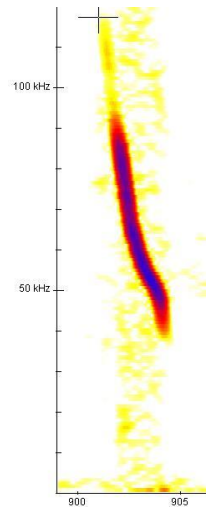


Visual determination of Myotis from sonograms

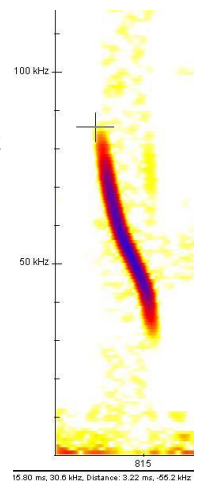


Myotis brandtii



Purpose and Limitations :

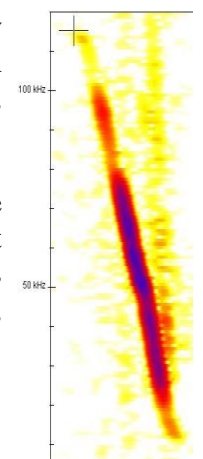
This paper aims to synthesize knowledge on acoustic criteria which are visible in sonograms, for distinguishing between French *Myotis* species. This knowledge currently comes only from the experienced writers and many of their collaborators. Taking this step has the advantage of opening up to the readers identification criteria which are strongly supported but still unproven. The resulting benefit will be to improve potential criteria by including new ideas and retiring those which are least reliable. The approach shown cannot be not be used alone to confidently identify species of *Myotis*. We refer the reader to the publications and trainings undertaken by Michel Barataud.

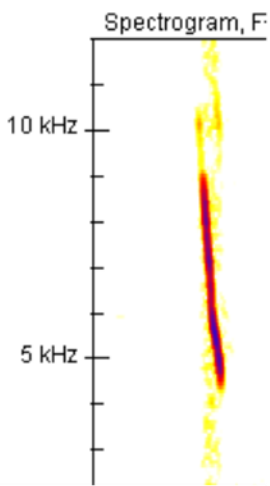
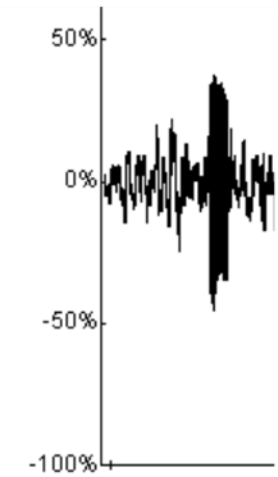


Usage tips :

The method developed by Michel Barataud proposes that calls of *Myotis* are rarely individually identifiable because of the broad overlap between calls of different species. Thus, identification will be more solid when based on a sequence which includes different types of calls. In short, the identification is done by elimination in the hope that only one species remains possible.

For each species, three types of calls are shown. It is important to note that all intermediate variations are possible, but not illustrated for simplicity. These three categories represent different classes of duration. They also relate to the distance from the bat to obstacles (proportional to the call duration) and the rhythm of the sequence (= Pulse Repetition Rate, PRR, inversely proportional to the duration of calls).

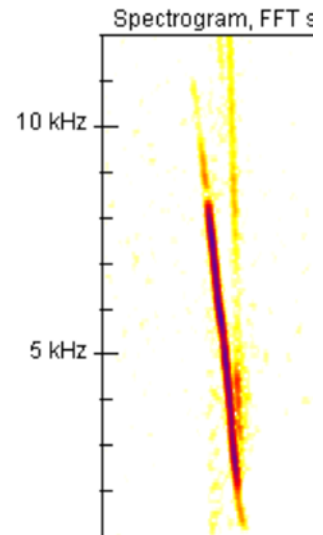
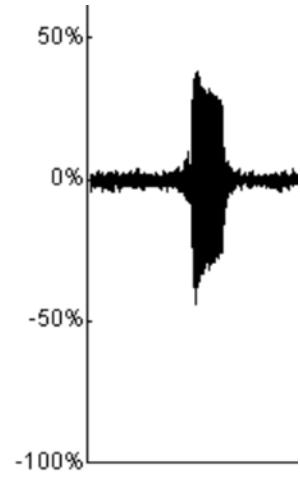




Myotis alcaethoe,
Explosive start

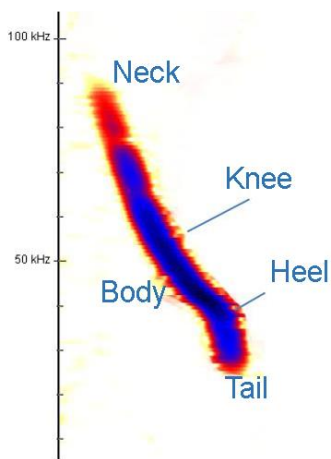
General:

- *Myotis* are characterized by the steep frequency modulation: Call frequency decreases rapidly.
- *Pipistrellus* can sometimes produce “steep” calls, but in this case, the energy peak is close to the terminal frequency. It is higher in *Myotis*
- *Plecotus*, *Eptesicus* and *Nyctalus* sometimes produce steep calls, but at lower and more restricted frequencies (~ 20-40 kHz)

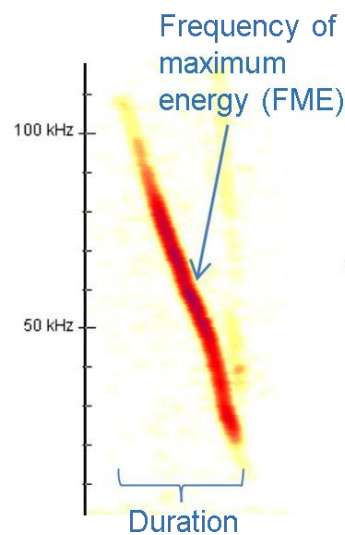


Myotis nattereri,
Final clap

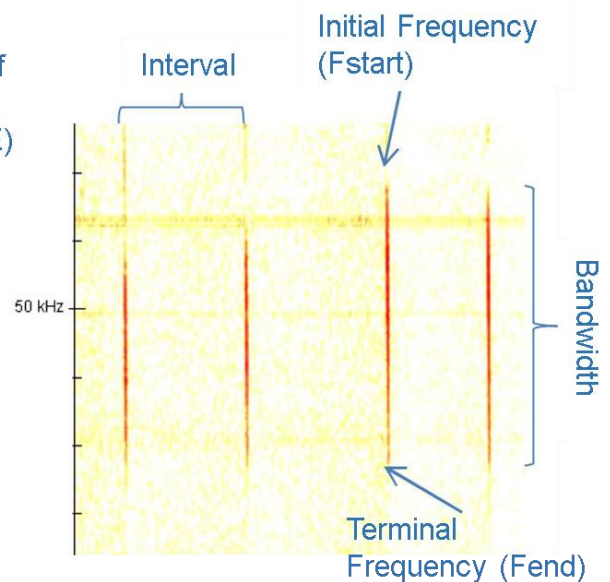
Graphical Lexicon:



Myotis daubentoni



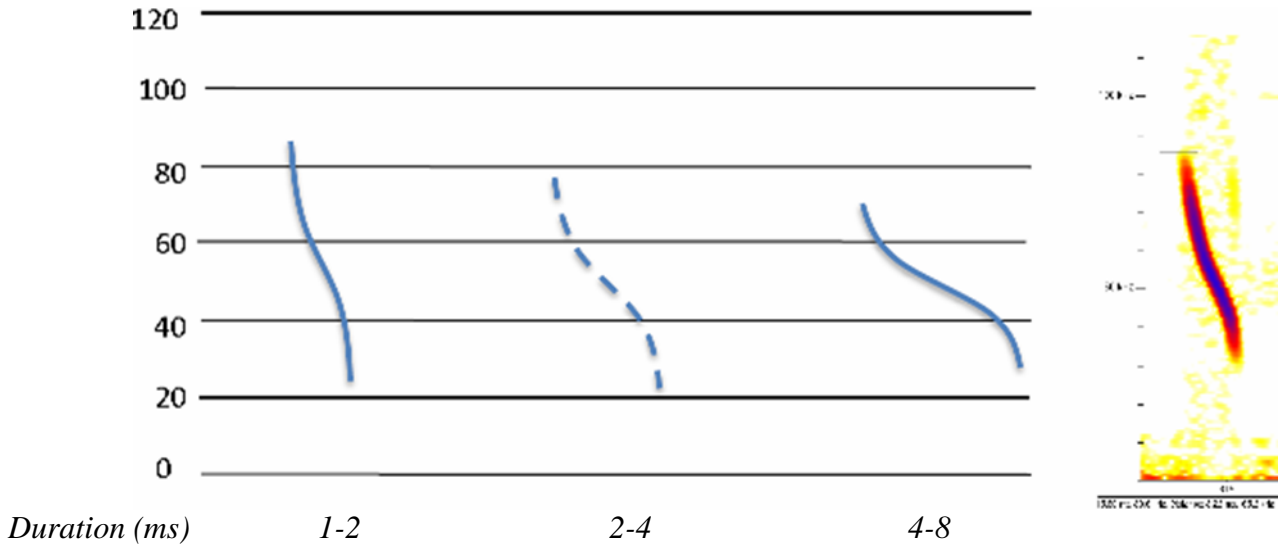
Natterer's Bat



Natterer's Bat sequence showing
increasing Pulse Repetition Rate

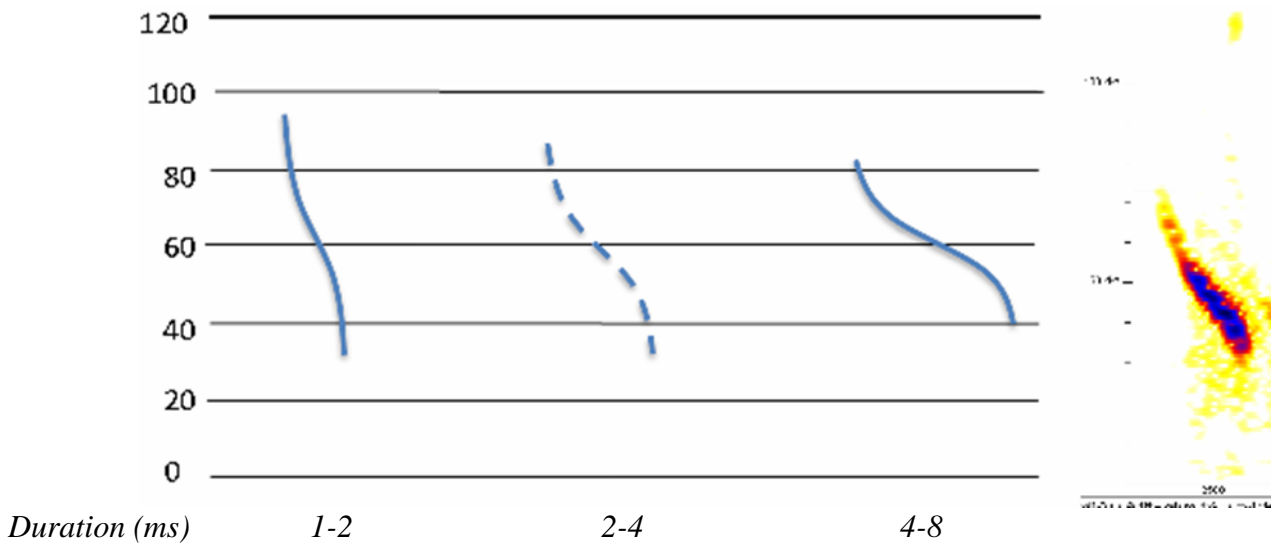
Myotis daubentonii :

- Signal regularly has sigmoidal shape
- Fstart never high (rarely > 100 kHz)
- Heel around 40 KHz
- Fend around 25 KHz. It increases with increasing duration
- Forms sinusoidal amplitude modulation above water (calls " Dotted ")



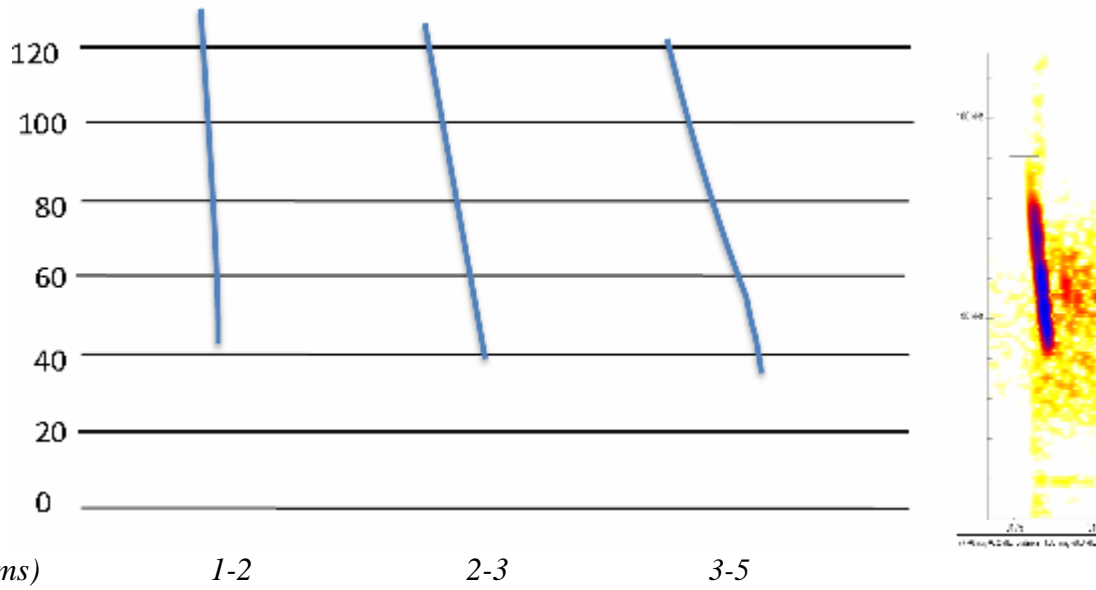
Myotis capaccini :

- Like *daubentonii* but with slightly higher frequencies (Heel 45KHz and Fend to 35 KHz)
- Only *Myotis* with Fend around 35 kHz combined with Dur > 5 ms
- Forms sinusoidal amplitude modulation above water (calls "Dotted ")



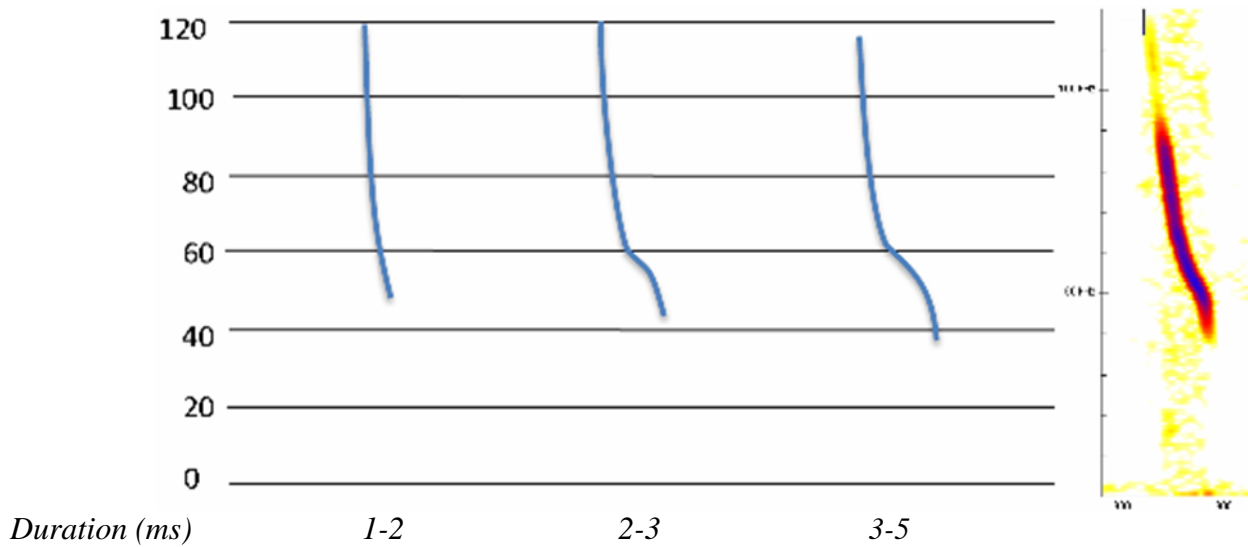
Myotis emarginatus :

- Calls often very straight (linear)
- Fstart often high (up to 140 KHz)
- Fend very high (in closed environment, > 40 KHz)
- Heel sometimes marked but very rarely shows a knee (only when calls > 4 ms)
- Duration rather short (mostly 1-3 ms)



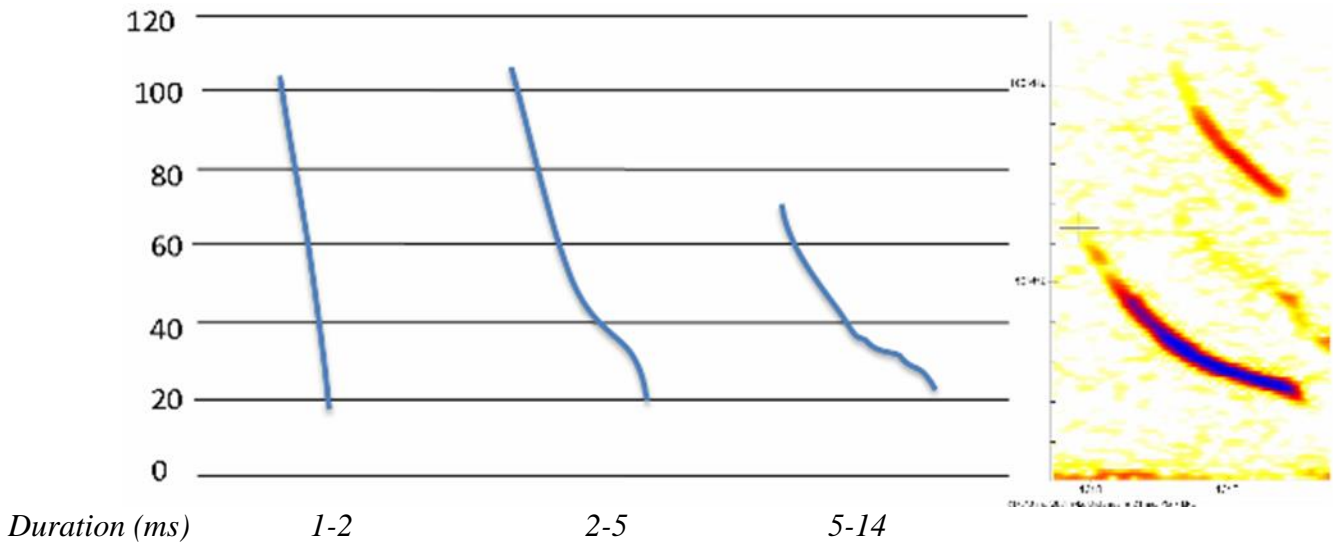
Myotis alcathoe :

- Fend very high (averages > *M. emarginatus*)
- Knee always obvious, little heel on the short calls
- Signal with explosive start because Neck always steep and with lots of energy.



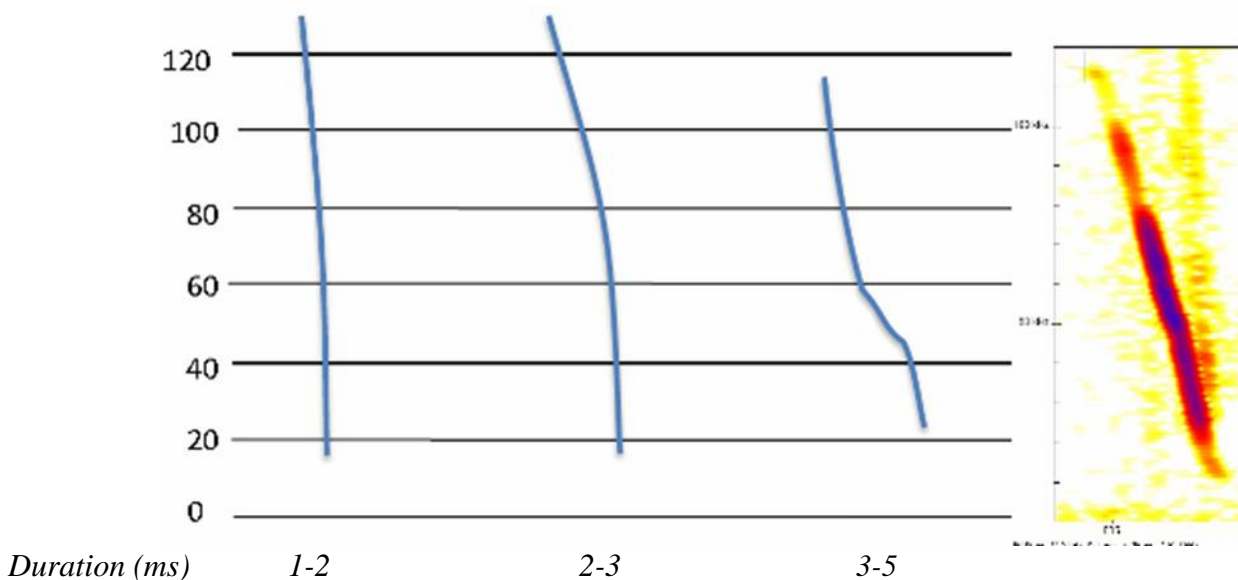
Myotis myotis / blythii :

- Fend between 12 and 30 KHz
- Duration may be very long (> 10 ms)
- FME low, to 30-35 KHz
- Body often zigzag in long calls (> 6 ms)
- Only *Myotis* in which the FME is close to Fend
- Rythm particularly regular and maximum energy relatively spread out compared to *Eptesicus serotinus*
- May be confused with *M. nattereri* when high PRR (approach phase)



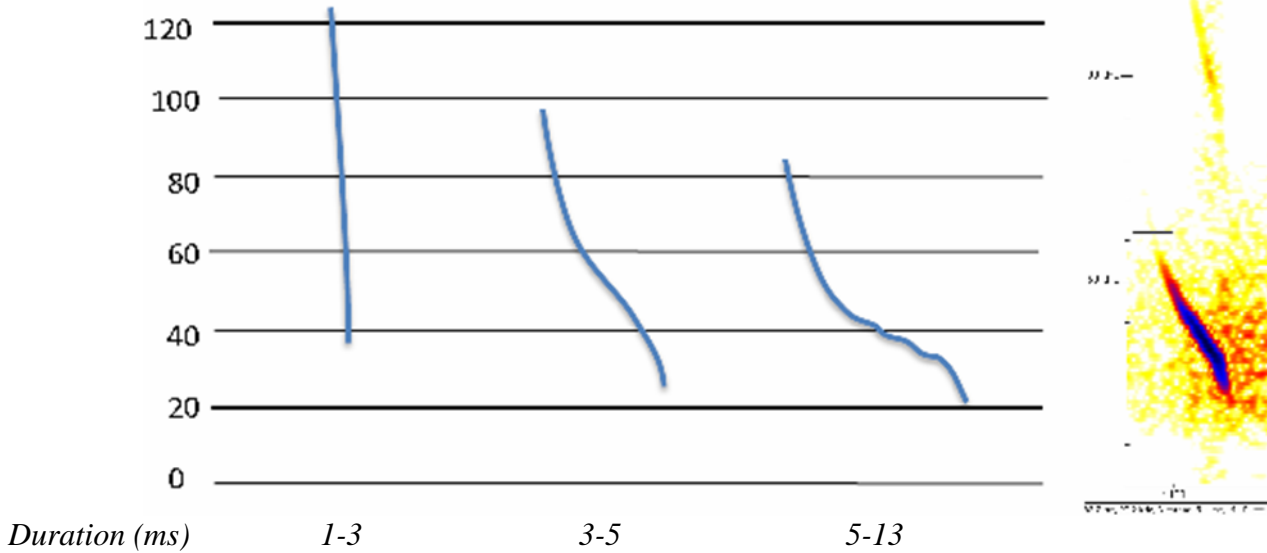
Myotis nattereri:

- Very wide bandwidth
- Fend down into the audible (<20 KHz) when bat is very close
- Able to sweep more than 100 KHz in 1 ms
- In closed and semi-closed environments, no Knee and slight Heel



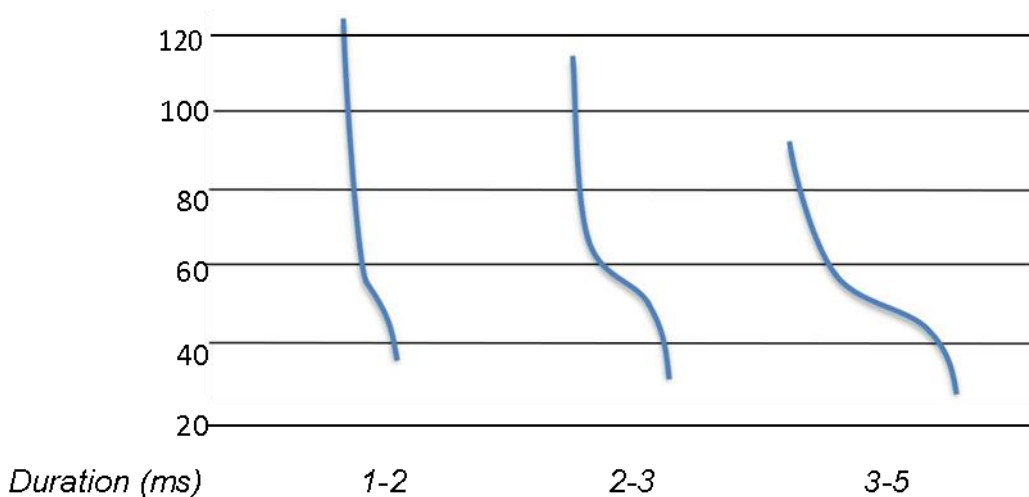
Myotis bechsteinii:

- In closed environment, calls close to *M. emarginatus*
- In semi-open environment, close to *M. daubentonii* but may lengthen call beyond 8 ms in open areas.
- Unlike *M. daubentonii*, terminal frequency decreases with increasing duration
- Body may be zigzag as in *M. myotis/blythii*
- In open environment, FME is higher than that of *M. myotis/blythii* (> 35 kHz)



Myotis mystacinus:

- Knee often more pronounced than the Heel
- Neck steep except when in open transit
- In closed environments, like *M. alcathoe* but lower frequency
- In open environments, very close to *M. daubentonii*
- Unlike *M. daubentonii*, Fend decreases with increasing duration



Confusion possible with *M. brandtii*.
No clear-cut visual criteria to differentiate between these two species, only some subtle acoustic criteria

Bas, Y., Cornut, J. & Colombo, R. 2011. *Détermination visuelle des Myotis sursonograme.*

Translated by Chris Corben, Aug 2016.