

# New Records of the Western Barbastelle *Barbastella barbastellus* (Schreber, 1774) and Other Rare Bat Species in Montenegro

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**Abstract:** The aim of our study was to explore the bat fauna of Montenegro in areas, which have not been previously surveyed. Simultaneous recordings with bat detectors and mist nets were carried out at eight sites scattered around Montenegro. Mist netting resulted in the capture of 70 bats of 16 species: *Barbastella barbastellus*, *Hypsugo savii*, *Myotis aurascens*, *M. capaccinii*, *M. daubentonii*, *M. emarginatus*, *M. mystacinus*, *M. blythii*, *Miniopterus schreibersii*, *Nyctalus noctula*, *Plecotus macrobullaris*, *Pipistrellus nathusii*, *P. pipistrellus*, *Rhinolophus euryale*, *R. hipposideros* and *Vespertilio murinus*. A total of 317 bat flight passes were recorded, including of four further species: *P. kuhlii*, *P. pygmaeus*, *Eptesicus serotinus* and *N. leisleri*. Five individuals of barbastelle (*B. barbastellus*), captured in the Durmitor National park in July 2015, included three females, one of which was lactating, confirming the reproduction of this species in Montenegro. This observation is important as the barbastelle is currently considered rare in Europe and is included in Annex II of the EU habitat Directive (92/43/EEC). In addition, three breeding colonies of bats were found: two of *R. hipposideros* (in a cave near the Dobrilovina Monastery and a barn in the Durmitor National Park) and one of *R. euryale* (in a cave near Risan).

**Key words:** bats, Montenegro, western barbastelle, Natura 2000

## Introduction

Despite a growing interest in Montenegrin nature, the currently available data regarding species composition and distribution of bats are incomplete. The first published data of bats from Montenegro were based on materials collected by Ludwig van Fuehrer at the end of the 19th century (MILLER 1912). From that time until the 1960s, information about this group of animals from Montenegro has been mostly accidental and incomplete. The first fundamental survey for bats was carried out by Mirić in the

1960s (DULIĆ & MIRIĆ 1967, MIRIĆ 1973a, b) and more comprehensively reported in the paper MIRIĆ (1987). Since then, many species of bats have been recorded for the country. NOBLET (1986) published information about three new species found during his research, then PETROVIC et al. (1987) reported the field observation of another species. In the 1980s, published data on bats from Montenegro included the following species: *Rhinolophus ferrumequinum* (Schreber, 1775), *R. blasii* Peters, 1866, *Myotis*

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*blythii* Tomes, 1857, *M. emarginatus* (E. Geoffroy Saint-Hilaire, 1806), *M. capaccinii* Bonaparte, 1837, *Pipistrellus pipistrellus* (Schreber, 1774), *P. nathusii* (Keyserling & Blasius, 1839), *Eptesicus serotinus* (Schreber, 1774), *Miniopterus schreibersii* (Kuhl, 1817), *Myotis nattereri* (Kuhl, 1817), *M. mystacinus* (Kuhl, 1817), *Pipistrellus kuhlii* (Kuhl, 1817) and *Vespertilio murinus* Linnaeus, 1758. Using published and unpublished data in the mid-90s, the overview of Montenegrin mammal species included a list of 15 bat species referred for the country (MIRIĆ & PAUNOVIĆ 1994; SAVIĆ et al. 1995).

In the late 1990s and 2000s, many new field studies were carried out, both local (e.g. BENDA 2004, CIECHANOWSKI et al. 2005, SACHANOWICZ et al. 2006) and more comprehensive (e.g. PRESETNIK 2006, 2007, JAZBEC 2006, PRESETNIK 2012). In addition, PAUNOWIC et al. (2010) examined a series of museum specimens, discovering the presence of *Plecotus macbullaris* and reporting 25 species (but no *Myotis alcathoe*). Finally, PRESETNIK et al. (2014) reported 28 species for the country, collating data from previous surveys and its own latest results. They included: *Rhinolophus ferrumequinum*, *R. hipposideros* (Bechstein, 1800), *R. euryale* (Blasius, 1853), *R. blasii*, *Myotis myotis* Borkhausen, 1797, *M. blythii*, *M. nattereri*, *M. emarginatus*, *M. mystacinus*, *M. brandtii* (Eversmann, 1845), *M. alcathoe* von Helversen & Heller, 2001, *M. capaccinii*, *M. daubentonii* (Kuhl, 1817), *Nyctalus noctula* (Schreber, 1774), *N. leisleri*, *Pipistrellus pipistrellus*, *P. pygmaeus* (Leach, 1825), *P. kuhlii*, *P. nathusii*, *Hypsugo savii* Bonaparte, 1837, *Eptesicus serotinus*, *Vespertilio murinus*, *Barbastella barbastellus* (Schreber, 1774), *Plecotus auritus* (Linnaeus, 1758), *P. austriacus* (J.B. Fischer, 1829), *P. macbullaris* Kuzjakin, 1965, *Miniopterus schreibersii* and *Tadarida teniotis* (Rafinesque, 1814). The record of an individual of *M. bechsteinii* in 2015 (THEOU & ĐUROVIĆ 2015) was subsequently found to be an error – the observed individual was actually *M. emarginatus* (RADONJIĆ & THÉOU 2016).

Despite recently increased bat studies in Montenegro, according to PRESETNIK et al. (2014), only 33% of the 10×10 km UTM squares covering Montenegro contain at least one bat record. The natural habitats of Montenegro are diverse and mostly mountainous, which increases difficulties for fieldwork. As bats present a large variety of habitat preferences depending on species, supplementing such knowledge is urgently needed, especially since lack of it is likely to hamper conservation efforts. The aim of our study was to explore bat fauna in places which have not been previously surveyed, with the qualitative broadening of knowledge of the occurrence of rarer species with high conservation status.

## Materials and Methods

The study was conducted on 20–30 August 2014 and 20–30 July 2015. Nightly observations were made at different sites. At each study site, a netting point was established and a bat recording transect was walked in its close vicinity. The transect walking started approximately half an hour after sunset and its average length was 2.5 km. Each transect was traversed twice (in both directions), on foot, which resulted in one hour in total of recording for each transect. We used the Pettersson D-1000x (Pettersson Elektronik, Sweden) and ANABAT SD2 (Titley Scientific, Australia) detectors for recording. The analyses were carried out using the Pettersson BatSound 4.2 and SonoBat programs (with wav. files) and Titley's AnaLook program with ANABAT files.

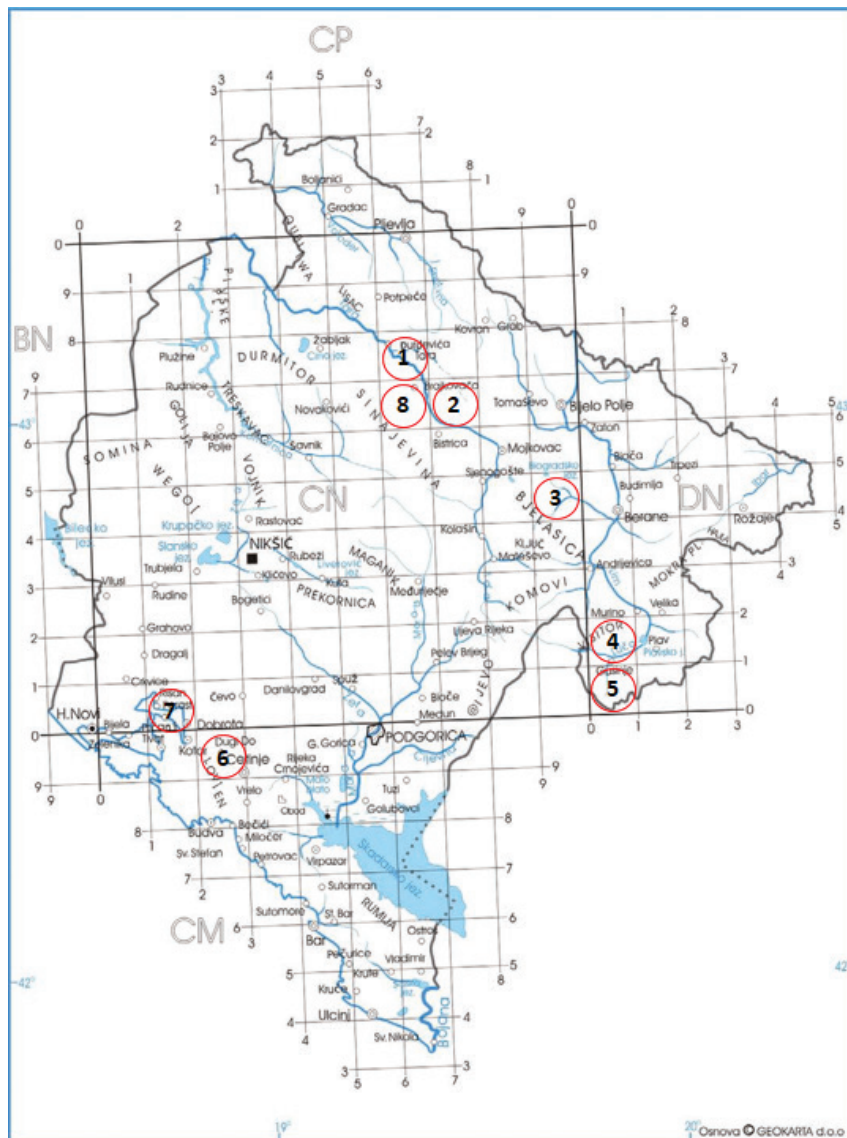
The netting was conducted using mist-nets (Ecotone, Poland). Three nets were placed in a row at each point, while the detailed location of individual nets depended on the conditions in the field. The netting was conducted during bat activity, from 30 min after sunset until 30 min before dawn. The captured bats were identified, measured and immediately released. In accordance with the permit, no bats and no tissue samples were collected. A representative of the National Parks of Montenegro was present during fieldwork. Netting bats was carried out on the basis of an official permit (license number UPI-1265/5, Agencija za Zaštitu Životne Sredine).

UTM squares and geographic coordinates of points were used for localisation purposes. Each "Number of location" (Fig. 1, Tables 1 and 2, Appendix 1) indicated both netting point and corresponding transect, except where stated otherwise.

## Results

In total, 20 species of bats were found: 16 species by netting and four further species by recordings (Tables 1 and 2).

Most of the locations in which bats occurred are new to the country. The (currently) rarest species of bats in Montenegro, the barbastelle, was netted in old beech forests in the Durmitor National Park (Table 1). Among the five specimens caught there was one lactating female, for the first time indicating that this species reproduces in Montenegro. *Barbastella barbastellus* was also detected through ultrasound monitoring from two places: in the Durmitor National Park and near the Biogradska Gora National Park (Table 2). Another rare for Montenegro species, *M. daubentonii*, was caught at four places (Table 1), including the neighbourhood of the Biogradska Gora NP (where



**Fig. 1.** Map of Montenegro with marked study sites. Numbers (1-8) refer to sites and adequate UTM squares: 1 – CN67, 001 Tara Valley Durmitor N.P. (point/transect 1) and 010 Tara Valley Durmitor N.P. (“near *R. hipposideros* roost”), 2 – CN76, 002 Tara Valley Durmitor N.P. point/transect 2), 3 – C94, 003 on the border of Biogradska Gora N.P., 4 – DN01, 004 Vruja River Prokletije N.P., 5 – DN00, 005 Oko Skakavice, 6 – CM29, 008 Lovcen N.P., 7 – CN10, 009 Cave near Risan, 8 – CN66, 006 small cave near the road to Durmitor (Tara Valley) and 007 Tara Valley Durmitor N.P. “forest netting site”. Grid means UTM squares.

this bat has already been observed). Since only males have been caught, the reproductive status of this species was not confirmed for these new records.

## Discussion

The current species composition of bats in Montenegro includes 28 species, some of which have been discovered relatively recently (PRESETNIK et al. 2014). Because the country is still poorly researched for the occurrence of bats, following the initial aim of the present study, most of the places studied for bats are either completely new locations or those where observations were made earlier, but the results indicated that

they were worth following up. An example of the latter is the Durmitor National Park, where the habitat of old deciduous forests indicated the possible presence of a reproductive population of the Western barbastelle (which has been proven during this study, Table 1). The earlier finding of this species in Montenegro concerned only the Biogradska Gora region and was based on ultrasonic detection (PRESETNIK et al. 2014, BUYS et al. 2016). The nursing female that has been caught clearly indicates breeding by this species there. *Barbastella barbastellus* is a species listed in Annex II of the Habitat Directive, so its presence there will allow it to be considered as a subject of protection within the proposed Natura 2000 area.

**Table 1.** Number of bats, which were caught during the netting or were observed and counted directly in another way (e.g. at the wall of a cave). Bats were identified to species or to genus level. “m” = male, “f” = female. Lact = lactating. “Site” refers to map (Figure 1).

Lp.	Species	UTM square/number/site/n/sex
1.	<i>M. mystacinus</i>	CN67: 001 Tara Valley, Durmitor N.P. (point 1), 1f, CN76: 002 Tara Valley, Durmitor N.P. (point 2), 1m, CN94: 003 on the border of Biogradska Gora N.P., 1m, DN01: 004 Vruja River Prokletije N.P., 1m, DN00: 005 Oko Skakavice, 1f
2.	<i>Myotis</i> spp.	CN94: 003 On the border of Biogradska Gora N.P., 3 (sex indet.)
3.	<i>M. aurascens</i>	DN01: 004 Vruja River Prokletije N.P., 1 m
	<i>M. daubentonii</i>	CN76: 002 Tara Valley Durmitor N.P. (point 2), 1m, CN94: 003 On the border of Biogradska Gora N.P., 1m, DN01: 004 Vruja River Prokletije N.P., 2m, DN00: 005 Oko Skakavice, 1m
4.	<i>M. capaccinii</i>	DN01: 004 Vruja River Prokletije N.P., 2m
5.	<i>M. emarginatus</i>	DN00: 005 Oko Skakavice, 1m
6.	<i>M. blythii</i>	CN66: 006 Small cave near the road to Durmitor (Tara Valley), 2m
7.	<i>B. barbastellus</i>	CN66: 007 Tara Valley Durmitor N.P. – forest netting site, 2m, 3f (1 lact.)
8.	<i>P. nathusii</i>	CN94: 003 On the border of Biogradska Gora N.P., 1f
9.	<i>P. pipistrellus</i>	DN00: 005 Oko Skakavice, 1f, CN10: cave near Risan, 1m
10.	<i>H. savii</i>	DN01: 004 Vruja River Prokletije N.P., 4m, 2f
11.	<i>V. murinus</i>	DN01: 004 Vruja River Prokletije N.P., 19m, 1f
12.	<i>N. noctula</i>	DN01: 004 Vruja River Prokletije N.P., 1m, 1f
13.	<i>P. macrobullaris</i>	CM29: 008 Lovcen N.P., 1f
14.	<i>M. schreibersii</i>	CN10: 009 cave near Risan, 2f
15.	<i>R. euryale</i>	CN10: 009 cave near Risan, 3f
16.	<i>R. hipposideros</i>	CN66: 006 Small cave near the road to Durmitor (Tara Valley), 9 (sex indet.)

**Table 2.** Number of bat flights recorded on line transects, with identification. Signals were identified to species level or to the nearest possible level (e.g. genus). The table does not contain unidentified bat flights. “Site” refers to map (Figure 1).

Lp.	Species/genus	UTM square/number/site/n
1.	<i>Myotis</i> spp.	CN76: 002 Tara Valley Durmitor N.P. (transect 2), 6, CN94: 003 On the border of Biogradska Gora N.P., 1, DN01: 004 Vruja River Prokletije N.P., 3, DN00: 005 Oko Skakavice, 4, CM29: 008 Lovcen N.P., 6, CN10, 009 Cave near Risan, 1
2.	<i>M. myotis/M. blythii</i>	CN76: 002 Tara Valley Durmitor N.P. (transect 2), 1
3.	<i>M. brandtii/M. mystacinus</i>	CN94: 003 On the border of Biogradska Gora N.P., 4, DN01: 004 Vruja River Prokletije N.P., 10
4.	<i>B. barbastellus</i>	CN76: 002 Tara Valley Durmitor N.P. (transect 2), 1, CN66: 007 Tara Valley Durmitor N.P. (forest netting site), 5, CN94: 003 On the border of Biogradska Gora N.P., 2
5.	<i>P. nathusii</i>	DN00: 005 Oko Skakavice, 3, CM29: 008 Lovcen N.P., 2
6.	<i>P. pygmaeus</i>	CN67: 001 Tara Valley Durmitor N.P. (transect 1), 42, CN76: 002 Tara Valley Durmitor N.P. (transect 2), 62, 004 DN01: Vruja River Prokletije N.P., 7, CM29: 008 Lovcen N.P., 3, CN10: 009 Cave near Risan, 1
7.	<i>P. pipistrellus</i>	CN67: 001 Tara Valley Durmitor N.P. (transect 1), 5, CN76: 002 Tara Valley Durmitor N.P. (transect 2), 15, CN66: 007 Tara Valley Durmitor N.P. (forest netting site), 1, DN00: 005 Oko Skakavice, 4, CN10: 009 Cave near Risan, 10
8.	<i>P. kuhlii</i>	CN67: 001 Tara Valley Durmitor N.P. (transect 1), 1, CN94: 003 On the border of Biogradska Gora N.P., 2, DN01: 004 Vruja River Prokletije N.P., 1, DN00: 005 Oko Skakavice, 1,
9.	<i>H. savii</i>	CN76: 002 Tara Valley Durmitor N.P. (transect 2), 3, CN94: 003 On the border of Biogradska Gora N.P., 4, DN01: 004 Vruja River Prokletije N.P., 3, DN00: 005 Oko Skakavice, 7,
10.	<i>Pipistrellus</i> spp.	CN76: 002 Tara Valley Durmitor N.P. (transect 2), 1, DN00: 005 Oko Skakavice, 1
11.	<i>N. noctula</i>	CN67: 001 Tara Valley Durmitor N.P. (transect 1), 3, DN01: 004 Vruja River Prokletije N.P., 8, DN00: 005 Oko Skakavice, 4,
12.	<i>N. leisleri</i>	CN76: 002 Tara Valley Durmitor N.P. (transect 2), 3, DN01: 004 Vruja River Prokletije N.P., 2
13.	<i>Nyctalus</i> spp.	DN00: 005 Oko Skakavice, 1
14.	<i>E. serotinus</i>	CN76: 002 Tara Valley Durmitor N.P. (transect 2), 3, DN01: 004 Vruja River Prokletije N.P., 2
15.	<i>V. murinus</i>	DN01: 004 Vruja River Prokletije N.P., 2,
16.	<i>M. schreibersii</i>	CN10: 009 Cave near Risan, 16
17.	<i>R. hipposideros</i>	CN67: 010 Tara Valley Durmitor N.P. (near <i>R. hipposideros</i> roost), 8
18.	<i>R. euryale</i>	CN10: 009 Cave near Risan, 15

*Myotis daubentonii* is considered rare in Montenegro and has been found only once in this country prior to this research, near the Biogradsko Ozero (PRESETNIK et al. 2014, BUYS et al. 2016). It is a small bat species, hunting for insects (mostly non-biting midges of Chironomidae) on the surface of the water and from above the surface. In terms of environmental and nutritional preferences, as well as in terms of hunting style, it is a species very similar to the common in Southern Europe *M. capaccinii*. Both species are “trawling” or (to a lesser extent) aerial hunters, preferring riparian areas and calm waters (BISCARDI et al. 2007, SWIFT & RACEY 2009, DIETZ et al. 2009, ALMENAR et al. 2009, HÜGEL et al. 2017). *Myotis capaccinii* is considered common in Montenegro, where there are both summer and hibernating populations (MIRIĆ 1973 a, b, PAUNOVIĆ et al. 2004, 2010, Đurović 2011, Đurović et al. 2012, PRESETNIK 2012). In these studies, *M. capaccinii* was caught on the Vruja River, where there was a large multi-species community of bats hunting near the water (Table 1). The Daubenton’s bat was found more widely, wherever environmental conditions allowed, indicating that this species is more widespread in Montenegro than previously thought.

Due to the still insufficient level of research, many species of bats, including those potentially common (according to known geographical range and ecological needs), are still represented by a small number of points on the map of Montenegro. For example, *P. macrotis* was found by us in the Lovcen National Park, at high altitude (approx. 1500 m a.s.l.), the fourth location so far, and closest to the coast (Fig. 1). A colony of *R. euryale* (one of a few discovered yet, PRESETNIK et al. 2014) was found in a cave in the suburbs of Risan (Table 1). In addition to the *R. euryale*, the cave is inhabited by a colony of *M. schreibersii*. There is a water intake in the cave, which is a good resource for bats colonising the cave. *Myotis aurascens* (which is a synonym of *Myotis davidii* according to BENDA et al. 2016) was found during the netting on the Vruja River (Figure 1, Table 1), in the place where the largest number of bats was caught (*M. daubentonii* was also found there). Previously, *M. aurascens* was found by BENDA (2004) and then by JAZBEC (2006) in the north of the country (Stabna Area) and in the coastal region, respectively.

According to PRESETNIK et al. (2014), the most comprehensive study on the subject until now, “much more research effort is needed to record all bat species occurring in Montenegro, to assess their distribution status, and to identify their important habitats”. In our work during a relatively short pe-

riod of research, we managed to find 20 species of bats, in large part in previously unknown locations. This shows how great the potential of Montenegro is for research on bats and that a lot of basic fieldwork still remains to be done. Focusing on this problem is now advisable due to the Natura 2000 network for Montenegro being currently prepared, where certain bat species will be subject of protection.

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## Appendix 1

### Locations of bat observations in Montenegro on 20-31 August 2014:

(Data arrangement: UTM square: Number of the location: description of the location [latitude in °N, longitude in °E])  
**CN67: 001** Tara Valley, Durmitor N.P. (point/transect 1): near the river, close to the forest/hedges habitat [N 43°00'23.9" E 19°25'54.7"]. **CN76: 002** Tara Valley, Durmitor N.P. (point/transect 2): near the river, close to the water [N 43°08'16.37" E 19°18'7.04"]. **CN94: 003** on the border of Biogradska Gora N.P.: outside the National Park, near the small river [N 42°50'47" E 19°43'42,1"]. **DN01: 004** Vruja River Prokletije N.P.: near the bridge over the river, mostly riparian habitat [N 42°32'58,7" E 19°49'47,3"]. **DN00: 005** Oko Skakavice: river source pond, surrounded by small rocks and trees [N 42°30'42,35" E 19°50'5,85"]. **CN66: 006** Small cave near the road to Durmitor (Tara Valley) [N 43°01'27,6" E 19°23'54,4"]. **CM29: 008** Lovcen N.P.: open area, rocks, pastures [N 42°24'07" E 18°49'32"]. **CN10: 009** cave near Risan: medium cave with open water source inside, the close neighbourhood of the urban buildings [N 42°31'02,6" E 18°41'42,6"].

Locations of bat observations in Montenegro on 20-28 July 2015:

**CN66: 007** Tara Valley, Durmitor N.P. (forest netting site): higher above the water level, in the mountain beech forest habitat [N 43°0'45.77" E 19°23'53.03"]. **CN67: 010** Tara Valley Durmitor N.P. (near *R. hipposideros* roost): pastures, farmhouses. [N 43°9'19.95" E 19°17'40.88"].