DIVERSITY OF MAMMAL FAUNA FROM THE AREA CRICOVA-GOIAN OF ICHEL RIVER BASIN, REPUBLIC OF MOLDOVA

**Alina Larion¹, Tatiana Cîrlig², Victoria Nistoreanu¹, Vladislav Caldari¹,
Natalia Dibolscaia¹, Victoria Burlacu¹**

¹Institute of Zoology, Chişinău, Republic of Moldova, e-mail: alina.larion@zoology.md

²State University of Tiraspol, Chisinau, Republic of Moldova

Abstract. The studies were performed in 2017- 2021 in various types of ecosystems from the area Cricova-Goian of Ichel river basin. 45 species of mammals were registered: one hedgehog species, 5 species of Soricomorpha, 12 bat species, 18 rodent species, one hare species, 6 carnivorous species and 2 artiodactyl species. The multiannual dynamics of bat communities in Cricova and Goianul Noi stone mines was assessed. The rodent species were the most numerous and spread in the ecosystems of the studied area. 14 species are listed in the Red Book of the Republic of Moldova.

Introduction

The Ichel river is an affluent of Nistru river of the Republic of Moldova. The studied area presents a mosaic landscape, where the remaining natural ecosystems (woods, meadows, steppe sectors, slopes with rocky sites, gorges) alternate with the anthropized ones: shelter belts, agrocoenoses, localities, stone mines, roads. This natural complex is intensely subjected to the action of anthropogenic factors, such as grazing, limestone extraction, wastewater discharge, garbage storage etc. The building of dams and use of river waters for irrigation and aquaculture purposes disturbed the natural course of Ichel river and has affected the natural components of the area. Nevertheless, the terrestrial vertebrate fauna of the area Cricova-Goian from lower Ichel basin is rather rich and at initial fauna inventory there were indicated 97 species of terrestrial vertebrates [2] and up to 138 species in subsequent studies [3, 6]. Data on some bat species in the study area are presented in several studies [4, 5, 7, 8]. The aim of the study is to complete the data on diversity and some ecological peculiarities of mammal species the area Cricova-Goian of Ichel river basin.

Materials and methods

The studies were performed in 2017- 2021 in various types of ecosystems from the area Cricova-Goian of Ichel river basin. The ecosystems were represented by small woods, forest belts, rocky habitats, riverine and paludous biotopes, agrocoenoses and rural localities (fig. 1). The mammal species were recorded by direct observations, using traps (small mammals), counts on the route, after the traces and trophic activity (carnivorous mammals and artiodactyls), catch with nets and use of ultrasound detector (bats).

Figure 1. Ichel river and rocky ecosystem of Cricova mines and forest belt near Goianul Nou

In the ecological analysis of mammal communities, the indexes of abundance and frequency were used. Also, the ecological significance was evaluated (W), using the formula $W = F \cdot A / 100$, where F is frequency of the species and A – abundance index. The species with the significance lower than 1% in the studied biocenoses are considered accidental; 1.1 – 5% - accessory; 5.1-10% – characteristic and $W > 10\%$ - constant in ecosystem.

Results and discussions

In the studied ecosystems of Crivova-Goian area 45 species of mammals were registered: one hedgehog species, 5 species of Soricomorpha, 12 bat species, 18 rodent species, one hare species, 6 carnivorous species and 2 artiodactyl species (tab. 1).

Table 1. Diversity and biotopic distribution of mammals species in the studied biotopes from the area Cricova-Goian of Ichel river

No	Species	Ecosystems					Locali-ties
		Forest	Pasture	Rocky sites	Wet	Agroce-noses	
	Erinaceomorpha						
1	<i>Erinaceus roumanicus</i>	+	+	+	+	+	+
2	Soricomorpha						
3	<i>Talpa europaea</i>	+	+	+	+	+	+
4	<i>Sorex araneus</i>	+	-	-	+	-	-
5	<i>Sorex minutus</i>	+	-	-	+	-	-
6	<i>Crocidura leucodon</i>	+	+	-	+	-	-
7	<i>Crocidura suaveolens</i>	+	+	-	+	+	+
	Chiroptera						
8	<i>Rhinolophus hipposideros</i>	+	-	+	-	-	-
9	<i>Myotis myotis</i>	-	-	+	-	-	-
10	<i>Myotis blythii</i>	-	-	+	-	-	-
11	<i>Myotis bechsteini</i>	-	-	+	-	-	-
12	<i>Myotis daubentoni</i>	+	-	+	+	-	+

13	<i>Myotis dasycneme</i>	+	-	+	+	-	-
14	<i>Myotis mystacinus</i>	+	-	+	+	-	-
15	<i>Nyctalus noctula</i>	-	+	-	+	+	+
16	<i>Pipistrellus pipistrellus</i>	-	-	+	+	+	+
17	<i>Plecotus auritus</i>	+	-	+	+	-	-
18	<i>Plecotus austriacus</i>	+	-	+	+	+	+
19	<i>Eptesicus serotinus</i>	+	+	+	+	+	+
	Rodentia						
20	<i>Sciurus vulgaris</i>	+	-	-	-	-	+
21	<i>Dryomys nitedula</i>	+	-	-	-	+	-
22	<i>Muscardinus avellanarius</i>	+	-	-	-	-	-
23	<i>Nannospalax leucodon</i>	-	+	+	-	+	+
24	<i>Ondatra zibethicus</i>	-	-	-	+	-	-
25	<i>Arvicola terrestris</i>	-	-	-	+	-	-
26	<i>Cricetus cricetus</i>	-	+	-	-	-	-
27	<i>Rattus norvegicus</i>	-	-	-	-	+	+
28	<i>Mus musculus</i>	-	-	-	+	+	+
29	<i>Mus spicilegus</i>	-	+	-	+	+	+
30	<i>Micromys minutus</i>	-	-	-	+	-	-
31	<i>Apodemus sylvaticus</i>	+	-	+	+	+	+
32	<i>Apodemus uralensis</i>	-	+	+	+	+	+
33	<i>Apodemus flavicollis</i>	+	-	-	-	+	+
34	<i>Apodemus agrarius</i>	+	+	-	+	+	+
35	<i>Microtus arvalis</i>	-	+	-	+	-	+
36	<i>M. rossiaemeridionalis</i>	+	-	-	+	-	+
37	<i>Clethrionomys glareolus</i>	+	-	-	-	-	-
	Lagomorpha						
38	<i>Lepus europaeus</i>	+	-	-	-	+	-
39	Carnivora						
40	<i>Felis sylvestris</i>	+	-	-	-	-	-
41	<i>Lutra lutra</i>	-	-	-	+	-	-
42	<i>Mustela nivalis</i>	+	-	+	-	+	+
43	<i>Mustela putorius</i>	+	-	+	-	-	-
44	<i>Martes foina</i>	+	-	+	-	-	-
45	<i>Vulpes vulpes</i>	+	+	+	+	+	+
	Artiodactyla						
46	<i>Capreolus capreolus</i>	+	-	-	-	-	-
47	<i>Sus scrofa</i>	+	-	-	-	+	-

The common and eurytopic mammals species, such as the northern white-breasted hedgehog, the mole, the mole-rat, the wood mouse, the fox are frequent and widespread in the studied territory, with a frequency of 47%-89% and a characteristic or constant ecological significance ($W = 8.8 - 56,4\%$).

The shrew species were registered in low number mostly in forest and wet natural biotopes, with accidental or accessorial ecological significance ($W = 0,6 - 4,7\%$). The white-toothed shrew is a vulnerable species, listed in the Red Book of Moldova (2015).

The bat fauna is represented by 12 species, of which 9 species were registered in Cricova lime stone mines and 10 species in Goianul Nou stone mines (tab. 2,3). The species *N. noctula* and *P. pipistrellus* were reregistered with the ultrasound detector in the evening period in localities, rocky sites, agrocoenoses. The monitoring of bat hibernation communities in Cricova mines allow to emphasize the multiannual dynamics of bat species (tab. 2).

Table 2. Dynamics of bat community structure (%) in Cricova mines in the hibernation period

No	Species	2013	2014	2015	2016	2017	2018	2019	2021
1	<i>Rhinolophus hipposideros</i>	-	12.73	7.97	5,77	10	22.54	9.09	3.33
2	<i>Myotis blythii</i>	-	-	-	-	2	1.41	3.03	-
3	<i>Myotis daubentonii</i>	51.22	41.82	65.49	71.15	50	45.07	63.64	60
4	<i>Myotis dasycneme</i>	29.27	5.45	12.39	13.47	22	14.08	9.09	6.67
5	<i>Myotis mystacinus</i>	2.44	16.36	2.65	3.85	2	1.41	-	-
6	<i>Myotis bechsteini</i>	2.44	12.73	8.85	1.92	12	9.86	12.12	20
7	<i>Plecotus austriacus</i>	14.63	5.45	0.88	-	2	-	-	6.67
8	<i>Plecotus auritus</i>	-	3.64	1.77	1.92	-	1.41	3.03	3.33
9	<i>Eptesicus serotinus</i>	-	1.82	-	1.92	-	4.23	-	-
	Total individuals	41	55	113	51	50	71	33	30

The most numerous during the entire study period was *M. daubentonii*, which represented more than half of the community, followed by *M. dasycneme* with the abundance of 6%-30%. Since these species prefer aquatic biotopes, their high proportion in Cricova mines is explained by the proximity of the Ichel river. The third most abundant species was the lesser horseshoe bat, followed by the Bechstein's bat and the whiskered bat. The *Plecotus* bats constituted 2-6% of the community, while *M. blythii* and *E. serotinus* single individuals.

In the Goianul Nou mines the number of individuals is rather low, due to the small surface of the mines, but the bat diversity is high, being registered 10 species. The diversity of bat community is the lowest at the end of hibernation period and the highest in september, when the individuals are intensely feeding and preparing for the hibernation. The most abundant was *M. daubentonii*, followed by *M. myotis* and *M. bechsteini* (tab. 3).

The mines of Goian have a very low depth and only two species were recorded: *M. mystacinus* and *P. austriacus*, both protected by law.

Table 3. Dynamics of bat community structure (%) in Goianul Nou mines in the study years

No	Species	04.2016	09.2020	03.2021
1	<i>Rhinolophus hipposideros</i>	18.18	-	-
2	<i>Myotis myotis</i>	-	2.78	29.63
3	<i>Myotis blythii</i>	-	-	7.41
4	<i>Myotis daubentoni</i>	36.36	36.11	37.03
5	<i>Myotis dasycneme</i>	-	5.56	-
6	<i>Myotis mystacinus</i>	9.09	-	-
7	<i>Myotis bechsteini</i>	36.36	11.11	18.52
8	<i>Plecotus austriacus</i>	-	-	7.41
9	<i>Plecotus auritus</i>	-	5.56	-
10	<i>Eptesicus serotinus</i>	-	47.22	-
	Total individuals	11	36	27

All species identified in Cricova and Goianul Nou mines, except *E. serotinus*, are rare species, listed in the Red Book of the Republic of Moldova [1] with different rarity criteria. The presence of critically endangered species *M. myotis* and *M. bechsteini* is of particular interest and emphasize the importance of these sites in bat diversity conservation in central area of the republic.

The rodent species were the most numerous and spread in the ecosystems of the studied area. The arboreal rodents – the dormouse species and the squirrel were recorded in the forest habitats and at forest edge, especially in forested canyons of the area. The semiaquatic species *Arvicola terrestris* and *Ondatra zibethicus* were registered only near Ichel river. A nest of *Micromys minutus* was found in the reed thickets on the river bank. The small rodent fauna was represented by 9 species of genera *Mus*, *Apodemus*, *Microtus*, *Clethrionomys* with characteristic and constant ecological significance ($W = 4.2-53.7\%$). At forest edge the dominant species were *A. sylvaticus* and *A. flavicollis* with more that 70% of small rodent community. In forest belt dominated *A. uralensis* (37.04%), followed by *C. glareolus* with 18.52%. In wet ecosystems the highest diversity was registered (8 species), dominant being *A. sylvaticus* (33.33%) and *A. agrarius* (31.37%) and in various types of agrocoenoses dominant was *M. spicilegus* with about 40%, followed by *A. sylvaticus* with about 22% (fig. 2).

The proximity of Ichel river, the abundant and diverse vegetation, the rocky relief with many canyons and a rich fauna of rodents and birds create favorable conditions for the existence and prosperity of several species of carnivorous mammals (tab. 1). *M. nivalis* was the rarest species, being observed twice on the rocky slopes near the river meadow [3]. The wild cat (*F. silvestris*) and the otter (*L. lutra*) are rare species, listed in the Red Book of Moldova as vulnerable species [1], and were observed several times in forest and riverine habitats of the area.

Two species of artiodactyl mammals (*C. capreolus*, *S. scrofa*) were recorded in the area. Both species populate forest ecosystems, but were sporadically observed at forest edge, in for-

Figure 2. Structure of small rodent communities in various ecosystems of Cricova-Goian area

est shelter belts and in adjacent agricultural ecosystems.

In the localities of the studied area, eight mammal species were registered: *E. roumanicus*, *C. suaveolens*, *N. noctula*, *P. pipistrellus*, *E. serotinus*, *M. musculus*, *R. norvegicus*, *V. vulpes*.

The area Cricova-Goianul Nou of Ichel river with a high variety of ecosystems – forest, wet and rocky habitats provide favorable conditions for a high number of mammal species, of which 14 are listed in the Red Book of the Republic of Moldova, despite of strong anthropic disturbances.

The studies were performed within the State Program project 20.80009.7007.02.

Bibliography

1. Cartea Roșie a Republicii Moldova. Ediția a III-a. Chișinău, Î.E.P. Știința, 2015, p. 234-265.
2. Cîrlig T., Cîrlig V. Contribuții la studiul stării faunei vertebratelor ariei naturale Cricova-Goian. Materialele Conferinței științifice consacrate aniversării de 85 de ani a UST „Problemele actuale ale științelor exacte și ale naturii”, 2015, p. 91-99, Chișinău.
3. Cîrlig V., Cîrlig T., Coadă V., Chiriac E., Țigănaș A., Pânzaru P., Bejenaru Gh. Contribuții la studierea faunei și florei din cadrul ariei naturale a bazinului cursului inferior al râului Ichel. Chișinău, 2017, 163 p.
4. Dibolscaia N. Species diversity and location of bats (Mammalia: Chiroptera) in Cricova stone quarries. 2016. Materials of IX-th International Conference of Zoologists, p. 49-50, Chișinău.
5. Nistoreanu V., Andreev S., Larion A., Postolachi V., Caldari V. Data on bat hibernation (Mammalia, Chiroptera) in abandoned stone quarries near Cricova town. DROBETA, Științele Naturii, XXIV/2014, p. 155–160.
6. Nistoreanu V., Cîrlig T., Larion A., Turcan V., Burlacu V., Postolachi V. Diversity and status of terrestrial vertebrate fauna in lower course of Ichel river bazin, Republic of Moldova. DROBETA, Științele Naturii, XXVI, 2016, 115–124.
7. Дорошенко А.В. Места обитания и численность летучих мышей Молдавии Экология птиц и млекопитающих Молдавии. Кишинев: Штиинца, 1975, с. 82-96.
8. Нистрян В. Б., Калдари В. В., Дибольская Н.М., Ларион А. Ф. Многолетняя динамика зимующих сообществ летучих мышей (Mammalia: Chiroptera) в штольнях поселка Крикова, муниципия Кишинэу, Республика Молдова. Материалы докладов VI Всероссийской заочной научно-практической конференции „Биоразнообразие и рациональное использование природных ресурсов” Махачкала, 2018, с. 137-141.