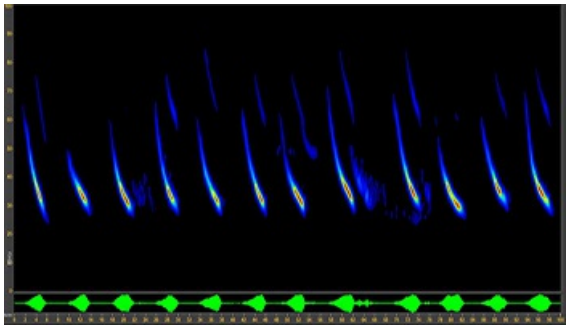
Identification appendix 1: Serotine *Eptesicus serotinus* and Leisler's Bat *Nyctalus leisleri*



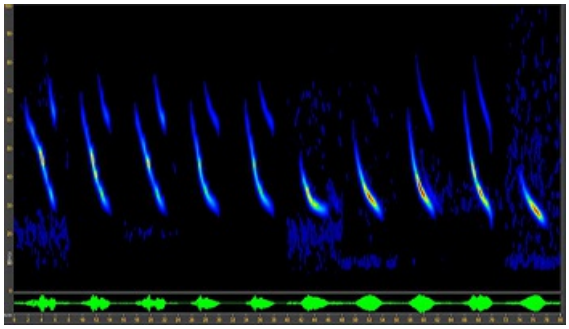
Serotine - call duration 2.7-3.0 ms



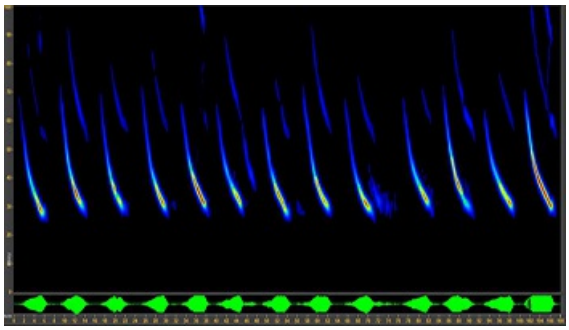
Leisler's Bat - call duration 2.7-3.0 ms



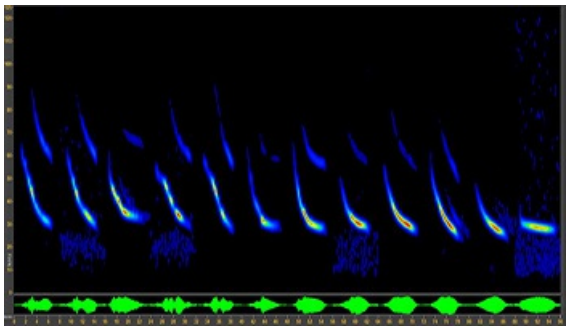
Serotine - call duration 4.0 ms



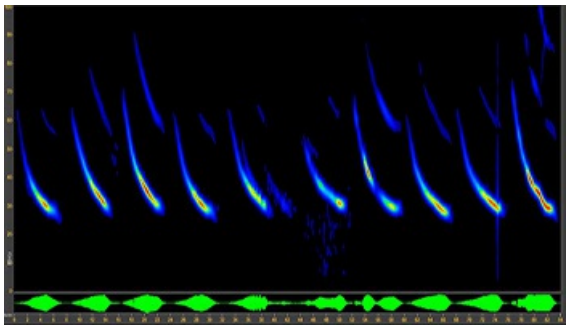
Leisler's Bat - call duration 4.0 ms



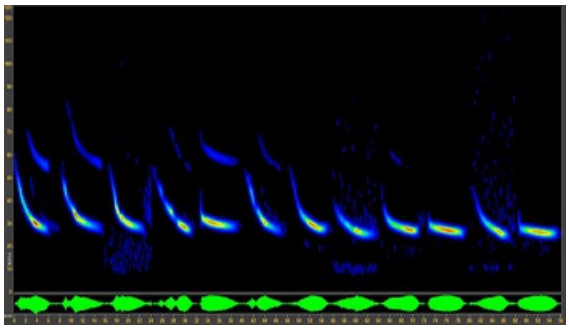
Serotine - call duration 5.0 ms



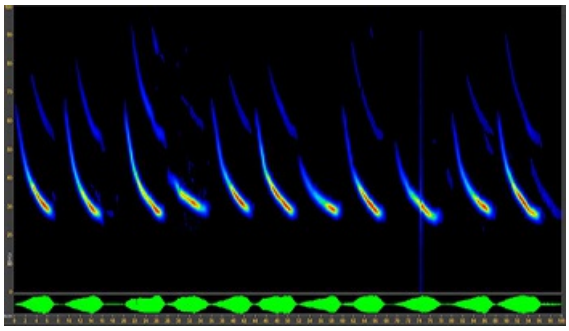
Leisler's Bat - call duration 5.0 ms



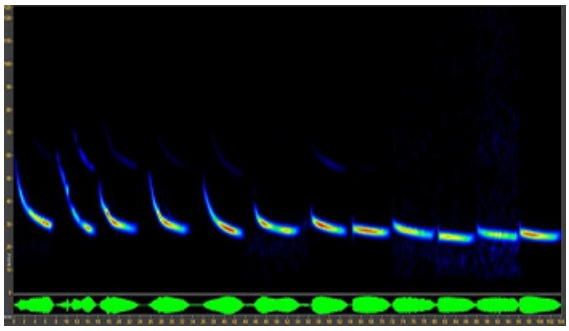
Serotine - call duration 6.0 ms



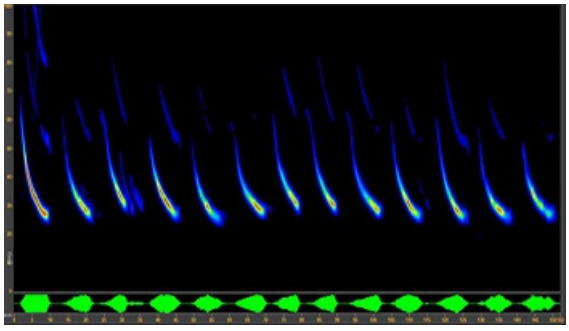
Leisler's Bat - call duration 6.0 ms



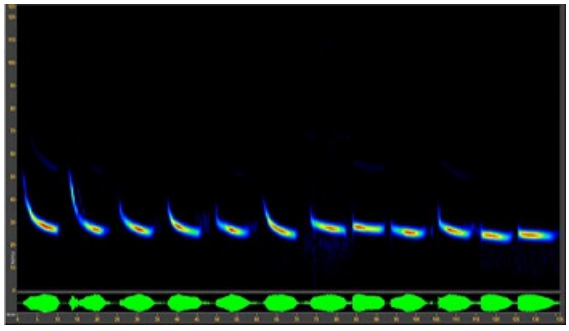
Serotine - call duration 7.0 ms



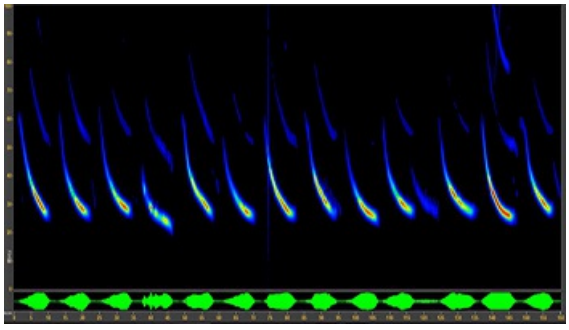
Leisler's Bat - call duration 7.0 ms



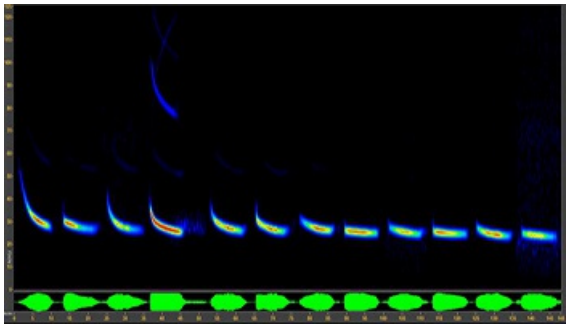
Serotine - call duration 8.0 ms



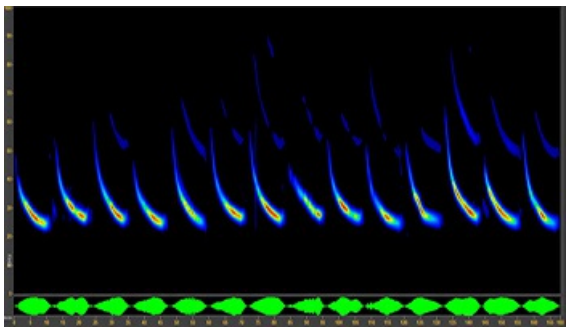
Leisler's Bat - call duration 8.0 ms



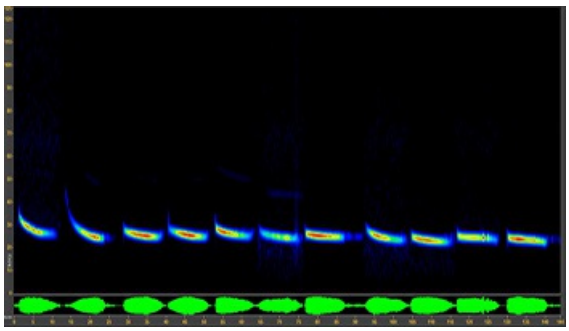
Serotine - call duration 9.0 ms



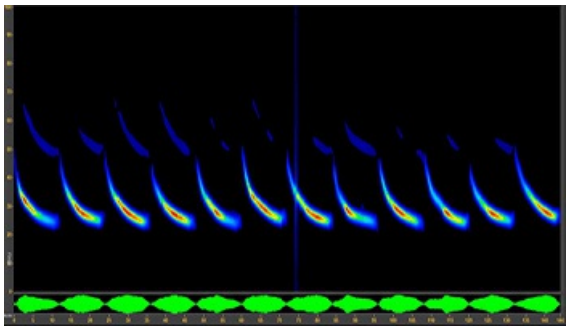
Leisler's Bat - call duration 9.0 ms



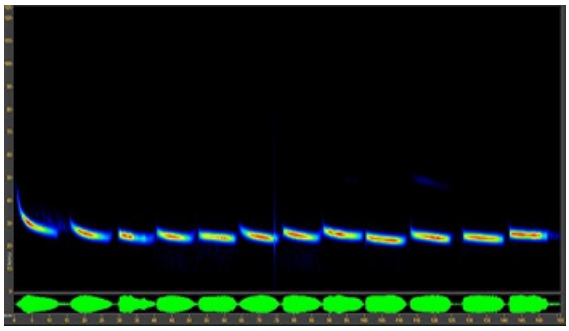
Serotine - call duration 10.0 ms



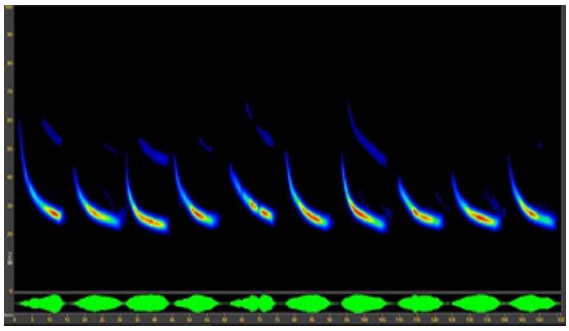
Leisler's Bat - call duration 10.0 ms



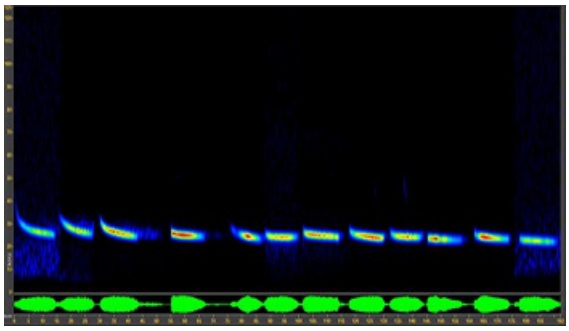
Serotine - call duration 11.0 ms



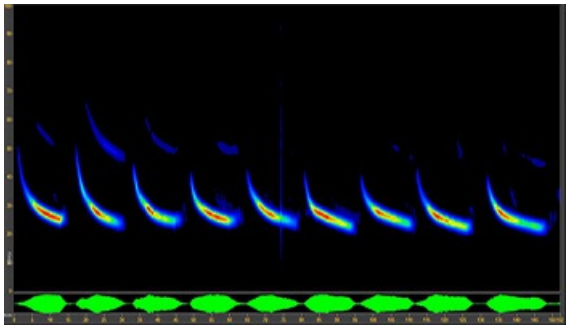
Leisler's Bat - call duration 11.0 ms



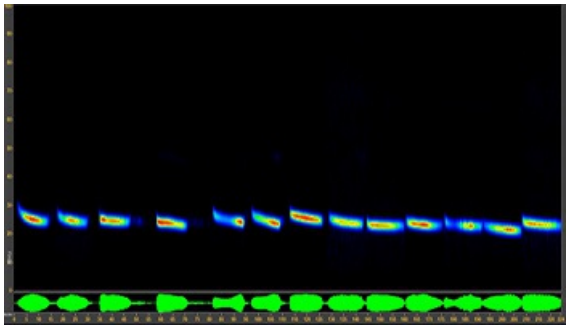
Serotine - call duration 12.0 ms



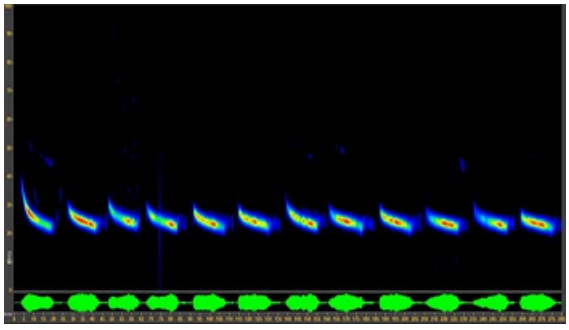
Leisler's Bat - call duration 12.0 ms



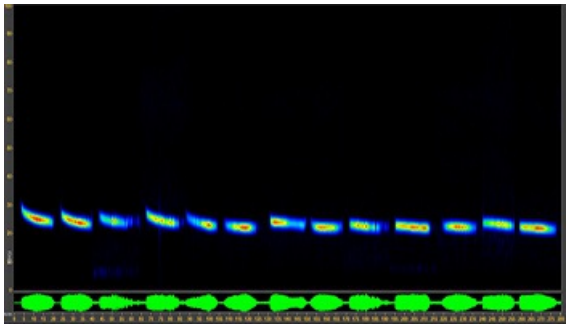
Serotine - call duration 13.0-16.0 ms



Leisler's Bat - call duration 13-16 ms

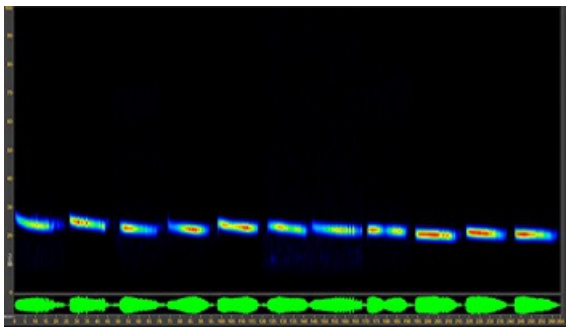


Serotine - call duration 17.0-18.0 ms



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*

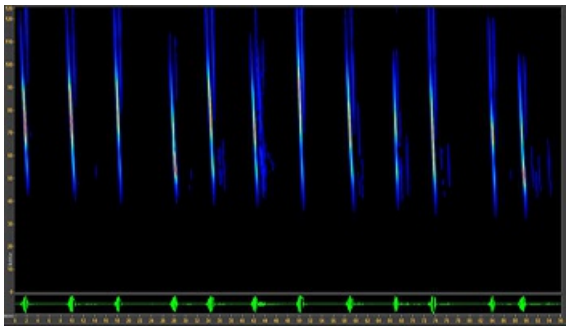
In the below we provide a visual comparison of echolocation calls of the same call duration of Whiskered Bat *Myotis mystacinus* and Brandt's Bat *Myotis brandtii* alongside each other. In producing these comparisons, we would like to explore whether there are any patterns of differences between the 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.

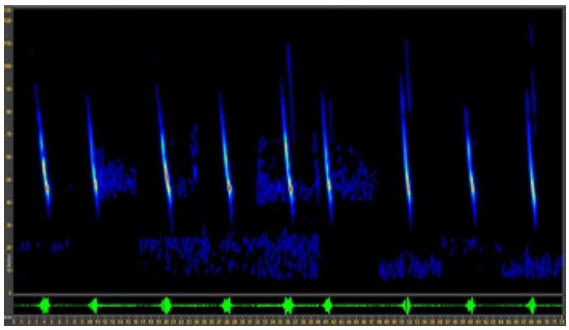
M. mystacinus and *M. brandtii* are two of the most difficult bat species in Europe to distinguish from their echolocation calls. For a given call duration, the echolocation calls of these species are visually extremely similar in frequency and shape.

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*.

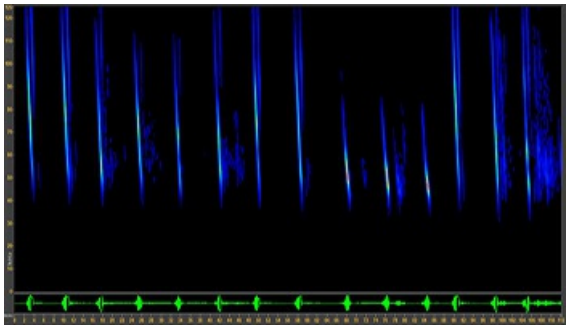
It is difficult to be sure that the recordings here are completely representative of *M. mystacinus* and *M. brandtii* to infer too much from this, but it was easy to find recordings of *M. mystacinus* of less 1.7 ms, but hard to find similar short duration calls of *M. brandtii*. This may suggest that *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*.



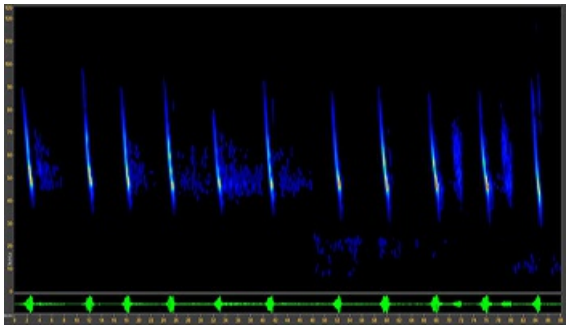
Whiskered Bat - call duration up to 1.3 ms



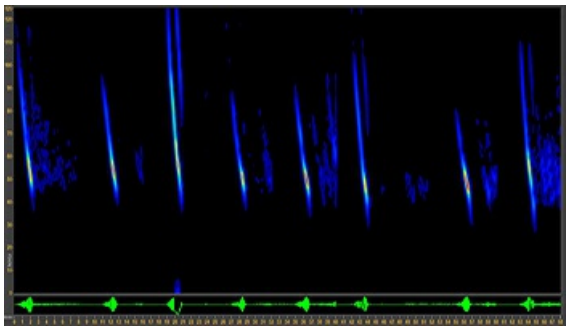
Brandt's Bat - call duration up to 1.3 ms



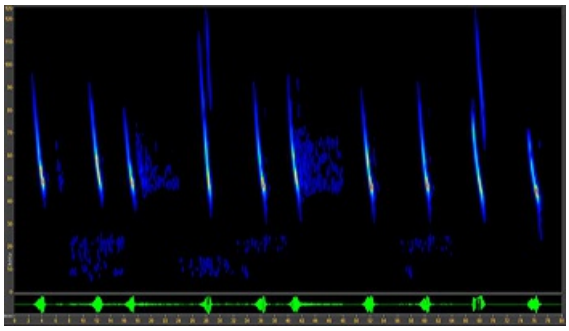
Whiskered Bat - call duration 1.4-1.5 ms



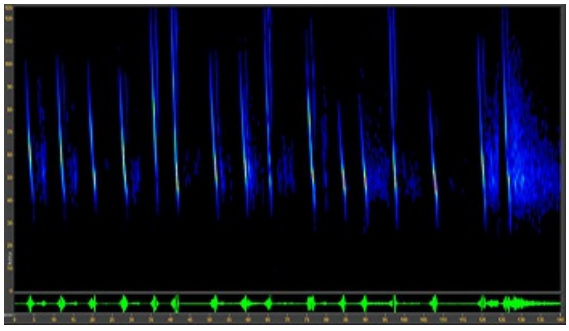
Brandt's Bat - call duration 1.4-1.5 ms



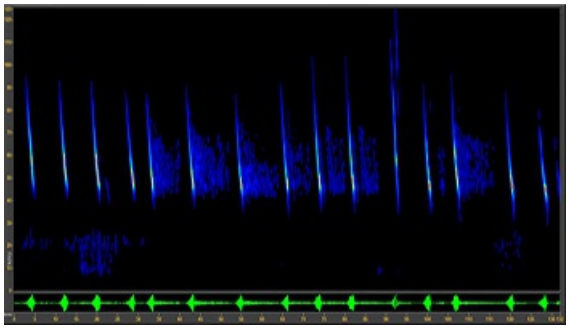
Whiskered Bat - call duration 1.6-1.7 ms



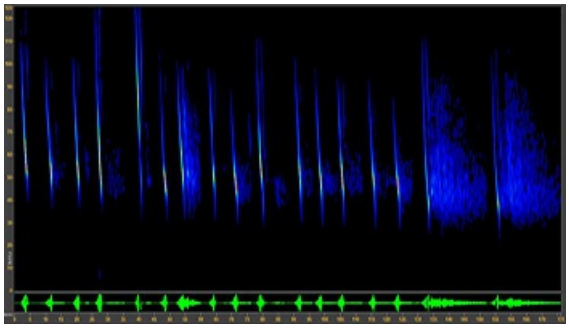
Brandt's Bat - call duration 1.6-1.7 ms



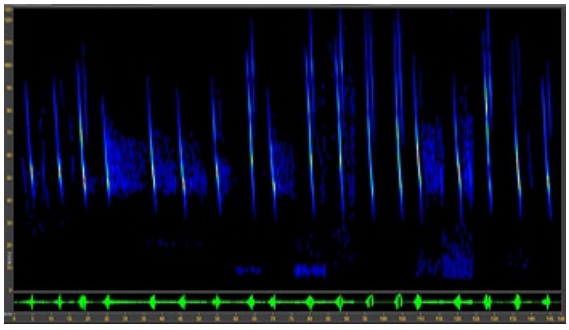
Whiskered Bat - call duration 1.8-1.9 ms



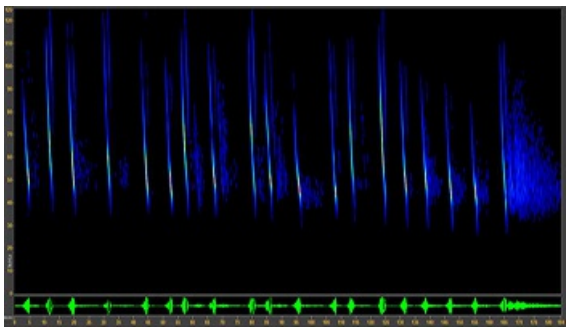
Brandt's Bat - call duration 1.8-1.9 ms



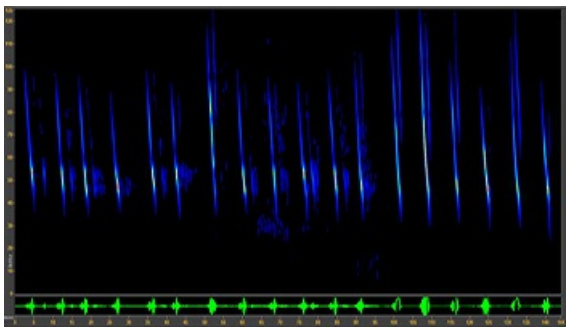
Whiskered Bat - call duration 2.0-2.1 ms



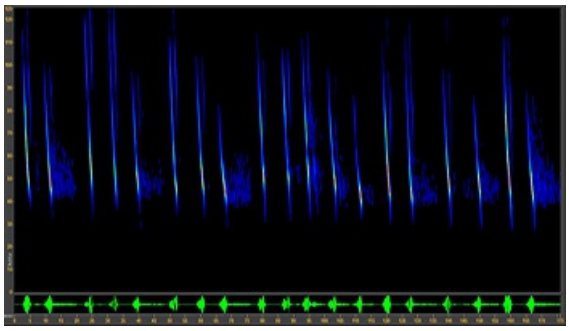
Brandt's Bat - call duration 2.0-2.1 ms



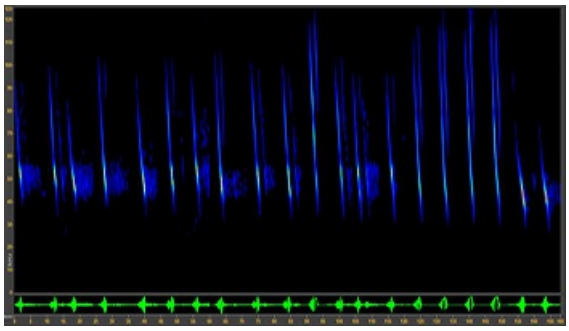
Whiskered Bat - call duration 2.2-2.3 ms



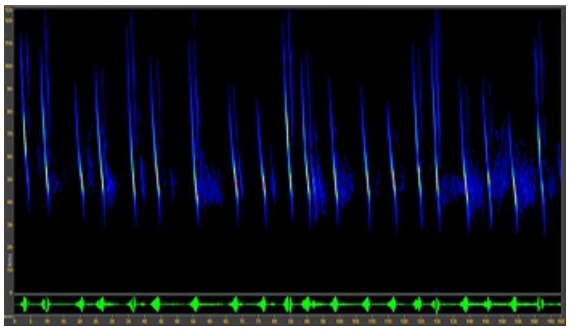
Brandt's Bat - call duration 2.2-2.3 ms



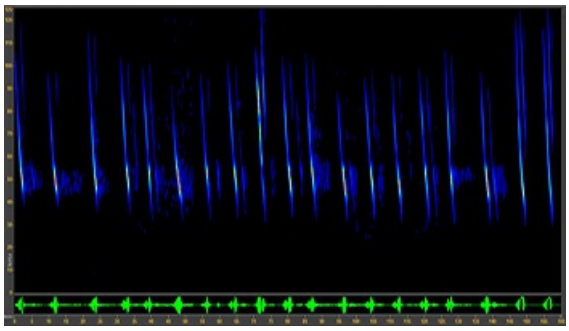
Whiskered Bat - call duration 2.4-2.5 ms



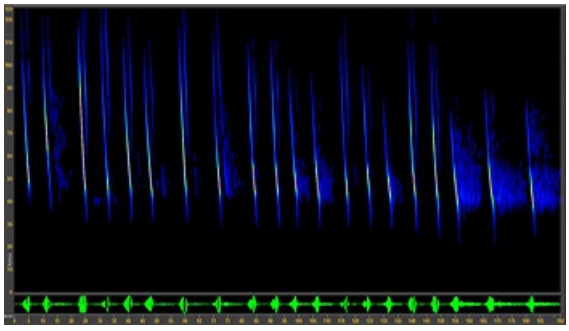
Brandt's Bat - call duration 2.4-2.5 ms



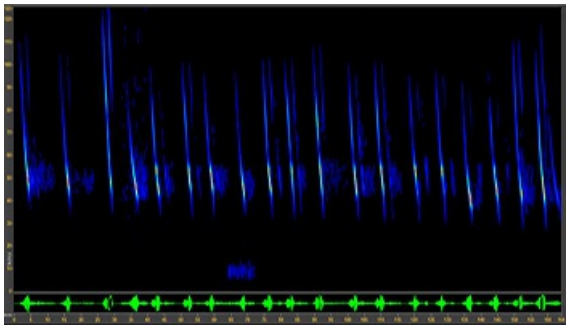
Whiskered Bat - call duration 2.6-2.7 ms



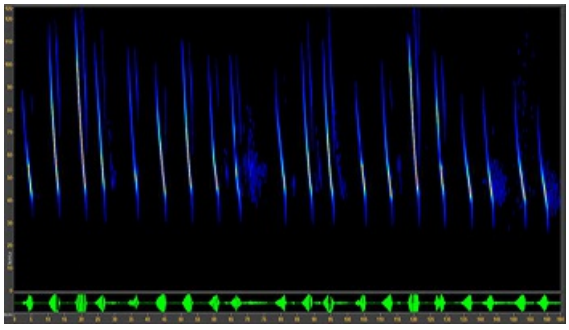
Brandt's Bat - call duration 2.6-2.7 ms



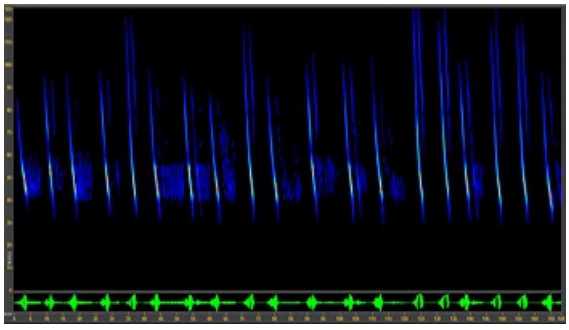
Whiskered Bat - call duration 2.8-2.9 ms



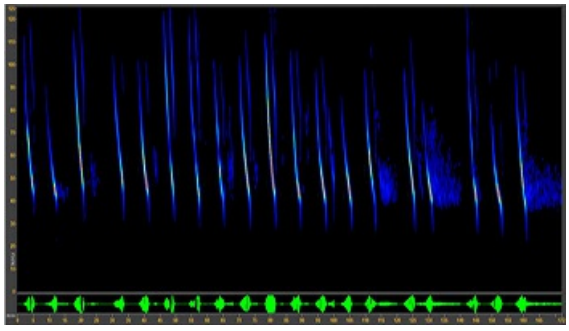
Brandt's Bat - call duration 2.8-2.9 ms



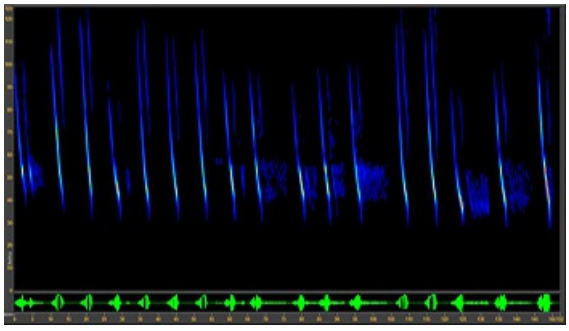
Whiskered Bat - call duration 3.0-3.1 ms



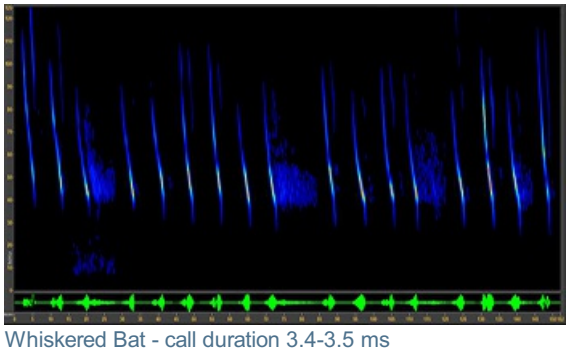
Brandt's Bat - call duration 3.0-3.1 ms



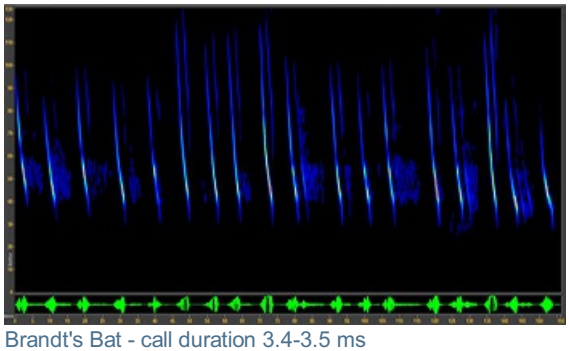
Whiskered Bat - call duration 3.2-3.3 ms



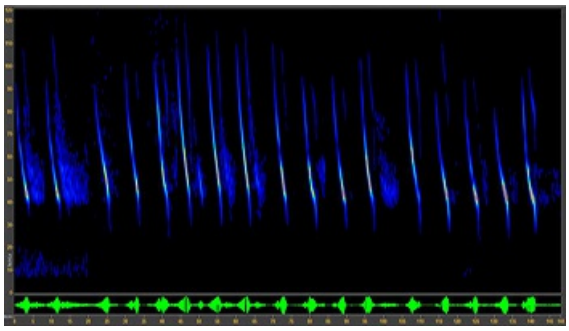
Brandt's Bat - call duration 3.2-3.3 ms



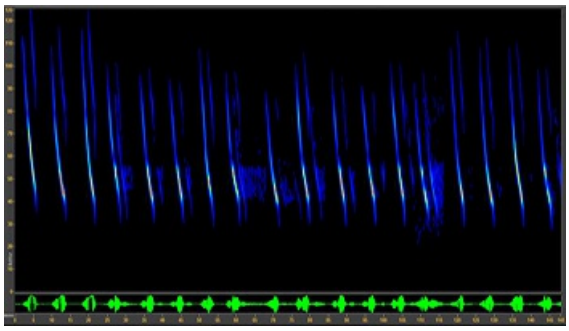
Whiskered Bat - call duration 3.4-3.5 ms



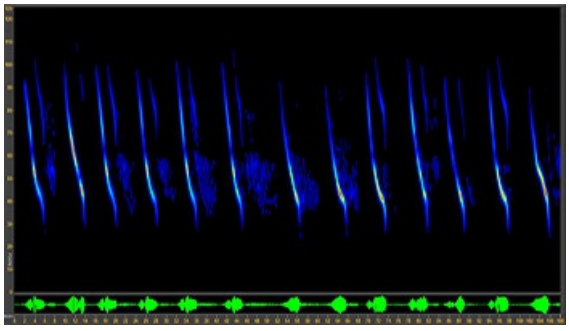
Brandt's Bat - call duration 3.4-3.5 ms



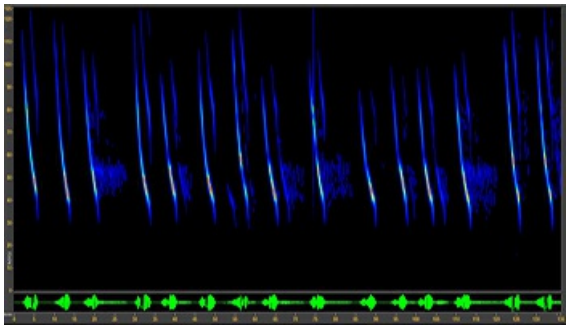
Whiskered Bat - call duration 3.6-3.7 ms



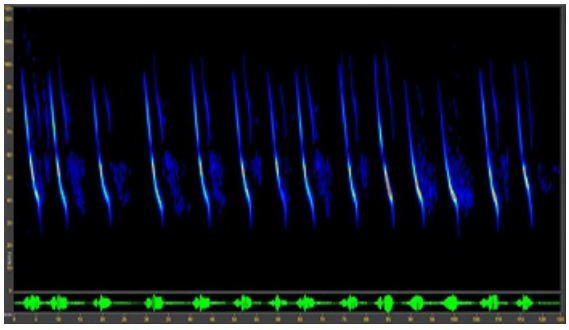
Brandt's Bat - call duration 3.6-3.7 ms



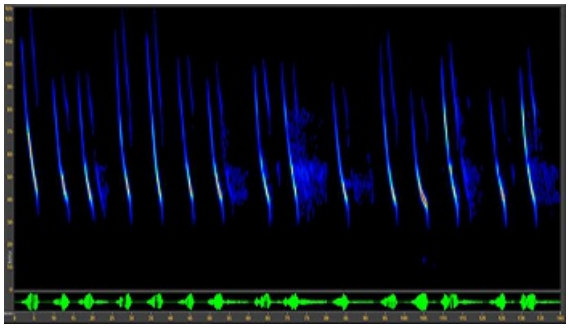
Whiskered Bat - call duration 3.8-3.9 ms



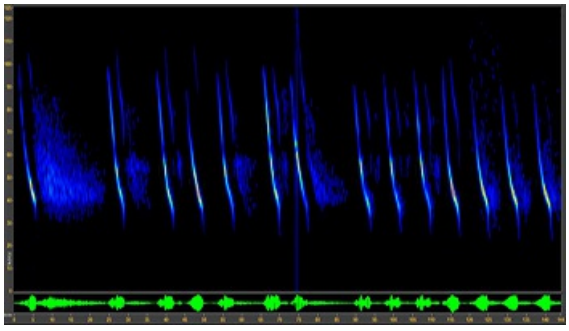
Brandt's Bat - call duration 3.8-3.9 ms



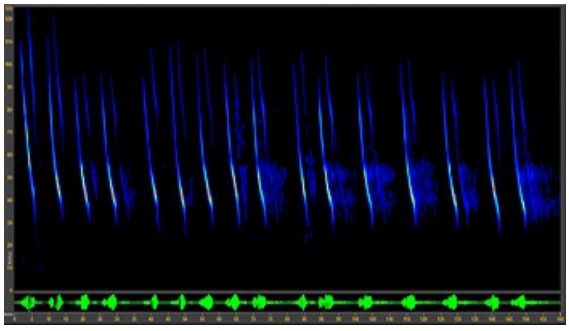
Whiskered Bat - call duration 4.0-4.1 ms



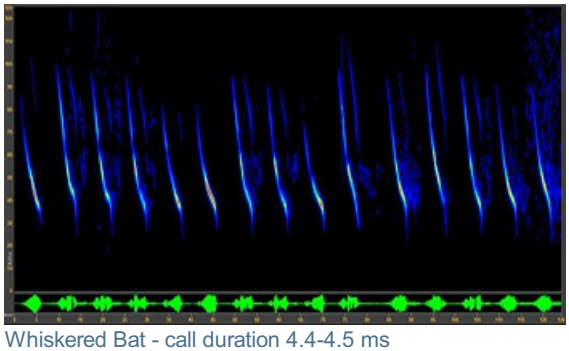
Brandt's Bat - call duration 4.0-4.1 ms



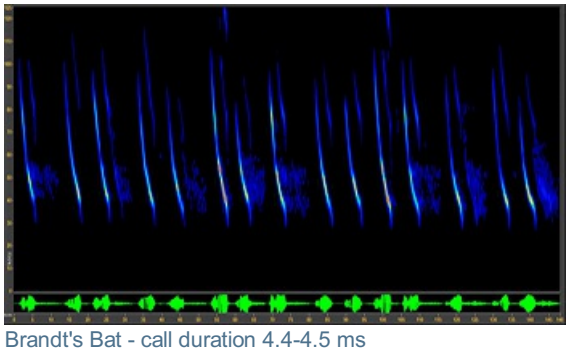
Whiskered Bat - call duration 4.2-4.3 ms



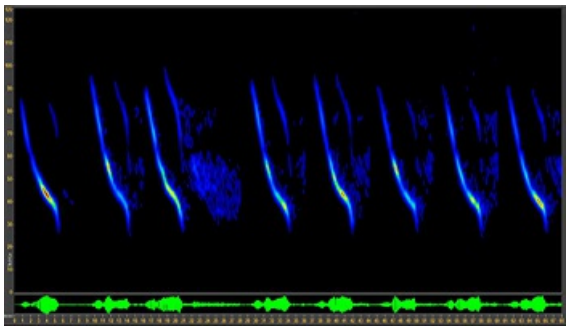
Brandt's Bat - call duration 4.2-4.3 ms



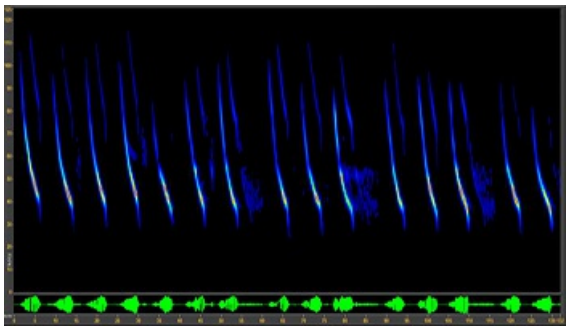
Whiskered Bat - call duration 4.4-4.5 ms



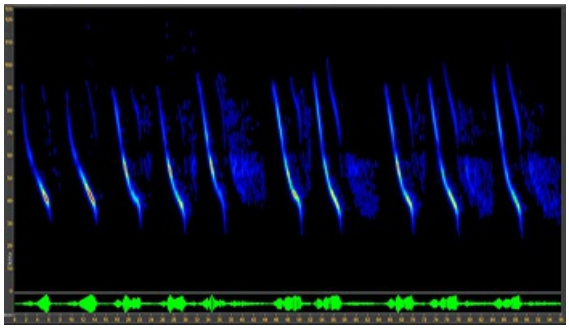
Brandt's Bat - call duration 4.4-4.5 ms



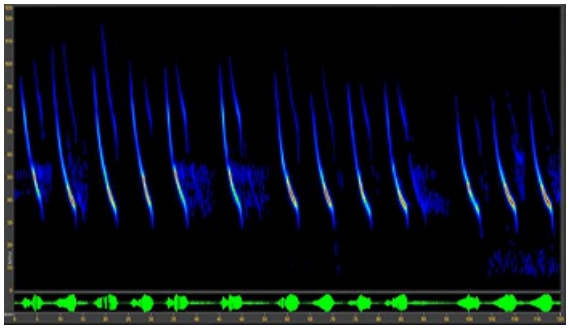
Whiskered Bat - call duration 4.6-4.7 ms



Brandt's Bat - call duration 4.6-4.7 ms

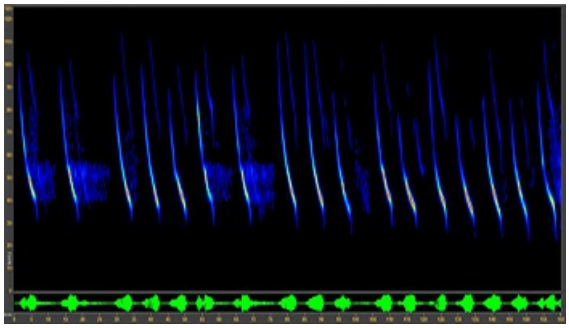


Whiskered Bat - call duration 4.8-5.1 ms



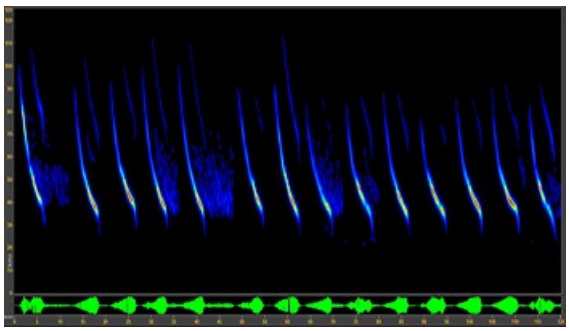
Brandt's Bat - call duration 4.8-5.1 ms

Whiskered Bat call duration 5.2-5.3 ms no examples



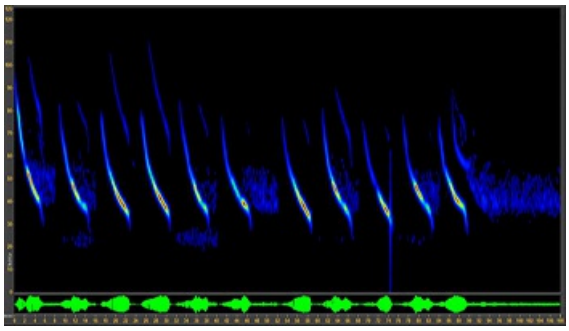
Brandt's Bat - call duration 5.2-5.3 ms

Whiskered Bat call duration 5.4-5.5 ms no examples

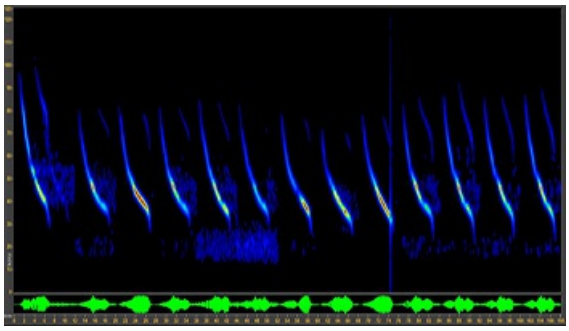


Brandt's Bat - call duration 5.4-5.5 ms

Whiskered Bat call duration 5.6-5.7 ms no examples

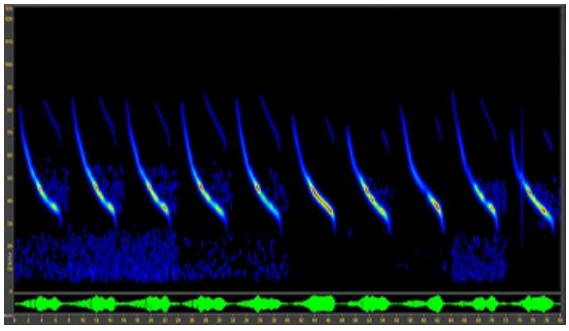


Brandt's Bat - call duration 5.6-5.7 ms



Whiskered Bat call duration 5.8-5.9 ms no examples

Brandt's Bat - call duration 5.8-5.9 ms

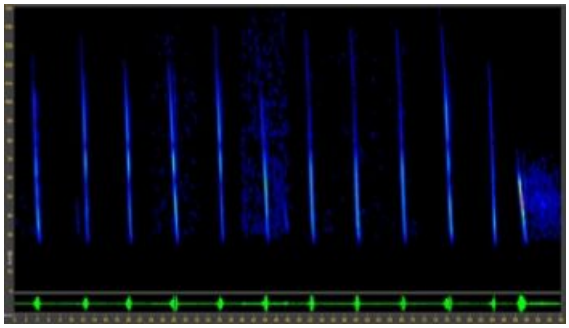


Whiskered Bat call duration 6.0-6.5 ms no examples

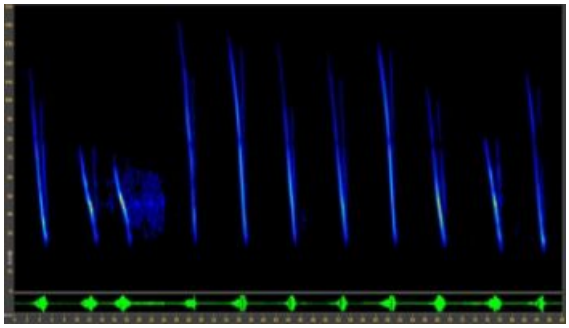
Brandt's Bat - call duration 6.0-6.5 ms

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

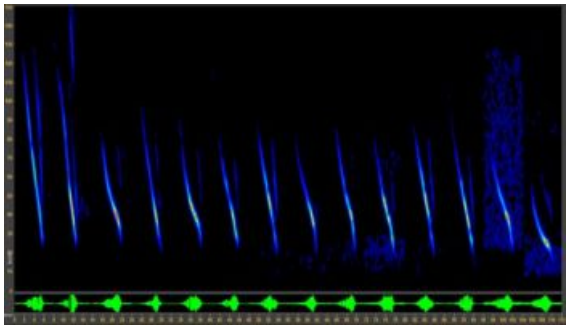
As with Whiskered and Brandt's Bat, the first consideration when looking at recordings is the quality of the recording, to consider whether the quality is good enough to try to assign the recording to species. Given a good recording, Natterer's Bat can occasionally produce atypical calls that could be 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.



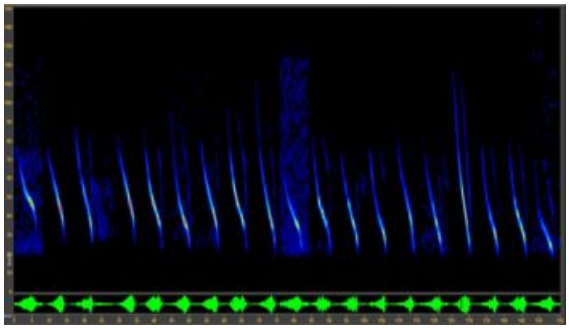
Natterer's Bat - call duration up to 1.2 ms



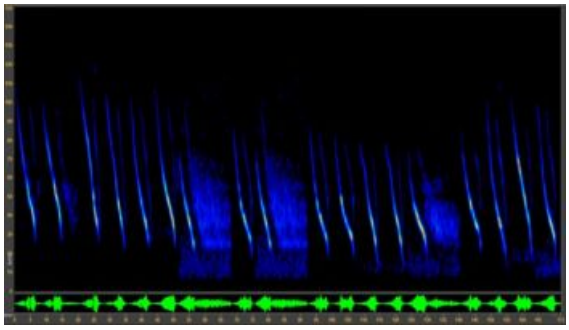
Natterer's Bat - call duration 2.7-2.8 ms



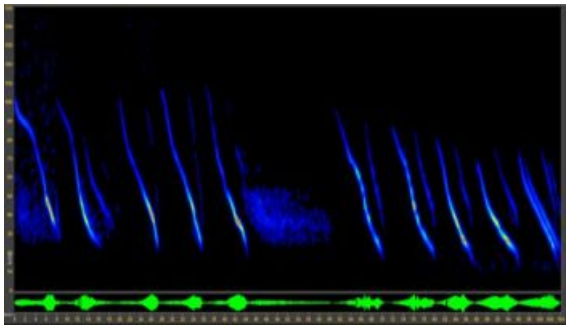
Natterer's Bat - call duration 3.9-4.0 ms



Natterer's Bat - call duration 4.9-5.0 ms

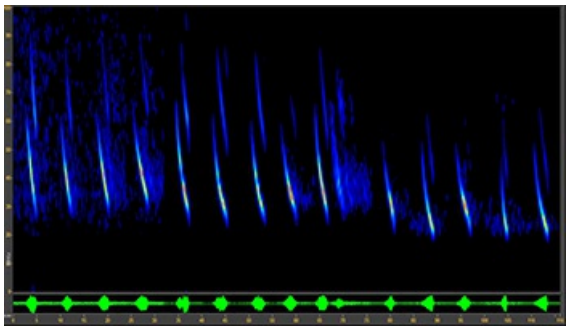


Natterer's Bat - call duration 5.9-6.0 ms

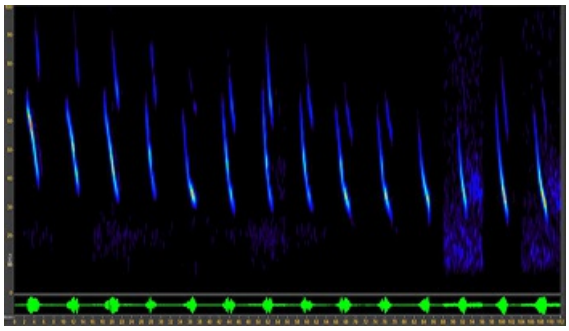


Natterer's Bat - call duration 7.1-9.4 ms

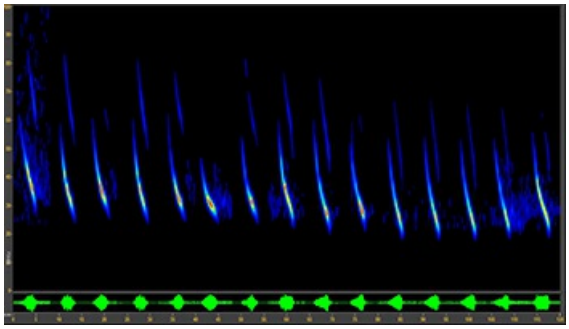
Identification appendix 4: Common Noctule *Nyctalus noctula* and Leisler's Bat *Nyctalus leisleri*



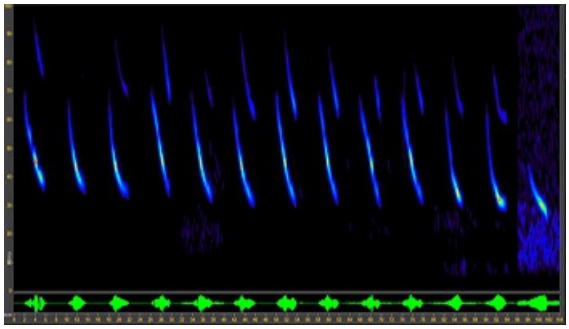
Common Noctule - call duration 1.4-3.0 ms



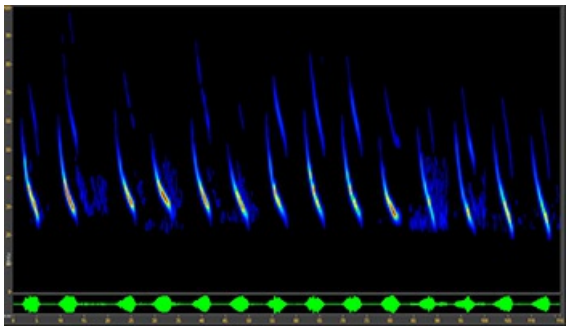
Leisler's Bat - call duration 1.4-3.0 ms



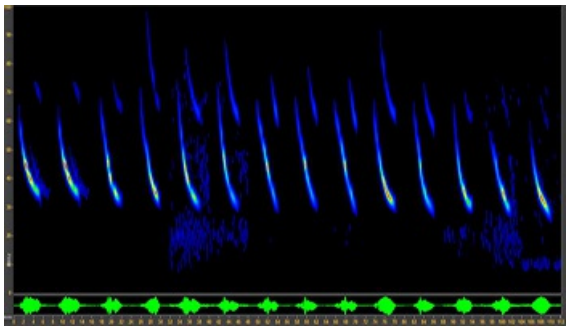
Common Noctule - call duration 3.1-3.7 ms



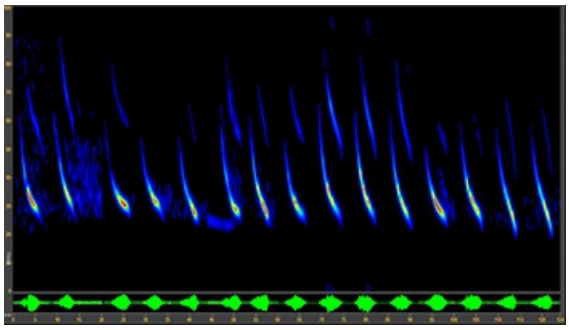
Leisler's Bat - call duration 3.1-3.7 ms



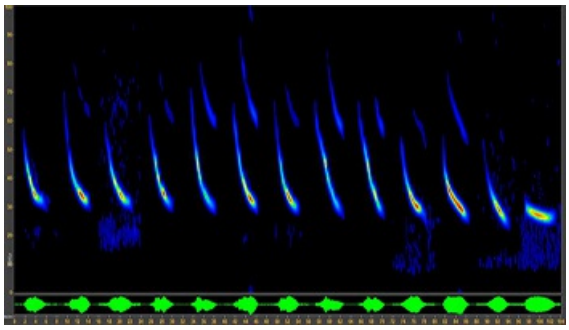
Common Noctule - call duration 3.8-4.3 ms



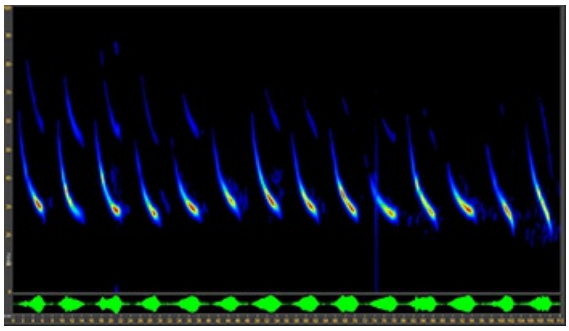
Leisler's Bat - call duration 3.8-4.3 ms



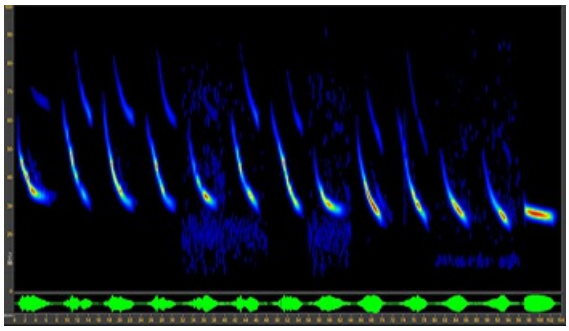
Common Noctule - call duration 4.4-4.9 ms



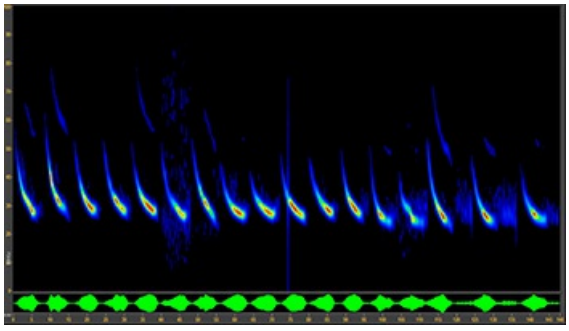
Leisler's Bat - call duration 4.4-4.9 ms



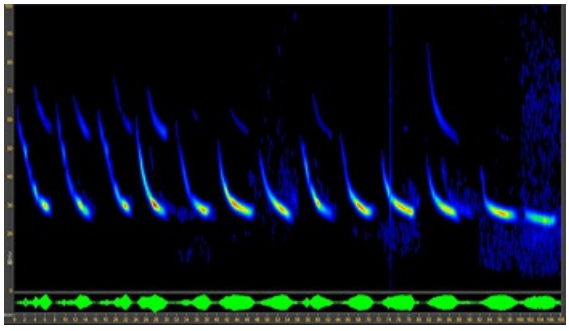
Common Noctule - call duration 5.0-5.9 ms



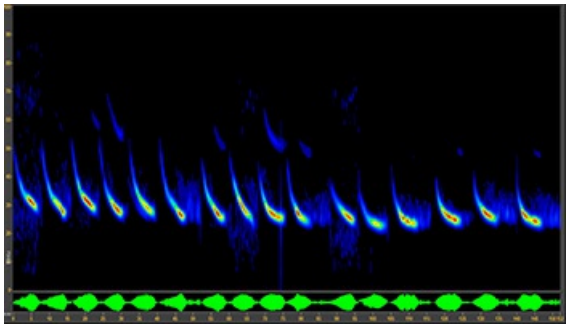
Leisler's Bat - call duration 5.0-5.9 ms



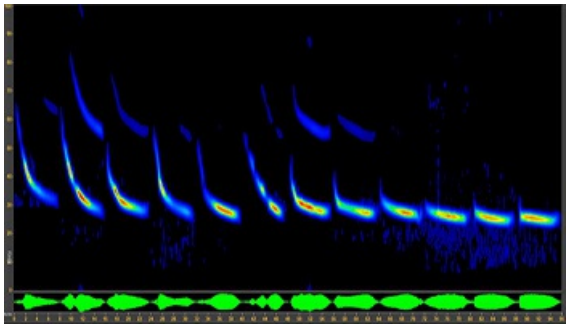
Common Noctule - call duration 6.0-6.8 ms



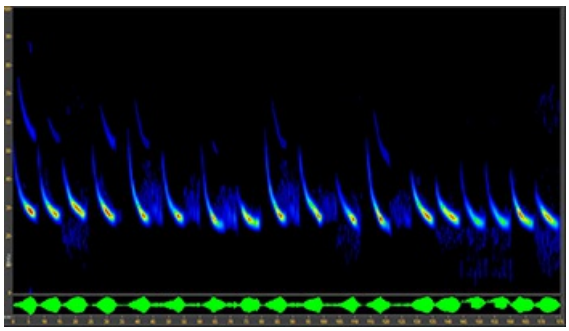
Leisler's Bat - call duration 6.0-6.8 ms



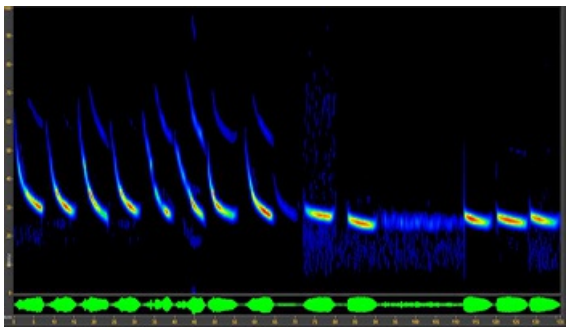
Common Noctule - call duration 6.9-7.2 ms



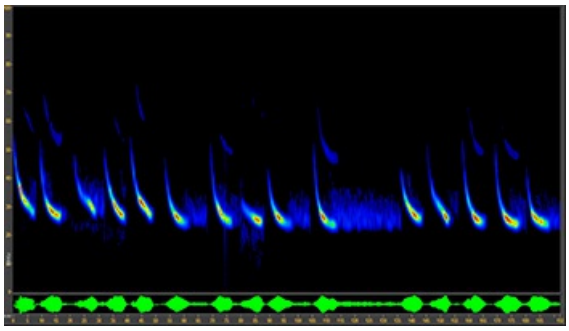
Leisler's Bat - call duration 6.9-7.2 ms



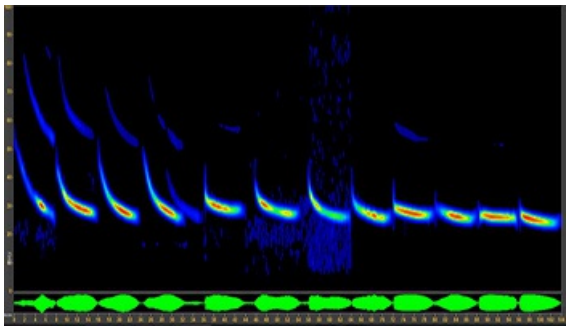
Common Noctule - call duration 7.3-7.6 ms



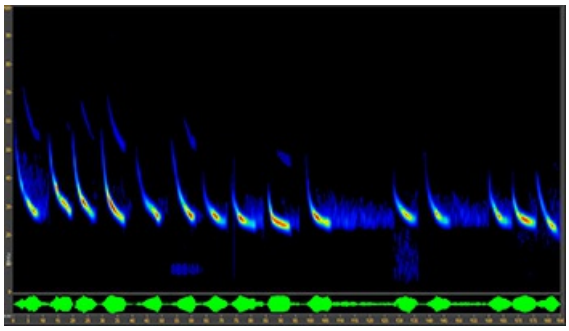
Leisler's Bat - call duration 7.3-7.6 ms



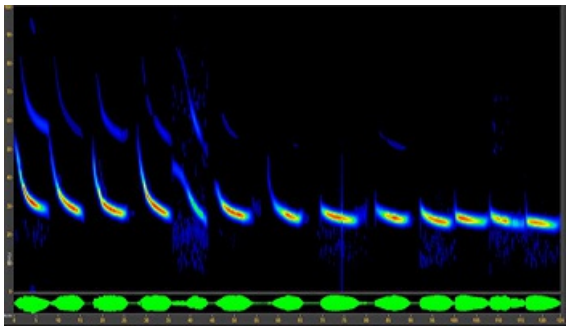
Common Noctule - call duration 7.7-7.8 ms



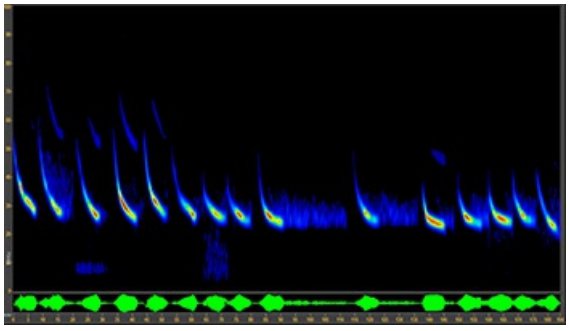
Leisler's Bat - call duration 7.7-7.8 ms



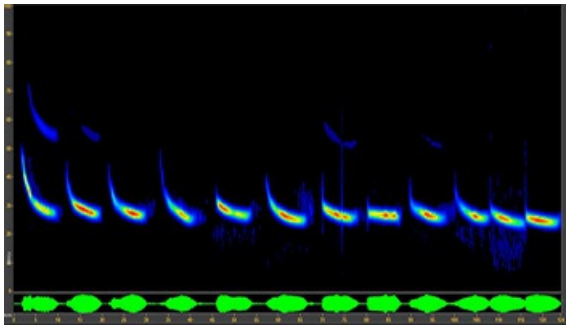
Common Noctule - call duration 7.9-8.0 ms



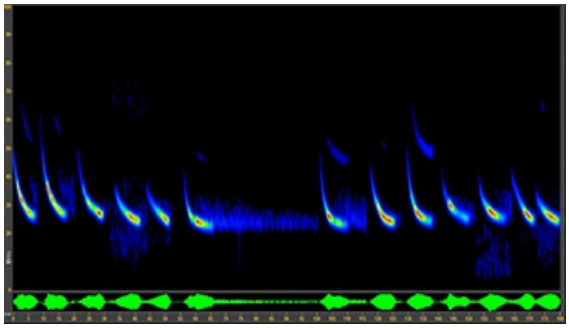
Leisler's Bat - call duration 7.9-8.0 ms



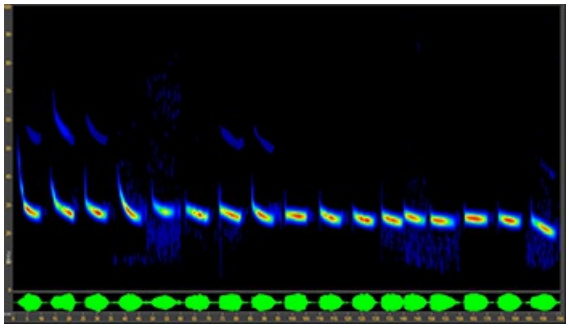
Common Noctule - call duration 8.1-8.3 ms



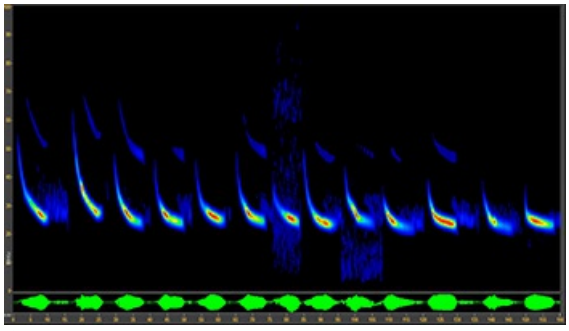
Leisler's Bat - call duration 8.1-8.3 ms



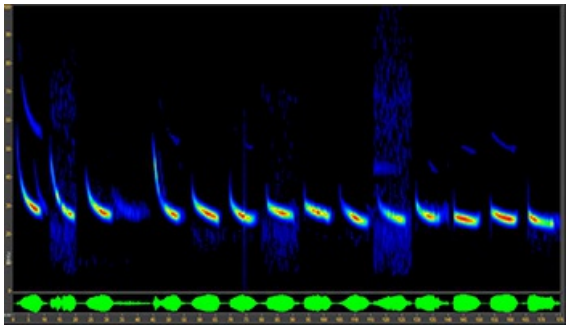
Common Noctule - call duration 8.4-8.5 ms



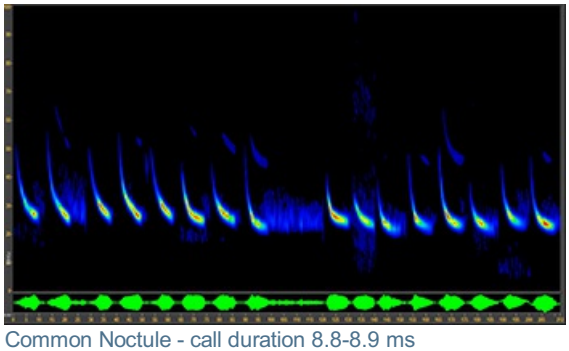
Leisler's Bat - call duration 8.4-8.5 ms



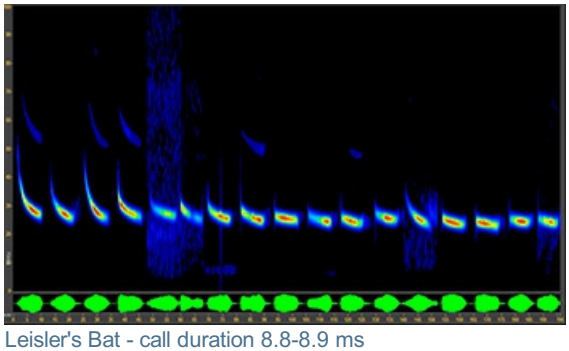
Common Noctule - call duration 8.6-8.7 ms



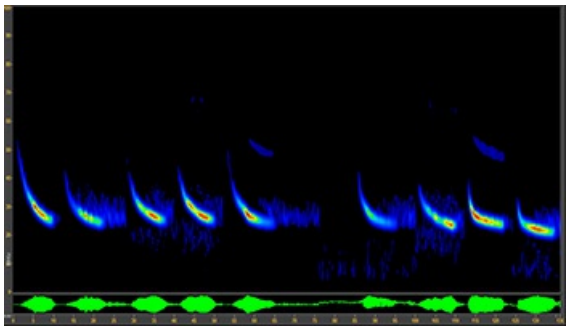
Leisler's Bat - call duration 8.6-8.7 ms



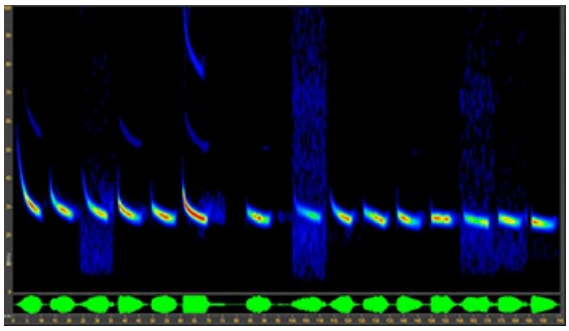
Common Noctule - call duration 8.8-8.9 ms



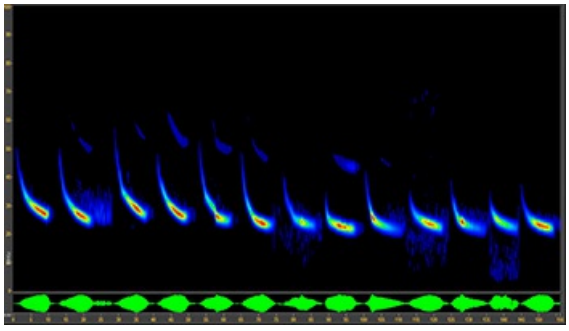
Leisler's Bat - call duration 8.8-8.9 ms



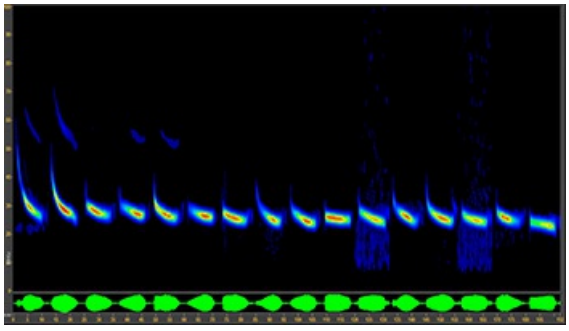
Common Noctule - call duration 9.0-9.1 ms



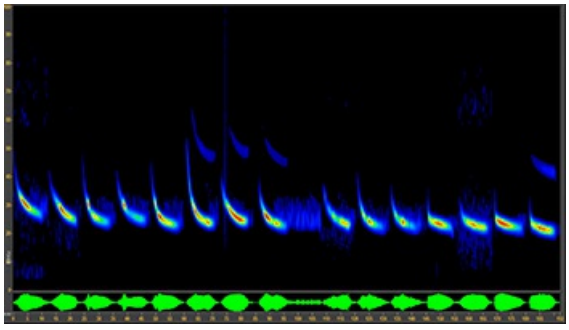
Leisler's Bat - call duration 9.0-9.1 ms



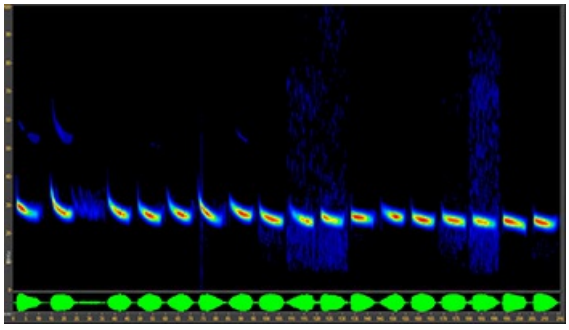
Common Noctule - call duration 9.2-9.3 ms



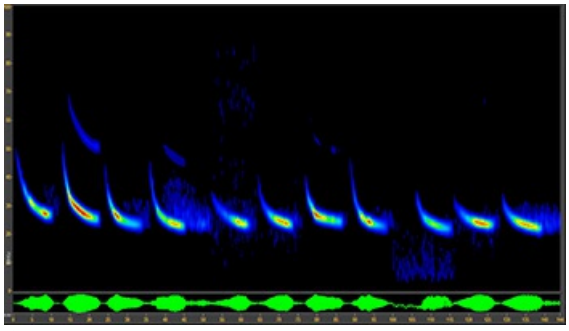
Leisler's Bat - call duration 9.2-9.3 ms



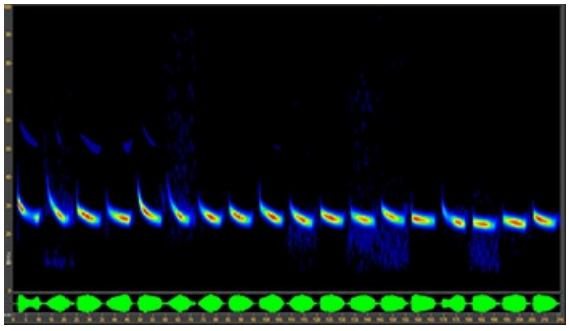
Common Noctule - call duration 9.4-9.5 ms



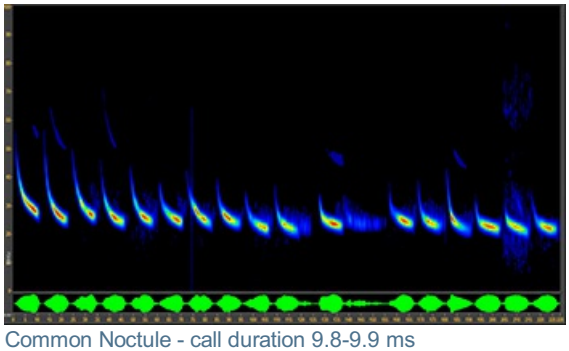
Leisler's Bat - call duration 9.4-9.5 ms



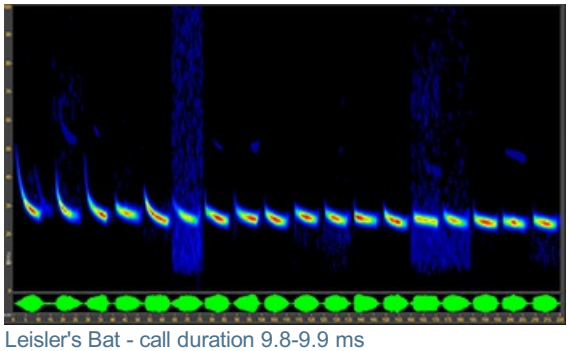
Common Noctule - call duration 9.6-9.7 ms



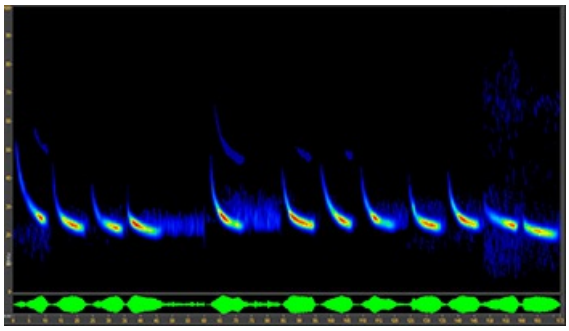
Leisler's Bat - call duration 9.6-9.7 ms



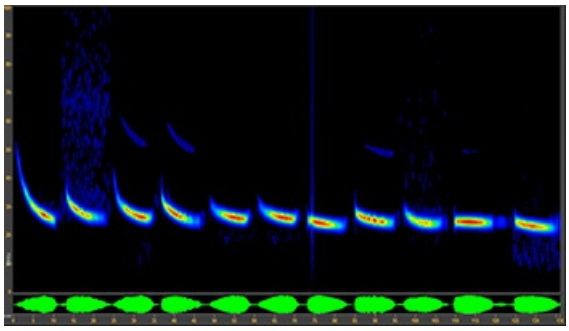
Common Noctule - call duration 9.8-9.9 ms



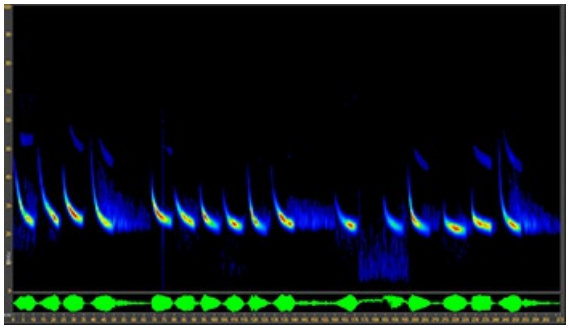
Leisler's Bat - call duration 9.8-9.9 ms



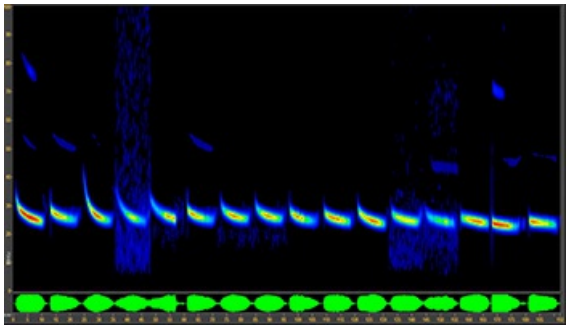
Common Noctule - call duration 10.0-10.1 ms



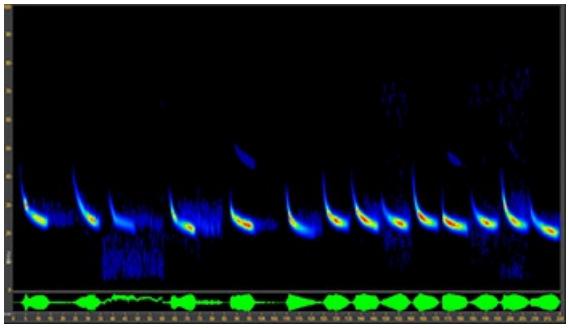
Leisler's Bat - call duration 10.0-10.1 ms



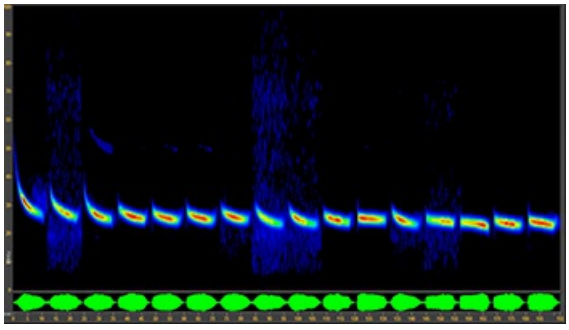
Common Noctule - call duration 10.2-10.3 ms



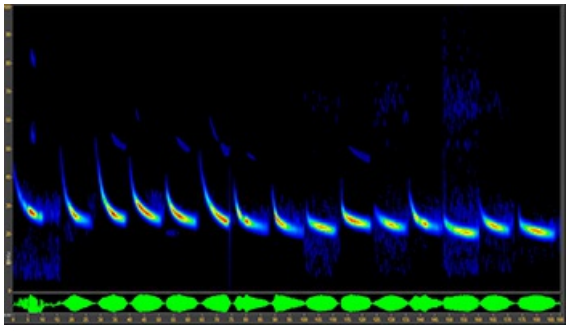
Leisler's Bat - call duration 10.2-10.3 ms



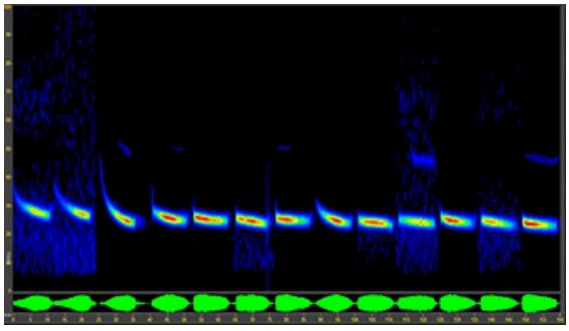
Common Noctule - call duration 10.4-10.5 ms



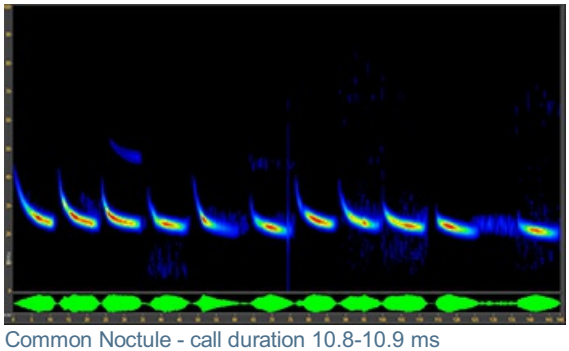
Leisler's Bat - call duration 10.4-10.5 ms



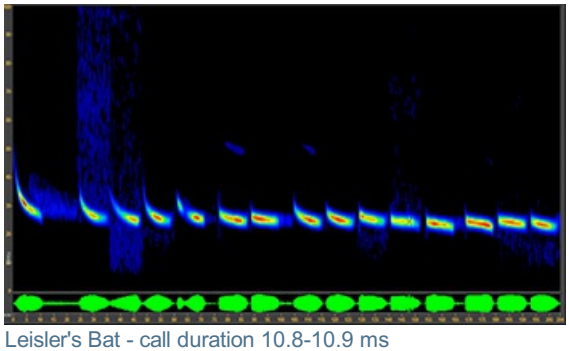
Common Noctule - call duration 10.6-10.7 ms



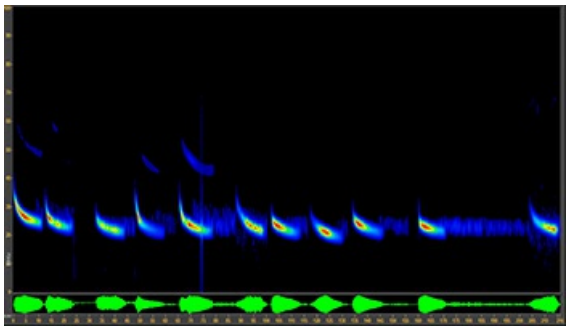
Leisler's Bat - call duration 10.6-10.7 ms



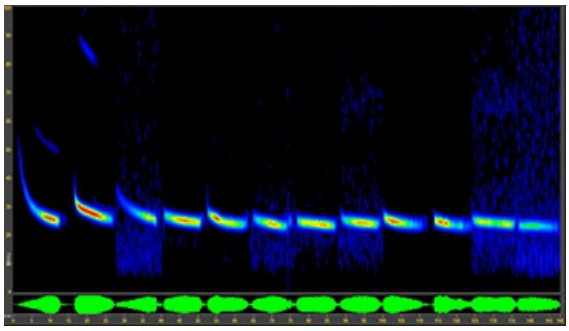
Common Noctule - call duration 10.8-10.9 ms



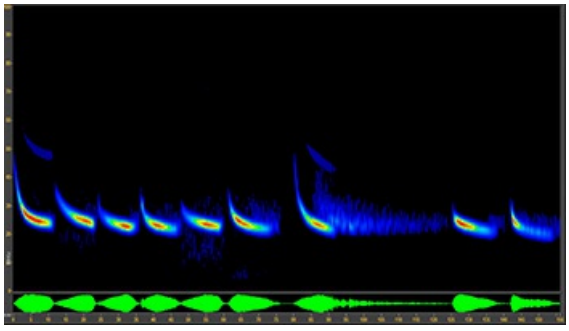
Leisler's Bat - call duration 10.8-10.9 ms



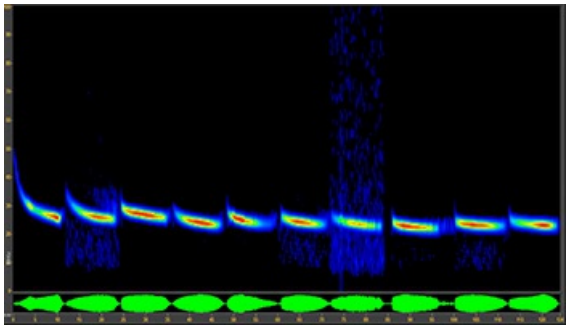
Common Noctule - call duration 11.0-11.1 ms



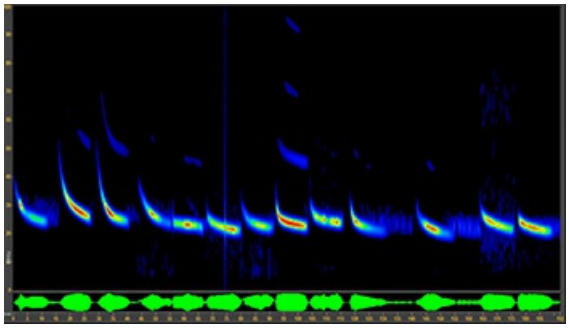
Leisler's Bat - call duration 11.0-11.1 ms



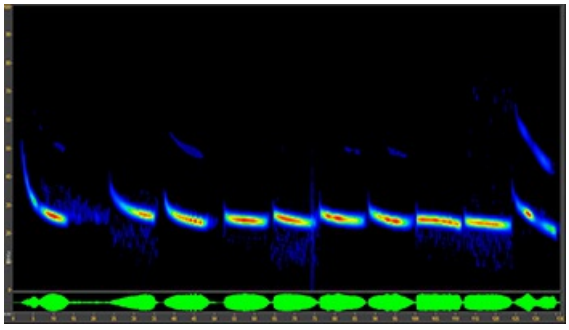
Common Noctule - call duration 11.2-11.3 ms



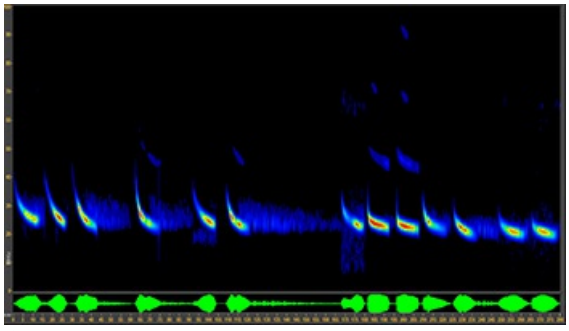
Leisler's Bat - call duration 11.2-11.3 ms



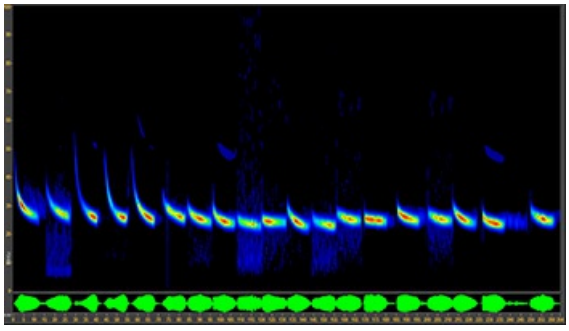
Common Noctule - call duration 11.4-11.5 ms



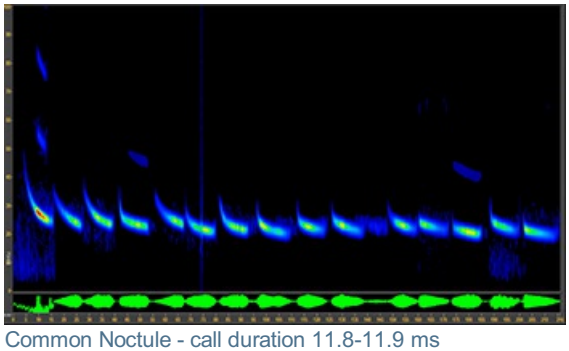
Leisler's Bat - call duration 11.4-11.5 ms



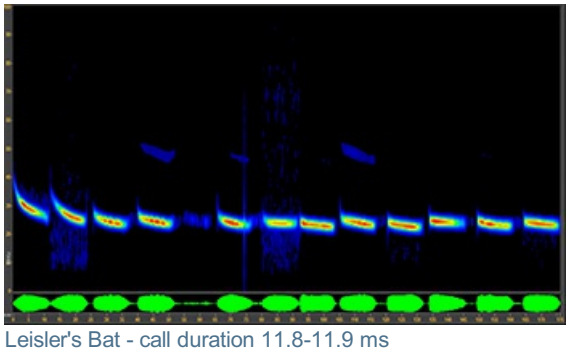
Common Noctule - call duration 11.6-11.7 ms



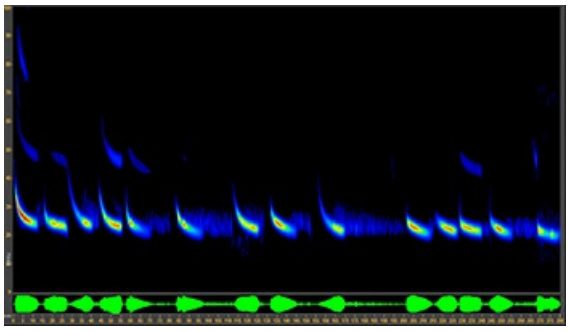
Leisler's Bat - call duration 11.6-11.7 ms



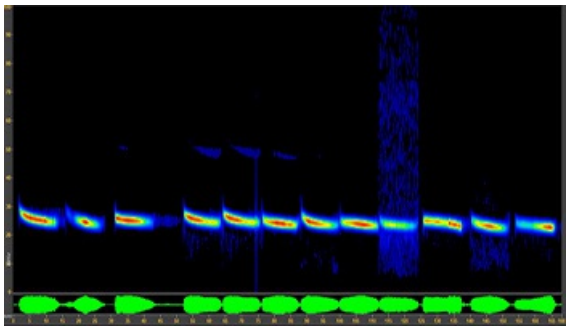
Common Noctule - call duration 11.8-11.9 ms



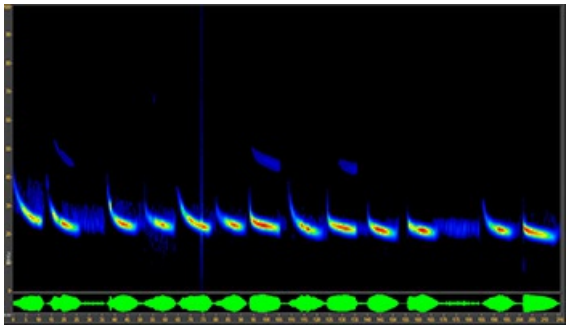
Leisler's Bat - call duration 11.8-11.9 ms



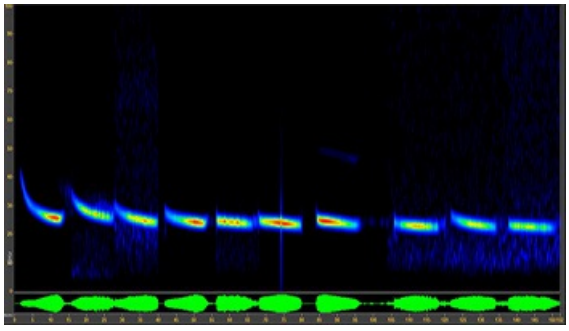
Common Noctule - call duration 12.0-12.2 ms



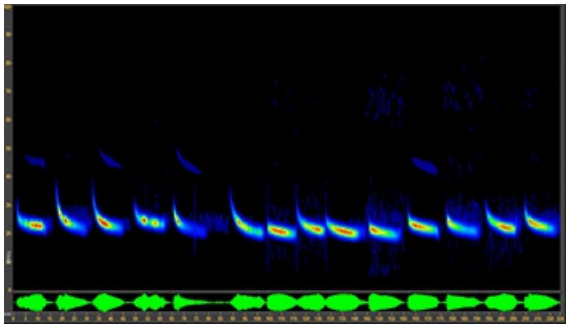
Leisler's Bat - call duration 12.0-12.2 ms



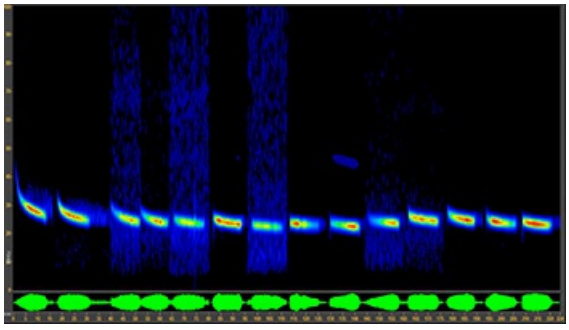
Common Noctule - call duration 12.3-12.4 ms



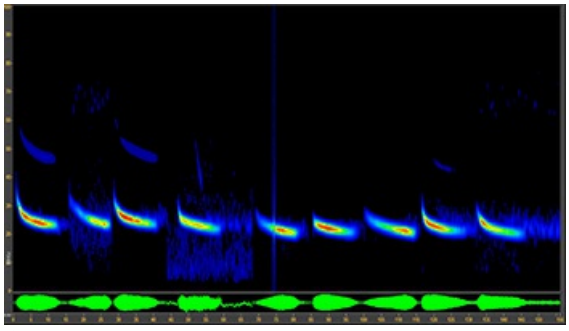
Leisler's Bat - call duration 12.3-12.4 ms



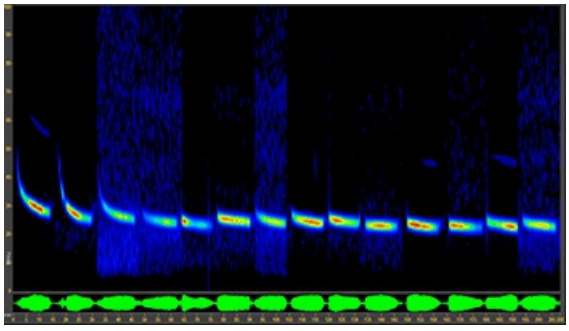
Common Noctule - call duration 12.5-12.7 ms



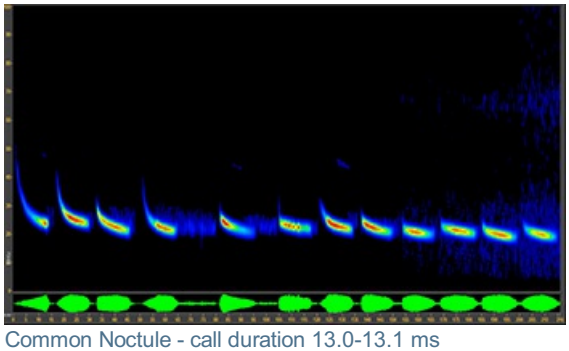
Leisler's Bat - call duration 12.5-12.7 ms



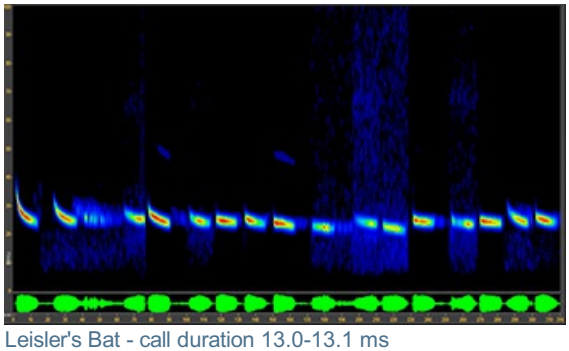
Common Noctule - call duration 12.8-12.9 ms



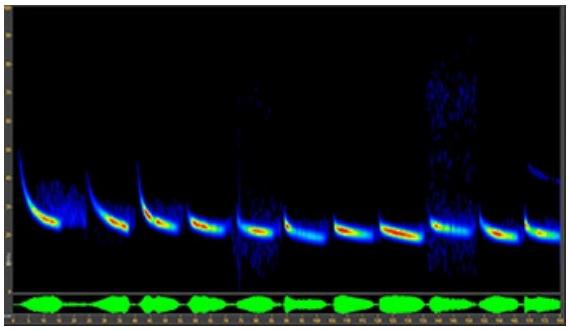
Leisler's Bat - call duration 12.8-12.9 ms



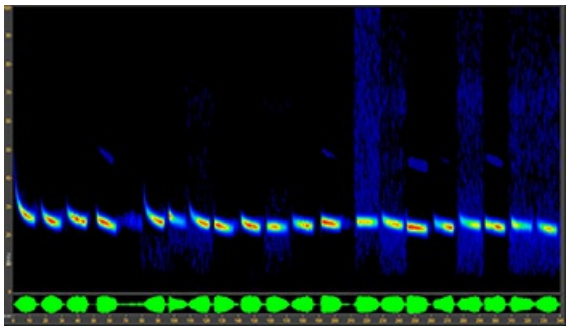
Common Noctule - call duration 13.0-13.1 ms



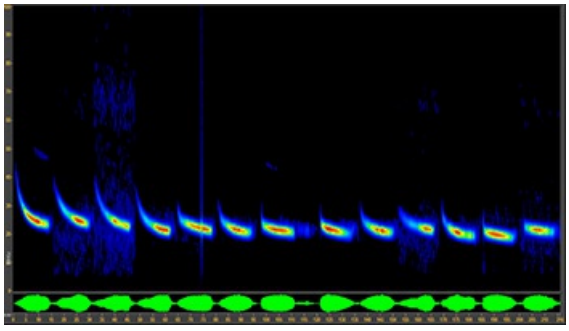
Leisler's Bat - call duration 13.0-13.1 ms



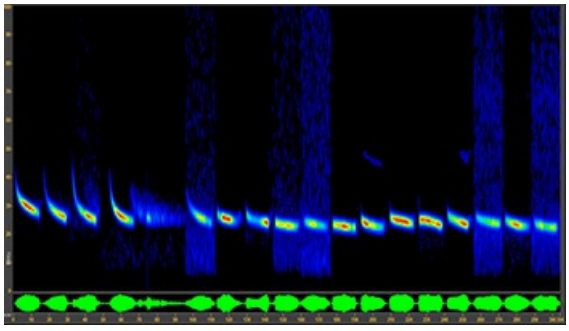
Common Noctule - call duration 13.2-13.3 ms



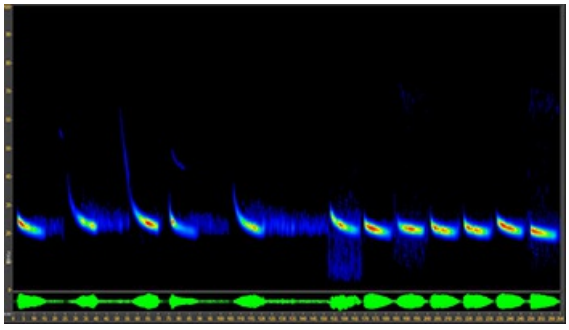
Leisler's Bat - call duration 13.2-13.3 ms



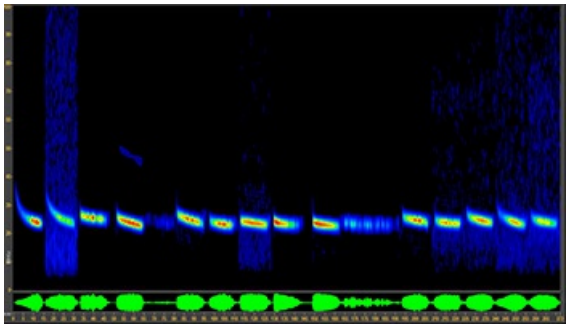
Common Noctule - call duration 13.4-13.5 ms



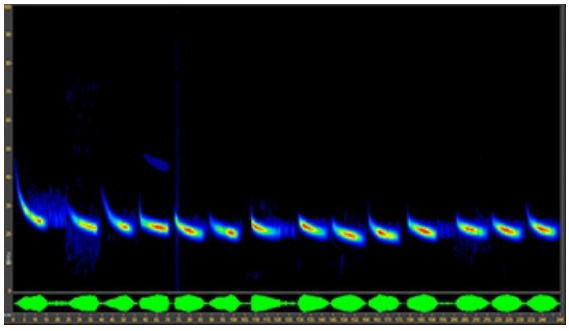
Leisler's Bat - call duration 13.4-13.5 ms



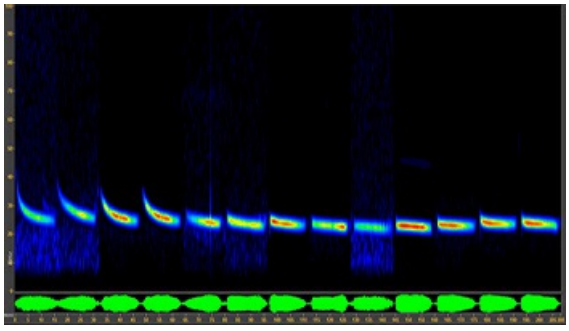
Common Noctule - call duration 13.6-13.7 ms



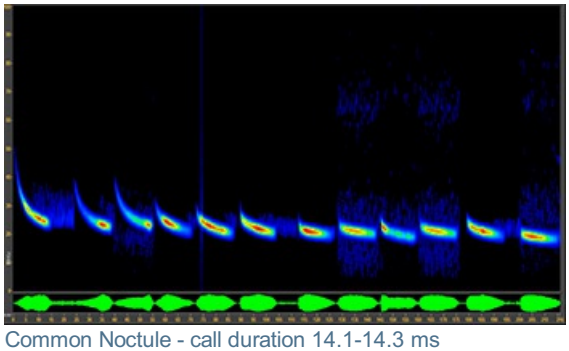
Leisler's Bat - call duration 13.6-13.7 ms



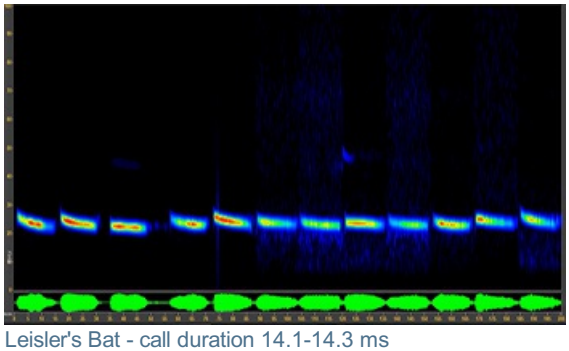
Common Noctule - call duration 13.8-14.0 ms



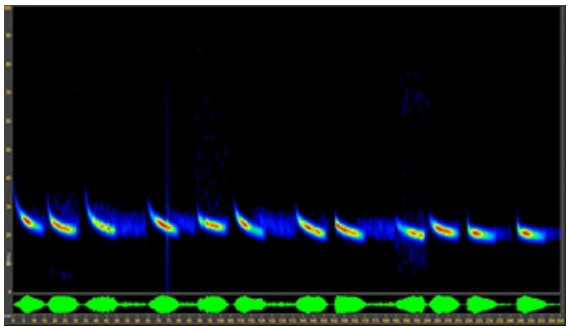
Leisler's Bat - call duration 13.8-14.0 ms



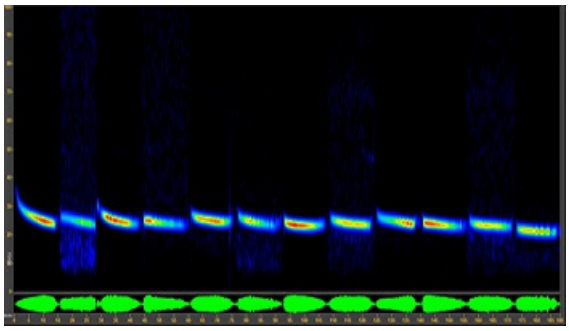
Common Noctule - call duration 14.1-14.3 ms



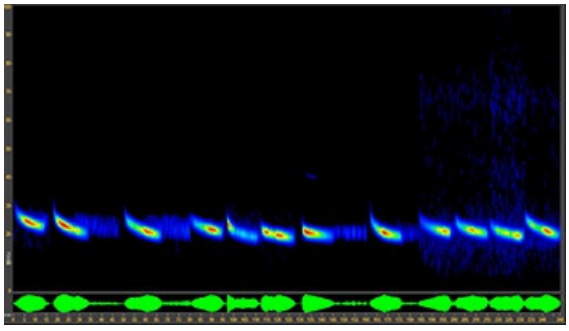
Leisler's Bat - call duration 14.1-14.3 ms



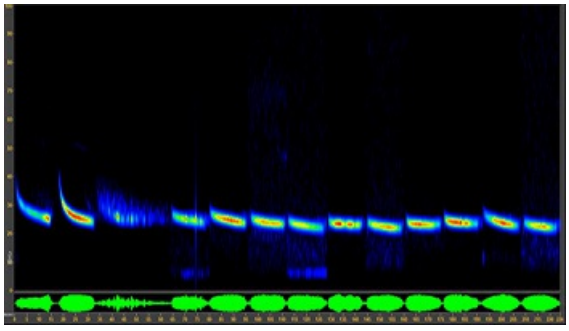
Common Noctule - call duration 14.4-14.5 ms



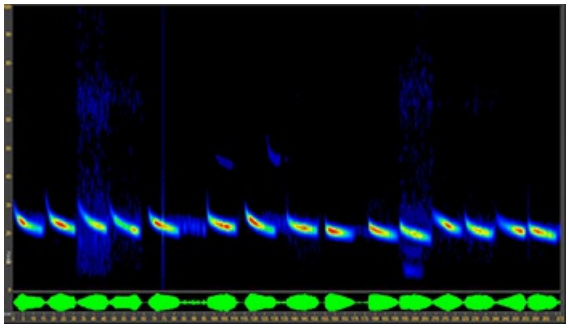
Leisler's Bat - call duration 14.4-14.5 ms



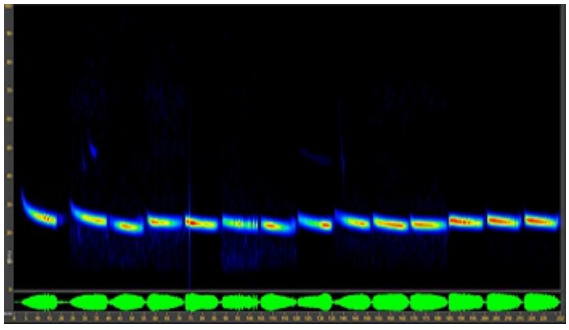
Common Noctule - call duration 14.6-14.8 ms



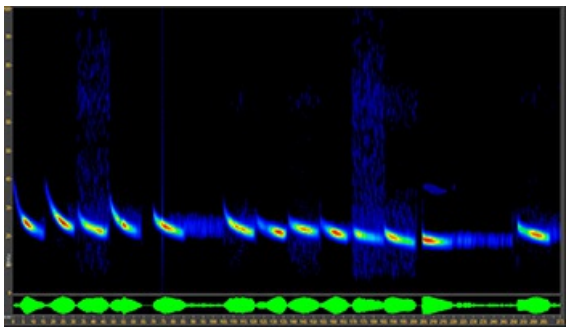
Leisler's Bat - call duration 14.6-14.8 ms



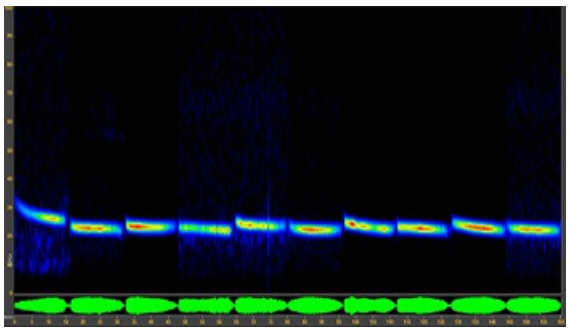
Common Noctule - call duration 14.9-15.1 ms



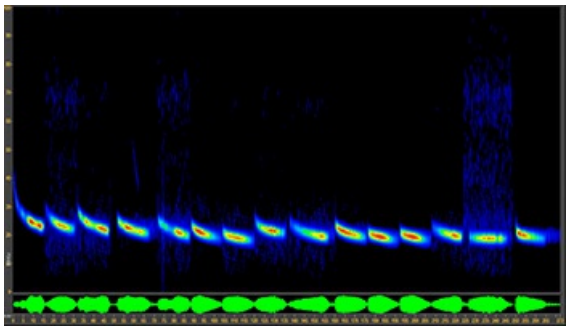
Leisler's Bat - call duration 14.9-15.1 ms



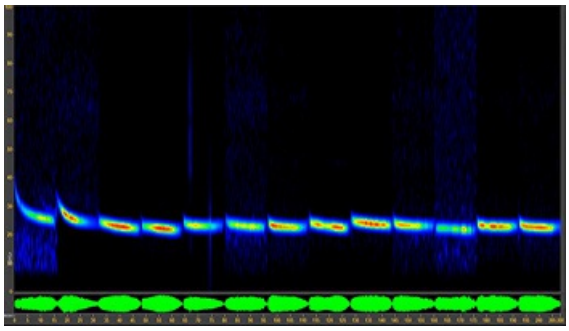
Common Noctule - call duration 15.2-15.3 ms



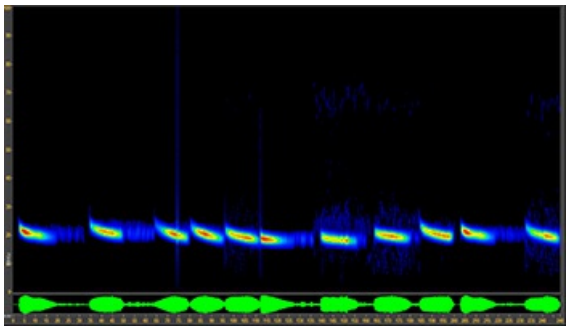
Leisler's Bat - call duration 15.2-15.3 ms



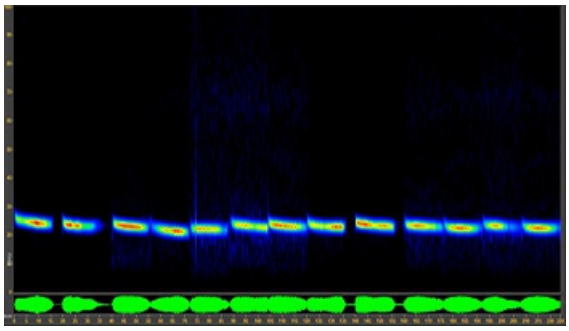
Common Noctule - call duration 15.4-15.7 ms



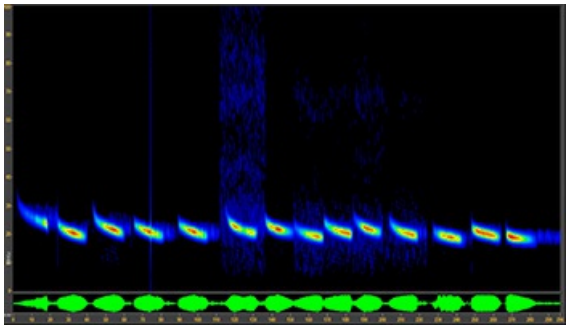
Leisler's Bat - call duration 15.4-15.7 ms



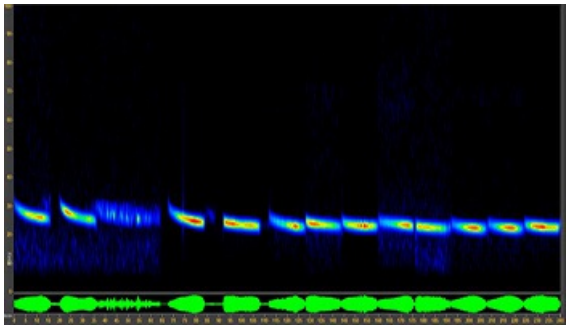
Common Noctule - call duration 15.8-16.0 ms



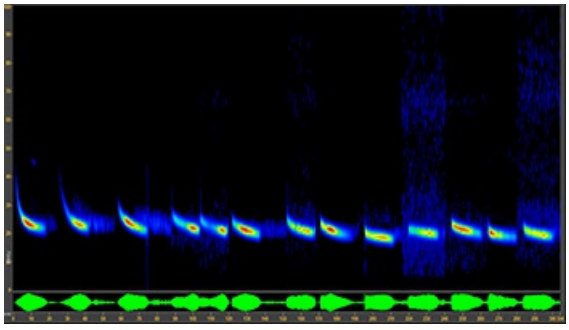
Leisler's Bat - call duration 15.8-16.0 ms



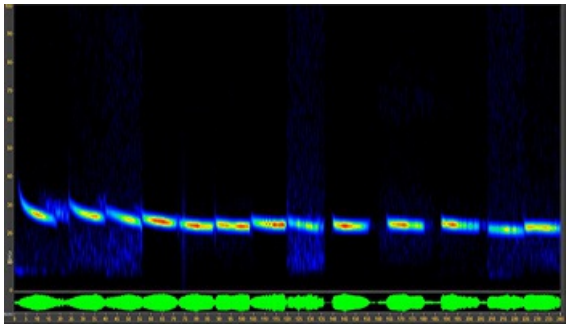
Common Noctule - call duration 16.1-16.3 ms



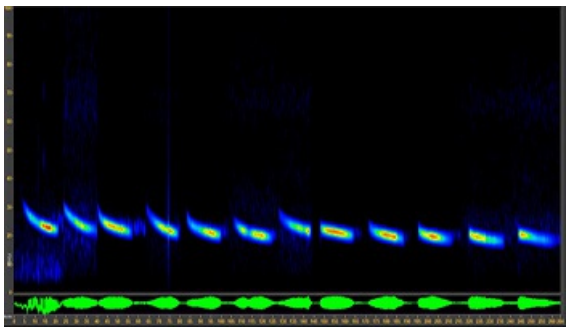
Leisler's Bat - call duration 16.1-16.3 ms



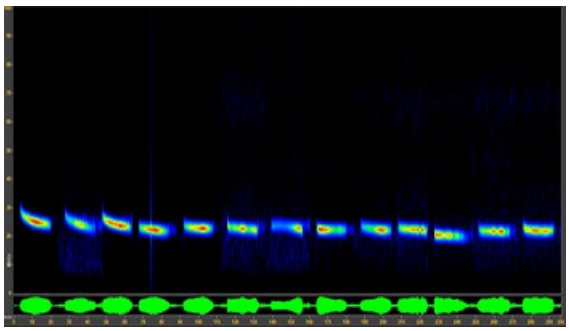
Common Noctule - call duration 16.4-16.6 ms



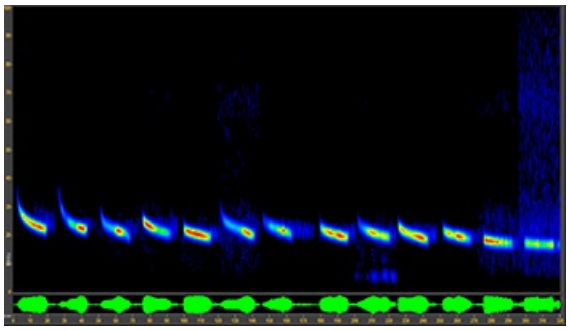
Leisler's Bat - call duration 16.4-16.6 ms



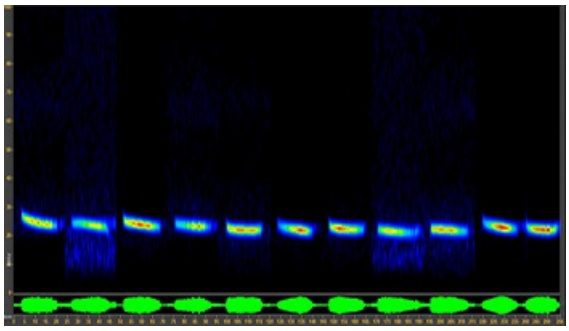
Common Noctule - call duration 16.7-17.0 ms



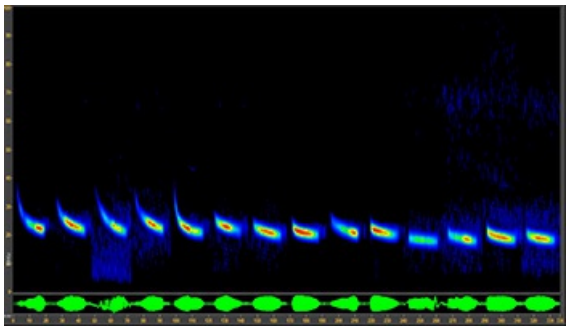
Leisler's Bat - call duration 16.7-17.0 ms



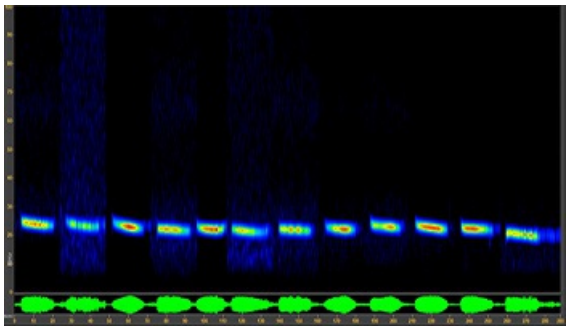
Common Noctule - call duration 17.1-17.2 ms



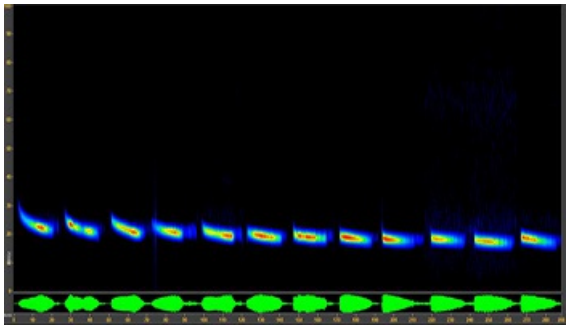
Leisler's Bat - call duration 17.1-17.2 ms



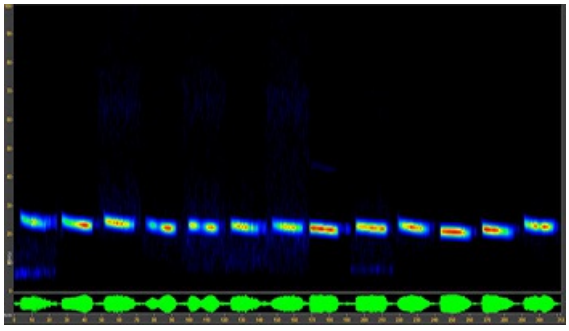
Common Noctule - call duration 17.3-17.4 ms



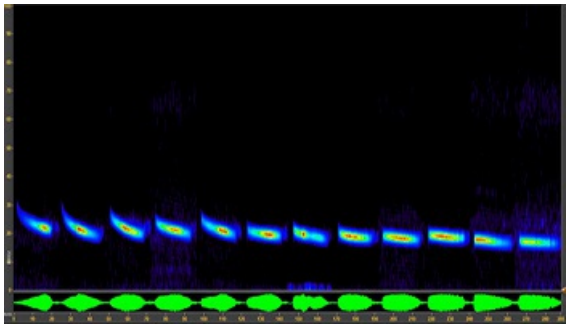
Leisler's Bat - call duration 17.3-17.4 ms



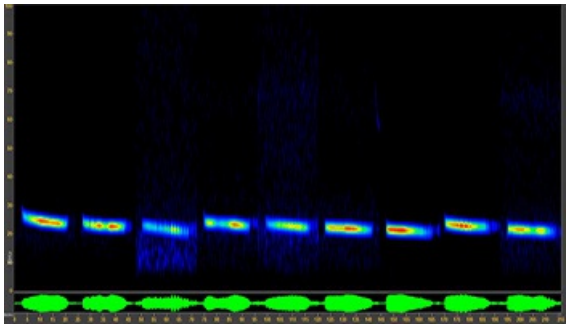
Common Noctule - call duration 17.5-18.2 ms



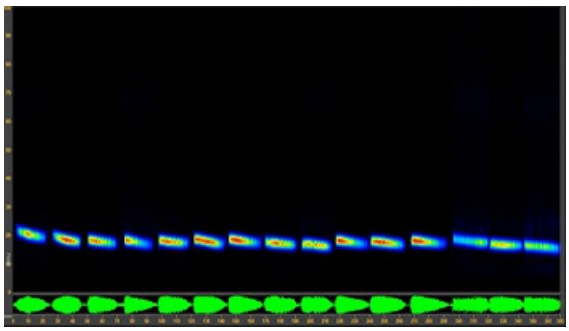
Leisler's Bat - call duration 17.5-18.2 ms



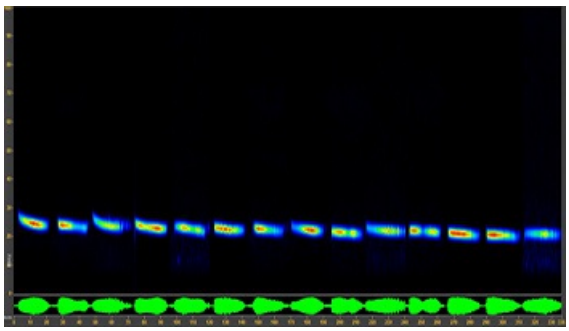
Common Noctule - call duration 18.3-18.7 ms



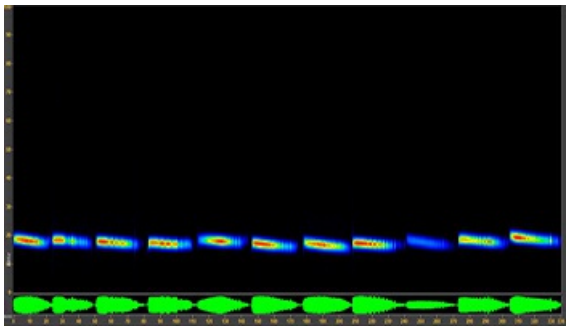
Leisler's Bat - call duration 18.3-18.7 ms



Common Noctule - call duration 18.8-24.0 ms



Leisler's Bat - call duration 18.8-24.0 ms

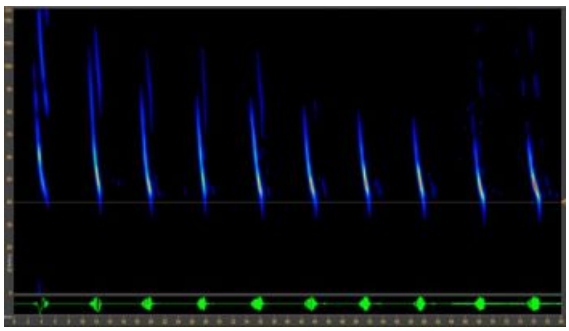


Common Noctule - call duration 24.1-31.7 ms

Leisler's Bat - no examples for this call duration

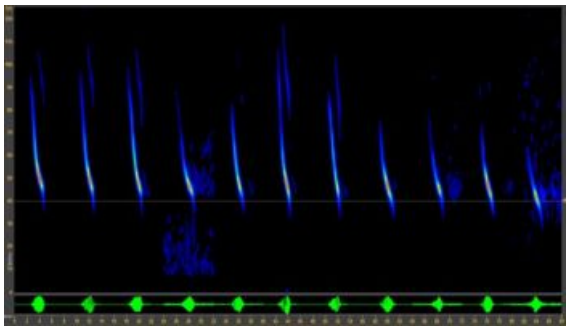
Identification appendix 5: Kuhl's Pipistrelle *Pipistrellus kuhlii* and Nathusius' Pipistrelle *Pipistrellus nathusii*

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.

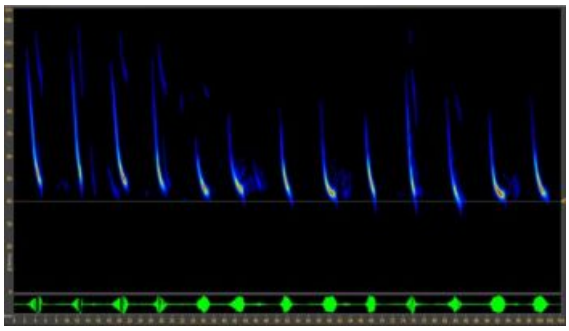


Kuhl's Pipistrelle - call duration 1.1-1.7 ms

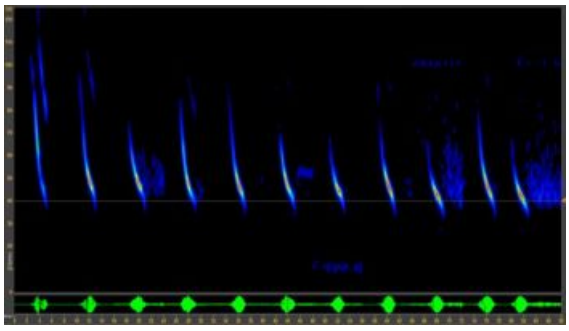
Nathusius' Pipistrelle - fewer examples for this call duration



Kuhl's Pipistrelle - call duration 1.8-2.2 ms

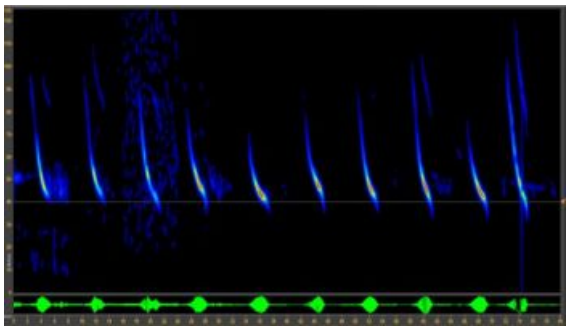


Nathusius' Pipistrelle - call duration 1.8-3.0 ms



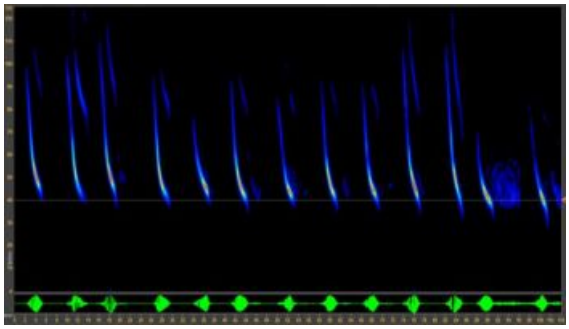
Kuhl's Pipistrelle - call duration 2.3-2.6 ms

Nathusius' Pipistrelle - fewer examples for this call duration



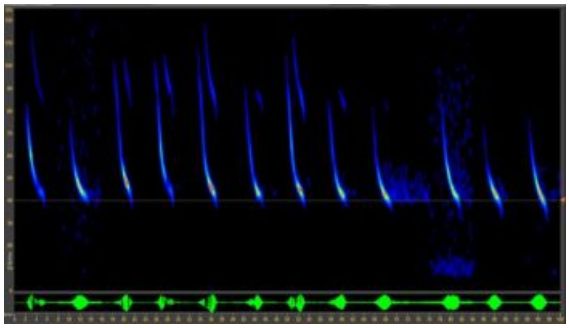
Kuhl's Pipistrelle - call duration 2.7-2.9 ms

Nathusius' Pipistrelle - fewer examples for this call duration

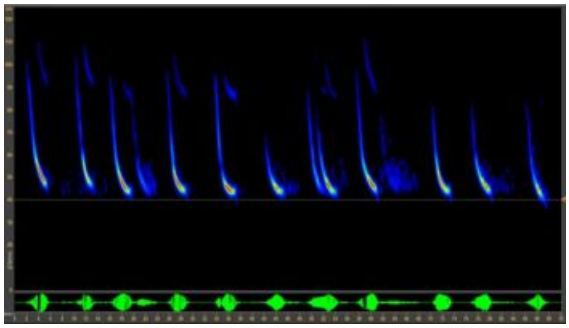


Kuhl's Pipistrelle - call duration 3.0-3.1 ms

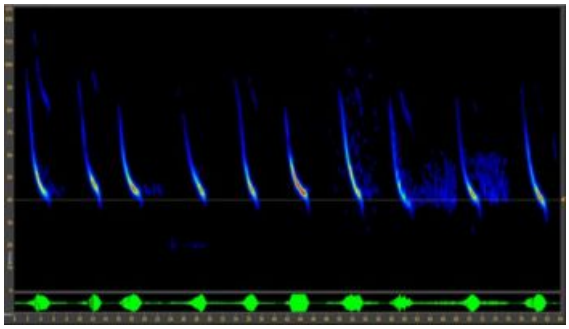
Nathusius' Pipistrelle - fewer examples for this call duration



Kuhl's Pipistrelle - call duration 3.2-3.3 ms

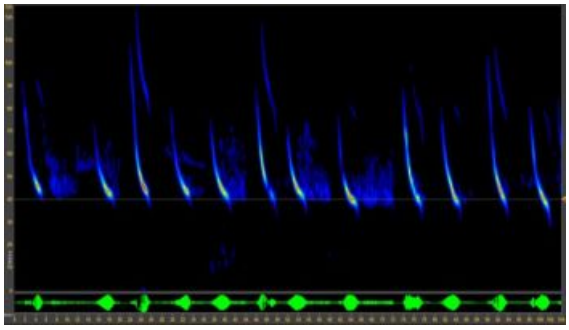


Nathusius' Pipistrelle - call duration 3.1-3.6 ms



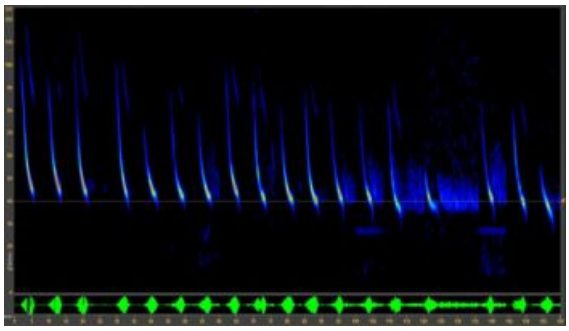
Kuhl's Pipistrelle - call duration 3.4-3.5 ms

Nathusius' Pipistrelle - fewer examples for this call duration

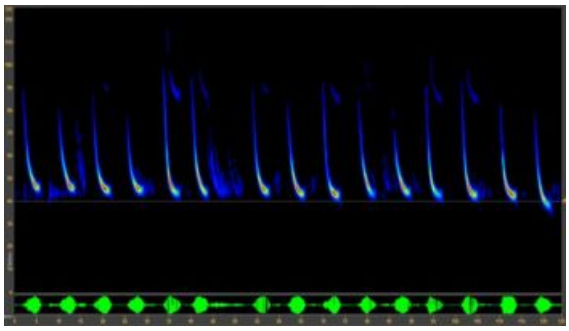


Kuhl's Pipistrelle - call duration 3.6-3.7 ms

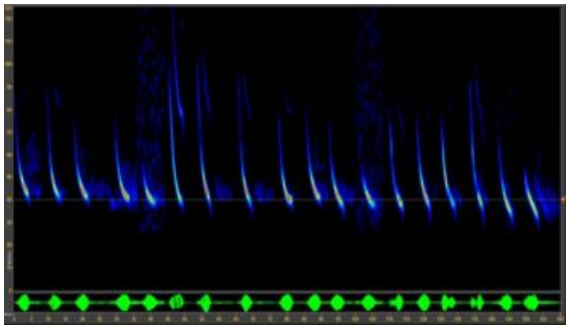
Nathusius' Pipistrelle - fewer examples for this call duration



Kuhl's Pipistrelle - call duration 3.8-3.9 ms

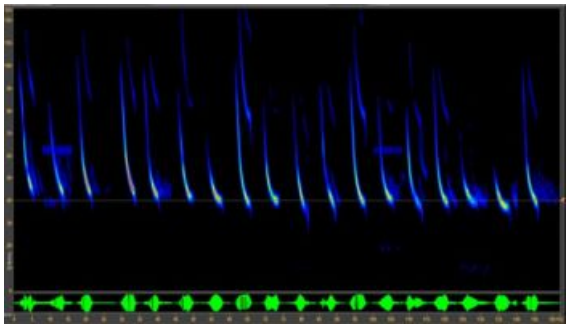


Nathusius' Pipistrelle - call duration 3.7-4.0 ms

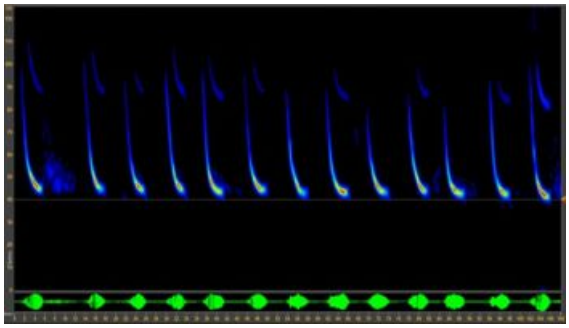


Kuhl's Pipistrelle - call duration 4.0-4.1 ms

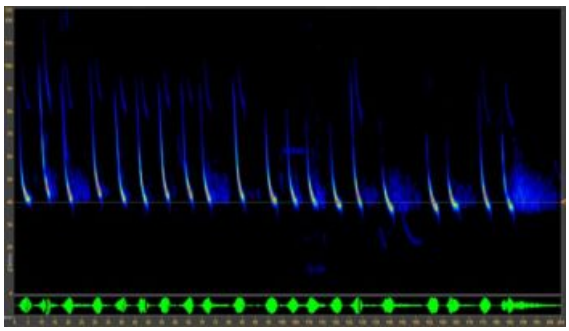
Nathusius' Pipistrelle - fewer examples for this call duration



Kuhl's Pipistrelle - call duration 4.2-4.3 ms

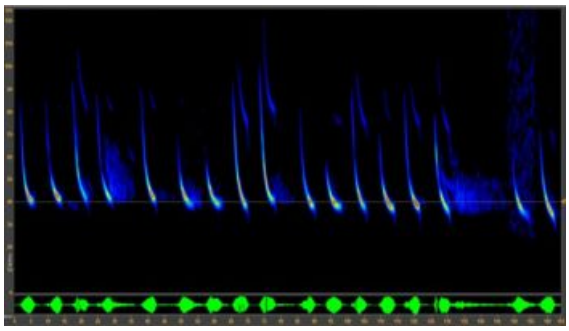


Nathusius' Pipistrelle - call duration 4.1-4.4 ms

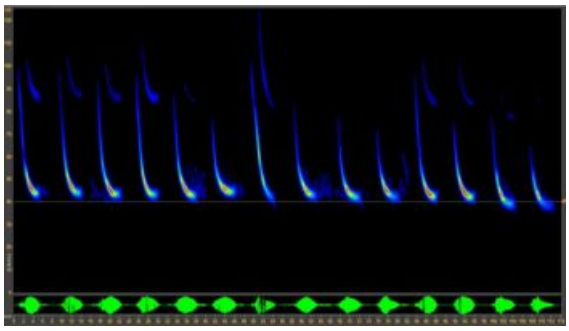


Kuhl's Pipistrelle - call duration 4.4-4.5 ms

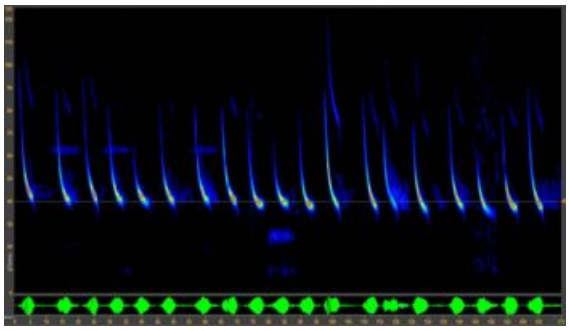
Nathusius' Pipistrelle - fewer examples for this call duration



Kuhl's Pipistrelle - call duration 4.6-4.7 ms

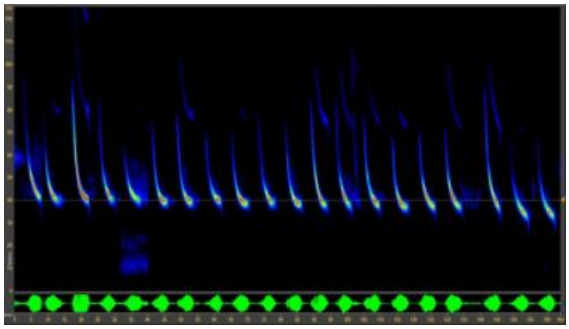


Nathusius' Pipistrelle - call duration 4.5-4.8 ms

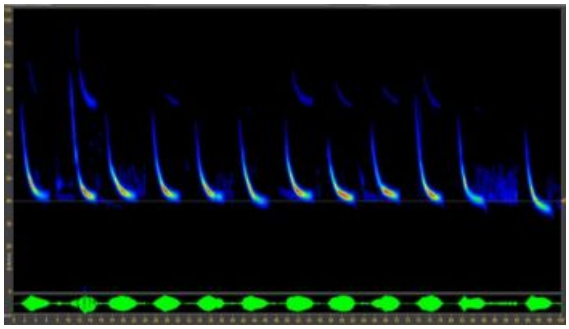


Kuhl's Pipistrelle - call duration 4.8-4.9 ms

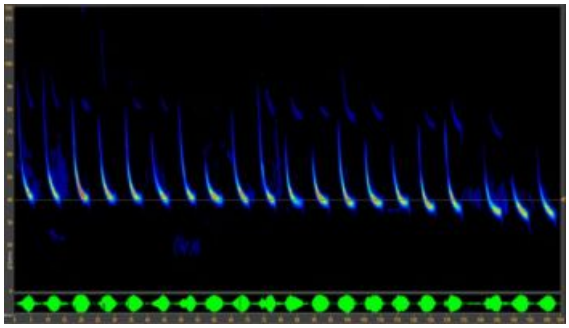
Nathusius' Pipistrelle - fewer examples for this call duration



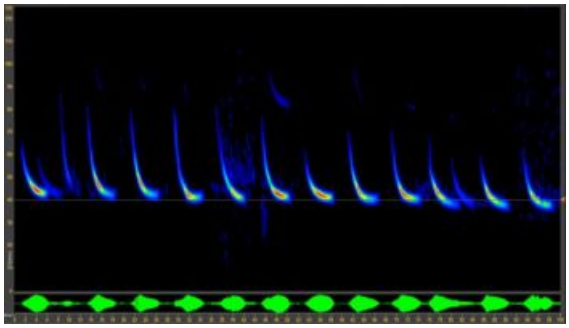
Kuhl's Pipistrelle - call duration 5.0-5.1 ms



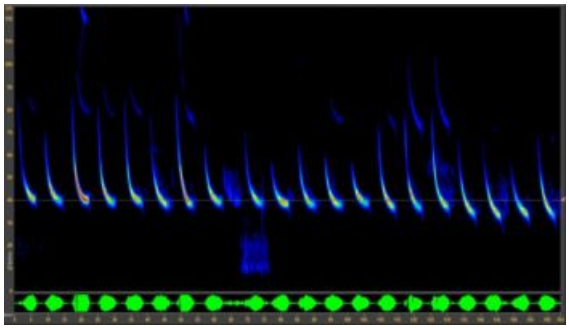
Nathusius' Pipistrelle - call duration 4.9-5.1 ms



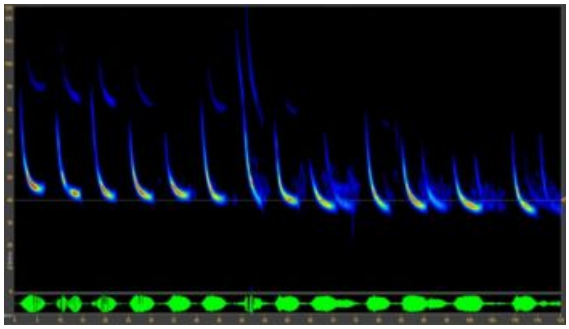
Kuhl's Pipistrelle - call duration 5.2-5.3 ms



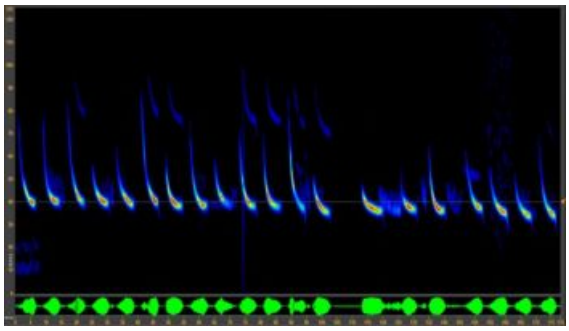
Nathusius' Pipistrelle - call duration 5.2-5.3 ms



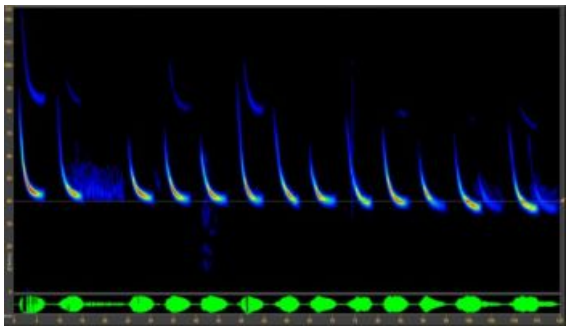
Kuhl's Pipistrelle - call duration 5.4-5.5 ms



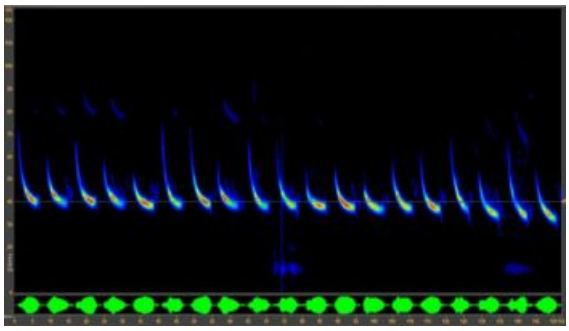
Nathusius' Pipistrelle - call duration 5.4-5.5 ms



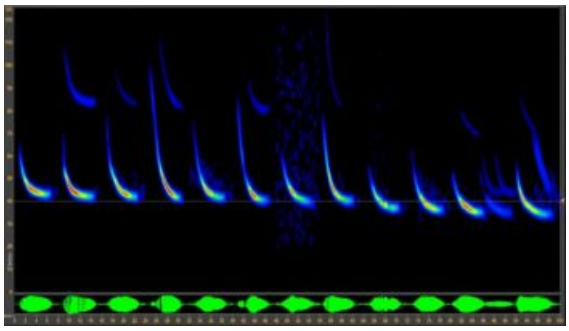
Kuhl's Pipistrelle - call duration 5.6-5.7 ms



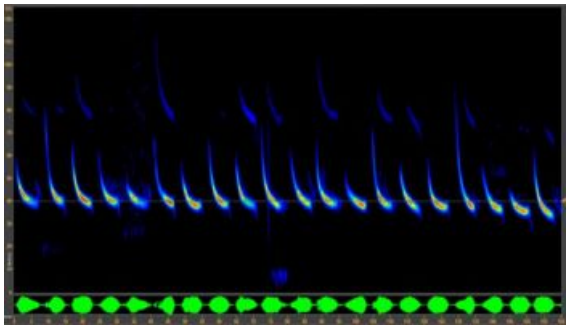
Nathusius' Pipistrelle - call duration 5.6-5.7 ms



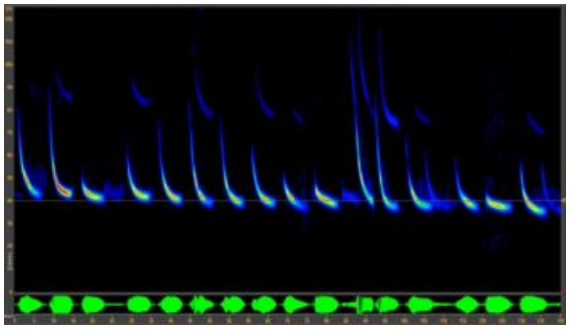
Kuhl's Pipistrelle - call duration 5.8-5.9 ms



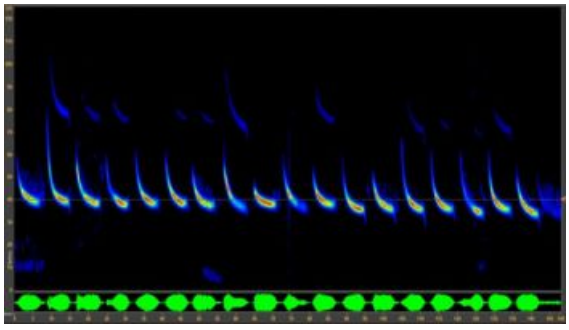
Nathusius' Pipistrelle - call duration 5.8-5.9 ms



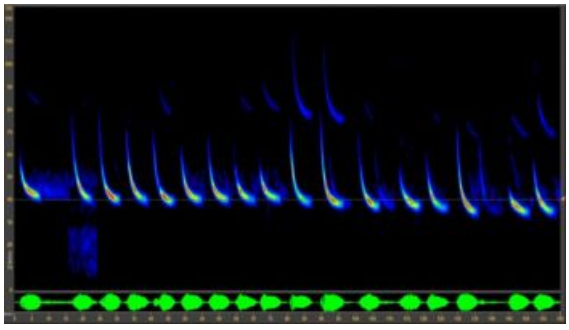
Kuhl's Pipistrelle - call duration 6.0-6.1 ms



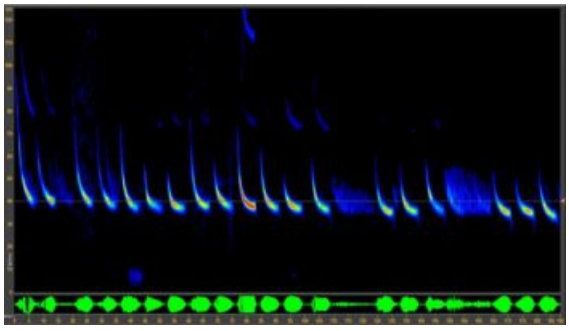
Nathusius' Pipistrelle - call duration 6.0-6.1 ms



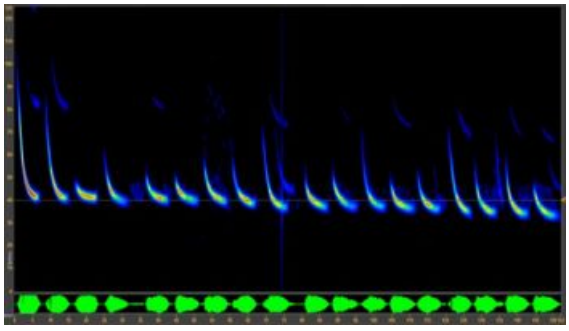
Kuhl's Pipistrelle - call duration 6.2-6.3 ms



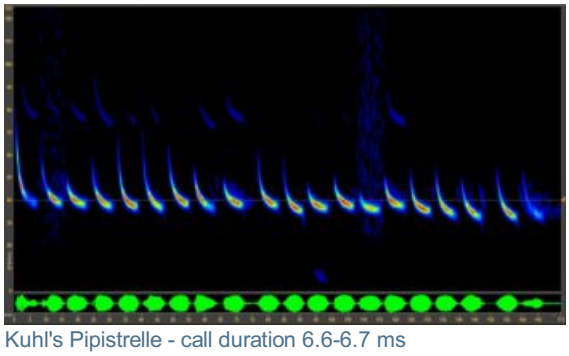
Nathusius' Pipistrelle - call duration 6.2-6.3 ms



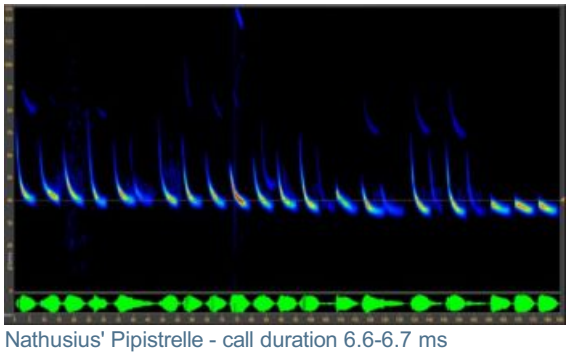
Kuhl's Pipistrelle - call duration 6.4-6.5 ms



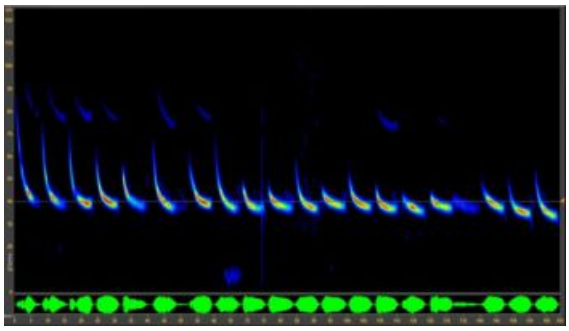
Nathusius' Pipistrelle - call duration 6.4-6.5 ms



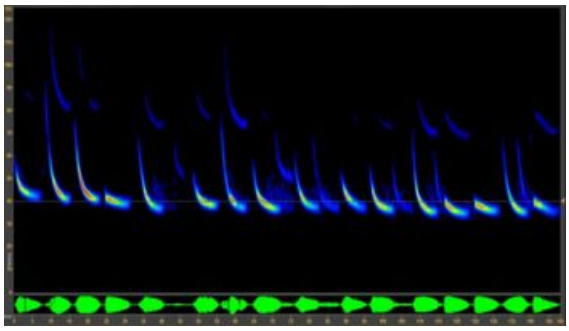
Kuhl's Pipistrelle - call duration 6.6-6.7 ms



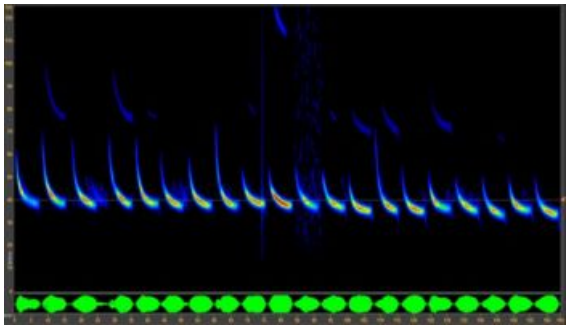
Nathusius' Pipistrelle - call duration 6.6-6.7 ms



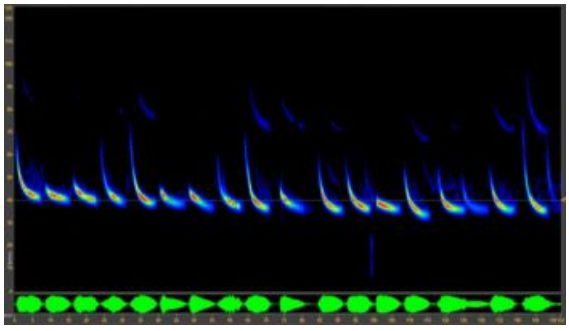
Kuhl's Pipistrelle - call duration 6.8-6.9 ms



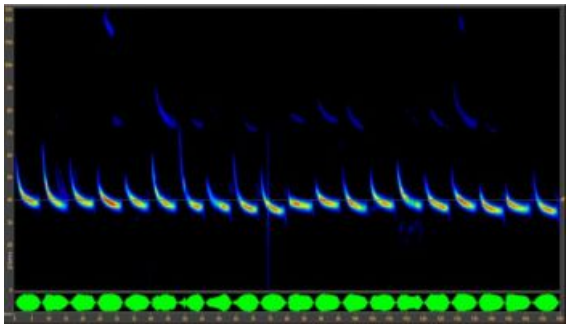
Nathusius' Pipistrelle - call duration 6.8-6.9 ms



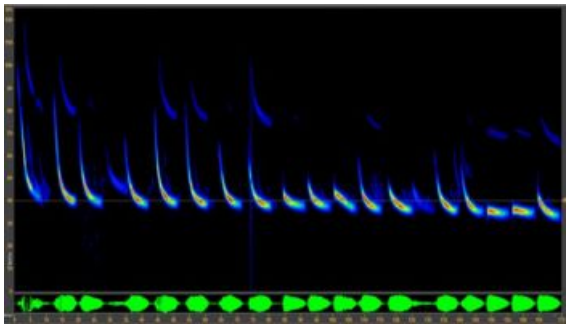
Kuhl's Pipistrelle - call duration 7.0-7.1 ms



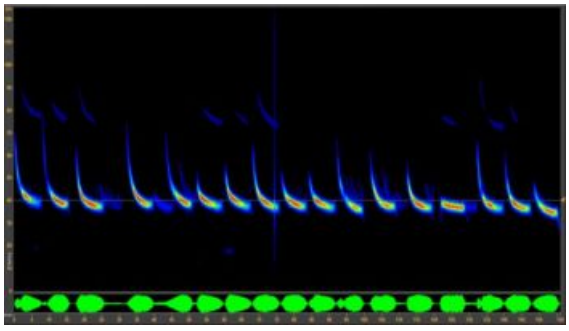
Nathusius' Pipistrelle - call duration 7.0-7.1 ms



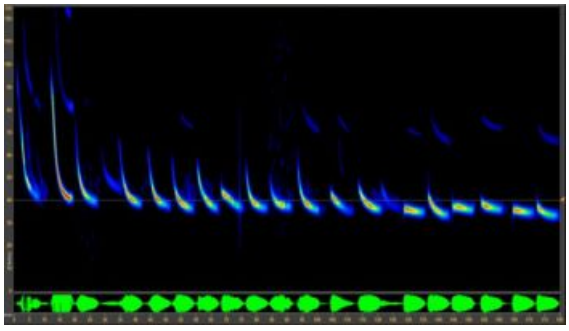
Kuhl's Pipistrelle - call duration 7.2-7.3 ms



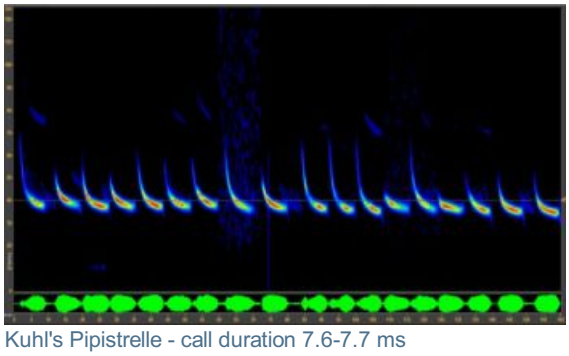
Nathusius' Pipistrelle - call duration 7.2-7.3 ms



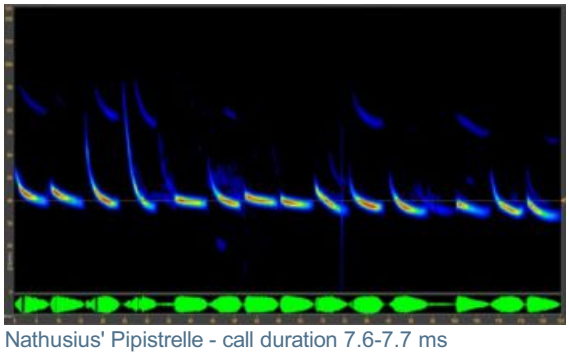
Kuhl's Pipistrelle - call duration 7.4-7.5 ms



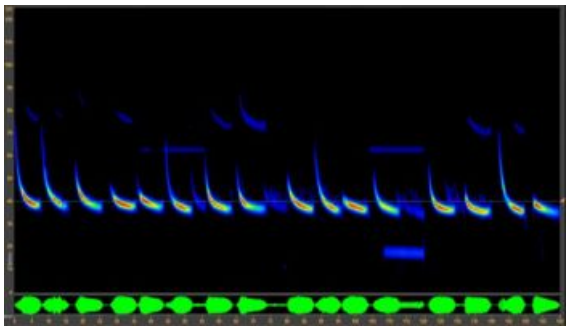
Nathusius' Pipistrelle - call duration 7.4-7.5 ms



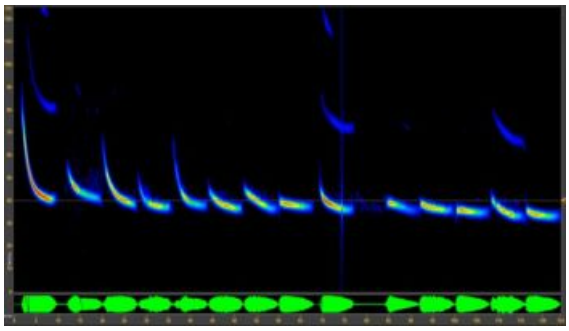
Kuhl's Pipistrelle - call duration 7.6-7.7 ms



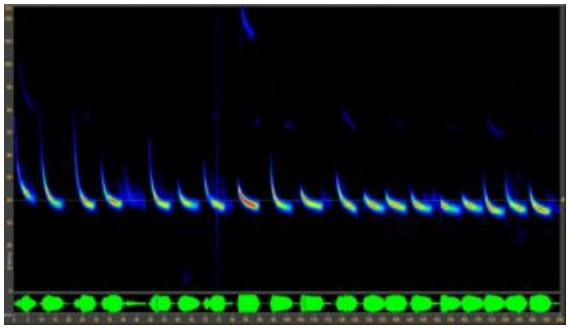
Nathusius' Pipistrelle - call duration 7.6-7.7 ms



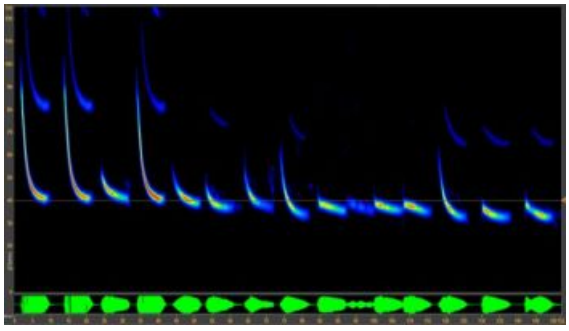
Kuhl's Pipistrelle - call duration 7.8-7.9 ms



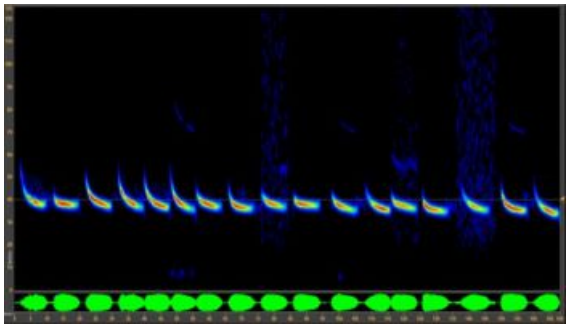
Nathusius' Pipistrelle - call duration 7.8-7.9 ms



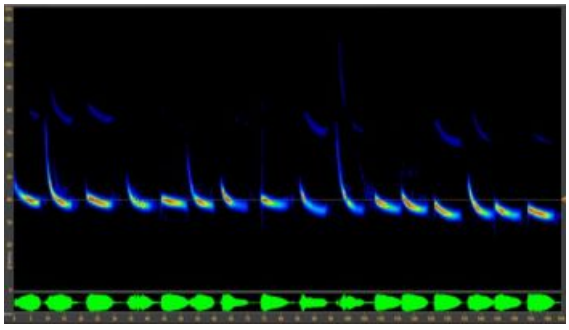
Kuhl's Pipistrelle - call duration 8.0-8.1 ms



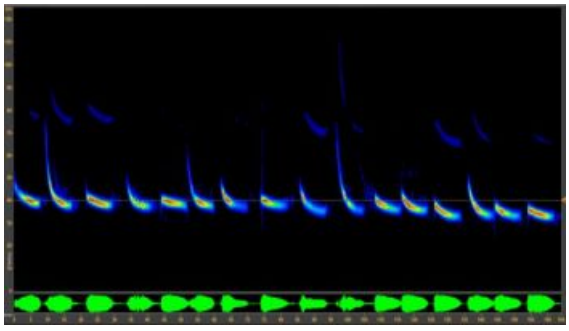
Nathusius' Pipistrelle - call duration 8.0-8.1 ms



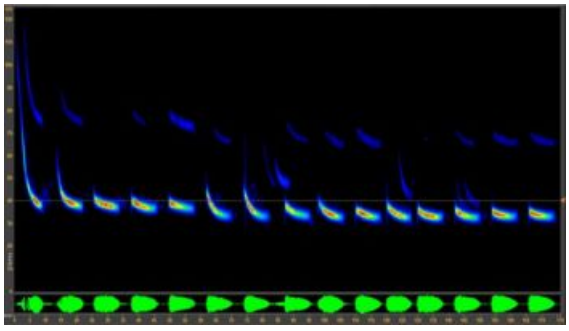
Kuhl's Pipistrelle - call duration 8.2-8.3 ms



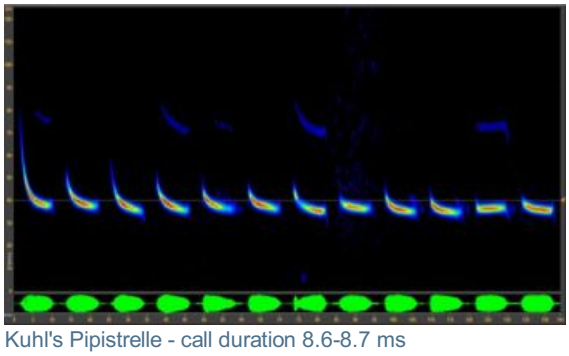
Nathusius' Pipistrelle - call duration 8.2-8.3 ms



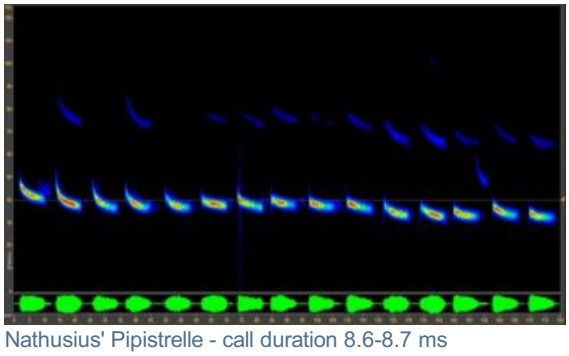
Kuhl's Pipistrelle - call duration 8.4-8.5 ms



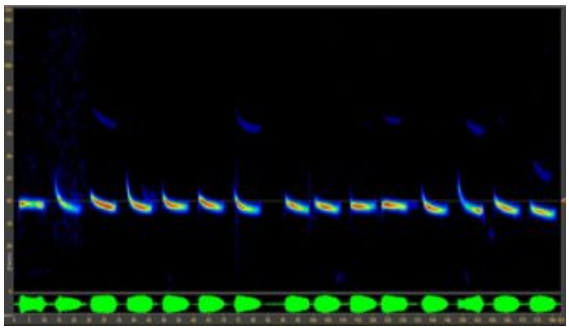
Nathusius' Pipistrelle - call duration 8.4-8.5 ms



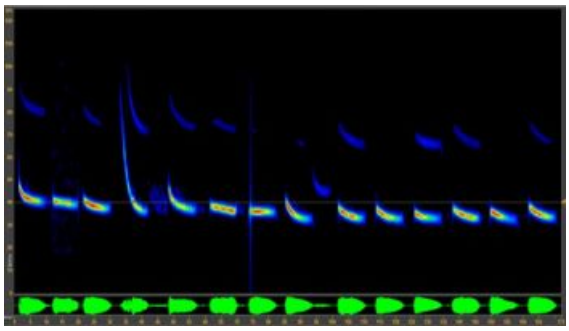
Kuhl's Pipistrelle - call duration 8.6-8.7 ms



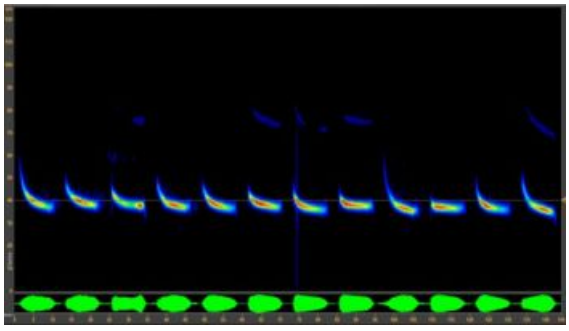
Nathusius' Pipistrelle - call duration 8.6-8.7 ms



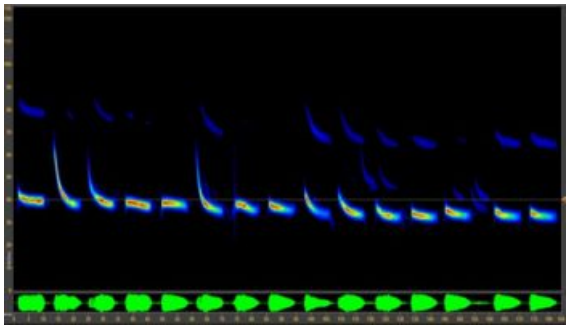
Kuhl's Pipistrelle - call duration 8.8-8.9 ms



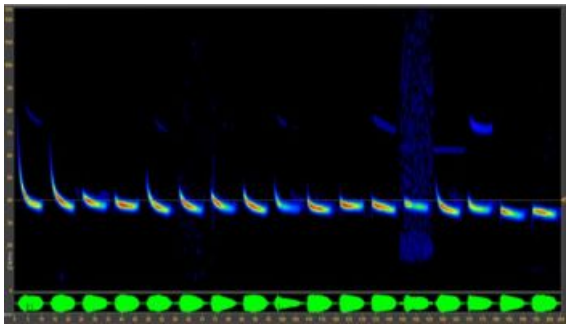
Nathusius' Pipistrelle - call duration 8.8-8.9 ms



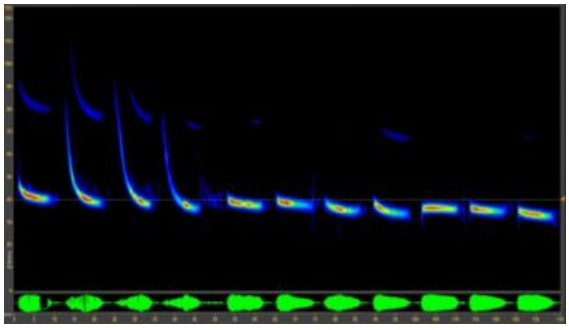
Kuhl's Pipistrelle - call duration 9.0-9.1 ms



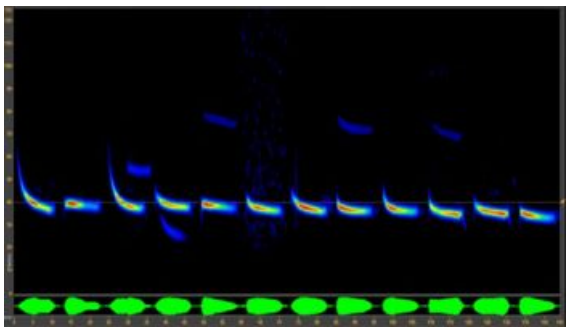
Nathusius' Pipistrelle - call duration 9.0-9.1 ms



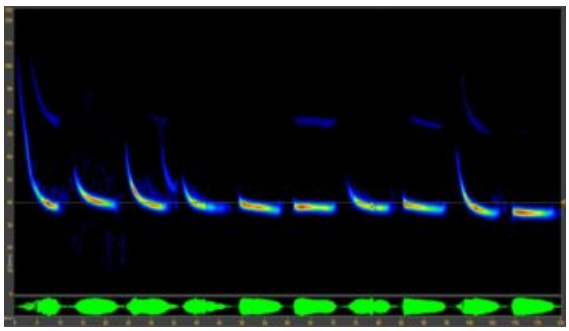
Kuhl's Pipistrelle - call duration 9.2-9.3 ms



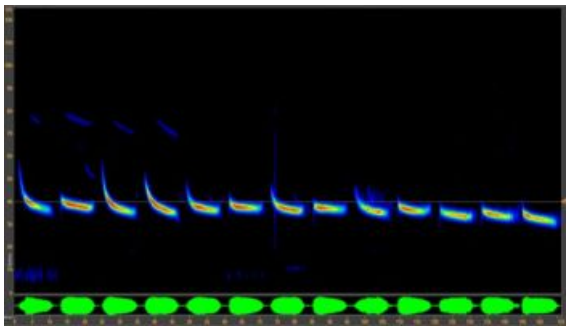
Nathusius' Pipistrelle - call duration 9.2-9.3 ms



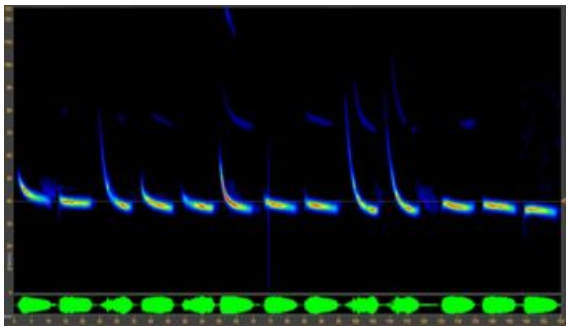
Kuhl's Pipistrelle - call duration 9.4-9.5 ms



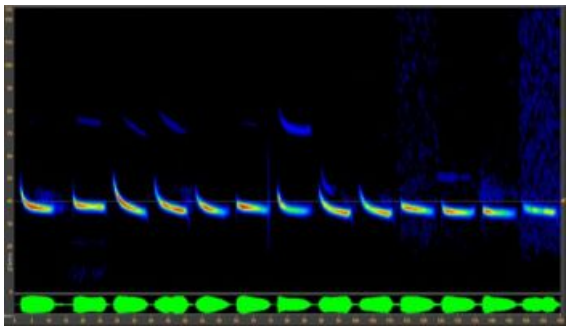
Nathusius' Pipistrelle - call duration 9.4-9.5 ms



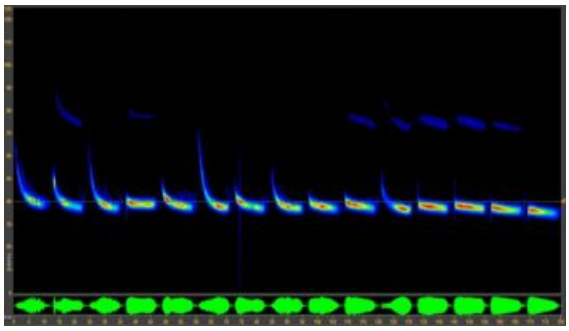
Kuhl's Pipistrelle - call duration 9.6-9.8 ms



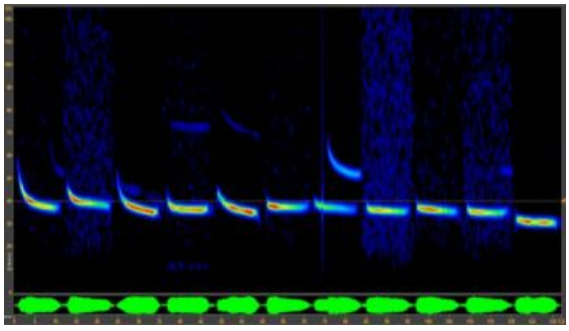
Nathusius' Pipistrelle - call duration 9.6-9.8 ms



Kuhl's Pipistrelle - call duration 9.9-10.1 ms

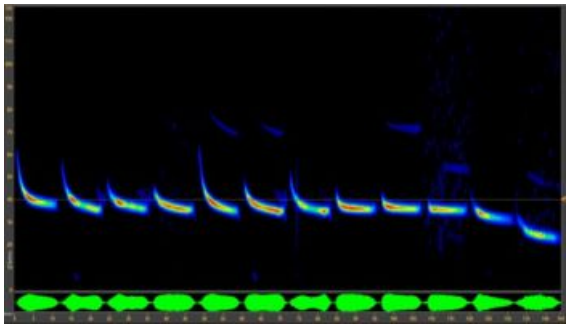


Nathusius' Pipistrelle - call duration 9.9-10.2 ms



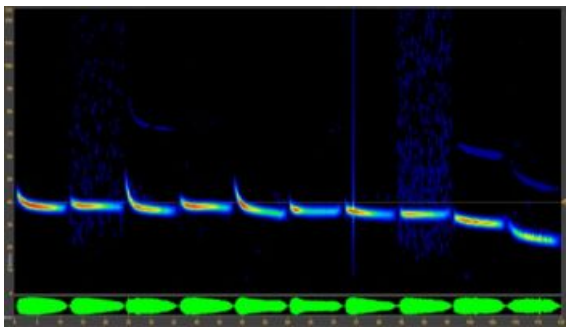
Kuhl's Pipistrelle - call duration 10.2-10.4 ms

Nathusius' Pipistrelle - fewer examples for this call duration

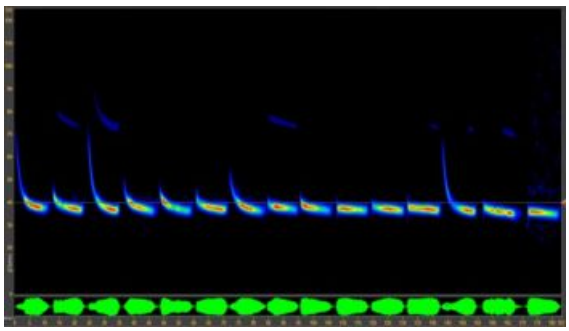


Kuhl's Pipistrelle - call duration 10.5-10.9 ms

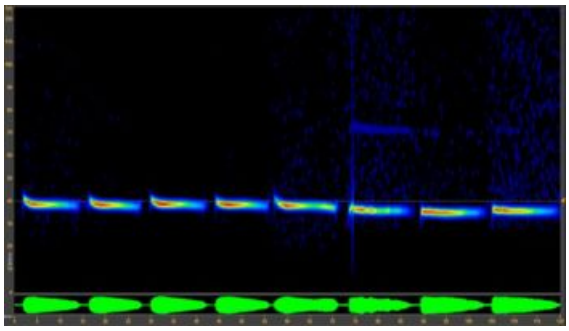
Nathusius' Pipistrelle - fewer examples for this call duration



Kuhl's Pipistrelle - call duration 11.0-11.7 ms



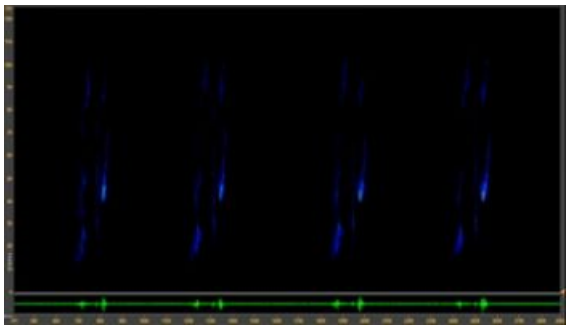
Nathusius' Pipistrelle - call duration 10.3-12.3 ms



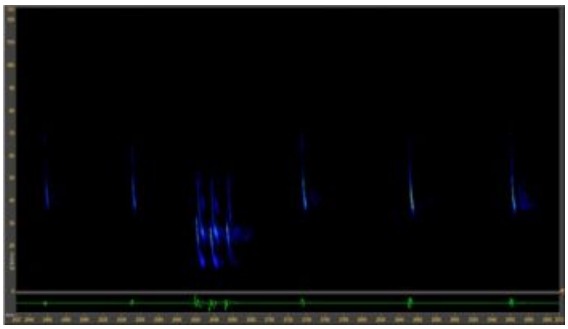
Kuhl's Pipistrelle - call duration 11.8-14.7 ms

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

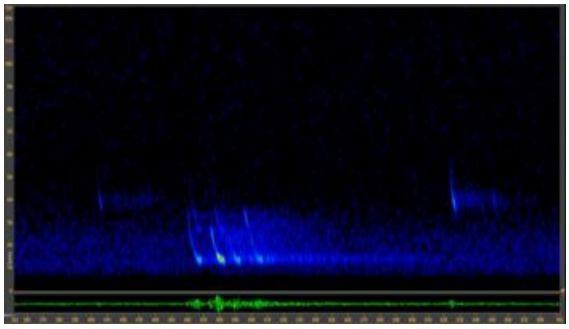
In addition to echolocation calls Kuhl's Pipistrelle and Nathusius' Pipistrelle also produce a range of social calls which can be assigned to species with confidence (observed variation in social calls shown below). Most of the observed social calls of Nathusius' Pipistrelle and Kuhl's Pipistrelle shown 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-sigmoides.pdf



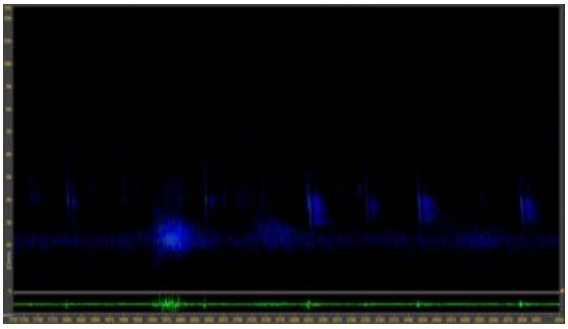
Nathusius' Pipistrelle male advertisement calls



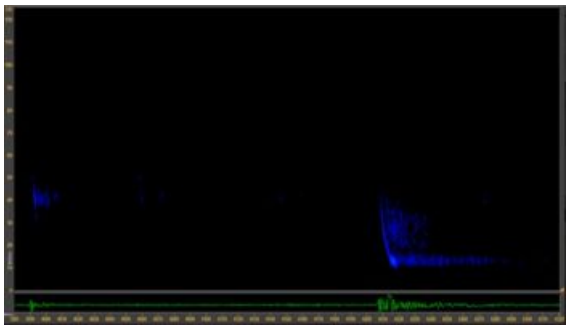
Kuhl's Pipistrelle - three-component social call



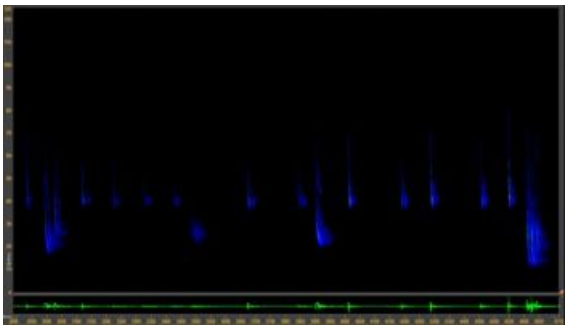
Kuhl's Pipistrelle - four-component social call



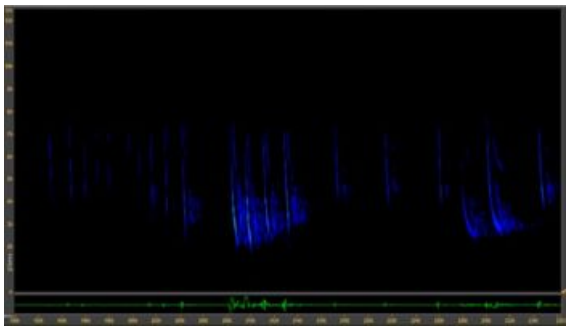
Kuhl's Pipistrelle - trills and low frequency 'myotis-like echolocation calls with social function



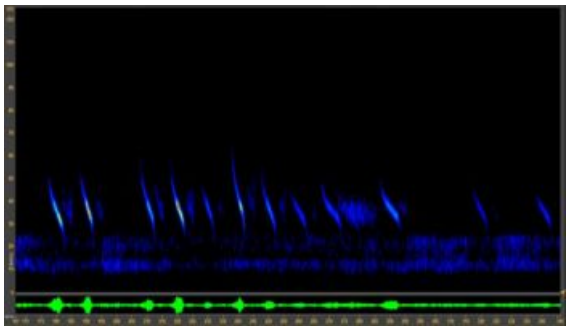
Kuhl's Pipistrelle - one-component social call



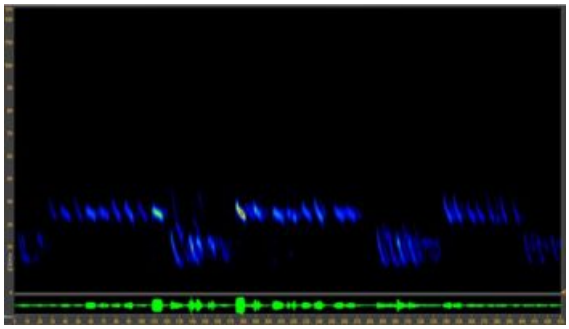
Kuhl's Pipistrelle - variation in social calls with different end frequency



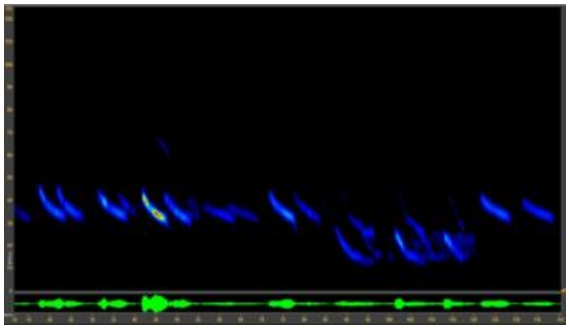
Kuhl's Pipistrelle - variation in social calls with different frequency



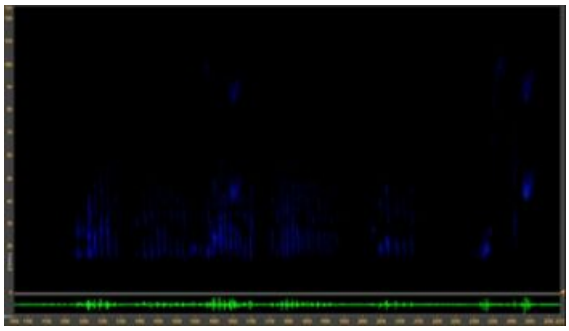
Kuhl's Pipistrelle - low frequency 'barbastelle-like' echolocation calls with social function



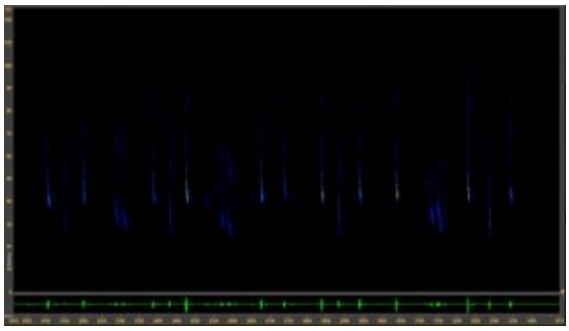
Kuhl's Pipistrelle - low frequency echolocation calls with social function and trills



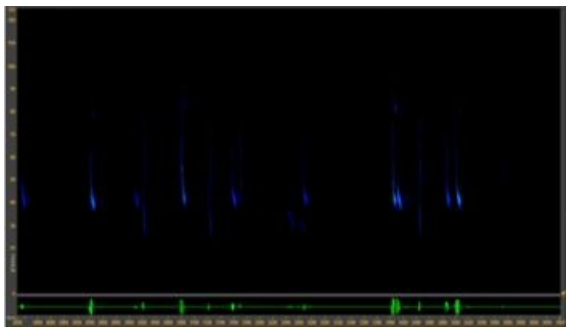
Kuhl's Pipistrelle - low frequency echolocation calls with social function and trills



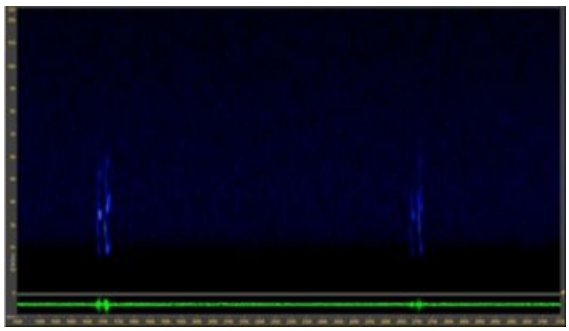
Nathusius' Pipistrelle - male advertisement calls and other social calls



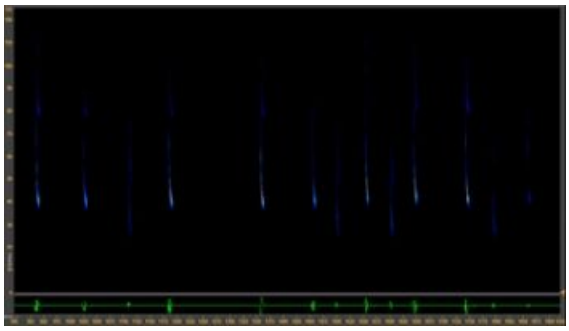
Nathusius' Pipistrelle - variation in social calls, including Plecotus-like calls



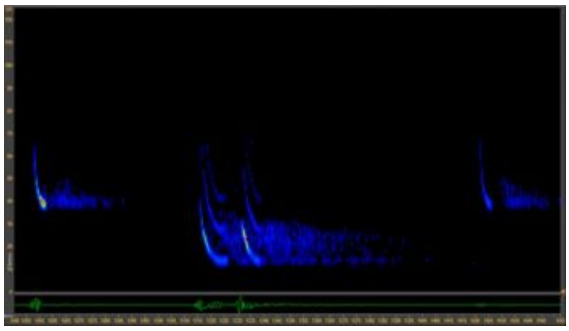
Nathusius' Pipistrelle - Plecotus-like social calls



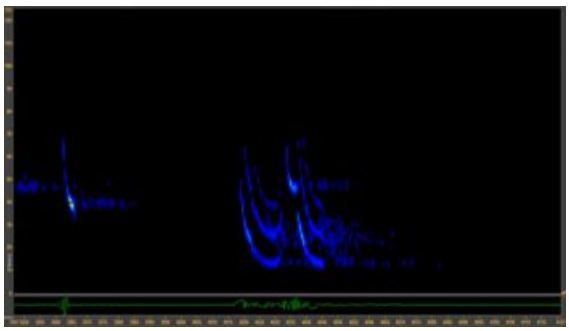
Nathusius' Pipistrelle - variation in social calls - potential confusion with Kuhl's Pipistrelle



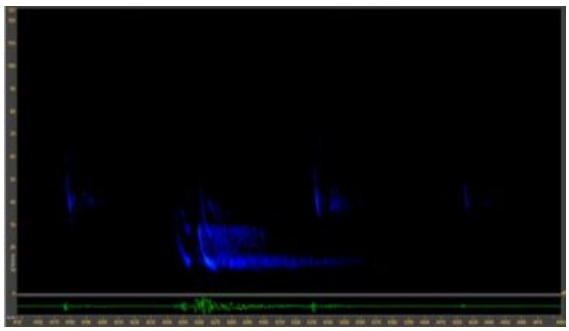
Nathusius' Pipistrelle - Plecotus-like social calls



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



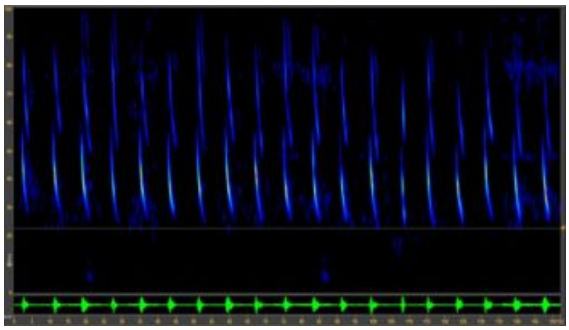
Kuhl's Pipistrelle - variation in two-component social calls



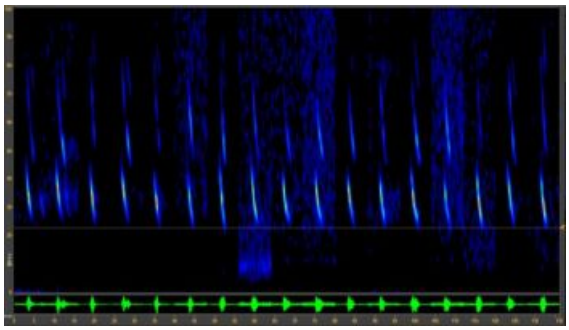
Kuhl's Pipistrelle - variation in two-component social call

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

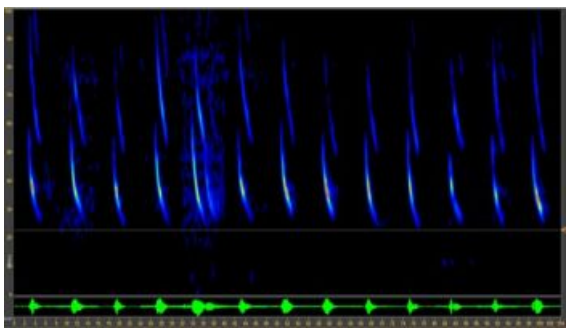
The echolocation and social calls of Grey Long-eared Bat are very similar to Brown Long-eared Bat, but given good recordings and an understanding of what the calls of the two species should look like given the call duration, it should be possible to assign a majority of recordings to species. To illustrate 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 to 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).



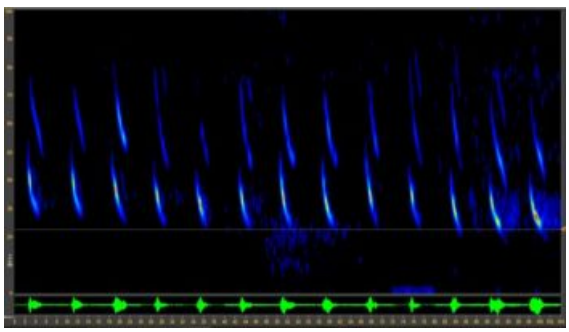
Brown Long-eared Bat - call duration 1.0-1.8 ms



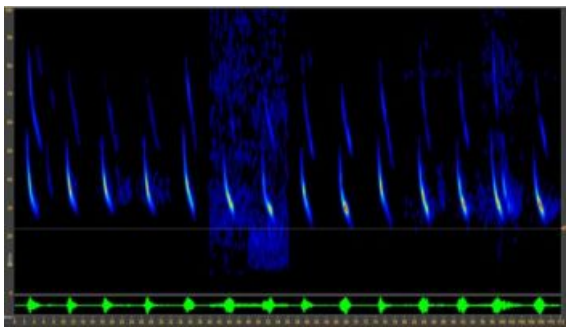
Grey Long-eared Bat - call duration 1.2-1.6 ms



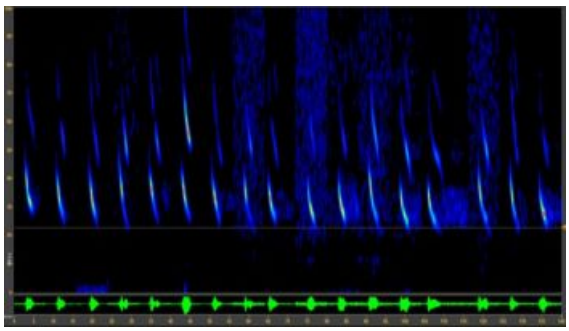
Brown Long-eared Bat - call duration 1.9-2.0 ms



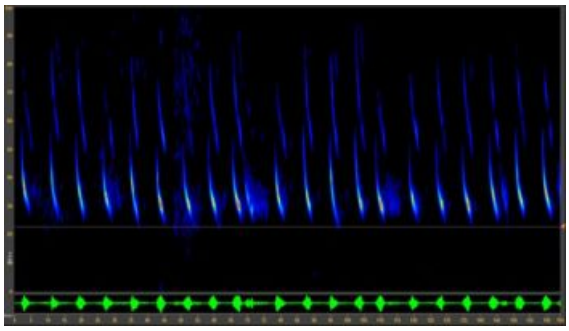
Grey Long-eared Bat - call duration 1.9-2.0 ms



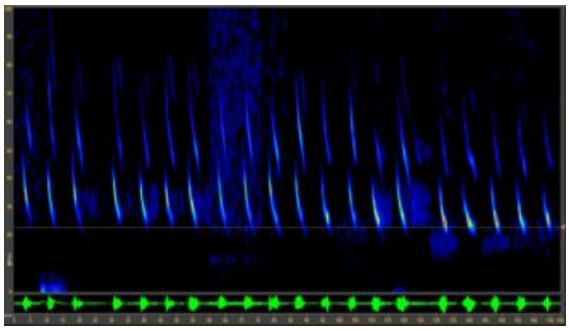
Brown Long-eared Bat - call duration 2.1-2.2 ms



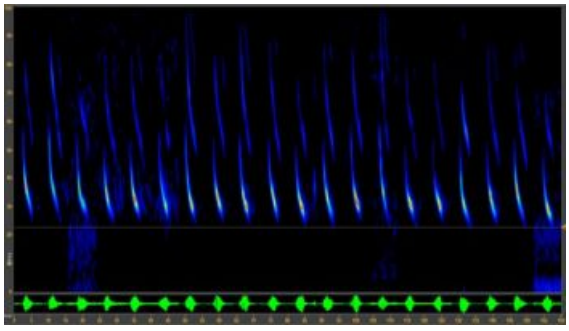
Grey Long-eared Bat - call duration 2.1-2.2 ms



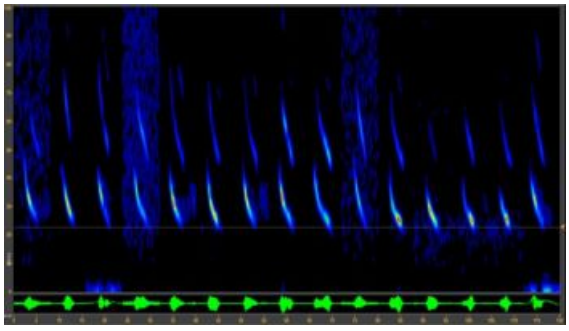
Brown Long-eared Bat - call duration 2.5-2.6 ms



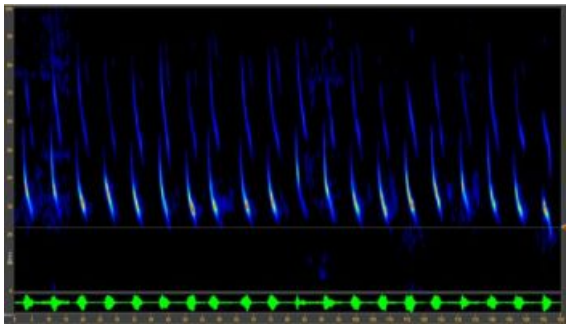
Grey Long-eared Bat - call duration 2.3-2.6 ms



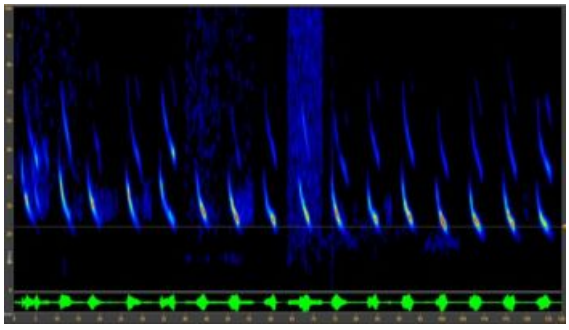
Brown Long-eared Bat - call duration 2.7-2.8 ms



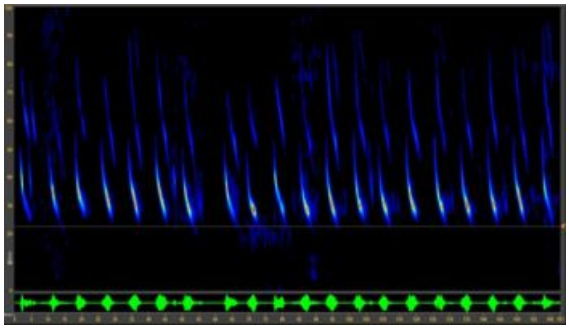
Grey Long-eared Bat - call duration 2.7-2.8 ms



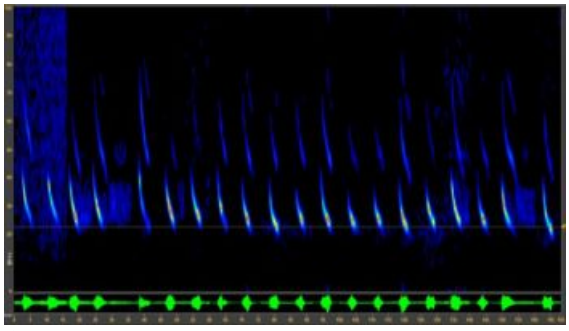
Brown Long-eared Bat - call duration 2.9-3.0 ms



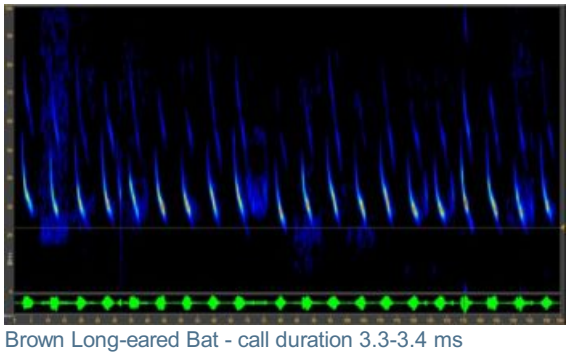
Grey Long-eared Bat - call duration 2.9-3.0 ms



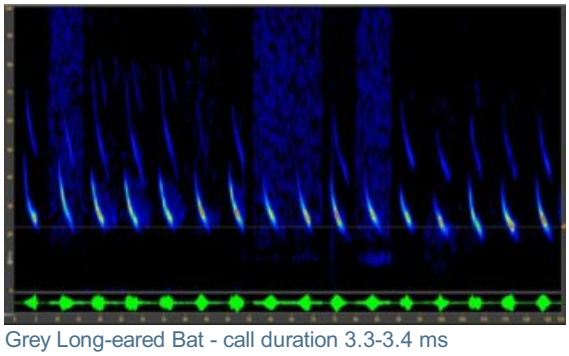
Brown Long-eared Bat - call duration 3.1-3.2 ms



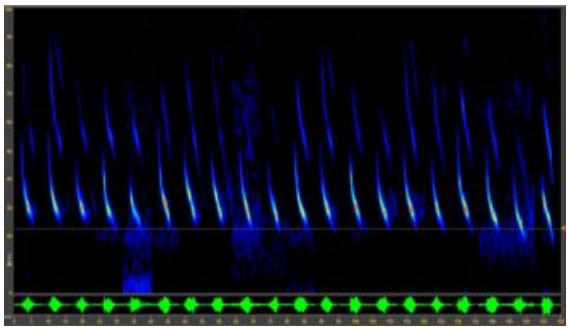
Grey Long-eared Bat - call duration 3.1-3.2 ms



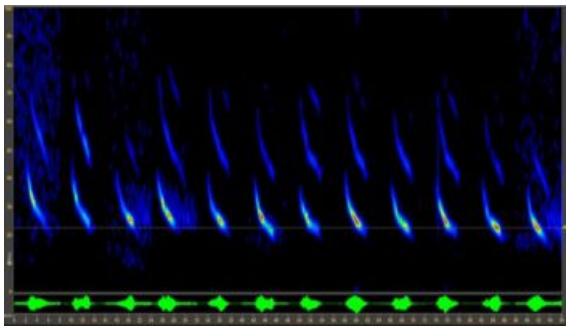
Brown Long-eared Bat - call duration 3.3-3.4 ms



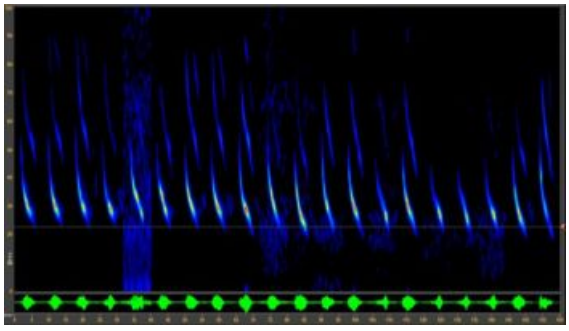
Grey Long-eared Bat - call duration 3.3-3.4 ms



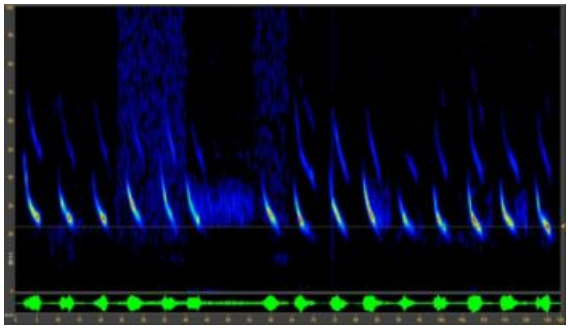
Brown Long-eared Bat - call duration 3.5-3.6 ms



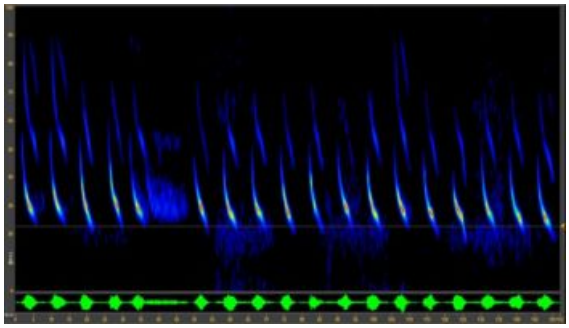
Grey Long-eared Bat - call duration 3.5-3.6 ms



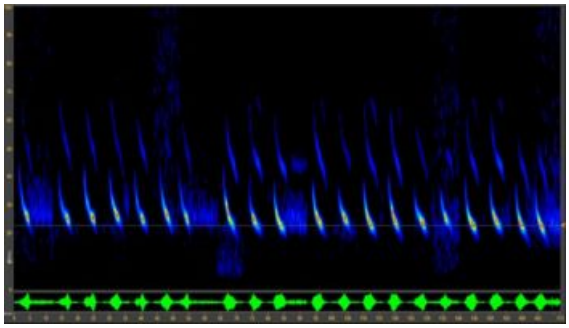
Brown Long-eared Bat - call duration 3.7-3.8 ms



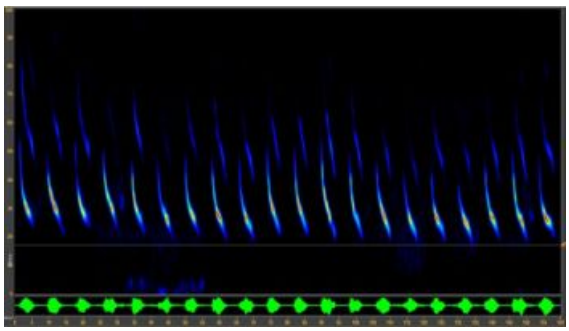
Grey Long-eared Bat - call duration 3.7-3.8 ms



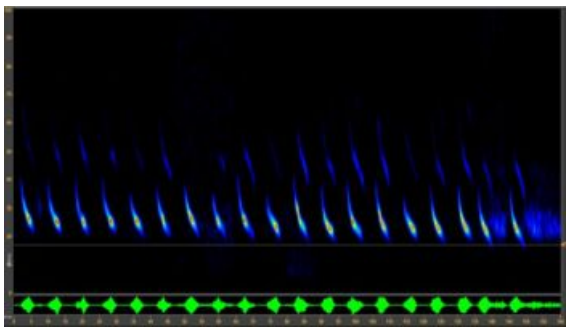
Brown Long-eared Bat - call duration 3.9-4.0 ms



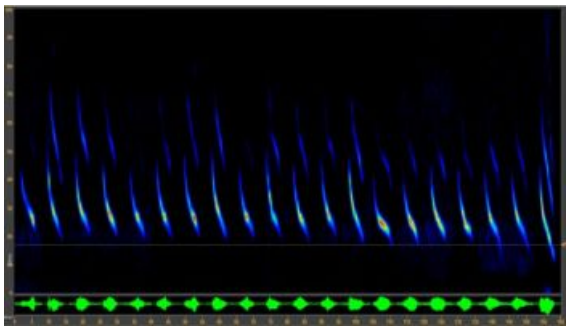
Grey Long-eared Bat - call duration 3.9-4.0 ms



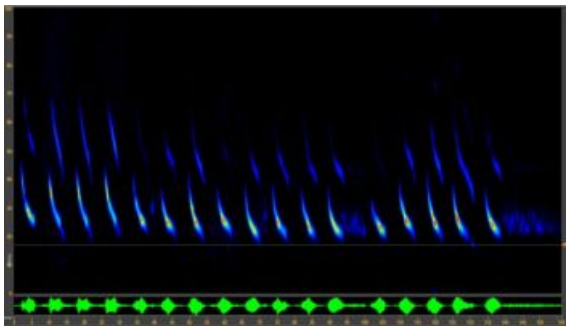
Brown Long-eared Bat - call duration 4.1-4.2 ms



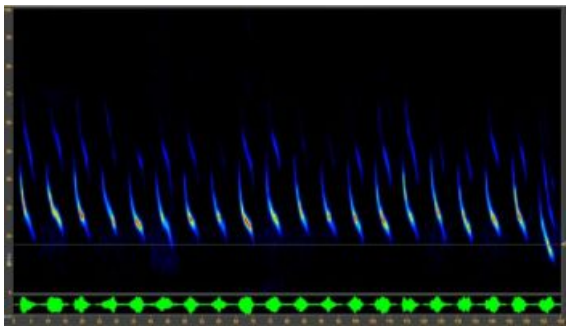
Grey Long-eared Bat - call duration 4.1-4.2 ms



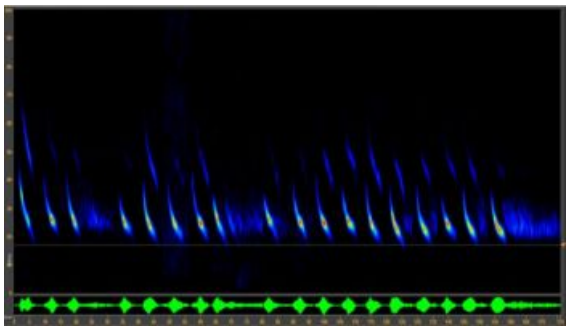
Brown Long-eared Bat - call duration 4.3-4.4 ms



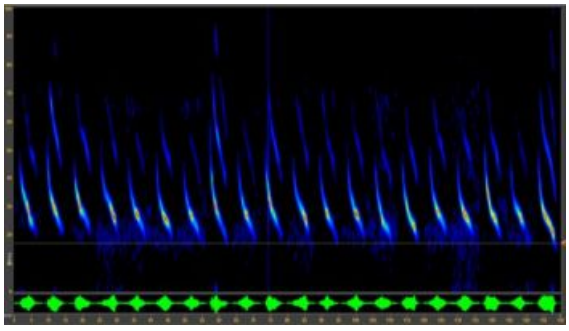
Grey Long-eared Bat - call duration 4.3-4.4 ms



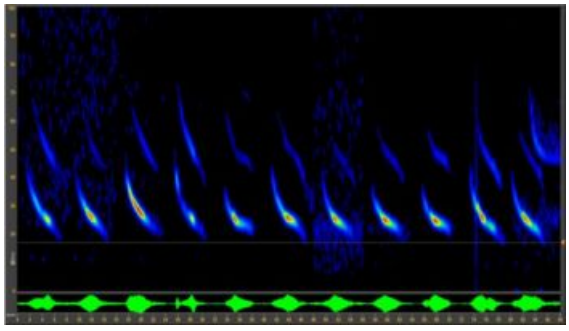
Brown Long-eared Bat - call duration 4.5-4.6 ms



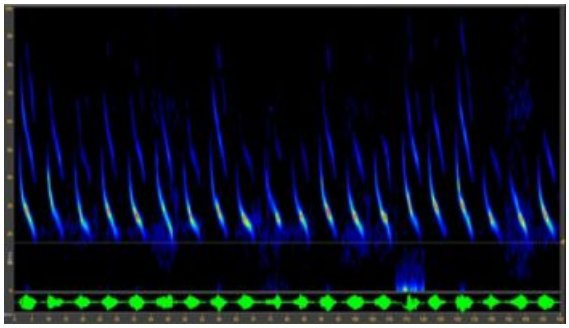
Grey Long-eared Bat - call duration 4.5-4.6 ms



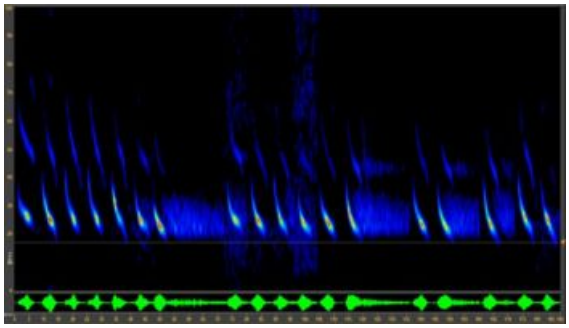
Brown Long-eared Bat - call duration 4.7-4.8 ms



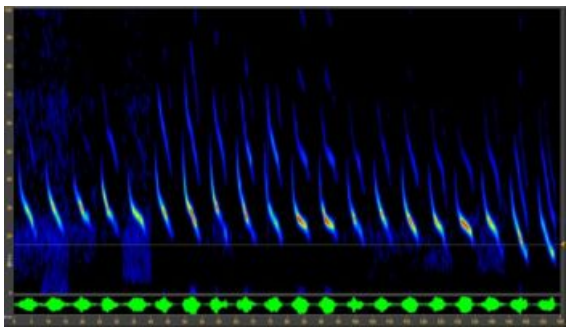
Grey Long-eared Bat - call duration 4.7-4.8 ms



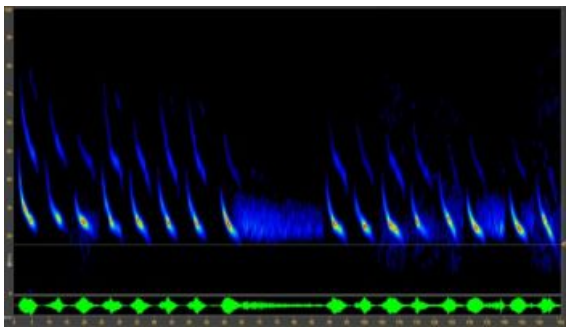
Brown Long-eared Bat - call duration 4.9-5.0 ms



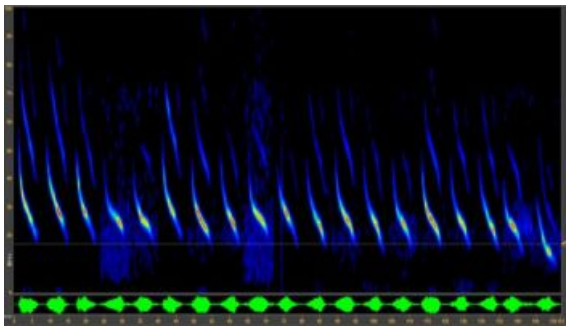
Grey Long-eared Bat - call duration 4.9-5.0 ms



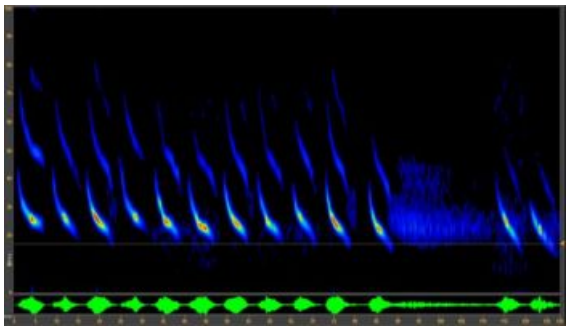
Brown Long-eared Bat - call duration 5.1-5.2 ms



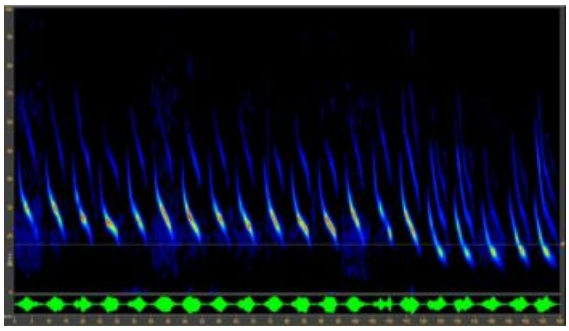
Grey Long-eared Bat - call duration 5.1-5.2 ms



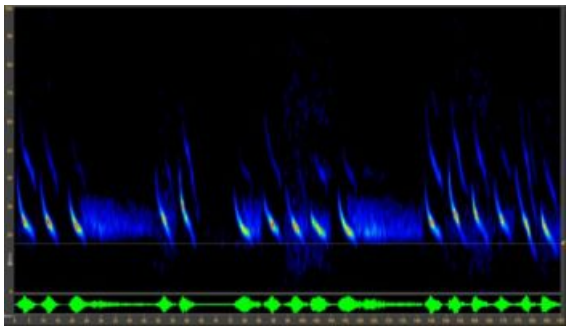
Brown Long-eared Bat - call duration 5.3-5.4 ms



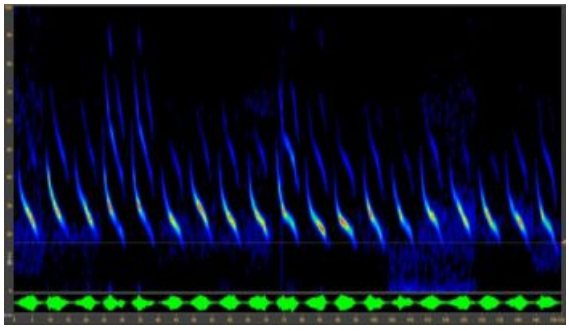
Grey Long-eared Bat - call duration 5.3-5.5 ms



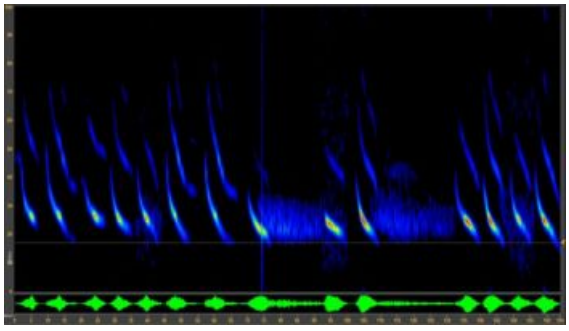
Brown Long-eared Bat - call duration 5.5-5.8 ms



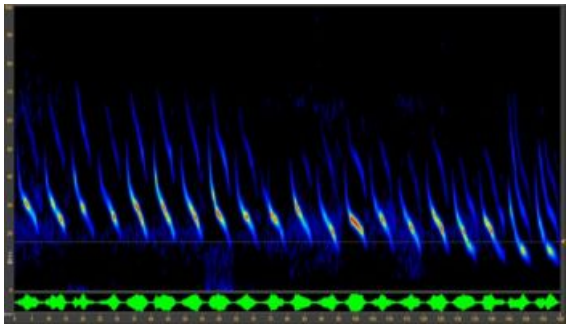
Grey Long-eared Bat - call duration 5.6-5.8 ms



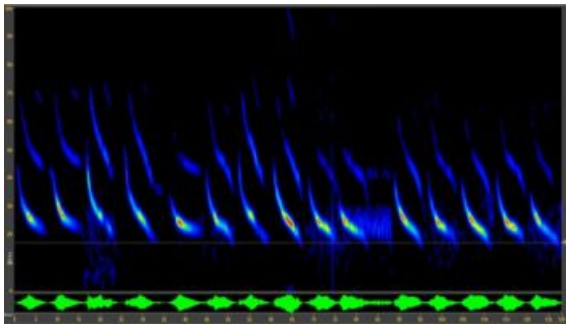
Brown Long-eared Bat - call duration 5.9-6.2 ms



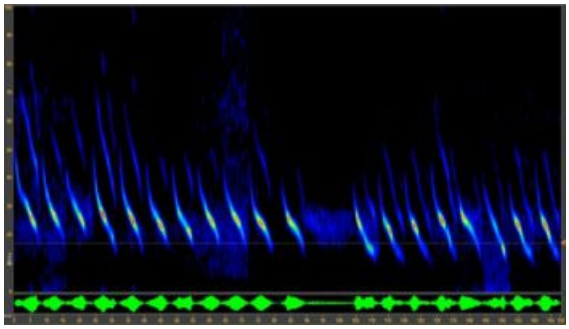
Grey Long-eared Bat - call duration 5.9-6.2 ms



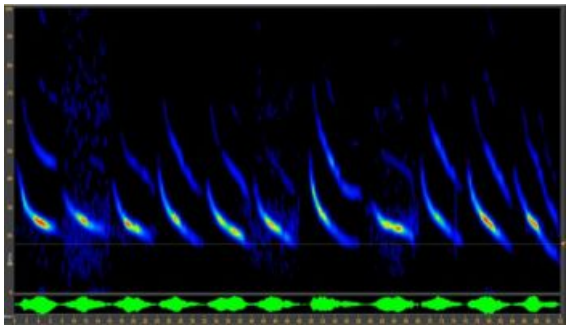
Brown Long-eared Bat - call duration 6.3-6.4 ms



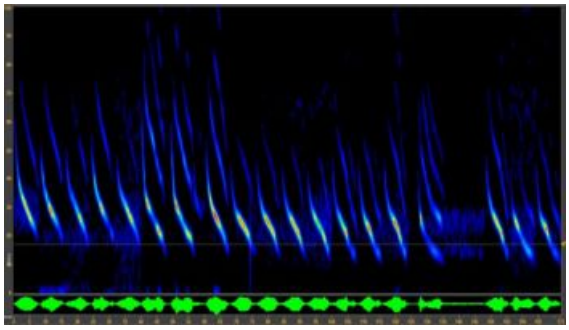
Grey Long-eared Bat - call duration 6.3-6.5 ms



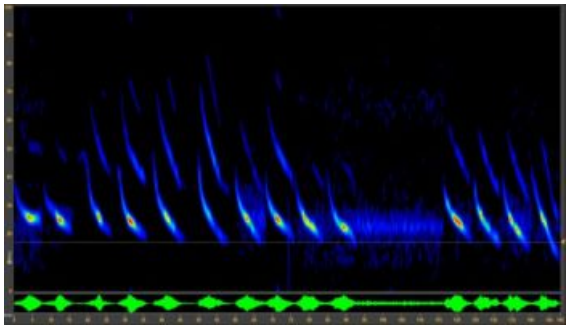
Brown Long-eared Bat - call duration 6.7-6.8 ms



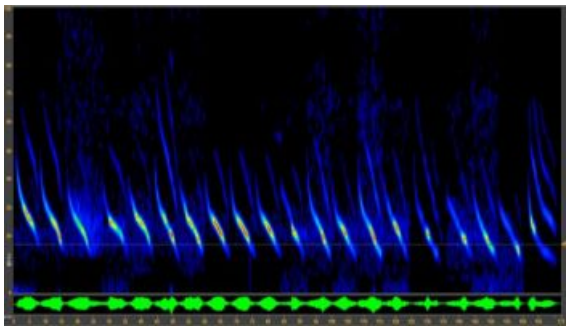
Grey Long-eared Bat - call duration 6.6-6.8 ms



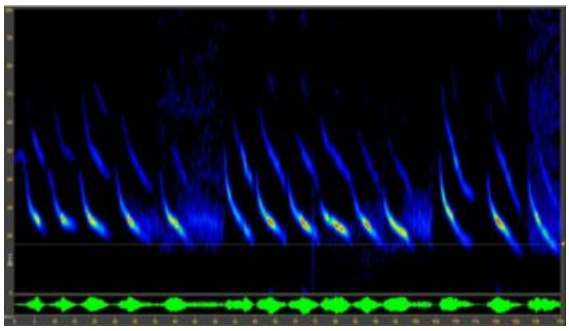
Brown Long-eared Bat - call duration 6.9-7.0 ms



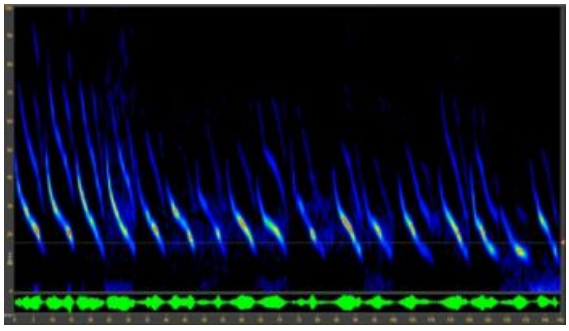
Grey Long-eared Bat - call duration 6.9-7.1 ms



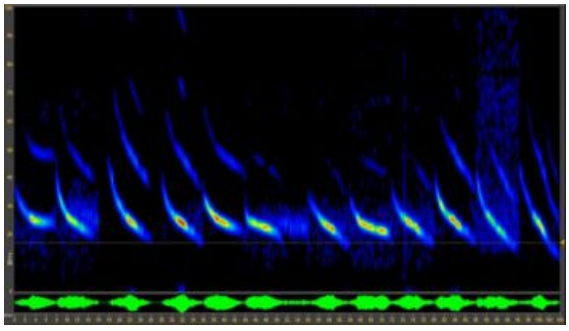
Brown Long-eared Bat - call duration 7.3-7.4 ms



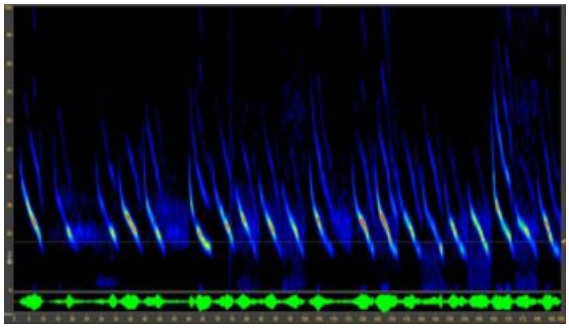
Grey Long-eared Bat - call duration 7.2-7.4 ms



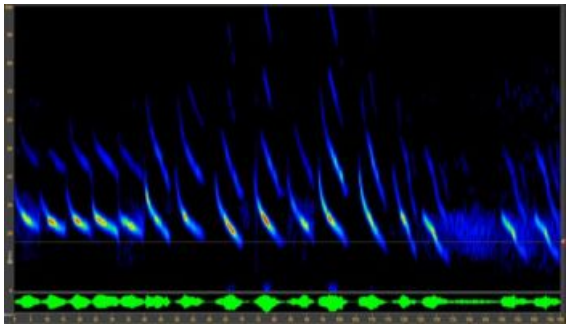
Brown Long-eared Bat - call duration 7.5-7.6 ms



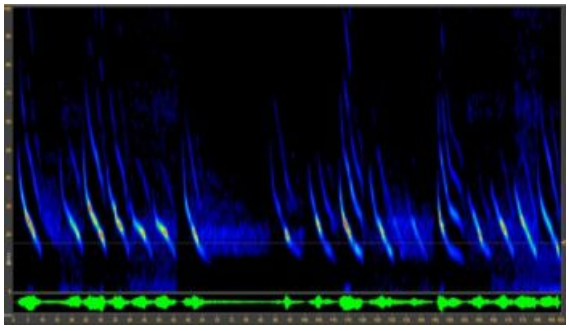
Grey Long-eared Bat - call duration 7.5-7.6 ms



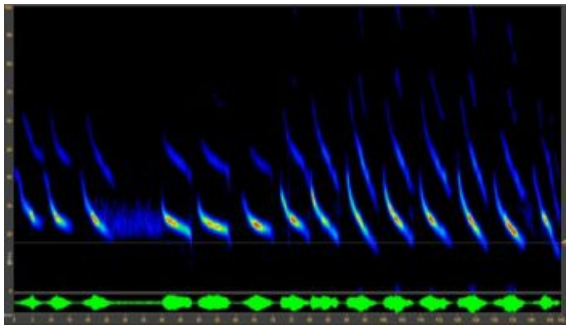
Brown Long-eared Bat - call duration 7.7-7.8 ms



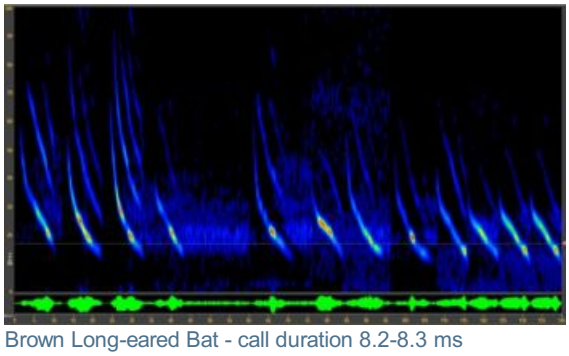
Grey Long-eared Bat - call duration 7.7-7.8 ms



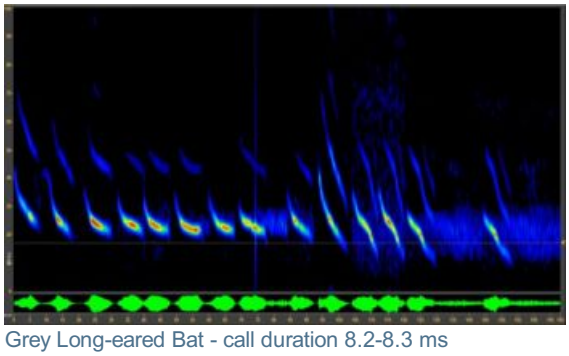
Brown Long-eared Bat - call duration 7.9-8.1 ms



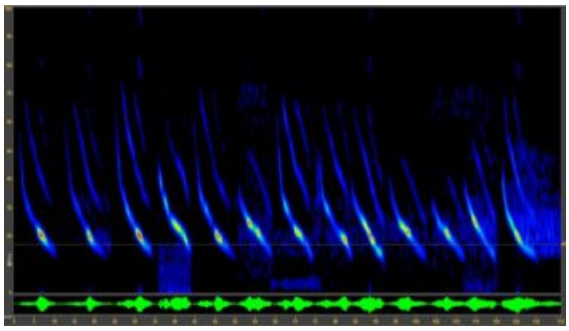
Grey Long-eared Bat - call duration 7.9-8.1 ms



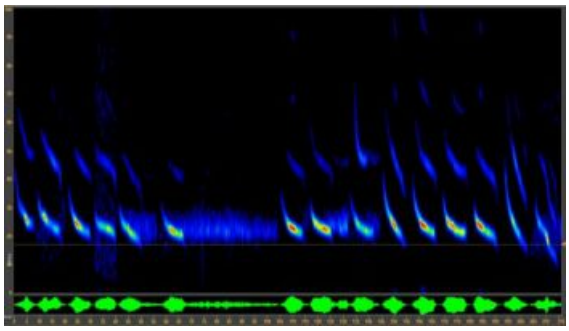
Brown Long-eared Bat - call duration 8.2-8.3 ms



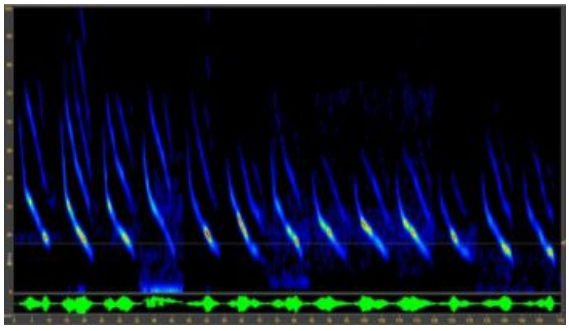
Grey Long-eared Bat - call duration 8.2-8.3 ms



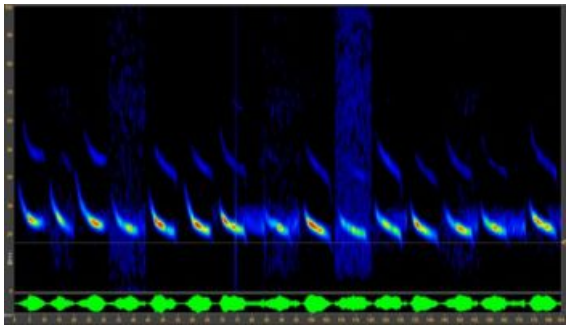
Brown Long-eared Bat - call duration 8.4-8.6 ms



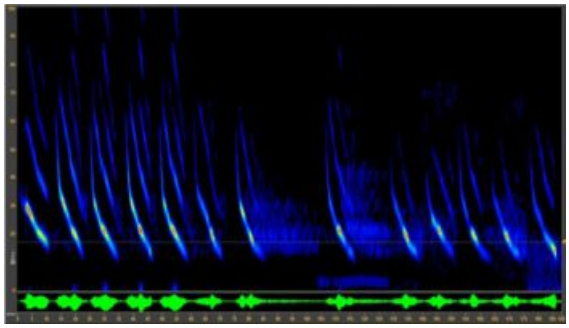
Grey Long-eared Bat - call duration 8.4-8.7 ms



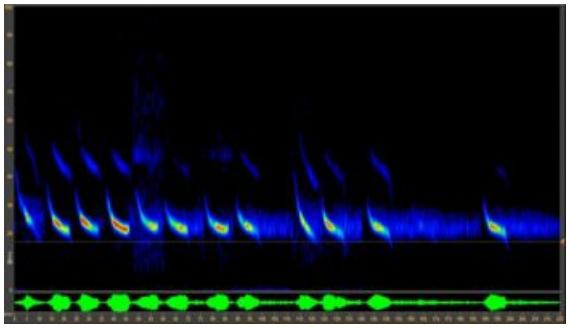
Brown Long-eared Bat - call duration 8.7-9.0 ms



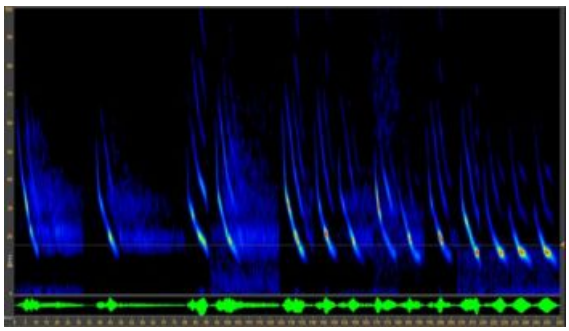
Grey Long-eared Bat - call duration 8.8-9.1 ms



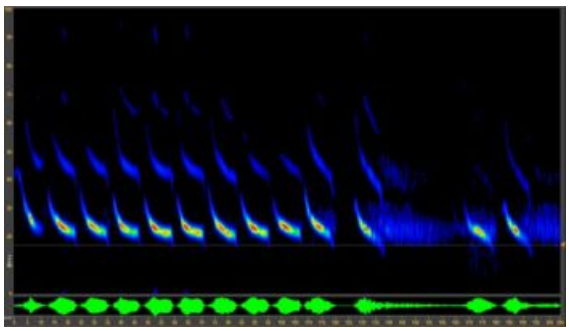
Brown Long-eared Bat - call duration 9.1-9.5 ms



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

Identification appendix 8: Unidentified ‘big bat’ on Sark

A series of 11 recordings of an interesting ‘big bat’ species were made on Sark from the same location (49.43643, -2.35531) over three consecutive nights between the 7-9th September.

- There was no evidence of alternation in the frequency of the calls (‘clip-clop’ sound when played), which is normally seen / heard in a sequence of calls produced by Leisler’s bat or Noctule. It would be unusual not to see clear alternation in the frequency of calls in all 11 recordings, if these were produced by Leisler’s bat (or Noctule).
- We excluded Noctule as a possibility because the calls, given the observed call duration, were higher in frequency than expected for Noctule.
- Serotine and Parti-coloured Bat (a potential vagrant to the Channel Islands) do not produce calls that alternate in frequency. In support of Parti-coloured bat, some sequences of longer duration calls, would also be very unusual for Serotine.
- The shape of some of the calls were very similar to calls commonly produced by Parti-coloured Bat based on known recordings of this species. For example, see the shape of the calls in the recording from the 7th September at 00:39:04.

Marc Van de Sijpe and Alex Lefevre

We think that these recordings are interesting and intriguing.

- There are no long narrow-band quasi-constant frequency calls indicative of a bat in high flight in the open.
- Many calls are quite short.
- The frequencies are generally high.
- Some broadband calls here have quite high-end frequencies (some around 30 kHz) combined with a duration of almost 10 ms. Other calls have lower end frequencies around 25-26.
- We also listened to these calls in heterodyne as well as using ‘virtual bat’ in the software BatSound.

We do not believe that these calls were produced by a *Nyctalus* species (Leisler’s Bat or Noctule). We also do not think that these were produced by Serotine. We believe that Parti-coloured Bat is the most probable species.

Chris Corben

- The following four wav files look like Serotine. Looking at the timing, these files depict two events two nights apart (7th September 00:39:04 and 0039:09, and 9th September 03:05:56 and 03:05:01).
- The next five files all happened in 8 minutes, and so are likely to be the same bat. They also show similar features, which are consistent with Leisler’s Bat or Noctule. I consider that Leisler’s Bat is more likely, because a large part of the calls are above 25 kHz (9th September 05:04:03, 05:11:33, 05:11:57, 05:12:02, 05:12:14).
- My guess is that Parti-coloured Bat does not often produce calls like these. I watched a Parti-coloured Bat for hours in Vilnius, and the thing which struck me most, is that its behaviour reminded me more of Pipistrelle species in some ways. So, the rapid changes in frequency were short duration events in long strings of similar low slope calls. Think of a bat hunting fairly close to trees, but rather quickly dropping back to produce low clutter type calls (long narrow band calls) between each attack event, apparently not sensing clutter from as far as a *Nyctalus*, and perhaps from not even so far as Serotine.
- The following two files are different (9th September 04:19:01 and 8th September 02:54:18). The first of these could be Serotine in a lot of clutter. In this case, I do not have any recordings of Serotine which look quite like this file. This might just be a weird Leisler’s Bat, for example, but I think extended sequences of high clutter calls is more an *Eptesicus* thing than *Nyctalus*. The second file from the 8th September is the only file from that night. The pulses are similar in duration to most of the pulses in your 11 files, but a lot lower in slope. I could imagine similar pulses being made by Leisler’s Bat or Parti-coloured Bat.

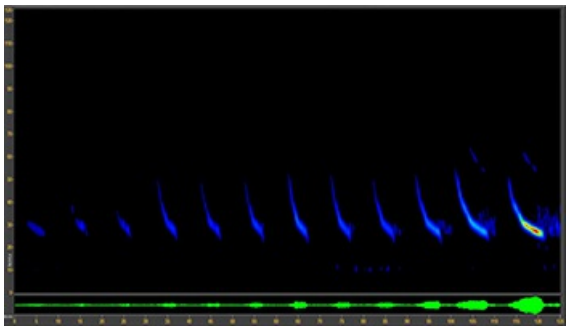
I suppose a subject worth thinking about is what effect vagrancy has on a bat. What happens if a bat finds itself somewhere very unfamiliar? This is one of the things I love about vagrancy. They give you the chance to see what a single individual can get up to. And that also relates to your point about these Sark recordings. If one bat turns up somewhere unusual in a vagrancy event, why couldn’t others also? So, my suggestion is that you have two bats in these files rather than just one, and maybe these last two recordings are of another. But overall, you have 5 events,

two of which seem very similar. Maybe they are all the same bat, but I think it makes more sense if there were at least two.

Summary

- Parti-coloured bat is one of the most difficult bat species in Europe to identify given echolocation calls alone, particularly to distinguish this species from Leisler's Bat (see e.g. Russ 2021).
- Marc Van de Sijpe and Alex Lefevre are in agreement with our initial thinking that these recordings are unusual, and were most likely to have been produced by Parti-coloured Bat. In contrast, Chris Corben considered that the most likely possibility was that the recordings were produced by more than one bat, of two species, Serotine (and most likely) Leisler's Bat.
- More typical sequences of Leisler's Bat (as a new species for Sark) calls were recorded on Sark about a month later, but there is a question around how likely is it that two new species for Sark - Leisler's Bat and Serotine, were recorded at the same location within a day of each other? As both species are likely to be migrants, perhaps this is possible given similar weather conditions?

Given the above comments, we agree with Chris Corben, that it is conceivable that the recordings were produced by two bat species – Serotine and Leisler's Bat. However, there are still some unexpected characters that initially led us to consider Parti-coloured Bat, where we are still not confident to assign these to Serotine and Leisler's Bat.



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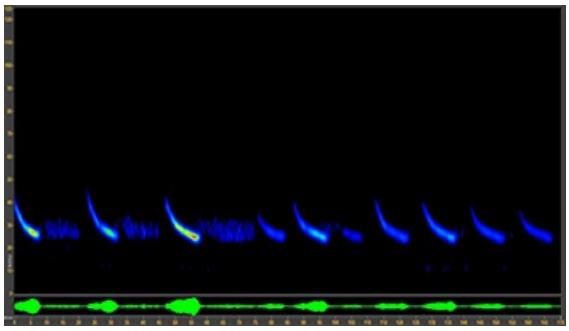

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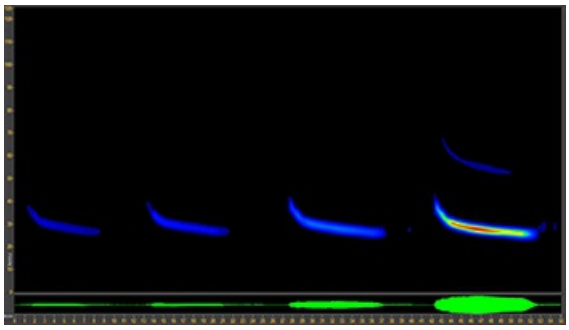

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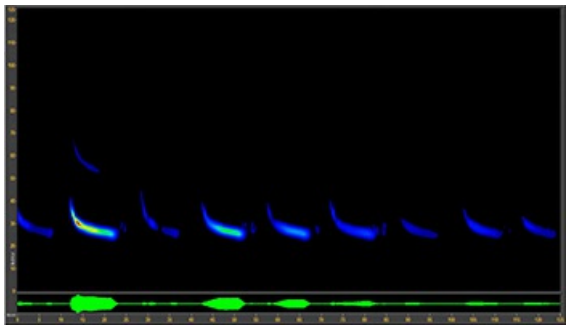

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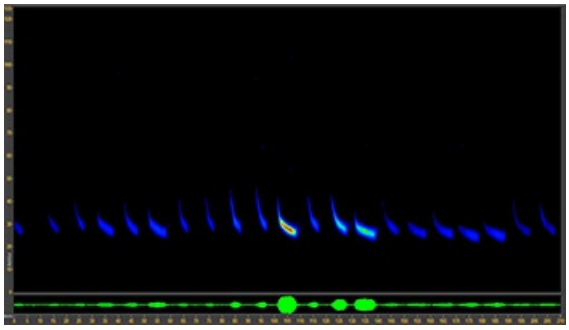

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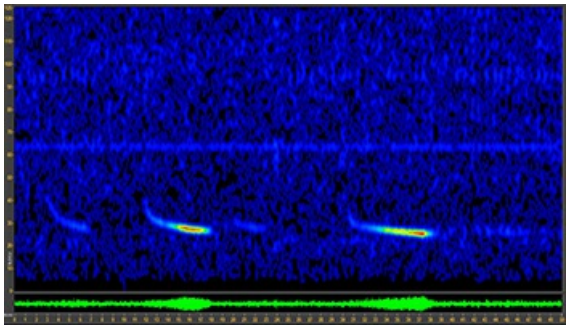

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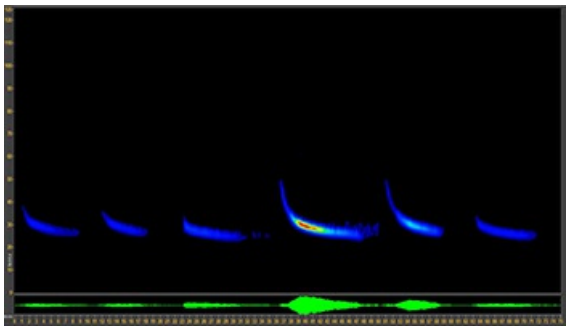

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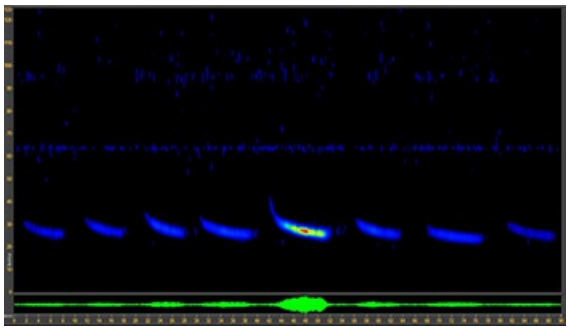

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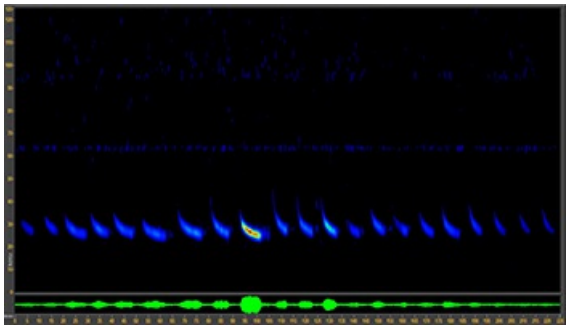

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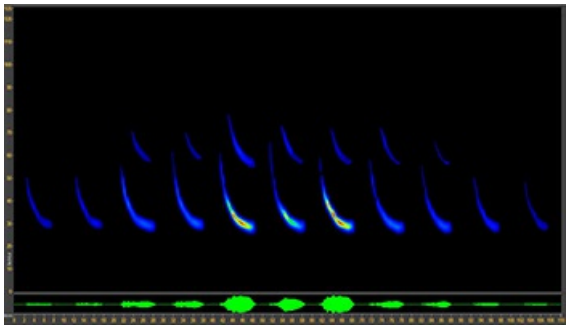

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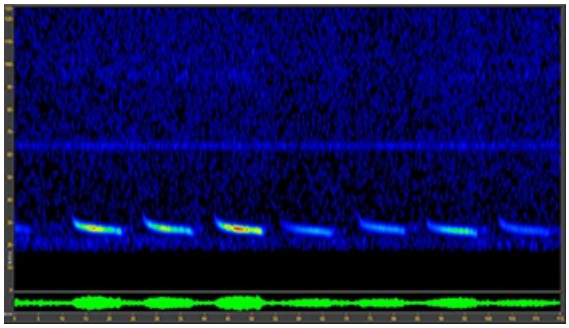

Unidentified - 8th Sept 025418




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: Grey Long-eared Bat, by Henry Schofield.

Bailiwick Bat Survey: 2023 season 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.W., Henney, J.M., Higgins, L., McLellan, G.D., Lewis, M., Simmons, M.C., & Atkinson, P.W. (2024). Bailiwick Bat Survey: 2023 season report. *BTO Research Report* **764**, BTO, Thetford, UK.

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