

CONTRIBUTION TO SPRING CHIROPTERA FAUNA OF LAKE GREAT PRESPA AND ITS VICINITY IN THE REPUBLIC OF MACEDONIA

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Abstract

During a six-day survey (25 April–2 May 2015), 14 bat species were found at 20 sites at Lake Great Prespa and its vicinity in the Republic of Macedonia: *Rhinolophus ferrumequinum*, *R. hipposideros*, *R. blasii*, *Myotis myotis*, *M. mystacinus*, *M. capaccinii*, *Nyctalus leisleri*, *N. noctula*, *Pipistrellus pipistrellus*, *P. kuhlii*, *P. nathusii*, *Hypsugo savii*, *Vespertilio murinus* and *Miniopterus schreibersii*. While roosts of groups of *M. myotis*, *M. capaccinii* and *M. schreibersii* were found in caves, a number of roosts of *R. hipposideros* were recorded in buildings. In various cracks in buildings, colonies of *P. pipistrellus*, *P. kuhlii*, *P. nathusii* and *N. leisleri* were also observed. Some notes on the foraging habitat of particular species are also presented.

Key words: bats, distribution, Macedonia, Lake Great Prespa, Lake Ohrid, roosts, mist netting, ultrasound inventarisaton

Përmbledhje

Gjatë një vëzhgimi gjashtë ditor (25 Prill – 2 Maj 2015), 14 lloje lakuriqësh nate janë gjetur në 20 vende në Liqenin e Prespës së Madhe dhe në afërsi të Republikës së Maqedonisë: *Rhinolophus ferrumequinum*, *R. hipposideros*, *R. blasii*, *Myotis myotis*, *M. mystacinus*, *M. capaccinii*, *Nyctalus leisleri*, *N. noctula*, *Pipistrellus pipistrellus*, *P. kuhlii*, *P. nathusii*, *Hypsugo savii*, *Vespertilio murinus* dhe *Miniopterus schreibersii*. E ndërsa vendbanimet e grupeve të *M. myotis*, *M. capaccinii* dhe *M. schreibersii* janë gjetur në shpella, një numër i vendbanimeve të *R. hipposideros* janë regjistruar në ndërtesa. Në disa çarje të shtëpive janë gjetur koloni të *P. pipistrellus*, *P. kuhlii*, *P. nathusii* dhe *N. leisleri*. Gjithashtu janë paraqitur disa të dhëna mbi habitatet e ushqimit të llojeve të veçanta

Fjalëkyçe: Lakuriq nate, përhapje, Maqedoni, Prespa e Madhe, Liqeni i Ohrit, vendbanime, mist netting, inventarizimi me ultratinguj.

Introduction

Macedonian bat fauna is not well known, though research has more or less sporadically been done from the middle of the 1980s, and literature sources have recently been summarised by Micevski *et al.* (2014). Although, for large areas of the Republic of Macedonia, not even a single record for the presence of bats has been published, Lake Great Prespa and its vicinity has been given the most research attention. Earlier research was summarized by Kryštufek *et al.* (1992). Later, the major contribution for the area was made during the survey conducted by members of the Dutch Society for the Study and Conservation of Mammals in Galičica National Park and its vicinity

(Boshamer *et al.*, 2006), which also resulted in the confirmation of three new bat species for the country (e.g. Bekker & Boshamer, 2007). In 2010–2011, additional research was conducted during a cooperative study by Greek, Albanian and Macedonian researchers, which resulted in a common “Conservation action plan for the bats of Prespa” (Papadatou *et al.*, 2011). Later still, some bat observations were also published by Micevski *et al.* (2014). Similarly, in Greece and Albania, the vicinity of Prespa lakes has received special attention by bat researchers, and the results were presented by Papadatou *et al.* (2011) and Théou *et al.* (2015), who reported 27 bat species for the transboundary Prespa Park, while *Vespertilio murinus* Linnaeus was found in its immediate vicinity.

Materials and methods

During the Slovenian *Biology Students' Society* (Societas studiosorum Biologiae Universitatis Labacensis) research camp “Ekosistemi Balkana – Makedonija, Krani 2015”, from 25 April to 3 May 2015, the bat research group was also active. Two aims of our research work were i) to check the spring status of selected cave roosts suggested by Papadatou *et al.* (2011) for monitoring, and ii) general additional inventarisation of Lake Great Prespa and its vicinity. We inspected known and potential bat roosts, and counted the encountered bats. In the case that there were larger groups, we took photographs and later counted the number of bats using a computer. In the results are included also survey data of two bat roosts in the area made by Philippe Théou in April 2014. We also used mist nets or hand nets and we recorded bat ultrasound and social calls with ultrasound detectors (Pettersson D240x) with the aid of a digital recorder (Marantz PMD 670). At home we used the program BatSound 4.1.4 (Pettersson Electronic and Acoustic AB) to analyse the recordings, taking into consideration the same literature as used by Micevski *et al.* (2014).

A detailed bio- and socio-geographic description of the investigated area is provided by Papadatou *et al.* (2011). Specific to our survey was the vegetation around Lake Great Prespa that was at a very early stage of its growth (e.g. blossoming of *Prunus spinosa* L., beginning of new leaf growth *Fagus sylvatica* L.), while the snow still covered the upper part of the Galičiča and Pelister mountains. The melting of the snow also contributed to higher stream levels, which reduced the possible mist netting places above water.

All research was conducted according to the permit issued by the Republic of Macedonia’s Ministry of Environment and Physical Planning (no. 11-3052/5, dated 24 April 2015), and the management bodies of Galičiča National Park, Pelister National Park, and the Ezerani Nature Reserve were also informed.

Results and discussion

General section

During six days of surveys (evening of 25 April–evening of 2 May 2015) on 20 sites (Table 1, Figure 1), 14 bat species were found: *Rhinolophus ferrumequinum* (Schreber, 1774), *R. hipposideros* (Bechstein, 1800), *R. blasii* Peters, 1866, *Myotis myotis* (Borkenhausen, 1797), *M. mystacinus* (Kuhl, 1817), *M. capaccinii* (Bonaparte, 1837), *Nyctalus leisleri* (Kuhl, 1817), *N. noctula* (Schreber, 1774), *Pipistrellus pipistrellus* (Schreber, 1774), *P. kuhlii* (Kuhl, 1817), *P. nathusii* (Keyserling & Blasius, 1839), *Hypsugo savii* (Bonaparte, 1837), *Vespertilio murinus* Linnaeus, 1758 and *Miniopterus schreibersii* (Kuhl, 1817). In some cases, ultrasound or visual observations were insufficient to definitively determine species, and therefore in Table 1 we have sometimes presented data on observed taxa that are comprised of two possible species.

The late spring and cold weather obviously contributed to the fact that we found far fewer bats in caves than would be expected to be present during the summer period according to Papadatou *et al.* (2011). This was especially noticeable in the caves, Leskovska peštara, Bimbilova peštara, and Golema peštara, south of Trpejca (all caves marked as important cave roosts in/or near the Prespa Basin by Papadatou *et al.* (2011)) and to lesser extent in the cave, Javorec peštara. Conspicuous was the almost total absence of middle sized *Rhinolophus* bats, but on the other hand, in the specified caves we observed at least some bats of the other previously recorded species. The cold weather (e.g. on 29 April at 8 p.m. the temperature was approximately 10°C) also meant that bat activity was low and noticeable more or less close to the bat roosts. With one exception, possible foetuses were not palpable in captured females.

Regarding “Naumova cave”, the name given by Papadatou *et al.* (2011) for the cave on the Lake Ohrid shore, south of the village, Trpejca, we can report that local villagers know it as just “Golema peštara” or “Golema dupka”, meaning “big cave”, so as to distinguish it from other smaller caves in the vicinity. Additionally, locals connected the name “Naum” with the monastic complex and church of St. Naum 5 km away to the south, on the Macedonian–Albanian border, therefore we recommend that only the local name, “Golema peštara” is used in future.

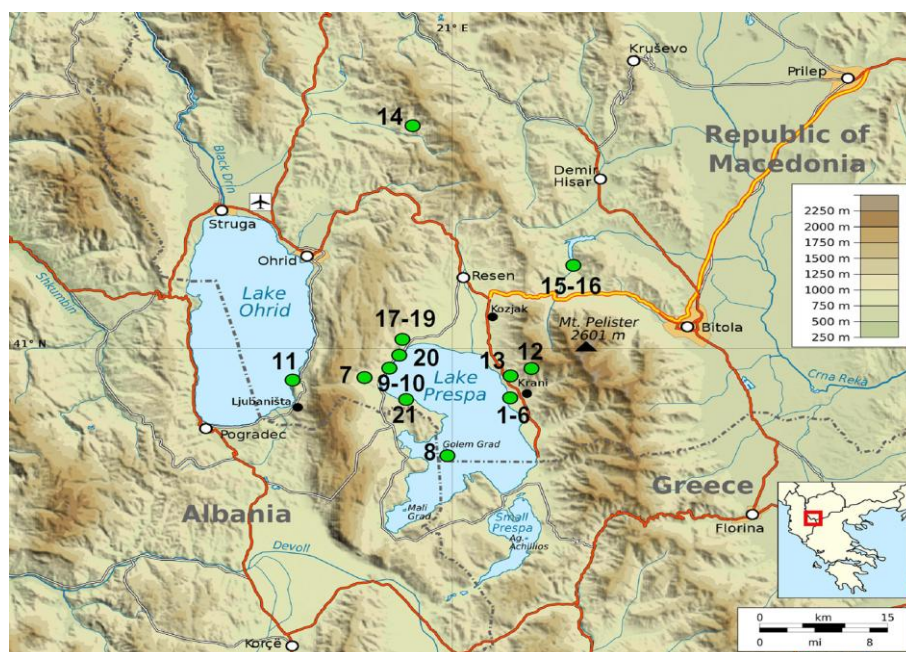


Figure 1. Bat sites in the vicinity of Lake Great Prespa found from 25 April to 2 May 2015 during a research study.

(for site details see Table 1; basic topographic map prepared by *Future Perfect at Sunrise* from Wikimedia Commons)

Table 1. Sites and bat species observed in the vicinity of Lake Great Prespa from 25 April to 2 May 2015.

(Methods of detection: d – ultrasound detector, m – measurement/mist-netting of bats, o – visual observation/photo counting; age: ad – adult, subad – sub adult; sex: M – male, F – female, un – unknown age and sex; estimation of number: i – individuals, s – several bats).

Site no.	Site name (largest nearby town) [lat. (°N) / long. (°E) / m a.s.l.]	Date	Species
1	Auto camp Krani (Resen) [40.9352 / 21.0819 / 860]	25.4.2015	<i>P. nathusii</i> (d: s, social calls) <i>Mi. schreibersii</i> (d: i)
		29.4.2015	<i>P. nathusii</i> (d: s, social calls) <i>N. leisleri</i> (d: i)
2	Apartments in auto camp Krani (Resen) [40.9352 / 21.0819 / 860]	26.4.2015	<i>P. pipistrellus</i> (m: 2 ad M) <i>P. nathusii</i> (m: 1 ad M, 1 ad F, 1 un) <i>P. sp.</i> (o: 15 un)

Site no.	Site name (largest nearby town) [lat. (°N) / long. (°E) / m a.s.l.]	Date	Species
3	Apartment no. 15 in auto camp Krani (Resen) [40.9337 / 21.0819 / 855]	27.4.2015	<i>P. pipistrellus</i> (m: 1 subad F, 1 ad F)
		28.4.2015	<i>P. nathusii</i> (m: 1 subad M, 1 ad M, 3 subad F, 3 ad F) <i>P. sp.</i> (o: 33 un)
4	Apartment no. 20 in auto camp Krani (Resen) [40.9350 / 21.0223 / 855]	27.4.2015	<i>P. kuhlii</i> (m: 2 subad F, 5 ad F) <i>P. nathusii</i> (m: 1 ad M, 3 subad F, 2 ad F) <i>P. sp.</i> (o: 4 un)
		28.4.2015	<i>P. sp.</i> (o: 7 un)
5	Lake Prespa shore, 400 m west of auto camp Krani (Resen) [40.9352 / 21.0759 / 842]	25.4.2015	<i>P. nathusii</i> (d: s, social calls) <i>M. daubentonii</i> / <i>M. capaccinii</i> (o: i)
6	Forest edge, 250 m west of auto camp Krani (Resen) [40.9341 / 21.0792 / 847]	26.4.2015	<i>P. kuhlii</i> / <i>P. nathusii</i> (d: i) <i>Mi. schreibersii</i> (d: i)
7	Cave, Leskovska peštara (Leskoec, Resen) [40.9591 / 20.8779 / 880]	25.4.2014	<i>R. hipposideros</i> (o: 2 un) <i>R. sp.</i> - middle size (o: 1 un)
		26.4.2015	<i>R. hipposideros</i> (m: 1 subad M, o: 2 un) <i>R. ferrumequinum</i> (m: 1 ad M) <i>R. blasii</i> (m: 1 subad F)
8	Cave, Bimbilova peštara on Golem grad island (Resen) [40.8716 / 20.9897 / 860]	27.4.2015	<i>M. capaccinii</i> / <i>Mi. schreibersii</i> (o: approx. 1500 un) <i>M. capaccinii</i> (m: 1 F ad) <i>Mi. schreibersii</i> (m: 1 M ad)
9	Abandoned building 1 (smaller) of hotel, Evropa (Oteševo, Resen) [40.9799 / 20.9149 / 880]	27.4.2015	<i>R. hipposideros</i> (o: 20 un)
10	Abandoned building 2 (bigger) of hotel, Evropa (Oteševo, Resen) [40.9796 / 20.9156 / 880]	27.4.2015	<i>R. hipposideros</i> (o: 14 un)

Site no.	Site name (largest nearby town) [lat. (°N) / long. (°E) / m a.s.l.]	Date	Species
11	Cave, Golema peštara, 300 m south-west of the bay of the village, Trpejca (Ohrid) [40.9559 / 20.7764 / 710]	28.4.2015	<i>R. hipposideros</i> (o: 1 un) <i>R. ferrumequinum</i> (o: 1 subad, 2 un) <i>R. sp.</i> (o: 1 un)
12	Church, St. Bogorodica (Slivnica, Resen) [40.9779 / 21.1002 / 1250]	29.4.2015	<i>N. leisleri</i> (m: 1 subad F, 2 ad F) <i>P. nathusii</i> (m: 1 subad F) <i>H. savii</i> (m: 1 subad M) <i>V. murinus</i> (m: 1 ad F) Vespertilionidae (o: 19 un)
13	Slivnica village (Resen) [40.9579 / 21.0774 / 930]	29.4.2015	<i>P. kuhlii</i> / <i>P. nathusii</i> (d: i)
14	Cave, peštara Javorec (Velmej) [41.2933 / 20.9451 / 1010]	30.4.2015	<i>R. hipposideros</i> (o: 1 subad F, 1 subad un) <i>M. myotis</i> (o: 400 subad + ad; m: 4 subad F, 11 ad F) <i>Mi. schreibersii</i> (o: 200 ad; m: 4 ad M, 2 subad F)
15	Outflow or right branch of River Šemnica in River Srbečka reka in Lera village (Bitola) [41.1020 / 21.1700 / 755]	1.5.2015	<i>M. mystacinus</i> (m: 1 subad M) <i>N. leisleri</i> (d: i) <i>N. noctula</i> (m: 1 ad M) <i>P. pipistrellus</i> (d: i) <i>P. nathusii</i> (m: 1 ad M)
16	Lera village, by street lights (Bitola) [41.1013 / 21.1716 / 760]	1.5.2015	<i>P. kuhlii</i> / <i>P. nathusii</i> (d: i)
17	Abandoned school in Pokrvenik village (Resen) [41.0242 / 20.9511 / 910]	2.5.2015	<i>R. hipposideros</i> (o: 4 un, m: 5 subad F, 2 ad F)
18	Abandoned house in Volkoderi village (Resen) [41.0201 / 20.9434 / 900]	2.5.2015	<i>R. hipposideros</i> (o: 26 un, m: 6 subad F, 1 ad F)

Site no.	Site name (largest nearby town) [lat. (°N) / long. (°E) / m a.s.l.]	Date	Species
19	Cellar of abandoned house in Volkoderi village (Resen) [41.0209 / 20.9440 / 900]	2.5.2015	<i>R. hipposideros</i> (o: 16 subad + ad)
20	Dry drainage pipe ($\Phi = 1$ m) under the road, Šurlenci–Oteševo, closed at one end (Resen) [40.9942 / 20.9329 / 860]	2.5.2015	<i>R. hipposideros</i> (m: 1 subad M)
21	Cave near the lake Prespa (Stenje, Resen) [40.9352 / 20.9395 / 850]	24.4.2014	<i>R. hipposideros</i> (o: 6 un)

Species section

Only a few *R. ferrumequinum* were observed in two caves (Sites 7, 11), very similar to the observations for winter/spring reported for these roosts by (Kryštufek *et al.*, 1992; Papadatou *et al.*, 2011).

Rhinolophus hipposideros was the species found at the greatest number of locations – 9 and with additional observation in one roost in 2014. The species was observed in four caves (Sites 7, 11, 14, 21) which contained one or a few animals, mostly sub adults born the previous year. With the exception of the chance finding of one sub adult in a dry drainage pipe (Site 20), all other roosts were located in buildings. Most bats were found in cellars (Sites 9, 19), though some bats were found in the darker rooms of first or higher floors (Sites 10, 18), and only once were the majority of bats observed in the attic (Site 17). This may indicate that some of the surveyed locations may also serve as hibernacula and should be inspected during the winter period to confirm our supposition. In the previously (Boshamer *et al.*, 2006) confirmed maternity roost of approximately 30 adult *R. hipposideros* in the abandoned school in Pokrvenik (Site 17), only 11 animals were present, which indicated that most of the animals had not yet migrated to their nursery roost. The observed bats were mostly nulliparous females, a similar finding applies to a nearby house (Site 18, Table 1).

We saw just one nulliparous female of *R. blasii* in the cave (Site 7), where this species had already been reported by Kryštufek *et al.* (1992) and Papadatou *et al.* (2011).

Myotis myotis we found in one cave nursery roost (Site 14), where it had been previously reported (Hackethal & Peters, 1987; Kryštufek *et al.*, 1992; Boshamer *et al.*, 2006). Torpid or sluggish bats were hanging in two smaller and one bigger cluster in the end chamber of the cave, mixed with *Mi. schreibersii*. We measured 3 nulliparous and 12 parous females, all of which certainly belong to *M. myotis* (e.g. length of upper tooth row – CM³

was on average 10.03 mm, sdev: 0.39 mm, N=15). Therefore the origin of the *M. blythii* tentatively reported by Boshamer *et al.* (2006) from the dammed spring, approximately 2.5 km south-east of the village, Velmej (= Velmej pond) is still in question. Judging by the large forearm length and weight measurements provided by Boshamer *et al.* (2006), those *M. cf blythii* may have in fact belonged to *M. myotis*, as pointed out also by Micevski *et al.* (2014), and therefore the presence of *M. blythii* is yet to be confirmed for that region. Only one sub adult male *M. mystacinus* was mist netted as it flew along a small stream at the dusk (Site 15). By its outer characteristics, its form was typical of the species.

In the one of the largest known all-year-round roost of *M. capaccinii* in the vicinity of the Prespa lakes (Site 8; Papadatou *et al.*, 2011), we captured one possibly pregnant female. Alert bats were hanging in two (500 and 1000 strong) mixed groups with *Mi. schreibersii*. One possible *M. capaccinii* was also seen foraging late at night (at approximately 11 p.m.) over Lake Greater Prespa (Site 5), however its definite differentiation from *M. daubentonii* was not unquestionable.

We observed a group of *N. leisleri* roosting behind the wooden planks covering the corner of the belfry of the church, St. Bogorodica (Site 12). All the bats captured there during evening emergence were females (two parous, one nulliparous). Since we also captured, or previously found, individuals of *P. nathusii*, *H. savii* and *V. murinus* in the belfry, we cannot say how many of the other 19 uncaptured bats which emerged were *N. leisleri*. So far, all captured *N. leisleri* in the vicinity of Lake Great Prespa have been males (Boshamer *et al.*, 2006; Micevski *et al.*, 2014), so our find of a group of females raises the question whether this species is reproducing in the area. Therefore, we recommend this site be surveyed during summer, when we could possibly expect to find maternity groups. We heard the distinctive alternating ultrasound echolocation of *N. leisleri* at two additional locations (Sites 1, 15), where animals possibly foraged.

To date, only evidence from its echolocations placed *Nyctalus noctula* in the Prespa area (Papadatou *et al.*, 2011), but by chance, we found an adult male (Site 15). The animal was hanging in full day light, approximately 1.8 m above ground, on an only 5 cm thick branch by the stream bank. When, later in the evening, we put it on a tree trunk, it had problems climbing, and in the end it fell to the ground, so we put it in a nearby tree hole. The animal was possibly exhausted from the long winter. Two adult males of *P. pipistrellus* were found separately in cracks between the wall and metal roof-endings of two different apartments (Site 2). The next evening, one parous and one nulliparous female emerged from roof cracks of apartment no. 15 (Site 3) among several *P. nathusii*. Since we did not capture the other 33 pipistrelle bats that emerged from the same site, it was impossible to determine them to species level. One *P. pipistrellus* was also heard foraging along riparian vegetation (Site 15).

We discovered a colony of *P. kuhlii* females (five parous and two nulliparous) in cracks between a wall and metal roof-ending (Site 4). The roost was shared by a similar number of *P. nathusii*. This could be first definite site of a reproduction colony of *P. kuhlii* in the vicinity of Prespa lakes (Papadatou et al. 2011). Due to the lack of characteristic social calls (e.g. Barataud, 1996; Skiba, 2009), some animals could not be distinguished from *P. nathusii*, which uses similar echolocation calls (sites 6, 13, 16). *P. kuhlii* was reported for the Republic of Macedonia's side of Lake Great Prespa by Boshamer et al. (2006) using a bat detector, sadly, no mention was made of whether its social calls were present. Therefore, we must take their data as observations of *P. kuhlii/P. nathusii*. Boshamer et al. (2006) had also not mist netted the species, as has been erroneously published by Papadatou et al. (2011). Consequently, as the first reliable data on the presence of this species in the investigation area should be regarded that of Micevski et al. (2014), again on the eastern shores of Lake Great Prespa.

One of the most interesting finds were those involving *P. nathusii*. A number of animals were hiding in several roof cracks of apartments (Site 2), the most numerous being those in apartment 15 and 20 (Sites 3, 4). There we measured a total of 5 parous, 6 nulliparous females, 1 sub adult and 3 adult males. No wonder that the social calls of *P. nathusii* were heard whenever we checked the auto camp, Krani, and the nearby lake shore (Sites 1, 5). One nulliparous female was hiding in a crack in the belfry of the church, St. Bogorodica (Site 12), which is now, with its elevation of 1,250 m a. s. l., also the highest observation of this species in the country. Additionally an adult male was mist netted approximately 20 minutes after sunset over a small stream (Site 15). Along with the summer observations of Micevski et al. (2014), our observations form the first data on this species in the vicinity of Lake Great Prespa in the Republic of Macedonia. Only further research will reveal whether the females were only spending winter on the eastern shores of Lake Great Prespa, or were they also forming a maternity colony.

One *H. savii* sub adult male, that was hiding in the crack of a window frame in the belfry of the church, St. Bogorodica (Site 12), supplements a picture of species distribution in this part of the Republic of Macedonia as given by Boshamer et al. (2006), Papadatou et al. (2011) and Micevski et al. (2014). A parous female of *V. murinus* was found in the same crack of the belfry of the church, St. Bogorodica (Site 12) that *N. leisleri* females were using. This is first definitive confirmation of this species in transboundary Prespa Park (Papadatou et al., 2011), though Micevski et al. (2014) had, on the basis of echolocation calls, already tentatively assumed its presence.

Miniopterus schreibersii was predictably (Papadatou et al., 2011) found in two caves (Sites 8, 14), in the first in a mixed group with *M. capaccinii*, and in the other with *M. myotis*. Twice, we also detected it in its probable foraging habitats (Sites 1, 6).

Conclusions

With our research we have substantially added knowledge of the spring status of bat fauna in the vicinity of Lake Great Prespa in the Republic of Macedonia, and pointed out many needs for the further study of bats in that area – especially regarding the reproduction sites of *P. kuhlii*, *P. nathusii* and *N. leisleri*. We also hope our discovery of roosts in buildings of *R. hipposideros* will contribute to the conservation of those roosts.

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