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Lesser Mouse-eared Bat (*Myotis blythii*) in Slovakia: distributional status with notes on its biology and ecology (Chiroptera: Vespertilionidae)

Netopier ostrouchý (*Myotis blythii*) na Slovensku: rozšírenie s poznámkami k biológii a ekológii (Chiroptera: Vespertilionidae)

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Abstract. All available data on distribution of the lesser mouse-eared bat, *Myotis blythii* (Tomes, 1857) in Slovakia are summarised and some ecological notes are added. In total, more than 260 occurrence sites and almost 1,000 records (obtained by various survey methods, e.g. roost checks, nettings, winter census, analyses of owl pellets and osteological remains from caves) coming from the period 1924–2008 were included in the evaluation of distribution pattern. The species was recorded in 106 mapping squares making up 24.7% of the area of Slovakia. *M. blythii* was never evidenced in the northwestern (Kysuce region) and northeastern (Šariš region) parts of the country. Most of the records are concentrated to the karstic regions in the south of central Slovakia (Slovenský kras Mts., Muránska planina Mts., Slovenský raj Mts.) and to the mountains of eastern Slovakia (Slanské vrchy Mts.). In other parts of Slovakia, its distribution has a rather patchy character. While the breeding range has a northern margin at appr. 48° 50' N (upper Hron river basin) and does not exceed the mountain range of the Nízke Tatry Mts., hibernacula were recorded northward up to appr. 49° 05' N. The nursery colony in the Turčianska Štiavnička manor house (49° 05' N) is reported here as the northernmost site of reproduction within the whole distribution area. Generally, the distribution range of *M. blythii* is well correlated with climatic regions and (at least for the breeding range) it could be described as the area with the maximum mean January temperature of –3 °C and the minimum mean July temperature of 16 °C. *M. blythii* in Slovakia reaches elevations of up to 1200 m, summer roosts occur at lower altitudes (81% are situated below 400 m a. s. l.) than hibernacula (91% in the altitude range of 200–1000 m a. s. l.). As revealed from netting data, the date of parturition in Slovakia is estimated at the end of May and/or the beginning of June. Most usually, the species creates mixed nursery colonies with its sibling, *Myotis myotis*; only four monospecific breeding colonies were evidenced in the country. Long-term population changes of the species were shown using the winter census data from artificial hibernacula in the Slanské vrchy Mts. (E Slovakia), however, we do not report any obvious trend in its population numbers.

Key words. *Myotis blythii*, Slovakia, distribution range limits, breeding range, population trends.

INTRODUCTION

The lesser mouse-eared bat, *Myotis blythii* (Tomes 1857), is a species with South Palaearctic and Oriental distribution, it ranges from the European Mediterranean region through the Middle East and central Asia to southern Russia and northeastern China (Strelkov 1972, Horáček et al. 2000). Its distribution range in the Palaearctic is centred to the Mediterranean zone where it belongs to the most typical gregarious and cave-dwelling species. The European range includes the Iberian peninsula, central and southern France, Italy, Switzerland, Hungary, the Balkan countries, incl. Turkish Thrace. In Central Europe, *M. blythii* reaches the northern margin of its distribution range, the northernmost records come from eastern Bohemia (Czech Republic), northern Slovakia and western Ukraine (Topál 1999, Topál & Ruedi 2001, IUCN 2007). Recently, a first record of *M. blythii* was reported from southern Poland (Piksa 2006). Populations of the European part of the species range are considered to belong to the subspecies *M. b. oxygnathus* (Monticelli, 1885) (Topál & Ruedi 2001), sometimes regarded a full species separated from the Asian populations (e.g. Spitzenberger & Bauer 2001, Simmons 2005). Such a taxonomic interpretation is based on analysis of mitochondrial genomic data (Castella et al. 2000) however, analysis of nuclear genes suggested the assignation of European *oxygnathus* to *M. blythii* (Berthier et al. 2006, Ruedi unpubl. data).

From Slovakia, the first record of *M. blythii* was reported by Éhik (1924) from Revúca. This evidence was based on a revision of Méhely's collection deposited in the National Museum in Budapest. Some years later, reproduction of the species in Slovakia was confirmed, a nursery colony was found in a church attic in Chľaba near the Hungarian border (W Slovakia) in 1955 (Gaisler & Hanák 1956). In the 1960s, as a part of the book on mammals of Slovakia (Feriancová-Masárová & Hanák 1965), an evaluation of *M. blythii* distribution in the country was compiled. This summary presented ca. 30 sites of occurrence. Since that time, the number of known sites has significantly increased based on records from hibernacula, summer surveys in roosts, mist nettings, analyses of owl pellets and analyses of osteological material from caves. With an exception of several papers focused on bat records from the whole area of Slovakia (e.g. Gaisler & Hanák 1972, 1973, Horáček 1976, Horáček et al. 1979, 1995, Obuch 1985d, 1994, 1998b, Gaisler et al. 2003, Vachold 2003, Danko et al. 2007), most of the evidence is dispersed among numerous papers and unpublished reports. Thus, the aim of the presented study is to compile all available records and provide an evaluation of some ecological and biological data. This contribution continues the publication of similarly arranged accounts of Slovakian bat species (Uhrin et al. 1995, 1996c, 1997, Danko et al. 2004).

MATERIAL AND METHODS

All available data on the distribution of *M. blythii* in Slovakia were used for the evaluation, including those from literature, unpublished theses and reports as well as original data. For lists of the data sources checked see the Slovak chiropterological bibliographies by Uhrin & Polakovičová (2000) (until 1999) and Uhrin (2006) (complemented until 2005). A special data source is the series of winter bat censuses, conducted mostly by members of the Slovak Bat Conservation Society (Uhrin 1994, 1995b, 1996, 1997c, Hapl & Lehotská 1999, Hapl & Uhrin 1999b, Lehotská 2000, 2001, 2002a, 2003, Pjenčák & Fulín 2006a, b, c, and Pjenčák 2008). A complete list of the data compiled is given in Appendix. Several particular records presented mainly by inexperienced students (Kaňuch & Ceľuch 2000, Ceľuch 2001, Hájková 2001), where *M. blythii* identification was not quite correct (P. Kaňuch, pers. comm.), were excluded from evaluation. The compiled data (Table 1) originate from more or less systematic regional surveys in which several standard methods of field bat research were used: (1) checks of attics in larger buildings

Table 1. Structure of the database of *Myotis blythii* records used in the analysis
Tab. 1. Štruktúra databázy nálezov *Myotis blythii* použitých v analýze
Explanations / vysvetlivky: Q – number of mapping squares / počet mapovacích kvadrátov; S – number of sites / počet lokalít; R – number of records / počet nálezov

survey method / metóda evidencie	Q	S	R
hibernacula / zimoviská	49	117	645
summer records / letné nálezy			
attics / podkrovia	39 [15*]	56 [18*]	84
caves / jaskyne	9 [2*]	10 [2*]	12
nettings / odchyty do sietí	29	41	82
other summer records / ostatné letné nálezy	10	11	11
osteological records / osteologické nálezy			
owl pellets / vývržky sov	29	51	75
cave thanathocoenoses / tanatocenózy v jaskyniach	13	16	18
other records / ostatné nálezy	11	16	21
all / všetky	106	263	948

* nursery colonies / samičie kolónie

during the summer period (e.g. churches, schools, historical buildings, etc.), (2) surveys of underground roosts (e. g. caves, mines, galleries) both in the summer and winter seasons, with regular winter censuses carried out in many of the roosts as a part of long-term monitoring of bat populations, (3) capture sessions with mist nets usually installed at the entrances to underground spaces and above water level at smaller water bodies, (4) analyses of osteological material coming from owl pellets or from cave bottom deposits (thanatocoenoses), (5) other types of records (e.g. accidental findings of dead animals). Additionally, in 2006–2008, we conducted a special survey of nursery colonies throughout the whole range of the Western Carpathians in Slovakia, in which some of the previously known nursery colonies of mouse-eared bats were found (Table 2).

RESULTS AND DISCUSSION

Pattern of Distribution

Using the above mentioned sources we gathered about 950 records of *M. blythii* from 263 sites belonging to 106 mapping squares (grid squares of ca. 11.2×12 km; see Kroupová 1980) (Table 1, Fig. 1, Appendix). The occupied squares make up about one quarter (24.7%) of the whole area of Slovakia. Generally, the species shows a scattered and patchy distributional pattern. This can be a result of lower population density, but also of a rather difficult field identification from its sibling species, *Myotis myotis* (Borkhausen, 1797) (see Arlettaz et al. 1993). However, it seems clear that *M. blythii* does not occur regularly in the northernmost parts of the country (e.g. the Kysuce region in the northwest or the Šariš region in the northeast of Slovakia). In the latter regions, despite the intensive research effort (Štollmann & Randík 1980, Štollmann 1985, Danko & Mihók 1989, Korňan & Obuch 1995, Danko & Pjenčák 2002, Danko et al. 2003), no record of *M. blythii* has been made and its occurrence there has not been confirmed yet.

Most of the available distribution data are concentrated to the traditionally and long-studied southern parts of central and eastern Slovakia. In these areas, *M. blythii* was frequently recorded

in the Slovenský raj Mts., Muránska planina Mts., Slovenský kras Mts., Slanské vrchy Mts., Vihorlat Mts. and in adjacent basins and lowlands (e.g. Košická kotlina basin, Juhoslovenská kotlina basin; Gaisler & Hanák 1972, 1973, Horáček et al. 1979, 1995, Anděra et al. 1989, Danko & Mihók 1989, Matis 1998, Danko & Pjenčák 2002, etc.). Findings from the areas north of these regions, in higher elevations of the Nízke Tatry Mts., Veľká Fatra Mts., Malá Fatra Mts., and the Turiec region are less frequent and they are represented mostly by the records from hibernacula and also from various types of osteological material (e.g. Gaisler & Hanák 1972, 1973, Obuch 19985d, 2004, Gaisler et al. 2003). In these mountains, several wintering sites are known with higher *M. blythii* numbers regularly registered (Harmanecká jaskyňa cave, Liskovská jaskyňa cave, Bystrianska jaskyňa cave).

A separate group of occurrence sites is represented by the records from the Malé Karpaty Mts. and the Záhorie region in the western part of the country. The most important sites of this group are the Plavecká jaskyňa cave and the manor house of Veľké Leváre. In the first site, a mixed nursery colony of *M. blythii* and *M. myotis* was documented in 1964–1977 (Gaisler & Hanák 1972, 1973, Horáček et al. 1979). In the attic of the Veľké Leváre manor house (Záhorie region), a westernmost nursery colony of *M. blythii* in Slovakia was found in 1964 (Gaisler & Klíma 1965, Krátký et al. 1969). However, since the late 1970s chiropterological research in western Slovakia has been interrupted and *M. blythii* situation in these two important sites remains unclear. Unfortunately neither the authors of two most comprehensive reviews of bat fauna of the Záhorie region and the Malé Karpaty Mts. (Brinzík et al. 2002a, Lehotská 2002c) distinguished between *M. myotis* and *M. blythii*. During our checks in the region in the summer of 2007 (Plavecká jaskyňa cave; Borský Mikuláš, bakery attic; Table 2), no individual of *M. blythii* was found. Anyway, recently published records (Noga 2007, Kovarik 2008) suggest permanent presence of the species in western Slovakia, both in the winter and summer periods. Other records in western Slovakia outside the Danube lowland come from the surroundings of

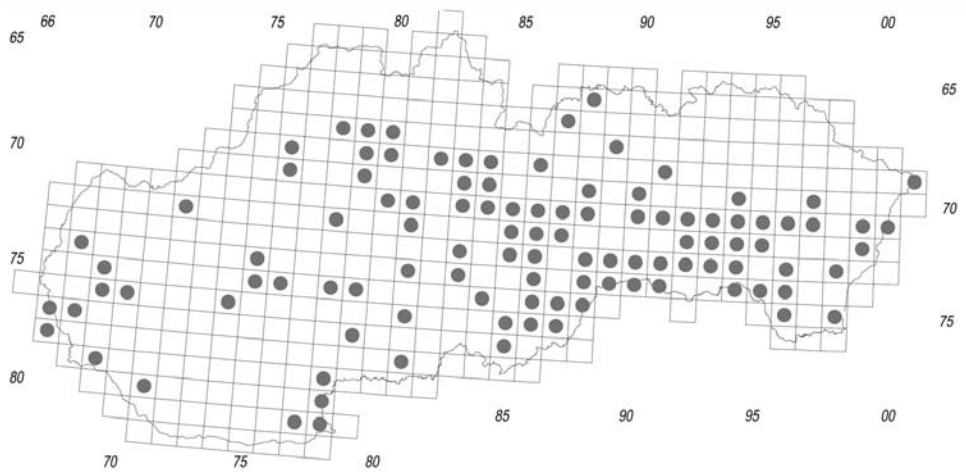


Fig. 1. Distribution of *Myotis blythii* in Slovakia shown in the square mapping grid. All available data were used (see Appendix).
Obr. 1. Rozšírenie *Myotis blythii* na Slovensku zobrazené v kvadrátovej mapovacej sieti. Použité sú všetky údaje (pozri Appendix).

Table 2. List of surveyed nursery colonies of mouse-eared bats (genus *Myotis*)
Tab. 2. Prehľad kontrolovaných reprodukčných kolónií veľkých netopierov rodu *Myotis*
Explanations / vysvetlivky: Q = quadrate no. / č. kvadrátu; N = no. of bats / počet netopierov; MB = *Myotis blythii*; MM = *Myotis myotis*; f = female / samica; m = male / samec; a = adult / dospelý; s = subadult / nedospelý; j = juvenile / mláďa; G = pregnant / gravidná; L = lactating / laktujúca; [slov. vysvetlivky: church attic = povala kostola; bakery attic = povala pekárne; manor house attic = povala kaštieľa; cave = jaskyňa; roost inspection = kontrola úkrytu; netting = odchyt do siete]

site / lokalita	habitat	Q	date / dátum	N	method / metóda	examined inds. / skúmané kusy
Blhovce	church attic	7885	17 May 2007	500	roost inspection	14 faG MM
Borský Mikuláš	bakery attic	7369	26 June 2007	400	roost inspection	3fa, 11faL, 1fj MM
Borský Mikuláš	bakery attic	7369	9 July 2008	400	roost inspection	20faL MM
Borský Mikuláš	bakery attic	7369	24 April 2008 27 May 2008	361*	netting	10fa, 5faG MM
Brezina	church attic	7495	28 June 2007	60	roost inspection	1fa MB; 11 MM: 2fa, 2faL, 2mj
Čaňa	church attic	7393	27 June 2007	200	roost inspection	MM
Dlhá Lúka	church attic	6693	29 June 2007	300	roost inspection	1mj MM
Drienovská jaskyňa	cave	7391	2006–2008	ca. 1000	netting	11 MB: 6fa, 3faG, 2faL; 480 MM: 114fa, 80faG, 175faL, 63fj, 5ma, 43mj
Hontianske Nemce	church attic	7779	22 June 2007	1000	roost inspection	16 faL MM
Horný Vadičov	church attic	6779	30 June 2007	120	roost inspection	2faL, 2fs, 1ma MM
Hosťovce	church attic	7491	24 April 2006 9 May 2006	150	roost inspection / netting	12fa, 2ma MB
Chľaba	church attic	8178	21 June 2007	0	roost inspection	–
Jelšava	church attic	7387	17 May 2007	500	roost inspection	7 faG MM
Kokava nad Rimavicou	church attic	7485	23 June 2007	100	roost inspection	11faL, 1fs MM
Košické Olšany	church attic	7294	26 June 2007	400	roost inspection	11faL, 2fs MM
Ladice	church attic	7675	22 June 2007	120	roost inspection	8faL, 5fs MM
Legnava	church attic	6691	29 June 2007	100	roost inspection	15faL, 1fs MM
Myslava	church attic	7293	27 June 2007	250	roost inspection	5 faL, 1 fs, 4 fj, 4 mj MM
Necpaly	church attic	7079	30 June 2007	1000	roost inspection	15faL, 2fs, 1ms MM
Očová	church attic	7481	23 June 2007	1000	roost inspection	12faL, 1fa, 1fs MM
Osadné	church attic	6898	28 June 2007	350	roost inspection	10faL, 1mj, 1fj MM
Plavecká jaskyňa	cave	7569	20 June 2007 9 July 2008	–	netting	46faL MM
Príbelce	church attic	7881	22 June 2007	350	roost inspection	1faL MB; 6faL, 1fa, 5fs MM
Rajec	church attic	6977	30 June 2007	1200	roost inspection	10faL, 3fs, 1fj, 1mj MM

Table 2. (continued)
Tab. 2. (pokračovanie)

site / lokalita	habitat	Q	date / dátum	N	method / metóda	examined inds. / skúmané kusy
Rajec	church attic	6977	30 June 2007	1200	roost inspection	10faL, 3fs, 1fj, 1mj MM
Rochovce	church attic	7287	2006–2008	ca. 500	netting	17 MB: 4fa, 4faG, 6faL, 1fj, 1ma, 1mj; 384 MM: 69fa, 40faG, 163faL, 53fj, 14ma, 45mj
Sačurov	church attic	7196	27 June 2007	2200	roost inspection	32faL, 1fj MM
Slovenská Ľupča	church attic	7281	23 June 2007	200	roost inspection	1fa, 4faL, 5fs, 3fj, 3mj MM
Turčianska Štiavnička	manor house attic	6980	29 June 2007	30	roost inspection	6faL with j, 1fs MB; 1faL Mmyo MM
Vinné	church attic	7197	27 June 2007	47	roost inspection	1fa, 11faL, 2fj, 1mj, 2fs MM
Vyšná Rybnica	church attic	7199	28 June 2007	100	roost inspection	MM
Vyšný Mirošov	church attic	6694	29 June 2007	115	roost inspection	

*counting of the bats emerged

Nitra (Gaisler et al. 2003) and from the Štiavnické vrchy Mts. In the latter mountains, rich in artificial mines and galleries, *M. blythii* was evidenced both in the hibernation and summer periods (Palášthy 1971b, Štollmann 1971, Uhrin et al. 2002e, Mihál 2004, Mihál & Kaňuch 2006).

The population in western Slovakia is most probably closely connected with the populations registered in eastern Austria and southeastern Czech Republic (Spitzenberger & Bauer 2001, Hanák & Anděra 2006). In the latter country, the main distribution range of *M. blythii* is restricted to central and southeastern Moravia. However, such connection has not been confirmed by bat-banding yet (Gaisler et al. 2003). So the information mentioned in the atlas of bat migrations in Europe (Hutterer et al. 2005) is obviously erroneous. In Moravia, new records are still sporadically reported (see Lučan et al. 2007) even in the summer season and the species does not seem to be very abundant there.

As revealed in the available data set, *M. blythii* reaches lower level of abundance in lowland areas. It is probably absent from the in Podunajská nížina lowland (Danube lowland), with only older and unclear records from Šamorín and Trstená na Ostrove being available (Topál 1954, Ferianc 1956, Mituch 1963). There are several records from the eastern part of this lowland, which were connected to the nursery colony in Chľaba (Gaisler & Hanák 1956, Gaisler et al. 2003). A current visit of the attic in Chľaba showed that the whole colony had disappeared from the church (21 June 2007; leg. M. Uhrin & P. Benda). Despite the lower level of knowledge on bats in the Danube lowland, we can suppose that *M. blythii* is not abundant in this kind of landscape. This opinion is also supported by the situation in lowlands of eastern Slovakia. Here, only few records in winter, in summer and also in the food of *T. alba* food were made (e.g. Danko & Mihók 1989, Pjenčák 1995, 2002a, Danko 1997, Danko et al. 2007, own data). The generally low abundance of *M. blythii* in these lowlands is confirmed also by the results of faunistic research conducted here in 1994–1999 (Danko et al. 2000). During the checks of 315 buildings, *M. blythii* was found only in 2 of them. A similar pattern of *M. blythii* distribution was reported also from Hungary. The records are concentrated to mountain regions in the northern part of the country and along the Danube river, the species is also missing in lowlands (Bihari 2007).

The northernmost* record of *M. blythii* in Slovakia comes from the Aksamitka cave in the Pieniny Mts. very close to the Polish border, where a torpid female was found in July (Horáček et al. 1979). This record should be considered as exceptional occurrence outside an ordinary range of the species. Similarly, the single record of *M. blythii* from Poland was evaluated as very temporal and a regular occurrence of the species in Poland is not expected (Piksa 2006). A winter record from the Belianska jaskyňa cave in the Slovakian part of the same mountain massive of the Tatry Mts. (Mošanský & Gaisler 1965, Gaisler & Hanák 1972, 1973) has probably a similar character. The easternmost Slovakian records are known from the summer period; an adult female was netted in the Bukovské vrchy Mts. (Matis et al. 2000). In the Transcarpathian region of Ukraine – the easternmost part of the species distribution range in Central Europe – the records of *M. blythii* are very rare (Bashta & Potish 2007).

The records of *M. blythii* from the summer period are shown in Figs. 2 and 3. It can be stated that the distribution range of *M. blythii* in the active period is rather limited to the southern part of the country. Generally, this range does not exceed 48° 50' N, an approximate line running

* Topál & Ruedi (2001) erroneously mentioned one of the limit sites of *M. blythii* range (Čertova diera cave) to be situated in Moravia (E Czech Republic) instead of southern Slovakia, where the cave is actually located (e. g. Gaisler & Hanák 1972, 1973; Horáček et al. 1979, 1995). No site of this name is listed in Moravia (Hanák & Anděra 2006).

Fig. 2. Distribution of *Myotis blythii* in Slovakia: summer records in attics and nursery colonies. Yellow – records in attics, red – nursery colonies in attics, green – nursery colonies in caves, grey – all records.
Obr. 2. Rozšírenie *Myotis blythii* na Slovensku: letné nálezy v podkroviach a kolónie. Žltá – nálezy v podkroviach, červená – kolónie v podkroviach, zelená – kolónie v jaskyniach, sivá – všetky nálezy.

along the valley of the upper Hron river. Such a limit is valid for the range of distribution of summer roosts in attics. The new record of nursery colony in a manor house in Turčianska Štiavnička (Turčianska kotlina basin) at 49° 05' N can be considered exceptional and it recently represents the northernmost site of reproduction in the whole species' distribution range (see

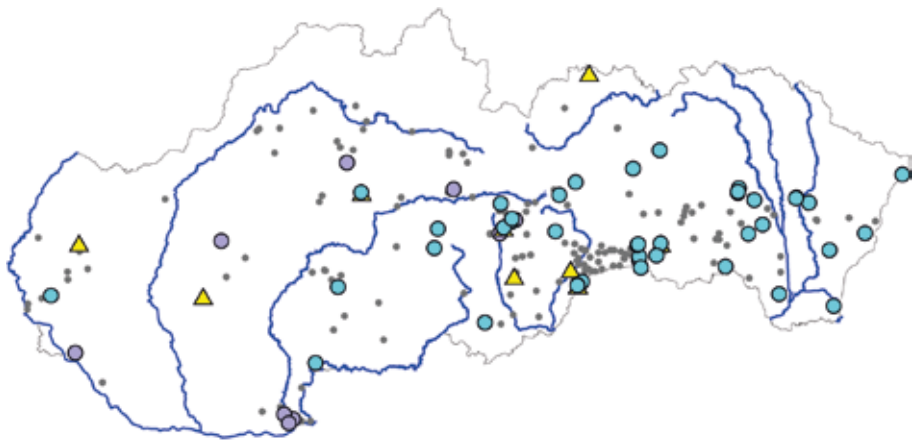


Fig. 3. Distribution of *Myotis blythii* in Slovakia: summer records. Turquoise – nettings, light blue – different other summer records, yellow triangle – records in caves, grey – all records.
Obr. 3. Rozšírenie *Myotis blythii* na Slovensku: letné nálezy. Tyrkysová – odchyty do sietí, svetlomodrá – rôzne letné nálezy, žltý trojuholník – nálezy v jaskyniach, sivá – všetky nálezy.

Topál & Ruedi 2001). There are only two nursery colonies known to be situated in caves; the Plavecká jaskyňa cave in the Malé Karpaty Mts. (W Slovakia) and the Drienovská cave in the Slovenský kras Mts. (SE Slovakia). The delineated general pattern of summer distribution of *M. blythii* in Slovakia conforms with the records coming from the analyses of the food of owls and other predators (Fig. 5). These data can be considered (with a certain level of simplification) as the records from summer period. However, presence of *M. blythii* in this kind of evidence is very rare (Obuch 1998b).

Hibernation of *M. blythii* was recorded in a series of various roosts within the whole Slovakian range (Table 1, Fig. 4). Most of the sites are reported from karstic regions in central and southern Slovakia, e.g. in the Veľká Fatra Mts., Slovenský kras Mts., Muránska planina Mts. and Slovenský raj Mts., where also the most abundant hibernacula occur (e.g. Harmanecká jaskyňa cave, Liskovská jaskyňa cave, Haska 3 gallery; Gaisler & Hanák 1972, 1973, Bobáková 2002a, Bobáková & Hapl 2002, Matis et al. 2002b, etc.). The northernmost hibernation site is the Belianska jakyňa cave in the Belianske Tatry Mts. (eastern part of the Tatry mountain range) (Gaisler & Hanák 1972, 1973), from where only one record is available so far. Other sites are scattered throughout the country, the westernmost Slovakian sites are reported from the Malé Karpaty Mts.

The mountain ranges stretching across central Slovakia, particularly the Nízke Tatry Mts. (its highest peak, Mt. Ďumbier, reaching 2043 m a. s. l.), seem to represent the main geographical factor limiting the distribution of *M. blythii* in Slovakia and its dispersal northwards. We suppose that the lesser mouse-eared bat penetrated to the sites evidenced north of this mountain range through river valleys in western and in eastern Slovakia. Several records are scattered along the Váh river, in a valley stretching from SW to central NE Slovakia where it borders the two highest Tatra ranges, the Nízké Tatry and Vysoké Tatry Mts. Dispersal conditions in eastern Slovakia are even better, generally because of the lower altitude, presence of larger rivers (Topľa, Ondava, and Laborec rivers) and because of the north-south direction of both these geographical phenomena (rivers and mountain ranges).

In the southern part of Slovakia, the distribution of *M. blythii* is probably limited by altitude and by the availability of karstic phenomena as suitable roosts (cf. their extensive absence in south-Slovakian lowlands, see also Figs. 1–5). On the other hand, in the northern part of Slovakia, climatic conditions seem to be the occurrence limits for *M. blythii* (as well as for other faunal elements of the Mediterranean type, see below).

The extent and pattern of the distribution of *M. blythii* in Slovakia (Figs. 1–5) could be well correlated with the main climatic regions of Slovakia. With the exception of several *M. blythii* hibernation sites situated in the northern part of the known range, no summer records of the species are available from the 'moderately cool region' (C1, after Lapin et al. 2002) and all lie within the 'moderately warm and humid region' (M7). Thus, the breeding range of *M. blythii* in Slovakia can be described as the climatic regions with the maximum mean January temperature of –3 °C and the minimum mean July temperature of 16 °C. This climatic region covers also the locality of the northernmost monospecific nursery colony in the Turčianska kotlina basin (Turčianska Štiavnička, own data, see above and Appendix) and/or in the upper Hron river valley (Bačkor et al. 2007). Considering precipitation, the breeding range of *M. blythii* in Slovakia lies in the area with 800 mm of the mean annual totals, with 50–60 mm of the mean January totals, and with 80–100 mm of the mean July totals (Faško & Šťastný 2002).

Several hibernacula (e.g. Liskovská jaskyňa cave, Dobšinská ľadová jaskyňa cave, Harmanecká jaskyňa cave) are situated in the 'moderate cool' or the 'cool mountainous' climatic regions,

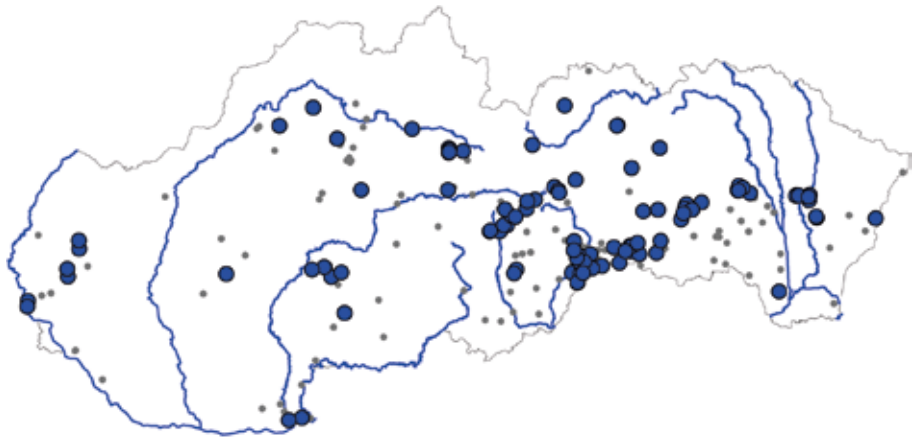


Fig. 4. Distribution of *Myotis blythii* in Slovakia: winter records. Blue – hibernacula, grey – all records.
Obr. 4. Rozšírenie *Myotis blythii* na Slovensku: zimné nálezy. Modrá – zimoviská, sivá – všetky nálezy.

but according to the banding data (Gaisler et al. 2003, Fig. 6), the bats from the nurseries of southern Slovakia hibernate in these caves. Even the northernmost Slovakian record from the Aksamitka cave in the Pieniny Mts. (Horáček et al. 1979) belongs to the 'moderately warm and humid region' climatic region as well as the whole Poprad river catchment.

A question arises, however, why *M. blythii* absents from the north-easternmost Slovakia, where the climatic conditions are well suitable according to the above delineated optimal climatic

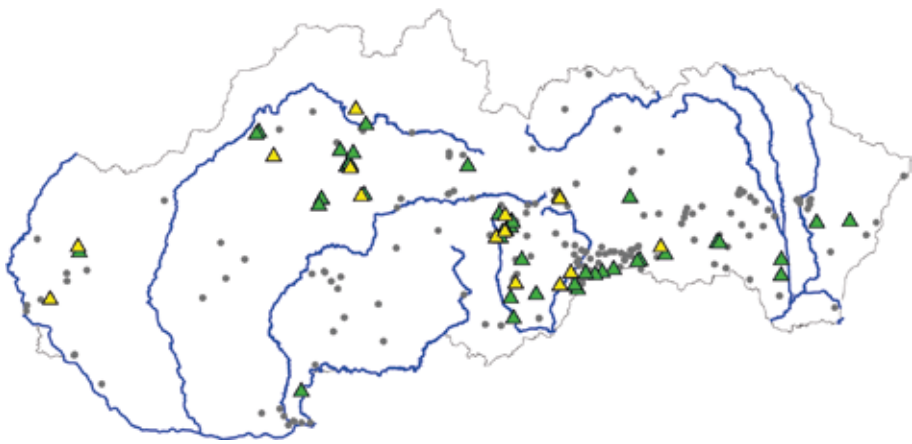


Fig. 5. Distribution of *Myotis blythii* in Slovakia: osteological records. Green – food of owls and *Corvus corax*, yellow – thanatocoenoses in caves or abysses, grey – all records.
Obr. 5. Rozšírenie *Myotis blythii* na Slovensku: osteologické nálezy. Zelená – potrava sov a *Corvus corax*, žltá – tanatocenózy v jaskyniach a priepastiach, sivá – všetky nálezy.

pattern of its range. Despite a detailed faunal survey (Danko et al. 2003), the species has not been found to occur in this part of the country (with the only exception of a hibernaculum in the Vyšná Hurka 1 cave). However, this range well conforms with the ranges of breeding colonies in other bat species of the Mediterranean type in Slovakia, e.g. *Rhinolophus euryale* Blasius, 1853, *R. ferrumequinum* (Schreber, 1774), and/or *Miniopterus schreibersii* (Kuhl, 1817) or with some phenotype characteristics in bat fauna, such as the cave dwelling of nursery colonies in *Myotis myotis* or the creating of conspicuous mass hibernation aggregations in underground spaces in *Pipistrellus pipistrellus* (Schreber, 1774) (Horáček 1984).

Notes on biology and ecology

Altitudinal distribution

More than a half of all sites of *M. blythii* in Slovakia are situated in the altitudinal range of 200–600 m a. s. l. (Fig. 7). This altitudinal range represents the regions where the largest proportion of records was registered (e.g. Slovenský kras Mts., Muránska planina Mts. etc.). More than 80% of the records were made at the range of 200–1000 m a. s. l. When we consider only the roost sites, a slight separation between the attic and/or cave summer roosts and the hibernacula can be observed. Most of summer roosts (81%) are situated at the elevation of up to 400 m, while for hibernation *M. blythii* usually selects roosts in the regions with a slightly higher altitude (and also the longitude; Fig. 7B). Up to 91% of the hibernacula fall in the range of 200–1000 m a. s. l. with the largest proportion at the range of 600–800 m.

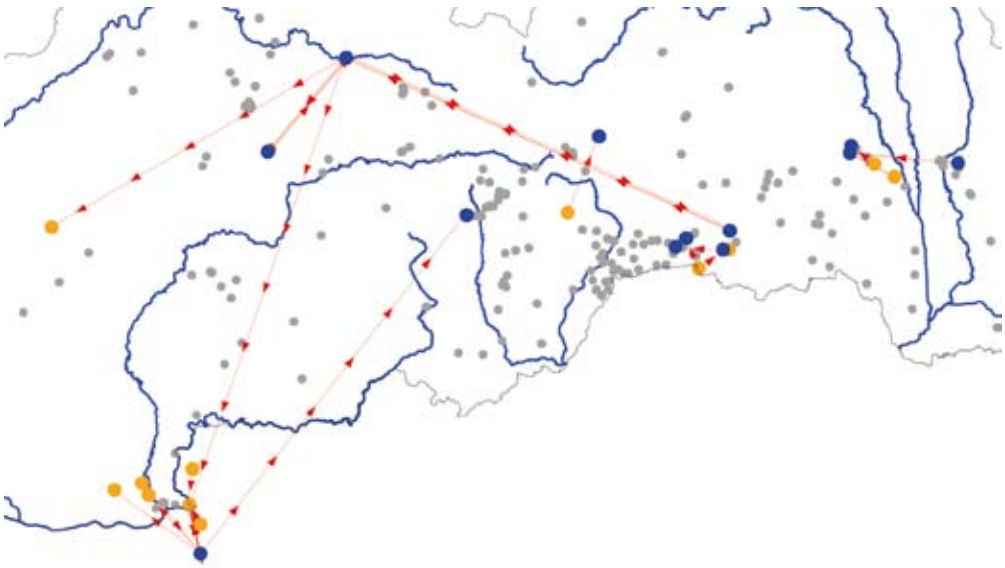


Fig. 6. Movements of *Myotis blythii* in Slovakia as revealed by ringing data. Red arrows show direction of movements between roosts, blue – hibernacula, cinnamic – summer roosts, grey – all records.
Obr. 6. Prelety *Myotis blythii* na Slovensku na základe výsledkov krúžkovania. Červené šípky vyjadrujú smery preletov medzi úkrytmi, modrá – zimoviská, škoricová – letné úkryty, sivá – všetky nálezy.

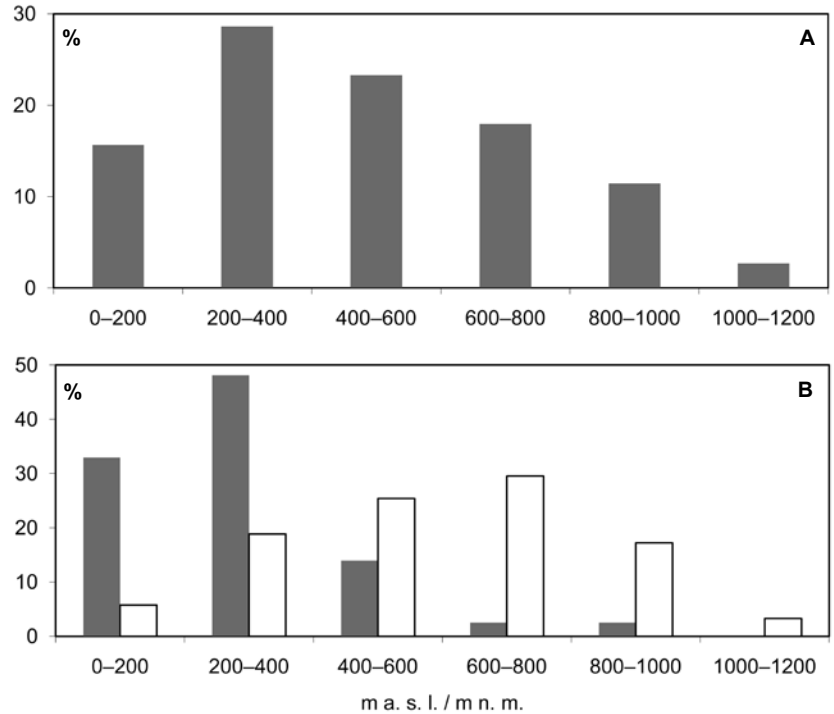


Fig. 7. Altitudinal distribution of *Myotis blythii* in Slovakia. A. all sites (n=262 sites). B. summer roosts (grey column, n=79 sites) and winter roosts (white column, n=122 sites).
Obr. 7. Charakteristika výskytu *Myotis blythii* na Slovensku podľa nadmorských výšok. A. všetky úkryty (n=262 lokalít). B. letné úkryty (sivý stĺpec, n=79 lokalít) a zimné úkryty (biely stĺpec, n=122 lokalít).

In central Slovakia (Poľana Mts.), the species was less abundant in the evaluated catch of netted bats and therefore did not show any altitudinal preferences (KAŇUCH & KRIŠTÍN 2006). Also in Moravia, a difference between the sites of summer and winter occurrence was observed (HANÁK & ANDĚRA 2006); the summer records come from the altitudinal range of 180–460 m, while the winter ones are reported from higher sites (310–490 m a. s. l.). The altitudinal range in Austria was reported to be wider (100–1400 m a. s. l.), as it includes also several sites in the Alps (SPITZENBERGER & BAUER 2001). In Bulgaria, the *M. blythii* nursery colonies were reported from locations up to 800 m a. s. l. (PANDURSKA 1996); such a difference can be explained by the more southern location of that country within the species range and presumably, by more suitable climatic conditions present also in higher elevations than in central Europe.

Population structure

As revealed in the sample of netted animals (Fig. 8), the first pregnant females of *M. blythii* in Slovakia appear in May (earliest record on 18 May 2007; Drienovská jaskyňa cave). The parturition period falls to the end of May and beginning of June; it could be documented by the increasing proportion of lactating females in the netted catch at the Drienovská jaskyňa

cave (hosting a cave nursery colony). The earliest lactating female was recorded in the second decade of June (12 June 2007, Drienovská jaskyňa cave). Volant juveniles appeared in the catch in July and August (earliest record on 10 July 2007 in Rochovce; church attic colony). In the Turčianska Štiavnička manor house, non-volant juveniles were observed on 30 June 2007 (LAt 28.2–44.5 mm; n=6). Feriancová-Masárová & Hanák (1965) reported juveniles of different age from the nursery colony in the church at Chľaba on 3 July 1955. The published data coming from the southern part of the species range reported parturitions more early, in the second half of May (for a review see Topál & Ruedi 2001).

Majority of *M. blythii* records made in attics comes from the colonies of *Myotis myotis* (e.g. Gaisler & Hanák 1956, Horáček et al. 1979, 1995, Matis 1998), where *M. blythii* represented a smaller proportion. However, an increasing trend in population abundance can be observed in the direction from north to south. Generally, population densities of *M. blythii* (when compared with the sibling *M. myotis*) are lower. In a sample of 31 roosts checked in 2006–2008, presence of *M. blythii* was recorded only in five of them (16.1%, Table 2). Findings of monospecific nursery colonies composed of *M. blythii* only are very rare in Slovakia. The first of them was reported from the Rimavská kotlina basin (Cakov, church attics; Horáček et al. 1995) and later,

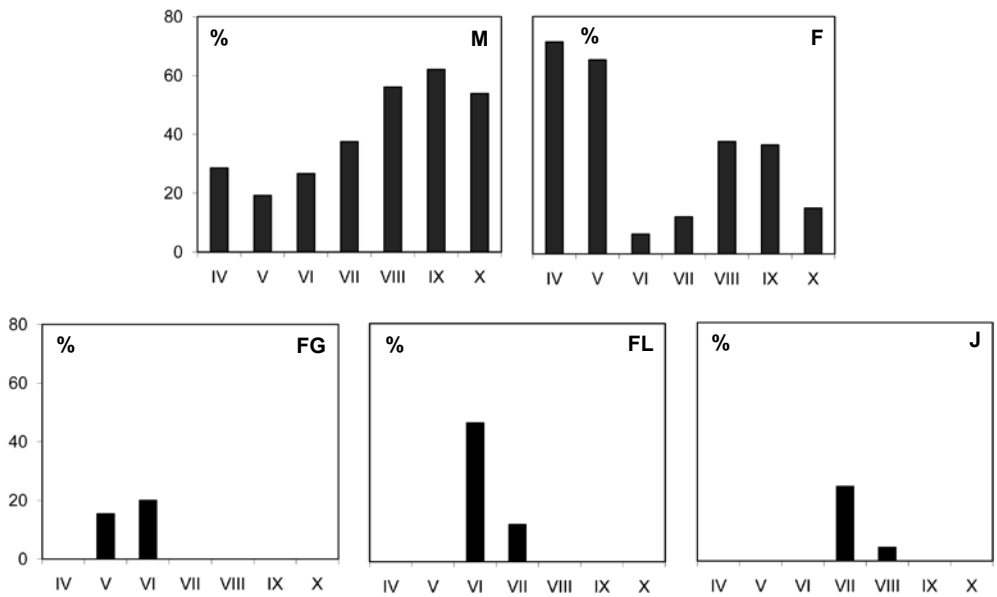


Fig. 8. Population structure and phenology of *Myotis blythii* as revealed by netting data (1970–2008). M – males, F – non-pregnant and non-lactating females, FG – pregnant females, FL – lactating females, J – juveniles (n=82 nettings, 238 bats, 41 sites). Percentage of different bat categories captured within the particular month is shown.

Obr. 8. Populačná štruktúra a fenológia *Myotis blythii* na základe údajov z odchytov do sietí (1970–2008). M – samce, F – negravidné a nekojace samice, FG – gravidné samice, FL – kojace samice, J – mláďatá (n=82 odchytov, 238 netopierov, 41 lokalít). Zobrazený je percentuálny podiel kategórií netopierov odchytených v rámci mesiaca.

only three more were found in the upper Hron river basin (Beňuš, kindergarten attic; Bačkor et al. 2007), in the Košická kotlina basin (Hosťovce, church attic) and in the Turčianska kotlina basin (Turčianska Štiavnička, manor house; see also Table 2). In the latter site, no *M. blythii* individuals were recorded previously, however, a nursery colony of *M. myotis* was evidenced there (Obuch & Kadlečík 1997, Boďová & Obuch 2006). During our check (29 June 2007), no individual of *M. myotis* was found.

Population trends

M. blythii is a bat species hard to identify, particularly in hibernacula. Thus, gathering a data set sufficient for evaluation of population trends is difficult. However, some information on the population decline of *M. blythii* was reported. In a long-monitored hibernaculum in the Na Turoldu cave in southern Moravia (Czech Republic), this species was recorded regularly in the period 1958–1972, however, no individual was found later (Chytil & Gaisler 2001). On the other hand, in caves of the Moravský kras Mts. (central Moravia) a slight increase of numbers of hibernating *M. myotis* individuals was documented in the period 1983–1992 (Zima et al. 1994). As the individuals of *M. blythii* were included in the evaluated sample of *M. myotis*, its contribution to that population trend cannot be evaluated with certainty, but, theoretically, can be expected to be similar. In other parts of the distribution range, *M. blythii* is reported to be a declining species; for example, at a rate of one third over the last 10 years in large colonies in Andalucia, Spain (Franco & Rodrigues de los Santos 2001).

In Slovakia, only one case is known that a nursery colony disappeared; a large colony of *M. blythii* mixed with *M. myotis* (ca. 1500 individuals) was present in the attic of the Chľaba church, SW Slovakia in 1955–1974 (Gaisler & Hanák 1956, Horáček et al. 1979, Gaisler et al. 2003). During the check in the summer of 2007 (Table 2), no trace of bat presence was found in this attic.

However, in several hibernation sites in mines in the Slanské vrchy Mts. (E Slovakia), this species is more easily recognisable thanks to the structure of underground corridors, and it is

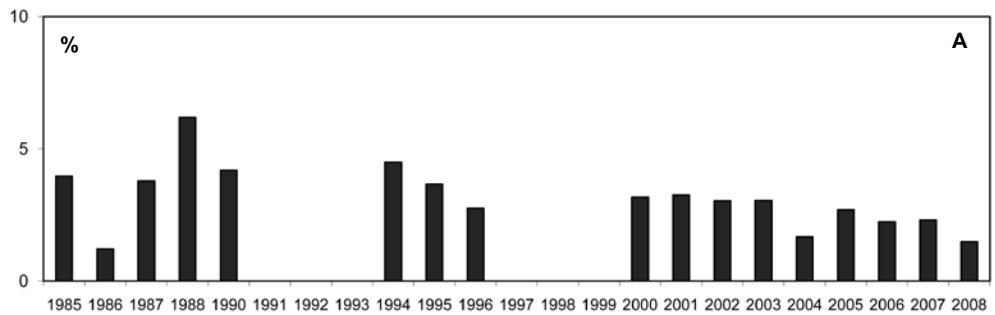
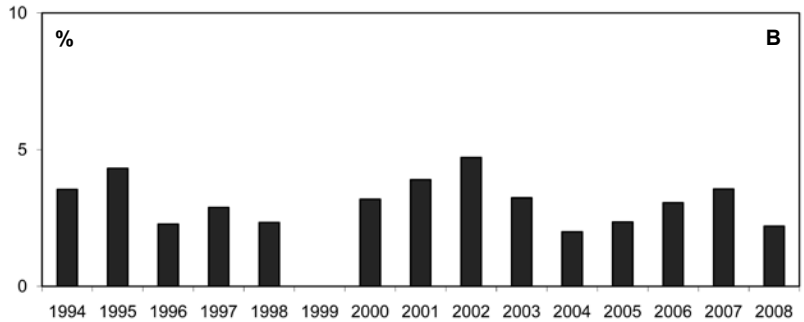


Fig. 9. Changes in numbers of *Myotis blythii* hibernating in the Slanské vrchy Mts.: A – Libanka mine, B – Leštiny mine, C – Malá Šimonka mine, D – Dubník, galleries, E – Zámutov, galleries. Different parts of the roosts were checked in different years, so the number of *M. blythii* is expressed as a percentage of the total number of counted bats.

Obr. 9. Zmeny početnosti *Myotis blythii* v zimoviskách Slanských vrchov. A – baňa Libanka, B – baňa Leštiny, C – baňa Malá Šimonka, Dubník – štôlne, Zámutov – štôlne. V jednotlivých rokoch sa sčítali rôzne časti úkrytov, preto je podiel *M. blythii* vyjadrený percentom z celkového počtu sčítaných netopierov.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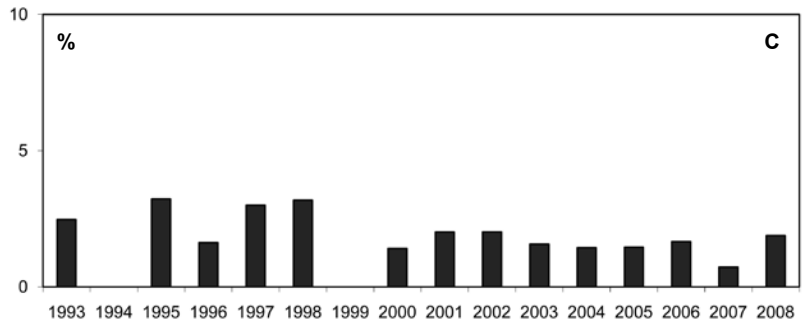
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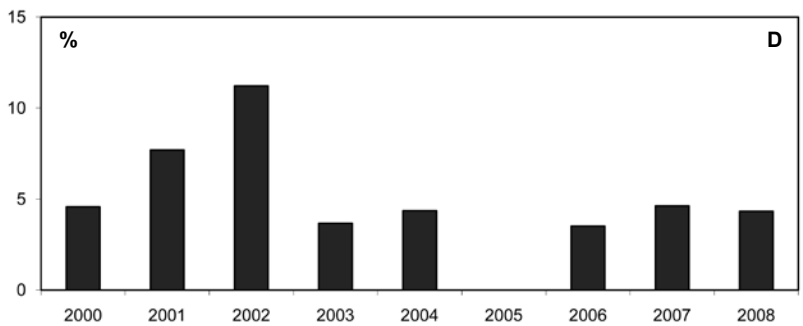
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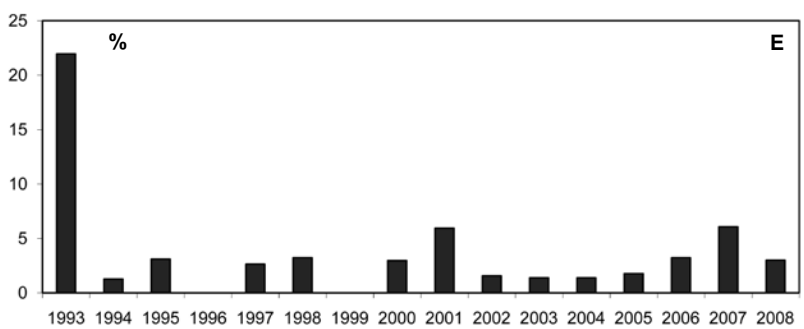
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possible to study development of *M. blythii* populations (see e.g. Danko 1997; Fig. 9). Certain trend was recorded in the checked roosts. In the Libanka mine (Fig. 9A), a slight decrease in the numbers of hibernating bats was observed, being particularly obvious in the period 2000–2008. In comparison, in the Leštiny gallery (Fig. 9B), a part of the mine, such trend was not so clear and the proportion of hibernating *M. blythii* rather fluctuated. In another mine of that area, Malá Šimonka mine (Fig. 9C), a decrease of hibernating *M. blythii* proportion is documented, comparing the periods 1993–1998 and 2000–2008. In the last years, the population seems to be stable. In groups of short galleries in this region (the Dubník and Zámutov mines; Fig. 9D, E), cyclic changes with periods of increase and decrease can be observed.

Movements, fidelity and longevity

Almost 1300 individuals of *M. blythii* were banded in Slovakia until 2008 (Palášthy 1987, Gaisler et al. 2003, Fulín & Matis 2007, own data). All movements of this species recorded in Slovakian populations are shown in Fig. 6. The data document several longer flights (up to 145 km) between different hibernacula and from hibernacula to the sites of nursery colonies. High level of fidelity to winter site (recovered in the range of one year up to 22 years and 7 months) was repeatedly reported from hibernacula in the Slanské vrchy Mts. (Libanka mine, Malá Šimonka mines) and from the Slovenský kras Mts. (Jasovská jaskyňa cave) (Palášthy 1987, Danko 1997, Fulín & Matis 2007).

The highest age recorded in this species is ca. 33 years and 8 months (Gaisler et al. 2003). The individual of this age was banded in the Szoplaki Ördöglyuk cave in northern Hungary (9 March 1952) and found in the Michňová cave in central Slovakia (15 February 1985).

Some new records are also of certain importance; a male (ring no. B1006) banded near a monospecific nursery colony in the Hosťovce church (SE Slovakia) was found wintering twice in the Haska 3 gallery (Slovenský kras Mts., SE Slovakia; 29 December 2006, 24 January 2008). This gallery is currently the most abundant hibernaculum of the species in Slovakia (up to 330 individuals; see Appendix). The presented data conform with the previous opinions and show *M. blythii* to be not a real long-distance migrant moving only occasionally at long distances (see e.g. Hutterer et al. 2005).

ACKNOWLEDGMENTS

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APPENDIX

Review of records of *Myotis blythii* in Slovakia

Data in two parts (unpublished and published records) are arranged by numbers of mapping quadrats (quadrat ca. 11,2×12 km; see also Kroupová 1980). After site name, no. of geomorphological unit (Mazúr & Lukniš 1980) and altitude are given in brackets following than by date and description of the record (see explanations below). Within published records only date, basic characteristic and references are given.

Geomorphological Unit Numbers. 010 – Veporské vrchy Mts., 021 – Muránska planina Mts., 022 – Slovenský raj Mts., 030 – Stolické vrchy Mts., 040 – Revúcka vrchovina Mts., 050 – Rožňavská kotlina basin, 060 – Slovenský kras Mts., 070 – Volovské vrchy Mts., 080 – Čierna hora Mts., 090 – Malé Karpaty Mts., 110 – Tríbeč Mts., 120 – Strážovské vrchy Mt., 130 – Žiar Mts., 140 – Malá Fatra Mts., 150 – Veľká Fatra Mts., 183 – Belianske Tatry Mts., 190 – Nízke Tatry, Mts., 200 – Kozie chrbty Mts., 220 – Žilinská kotlina basin, 230 – Hornonitrianska kotlina basin, 240 – Turčianska kotlina basin, 251 – Liptovská kotlina basin, 260 – Hornádska kotlina basin, 270 – Horehronské podolie Mts., 300 – Štiavnické vrchy Mts., 350 – Krupinská vrchovina Mts., 360 – Zvolenská kotlina basin; 393 – Rimavská kotlina basin, 400 – Košická kotlina basin, 420 – Burda Mts., 430 – Cerová vrchovina Mts., 440 – Slanské vrchy Mts.,

450 – Zemplínske vrchy Mts., 540 – Kysucká vrchovina Mts., 600 – Pieniny Mts., 610 – Ľubovnianska vrchovina Mts., 670 – Levočské vrchy Mts., 680 – Bachureň Mts., 710 – Vihorlatské vrchy Mts., 720 – Bukovské vrchy Mts., 740 – Ondavská vrchovina Mts., 750 – Laborecká vrchovina Mts., 760 – Beskydské predhorie Mts., 770 – Borská nížina lowland, 790 – Podunajská rovina lowland, 801 – Trnavská pahorkatina Mts., 802 – Nitrianska pahorkatina Mts., 803 – Žitavská pahorkatina Mts., 804 – Hronská pahorkatina Mts., 805 – Ipeľská pahorkatina Mts., 810 – Východoslovenská pahorkatina Mts., 820 – Východoslovenská rovina lowland.

Abbrevations. a – adult; C – nursery colony; f – female; G – pregnant female; ind. – individual; j – juvenile; L – lactating female; m – male; net. – netting; OW – owl pellets (*Sa – Strix aluco*, *Ta – Tyto alba*, *Bb – Bubo bubo*); OS – osteological records; s – subadult; S – summer record (usually a period between 16 April – 14 October); SF – subfossil remains; SR – subrecent remains; W – winter record (usually a period 15 October – 15 April).

Author Name Abbrevations. AR – Antonín Reiter, EH – Ervín Hapl, IH – Ivan Horáček, IV – Ivan Valach, JO – Ján Obuch, JOb – Július Obrcian, LB – Lucia Bobáková, LD – Laura Dittel, MB – Miloš Balla, MF – Miroslav Fulín, MO – Milan Olekšák, MR – Martin Riník, PB – Peter Bačkor, PBe – Petr Benda, PBr – Peter Bryndza, PK – Peter Kaňuch, PP – Peter Pjenčák, SB – Sándor Boldogh, ŠD – Štefan Danko, ŠM – Štefan Matis, VH – Vladimír Hanák, ZJ – Zoltán Jerg.

Unpublished records

6880: **Turany**, catholic church (240, 406 m a. s. l.), 14 April 1996 – 1 ind., OW *Ta* (JO). – **7079**: **Blatnica**, house (150, 500 m a. s. l.), 26 September 2008 – 1 fa found dead, S (JO). – **7088**: **Medvedia jaskyňa cave** (022, 905 m a. s. l.), 30 December 2007 – 1 fa [ring no. B1213] W (ŠM). – **7090**: **Veľká priepasť cave** (260, 648 m a. s. l.), 20 September 2002 – 4 f, 12 m, net. S (ŠD, PP). – **7094**: **Dubník**, Libanka mine, entrance Richard (440, 620 m a. s. l.), 3 October 2002 – 1 f, net. W (ŠD); **Dubník**, gallery no. 1 (440, 650 m a. s. l.), 5 December 2000 – 1 ind., W (PP), 10 January 2002 – 1 ind., W (ŠD, PP), 14 January 2004 – 1 ind., W (ŠD, PP); **Dubník**, gallery no. 3 (440, 656 m a. s. l.), 27 February 2002 – 5 inds., W (ŠD, PP), 3 October 2002 – 2 f, net. W (PP), 28 February 2003 – 2 inds., W (ŠD, PP), 26 February 2004 – 5 inds., W (ŠD, PP); **Dubník**, gallery no. 8 (440, 660 m a. s. l.), 26 February 2002 – 1 ind., W (ŠD, PP), 28 February 2003 – 1 ind., W (ŠD, PP), 26 February 2004 – 1 ind., W (ŠD, PP); **Dubník**, gallery no. 9 (440, 660 m a. s. l.), 27 February 2002 – 5 inds., W (ŠD, PP), 26 February 2004 – 1 ind., W (ŠD, PP); **Dubník**, gallery no. 10 (440, 640 m a. s. l.), 27 February 2002 – 6 inds., W (ŠD, PP), 28 February 2003 – 1 ind., W (ŠD, PP), 26 February 2004 – 3 inds., W (ŠD, PP); **Dubník**, gallery no. 11 (440, 620 m a. s. l.), 27 February 2002 – 16 inds., W (ŠD, PP), 28 February 2003 – 9 inds., W (ŠD, PP), 26 February 2004 – 7 inds., W (ŠD, PP); **Dubník**, gallery C (440, 660 m a. s. l.), 28 February 2003 – 1 ind., W (ŠD, PP), 14 January 2003 – 1 ind., W (ŠD, PP); **Libanka**, Leštiny (440, 625 m a. s. l.), 4 October 2002 – 1 m net., S (ŠD); 14 January 2003 – 23 inds., W (ŠD, PP); **Zámutov 1 gallery** (040, 640 m a. s. l.), 28 February 1998 – 3 inds., W (PP); 16 January 2001 – 2 inds., W (PP). – **7100**: **Vyšná Hurka 1 cave** (760, 540 m a. s. l.), 18 January 2008 – 18 inds., W (PP, ŠD). – **7180**: **Harmanecká jaskyňa cave** (150, 820 m a. s. l.), 14 January 2002 – 1 ind., W (LB); 14 May 2002 – 20 inds., W (LB); 10 December 2002 – 1 ind., W; 10 January 2003 – 1 ind., W (JOb). – **7187**: **Dobšinská ľadová jaskyňa cave** (022, 971 m a. s. l.), 15 December 2000 – 1 ind., W (LB); 13 January 2001 – 2 inds., W (LB). – **7195**: **Juskova Voľa**, stream (440, 234 m a. s. l.), 24 May 2007 – 1 ma net., S (PP, ŠD); 2 July 2008 – 1 m net., S (ŠD, PP). – **7196**: **Sačurov**, church (820, 131 m a. s. l.), 12 July 1998 – 1 f, S (PP, ŠM). – **7197**: **Brekovská jaskyňa cave** (710, 240 m a. s. l.), 10 December 2002 – 1 ind., W (PP); 11 December 2006 – 1 ma net., S (ŠD, MR). – **7285**: **Šarkanica**, cave (021, 700 m a. s. l.), 26 December 2000 – 1 ind., OW *Sa* (JO); **Voniaca**, cave (021, 850 m a. s. l.), 26 December 2000 – 1 ind., OW *Sa* (JO); 3 July 2003 – 1 ind., OW *Sa* (JO). – **7287**: **Rochovce**, church (040, 384 m a. s. l.), 21 June 2006 – 1 faL, 1 faG net., S (MU, EH); 8 August 2006 – 1 fa net., S (MU, PK); 21 August 2006 – 1 fs, 1 ms net., S (MU, PBe); 11 June 2007 – 1 faG net., S (MU); 25 June 2007 – 1 faL net., S (MU, PBe); 10 July 2007 – 1 faL, 1 mj net., S (MU, PB); 12 August 2007 – 2 fa net., S (MU); 24 May 2008 – 2 faG, 1 fa net., S (MU). – **7385**: **Tisovec**, park (030, 411 m a. s. l.), 13 November

2002 – 2 inds. OW *Sa* (JO). – **7389**: **Krásnohorské Podhradie**, church (050, 369 m a. s. l.), 9 July 2008 – 1 ind., S (ŠM, SB); **Veľká Bikfa cave** (060, 595 m a. s. l.), 7 December 2007 – 3 inds., W (ŠM, ZJ). – **7390**: **Čertova diera na Hornom vrchu cave** (060, 776 m a. s. l.), 18 March 2006 – 4 inds., W (ŠM, PP, ZJ), 19 February 2008 – 10 inds., W (ŠM, ZJ); **Haska 3 gallery** (060, 800 m a. s. l.), 29 December 2006 – 1 ma [ring No. B1006], W (ŠM), 24 January 2008 – 307 inds.: 1 ma [ring. No. B1006], W (ŠM); **Okrajová priepasť cave** (060, 700 m a. s. l.), 24 January 2008 – 134 inds., W (ŠM). – **7391**: **Drienovská jaskyňa cave** (060, 245 m a. s. l.), 8 May 2006 – 4 fa net., S (MU, MF); 1 June 2006 – 1 faG net., S (MU, PK, MF, EH); 30 June 2006 – 1fa, 1faL net., S (MU, PK, MF); 18 July 2006 – 1 fa net., S (MU); 18 November 2006 – 1 ind., W (ŠM, MF); 18 May 2007 – 1 faG net., S (MU, PK, EH, PB); 12 June 2007 – 1 faL net., S (MU, MF); 30 November 2007 – 2 inds.: 1 fa [ring No. B1012], W (ŠM, MF); 25 May 2008 – 1 faG net., S (MU, MF); **Erňa cave** (060, 390 m a. s. l.), 3 August 1980 – 1 ind. net., S (IH); 16 February 1994 – 1 ind., OW *Sa* (JO); 17 February 1995 – 2 inds., OW *Sa* (JO); 9 February 2002 – 2 inds., OW *Sa* (JO); 20 April 2003 – 1 fa, 2 m net., S (MU, PBe, VH); 25 September 2007 – 1 fs net., S (MU, PK, MF); **Jasovská jaskyňa cave** (060, 256 m a. s. l.), 12 February 1993 – 1 ind., W; 22 December 1996 – 1 ind., W; 23 February 1997 – 1 ind., W; 14 March 1997 – 1 ind., W; 29 August 1997 – 1 ind., S; 10 September 1997 – 4 inds., S; 30 November 1997 – 1 ind., W; 13 December 1997 – 1 ind., W; 30 December 1997 – 2 inds., W; 15 January 1998 – 3 inds., W; 30 January 1998 – 4 inds., W; 18 February 1998 – 3 inds., W; 13 March 1998 – 1 inds., W; 11 April 1998 – 3 inds., W; 12 October 1998 – 1 ind., W; 8 November 1998 – 2 inds., W; 6 December 1998 – 1 ind., W; 27 December 1998 – 1 ind., W; 10 January 1999 – 1 ind., W; 22 October 1999 – 2 inds., W; 28 November 1999 – 2 inds., W; 13 December 1999 – 3 inds., W; 27 December 1999 – 2 inds., W; 28 January 2000 – 1 ind., W; 16 February 2000 – 3 inds., W; 2 March 2000 – 4 inds., W; 23 February 2000 – 4 inds., W; 30 October 2000 – 1 ind., W; 12 November 2000 – 2 inds., W; 24 November 2000 – 3 inds., W; 19 December 2000 – 2 inds., W; 31 December 2000 – 1 ind., W; 20 March 2001 – 1 ind., W; 5 April 2001 – 1 ind., W; 25 December 2001 – 1 ind., W; 1 December 2001 – 2 inds., W; 14 December 2001 – 1 ind., W; 31 December 2001 – 3 inds., W; 12 January 2002 – 5 inds., W; 25 January 2002 – 3 inds., W; 20 March 2002 – 1 ind., W; 29 October 2003 – 2 inds., W; 30 November 2003 – 1 ind., W; 14 December 2003 – 1 ind., W; 31 December 2003 – 1 ind., W; 4 February 2004 – 1 ind., W; 18 February 2004 – 2 inds., W; 1 April 2004 – 1 ind., W; 12 September 2004 – 2 inds., W; 14 September 2004 – 1 ind., W; 4 November 2004 – 2 inds., W; 24 November 2004 – 2 inds., W; 14 December 2004 – 1 ind., W; 28 December 2004 – 1 ind., W; 7 January 2005 – 2 inds., W; 26 January 2005 – 1 ind., W; 11 February 2005 – 2 inds., W; 24 March 2005 – 4 inds., W; 13 October 2005 – 2 inds., W; 27 October 2005 – 2 inds., W; 10 November 2005 – 3 inds., W; 1 December 2005 – 2 inds., W; 2 January 2006 – 4 inds., W; 31 January 2006 – 2 inds., W; 11 February 2006 – 2 inds., W; 7 March 2006 – 1 ind., W; 10 November 2006 – 1 ind., W; 1 December 2006 – 1 ind., W; 17 January 2007 – 5 inds., W; 2 February 2007 – 4 inds., W; 23 February 2007 – 4 inds., W; 9 March 2007 – 6 inds., W; 18 October 2007 – 1 ind., W; 15 November 2007 – 2 inds., W; 28 November 2007 – 4 inds., W; 12 December 2007 – 3 inds., W; 31 December 2007 – 2 inds., W; 10 January 2008 – 3 inds., W; 25 January 2008 – 3 inds., W; 26 February 2008 – 2 inds., W; 18 March 2008 – 1 ind., W; 28 October 2008 – 2 inds., W; 1 December 2008 – 1 ind., W; 30 December 2008 – 3 inds., W (all MF); **Skalistý potok stream** (060, 200 m a. s. l.), 27 May 2005 – 2 inds. net., S (ŠM, LD). – **7396**: **Trebišov**, Sady (820, 109 m a. s. l.), September 2004 – 1 ind., OW *Ta* (ŠD). – **7486**: **Ratková**, evangelic church (040, 298 m a. s. l.), 27 June 2000 – 1 ind., OW *Ta* (JO); March 2002 – 3 ind., OW *Ta* (JO); 10 June 2002 – 20 inds., OW *Ta* (JO). – **7489**: **Silická Jablonica**, church (060, 256 m a. s. l.), 13 August 1992 – 1 ind., OW *Ta* (JO); **Silická ľadnica cave** (060, 503 m a. s. l.), 11 November 1976 – 4 inds., OW *Sa* (JO); 6 February 2002 – 1 ind., OW *Sa* (JO); **Zbojnícka jaskyňa cave** (060, 380 m a. s. l.), 26 October 1981 – 7 inds. (4 ind. SR, 3 ind. SF), OW *Sa* (JO); 26 January 2005 – 1 ind., OW *Sa* (JO). – **7490**: **Malá sovia priepasť cave** (060, 520 m a. s. l.), 21 December 2004 – 1 ind., OW *Sa* (JO); **Márnica cave** (060, 539 m a. s. l.), 13 February 2008 – 8 inds., W (ŠM). – **7491**: **Hosťovce**, catholic church (400, 175 m a. s. l.), 24 April 2006 – C of 80 inds. in attic, 4 fa net., S (MU, PK); 9 May 2006 – 8 f, 2 m net., S (MU, PK); 2 June 2006 – C of 100 ind. in attic, S (MU, PK); 24 June 2007 – 340 inds., S (ŠM). – **7579**: **Nad Rabensteinom gallery** (300, 541 m a. s. l.), 6 February 2008 – 1 ind., W (PB, IV). – **7586**: **Pokoradz**, gallery (040, 450 m a. s. l.), 7 April 2006 – 1 ind.,

OW *Sa* (JO). – **7588**: **Kečovo**, stream (060, 370 m a. s. l.), 19 July 2004 – 1 ind. net., S (ŠM, MO), 28 July 2005 – 3 inds. net., S (ŠM, MO, LD), 23 June 2008 – 1 ind. net., S (ŠM, MF); **Líščia diera cave** (060, 373 m a. s. l.), 17 March 2006 – 1 ind., OW *Sa* (JO). – **7596**: **Kašov**, cellar (820, 180 m a. s. l.), 23 November 2004 – 6 inds., W (ŠD, MB); 17 January 2008 – 17 inds., W (ŠD, MB). – **7598**: **Boťany** (820, 101 m a. s. l.), 2 August 2007 – 1 ma net., S (ŠD). – **8178**: **Kováčov**, gallery (420, 380 m a. s. l.), 14 February 2004 – 1 ind., W (MU, PBe, AR).

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6688: **Aksamitka cave** (600, 756 m a. s. l.), S, W (Hanák 1971), S (Horáček et al. 1979). – **6787**: **Belianska jaskyňa cave** (183, 890 m a. s. l.), W (Mošanský & Gaisler 1965, Hanák 1971, Gaisler & Hanák 1972, 1973, Obuch 1994). – **6878**: **Priepastná jaskyňa 4 cave** (140, 500 m a. s. l.), W (Ondruška 2002). – **6879**: **Stratenecká priepasť cave** (140, 1120 m a. s. l.), OS SF (Obuch 1985d). – **6889**: **Pod Jankovcom 2 cave** (670, 1060 m a. s. l.), W (Uhrin 1997c, Fulín 2002). – **6901**: **Nad Bystrianskym potokom cave** (720, 785 m a. s. l.), S (Matis et al. 2000). – **6976**: **Ostré vŕšky** (120, 450 m a. s. l.), OW *Bb* (Obuch 1985a, d); **Veľká závadská jaskyňa cave** (120, 585 m a. s. l.), W (Gaisler & Hanák 1972, 1973). – **6979**: **Trebostovo** (240, 470 m a. s. l.), W (Štollmann 1968, 1985). – **6980**: **Turčianska Štiavnička**, manor house (240, 435 m a. s. l.), C (Ceľuch et al. 2007). – **6982**: **Liskovská jaskyňa cave** (251, 500 m a. s. l.), S (Hanák 1971), W (Obuch 1994, Hůrka 1970, Gaisler & Hanák 1972, 1973, Benda 1993, Uhrin 1994, Benda & Horáček 1995b, Bobáková 2002c, 2005, Gaisler et al. 2003). – **6983**: **Beníková cave** (190, 908 m a. s. l.), W (Vachold 1961, 2003, Dudich & Matoušek 1985); **Demänovská ľadová jaskyňa cave** (190, 840 m a. s. l.), W (Hůrka 1964, Gaisler & Hanák 1972, 1973, Brinzík et al. 2002b); **Okno cave** (190, 916 m a. s. l.), W (Vachold 1961, 2003, Dudich & Matoušek 1985, Matoušek 1998, Gaisler & Hanák 1972, 1973); **Suchá jaskyňa cave** (190, 903 m a. s. l.), W (Vachold 1961, 2003, Gaisler & Hanák 1972, 1973, Dudich & Matoušek 1985). – **6984**: **Stanišovská jaskyňa cave** (190, 761 m a. s. l.), W (Gaisler & Hanák 1972, 1973). – **6986**: **Lučivnianska jaskyňa 1 cave** (200, 800 m a. s. l.), W (Dulák 1995, Matis & Pjenčák 2002). – **6991**: **Zlá diera cave** (680, 780 m a. s. l.), W (Palášthy 1988, Králiková 1995, Hapl & Lehotská 1999, Kaňuch & Ceľuch 2002, Ceľuch & Kaňuch 2003), S net. (Hájková 1999, 2000, Kaňuch & Ceľuch 2002). – **6992**: **Uzovské Pekľany**, church (680, 780 m a. s. l.), S (Palášthy 1971a). – **7076**: **Četníkova svadba cave** (120, 1150 m a. s. l.), OS SF (Obuch 2004a). – **7079**: **Blatnica** (240, 500 m a. s. l.), OW *Bb* (Vondráček & Obuch 1980); **Blatnický hrad** (150, 658 m a. s. l.), OW *Bb* (Obuch & Darola 1980, Obuch 1985d); **Izabela Textorisová's cave** (150, 740 m a. s. l.), OW *Sa* (Obuch & Darola 1980, Obuch 1985d); **Necpaly**, church (240, 515 m a. s. l.), OW *Ta* (Obuch 1983, 2002a); **Príbovce**, church (240, 420 m a. s. l.), OW *Ta* (Schmidt & Štollmann 1972, Obuch 1983, 2002a); **Žiarna 2 cave** (150, 695 m a. s. l.), OW *Sa*, OS SR (Kadlečík et al. 1995). – **7080**: **Uhliská, cave** (150, 1000 m a. s. l.), food of *Corvus corax*, SR (Obuch 2007). – **7083**: **Demänovská dolina valley** (190), W (Hanák 1971, Mošanský 1981); **Demänová caves** (190), W (Vachold 1956). – **7084**: **Peklisko** (022, 686 m a. s. l.), OW *Sa* (Obuch 1994, 1995b). – **7088**: **Medvedia jaskyňa cave** (022, 905 m a. s. l.), W (Hájková 2001, Lehotská 2001, Hájek et al. 2002). – **7090**: **Ľadová jaskyňa cave** (260, 525 m a. s. l.), W (Lehotská 2001, Pjenčák et al. 2002, Pjenčák & Fulín 2006b, 2006c, Pjenčák 2008). – **7094**: **Dubník mines** (440), W (Palášthy 1988); **Dubník** (440), W (Hormada 1998); **Dubník**, gallery (440), W (Palášthy 1969); **Dubník**, C gallery (440, 660 m a. s. l.), W (Lehotská 2000); **Dubník**, blind galleries (440), W (Danko & Mihók 1989, Uhrin 1994, 1995b, Lehotská 2001, 2002a, 2003, Pjenčák & Danko 2002b, Ceľuch et al. 2006, 2007, Pjenčák & Fulín 2006a, Pjenčák 2008, Ceľuch et al. 2008); **Dubník**, gallery no. 1 (440, 650 m a. s. l.), W (Danko & Mihók 1989, Lehotská 2000, Danko & Pjenčák 2002, Ceľuch et al. 2006, Pjenčák & Fulín 2006c, b); **Dubník**, gallery no. 2 (440, 635 m a. s. l.), W (Danko 1995b); **Dubník**, gallery no. 3 (440, 656 m a. s. l.), W (Lehotská 2000, Danko & Pjenčák 2002); **Dubník**, gallery no. 4 (440, 660 m a. s. l.), W (Danko 1997, Lehotská 2000, Danko & Pjenčák 2002); **Dubník**, gallery no. 5 (440, 660 m a. s. l.), W (Danko & Pjenčák 2002); **Dubník**, gallery no. 7 (440, 665 m a. s. l.), W (Danko & Pjenčák 2002); **Dubník**, gallery no. 8 (440, 660 m a. s. l.), W (Uhrin 1996, Danko & Pjenčák 2002); **Dubník**, gallery no. 9 (440, 660 m a. s. l.), W (Lehotská 2000, Danko & Pjenčák 2002); **Dubník**,

gallery no. 10 (440, 640 m a. s. l.), W (Danko 1995b, Uhrin 1996, Nadzamová 1997, Hapl & Uhrin 1999b, Danko & Pjenčák 2002); **Dubník**, gallery no. 11 (440, 620 m a. s. l.), W (Uhrin 1996, Nadzamová 1997, Hapl & Uhrin 1999b, Lehotská 2000, Danko & Pjenčák 2002, Pjenčák & Fulín 2006c); **Dubník**, galleries no. 1 and 10 (440), W (Pjenčák & Danko 2002b); **Dubník**, galleries no. 1 and 3 (440), W (Pjenčák & Danko 2002b); **Dubník**, galleries no. 1–3 (440), W (Pjenčák & Danko 2002b); **Dubník**, galleries no. 1–5 (440), W (Pjenčák & Danko 2002b); **Dubník**, galleries no. 1–7 (440), W (Pjenčák & Danko 2002b); **Dubník**, galleries 1–11, A, C, F, Apollónia (440), W (Uhrin 1997c); **Jozef**, mine (440, 500 m a. s. l.), W (Uhrin 1995b); **Malá Šimonka**, mine (440, 880 m a. s. l.), W (Palášthy 1972, Danko & Mihók 1989, Uhrin 1994, 1995b, 1996, 1997c, Danko 1995b, 1997, Uhrin & Danko 1996, Nadzamová 1997, Hapl & Uhrin 1999b, Lehotská 2000, 2001, 2002a, 2003, Danko & Pjenčák 2002, Pjenčák & Danko 2002a, Ceľuch et al. 2006, 2007, Pjenčák & Fulín 2006a, b, c, Ceľuch et al. 2008, Ceľuch et al. Pjenčák 2008); **Libanka mine** (440, 625 m a. s. l.), W (Palášthy & Olejár 1963, Gaisler & Hanák 1972, 1973, Mošanský 1981, Danko & Mihók 1989, Uhrin 1994, 1995b, 1996, Danko 1995a, 1997, Lehotská 2000, 2001, 2002a, 2003, Danko & Pjenčák 2002, Pjenčák & Danko 2002a, Gaisler et al. 2003) Danko & Pjenčák 2002, Ceľuch et al. 2006, 2007, 2008, Pjenčák & Fulín 2006a, b, c, Pjenčák 2008); **Libanka mine**, part Leštiny (440, 625 m a. s. l.), W (Uhrin 1994, 1995b, 1997c, Danko 1995b, 1997, Nadzamová 1997, Hapl & Uhrin 1999b, Lehotská 2000, 2001, Danko & Pjenčák 2002, Pjenčák & Fulín 2006b, c, Ceľuch et al. 2007, 2008, Pjenčák 2008); **Libanka mine**, part Viliam (440, 625 m a. s. l.), W (Ceľuch et al. 2006); **Zámutov 1 gallery** (440, 640 m a. s. l.), W (Uhrin 1997c, Hapl & Uhrin 1999b, Lehotská 2000, 2002a, 2003, Pjenčák 2002b, Pjenčák & Fulín 2006a, b, c, Pjenčák 2008); **Zámutov**, galleries (440, 640 m a. s. l.), W (Pjenčák 1995). – **7097**: **Dúpna jaskyňa cave** (710, 320 m a. s. l.), W (Danko & Mihók 1989, Pjenčák & Danko 2002d). – **7100**: **Vyšná Hurka 1 cave** (760, 540 m a. s. l.), W (Uhrin 1995b, 1997c, Lehotská 2000, Pjenčák & Danko 2002c, Danko et al. 2003, Pjenčák & Fulín 2006c, Pjenčák 2008). – **7180**: **Bystrická dolina valley**, cave near tunnel (150, 670 m a. s. l.), 12. 7. 1978, 19. 11. 1978 – OW *Sa* (Obuch 1985d, Obuch 1998b); **Harmanecká jaskyňa cave** (150, 820 m a. s. l.) (Benda 1993, Benda & Horáček 1995b), S (Hanák 1971), W (Hanák 1960, Hůrka 1963, 1964, Gaisler & Hanák 1972, 1973, Dusbábek & Rosický 1976, Štollmann 1968, Uhrin 1995b, Hapl & Lehotská 1999, Bobáková 2002a, Bobáková & Hapl 2002, Gaisler et al. 2003, Lehotská 2003, Vachold 2003, Bobáková 2004), OW *Sa* (Obuch 1998b, 1992b, 2006), Bobáková & Hapl 2002, Bobáková 2002a). – **7181**: **Moštenica**, catholic church (360, 730 m a. s. l.), S (Bačkor et al. 2007). – **7183**: **Bystrá**, church (270, 560 m a. s. l.), S (Hanák 1960); **Bystrianska jaskyňa cave** (270, 566 m a. s. l.) (Benda 1993, Benda & Horáček 1995b), W (Mituch 1963, Štollmann 1968, 1985, Gaisler & Hanák 1972, 1973, Hapl & Uhrin 1999b, Uhrin & Urban 2002, Vachold 2003); **Mýto pod Ďumbierom** (270, 630 m a. s. l.) (Benda 1993, Benda & Horáček 1995b), S (Hanák 1960, 1971, Hanák Feriancová-Masárová & Hanák 1965). – **7184**: **Beňuš**, nursery school (270, 560 m a. s. l.), C (Bačkor et al. 2007). – **7185**: **Hronec**, stream (021, 850 m a. s. l.), S (Kaňuch 2005). – **7186**: **Ladzianskeho jaskyňa cave** (021, 856 m a. s. l.) (Benda 1993, Benda & Horáček 1995b), W (Gaisler & Hanák 1972, 1973, Dusbábek & Beron 1975, Obuch 1994, Uhrin et al. 2002c); **Zlatnica cave** (021, 940 m a. s. l.), W (Uhrin 1995c). – **7187**: **Dobšinská ľadová jaskyňa cave** (022, 971 m a. s. l.), S (Hanák 1971), W (Gaisler & Hanák 1970a, b, 1972, 1973, Mošanský 1981, Obuch 1994, Uhrin 1997c, 1998, Hapl & Lehotská 1999, Bobáková 2002b, 2005, Pjenčák & Fulín 2006c, Ceľuch et al. 2007, 2008), OS SR (Horáček 1976, Obuch 1995a); **Duča cave** (022, 995 m a. s. l.), OW *Sa* (Obuch 1992b), OS SR (Obuch 1995a); **Koniarova jaskyňa cave** (022, 1090 m a. s. l.), W (Hájková 2001, Lehotská 2001, Kaňuch et al. 2002a, Frankovičová 2005, Pjenčák & Fulín 2006b); **Pustá jaskyňa cave** (022, 944 m a. s. l.), W (Vachold 1961, 2003, Mituch 1963); **Stratenská jaskyňa cave** (022, 991 m a. s. l.), W (Dulák 1995, Lehotská 2002a, Ceľuch et al. 2006), OW *Sa* (Obuch 1992b, 1995b, 1998b), OS SR (Ižoldová 2003). – **7188**: **Dobšiná**, evangelic church (040, 468 m a. s. l.), S (Uhrin et al. 1996b). – **7190**: **Poráčska dolina valley** (070, 800 m a. s. l.), food of *Corvus corax* (Obuch 2007). – **7191**: **Barbora**, gallery (070, 520 m a. s. l.), W (Uhrin 1995b, Nadzamová 1997, Pačenovský 2002b); **Gallery in Tokáreň valley** (070, 575 m a. s. l.), W (Uhrin 1995b, 1996, Nadzamová 1997, Hapl & Uhrin 1999b, Pačenovský 2002b); **Líščia štôlňa gallery** (070, 500 m a. s. l.), W (Nadzamová 1997). – **7192**: **Veľká ružínska jaskyňa cave** (080, 614 m a. s. l.), W (Uhrin 1994, Lehotská 2000, 2001, 2002a, Pjenčák &

Matis 2002, Pjenčák & Matis 2002); **Vysoký vrch** (080, 850 m a. s. l.), W (Danko & Mihók 1989). – **7193**: **Krížová jaskyňa cave** (080, 774 m a. s. l.), W (Uhrin 1994, 1995b, 1996, Nadzamová 1997, Pačenovský 2002a); **Kysacká jaskyňa cave** (080, 354 m a. s. l.), W (Palášthy & Olejár 1963, Kaňuch et al. 2002b). – **7194**: **Kecerovce**, catholic church (400, 328 m a. s. l.), S (Matis 1998). – **7195**: **Juskova Voľa**, stream (740, 234 m a. s. l.), S (Ceľuch et al. 2006); **Kamenná Poruba**, church (810, 153 m a. s. l.), S (Pjenčák 1995, Danko 1997); **Pod Baranom cellar** (810, 380 m a. s. l.), W (Pjenčák 1995, 2002a, Uhrin 1995b). – **7197**: **Brekov**, gallery (710, 240 m a. s. l.), W (Pjenčák & Danko 2002d); **Brekovská jaskyňa cave** (710, 240 m a. s. l.), S (Danko & Pjenčák 2002), W (Lehotská 2002a); **Dudlakova diera cave** (710, 450 m a. s. l.), S, W (Danko & Pjenčák 2002); **Jasenov**, gallery under castle (710, 340 m a. s. l.), W (Danko & Mihók 1989, Danko 1997, Pjenčák & Danko 2002d, Gaisler et al. 2003); **Krivošťany**, church (810, 135 m a. s. l.), S (Danko & Mihók 1989); **Oreské**, catholic church (780, 183 m a. s. l.), S (Danko et al. 2000); **Veľká Artajama cave** (710, 260 m a. s. l.), W (Danko & Pjenčák 2002); **Vinné**, castle (710, 318 m a. s. l.), W (Beneš & Hanák 2003); **Vinné**, castle cellar (710, 318 m a. s. l.), W (Danko & Mihók 1989, Uhrin 1996, Pjenčák & Danko 2002d; **Vinné, church** (710, 151 m a. s. l.), S (Danko 2000, Danko et al. 2000, Danko & Pjenčák 2002), C (Danko & Beneš 1976, Horáček et al. 1979, Anděra et al. 1982), OW *Ta* (Danko 2005, Danko & Pjenčák 2002); **Vinné**, cellar (710), W (Vachold 2003). – **7199**: **Vyšná Rybnica**, greek-catholic church (810, 224 m a. s. l.), OW *Ta* (Ceľuch et al. 2007). – **7272**: **Čachtice**, church (801, 180 m a. s. l.), S (Vachold 2003). – **7278**: **Pod Horeňovom** (130, 800 m a. s. l.), OW *Bb* (Obuch 1985d); **Ráztočno** (230, 350 m a. s. l.), OW *Bb* (Obuch 1980). – **7281**: **Slovenská Ľupča**, evangelic church (360, 370 m a. s. l.), C (Bačkor et al. 2007). – **7285**: **Dielik**, tunel (021, 500 m a. s. l.), W (Obuch 1994, Uhrin 1993b, 1995a, d); **Pod Kľakom cave** (021, 900 m a. s. l.), W (Uhrin 1994, 1995c), OS SF, SR (Obuch 1995a, Obuch & Uhrin 1998); **Malá Stožka** (021, 960 m a. s. l.), OW *Sa* (Obuch 1985c); **Martincová no. 25 cave** (021, 820 m a. s. l.), S (Darola et al. 1985, Uhrin et al. 2002c), W (Obuch 1994, Hůrka 1997, Lehotská 2002a); **Martincová valley** (021), OW *Sa* (Obuch 1998b), OS SF (Obuch 1985c, d); **Voniaca cave** (021, 850 m a. s. l.), OW *Sa* (Obuch 1997). – **7286**: **Bobačka cave** (021, 780 m a. s. l.), W (Hanák & Anděra 1980, Obuch 1994, Uhrin et al. 1995c, 2002c); **Brestová** (021, 550 m a. s. l.), OW *Sa* (Obuch 1994, 2004b, 1997); **Brestová cave** (021, 550 m a. s. l.), S (Uhrin et al. 2002c),W (Hanák & Anděra 1980, Uhrin 1995b, 1997b, Uhrin et al. 2002c, Pjenčák & Fulín 2006b); **Brestová**, stone chimney (021, 550 m a. s. l.), OW *Sa* SR (Obuch 1997); **Hrdzavá valley**, right side (021, 500 m a. s. l.), OW *Sa* (Obuch 1985b, c, d); **Na Osiskách cave** (021, 530 m a. s. l.), W (Uhrin 1995c); **Javorníčková** (021, 450 m a. s. l.), OW *Sa* (Obuch 2004b); **Javorníková valley** (021, 500 m a. s. l.), S (Uhrin et al. 2002c); **Javorníková**, cave no. 12 (021, 500 m a. s. l.), S (Hapl & Uhrin 1999a); **Muráň** (021, 394 m a. s. l.), S (Matoušek 1998); **Odštiepená skala** (021, 500 m a. s. l.), OW *Sa* (Obuch 2004b). – **7287**: **Rochovce**, church (040, 384 m a. s. l.), S (Ceľuch et al. 2007). – **7292**: **Pod Širokým hŕbkom gallery** (070, 585 m a. s. l.), 28. 1. 1995 – W (Uhrin 1995b, 1996, Pačenovský 2002b). – **7293**: **Baška**, catholic church (400, 352 m a. s. l.), C (Matis 1998); **Zdoba**, greek-catholic church (400, 224 m a. s. l.), OW *Ta* (Obuch & Matis 1998). – **7294**: **Košické Olšany**, catholic church (400, 200 m a. s. l.), C (Matis 1998); **Vyšná Kamenica**, catholic church (400, 352 m a. s. l.), C (Matis 1998). – **7295**: **Dargov 3, Ružový sad** (440, 460 m a. s. l.), S (Danko et al. 2007, Ceľuch et al. 2007); **Sečovská Polianka** (810, 160 m a. s. l.), S (Danko et al. 2007, Ceľuch et al. 2007). – **7299**: **Priekopa**, stream (710, 340 m a. s. l.), S (Danko & Pjenčák 2002, Danko et al. 2007). – **7383**: **Kamenistá dolina valley** (010, 657 m a. s. l.), S (Ceľuch et al. 2006, Danko et al. 2007). – **7385**: **Hradová**, abyss (021, 880 m a. s. l.), OS SF (Obuch 1985c, d); **Netopierov cave** (021, 589 m a. s. l.), W (Hůrka 1963, 1964, Gaisler & Hanák 1972, 1973, Obuch 1994); **Michňová cave** (021, 600 m a. s. l.), W (Gaisler et al. 2003, Ceľuch et al. 2007, Pjenčák 2008); **Tisovec**, cave (021), W (Vachold 2003); **Tisovec**, catholic church (021, 411 m a. s. l.), C (Horáček et al. 1979); **Tisovec** (021, 411 m a. s. l.), S (Zima 1978). – **7386**: **Rákoš**, evangelic church (040, 330 m a. s. l.), S (Uhrin et al. 2002a); **Revúca** (040, 318 m a. s. l.) (Éhik 1924). – **7388**: **Brzotín**, catholic church (050, 267 m a. s. l.), S (Horáček et al. 1979); **Kružná**, church (050, 309 m a. s. l.), C (Horáček et al. 1979); **Šingliarova priepasť cave** (060, 680 m a. s. l.), W (Mošanský 1981, Pjenčák & Fulín 2006c); **Štítnik**, evangelic church (040, 286 m a. s. l.), S (Uhrin 1997a); **Zvonica cave** (060, 669 m a. s. l.), W (Pjenčák & Fulín 2006a, Pjenčák 2008). – **7389**: **Brzotín**, church (050, 267 m a. s. l.), S (Matis et al. 2007); **Dr-**

nava, church (060, 382 m a. s. l.), C (Horáček et al. 1979, 1995), S (Horáček et al. 1995); **Krásnohorská Dlhá Lúka**, church (050, 315 m a. s. l.), S (Horáček et al. 1995); **Krásnohorské Podhradie**, church (050, 369 m a. s. l.), S (Horáček et al. 1979); **Lipovník**, church (060, 364 m a. s. l.), S (Horáček et al. 1979); **Veľká Bikfa cave** (060, 595 m a. s. l.), W (Pjenčák & Fulín 2006a). – **7390**: **Čertova diera na Hornom vrchu cave** (060, 776 m a. s. l.), W (Hapl & Uhrin 1999b, Lehotská 2002a, 2003, Matis 2002b, Pjenčák & Fulín 2006a); **Hačava**, swimming pool (070, 680 m a. s. l.), S (Matis et al. 2002a); **Hačavská jaskyňa cave** (060, 805 m a. s. l.) (Benda 1993, Benda & Horáček 1995b), W (Hanák 1959, Hanák 1960, Hůrka 1963, 1964, Hůrková 1963, Gaisler & Hanák 1972, 1973, Uhrin 1993a, Obuch 1994, Hapl & Lehotská 1999, Hapl & Uhrin 1999b, Lehotská 2000, 2002a, 2003, Matis et al. 2002c, Pjenčák & Fulín 2006a, b, Pjenčák 2008); **Haska 3 gallery** (060, 800 m a. s. l.), W (Uhrin 1997c, Hapl & Lehotská 1999, Hapl & Uhrin 1999b, Lehotská 2000, 2003, Matis et al. 2002b, Pjenčák & Fulín 2006a, b, c, Pjenčák 2008); **Haska 4 gallery** (060, 800 m a. s. l.), W (Pjenčák 2008); **Hrhov** (060, 219 m a. s. l.) (Benda 1993, Benda & Horáček 1995b), S (Hanák 1960, Hůrka 1963); **Lúčka**, church (060, 588 m a. s. l.), S (Horáček et al. 1995); **Marciho cave** (060, 859 m a. s. l.), W (Mošanský 1981, Uhrin 1997c, Hapl & Lehotská 1999, Lehotská 2002a, Matis et al. 2002a, c); **Okrajová priepasť cave** (060, 700 m a. s. l.), W (Hapl & Lehotská 1999, Lehotská 2000, 2001, 2002a, 2003, Matis et al. 2002e, Ceľuch et al. 2006, Pjenčák & Fulín 2006a, b, c, Pjenčák 2008); **Veterná priepasť cave** (060, 722 m a. s. l.), W (Pjenčák & Fulín 2006a); **Zádiel** (060, 255 m a. s. l.), OW *Sa* (Obuch 1998a). – **7391**: **Drienovská jaskyňa cave** (060, 245 m a. s. l.) (Benda 1993, Benda & Horáček 1995b), S (Horáček et al. 1979), W (Vachold 1957, 2003, Hanák 1960, Gaisler & Hanák 1962, 1972, 1973, Hůrková 1963, Hapl & Uhrin 1999b, Lehotská 2000, 2001, Matis 2000, 2002a, Ceľuch et al. 2006, 2007, 2008, Pjenčák & Fulín 2006b, c, Pjenčák 2008); **Dvorníky** (060, 214 m a. s. l.), S (Hanák 1960); **Erňa cave** (060, 390 m a. s. l.), S (Uhrin 1997a), W (Lehotská 2000, 2002a, Matis et al. 2002d, Pjenčák 2008), OW *Sa* SR (Obuch 1998b); **Jasov**, monastery (400, 280 m a. s. l.), S (Horáček et al. 1995); **Jasovská jaskyňa cave** (060, 256 m a. s. l.), S (Fulín & Matis 2002), S, W (Vachold 1957), W (Hůrková 1959, 1963, Hanák 1960, 1988, Hůrka 1963, 1964, Mituch 1963, Gaisler & Hanák 1972, 1973, Mošanský 1981, Krištofík 1982, Dudich & Matoušek 1985, Uhrin 1993a, 1995b, Obuch 1994, Fulín 1995, 1996, 1998b, Fulín & Poremba 1998, Hapl & Lehotská 1999, Hapl & Uhrin 1999b, Lehotská 2000, 2001, 2002a, Fulín & Matis 2002, Matis et al. 2002a Gaisler et al. 2003, Fulín & Matis 2002, 2006, 2007, Ceľuch et al. 2006, 2007, 2008, Pjenčák & Fulín 2006a, b, c, Pjenčák 2008), OS (Obuch 2002b); **Ohnište cave** (060, 400 m a. s. l.), OW *Sa* SR (Obuch 1994, 1998b). – **7392**: **Hatiny** (400, 230 m a. s. l.), OW *Ta* SR (Obuch 1992a, 1994). – **7393**: **Čaňa**, church (400, 177 m a. s. l.), C (Sitášová et al. 2000), S (Mošanský 1981). – **7394**: **Vyšný Čaj**, church (440, 230 m a. s. l.), S (Matis 1998). – **7398**: **Senné**, fishponds (820, 104 m a. s. l.), S (Danko & Mihók 1989). – **7468**: **Veľké Leváre**, church (770, 170 m a. s. l.), (Benda & Horáček 1995b), S (Gaisler 1967, Hanák 1971), C (Gaisler & Klíma 1965). – **7475**: **Topoľčany**, Zľavy (802, 174 m a. s. l.), S (Gaisler et al. 2003). – **7481**: **Očová**, church (360, 399 m a. s. l.), W (Hrúz et al. 2000). – **7483**: **Hriňová**, Slatina stream (360, 456 m a. s. l.), S (Kaňuch et al. 2005). – **7486**: **Pri Maruškinom jarku cave** (040, 250 m a. s. l.), S (Kečkemétyová 1978, Králiková 1995), W (Gaál 2000, Uhrin et al. 2002d); **Podbanište, cave** (040, 252 m a. s. l.), W (Králiková 1995); **Ratková**, evangelic church (040, 298 m a. s. l.), C, OW *Ta* (Uhrin et al. 2002a), OW *Ta* (Obuch 2000, Uhrin et al. 2002a); **Rovné, church** (040, 335 m a. s. l.), S (Uhrin et al. 2002a). – **7488**: **Ardovská jaskyňa cave** (060, 314 m a. s. l.), W (Gaisler & Hanák 1972, 1973); **Brázda cave** (060, 598 m a. s. l.), W (Hapl & Uhrin 1999b, Hapl et al. 2002); **Hámorská jaskyňa cave** (060, 260 m a. s. l.), S (Horáček et al. 1995), OS (Horáček & Ložek 1993); **Krkavčia priepasť cave** (060, 608 m a. s. l.), W (Hapl & Lehotská 1999, Hapl et al. 2002); **Lavička cave** (060, 480 m a. s. l.), W (Pjenčák & Fulín 2006b); **Ľudmila cave** (060, 249 m a. s. l.), W (Hůrková 1959, Hanák 1960, Gaisler & Hanák 1972, 1973, Vachold 2003); **Milada cave** (060, 420 m a. s. l.), W (Uhrin 1997c, Lehotská 2000, Hapl et al. 2002); **Veľká Peňažnica cave** (060, 667 m a. s. l.), W (Pjenčák & Fulín 2006a). – **7489**: **Majkova jaskyňa cave** (060, 500 m a. s. l.), W (Hanák 1988, Obuch 1994, Hapl et al. 2002); **Silica**, church (060, 549 m a. s. l.), S (Horáček et al. 1979); **Silická Jablonica**, catholic church (060, 256 m a. s. l.), S (Horáček et al. 1979, 1995); **Silická ľadnica cave** (060, 503 m a. s. l.), OW *Sa* (Obuch 1985b, d, 1994, 1998a, b). – **7490**: **Diviačia priepasť cave** (060, 597 m a. s. l.), W (Pjenčák & Fulín 2006a);

Márnica cave (060, 539 m a. s. l.), W (Lehotská 2000, 2001, Matis 2002b, Pjenčák 2008). – **7491**: **Hosťovce**, catholic church (400, 175 m a. s. l.), S (Matis 1998). – **7494**: **Lysá hora Mt.** (440, 485 m a. s. l.), S (Ceľuch et al. 2006; Danko et al. 2006, 2007). – **7495**: **Brezina**, greek-catholic church (440, 186 m a. s. l.), S (Ceľuch et al. 2007). – **7496**: **Zemplínske Hradište** (820, 103 m a. s. l.), OW *Ta* (Danko & Mihók 1989). – **7569**: **Červenica 3 cave** (090, 360 m a. s. l.), OW *Sa* (Noga 2007); **Haviareň cave** (090, 730 m a. s. l.), W (Kečkemétyová 1978, Králiková 1995); **Plavecká jaskyňa cave** (090, 240 m a. s. l.), (Benda & Horáček 1995b), C (Gaisler & Klíma 1965, Gaisler & Hanák 1972, 1973), W (Kečkemétyová 1978, Králiková 1995); **Pružinská jaskyňa cave** (590, 590 m a. s. l.), OS (Obuch 2004a). – **7575**: **Gýmeš**, castle (110, 514 m a. s. l.), S (Gaisler & Hanák 1972, 1973). – **7578**: **Schöpfer mine** (300, 330 m a. s. l.), W (Uhrin 1996, Uhrin et al. 2002e). – **7579**: **Floriánka**, gallery (300, 400 m a. s. l.), W (Hapl & Uhrin 1999b, Uhrin et al. 2002e); **Ignác, gallery** (300, 538 m a. s. l.), W (Mihál 2004); **Jurajova štôlňa gallery** (300, 470 m a. s. l.), S (Palášthy 1971b, Štollmann 1971, Uhrin et al. 2002e); **Lom Diery pri Kysihýbli**, gallery (300, 700 m a. s. l.), W (Lehotská 2001, Mihál 2002, Uhrin et al. 2002e, Mihál & Kaňuch 2006); **Rabenstein**, gallery (300, 700 m a. s. l.), W (Mihál 2004). – **7584**: **Brezničká**, church (040, 219 m a. s. l.), S (Kečkemétyová 1978, Králiková 1995). – **7586**: **Ostrany**, church (040, 310 m a. s. l.), S (Horáček et al. 1995); **Veľká Drienčanská jaskyňa cave** (040, 280 m a. s. l.), OS SF (Obuch 1995a). – **7587**: **Nižné Valice**, manor house (393, 215 m a. s. l.), OW *Sa* (Uhrin et al. 2002a). – **7588**: **Čertova diera pri Domici cave** (060, 314 m a. s. l.), S (Matoušek 1998, Uhrin et al. 1996a, Uhrin et al. 2002b), W (Gaisler 1975, Hanák 1988, Obuch 1994, Uhrin et al. 1996a, 2002b, Hapl & Lehotská 1999, Bobáková 2002d); **Dlhá Ves**, church (060, 330 m a. s. l.), OW *Ta* (Obuch 1998a); **Kečovská vyvieračka spring** (060, 370 m a. s. l.), S (Matis et al. 2003, Danko et al. 2007); **Líščia diera cave** (060, 373 m a. s. l.), S (Zima 1978, Horáček et al. 1979, 1995, Uhrin 1997a, Uhrin et al. 1996a, 2002b, Bobáková 2002d), W (Hanák 1960, Gaisler & Hanák 1972, 1973, Uhrin et al. 2002b); **Peško cave** (393, 200 m a. s. l.), OS (Ložek et al. 1989). – **7596**: **Kašov**, cellar (450, 180 m a. s. l.), W (Pjenčák & Fulín 2006c, Ceľuch et al. 2007). – **7669**: **Baba**, gallery (090, 500 m a. s. l.), W (Kečkemétyová 1978, Králiková 1995); **Pezinok**, Stratená (090, 200 m a. s. l.), W (Kečkemétyová 1978). – **7670**: **Červený Kameň**, castle (090, 339 m a. s. l.), W (Kúdela 1975); **Červený Kameň**, gallery (090, 339 m a. s. l.), S (Kúdela 1975). – **7674**: **Nitra**, castle cave (802 , 190 m a. s. l.), S (Ligač 1971, 1986). – **7681**: **Senohrad**, catholic church (350, 592 m a. s. l.), S (Uhrin 1999). – **7686**: **Rimavské Janovce**, church (393, 197 m a. s. l.), OW *Ta* (Darolová 1976, Obuch 1994). – **7687**: **Cakov**, catholic church (393, 117 m a. s. l.), C (Horáček et al. 1995); **Cakov**, lower church (393, 117 m a. s. l.), C (Horáček et al. 1995). – **7767**: **Devínska Nová Ves** (770, 162 m a. s. l.), W (Zima 1978); **Pod Slovincom 1 a 2 gallery** (090, 140 m a. s. l.), W (Lehotská 2002b, 2005). – **7768**: **Marianka**, church (090, 220 m a. s. l.), C (Kúdela 1975); **Trojuholník cave** (090, 356 m a. s. l.), W (Kovarik 2008); **Zbojnícka jaskyňa cave** (090, 327 m a. s. l.), S (Noga 2007, Kovarik 2008), OS (Noga 2007). – **7779**: **Hontianske Nemce**, catholic church (350, 195 m a. s. l.), C (Uhrin 1999), W (Hapl & Lehotská 1999); **Šipice**, evangelic tower (805, 163 m a. s. l.), S (Uhrin 1999). – **7785**: **Hodejov, evangelic church** (430, 207 m a. s. l.), S (Uhrin et al. 2008); **Konrádovce**, quarry (430, 390 m a. s. l.), S (Uhrin et al. 2008). – **7881**: **Príbelce**, church (350, 300 m a. s. l.), C (Ceľuch et al. 2007). – **7969**: **Šamorín** (790, 130 m a. s. l.) (Topál 1954); **Šamorín**, church (790, 130 m a. s. l.), S (Ferianc 1956, Mituch 1963). – **7978**: **Ivanka** (805, 170 m a. s. l.), S (Ceľuch et al. 2007), – **8071**: **Trstená na Ostrove**, church (790, 118 m a. s. l.), S (Ferianc 1956). – **8078**: **Pastovce** (805, 124 m a. s. l.), OW *Ta* (Darolová 1976). – **8177**: **Gbelce** (804, 144 m a. s. l.), S (Gaisler et al. 2003); **Kamenín** (804, 132 m a. s. l.), S (Gaisler et al. 2003); **Malá nad Hronom** (805, 140 m a. s. l.), S (Gaisler et al. 2003), – **8178**: **Chľaba** (420, 117 m a. s. l.), S (Hůrka 1963); **Chľaba**, church (420, 117 m a. s. l.) (Benda 1993, Benda & Horáček 1995b), S (Gaisler & Hanák 1956, Vachold 1956, 2003, Hanák 1960, 1971, Hanák et al. 1962, Hůrka 1964, Gaisler et al. 2003), C (Zima 1978, Horáček et al. 1979, Gaisler et al. 2003, Vachold 2003); **Kamenica nad Hronom**, church (805, 117 m a. s. l.), S (Matoušek 1998, Vachold 2003); **Kováčov**, gallery (420, 380 m a. s. l.), W (Vachold 1956); **Nána** (804, 110 m a. s. l.), W (Vachold 1956); **Nána**, cellar (804, 110 m a. s. l.), S (Vachold 2003). – **Nízke Tatry Mts.** (190) (Benda 1993, Benda & Horáček 1995b). – **Slovenský kras Mts.** (022) (Benda 1993, Benda & Horáček 1995b). – **Tríbeč Mts.** (110) (Benda 1993, Benda & Horáček 1995b). – **Východoslovenská rovina lowland** (820), 1963 – S (Ferianc 1967).