



MONITORING OF BATS IN KEY WINTERING SHELTERS OF THE NORTHERN BLACK SEA REGION (UKRAINE)

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Abstract

Based on the results of winter monitoring of bats conducted in 2020–2022 in key wintering sites—limestone mines located within the continental part of the Black Sea area and the steppe area of Ukraine (Mykolayiv and Odesa oblasts)—we have recorded 7 species of bats: *Myotis daubentonii*, *M. dasycneme*, *M. aurascens*, *M. mystacinus*, *Plecotus auritus*, *P. austriacus*, and *Eptesicus serotinus*. Compared to results of monitoring conducted between 2008 and 2011, the number of bats that winter in the mentioned mines has doubled, from 702 to 1421 specimens. One individual of *M. aurascens*, which was ringed in the mine KVL-K in 2008–2011, was recorded there for the second time. The ring number is VT 03492, Kyiv, Ukraine. Five species of bats were recorded in each of the three monitored sites. The results of the two monitoring sessions appear to be almost identical both by species composition and abundance. The dominating species in the inspected sites and, apparently, generally for winter aggregations of the same type in the region is *M. daubentonii*. The species share in the total sample was 77%. In Kovalivka (KVL-K) and Illyinka (ILN-K) mines, the co-dominance of two species—*M. daubentonii* and *M. aurascens*—was observed (23.3% and 26.8%, respectively). The species *M. mystacinus* was recorded only in the Kovalivsky mines (9.6%), whereas *P. auritus* was found only in the Nova Odesa mines (0.1%). The Nova Odesa mines play a key role in preserving the rare *M. dasycneme* in Ukraine harbouring the most abundant and widely known accumulation of this species. All investigated caves are particularly important for the preservation of bat populations in the region and their support during critical stages of their life. Granting the Kuyalnik Estuary the status of nature reserve will contribute to the conservation of habitats important for bats. Monitoring of key habitats for conservation of bat species is an important task for the implementation of EUROBATs agreement, which was signed by Ukraine. The obtained data are especially crucial considering the invasion of the Russian Federation to Ukraine since it is unclear when there will be a chance to continue the monitoring of bats in these key wintering sites and what is their current condition.

Cite as

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Моніторинг кажанів ключових зимових сховищ Північного Причорномор'я (Україна)

Михайло Дребет

Резюме. За результатами зимових обліків кажанів 2020-2022рр. в ключових зимових сховищах — вапнякових копальнях в межах Континентального Причорномор'я в степовій зоні України (Миколаївська та Одеська обл.) обліковано 7 видів кажанів: *Myotis daubentonii*, *M. dasycneme*, *M. aurascens*, *M. mystacinus*, *Plecotus auritus*, *P. austriacus*, *Eptesicus serotinus*. Відносно попередніх обліків 2008-2011рр. чисельність кажанів на зимівлі у зазначених каменоломнях зростає вдвічі — з 702 до 1421 особин. Повторно обліковано одну особину *Myotis aurascens*, що була закріплена в KVL-K копальні в 2008-2011 роках. Номер кільця — BT 03492 Kyiv Ukraine. П'ять видів відмічені для усіх трьох обстежених підземель. Результати обліків за два сезони практично ідентичні, як за видовим складом, так і за чисельністю. Домінуючим видом в обстежених зимових сховищах і очевидно загалом для зимових агрегацій подібного типу в регіоні є *Myotis daubentonii*. Частка в загальному обліку становить рівно 77%. У Ковалівських (KVL-K) та Іллінських (ILN-K) спостерігається фактично співдомінування двох видів — *Myotis daubentonii* та *Myotis aurascens* — 23,3 та 26,8 % відповідно. *Myotis mystacinus* облікована лише в Ковалівських (9,6%), а *Plecotus auritus* лише в Ново-Одеських (0,1%) підземлях. Ново-Одеські копальні відіграють ключову роль для збереження рідкісного виду кажанів в Україні — *Myotis dasycneme*, тут знаходиться найчисельніше з відомих скупчення виду в Україні. Усі обстежені каменоломні є надзвичайно важливими для збереження популяцій рукокрилих ссавців регіону та підтримки їх популяцій на критичних стадіях їх життєдіяльності. Надання території Куяльницького лиману статусу національного природного парку «Куяльницький» сприятиме збереженню важливих оселищ для кажанів. Моніторинг ключових оселищ для збереження кажанів, є важливим завданням на виконання окремої Угоди EUROBATS Бернської конвенції, стороною якої є Україна. Зібрані дані мають дуже важливе значення у зв'язку з військовою агресією російської федерації на території України. Наразі не зрозуміло коли з'явиться можливість продовжити моніторингові спостереження в цих ключових зимових сховищах і яка ситуація з ними в даний час.

Ключові слова: Моніторинг, кажани, зимівля, ключові сховища, Північне Причорномор'я.

Introduction

In 1999, Ukraine joined the EUROBATS agreement [Domashlinets 2018]. In line with the recommendations set in this agreement, each participant responsible for the identification of localities that are important for the preservation of bats; these localities must be protected from destruction and infraction [Zagorodniuk 2004]. Nowadays, the volumes and intensity of natural area reclamation in Ukraine are growing from day to day. Artificial underground cavities are utilized for growing mushrooms, preservation of wines, as tourist attractions, and for household needs. The areas around the caves are used for cattle grazing and the entrances are often filled up with garbage or other wastes.

The monitored area is incredibly rich in artificial underground cavities. There are dozens of abandoned stone mines, especially in Odesa oblast, some of which are more widely known, and some have protected status (e.g. the Odesa catacombs have a status of geological natural landmark of state importance). Other cavities are less well-known, but they have a significant role as habitats of rare animal species, in particular bats [Godlevska et al. 2011].

During 2008–2011, our colleagues explored about 50 underground objects or complexes that are used by bats in the summer or winter periods. In summer, bats were recorded in 16 out of 48 objects, and in winter they were found in 29 out of 30 objects. As a result, 6 bat species were recorded in the region. Additionally, we have identified 4 key underground sites of bats in the continental part of the Black Sea region of Ukraine: two in Odesa Oblast (KVL-2 and ILN-1 mines), one in Mykolayiv Oblast (NOD mines), and one in Kherson Oblast (OSK mines). These artificial objects were recognised as significant wintering sites of bats, in which more than half (66.4%) of the animals were recorded in winter [Godlevska et al. 2011].

As of 2014, 35 underground sites in the territory of Ukraine were included as key territories for protection and preservation of bats in Europe; three of them were mentioned earlier (KVL-K, ILN-K, and NOD-K)¹.

Three out of the four key underground sites of bats (NOD, KVL-2, and ILN-1 mines) were investigated in 2020–2022. In the context of the above issues, monitoring of wintering sites of bats and the obtained results are important for further implementation of efficient conservation measures to ensure the preservation of these animals in regard to existing threats. The monitoring conducted in 2020–2022 contributes to the understanding of population dynamics of bats in winter.

Materials and Methods

Fenix HL60R headlamps were used during monitoring. A Nikon D200 camera with different lenses and a mirrorless Panasonic Lumix DC camera with different lenses were used to photograph the animals. Morphometric measurements were taken with an electronic calliper.

The methodical approaches used in the study follows Zagorodniuk *et al.* [2002]. The identification of bats was carried out with a reference to the illustrated guide of bats of Europe [Dietz & von Helversen 2004].

Abbreviations used in the article: MDAU—*Myotis daubentonii*; MDAS—*M. dasycneme*; MAUR—*M. aurascens*; MMYS—*M. mystacinus*; PAUR—*Plecotus auritus*; PAUS—*P. austriacus*; ESER—*Eptesicus serotinus*; KVL-K—limestone mines near the village of Kovalivka; ILN-K—limestone mines near the village of Illyinka; NOD-K—limestone mines near the village of Nova Odesa; T1-4—ordinal numbers of the mines in the list.

Monitoring sessions in 2020–2022 were conducted under the same conditions by two observers and with the same type of lighting to ensure comparability.

Results

General characteristic of the limestone mines

The examined underground cavities are located within the continental part of the Black Sea region and in the steppe zone of Ukraine (Fig. 1). All of the examined localities are underground limestone mines with a considerable total length of underground passages (5 to 30 km).



Fig. 1. Research region and location of key wintering sites.

Рис. 1. Регiон дослідження та місцезнаходження ключових зимових сховищ.

¹ Source: <https://www.eurobats.org> (<https://bit.ly/3dnCEEem>)



Fig. 2. One of the entrances and passages in mine ILN-K.
Рис. 2. Один із входів і тунелів штольні ILN-K.



Fig. 3. One of the entrances and passages in mine KVL-K.
Рис. 3. Один із входів і тунелів штольні KVL-K.

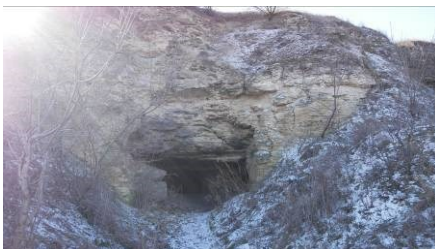


Fig. 4. One of the entrances and passages in mine NOD-K.
Рис. 4. Один із входів і тунелів штольні NOD-K.

Table 1. Results of bat monitoring for 2020–2022 in key wintering shelters of the Northern Black Sea region

Таблиця 1. Результати моніторингу рукокрилих за 2020–2022 роки у ключових зимувальних сховищах Північного Причорномор'я

No.	Species	2020–2021	2021–2022
1.	<i>Myotis daubentonii</i> (Kuhl, 1817)	1127	1010
2.	<i>Myotis dasycneme</i> (Boie, 1825)	161	151
3.	<i>Myotis aurascens</i> Kuzyakin, 1935	88	80
4.	<i>Myotis mystacinus</i> (Kuhl, 1817)	3	7
5.	<i>Plecotus auritus</i> (Linnaeus, 1758)	8	1
6.	<i>Plecotus austriacus</i> (Fischer, 1829)	11	18
7.	<i>Eptesicus serotinus</i> (Schreber, 1774)	9	12
Total number of animals		1421	1312

All entrance areas of mines were carefully inspected (from the entry to the area of steady temperature from +12 and above); the elongated passages with dynamic temperature conditions were inspected by the transect method.

These limestone mines, despite their artificial nature, are vulnerable shelters important for the preservation of a whole group of rare bats. The most important task in regard to the preservation of bats is the protection of their wintering sites from unauthorized visits. A possibility of installation of protective grates must be considered. Limitations on the number of visits must be approved for the Kovalivka mines to decrease the disturbance of this place in specific periods (in particular, during the hibernation of bats), which can be implemented by creating the Kuyalnyk National Nature Park.

The catacombs in Odesa Oblast are located between the Hadzhybei and Kuyalnyk estuaries in close vicinity to the villages Kovalivka and Illyinka of Bilyaivka Raion, Odesa Oblast.

The mines in Mykolayiv Oblast (Nova Odesa) have two entrances and approximately 5 km of corridors (Fig. 2). In fact, the mines consist of two parts: one part has more dynamic micro climatic conditions that are more convenient for the hibernation of bats and, for some species, also for the creation of summer breeding colonies.

General characteristics of the species composition of bats

The results of the 2-year-long monitoring appear to be almost identical by both species composition and abundance of bats, except for one species—*Myotis aurascens*.

The total number of the registered species in 2021–2022 was somewhat lower compared to the respective season in 2020–2021, which might be due to the warmer winter. Under such conditions, wintering colonies of bats tend to be more dynamic, which can be reflected in the monitoring results. Besides, the difference might be insignificant (Tab. 1).

In total, seven bat species have been identified: *Myotis daubentonii*, *M. dasycneme*, *M. aurascens*, *M. mystacinus*, *Plecotus auritus*, *P. austriacus*, and *Eptesicus serotinus*. Of these seven registered species, five were found in each inspected site.

Features of the species

Of the seven registered species, five were recorded in each of the inspected sites. The whiskered bat (*Myotis mystacinus*) was registered only in the Kovalivka mines (9.6%), and the brown long-eared bat was registered only in the Nova Odesa mines (0.1%). In the Kovalivka (KVL-K) and Illyinka (ILN-K) mines, Daubenton's bat and the steppe whiskered bat (*Myotis aurascens*) appeared to be co-dominant species.

Daubenton's bat (*Myotis daubentonii*) has been a dominating species during both survey seasons and is, apparently, the dominating species in general in wintering colonies in the region. The ratio of the species in the total sample was 77%. It was also a dominating species in all inspected mines. Only in the Nova Odesa mines (NOD-K), the number of Daubenton's bats was higher

(81.6%). The concentration of Daubenton's bat for winter hibernation in the Nova Odesa mines is apparently related to the presence of considerable foraging areas around the wintering sites (floodplains of the rivers Southern Bug and Gnylyi Yelanets).

Pond bat (*Myotis dasycneme*). The Nova Odesa mines contained the largest number of known pond bat wintering sites in Ukraine. The pond bat arrange their winter hibernation in a number of groups that comprise a couple of dozens of bats; mainly, they create groups of 3–6 bats, seldom they hibernate alone. Some groups are mixed with Daubenton's bats. The pond bat has important functional role in wetland ecosystems and, respectively, its summering and wintering sites are concentrated around these habitats. The Nova Odesa mines are located close to the Southern Bug and its left tributary, the Gnylyi Yelanets (3.5 km). In the floodplains of these rivers are large areas of temporary and permanent fish farms (1 km) and other ponds, which provide important foraging areas for the pond bat. The Illyinka and Kovalivka mines are also important wintering sites for the pond bat and the natural habitats around them (the Hadzhybey and Kuyalnik Estuaries) are important foraging areas.

Steppe whiskered bat (*Myotis aurascens*). In 2000–2017, the steppe whiskered bat was registered in different caves of the region [Godlevska *et al.* 2018]. In 2020–2021, in KVL-K mines, the author registered a steppe whiskered bat (male, R = 34.1) with a ring No. VT 03492, Kyiv, Ukraine. This specimen was ringed during the first full-scale survey of bats in an underground object of the continental part of the Black Sea region of Ukraine in 2008–2011 [Godlevska *et al.* 2011]. Evidently, at that time, the steppe whiskered bat was considered as a representative of the 'whiskered bat' and therefore it was not listed as a separate species. The differentiation of 'whiskered' bats is quite complicated, especially of young individuals [Dietz & von Helversen 2004].

Whiskered bat (*Myotis mystacinus*). This species differs by darker colouration of the fur without golden shine. As a rule, the fur of the hibernating bats is strongly dishevelled, its structure is thin and therefore it gets wet and swaddles. When inspecting the mines, such animals look very wet especially if compared with the rest.

Brown long-eared bat (*Plecotus auritus*). It was registered only in the Nova Odesa mines. Its abundance is low. The bats of this species usually settle alone in the pre-entrance areas of caves/mines openly or in small niches.

Grey long-eared bat (*Plecotus austriacus*). Mostly located alone in the pre-entrance areas of the caves/mines.

Serotine bat (*Eptesicus serotinus*). In the inspected caves, the serotine bat was located in the pre-entrance areas in groups of several individuals. They mostly hibernate in vertical niches. Bright orange ectoparasites (ticks) were often noticed on the face of serotine bats.

Discussion

As a result of the first full-scale survey of bats in the continental (northern) part of the Black Sea region conducted in 2008–2011 (in the mines of Odesa, Mykolayiv, and Kherson oblasts of Ukraine), 6 species of bats were identified—*Myotis daubentonii*, *M. dasycneme*, *M. mystacinus*, *Plecotus auritus*, *P. austriacus*, and *Eptesicus serotinus* in approximately 50 inspected sites. During the second survey, the list of species was amended by *Pipistrellus pipistrellus*, which was registered in the KVL mine. Five of the revealed earlier six species were registered all around the region, and the exception was *P. auritus* with a single, and rather occasional, registration. The total number of bats in summer was only 211, while in winter their number was 1516 individuals. The dominating species in the region was *Myotis daubentonii* (46.1%). The total number of bats in the KVL-K, ILN-K, and NOD-K mines was 702 individuals [Godlevska *et al.* 2011].

During the monitoring period in 2020–2022, the number of the registered 7 species in the three key sites of bats in the continental part of the Black Sea region was 1421 individuals (Tab. 2). Considering the specifics and methods of winter surveys in mines inhabited by the mentioned species, their total number might be higher.

Thus, within 10 years, the number of bats in the mines has doubled.

The list of species was complemented with the steppe whiskered bat, the absence of which during the previous surveys was due to the approved systematic approach, because in the past these bats were recorded as whiskered bats [Godlevska *et al.* 2010]. Later, the taxonomic status of the steppe whiskered bat has changed and it was distinguished as a separate species—*Myotis aurascens* [Zagorodniuk 2012]. The steppe whiskered bat is listed in the checklist of mammal species of Ukraine [Zagorodniuk & Emelyanov 2012].

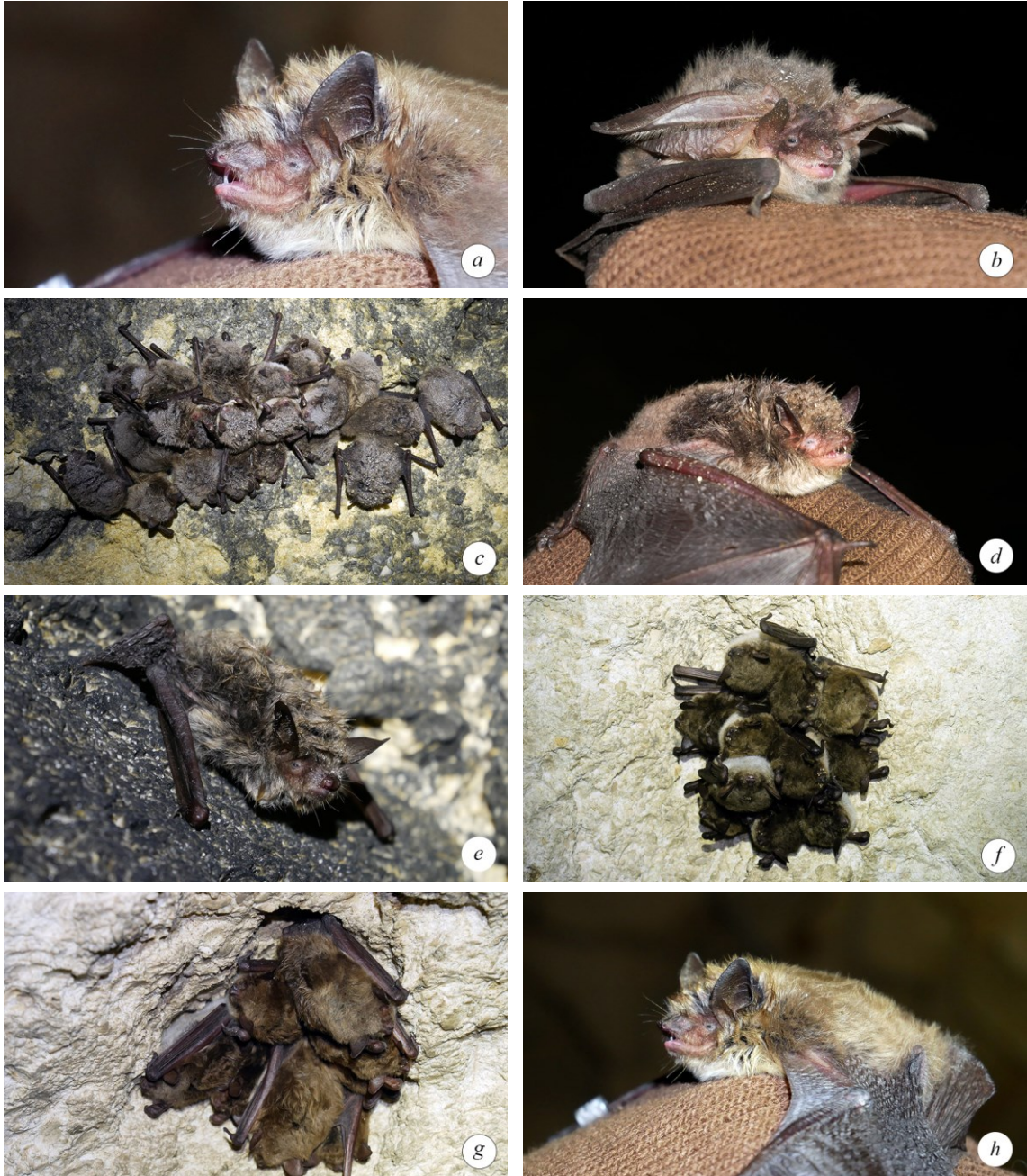


Fig. 5. Bats in limestone mines: *a, h*, steppe whiskered bat; *b*, grey long-eared bat; *c*, typical wintering clusters—Daubenton's bat; *d*, Daubenton's bat; *e*, whiskered bat; *f-g*, typical wintering clusters—pond bat.

Рис. 5. Рукокрилі у вапнякових штольнях: *a, h* — нічниця степова; *b* — вухань австрійський; *c* — типовий зимувальний кластер — нічниця водяна; *d* — нічниця водяна; *e* — нічниця вусата; *f-g* — типовий зимувальний кластер — нічниця ставкова.

Table 2. The ratio (%) of colonies of different bat species registered in 2020–2022 in key wintering shelters of the Northern Black Sea region (Ukraine)

Таблиця 2. Частка (%) колоній різних видів рукокрилих, знайдених у 2020–2022 рр. у ключових зимувальних сховищах Північного Причорномор'я (Україна)

Shelter	MDAU	MDAS	MAUR	MMYS	PAUR	PAUS	ESER	M. sp.
KVL-K	24.7	15.1	23.3	9.6	—	8.2	9.6	9.6
ILN-K	34.1	9.8	26.8	—	—	12.2	7.3	9.8
NOD-K	81.6	11.4	4.3	—	0.1	0.6	0.2	1.8

The mines in Mykolayiv Oblast (NOD-K, Nova Odesa) are extremely important for the winter hibernation of bats. They support the existence of the biggest of the registered winter clusters of the pond bat—one of the rarest bat species in Ukraine. The Nova Odesa mines are another wintering sites of one of the biggest clusters of the pond bat in Ukraine (the abundance of the species increases and now it is more than 1000 individuals).

During 2020–2021, in the Kovalivka mines, the registration of bats took place alongside with a public event—militaristic orienteering game. Approximately 30–40 people participated in that game. The game proceeded in the pre-entrance areas of the mines and was accompanied by the instructors. Evidently, such public event, which regularly (according to the players) takes place during the entire winter period, influences the hibernation of bats. The mines located near Illyinka are unsuitable for the aforementioned events as they are in far more worse technical condition and the later are being used by the local population as dumps. During the survey, the author noticed a considerable dumping ground with lots of old car parts.

Strengthening the protection regime near the Kovalivka and Illyinka mines by granting the area around the Kuyalnyk Estuary the status of Kuyalnyk National Nature Park and arranging its administration with a respective number of staff and state funding will allow to ensure the appropriate protection of its natural complexes, including the key territories for protection of bats. The decree on the establishing the Kuyalnyk National Natural Park was issued in January 2022¹. Nevertheless, it is obvious that this issue will be finalized only when the unprovoked aggression of the russian federation against Ukraine ends.

The Nova Odesa mines are located in the slope of a steppe ravine with a small stream at the bottom, which undergo severe anthropogenic interference in the form of voluntary tourism. Manifestations of such interference are fumigation, soothing, and littering of the limestone mines. A lot of advertisement can be found on the Internet from the local guides offering a tour to the caves. These types of interventions to the underground sites endanger the steady winter clusters of bats. Thus, despite the potential and actual interference, the inspected wintering clusters in the region have an immensely important role due to the lack of other shelters while the number of hibernating bats is constantly growing. Besides, these shelters may also play the important role of not only of a hibernation place but also as a transit shelter during seasonal migrations [Godlevska *et al.* 2018].

In recent years, there have been numerous cases of creation of wintering clusters of bats involving different migratory species, particularly in the east of Ukraine [Zagorodniuk 2018]. The protection of bats is also emphasized by the natural habitats located in close vicinity to the mentioned mines—the river valleys of the Southern Bug and Gnylyi Yelanets and their floodplains, as well as the Hadzhybei and Kuyalnyk estuaries, which play a key role in providing the bats with food resources.

Conclusions

The inspected wintering sites KVL-K, ILN-K, and NOD-K play a key role in the hibernation of 7 bat species in Ukraine, including vulnerable, rare, and endangered species.

¹ Decree of the President of Ukraine No. 3/2022. On establishing the Kuyalnyk National Nature Park. Online: <https://www.president.gov.ua/documents/32022-41117>

An equally important role in supporting the population of bats is played by the natural areas around their key sites—the river valleys of the Southern Bug and Gnylyi Yelanets, their floodplains and the Hadzhybei and Kuyalnyk Estuaries, which are important feeding locations.

During 2020–2022, the total number of wintering bats in KVL-K, ILN-K, and NOD-K was 1500 individuals, according to the survey results.

Within 10 years between 2011 and 2022, the number of bats hibernating in the mentioned mines has doubled—from 702 to 1421 animals.

The dominating species in all mines was the Daubenton's bat with a total ratio of 77%.

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