**Acta Theriologica 35 (3–4): 364–368, 1990.**
PL ISSN 0001–7051

# Changes in numbers of *Myotis daubentoni* (Kuhl, 1819) in autumn shelters and the effect of disturbance

Grzegorz LESIŃSKI

Lesiński G. 1990. Changes in numbers of *Myotis daubentoni* (Kuhl,1819) in autumn shelters and the effect of disturbance. Acta theriol. 35: 364–368.

Undergrounds of 2 forts in Central Poland were inhabited by *Myotis daubentoni* at the beginning of August. From the half of September the majority of individuals remained in lethargy. The maximum numbers were reached in the end of October (in 1984 – 70 individuals, in 1985 – 52 individuals). Studied forts are only autumn shelters for the majority of individuals, not proper hibernacula. It was found that the process of bat ringing resulted faster leaving undergrounds. Disturbance with the frequency once per two weeks changed natural dynamics in lower degree than more frequent controls.

Department of Vertebrate Ecology, Institute of Ecology, Polish Academy of Sciences, Dziekanów Leśny n. Warsaw, 05–092 Łomianki, Poland

*Key words*: autumn shelters, *Myotis daubentoni*, disturbance, Poland

## Introduction

*Myotis daubentoni* (Kuhl, 1819) hibernates in the highest numbers in undergrounds of Central and Eastern Europe (Strelkov 1971, Haitlinger 1976, Bogdanowicz 1983, Degn 1987). It prefers large undergrounds (Bagrowska-Urbańczyk and Urbańczyk 1983) and only occasionally has been found in small cellars (Masing 1982). The data relating to the changes in numbers of *M. daubentoni* in undergrounds were shown in many works but the term of inhabiting the shelters and its variability in local populations and different parts of a continent have been still not exactly determined. It was observed that in some winter shelters the maximum numbers of this species falled on autumn months (Strelkov 1971, Lesiński 1986), and the number of individuals gradually decreased later, during winter being rather low.

The aim of this work is to determine the changes in numbers of *M. daubentoni* in late summer and autumn in undergrounds of Central Poland and if it is modified by disturbance.

## Study area and methods

The study was carried out in 2 forts (Janowo, Strubiny) belonging to the outer part of the Modlin fortress (Central Poland), studied previously during hibernation period (Lesiński 1986). Some results were published in preliminary paper (Lesiński 1989). The forts are located in agricultural landscape on the border of small village, 0.5–1 km appart from the small wood, 5 km$^2$ in size. They differ mainly in size, shape and distribution of corridors, number of entrances *etc.* In majority of corridors, permanent air circulation precludes stable thermal conditions (many entrances).

The study was conducted during 4 seasons in each using different variant of census (with regard to frequency of controls and with or without disturbance), as follows:
1981 – study period: 22 Sep. – 17 Nov., one control per 14 days on average, bats marked,
1982 – 9 Sep. – 10 Nov., one control per 7 days, bats marked,
1984 – 28 July – 19 Dec., one control per 7 days, bats not marked,
1985 – 11 Sep. – 21 Dec., one control per 14 days, bats not marked.

Three cathegories of bats were distinguished: (1) remaining in lethargy (Fig. 1, A), flying in corridors (B), (3) sheltered in deep crevices which presence was possible to establish by voices beeing a reaction to light.

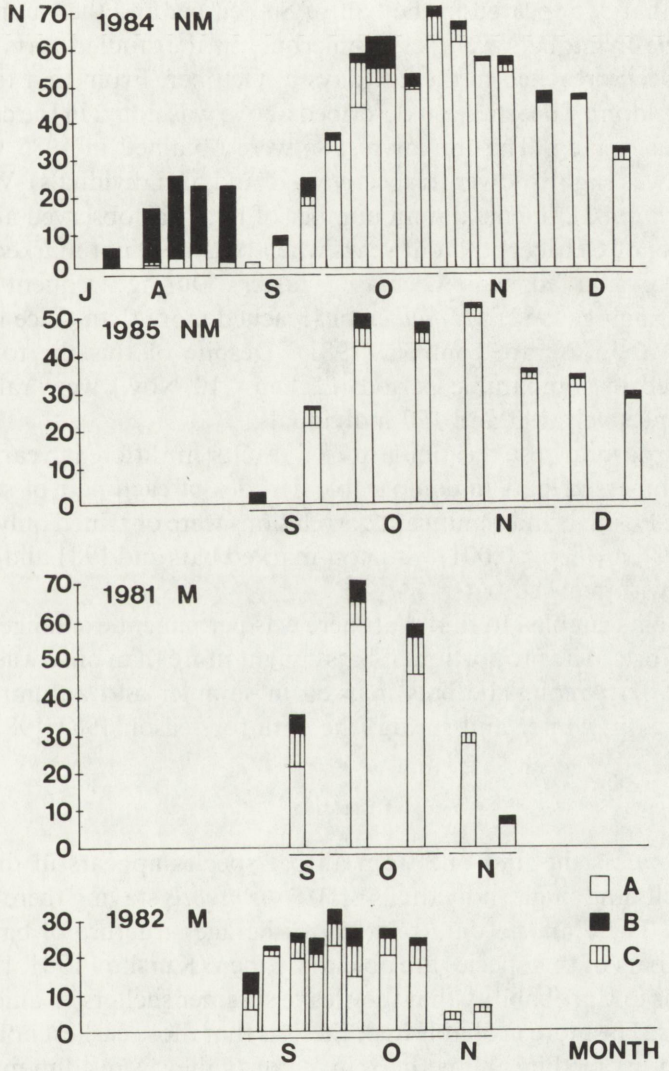


Fig. 1. Changes in numbers of *Myotis daubentoni* in studied undergrounds (data for two forts). A – in lethargy, B – flying, C – voices from deep crevices, M – marked, NM – not marked.

## Results

The numbers of *M. daubentoni* were not proportional to the size of two studied forts (at Janowo only 1/4 of total number of bats was found). As the changes in numbers in the forts were very similar, the analysis was based on the clumped results.

The most complete data on changes in bat numbers were obtained in 1984 (Fig. 1). It was seen that *M. daubentoni* inhabited the forts at the beginning of August. Individuals met until the half of September in majority of cases were active. Those remaining in lethargy appeared in the half of September and their number increased rapidly while the flying bats were less numerous. In the studied forts the maximum numbers this species reached in the last days of October. From that time flying bats appeared very seldom. The situation described above was noted in the case of frequent controls without ringing. The similar results were obtained in 1985 when the total number of bats was slightly lower (respectively 70 and 52 individuals). When bats were marked (in 1981, 1982), the maximum number of bats was observed almost a month earlier (first days of October) than in years when bats were not marked (1984, 1985). The numbers of marked bats decreased faster. During frequent controls and disturbance by ringing (1982) *M. daubentoni* reached more than twice lower numbers (33 individuals) than at rare controls (1981). Despite of this the total number of individuals noted in comparable period (22 Sep. – 10 Nov.) were rather similar in both years – respectively 195 and 177 individuals.

For the purpose to test the similarity of results in different years, correlations between the numbers of bats in comparable decades of each pair of studied periods were calculated. Positive and significant correlations were obtained only in years: 1984 and 1985 ($r = 0.94$, $n = 8$, $p < 0.001$) with non-marked bats and 1981 and 1982 ($r = 0.89$, $n = 5$, $p < 0.05$) with marked bats.

Ringing of bats enabled to find that there was permanent exchange of individuals in both studied forts. The proportion of bats caught more than once was 5.2% in 1981 and 7.6% in 1982. Among the bats marked in summer and autumn, only 4% of individuals stayed in winter and spring (the data for season 1981/1982).

## Discussion

*M. daubentoni* as the first one from all bat species appears in the forts before hibernation, excluding single individuals of *Myotis myotis* staying there all year round (Lesiński 1988). There are no data relating to the age structure of bats observed in August. Young bats of this species are able to fly then (Kurskov 1981, Lundberg *et al.* 1983) but there is low probability that they leave summer shelters so quickly and move to undergrounds. The more probable hypothesis is that those earliest noted individuals did not take part in breeding and perhaps in majority they were adult males, as it took place in Czechoslovakia (Horáček *et al.* 1979, Červený 1982).

The abundance of food is so high in August and at the beginning of September,

that bats are not forced to remain in lethargy, and for that reason they fly in corridors. Intensive arrival of individuals falling into torpor, taking place in late September (Fig. 1), is closed to the term when this species reaches the maximum body weight (Lesiński 1986). Microclimatic conditions of studied forts in late summer and in autumn (cooler as compared with other types of shelters) make possible to use optymally winter food deposits. The numbers of *M. daubentoni* increases until the end of October when its foraging comes to an end (data for Białowieża Forest – Kurskov 1981). In winter this species does not find the optimal conditions for hibernation because of low temperatures (below 0° C) noted in many parts of corridors, and for that reason the numbers is much lower then (Lesiński 1986, 1988). The studied undergrounds can be defined as autumn quarters of bats. The proper winter quarters are located elsewhere.

The studied forts are inhabited by *M. daubentoni* in the similar term as big cave in Denmark, though the numbers of this species increases there until March, in the end of October reaching only 20% of the maximum numbers (Degn 1987). Also in Belgium the appearance of the first individuals in undergrounds was noted in August (Gilson 1985).

The most similar results, both with regard to term of arrival, and to changes in numbers, were obtained by Klawitter (1980) in West Berlin. The undergrounds of Spandau comparing with the studied forts were characterized by relatively higher numbers of *M. daubentoni* in August. In majority the individuals noted then were active and flying. The distinct decreasing in numbers and term of arrival of bats falling into torpor (first days of September), were very similar in surroundings of Warsaw and in Berlin.

Results of many studies on bats marked with metallic rings, suggest a decrease in numbers of majority of species after some years of study (Stebbings 1969, Rybář 1973). The reaction to disturbance of *Rhinolophidae* bats is stronger comparing with *Vespertilionidae* bats (Bezem *et al.* 1960, Gaisler 1975). *M. daubentoni* belongs to species less sensitive to disturbance than others (Bezem *et al.* 1960, Gaisler 1975). The literature showing the short term effects of disturbance is scare. This note indicates the lesser influence on bats when controls are carried out in the similar cycle as natural cycle of awakings (in the case of *M. daubentoni* approximately every two weeks during hibernation – Daan 1973).

## References

Bagrowska – Urbańczyk E. and Urbańczyk Z. 1983. Structure and dynamics of a winter colony of bats. Acta theriol. 28: 183 – 196. — Bezem J. J., Sluiter J. W. and van Heerdt P. F. 1960. Population statistics of five species of the bat genus *Myotis* and one of the genus *Rhinolophus* hibernating in the caves of S. Limburg. Arch. Neérl. Zool. 13: 511 – 539. — Bogdanowicz W. 1983. Community structure and interspecific interactions in bats hibernating in Poznań. Acta theriol. 28: 357 – 370. — Červený J. 1982. Results of investigation of bats (*Chiroptera*) at Loreta near Klatovy. Lynx (Praha), n. s. 21: 41 – 65. — Daan S. 1973. Activity during natural hibernation in three species of vespertilionid bats. Neth. J. Zool. 23: 1 – 71. — Degn

H. J. 1987. Bat counts in Mønsted limestone cave during the year. Myotis 25: 85–90. — Gaisler J. 1975. A quantitative study of some populations of bats in Czechoslovakia (*Mammalia, Chiroptera*). Acta Sci. Nat. Brno 9: 1–44. — Gilson R. 1985. La réserve chéiroptérologique de Zussen. Bull. du Centre de Rech. Cheiropt. de Belg. 8: 41–55. — Haitlinger R. 1976. Nietoperze Dolnego Śląska. Przegl. zool. 20: 124–134. Hoŕáček I., Zima J. and Červený J. 1979. Letni nálezy netopýrů na Slovensku (1966–1977). Lynx (Praha), n. s. 20: 75–98. — Klawitter J. 1980. Spätsommerliche Einfluge und Überwinterungsbeginn der Wasserfledermaus (*Myotis daubentoni*) in der Spandauer Zitadelle. Nyctalus 3: 227–234. — Kurskov A. N. 1981. Rukokrylyje Belorusii. Nauka i Technika, Minsk: 1–135. — Lesiński G. 1986. Ecology of bats hibernating underground in Central Poland. Acta theriol. 31: 507–521. — Lesiński G. 1988. Skład gatunkowy i liczebność nietoperzy w fortach modlińskich w ciągu roku. Przegl. zool. 32: 575–587. — Lesiński G. 1989. Summer and autumn dynamics of *Myotis daubentoni* in underground shelters in central Poland. [In: European Bat Research. V. Hanák, I. Horáček and J. Gaisler, eds]. Charles Univ. Pres, Pracha: 519–521. — Lundberg K., Almgren B. and Odelberg C. 1983. Något om vattenfladdermusens (*Myotis daubentoni*) ekologi. Fauna och Flora 78: 237–242. — Masing M. 1982. On the hibernation of bats in Estonia. Myotis 20: 5–10. — Rybář P. 1973. Remarks on banding and protection of bats. Period. biol. 75: 177–179. — Stebbings R. E. 1969. Observer influence on bat behaviour. Lynx (Praha). n. s. 10: 93–100. — Strelkov P. P. 1971. Ekologičeskie nabludenija za zimnej spjačkoj letučich myšej (*Chiroptera, Vespertilionidae*) Leningradskoj oblasti. [In: Morfologija i ekologija pozvonočnych. B. E. Bychovskij, ed.] Trudy Zool. Inst. AN SSSR 48: 251–302.

*Received 27 July 1988, accepted 27 February 1991.*