

'NARROWBAND' Species

	EUMA	NYMA	LACI	TABR	EPFU	LANO	ANPA	LABO	LABL	PAHE
EUMA										
NYMA										
LACI				1	P	P	P			
TABR			1		2	3	S			
EPFU			P	2		4	5	P	P	
LANO			P	3	4		S	P	P	
ANPA			P	S	5	S				
LABO					P	P			X	P
LABL					P	P		X		P
PAHE								P	P	

- EUMA Spotted Bat
- NYMA Big Free-tailed Bat
- LACI Hoary Bat
- TABR Mexican Free-tailed Bat
- EPFU Big Brown Bat
- LANO Silver-haired Bat
- ANPA Pallid Bat
- LABO Eastern Red Bat
- LABL Western Red bat
- PAHE Canyon Bat

Colors:

- Fmin standard deviation overlaps; separate based on other characters
- Fmin range overlaps, but not standard deviation, so can separate using K-Shape rule* (& other characters if listed)
- Fmin ranges do not overlap, or n/a

**K-Shape rule: 'within the Fmin range of a species, lower Fmin have flatter calls while higher Fmin have steeper calls'*

Other characters:

- P Pattern (steady vs bouncy Fmin)
- S Shape (presence of flat calls or dog's paw calls)
- X indistinguishable

- 1 TABR vs LACI; TABR has molossid call shape and carrot-shaped oscillogram; LACI has evenly distributed power in oscillogram
- 2 EPFU vs TABR; TABR has molossid call shape; EPFU call shape lacks upswing into call
- 3 LANO vs TABR; LANO has flat call ≥ 25 kHz, power evenly distributed through oscillogram, and usually upsweep out of call; TABR has flat call < 25 kHz, carrot-shaped oscillogram, and molossid call shape
- 4 EPFU vs LANO; EPFU has $F_{max} \geq 60$ kHz; LANO has $F_{max} < 60$ kHz + < 6 ms + harmonic OR LANO has flat call ≥ 25 kHz
- 5 EPFU vs ANPA; ANPA emits < 6 pulses/sec

**Note that all narrowband species are capable of making broadband calls in cluttered habitat. Assess your detector deployment when vetting.*

BROADBAND Species

	COTO	MYTH	MYEV	MYSE	MYLU	MYOC	MYVO	LASP	MYCI	MYCA	MYYU
COTO		H	H	H							
MYTH	H										
MYEV	H										
MYSE	H				1	1	1	P	1	B	B
MYLU				1		X	2	3	4		
MYOC				1	X		2	3	4		
MYVO				1	2	2		3	4		
LASP				P	3	3	3		P		
MYCI				1	4	4	4	P			
MYCA				B							5
MYYU				B						5	

- COTO Townsend's Big-eared Bat
- MYTH Fringed Bat
- MYEV Western Long-eared Bat
- MYSE Northern Long-eared Bat
- MYLU Little Brown Bat
- MYOC Arizona Bat
- MYVO Long-legged Bat
- LASP Eastern Red/Western Red Bat
- MYCI Western Small-footed Bat
- MYCA California Bat
- MYYU Yuma Bat

Colors:

- Fc standard deviation overlaps; separate based on other characters
- Fc standard deviation does not overlap, so can likely separate using K-Shape rule* (& other characters if listed)
- Fmin ranges do not overlap, or n/a

**Fmin ranges overlap for most broadband species, but Fmin is a less reliable characteristic for Myotis. Characteristic frequency (Fc) is better for separating Myotis, and has a similar relationship with shape as Fmin (within the Fc standard deviation of a species, lower Fc have longer duration calls while higher Fc have steeper calls).*

Other characters:

- H Presence of harmonics distinguishes complete calls from fragments
- B Bandwidth (>75 kHz vs ≤75 kHz)
- P Pattern (steady vs bouncy Fmin)
- X indistinguishable

- 1 MYSE vs 40k *Myotis* ; >75 kHz bandwidth when <5 ms and <16 pulses/sec
- 2 MYVO vs MYLU/MYOC; 4-6 ms and lower slope >3 when recorded in open airspace
- 3 LASP vs MYLU/MYOC/MYVO; steep LASP calls have Fmin >40 kHz and bouncy Fmin
- 4 MYCI vs 40k *Myotis* ; calls have smooth margins and baskets @ ~44 Fc
- 5 MYUY vs MYCA; inflections; power @ Fc; calls >6 ms with upper slope <16 & lower slope <3 diagnostic

