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SPECIES COMPOSITION OF SMALL MAMMALS IN KEY BIOTOPES NEAR KOLOMAK (KHARKIV OBLAST)

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Species composition of small mammals in key biotopes near Kolomak (Kharkiv Oblast). — O. Markovska. — The study of the species composition and biotope preferences of small mammals around Kolomak had been carried out for four years (2017–2020). During the study period, 9 species of mouse-like rodents and 3 species of insectivores were found. No *Cricetulus migratorius*, *Terricola subterraneus* or *Microtus oeconomus* were found from the theoretically expected species already known for this area. Around Kolomak, 11 biotopes were investigated, including maple-linden oak forest, agrocenoses, dry and flooded meadows, which are located along the banks of a pond and in a gully-ravine system. The first year of research was in a year of high abundance (2017), and then 9 species were immediately discovered, but species with small abundance, such as *Crocidura suaveolens*, *Sorex minutus*, and *Micromys minutus*, were found in years with a small relative abundance of small mammals. *Myodes glareolus*, *Sylvaemus tauricus* and *Sylvaemus uralensis* are dominant species in the captures. According to the trapping results, 2017 was the year of high relative abundance of small mammals, 2018 was the year of the lowest relative abundance, 2019 and 2020 were years with an average relative abundance. During the study period, 6 species were identified in forest biotopes (*Apodemus agrarius*, *Sylvaemus tauricus*, *Sylvaemus uralensis*, *Myodes glareolus*, *Sorex araneus*, and *Dryomys nitedula*). In ecotones with floodplain biotopes, 8 species were found (*Apodemus agrarius*, *Sylvaemus sylvaticus*, *Sylvaemus uralensis*, *Mus musculus*, *Micromys minutus*, *Myodes glareolus*, and *Sorex araneus*). Four species (*Mus musculus*, *Sylvaemus sylvaticus*, *Sylvaemus uralensis*, and *Microtus levis*) were discovered near human settlements. In general, biotopes with the greatest species diversity and number of caught individuals are ecotones of dry and floodplain meadows. In years of high abundance, both species diversity and the number of individuals caught in the oak forest and in ecotones near the pond increased. It should be noted that *Myodes glareolus* was caught in clear-cuts during the two years (2019–2020) only in the summer of 2020. Earlier, not a single specimen of this species was caught there, although there is a dense weed grass cover in this area and the shrub layer has also grown up in some places, and the clear-cut is surrounded by oak forest.

Key words: small mammals, relative abundance, biotope preference, species composition, long-term monitoring.

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Introduction

The study of local faunas is of great value in further analysis of the general patterns and characteristics of both particular species and communities in general. Such data are especially useful in a detailed study of the distribution ranges of species (Zagorodniuk 2015). Long-term faunistic studies of local territories expand our understanding of the processes of fluctuations in the abundance and biotope preferences of certain species. Moreover, as noted by many authors (Zorya 2005; Zagorodniuk 2006), despite a rather large array of data on the current state of theriofauna, our knowledge is still fragmentary and requires long-term research. Also such data make it possible to track the reactions of local communities to certain biotic and abiotic factors, for example, to a change in the climate regime. A particular value of local faunistic research is the discovery of habitats of rare and endangered species and the development of nature conservation measures for their preservation (Zorya 2008).

The aim of this work is to study the species composition of small mammals around Kolomak, to explore their biotope preferences and fluctuations in the abundance. It should be noted that in 2000, employees of the Kharkov Sanitary and Epidemiological Station examined only the area of the

floodplain forest around Kolomak, where three species of small mammals were found (*Sylvaemus uralensis*, *Myodes glareolus*, and *Mus musculus*). The study area is represented by biotopes typical for the forest-steppe zone. More trap-lines were set in different biotopes and annual monitoring was started for a more detailed study and detection of the full species composition.

Study area

The study area is located around Kolomak (Kharkiv Oblast), represented by a maple-linden oak forest, agrocenoses, dry and floodplain meadows, which are located along the banks of the pond and in the ravine-gully system, along the bottom of which a stream flows.

Eleven biotopes were explored: ecotone on the border of riparian-aquatic vegetation and soybean field, ecotone on the border of riparian-aquatic vegetation and floodplain meadows, dry meadows on a slope near a pond, ecotone on the border of dry meadows and gardens, dry maple-linden oak forest, ecotone on the border of dry maple-linden oak forest and sunflower field, clear-cut in an oak forest, ecotone on the border of dry and mown dry meadows, dry meadows on the slopes of the ravine, floodplain meadows, ecotone on the border of floodplain and dry meadows (Fig. 1).

Materials and Methods

To survey the abundance of small mammals, the standard trap-line method using Gero traps was used (Numerov *et al.* 2010). In the lines, 25/50/100 traps were set; the capture was carried out for one night in each biotope. The study was conducted over four years, from summer 2017 to autumn 2020.

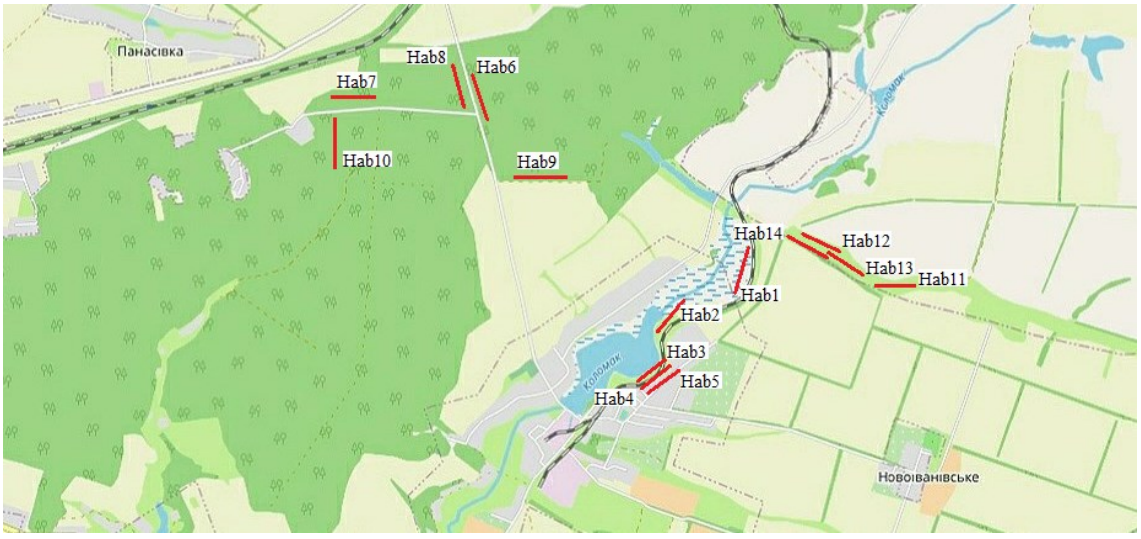

Fig. 1. Habitats in the surrounding of the village of Kolomak studied: Hab1 — ecotone on the border of riparian-aquatic vegetation and soybean field, Hab2 — ecotone on the border riparian-aquatic vegetation and floodplain meadows, Hab3 — dry meadows on a slope near a pond (middle of the slope), Hab4 — dry meadows on a slope near a pond (top of the slope), Hab5 — ecotone on the border of dry meadows and gardens, Hab6, Hab7, Hab8 — dry maple-linden oak forest, Hab9 — ecotone on the border of dry maple-linden oak forest and sunflower field, Hab10 — clear-cut in an oak forest, Hab11 — ecotone on the border of dry and mown dry meadows, Hab12 — dry meadows on the slopes of the ravine, Hab13 — floodplain meadows, Hab14 — ecotone on the border of floodplain and dry meadows.

Рис. 1. Досліджені біотопи в околицях смт Коломак: Hab1 — екотон на межі прибережно-водної рослинності та поля сої, Hab2 — екотон на межі прибережно-водної рослинності та заплавних лук, Hab3 — суходільні луки на схилах ставу (середина схилу), Hab4 — суходільні луки на схилах ставу (верх схилу), Hab5 — екотон на межі суходільних лук та людських городів, Hab6, Hab7, Hab8 — суха кленово-липова діброва, Hab9 — екотон на межі сухої кленово-липової діброви та поля соняшнику, Hab10 — вирубка в діброві, Hab11 — екотон на межі суходільних лук та скошених суходільних лук, Hab12 — суходільні луки на схилах балки, Hab13 — заплавні луки дном балки, Hab14 — екотон на межі заплавних та суходільних лук.

The counts were carried out, if possible, three times a year — in spring, summer, and autumn. In total, 14 trap-lines were set, 2200 trap-nights were worked and 145 small mammals were caught.

To describe the species composition, a taxonomic scheme was used, adopted by the Ukrainian Theriological Society of the National Academy of Sciences of Ukraine (Zagorodniuk & Emelianov 2012).

Results

Species composition

During the study, 12 species were found around Kolomak, which belong to 4 families:

- family Gliridae Thomas, 1897: forest dormouse (*Dryomys nitedula* Pallas, 1778);
- family Muridae Illiger, 1811: striped field mouse (*Apodemus agrarius* Pallas, 1771), European wood mouse (*Sylvaemus sylvaticus* Linnaeus, 1758), Ural wood mouse (*Sylvaemus uralensis* Pallas, 1811), yellow-necked wood mouse (*Sylvaemus tauricus* Pallas, 1811), house mouse (*Mus musculus* Linnaeus, 1758), Eurasian harvest mouse (*Micromys minutus* Pallas, 1771);
- family Arvicolidae Gray, 1821: bank vole (*Myodes glareolus* Schreber, 1780), southern vole (*Microtus levis* Miller, 1908);
- family Soricidae Fisher, 1821: lesser white-toothed shrew (*Crocidura suaveolens* Pallas, 1811), common shrew (*Sorex araneus* Linnaeus, 1758), Eurasian pygmy shrew (*Sorex minutus* Linnaeus, 1766).

From the theoretically expected species that are already known for this area, during the study period, we did not find the grey dwarf hamster (*Cricetulus migratorius*), the European pine vole (*Terricola subterraneus*), and the root vole (*Microtus oeconomus*) (Markovska & Tkach 2020).

Dominance structure and relative abundance of species

It should be noted that around Kolomak the capture was carried out from August 2017 to October 2020, while monitoring was not carried out in the summer and autumn of 2018 (Table 1).

Table 1. Dynamics of trapping of small mammals by seasons in the surroundings of the village of Kolomak
Таблиця 1. Динаміка відлову мікромамалій за сезонами в околицях смт Коломак

Species	Summer 2017		Autumn 2017		Spring 2018		Spring 2019		Summer 2019		Autumn 2019		Spring 2020		Summer 2020		Autumn 2020	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Ap-Agr	6	10	5	18	—	–	–	–	7	44	–	–	–	–	2	16	–	–
Sy-Ura	12	21	2	7	–	–	1	50	5	31	1	11	1	17	3	22	–	–
Sy-Syl	4	7	1	4	1	50	–	–	–	–	1	11	2	32	1	6	–	–
Sy-Tau	7	12	6	21	–	–	–	–	2	13	1	11	1	17	3	22	1	10
Mu-Mus	–	–	2	7	1	50	–	–	1	6	–	–	1	17	1	6	–	–
Mi-Min	–	–	–	–	–	–	–	–	–	–	2	22	–	–	–	–	–	–
Mi-Lev	8	14	2	7	–	–	1	50	–	–	–	–	–	–	1	6	–	–
My-Gla	17	29	10	36	–	–	–	–	1	6	2	22	1	17	3	22	6	60
So-Ara	3	5	–	–	–	–	–	–	–	–	1	11	–	–	–	–	2	20
So-Min	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	10
Cr-Sua	–	–	–	–	–	–	–	–	–	–	1	11	–	–	–	–	–	–
Dr-Nit	1	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Total	58	100	28	100	2	100	2	100	16	100	9	100	6	100	14	100	10	100

* Ap-Agr (*Apodemus agrarius*), Sy-Ura (*Sylvaemus uralensis*), Sy-Syl (*S. sylvaticus*), Sy-Tau (*S. tauricus*), Mu-Mus (*Mus musculus*), Mi-Min (*Micromys minutus*), Mi-Lev (*Microtus levis*), My-Gla (*Myodes glareolus*), So-Ara (*Sorex araneus*), So-Min (*S. minutus*), Cr-Sua (*Crocidura suaveolens*), Dr-Nit (*Dryomys nitedula*).

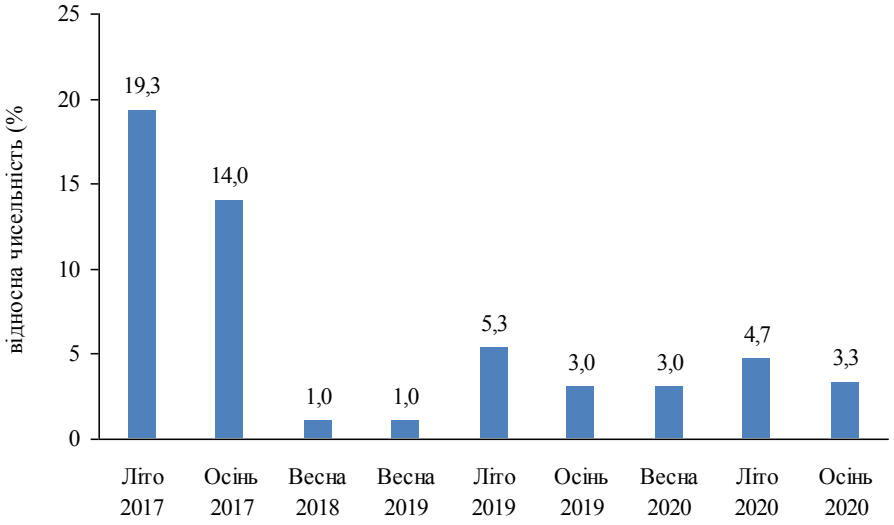

Fig. 2. The relative abundance (individuals/ 100 trap-nights) of small mammals during 2017–2020.

Рис. 2. Відносна чисельність (особини/100 пастко-ночей) дрібних ссавців протягом 2017–2020 рр.

We can see that in the summer of 2017, *Myodes glareolus* and *Sylvaemus uralensis* dominated, in the autumn of 2017 — *Myodes glareolus* and *Sylvaemus tauricus*, in the spring of 2018, 2019 and 2020 the total number of captured individuals was low, therefore the dominant species were not identified, in the summer of 2019 *Apodemus agrarius* and *Sylvaemus uralensis* dominated, in the autumn of 2019 — *Myodes glareolus* and *Micromys minutus*, in the summer of 2020 — *Sylvaemus uralensis*, *Sylvaemus tauricus*, and *Myodes glareolus*, in the spring of 2020 — *Myodes glareolus* (Table 1). In general, *Myodes glareolus*, *Sylvaemus tauricus*, and *Sylvaemus uralensis* are constantly dominating in the catches.

When analysing the dynamics of species composition, we can see the benefits of long-term monitoring, because each year several new species are added to the checklist. In the first year of the study, there was a year with a high abundance (2017) and then nine species were immediately discovered, but species with a low abundance, such as *Crocidura suaveolens*, *Sorex minutus*, and *Micromys minutus*, were found in years with a low relative abundance of small mammals.

We can see that 2017 was the year with the highest relative abundance (Fig. 2) and 2018 was the year of the minimum relative abundance; in the spring, only rare meetings of small mammals were found; in the summer and autumn, no capture was carried out. 2019 and 2020 can be considered years of average relative abundance, small indicators in the spring were continued by an increase in the abundance in summer.

Distribution of small mammals in the studied biotopes

Around Kolomak in the summer of 2017, 300 trap-nights were worked out and three biotopes were studied: ecotone on the border of riparian-aquatic vegetation and soybean field (Hab1, 100 traps), dry maple-linden oak forest (Hab6, 100 traps), ecotone on the border of dry and mown dry meadows (Hab11, 100 traps) (Table 2). Five species were found in a dry maple-linden oak forest, *Myodes glareolus* dominated among them; near the shrubs, *Dryomys nitedula* was caught, which was captured only once during the entire study period. Three species were recorded in each ecotone; *Apodemus agrarius* and *Sylvaemus uralensis* dominated near the riparian-aquatic vegetation, and *Microtus levis* dominated in dry meadows.

In the autumn of 2017, 200 trap-nights were worked out and two biotopes were studied: dry maple-linden oak forest (Hab6, 100 traps) and ecotone on the border of dry meadows and gardens (Hab5, 100 traps) (Table 2).

Table 2. Habitat distribution of small mammals in 2017 in the surrounding of the village of Kolomak
Таблиця 2. Біотопний розподіл мікромамалій в 2017 р. в околицях смт Коломак

Species	Summer 2017			Autumn 2017	
	Hab1	Hab11	Hab6	Hab6	Hab5
Apodemus agrarius	6	–	–	5	–
Sylvaemus uralensis	5	4	3	2	–
Sylvaemus sylvaticus	4	–	–	–	1
Sylvaemus tauricus	–	–	7	6	–
Mus musculus	–	–	–	–	2
Microtus levis	–	8	–	–	2
Myodes glareolus	–	–	17	10	–
Sorex araneus	–	1	2	–	–
Dryomys nitedula	–	–	1	–	–
Number of species	3	3	5	4	3

Four species were recorded in the oak forest, compared to the summer, *Dryomys nitedula* and *Sorex araneus* were not caught, but *Apodemus agrarius* was captured, which most likely came into the oak forest from adjacent harvested fields; *Myodes glareolus* remained the dominant species. Three species were found in the meadows, one of them is *Mus musculus*, since the capture was carried out near human settlements, and also *Sylvaemus sylvaticus*, the record of which is probably associated with a forest plantation located nearby.

In the spring of 2018, 200 trap-nights were worked out and three biotopes were investigated: a dry maple-linden oak forest (Hab6, 100 traps), where not a single individual was caught; ecotone on the border of riparian-aquatic vegetation and a wheat field (Hab1, 50 traps), where only one specimen of *Sylvaemus sylvaticus* was found, while last year *Apodemus agrarius* and *Sylvaemus uralensis* were also recorded in this biotope; dry meadows (Hab12, 50 traps), where only one *Mus musculus* was caught and not a single individual from the expected *Microtus levis* and *Sylvaemus uralensis*. The number of individuals caught in these biotopes has significantly decreased compared to the previous year, which can be explained by both the general trend of catching a small number of individuals in the spring and a significant decrease in the abundance in 2018, which was confirmed by catches in other areas of Kharkiv Oblast.

In the spring of 2019, 100 trap-nights were worked out and four biotopes located at an altitude along the slope near the pond were studied: an ecotone at the border of riparian-aquatic vegetation and flooded meadows (Hab2, 25 traps), where one individual of *Sylvaemus uralensis* was caught; dry meadows in the middle of the slope (Hab3, 25 traps), where one individual of *Microtus levis* was captured; dry meadows at the top of the slope (Hab4, 25 traps), where not a single individual was found and ecotone at the border of dry meadows and gardens (Hab5, 25 traps), where not a single individual was found either, but earlier we recorded *Mus musculus*, *Microtus levis*, and *Sylvaemus sylvaticus* in this biotope (Table 3). The small number of both captured individuals and recorded species is associated not only with the spring decline in the abundance, but probably also with the burning of grass, which occurred before the study session.

In the summer of 2019, 300 trap-nights were worked out and nine biotopes were studied: ecotone at the border of riparian-aquatic vegetation and floodplain meadows (Hab2, 50 traps), where, in addition to the previously captured *Sylvaemus uralensis*, *Mus musculus* was found, that descended the slope into the floodplain from human settlements; dry meadows in the middle of the slope (Hab3, 25 traps), where *Sylvaemus uralensis* was recorded and, compared to spring, not a single *Microtus levis* was found; floodplain meadows (Hab13, 25 traps), where *Apodemus agrarius* was captured; ecotone on the border of floodplain and dry meadows (Hab14, 25 traps), where *Apodemus agrarius* dominated and *Myodes glareolus* was found, the presence of which is probably associated with a nearby forest plantation; dry maple-linden oak forest (Hab7, 50 traps), where *Sylvaemus tauricus* was recorded (Table 3); ecotone on the border of dry meadows and gardens (Hab5, 25 traps), where,

as in the spring, not a single individual was found; ecotone on the border of dry and mown dry meadows (Hab11, 50 traps), where, unlike in previous years, not a single individual was recorded either; ecotone at the border of a dry maple-linden oak forest and a sunflower field (Hab9, 25 traps) and clear-cut in an oak forest (Hab10, 25 traps), where not a single individual was caught either.

In the autumn of 2019, 300 trap-nights were worked out and the same biotopes were studied as in the summer, only instead of the ecotone of the oak forest and the sunflower field, other areas of the oak forest were explored (Hab6 and Hab8) (Table 3). From three biotopes on the slope near the pond, small mammals were found only in dry meadows in the middle of the slope (Hab3, 25 traps), where *Crocidura suaveolens* was recorded for the first time in this area in our trapping. In the ecotone on the border of riparian-aquatic vegetation and floodplain meadows (Hab2, 50 traps) and in the ecotone on the border of dry meadows and gardens (Hab5, 25 traps), not a single individual was caught. Among forest biotopes: in the clear-cut (Hab10, 25 traps), again, not a single individual was found; in the first site of dry maple-linden oak forest (Hab6, 50 traps), only *Myodes glareolus* was captured; in the third site of the oak forest (Hab8, 25 traps), only *Sylvaemus tauricus* was recorded. In the ecotone on the border of dry and mown dry meadows (Hab11, 25 traps), as in summer, not a single individual was found, as well as in floodplain meadows (Hab13, 25 traps). In the ecotone on the border of floodplain and dry meadows (Hab14, 50 traps), four species were recorded, from which *Micromys minutus* was found for the first time during the study period, compared to summer, *Apodemus agrarius* was not captured, but *Sylvaemus uralensis*, *Sylvaemus sylvaticus* and *Sorex araneus* were caught. In autumn, as in summer, more individuals were caught in the ecotone of floodplain and dry meadows, but the number of caught species in autumn increased and *Apodemus agrarius* was not recorded, although it was dominant in summer.

In the spring of 2020, 200 trap-nights were worked out and eight biotopes were investigated: ecotone on the border of riparian-aquatic vegetation and floodplain meadows (Hab2, 25 traps), where, as in autumn, not a single individual was caught; dry meadows in the middle of the slope (Hab3, 25 traps), where one specimen of *Sylvaemus sylvaticus* was captured; dry meadows at the top of the slope (Hab4, 25 traps), where, again, not a single individual was recorded; it should be noted that the slope was burnt a week before the trapping, which probably influenced the survey results; ecotone on the border of dry meadows and gardens (Hab5, 25 traps), where the last year's harvest of sunflower remained, *Sylvaemus uralensis*, *Sylvaemus sylvaticus*, and *Mus musculus* were captured (Table 4); dry maple-linden oak forest (Hab6, Hab7 and Hab8, 25 traps each), where *Sylvaemus tauricus* was caught on the first line, although only *Myodes glareolus* was captured here in autumn; *M. glareolus* was recorded on the second line, although earlier only *S. tauricus* was captured here;

Table 3. Habitat distribution of small mammals in 2019 in the surrounding of the village of Kolomak

Таблиця 3. Біотопний розподіл мікромамалій в 2019 р. в околицях смт Коломак

Species	Hab2		Hab3			Hab13	Hab14		Hab7	Hab6	Hab8
	Sp	Sm	Sp	Sm	A	Sm	Sm	A	Sm	A	A
Apodemus agrarius	–	–	–	–	–	1	6	–	–	–	–
Sylvaemus uralensis	1	2	–	3	–	–	–	1	–	–	–
Sylvaemus sylvaticus	–	–	–	–	–	–	–	1	–	–	–
Sylvaemus tauricus	–	–	–	–	–	–	–	–	2	–	1
Mus musculus	–	1	–	–	–	–	–	–	–	–	–
Micromys minutus	–	–	–	–	–	–	–	2	–	–	–
Microtus levis	–	–	1	–	–	–	–	–	–	–	–
Myodes glareolus	–	–	–	–	–	–	1	–	–	2	–
Sorex araneus	–	–	–	–	–	–	–	1	–	–	–
Crocidura suaveolens	–	–	–	–	1	–	–	–	–	–	–
Number of species	1	2	1	1	1	1	2	4	1	1	1

Seasons of catching: spring (Sp), summer (Sm), autumn (A).

on the third line, not a single individual was caught, although *S. tauricus* was captured here in autumn; clear-cut in an oak forest (Hab10, 25 traps), where, as in the previous year, not a single individual was caught.

In the summer of 2020, 300 trap-nights were worked out and six biotopes were studied: an ecotone on the border of riparian-aquatic vegetation and floodplain meadows (Hab2, 50 traps), where, as in the spring, not a single individual was caught; dry meadows in the middle of the slope (Hab3, 50 traps), where nothing was captured either, it should be mentioned that this year the slope had a significant influence of grazing, which could have affected the results of capture; dry maple-linden oak forest (Hab6, 50 traps), where, as in the previous year, *Sylvaemus tauricus* and *Myodes glareolus* were recorded; clear-cut in an oak forest (Hab10, 50 traps), where *Myodes glareolus* was first captured (Table 4); ecotone on the border of floodplain and dry meadows (Hab14, 50 traps), where *Sylvaemus uralensis* and *Microtus levis* were caught, which were not found here last year; ecotone on the border of dry and mown dry meadows (Hab11, 50 traps), where *Apodemus agrarius*, *Sylvaemus sylvaticus*, and *Mus musculus* were found, whereas last year not a single individual was captured here.

In the autumn of 2020, 300 trap-nights were worked out and six biotopes were studied: ecotone on the border of riparian-aquatic vegetation and floodplain meadows (Hab2, 50 traps), where, as in summer, not a single individual was found; dry meadows in the middle of the slope (Hab3, 50 traps), where, as in summer, nothing was recorded either; dry maple-linden oak forest (Hab6, 50 traps), where, as in summer, *Sylvaemus tauricus* and *Myodes glareolus* were caught, but *Myodes glareolus* dominated; clear-cut in an oak forest (Hab10, 50 traps), where, again, only *Myodes glareolus* was captured (Table 4); ecotone on the border of floodplain and dry meadows (Hab14, 50 traps), where, in comparison with previous captures, only *Sorex araneus* was recorded; ecotone on the border of dry and mown dry meadows (Hab11, 50 traps), where *Sorex araneus* was captured and for the first time during the study period *Sorex minutus* was caught.

It should be noted that *Myodes glareolus* was found in the clear-cut during the two years (2019–2020) only in the summer of 2020 and not a single individual was recorded there before, although a rather dense weed grass cover is present in this area and in some places a shrub layer has grown, also the clear-cut is surrounded on all sides by an oak forest.

In general, the ecotone of dry and floodplain meadows belongs to the biotopes with the highest species diversity and the highest number of caught individuals. In years of high relative abundance, both species diversity and the number of individuals caught in the oak forest and in ecotones near the pond increase.

Table 4. Habitat distribution of small mammals in 2020 in the surrounding of the village of Kolomak

Таблиця 4. Біотопний розподіл мікромамалій в 2020 р. в околицях смт Коломак

Species	Hab3	Hab14		Hab5	Hab11		Hab6			Hab7	Hab10	
	Sp	Sm	A	Sp	Sm	A	Sp	Sm	A	Sp	Sm	A
Apodemus agrarius	–	–	–	–	2	–	–	–	–	–	–	–
Sylvaemus uralensis	–	3	–	1	–	–	–	–	–	–	–	–
Sylvaemus sylvaticus	1	–	–	1	1	–	–	–	–	–	–	–
Sylvaemus tauricus	–	–	–	–	–	–	1	3	1	–	–	–
Mus musculus	–	–	–	1	1	–	–	–	–	–	–	–
Micromys minutus	–	–	–	–	–	–	–	–	–	–	–	–
Microtus levis	–	1	–	–	–	–	–	–	–	–	–	–
Myodes glareolus	–	–	–	–	–	–	–	2	4	1	1	2
Sorex araneus	–	–	1	–	–	1	–	–	–	–	–	–
Sorex minutus	–	–	–	–	–	1	–	–	–	–	–	–
Crocidura suaveolens	–	–	–	–	–	–	–	–	–	–	–	–
Number of species	1	2	1	3	3	2	1	2	2	1	1	1

Seasons of catching: spring (Sp), summer (Sm), autumn (A).

Biotope preferences

The bitop preference is calculated using the formula:

$F_{ij} = (n_{ij} \times N — n_i \times N_j) / (n_{ij} \times N + n_i \times N_j — 2n_{ij} \times N_j)$,

where n_{ij} — the number of individuals of the i-th species in the j-th sample (biotope) of volume N_j, n_i — the number of individuals of this species in all catches with a total volume of N (Zagorodniuk & Naglov 2017).

The value of F_{ij} ranges from –1 to +1:

–1 — the species is absent in this biotope,
+1 — the species is found only in this biotope,
0 — the species is indifferent to this biotope (neither prefers nor avoids).

The data that are necessary for calculating the degree of biotope preference are summarized in a table that includes the results of counts for the entire survey period from 2017 to 2020 (Table 5).

Thus, if the value is less than zero, the species tends to avoid the studied biotope; if it is greater than zero, the species prefers the studied biotope, and the closer the value is to one, the greater the preference of the species to this biotope.

Also, this indicator allows the eurytopicity or stenotopicity of the species to be determined. If a species is found only in one biotope (+1), or if it prefers it more (> +0,7) with a negative or indifferent (close to zero) "attitude" to other biotopes, then it is a stenotopic species. If the preference indices in all studied biotopes are equal to zero or slightly (within the limit of ± 0.3) deviate from zero, then the species should be classified as eurytopic. An intermediate position is occupied by species that have sufficient ecological valence (plasticity) and inhabit several biotopes (Zagorodniuk & Naglov 2017).

The obtained values of the biotope preference index are presented in Table 6. Results indicate that *Apodemus agrarius* prefers several biotopes, all of which border with floodplain meadows. *Sylvaemus uralensis* tends to inhabit wet floodplain biotopes, but also often occurs in dry meadows, the species is inclined to eurytopicity. *Sylvaemus sylvaticus* shows the greatest propensity to floodplain biotopes that border with fields; it should be mentioned that the species avoids the oak forest.

Table 5. The number of caught individuals and species in the studied habitats for the entire survey period
Таблиця 5. Кількість зловлених особин та видів в досліджених біотопах за весь період відлову

Species	Hab1	Hab2	Hab3	Hab5	Hab6	Hab7	Hab8	Hab10	Hab11	Hab12	Hab13	Hab14	Total
Ap-Agr	6	–	–	–	5	–	–	–	2	–	1	6	20
Sy-Ura	5	3	3	1	5	–	–	–	4	–	–	4	25
Sy-Syl	5	–	1	2	–	–	–	–	1	–	–	1	10
Sy-Tau	–	–	–	–	18	2	1	–	–	–	–	–	21
Mu-Mus	–	1	–	3	–	–	–	–	1	1	–	–	6
Mi-Min	–	–	–	–	–	–	–	–	–	–	–	2	2
Mi-Lev	–	–	1	2	–	–	–	–	8	–	–	1	12
My-Gla	–	–	–	–	35	1	–	3	–	–	–	1	40
So-Ara	–	–	–	–	2	–	–	–	2	–	–	2	6
So-Min	–	–	–	–	–	–	–	–	1	–	–	–	1
Cr-Sua	–	–	1	–	–	–	–	–	–	–	–	–	1
Dr-Nit	–	–	–	–	1	–	–	–	–	–	–	–	1
Total individuals	16	4	6	8	66	3	1	3	19	1	1	17	145
Total species	3	2	4	4	6	2	1	1	7	1	1	7	12

* Ap-Agr (*Apodemus agrarius*), Sy-Ura (*Sylvaemus uralensis*), Sy-Syl (*S. sylvaticus*), Sy-Tau (*S. tauricus*), Mu-Mus (*Mus musculus*), Mi-Min (*Micromys minutus*), Mi-Lev (*Microtus levis*), My-Gla (*Myodes glareolus*), So-Ara (*Sorex araneus*), So-Min (*S. minutus*), Cr-Sua (*Crocidura suaveolens*), Dr-Nit (*Dryomys nitedula*).

Table 6. Values of the biotopic preference index (F_{ij})

Таблиця 6. Показники ступеню біотопної приуроченості (F_{ij})

Species	Hab1	Hab2	Hab3	Hab5	Hab6	Hab7	Hab8	Hab10	Hab11	Hab12	Hab13	Hab14
Ap-Agr	**0.6**	-1.0	-1.0	-1.0	-0.4	-1.0	-1.0	-1.0	-0.2	-1.0	**0.8**	**0.5**
Sy-Ura	0.3	**0.7**	**0.5**	-0.2	-0.5	-1.0	-1.0	-1.0	0.1	-1.0	-1.0	0.2
Sy-Syl	**0.8**	-1.0	0.4	**0.6**	-1.0	-1.0	-1.0	-1.0	-0.2	-1.0	-1.0	-0.1
Sy-Tau	-1.0	-1.0	-1.0	-1.0	**0.8**	**0.7**	**0.8**	-1.0	-1.0	-1.0	-1.0	-1.0
Mu-Mus	-1.0	**0.8**	-1.0	**0.9**	-1.0	-1.0	-1.0	-1.0	0.1	**0.9**	-1.0	-1.0
Mi-Min	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	**1.0**
Mi-Lev	-1.0	-1.0	0.4	0.5	-1.0	-1.0	-1.0	-1.0	**0.9**	-1.0	-1.0	-0.2
My-Gla	-1.0	-1.0	-1.0	-1.0	**0.8**	0.1	-1.0	**0.6**	-1.0	-1.0	-1.0	-0.7
So-Ara	-1.0	-1.0	-1.0	-1.0	-0.3	-1.0	-1.0	-1.0	0.5	-1.0	-1.0	**0.6**
So-Min	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	**1.0**	-1.0	-1.0	-1.0
Cr-Sua	-1.0	-1.0	**1.0**	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Dr-Nit	-1.0	-1.0	-1.0	-1.0	**1.0**	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Mean	-0.6	-0.7	-0.5	-0.5	-0.4	-0.8	-0.9	-0.9	-0.2	-0.8	-0.9	-0.3
Species in the biotope with $F_{ij} > 0$	3	2	4	3	3	2	1	1	5	1	1	4

* Ap-Agr (*Apodemus agrarius*), Sy-Ura (*Sylvaemus uralensis*), Sy-Syl (*S. sylvaticus*), Sy-Tau (*S. tauricus*), Mu-Mus (*Mus musculus*), Mi-Min (*Micromys minutus*), Mi-Lev (*Microtus levis*), My-Gla (*Myodes glareolus*), So-Ara (*Sorex araneus*), So-Min (*S. minutus*), Cr-Sua (*Crocidura suaveolens*), Dr-Nit (*Dryomys nitedula*).

Sylvaemus tauricus is a stenotopic species that has been recorded only in the oak forest. *Mus musculus* had the highest indicators in biotopes located near human settlements, in general, in dry meadows. *Micromys minutus* is a stenotopic species; it was found only in the ecotone on the border of floodplain and dry meadows. *Microtus levis* is also inclined to stenotopicity and prefers dry meadows. *Myodes glareolus* is a stenotopic species that prefers oak forest. *Sorex araneus* is inclined to eurytopicity; during the humid period it is found in different biotopes, but it has a great propensity towards floodplain biotopes. *Sorex minutus* is a stenotopic species found only in dry meadows. *Crocidura suaveolens* is also a stenotopic species; it was found in dry meadows. *Dryomys nitedula* was caught only in the oak forest, also being a stenotopic species.

Conclusions

1. Around Kolomak, during the study period from 2017 to 2020, nine species of mouse-like rodents and three species of insectivores were identified.

2. *Myodes glareolus*, *Sylvaemus tauricus*, and *Sylvaemus uralensis* are dominant species in the captures.

3. During the study period, six species were identified in forest biotopes (*Apodemus agrarius*, *Sylvaemus tauricus*, *Sylvaemus uralensis*, *Myodes glareolus*, *Sorex araneus*, and *Dryomys nitedula*). In ecotones near floodplain biotopes, eight species were found (*Apodemus agrarius*, *Sylvaemus sylvaticus*, *Sylvaemus uralensis*, *Mus musculus*, *Micromys minutus*, *Myodes glareolus*, and *Sorex araneus*). In addition, four species (*Mus musculus*, *Sylvaemus sylvaticus*, *Sylvaemus uralensis*, and *Microtus levis*) were discovered nearby to human settlements.

4. Stenotopic species are *Sylvaemus tauricus*, *Micromys minutus*, *Myodes glareolus*, *Sorex minutus*, *Crocidura suaveolens*, and *Dryomys nitedula*. *Microtus levis* tends to be stenotopic. *Sylvaemus uralensis* and *Sorex araneus* are inclined to eurytopicity.

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