

Supplementary Material

Supplementary Table 1. Summary of frequency ranges (minimum (kHz; the minimum frequency of the fundamental harmonic) – maximum (kHz; the maximum frequency of the dominant harmonic)) reported in acoustic literature (n = 89) and ecological traits (body mass (g), sociality (social: stable social structure of multiple individuals (colonial, congregated single-burrow systems, monogamous); solitary: stable solitary lifestyle; alternate: semi-stable social structure with alternating periods of solitude), diel activity patten (Diel A.P.; diurnal: active during day; nocturnal: active during night; crepuscular: active during dawn and/or dusk), and habitat openness (openness of dominant habitat type; closed: closed canopy, taller vegetation; open: open canopy, shorter vegetation) of Sciuridae (n = 73).

Species	Reference	Location	Min–Max Freq	Body Mass	Sociality	Diel A.P.	Habitat Openness
<i>Callosciurus caniceps</i>	(Tamura 1993) (Tamura and Yong 1993)	Selangor, Malaysia*	1.7–5.4^ 1.4–8.0^	312.9	Solitary	Diurnal	Closed
<i>Callosciurus erythraeus thaiwanensis</i>	(Tamura 1995)	Kanagawa, Japan	0.92–1.4^	375.1	Solitary	Diurnal	Closed
<i>Callosciurus nigrovittatus</i>	(Tamura and Yong 1993)	Selangor, Malaysia	1.6–8.3^	239.4	Solitary	Diurnal	Closed
<i>Callosciurus notatus</i>	(Tamura 1993) (Tamura and Yong 1993)	Selangor, Malaysia*	0.9–9.4^ 0.8–11.1^	227.9	Solitary	Diurnal	Closed
<i>Callospermophilus lateralis</i>	(Eiler and Banack 2004)	(California, Nevada), USA	4.4–10.6^	159.7	Social	Diurnal	Closed
<i>Callospermophilus saturatus</i>	(Eiler and Banack 2004)	Washington, USA	9.6–13.2^	350	Solitary	Diurnal	Closed
<i>Cynomys gunnisoni</i>	(Ackers and Slobodchikoff 1999)	Arizona, USA	0.7–6.2^	644	Social	Diurnal	Open
	(Loughry et al. 2019)	New Mexico, USA	0.4–1.2^				
	(Loughry, M. Oeser, and Hoogland 2019)	New Mexico, USA	0.4–1.2^				
	(Slobodchikoff et al. 2012)	Arizona, USA	0.5–4^				

Supplementary Table 1. Continued (2/9).

Species	Reference	Location	Range (kHz)	Body Mass	Sociality	D.A.P.	Habitat Openness
<i>Cynomys gunnisoni</i> (cont.)	(Waring 1970)	Colorado, USA	0.1–4.2^	644	Social	Diurnal	Open
<i>Cynomys leucurus</i>	(Waring 1970)	Colorado, USA	0.1–4.2^	925	Social	Diurnal	Open
<i>Cynomys ludovicianus</i>	(Shannon et al. 2020)	Colorado, USA*	1.2–2.0^	819	Social	Diurnal	Open
	(Waring 1970)		0.1–4^				
	(Wilson-Henjum et al. 2019)		2.0–4.1^				
<i>Glaucmys sabrinus</i>	(Gilley 2013)	Missouri, USA	8.1–24.7	141.3	Social	Nocturnal	Closed
	(Gilley et al. 2019)	Missouri, USA	10.9–				
	(Murrant et al. 2013)	Ontario, Canada	24.9^				
			20–80				
<i>Glaucmys sabrinus coloratus</i>	(Gilley 2013)	North Carolina, USA	9.3–28.7	127.7	Social	Nocturnal	Closed
<i>Glaucmys volans</i>	(Eisinger, Scheibe, and Flaherty 2016)	Indiana, USA	4–42	57.6	Social	Nocturnal	Closed
	(Gilley 2013)	(Alabama, Missouri, North Carolina), USA	5.8–40.0^				
	(Gilley et al. 2019)	North Carolina, USA	15.6–				
			25.6^				
	(Murrant et al. 2013)	Ontario, Canada	19–80^				
<i>Ictidomys mexicanus</i>	(Matocha 1975)	Texas, USA	2.7–5.7	398	Social	Diurnal	Open
<i>Ictidomys tridecemlineatus</i>	(Matocha 1975)	Texas, USA*	1.4–5.9	270	Solitary	Diurnal	Open
	(Matocha 1977)		4.2–5.9				
<i>Marmota baibacina</i>	(Brandler, Nikol'sky, and Kolesnikov 2010)	(Khangai, Ulagchin-Gol), Mongolia	0.7–4.2^	7850	Social	Diurnal	Open
<i>Marmota baibacina centralis</i>	(Nikol'skii et al. 2015)	Aksu, China	0.01–3.4^	NA	Social	Diurnal	Open
<i>Marmota bobak</i>	(Nikol'skii 2007)	(Orenburg, Luhansk, Kharkov), Ukraine	3.6–4.6^	3875	Social	Crepuscular	Open
	(Nikol'skii 2008a)	(Ulyanovsk, Orenburg), Russia	1–4^				

Supplementary Table 1. Continued (3/9).

Species	Reference	Location	Range (kHz)	Body Mass	Sociality	D.A.P.	Habitat Openness
<i>Marmota bobak</i>	(Nikol'skii 2008b)	Karaganda, Kazakhstan; (Luhansk, Kharkov), Ukraine)	0.5–5.4 [^]	3875	Social	Crepuscular	Open
<i>Marmota caligata</i>	(Blumstein 1999)	Washington, USA	1.8–4.2	4900	Social	Diurnal	Open
	(Taulman 1977)	Washington, USA	0.3 – 3.8 [^]	4900	Social	Diurnal	Open
	(Waring 1966)	Colorado, USA	2.5–3.5 [^]				
<i>Marmota caudata</i>	(Nikol'skii et al. 2015)	Alai Valley, Kyrgystan	0.01–4.3 [^]	5000	Social	Diurnal	Open
<i>Marmota flaviventris</i>	(Blumstein and Armitage 1997)	(Colorado, Utah), USA	1–4.2 [^]	2800	Social	Diurnal	Open
	(Davis 1991)	California, USA	2.2–4.0				
	(Matrosova et al. 2011)	Colorado, USA	2.5–4.3 [^]				
	(Waring 1966)	Colorado, USA	1.5–5 [^]				
<i>Marmota marmota</i>	(Blumstein and Arnold 1995)	Berchtesgaden National Park, Germany	2.8–3.4	3324	Social	Diurnal	Open
<i>Marmota monax</i>	(Lloyd 1972)	New York, USA	1.5–5 [^]	3526	Solitary	Diurnal	Open
<i>Marmota olympus</i>	(Blumstein 1999)	Washington, USA	1–6 [^]	7100	Social	Diurnal	Open
<i>Marmota sibirica</i>	(Brandler et al. 2010)	(Khangai, Ulagchin-Gol), Mongolia	1–3.7 [^]	8000	Social	Diurnal	Open
	(Nikol'skii et al. 2015)	Khangai, Mongolia	0.01–2.7 [^]				
<i>Marmota vancouverensis</i>	(Blumstein 1999)	British Columbia, USA	1–3.8 [^]	5500	Social	Diurnal	Open
<i>Otospermophilus beecheyi</i>	(Leger, Owings, and Gelfand 1980)	California, USA*	3.3–4.1 [^]	601.2	Social	Diurnal	Open
	(Owings and Leger 1980)		2–13 [^]				
	(Owings and Virginia 1978)		2–12 [^]				
	(Rabin et al. 2003)		3.4–6.1 [^]				

Supplementary Table 1. Continued (4/9).

Species	Reference	Location	Range (kHz)	Body Mass	Sociality	D.A.P.	Habitat Openness
<i>Otospermophilus variegatus</i>	(Krenz 1977)	Texas, USA	0.05–7 [^]	796	Social	Diurnal	Open
<i>Petaurista lena</i>	(Shen 2013)	Chiayi, Taiwan	1.5–10.3 [^]	1454.3	Solitary	Nocturnal	Closed
<i>Petaurista leucogenys</i>	(Ando and Kuramochi 2008)	Kyushu, Japan	0.8–12 [^]	1178	Solitary	Nocturnal	Closed
<i>Sciurus aberti kaibabensis</i>	(Hall 1981)	Arizona, USA	1–4.5	618.6	Social	Diurnal	Closed
<i>Sciurus carolinensis</i>	(Lishak 1982) (Lishak 1984)	Alabama, USA*	0.05–14 [^] 0.2–16 [^]	505	Social	Diurnal	Closed
<i>Sciurus niger rufiventer</i>	(Zelley 1971)	Illinois, USA	0.08–5 [^]	1361	Social	Diurnal	Closed
<i>Spermophilus alaschanicus</i>	(Nikol'skii 2019)	Almaty, Kazakhstan	3.7–8.5	220	NA	Diurnal	Open
<i>Spermophilus citellus</i>	(Koshev and Pandourski 2008)	(Ponor Mountain, Sofia), Bulgaria	7.1–15.3 [^]	202.3	Solitary	Diurnal	Open
	(Matrosova et al. 2012)	Prague, Czech Republic	0.3–15.8 [^]				
	(Schneiderová 2008)	Prague, Czech Republic	0.1–14.8 [^]				
	(Schneiderová 2012)	Prague, Czech Republic	7–13 [^]				
	(Schneiderová and Policht 2012a)	Prague, Czech Republic	5.8–15.2 [^]				
	(Schneiderová and Policht 2012b)	(Loděnice, Prague), Czech Republic;	7.0–15.1 [^]				
		Budapest, Hungary					
	(Schneiderová et al. 2015)	Prague, Czech Republic	7.6–12				
	(Schneiderová et al. 2017)	Prague, Czech Republic	8.5–14				
	(Schneiderová, Štefanská, and Kratochvíl 2019)	(Mohelno, Prague, Raná, Velká Dobrá, Vyškov), Czech Republic	7.4–13.5 [^]				

Supplementary Table 1. Continued (5/9).

Species	Reference	Location	Range (kHz)	Body Mass	Sociality	D.A.P.	Habitat Openness
<i>Spermophilus erythrogenys</i>	(Matrosova et al. 2019)	Almaty, Kazakhstan	4.4–8.6^	355	NA	Diurnal	Open
<i>Spermophilus fulvus</i>	(Matrosova et al. 2007)	Saratov, Russia*	2.7–6.5^	573	Solitary	Diurnal	Open
	(Matrosova et al. 2011)		1.6–5.4^				
	(Matrosova et al. 2012)		0.1–6.3^				
	(Matrosova, Volodin, Volodina, and Vasilieva 2010)		1.7–5.5^				
	(Matrosova, Volodin, Volodina, Vasilieva, et al. 2010)		1.9–5.5^				
	(Volodina, Matrosova, and Volodin 2010)		3.6–5.8^				
<i>Spermophilus major</i>	(Brandler, Tukhbatullin, and Nikol'skii 2019)	(Kurgan, Orenburg, Samara, Chelyabinsk), Russia; Republic of Bashkortostan; Republic of Tatarstan; (Aktobe, Kostanay, West K.), Kazakhstan	2.9–7.6	535	Social	Diurnal	Open
<i>Spermophilus musicus</i>	(Nikol'skii 2019)	Mount Aragats, Armenia	2.5–7	275	Solitary	Diurnal	Open
<i>Spermophilus pallidicauda</i>	(Nikol'skii 2017)	Lake Valley, Mongolia	4.5–8.5	NA	Social	Diurnal	Open
<i>Spermophilus pygmaeus</i>	(Nikol'skii 2007)	Yelansky, Russia	5.0–5.6	235.2	Social	Diurnal	Open
	(Nikol'skii 2019)	Orenburg, Ukraine	4.0–9.1				

Supplementary Table 1. Continued (6/9).

Species	Reference	Location	Range (kHz)	Body Mass	Sociality	D.A.P.	Habitat Openness
<i>Spermophilus suslicus</i>	(Matrosova et al. 2007)	Moscow, Russia	6.3–11.8	220	Social	Diurnal	Open
	(Matrosova et al. 2011)	Moscow, Russia	8.9–10.0				
	(Matrosova et al. 2012)	Moscow, Russia	0.2–84^				
	(Matrosova et al. 2016)	(Lipetsk, Moscow, Tambov), Russia; (Odessa, Ozerne), Ukraine	7.8–9.9^				
	(Matrosova, Volodin, and Volodina 2006)	Moscow, Russia	0.01–14^				
	(Matrosova, Volodin, and Volodina 2009)	Moscow, Russia	9.0–9.7				
	(Volodin 2005)	Moscow, Russia	9.0–9.8				
	(Volodin et al. 2008)	Moscow, Russia	9.3–9.7				
	(Volodina et al. 2010)	Moscow, Russia	8.7–10.4				
<i>Spermophilus taurensis</i>	(Schneiderová 2008)	Antalya, Turkey	4.7–9.1^	201	Solitary	Diurnal	Open
	(Schneiderová 2012)	Antalya, Turkey	4–10^				
	(Schneiderová and Policht 2012a)	Antalya, Turkey	3.7–12.7^				
	(Schneiderová and Policht 2012b)	Taurus Mountains, Turkey	4.6–8.2^				
<i>Spermophilus xanthoprymnus</i>	(Nikol'skii 2019)	Saratov, Russia	2–10	177.9	Social	Diurnal	Open
	(Schneiderová 2012)	Kayseri, Turkey	3–11^				
	(Schneiderová and Policht 2012b)	Kayseri, Turkey	4.0–10.7^				
<i>Tamias alpinus</i>	(Brand 1976)	California, USA	1.5–9.5	36.55	Solitary	Diurnal	Closed
<i>Tamias amoenus</i>	(Brand 1976)	California, USA	1.5–11.5	51.3	Solitary	Diurnal	Open

Supplementary Table 1. Continued (7/9).

Species	Reference	Location	Range (kHz)	Body Mass	Sociality	D.A.P.	Habitat Openness
<i>Tamias dorsalis</i>	(Dunford and Davis 1975)	Arizona, USA	0.8–16.1^	74.4	Solitary	Diurnal	Closed
<i>Tamias dorsalis dorsalis</i>	(Dunford and Davis 1975)	Guaymas, Mexico	0.8–16.1^	NA	Solitary	Diurnal	Closed
<i>Tamias merriami</i>	(Brand 1976)	California, USA	1.5–15	75	Social	Diurnal	Closed
<i>Tamias minimus</i>	(Bergstrom and Hoffmann 1991)	Colorado, USA	1–13^	42.7	Solitary	Diurnal	Closed
	(Brand 1976)	California, USA	2–10				
<i>Tamias ochrogenys</i>	(Gannon and Lawlor 1989)	California, USA	3.6–12.2	94.1	Solitary	Diurnal	Closed
<i>Tamias palmeri</i>	(Gannon and Stanley 1991)	Nevada, USA	2.7–12.2	55.2	Solitary	Diurnal	Closed
<i>Tamias panamintinus</i>	(Brand 1976)	California, USA	1.5–13.5	57.3	Solitary	Diurnal	Closed
<i>Tamias quadrimaculatus</i>	(Brand 1976)	California, USA	1.5–12.5	91.9	Solitary	Diurnal	Closed
<i>Tamias quadrivittatus</i>	(Bergstrom and Hoffmann 1991)	Colorado, USA	1–8^	63.5	Social	Diurnal	Closed
<i>Tamias senex</i>	(Gannon and Lawlor 1989)	(Oregon, California), USA	2.4–13.0	94	Solitary	Diurnal	Closed
<i>Tamias sibiricus</i>	(Blake 1992)	(London, Somerset), United Kingdom	1.2–8.5^	96.2	Solitary	Diurnal	Closed
	(Lissovsky, Obolenskaya, and Emelyanova 2007)	Inner Mongolia, China; (Altai, Buryata, Irkutsk, Krasnoyarsk, Moscow, Primorsky, Tomsk, Zabaykalsky), Russia	1–11.8^				
<i>Tamias siskiyou</i>	(Gannon and Lawlor 1989)	(Oregon, Washington), USA	3.9–14.5	85	Solitary	Diurnal	Closed
<i>Tamias sonomae</i>	(Brand 1976)	California, USA	7–12.5	75	Solitary	Diurnal	Closed
<i>Tamias speciosus</i>	(Brand 1976)	California, USA	1.5–13	62	Solitary	Diurnal	Closed

Supplementary Table 1. Continued (8/9).

Species	Reference	Location	Range (kHz)	Body Mass	Sociality	D.A.P.	Habitat Openness
<i>Tamias striatus</i>	(Burke da Silva, Kramer, and Weary 1994)	Québec, Canada	0.5–8.7^	93.9	Solitary	Diurnal	Closed
	(Dunford 1970)	New York, USA	1–10				
	(Elliott 1978)	New York, USA	1–2				
<i>Tamias townsendii</i>	(Brand 1976)	California, USA	0.5–14.5^	76.1	Solitary	Diurnal	Closed
	(Gannon and Lawlor 1989)	(Oregon, Washington), USA	3.5–11.1	76.1	Solitary	Diurnal	Closed
	(Warner 1971)	Oregon, USA	0.5–11.6				
<i>Tamias umbrinus</i>	(Bergstrom and Hoffmann 1991)	Colorado, USA	1–13^	67.2	Solitary	Diurnal	Closed
<i>Tamiasciurus douglasii</i>	(Brand 1976)	California, USA	1.5–12.5				
	(Smith 1978)	British Columbia, Canada; (Maine, Maryland, Tennessee), USA	0.5–8^	199.3	Solitary	Diurnal	Closed
<i>Tamiasciurus hudsonicus</i>	(Greene and Meagher 1998)	Montana, USA	2.4–10.1	213	Solitary	Diurnal	Closed
	(Smith 1978)	British Columbia, Canada; (Maine, Maryland), USA	0.5–6.5^				
<i>Urocitellus armatus</i>	(Balph and Balph 1966)	Utah, USA	2–7.3^	313	Social	Diurnal	Open
	(Koepl, Hoffmann, and Nadler 1978)	Montana, USA	0.05–11^				
<i>Urocitellus beldingi</i>	(Leger, Berney-Key, and Sherman 1984)	California, USA	3.5–5.6^	265.2	Social	Diurnal	Open
	(Robinson 1980)	Oregon, USA	4–7				
	(Robinson 1981)	Oregon, USA	5.9–7.1				
<i>Urocitellus columbianus</i>	(Betts 1976)	Montana, USA	0.1–10^	441.4	Social	Diurnal	Open

Supplementary Table 1. Continued (9/9).

Species	Reference	Location	Range (kHz)	Body Mass	Sociality	D.A.P.	Habitat Openness
<i>Urocitellus columbianus</i> (cont.)	(Koepl et al. 1978) (Manno et al. 2007)	Montana, USA Alberta, Canada	0.01–7 [^] 1.6–5.8 [^]	441.4	Social	Diurnal	Open
<i>Urocitellus elegans</i>	(Fagerstone 1987)	(Colorado, Wyoming), USA	0.01–7.5 [^]	284.3	Social	Diurnal	Open
<i>Urocitellus richardsonii</i>	(Koepl et al. 1978) (Davis 1984) (Fagerstone 1987) (Koepl et al. 1978) (Sloan, Wilson, and Hare 2005) (Wilson and Hare 2004) (Wilson and Hare 2006)	Montana, USA Alberta, Canada Alberta, Canada; Montana, USA Montana, USA Manitoba, Canada Manitoba, Canada Manitoba, Canada	0.01–8 3.5–11 0.01–9.0 [^] 0.05–8.5 [^] 3.2–10 [^] 31.7–55 [^] 24.4– 56.3 [^]	590	Social	Diurnal	Open
<i>Urocitellus undulatus</i>	(Melchior 1971)	Alaska, USA	1–8 [^]	742.9	Social	Diurnal	Open
<i>Xerospermophilus spilosoma annectens</i>	(Matocha 1975)	Texas, USA	3.8–6.6 [^]	89	Solitary	Diurnal	Open
<i>Xerospermophilus spilosoma marginatus</i>	(Matocha 1975)	Texas, USA	3.7–5.4	89	Solitary	Diurnal	Open
<i>Xerus inauris</i>	(Furrer and Manser 2009)	Kalahari Desert, South Africa	3–14	522	Social	Diurnal	Open

*Indicates that the same location was used in all studies listed.

[^]Indicates that harmonics were detected in at least one call reported.

Bolded (sub)species could not be incorporated into analyses because body mass, ecological, and/or phylogenetic data was not available at time of publication.

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