

ECOLOGY OF BAT SPECIES IN THE ARID REGION OF THE DAURIAN STEPPE AT THE PEAK OF DROUGHT

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Bats (Chiroptera) are the least studied group of mammals in the Daurian steppe (Inner Asia: Mongolia, Russia and China). We surveyed the bat fauna of the Daurian steppe and some ecological features of bat species in 2008–2019. We recorded six bat species in this region, of which *Vespertilio murinus*, *V. sinensis* and *Myotis davidii* are the most abundant. *Myotis davidii* tended to hide in the rocks near fresh water sources. Unlike *Vespertilio*, *M. davidii* avoided settling in human constructions. *Vespertilio* species can live farther from water sources compared to *M. davidii*. The sex ratio of collected adult *V. murinus*, *V. sinensis*, *M. davidii* was female-based. This indicates that these species do not hibernate in the Daurian steppe region. Our results show the important role of the studied region for these migratory bat species, as it is a breeding territory. At the beginning of the XXI century, many lakes and rivers dried up partially or completely in Dauria. In the Russian part of the Daurian steppe, we observed an increase in the *V. sinensis* population and a decrease in the populations of *M. petax* and *M. davidii*. We speculate that the change in the bat community is a consequence of the reduction in the number of water bodies in Dauria, especially in the Mongolian part (Dornod aimag).

Key words: climate change, dry period, Mongolia, range extension, sex ratio

Introduction

Bats (Chiroptera) are an important group of mammals because of their multiple functional roles in ecosystems (Boyles et al., 2011; Kunz et al., 2011). Bats are slow-breeding animals and therefore relatively vulnerable to abrupt environmental changes (IUCN, 2020). They have an excellent mobility and can respond quickly to environmental changes (Norberg & Rayner, 1987; Luo et al., 2019). Climate change has altered the distribution and ecology of many species including bats (Lundy et al., 2010; Sherwin et al., 2013; Wu, 2016). One possible mechanism for the change in geographic distribution of bats is that climate change could cause a reduced available fresh water source in arid ecosystems (Sherwin et al., 2013; Razgour et al., 2018). In these ecosystems, bat activity and diversity concentrates near water bodies and associated vegetation (Adams, 2010; Korine et al., 2016; Amorim et al., 2018). For example, in Central Mongolia, even sub-optimal water sources such as water containers for livestock are used by bats under conditions of a lack of natural water sources (Nyambayar et al., 2010).

The Daurian steppe is located on the northern periphery of Inner Asia. It is a globally important arid, ecological region due to the high biodiversity. The «Landscapes of Dauria» (in Russian and Mongolian) is a transboundary serial World Heritage since 2017. The Daurian steppe is a region ecologically strongly depending on climate changes. Long-term changes in

precipitation of the Daurian steppe are cyclic (Obyazov, 2012). The lake level and river flows directly depend on precipitation. Many water bodies of the Daurian steppe were drying up in the early XXI century (Sosnina & Kurganovich, 2015; Golyatina et al., 2018). For example, the largest lakes and many small lakes in Transbaikalia Torey had dried up completely by 2017. The Daurian ecosystem is adapted to cyclical changes in humidity. Landscapes changed from wetland to dry steppe and in wet phases the reverse processes took place (Kirilyuk et al., 2012).

In the Daurian steppe, the ecological features of bat fauna are poorly studied (Botvinkin, 2002). To date, six bat species were known, including *Myotis davidii* (Peters, 1869), *M. petax* Hollister, 1912, *Plecotus ognevi* Kishida, 1927, *Vespertilio sinensis* Peters, 1880, *V. murinus* Linnaeus, 1758, and *Eptesicus nilssonii* (Keyserling & Blasius, 1839) (Rosina & Kirilyuk, 2000; Botvinkin, 2002; Bazhenov, 2013; Monhnast, 2014; Ariunbold, 2016). Four of them (*M. davidii*, *M. petax*, *P. ognevi*, *V. sinensis*) are listed in the Red Data Book of Zabaikalsky Krai (2012) (Russia) as «needed protection» or as «data deficient». *Vespertilio sinensis* is listed in the Mongolian Red Book (2013). None of them is considered as threatened species by the International Union for Conservation of Nature (IUCN).

The aim of this study is to summarise data on the bat species distribution in the Daurian steppe, relative abundance of bats and sex ratios of them, and exam-

ine the effect of climate change (drought for several years) on the occurrence and distribution of bats in the Daurian steppe. Despite an increase in interest in the relationship between range expansions and climatic change (Lundy et al., 2010; Wu, 2016), the effects of climatic factors on bat distribution remain rarely studied. The study of bat populations in Dauria is important for understanding the modern climate change effects on threatened species in arid ecosystems of Central Asia.

Material and Methods

The study was conducted in the Daurian steppe situated at the juncture of the Mongolian, Russian and Chinese state borders, in the northern part of Inner Asia. The Daurian steppe has a mid-temperate, semiarid and continental monsoon climate. The average annual rainfall is 250–350 mm.

The largest amount of data has been obtained in the Daurian State Nature Reserve and its buffer zone (Zabaikalsky Krai, Russia), Mongol Daguur Strictly Protected Area (Dornod Aimag, Mongolia), and Hulun Lake Reserve (Inner Mongolia, China).

We caught bats during the warm season (from May to August). We did not find any bats between September and April. We searched for bats in vari-

ous potential shelters and caught them by hand, tweezers or net. In addition, we sampled bats in ground-level mist nets. Mist nets (4 × 10 m, mesh size = 17 mm) were placed near previously known or supposed bat shelters or near water sources. Bats were collected, identified for age and gender, measured, and weighed. All animals were released then at the capture sites. In Russia and Mongolia, some bats were tagged with numbered bands on their right forearms (Russian ornithological bands with the inscription «Moscow №» and special wing bands with the inscription «Russia №», produced by Aranea, Poland) for future tracking. Band diameters are 2.9 mm for *Myotis* and 4.2 mm for *Vespertilio*.

In 2008–2019, we sampled 21 sites in the Daurian steppe (Fig. 1). Each site included one to five sampled localities. We tested the relationship between the more common bat species and important elements of the environment in 500-m buffer around the bat locations. We used 31 locations of recorded bats (each site from Table 1 contains one to three locations with the same or other environment elements). We assessed whether the sex ratio of bats varied from 1:1 using Pearson’s Chi-square test performed using R 3.4.2 (R Core Team, 2020).

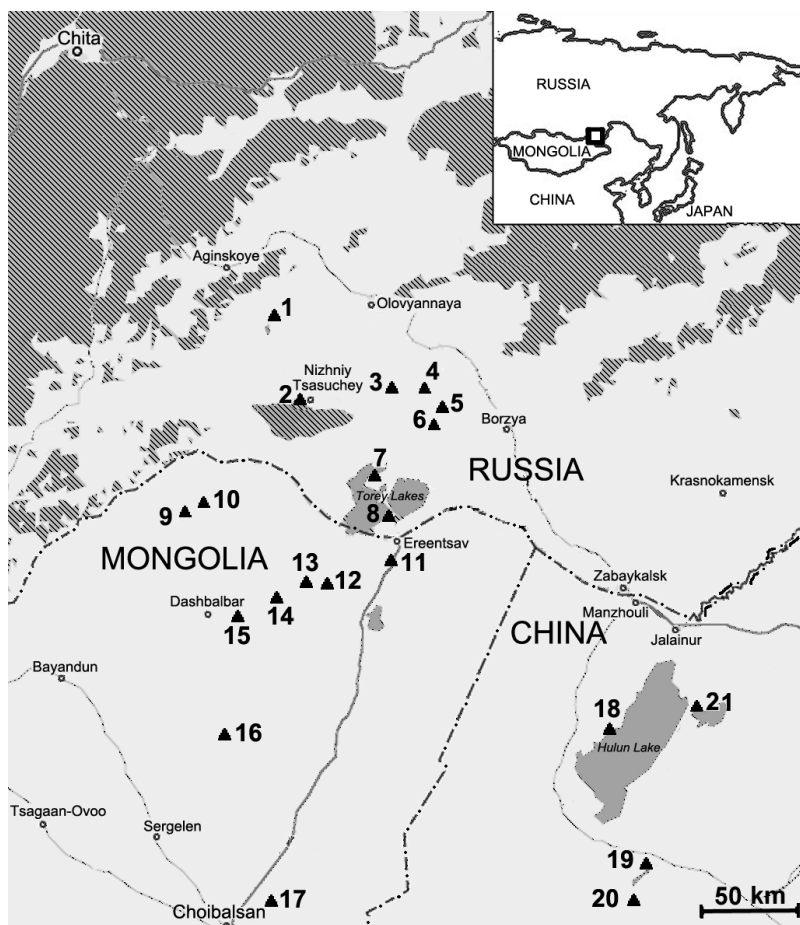


Fig. 1. Map of the Daurian steppe with bat capture sites in 2008–2019. Forest areas are hatched. Numeration of the study sites is defined in Table 1.

Table 1. Number and percentage (in brackets) of bats at each site in the Daurian steppe

No	Location	<i>Vespertilio murinus</i>	<i>Vespertilio sinensis</i>	<i>Myotis davidii</i>	<i>Myotis petax</i>	<i>Plecotus ognevi</i>	<i>Eptesicus nilssonii</i>
Russia, Zabaikalsky Krai							
1	Aginsky district, cliffs by the lake Ulin. 50.9081° N, 114.9036° E	2 (5.4)	3 (8.1)	32 (86.5)	–	–	–
2	Ononsky district, River Onon bank near the car bridge: rocks, concrete bridge, buildings in the villages of Verhniy Tsasuchey and Nizhniy Tsasuchey. 50.5244° N, 115.0533° E	8 (27.6)	18 (62.1)	–	–	2 (6.9)	1 (3.4)
3	Aginsky district, right bank of the River Onon, 6 km northeast of the village of Ust-Borzya: Kheetey cave (Sukhaya). 50.6431° N, 115.7661° E	–	–	–	–	1 (100)	–
4	Olovyanninsky district, north of Adun-Chelon mountains: country road, several concrete small bridges. 50.5789° N, 115.9552° E	17 (68.0)	8 (32.0)	–	–	–	–
5	The juncture of Olovyanninsky, Borzinsky and Ononsky districts: cliffs of the Adun-Chelon mountains, forest-steppe. 50.4900° N, 116.0670° E	8 (34.8)	5 (21.7)	2 (8.7)	–	8 (34.8)	–
6	Ononsky district, southwest of Adun-Chelon mountains: ruined concrete building. 50.3706° N, 115.9428° E	7 (35.0)	13 (65.0)	–	–	–	–
7	Ononsky district, the eastern shore of the Lake Barun-Torey, Myrgen Peninsula: wooden barn. 50.1739° N, 115.5678° E	2 (100)	–	–	–	–	–
8	Borzinsky district, the southwestern shore of the Lake Zun-Torey: Utochi research station buildings. 49.9997° N, 115.7311° E	243 (86.8)	37 (13.2)	–	–	–	–
Mongolia, Dornod Aimag							
9	The right bank of the River Duchiyin-Gol, Erhat-Ula mountain: cracks in the rock. 50.0431° N, 114.1991° E	–	–	1 (100)	–	–	–
10	The right bank of the River Duchiyin-Gol: coastal cliffs opposite the mountain Gatsa. 50.0866° N, 114.2875° E	–	–	1 (100)	–	–	–
11	10 km south of the Erenzav station: the railroad bridge over the River Teliyn-Gol. 49.8089° N, 115.7231° E	–	39 (100)	–	–	–	–
12	The right bank of the River Uldza opposite lake Galutin-Nuur: rocks. 49.7064° N, 115.3281° E	3 (15.0)	–	17 (85.0)	–	–	–
13	The shore of the Lake Galutin-Nuur: wooden barn. 49.7322° N, 115.3111° E	–	55 (100)	–	–	–	–
14	The right bank of the River Uldza, Ile-Turut mountain: rocks and the shepherd farm. 49.6369° N, 114.9447° E	1 (16.7)	–	5 (83.3)	–	–	–
15	The Lake Shogoy-Tsagan-Nuur (Chuh-Nuur): rocks and the rest station buildings. 49.5256° N, 114.6681° E	19 (29.2)	6 (9.2)	40 (61.5)	–	–	–
16	20 km northwest the Lake Yakhiyn-Nuur: the rock near the spring. 48.8039° N, 114.2181° E	–	–	2 (100)	–	–	–
17	The left bank of the River Kerulen 5 km downstream of Choibalsan town. 48.1281° N, 114.7167° E	–	–	–	10 (100)	–	–
China, Inner Mongolia							
18	The shore of the Lake Hulun-Nuur (Dalay-Nor): coastal cliffs and buildings. 48.9222° N, 117.1083° E; 48.9033° N, 117.0078° E	19 (7.1)	222 (83.1)	12 (4.5)	14 (5.2)	–	–
19	The shore of the Lake Wulan-Nuur, Orshun-Gol River basin: buildings. 48.3761° N, 117.5158° E	10 (41.7)	13 (54.2)	1 (4.2)	–	–	–
20	River Orshun-Gol 15 km upstream the confluence the Lake Wulan-Nuur: concrete car bridge. 48.2400° N, 117.6353° E	–	54 (100)	–	–	–	–
21	The north shore of the New Dalai Lake Bay: coastal cliffs. 49.0919° N, 117.8572° E	14 (27.5)	6 (11.8)	31 (60.8)	–	–	–

Results

Bat records

A total of 1013 bat specimens were captured. They belonged to four genera and six species (Table 1, Fig. 2), including 479 individuals of *Vespertilio sinensis*, 353 individuals of *V. murinus*, 145 individuals of *Myotis davidii*, 24 individuals of *M. petax*, 11 individuals of *Plecotus ognevi*, and one individual of *Eptesicus nilssonii*.

Summer shelters of bats

The natural shelters of bats in the Daurian steppe are composed of cracks and niches in

the rocks, heaps and scree of stones. Human constructions in the steppe are also important for bats. The results of Chi-square test are demonstrated in Table 2. A significant positive association of *Myotis davidii* records with fresh water sources and rocks was found. A significant negative association of *M. davidii* and human constructions was found too. *Vespertilio* species are less choosy in selecting the summer shelters. A positive (but statistically insignificant) relationship between both *Vespertilio* species and the presence of buildings was demonstrated.



Fig. 2. Bat species of the Daurian steppe. Designations: A – *Vespertilio murinus* on Torey lakes (Russia); B – band tagged *Vespertilio sinensis* on Torey lakes (Russia); C – captured *Myotis davidii* on Lake Hulun-Nuur (China); D – female and young *Myotis petax* on Lake Hulun-Nuur (China).

Table 2. The relationships between the most common Daurian steppe bat species and most important environment elements in a 500-m buffer around the recorded location

Environment elements	Species		
	<i>Vespertilio murinus</i>	<i>Vespertilio sinensis</i>	<i>Myotis davidii</i>
Buildings	+ 1.8357 / 0.1755	+ 2.6751 / 0.1019	– 5.6076 / 0.0179
Rocks	– 1.7003 / 0.1923	– 1.7003 / 0.1923	+ 12.1730 / 0.0005
Forest (trees)	+ 0.4858 / 0.4858	+ 0.0094 / 0.9227	– 0.000 / 1.0000
Open fresh water sources	+ 0.0036 / 0.9524	– 0.000 / 1.0000	+ 5.2102 / 0.0225

Note: Results of Chi-square test (X-squared / p-value); positive (+) and negative (–) correlation. The statistically significant relationships are in bold.

Almost all of the *Myotis davidii* specimens were found only in natural shelters near fresh water sources. Noteworthy, some *M. davidii* specimens were hiding under the «stone visor» in the Dalai Lake coastal cliffs (China). They sat almost openly in small niches during the day. In scree of flat rock fragments, the brood colonies of *M. davidii* are characteristic of crags in Mongolia. We did not observe this species in the buildings in the Daurian steppe, although previous study confirmed that *M. davidii* dwelled in the building walls on the west shore of Lake Zun-Torey (Rosina & Kirilyuk, 2000). On the

contrary, we found most often the *Vespertilio* shelters in human buildings: under a covering of walls and roofs, in cracks of concrete bridges and other structures. *Vespertilio* bats tended to hide in big rock cracks, caves and heaps of stones too. Few summer records of *Vespertilio* specimens are known in hollows and under the lagged old pines in Tsasushey pine (*Pinus sylvestris* L.) forest (Russia) (Rosina & Kirilyuk, 2000; our data).

We have found the *Myotis petax* shelter only once, deeply hidden in a small cave in Lake Dalai coastal cliffs. Probably *Plecotus ognevi* bats hides

in rock cracks of the Adun-Chelon Mountains. Shelters of *Eptesicus nilssonii* were not found.

Sex ratios

All of the captured adult *Vespertilio sinensis* individuals determined by gender and age (n = 90) were females (Table 3). The sex ratio of *V. sinensis* juveniles in China was approximately equal. But the sex ratio of *V. sinensis* subadults was female-biased ($\chi^2 = 5.97, p < 0.05$).

In Russia, only one of the 183 adults of *Vespertilio murinus* was male ($\chi^2 = 116.55, p < 0.001$). The sex ratio of *V. murinus* subadults is female-biased, too (no significant difference). We caught adult *Myotis davidii* males in Russia and Mongolia. Its sex ratio was female-biased ($\chi^2 = 46.57, p < 0.001$).

Observation dates

We have representative data about the three most abundant bat species. The first yearly records of *Myotis davidii* were in early May. We found this species on 8 May (Lake Shogoy-Tsagan-Nuur, Mongolia) and 13 May (Lake Ulin, Russia). In Mongolia, one bat was found in scree of the stones on the shore of a lake. In Russia, about ten bats were found in the rock crack just a few centimetres from the surface. The bats warmed themselves during the day. The air temperature was not high (about 5°C) but the rock surface was well warmed by the sun. We cannot exclude the possibility of bat wintering in the rock crack deep. It is impossible to find bats in such places in winter. Caves with large colonies of hibernating bats are not known in the Daurian steppe. On 6–7 September, we specifically examined some previously known summer shelters of *Myotis davidii* in Mongolia, but bats

were not found there. We observed this bat species mainly from the last decade of May to mid-August.

The earliest first record of *Vespertilio murinus* was made on 19–20 May, while the latest first record was on 9–10 June based on 12 years of observation on Torey Lakes (Russia). In Mongolia, the earliest first record of *V. murinus* was on 16 May. We caught this individual together with *Myotis davidii* on Lake Shogoy-Tsagan-Nuur rocks. *Vespertilio sinensis* settled in summer shelters later than *Vespertilio murinus*. In Russia, the earliest first records of *V. sinensis* were in the second half of June. The latest records of *Vespertilio* sp. were in late August. Single individuals of *Vespertilio* sp. were observed in early September.

Bat community dynamics

Since 2013, we have observed an increase in the proportion of *Vespertilio sinensis* among the captured bats. For example, its percentage was 6.3% in 2011 (n = 16), while it was 1.4% (n = 73) in 2012, 24.4% (n = 90) in 2013, 15.1% (n = 86) in 2014 on Torey lakes (Russia). In 2013, we observed this species for the first time near Lake Ulin (Fig. 1, Table 1). It is the northernmost location of the species in the Eastern Transbaikalia. We found that *V. sinensis* colonies consisted of several to thousands of individuals. All large colonies of *V. sinensis* were single-species ones. In little colonies *V. sinensis*, specimens can live in association with *V. murinus*. In 2013–2014, in Russia (Torey lakes) we noted displacement of *V. murinus* by *V. sinensis* in small shelters in building. Females of *V. sinensis* arrived from wintering later than *V. murinus*, but settled in the same shelter. In a few days most females of *V. murinus* moved to neighbouring but less comfortable shelters.

Table 3. Number and percentage (in brackets) of male and female bats that were captured in the Daurian steppe in 2008–2019

Location	adult		subadult		juvenile	
	♂♂	♀♀	♂♂	♀♀	♂♂	♀♀
<i>Vespertilio murinus</i>						
All	1 (0.5%)	182 (99.5%)	17 (40.5%)	25 (59.5%)	–	–
<i>Vespertilio sinensis</i>						
All	0 (0%)	90 (100%)	32 (32.0%)	68 (68.0%)	66 (46.5%)	76 (53.5%)
<i>Myotis davidii</i>						
China	0 (0%)	18 (100%)	8 (53.3%)	7 (46.7%)	0 (0%)	1 (100%)
Mongolia	1 (2.9%)	33 (97.1%)	7 (63.6%)	4 (36.4%)	–	–
Russia	1 (3.1%)	31 (96.9%)	–	–	–	–
<i>Myotis petax</i>						
Mongolia, China	2 (14.3%)	12 (85.7%)	1 (50.0%)	1 (50.0%)	3 (37.5%)	5 (62.5%)
<i>Plecotus ognevi</i>						
Russia	5 (55.6%)	4 (44.4%)	0 (0%)	1 (100%)	–	–
<i>Eptesicus nilssonii</i>						
Russia	0 (0%)	1 (100%)	–	–	–	–

We did not find changes in the abundance of other bat species during the study period. However, we found differences in the bat communities of Russian Dauria when comparing our data with literature. So, *Myotis davidii* and *M. petax* were collected in 1990s in the Torey lakes and its tributary, River Imalka (Daursky State Nature Reserve, Russia) (Nekipelov, 1960; Krusko & Borissenko, 1996; Rosina & Kirilyuk, 2000). In the study period (2008–2019), we could not find *Myotis* species here, despite a careful search.

Discussion

Six bat species were registered in the Daurian steppe. Three of them, *Vespertilio sinensis*, *V. murinus* and *Myotis davidii*, were the most abundant and common bat species in the studied region.

Our data confirm that *Vespertilio sinensis* and *V. murinus* are migrating species living in the region only in the summer period. In Dauria, the populations of these two species are female-biased. We assume that adult males inhabit other areas. In the caves of Mongolia, the hibernating *Vespertilio* species were not found in winter either (Ariunbold, 2016). Winter presence of (supposedly subadult) *V. murinus* in the Baikal region (Russia) is very rare (Botvinkin et al., 2011). Noteworthy, the female predominance was noted not only among adults but also among subadult *Vespertilio*, too. To date, we have no explanation for this fact.

Winter records of *Myotis davidii* are not known in the Russian part of the Dauria region (Botvinkin, 2002; our study). We are not sure whether *M. davidii* is a migratory species in the Daurian steppe or not. The summer sex ratio of this species argues in favour of a migration hypothesis. The nearest locations of the hibernated *M. davidii* are known in the caves (Taliin agui, Shar khanan, Tsagaandel) in southern Mongolia (Ariunbold, 2016).

Our findings and literature data reveal the tendency of a northward shift of *Vespertilio* species ranges. In the southeast Transbaikalia and Mongolia, *V. sinensis* was classified as a rare species. Since 2013, we consider this species as one of the predominant bats in Dauria. In 2000s, *V. sinensis* was found to the west (Erdenesant, west of Tov Province, Mongolia) of previously known locations in Mongolia (Nyambayar et al., 2010). Similarly, Botvinkin et al. (2011) registered *V. murinus* near Lake Baikal, i.e. about 100 km north of the range boundaries known in the XX century. We do not exclude the effect of global increasing temperature on *Vespertilio* ranges shift. We believe that one of the

important reasons of northward range expansion of *V. sinensis* in the study period may be attributed to the reduced number of the large lakes and rivers in the Mongolian part of Dauria. Unlike small species, *Vespertilio* is more mobile and can settle in shelters located far from water sources. Similarly, *Phalacrocorax carbo* (Blumenbach, 1798) increased abundantly in the northern periphery of the range as a result of the drying up of lakes in Dauria. This fish-eating species populated the large rivers of Transbaikalia, namely Onon, Shilka, Ingoda (our data), and Lake Baikal (Pyzhjanov & Pyzhjanova, 2010; Pyzhjanov et al., 2016) in the early XXI century. In the northern (Russian) part of the Daurian steppe, the average annual rainfall and the number of permanent water sources is higher. In addition, the large steppe river, Onon, flows here.

At the same time, records of *Myotis petax* were rare in the Daurian steppe. The strict reliance on riparian habitats is one of the main ecological factors characterising bats of the «*Myotis daubentonii*» group (*M. daubentonii* (Kuhl, 1817) and *M. petax*). *Myotis petax* forages mostly at water surfaces. In Dauria, many lakes and rivers dried up completely in the early XXI century. For example, Rosina & Kirilyuk (2000) found *Myotis petax* near Torey lakes. Yet, we could not find this species at this location in 2008–2019.

Supposedly, *Myotis davidii* is associated with the large water bodies in a less degree. Nevertheless, all of our *M. davidii* finds were made near fresh water bodies. For this species, the water sources could be smaller, e.g. natural springs or condensates in the rocks. Similarly to *Myotis petax*, we could not find *M. davidii* near Torey lakes, despite the fact that in the 1990s *M. davidii* was a common species there. In Dauria, both the *Myotis* species settle near fresh water sources: on the lake shores, along rivers and springs. Apparently, these species have left their shelters after drying up of the nearest fresh water bodies.

Conclusions

Our study reveals a comparatively low bat species diversity in the Daurian steppe during the study period. Comparison with literature data showed the changes in the bat community structure in Daurian steppe over the last decades. We assume that the drying up of water sources affects considerably the occurrence and distribution of bats in the Daurian steppe, which especially concerns small *Myotis* species. The studied region plays an important role for bat species, as it serves as

a breeding area for migratory species (*Vespertilio murinus*, *V. sinensis*, and probably *Myotis davidii*) whose summer populations in Dauria are female-biased. We recommend excluding *V. sinensis* from the regional Red Data Book of Zabaikalsky Krai and national Red Book of Mongolia, taking into account that this species is common in the Daurian steppe even under the drought conditions.

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ЭКОЛОГИЯ РУКОКРЫЛЫХ АРИДНОГО РЕГИОНА (ДАУРСКАЯ СТЕПЬ) НА ПИКЕ ЗАСУХИ

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Рукокрылые (Chiroptera) – наименее изученная группа млекопитающих Даурской степи (Внутренняя Азия: Монголия, Россия и Китай). Мы изучали фауну рукокрылых Даурской степи и некоторые экологические особенности видов летучих мышей в 2008–2019 гг. Мы зарегистрировали шесть видов рукокрылых, среди которых наиболее многочисленны *Vespertilio murinus*, *V. sinensis* и *Myotis davidii*. *Myotis davidii* предпочитает в качестве убежищ скалы вблизи пресных водных источников. В отличие от рукокрылых рода *Vespertilio*, *M. davidii* избегает селиться в постройках человека. Виды *Vespertilio* могут обитать гораздо дальше от источников воды по сравнению с *M. davidii*. Соотношение полов среди отловленных особей *M. davidii*, *Vespertilio murinus* и *V. sinensis* смещено в сторону преобладания самок. Это предполагает, что данные виды, скорее всего, не зимуют в Даурской степи. Наши результаты показывают важную роль региона для этих мигрирующих видов рукокрылых как зоны размножения. В начале XXI в. многие озера и реки Даурии пересохла полностью или частично. В российской части Даурской степи мы наблюдали увеличение популяции *V. sinensis* и уменьшение популяций *Myotis davidii* и *M. petax*. Мы предполагаем, что изменения в сообществе рукокрылых являются следствием сокращения числа водоемов в Даурии, особенно в ее монгольской части (аймак Дорнод).

Ключевые слова: засушливый период, изменения климата, Монголия, расширение ареала, соотношение полов