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Discovery of a big hibernacula of Noctule bats, *Nyctalus noctula* (Schreber, 1774) (Chiroptera: Vespertilionidae) in the town of Plovdiv, Bulgaria

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Abstract. The current article presents data on the wintering colony of Noctule bats at a river bridge in the town of Plovdiv, Bulgaria. The data were obtained during a rescue operation aimed at saving the wintering colony threatened by repair works on the Gerdzhika bridge over the Maritza River in the centre of Plovdiv. The operation was carried out during the period 26.11.2005 – 31.11.2005 by volunteers from the Green Balkans Federation, and all activities were coordinated with representatives of the Regional Inspectorate of Environment and Waters – Plovdiv and the Wildlife Rehabilitation and Breeding Center – Stara Zagora. The bats were using the gaps of the bridge as a shelter for hibernation and the ongoing repair was threatening them by squeezing or burying them under the construction debris. During the rescue the bats were taken from their shelters and transported for a temporary stay to the Wildlife Rehabilitation and Breeding Center of Green Balkans – Stara Zagora. The reported minimal number of wintering *Nyctalus noctula* in the gaps of the Gerdzhika Bridge in Plovdiv is 1035 individuals, this is the most numerous colony registered in Bulgaria to date. The colony consists of 57 % female and 47 % male individuals. Cranio-mandibular measurements taken contribute to the data published in "Fauna of Bulgaria".

Key words: Noctule bat, *Nyctalus noctula*, sex structure, wintering colony, Bulgaria, bridge

Introduction

The Noctule bat *Nyctalus noctula* (Schreber, 1774) is distributed all over Europe, except for the northern and southernmost parts (DIETZ & VON HELVERSEN, 2004). The species is one of the most common and most reported bats in Bulgaria.

Almost all from a total of 92 known localities are in the lower parts of the country – up to 500 meters above sea level (BENDA et al., 2003). The species is semisynanthropic (PESHEV et al., 2004), often acting as synanthropic, common species in urbanized habitats for some countries (GAISLER et al., 1979; BIHARI, 1999; ALCALDE, 1999). This is related to the loss of natural habitats and to the presence of suitable conditions in some urbanized buildings, which makes them preferred shelters for the species. The density of the colonies in buildings in many cases is greater than that in natural wood habitats (BIHARI, 1999).

Despite the fact that according to our observations the species is numerous in the town of Plovdiv, no detailed data are published, except for a single observation of two individuals (BĂČVAROV, 1963).

The current article presents data on the wintering colony of Noctule bats at the Gerdzhika Bridge in Plovdiv. The colony was examined during the rescue operation of wintering bats, which were threatened by the construction works going on at the bridge.

Material and methods

The data were obtained during a rescue operation aimed at saving the wintering colony threatened by the repair works on the Gerdzhika bridge over the Maritza River (Fig. 1) in the centre of Plovdiv (elevation 163 meters above sea level, GPS-coordinates WGS 84: N 42º9'12,4", E 24º44'19,1"). The operation was carried out during the period 26.11.2005 – 31.11.2005 by volunteers from the Green Balkans Federation, and all activities were coordinated with representatives of the Regional Inspectorate of Environment and Waters – Plovdiv and the Wildlife Rehabilitation and Breeding Center – Stara Zagora.

The bats were using the gaps of the bridge as a shelter for hibernation and the ongoing repair was threatening them by squeezing or burying them under the construction debris. During the rescue the bats were taken from their shelters and transported for a temporary stay to the Wildlife Rehabilitation and Breeding Center of Green Balkans – Stara Zagora. A total of 977 bats were taken out alive and 59 corpses of dead individuals were found. Therefore the total number of wintering individuals of the same species found is 1035.

The sex of all live and dead individuals was determined (except for 2 individuals, whose body traumas made it impossible to identify their sex).

The weight of 41 individuals was measured (28 females and 13 males). Measurements were taken with digital scales TH-2000 with 1 gram precision.

The undamaged skulls (a total of 37-16 females and 21 males) of the dead individuals were separated, cleaned and measured. Body measurements were taken from 128 individuals (69 live and 59 dead). Measurements were taken by caliper with 0.1 mm precision after DIETZ & VON HELVERSEN (2004), recording the following measurements: length of forearm (LR), length of third finger (D3) and length of fifth finger (D5).

The abbreviations used in the present publication stand for: LR – length of forearm, D3 and D5 – length of third and fifth fingers, CBL – condylobasal length, CCL – condylocanine length of skull, LI^1-M^3 – length of upper dental row, LC-M^3 – length of upper dental row from the canine, ARW – anterior rostrum width, PRW – posterior rostrum width, IOW – interorbital width, ZW – zygomatic width, BCW – brain cavity width, MH – maximum height of skull, LMd – length of mandible, HPC – height of *proc. coronoideus*, LI_1-M_3 – length of lower dental row, LC-P_4 - length of C-P_4.

A total of 14 craniometric and mandibular characters were measured. The measurements were made with calipers with 0,2 mm accuracy.

The results were processed statistically in order to determine the minimum, maximum, and average values, as well as standard deviations. The characteristics for the two sexes were compared for identifications of such, indicative of sex affiliation. T-test was used for checking the equality

of two mathematical expectations of the two general populations at 95 % probability. After the examination of the bone material, it was deposited in the National Museum of Natural History, BAS, Sofia.

After a temporary stay in the Wildlife Rehabilitation and Breeding Center (from 1 to 6 days), a total of 973 individuals were released in the Devetashka cave (Northern Bulgaria), where there is a known wintering colony of the same species (Ivanova, pers. comm.; BENDA et al., 2003).

Four of the individuals had fractures and severe injuries and died during their stay in the Center.

Parasites were collected during the rescue operation, preserved in 70 % ethyl alcohol and sent to NMNH – BAS, Sofia for further analysis.

Results and discussion

The individuals, wintering in the bridge gaps, were considered a single colony. A total of 1035 were registered in this wintering colony. The observations show that a certain number of individuals had woken up from hibernation and left the shelter in the bridge due to extreme disturbance and despite their conservative preference to the shelters observed during the rescue operation. It is also possible that some dead individuals remained buried under the construction debris in the niches. The presence and number of suitable holes for sheltering, the presence of droppings as well as evidence of eyewitnesses show that the number of individuals inhabiting the bridge during the hibernation period was most probably significantly larger than the number of individuals found after the beginning of the bridge reconstruction.

According to BENDA et al. (2003) this makes the observed colony the biggest wintering colony of the species registered in Bulgaria.

During the rescue operation the Noctule bats were found in groups of 20 to 200 individuals in cavities, formed in gaps of the bridge (some of them partially filled with construction debris).

Two type of gaps were found in the bridge (Fig. 1), perpendicular to its longitudinal axis, with the following dimensions: length of 12.50 m, depth of 0.66 m in the middle part and 0.25 m in the terminal part and width of 3-4 cm. The gaps of type one (I) were located entirely over the river bed (water or bank). These gaps held low numbers of bats and were almost filled with construction debris. The gaps of type two (II), localized in the carrying pillars, not directly over the water, secured greater numbers of bats and were less filled with construction debris. A total of 13 gaps were found on the bridge – 5 from type I and 8 from type II. The gaps were 12,7 m and 7.7 m away from one another. The average density of population was 80 bats per gap.

The individuals that flew out of the gaps during the rescue operation returned to the other individuals which were enclosed in transport boxes meters away from their previous shelter. We consider this as evidence of the tight social relations among the individuals of the colony.

No other bat species were found in the colony during the whole examination.

Only two dead bats were found except for the individuals killed during the repair works.

Sex determination of 1033 individuals shows that 586 (57 %) of them were females and 447 (or 43 %) were males.

Fig. 1. Gerdzhika Bridge, over the Maritsa River, Plovdiv. Arrows indicate the location of the gaps, sheltering the wintering *Nyctalus noctula*: a – type I, b – type II. Photo: D. Georgiev

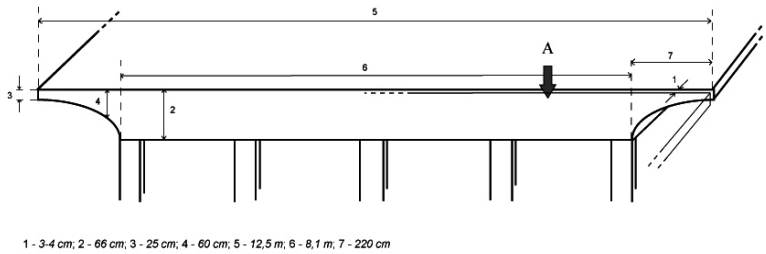

Fig. 2. Structure and dimensions of the bridge gaps, sheltering *Nyctalus noctula*. A indicates the gap inhabited by bats

The weight, as well as general craniometric data, were reported, contributing to the morphometry of the species in Bulgaria in comparison to the data published in "Fauna of Bulgaria", volume 27 (PESHEV et al., 2004).

The completed comparisons between the characteristics of both sexes (Table 1) show that the values of the particular characteristics are very close to one another.

General craniometric data on the species are presented in Table 2 and are close to the data reported for Bulgaria by other authors (BENDA et al., 2003; PESHEV et al., 2004).

According to SIMOV et al. (2006) the *Cimex dissimilis* (Horvath) (Insecta: Hemiptera: Cimidae) parasite was discovered in two individuals (a male and a female). The author states that the species can be considered a vagrant species that does not form a stable population on the local resident bat population, but arrives occasionally, transferred by migrating bats (mainly females, breeding in the northern parts of the breeding area).

Table 1

Weight and somatometric data of both sexes of *Nyctalus noctula* from the examined colony

Nyctalus noctula	**Weight (g)**			**LR**		**D5**		**D3**	
	Total	♀♀	♂♂	♀♀	♂♂	♀♀	♂♂	♀♀	♂♂
Min	24	28	24	51.7	49.7	47.4	48.5	8.9	81.5
Max	38	38	35	58.4	57.4	58.6	56.7	98.35	95.3
$\overline{X}$	31.39	32.21	29.6	54.37	53.50	54.20	53.13	90.85	89.71
STD	2.96	2.50	3.18	1 566	1 752	2 097	1 930	10 043	2 922
RSD %	0.09 %	0.08 %	0.11 %	2.88 %	3.28 %	3.87 %	3.63 %	11.06 %	3.26 %
N	41	28	13	73	55	73	55	73	55

Table 2

Craniometric data of *Nyctalus noctula* from the examined colony

Nyctalus noctula		**Min**	$\overline{X}$	**Max**	**SD**	**N**	**RSD %**
CBL	♀♀	18.3	18.80	19.30	0.32	16	
	♂♂	18	18.81	19.30	0.33	21	
	Total, ♀♂	18.00	18.81	19.3	0.321	37	1.71 %
CCL	♀♀	18.6	19.18	19.70	0.28	16	
	♂♂	18.5	19.12	19.70	0.32	21	
	Total, ♀♂	18.50	19.15	19.7	0.302	37	1.58 %
LI1 - M3	♀♀	7.8	8.19	8.40	0.15	16	
	♂♂	8	8.21	8.40	0.15	21	
	Total, ♀♂	7.80	8.20	8.4	0.146	37	1.78 %
LC- M3	♀♀	7	7.29	7.50	0.12	16	
	♂♂	7.1	7.35	7.50	0.09	21	
	Total, ♀♂	7.00	7.33	7.5	0.110	37	1.50 %
ARW	♀♀	7	7.35	7.70	0.19	15	
	♂♂	7.1	7.38	7.60	0.17	21	
	Total, ♀♂	7.00	7.37	7.7	0.177	36	2.41 %
PRW	♀♀	8.4	8.86	9.30	0.22	16	
	♂♂	8.6	8.89	9.30	0.22	21	
	Total, ♀♂	8.40	8.88	9.3	0.216	37	2.44 %
IOW	♀♀	5	5.35	5.60	0.15	16	
	♂♂	4.8	5.29	5.50	0.15	21	
	Total, ♀♂	4.80	5.32	5.6	0.155	37	2.92 %
ZW	♀♀	12.8	13.25	13.60	0.27	13	
	♂♂	12.4	13.21	13.80	0.33	18	
	Total, ♀♂	12.40	13.23	13.8	0.303	29	2.29 %

Table 2
Continued

Nyctalus noctula		**Min**	$\overline{X}$	**Max**	**SD**	**N**	**RSD %**
BCW	♀♀	9.5	9.80	10.30	0.21	16	
	♂♂	9.2	9.72	10.20	0.25	21	
	Total, ♀♂	9.20	9.76	10.3	0.238	37	2.43 %
MH	♀♀	8.5	8.78	9.30	0.23	13	
	♂♂	8.4	8.72	9.20	0.18	20	
	Total, ♀♂	8.40	8.74	9.3	0.203	33	2.32 %
LMd	♀♀	13.5	14.06	14.60	0.28	16	
	♂♂	13.4	14.02	14.80	0.37	21	
	Total, ♀♂	13.40	14.04	14.8	0.329	37	2.34 %
HPC	♀♀	4.5	4.69	4.90	0.12	16	
	♂♂	4.4	4.68	5.00	0.15	21	
	Total, ♀♂	4.40	4.68	5	0.136	37	2.91 %
LI1-M3	♀♀	8.5	8.74	8.90	0.14	14	
	♂♂	8.5	8.80	9.10	0.15	21	
	Total, ♀♂	8.50	8.77	9.1	0.147	35	1.67 %
LC-M3	♀♀	7.6	7.83	8.00	0.14	15	
	♂♂	7.5	7.84	8.10	0.13	20	
	Total, ♀♂	7.50	7.84	8.1	0.135	35	1.73 %

Conclusion

1. The reported minimum number of wintering *Nyctalus noctula* in the gaps of the Gerdzhika Bridge in Plovdiv is 1035 individuals. This is the most numerous colony registered in Bulgaria to date.

2. The colony consists of 57 % female and 47 % male individuals.

3. Measurements taken contribute to the data published in "Fauna of Bulgaria" (PESHEV et al., 2004).

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Многочислена зимна колония на *Nyctalus noctula* (Schreber, 1774) (Chiroptera: Vespertilionidae) в град Пловдив (Южна България)

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(Р е з ю м е)

Представените данни са получени при спасяването на зимуващата колония на *Nyctalus noctula*, застрашена от ремонтните дейности на мост Герджика над река Марица, град Пловдив. Изследването е проведено в периода 26.11.2005 – 31.11.2005. Минималният регистриран брой зимуващи индивиди във фугите на моста е 1035 индивида, като това е най-многочислената колония, регистрирана досега в България. Средната установена гъстота на заселеност е 80 прилепа във фуга. Колонията се състои от 57 % женски и 47 % мъжки индивида. Изследваните сомато- и краниометрични признаци, както и получените тегловни данни, не могат да се използват за детерминиране на пола при вида от изследвания район.