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USE OF KYIV CAVES BY BATS (CHIROPTERA): HIBERNATION AND SWARMING

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Use of Kyiv Caves by Bats (Chiroptera): Hibernation and Swarming. Godlevskaya E. V. — We present results of bat observation in the underground cavities of Kyiv and vicinities carried out in 1999—2006. In the studies we examined 28 objects of four different types (sacral artificial caves, loess natural caves, desolated military constructions, and drainage gallery systems (DGS)). We found that DGS were the most used by bats. In one of the DGS we counted up to 269 specimens. The dominant of the hibernation aggregations was *M. daubentonii* — 97.4% of found individuals. The rest 2.6% was represented by *M. dasycneme*, *M. mystacinus*, *P. auritus*. We discovered that bats start departing DGS no later than the end of March, with the departure peak falling at the middle of April. We observed autumn swarming by the DGS. Totally, five species were registered in the swarming: *M. daubentonii*, *M. dasycneme*, *M. mystacinus*, *P. auritus* and *E. serotinus*. Again the dominant species was *M. daubentonii* — 97.4% of individuals captured.

Key words: bats, hibernation, swarming, urban caves, Ukraine.

Использование рукокрылыми (Chiroptera) подземелий Киева: зимовка и роение. Годлевская Е. В. — Представлены результаты наблюдений рукокрылых в подземельях Киева в 1999—2006 гг. Обследовано 28 объектов, относящихся к четырем типам: сакральным рукотворным пещерам, лессовым природным пещерам, оборонным сооружениям и дренажным штольневым системам (ДШС). Из 4 типов убежищ рукокрылыми в наибольшей степени используются ДШС. В них обнаружены относительно крупные зимовочные скопления — до 269 особей в одном объекте. Доминантом зимних скоплений рукокрылых в осмотренных подземельях является *M. daubentonii* — 97,4% общего количества всех учтенных особей. Остальные 2,6% представлены *M. dasycneme*, *M. mystacinus*, *P. auritus*. Весеной рукокрылые начинают покидать штольни не позднее конца марта с пиком приблизительно в середине апреля. Для ДШС зарегистрировано явление осеннего роения, во время которого отмечено 5 видов рукокрылых: *M. daubentonii*, *M. dasycneme*, *M. mystacinus*, *P. auritus* и *E. serotinus* (доминантом является первый вид — 97,4%).

Ключевые слова: рукокрылые, зимовка, роение, городские подземелья, Украина.

Introduction

In comparison with other plain caveless regions of Ukraine, Kyiv and its vicinities have a relatively long history of bat studies that goes back for more than 150 years. The first results were published in 1851 and in 1915 (Кесслер, 1851; Шарлемань, 1915). For the period, overall 13 species were registered for the bat fauna of the city of Kyiv: 2 — *Myotis*, 1 — *Plecotus*, 1 — *Barbastella*, 3 — *Nyctalus*, 4 — *Pipistrellus*, 1 — *Vespertillio*, 1 — *Eptesicus* (Godlevsky, 2000; Загороднюк, Тищенко-Тишковець, 2001).

Records of bats dwelling in the underground cavities of Kyiv (except cellars and vaults) were first mentioned in the work of Abelentsev and Popov (Абелєнцев, Попов, 1956). Some additional information can be found in Abelentsev et al. (Абеленцев и др., 1969), Likhotop et al. (Лихотоп и др., 1990), and also in the collections of Zoological museum of the National Scientific Museum of Natural History of NAS of Ukraine (NMNH), Zoological museum of Kyiv National University (ZM KNU), and Zoological museum of Moscow State University (ZM MSU).

Among underground bat roosts mentioned for Kyiv there are “hydroconstructions” of the right bank of Dnieper River, Varyazhskie caves, caves of Kyiv-Pecherskaya Lavra, Dosifeevskaya Cave, cave in Kitaevo, cave in Goloseevo, cave of Tserkovschina, Heliograph Cave near village Khodosovka (here names are given according to published sources).

Overall, according to the publications and museum data, in the underground cavities of Kyiv and vicinities there are five known species: *Myotis daubentonii* (Kuhl, 1817), *Myotis dasycneme* (Boie, 1825), *Plecotus auritus* (Linnaeus, 1758), *Barbastella barbastellus* (Cretzschmar, 1826), *Eptesicus serotinus* (Schreber, 1774). There were two specimens collected in vicinities of Kyiv and erroneously identified as *M. mystacinus* in NMNH. Recently they have been reidentified as *M. daubentonii* (Загороднюк, 1999).

So far all available data for Kyiv caves had a fragmentary character. The main goal of this work is to determine the usage character of Kyiv caves by bats. Preliminary results of winter counts were published in the article analyzing *Myotini* species in the Central Dnieper Region (Загороднюк, Годлевська, 2003).

Study area

Kyiv is the biggest city of Ukraine with the population of 2,6 million (in 2001). The city is situated at the border of forest and forest-steppe natural zones of Ukrainian plains. The territory is characterized by almost full absence of natural underground cavities with the exception of short pseudokarst caves in loess. In general, all investigated cavities may be divided into four groups: sacral artificial caves, loess natural caves, military constructions and drainage gallery systems.

Sacral artificial caves. In Kyiv region there are known extensive groups of artificial caves dug in loess by monks. Such caves are Kyiv-Pecherskaya Lavra (including Varyazhskie) caves, Zverinetskie caves, Kitaevskie caves (including "Dosifeevskaya Cave", "cave in Goloseevo" mentioned by Abelentsev and Popov (Абелєнцев, Попов, 1956), "Pirogovskie caves" as mentioned on the label of collected *B. barbastellus* specimen in ZM MSU), and caves in Tserkovschina, etc (fig. 1).

Loess natural caves. These caves are represented by burrow-like corridors washed out in loess. Some of them are artificially broadened by man. Their maximal length may reach up to 100 m. The caves are visited regularly by speleologists, diggers, and local inhabitants. Four caves of this type were inspected. All of them are situated in the vicinities of village Khodosovka (fig. 1), south of Kyiv. We call the biggest cave Heliograph as proposed by R. Likhotop et. al. (Лихотоп и др., 1990).

Desolated military constructions. Kyiv fortified district (KFD) of Stalin Line built in 1928—1937 has objects that belong to this type of cavities. Main units of the KFD are gun pillboxes of different types; the most regular are single storey pillboxes of "M" type and two storey pillboxes of "B" type (Кузяк, 1999). Few of these objects have mine-galleries as well as additional chambers for storing ammunition, subsidiary equipment, etc. Attendance of these structures varies. Some of them are actively visited by local inhabitants, "black archeologists", diggers, etc. The length of the most ramified object is about 350 m. We inspected six pillboxes, two of them belonged to the "mine" type. The KFD also includes a secret "Object Number One". We inspected the longest construction preserved – tunnel at the Zhukov Island. This structure is a tunnel slowly going underground flooded with water. The length from the tunnel portal to the point where the water reaches its ceiling is about 700 m. The height from the water surface to the ceiling at the entrance is about 4—5 m. The military underground cavities also include multi level well of the Lysogorsky Fort that belongs to the Novo-Pecherskaya Fortress used for the drainage of the fort. The object includes three wells connected with short horizontal galleries. Inspected objects are shown on figure 1.

Drainage gallery systems (DGS). DGS are the most extensive systems from all the four types. These are galleries used to dry up potentially sliding sections of the city ground: slopes of the high right Dnieper bank and a number of ravine lands. The linings of these galleries are diverse. The most used type is reinforced concrete trapezoidal blocks arranged at the distance of 4—12 cm to each other. The average height of the galleries is 1.2—1.8 m; the width is about 1 m. The lengths of the systems range from few dozen to few thousand meters. There are more than 50 such systems in Kyiv. Some of them are connected with each other. The galleries come out on the surface with vertical ventilation-sight wells (closed with hatches) and with horizontal portal entrances equipped with solid doors, grill doors, and sliding metallic shields. Entrances to DGS are located in terraced park zones of the city, immediately near the zones of high-rise apartment complexes, in private house sectors, and in industrial zones. Each system has from one to six horizontal entrances. The average temperature inside the DGS is 9—12° C; average humidity is 64—98%. Somewhere due to poor ventilation the temperature may reach higher values: in the spring of 2000, the temperature in central parts of a multi passage system reached 14° C with 0° C outside. The temperature gradient depends on whether the entrance is open or closed, the degree of passage branching next to the entrance, and the presence of ventilation wells.

It is important to note that DGS are popular both among speleologists who use the systems as training range and increasing number of diggers. The attendance rate mostly depends on the entrance access. Some of the entrances are frequently broken in by unauthorized visitors. Being technical structures the DGSs are examined regularly (with periodicity of 1—4 weeks) by service workers. They maintain, clean, restore the systems and build new passages.

We examined 13 DGS (fig. 1). Eleven DGS were inspected through their whole length (the length varies from 30 to 1300 m). Two other ones were examined partially.

Methods

Visual examination of caves with bat counting was carried out in 1999—2005. In 2003—2006 bats were netted at the entrances to the systems. To capture bats we used a harp-trap (1.5 x 1.25 m) made following recommendations of Gas and Postawa (2001) with some modifications. The trap was installed in front of the entrances before sunset for a period of 2—6 hours. The netting was stopped if there were no bats captured for

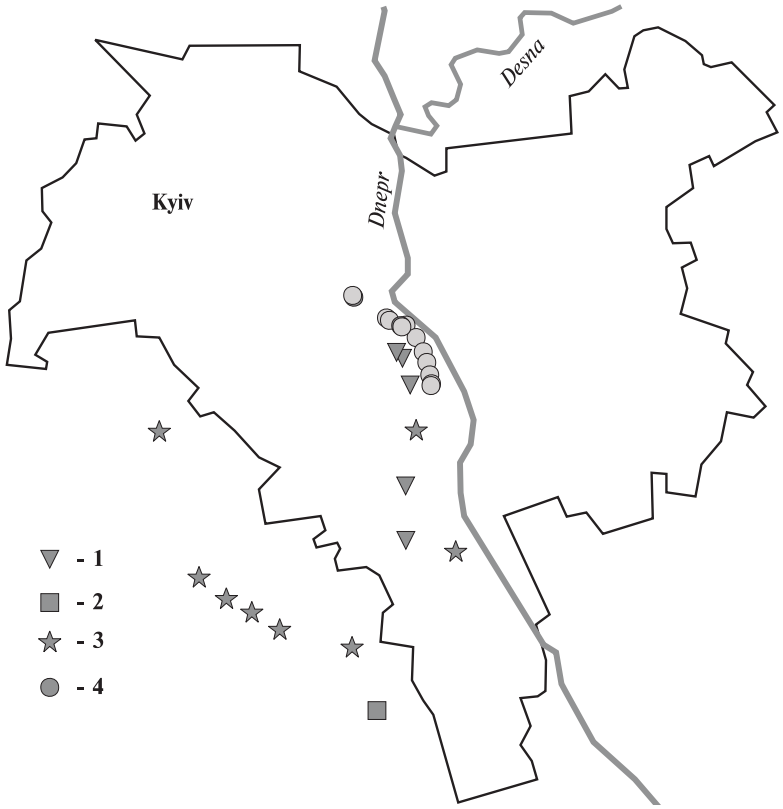

Fig. 1. Location of examined cavities: 1 – sacral artificial caves; 2 – loess natural caves; 3 – underground cavities of military constructions; 4 – drainage gallery systems (DGS).

Рис. 1. Расположение обследованных объектов: 1 – сакральные пещеры; 2 – лессовые природные пещеры; 3 – подземные оборонные сооружения; 4 – дренажные штольневые системы (ДШС).

a continuous period of 50–60 minutes (it was often that though we had not captured any bats there was their high flying activity around the site). In the beginning of spring departure we counted bats without capturing them. The entrances where we netted bats had the following conditions: DGS N 12–P2 where we performed the most of captures during the last 4 years was completely open; at the moment of netting, DGS N 47–P2 was closed with a grilled door padded from inside with a plywood shield few holes that bats used as exits; DGS N 27–ZT was completely open; DGS N 46–P3 was closed with a grilled door.

Bats were examined according to a standard procedure – species, sex, forearm length, weight and parasites were recorded. We measured bat forearms with the accuracy of 0,1 mm using calipers. The weighing was done by Pesola spring balances with the accuracy of 0,5 g.

Selective tagging of bats was done with chiropterological "A"-series rings of Krakow Centre of Chiropterological Information (inscription "C. I. C. Krakow") and previously smoothed ornithological «B»-series rings of Ukrainian Centre for Ringing, Kyiv (inscription "Ukraine Kyiv"). For temporary tagging a white marker was applied on the fur between ears of bats.

Results

Visual counts of bats in cavities

Artificial sacral caves. Most of these caves had been returned back to the possession of monasteries they belonged. Therefore now they are objects for pilgrimage and tourism. Today none of the sacral caves mentioned in the literature can be permanent roosts for bats due the high level of visitors. Single bats are rarely met by visitors and maintenance stuff (table 1).

Loess natural caves. We found single specimens of *M. daubentonii* and *M. dasycneme* only in the Heliograph Cave. Currently the Heliograph Cave is the only known site of hibernation of *M. dasycneme* in Kyiv area and its province (table 1).

Table 1. Results of bat census in loess, sacral and military caves of Kyiv
Таблица 1. Результаты учета рукокрылых в лессовых, сакральных и оборонных подземельях Киева

Object's name	Date	MDAU	MDAS	PAUR	VGSP
Heliograph Cave	10.03.2001	7	1	–	–
	23.01.2002	1	2	–	–
	16.02.2003	2	1	–	–
	06.10.2004	–	1	–	–
"No name" Cave 1	10.03.2001	–	–	–	–
"No name" Cave 2	06.10.2004	–	–	–	–
"No name" Cave 3	06.10.2004	–	–	–	–
Pillbox N 211	15.11.1999	5	–	5	–
	26.02.2002	6 (2♂)	–	1 (1♂)	–
Pillbox N 402	21.11.2004	–	–	–	–
Pillbox N 124 (?)	10.03.2001	–	–	–	–
Pillbox N ? (1)	15.11.1999	–	–	–	–
Pillbox N ? (2)	15.11.1999	–	–	–	–
Pillbox N ? (3)	15.11.1999	–	–	–	–
Lysogorska System	24.10.2004	–	–	–	–
Object N 1	04.09.2005	~ 30 (3♂)	–	–	–
Varyazhskie caves*	1999	–	–	–	2
Zverinetskie caves*	1999	–	–	–	1
	23.04.1999	–	–	–	–
Kitaevskie caves*	10.2003	–	–	–	1
Total	1999—2005	~ 51	5	6	4

Note. Here and further species acronyms are used: MDAU – *M. daubentonii*, MDAS – *M. dasycneme*, MMYS – *M. mystacinus*, PAUR – *P. auritus*, ESER – *E. serotinus*, VGSP – Vespertilionidae Genus sp.; * – interviewing data are used.

Cavities of military structures. We located hibernating *M. daubentonii* and *P. auritus* only in one of six inspected pillboxes (N 211). In the watered tunnel at the Zhukov Island there was recorded a summer colony of Daubenton's bats (table 1).

Drainage gallery systems represent the biggest interest because of their immediate urban location. From 13 examined cavities we found bats in 11 systems. There were found three hibernating species: *M. daubentonii*, *M. mystacinus*, and *P. auritus*, with the *M. daubentonii* dominating among them (98% from all the counted individuals). The results of visual bat counts for different systems are presented in table 2. There was discovered quite a big number of hibernating bats in three systems: 269, 195 and 142 (a sum of results of two inspections: 105 + 37) individuals. Table 2 also includes results of partial examinations of few systems covering the length of 80—400 m.

Places for bat location inside DGS were exclusively crevices between upper ceiling and side blocks of a lining. In most cases bats roosted alone, very rarely by two or by three specimens (e. g. among 268 individuals of *M. daubentonii* found in DGS N 47 there were only 6 pairs; among 105 individuals of this species found in DGS N 12 there were only 2 pairs).

Spring departure of bats from DGS

According to our observations the spring departure of bats from DGS begins no later than the end of March. The departure appears to go gradually. Early spring entrance surveillance in the DGS N 47, that had the biggest number of hibernating animals recorded, showed that during the 2—3 hour period after sunset only 3—5 bats flied out (table 3). Peak of the spring departure happened in the middle of April (fig. 2).

After that the process gradually declines, and by the end of April the drainage galleries becomes empty. For example, on 6th of April 2004 in one of the short galleries (DGS N 8-bis) we observed 8 specimens of *M. daubentonii* being in torpor; by 27th April 2004 all the bats in the gallery were missing. Surveillance of few other galleries in May revealed a small number of mostly active bats (not included in the table). A thor-

Table 2. Results of bat census in drainage gallery systems of Kyiv
Таблица 2. Результаты учета рукокрылых в ДШС г. Киева

Object's name	Inspected length, м	Date	MDAU	MMYS	PAUR
N 8	~ 150	04.02.2002	13	–	3
		25.09.2004	11 (6♀)	–	2
N 8-bis	~ 150	04.02.2002	5	–	–
		30.12.2002	12	–	–
		06.04.2004	8	–	–
		27.04.2004	–	–	–
		25.09.2004	8 (3♀)	–	–
N 12—P1+*	~ 400	25.02.2004	37	–	1
N 12—P2+*	~ 1400	13.03.2004	103 (1♀)	–	2
	~ 700	29.09.2005	20 (5♂, 12♀)	–	–
N 18	~ 700	31.03.1999	4	–	–
N 20-bis	~ 300	12.04.1999	–	–	–
N 27—PZT+*	~ 550	07.03.2003	37	–	–
N 27—P16+*	~ 450	03.03.2002	21 (4♂, 5♀)	–	4 (1♀)
N 46	~ 450	09.10.2004	82 (3♂, 6♀)	–	–
		02.05.2005	2 (2♂)	–	–
N 47—P1—2	~ 1000	12.01.2003	268 (1♂)	1 (♀)	–
N 47—P3	~ 400	21.12.2002	42	–	–
N 50	~ 750	11.12.2002	195	–	–
		25.12.2005	154	–	–
ZT—SMD	~ 1200	24.01.2003	20	–	–
B. Zh.—P1—2	~ 1300	19.02.2003	28	–	1
B. Zh.—П3	~ 30	22.01.2003	–	–	–
partial inspections (sum)	~1430	Jan. 2000—Feb. 2002	172 (2♂, 2♀)	–	5 (1♀)
Total		1261 (100%)	1242 (98,49%)	1 (0,08%)	18 (1,43%)

Note. * – an object was inspected partially; P – a portal; P... + – an inspection was carried out beginning from a certain portal, e. g., P1, P16, etc.

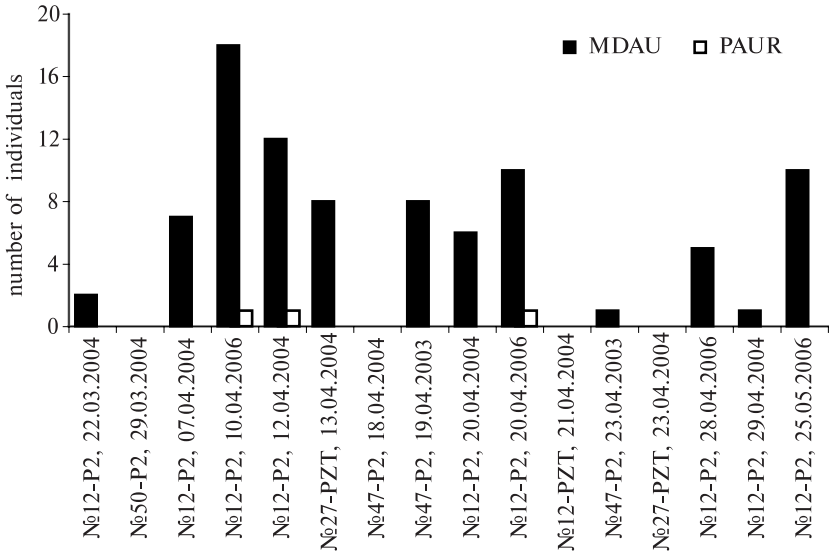

Fig. 2. Results of spring netting of bats at entrances into four drainage systems during 2003—2004 and 2006.

Рис. 2. Результаты весенних отловов рукокрылых на входах в четыре дренажные системы в 2003—2004 и 2006 гг.

Table 3. Observation results of bat departure from the DGS in springs of 2003 and 2004 obtained without netting

Таблица 3. Результаты наблюдений за вылетом рукокрылых из ДШС без отлова весной 2003 и 2004 гг.

Point of observation	Date	Number of individuals left DGS	Observation period / astronomical sunset	Temperature
N 47—P2	19.03.2004	4 ind.	18: 20 – 20: 30 / 18: 10	+10—7°C
	25.03.2003	5 ind.	18: 25 – 19: 50 / 18: 20	+8°C
	31.03.2004	5 ind.	19: 30 – 22: 00 / 19: 29	+12—9°C
	06.04.2003	3 ind.	19: 40 – 20: 55 / 19: 37	+3,5—3°C

ough visual examination of DGS N 46 in May 2005 showed only two individuals (table 2). We are inclined to explain the absence of bats in DGS N 20-bis observed on 12.04.99 by the fact that all hibernating animals had already left the shelter. Capturing bats by the entrance of DGS on 25th May 2006 (10 individuals of *M. daubentonii* were caught, figure 2) is an exception.

In the spring netting as well as during winter hibernation, Daubenton's bats predominantly outnumbered the rest of the species. The second species *P. auritus* recorded in spring was presented by few specimens (3,3% of total number of netted bats).

In April—May of 2006 the *M. daubentonii* mean weight was 7.4 ± 0.73 g ($n = 27$) and 8.3 ± 0.70 g ($n = 17$) for males and females correspondingly.

Based on the results of nettings of *M. daubentonii* near DGS we may say that females leave the roosts first. Males leave the shelters the last: after the 20th April the animals caught were represented only by males (fig. 3). Few examined Daubenton's bats found during visual census were also males (table 2).

Bat swarming, beginning of hibernation

Bat autumn swarming phenomena was recorded for DGS. Beginning from the end of July near the entrances into the drainage galleries there was growing activity of bats. For instance, while none of the bats were observed in the middle of June (12.07.04), in a month later (16.08.04) there were caught 63 individuals of *M. daubentonii* at the

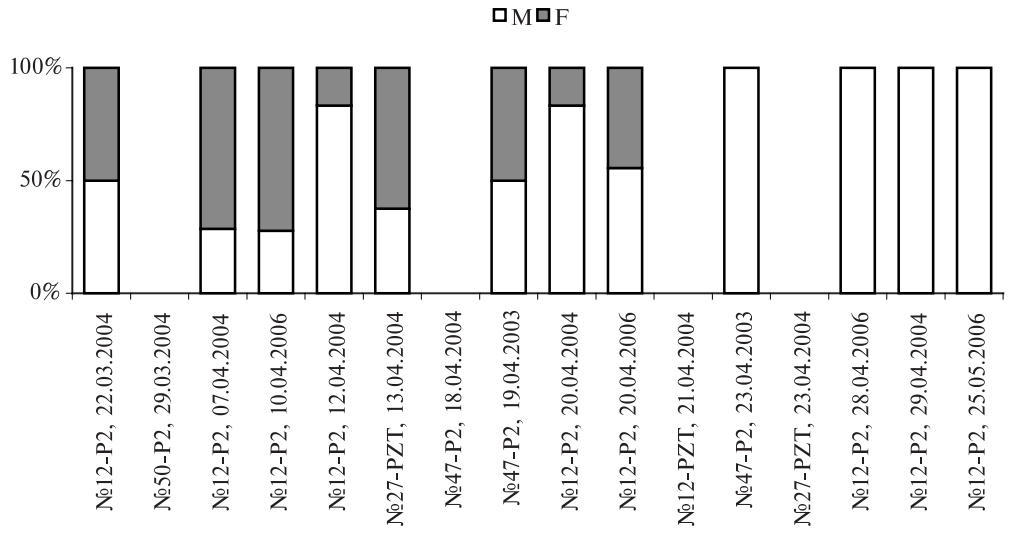

Fig. 3. Sex ratio of *M. daubentonii* netted at entrances into four drainage systems in spring during 2003—2004 and 2006.

Рис. 3. Соотношение полов *M. daubentonii*, отловленных на входах в четыре дренажные системы весной 2003—2004 и 2006 гг.

same location (entrance P2 into DGS N 12). Among netted bats there were both those flying in and out from the roost.

During autumn nettings near DGS besides *M. daubentonii* and *P. auritus* there were three more species revealed (fig. 4): *M. dasycneme*, *E. serotinus* (not recorded by us during the hibernation in DGS) and *M. mystacinus* (earlier found a single male during winter census). Again, *M. daubentonii* was discovered to be almost the absolute dominant among netted animals – 97.36%.

Activity of *M. daubentonii* near the DGS entrances reached its peak value around the middle of August and then gradually declined. There was a difference of netted bat counts during the same period of two consecutive years (2004 and 2005) at one entrance. Although dynamics has a similar character, the number of bats netted for the same dates with a difference of one year varies by a factor of two-three and more. For example, on 05.09.04 there were 11 individuals of *M. daubentonii* netted; on 06.09.05 we caught 32 individuals; on 12.09.04 we counted 9 individuals, and on 13.09.05 there were 22 bats; etc.

Overall, as it might be seen from figure 5, for the majority of late summer and autumn nettings, the dominance of males was observed. Since the middle of September, only males were observed among netted Daubenton's bats.

Visual daytime inspection of two drainage systems (N 8, N 8-bis) in the end of September and beginning of October showed number of bats similar to the winter observation (table 2). The animals found around these days were in a condition of deep torpor similar to the hibernation torpor.

We would like to point out a remarkable difference in sex ratio of animals caught by the DGS entrances and found inside the caves during daytime inspection – late summer and autumn nettings *M. daubentonii* male/female ratio was 192/101, whereas inside gallery ratio was 8/27, respectively. Among females, there were mostly adult individuals.

We also found a big weight difference of *M. daubentonii* netted near entrances in September–October 2003–2005 and found inside the shelters in autumn in September–October of 2004 and 2005 (table 4). The difference reached 4–5 g.

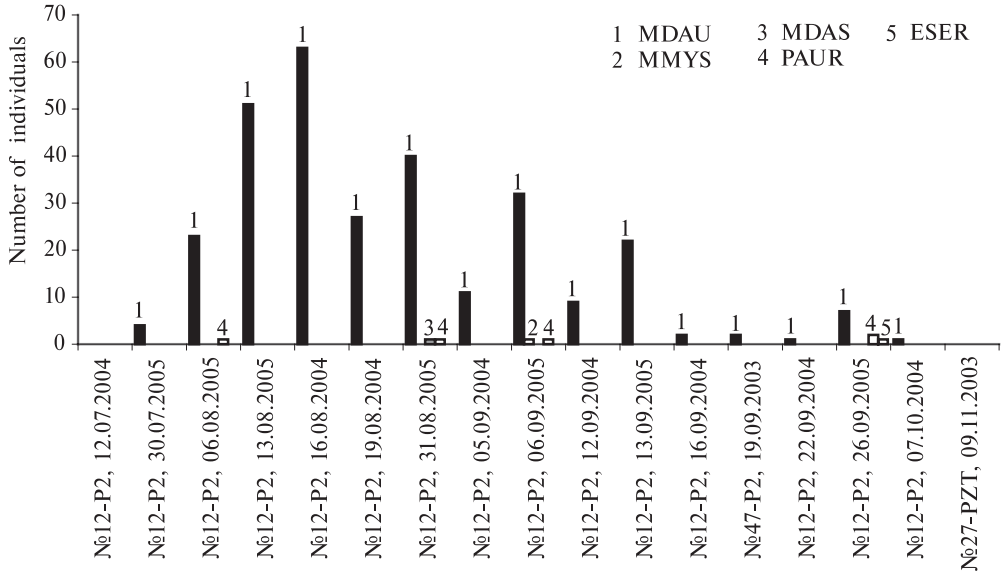

Fig. 4. Results of late summer and autumn netting of bats at entrances into three drainage systems during 2003–2005.

Рис. 4. Результаты позднелетних и осенних отловов рукокрылых на входах в три дренажные системы в 2003–2005 гг.

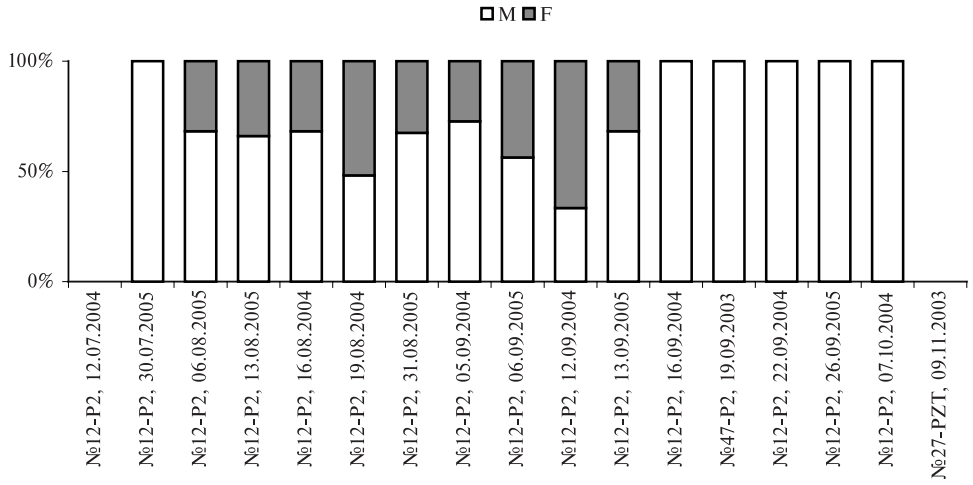

Fig. 5. Sex ratio of *M. daubentonii* netted at entrances into three drainage systems in autumn of 2003–2005.

Рис. 5. Соотношение полов *M. daubentonii*, отловленных на входах в три дренажные системы осенью в 2003–2005 гг.

Table 4. Weight of *M. daubentonii* found inside and netted near entrances of DGS in autumn

Таблица 4. Вес *M. daubentonii*, обнаруженных внутри и отловленных возле входов ДШС осенью

Sex	Found inside			Netted near entrances		
	weight, g	x ± S, g	n, ind.	weight, g	x ± S, g	n, ind.
females	11,5—14,5	12,56 ± 0,91	27	7,5—9,5	8,29 ± 0,55	30
males	11,5—14,5	12,75 ± 1,0	8	7,0—12,5	7,74 ± 0,85	54

Results of ringing

The number of recaptured ringed bats during the same season was relatively small. For example, out of 166 *M. daubentonii* individuals netted and ringed at the entrance N 12—P2 in late summer – autumn of 2005 only 7 ones were captured back (one specimen was recaptured twice). Overall, 280 bats were ringed in Kyiv DGS: 9 – *P. auritus* (5M, 4F), 1 – *M. mystacinus* (1M), 270 – *M. daubentonii* (161M, 109F, 1U). Later only Daubenton's bats were recaptured – 5 females and 19 males (two males were recaptured twice; one male was captured three times).

All bats, except one, were recaptured at the sites of their ringing. One specimen was caught the next day after ringing at the entrance to another system within 1 km from the site of initial netting.

Discussion

In the Kyiv underground cavities 5 bat species were found (*M. daubentonii*, *M. dasycneme*, *M. mystacinus*, *P. auritus*, *E. serotinus*). One of them (*M. mystacinus*) was recorded for the first time. We did not find *B. barbastellus* that was mentioned in earlier records as dwelling in Kyiv caves in 20th century. In Kyiv and vicinities this species was relatively often registered between 1939 and 1952 (totally 16 records, Абелєнцев, Попов, 1956; Абеленцев и др., 1969; collections of NMNH, ZM KNU, ZM MSU). Since then there had been only one record of the species in 1983 (Лихотоп и др., 1990).

According to all our observations the number of *M. daubentonii* represents 97.4% of all the specimens counted in Kyiv caves. Taking into account, that this ratio was obtained mostly by the census in DGS, it is interesting to compare our results with those received by Ponimatko in drainage systems of Nizhniy Novgorod City (Russia) which are, evidently, a full analogue of Kyiv DGS. It is worth mentioning that similar to Kyiv, in Nizhniy Novgorod drainage systems the dominant species is *M. dauben-*

tonii – 90.4% of all the counted individuals, with n = 43 (Пониматко, 1998). At the same time, the bat fauna of Nizhny Novgorod region includes more potential winter cave-dwellers: besides found in DGS *M. daubentonii*, *M. dasycneme* and *P. auritus* there were three more *Myotis* species and *Eptesicus nilssonii* found in the cavities of the region (Бакка, Бакка, 1999). The predominance of the species, besides all other explanations (presence of certain microclimate indices, percentage ratio of potentially cave species of regional chiropterofauna, etc.), can also be explained by the tolerance of the species to the disturbance caused by man.

Some authors (Стрелков, 1971) suggest that the higher the temperature is in the roost the more sensitive bats are to disturbance. The DGS at the most part of their length have relatively high temperature (about 9—10°C and higher). Hence, we may expect for a successful hibernation the species dwelling in the cave with high attendance and high temperature should be more tolerant. During each our visit for visual counting (absence of physical contact with bats) 1—10 and more individuals woke up and started to fly. In this case we may presume that among other potential winter cave-dwellers of the region *M. daubentonii* is the most resistant to numerous constant visits of man into caves.

Autumn swarming of bats by the entrances of cavities situated inside the territory of a big city was registered for the first time. We observed the swarming by the cavity entrance located in a park. However we do not exclude DGS entrance swarming on other types of Kyiv urban territories.

Overall the pattern of *M. daubentonii* swarming (season time, sex ratio of netted bats, ratio of recaptured bats at the same season) corresponds to the swarming in caves of south-western Germany (Nagel et al., 2004), Polish caves (Furmankiewicz, Gorniak, 2002), and, evidently, caves of Great Britain and Czech Republic (Parsons et al., 2003; Bauerova, Zima, 1988).

We presume that the count difference of bats netted in late summer and autumn of 2005—2006 may be determined not only by fluctuations of bat populations which use DGS as swarming sites. Although for the considered type of cavities the anthropogenic factor may have a substantial weight, we presume that the number increase for the bats visiting cavities depends on the duration of the period during which an entrance was opened. We also presume that the swarming takes place by cavities with completely open entrances, in such a way the bats could fly though them.

By absolute number of specimens found during hibernation, three Kyiv DGS mentioned above are among 20 underground cavities with the biggest winter aggregations in Ukraine (the rating is compiled based on data available for 2006 according to: own data; Варгович, 1993; Vargovich, 2000; Тищенко та ін., 2005). These cavities seem to be quite important for bats because of almost the full absence of other natural cavities. At the same time these objects are technical structures and, as it was mentioned above, they are periodically exposed to technical inspection, cleaning, restoration and other maintenance. Currently restricting access to the DGS by unauthorized visitors would greatly decrease disturbance of the bats. Taking into account that the swarming sites are important for bats no less than stationary roosts (Parsons, Jones, 2005), it may be imperative to maintain the entrances in the appropriate condition.

Conclusion

1. In Kyiv area, from the four types of underground shelters bats use the drainage gallery systems (DGS) the most. We discovered a winter aggregations with up to 269 specimens in one of such underground objects.

2. The dominant species of winter aggregations of bats in Kyiv caves is *M. daubentonii* – 97.4% of the counted specimens. Other species found during hibernation are *M. dasycneme*, *M. mystacinus*, *P. auritus*, which constitutes 2.6%.

3. A spring departure of bats from DGS begins no later than end of March. The departure reaches its peak around the middle of April. In May only single males are left.

4. Since the end of July there is a growth of swarming activity of bats by the entrances to drainage galleries. Among the five species presented during swarming (*M. daubentonii*, *M. dasycneme*, *M. mystacinus*, *P. auritus*, *E. serotinus)*, *M. daubentonii* has a dominant position (97% of netted animals).

5. The peak of *M. daubentonii* swarming falls at the second half of August. Most of active animals are represented by males – 65.5% of specimens netted in late summer and autumn.

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