



## HIBERNATING BAT SPECIES OF BELARUS: RESULTS OF THE WORK OF THE MINSK BAT CONTACT CENTRE 'KAZHANAPOLIS' (2018–2022)

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### Key words

bats, hibernation, distribution, Minsk Bat contact centre 'Kazhanapolis', Belarus

### doi

<http://doi.org/10.53452/TU2506>

### Article info

submitted 16.06.2023

revised 30.06.2023

accepted 30.06.2023

### Language

English, Ukrainian summary

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### Abstract

Bat rehabilitation centres, in addition to their main goal, namely, animal rescue, may provide a significant scientific information, and are also sites for popular science activities. This article presents the results of the work of the Minsk Bat contact centre 'Kazhanapolis' in 2018–2022. The work of the Centre includes the rescue of animals by means of artificial hibernation with subsequent release into the wild. Species identification is carried out directly when possible, but sometimes also by photographs. During the hibernation seasons (October–March) in 2018 to 2022, 565 finds were recorded, accounting for more than 730 individuals of 10 species of bats, including *Barbastella barbastellus*, *Eptesicus nilssonii*, *E. serotinus*, *Myotis dasycneme*, *M. daubentonii*, *Nyctalus noctula*, *Pipistrellus kuhlii*, *P. pygmaeus*, *Plecotus auritus*, and *Vespertilio murinus*. Data were collected from 56 unique localities. Compared to the previous period of work (2007–2017), an increase in the number of recorded species, in the total number of individuals, as well as in the number of localities is shown. By the number of finds (55.47%), as well as recorded specimens (71.32%), *V. murinus* prevails. A significant proportion (more than 5%) of records are those of *N. noctula* (23.28% ind. and 8.31% finds), *E. serotinus* (8.9% ind. and 11.32% finds), and *E. nilssonii* (5.75% ind. and 3% finds). We consider the record of *P. pygmaeus* as accidental or migrant. Most of the finds of *V. murinus*, *E. serotinus*, *P. auritus*, *P. kuhlii*, *M. dasycneme*, and *P. pygmaeus* were represented by solitary individuals. *N. noctula*, *E. nilssonii*, *M. daubentonii*, and *B. barbastellus* are mainly recorded in colonies. The largest colony size (more than 100 ind.) was recorded for *N. noctula*. The sex ratio (M : F) ranges from 33.3 : 66.6% in *E. nilssonii* to 74.2 : 25.8% in *N. noctula*. *Plecotus auritus* and *Myotis dasycneme* are represented exclusively by females. Thus, we state the dominance in the species structure of wintering 'urban bat species' in Belarus of *V. murinus* and, at the same time, the expansion of the winter range of *N. noctula* and *P. kuhlii*. In addition, the collected data significantly contribute to our knowledge on the winter range and some hibernation traits of *B. barbastellus*, *M. dasycneme*, *E. nilssonii*, and *E. serotinus* in Belarus and Eastern Europe.

### Cite as

Shpak, A. 2023. Hibernating bat species of Belarus: results of the work of the Minsk bat contact centre 'Kazhanapolis' (2018–2022). *Theriologia Ukrainica*, 25: 55–67. [In English, with Ukrainian summary]

## Зимуючі види кажанів Білорусі: результати роботи Мінського контакт-центру «Кажанополіс» (2018–2022)

Аляксей Шпак

**Резюме.** Реабілітаційні центри для рукокрилих, крім своєї основної цілі, а саме спасіння тварин, забезпечують збір значної кількості наукової інформації, а також є майданчиками для науково-популярної діяльності. У цій статті представлені результати роботи Мінського контакт-центру з рукокрилих «Кажанополіс» у 2018–2022 роках. Робота центру включає перетримку тварин у період глибокого сну з наступним випуском у природу. Видова ідентифікація здійснюється, по можливості, контактено, але іноді за фотографіями. За цей період протягом гібернаційних сезонів (жовтень–березень) описано 565 знахідок, що налічують понад 730 особин 10 видів рукокрилих, а саме, в алфавітному порядку: *Barbastella barbastellus*, *Eptesicus nilssonii*, *E. serotinus*, *Myotis dasycneme*, *M. daubentonii*, *Nyctalus noctula*, *Pipistrellus kuhlii*, *P. pygmaeus*, *Plecotus auritus* та *Vespertilio murinus*. Дані отримано із 56 унікальних локалітетів. Порівняно з попереднім періодом роботи (2007–2017) показано збільшення кількості зареєстрованих видів, загальної кількості особин та кількості локалітетів. За кількістю знахідок (55.47%), а також зареєстрованих особин (71.32%) переважає *V. murinus*. Значну частку (понад 5%) становлять *N. noctula* (23.28% особин та 8.31% знахідок), *E. serotinus* (8.9% особин та 11.32% знахідок) та *E. nilssonii* (5.75% особин та 3% знахідок). Реєстрацію *P. pygmaeus* ми розглядаємо як випадкову або як мігранта. Більшість знахідок *V. murinus*, *E. serotinus*, *P. auritus*, *P. kuhlii*, *M. dasycneme* та *P. pygmaeus* були представлені одиночними особинами. Головним чином у колоніях представлені *N. noctula*, *E. nilssonii*, *M. daubentonii* та *B. barbastellus*. Найбільший розмір колонії (понад 100 особин) було відзначено для *N. noctula*. Співвідношення статей (М : F) коливається від 33.3 : 66.6% у *E. nilssonii* до 74.2 : 25.8% у *N. noctula*. *Plecotus auritus* та *Myotis dasycneme* представлені виключно самками. Таким чином, ми констатуємо домінування у видовій структурі зимуючих «міських видів» Білорусі *V. murinus* і, водночас, розширення зимового ареалу *N. noctula* та *P. kuhlii*. Крім того, зібрані дані роблять істотний внесок у наші знання про зимові ареали та деякі особливості зимівлі *B. barbastellus*, *M. dasycneme*, *E. nilssonii* та *E. serotinus* у Білорусі та Східній Європі.

**Ключові слова:** кажани, гібернація, розповсюдження, Мінський контакт-центр «Кажанополіс», Білорусь.

### Introduction

This article is part of a series of works devoted to the results of the activity of the Minsk Bat contact centre ‘Kazhanapolis’ and a direct continuation of our previous work [Shpak 2018].

Bats are mammals protected in most European countries (Council Directive 92/43/EEC, Bern and Bern Conventions). In Belarus, eight species of bats are included in the national Red Data Book [2015]. To a large extent, the vulnerability of bat populations is determined by their dependence on humans [Voight *et al.* 2016]; many species use human buildings as permanent or temporary shelters, including hibernaculum. ‘Animal–human’ contacts often end in the death of animals or their expulsion from the shelter. Due to the colonial lifestyle of bats, in this case, it can lead to the death of a significant number of animals. To solve this problem, there are rehabilitation centres that, firstly, are engaged in animal rescue and, secondly, in popularisation work to improve people’s attitude towards bats. In addition, the result of the work of such centres is the accumulation of scientific information and monitoring of the bat fauna. Examples include the activities of rehabilitation centres in Ukraine [Prylutska & Vlaschenko 2013; Godlevska 2015; Drebet 2018; Prylutska *et al.* 2023], the Czech Republic [Jahelkova *et al.* 2014], Slovenia [Podgorelec *et al.* 2014], Norway [Kooij 2007], and other countries. The most complete information on the activities of European rehabilitation centres is presented in the report of the Bat Rescue and Rehabilitation IWG of EUROBATS [Report...2015].

The Minsk contact centre ‘Kazhanapolis’ was formally organised in 2018 as a result of cooperation between the National Academy of Sciences of Belarus, APB/BirdLife–Belarus and the Republican Centre for Ecology and Local History. Currently, it functions on the basis of the Lyceum of the

Belarusian State University. The main principles of the Centre's work are described by us in our previous work [Shpak 2018]. It should be noted that in the period of 2007–2017, the activities of the Centre were carried out by the author informally.

## Materials and Methods

The data were collected in 56 localities of Belarus during the hibernation seasons in 2018–2022. According to the literature data [Kurskov 1981], all bats found between 1 October and 30 March were considered hibernating. However, there is a possibility that the individuals registered in the beginning of October or second half of March were migrants.

The work of the Centre is mainly to provide information support to persons, who have applied upon detection of bats. If the animals could not be left in their original hibernation roost (grounded animals, found on balconies and in living quarters, during construction works, etc.), bats were accepted by the Centre for rehabilitation and artificial hibernation with subsequent release into the wild. Captured animals were examined for species identification, trauma detection and registration of basic morphometrical parameters. In some cases, species identification was done according to the provided photos. All the information received was added to the database with the following sections: species, date, sex, age, forearm length, weight, place of registration, details, further fate, name of the person applying, phone number, source of information about the Centre, and photo of the animal (if possible).

*Geographical terms.* 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. These units are abbreviated in the text as 'Vob.' and 'Dis.'

*Used abbreviations:* *ci*, contact identification; *ph*, photo identification; *gr*, found grounded outside of buildings; *ex*, found outside of buildings (e.g. on the wall).

*Acronyms of bat species names, alphabetically:* BBAR, *Barbastella barbastellus*; ENIL, *Eptesicus nilssonii*; ESER, *E. serotinus*; MDAS, *Myotis dasycneme*; MDAU, *M. daubentonii*; NNOC, *Nyctalus noctula*; PKUH, *Pipistrellus kuhlii*; PPYG, *P. pygmaeus*; PLAUR, *Plecotus auritus*; VMUR, *Vespertilio murinus*.

*Sex and age:* M, male; F, female; ?, unknown sex.

*List of study localities:*

- 1—Astraviec; • 2—Babrujsk; • 3—Bačejkava village, Biešankovičy dis.; • 4—Baranavičy; • 5—Barysaŭ; • 6—Biarezynski Biosphere Reserve; • 7—Biešankovičy; • 8—Brest; • 9—Dobruš; • 10—Dziaržynsk; • 11—Dziatlava; • 12—Dzinarauka village, Smaliavičy dis.; • 13—Homiel; • 14—Hrodna; • 15—Kalinaŭka village, Miadziel dis.; • 16—Kamianiec; • 17—Kamianiuki village, Kamianiec dis.; • 18—Klieck; • 19—Kobryn; • 20—Krychaŭ; • 21—Liachavičy; • 22—Lida; • 23—Mahilioŭ; • 24—Maładziečna; • 25—Marjina Horka; • 26—Mazyr; • 27—Minsk; • 28—Moladzi village, Lahojsk dis.; • 29—Navahrudak; • 30—Navapolack; • 31—Navickavičy village, Kamianiec dis.; • 32—Orša; • 33—Parachonsk village, Pinsk dis.; • 34—Pinsk; • 35—Polack; • 36—Rečyca; • 37—Salihorsk; • 38—Ščučyn; • 39—Sianno; • 40—Słabodka village, Stoŭbcy dis.; • 41—Slonim; • 42—Smaliavičy; • 43—Smolki village, Haradok dis.; • 44—Starajelnia village, Dziatlava dis.; • 45—Staryja Darohi; • 46—Stoŭbcy; • 47—Svislač; • 48—Turec-Bajary village, Maładziečna dis.; • 49—Vaŭkavysk; • 50—Viciebsk; • 51—Viercialski village, Hrodna dis.; • 52—Viliejka; • 53—Vuhliany village, Kamianiec dis.; • 54—Zaslaŭje; • 55—Ždanovičy; • 55—Žlobin; • 56—Žodzina.

Thus, each find is described as follows: Number of locality—date of registration (dd.mm.yy): number of individuals, sex, type of identification (*ci* or *ph*), and details. It should be noted that we distinguish 'find' and 'record.' 'Record' is one specimen. 'Find' may include multiple 'records.' For example, the 'find' of one colony includes 'records' of all individuals.

## Results and Discussion

During the hibernation seasons of 2018–2022, for the territory of Belarus ‘Kazhanapolis’ recorded over 730 individuals (565 finds) of 10 bat species, namely *Barbastella barbastellus* (Schreber, 1774), *Eptesicus nilssonii* (Keyserling and Blasius, 1839), *Eptesicus serotinus* (Schreber, 1774), *Myotis dasycneme* (Boie, 1825), *Myotis daubentonii* (Kuhl, 1817), *Nyctalus noctula* (Schreber, 1774), *Pipistrellus kuhlii* (Kuhl, 1817), *Pipistrellus pygmaeus* (Leach, 1825), *Plecotus auritus* (Linnaeus, 1758), and *Vespertilio murinus* Linnaeus, 1758. Most of the finds (556 ind.) were represented by single specimens; more than 174 individuals were found in 11 colonies.

The data are presented as species essays listed alphabetically. Each essay contains a description of the species status in Belarus, an overview of previous finds described in the literature, as well as a list of own records. A full description is provided for *B. barbastellus*, *M. dasycneme*, *M. daubentonii* and *P. pygmaeus*. For *E. nilssonii*, *E. serotinus*, *N. noctula*, *P. kuhlii*, *P. auritus*, and *V. murinus*, a detailed account including literature analysis and our own data for the period of ‘Kazhanapolis’ activity in 2007–2017 was published in our previous work [Shpak 2018] and therefore is presented here in brief.

***Barbastella barbastellus* (Schreber, 1774).** The western barbastelle is a rare species in Belarus [Serzhanin 1961; Kurskov 1981], included in the Red Data Book of Belarus (RDB) [1981]. Currently [Red... 2015], its status is assessed as Endangered (EN). Until 2020, the hibernation was recorded exclusively in the Brest vob. [Serzhanin 1961; Kurskov 1981; Demianchyk & Demianchyk 2008]. In 2020, as a result of bat winter census in underground hibernacula of Belarus, the species was recorded in all voblasés of Belarus, with the exception of Viciebsk vob. [Godlevska *et al.* 2023]. During the hibernation period, we recorded more than four specimens of *B. barbastellus* in two localities of Hrodna vob.

• 38—02.12.21: 1? ph, ex; • 49—01.02.20: 3+? ph, in.

***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). We recorded more than 42 individuals of *E. nilssonii* in eight localities of four voblasés: Brest, Homiel, Minsk, and Viciebsk. Thirteen individuals were recorded solitary and over 29 in four colonies. The number of recorded individuals in one colony ranged from 3 to 18. Colonies were found in former military bunkers, under the floor and in the attic of private houses.

• 3—26.12.21: 1?, ph, flew into the house; • 4—15.12.19: 1?, ph, in; • 15—27.03.21: 1?, ph, in; • 26—15.12.19: 1M, ci, in; • 27—24.11.19: 1F, ci, in; 28.12.20: 1M, ci., in; 23.11.20: 1?, ph., in; 02.01.21: 1?, ph, in; 03.12.21: colony: 5F, ci, under the floor of a private house; 22.03.22: 1M, ci, in; 23.03.22: 1F, ci, in; 29.11.22: 3?+, ph, in a bunker; 18.12.22: 3?+, ph, in a bunker; • 28—10.11.20: 1?, ph, in; 02.12.22: 1M, ci, in; • 52—08.02.21: 1F (colony (17 ind.) in the attic of a private house, the remaining individuals froze), ci, in; • 56—02.11.20: 1?, ph, in.

***Eptesicus serotinus* (Schreber, 1774).** The species is included in the Annotated list of species of the RDB of Belarus [2004] with the DD (Data deficient) category. ‘Kazhanapolis’ recorded more than 65 individuals of *E. serotinus* in 19 localities of all voblasés except for Viciebsk. Almost all finds (63 ind.) were represented by solitary specimens, but one small group (2 ind.) was recorded in a former military bunker.

• 2—03.02.20: 1?, ph, in • 8—09.11.21: 1?, ph, in; 15.02.22: 1?, ph, gr; • 13—20.01.21: 1?, ph, in; 02.03.21: 1?, ph, in; 14.03.21: 1?, ph, in; 20.10.21: 1?, ph, in; 12.11.21: 1?, ph, ex; 08.02.22: 1?, ph, in; • 14—05.11.21: 1?, ph, in; 09.12.21: 1?, ph., in; • 16—19.12.22: 1?, ph, in; • 17—14.12.21: 1?, ph, in; • 24—22.12.21, 1?, ph, in; • 26—20.02.21: 1?, ph, in; • 27—27.02.18: 1M, ci, in; 07.12.18: 1M, ci, in; 15.12.18: 1F, ci, in; 17.12.18: 1M, ci, in; 20.12.18: 1M, ci, in; 30.12.18: 1F, ci, in; 10.01.19: 1M, ci., in; 21.10.19: 1?, ph, in; 01.12.19: 1M, ci, in; 09.02.20: 1F, ci, gr; 07.03.20: 1?, ph, in; 09.12.20: 1M, ci., in; 14.12.20: 1F, ci., in; 29.12.20: 1M, ci., in; 15.01.21: 1M, ci., in; 20.01.21: 1?, ph, in; 30.01.21: 1?, ph, in; 30.01.21: 1F, ci, in; 22.02.21: 1F, ci, in; 22.02.21: 1F, ci, in; 26.02.21: 1M, ci, in; 26.03.21: 1F, ci, gr; ; 27.03.21: 1?, ph, ex; 29.10.21: 1?, ph, gr;

25.11.21: 1M, ci, gr; 03.12.21: 1?, ph, in; 08.12.21: 1M, ci, in; 11.12.21: 1F, ci, in; 16.12.21: 1F, ci, in; 24.01.22: 1F, ci, in; 25.01.22: 2?+, ph, in a bunker; 07.02.22: 1F, ci, in; 04.10.22: 1?, ph, in; 05.10.22: 1F, ci, in; 08.10.22: 1?, ph, in; 14.11.22: 1?, ph, in; 30.11.22: 1F, ci, in; 30.11.22: 1M, ci, in; 10.12.22: 1F, ci, in; • 29—13.02.22: 1M, ci, under the porch of a private house in a woodpile; • 34—29.12.21: 1?, ph, in; 17.01.22: 1?, ph, in; • 36—21.12.19: 1?, ph, in; • 37—14.12.20: 1?, ph, in; • 40—05.03.20: 3?, ph, in; • 41—15.02.21: 1?, ph, in; • 45—16.12.19: 1?, ph, in; • 47—16.11.19: 1?, ph, gr; • 55—18.02.21: 1?, ph, in; 24.11.21: 1?, ph, in; • 56—30.12.20: 1?, ph, in.

***Myotis dasycneme* (Boie, 1825).** The pond bat is a rare species in Belarus [Serzhanin 1961; Kurskov 1981], included in the Red Book of Belarus [1981]. Currently [Red... 2015] its status is assessed as Endangered (EN). Hibernation of solitary individuals has been recorded in Belarus since the mid-1990s, exclusively in the south-west of Brest vob. [Demianchyk & Demianchyk 2000], where the share of *M. dasycneme* in the total structure of hibernating species was estimated at 0.18% [Demianchyk *et al.* 2012]. All finds described earlier have used the basements of the Brest Fortress casemates as hibernacula. We recorded one hibernating female of *M. dasycneme* in Viciebsk city. It should be noted that this is the only record of the pond bat for the entire period of 'Kazhanapolis' activity (2007–2022) and the first outside of Brest vob.

• 50—03.12.18: 1F, ci, in, between window frames.

***Myotis daubentonii* (Kuhl, 1817).** Daubenton's bat is considered in Belarus as a relatively abundant and widespread species of the bat fauna. Until recently, documented records of hibernating *M. daubentonii* were reported exclusively from Brest vob. [Serzhanin 1961; Kurskov 1981; Demianchyk & Demianchyk 2008]. In 2020, as a result of bat winter census in underground hibernacula of Belarus, the species was recorded in all voblascs of Belarus, with the exception of Minsk and Homiel vob. [Godlevska *et al.* 2023]. In 2018–2022, we recorded 16 specimens of *M. daubentonii* in 4 localities of Minsk and Hrodna voblascs. Some of them were solitary (5 ind.) and 11 individuals were found in two colonies. The colony size ranged from two to nine specimens.

• 11—03.11.19: 1?, ph, in; • 15—29.10.20: 2?, ph, in a well; • 27—17.01.19: 1F, ci, in; 14.12.19: 1F, ci., in; 07.12.20: 1M, ci., in; 11.03.21: 1M, ci., gr; • 44—16.12.19: 9?, ph, in.

***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]. We recorded more than 170 individuals of *N. noctula* in 21 localities of all Belarusian voblascs. Forty-four individuals were recorded solitary and more than 124 in three colonies. The colony size ranged from more than 10 to more than 100 ind.

• 2—14.01.20: 1?, ph, gr; • 4—12.12.19: 1?, ph, in; • 5—15.10.19: in flight, 1?, ph; 26.11.19: 1?, ph, in; 09.01.21: colony: 12M+4F, ci, in; 12.11.21: 1?, ph, in; ; • 6—20.10.21: in flight, 1?, ph; • 7—06.01.22: 1?, ph, in; • 8—20.01.21: 1?, ph, gr; 28.02.21: 1?, ph, gr; 31.03.21: 1?, ph, gr; 25.11.21: 1?, ph, in; 23.03.22: 1?, ph, gr; • 9—07.11.21: in flight, 1?, ph; • 14—30.11.22: colony under the balcony cladding, 100+, ph; • 16—16.03.21: 1?, ph, gr; • 19—25.03.20: 1?, ph, in; • 21—27.12.18: colony, ph, in; • 23—14.01.20: 1?, ph, in; • 24—24.03.22: 1M, ci, gr; • 25—25.12.21: 1M, ph, in; • 26—25.03.20: in flight, 1?, ph; • 27—03.12.19: 1M, ci, in; 06.12.19: 1M, ci, in; 14.01.20: 1M, ci., in; 21.01.20: 1M, ci., in; 30.10.20: 1?, ph, gr; 07.11.20: 1?, ph, in; 21.12.20: 1F, ci., gr; 27.03.21: 1M, ci, gr; ; 18.10.21: 1?, ph, in; 11.11.21: 1F, ci, gr; 15.11.21: 1?, ph, in; 18.11.21: 1?, ph, gr; 19.11.21: 1?, ph, gr; 05.12.21: 1?, ph, in; 16.12.21: 1F, ci, in; 06.02.22: 1F, ci, in; 08.02.22: 1?, ph, gr; 11.02.22: 1M, ci, in; 22.03.22: 1M, ci, gr; 22.12.22: 1M, ci, in; • 36—09.12.19: 1?, ph, in; • 37—25.01.21: 1?, ph, in; • 50—24.02.22: 1?, ph, gr; • 54—30.10.21: in flight, 1?, ph; • 55—15.11.20: 1M, ci, in, in group of *V. murinus*.

***Pipistrellus kuhlii* (Kuhl, 1817).** Kuhl's pipistrelle is a new species in the Belarusian fauna. Previous rare finds were recorded in Brest [Demianchyk 2013], Homiel and Minsk voblascs [Shpak & Larchanka 2016; Shpak *et al.* 2022]. All these records were represented by single specimens. We recorded eight individuals in six localities of all voblascs of Belarus except for Hrodna. All hibernating specimens were solitary except for one small group (2 ind.).



- 13—02.12.21: 1?, ph, in; • 16—07.12.21: 1?, ph, in; • 20—06.11.19: 2?, ph, in • 26—02.12.21: 1F, ci, in;
- 27—09.02.21: 1M, ci, in; 04.01.22: 1?, ph, in; • 50—21.01.21: 1?, ph, in.

***Pipistrellus pygmaeus* (Leach, 1825).** The species is common and widespread in Belarus [Demianchyk & Demianchyk 2008; Shpak *et al.* 2022]. We recorded one hibernating male of *P. pygmaeus* in Minsk city. It is the only record of the hibernating soprano pipistrelle for the entire period of research in Belarus.

- 27—15.10.19: 1M, ci, in.

***Plecotus auritus* (Linnaeus, 1758).** The brown long-eared bat is considered as a relatively abundant and widespread species in Belarus [Serzhanin 1961; Kurskov 1981]. We have recorded 18 individuals of *P. auritus* in 13 localities of Brest, Homiel, Minsk, and Viciebsk voblasćs. All specimens were solitary except for two groups of two individuals.

- 5—29.12.21: 1?, ph, in a basement; • 8—04.11.21: 1?, ph, in; • 12—04.12.20: 1?, ph, in; • 18—03.10.19: 1?, ph, in; • 27—25.01.20: 2F, ci, in; 06.10.21: 1?, ph, gr; • 31—05.01.22: 1?, ph, in; • 33—13.01.22: 1?, ph, in a basement; • 36—10.12.20: 1?, ph, in; • 43—21.01.18: 1?, ph, in; • 46—12.12.18: 1?, ph, in; • 48—19.01.22: 2?, ph, in a basement; • 50—18.01.19: 1?, ph, in; 08.10.21: 1?, ph, gr; 03.03.22: 1?, ph, in; • 53—25.01.20: 1?, ph, in.

***Vespertilio murinus* Linnaeus, 1758.** The parti-coloured bat is a widespread species in Belarus [Kurskov 1981; Demianchyk & Demianchyk 2008]. The species is regularly recorded in Minsk and other cities in both summer and winter [Shpak 2017; 2018]. We have recorded 405 individuals of *V. murinus* in 23 localities of all voblasćs. All recorded specimens were solitary except for one small group (3 ind.).

- 1—12.12.20: 1F, ci, in; 28.12.21: 1?, ph, in; • 2—20.01.21, 1?, ph, in; 08.12.22: 1?, ph, in; • 5—17.01.19: 1M, ci, in; 16.02.22: 1F, ci, in; • 8—12.01.19: 1?, ph, in; 15.10.22: 1?, ph, gr; 14.12.22: 1?, ci, in; • 10—14.01.22, 1?, ph, in; • 13—14.02.21: 1?, ph, in; 30.12.21: 1?, ph, in; 20.11.22: 1?, ph, in; 30.11.22: 1F, ci, in; • 14—18.11.19: 1?, ph., in; 11.12.19: 1?, ph, gr; 07.12.20: 1?, ph, in; 13.12.20: 1?, ph., in; 09.12.21: 1?, ph., in; 26.12.21: 1?, ph., in; 26.10.22: 1?, ph, gr; • 19—21.01.19: 1?, ph., in; • 22—03.02.22: 1?, ph, in; • 23—29.11.21: 1?, ph, gr; 05.12.22: 1?, ph, in; • 24—22.02.21: 1F, ci, in; • 27—23.01.18: 1M, ci, in; 12.03.18: 1F, ci, gr; 13.03.18: 1F, ci, in; 15.11.18: 1M, ci, in; 16.11.18: 1M, ci, in; 16.11.18: 1F, ci, in; 18.11.18: 1M, ci, in; 19.11.18: 1M, ci, in; 19.11.18: 1F, ci, gr; 20.11.18: 1M, ci, in; 25.11.18: 1M, ci, in; 25.11.18: 1F, ci, in; 27.11.18: 1F, ci, in; 27.11.18: 1M, ci, in; 27.11.18: 1F, ci, in; 29.11.18: 1F, ci, in; 29.11.18: 1M, ci, in; 30.11.18: 1M, ci, in; 01.12.18: 1F, ci, in; 02.12.18: 1M, ci, in; 03.12.18: 1M, ci, in; 04.12.18: 1F, ci, in; 05.12.18: 1F, ci, in; 06.12.18: 1M, ci, in; 07.12.18: 1M, ci, in; 08.12.18: 1M, ci, in; 09.12.18: 1M, ci, in; 10.12.18: 1F, ci, in; 11.12.18: 1F, ci, in; 12.12.18: 1M, ci, in; 13.12.18: 1F, ci, in; 14.12.18: 1F, ci, in; 14.12.18: 1F, ci, in; 15.12.18: 1M, ci, in; 15.12.18: 1M, ci, in; 15.12.18: 1F, ci, in; 16.12.18: 1M, ci, in; 17.12.18: 1F, ci, in; 18.12.18: 1M, ci, in; 20.12.18: 1M, ci, in; 20.12.18: 1M, ci, in; 21.12.18: 1F, ci, in; 04.01.19: 1M, ci., in; 09.01.19: 1M, ci., in; 11.01.19: 1?, ph., in; 11.01.19: 1?, ph., gr; 12.01.19: 1F, ci., in; 14.01.19: 1F, ci., in; 16.01.19: 1F, ci., in; 18.01.19: 1M, ci., in; 19.01.19: 1F, ci., in; 03.10.19: 1M, ci., gr; 05.10.19: 1?, ph., gr; 05.10.19: 1?, ph., in; 07.10.19: 1?, ph., in; 07.10.19: 1?, ph., in; 11.10.19: 1?, ph., in; 12.10.19: 1?, ph., in; 14.10.19: 1?, ph., in; 14.10.19: 1?, ph., in; 14.10.19: 1?, ph., in; 15.10.19: 1?, ph., in; 15.10.19: 1?, ph., in; 16.10.19: 1?, ph., in; 21.10.19: 1?, ph., in; 22.10.19: 1?, ph., in; 23.10.19: 1?, ph., in; 23.10.19: 1?, ph., in; 23.10.19: 1?, ph., gr; 31.10.19: 2?, ph., in; 04.11.19: 1?, ph., in; 05.11.19: 1?, ph., in; 05.11.19: 1?, ph., in; 06.11.19: 1?, ph., in; 06.11.19: 1?, ph., in; 09.11.19: 1?, ph., in; 12.11.19: 1?, ph., in; 12.11.19: 1?, ph., in; 13.11.19: 1?, ph., in; 14.11.19: 1?, ph., in; 14.11.19: 1?, ph., in; 15.11.19: 1?, ph., in; 16.11.19: 1?, ph., in; 18.11.19: 1F, ci., in; 20.11.19: 1?, ph., in; 20.11.19: 1?, ph., gr; 21.11.19: 1F, ci., gr; 23.11.19: 1F, ci., in; 25.11.19: 1F, ci., in; 25.11.19: 1F, ci., in; 26.11.19: 1F, ci., in; 27.11.19: 1M, ci., in; 27.11.19: 1M, ci., in; 27.11.19: 1F, ci., in; 28.11.19: 1F, ci., in; 29.11.19: 1M, ci., in; 30.11.19: 1M, ci., in; 30.11.19: 1M, ci., in; 02.12.19: 1F, ci., in; 02.12.19: 1M, ci., in; 03.12.19: 1F, ci., in; 03.12.19: 1M, ci., in; 03.12.19: 1F, ci., in; 03.12.19: 1F, ci., in; 04.12.19: 1M, ci., in; 04.12.19: 1F, ci., in; ; 06.12.19: 1F, ci., in; 07.12.19: 1F, ci., in; 09.12.19: 1F, ci., in; 09.12.19: 1M, ci., in; 09.12.19: 1M, ci., in; 10.12.19: 1F, ci., in; 10.12.19: 1M, ci., in; 11.12.19: 1M, ci., in; 11.12.19: 1M, ci., in; 13.12.19: 1F, ci., in; 13.12.19: 1F, ci., in; 18.12.19: 1F, ci., gr; 18.12.19: 1F, ci., in; 20.12.19: 1F, ci., in; 20.12.19: 1M, ci., in; 23.12.19: 1F, ci., in; 23.12.19: 1F, ci., in; 26.12.19: 1F, ci., in; 28.12.19: 1M, ci., in; 28.12.19: 1M, ci., in; 29.12.19: 1F, ci., in; 30.12.19: 1M, ci., in; 02.01.20: 1F, ci., gr; 03.01.20: 1M, ci., in; 04.01.20: 1F, ci., in; 09.01.20: 1F, ci., in; 18.01.20: 1F, ci., in; 20.01.20: 1M, ci., gr;

25.01.20: 1M, ci., in; 03.02.20: 1?, ph, in; 06.02.20: 1F, ci., in; 15.02.20: 1F, ci., gr; 18.02.20: 1F, ci., in; 19.02.20: 1F, ci., gr; 05.03.20: 1F, ci., in; 05.03.20: 1M, ci., in; 23.03.20: 1F, ci., in; 26.03.20: 1M, ci., gr; 28.03.20: 1?, ph, gr; 30.10.20: 1?, ph, gr; 02.11.20: 1?, ph, gr; 02.11.20: 1?, ph, in; 06.11.20: 1?, ph, in; 07.11.20: 1?, ph, in; 09.11.20: 1?, ph, in; 09.11.20: 1?, ph, gr; 09.11.20: 1?, ph, in; 18.11.20: 1?, ph., in; 19.11.20: 1?, ph., in; 21.11.20: 1?, ph., in; 23.11.20: 1?, ph., in; 24.11.20: 1?, ph., in; 24.11.20: 1?, ph., in; 28.11.20: 1M, ci., gr; 30.11.20: 1F, ci., in; 02.12.20: 1F, ci., in; 03.12.20: 1M, ci., in; 04.12.20: 1F, ci., in; 04.12.20: 1M, ci., in; 04.12.20: 1F, ci., in; 06.12.20: 1F, ci., in; 07.12.20: 1F, ci., in; 08.12.20: 1M, ci., in; 08.12.20: 1F, ci., in; 10.12.20: 1F, ci., in; 12.12.20: 1F, ci., in; 12.12.20: 1M, ci., in; 13.12.20: 2F, ci., in; 14.12.20: 1M, ci., in; 15.12.20: 1F, ci., in; 15.12.20: 1?, ph, in; 16.12.20: 1F, ci., in; 16.12.20: 1F, ci., in; 17.12.20: 1F, ci., in; 18.12.20: 1F, ci., in; 18.12.20: 1M, ci., in; 20.12.20: 1M, ci., in; 20.12.20: 1M, ci., in; 21.12.20: 1F, ci., in; 21.12.20: 1M, ci., in; 23.12.20: 1F, ci., in; 29.12.20: 1F, ci., in; 06.01.21: 1F, ci., in; 09.01.21: 1F, ci., in; 11.01.21: 1M, ci., in; 13.01.21: 1F, ci., in; 15.01.21: 1M, ci., in; 15.01.21: 1M, ci., in; 23.01.21: 1F, ci., in; 23.01.21: 1F, ci., in; 23.01.21: 1F, ci., in; 29.01.21: 1?, ph, in; 30.01.21: 1?, ph, in; 06.02.21: 1F, ci, in; 15.02.21: 1F, ci, in; 18.02.21: 1M, ci, in; 25.02.21: 1F, ci, in; 26.02.21: 1M, ci, in; 27.02.21: 1F, ci, in; 15.03.21: 1F, ci, in; 20.03.21: 1F, ci, in; 02.10.21: 1?, ph, gr; ; 07.10.21: 1?, ph, gr; ; 13.10.21: 1?, ph, in; ; 19.10.21: 1?, ph, in; 23.10.21: 1?, ph, in; 27.10.21: 1?, ph, gr; 28.10.21: 1?, ph, in; 29.10.21: 1?, ph, in; 30.10.21: 1?, ph, gr; 01.11.21: 1?, ph, gr; 12.11.21: 1?, ph, in; 12.11.21: 1?, ph, in; 13.11.21: 1F, ci, in; 15.11.21: 1?, ph, ex; 15.11.21: 1?, ph, in; 17.11.21: 1?, ph, in; 23.11.21: 1M, ci, in; 25.11.21: 1M, ci, in; 26.11.21: 1F, ci, in; 27.11.21: 1?, ph, in; 29.11.21: 1F, ci, in; 01.12.21: 1F, ci, in; 02.12.21: 1F, ci, in; 02.12.21: 1F, ci, in; 03.12.21: 1?, ph, in; 05.12.21: 1M, ci, in; 05.12.21: 1M, ci, in; 05.12.21: 1F, ci, in; 06.12.21: 1M, ci, in; 07.12.21: 1M, ci, in; 08.12.21: 1F, ci, in; 10.12.21: 1F, ci, in; 11.12.21: 1F, ci, in; 14.12.21: 1F, ci, in; 14.12.21: 1?, ph, in; 16.12.21: 1F, ci, in; 16.12.21: 1M, ci, in; 19.12.21: 1F, ci, in; 19.12.21: 1F, ci, in; 19.12.21: 1F, ci, in; 23.12.21: 1F, ci, gr; 30.12.21: 1?, ph, gr; 31.12.21: 1?, ph, in; ; 03.01.22: 1M, ci, in; 03.01.22: 1M, ci, in; 05.01.22: 1M, ci, in; 08.01.22: 1M, ci, in; 12.01.22: 1F, ci, in; 18.01.22: 1F, ci, gr; 21.01.22: 1F, ci, in; 28.01.22: 1F, ci, in; 10.02.22: 1?, ph, in; 10.02.22: 1F, ci, in; 11.02.22: 1F, ci, in; 11.02.22: 1M, ci, in; 12.02.22: 1M, ci, in; 11.02.22: 1M, ci, in; 13.03.22: 1F, ci, in; 23.03.22: 1?, ph, ex; 05.10.22: 1?, ph, gr; 05.10.22: 1?, ph, in; 08.10.22: 1?, ph, gr; 10.10.22: 1?, ph, gr; 10.10.22: 1?, ph, in; 11.10.22: 1?, ph, gr; 11.10.22: 1?, ph, gr; 18.10.22: 1?, ph, gr; 22.10.22: 1?, ph, in; 22.10.22: 1?, ph, in; 23.10.22: 1?, ph, in; 28.10.22: 1?, ph, ex; 30.10.22: 1?, ph, in; 03.11.22: 1?, ph, gr; 09.11.22: 1?, ph, in; 10.11.22: 1?, ph, ex; 17.11.22: 1?, ph, in; 17.11.22: 1?, ph, in; 18.11.22: 1M, ci, in; 19.11.22: 1F, ci, in; 20.11.22: 1M, ci, in; 20.11.22: 1F, ci, in; 22.11.22: 1F, ci, in; 22.11.22: 1F, ci, in; 22.11.22: 1F, ci, in; 23.11.22: 1F, ci, in; 23.11.22: 1M, ci, in; 24.11.22: 1F, ci, in; 24.11.22: 1F, ci, in; 24.11.22: 1M, ci, in; 25.11.22: 1M, ci, in; 25.11.22: 1F, ci, in; 26.11.22: 1M, ci, in; 27.11.22: 1M, ci, in; 27.11.22: 1M, ci, in; 28.11.22: 1M, ci, in; 28.11.22: 1M, ci, in; 28.11.22: 1F, ci, in; 28.11.22: 1M, ci, in; 29.11.22: 1F, ci, in; 30.11.22: 1F, ci, in; 01.12.22: 1F, ci, in; 01.12.22: 1F, ci, in; 02.12.22: 1M, ci, in; 03.12.22: 1M, ci, in; 05.12.22: 1M, ci, in; 06.12.22: 1?, ph, in; 06.12.22: 2 (1M+1F), ci, in; 07.12.22: 1F, ci, in; 08.12.22: 1M, ci, in; 08.12.22: 1F, ci, in; 08.12.22: 1F, ci, in; 08.12.22: 1F, ci, in; 09.12.22: 1F, ci, in; 09.12.22: 1F, ci, in; 09.12.22: 1F, ci, in; 10.12.22: 1F, ci, in; 11.12.22: 1F, ci, in; 11.12.22: 1F, ci, in; 11.12.22: 1F, ci, in; 12.12.22: 1F, ci, in; 12.12.22: 1F, ci, in; 13.12.22: 1M, ci, in; 13.12.22: 1M, ci, in; 15.12.22: 1M, ci, in; 18.12.22: 1F, ci, in; 18.12.22: 1M, ci, in; 18.12.22: 1F, ci, in; 19.12.22: 1F, ci, in; 19.12.22: 1M, ci, in; 20.12.22: 1F, ci, in; 20.12.22: 1M, ci, in; 21.12.22: 1M, ci, in; 21.12.22: 1M, ci, in; 21.12.22: 1F, ci, in; 21.12.22: 1F, ci, in; 22.12.22: 1F, ci, in; 22.12.22: 1F, ci, in; 22.12.22: 1F, ci, in; 23.12.22: 1F, ci, in; 24.12.22: 1M, ci, in; 25.12.22: 1F, ci, gr; 25.12.22: 1F, ci, in; 26.12.22: 1F, ci, in; 26.12.22: 1M, ci, in; 26.12.22: 1F, ci, in; 30.12.22: 1M, ci, in; • 30—03.01.21: 1M, ci, in; • 32—15.02.21: 1?, ph, in; • 35—21.11.19: 1?, ph, in; 26.11.21: 1?, ph, in; 29.11.21: 1?, ph, in; • 37—12.01.22: 1?, ph, in; • 39—11.10.22: 1?, ph, in; • 42—28.11.19: 1F, ci, in; 22.11.21: 1M, ci, in; • 50—11.10.19: 1?, ph., gr; 12.10.19: 1?, ph., gr; 15.10.19: 1?, ph., gr; 18.10.19: 1?, ph., in; 02.11.20: 1?, ph., in; 06.11.21: 1M, ci, in; • 51—25.01.18: 1?, ph., in; • 52—29.11.22: 1?, ph., in; • 55—15.11.20: 1F, 2M, ci, in; 16.11.21: 1?, ph, in; • 56—27.03.21: 1?, ph, in; 29.11.21: 1?, ph, in; 26.03.22: 1F, ci, gr;

When discussing the results obtained, several important aspects of our study should be taken into account. Firstly, 'Kazhanapolis' is not engaged in a purposeful search for hibernation shelters of bats with subsequent counting of the number of individuals. All the finds described by us are accidental finds of individuals, with a few exceptions, inside or outside various types of used premises (residential, commercial, auxiliary, etc.), or on the ground. Secondly, in view of the foregoing, our data largely represent the 'urban' fauna of bats.

In total, over 730 individuals (565 finds) of 10 species of bats were recorded in 56 different localities of Belarus during the period presented. In the previous period (2007–2017), we recorded more than 113 finds of 6 species from 18 localities. Thus, there was a significant increase in all parameters, despite the shorter period of activity.

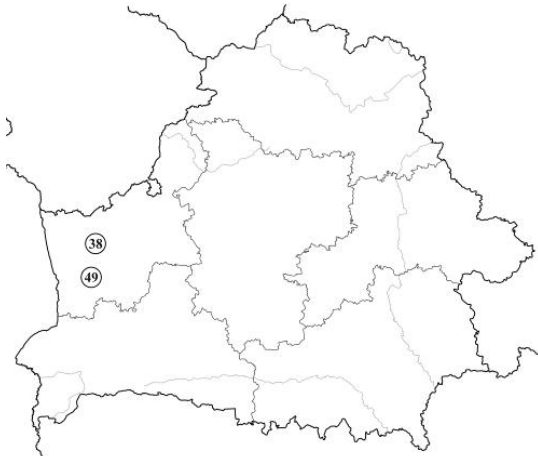
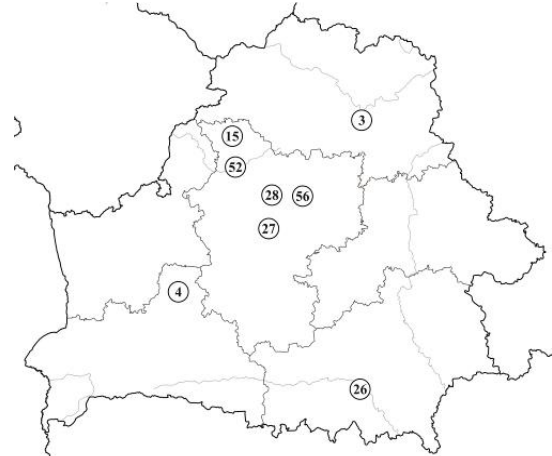
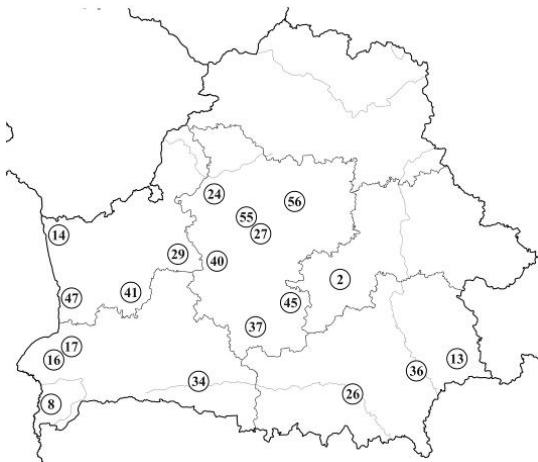
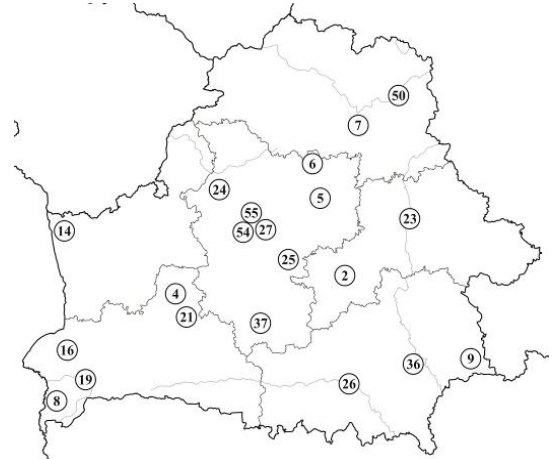
*Barbastella barbastellus**Eptesicus nilssonii**E. serotinus**Myotis dasycneme**Myotis daubentonii**Nyctalus noctula*

Fig. 1. Localities of finds of wintering bats in Belarus: *Barbastella barbastellus*, *Eptesicus nilssonii*, *E. serotinus*, *Myotis dasycneme*, *M. daubentonii*, and *Nyctalus noctula*. Numbers correspond to the list of localities in Materials and Methods.

Рис. 1. Місцезнаходження зимуючих кажанів в Білорусі: *Barbastella barbastellus*, *Eptesicus nilssonii*, *E. serotinus*, *Myotis dasycneme*, *M. daubentonii*, *Nyctalus noctula*. Номери відповідають списку локалітетів в розділі «Матеріали і методи».



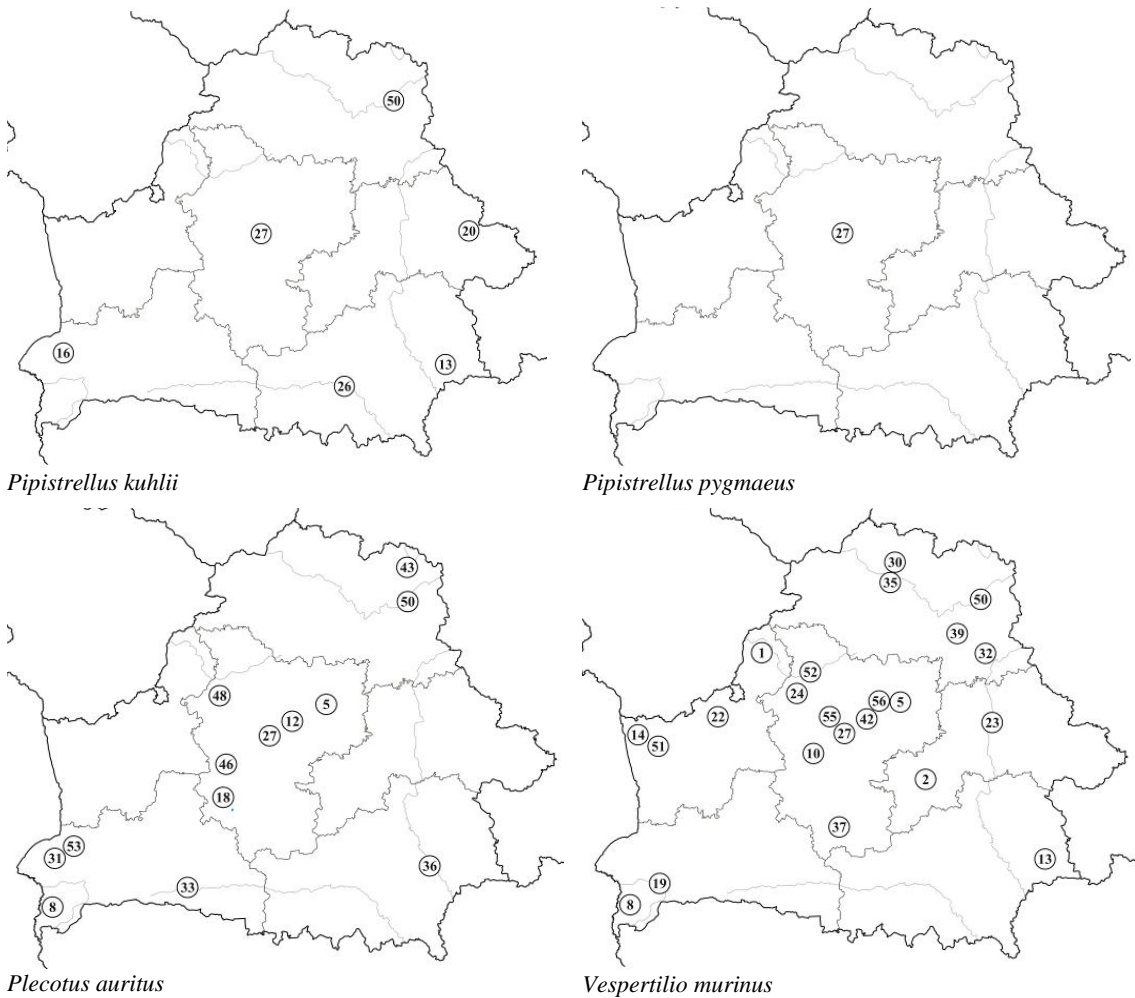


Fig. 2. Localities of finds of wintering bats in Belarus: *Pipistrellus kuhlii*, *P. pygmaeus*, *Plecotus auritus*, and *Vespertilio murinus*. Numbers correspond to the list of localities in Materials and Methods.

Рис. 2. Місцезнаходження зимуючих кажанів в Білорусі: *Pipistrellus kuhlii*, *P. pygmaeus*, *Plecotus auritus*, *Vespertilio murinus*. Номери відповідають списку локалітетів в розділі «Матеріали і методи».

In relation to the recorded species, we have found all species of the past period and, in addition, *B. barbastellus*, *M. dasycneme*, *M. daubentonii*, and *P. pygmaeus*. Thus, we recorded all bat species wintering in Belarus, with the exception of *Myotis mystacinus/Myotis brandtii*, *Myotis nattereri*, and *Plecotus austriacus*.

For the first time in Belarus, *P. pygmaeus* was recorded during the hibernation period. However, taking into account the date of record (October 15, 2019) and the single character of this find, we assume that this is either an accidental or migrating individual.

The absence of *M. nattereri*, *M. mystacinus/brandtii* complex, and *P. austriacus* among our finds can be explained by the relative rarity of these species; they are included in the Red Data Book of Belarus [2015].

In 2018–2022, there was a gradual increase in the number of finds (Fig. 3) compared to the period of 2007–2017. This is due to the growth in the information about our activities, as well as popular science activity (lectures, seminars, International Bat Nights, etc.).

By months, there is an increase in the number of finds from October ( $n = 49$ , Avg = 16.3) reaching an absolute maximum in December ( $n = 211$ , Avg = 42.2). In January, there is a significant de-

crease in the number of registrations ( $n = 69$ ,  $\text{Avg} = 13.8$ ), reaching an absolute minimum in March ( $n = 32$ ,  $\text{Avg} = 8.0$ ) (Fig. 4).

In quantitative terms, among the recorded individuals, the species are distributed in the following order: *V. murinus*, *N. noctula*, *E. serotinus*, *E. nilssonii*, *P. auritus*, *M. daubentonii*, *P. kuhlii*, *B. barbastellus*, *M. dasycneme*, and *P. pygmaeus*. It should be noted that when calculating the number of finds, the picture looks somewhat different: relatively large (8–405 ind.) in *V. murinus*, *E. serotinus*, *N. noctula*, *E. nilssonii*, *P. auritus*, and *M. daubentonii*, and relatively small (1–4 ind.) in *P. kuhlii*, *B. barbastellus*, *M. dasycneme*, and *P. pygmaeus* (Table 1).

Thus, *Vespertilio murinus* predominates among both records and finds, represented mainly by solitary individuals. The prevalence of solitary individuals is also shown for *E. serotinus*, *M. dasycneme*, and *P. pygmaeus* (although the latter two species are represented by single individuals), and, to a lesser extent, to *P. auritus* and *P. kuhlii*. In *N. noctula*, *E. nilssonii*, *M. daubentonii*, and *B. barbastellus*, most of the individuals were found in colonies of various size (Fig. 5). The largest colony size (more than 100 ind.) was recorded for *N. noctula*.

Regarding the sex ratio, the following should be noted: *P. auritus*, *M. dasycneme*, and *P. pygmaeus* were represented exclusively by females, although the latter two species are represented by single individuals. In general, for other species, there is a more or less equilibrium sex ratio, which nevertheless ranges from M: 33.3% & F: 66.6% for *E. nilssonii* to M: 74.2% & F: 25.8% for *N. noctula*. The significant male predominance in *N. noctula* in Central Europe is also confirmed by previous studies [Strelkov 1969; Lehnert *et al.* 2018].

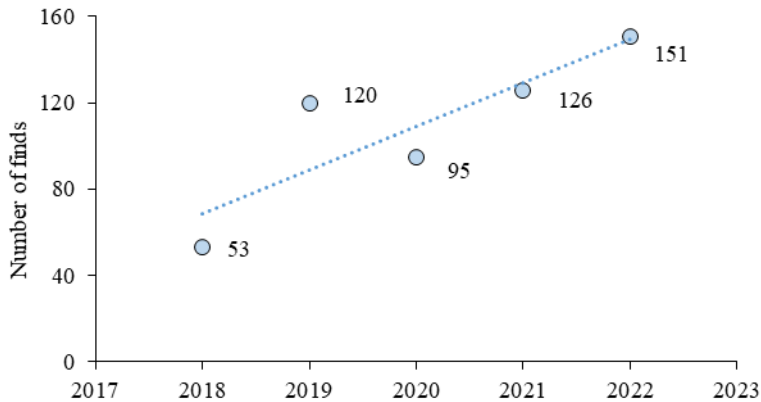


Fig. 3. Number of finds recorded by years.

Рис. 3. Кількість знахідок, зареєстрованих за роками.

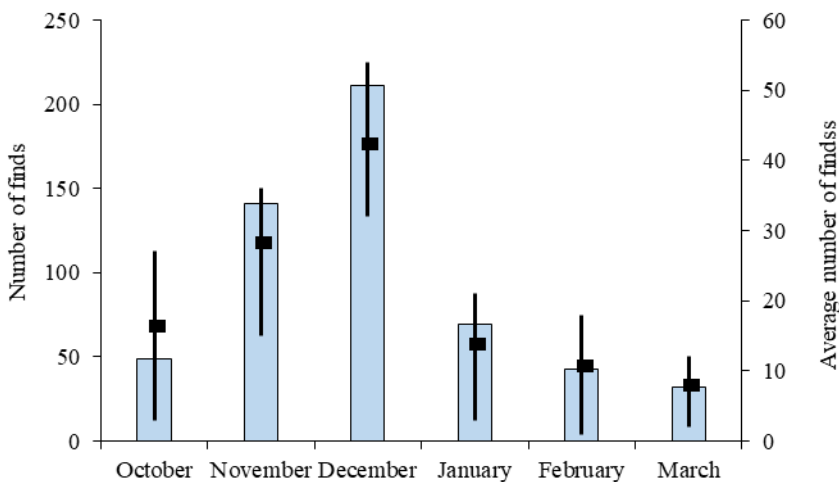


Fig. 4. Total and average number of finds recorded by years.

Рис. 4. Загальна та середня кількість знахідок, зареєстрованих за місяцями.

Table 1. The number and percentage of records and finds of bat species

Таблиця 1. Кількість та відсоткове співвідношення реєстрацій та знахідок видів кажанів

Species	Records		Finds	
	N	%	N	%
<i>Barbastella barbastellus</i>	4	0.54	2	0.35
<i>Eptesicus nilssonii</i>	42	5.75	17	3
<i>Eptesicus serotinus</i>	65	8.9	64	11.32
<i>Myotis dasycneme</i>	1	0.13	1	0.17
<i>Myotis daubentonii</i>	16	2.19	7	1.23
<i>Nyctalus noctula</i>	170	23.28	47	8.31
<i>Pipistrellus kuhlii</i>	8	1.09	7	1.23
<i>Plecotus auritus</i>	18	2.46	17	3
<i>Pipistrellus pygmaeus</i>	1	0.13	1	0.17
<i>Vespertilio murinus</i>	405	55.47	403	71.32

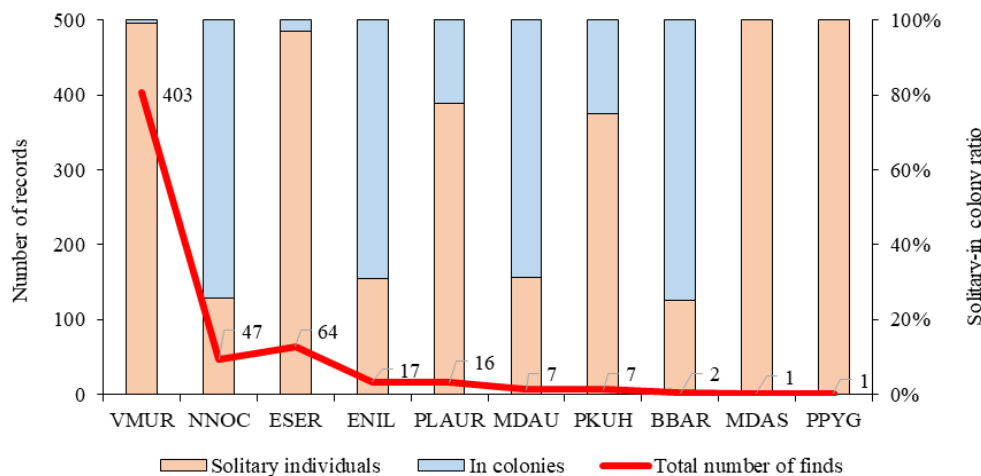


Fig. 5. Ratio of solitary/colonial individuals. The order of species is given in accordance with the number of records.

Рис. 5. Співвідношення одиночних особин та особин у складі колоній. Порядок видів наведено відповідно до кількості зареєстрованих особин.

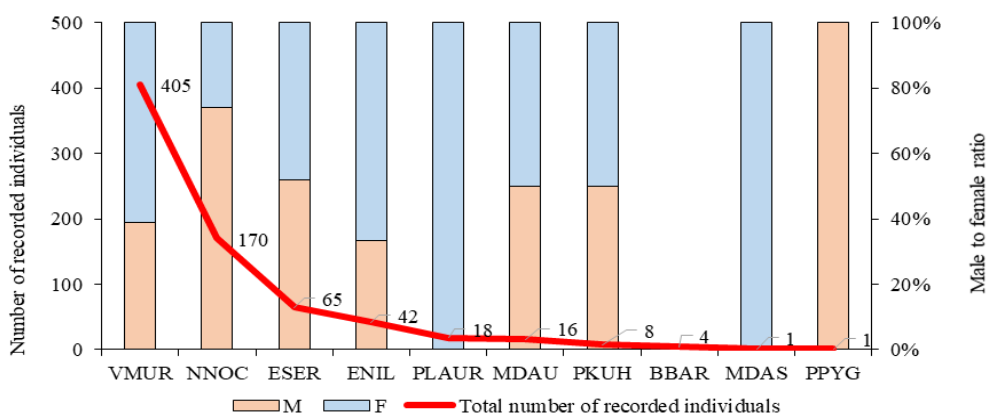


Fig. 6. Male to female ratio. The order of species is given in accordance with the number of records.

Рис. 6. Співвідношення самців та самок. Порядок видів наведено відповідно до кількості зареєстрованих особин.

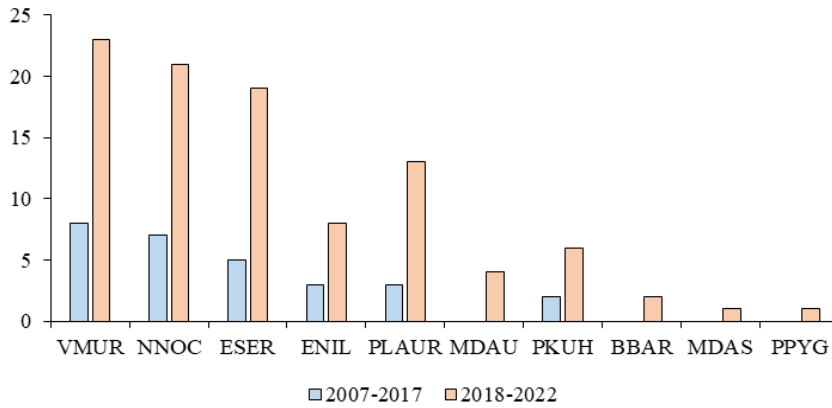


Fig. 7. Number of localities in 2007–2017 and 2018–2022. The order of species is given in accordance with the number of records.

Рис. 7. Кількість локалітетів у 2007–2017 та 2018–2022. Порядок видів наведено відповідно до кількості зареєстрованих особин.

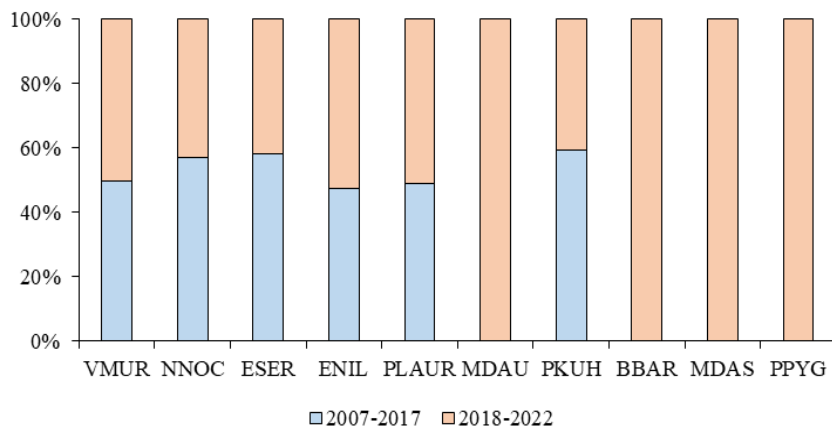


Fig. 8. Percentage of bats recorded in 2007–2017 and 2018–2022. The order of species is given in accordance with the number of records.

Рис. 8. Відсоткове співвідношення кажанів, зареєстрованих у 2007–2017 та 2018–2022. Порядок видів наведено відповідно до кількості зареєстрованих особин.

Compared to the previous period (2007–2017), there is an increase in the number of recorded localities for all species (Fig. 7). We assume there are several possible explanations for this:

- Distribution of information about the activities of ‘Kazhanapolis’ in the media and, as a result, an increase in the number of requests. This reason may be true for sedentary species (*E. serotinus*, *E. nilssonii*, *M. daubentonii*, *P. auritus*, and *M. dasycneme*);
- Further expansion of the hibernation range of *N. noctula* and *V. murinus*—species that were previously considered migratory;
- Expansion of the range of a new species for Belarus—*P. kuhlii*;
- A combination of all of the above reasons.

The percentage of finds of various species when comparing data from 2007–2017 and 2018–2022 did not change significantly (Fig. 8), with the exception of *M. daubentonii*, *B. barbastellus*, *M. dasycneme*, and *P. pygmaeus*, the number of which, however, is small. In our opinion, this comparison adequately reflects the species structure of the ‘urban’ bat fauna in Belarus, and shows the high reliability of our previous work (2007–2017) despite the small sample size presented at that time (113 finds).

## Conclusion

As a result of the work of ‘Kazhanapolis’ in 2018–2022, 10 species of bats wintering in Belarus were recorded. Compared to the period of 2007–2017, an increase in the number of recorded species and in the total number of individuals and localities is shown. The largest number of individuals during the hibernation season is on average recorded in December, and the smallest in March.

For the so-called 'urban' bat fauna, a significant predominance of *V. murinus*, *N. noctula*, and *E. serotinus* is shown, while the absolute dominant is *V. murinus*, both in terms of the number of finds and individuals. For *N. noctula*, a species that until recently was considered migratory, a significant expansion of the hibernation range is shown. With regard to *E. serotinus*, it should be noted that for the entire period of activity of 'Kazhanapolis' (2007–2022), there were no records in northern Belarus.

Of considerable interest are the registrations of species included in the Red Data Book, namely *B. barbastellus*, *E. nilssonii*, and *M. dasycneme*. Our data significantly expand the understanding of the distribution of these species in Belarus. In addition, data were obtained confirming the further expansion of the *P. kuhlii* in Belarus.

## Acknowledgements

We thank all volunteers for their kind help. At different times, the activity of Kazanapolis was supported by APB/BirdLife–Belarus, National Academy of Sciences of Belarus, Republican Centre for Ecology and Local History and Lyceum of Belarusian State University. We are also grateful to Lena Godlevska for her help as well as to two anonymous reviewers for their many insightful comments and suggestions.

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