



Key to the echolocation calls of British bats

This key is based on the typical echolocation calls as heard on a heterodyne bat detector. Some additional points relating to sonograms are included to aid explanation, but sonograms can be produced only from a frequency division, time expansion or full spectrum detector. Careful tuning of a heterodyne detector can allow some characteristics of the sonogram to be deduced by noting how the sound changes at different frequency settings.

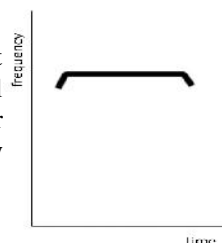
Several points should be borne in mind:

- Bat calls are very variable, in particular with the nature of the bat's surroundings. In unusual locations or circumstances, the calls may differ significantly from the typical pattern described for the species.
- In a specific environment (such as woodland), the calls of many species will sound quite similar as the bats adjust their calls to suit the structure of their surroundings. The environment must always be kept in mind.
- Accurate identification of species from echolocation calls is not always possible. Additional information such as the appearance of the bat, the pattern of flight and the structure of the environment will sometimes help.
- The key does not cover social calls, which are usually, but not always, quite different from echolocation calls.
- The key covers only the 17 (or 18) resident British species. If vagrant European bats are encountered, the key will not be successful even in approximate identification and may give very misleading results.

It is essential that the bat detector is used actively, by adjusting the tuning until the frequency range of the call, the frequency at which the call sounds loudest, the sound quality at different frequencies and the apparent drop in volume at different frequency settings have all been noted. The repetition rate (rapid, medium or slow), the regularity or irregularity of the rhythm of calls, and any apparent volume fluctuations should also be considered. Taking account of all these factors requires considerable practice with the detector before reliable identifications can be attempted.

1. Call sounds like a prolonged warbling or whistling.....**Horseshoe bats**.....go to 2
Calls consists of a series of *clicks*, soft *ticks* or loud *slaps*.....**Vespertilionid bats**.....go to 3

2. Horseshoe bat calls consist of prolonged (up to 50 msec or more) whistling sounds at a near constant frequency. Doppler shift causes the pitch of the sound to fluctuate. The calls are narrowband, and will therefore be heard only when the detector is tuned very close to the peak frequency of the call (or sometimes to half that frequency). At other frequencies, nothing will be heard. The calls are also very directional, and will be loud only when the bat is flying directly toward the bat detector.



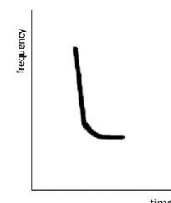
- Peak frequency is just above 80 kHz.....**Greater Horseshoe Bat**
Peak frequency is about 110 kHz.....**Lesser Horseshoe Bat**

3. Vespertilionid bat calls are very brief (usually less than 10 msec), but emitted in a rapid series with up to 25 calls per second. Each call will be heard as a short *click*, but may be prolonged into a slightly longer *tock* or a much longer *slap*. Very quiet or distant calls may appear to be very quiet *ticks*.

Tuning the detector enables the sound to become loud as a series of *slaps* at a frequency somewhere between 20 kHz and 60 kHz. At other frequencies, the sound becomes rather quieter *clicks*.....**pipistrelles** and **big bats**.....go to 4

The sound quality (typically a *click*) does not change when adjusting the tuning of the detector over a wide range, although the sound may drop in volume or disappear altogether at some frequencies.....**Myotis** and **plecotine bats**.....go to 9

4. *Pipistrellus* sp., *Nyctalus* sp. and *Eptesicus serotinus* have loud calls that begin with a downward FM sweep and end with a more or less constant frequency. The CF part of the call contains the peak frequency, usually sounds considerably louder than the FM sweep, and has the quality of a prolonged *slap* rather than the short *click* produced by the FM sweep. Tuning the detector therefore allows the approximate frequency of the CF tail to be identified.



- The frequency of the *slapping* sound (which is also the loudest part of the call) is above 35 kHz.....**pipistrelles**.....go to 5
The frequency of the *slapping* sound is below 32 kHz.....**big bats**.....go to 7

5. Pipistrelle calls have peak frequencies between 36 and 60 kHz, with an erratic rhythm. With care, it is possible to separate the three species by careful tuning of the detector to identify the peak frequency. This is best done by using headphones, and is feasible only when it is possible to listen to one bat at a time or when only one pipistrelle species is present.

The calls have a medium repetition rate (10 calls or more per second) and the peak frequency is above 40 kHz.....go to 6

The calls have a slow repetition rate (typically 6 - 7 calls per second) and the peak frequency is below 40 kHz.....**Nathusius' Pipistrelle†**

6. The peak frequency is above 52 kHz (typically 53-60).....**Soprano Pipistrelle**

The peak frequency is below 52 kHz (typically 43-50).....**Common Pipistrelle**

Note that pipistrelle calls are very variable. In cluttered habitats such as woodland, the calls become shorter and less *slappy* with a more rapid repetition rate. In very open environments such as lakes, they become longer with very little FM component and a slow repetition rate. When several pipistrelles are feeding in the same area, they tend to adjust the peak frequency of their calls so that each bat's peak frequency is slightly different. Some caution is therefore required in identifying species, and certain identification is not always possible.

† Kuhl's Pipistrelle, for which there are a handful of British records, is indistinguishable from Nathusius' Pipistrelle. Savi's Pipistrelle (peaking at about 35 kHz) is very unlikely.

7. The big bats (Noctule *Nyctalus noctula*, Leisler's Bat *Nyctalus leisleri* and Serotine *Eptesicus serotinus*) have calls with lower peak frequencies than pipistrelles and, typically, with distinctive rhythms. However, they share the variability of pipistrelles' calls and are very difficult (sometimes impossible) to distinguish from each other in woodland, when the peak frequency is raised and the distinctive rhythms tend to disappear. Note that there have recently been isolated records of Parti-Coloured Bats in Britain, which should key out with Serotine.

The peak frequency is between 27 and 32 kHz, with a medium repetition rate (about 10 calls per second) and often an erratic, "drunken syncopated" rhythm*.....**Serotine**

The peak frequency is between 18 and 27 kHz, with a low repetition rate (typically 3 – 6 calls per second) and frequently an alternation between calls of higher and lower peak frequencies (giving a *chip-chop* sound).....**Nyctalus sp.**.....go to 8

*Three other species may sometimes appear to key out as Serotine, and close attention to detailed characteristics of the calls is needed to avoid misidentifications. The species are:

Brown Long-Eared Bat – the typical calls of this species are quite different, but they occasionally make loud calls in which the FM sweep starts to level out into an almost constant frequency tail. The best check for this is to try to listen for a longer time to see if any of the more characteristic Brown Long-Eared Bat calls (see below) become detectable. Catching sight of the bat will help.

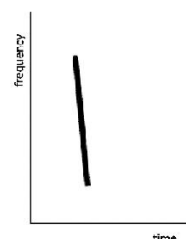
Barbastelle – the calls are never truly *slaps*, but tend to be rather prolonged *clicks* (=tocks). Practice and careful listening enables them to be distinguished. The rhythm is also rather different, being reminiscent of impatient rapping on a door rather than the slightly slower and more syncopated rhythm of a Serotine. The peak frequency is above 32 kHz.

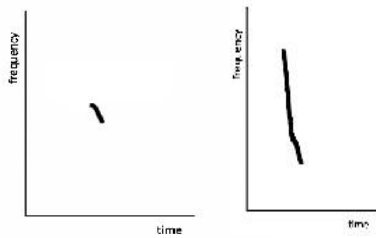
Greater Mouse-Eared Bat – so rare in Britain as to be scarcely worth considering. The sound of the calls is *tocks*, usually regular in rhythm, but occasionally erratic in the same pattern as a pipistrelle rather than the syncopated rhythm of a Serotine. The peak frequency is about 30 kHz.

8. The peak frequency of at least some of the calls is at or below 20 kHz, with alternation of higher and lower calls usually well marked.....**Noctule**

The peak frequency of all the calls is above 21 kHz and alternation of higher and lower calls is less predictable, sometimes absent.....**Leisler's Bat**

9. The bats of the genus *Myotis*, together with the Barbastelle and the long-eared bats, produce calls which are FM sweeps with no true constant frequency tails. The sound on the detector is a *click*, very brief and flat with no *slappy* quality. However, variations in the rate at which the FM sweep occurs cause some species (Barbastelle, Whiskered, sometimes Brown Long-Eared and Greater Mouse-Eared) to produce some calls which are slightly longer than the usual *clicks*, and are better described as *tocks*. Some of the species (Natterer's, Bechstein's and the long-eared bats) produce very quiet calls which tend to be soft *ticks* rather than clear *clicks*.





FM calls of a Barbastelle (left) and a *Myotis* bat (right) with a reduced rate of frequency change in at least part of the call. These will produce longer *tock* sounds if the detector is tuned to the appropriate frequency.

The calls are *tocks*, with a peak frequency of 32-34 kHz. They have a narrow frequency range, and are audible only between 30 and 45 kHz. There are two alternating calls, peaking at 33 and 41 kHz, but this is detectable only on sonograms. The characteristic rhythm is reminiscent of someone knocking impatiently on a door.....**Barbastelle**
 The calls are *clicks*, *ticks* or *tocks*, and are audible over a frequency range of at least 30 – 60 kHz with no obvious change in sound quality. The repetition rate is often rapid (typically more than 10 calls per second).....**Myotis** and **long-eared bats**.....go to 10 ✕

- ✕ 10. The calls do not show such a clearly marked peak frequency as do the calls of pipistrelles and big bats. A peak frequency, when detectable, generally corresponds to a fairly broad peak on the frequency spectrum. The calls are generally quieter than the calls of pipistrelles and the repetition rate, although very variable, tends to be faster than that of pipistrelles.

Moderately loud, very regular *clicks* or *tocks* with a rapid repetition rate (11 – 14 calls per second)†.....**some Myotis spp. (Daubenton's, Whiskered and Brandt's Bats)**
 Quiet or very quiet regular *clicks* or *ticks* with a medium, rapid or very rapid repetition rate (9 – 15 calls per second).....**long-eared** and **some Myotis bats**.....go to 11

Note that there is not a complete separation between these two options. Natterer's Bat, in particular, can key out to either option. If the key seems not to work from 11 to 14, try returning to 10 and consider the other option.

Daubenton's, Whiskered, and Brandt's Bats (and often Natterer's Bat) cannot confidently be distinguished purely from bat detector evidence. Daubenton's Bat can be confirmed if seen flying low (<15 cm) over water. Whiskered Bats tend to have a strongly marked peak frequency between 40 and 45 kHz; in Daubenton's Bat and Brandt's Bat the peak is less apparent. It would be unwise to rely on this without supporting evidence.

† The Greater Mouse-Eared Bat (so rare in Britain as to be scarcely worth considering) should key out here. The sound of the calls is moderately loud *tocks* with a medium repetition rate, usually regular in rhythm, but occasionally erratic in the same pattern as a pipistrelle. The peak frequency is about 30 kHz.

- ✕ 11. Calls are audible above 110 kHz.....**Alcathöe, Natterer's and Bechstein's Bats**.....go to 12
 Calls are inaudible above 65 kHz. Sonogram shows a levelling out towards a constant frequency at the end of the call, and a strong harmonic.....**long-eared bats**.....go to 14

- ✕ 12. Calls are not audible below 40 kHz.....**Alcathöe Bat**
 Calls are audible between 30 and 40 kHz..... **Natterer's and Bechstein's Bat**....go to 13

- ✕ 13. Calls are audible below 30 kHz, with rapid repetition rate.....**Natterer's Bat**
 Calls are not audible below 30 kHz, with medium repetition rate (9-11 calls per second).....**Bechstein's Bat**

- ✕ 14. **Brown Long-Eared Bat and Grey Long-Eared Bat.** Reported differences in peak frequency appear not to be reliable. Typical peak frequency is about 30 kHz for both. Differences in repetition rate probably depend on habitat rather than species.

✕ It should be understood that the reliability of the key is significantly reduced in 10 – 14. The variability of the calls of *Myotis* and *Plecotus* bats, and their preference for woodland habitats with all its associated difficulties for bat detector work, mean that identifications of these species must be treated with caution. In woodland, it is unlikely that realistic identifications of these bats can be made below the genus level without additional information.