

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

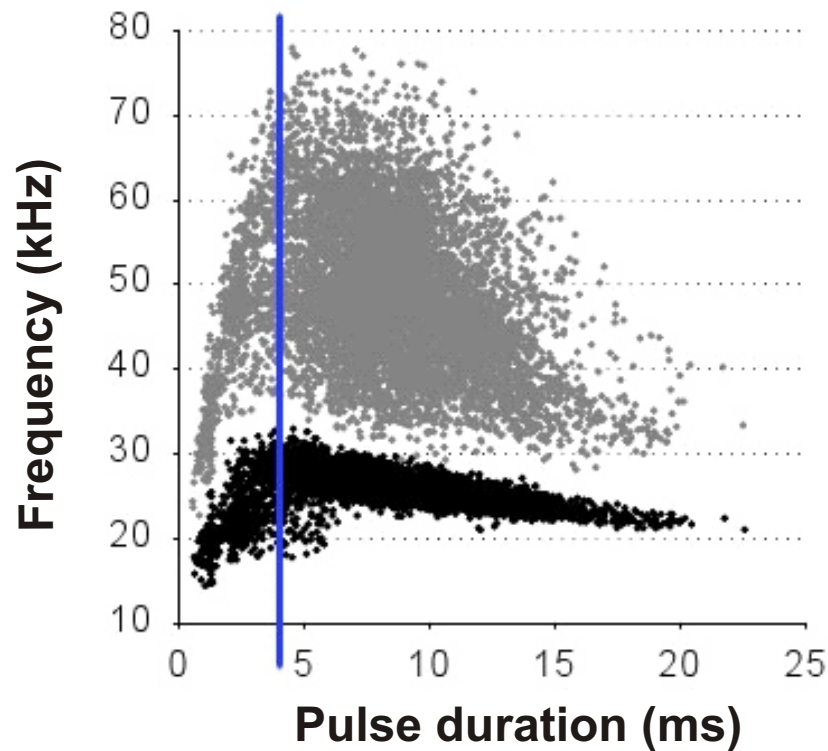
PD = Pulse Duration

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>

