

Limits of echolocation calls of european bats

species	min QCF	max QCF	min PD*	max PD	max freq	min freq	peaks of typical IPI	remarks
Rhinolophus ferrumequinum	77	84	16	74			90	no overlap with other rhinolophids
Rhinolophus hipposideros	105	114	12	61			70	106-108 kHz could be 3 species
Rhinolophus euryale	104 (102)	109						in sympatric distribution euryale uses cf-calls 2-5 kHz lower than mehelyi but both species overlap considerably
Rhinolophus blasii	92	98						no overlap with other rhinolophids
Rhinolophus mehelyi	104	112						104-112 kHz after Siemers et al 2005, young included, Sardinia after Russo et al. 2007 102 - 111 kHz.
Myotis mystacinus	40	44	2 (1.5)	4 (6.4)	115 (125)	35 (28)	85 (SD=30)	Pulses < 4 ms mostly >-0.25 to linear, even convex
Myotis brandtii	38	41	2.2	5.5 (7)	120 (128)	28-30 (26)	88 (SD=28)	5 ms normal, mostly curved (<-0.25), also in clutter
Myotis emarginatus	NA	NA	2 (1.5)	4.5 (5.8)	160 (170)	38 (30-48)	70 (SD=24)	
Myotis nattereri	43	51	2 (1.5)	5 (10)	140 (175)	15 (7)	80 (SD=40)	Often uses convex pulses when pulse duration is short. > 4 ms normal concave curvature in pulse (open environment)
Myotis alcaethoe	NA	NA	1.5	4 (5)	130 (145)	44 (40)	81 (SD=28)	
Myotis bechsteinii	48	52	2 (1.5)	5 (11)	140	40-28 (22)	84 (SD=26)	clutter:soft, short FM, open:louder diagonal sweep with QCF at 50 kHz
Myotis myotis/oxygnathus	26	29	3.5 (3)	10 (12)	90-100 (110)	26 (25)	105 (SD=18)	When longer than 4 ms: curved, shorter: linear; no clear terminal hook
Myotis capaccini	?	?	2	6 (7)	85-90 (100)	32 (30)	65 (SD=16)	
Myotis daubentonii	35	39	2 (1.5)	6 (7)	85-90 (100)	28 (25)	75 (SD=30)	Pulses >2.5ms curved with clear final hook
Myotis dasycneme	31	33 (36)	2	10 (20)	65-70 (85)	28 (25)	90-100 (SD=25)	Pulses >2.5ms curved with clear final hook, positioned after QCF part.
Pipistrellus pipistrellus	41	50 (53)	2.5	7.5 (10)	100 (120)	41 (40)	90 and 165	Attention, some short duration whispering pulses may have a QCF component up to 53kHz!
Pipistrellus nathusii	37 (34)	42 (43)	?	10 (11.5)	90	37 (34)	100 and 205	Often uses many long duration (8 ms) pulses with QCF only.
Pipistrellus kuhlii	37 (36)	41	?	9 (11)	95 (100)	37 (36)	95 and 172	SD of IPI in all pups IPI around 15ms
Pipistrellus pygmaeus	53 (50)	60 (65)	?	6.5 (9.7)	100 (110)	52 (50)	75 and 165	
Hypsigugo savii	32 (29)	37	?	12 (16)	80	32 (29)	95 and 175	
Miniopterus schreibersi	50 (48)	53 (56)	?	11 (15)	110 (115)	50 (48)	80	sometimes has a starting hook
Nyctalus noctula (high)	21	24	4-5?	20 (25)	52	23 (21)	140 and 230	
Nyctalus noctula (low)	17	22	NA	18-25 (30)	30	18	170, 300 and 450	
Nyctalus leisleri (high)	26 (24)	28 (32)	3-4?	12 (16)	70	26 (24)	120 and 220	most common, alternates less than N.noctula
Nyctalus leisleri (low)	23 (21)	24	10?	17 (25)	26 (30)	23 (21)	?	longest pulses often just horizontal stripe
Nyctalus lasiopterus	16 (14)	22 (23)	?	28 (40)	50	16 (14)	150 and 270	
Eptesicus serotinus	25 (23)	28	3.5	12-14 (23)	65 (77)	25 (23)	143 and 278	
Eptesicus nilssonii	26	31	3.5	12-14 (18)	65 (77)	27	95, 195 and 300	
Vespertilio murinus	23 (21)	25 (27)	4.5 (4)	16-18 (20)	55 (60)	23 (21)	129, 240 and 336	
Barbastella barbastellus (high)	42	48	?	8 (11)	48	32 (24)	55-60 (SD=8)	starts with CF and then has terminal sweep
Barbastella barbastellus (low)	NA	NA	?	3 (4)	36 (40)	26 (25)	92 and 180	FM sweep, can have strong harmonics
Plecotus auritus	20	26	0.5	3 (4)	55	24	50	Can shift its resonance optimum from pulse to pulse amplifying first or second harmonic specifically
Plecotus austriacus	20	24?	0.5	5 (6)	45	20	?	Can shift its resonance optimum from pulse to pulse amplifying first or second harmonic specifically
Tadarida teniotis	11 (8)	15?	8?	20 (27)	31	9 (8)	1.4027E+11	Overlap may exist with Nyct.lasiopterus

* with first harm intact

QCF = Quasi constant frequency

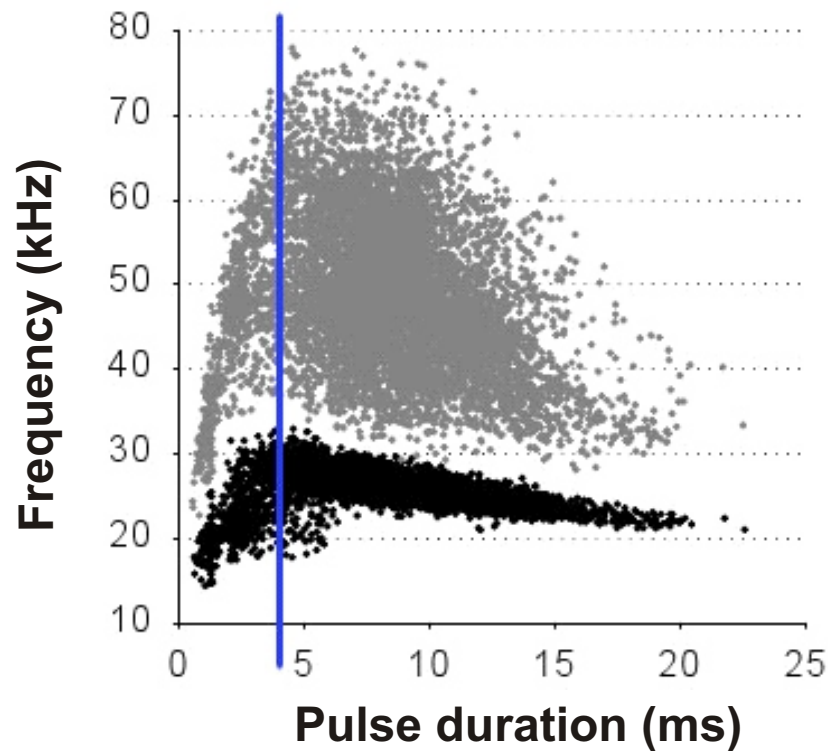
PD = Pulse Duration

IPI = Interpulse Interval

in brackets extremest value recorded

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Blue line denotes *minimum pulse duration*. Each pair of dots (grey and black) represent measurements of 1 pulse. Left of line, start- and end frequency drop: buzz pulses. Right of line: search and approach pulses. Position of line differs between many QCF species. Grey dot: start frequency of a pulse. Black dot: end frequency of a pulse.



The table describes echolocation pulses used by each species when forced to adapt its calls to a very dense and also to a very open environment, using perfect recordings. Only IPI are typical of an average, half-open habitat. To give feedback and for the latest version of this identification table please refer to: <http://www.batecho.eu>

