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Survey results of the main fortifications of the Barbariga Defensive Group (Croatia)

Rezultati pregleda glavnih utvrda Obrambene grupe Barbariga (Hrvatska)



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Abstract

We are presenting the results of the first bat survey of the main fortifications of the Barbariga Defensive Group near the settlement Barbariga in Istria (Croatia). The survey was done on 18 August 2024 during a tourist excursion of the freely accessible fortifications. In four fortifications we found bats of five different species: *Rhinolophus hipposideros*, *R. ferrumequinum*, *R. euryale*, *Myotis myotis/blythii* and *Plecotus kolombatovici*. In three of them only small number of bats were found, but in Polygonal Fort Paravia West we found a larger colony of *R. ferrumequinum* and a smaller colony of *R. euryale* and *R. hipposideros*. The newfound roost of *P. kolombatovici* is also an important find and one of the few records for this species in Istria and on the northern edge of species distribution.

Key words: Chiroptera, roost survey, fortifications, Istria, Croatia

Sažetak

Predstavljamo rezultate prvog istraživanja šišmiša u glavnim utverdama Obrambene grupe Barbariga u blizini naselja Barbariga u Istri (Hrvatska). Istraživanje je provedeno 18. 8. 2024. tijekom turističkog obilaska slobodno dostupnih utvrda. U četiri utvrde pronašli smo šišmiše pet različitih vrsta: *Rhinolophus hipposideros*, *R. ferrumequinum*, *R. euryale*, *Myotis myotis/blythii* i *Plecotus kolombatovici*. U tri od njih pronađen je samo mali broj šišmiša, ali u poligonalnoj oklopnoj utvrdi Paravia Zapad pronašli smo veću koloniju *R. ferrumequinum* i manju koloniju *R. euryale* i *R. hipposideros*. Novootkriveno sklonište *P. kolombatovici* također je važno nalazište i jedan od rijetkih podataka o ovoj vrsti u Istri i na sjevernom rubu rasprostranjenosti vrste.

Cljučne riječi: Chiroptera, pregled skloništa, utvrda, Istra, Hrvatska

Introduction

The Barbariga Defensive Group was part of the Austro-Hungarian defensive system of Pula (Croatia). The fortifications were built between 1889 and 1914, northwest of Pula, close to where present-day settlement Barbariga is located. The Defensive Group consists of six permanent fortifications, four forts of mixed permanent and field construction (semi-permanent fortifications) and some rear facilities and supporting buildings (barracks, shelters, etc.). In the southwest, there are three forts that were used for coastal defence (Coastal-defence mortar battery Caluzzi, Coastal-defence polygonal battery San Benedetto, Coastal Polygonal Fort Forno) and in the northeast, there are three land fortifications (Polygonal Fort Paravia West, Polygonal Fort Paravia East, Fort Paravia Untertritt) (Barbariga Defensive Group n.d.).

While some other fortifications in Istria have already been surveyed for bats in the past (e.g. Žalac et al. 2018, Rnjak et al. 2023), to our knowledge, the Barbariga Defensive Group fortifications were not among them. From mentioned surveys, it is also known that bats can choose them as summer roosts, sometimes in large numbers (e.g. Žalac et al. 2018).

Materials and methods

On 18 August 2024 we attempted to visit all six permanent fortifications of the Barbariga Defensive Group (Figure 1). The fortifications were surveyed using

headlamps and handheld flashlights, and bat species were mostly determined using ultrasound microphone for a mobile phone (Pettersson u384 USB Ultrasound Microphone) and by visual observation. The bats were determined following Barataud (2015) and Dietz & Kiefer (2016).

Results

Of the six permanent fortifications (Figure 1, Table 1), one was locked and therefore not accessible, so only five of them were surveyed for bats. Bats were found in four of them. A total of five species were found: *Rhinolophus hipposideros*, *R. ferrumequinum*, *R. euryale*, *Myotis myotis/blythii* and *Plecotus kolombatovici*.

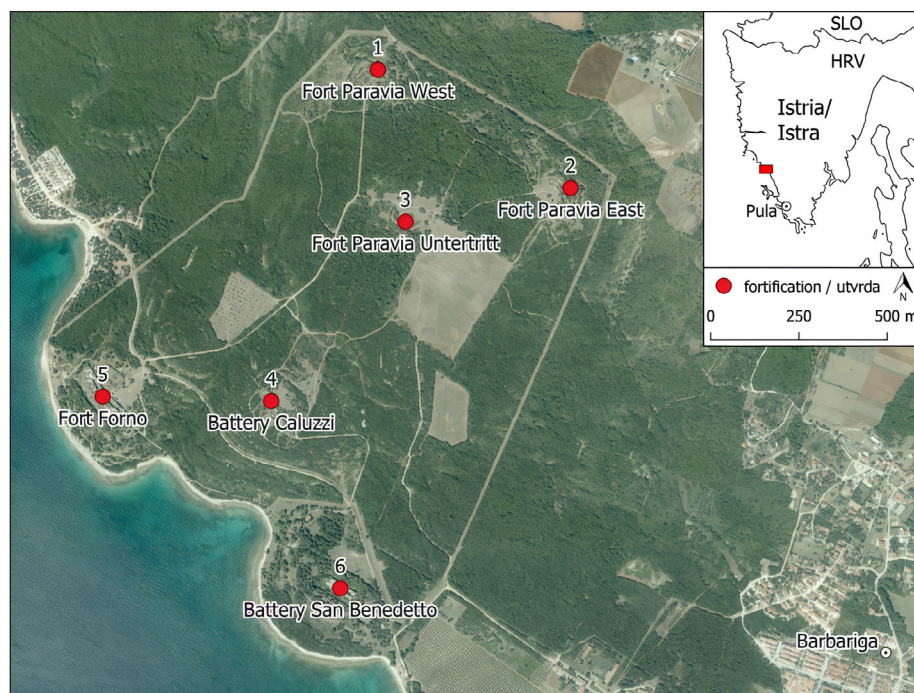


Figure 1. Map of the surveyed fortifications of the Barbariga Defensive Group near the settlement Barbariga (Croatia) on 18 August 2024.

Slika 1. Karta istraženih utvrda Obrambene grupe Barbariga kod naselja Barbariga (Hrvatska) 18. 8. 2024.

Table 1. Surveyed main fortifications of the Barbariga Defensive Group near the settlement Barbariga (Croatia) on 18 August 2024.

(juv – juvenile, ad – adult, ad F + juv – adult female with a juvenile, un – unknown age and sex, “/” – no bats found)

Tabela 1. Istražene glavne utvrde Obrambene grupe Barbariga kod naselja Barbariga (Hrvatska) 18. 8. 2024. (juv – mlad, ad – odrastao, ad F + juv – odrasla ženka s mladim, un – spol i starost nisu poznati, “/” – šišmiši nisu bili uočeni)

Site no. Br. lok	Fortification Utvrda	WGS 84 (latitude, longitude) WGS 84 (geografska širina, dužina)	m a.s.l. m n.v.	Bat species (no. of bats) Vrsta (br. jedinki)
1	Polygonal Fort Paravia West Poligonalna oklopna utvrda Paravia Zapad	45.007351, 13.734849	55	<i>R. ferrumequinum</i> (cca. 100 un) <i>R. euryale</i> (min 10 un) <i>R. ferrumequinum/ euryale</i> (cca 10 un) <i>R. hipposideros</i> (min 2 un)
2	Polygonal Fort Paravia East Poligonalna oklopna utvrda Paravia Istok	45.004536, 13.741925	55	<i>R. ferrumequinum</i> (3 un) <i>R. hipposideros</i> (6 un) <i>P. kolombatovici</i> (1 ad M)
3	Paravia Untertritt Paravia Untertritt	45.003494, 13.736057	50	<i>R. hipposideros</i> (1 ad F + juv)
4	Coastal-defence mortar battery Caluzzi Mužarska obalna bitnica Caluzzi	44.998793, 13.731481	40	/
5	Coastal Polygonal Fort Forno Obalna poligonalna oklopna utvrda Forno	44.998795, 13.725511	25	<i>R. hipposideros</i> (3 un) <i>M. myotis/blythii</i> (4 un)
6	Coastal-defence polygonal battery San Benedetto Obalna poligonalna bitnica San Benedetto	44.994071, 13.734227	10	Locked gate, could not survey.

The highest number of bats were found in Polygonal Fort Paravia West (site no. 1, Figure 2). The fort has a ground floor and a first floor. The first bats were observed on the first floor near the stairs, but quickly flew to the darker parts of the ground floor. On the ground floor we found bats in three different parts of the fort: in two crude corridors (about 20 m long) with the entrance by the stairs on the west and east side of the fort, leading to the defensive position, and in a narrow passage extending behind all rooms on the ground floor (Figure 2, 3). Bats were active and flying when approached. Around 50 *R. ferrumequinum* were found in the western corridor leading to the defensive position, in the eastern corridor around 30 *R. ferrumequinum*, 10 *R. ferrumequinum/euryale*, a group of at least 10 *R. euryale* and 2 *R. hipposideros* were found and around 20 *R. ferrumequinum* were counted in the narrow passage behind the rooms (Figure 2b). Based on the colour difference, we were able to determine that the colony of *R. ferrumequinum* and *R. euryale* was a mixture of adults and juveniles. This could mean that this is also a nursery roost, so in the future it should be surveyed at the appropriate time to confirm this.

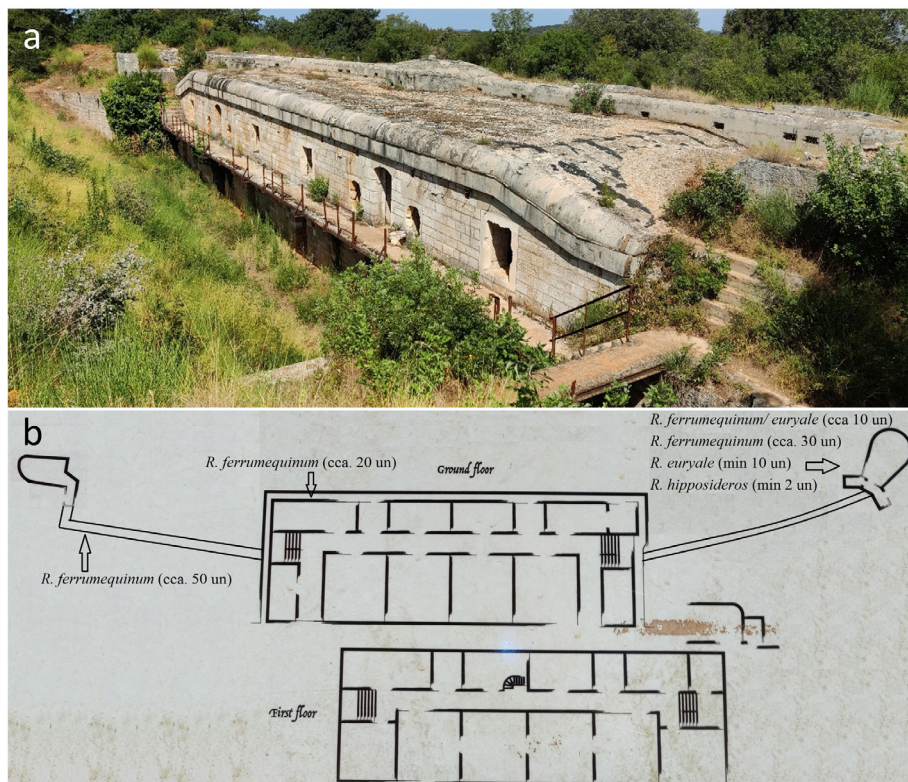


Figure 2. a) The Polygonal Fort Paravia West, b) adapted map of the fort from the information board in front of the fortification (Paravia West n.d.), on which we have sketched the crude corridors and marked bat locations.

Slika 2. a) Poligonalna oklopna utvrda Paravia Zapad, b) prilagođena karta utvrde s informativne ploče ispred utvrde (Paravia West n.d.) gdje smo skicirali koridore i označili lokacije šišmiša.
(photo/foto: Eva Pavlovič)

The Polygonal Fort Paravia East (site no. 2, Figure 4) has the same main floor plan as the Polygonal Fort Paravia West (site no. 1), but with differently shaped defensive positions at the end of the crude corridors. On the ground floor (in the darker rooms, the narrow passage behind the rooms and in the crude corridors) we found altogether 6 *R. hipposideros*, 3 *R. ferrumequinum* and 1 adult male *P. kolombatovici*. The roosting *P. kolombatovici* was an interesting find and one of the few in Istria (Schofield et al. 2023). The northernmost find in Croatia is a nursery roost in the Church of sv. Juraj/St. George in Boljun, about 45 km northeast of our find, also in Istria. Another find of *P. kolombatovici* is an old record from Rovinj, located about 12 km northwest of our survey and closest to our locality (Tvrtković et al. 2005, Schofield et al. 2023). Thus, this find is one of the few in this area.



Figure 3. a) The entrance by the stairs, b) the crude corridor, c) the defensive position on the west side of the Polygonal Fort Paravia West.

Slika 3. a) Ulaz po stepenicama, b) grubi koridor, c) obrambeni položaj na zapadnoj strani poligonalne oklopne utvrde Paravia Zapad.
(photo/foto: Eva Pavlovič)



Figure 4. a) The Polygonal Fort Paravia East, b) *Plecotus kolombatovici* found in the dark room.

Slika 4. a) Poligonalna oklopna utvrda Paravia Istok, b) *Plecotus kolombatovici* pronađen u tamnoj sobi.
(photo/foto: Eva Pavlovič)

The fortification Paravia Untertritt (site no. 3, Figure 5) were the military barracks in which most of the rooms were bright, with sun shining into the rooms. In the dark narrow passage that stretched behind all the rooms, we found one adult female

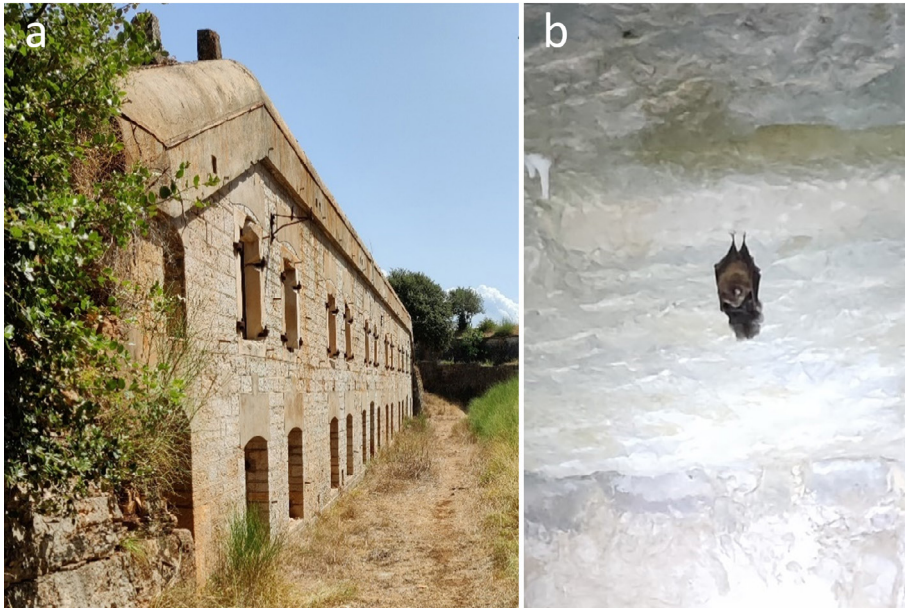


Figure 5. a) The fortification Paravia Untertritt, b) the adult female *Rhinolophus hipposideros* with a pup in the dark narrow passage.

Slika 4. a) Utvrda Paravia Untertritt, b) odrasla ženka *Rhinolophus hipposideros* s mladunčecom u mračnom uskom prolazu.

(photo/foto: Eva Pavlovič)

R. hipposideros that still had a small pup hanging from her (Figure 5b). We believe that the female must have had the pup very late, because by this time juveniles should already be independent.

The Coastal Polygonal Fort Forno (site no. 5) was the largest surveyed fort and probably also the most visited one. The fort is occasionally also used for public events. It has many dark rooms on the ground level, but we only found a few *R. hipposideros* and *M. myotis/blythii*. *M. myotis/blythii* were found in pairs hanging together, one pair in the southeast in a large room above the water storage pool and one in a dark room in the northwest of the fort. It is possible that the pairs of *M. myotis/blythii* were mating, but we could not say for sure. *R. hipposideros* were found in the deepest corridors, two in the southeast and one in the northwest of the fort.

No bats were found in the Coastal-defence mortar battery Caluzzi (site no. 4) as it was damaged and no longer has any enclosed rooms. We did not see any bats in the tunnel next to it either. Because of locked gates we could not survey Coastal-defence

polygonal battery San Benedetto (site no. 6), but according to the google reviews of this fortification, bats can be found inside. So, if possible, this fortress should be included in possible future surveys.

Discussion

It is known that unused fortresses in Europe (Marnell & Presetnik 2010), such as those of the Barbariga Defensive Group that we surveyed, are sometimes good roosts for individual bats or for bat colonies. Our results confirm this, as we found bats in most of the surveyed fortresses. We believe that the most important site is Polygonal Fort Paravia West (site no. 1), which may serve as a nursery roost for *R. ferrumequinum* and *R. euryale*. However, as our survey took place in late summer, when the nursery colonies may have already dispersed, a further survey should be conducted to confirm whether this is the case. Furthermore, the occurrence of *P. kolombatovici* in Polygonal Fort Paravia East (site no. 2) adds to the limited records of this species in the region. Overall, this study along with previous ones (e.g. Žalac et al. 2018) contributes to the growing knowledge of the ecological value of historic fortifications and highlights the need for their continued protection and monitoring. We suggest that all similar fortifications along Adriatic coast should be surveyed for bat maternity roost, hibernacula and other roost type (e.g. mating, traditional roosts), their value for bat conservation should be estimated and consequently, the important roosts should be physically protected to minimize bat disturbance by visitors.

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The Gabrovška jama cave (Slovenia) as a transitional roost for *Rhinolophus hipposideros* (Chiroptera)

Pećina Gabrovška jama (Slovenija) kao tranzitno sklonište vrste *Rhinolophus hipposideros* (Chiroptera)



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Abstract

The Gabrovška jama is a cave located in Menišija plateau, Slovenia. Since 2007 the cave has been included in the Slovenian state bat monitoring programme as a hibernaculum of *Rhinolophus hipposideros*. After finding only three bats hibernating in the cave in January 2020, it was decided to monitor the cave for bat presence on a monthly basis for 18 months, in the period from January 2020 to June 2021, to determine if the cave is used by bats in other parts of the year. Highest number of bats was observed in spring (March, April and May) and autumn (September, October and November), with a decrease during winter (December, January). Based on survey results, we conclude that a decrease in number of bats in winter was not a result of a significant decrease of the local population of *R. hipposideros*. Instead, it appears that the Gabrovška jama cave is currently primarily a transitional roost for *R. hipposideros*, rather than a winter roost that it seemed to be in the past.

Key words: Chiroptera, cave, *Rhinolophus hipposideros*, transitional roost

Sažetak

Pećina »Gabrovska jama« nalazi se na planoti Menišija u Sloveniji. Od 2007. godine uključena je u državni monitoring šišmiša u Sloveniji, kao zimsko sklonište malog potkovičara (*Rhinolophus hipposideros*). Kad su u januaru 2020. godine u pećini pronađena samo tri šišmiša, odlučeno je pećinu za prisutnost šišmiša mjesečno provjeravati 18 mjeseci, od januara 2020. do juna 2021., da bi odredili da li pećina u nekom drugom periodu još uvijek služi kao sklonište za šišmiše. Najveća brojnost šišmiša uočena je u proljeće (mart, april, maj) i jesen (septembar, oktobar, novembar), a pad brojnosti šišmiša u pećini zabilježen je zimi (decembar, januar). Na temelju rezultata istraživanja, možemo zaključiti da pad broja šišmiša u zimskom periodu nije posljedica značajnog pada brojnosti lokalne populacije *R. hipposideros*. Umjesto toga, Gabrovska jama očigledno sada primarno predstavlja tranzitno sklonište za vrstu *R. hipposideros*, ne više zimsko sklonište, kao u prošlosti.

Ključne riječi: Chiroptera, pećina, *Rhinolophus hipposideros*, tranzitno sklonište.

Introduction

Slovenian karst caves play an important role in the ecology of several bat species (Presetnik et al. 2009, 2023, Presetnik & Hudoklin 2012). At least 22 species are known to use karst caves as roosts (Presetnik et al. 2009), mainly as winter roosts, but also as maternity roosts, swarming sites, and transitional roosts. In general, the role of transitional roost is not fully understood. Transitional roosts can serve both as mating sites, as well as roosts where bats spend the day in a state of torpor, while still foraging at night to increase their reserves for hibernation (Gaisler 1966, Warchałowski et al. 2022). For *Rhinolophus hipposideros*, it is postulated that transitional roosts provide a more stable environment, compared to summer roosts, as they tend to be less susceptible to seasonal temperature fluctuations (Warchałowski et al. 2022).

Here we present an example where a cave roost that appeared to serve as a winter roost for *R. hipposideros* in the past, nowadays appears to primarily serve as a transitional roost.

Since 2007, Gabrovska jama has been included in the Slovenian state bat monitoring programme as a winter roost for *R. hipposideros*, based on the survey made by caver Jože Stražiščar in October 2004 (Presetnik et al. 2007). Since then, two visits in winters 2011 and 2015 (Presetnik et al. 2011, 2015), made by professional bat

workers, confirmed cave as hibernaculum of several tens of *R. hipposideros*. However, due to the surprisingly low number of bats in January 2020 (Presetnik et al. 2020), it was decided to monitor the number of bats by regularly inspecting the cave over a period of 1.5 years to determine whether the cave was used as a winter or as a transitional roost.

Materials and methods

The Gabrovška jama cave, also known as Fežnarjeva jama (Slovenian cave cadastre no. 378, 45.8571° N, 14.3526° E, 685 m a.s.l.), is a cave located in Menišija plateau, northeast of the settlement of Rakek (Figure 1). The cave entrance is located in deciduous forest with a diameter of approximately 1 m (Figure 3). It is closed by dense iron mesh, but openings by its end still allows bats to fly by. The cave is 92 m long and 28 m deep (IZRK 2022). It consists of a vertical 15 m deep entrance shaft that descends into an entrance chamber. Two separate passages lead to two side chambers (Figure 2).

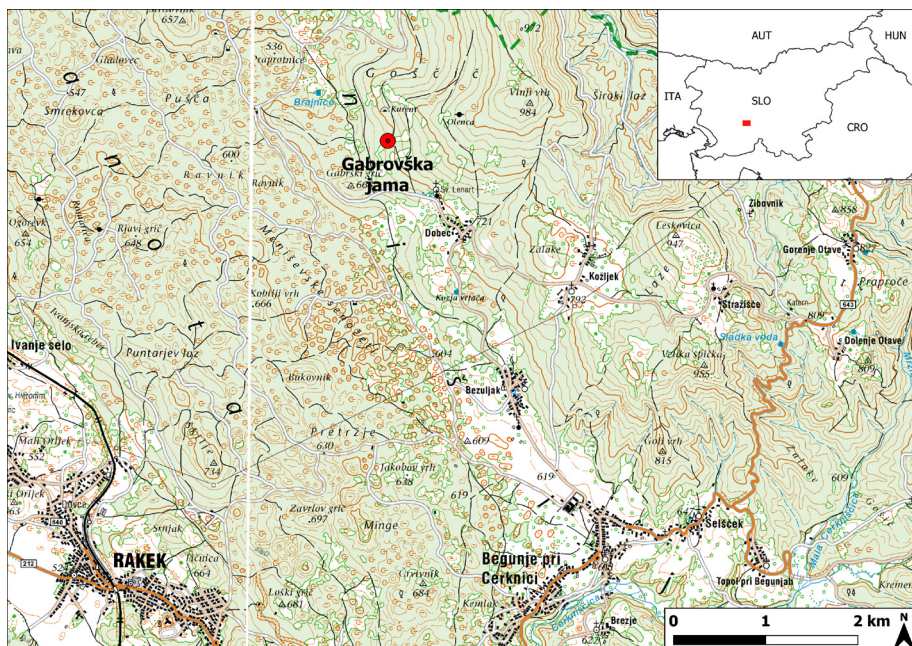


Figure 1. Location of the Gabrovška jama cave (cartographical data from GURS).

Slika 1. Lokacija pečine Gabrovška jama (vir kartografskih podatka: GURS).

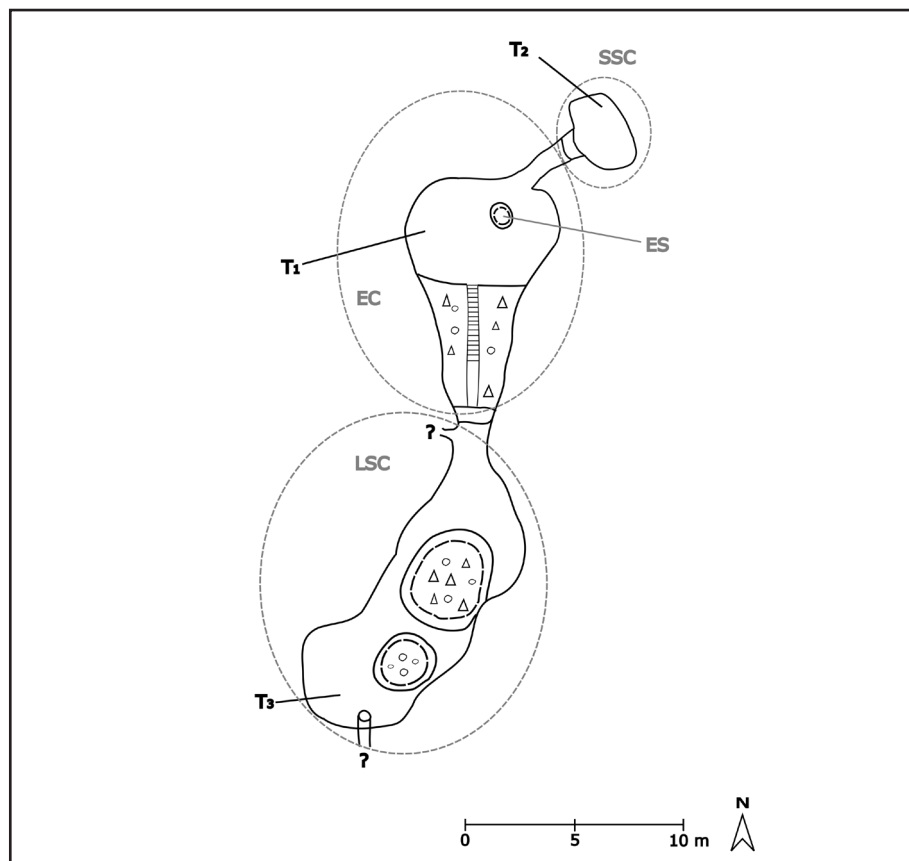


Figure 2. A sketch of the floor plan of the Gabrovška jama cave, adapted and modified from the original plan by Drame (1982). The sketch and scale bar are approximate and are for illustrative purposes only. (ES – entrance shaft, EC – entrance chamber, SSC – smaller side chamber, LSC – larger side chamber, »T_x« – locations where the temperature was measured, »?« – some smaller parts of the cave which, as far as we know, have never been surveyed for bats.)

Slika 2. Skica tlocrta pećine Gabrovška jama, nacrtana po originalnom tlocrtu, Drame (1982). Skica i skala su aproksimacija, predstavljeni isključivo zbog lakšeg predstavljanja podataka. (ES – ulazna jama, EC – ulazna sala, SSC – manja bočna dvorana, LSC – veća bočna dvorana, »T_x« – mjesta bilježenja temperature, »?« – manji dijelovi pećine koji do našeg znanja nikad nisu bili provjereni za prisutnost šišmiša.)

The cave was surveyed at least once a month from January 2020 to June 2021, except in July 2020 when no surveys were carried out. All accessible parts of the cave (Figure 2) were surveyed using head and hand lamps. The bats were determined using Dietz & Kiefer (2016). During every survey, temperature measurements were taken with electronic thermometer in each of the three main chambers of the cave at a height of approximately 1.5 m above the ground. The mean monthly temperatures from the weather station in Nova Vas (ARSO 2024), which is located 15.5 km from the



Figure 3. Entrance of the Gabrovška jama cave with an open iron mesh, 12. 1. 2020.

Slika 3. Ulaz u pećinu Gabrovška jama sa otvoreno željezno mrežo, 12. 1. 2020.
(photo/foto: Primož Presetnik)

cave, and has a difference in elevation about 35 m, are given as a reference for the temperatures measured in the cave. Average monthly temperature in Nova Vas was calculated from measurements were taken at 7:00, 14:00 and 21:00. Average temperature for June 2021 was calculated using data until the 15 June, when the survey was carried out (ARSO, 2024).

Results and discussion

Nearly all bats recorded in Gabrovška jama were *R. hipposideros* (Figure 4, Tabel 1), except for one male juvenile *Myotis emarginatus* (AB=37.2 mm, m=6.5 g), which was recorded on 30 September 2020. This bat was found in the larger side chamber in the ceiling crevice. However, most of the bats recorded during our survey (more than 85%) were found in the entrance chamber.

The highest number of *R. hipposideros* (87) was recorded on 17 October 2020. During

all our surveys in the cave, all recorded bats were in torpor, except in June 2021 when the only *R. hipposideros* found in the cave was active (flying). During the summer (June to August), bats were present in small numbers or absent. Interestingly, there were peaks of bat presence in spring (March to May) and autumn (September to November) (Figure 4). However, the number of bats declined between December and March, with fewer than 10 bats recorded in December and January. This is in contrast with observations in 2011 and 2015 (Table 1), when a higher number of bats were recorded using the cave as a winter roost in mid-January and beginning of February (CKFF, 2024).

Table 1. Data from bat surveys with the numbers of *Rhinolophus hipposideros* and the measured temperature in the Gabrovška jama cave (data before 12.1.2020 provided by CKFF (2024)).
 ("—" – not recorded/measured)

Tabela 1. Podaci pregleda pećine sa brojem *Rhinolophus hipposideros* i izmjenjenima temperaturama u pećini Gabrovška jama (podaci ispred 12.1.2020 iz CKFF (2024)).
 („—" - nije evidentirano/izmjereno)

Date Datum	Number of <i>R. hipposideros</i> Broj <i>R. hipposideros</i>				Temperature [°C] Temperatura [°C]			
	Entrance chamber Ulazna sala	Smaller side chamber Manja stranjska sala	Larger side chamber Veća stranjska sala	Total Ukupno	T1 Entrance chamber Ulazna sala	T2 Smaller side chamber Manja stranjska sala	T3 Larger side chamber Veća stranjska sala	Mean Prosjek
3.10.04	/	/	/	53	/	/	/	/
5.2.11	67	0	2	69	7.8	/	/	7.8
15.1.15	37	0	3	40	/	/	/	/
12.1.20	3	0	0	3	10.3	/	/	10.3
2.2.20	7	0	0	7	9.0	9.8	9.3	9.4
23.2.20	6	0	0	6	/	/	/	/
15.3.20	36	0	1	37	8.9	9.2	8.9	9.0
21.4.20	9	1	6	16	8.4	9.0	8.8	8.7
16.5.20	10	1	14	25	9.0	8.9	9.0	9.0
17.6.20	0	0	0	0	9.1	8.9	8.9	9.0
22.8.20	2	0	1	3	9.8	10.2	9.4	9.8
30.9.20	61	4	2	67	10.4	10.1	9.6	10.0
17.10.20	79	3	5	87	10.8	10.7	9.9	10.5
22.11.20	39	1	1	41	10.5	10.5	9.7	10.2
20.12.20	6	0	1	7	9.6	10.3	9.7	9.9
16.1.21	5	0	0	5	9.0	9.7	9.3	9.3
27.2.21	37	4	0	41	8.8	9.2	9	9.0
28.3.21	37	1	1	39	8.4	8.8	8.7	8.6
17.4.21	46	2	8	56	8.4	8.6	8.7	8.6
16.5.21	9	3	6	18	8.6	8.6	8.5	8.6
12.6.21	0	0	1	1	8.9	8.7	8.6	8.7

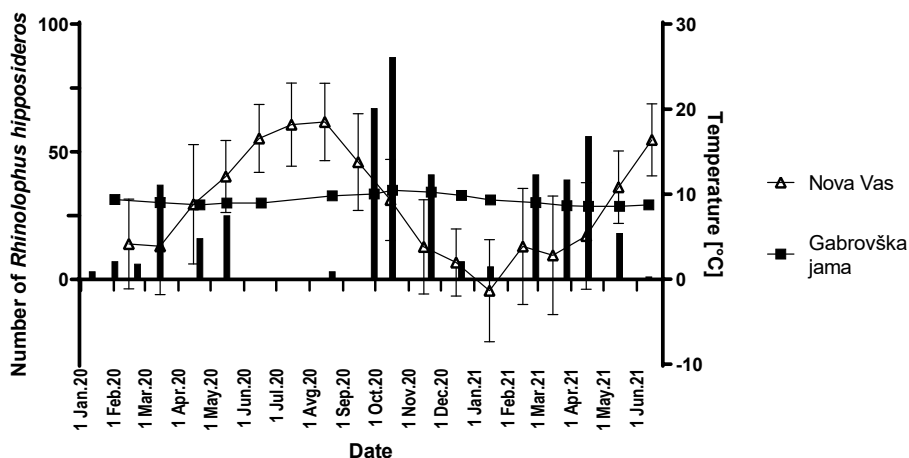


Figure 4. Number of *Rhinolophus hipposideros* found in the Gabrovška jama cave (represented by columns) with the temperature dynamics of average temperatures in Gabrovška jama and surface temperature dynamics of Nova Vas. No bats were found during the survey on 17 June 2020.

Slika 4. Broj *Rhinolophus hipposideros* u pećini Gabrovška jama (prezentiran stupićima) sa temperaturnom dinamikom prosječnih temperatura pećine Gabrovška jama i prosječne mjesečne temperature s mjerne postaje Nova Vas. Kod pregleda 17. juna 2020 nije bilo šišmiša.

The mean temperature in the cave fluctuated between 8.4 °C and 10.5 °C, with little temperature variation between the individual chambers (Table 1). This indicates a very stable climate, especially compared to the surface temperature (Figure 4). However, throughout the course of our study, the winter temperature in the entrance chamber, where most of the bats were found, was always more than 0.5 °C higher than in February 2011, when the highest winter number of bats was recorded (Table 1).

The results of this study indicate that the roost in question may no longer function primarily as a hibernaculum, as it was first perceived in the beginning of monitoring programme (Presetnik et al. 2007), but rather as a transitional roost. The dramatic decline in the number of bats recorded during the winter of 2020 and 2021, compared to the previous surveys (Table 1), does not appear to be the result of a dramatic collapse of the local *R. hipposideros* population, as a higher number of bats were present during the transitional periods in spring and autumn (Figure 4). It is unlikely that the decline in the bat numbers was a result of human disturbance in the roost, as the cave entrance has been closed with an iron mesh for at least 30 years (Figure 3) and can only be entered with the knowledge and permission of the cave manager. The cave has not been visited frequently in recent years (most visits were during our bat surveys), and neither the state monitoring programme (Presetnik et

al. 2007, 2011, 2015, 2020) nor our survey detected any signs of disturbance/change.

The average cave temperature is in the warmer part of the temperature range measured in some winter roosts of *R. hipposideros* (Harmata 1987, Gaisler & Chytil 2002, Petrinjak, 2005, Warchałowski et al. 2022). Unfortunately, we have only one temperature measurement from the year 2011 and none from 2004 or 2015 (Table 1), which is not enough to confirm that the temperature changes have affected the dynamics of bats roosting in Gabrovška jama. We must also bear in mind, that temperature alone is not sufficient to fully understand the hibernation energetics (McGuire et al. 2021). Unknown factors may also have contributed to the changes in the bats roosting dynamics. A similar study to Warchałowski et al. (2022) should be carried out to get a better perspective and overview of the bat roosting dynamics in Gabrovška jama.

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Bat surveys in artificial underground roosts on the Tirana hills in years 2020–2024 (Albania)

Istraživanja šišmiša u vještačkim podzemnim skloništima na brdima Tirane u godinama 2020. – 2024. (Albanija)



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Abstract

Following a regular monitoring carried out in the Tirana hills in the period from 2011 to 2015, several surveys were organised between 2020 and 2024 to collect additional data on bats in the main roosts identified. Single specimens and groups of *Rhinolophus ferrumequinum* and *R. hipposideros* were recorded, consolidating our knowledge in the peri-urban area, which is under threat, due to the constant growth of the urban area of Tirana.

Key words: Chiroptera, Albania, Bunker

Sažetak

Nakon redovnog monitoringa provedenog na brdima Tirane između 2011. i 2015. godine, organizovano je nekoliko istraživanja između 2020. i 2024. godine kako bi se prikupili dodatni podaci o šišmišima u identificiranim glavnim skloništima. Zabilježeni su pojedinačni primjerci i skupine *Rhinolophus ferrumequinum* i *R. hipposideros* koji upotpunjuju naše znanje o vrstama u suburbanom području Tirane koje je ugroženo zbog stalnog rasta urbanog područja grada.

Glavne riječi: Chiroptera, Albanija, bunker

The network of bunkers and tunnels located in the hills of Tirana, near the artificial lake, was one of the first bat monitoring areas established in Albania, between 2011 and 2015 (Théou 2015). The area was selected for monitoring at that time case due to its rather good accessibility from the city, as well as its importance for two bat species, protected in Albania: *Rhinolophus ferrumequinum* and *R. hipposideros*. The monitoring programme revealed the importance of the underground roosts network for these species throughout the year, as well as the immediate threats to the roosts and bat species utilising them. Unfortunately the monitoring was not regularly implemented after 2015, but several surveys were organised in the area during the last years. In this short communication we are sharing the data collected, along with an updated conservational assessment of the area. During the surveys, specimens were only identified visually, without handling.

Table 1. Results of bat surveys of artificial underground roosts in the Tirana hills (2020 – 2024). (Site no. – numbers correspond to Figure 1 in Théou & Bego (2014)).

Tabela 1. Rezultati istraživanja šišmiša vještačkih podzemnih skloništa na brdima Tirane (2020 – 2024). (Broj lokacije – brojevi odgovaraju Slici 1 u Théou & Bego (2014)).

Species Vrsta	Site no. Br. lok.	Date Datum	No. of ind. Br. jedinki	Comments Komentari
<i>Rhinolophus ferrumequinum</i>	B15	29.10.2020	73	In the deeper room of the bunker
		10.4.2023	87	In the corridor
		29.5.2024	56	Two groups, 43 ind. in the deeper room, and 13 ind. in the stairs. 5 carcasses found in the corridor
	C4	29.5.2024	1	-
	C6	29.5.2024	-	Could not enter due to high level of water
<i>R. hipposideros</i>	C4	29.5.2024	1	-
	B11	29.5.2024	5	-

The results of presented surveys confirm that this network, or at least the few bunkers and tunnels inspected, are still hosting a rather important bat population. The maximum number of *R. ferrumequinum* recorded at the site B15 was 134 in April 2024, while it was of 87 in April 2023. Considering the significant increase in urbanisation in the area over the last 10 years, (with the urban area of Tirana starting at about 650 m from the site B15 in 2015, while it is now (in year 2024) located at less than 70 m) the presence of observed bat could still be considered as positive. However, given the high probability of further urban development in the area within a few years, the sustainability of the roosts, as well as the entire habitats used by bats around them, is at high risk. Enforcement of national legislation, in line with the EU *acquis* and in particular the Habitats Directive, should provide a strong legal support for the protection of this area, and we hope that the confirmation of the presence of the roots of strictly protected bats species in this area could support such positive development for nature.



Figure 1. Main *Rhinolophus ferrumequinum* group recorded in October 2020.

Slika 1. Glavna grupa *Rhinolophus ferrumequinum* zabilježena je u oktobru 2020.
(photo/foto: Philippe Théou)



Figure 2. Main *Rhinolophus ferrumequinum* group recorded in April 2023.

Slika 2. Glavna grupa *Rhinolophus ferrumequinum* zabilježena je u aprilu 2023.
(photo/foto: Ervis Loçe)

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Bat observations in cultural heritage buildings during Youth Biology Camp 2024, Poljčane (Slovenia)

Promatranja šišmiša u objektima kulturne baštine tijekom Biološkog kampa učenika 2024., Poljčane (Slovenija)



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Abstract

Between 4th and 11th of August 2024 we inspected seven churches and other bat roosts in the vicinity of Boč mountain (Eastern Slovenia), recording five bat species. Among others, we may have detected what could be the easternmost currently known nursery colony of the *Plecotus macrobullaris* in Slovenia. Additionally, we also found a new nursery roost for *Myotis mystacinus/davidii*, a species group whose roosts are rare in church buildings in the country. Our data highlights the prudence of occasional reinspection of already surveyed cultural heritage buildings.

Key words: Chiroptera, churches, *Plecotus macrobullaris*, Eastern Slovenia

Sažetak

Između 4. i 11. kolovoza 2024. pregledali smo sedam crkvi i drugih skloništa šišmiša u blizini planine Boč, (istočna Slovenija), zabilježivši pet vrsta šišmiša. Među ostalima, možda smo otkrili što bi mogla biti najistočnija trenutno poznata porodična kolonija gorskog dugoušana (*Plecotus macrobullaris*) u Sloveniji. Osim toga, pronašli smo i novo porodično sklonište za *Myotis mystacinus/davidii*, skupinu vrsta čija skloništa su rijetka u crkvenim zgradama u zemlji. Naši podaci sugeriraju smislenost povremenih preispitivanja već pregledanih objekata kulturne baštine.

Key words: Chiroptera, crkve, *Plecotus macrobullaris*, istočna Slovenija

Buildings, considered cultural heritage (such as churches, castles and other historic landmarks), have long been an object of interest for Slovene bat researchers, as they present suitable bat roosts. Presetnik & Zamolo (2021) have highlighted their importance, noting that in Slovenia, at least 23 species are known to utilise culturally significant buildings at least occasionally. With primary attention towards churches and other sacral monuments, the degree of inspection of potential building roosts in the country has steadily increased in the past decades (Presetnik & Zamolo 2021). Nonetheless, some buildings of cultural heritage remained unsurveyed, while others had not been surveyed for a while.

During Youth Biology Camp 2024, which took place between the 4th and 11th of August 2024 in the vicinity of Poljčane, Eastern Slovenia, we inspected a few of such cultural monuments. We surveyed buildings in an area roughly encompassing southern and northern slopes of Boč mountain and surrounding hills (Figure 1a). The region contains diverse landscapes, with higher areas covered predominantly with deciduous forests and lower lying areas composed out of a mosaic structure of intensive and extensive agricultural lands interspersed with mixed forests and rural settlements.

Points of interests were pinpointed according to a bat data extract from Centre for Cartography of Fauna and Flora database (CKFF 2024). Buildings were inspected visually, using head and hand lamps. If bats were present and required measurements for precise identification, we caught individuals using a hand net. Bats were identified using the determination key in Dietz et al. (2009). Sexual characteristics and age were assessed using the manual provided by Haarsma (2007). All measured bats were handled in accordance with permitt no. ARSO 35601-59/2020-6 from the Slovene Environmental Agency.

During field work we detected bat presence in seven cultural heritage buildings (six churches and one former monastery) (Table 1, Figure 1a), recording five species: *Rhinolophus hipposideros*, *R. ferrumequinum*, undetermined small *Myotis* (either *M. mystacinus* or *M. davidii*), *Eptesicus serotinus* and *Plecotus macrobullaris*.

Table 1. Inspected buildings, bat species and other observations made during Youth Biology Camp 2024.

(ad – adult, juv – juvenile, un – unknown age and sex, F – female, M – male, cad. – cadaver)

Tabela 1. Pregledane zgrade, vrste šišmiša i druga opažanja tijekom Biološkog kampa učenika 2024.

(ad – odrasli, juv – mladi, un – uniseks, F – ženka, M – mužjak, cad. – mrtva jedinka)

Site no. Br. lok.	Structure [Slovene name] (lat./long./m a.s.l.) Građevina [Slovensko ime] (lat./long./m.n.v.)	Date Datum	Bat observations [no.] Zapažanja šišmiša [broj]	Comments Komentari
1	Church of st. Michael [Cerkev sv. Mihaela], Pečica (46.27501° N / 15.52972° E / 497 m)	5.8.24	<i>R. hipposideros</i> [2: 1 un, 1 juv] <i>R. ferrumequinum</i> [1 ad] <i>M. mystacinus/davidii</i> [5: 4 un, 1 juv M cad.] / medium amount of small-sized guano; small amount of medium-sized guano	
2	Church of st. Mary [Cerkev sv. Marije], Sladka Gora (46.26457° N / 15.52993° E / 300 m)	5.8.24	<i>R. hipposideros</i> [2: 1 un, 1 un cad.] <i>E. serotinus</i> [1 un (possibly cad.?)] small amount of small-sized guano; large amount of large-sized guano	the <i>E. serotinus</i> individual was unreachable and remained completely still despite illumination
3	Church of st. Pancras [Cerkev sv. Pankracija], Lemberg pri Šmarju (46.25792° N / 15.55181° E / 289 m)	5.8.24	<i>R. hipposideros</i> [12: 10 un, 1 ad, 1 juv] medium amount of small-sized guano; small amount of medium-sized guano	/
4	Church of st. Nicholas [Cerkev sv. Miklavža], Lemberg pri Šmarju (46.25756° N / 15.55361° E / 239 m)	5.8.24	<i>P. macrobullaris</i> [17: 15 un, 2 ad F] small amount of small and large-sized guano	/
5	Church of st. Nicholas on Boč mountain [Cerkev sv. Miklavža na Boču], Drevenik (46.28293° N / 15.59348° E / 657 m)	8.8.24	small amount of small-sized guano	shed skin of <i>Zamenis longissimus</i> in the belfry and attic
6	Former Dominican Convent [nekdanji samostan Dominikank], Studenice (46.29899° N / 15.61398° E / 264 m)	9.8.24	<i>R. hipposideros</i> [2: 1 ad, 1 un] <i>R. ferrumequinum</i> [2 ad] small amount of small, medium and large-sized guano	only southern tract inspected
7	Church of st. Lucy [Cerkev sv. Lucije], Studenice (46.30646° N / 15.61191° E / 294 m)	9.8.24	very small amount of small-sized guano	/

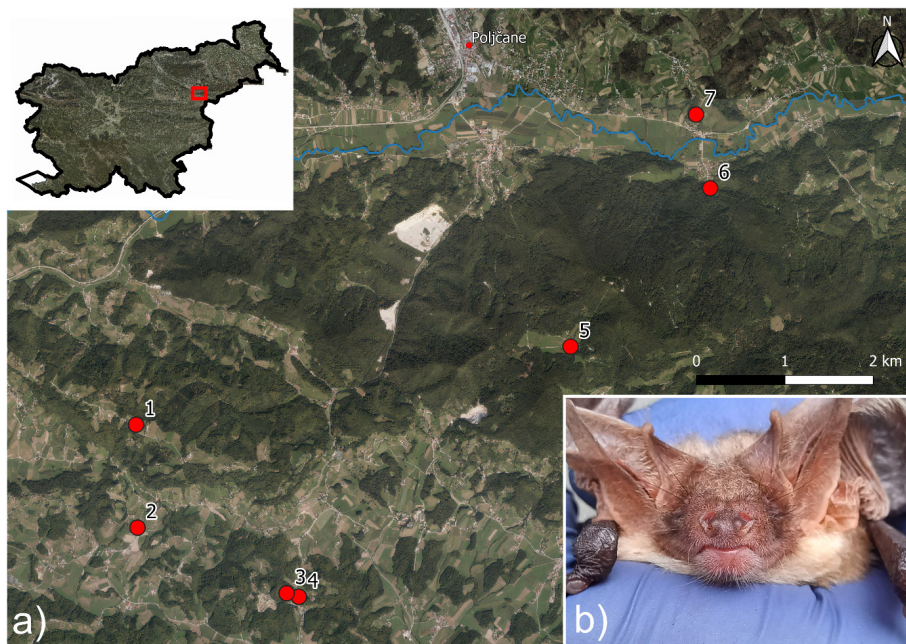


Figure 1. (a) Surveyed buildings and (b) a *P. macrobullaris* female, caught at the Church of st. Nicholas at Lemberg pri Šmarju.

Slika 1. (a) Posmatrane lokalitete i (b) ženka *P. macrobullaris*, ulovljena u crkvi sv. Nikole u Lembergu pri Šmarju.
(photo/foto: Patricija Kostanjšek)

We measured the foot (9.2 mm), claw (2.6 mm) and thumb (7.2 mm) of one caught female of the *Plecotus macrobullaris* at the Church of st. Nicholas in Lemberg (site 4, Table 1) to reaffirm our identification. We also measured the tibia (11.8 mm) and the foot (6.8 mm) of the deceased *Myotis mystacinus/davidii* juvenile, found at the Church of st. Michael (site 1). The placement of premolars in the upper tooth row resembled that of the Whiskered bat (*M. mystacinus*) (sensu Benda et al. 2012). A tissue sample was also taken for further genetic testing.

Out of seven inspected roosts presented in Table 1, only the church in Studenice (site 7) had never been inspected before (CKFF 2024, own data). Most commonly, we encountered the *Rhinolophus hipposideros*, which is unsurprising since the species is an easily recognised and regular occupant of church attics in Slovenia (Petrinjak 2009, Presetnik & Zamolo 2021). The observation of the *Eptesicus serotinus* at church on Sladka Gora (site 2) is a new site for the species. The church had been inspected last in 2006, with only *R. hipposideros* present (CKFF 2024). The presence of notable amounts of large-sized guano additionally opens the possibility of a potential nursery roosts. *E. serotinus* is otherwise known from the area, with nursery roosts

registered in, e.g., the nearby Haloze hills (Presetnik 2009, Podgorelec et al. 2022).

Perhaps the most intriguing find was the observation of a group of at least 17 *P. macrobullaris* at the church of st. Nicholas in Lemberg pri Šmarju (site 4). The church was last inspected in 2006, with no bat records (CKFF 2024). The capture of two parous adult females (Figure 1b) strongly suggests the church presents a newly recorded nursery roost for the species. To our knowledge, our finding is currently the easternmost nursery of *P. macrobullaris* in Slovenia, located over 40 km eastwards from the previously known easternmost nursery of the species at Rožnik near Mozirje, Northern Slovenia (Pavlovič 2021). So far, the species was thought to be mostly limited to western and central Slovenia (Gojznikar & Presetnik 2015), with no known nursery roost recorded in the eastern parts of the country (Presetnik & Zamolo 2021). Towards the east of Slovenia, *P. macrobullaris* is gradually replaced by the Grey long-eared bat (*Plecotus austriacus*) (Gojznikar & Presetnik 2015, Presetnik & Zamolo 2021), with simultaneous observation of both species known only from a single site (Presetnik et al. 2019). The Church of st. Nicholas in Lemberg pri Šmarju is located in a forested area on the southern approaches to Boč mountain, an area which might better suit *P. macrobullaris*. While it has been postulated that the species occupy a similar niche, *P. macrobullaris* seems to be preferential towards higher elevations and *P. austriacus* towards the warmer lowlands (Dietrich et al. 2006, Dietz & Kiefer 2016). It is possible that the general east-west division, observed in Slovenia (Gojznikar & Presetnik 2015), is partially connected to geographic preferences (e.g., climate, topography) of the two species. A more detailed study is however required before to assess the credibility of such scenario.

Our finding of *M. mystacinus/davidii* at the church on Pečica (site 1) is of interest, since it presents a newly discovered nursery roost that was not detected during the survey in 2013 (CKFF 2024), which may be due to the species preference to hide in crevices, which are often not accessible to human observers. Alternatively, the species may have colonised the church sometime after 2013. Known church roosts of *M. mystacinus/davidii* species group in Slovenia are scarce (Likozar 2013, Gojznikar et al. 2020, Presetnik & Zamolo 2021) and, to our knowledge, thus far no confirmed roosts with a distinction made between the Steppe whiskered bat (*M. davidii*) or *M. mystacinus* is known from buildings of cultural heritage. This is unsurprising, since *M. davidii* was indisputably distinguished from *M. mystacinus* in Slovenia only recently (Çoraman et al. 2020, Presetnik 2021). While the upper tooth row of the deceased juvenile, found in the church, resembled that presented as *M. mystacinus* by Benda et al. (2012), the foot and tibia measurements following Milchram et al. (2023) were less conclusive. While the foot length potentially suited both species, the tibia was too short for any valid comparison, probably due to uneven growth in juveniles. This suggests that the ratio between the tibia and the hindfoot length (sensu Milchram et al. 2023) might not be the best suited to discriminate between (still-growing) juvenile

and/or deceased individuals of *M. mystacinus* and *M. davidii*. Further determination of the colony, present at the church on Pečica in 2024, will have to await the results of genetic analysis.

Although not a finding closely related to bats, we also recorded snakeskin sheddings of *Zamenis longissimus* in both the belfry and the attic of the church on Boč (site 5). *Z. longissimus* is a common snake species in Slovenia (Krofel et al. 2009) and has been observed to visit bat roosts before. For example, Koselj & Aupič (2001) have reported an individual, crawling close by *R. hipposideros* individuals at Pišce castle, hinting at the potential for predation. This behaviour is however highly unlikely at st. Nicholas' on Boč since no bats were observed in the building during our inspection.

In conclusion, our data highlights that buildings of cultural heritage surrounding Boč mountain present an important roosting habitat for several bat species and are of conservational interest. Our data shows that further continuous inspections of already surveyed cultural heritage buildings are required, not only near Boč but also elsewhere in Slovenia.

Acknowledgements

We wish to thank the participants of the bat research group – Julija Genorio, Anja Lamot, Jernej Skledar and Zala Vodopivec – for their assistance with field work. Jernej and Zala, being local inhabitants of the research area, also contributed significantly when obtaining permissions to enter inspected building. A big debt of gratitude also goes towards Patricija Kostanjšek, who provided keys for the churches at Lemberg. Many thanks also to Primož Presetnik, who provided the bat data for surveyed area from Centre for Cartography of Fauna and Flora database and literature sources. Jakob Majdič also occasionally assisted with field work. We are also grateful to the organisers of Youth Biology Camp and Herpetological society – Societas herpetologica Slovenica for enabling the existence of bat research group.

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Plecotus sp., 28. 8. 2024, Sazan Island (Albania)

Plecotus sp., 28. 8. 2024, Ishulli i Sazanit (Shqipëri)



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A one-day expedition to the main Albanian island, Sazan island, on 28th of August 2024 allowed me to survey different sites previously surveyed for bats during the last decade (Théou & Loce 2017), including tunnels, bunkers and buildings (Figure 1a). All the sites visited had indicators of bat presence (small quantity of guano) but no bat was recorded except in one of them. In this bunker (Figure 1b) (40.4991° N, 19.2805° E), I found an individual of *Plecotus* sp. (Figure 2). Considering previously recorded individual of *P. kolombatovici* in this site – also in August (in year 2016), the individual observed was also likely to be a *P. kolombatovici*. However, as I did not take any measurements, it is prudent to classify it as *Plecotus* sp. Considering current plan regarding future urbanization of this currently uninhabited island, additional survey, including current gap regarding island use by bats during winter, and their foraging grounds, would be needed.

Një ekspeditë njëditore, në 28 Gusht 2024, në ishullin kryesor shqiptar, ishullin e Sazanit, më lejoi të vëzhgoja vende të ndryshme të vizituara më parë për lakuriqët e natës gjatë dekadës së fundit (Théou & Loce 2017), duke përfshirë tunele, bunkerë dhe ndërtesa (Figura 1a). Të gjitha vendet e vizituara ishin të përdorura nga lakuriqët e natës (sasi e vogël e feçeve), por asnjë lakuriq nuk u regjistrua përveç një prej bunkerëve. Në këtë bunker (Figura 1b) (40.4991° N, 19.2805° E), u gjet një individ i *Plecotus* sp. (Figura 2). Duke marrë parasysh individin e regjistruar më parë të *P. kolombatovici* në këtë vend - gjithashtu në gusht (në vitin 2016), individi i vëzhguar ka të ngjarë të jetë gjithashtu *P. kolombatovici*. Megjithatë, meqënëse nuk kam bërë asnjë matje, preferoj që ta klasifikoj atë si *Plecotus* sp.. Duke marrë parasysh planin aktual në lidhje me urbanizimin e ardhshëm të këtij ishulli aktualisht të pabanuar, do të nevojitej një studim shtesë, duke përfshirë hendekun aktual në lidhje me përdorimin e ishullit nga lakuriqët e natës gjatë dimrit, dhe terrenet e tyre për ushqim.



Figure 1. a) All sites visited on the Sazan Island on 28. 8. 2024. Red dot marks site of *Plecotus* sp. b) entrance to the bunker.

Figura 1. a) Të gjitha vendet e vizituara në ishullin e Sazanit në datën 28. 8. 2024. Pika e kuqe është vend ndodhja e *Plecotus* sp. b) hyrja e bunkerit.

(Map/Harta: GoogleEarth, photo/foto: Ervis Loce)



Figure 2. *Plecotus* sp. in the bunker on the Sazan Island.

Figura 2. *Plecotus* sp. në bunker në ishullin e Sazanit.
(photo/foto: Ervis Loce)

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Chiroptera, 10. 10. 2023, Brodar, 15. 10. 2023, Dobrun, Višegrad (Bosnia and Herzegovina)

Chiroptera, 10. 10. 2023., Brodar, 15. 10. 2023., Dobrun, Višegrad (Bosna i Hercegovina)



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A small project, financially supported by the European Mammal Foundation, enabled us to go to Eastern Bosnia, more precisely towards Višegrad. We do not have any collected data on bats from those areas, although we have known for several years, according to stories from the police, that there are a lot of bats in the abandoned railway tunnels that were the route for migrants from Serbia to Bosnia and Herzegovina.

The first tunnel (43.73868° N, 19.21394° E, 350 m a.s.l.), about 300 m long, is located at the confluence of the Lim River with the Drina in Brodar. It is a road tunnel that connects the small village of Blaž with the main road M5 (Sarajevo - Višegrad). A smaller part of the tunnel is concrete, and the larger part is natural rock (Figure 1). In that part, approximately halfway through the tunnel, we found on 10 October 2023 one individual of each species: *Myotis capaccinii*, *Eptesicus serotinus* and

Mali projekt, finansijski potpomognut od European Mammal Foundation, omogućio nam je odlazak u Istočnu Bosnu, tačnije prema Višegradu. Iz tih krajeva nemamo prikupljenih podataka o šišmišima, iako već nekoliko godina znamo, prema pričama iz policije, da u napuštenim željezničkim tunelima koji su bili ruta za prolazak migranata iz Srbije u Bosnu i Hercegovinu, ima dosta šišmiša.

Prvi tunel (43,73868° N, 19,21394° E, 350 m n. v.), dužine oko 300 m, nalazi se na ušću rijeke Lim u Drinu u mjestu Brodar. To je cestovni tunel koji povezuje malo selo Blaž sa magistralnom cestom M5 (Sarajevo - Višegrad). Manji dio tunela je betoniran, a veći dio je prirodna stijena (Slika 1). U tom dijelu, otprilike oko polovice tunela, pronašli smo 10. 10. 2023. po jednu jedinku vrste: *Myotis capaccinii*, *Eptesicus serotinus* i *Nyctalus* sp. To su prvi podaci o šišmišima opštine Višegrad.

15. 10. 2023. obišli smo željeznički

Myctalus sp. These are the first data on bats in the municipality of Višegrad.

On 15 October 2023, we visited the railway tunnel near Dobrun and the cave above it (43.5713° N, 19.4064° E, 460 m above sea level). In the cave with a large entrance (20 x 15 m), which consists of a simple channel about 80 m long, we recorded large colony of long-fingered bat (*Myotis capaccinii*) and Common bent-wing bat (*Miniopterus schreibersii*) in flight, three lesser horseshoe bats (*Rhinolophus hipposideros*) and large amount of guano. So, we decided to visit the cave again during the winter monitoring. There were no bats in the tunnel whose walls are natural rock (about 250 m long).

tunel kod Dobruna i pećinu iznad njega (43,5713° N, 19,4064° E, 460 m n. v.). U pećini sa velikim ulazom (20 x 15 m), koja se sastoji od jednostavnog kanala dužine oko 80 m, zabilježena je velika kolonija dugoprstog šišmiša (*Myotis capaccinii*) i Šrajberovog šišmiša (*Miniopterus schreibersii*) u letu, tri mala potkovasta šišmiša (*Rhinolophus hipposideros*) i mnogo gvana. Stoga smo odlučili da ponovo posjetimo pećinu tokom zimskog monitoringa. U tunelu čiji su zidovi prirodna stijena (dužine oko 250 m) nije bilo šišmiša.



Figure 1. The interior of the tunnel at the mouth of the Lim river.

Slika 1. Unutrašnjost tunela na ušću Lima.
(photo/foto: Jasminko Mulaomerović)

Myotis bechsteinii, 8. 9. 2023, Dragočaj (Bosnia and Herzegovina)

Myotis bechsteinii, 8. 9. 2023., Dragočaj (Bosna i Hercegovina)



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On 8 September 2023 I was traveling by car on the main road between Prijedor and Banja Luka. At 22:29 my car windshield came into contact with an adult male of *Myotis bechsteinii* (Figure 1a) near the village of Dragočaj (44.84926° N, 17.16915° E, Figure 1b). Directly after the contact, the bat was examined and put on a birch (*Betula pendula*) tree trunk a few hundred meters away, in dire hopes, that it might recover and fly off eventually. After about an hour had passed, I returned to the scene of the accident, only to find out that the bat had unfortunately succumbed to its injuries. There is little data available on the distribution of *M. bechsteinii* in Bosnia and Herzegovina (Pašić et al. 2011–2012, Karapandža 2014, Pašić & Mulaomerović 2015, Hodžić et al. 2017, Verhees et al. 2021, Presetnik et al. 2022), however, it was known to be present in the region, since the location is less than 20 km away from a known site for *M. bechsteinii* in Ljubačevo cave (Pašić et al. 2011–2012). Presetnik et. al. (2022) found the species in a landscape with dry maquis

Putovao sam 8. septembra 2023. autom po glavnoj cesti od Prijedora prema Banja Luci. U 22:29 vjetrobransko staklo moga auta došlo je u bliski kontakt s adultnim mužjakom *Myotis bechsteinii* (Slika 1a) kod sela Dragočaj (44,84926° S, 17,16915° I, Slika 1b). Odmah nakon kontakta, šišmiš je stavljen na stablo breze (*Betula pendula*) udaljene nekoliko stotina metara, u žaru nade da će se oporaviti i na kraju poletjeti. Nakon otprilike sat vremena vratio sam se na mjesto nesreće, da bih otkrio da je šišmiš uginuo od ozljeda. O distribuciji *M. bechsteinii* u Bosni i Hercegovini postoji malo podataka (Pašić et al. 2011–2012, Karapandža, 2014, Pašić & Mulaomerović 2015, Hodžić et al. 2017, Verhees et al. 2021, Presetnik et al., 2022), ali u toj regiji njegova prisutnost je već potvrđena, jer je lokalitet manje od 20 km udaljen od poznatog nalaska *M. bechsteinii*, pećine Ljubačevo (Pašić et al. 2011–2012). Presetnik et. al. (2022) su pronašli vrstu na području suhe, makijske vegetacije, koja je netipična za *M. bechsteinii*, jer se pretpostavlja da je vezana više manje na hrastove i bukove šume (Dietz & Kiefer, 2016,

vegetation, which is atypical for the species, as it is thought to be predominantly found in oak and beech forests (Dietz & Kiefer, 2016, Presetnik et al. 2022). In our case, the surrounding area is a mixture of semi-urban areas with patches of meadows (Figure 1b), which is also atypical for this species (Dietz & Kiefer, 2016).

Presetnik et al. 2022). U našem slučaju okolina nalaza je mozaik polu-urbanog područja i livada (Slika 1b), koja je također atipična za ovu vrstu.



Figure 1. a) Adult male *Myotis bechsteinii* after close contact with the car windshield, b) Main road Prijedor - Banja Luka, view towards the point of the accident (point of contact was near the white van).

Slika 1. a) Odrasli mužjak *Myotis bechsteinii* nakon bliskog kontakta s vjetrobranskim staklom, b) Glavna cesta Prijedor – Banja Luka, pogled prema mjestu nesreće (mjesto kontakta bilo je negdje blizu bijelog kombija). (photo/foto: Samo Grgurević)

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Nyctalus noctula, 8. 8. 2019, 6. 11. 2024, Lake Pod Ilovice, Trnovo (Bosnia and Herzegovina)*Nyctalus noctula*, 8. 8. 2019., 6. 11. 2024., Jezero u Pod Ilovicama, Trnovo (Bosna i Hercegovina)**Jasminko Mulaomerović¹**¹ Centar za krš i speleologiju, Branilaca Sarajeva 30, Sarajevo (Bosnia and Herzegovina)E-mail: dodospeleo@gmail.com (J.M.)

Several years ago, captivated by the charm of a small ultrasonic detector that attaches to a mobile phone, I recorded ultrasonic signals whenever the opportunity arose during my nighttime travels. On August 8, 2019, I used the Echo Meter Touch 2 detector (WildLife Acoustic, USA) to record at an artificial lake Pod Ilovice (43,716001° N, 18,436348° E) in the municipality of Trnovo. This small lake is bordered by a flooded forest, primarily composed of alders, limestone cliffs, and mountain grasslands. The species *Nyctalus noctula* and the genus *Myotis* sp. were detected. I went back on November 6, 2024, to make the most of the last warm days. I recorded with the Batlogger M detector (Elekon, Switzerland). However, the evening was not warm, with temperatures dropping to 5 – 6°C. Nonetheless, the species *N. noctula* and the genus *Myotis* sp. were recorded once again, along with *Pipistrellus pipistrellus/Miniopterus schreibersii*. Signal processing was carried out using the Bat Sound 4.1.4 software (Pettersson, Sweden) and relevant literature (Russo & Jones 2002, Barataud 2015).

Prije više godina, obuzet čarima malog ultrazvučnog detektora koji se prikači sa mobilni telefon, snimao sam ultrazvučne signale gdje god mi se pružila prilika tokom noćnih putovanja. Tako sam 8. avgusta 2019. snimao detektorom Echo Meter Touch 2 (WildLife Acoustic, SAD) na vještačkom jezeru u Pod Ilovicama (43,716001° N, 18,436348° E) u općini Trnovo. To je malo jezero kojeg okružuje plavljena šuma, uglavnom johe, krečnjačke stijene i planinski travnjak. Registrovana je vrsta *Nyctalus noctula* i rod *Myotis* sp. Ponovo sam tamo otišao 6. novembra 2024. da iskoristim zadnje tople dane. Snimao sam detektorom Batlogger M (Elekon, Švajcarska). Večer, međutim, nije bila topla, temperatura se spustila na 5 – 6°C. Ipak, ponovo je registrovana vrsta *Nyctalus noctula* i rod *Myotis* sp., uz *Pipistrellus pipistrellus/Miniopterus schreibersii*. Za obradu signala korišten je softver Bat Sound 4.1.4. (Pettersson, Švedska) i odgovarajuća literatura (Russo & Jones 2002, Barataud 2015).

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Chiroptera, 15. / 16. 6. 2024, Žunova village, Olovo (Bosnia and Herzegovina)

Chiroptera, 15. / 16. 6. 2024., selo Žunova, Olovo (Bosna i Hercegovina)



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A visit to the old aunt's house in village Žunova (44,17368° N, 18,56282° E) for the purpose of collecting ethnographic material revealed a considerable amount of guano on the first floor of the house, on a display case, covering an area of approximately 0.5 m². It was evidently the remains of a small colony of some bat species. A follow-up visit in mid-June 2024, unfortunately without the house key, prevented us from determining if any species had resettled in the kitchen. We were only able to set up a small stationary AudioMoth detector (Open Acoustic Devices). We recorded from 8:30 PM on June 15 to 2:50 AM on June 16. For the analysis of echolocation signals, we used the BatSound 4.1.4 software (Petersson, Sweden) and relevant literature (Russo & Jones 2002, Barataud 2015). We registered *Rhinolophus hipposideros*, *Nyctalus noctula*, *Pipistrellus pipistrellus*, at least two species of *Myotis* sp., and the acoustic group *P. kuhlii/nathusii*. The species with the highest number of passes was *P. pipistrellus*, followed by *R. hipposideros*. We won't know

Obilazak stare tetkine kuće u Žunovi (44,17368° N, 18,56282° E) radi prikupljanja etnografskog materijala otkrio je na spratu kuće, na vitrini, solidnu količinu guana na prostoru od oko 0,5 m². Očito se radilo o manjoj koloniji neke vrste šišmiša. Ponovni dolazak sredinom juna 2024. godine, na žalost bez ključa od kuće, nije nam omogućio da vidimo da li se neka vrsta ponovo naselila u sobu. Mogli smo samo postaviti mali stacionarni detektor AudioMoth (Open Acoustic Devices). Snimali smo od 20:30 sati 15. juna do 2:50 sati 16. juna. Za analizu eholokacijskih signala koristili smo softver BatSound 4.1.4. (Petersson, Švedska) i odgovarajuću literaturu (Russo & Jones 2002, Barataud 2015). Registrovali smo vrste *Rhinolophus hipposideros*, *Nyctalus noctula*, *Pipistrellus pipistrellus*, najmanje dvije vrste *Myotis* sp. i fonetsku grupu *P. kuhlii/nathusii*. Najveći broj preleta imala je vrsta *P. pipistrellus*, a onda *R. hipposideros*. Koja vrsta ima koloniju u tetkinoj kući, ipak nećemo saznati prije ljeta 2025. godine. Tada ćemo, nadam se pregledati i okolicu, jer je selo puno starih i napuštenih kuća.

which species colony inhabits the aunt's house until summer 2025. Then, I hope, we'll look around, since the village is full of old and abandoned houses.

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Pipistrellus kuhlii – healed wing membrane, 12. 10. 2018 & 22. 9. 2019, Metlika (Slovenia)

Pipistrellus kuhlii – zarasla krilna opna, 12. 10. 2018. & 22. 9. 2019., Metlika (Slovenija)



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On 12 October 2018, during banding of *Pipistrellus kuhlii* from the known roost in house Cesta bratstva in enotnosti no. 96 in Metlika, Slovenia (WGS 84: 45.6437° N, 15.3193° E, 155 m a.s.l.) (Pavlovič 2022), an adult male of *P. kuhlii* (antebrachium length: 34.0 mm, weight: 6.5 g) with a partially healed laceration between the fourth and fifth digits of the left wing (Figure 1a) was captured. At the time of the injury, the laceration was probably about 3 cm long, but by the time of the first capture, it was already half healed. The bat flew without obvious difficulty and was not malnourished.

When recaptured from the same roost on 22 September 2019, the tear was completely healed (Figure 1b). The site of the previous injury had pale discolouration of the flight membrane and had no other visible damage. The bat weighed 6.0 g on recapture.

Heckethal & Oldenburg (1991) also reported finding two bats in the wild with large tears in the wing membranes. Both

Pri obročkanju belorobih netopirjev (*Pipistrellus kuhlii*) iz znanega zatočišča v hiši Cesta bratstva in enotnosti 96 v Metliki, Slovenija (WGS 84: 45.6437° N, 15.3193° E, 155 m n. v.) (Pavlovič 2022), je bil 12. 10. 2018 obročkan tudi odrasel samec *P. kuhlii* (dolžina podlakti: 34,0 mm, masa: 6,5 g) z delno zaceljeno raztrganino med četrtnim in petim prstom leve prhuti (Slika 1a). Ob poškodbi je bila raztrganina verjetno dolga okoli 3 cm, v času prvega ujetja pa je bila že polovično zaceljena. Netopir je letel brez očitnih problemov in ni bil podhranjen.

Ob ponovnem ulovu 22. 9. 2019 na isti lokaciji, je bila raztrganina popolnoma zaceljena (Slika 1b). Na mestu nekdanje poškodbe je bila vidna bleda obarvanost letalne opne, poleg tega pa ni imel nobenih drugih vidnih poškodb. Ob ponovnem ujetju je tehtal 6,0 g.

Tudi Heckethal & Oldenburg (1991) poročata o najdbi dveh netopirjev v naravi z velikimi raztrganinami membrane prhuti. Oba netopirja sta imela normalno maso,



Figure 1. a) *Pipistrellus kuhlii* caught on 12 October 2018 with partially healed tear between fourth and fifth finger of the left wing; b) the same *P. kuhlii* caught on 22 September 2019 with completely healed left wing.

Slika 1. a) Belorobi netopir (*Pipistrellus kuhlii*) ujet 12. 10. 2018 z delno zaceljeno raztrganino med četrtnim in petim prstom leve prhuti; b) isti белорobi netopir ujet 22. 9. 2019 s popolnoma zaceljeno levo prhutjo. (photo/foto: Roman Pavlovič, Dan Pavlovič)

bats were of normal weight, suggesting that they were able to forage successfully despite the injury, although one was observed to have a reduced ability to fly. However, as the bats were never recaptured, it is not known if the injury healed or if they survived.

iz česar sta avtorja predvidevala, da sta se bila kljub poškodbi zmožna uspešno prehranjevati, čeprav je bila pri enem opažena slabša zmožnost letenja. Netopirja nista bila ponovno ujeta, zato ni znano, ali sta se poškodbi zacelili in ali sta sploh preživela.

In our case, the bat healed a tear of about 1.5 cm in less than a year in the wild, without human help (the tear was already half healed before the first capture). With the initial 3 cm, it was apparently still able to fly and hunt successfully. This case shows that bats can survive in the wild and heal even large injuries to the flight membrane if the damage allows them to fly and forage successfully.

V našem primeru se je netopirju približno 1,5 cm dolga raztrganina zacelila v manj kot enem letu v naravi, brez pomoči človeka (polovično je bila raztrganina zaceljena že pred prvim ulovom). S 3 cm dolgo raztrganino, ki jo je imel na začetku, je bil očitno še zmeraj zmožen letenja in uspešnega lova. Iz tega primera je razvidno, da lahko netopirji v naravi preživijo in zacelijo tudi večje poškodbe letalne opne, če jim poškodba omogoča, da lahko letijo in uspešno lovijo.

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Chiroptera, 6. 7. 2024, Pond Na Kaličih, Škocjan Caves Regional Park, Matavun (Slovenia)

Chiroptera, 6. 7. 2024., Kal Na Kaličih, Regijski park Škocjanske jame, Matavun (Slovenija)



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Many different bat surveys have been carried out in Škocjan Caves Regional Park, during which the presence of 24 bat species has been recorded in the park (Presetnik 2017, Presetnik et al. 2020, Presetnik & Zamolo 2021), but other species could still be present. That is why we mist netted bats on 6 July 2024 around pond Na Kaličih, which is located along a gravel road around 0.5 km northwest from the settlement Matavun (WGS 84: 45.664801° N, 13.983645° E, 440 m a.s.l.). The pond is approximately 16×8 m wide and was restored in 2019, as it had previously dried out (Kokalj & Pečar 2024).

Mist nets were set around the entire pond and five species were caught. We captured one adult male of *Myotis blythii*, one lactating female of *M. nattereri* complex, one adult male of *M. emarginatus*, two adult males of *Hypsugo savii* and one adult male and one adult non-lactating female of *Miniopterus schreibersii*. The presence of the bat sound group

V Regijskem parku Škocjanske jame je bilo že veliko različnih raziskav netopirjev med katerimi je bila zabeležena prisotnost 24 vrst netopirjev (Presetnik 2017, Presetnik in sod. 2020, Presetnik & Zamolo 2021), vendar je prisotnost dodatnih vrst še vedno mogoča. Zato smo 6. 7. 2024 mrežili netopirje na kalu Na Kaličih, ki se nahaja ob makadamski cesti 0,5 km severozahodno od naselja Matavun (WGS 84: 45,664801° N, 13,983645° E, 440 m n. m.). Kal je velik približno 16×8 m in se je v preteklosti presušil ter bil obnovljen leta 2019 (Kokalj & Pečar 2024).

Mreže smo postavili okoli celotnega kala in ujeli pet vrst netopirjev. Ujeli smo enega odraslega samca ostrouhega netopirja (*Myotis blythii*), eno doječo samico resastega netopirja (*M. nattereri* complex), enega odraslega samca vejicatega netopirja (*M. emarginatus*), dva odrasla samca Savijevega netopirja (*Hypsugo savii*) in enega odraslega samca ter eno odraslo samico dolgokrilega netopirja (*Miniopterus schreibersii*). Z ultrazvočnim mikrofonom

Pipistrellus kuhlii/nathusii was additionally recorded using an ultrasound phone microphone (u384 USB Ultrasound Microphone, Pettersson Elektronik). All species have been recorded in Škocjan Caves Regional Park in the past, however, two new findings are worth highlighting. The discovery of a lactating female of the *M. nattereri* confirms the assumption that the bats of this species have a nursery roost in the park or in its immediate surroundings (Presetnik 2017). The finding of the *M. emarginatus* is the first record of this species outside its roost in Škocjan Caves (Presetnik & Zamolo 2021).

za telefon (u384 USB Ultrasound Microphone, Pettersson Elektronik) smo zabeležili še prisotnost netopirjev zvočne skupine belorobega/Nathusijevega netopirja (*Pipistrellus kuhlii/nathusii*). Vse vrste so bile v Regijskem parku Škocjanske jame že zabeležene v preteklosti, kljub temu pa je za izpostaviti dve najdbi. Doječa samica resastega netopirja potrjuje predvidevanje, da živali te vrste v parku ali neposredni okolici tudi kotijo (Presetnik 2017). Najdba vejicatega netopirja pa je prvo opažanje te vrste v parku izven njenega zatočišča v Škocjanskih jamah (Presetnik & Zamolo 2021).

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