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RESULTS OF MONITORING OF BAT WINTER ROOSTS IN THE SILESIAN BESKIDS AND ŻYWIEC BESKIDS (WESTERN CARPATHIANS, POLAND)

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Abstract

We present the results of bat monitoring conducted between 2012 and 2025 in the Silesian Beskids and Żywiec Beskids. The research aimed to monitor known bat hibernation sites, discover new ones and analyse trends among the most numerous species of hibernating bats. Winter monitoring of caves was conducted in teams of at least two people, during the winter (mid-December to mid-March), from sunrise to sunset. Counts were conducted at sites that were adjacent to each other or could be connected during the same day to avoid errors resulting from recounting bats that had previously awakened. During the study, 19 caves were inspected irregularly. In total, 15 objects in the Silesian Beskids (caves Dująca, Głęboka w Stołowie, Wisłańska, Malinowska Studnia, Miecharska, Salmopolska, Ostra-Rolling Stones, W Jaworzynie, Grabowa, W Trzech Kopcach, Malinowska, Lotnych Piasków, Półkuli, Studnia Wiatrów, and Czorny Grzib) and 4 in the Żywiec Beskids (caves W Boraczej, W Sopotni Wielkiej, Dymiąca Piwnica, and Oblica) were surveyed. The dominant species were the lesser horseshoe bat (*Rhinolophus hipposideros*) and the Geoffroy's bat (*Myotis emarginatus*). Also found were the brown long-eared bat (*Plecotus auritus*), Natterer's bat (*Myotis nattereri*), Daubenton's bat (*M. daubentonii*), greater mouse-eared bat (*M. myotis*), and whiskered bat/Brandt's bat (*M. mystacinus/brandtii*). A statistically significant increase in the number of lesser horseshoe bats was observed in caves W Trzech Kopcach (r = 0.882, $p \leq 0.01$) and Miecharska (r = 0.937, $p \leq 0.01$) between 1996 and 2025. The increase in the number of these bats in caves Ostra-Rolling Stones and Wisłańska was statistically insignificant between 2013 and 2025. It is also worth noting a clear increase in the number of Geoffroy's bats wintering in the region, which is quite clearly visible in Wiślańska Cave. The most numerous hibernacula in the study area were the caves Ostra-Rolling Stones, Wiślańska, and Miecharska. The sites with the highest diversity (Simpson's coefficient) include the caves Czorny Grzib, Wiślańska, Miecharska, and Głęboka w Stołowie.

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Результати моніторингу зимових сховищ кажанів у Сілезьких та Живецьких Бескидах (Західні Карпати, Польща)

Марцін Вархаловський, Войцех Й. Губала, Чеслав Шура, Гжегож Шабот, Бартомієй Юрошек, Якуб Пиш, Пьотр Дзікі, Павел Ґондек

Резюме. Представлено результати моніторингу кажанів, проведеного між 2012 і 2025 роками в Сілезьких і Живецьких Бескидах. Дослідження мало на меті моніторинг відомих місць зимівлі кажанів, виявлення нових місць та аналіз тенденцій для найчисленніших видів кажанів, що зимують. Зимовий моніторинг печер проводився групами щонайменше з двох осіб, протягом зими (з середини грудня до середини березня), від сходу до заходу сонця. Обліки проводили на ділянках, що прилягали одна до одної або могли бути об'єднані протягом одного дня, щоб уникнути помилок, що виникають внаслідок повторного обліку кажанів, які прокинулися раніше. Під час дослідження 19 печер обстежували нерегулярно. У Сілезьких Бескидах знайдено 15 місць (печери Дуя, Глибока в Столуві, Вісланська, Маліновська Студня, Мехарська, Сальмопольська, Гостра-Rolling Stones, Яворина, Грабова, Трьох Корчів, Маліновська, Льотних Пісків, Пулкулі, Студня Вітрів, Чорний Гриб) і 4 об'єкти в Живецьких Бескидах (печери Борача, Сопотня Велька, Димянка Півниця, Обліца). Домінуючими видами кажанів у моніторингу були підковик малий (*Rhinolophus hipposideros*) та нічниця триколірна (*Myotis emarginatus*). Також зустрічаються вухань бурий (*Plecotus auritus*), нічниці війчаста (*Myotis nattererri*), водяна (*M. daubentonii*), велика (*M. myotis*) та вусата або північна (*M. mystacinus / brandtii*). Статистично значуще збільшення кількості підковиків малих спостерігалося в печерах з Тшех Копках ($r = 0{,}882$, $P \leq 0{,}01$) та Мехарська ($r = 0{,}937$, $P \leq 0{,}01$) між 1996 та 2025 роками. Збільшення кількості цих кажанів у печерах Остра-Роллінг Стоунз та Вісланська було статистично незначним між 2013 та 2025 роками. Варто також відзначити явне збільшення кількості кажанів Жоффруа, які зимують у регіоні, що досить чітко видно в печері Вісланська. Найчисленнішими зимівниками в досліджуваній зоні були печери Остра-Роллінг Стоунз, Вісланська та Мехарська. До місць з найбільшим різноманіттям (коефіцієнт Сімпсона) належать печер Чорний Гриб, Вісланська, Мехарська та Глибока в Столуві.

Ключові слова: флішеві печери, зимівля, нічниця триколірна, малий підковик, Західні Карпати.

Introduction

Early data on bat hibernation in the Western Beskids were provided by Pax [1925]. Further studies appeared in the postwar years. At that time, the most important hibernacula were the caves W Trzech Kopcach and Malinowska [Kowalski 1953]. Later records resulted from improved cave exploration by amateur speleologists. New data were not published until the early 21st century [Mysłajek 2002; Mysłajek *et al.* 2007; Mysłajek *et al.* 2010]. In the last decade, over a dozen new bat hibernacula have been discovered in the Silesian Beskids, important for local bat populations.

At the same time, significant progress was made in discovering summer roosts for bats, especially lesser horseshoe bats (*Rhinolophus hipposideros*). In the 1990s, a colony of lesser horseshoe bats and greater mouse-eared bats (*Myotis myotis*) was described in a church in Górki Wielkie [Zygmunt 1995]. A small colony of lesser horseshoe bats was also found in an old mill in Pierściec. Subsequently, a colony of lesser horseshoe bats was described in a school in Brenna [Mysłajek & Jonderko 2010] and bat roost in Jaworze [Warchałowski *et al.* 2011].

Furthermore, roosts of lesser horseshoe bats and greater mouse-eared bats were discovered in Rychwałd. Two bat roost of lesser horseshoe bats were also found, located in a school and a castle, and a roost in an abandoned building in Grodziec [Warchałowski *et al.* 2014]. In 2017, new roosts were discovered in the village of Górki Wielkie [Warchałowski *et al.* 2018]. Long-term monitoring of breeding colonies in the area showed an increase in bat populations. At the same time, single bat roost of pipistrelles, brown long-eared bats, and Geoffroy's bats were also described during this period [Wołoszyn *et al.* 1994; Mysłajek *et al.* 2015; Warchałowski *et al.* 2019].

The present research aimed to monitor known bat hibernation sites, discover new ones and analyse trends among the most numerous species of hibernating bats.

Material and Methods

Winter monitoring of known caves was conducted in teams of at least two people, during the winter (mid-December to mid-March), from sunrise to sunset. Counts were conducted at sites that were adjacent to each other or could be connected during the same day to avoid errors resulting from recounting bats that had previously awakened. Bats were identified to species level by their external characteristics, without touching and awakening. Species that were difficult to distinguish with this method were counted as a group, e.g. *Myotis mystacinus/brandii* complex. Bats found in larger aggregations (e.g., Geoffrey's bats) were photographed and then counted from the photographs on a computer. Using simple graphics programs, a dot was marked above the face of each bat and then they were counted manually.

To estimate species diversity in the monitored sites, Simpson's coefficient (index) was calculated using the following formula:

$$D = \frac{\sum_{i=1}^{s} n_i\,(n_i - 1)}{N(N-1)}$$

where S is number of species; N is number of individuals; and n_i is number of individuals of the species.

The study was conducted in the Silesian Beskids and Żywiec Beskids [Kondracki 2011; Solon 2018]. Nineteen caves were inspected, where at least a few bats had been recorded over several years, particularly greater mouse-eared bats, lesser horseshoe bats, and Geoffroy's bats (Fig. 1). The sites were inspected with moderate regularity over the years (2012–2025), with an effort to regularly inspect sites of significant importance to the studied populations.

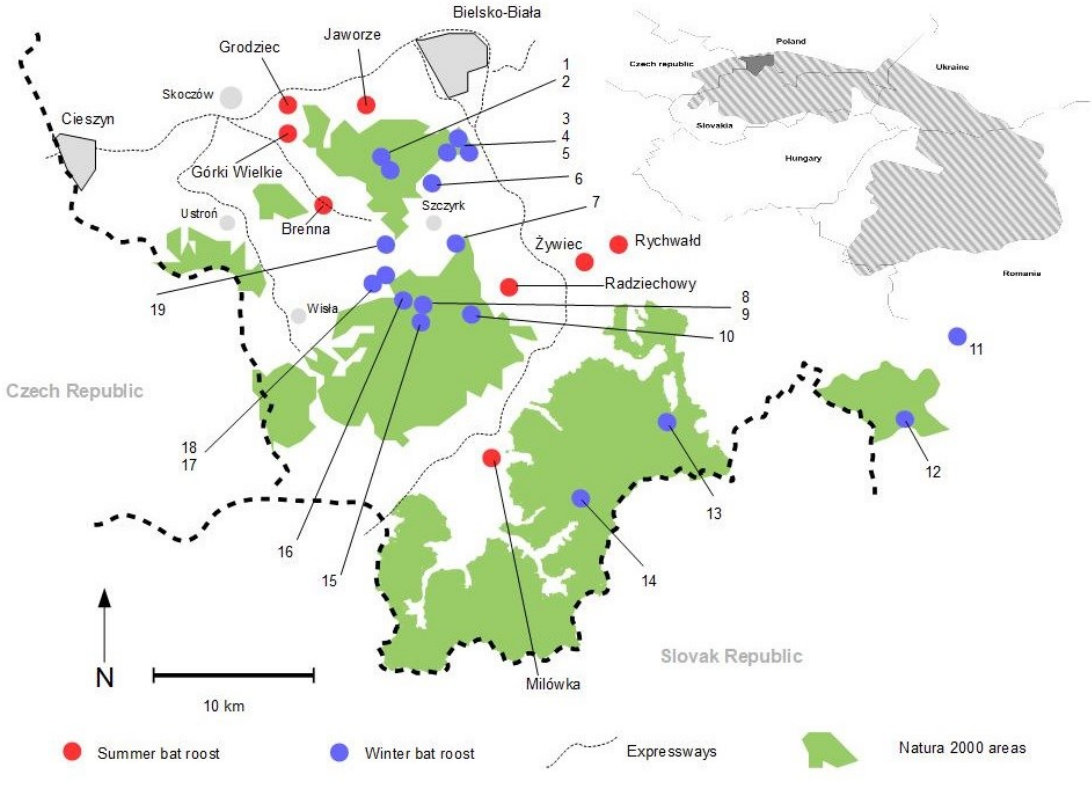

Fig. 1. Study area with marked controlled caves and known summer bat roost in the area. The grey dashed area indicates the Carpathians, the darker unhatched area is the study area (Beskid Śląski, Beskid Żywiecki).

Рис. 1. Досліджувана територія з контрольованими печерами і відомими літніми місцезнаходженнями кажанів. Сіра область — Карпати, темніша область — досліджена територія (Сілезькі та Живецькі Бескиди).

Table 1. Morphometric data of caves in the Silesian Beskids and Żywiec Beskids
Таблиця 1. Морфометричні дані печер у Сілезьких та Живецьких Бескидах

No.	Object	Length	Denive-lation	Altitude of main entrance (a.s.l.)	Description
1	Dująca cave	498 m	-17.5 m	989 m	
2	Głęboka Stołowie cave	554 m	-25.0 m	979 m	
3	Lotnych Piasków cave	726 m	23.4 m	1109 m	
4	Studnia Wiatrów cave	437 m	-18.5 m	~850 m	
5	Półkuli cave	51 m	-11.5 m	~850 m	
6	W Trzech Kopcach cave	1244 m	32.6 m	972 m	Cave known since the 1940s, for years the longest cave in Polish Flysh Carpathians
7	W Jaworzynie cave	86 m	-4.0 m	1019 m	
8	Malinowska cave	230 m	-19.5 m	1075 m	Cave known at least since the 1910s. A well known tourist attraction, near a large mountain pass
9	Malinowska Studnia cave	324,6 m	18.1 m	1029 m	
10	Ostra-Rolling Stones cave	885 m	-60.0 m	894 m	Deepest cave in Polish Flysh Carpathians, large horseshoe bat winter roost
11	Oblica cave	436 m	-21.1 m	634 m	Largest cave in the Żywiec Beskids, largest winter bat roost in the range
12	Dymiąca Piwnica cave	86.5 m	-10.5 m	1337 m	Largest cave in Babia Góra National Park
13	W Sopotni Wielkiej cave	101 m	-7 m	825 m	
14	W Boraczej cave	28 m	-8.0 m	1074 m	
15	Miecharska cave	1838 m	56.3 m	930 m	Second largest and second deepest cave in Polish Flysh Carpathians, active water stream, waterfalls and several ponds with cave fauna, large bat winter roost
16	Czorny Grzib cave	~1000 m	48 m	–	
17	Wiślańska cave	2275 m	41.0 m	889 m	Largest cave in Polish Flysh Carpathians, large bat winter roost
18	Salmopolska cave	1009.5 m	29.1 m	910 m	First 130 metres known at least since the 1970s, large deeper parts discovered recently
19	Grabowa cave	48 m	-9.1 m	870 m	

We used local names for caves with descriptor of geographic object (‘name of the object’ + cave), as proposed by Commission for Establishing Names of Localities and Physiographic Objects.

Results

During the study (2012–2025), 19 winter roosts were inspected and 7 bat species were recorded (67 checks, Fig. 2). The dominant bats found were the lesser horseshoe bat (*Rhinolophus hipposideros*) (74.25%) and Geoffroy’s bat (*Myotis emarginatus*) (11.55%). Other bat species recorded included the greater mouse-eared bat (*M. myotis*) (5.72%), whiskered/Brandt’s bat (*M. mystacinus complex*) (4.54%), Natterer’s bat (*M. nattereri*) (1.14%), Daubenton’s bat (*M. daubentonii*) (0.51%), and brown long-eared bat (*Plecotus auritus*) (0.27%).

If we analyse separately the data obtained during counts at four sites in the Żywiec Beskids and fifteen sites in the Silesian Beskids, we notice significant differences. In the Silesian Beskids, we record the presence of as many as seven bat species, while in the Żywiec Beskids only of three (Fig. 3). The dominant species in the Żywiec Beskids was Geoffroy’s bat, while in the Silesian Beskids it was the lesser horseshoe bat.

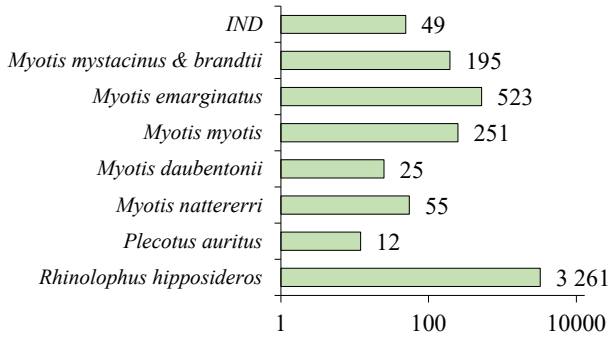

Fig. 2. The result of 66 inspections in the winter roosts in the Silesian and Żywiec Beskids in the years 2012–2025.

Рис. 2. Результат 66 обстежень у зимових сховищах в Сілезьких та Живецьких Бескидах у 2012–2025 рр.

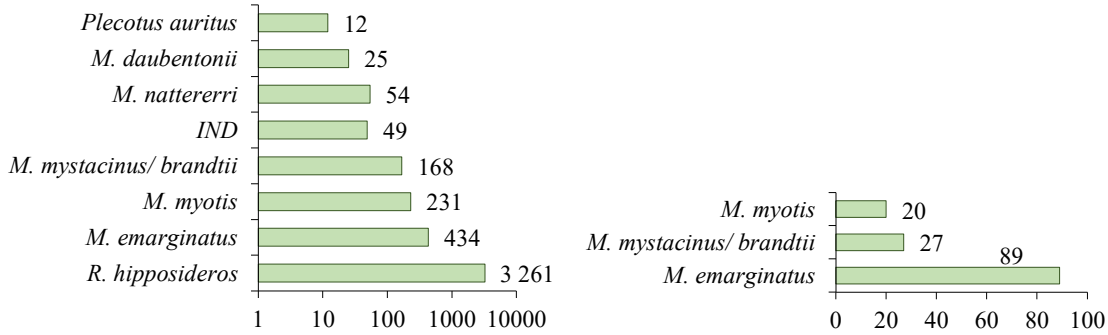

Fig. 3. Results of winter monitoring in 2012–2025. On the left, the Silesian Beskids; on the right, the Żywiec Beskids.

Рис. 3. Результати зимового моніторингу 2012–2025 рр. Сілезькі (ліворуч) та Живецькі Бескиди (праворуч).

During the season, 1 to 15 caves were inspected: 3 in 2012, 10 in 2013, 2 in 2014, 1 in 2015, 4 in 2016, 2 in 2017, 2 in 2018, 4 in 2019, 6 in 2020, 5 in 2021, 2 in 2022, 2 in 2023, 6 in 2024, and 5 in 2025. The largest numbers of bats were recorded in Ostra-Rolling Stones, Wiślańska, and Miecharska caves (Silesian Beskids). Currently, there are still no large wintering sites in the Silesian part of the Żywiec Beskids, where only small caves with single bats recorded are known (caves Boracza and W Sopotni Wielkiej).

The results are summarised in Table 2, which includes data for all counts.

During the research, individuals marked with rings were also recorded, including the lesser horseshoe bat ringed in the bat roost in Chapel in Radziechowy, which is located near the Ostra-Rolling Stones cave, and individuals recorded in the Wiślańska cave and marked in the bat roost in Grodziec, also recorded in the transition roost in Górki Wielkie [Warchałowski *et al.* 2022; Warchałowski & Pietraszko-Warchałowska 2023].

The sites with the highest diversity (Simson's coefficient) include the Czorny Grzib, Malinowska Studnia, and Głęboka w Stołowie caves.

During the study, the authors observed a very dynamic increase in the number of lesser horseshoe bats in Ostra-Rolling Stones cave (Fig. 4) and a stable level for the population wintering in Wiślańska cave. It is also worth noting a clear increase in the number of Geoffroy's bats wintering in the region, which is quite clearly visible in Wiślańska cave.

A statistically significant increase in the number of lesser horseshoe bats (Fig. 4) was observed in W Trzech Kopcach cave ($r = 0.882$, $p \leq 0.01$) and Miecharska cave ($r = 0.937$, $p \leq 0.01$) between 1996 and 2025. The increase in the number of these bats in Ostra-Rolling Stones and Wislańska caves was statistically insignificant between 2013 and 2025. A statistically significant increase in the number of Geoffroy's bats was also observed in Wislańska cave ($r = 0.918$, $p \leq 0.01$) between 2013 and 2025 (Fig. 5).

Table 2. Results of bat population monitoring in 2012–2021 in the Silesian Beskids and Żywiec Beskids
Таблиця 2. Результати моніторингу популяції кажанів у 2012–2021 роках у Сілезьких та Живецьких Бескидах

No.	Object	Date	*R. hip*	*P. aur*	*M. nat*	*M. dau*	*M. myo*	*M. ema*	*M. mys/bra*	In-det.	Total	Simpson index
1	Dująca cave	05.01.2013	49				2				51	0.925
		13.02.2021	82					1	1		84	0.953
2	Głęboka w Stołowie cave	05.01.2013					2		13**		29	0.769
		13.02.2021	11	1	1		6		10		15	0.308
3	Wiślańska cave	10.01.2013	121		9	7	13	11	5		166	0.548
		28.12.2013	123				5	7	5		140	0.777
		14.02.2016	107		1		9	11	7		135	0.642
		22.02.2020	69		3	1	6	43	2		124	0.433
		05.02.2021	142		2		10	45	2		201	0.552
		15.02.2024	78		1		6	42	3		130	0.467
		19.02.2025	93	2	9	1	17	68	16		**206**	0.328
4	Malinowska Studnia cave	01.02.2013	45				1		1		47	0.918
		20.02.2020	59				2	1			62	0.907
5	Miecharska cave	21.12.2012	38	1	2	4	8	14	4		71	(indet.)
		28.12.2013	59		1		8	12	3		83	0.537
		30.12.2014	57		3	1	3	8	2		74	0.609
		28.01.2016	67		1		7	7		8	90	0.574
		20.02.2020	56		6	4	4	8	2		80	0.511
		30.12.2021	76				2			26	104	0.950
		27.02.2022	61				7	18	14		100	0.429
		16.02.2024	58	1	2	1	6	21	2		91	0.465
		19.02.2025	95	1	4		9	17	1		127	0.584
6	Salmopolska cave	20.02.2013	2	1							3	0.556
		11.01.2021	26		1		2	8			37	0.544
7	Ostra- Rolling Stones cave	31.12.2013	156				13	1			171	0.848
		13.02.2016	151	1			16				177	0.817
		06.02.2021	293				6	3	3		305	0.405
		08.02.2021*	133				2	5			140	0.904
		17.02.2024	351				2	3			**356**	0.972
		21.02.2025	482				16	3	1		**502**	0.923
8	W Jaworzynie cave	20.01.2017	25								25	1.000
		20.02.2021	19						1		20	0.905
9	Grabowa cave	20.01.2013	2								2	1.000
		10.01.2021	9		1						10	0.82
		21.02.2021	5		1						6	0.722
10	W Trzech Kopcach cave	05.01.2013	36					2			38	0.900
		25.02.2021	94		2		5	1	1		103	0.836
11	Malinowska cave	08.02.2021	7	1					15		23	0.520
12	W Boraczej cave	18.03.2019					1				1	1.000
		26.02.2020					1				1	1,000
		01.03.2021									0	(indet.)
13	W Sopotni Wielkiej cave	08.03.2019					1				1	1.000
		17.01.2020									0	(indet.)
		29.01.2021									0	(indet.)
14	Lotnych Piasków cave	29.12.2022	133				3				138	0.957
		27.02.2024	35				3				38	0.855
15	Półkuli cave	29.01.2023	5							2	7	0.592
16	Studnia Wiatrów cave	29.12.2023	4				1			1	6	0.500
17	Czorny Grzib cave	29.12.2025	2	2	2	2	25	57	50		140	**0.326**

No.	Object	Date	*R. hip*	*P. aur*	*M. nat*	*M. dau*	*M. myo*	*M. ema*	*M. mys/bra*	In-det.	Total	Simpson index
18	Dymiąca Piwnica cave	09.03.2012							2		2	1.000
		19.02.2013					2		3		5	0.343
		30.01.2018							11		11	1.000
		24.02.2019							3		3	1.000
		28.02.2024							4		4	1.000
		15.02.2025							1		1	1.000
19	Oblica cave	14.02.2012						3	1		4	0.500
		28.12.2014						10			10	1.000
		08.03.2015						13			13	1.000
		23.01.2016			1		4	13			18	0.549
		11.03.2017					4	9			13	0.538
		29.01.2018						11			11	1.000
		22.02.2019					1	9			10	0.800
		05.03.2020						9	2		11	0.673
		15.02.2021					2	6			8	0.571
		28.02.2024					4	6			10	0.467

* Only part of the system: the Ostra cave was monitored; ** sensu lato.

Discussion

The current winter monitoring data for the study area is significantly outdated. The last decade of speleological research in the area has resulted in the discovery of entirely new bat sites and a significant expansion of knowledge about existing sites. A prime example is the Salmopolska cave, known since the 1970s, which is currently 1009.5 metres long (as of 2025), while at the time of discovery, its length was estimated at just over 100 metres. The W Trzech Kopcach cave has also seen a significant increase in length over the years (to over 1244 metres) [Grodzicki 2016].

The dominance of the lesser horseshoe bat in counts has been observed for many years. Already in Mysłajek's work [Mysłajek *et al.* 2007], it was the dominant species, constituting nearly 60% of the recorded bats. It should be noted, however, that at that time, its largest aggregations numbered less than 60 individuals (Wiślańska cave), significantly less than our results (over 400 ind.). The entire winter population of this species in the Silesian Beskids at that time was estimated by this author at only about 105 individuals [data for 2006; Mysłajek *et al.* 2007].

It is worth emphasising that similar population increases of this species are observed in other parts of the Carpathians [Piksa *et al.* 2020]. The lesser horseshoe bat is also frequently encountered during winter monitoring in the Pieniny Mountains [Gubała & Piksa 2012], the area around Ojców National Park [Nowak & Grzywiński 2007], the Beskid Niski Mountains [Piksa & Gubała 2012; Szkudlarek *et al.* 2018]. These are areas rich in a large number of caves. It is a species that in Poland almost exclusively hibernates in natural roost [Postawa 2022] and is only occasionally found in anthropogenic shelters.

A clear dominance of lesser horseshoe bats was also observed during captures conducted near the Wiślańska cave (70.5%, our data). However, it is worth emphasising that Geoffroy's bat (3.4%) was not recorded at that time. The authors speculate that the current captures would indicate a significant increase in the number of Geoffroy's bats captured, as the last decade has seen a significant increase in the number of these bats in winter counts, and new summer Geoffroy's bat roosts have been discovered [Warchałowski *et al.* 2019].

In the study area, during the summer, over 1300 lesser horseshoe bats were recorded in all summer roosts (see Fig. 1). In the winter of 2021, during monitoring of 10 caves (W Jaworzynie, Grabowa, Salmopolska, Malinowska, Wiślańska, Ostra-Rolling Stones, Miecharska, W Trzech Kopcach, Dująca, and Głęboka w Stołowie) 740 lesser horseshoe bats were recorded (Fig. 6).

The difference in these estimates indicates that there are still quite numerous unknown bat winter roosts in the Silesian Beskids.

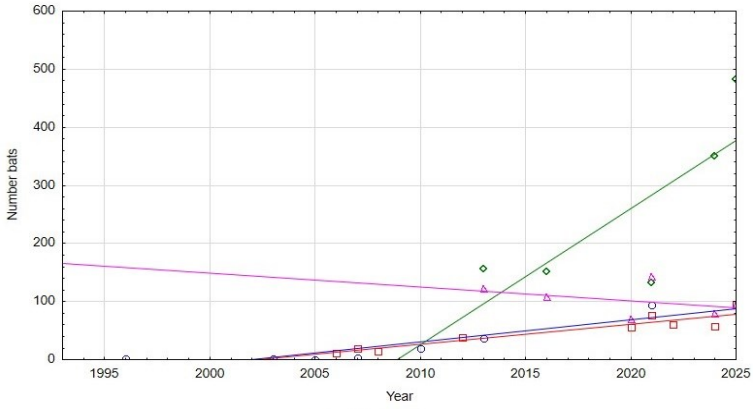

Fig. 4. Trend in the abundance of lesser horseshoe bats in the caves W Trzech Kopcach (blue), Miecharska (red), Ostra-Rolling Stones (green), and Wiślańska (pink).

Рис. 4. Зміни чисельності підковика малого в печерах В Трьох Корчах (синім), Мєхарська (червоним), Гостра-Rolling Stones (зеленим) та Віслянська (рожевим).

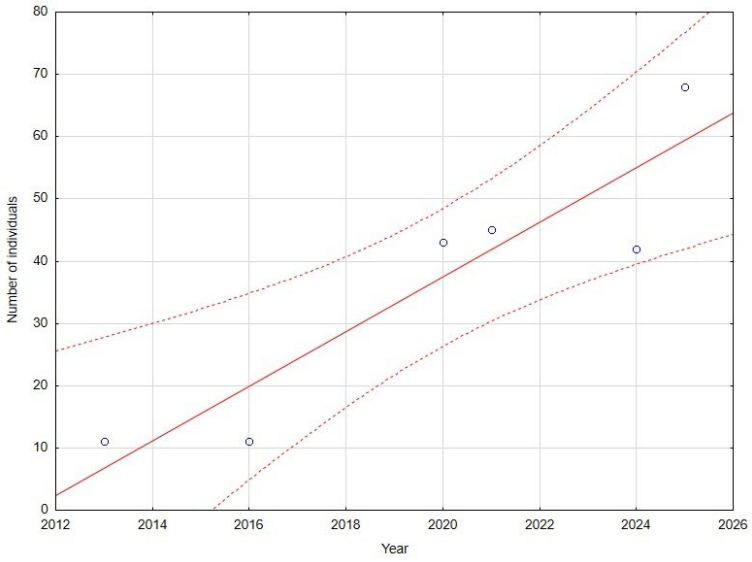

Fig. 5. Increase in the number of *Myotis emarginatus* in Wislańska cave ($r = 0.918$, $p \leq 0.01$) between 2013 and 2025.

Рис. 5. Збільшення чисельності *Myotis emarginatus* у Віслянській печері ($r = 0{,}918$, $p \leq 0{,}01$) між 2013 та 2025 роками.

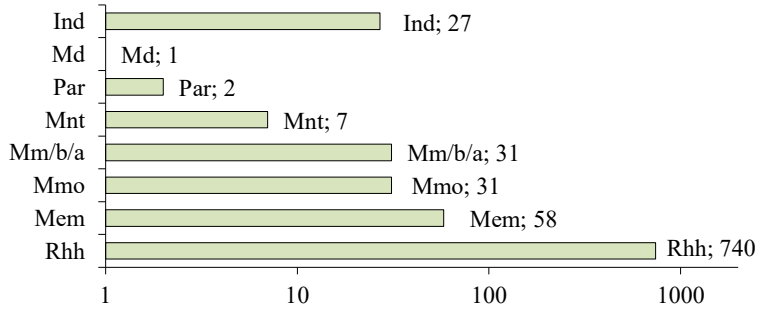

Fig. 6. Result of bat counts from 2021 in 11 winter roost.

Рис. 6. Результати обліку кажанів у 2021 р. у 11 зимових сховищах.

According to data already known from other publications on the migration of lesser horseshoe bats in the study area, we know that individuals from Radziechowy fly to the Ostra-Rolling Stones cave [Warchałowski *et al.* 2023] and individuals from Grodziec head to the Wiślańska cave [Warchałowski *et al.* 2022].

In the cases of caves where larger numbers of lesser horseshoe bats were recorded, and the studies were conducted over a longer period, multi-year trends were analysed (see Fig. 4). Available literature data were used for the analysis [Mysłajek 2002; Mysłajek *et al.* 2007]. In all cases, a significant increase in the population of lesser horseshoe bats was observed at the beginning of the 21st century. This trend is also observed in Poland, including the Kraków Upland [Nowak *et al.* 2002; Nowak & Grzywiński 2007; Nowak & Grzywiński 2012; Grzywiński *et al.* 2015], and in other Eu-

ropean countries [Uhrin *et al.* 2010]. In the study area, an increasing trend in the population of the lesser horseshoe bat was also observed in some summer roosts. In some cases, this trend was very strong (chapel in Radziechowy; $r = 0.701$ $p = 0.03$) or much weaker but noticeable, although slowing down in recent years (church in Radziechowy; $r = 0.26$, $p = 0.58$ [Warchałowski *et al.* 2022]; $r = 0.91$, $p < 0.05$ [Warchałowski *et al.* 2019b].

A growing trend is also observed in the local population of Geoffrey's bat. Large aggregations of Geoffrey's bats have also been observed in some sites (Wiślańska and Miecharska caves). In the study area, in the Silesian Beskids, Geoffroy's bat has become the second most dominant species, while in 2000–2006 it was recorded sporadically in the Miecharska and the W Trzech Kopcach caves. It should be noted that in recent years, breeding colonies of this species numbering dozens of individuals have been described in the study area [Warchałowski *et al.* 2019]. Less pronounced increases in the population size of this species were also observed in wintering grounds in Europe [Uhrin *et al.* 2010]. In the Żywiec Beskids, Geoffroy's bat is the most abundant species found during the hibernation period [Gubała *et al.* 2011]. The population of the species in the entire study area is probably much larger than that recorded during winter bat counts, considering that Geoffroy's bats usually hibernate in crevasses.

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Declarations

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Handling of materials. The studied specimens were handled according to the current legislation of the Republic of Poland.

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