



## DATA ON THE SUMMER BAT FAUNA OF BELARUS IN 2017–2020

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### Abstract

This report presents the results of the bat fauna survey carried out in Belarus during the warm seasons between 2017 and 2020. The presented data were collected in 31 localities in all six administrative regions (voblasts) of Belarus during field studies (mist-netting, searching for roosts and colonies, and acoustic surveys) and in the course of the work of the Minsk bat contact centre. Field data refer to 26 localities; acoustic observations to 14 localities; and netting was carried out in 19 localities (151 ind.). The data on bats collected via the contact centre came from 6 localities (35 ind.). In the course of our survey, we recorded 13 out of the 19 species of the Belarusian bat fauna. They are *Barbastella barbastellus*, *Eptesicus nilssonii*, *E. serotinus*, *Myotis dasycneme*, *M. daubentonii*, *Nyctalus lasiopterus*, *N. leisleri*, *N. noctula*, *Pipistrellus kuhlii*, *P. nathusii*, *P. pygmaeus*, *Plecotus auritus*, and *V. murinus*. The occurrence of all recorded species was confirmed by direct identification. Data on breeding have been added for all recorded species except for *N. lasiopterus* and *B. barbastellus*. Data on breeding have been added for all recorded species, except for *N. lasiopterus* and *B. barbastellus*. Maternity colonies were recorded for *E. serotinus*, *M. dasycneme* (the second record of a maternity colony of the species for the entire period of research in Belarus) and *M. daubentonii*. The largest number of individuals recorded by the contact centre represent *V. murinus*; other species in descending order are *E. serotinus*, *N. noctula*, *P. auritus*, *P. nathusii*, *B. barbastellus*, *M. daubentonii*, *P. kuhlii*, and *E. nilssonii*. Among the netted individuals, *P. nathusii* prevailed; other species in descending order were *M. daubentonii*, *P. pygmaeus*, *E. nilssonii*, *P. auritus*, *N. noctula*, *E. serotinus*, *M. dasycneme*, *N. leisleri*, and *N. lasiopterus*. Three species (*V. murinus*, *B. barbastellus*, and *P. kuhlii*) were presented only among bats reported via the contact centre. During the survey, the species *P. pipistrellus*, *Pl. austriacus*, *M. brandtii*, *M. nattereri*, *M. myotis*, and *M. mystacinus* included in the list of mammal species of Belarus were not recorded. The reasons of the lack of records of these six species are discussed. The collected data contribute to the general knowledge on the distribution, breeding, and status of bat species in Belarus and Eastern Europe.

### Cite as

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## Дані про літню фауну рукокрилих Білорусі за 2017–2020 роки

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Резюме. У роботі представлено результати обстеження рукокрилих фауни Білорусі в теплий період 2017–2020 років. Наведені дані зібрані в 31 пункті в межах усіх шести адміністративних областей Білорусі: під час польових робіт (відлов за допомогою павутинних сіток, пошук сховищ та колоній, детекторні спостереження) та роботи Мінського контактного центру рукокрилих. Польові роботи проходили в 26 пунктах, акустичні спостереження — в 14; відлови проводили в 19 пунктах (151 кажанів). Дані про кажанів, зібрані через контактний центр, надходили з шести пунктів (35 кажанів). За час дослідження було зафіксовано 13 з 19 видів рукокрилих фауни Білорусі: *Barbastella barbastellus*, *Eptesicus nilssonii*, *E. serotinus*, *Myotis dasycneme*, *M. daubentonii*, *Nyctalus lasiopterus*, *N. leisleri*, *N. noctula*, *Pipistrellus kuhlii*, *P. nathusii*, *P. pygmaeus*, *Plecotus auritus* та *Vespertilio murinus*. Видову приналежність всіх зареєстрованих видів визначено контактено. Доповнено дані про розмноження всіх зареєстрованих видів, окрім *N. lasiopterus* і *B. barbastellus*. Материнські колонії зареєстровано для: *E. serotinus*, *M. dasycneme* (друга знахідка материнської колонії виду за увесь період досліджень в Білорусі) та *M. daubentonii*. Найбільша кількість особин кажанів, зареєстрованих контактним центром, належала до *V. murinus*; інші види, в порядку спадання: *E. serotinus*, *N. noctula*, *P. auritus*, *P. nathusii*, *B. barbastellus*, *M. daubentonii*, *P. kuhlii* та *E. nilssonii*. Серед відловлених кажанів, за кількістю особин, переважав *P. nathusii*, інші види в порядку спадання чисельності: *M. daubentonii*, *P. pygmaeus*, *E. nilssonii*, *P. auritus*, *N. noctula*, *E. serotinus*, *M. dasycneme*, *N. leisleri*, *N. lasiopterus*. Три види (*V. murinus*, *B. barbastellus* та *P. kuhlii*) були зареєстровані лише контактним центром. В ході дослідження, нами не було виявлено шість видів рукокрилих фауни Білорусі: *P. pipistrellus*, *P. austriacus*, *M. brandtii*, *M. nattereri*, *M. myotis* та *M. mystacinus*. Розглянуто причини відсутності знахідок цих видів. Зібрані дані є доповненням до відомостей про поширення, розмноження та стан видів кажанів у Білорусі і Східній Європі в цілому.

Ключові слова: рукокрилі, фауна, поширення, розмноження, Білорусь, Східна Європа.

### Introduction

The bat fauna of Belarus is currently represented by 19 species [Shpak 2017a], which is about 25% of the mammal fauna of the country [Savicky *et al.* 2005]. Eight species are listed in the Red Data Book of Belarus (2015). All species are included in Annex II of the Convention on the Conservation of Migratory Species of Wild Animals and the Bern Convention on the Conservation of European Wildlife and Natural Habitats. These treaties were signed by Belarus and thus all bat species in Belarus as well as their habitats are subject to protection.

At the same time, effective conservation is impossible without a clear understanding of the geographical distribution of species and their status.

The survey of the bat fauna in Belarus started in the 1920s [Fiadziushyn 1927] in the context of the study of the fauna on the whole. In 1955, the first review of bat fauna was published as a section of the monograph ‘Mammals of the Byelorussian SSR’ [Serzhanin 1955]. However, a special monograph devoted to bats of Belarus was published only in 1981 [Kurskov 1981]. This book contained a review of all data on bats of Belarus available for that time, the biggest portion of which however referred to the south-west of Belarus (Brest Voblasć). In the following decades, the bat fauna was also studied mainly within the south-west of Belarus [Demianchuk 2001; Demianchuk & Demianchuk 2008; Dietz *et al.* 2018]. In the early 2000s, bat surveys started in other regions of Belarus. In particular, results of several studies of the species composition and ecological traits of bats inhabiting several protected territories have been published recently, including the Prypiacki National Park, the Stary Žaden Reserve, the Palieski Radiation-Ecological Reserve [Dombrovski & Bolotina 2014; Dombrovski *et al.* 2016; 2018], and the Naračanski National Park [Larchanka *et al.* 2020].

Results of bat studies recently carried out in different voblasćs, including protected territories and Minsk city, are also available [Shpak 2006; Savarin 2008; Larchanka & Shpak 2018]. Addition-

ally, some data were presented by A. Shpak, V. Dombrovski with colleagues, A. Kashtalian, G. Pettersons, and V. Vintulis at many conferences and published in conference proceedings.

Nevertheless, the current data on the bat fauna of Belarus, including its status and distribution, are still quite incomplete, especially for the central and northern parts of the country. The aim of this article is to present previously unpublished data on bat records and observations during the warm seasons of 2017–2020 across various regions of Belarus.

## Materials and Methods

The presented data were collected in 31 study localities in all six administrative regions (voblasćs) of Belarus (Fig. 1). The presented data correspond to two categories.

1) Field data collected in the summers of 2017, 2019, and 2020 in the territory of all six voblasćs of Belarus. We used the following set of methodical outlines for our fieldwork. Animals were captured by mist-nets. Ultrasonic detectors (Pettersson Elektronik D-200, D-240, and Wildlife Acoustics Echo Meter Touch 2 Pro) were used for acoustic survey. The analysis of bat call records was carried out using BatSound v.3 software. Searching for roosts was conducted during the examination of potential bat shelters by recording night/morning swarming and signs of bats presence (faeces, social sounds *etc.*).

2) Data collected by calls to the Minsk bat contact centre [Shpak 2018] during the conditionally warm period of the year, from 1 April to 1 October. These records concern bats identified by us directly or based on photos of sufficient quality.

In total, field data refer to 26 localities; acoustic observations to 14 localities; and netting was carried out in 19 localities (151 individuals). The data on bats collected via the contact centre come from 6 localities (35 individuals).

*Geographical terms.* Paliessie is the geographical region covering the entire southern part of Belarus, northern Ukraine, as well as the adjacent regions of Russia and Poland. In this article, we use this name for the designation of southern Belarus (Brest and Homiel voblasćs). Each locality in the lists of records is described mostly as follows: locality No.—coordinates; administrative region (voblasć), district (raion), (the nearest) settlement.

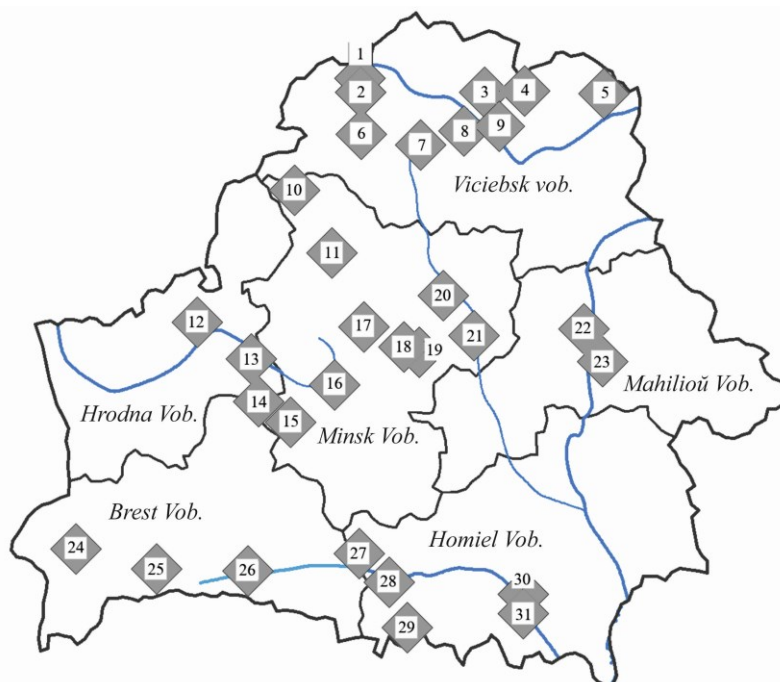


Fig. 1. Study localities. Numbers correspond to those in the lists of species records.

Рис. 1. Пункти дослідження. Номери відповідають номерам у списках реєстрацій видів.

Toponyms and names of territorial administrative units were transcribed according to the National System of Geographic Names Transmission into Roman Alphabet in Belarus (2007). Voblasć is the largest unit of administrative division in Belarus. There are six voblasćs: Brest, Homiel, Hrodna, Mahilioŭ, Minsk, and Viciebsk. Voblasćs are further divided into districts called rajons. These units are abbreviated in the text as ‘Vob.’ and ‘Raj.’.

*Localization of protected areas mentioned in the text (coordinates are given by the administrative centres of the areas):* Biarezinski Biosphere Reserve—54.742 N, 28.308 E, Minsk and Viciebsk voblasćs; Bielaviežskaja Pušča National Park—52.569 N, 23.803 E, Brest and Hrodna voblasćs; Stary Žaden Reserve—51.913 N, 27.599 E, Homiel Voblasć.

*Used abbreviations:* ne, netting; sh, shelter; ne/sh, netting near or in a shelter; de, detector observations; ci, contact identification of a bat reported via the contact centre; ph, identification by photos reported via the contact centre; gr, found on the ground outside of buildings; ia, found inside of buildings.

*Sex and age:* M, male; F, female (F-repr, breeding female; F-nrepr, non-breeding female); U, unknown sex; ad, adult; juv, juvenile ( $\leq 3$  months). Records of dead animals are given in square brackets, e.g. [3Ujuv].

*List of study localities* (see map on Fig. 1):

• 1—55.695 N, 27.497 E; Viciebsk Vob., Miory Raj., Asada Dziedzina; • 2—55.592 N, 27.506 E; Viciebsk Vob., Miory Raj., Sumaŭka Lake; • 3—55.592 N, 29.031 E; Viciebsk Vob., Polack Raj., near Novaja Palata; • 4—55.602 N, 29.521 E; Viciebsk Vob., Polack Raj., near Fiodaraŭka, Svina river valley; • 5—55.585 N, 30.493 E; Viciebsk Vob., Haradok Raj., Ciosta Lake; • 6—55.288 N, 27.512 E; Viciebsk Vob., Šarkaŭščyna Raj., Biarozaŭka river valley; • 7—55.211 N, 28.244 E; Viciebsk Vob., Hlybokaje Raj., Šo Lake; • 8—55.311 N, 28.779 E; Viciebsk Vob., Polack Raj., between Dalieckija and Plusy, Suja Lake; • 9—55.347 N, 29.207 E; Viciebsk Vob., Šumilina Raj., Hrudzinava; • 10—54.881 N, 26.699 E; Minsk Vob., Miadziel Raj., Narač Lake, Naračanski National Park; • 11—54.424 N, 27.157 E; Minsk Vob., Viliejka Raj., Viazyń; • 12—53.922 N, 25.506 E; Hrodna Vob., Lida Raj., Bierdaŭka; • 13—53.654 N, 26.168 E; Hrodna Vob., Navahrudak Raj., Ščorsy; • 14—53.345 N, 26.258 E; Brest Vob., Baranavičy Raj., Palaniečka; • 15—53.198 N, 26.650 E; Minsk Vob., Niasviž Raj., near Niasviž; • 16—53.467 N, 27.191 E; Minsk Vob., Uzda Raj., Uzda; • 17—53.890 N, 27.544 E; City of Minsk (different sites); • 18—53.742 N, 28.037 E; Minsk Vob., Smilavičy Raj., near Žuraŭkovičy, Volma river valley; • 19—53.703 N, 28.231 E; Minsk Vob., Červieŭ Raj., near Klinok, Volma river valley; • 20—53.827 N, 28.901 E; Minsk Vob., Bierazino Raj., Bierazino; • 21—54.115 N, 28.525 E; Minsk Vob., Barysaŭ Raj., Barysaŭ; • 22—53.874 N, 30.245 E; City of Mahilioŭ; • 23—53.635 N, 30.478 E; Mahilioŭ Vob., Byhaŭ Raj., Hrudzinaŭka; • 24—52.278 N, 24.016 E; Brest Vob., Žabinka Raj., Sieliščy; • 25—52.129 N, 25.002 E; Brest Vob., Drahichyn Raj., Zakaziel; • 26—52.117 N, 26.124 E; Brest Vob., Pinsk Raj., near Pinsk; • 27—52.241 N, 27.487 E; Brest Vob., Luniniec Raj., near Mikaševičy; • 28—52.034 N, 27.855 E; Homiel Vob., Žytkavičy Raj., near Aziarany; • 29—51.702 N, 28.078 E; Homiel Vob., Lielčycy Raj., near Baravoje, Ubarč river valley; • 30—51.947 N, 29.503 E; Homiel Vob., Kalinkavičy Raj., near Juravičy, Ličvin Lake; • 31—51.804 N, 29.504 E; Homiel Vob., Narouŭlia Raj., Narouŭlia.

## Results and Discussion

During the survey, we have recorded 13 out of the 19 species of the Belarusian bat fauna.

***Barbastella barbastellus* (Schreber, 1774).** The species is rare in Belarus [Serzhanin 1961; Kurskov 1981], therefore in 1981 *B. barbastellus* was included in the first edition of the Red Data Book of Belarus (RDB) [1981] and now has conservation category EN of RDB [2015].

Until recently, data on the distribution of this species have been limited to the south-western regions (Brest Voblasć) of Belarus [Serzhanin 1961; Kurskov 1981; Demianchyk & Demianchyk 2008]. In 2011–2012, the species was first revealed in the western [Dombrovski & Bolotina 2014] and, in 2016–2017, in the eastern part of Homiel Voblasć; in 2019, in Minsk Voblasć [Shpak & Mi-khailau 2021]. In 2020, in the course of the bat winter census in underground hibernacula of Belarus the species was recorded in Brest, Homiel, Hrodna, Mahilioŭ, and Minsk voblasćs. (Shpak et al. unpubl.). The breeding was confirmed only for the south and south-west of Belarus [Kurskov 1981;

Demianchyk & Demianchyk 2008; Dietz *et al.* 2018]. Maternity colonies were only recorded in Brest Voblasć [Demianchyk & Demianchyk 2008; Dietz *et al.* 2018].

During the summer period, we have found *B. barbastellus* only in one study locality. No breeding was recorded.

- 17—22.08.2019, ci (gr): 1Mad.

***Eptesicus nilssonii* (Keyserling & Blasius, 1839).** The species was included in the RDB [1993] and currently [Red... 2015] its status is assessed as Near Threatened (NT).

The occurrence of *E. nilssonii* was first revealed in Belarus in 1934 in the Biarezinski Biosphere Reserve [Serzhanin 1961]. Later, the species was recorded in five voblasćs of Belarus, all except for Mahilioŭ [Kurskov 1981; Demianchyk 2001; Larchanka *et al.* 2020; Shpak unpublished]. Almost all records were presented by single individuals, except for the observation of a ‘hunting colony’ in Brest Voblasć, in Bielaviežskaja Pušča [Kurskov 1981]. In 2015, a maternity colony of this species was found for the first time [Dietz *et al.* 2018]. Breeding of the species was recorded in Brest [Kurskov 1981; Dietz *et al.* 2018] and Homiel voblasćs [Dombrovski *et al.* 2017].

During our survey in the warm period of the year, we have recorded *E. nilssonii* in eight study localities in three voblasćs: Viciebsk, Hrodna, and Minsk. Breeding of the species was confirmed in Hrodna and Minsk voblasćs. The maximum number of captured animals per netting site was four individuals. No roosts were found. Records were mostly by netting or acoustic signs. One juvenile individual (from Minsk Voblasć) was reported by the contact centre.

- 2—17.07.2020, de; • 3—15.07.2020, de; • 5—12.07.2020, de; • 7—16.07.2020, de, ne: 4 (2Fad, 2Mad);
- 8—15.07.2020, de; • 10—20.06.2017, ne: 4Fad; 12.09.2017, ne: 1Mad; • 12—01.07.2019, ne: 1Fjuv;
- 17—26.04.2019, de; 08.05.2019, de; 17.06.2019, de; 02.08.2019, de; 09.08.2019, de; 10.08.2019, de; 25.08.2019, de; 01.09.2019, de; 17.08.2020, ci (gr): 1Fjuv (in the outskirts of Minsk City).

***Eptesicus serotinus* (Schreber, 1774).** The serotine bat is included in the Annotated list of species of the RDB of Belarus [2004] as one that requires additional study and attention for its preventive protection, currently with the DD (Data deficient) category.

Nikolski [1899] mentioned the species for Paliessie as a fairly common species. Semenov *et al.* [1905] pointed out that in ‘Minsk Paliessie’ this species is quite common in settlements. Kurskov [1981], based on the results of observations over a period of more than 25 years, stated that *E. serotinus* in Belarus is ‘a rather rare species.’ The largest museum collection of bats in Belarus (Zoological Museum of the Belarusian State University) contains only 10 specimens of the serotine bat, which is 4.4% of the total number of bat specimens [Godlevska & Shpak 2020]; all specimens but one were collected in the south-west part of Belarus. Demianchyk & Demianchyk [2008] claim that it is ‘common and relatively abundant’ in Belarus, however provide no factual data to support this statement.

Breeding of the species was known before for Brest Voblasć. For the first time, it was recorded in the late 1950s in Bielaviežskaja Pušča by Kurskov [1981]. This author presented data on two maternity colonies. In 2009–2013, the species was also found breeding in Brest Voblasć by Demianchyk [2013]. During the warm period of the year, we have recorded *E. serotinus* in five voblasćs: Brest, Homiel, Minsk, Hrodna, and Viciebsk. We revealed the breeding of the species in three voblasćs: Brest, Grodno, and Minsk, including two maternity colonies found in attics of churches in Brest Voblasć.

- 3—15.07.2020, de; • 7—16.07.2020, de; • 8—15.07.2020, de; • 11—02.07.2019, de; • 12—01.07.2019, ne: 4 (3Frepr, 1Mad); • 14—30.06.2019, sh, de + vo, maternity colony in a church attic; • 16—19.07.2017, ph (ia): 1Ujuv; • 17—18.08.2017, ci (ia): 1Mad; 24.04.2019, ph: 1U; 30.05.2019, de; 16.06.2019, de; 18.06.2019, de; 25.08.2019, de; 27.08.2019, de; 16.09.2019, ci (ph): 1U; 30.09.2019, ci (ph): 1U; 02.07.2020, ci (ia): 1Mad; • 20—13.05.2019, ph: 1U; • 25—29.06.2019, de; sh: 1U in an abandoned building; sh: maternity colony in the attic of a church with a crypt; • 26—11.04.2017, ph: 1U;
- 30—28.06.2019, de.

***Myotis dasycneme* (Boie, 1825).** *M. dasycneme* was included in the RDB in 1993 and currently [Red... 2015] has conservation category Endangered (EN).

The first documented record of the species refers to 1929 [Kurskov 1981]. Although, before, this species, without exact locality and details, was mentioned in the geographical description of the Upper Dnieper region and (Eastern) Belarus [Semenov *et al.* 1905]. In 1929–1973, there were only five records of the species: four single individuals (Hrodna and Viciebsk voblasćs; Biarezinski Biosphere Reserve) and a maternity colony in the attic of an old brick school building in Viciebsk Voblasć (55.526 N, 29.966 E), on 24 June 1973 [Serzhanin 1961; Kurskov 1981]. New records concern the 2000s. The species was revealed in Brest Voblasć [Demianchyk & Demianchyk 2008], in Minsk Voblasć [Larchanka *et al.* 2020], and in Viciebsk City in between window frames (n = 1, 03.12.2018) [Shpak unpublished], as well as acoustically in Brest, Homiel, and Viciebsk voblasćs [Dombrovski & Bolotina 2014; Dietz *et al.* 2018]. Breeding of the species was recorded in Brest [Demianchyk 2013], Viciebsk [Serzhanin 1961; Kurskov 1981], and Minsk voblasćs [Larchanka *et al.* 2020]. Haarsma *et al.* [2010] mentioned a ‘summer colony’ in Brest Voblasć, but without details.

We have recorded the pond bat only in a few points of Brest, Hrodna, and Minsk voblasćs (in 4 of 31 examined localities). In total, among the netted animals, there were only three individuals of *M. dasycneme* (Fig. 2). A maternity colony of the species was revealed in the attic of an abandoned building in Hrodna Voblasć. This is the second record of a maternity colony of the species for the entire period of bat research in Belarus.

• 10—20.06.2017, ne: 1Fad; • 13—01.07.2019, sh: maternity colony of several dozens of specimens [+3Ujuv] in the attic of an abandoned building of a manor; • 17—30.05.2019, de; 13.06.2019, de; 16.06.2019, de; 27.08.2019, de; • 27—21.08.2017, ne: 2 (1Fad, 1Mad).

***Myotis daubentonii* (Kuhl, 1817).** Daubenton’s bat have been repeatedly observed in all voblasćs of Belarus since the middle of the 19th century. Serzhanin [1961], Kurskov [1981], and Demianchyk [2008] considered it as a relatively abundant and widespread species of the bat fauna.

The breeding of the species was recorded in Brest [Kurskov 1981; Demianchyk 2013] and Minsk voblasćs [Larchanka *et al.* 2020]. Maternity colonies were found in Brest Voblasć [Kurskov 1981; Demianchyk & Demianchyk 2008].

We have recorded *M. daubentonii* in all voblasćs of Belarus. One maternity colony was found in gaps between the concrete beams of a bridge in Minsk Voblasć. The breeding of the species was confirmed in Minsk, Hrodna, Mahilioŭ, and Brest voblasćs.

• 3—15.07.2020, de; • 4—14.07.2020, de; • 5—12.07.2020, de; • 7—16.07.2020, de; • 8—15.07.2020, de; • 11—02.07.2019, ne: 7 (1Mad, 3Mjuv, 1Fad-nrepr, 2Fjuv); • 12—01.07.2019, ne: 4 (1Mad, 2Fjuv, 1Mjuv); • 17—20.05.2019, ci (gr): 1Mad; 18.06.2019, de; • 18—06.07.2019, maternity colony, 3 clusters, ≥15 ind. in a bridge; • 19—06.07.2019, de; • 23—04.07.2019, ne: 1Fjuv; • 25—29.06.2019, ne: 1Mjuv; • 27—21.08.2017, ne: 13 (10 Fad, 3 Mad); • 27—22.08.2017, ne: 2Mad; • 30—28.06.2019, de.

***Nyctalus lasiopterus* (Schreber, 1780).** For a long time, information about the distribution of the greater noctule bat in Belarus had been limited to a single find in 1930 in Homiel Voblasć [Serzhanin 1961]. In 1981, *N. lasiopterus* was included in the first edition of RDB [1981] with Category II of conservation significance (corresponds to the EN category of IUCN). Due to the absence of records for a long time, this species was excluded from the last edition of RDB [2015].

However, 85 years after the first and only record, in 2015, a maternity colony of *N. lasiopterus* was found in Homiel Voblasć (Stary Žaden Reserve) by Dombrovski *et al.* [2016]. In 2016, these researchers carried out a large-scale acoustic survey at 58 sites in southern Belarus on 350 kilometres from west to east. As a result, calls of *N. lasiopterus* were recorded exclusively in the immediate vicinity of the site of the first find (data presented by Dombrovski and colleagues on the International Berlin Bat Meeting, 2017).

We have netted one male of *N. lasiopterus* above the water surface of the Ubarć River in Homiel Voblasć (51.70 N, 28.07 E). The distance to the Stary Žaden Reserve is about 36 km. It allows us to suggest that our record concerns the revealed species locality in Stary Žaden.

- 29—22.08.2017, ne: 1M.

***Nyctalus leisleri* (Kuhl, 1817).** Leisler's bat has been considered as a fairly rare species since the beginning of systematic zoological research in Belarus [Serzhanin 1961; Kurskov 1981]. Respectively, it was included in the RDB in 1993 and currently has the conservation category 'Vulnerable' (VU) [Red... 2015].

Earlier, the species was recorded in all voblasćs except Mahilioŭ [Serzhanin 1955; Kurskov 1961]. The obvious facts of breeding of the species were noted only in Brest and Homiel voblasćs [Serzhanin 1955; Kurskov 1981; Demyanchyk & Demianchyk 2008]. Maternity colonies were recorded only in Bielaviežskaja Pušča [Kurskov 1981; Demianchyk & Demianchyk 2008; Dietz *et al.* 2018].

We have found the species in three study localities, in Viciebsk and Homiel voblasćs. Its breeding was confirmed in Homiel Voblasć.

- 3—15.07.2020, de; • 8—15.07.2020, de; • 28—22.08.2017, ne: 2 (1Fad, 1Fjuv).

***Nyctalus noctula* (Schreber, 1774).** The noctule bat is one of the relatively abundant and widespread species of bats in Belarus [Kurskov 1981; Demianchyk & Demianchyk 2008]. Breeding of the species has been recorded in all voblasćs [Kurskov 1981; Shpak, unpublished].

We have observed this species in all administrative regions of Belarus, except for Mahilioŭ voblasć. The breeding of the species was confirmed in Viciebsk, Minsk, Hrodna, and Brest voblasćs.

- 2—17.07.2020, de; • 3—15.07.2020, de; • 7—16.07.2020, de; • 8—15.07.2020, ne: 3 (1Fad preg., 1Fad, 1Mad), de; • 11—02.07.2019, ne: 2 (1Mjuv, 1Fjuv), de; • 12—01.07.2019, ne: 2 (1Fjuv, 1Frepr); • 14—30.06.2019, de; • 15—30.06.2019, ne: 1Mjuv; • 17—17.04.2019, ci (gr): 1Fad; 25.04.2019, ph (gr): 1U; 26.04.2019, de; 28.04.2019, ph (gr): 1U; 08.05.2019, de; 04.06.2019, de; 13.06.2019, de; 16.06.2019, de; 17.06.2019, de; 02.08.2019, de; 06.08.2019, de; 09.08.2019, de; 13.08.2019, de; 19.08.2019, de; 23.08.2019, de; 25.08.2019, de; 26.08.2019, de; 30.08.2019, de; 01.09.2019, de; 08.09.2019, de; • 19—06.07.2019, de; • 24—20.08.2017, ph (gr): 1U; • 25—29.06.2019, de; gr: 1Ujuv; • 30—28.06.2019, de.

***Pipistrellus kuhlii* (Kuhl, 1817).** Kuhl's pipistrelle is a new species in the Belarusian fauna. Wintering individuals were first recorded in Brest in 2013 [Demianchyk 2013] and later in Homiel (2015) and Minsk (2017) voblasćs [Shpak & Larchanka 2016]. Breeding of the species was recorded in Brest Voblasć [Demianchyk 2013].

In the course of our work, we have recorded one juvenile specimen in Minsk Voblasć.

- 21—16.08.2019, ci (gr): 1Fjuv.

***Pipistrellus nathusii* (Keyserling & Blasius, 1839).** The species is relatively abundant and widespread [Kurskov 1981; Demianchyk & Demianchyk 2008; Shpak 2017]. Its breeding was recorded before in Brest, Minsk, Viciebsk, and Homiel voblasćs [Kurskov 1981; Dombrovski *et al.* 2017; Godlevska & Shpak 2020; Larchanka *et al.* 2020]. Maternity colonies were recorded in Brest [Kurskov 1981; Dietz *et al.* 2018] and Minsk voblasćs [Godlevska & Shpak 2020; Larchanka *et al.* 2020].

We have recorded this species in all voblasćs of Belarus. Among all of the netted bats, this species was represented by over 35% of individuals (Fig. 2), with up to 23 ind. per netting site. Breeding of the species was recorded in Viciebsk, Hrodna, Mahilioŭ, Minsk, and Homiel voblasćs.

- 1—03.07.2019, de; • 2—17.07.2020, de, ne: 1Mad; • 3—15.07.2020, de; • 4—14.07.2020, de, ne: 6 (1Mjuv, 2Fad, 3Fjuv); • 5—12.07.2020, de; • 6—18.07.2020, de; • 7—16.07.2020, de; • 8—15.07.2020, de, ne: 5 (3Mad, 1Fjuv, 1Mjuv); • 9—03.07.2019, ne: 1Fad-repr; • 10—20.06.2017, ne: 4 Fad; • 11—02.07.2019, de, ne: 23 (3Mad, 7Mjuv, 7Fad-repr, 6Fjuv); • 12—01.07.2019, ne: 16 (3Frepr, 3Fjuv, 4Mad, 5Mjuv, 1?); • 14—30.06.2019, de; • 17—05.09.2017, ci (found on the wall outside): 1Fad; 08.05.2019, de; 30.05.2019, de; 13.06.2019, de; 16.06.2019, de; 17.06.2019, de; 18.06.2019, de; 06.08.2019, de; 09.08.2019, de; 13.08.2019, de; 19.08.2019, de; 26.08.2019, de; 27.08.2019, de; 01.09.2019, de; 06.09.2019, ci (ia): 1Mad; 08.09.2019, de; • 19—06.07.2019, ne: 1Fad-repr; • 23—04.07.2019, ne:

4 (2Fad-repr, 1Mjuv, 1Fjuv); • 30—28.06.2019, ne: 2 (1Fad, 1Mjuv); • 31—25.08.2017, ne: 3 (1Fad, 1Fjuv, 1Mjuv).

***Pipistrellus pygmaeus* (Leach, 1825).** The species was separated from *Pipistrellus pipistrellus* (Schreber, 1774) only in the late 1990s [Barrat *et al.* 1997; Mayer, von Helversen 2001]. Before that, they had been considered as a single species. Accordingly, for a long time, only ‘*P. pipistrellus*’ has been mentioned for the fauna of Belarus. However, now all old records of *P. pipistrellus* in Belarus should be interpreted *sensu lato*.

Since the end of the 19th century, *P. pipistrellus* s. l. has been mentioned as a common species for eastern Belarus [Semenov *et al.* 1905] and the Paliessie [Nikolski 1899]. Kurskov from 1954 to 1981 recorded about 500 individuals of *P. pipistrellus* s. l. in the western part of Belarus [Kurskov 1981]. The presence of *P. pygmaeus* in the fauna of Belarus has been unambiguously confirmed in Brest, Minsk, and Homiel voblasés, both in the course of field studies and by molecular genetic identification [Demianchyk & Demianchyk 2008; Dombrovski & Bolotina 2014; Shpak & Larchanka, own data; Dietz *et al.* 2018]. At the same time, the assumption about the occurrence of *P. pipistrellus* s. str. in Belarus is based only on detector observations and, to our opinion, requires additional research, including molecular genetic approaches for species identification.

Taking into account that, as of today, only *P. pygmaeus* is unequivocally recorded in Belarus, we suppose that old records of *P. pipistrellus* s. l. could refer to *P. pygmaeus*. In this case, *P. pygmaeus* was recorded in Brest, Hrodna, Homiel, Viciebsk, and Mahilioŭ voblasés [Kurskov 1981] and in the Biarezinski Biosphere Reserve [Serzhanin 1961]. Breeding of the species was recorded in Brest and Homiel voblasés [Kurskov 1981; Godlevska & Shpak 2020]. In recent years, the breeding of *P. pygmaeus* s. str. and maternity colonies were recorded in Brest [Dietz *et al.* 2018], Homiel [Dombrovski *et al.* 2017], and Minsk voblasés [Larchanka *et al.* 2020].

During our survey, we have recorded *P. pygmaeus* in all voblasés of Belarus except Brest. Breeding females and/or juveniles have also been found in all those voblasés.

• 2—17.07.2020, de; • 8—15.07.2020, de; • 9—03.07.2019, ne: 2Fad-repr; • 10—20.06.2017, ne: 1Fad; • 11—02.07.2019, ne: 1Fad-repr; • 12—01.07.2019, ne: 3 (2Fad-repr, 1Mad); • 17—17.06.2019, de; 09.08.2019, de; 26.08.2019, de; • 19—06.07.2019, ne: 1Fjuv; • 23—04.07.2019, ne: 9 (8Fad-repr, 1Mjuv); • 30—28.06.2019, ne: 1Fad-repr.

***Plecotus auritus* (Linnaeus, 1758).** The brown long-eared bat, first mentioned at the beginning of the 20th century, was considered as a relatively abundant and widespread species in Belarus [Serzhanin 1961; Kurskov 1981]. Kurskov [1981] mentioned that ‘typical subspecies of *Plecotus auritus* L. 1758 is distributed everywhere.’ Measurements of this species given by this author generally correspond to those of *P. auritus* *sensu stricto* (although maximum values of several cranial characters are slightly bigger than the typical for *P. auritus*, but smaller than for *P. austriacus* (see Strelkov 1988). In the course of an extended revision of long-eared bats of the territory of the former USSR based on museum specimens, Strelkov [1988] revealed only *P. auritus* s. str. for Belarus. In the collection of the Zoological Museum of the Belarusian State University, there are only specimens (n = 6) of *P. auritus* s. str. too [Godlevska & Shpak 2020]. Species *P. austriacus* was first recorded in Belarus in the winter of 1992–1993, in Brest Voblasć [Demianchyk & Demianchyk 2008], where its presence was also confirmed by molecular genetic identification [Shpak *et al.* 2020].

If considering that *P. austriacus* is a new species of the Belarusian fauna and, accordingly, all previous records of *P. auritus* s. l. as *P. auritus* s. str., then records of *P. auritus* s. str. are known from all six voblasés of Belarus. Breeding and maternity colonies of the species were recorded in Brest and Viciebsk voblasés [Kurskov 1981]. On the other hand, if considering only new records and clearly identified specimens from museum collections, then *P. auritus* s. str. is recorded only in Brest, Homiel, and Minsk voblasés, where reproduction and maternity colonies were also found [Demianchyk 2013; Dombrovski *et al.* 2017; Godlevska & Shpak 2020; Larchanka *et al.* 2020].

During our survey, we have recorded only *P. auritus* s. str. in Viciebsk, Minsk, Brest, and Mahilioŭ voblasés, and revealed breeding of the species in Viciebsk, Minsk, and Brest voblasés.



• 1—03.07.2019, ne/sh?: 2 (1Fad-repr, 1Fad-nrepr) in the cellar of an abandoned building; • 17—21.08.2019, ci: 1Mad; • 19—06.07.2019, ne: 4Fad-repr, • 22—29.04.2017, ph (ia): 1U; • 25—29.06.2019, ne: 1Fad-repr in an abandoned building; • 27—21.08.2017, ne: 2Fad.

***Vespertilio murinus* Linnaeus, 1758.** The parti-coloured bat is a widespread species throughout Belarus [Kurskov 1981; Demianchyk & Demianchyk 2008; Shpak 2017a]. *V. murinus* is regularly recorded in Minsk and other cities both in summer and winter [Shpak 2017b, 2018]. Breeding, including records of maternity colonies, has been known in Minsk [A. Shpak unpubl.; Larchanka et al. 2020], Brest [Demianchyk 2013], and Viciebsk [Godlevska & Shpak 2020] voblasćs.

During our survey, we have found *V. murinus* in Viciebsk Voblasć (acoustic observations), as well as in the cities of Minsk and Barysau. Breeding of the species was confirmed in Minsk Voblasć.

• 3—15.07.2020, de; • 7—16.07.2020, de; • 8—15.07.2020, de; • 17—13.07.2017, ci (ia): 1Mad; 24.08.2017, ci (ia): 1Fad; 04.09.2017, ph (ia): 1U; 07.09.2017, ci (gr): 1Fad; 14.04.2019, ci (ia): 1Fad; 21.05.2019, ph (ia): 1U; 23.05.2019, ci (ia): 1Mad; 27.05.2019, ph (ia): 1U; 04.06.2019, de; 13.06.2019, de; 16.06.2019, de; 26.08.2019, de; 08.09.2019, de; 11.09.2019, ph (gr): 1U; 13.09.2019, ph (ia): 1U; 29.09.2019, ph (found at the wall outside): 1U; 04.04.2020, ph (ia): 1U; 09.05.2020, ph (ia): 1U; 16.06.2020, ci (gr): 1F-repr; 06.07.2020, ci (ia): 1Fad; • 21—27.09.2019, ph (gr): 1U.

## Discussion

During our summer survey, we have recorded 13 bat species out of the 19 previously described for Belarusian bat fauna [Shpak 2017a]. The occurrence of all recorded species was confirmed by direct identification. Data on breeding have been added for all recorded species, except for *N. lasiopterus* and *B. barbastellus*. Reproduction was shown for the first time for *M. dasycneme* and *P. nathusii* in Hrodna Voblasć, *E. serotinus* and *P. kuhlii* in Minsk Voblasć, *P. nathusii* in Mahilioŭ Voblasć, and *P. pygmaeus* s. str. in Mahilioŭ and Viciebsk voblasćs. Maternity colonies were recorded in *E. serotinus* (Brest Voblasć), *M. dasycneme* (Hrodna Voblasć; the second record of maternity colony for the entire period of research in Belarus), and *M. daubentonii* (Minsk Voblasć).

In total, we have revealed 10 species among the netted bats (Fig. 2).

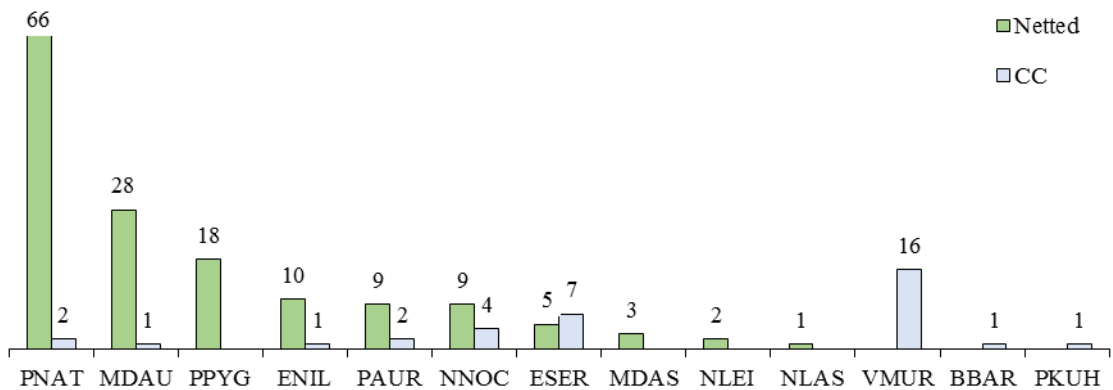


Fig. 2. The number of directly examined animals during the survey of the summer population of bats in Belarus presented in this article. Netted—bats captured with mist-nets (n = 151); CC—data collected by the Minsk bat contact centre (n = 35). Acronyms of species names: PNAT, *Pipistrellus nathusii*; MDAU, *Myotis daubentonii*; PPYG, *Pipistrellus pygmaeus*; ENIL, *Eptesicus nilssonii*; PAUR, *Plecotus auritus*; NNOC, *Nyctalus noctula*; ESER, *E. serotinus*; MDAS, *M. dasycneme*; NLEI, *N. leisleri*, NLAS, *N. lasiopterus*; VMUR, *Vespertilio murinus*; BBAR, *Barbastella barbastellus*; PKUH, *P. kuhlii*.

Рис. 2. Чисельність контактно обстежених тварин під час обстеження літньої популяції кажанів Білорусі, представленого в даній статті. Netted — кажани, відловлені павутинними сітками (n = 151); CC — дані, зібрані Мінським контакт-центром (n = 35). Акроніми видових назв: PNAT, *Pipistrellus nathusii*; MDAU, *Myotis daubentonii*; PPYG, *Pipistrellus pygmaeus*; ENIL, *Eptesicus nilssonii*; PAUR, *Plecotus auritus*; NNOC, *Nyctalus noctula*; ESER, *E. serotinus*; MDAS, *M. dasycneme*; NLEI, *N. leisleri*, NLAS, *N. lasiopterus*; VMUR, *Vespertilio murinus*; BBAR, *Barbastella barbastellus*; PKUH, *P. kuhlii*.

Among them, *P. nathusii* prevailed by the number of individuals (41% of all netted individuals). Other species were represented by less numbers. The less presented species in the captures were *M. dasynceme*, *N. leisleri*, and *N. lasiopterus*. Three species (*B. barbastellus*, *P. kuhlii*, and *V. murinus*) were not revealed by netting at all. It may be a result of the comparatively small number of netted bats. According to Gukasova & Vlaschenko [2011], an adequate assessment of the species composition can be achieved when the number of netted individuals is 200 per site.

The number of bat species recorded by calls to the contact centre was nine, and their composition differed from that found in captures. In particular, three species (*V. murinus*, *B. barbastellus*, and *P. kuhlii*) were presented only among bats reported to the contact centre. Additionally, the distribution of species by the number of individuals reported to the contact centre differs too. The largest portion of bats refers to *V. murinus* (16 of 35 ind.). Species that were quite common in captures (e.g. *M. daubentonii* and *P. pygmaeus*) were absent or presented only by few individuals in the ‘contact centre sample.’ The difference in the data collected with these two approaches is determined not only by the quite small size of samples, but also by the specifics of the methods used.

Netting covered a wide range of bat habitats including forests, parks, settlements, and others. Contact centre records are associated exclusively with settlements (mainly cities and towns). However, our results demonstrate that the two methods complement each other.

During the survey, we have not recorded six bat species that are included in the lists of fauna of Belarus: *P. pipistrellus*, *P. austriacus*, *M. brandtii*, *M. nattereri*, *M. myotis*, and *M. mystacinus*.

Due to the relatively recent systematic separation of *P. pipistrellus* and *P. pygmaeus*, the presence and distribution ranges of these species in Belarus began to require clarification. Evidence for the presence of *P. pygmaeus* in Belarus is presented in this article. At the same time, the absence of contact records of *P. pipistrellus* s. str. and its modern chorological characteristics suggest that the species is either not represented in the bat fauna of Belarus or is extremely rare with a distribution restricted to the extreme south-west of Belarus (Brest Voblasć) (Shpak unpubl.).

The grey long-eared bat was recorded for the first time in Belarus in the winter of 1992–1993 [Demyanchyk & Demianchuk 2008]. Until now, the records of *P. austriacus* are limited to the extreme south-west of Belarus while *P. auritus* is recorded all over Belarus (see above).

The presence of *Myotis brandtii* (Eversmann, 1845) in Belarus has been confirmed both by revision of collection specimens [Strelkov 1983] and in the course of recent field studies [Shpak 2010; Dombrovski 2018, Shpak et al., unpubl.].

The assumption about the presence of *M. mystacinus* s. str. in Belarus is based on results of the revision by P. P. Strelkov [Strelkov 1983], who identified this species among the collection specimens from Bielaviežskaja Pušča. Subsequently, *M. mystacinus* s. str. was included in the list of Belarusian bat fauna, but without detailed data. Studies of recent years in Belarus have not revealed *M. mystacinus* but recorded *M. brandtii*, which seems to be uncommon [Shpak 2010; Dombrovski 2018; Larchanka et al. 2020; Shpak et al. unpubl.]. Natterer’s bat is rare in Belarus; it has been recorded exclusively in Brest and Homiel voblasćs [Demyanchyk & Demianchuk 2008; Dombrovski et al. 2017]. *M. myotis* is another rare species in Belarus: for the entire period of research, only four individuals were recorded, the latest one in 1970 [Kurskov 1981].

In sum, the collected data contribute significantly to the current knowledge about the distribution, breeding, and status of bat species in Belarus.

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