Bats of the Isles of Scilly

2022

Isles of Scilly Wildlife Trust

Funded by:
ISLES OF SCILLY
Area of Outstanding Natural Beauty

Bat Conservation Trust

BTO

BIG SCILLY BAT SURVEY: 2022

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1. SUMMARY

The Big Scilly Bat Survey is a citizen science project which operated its first year of survey in 2022. This first year of the survey was funded by the Isles of Scilly Area of Outstanding Natural Beauty (supported by funds from Defra, Council of the Isles of Scilly, the Duchy of Cornwall, Tresco Estate and the Isles of Scilly Wildlife Trust). No funding has been identified for the survey in 2023, but the Isles of Scilly Wildlife Trust is committed to continuing it.

Led by the Isles of Scilly Wildlife Trust along with Stuart Newson of the British Trust for Ornithology (BTO), the survey involved deployment of static bat detectors across all five inhabited islands between May and October 2022. This was undertaken by volunteers who were involved in each step from deployment of the detector to uploading the data and receiving the initial results.

The technique uses a partially automated acoustic analysis technique – the BTO Acoustic Pipeline – with verification and correction by the project lead to ensure accuracy. The technique is primarily focussed on bats, but is also able to detect and identify bush-crickets, small mammals and audible moths.

The initial survey results confirm the widespread presence of common pipistrelle bats across all five islands, with Nathusius' and soprano pipistrelle confirmed significantly less frequently on a smaller geographic scale. No other bat species were identified. The absence of brown long-eared bats from the dataset is likely due to their very quiet echolocation characteristics and therefore the previously confirmed breeding populations may well have been overlooked by the surveys. However, the absence of records of Leisler's/serotine which have previously been suspected does indicate either their absence or only transient presence on the islands.

The very low levels of encounter with soprano pipistrelle would indicate a very small population – if viable breeding populations exist on the islands, it is likely that they are threatened through small genetic variation and susceptibility to stochastic events. As such, they would be a high priority for conservation efforts. Further research, potentially using more advanced techniques such as harp trapping or mist netting would be valuable to further characterise their current status.

Four different species of bush-cricket were identified, and the broad pre-existing understanding of their distribution across the islands was reflected by the survey results. These are long-winged conehead, speckled bush-cricket, grey bush-cricket and great green bush-cricket. Two species which were historically recorded on the islands – large conehead and short-winged conehead – were not identified in the dataset; however, this may well reflect the limitations of a static monitoring survey technique on a population with a restricted geographic range – therefore absence should not be assumed based on these initial results.

Three species of small mammal were recorded – these are wood mouse, lesser white-toothed shrew and brown rat. Whilst the widespread presence of lesser white-toothed shrew reflects our prior understanding, the infrequency of wood mouse and absence of house mouse are

likely due to their quiet and easily attenuated calls. The detection distance of these last two species is less than two meters (Newson & Pearce 2021), so raising up the bat detector into the bats flyway limits the chance of recording these species. Brown rat was confirmed on all islands except for St Agnes, as expected following the successful eradication of this species on that island.

The survey provides an excellent baseline for understanding the species composition and geographic distribution of bats on the islands, and the second and third year of surveys will refine the technique to answer further questions around habitat use, seasonal variation and species composition.

2. AIMS & OBJECTIVES

The Big Scilly Bat Survey harnesses the enthusiasm of local volunteers to participate in biodiversity monitoring to help collect bat distribution data across Scilly. In its first year, the surveys concentrated on the five inhabited islands of Tresco, St Mary's, Bryher, St Martin's and St Agnes. The project will run over three years.

The core aim of the project in its first year was to generate a robust dataset on which to inform our knowledge and understanding of bat species composition and geographic distribution across the Isles of Scilly. Over the course of three years, it is hoped that the data will reveal seasonal variation and habitat preferences for each species.

The acoustic detectors and analysis techniques also allow the identification of small terrestrial mammals, bush-crickets and audible moths – these too will be recorded and analysed in order to better understand the species composition and distribution across the islands.

As a Citizen Science project, the project has further aims which are realised as much through the undertaking of the project as from results. The recruitment of volunteers to deploy detectors, upload data and receive the results aims to involve and inspire a section of the local community to learn about and connect with a group of animals that is poorly known and misunderstood. This provides an ideal opportunity to further improve awareness of how a healthy population of bats can benefit the community, why the conservation of bats is important, what their habitat and roost requirements are, and ways in which the local community including householders can help them.

3. METHODS

3.1 Static detector protocol

Our survey method is based on the Bailiwick Bat Survey (Newson et al., 2021) and aims to assess the season-wide status of bat species across Scilly. In the first season – 2022 – the deployments were undertaken during the main active season from May to October. The scope and scale was realistically achievable through working with members of the public and our partner organisations.

The protocol enables members of the public to access passive bat recorders which are set out in suitable habitat. These detectors are automatically triggered to record the calls of bats to a memory card every time a bat passes throughout a night.

The locations of the detectors were determined by the project lead who identified the approximate centres of 1km x 1km project squares. In addition, further locations were selected when the surveys of the key locations were completed, in order to generate additional data. The data presented in this report includes both the strategic 1km x 1km square locations, and the more subjectively selected locations. In the initial analysis, all of the data is presented though the core stratified distribution will be subsequently extracted from the wider dataset for future analysis or inter-year comparison as the project progresses.

The volunteers were deployed to set the detector up as close to the centre of the grid square as possible, whilst having regard for suitable habitat. The detectors were mounted on a 1.5m poles to avoid ground noise and reduce recordings of reflected calls. Guidance was provided to volunteers on the placement of the detector in order to ensure production of good quality recordings – this included positioning the detector at least 1.5m away from vegetation, water or other obstructions.

The bat detectors – the Song Meter Mini Bat manufactured by Wildlife Acoustics – were placed out to record for six consecutive nights at each location. The use of multiple nights of recording is intended to generate a more representative snapshot of activity in that location, minimising the influence of weather and other variables which can affect the results.

The bat detectors were set to switch on and record from 30 minutes before sunset until 30 minutes after sunrise the following day.

3.2 Survey effort

The survey period in 2022 ran from the end of May until the end of October. The long survey season covers the main period of bat activity and allows the entire project area to be surveyed using rotating deployment of the limited number of detectors available.

Each 1km survey square was surveyed using a detector located in the same position on two separate occasions, each survey covering six nights of deployment.

3.3 Processing recordings and species identification

The detectors used were passive real-time detectors that are triggered when they detect sound within a certain frequency range. Our survey generated a very large volume of recordings (uncompressed wav format), far more than could be feasibly managed if we needed to manually look at each wav file. Instead, we used a semi-automated approach for assigning recordings to species as follows.

After each six-day recording period, the files recorded by the bat detector, as well as associated information on where the recording was carried out, were uploaded to the BTO's Acoustic Pipeline[1]. Volunteers and staff have their own online user account and desktop software which means they can upload the recordings directly to the cloud-based BTO Acoustic Pipeline for processing. Once analysed, the user is emailed automatically and are then able to download the automated results through their account as a .csv file. These initial results are provided with the caveat that additional manual auditing will be carried out before the survey season's end.

The BTO Acoustic Pipeline (BTO AP) 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 AP 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. Based on research into error rates in automated analysis undertaken by Barré *et al*. (2019), the decision was made that probability of less than 0.5 (50%) were discarded.

Verification of species identification was carried out through the manual checking of spectrograms using software SonoBat[2] which was used as an independent check of the original species identities assigned by the pipeline. The application of this auditing depended on the species in question and the aims of the project:

- For rarely encountered bats and small mammals where a measure of activity and abundance was desirable, the project lead manually checked all recordings to confirm identification.
- In the case of common pipistrelle (*Pipistrellus pipistrellus),* an R Shiny App[3] was used to pull out a random sample of 1,000 recordings for auditing to quantify the likely error rate for this species in the dataset.
- For bush-crickets and audible moths there can be a large number of recordings, often of the same individual, which precludes use of the data for activity or abundance calculations. Auditing focussed on producing an inventory of species presence instead, where the three recordings with the highest probability for each site and night were selected for auditing.

Common pipistrelle is normally straightforward to identify acoustically, but particular care is needed when considering 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. For example, considering the possibility for misidentification with soprano pipistrelle in extreme clutter, common pipistrelle typically produces very short calls that are elevated in frequency, where they could be mis-identified as soprano pipistrelle. 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. It is

[1] http://bto.org/pipeline
[2] http://sonobat.com/
[3] https://github.com/BritishTrustForOrnithology/BTOAcousticPipelineTools

normally possible to diagnose what is happening in most situations by looking at the sequence of calls, and if there are neighbouring recordings in close time of potentially the same bat. However, there will still be some occasions where this is not available, and it is not possible to assign a recording to species.

4. RESULTS

4.1 Survey coverage

During 2022, 93 locations were surveyed across the five inhabited islands of the Isles of Scilly for bats. Those locations are shown below. The recording effort spanned five months and collectively across the sites, 562 nights of recording effort was conducted.

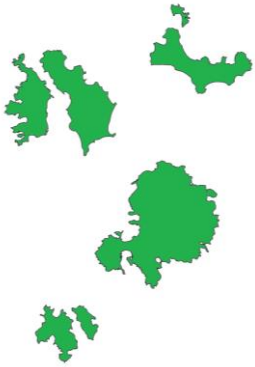
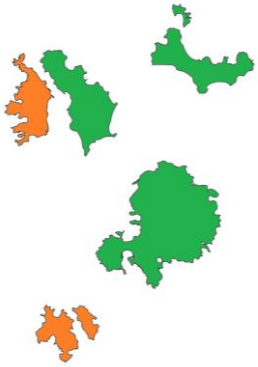
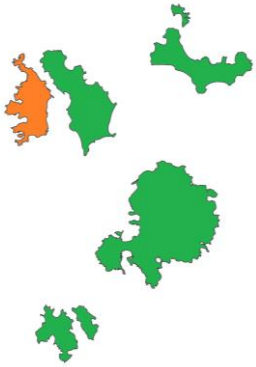
Map of the study area showing locations where detectors were deployed in 2022.

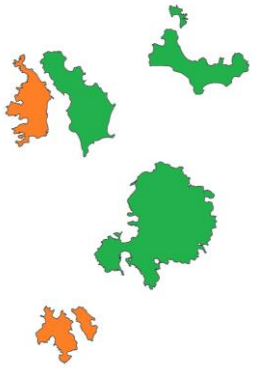
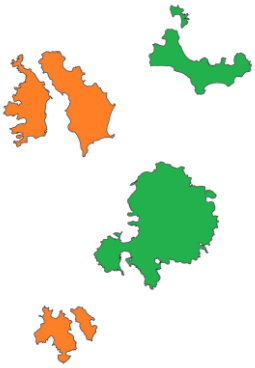
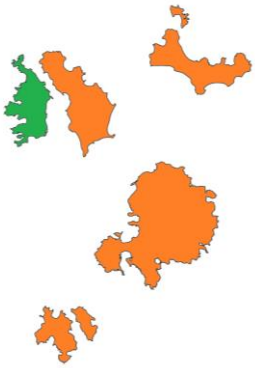
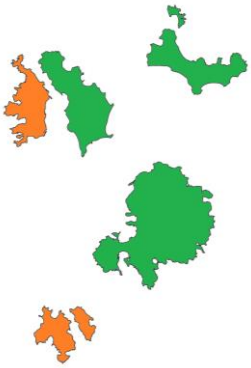
All maps reproduced in this report use map tiles by Stamen Design, under CC BY 3.0. Data by OpenStreetMap, under OpenStreetMap.

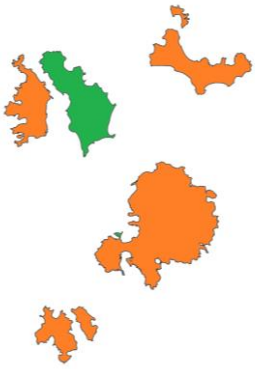
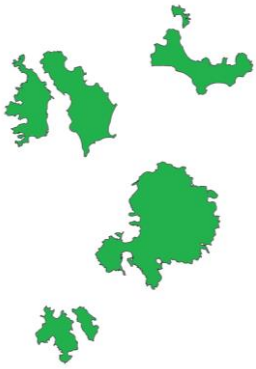
4.2 Overview of Data Gathered

Overall, 530,378 recordings were collected which, following analyses and validation, were found to include 286,996 bat recordings, and 988 small terrestrial mammal recordings. In addition, several species of bush-crickets and audible moth species were recorded (see table below).

Manual checking of recordings was carried out in line with the protocols outlined in Section 3. Following validation, the presence of three bat species, three small mammal species, four bush-cricket species and one audible moth species can be confirmed.

Bat Species		
		
Common pipistrelle Confirmed on all islands	**Soprano pipistrelle** Confirmed on St Mary's, St Martin's and Tresco	**Nathusius' pipistrelle** Confirmed on St Mary's, St Martin's, St Agnes and Tresco

Bush-crickets			
			
Long-winged conehead Confirmed on St Mary's, St Martin's and Tresco	**Speckled bush-cricket** Confirmed on St Mary's and St Martin's	**Grey bush-cricket** Confirmed on Bryher only	**Great green bush-cricket** Confirmed on St Mary's, St Martin's and Tresco

Small Mammals		
		
Wood mouse Confirmed on Tresco only	**Lesser white-toothed shrew** Confirmed on all islands	**Brown rat** Confirmed on St Mary's, St Martin's, Bryher and Tresco

Green indicates presence confirmed on an island; **orange** indicates absence of records from that island.

4.3 Bat Species

4.3.1 Baseline Status

The existing understanding of the bat populations on the Isles of Scilly, prior to undertaking the surveys outlined in this report, is broadly as follows:

- **Common pipistrelle** is known to be resident on all islands;
- **Soprano pipistrelle** has been identified on St Mary's;
- **Nathusius' pipistrelle** has been confirmed on St Mary's through trapping surveys, and from acoustic records from St Martin's.
- **Brown long-eared bats** have been confirmed on St Mary's and Tresco;
- **Leisler's bat and/or serotine bat** have potentially been recorded on static detectors on both St Mary's and St Martin's.

4.3.2 Overview of Survey Findings

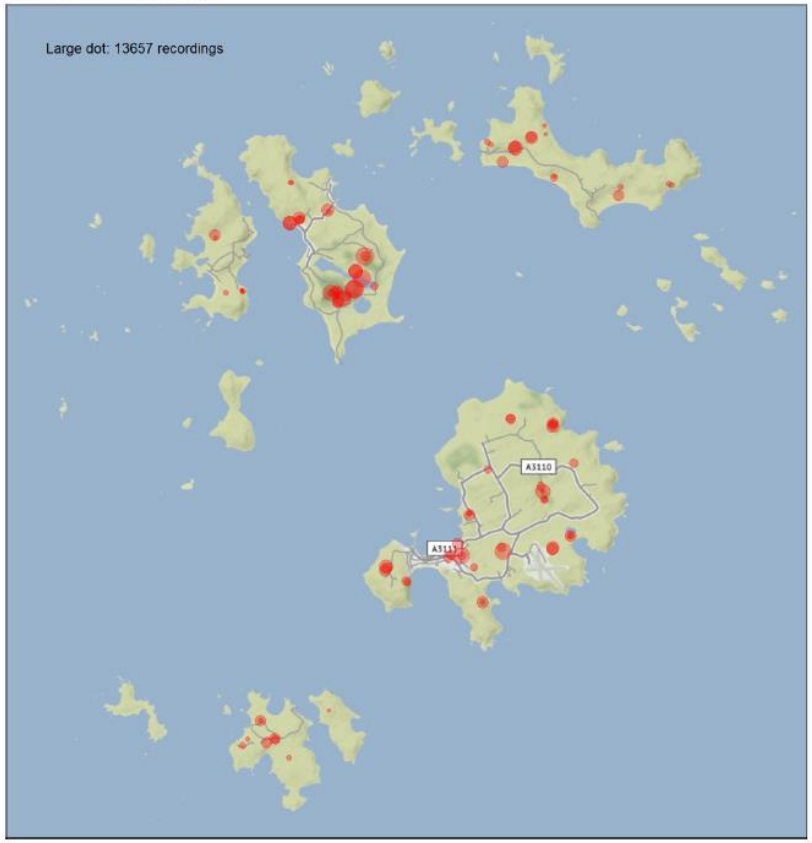
The surveys identified three bat species – these are common pipistrelle, soprano pipistrelle and Nathusius' pipistrelle. The number of calls and islands on which they are confirmed are outlined in the table below.

Species	No. of recordings post validation	Percentage of bat recordings	No. Locations (% total)	No. dates recorded	Islands where recorded
Nathusius' pipistrelle	31	0.011%	9 (9.5%)	11	St Mary's, Tresco, St Martin's, St Agnes
Common pipistrelle	286,886	99.96%	93 (100%)	557	St Mary's, Tresco, St Martin's, St Agnes, Bryher
Soprano pipistrelle	79	0.028%	9 (9.5%)	15	St Mary's, Tresco, St Martin's

Common pipistrelle

Common pipistrelle *Pipistrellus pipistrellus* was recorded on 157 nights, from 93 locations, giving a total of 286,886 recordings.

Spatial pattern of activity



Common pipistrelle was by far the most common and widely recorded bat species, with 286,886 recordings from 93 different locations (100% of survey locations). It was the only species of bat to be recorded on every island.

This species was previously understood to be resident on all islands, as identified acoustically through bat detector surveys and bat walks. A number of confirmed roosts are known across all five islands, including maternity use. The results of these surveys therefore confirm the prior understanding of the status of this species on Scilly.

Common pipistrelle on St Martin's – J. Faulconbridge

Soprano pipistrelle

Soprano pipistrelle *Pipistrellus pygmaeus* was recorded on 16 nights, from 9 locations, giving a total of 79 recordings.

Spatial pattern of activity

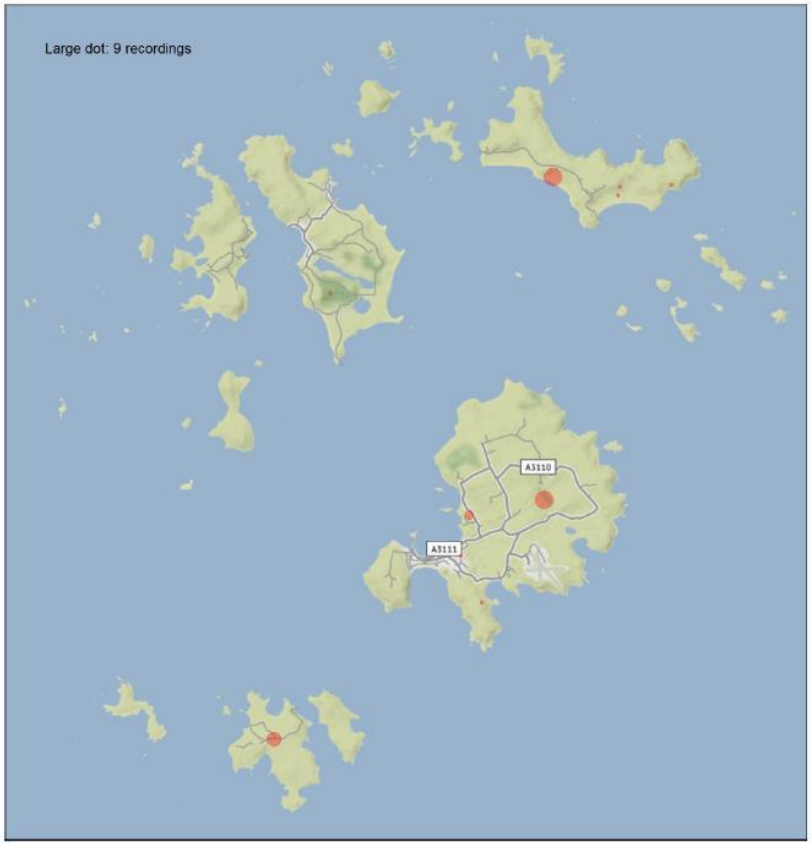
Soprano pipistrelle was recorded on three of the islands, but with only 79 recordings from nine different locations. The vast majority of recordings of this species come from just three individual nights where repeated recordings would suggest a single bat was active in the locality of the detector. These extended encounters occurred on Tresco and St Mary's, with sporadic individual recordings across both these islands as well as St Martin's. The spread of recordings was across the survey period from June to October, reflecting presence on the islands throughout the summer.

The spatial pattern of activity on St Mary's suggests towards a possible association with the wetlands at Porth Hellick and Holy Vale, even when controlling for the extended encounters with high numbers of calls on individual nights which were recorded in these locations.

Prior to the survey outlined in this report, soprano pipistrelle had been identified on St Mary's only[4].

The number of recordings of this species, compared with those of common pipistrelle, are very low – just 79 calls across the entire survey period in comparison to the 286,886 records for common pipistrelle. Whilst there are acoustic differences between these two species, and the higher frequency call of the soprano pipistrelle will experience higher attenuation resulting in it being slightly less detectable over distance, the reduction in encounter frequency attributable to acoustic characteristics would be minimal. Using the population of common pipistrelles as a benchmark, the results appear to indicate a very small population of soprano pipistrelle present on the islands. The isolated records on islands such as St Martin's also raises the potential that individual bats could be moving between the islands.

[4] https://www.exeter.ac.uk/news/research/title_143855_en.html



Nathusius' pipistrelle was recorded on ten nights, from ten locations, giving a total of 31 recordings. The records came from St Mary's, St Martin's, Tresco and St Agnes but no records were identified on Bryher.

This species was previously known to occur on the islands, confirmed through capture and identification in the hand on St Mary's, and occasional acoustic records exist on both St Mary's and St Martin's. No roosts are known and it is not known whether the population is resident or migratory.

As with the soprano pipistrelle, there are three extended encounters (often involving multiple recordings within a few minutes of each other) which between them account for 74% of all recordings identified in the survey. The remaining handful of recordings were scattered across the islands.

This species was recorded primarily in June, though with smaller number of records in July, September and October indicating a regular presence throughout the summer season. Nathusius' pipistrelle is known to be migratory, moving between the UK and mainland Europe with bats caught and ringed being subsequently recaptured as far away as Russia.

The results would be consistent with a small population of bats, possibly individuals, or a small number of bats moving through the islands but not remaining. Either option or a combination of both, would be consistent with the known ecology of this species.

Brown long-eared bats were not recorded during the survey. This species was confirmed on St Mary's in 2011 when a pregnant female bat was caught and radiotracked back to a roost in a split Monterey pine tree[5]. This confirmed not only the presence of an individual but of a breeding population. The species has also been identified on Tresco, confirmed through DNA analysis of droppings.

This species is often considered a 'woodland' bat, with a strong association with tree cover. St Mary's and Tresco have the highest levels of tree cover on the islands and it is consistent with the known behavioural ecology and habitat preferences of the species that these two islands would support populations which may not be present on the more sparsely vegetated islands of St Martin's, St Agnes and Bryher.

Brown long-eared bats are often known as the 'whispering bat' due to their quiet echolocation – as such they are often significantly under-represented or even not detected at all through acoustic surveys such as the static detectors deployed in this study. The absence of records for this species does not therefore indicate that the species is not present, but further survey effort and possibly deploying alternative techniques would be required to adequately assess the current status of this species on the islands.

Leisler's/serotine bats were not recorded during the survey. These two species have similar acoustic characteristics, and echolocation calls have been identified on St Mary's and St Martin's which are identified as these species.

These bats are relatively easy to detect through acoustic surveys such as the statics deployed in this survey – therefore the absence of any recordings during the surveys may indicate that historic records of these bat(s) represent individuals only transiently present on the islands. In continental Europe, Leisler's bat is considered to be a migratory species with several long distance movements being recorded – it is therefore possible that this species could be present through migration, or being blown off course and finding temporary habitat on the islands. Serotine are also known to move between the UK and mainland Europe[6]. Further acoustic surveys, especially if they included the transitionary periods in spring and autumn, may help build a clearer picture of the status of these species on the islands.

[5] https://www.exeter.ac.uk/news/research/title_143855_en.html
[6] https://www.nature.com/articles/hdy201520

4.4 Other Mammal Species

4.4.1 Baseline Status

The existing understanding of the island's small mammal populations, prior to undertaking the surveys outlined in this report, is broadly as follows:

- **Brown rat** is known to be resident on all islands except for St Agnes after a successful eradication exercise on that island;
- **Wood mouse** is known to be present, but the distribution across the islands is unclear;
- **Lesser white-toothed shrew** (also known as the Scilly shrew) occurs on all islands;
- **House mouse** is known to be present, but the distribution across the islands is unclear;
- **Hedgehogs** are present on St Mary's only;
- **Rabbits** are present on all islands.

4.4.2 Overview of Survey Findings

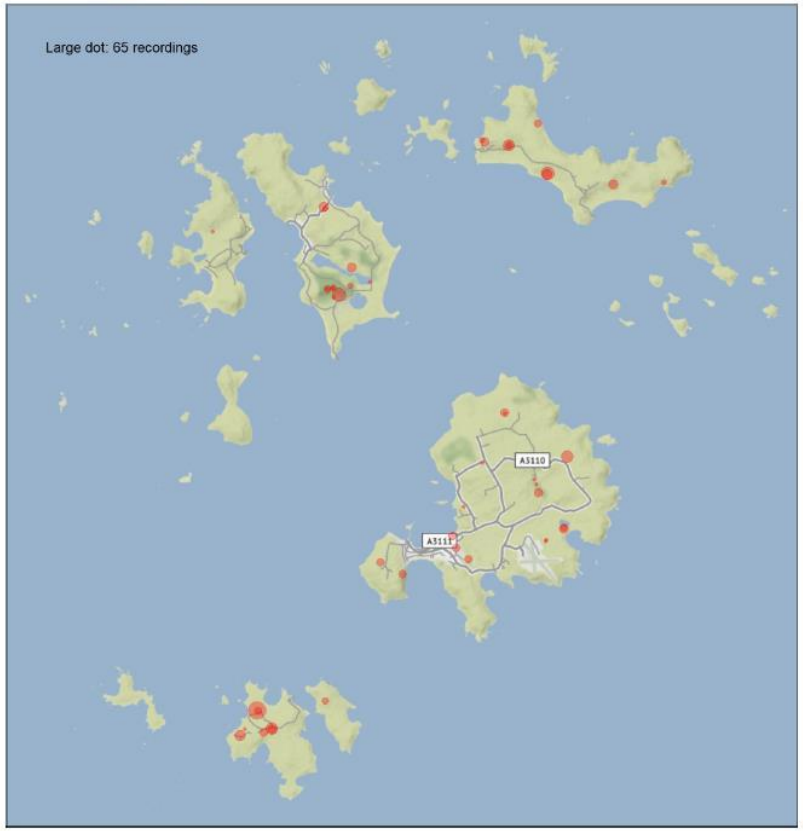
The surveys identified three small mammal species – these are wood mouse, lesser white-toothed shrew and brown rat. The number of recordings and islands on which they are confirmed are outlined in the table below.

Species	No. of recordings	Percentage of mammal recordings	No. Locations (% total)	No. dates recorded	Islands recorded
Wood mouse	4	0.4	1 (1%)	1	Tresco
Lesser white-toothed shrew	395	39.9	46 (49%)	46	St Mary's, Tresco, St Martin's, St Agnes, Bryher
Brown rat	589	59.7	22 (24%)	30	St Mary's, Tresco, St Martin's, Bryher

Lesser white-toothed shrew

Lesser white-toothed shrew *Crocidura suaveolens* was recorded on 85 nights, from 46 locations, giving a total of 395 recordings.

Spatial pattern of activity



The **lesser white-toothed shrew** was recorded on all five islands and is the only shrew species present on Scilly.

The distribution appears to indicate widespread occupancy across each island, with the exception of Bryher for which only a small number of records were confirmed. This may be due to sampling effort and further surveys would help to clarify this picture. This is the first study that has used acoustics to identify lesser white-toothed shrew.

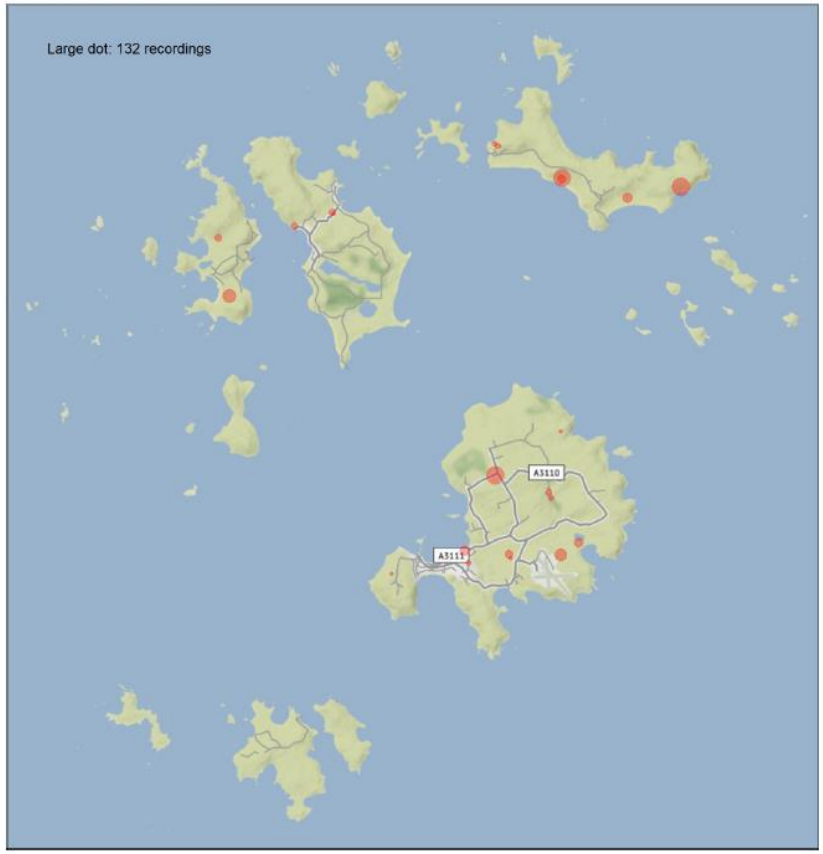
There is evidence of the lesser white-toothed shrew existing on Scilly since the Bronze Age, as far back as when the islands were a single landmass. It is unknown how the shrews arrived, although it is believed they may have stowed away on visiting ships during prehistoric times.

Lesser white-toothed shrew – Brendan White

Brown rat

Brown rat *Rattus norvegicus* was recorded on 30 nights, from 22 locations, giving a total of 589 recordings.

Spatial pattern of activity



Brown rat was recorded on the four islands of Bryher, St Mary's, St Martin's and Tresco. No records were returned from St Agnes and Gugh which is consistent with their rat-free status as declared February 2016 following a successful eradication exercise.

Inspection of the distribution indicates a broad presence across St Mary's, St Martin's and Bryher though records on Tresco appear confined to the northern part of the island.

Brown rat – J. Faulconbridge

Wood mouse

Wood mouse *Apodemus sylvaticus* was recorded on 1 nights, from 1 locations, giving a total of 4 recordings.

Spatial pattern of activity

Wood mouse was identified from just four recordings on Tresco – it was not confirmed on any other island. However, the calls of this species are much quieter than those of brown rat or lesser white-toothed shrew[7] – therefore the recorded distribution is likely to be an under-representation of the true distribution of this species across the islands.

Given these acoustic characteristics, the results confirm presence but should not be used to infer distribution or frequency.

Wood mouse – J. Faulconbridge

[7] Newson, S.E., Middleton, N., & Pearce, H. 2020. The acoustic identification of small terrestrial mammals in Britain. British Wildlife 32, 186-194.

House mouse was not recorded during the surveys – however the calls of this species can only typically be detected by the equipment at a proximity of around 1.5m. Given that this is the height at which the detectors were sited above the ground, it is very likely that this species was not detected due to its acoustic characteristics. It may also reflect the distribution of detectors in habitats which are optimal for bats, rather than necessarily reflecting ideal habitat for house mouse.

House mouse – J. Faulconbridge

Hedgehog and **rabbit** are not species which are detected by the survey methodology – therefore this report does not provide any information on the presence of distribution of these species on the islands.

4.5 Bush-crickets

4.5.1 Baseline Status

The existing understanding of the island's bush-cricket populations, prior to undertaking the surveys outlined in this report, is broadly as follows:

- **Great green bush-cricket** has been recorded recently on St Mary's and Tresco only;
- **Speckled bush-cricket** has been recorded on St Mary's and St Martin's;
- **Long-winged conehead** has been recorded on all inhabited islands, though the status on St Agnes is uncertain;
- **Short-winged bush-cricket** has been recorded on St Agnes;
- **Grey bush-cricket** has a localised distribution at the southern end of Bryher only;
- **Large conehead** has been recorded historically on Bryher, but there are no recent records;
- **House cricket** temporarily established on St Mary's as escapees from live food, two different species noted.

4.5.2 Overview of Survey Findings

The surveys identified four cricket species – these are long-winged conehead, speckled bush-cricket, grey bush-cricket and great green bush-cricket. The number of recording dates and islands on which they are confirmed are outlined in the table below.

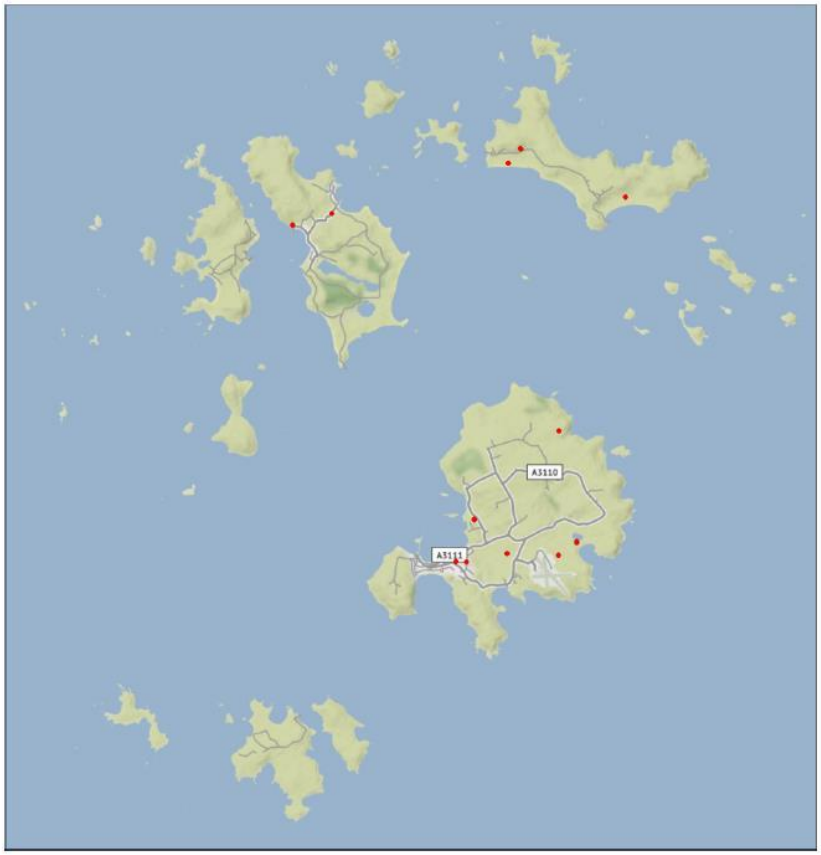
Bush-crickets are typically stationary and calling for long periods, which means that the number of recordings is not an informative measure of abundance. For this reason, the data shown here relates to species presence only.

Species	No. locations	No. dates recorded	Islands recorded
Long-winged conehead	16	34	Tresco, St Martin's & St Mary's
Speckled bush-cricket	16	35	St Martin's and St Mary's
Grey bush-cricket	5	7	Bryher
Great green bush-cricket	11	23	St Mary's, St Martin's and Tresco

Long-winged conehead

Long-winged conehead *Conocephalus fuscus* was recorded on 34 nights, from 16 locations.

Spatial pattern of detections



Long-winged conehead is a small species of bush-cricket typically found in rough grassland, dry heaths and woodland rides, as well as damp and coastal habitats. It is largely herbivorous, feeding on grasses, but will also eat small invertebrates.

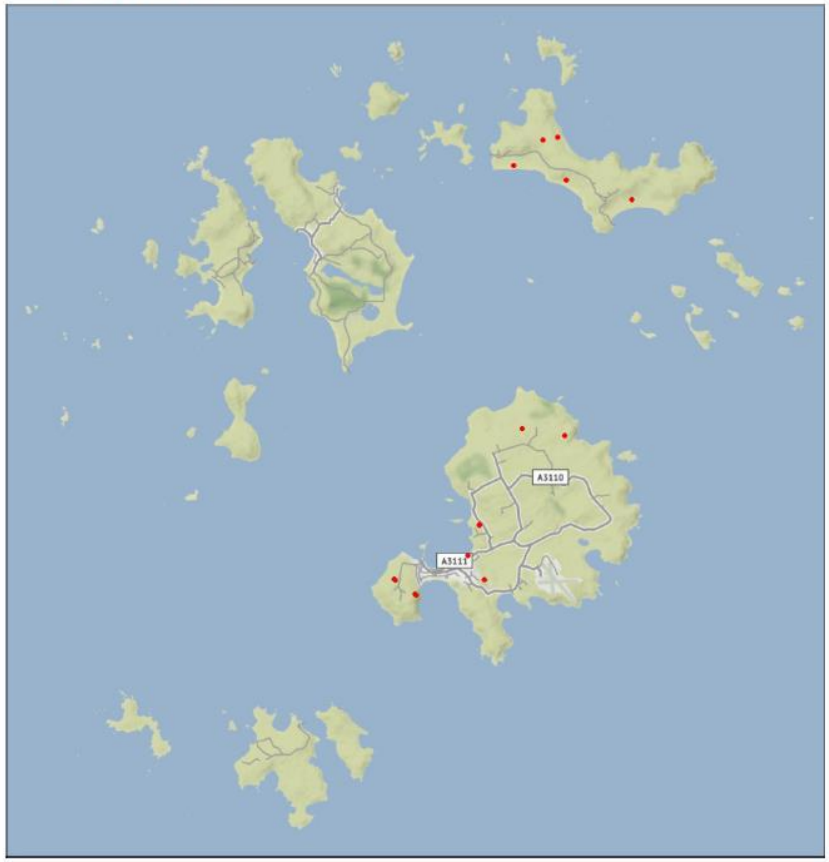
The survey recorded this species on three of the five islands – Tresco, St Martin's and St Mary's. The distribution on St Mary's and St Martin's indicates the population is present across much of the island – whilst the data on Tresco appears focussed to the north of the island.

Long-winged conehead female – M. P. Goodey

Speckled bush-cricket

Speckled bush-cricket *Leptophyes punctatissima* was recorded on 35 nights, from 16 locations.

Spatial pattern of detections



Speckled bush-cricket is found mainly in central and southern England, favouring rough grassland, scrub and garden habitats. It is readily identified through the covering of black speckles on their green body which also given them their common name.

This species was recorded as widely distributed on both St Mary's and St Martin's. The species was not recorded from any of the other three islands.

Speckled bush-cricket nymph – J. Faulconbridge

Grey bush-cricket

Grey bush-cricket *Platycleis albopunctata* was recorded on 7 nights, from 5 locations.

Spatial pattern of detections

Grey bush-cricket is considered to be a coastal species – found almost exclusively along the southern coast of England and Wales, it favours coarse grass and rough vegetation on sand dunes, shingle banks and south-facing cliffs.

The surveys identified this species as present on Bryher only, recorded on the southern portion of the island which reflects the pre-existing understanding of their distribution on the islands.

Grey bush-cricket female – R. Hathway

Great green bush-cricket

Great green bush-cricket *Tettigonia viridissima* was recorded on 23 nights, from 11 locations.

Spatial pattern of detections

The **great green bush-cricket** is the largest species of bush-cricket in the UK, with females growing to 7cm long. It favours rough grassland dotted with scrub and trees and shows a preference for light, dry soils in which the eggs are laid.

This species was recorded on Tresco, St Mary's and St Martin's though it was only identified in a single location in the latter case. The distribution on St Mary's appears to be focussed towards the southern portion of the island based on these initial results.

Great green bush-cricket nymph – David P Dimmock

Short-winged conehead was not recorded in the surveys – this species has been recorded historically on St Agnes only. Similarly, the **large conehead** which has historically been recorded on Bryher was not identified in this survey.

This absence should be interpreted only as interim data at this stage – the static nature of calling crickets coupled with the distribution of detectors within 1km squares means that populations could be easily overlooked if the detectors do not happen to be deployed close to a calling individual on a given night.

Further surveys would provide further clarity on the status of these species, especially if a finer-scale distribution of detectors were deployed.

House cricket is a true cricket rather than a bush-cricket, which produces lower frequency calls than bush-crickets, that are not likely to be recorded on the bat detectors used here – the survey results therefore provide no information on the distribution of this species.

Populations are known from St Mary's and may be present on other islands. They are known to be extant, but their longevity and sustainability are unclear as they are established from escaped live food for pets.

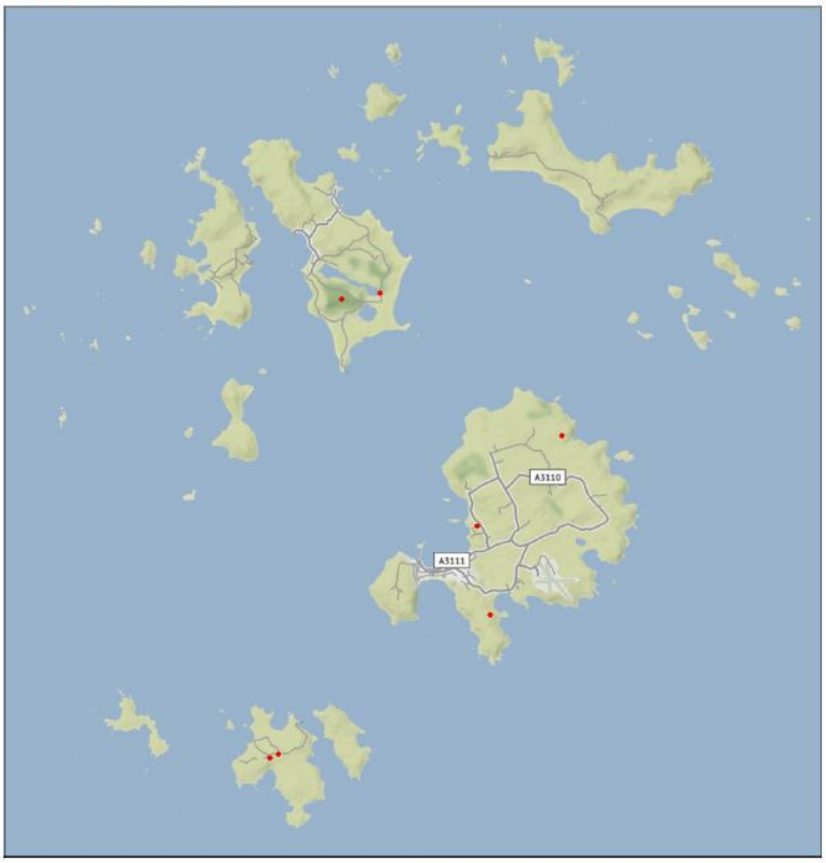
House cricket on St Mary's – M. P. Goodey

4.6 Audible moth species

Bird cherry ermine

Bird cherry ermine *Yponomeuta evonymella* was recorded on 9 nights, from 7 locations.

Spatial pattern of detections



Bird cherry ermine was recorded from seven separate locations on nine different dates throughout the survey period. The records were from St Agnes, St Mary's and Tresco.

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. Whilst we have assigned all recordings like this to this species, we cannot exclude the possibility that other closely related species produce similar sounds.

5. DISCUSSION

5.1 Overview

The current dataset of 286,996 bat recordings is valuable in adding to our understanding of patterns of occurrence and activity of bats across the Isles of Scilly, as well as our understanding of some other species groups that were recorded as 'by-catch' during bat surveys.

5.2 Bats

The results from the first season confirm the widespread presence of common pipistrelle across all inhabited islands, supporting the baseline assumption of breeding populations on all islands. Further surveys are unlikely to significantly change this view, but deployment of detectors across a finer scale could allow the habitat preferences of the population to be better understood. Information on the frequency with which the bats move between the islands would also be invaluable in order to understand the degree to which this species exists as a metapopulation which would buffer against the risks of local extinctions on individual islands, or risks associated with inbreeding in a small island population. This is likely to require advanced survey techniques such as radiotracking.

The identification of soprano and Nathusius' pipistrelle calls confirm the presence of these species on the islands, but the very low number of calls, when benchmarked against those of the common pipistrelle, indicate that the populations may be very small and may not constitute a viable long-term breeding population. Further survey work and research would be required to assess this. If breeding populations do exist, the results of the initial survey would suggest that their status is potentially threatened on the islands which would make them a conservation priority.

The absence of brown long-eared bats from the survey data is likely to reflect the likely low numbers of this species, combined with the low detection distance of this species. Continuing the survey is likely to increase the chances of recording this species, but complementary survey techniques could also be useful to improving our understanding of the population and distribution of this species on the islands. These techniques could include mist net or harp trapping surveys. Identification of active roosts would be another way to better understand the distribution of this species on the islands, and it is hoped that the additional public awareness and engagement raised by this project may aid in the identification of further roosts which may include brown long-eared bats. The late emergence of this species typically 40 minutes or more after sunset makes them less obtrusive to casual observers, but the characteristics of maternity roosts – often in larger loft spaces – may allow their detection and identification with further public awareness if the signs and evidence is better communicated.

Leisler's bat and/or serotine were not recorded by the surveys, and unlike brown long-eared bats, they have echolocation characteristics which would be readily detected by the survey methodology. They are also typically mobile, moving between habitats within a landscape[8] in such a way that it could be reasonably expected that they would be detected by static recording units. The results of the initial survey would suggest that historic records of this species reflects individuals only transiently present on the islands, though further surveys through years 2 and 3

[8] https://www.cambridge.org/core/journals/journal-of-zoology/article/abs/foraging-ecology-of-leislers-bat-nyctalus-leisleri-at-two-sites-in-southern-britain/D39A17894992A72855BAEB25406418FB

would provide greater confidence in this assessment. As both species are known to be migratory in some geographic locations, there is the potential for this species to be present as part of a migration route – Scilly is well known as a stopping point for migratory bird species in the spring and autumn. Deployment of the survey methodology through the transitionary periods in spring and autumn may provide further information on the status of these species on the islands.

5.3 Bush-crickets

The surveys confirm the majority of bush-crickets known to be present on Scilly, though two species whose populations are thought to be more restricted or possibly not extant – large conehead and short-winged conehead – were not identified.

Due to the combination of species ecology – typically calling for extended periods from a static location – and the static nature of the detectors, there is a high probability that species could be overlooked or that the population distribution may be wider than currently understood. These results therefore confirm the presence of those species recorded in the locations in which they are detected, but should be viewed at this stage as a likely incomplete picture – the lack of further records should not be used to infer absence of a population.

Further survey work at a finer geographic scale would help better understand the distribution of the species and the species composition on the islands. The behavioural ecology of the bush-crickets would also suggest that a transect survey approach could be highly beneficial in better understanding the species composition and geographic range on the island. This could either be a random or strategic route depending on the focus of interest – for example the potential for further grey bush-cricket sites could be assessed through transect surveys through similar habitats to the confirmed location on Bryher or other islands. The data gathered in this first year of survey could help inform the methodology for such surveys, through seasonal and nightly timings for the highest probability of encounter.

5.4 Small mammals

The widespread presence of lesser white-toothed shrew is confirmed, as is the presence of brown rat on all islands except for St Agnes and Gugh where a successful eradication programme was undertaken.

Wood mouse is confirmed as present on the archipelago, but the quiet acoustic characteristics of the species resulted in very few records and they are therefore likely to be more widely distributed than the single location on Tresco would indicate.

The absence of house mouse from the dataset is similarly likely to be a limitation of the survey technique when applied to this species, along with the locations of the detectors.

Further acoustic surveys may pick up further incidental records of these latter two species, but the methodology of deploying a bat detector at height is not optimal for recording these species. Further assessment of small mammal distribution on the islands would be better served through traditional survey techniques appropriate to the species, such as capture and release.

5.5 Ongoing Surveys

Based on the data gathered, the second year of surveys will aim to repeat the broad strategy of the first season, with a number of refinements and modifications.

Firstly, a more granular focus will be taken, with detectors deployed in 500m x 500m squares rather than 1km squares. It is likely that this would need to be matched with a reduction in either repetitions or recording time in order to achieve the coverage with the equipment available, though this would be designed to maximise data gathered within these confines. The results of this more granular survey would provide a more specific geographic assessment of presence, potentially allowing a better understanding of the habitat preferences of bat species when cross-referenced with habitat maps. This may also allow the identification of additional bush-cricket species, or identify further populations for the reasons outlined in 5.3 above. Deployment of detectors in a larger number of locations would help to identify populations or species which may have been overlooked in the initial survey window.

There is also an aspiration to extend the deployment of detectors to uninhabited islands in 2023 – this will depend on logistics and surveyor availability but would widen our understanding of the distribution of all of the species recorded in the first year of the survey. If bats are recorded on islands which do not offer roosting opportunities, this would provide strong evidence for movement between the islands within the archipelago which may be of significance especially for those species whose populations appear to be small, such as Nathusius' and soprano pipistrelle, or to understand the likelihood of a metapopulation structure for common pipistrelle on the individual islands.

One detector is being deployed on St Martin's through winter 2022/23 and into spring in order to gain an initial insight into the activity patterns through this period. There is then the potential for this to be repeated with year-round deployments of a greater number of detectors in specified locations through 2023/4 in order to better understand the activity levels of species such as common pipistrelle in the unusually mild winter climate of Scilly, and to look for seasonal variation in detection of potentially migratory species.

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