

## Prospects for studying bats of Karabakh as part of the Lesser Caucasus fauna

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The article highlights the gap in studying the bat fauna in Mountainous-Karabakh and adjacent areas within the Lesser Caucasus as no research studies were conducted in this part because of the prolonged territorial occupation. Comparative description of bat fauna is being provided between Mountainous-Karabakh and the Nakhchivan Autonomous Republic (AR) which reveals a close faunal similarity, one of the reasons of which is the local movements of bats between these sides. Nine species of regional bat fauna (19 species or 58% of local bat fauna) carry local conservation status. Most species tend to decline in global populations. The importance of studying the bat fauna of the Lesser Caucasus, including the bats in Karabakh, in more modern approaches and using stationary and mobile detectors which are already being applied in house by the author as well as other modern equipment (using acoustic and remote tracking methods) remains necessary for studying certain ecological peculiarities of bats. This article presents echo spectrograms of four bats as examples.

**Keywords:** *Lesser Caucasus, bats, chiropteroфаuna, biodiversity, new methods*

### INTRODUCTION

Mountainous Karabakh covers the mountain ranges of Murovdag and Karabakh, as well as the Karabakh Volcanic Massive and the Valley of Central Aras-Nakhchivan and forms the south-east edge of the Lesser Caucasus Natural Provinces within Azerbaijan. In general, the Lesser Caucasus is being characterized by a shortage of forests (Прилипко, 1970) and that its vertical belts are relatively even (except for the Murovdag and Zangazur). The climate is dry continental; the river system is not well established. The arid zone covers the skirts of the abovementioned ridges as well as the entire Nakhchivan Valley to the west direction. Anthropogenic factors have contributed to the transformation of natural landscapes, and over the last 30 years, and this process has negatively impacted the environment even faster and more purposefully.

The territory of the Nakhichevan AR is characterized by an exceptional wealth of natural conditions (Babayev, 1999). A wide variety of relief,

landscapes, climate, flora and fauna has always attracted the attention of specialists of different profiles. Due to a peculiar geological history, the northern outpost of the Middle East formation Center arose and is located here. This is the reason for the high level of endemism of the flora and fauna of this south-eastern edge of the Lesser Caucasus. In recent 15-20 years, significant changes have occurred in this area due to the intensification of infrastructure, industry and agriculture, the use of chemical means to combat various pests, the creation of new protected areas, border conflicts (Talibov, 2001).

The Lesser Caucasus owns 33% of all karst square (6000 sq. km) existing in Azerbaijan. The largest karst caves such as Azykh, Taghlar, Shusha, Daghtumas, Tugh etc. (having 240 caves with total lengths of 4km) are in Nagorno Karabakh. The local conditions provide convenient natural (rocky cliffs, caves, tree hollows, etc.) and manmade shelters (wells, buildings, mines, mining tunnels, etc.).

The Mountainous Karabakh area remains unstudied over the last 40 years and is considered as

a gap for a faunal overview of the overall Natural Province within Azerbaijan. The investigation of the Nakhchivan AR bat fauna occurred recently (Rakhmatulina, Həsənov 2009) when analogical research studies are not applicable to the bat fauna of Mountainous Karabakh (seven long-term occupied surrounding districts) and the available info in this sphere dates back to the before 1980's (Сатуни́н, 1912; Верещагин, 1959; Гаджиев, 1967; Дубовченко, 1969; Алекперов, 1966; Алекперов, Рахматулина, 1975); Фаттаев, 1978; Рахматулина, 1970, 1980, 2005).

In addition to the changed natural conditions that occurred over time, we assume that still unknown to us various anthropogenic changes that occurred during the occupation period have not gone beyond the bat fauna. Considering the time difference and the changes it is important to re-explore the bat fauna in Karabakh as an integral part of regional biodiversity. It also should be noted that the Lesser Caucasus bat fauna is the least studied compared to other natural provinces in Azerbaijan. Scientific literature also contains no or occasional information on bat species inhabiting the regions such as Gedabek, Dashkesen, Goygel, Goranboy, Tartar, Ganja and its surroundings. Over the last 40 years, no required research studies have been carried out in the territories of Nakhchivan and the Lesser Caucasus bordering with the former front line as well as Armenia as it was not safe. In view of all of this, for the detailed study of the Lesser Caucasus chiropteroфаuna within Azerbaijan, there is a need for deeper investigation of bats in Mountainous Karabakh covering about 30% of all mammal species via application of newer technology/methodologies.

To understand the work scope of bats fauna investigation in the Lesser Caucasus we have compared in this paper the faunal composition of Nakhchivan (own investigation data for 2006-2008, 2013 years) and Mountainous Karabakh with surrounded territories (based on literature data dated back to 1880s). Along with a comparative study of chiropteroфаuna, it also provides a general impression of how rich the bat fauna is in these two areas with a distinct specific climate and orographic conditions.

## **MATERIALS AND METHODS**

Field surveys and collation of materials in Nakhchivan AR were conducted in 2006-2008 jointly with Dr. I.K.Rakhmatulina and in 2013 independently.

The study area mainly covered the central and eastern regions of Nakhchivan, ranging from the distinctive semi-arid landscape of the Aras valley up to the alpine meadows. The main target was to revisit already known bat shelters, colonies as well as to reveal new roosts (hibernation sites, summer shelters). Over the study period we have recorded 14 bat species, 153 individuals captured (Mehely's and greater horseshoe bats, lesser mouse-eared bat, brown long-eared bat, eastern barbastelle, Schreiber's bent-winged bat) were banded and released back to nature.

Generally accepted methods of observation and counting were applied during the field surveys (Кузякин, 1950; Громов, Гупеев, 1963; Horacek et al., 2000; Kunz et al., 1996). Via using the ultrasound detectors, we have recorded many synanthropic bat species among which the predominant ones were common and Kuhl's pipistrelles. This article also covers the materials from collections of ANAS Institute of Zoology, the Zoological Museum of Moscow's State University, and the Russia Institute of Zoology (based on Rakhmatulina, 2005). We physically inspected those areas (natural and manmade structures) which could potentially be suitable as summer or winter roosts for bats. All captured individuals were identified to species level, age, sex and reproductive status were determined, measured (weight, length of body, forearm, and tail), banded and released back. Day-time surveys were based on visual observations (shelter designation), and night surveys on field-routes with active bat detectors (Pettersson D200). Bats were recorded directly in their shelters or captured and identified with nets. All methods were aimed at determining the species composition of bats and compiling the transect records on the flight intensity of bats.

Bat fauna composition related info is based on only literature materials dated back to 1980s (Рахматулина, 2005).

## RESULTS AND DISCUSSION

**Mountainous Karabakh** territory is well known for its karst caves as it is mentioned above. Only Azykh (located in the border of Khojavend and Fizuli districts) being the biggest in the Caucasus and 5<sup>th</sup> globally largest karst cave is home to 6 species of bats (*Rhinolophus ferrumequinum*, *R. mehelyi*, *Myotis blythii*, *Miniopterus schreibersii*, *Plecotus austriacus*, and *Barbastella leucomelas*), the largest karst cave in the southern Caucasus and the 5th largest karst cave in the world. The numerous and common species among them were Mehely's horseshoe bat (*R. mehelyi*) and Schreiber's bent-winged bat (*M. schreibersii*). The number of individuals of both species reaches up to 10-30 thousand. Each species depending on the physiological condition as well as the time of year occupies the various halls and parts of the cave. I.K. Rakhmatulina reviewed and consolidated all available for the last 100 years literature data, various collection materials as well as own long-terms scientific research results related to the bat fauna of Nagorno Karabakh (Сатунин, 1915; Верещагин, 1959; Кузякин 1950; Дубовченко 1968, Алекперов, 1966, 1968; Алекперов, Рахматулина, 1975) in own scientific papers and particularly in her final monography (Rakhmatulina 2005). This list consists of 19 species with the following split per genus: 5 *Rhinolophus* – 5, *Myotis* – 4, 1 (*Miniopterus* – 1, *Plecotus* – 1, *Barbastella* – 2, *Nyctalus* – 1, *Pipistrellus* – 3, 1 *Hysugo* – 1, *Eptesicus* – 1 və *Tadarida* – 1. This composition has close similarity with the Nakhchivan bat fauna (16 species) which is being described later in this paper (Rakhmatulina, Həsənov, 2009).

Bat species composition varies vertically. On the foothills the common and Kuhl's pipistrelles are numerous, greater horseshoe bat and serotine bat are common. The richest bat fauna belongs to the middle mountainous zone of 600-1000 m above sea level, where more than 10 bat species are common or numerous. Horseshoe bats, lesser mouse-eared bat, Schreiber's bent-winged bat, Kuhl's, Savi's, common pipistrelles are species-indicators. A number of speleophil species form bigger colonies. Colonies with more than 10 thousand individuals of 4 species were registered in Taghlar, Tugh, Azykh caves and 11 species in Shusha Dashalty (Рахматулина, 2005). This kind of diversity and

richness is due to both food availability (entomofauna) as well as the existence of suitable sheltering conditions during various seasons of the year. At an altitude of 1000-2000m, the population number of species decreases (3 numerous and 5 common species) in spite of the fact that the number of bats species is still 19. The minimum number of species is in the zone above 2000 m.

**Nakhchivan AR** - 16 bat species which were registered by us (physically and recording via ultrasounds) in the territory of the Nakhchivan AR in 2006-2008, 2013 belong to 3 families: Rhinolophidae (5 species), Miniopteridae (1) and Vespertilionidae (10).

Representatives of these families include 8 species throughout the territory - lesser horseshoe bat (*Rhinolophus hipposideros*), greater horseshoe bat (*R. ferrumequinum*), Schreiber's bent-winged bat (*Miniopterus schreibersii*), lesser mouse-eared bat (*Myotis blythii*), common pipistrelle (*Pipistrellus pipistrellus*), *P. pygmaeus*, Kuhl's pipistrelle (*P. kuhlii*), serotine bat (*Eptesicus serotinus*) and form the main species of fauna (Table 1).

During the field surveys, key attention was drawn to underground shelters (caves, mining tunnels). Synanthropic inhabitants of urbanized areas were registered and counted during evening fly out from the shelters as well as on the pathways and foraging sites. In addition, more detailed data was collected on the shelters, population number and age-sex composition of speliophil species such as *R. ferrumequinum*, *M. blythii*, *M. schreibersii*.

Extremely rare bat species include the mediterranean horseshoe bat and Blasius's horseshoe bat (*R. euryale* and *R. blasii*), and the brown long-eared bat (*Plecotus auritus*), the individual of which were captured in Ordubad and Shahbuz districts since the beginning of the 20th century. Two young males of the latter species were captured by us on October 20, 2006, in the Turkesh village of the Shahbuz district.

From recorded for the first time 4 bat species in the Nakhchivan AR - whiskered bat and Geoffroy's bat (*Myotis mystacinus*, *M. emarginatus*), soprano pipistrelle (*Pipistrellus pygmaeus*) were identified by ultrasound in Nakhchivan city and the Kotam village of the Ordubad district. Given the widespread distribution of these species throughout Azerbaijan, the same situation can be expected in the Nakhchivan AR. The dead body of another

new species, *Hypsugo savii*, was found in October 2006 in the village of Kalaki, Ordubad district.

The number of speleophil bat species here in different seasons ranged from 120 individuals for *R. ferrumequinum*, up to 60 for *R. mehelyi*, more than 500 for *M. blythii*, and up to 500 for *M. schreibersii*.

The largest breeding colony of *M. blythii* and *M. schreibersii* was revealed in the "Bat's Nest" cave in the Bilav village of the Ordubad district (Figure 3) with the total number of individuals of more than 1,000.

It was impossible to monitor the border zone of the Nakhchivan AR with Armenia – this is the site where the Kotam-Kilit cave system which is home to a number of the priority species such as Blasius's horseshoe bat, mediterranean horseshoe bat and greater horseshoe bat as well as the eastern barbastelle is located. It should be noted that more interesting groups of bats, as well as large breeding colonies of Schreiber's bent-winged bat and Lesser mouse-eared bat species, are inhabiting the Ordubad National Park.

Unfortunately, the Maralik Cave in the Shahbuz district, one of the dynamic shelters and previously recorded for Blasius's horseshoe bat, mediterranean horseshoe bat, greater horseshoe bat (10) has lost its important role as a shelter for bats after being used by shepherds.

Among the explored shelters, it is important to highlight the Sirab Cave. This place is known as the wintering roost for horseshoe bat species (*R. mehelyi*, *R. ferrumequinum*), which have been protected since the middle of the XX century. The first species has not yet been obtained, however, in summer and autumn seasons the Schreiber's bent-winged bat and the lesser mouse-eared bat become very common here. This cave is one of the main bat shelters in the central part of Nakhchivan AR. It is recommended to protect this site by declaring it a natural monument. It is recommended to give similar status to the "Bat's Nest" cave (Figure 3) in Bilav village of Ordubad district. This cave is a shelter for large breeding colonies of two locally and internationally protected species - *M. blythii* and *M. schreibersii*.

**Similarity between Mountainous Karabakh and Nakhchivan bat faunas.** Via comparing species composition of both areas' bat fauna it was revealed very close similarity between them –

16 bat species in Nakhchivan and 19 in Mountainous Karabakh. Future comprehensive investigations would clarify and reveal a more precise composition for both areas. As shown in Table 1, nine of these species are registered in the 2<sup>nd</sup> edition of the Red Book of the Azerbaijan Republic. Only 6 of all bat species recorded are with the stable trend, 3 unknown, and only one with the increasing global population trend. The rest of the species have a decreasing population trend globally. Despite recording of *T. teniotis* (European free-tailed bat) only once near Shusha city back in 1950) there is a probability to register these species also in Nakhchivan and even the Greater Caucasus. Figure 1 is a schematic map of recorded bat locations in the Lesser Caucasus covering Nakhchivan and Karabakh.

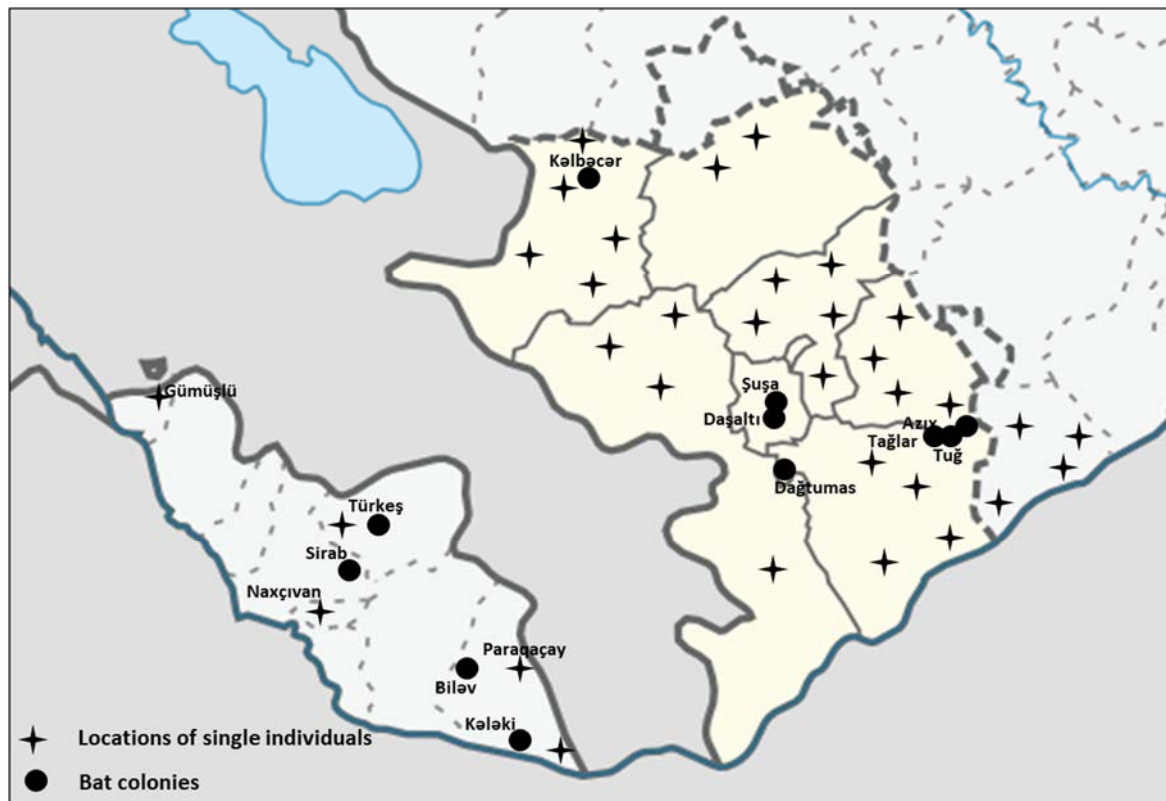
Local seasonal movements (change of summer and hibernation roosts) occur between the caves of Nakhchivan and Karabakh caves (Rakhmatulina, Hasanov 2001).

**Studying of bats by application of new methods.** Bats have a hidden lifestyle, roosts are not easily reachable in most cases, hibernation and breeding colonies are very vulnerable to be disturbed, from health and safety perspective of known and emerging zoonotic diseases (Kuzmin, Bozick, et al., 2011; Hasanov, Guliyeva, 2020) it is necessary to reduce as much physical contact as possible with all wild animals including bats and it is recommendable to investigate various ecological aspects of bats by application of newer and remote methods particularly taking into account the uneven and difficult relief of the Lesser Caucasus. With the use of remote equipment, bat's ethology can be studied in detail such as long-distance migration as well as local movements between hibernation and summer roosts, patterns of pathways and foraging routes, etc. Stationary (passive) and mobile detectors can be used to determine the relative number and activity intensity of transects and stations. Recording and processing of ultrasounds with dedicated programs allow determining the species without capturing them physically. One of the priorities is to create an ultrasound library of the Lesser Caucasus's bats via obtaining spectrograms, specific for various species (Figure 2) and can be used for species determination remotely.

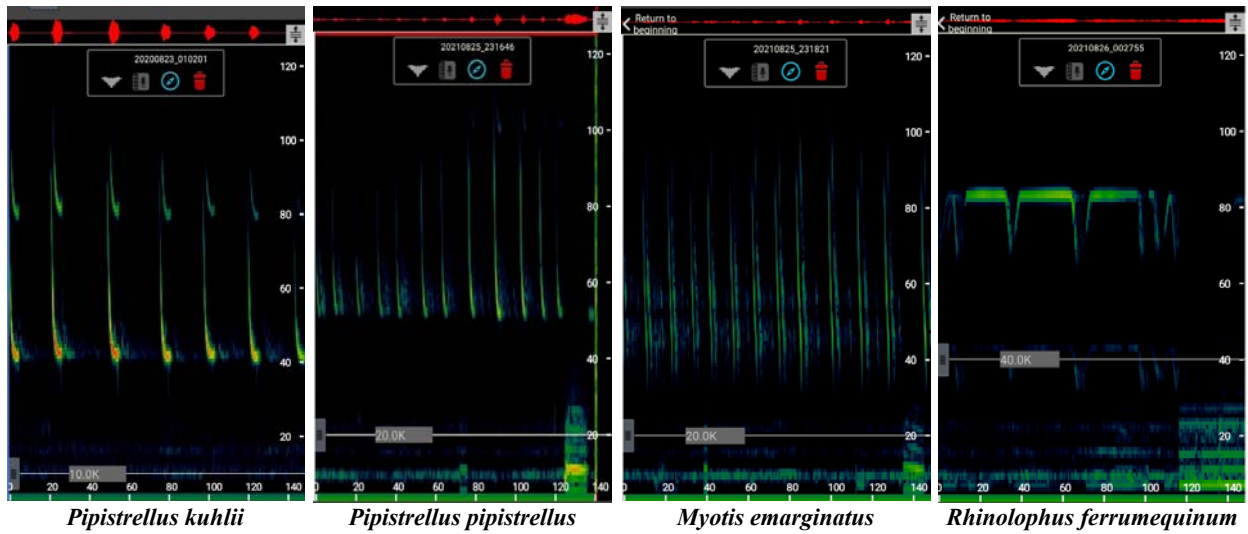
**Table 1.** Comparative composition of Karabakh and Nakhchivan Bat Faunas

N	Scientific name	Common name	Nakhchivan	Karabakh	Red Book	IUCN	Population Trend
1	<i>R. hipposideros</i>	Lesser horseshoe bat	+	+	+	LC	decreasing
2	<i>R. blasii</i>	Blasius's horseshoe bat	+	+		LC	decreasing
3	<i>R. euryale</i>	Mediterranean horseshoe bat	+	+	+	NT	decreasing
4	<i>R. mehelyi</i>	Mehely's horseshoe bat	+	+	+	VU	decreasing
5	<i>R. ferrumequinum</i>	Greater horseshoe bat	+	+	+	LC	decreasing
6	<i>M. blythii</i>	Lesser mouse-eared bat	+	+	+	NT	decreasing
7	<i>M. nattererii</i>	Natterer's bat		+		LC	stable
8	<i>M. emarginatus</i>	Geoffroy's bat	+	+		LC	stable
9	<i>M. mystacinus</i>	Whiskered bat	+	+		LC	stable
10	<i>P. auritus</i>	Brown long-eared bat	+	+		LC	decreasing
11	<i>B. barbastellus</i>	Western barbastelle		+	+	NT	decreasing
12	<i>B. caspica</i>	Eastern barbastelle	+	+	+	LC	unknown
13	<i>N. noctula</i>	Noctule bat	+	+		LC	unknown
14	<i>P. pipistrellus</i>	Common pipistrelle	+	+		LC	stable
15	<i>P. kuhlii</i>	Kuhli's pipistrelle	+	+		LC	increasing
16	<i>H. savii</i>	Savii's pipistrelle	+	+		LC	stable
17	<i>E. serotinus</i>	Serotine bat	+	+		LC	stable
18	<i>M. shreibersii</i>	Schreiber's bent-winged bat	+	+	+	VU	decreasing
19	<i>T. teniotis</i>	European free-tailed bat		+	+	LC	unknown

**Note:** *Pipistrellus pygmaeus* has not been reflected in this list yet as it needs additional justification.



**Fig. 1.** Bat registration locations in the Lesser Caucasus - Nakhchivan (2006-2008, 2013) and Karabakh (literature data covering the period over 1900-1980)



**Fig. 2.** Spectrograms of four bat species obtained by echo-meters in the Lesser Caucasus.

**Note:** each spectrogram is specific to the species and recognizable particularly for the species from various genera



“Bat Nest”, Bilav village, Ordubad district - 2009



*Myotis blythii* individuals – Nakhchivan city - 2009

**Fig. 3.** Photos of some bat species recorded in Nakhchivan

Application of passive detectors into the bat surveys has been started since 2020 in the Greater Caucasus. Remote control (distant) tools for the investigation of various ecological peculiarities of small size mammals including bats have not been practiced in Azerbaijan yet.

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## Qarabağda yarasaların Kiçik Qafqaz faunasının tərkib hissəsi kimi öyrənilmə perspektivləri

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Məqalədə Kiçik Qafqazın yarasalar faunasının təfərrüatlı tədqiqi perspektivindən Dağlıq Qarabağ və ətraf rayonların uzun müddət təddiq olunmaması ucbatından bir boşluq kimi qaldığı vurğulanır. Ədəbiyyat məlumatları əsasında Dağlıq Qarabağ və müəllif tədqiqatları əsasında Naxçıvan MR xireptofaunasının növ tərkibinin müqayisəsi verilir və nə onlar arasındakı bənzərliyə diqqət çəkilir ki, bunun səbəblərindən biri də yarasaların bu iki ərazi arasında lokal yerdəyişmələrin olmasıdır. Region yarasalar faunasının (19 növ

və ya yerli yarasa növlərinin 58%-i) 9-növü yerli qorunma statusuna malikdir. Növlərin böyük əksəriyyətinin global populyasiya trendi azalandır. Kiçik Qafqaz və o cümlədən Qarabağ xirepterofaunasının daha müasir üsullarla tədqiq olunması və ölkədə müəllif tərəfindən artıq tətbiq olunan stasionar və səyyar detektorlar, digər avadanlıqlar vasitəsilə yarasaların akustik və məsafədən izləmə metodları ilə bir-sıra ekoloji xüsusiyyətlərinin araşdırılmasının vacibliyi bildirilir. Dörd yarasa növünə aid exo-spektoqramlar əyani nümunə olaraq məqalədə təqdim olunur.

**Açar sözlər:** *Kiçik Qafqaz, yarasalar, xirepterofauna, biomüxtəliflik, yeni metodlar*

## **Перспективы изучения летучих мышей Карабаха, как части фауны Малого Кавказа**

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В статье указывается на существование пробела в изучении фауны рукокрылых Нагорного Карабаха и прилегающих районов в пределах Малого Кавказа, поскольку научные исследования в этой части не проводились из-за длительной территориальной оккупации. Дается сравнительное описание фауны летучих мышей Нагорного Карабаха и Нахчыванской Автономной Республики (АР), которое выявляет близкое фаунистическое сходство, одной из причин которого, являются локальные миграции летучих мышей между этими регионами. 9 видов региональной фауны рукокрылых (19 видов или 58% местной фауны летучих мышей) имеет местный охранный статус. Большинство видов имеют тенденцию к сокращению глобальной популяции. Внедрение более современных подходов в изучении фауны летучих мышей Малого Кавказа, в том числе летучих мышей Карабаха, с использованием стационарных и мобильных детекторов, которые уже применяются автором, а также другого современного оборудования с акустическим и дистанционным методами слежения, остается важным и необходимым условием для изучения целого ряда экологических особенностей летучих мышей. В качестве наглядного примера в статье представлены экзоспектрограммы четырех видов летучих мышей.

**Ключевые слова:** *Малый Кавказ, летучие мыши, хирептерофауна, биоразнообразие, новые методы*