

# Fauna of Bats (Mammalia: Chiroptera) from Sakar Mountain, South-Eastern Bulgaria

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**Abstract:** Data about the bat fauna in the region of Sakar Mountain are insufficient. In this study, information based on the visits of appropriate roosts and analyses of ultrasounds of bats is presented. The study covered four years (2009–2012) and a variety of unstudied habitats, mainly outside of karstic terrains. Totally, 20 bat species are recorded, six of them representing new records for this mountain. The habitat preferences, territorial distribution and relative activity are presented and discussed.

**Key words:** bats, Sakar Mountain, diversity, flight activity

## Introduction

Sakar is a low mountain situated in Eastern Upper Thracian Lowland in Bulgaria. An insignificant part of its territory falls in the most northwestern part of European Turkey. The mountain covers an area of about 1100 km<sup>2</sup> between the valleys of the rivers Maritsa and Tundzha. The highest peak is Vishegrad (856 m a.s.l.). In the periphery, especially in the southeast part, wide areas of Triassic and Jurassic limestones and sandstones are revealed, where as a result of karst processes natural caves have been formed. The climate is Continental-Mediterranean with pronounced autumn-winter maximum of precipitation and summer minimum.

Almost all the existing information concerning the presence of bats in Sakar Mountain is related to its south-eastern part, where the relatively extensive karst area with suitable underground roosts is situated. In this part BENDA *et al.* (2003) reported 10 bat species, of which only the Bechstein's bat (*Myotis bechsteinii*) is typical for the forest ecosystems and the other species are cave-dwelling. In 2003 PANDOURSKI and POPOV (personal data) registered two species using bat detector near the Monastery "Sveta Troitza", *Pipistrellus pipistrellus* and *Pipistrellus nathusii*. TILOVA *et al.* (2005) identified *Plecotus austriacus* and *Pipistrellus pipistrellus* inhabiting abandoned

buildings in the village of Sladun, and *Pipistrellus nathusii*, determined from pellets of the Barn Owl, *Tyto alba* (SCOPOLI, 1769), near the village of Studena. The project *Mapping and assessment of conservation status of habitats and species in Natura 2000 sites* (MOEW, 2011/13) gave information about two newly registered target Natura 2000 species: *Rhinolophus ferrumequinum* and *Myotis myotis*.

The aim of this work is to report new information about bat fauna diversity, their specific flight activity and habitat preferences in Sakar Mountain.

## Materials and Methods

The investigations were performed during 2009–2012 in variety of unstudied habitats, mainly outside of karstic terrains (Fig. 1) in selected points as well as by car or walking transects (Table 1).

Mist nets (16 mm mesh size) with length of 3 m, 6 m, 7 m, 10 m and 12 m were used. Direct observations of bats were performed in their roosts. Identification of species and the systematic determination follow PESHEV *et al.* (2004) and the field-guide of DIETZ & VON HELVERSEN (2004). All bats were released on the place of their capture, immediately after their identification.

**Table 1.** Points and transects of bats observation

<b>Points for mistnetting</b>			
<b>No</b>	<b>Locality</b>	<b>Coordinates</b>	<b>Dates</b>
(P1)	Manastirska river, around the Monastery „Sveta Troitsa”, near the village of Ustrem	N42° 02' 02.8" E26° 25' 50.6"	19/20.08.2011
(P2)	Forest cutting, near Vishegrad Peak	N41° 59' 20.5" E26° 19' 24.1"	19/20.08.2012
(P3)	Marsh near Vishegrad Peak	N41° 59' 18.0" E26° 19' 22.6"	19/20.08.2012
<b>Direct observations of bats in their roosts</b>			
(P4)	Rocky church near the village of Mihalich	N41° 51' 00.7" E26° 25' 29.7"	17.10.2009
(P5)	Rocky church neat the village of Sladun	N41° 50' 45.5" E26° 27' 31.4"	17.10.2009
(P6)	Military blockhouses, near the village of Shtit	N41° 51' 50.3" E26° 22' 08.3"	16.10.2009
(P7)	Military blockhouses, near the village of Shtit	N41° 51' 14.10" E26° 21' 54.95"	26.05.2010
(P8)	Military blockhouses, near to the“Golyamata zvezda”	N42° 00' 54.8" E26° 10' 42.0"	20.08.2011
(P9)	Cave “Babini bozki”, near the village of Mramor	N42° 01' 43.2" E26° 24' 31.4"	19.08.2011
<b>Points for bat calls registration</b>			
(P10)	Small dam near the village of Shtit	N41° 49' 44.0" E26° 22' 12.0"	09.06.2010
(P11)	Abandoned military blockhouses, near the village of Shtit	N41° 51' 55.2" E26° 22' 11.9"	16.10.2009
(P12)	Small dam near the village of Shtit	N41° 50' 44.2" E26° 22' 23.5"	08.06.2010
(P13)	Rocky formations near the village of Mihalich	N41° 51' 01.0" E26° 25' 30.0"	26.05.2010
(P14)	Open area near the village of Mihalich	N41° 51' 39.5" E26° 25' 05.6"	09.06.2010
(P15)	Open area around the Monastery „Sveta Troitza”, near the village of Ustrem	N42° 02' 02.0" E26° 25' 50.2"	19/20.08.2011
<b>Car and walking transects</b>			
(CT1)	Car transect from village of Mihalich to village of Shtit	starting point: N41° 51' 1.48" E26° 25' 30.04" end point: N41° 49' 29.42" E26° 21' 47.41"	9.91 km, 29.03.2010
(CT2)	Car transect from village of Shtit in the of village Sladun, to the village of Mihalich	starting point: N41° 49' 29.42" E26° 21' 47.41" end point: N41° 51' 1.48" E26° 25' 30.04"	14.5 km, 25.05.2010
(CT3)	Car transect from “Golyamata zvezda” (to the village of Bulgarska polyana	starting point: N42° 00' 40.1" E26° 11' 14.6" end point: N42° 01' 50.9" E26° 11' 56.1"	2.9 km, 30.09.2011

Table 1. Continued

(CT4)	Car transect from below the Vishegrad Peak to “Malkata zvezda”	starting point: N41° 59' 21.6" E26° 19' 58.5" end point: N42° 00' 55.5" E26° 18' 30.1"	5.4 km, 01.10.2011
(CT5)	Car transect from village of Planiniovo over the Vishegrad Peak, “Malkata zvezda”, ridge of Sakar, “Golyamata zvezda”, near village of Glavan	starting point: N41° 57' 25.3" E26° 22' 34.7" end point: N42° 00' 55.5" E26° 18' 30.1"	32 km, 28/29.04.2012
(WT1)	Walking transect near the village of Shtit	starting point: N41° 51' 44.9" E26° 22' 14.8" end point: N41° 50' 16.2" E26° 22' 24.4"	3.2 km, 30.03.2010
(WT2)	Walking transect near Visegrad Peak	starting point: N41° 59' 44.3" E26° 19' 30.7" end point: N41° 59' 10.0" E26° 19' 32.9"	2.6 km, 20.08.2011

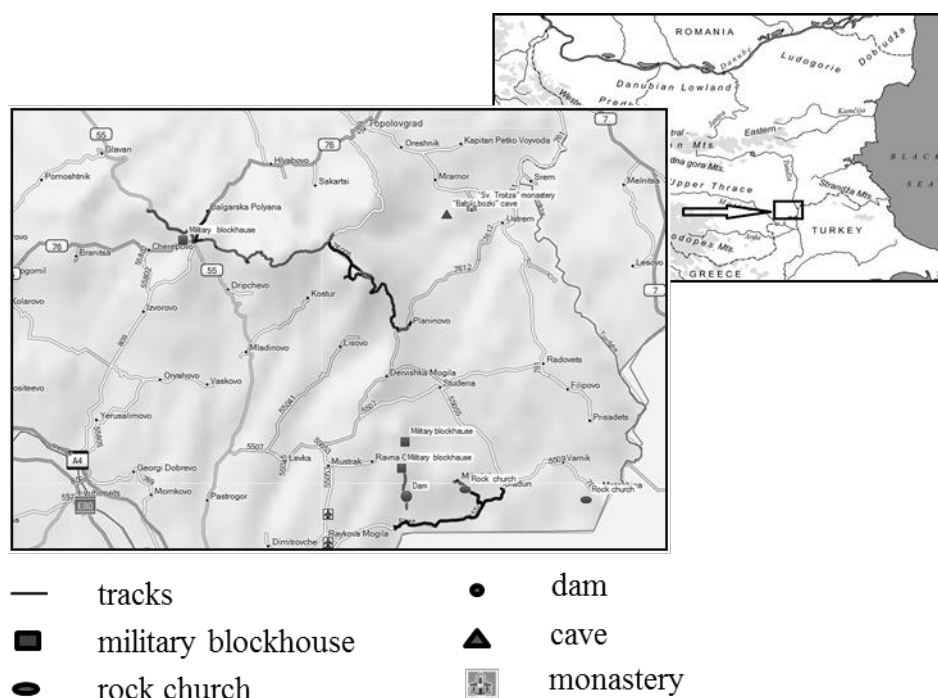


Fig.1. Map of study areas of bats in Sakar Mountain

Time expansion detectors (Pettersson D 240x and Tranquillity Transect bat detector) were used for registration of bat calls at selected points and during car or walking transects. The calls were recorded using “Olympus - PCM recorder LS-5” and “Transcend MP 860” audio recorders. The calls

were analyzed using BatSound 3.1 software for Windows with time expansion (x10). The frequency components were measured from the Fast Fourier Transform (FFT) power spectrum, size 512, hanning window. The following call parameters were measured: duration of separated pulses (ms), time

intervals between consecutive pulses (ms), frequency with the highest energy (kHz), highest and lowest frequencies (kHz).

The total length of transects is 70.510 km with 194 registered separate bat passes and covers predominantly mountain ridges and its surroundings.

## Results and Discussion

### Species composition and distribution

A total of 20 bat species are known till now from Sakar Mountain:

*Rhinolophus ferrumequinum* (SCHREBER, 1774).

Published and available data: BENDA *et al.* (2003), MOEW (2011/13). New data: (P4), (P5), (P6), (P7), (P8).

*Rhinolophus hipposideros* (BECHSTEIN, 1800).

Published and available data: BENDA *et al.* (2003), MOEW (2011/13). New data: (P8), (P9).

*Rhinolophus blasii* PETERS, 1866. Published data:

BENDA *et al.* (2003).

*Rhinolophus mehelyi* MATSCHIE, 1901. Published

data: BENDA *et al.* (2003).

*Rhinolophus sp.* New data: (P9).

*Myotis bechsteinii* (KUHLE, 1817). Published data:

BENDA *et al.* (2003).

*Myotis blythii* (TOMES, 1857). Published and available

data: BENDA *et al.* (2003), MOEW (2011/13). New data: (P4), (P8), (P13), (P15), (CT4), (CT5).

*Myotis capaccinii* (BONAPARTE, 1837). Published and

available data: BENDA *et al.* (2003), MOEW (2011/13). New data: (P4), (P13).

*Myotis emarginatus* (E. GEOFFROY, 1806). Published

data: BENDA *et al.* (2003). New data: (P8), (P13).

*Myotis myotis* (BORKHAUSEN, 1797). Available data:

MOEW (2011/13). New data: (P4), (P8), (P13), (P15), (CT4), (CT5).

*Myotis nattereri* (KUHLE, 1817). New data: (P8),

(P15).

*Myotis sp.* 45 kHz phonetic type. New data: (P15),

(CT5).

*Plecotus austriacus* (FISCHER, 1829): Published data:

TILOVA *et al.* (2005). New data: (P9).

*Barbastella barbastellus* (SCHREBER, 1774). New

data: (CT5).

*Nyctalus leisleri* (KUHLE, 1817). New data: (P15),

(CT5).

*Nyctalus noctula* (SCHREBER, 1774). New data:

(P13), (P15), (CT5), (WT1).

*Miniopterus schreibersii* (KUHLE, 1817). Published

data: BENDA *et al.* (2003), MOEW (2011/13). New data: (P10), (P12), (P15), (CT1), (CT2), (CT3), (CT4), (CT5).

*Pipistrellus pipistrellus* (SCHREBER, 1774). Published

and available data: TILOVA *et al.* (2005), PANDOURSKI, &

POPOV (personal observations). New data: (P10), (P12), (P13), (P14), (P15), (CT2), (CT3), (CT4), (CT5), (WT2).

*Pipistrellus kuhlii* (KUHLE, 1817). New data: (CT3), (CT4), (CT5).

*Pipistrellus nathusii* (KEYSERLING & BLÄSIUS, 1839).

Published and available data: BENDA *et al.* (2003), TILOVA *et al.* (2005), PANDOURSKI & POPOV (personal data). New data: (P10), (P12), (CT3), (CT4), (CT5).

*Hypsugo savii* (BONAPARTE, 1837). New data: (P1),

(P13), (P15), (CT2), (CT5).

*Eptesicus serotinus* (SCHREBER, 1774). Published data: BENDA *et al.* (2003). New data: (P14), (P15), (CT5), (WT1).

Presence and activity of bats in different habitats

#### Natural and artificial underground roosts:

Visited military blockhouses (P6, P7 and P8), rocky churches (P4 and P5) and the cave “Babini bozki” (P6) offer suitable daily roosts during the summer period for most of 9 observed species. Four species (*Rhinolophus ferrumequinum*, *Rhinolophus hipposideros*, *Myotis myotis* and *M. blythii*) have been registered with single specimens or in small groups reaching 8-9 individuals during the reproductive period of 2010.

**Rocky formations:** Our observations with bat detectors near isolated rocky formations (especially near the village of Mihalich – P13) revealed high flying activity of four species: *Myotis capaccinii*, *Hypsugo savii*, *Nyctalus noctula* and *Eptesicus serotinus*. *Myotis emarginatus* was registered only with a single passing individual.

**Open steppe terrains and shrubs:** The presence and flight activity of bats in this habitat depend mainly on surrounding environment, i.e. existence of roosts, forested areas, wetlands, etc. We cannot identify separate dominant species among the six registered: *Pipistrellus kuhlii*, *Pipistrellus nathusii*, *P. pipistrellus*, *Nyctalus noctula*, *Eptesicus serotinus* and *Miniopterus schreibersii*.

**Mosaic habitat near the Monastery “Sveta Troitza” (P1 and P15) formed by grassland, shrubs, isolated groups of trees, running water and rocky formation:** This relatively rich bat community includes 10 species: *Myotis blythii*, *Pipistrellus pipistrellus*, *P. nathusii*, *Nyctalus noctula*, *N. leisleri*, *Miniopterus schreibersii*, *Hypsugo savii*, *Myotis myotis*, *M. nattereri* and *Eptesicus serotinus*.

**Wetlands:** Three species have been registered above water surface of small dams near the village of Shtit. Two of them (*Pipistrellus pipistrellus* and *P. nathusii*) show relatively high flying activity, with 50 passes per hour in June 2010. The presence of *Miniopterus schreibersii* is probably occasional, with single hunting individuals.

**Forested habitats:** Only short segments of car transects pass through forest areas where one flying individual of *Barbastella barbastellus* have been registered (CT5).

In the summarizing article of BENDA *et al.* (2003) on the distribution of bats in Bulgaria, all known localities of bats in Sakar Mt. are concentrated in the karstic area near the village of Ustrem or in the valley of Tundzha river.

At two points (P2 and P3) we have not captured any bats.

During our study predominantly in the central and southern silicate parts of the mountain, six bat species are recorded for the first time in the Sakar Mountain: *Myotis nattereri*, *Hypsugo savii*, *Pipistrellus kuhlii*, *Nyctalus noctula*, *N. leisleri* and *Barbastella barbastellus*. For other eleven species, we give newly established roost or localities with flight activity: *Rhinolophus ferrumequinum* – 1, *Rhinolophus hipposideros* – 2, *Myotis capaccinii* – 1, *M. blythii* – 4, *M. emarginatus* – 2, *M. myotis* – 3, *Miniopterus schreibersii* – 4, *Eptesicus serotinus* – 2, *Plecotus austriacus* – 1, *Pipistrellus pipistrellus* – 3 and *P. nathusii* – 3 localities.

The seasonal dynamics of bats have been studied during 2009–2010 in the southern part of the mountain. Only five species have been registered during the autumn migration of 2009, as three of them probably form local populations: *Rhinolophus ferrumequinum*, *Rhinolophus hipposideros* and *Myotis myotis*. The spring migration of 2010 is characterized

by the flight activity of eight species, as *Pipistrellus pipistrellus* is the most numerous. During the reproductive period (May–June 2010), six species have been registered.

## Conclusions

In the present study, we have summarized all available information on bats in Sakar Mt., comprising 20 species or 60% of the Bulgarian chiropteran fauna. The use of ultrasound detectors for identification of bats has many advantages and gives much more information than the classical methods of direct observation or mistnetting (AHLÉN & BAAGØE 1999). Applying this method, six (mainly forest-dwelling) bat species have been registered for the first time in the studied area.

According to the biogeographical analysis of Bulgarian Chiropteran fauna (BENDA *et al.*, 2003), two species can be considered “largely boreal” by occurrence throughout their European ranges: *Barbastella barbastellus* and *Myotis nattereri*. As “Mediterranean” species, the following group of species can be considered: *Pipistrellus kuhlii*, *Hypsugo savii*, *Rhinolophus* spp., some *Myotis* spp., *Miniopterus schreibersii* and *Plecotus austriacus*. A separate group comprises migratory species: *Pipistrellus nathusii* and two *Nyctalus* spp.

The established bat community in Sakar Mt. shows high similarity with those in Danube lowland in Bulgaria, where karstic areas, open farmland, shrubs and forested areas form the landscape.

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