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Northern Europe's most important bat hibernation site

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In western Poland an underground fortification dating from the 1930s is the winter quarters for the largest aggregation of hibernating bats in northern Europe. Although a major threat has been averted, the bats remain vulnerable to disturbance. The author has been studying these animals since the mid-1970s and, with others, has been pressing for improved protection.

In parts of western Poland there are many remains of old military bunkers, forts and tunnels, some of which are used by bats for hibernation (Bogdanowicz and Urbanczyk, 1983; Urbanczyk, 1984). Among them the most interesting is the underground tunnel system of the former Miedzyrecki Fortified Region in the Lubuskie Lake District, about 100 km west of Poznan. More than 20,000 bats of 12 species hibernate there. These tunnels, known as 'Nietoperek', after a nearby village, are the most important bat hibernation site in northern Europe.

The tunnels are part of fortifications built by the Germans before and during World War II and comprise about 30 km of reinforced concrete passages about 30 m below ground. Some of them end in chambers connected by concrete steps to bunkers above ground. There are also numerous ventilation holes, gun slits, small doorways in bunkers and a large main entrance. There are numerous niches and crevices in the concrete walls. In many places water drips down the walls resulting in a variety of travertine forms; stalactites, stalagmites, columns and flow formations. Some parts of the corridors are flooded. Different parts of the system have different temperatures: near the entrances winter temperatures are lower and subject to considerable fluctuations, whereas further in they are higher and more stable.

The wide range of microclimatic conditions and the abundance of shelters make the corridors ideal for hibernating bats. It is also significant that the fortifications are in an area of sandy plains and moraines, where there are no natural winter quarters or mines.

The bats

Bats use the corridors primarily for hibernation, building up in numbers from August to September to a maximum in January. Numbers decline from the end of January to the end of April. Different species have their own characteristic seasonal changes in numbers (Bagrowska-Urbanczyk and Urbanczyk, 1983).

During the winter censuses about 20,000 bats belonging to 12 species are recorded, but the real number is certainly considerably higher. The most numerous are Daubenton's bat *Myotis daubentoni* (11,683 in January 1988), mouse-eared bat *M. myotis* (6039), barbastelle *Barbastella barbastellus* (930), brown long-eared bat *Plecotus auritus* (618) and Natterer's bat *M. nattereri* (475). Less numerous are Brandt's bat *M. brandti*, whiskered bat *M. mystacinus* and serotine *Eptesicus serotinus*. Small numbers of Bechstein's bat *M. bechsteini* and pond bat *M. dasycneme* hibernate there regularly but the pipistrelle *Pipistrellus pipistrellus* and grey long-eared bat *Plecotus austriacus* are only sporadically recorded.

Daubenton's bat hibernates in a wide variety of places – on walls, in niches and crevices, between stalactites, in horizontal and vertical steel pipes, under the floor, among rubble, and in various temperature conditions. It hibernates individually or in clusters, even of 140 bats, often with other species. Two females recorded had been ringed in summer in the German Democratic Republic (GDR), about 260 km and 150 km to the north-west. The system contains the largest known population of

Daubenton's bat in Europe; this common and widespread species has increased in some areas (Stebbings, 1988).

The mouse-eared bat hibernates in warmer places, on walls and ceilings, sometimes in niches, solitarily or in clusters of up to 250 individuals. Twelve bats (males and females) that had been ringed in summer and winter in the GDR, 95–185 km to the west-north-west have been recorded here in winter. This hibernation site is at the northernmost edge of the mouse-eared bat's range (Pucek and Racynski, 1983). It is distributed in most of Europe, but classified as rare or even endangered (Stebbings, 1988).

The barbastelle roosts in the cooler parts of the corridors, mostly in niches and crevices, individually or in clusters of up to 100 individuals. This species is widespread in Europe, but in most parts it is rare or endangered (Stebbings, 1988). The system holds the largest known hibernating population of this species in Europe.

The brown long-eared bat also prefers low temperatures, but often hibernates in warmer parts of the tunnels, usually individually, on walls or in niches, but sometimes in clusters of other species. Some individuals ringed in winter here have been found in summer in bat boxes in forest about 15 km to the east. It is distributed throughout most of Europe, being common in the north, and having declined in some areas (Stebbings, 1988). The numbers of this species recorded in the corridors is unusually high for Europe.

Natterer's bat hibernates individually or in small clusters, sometimes with other species, mostly in relatively warm places with high humidity. One individual ringed in a bat box in forest about 15 km east has been found in winter in the corridors. Like the brown long-eared, it occurs throughout most of Europe and has declined in some areas (Stebbings, 1988) and recorded numbers of this bat in the corridors are also unusually high for Europe.

In the corridors (*A. Leszczak*).

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Other species hibernating in the system are recorded only in small numbers, but their occurrence is noteworthy. The pipistrelle, considered to be a 'tree bat' is only exceptionally encountered in tunnels. Bechstein's bat and the pond bat, Europe's rarest bats, regularly use the corridors for hibernation. Bechstein's bat occurs mostly in southern Poland and this tunnel system is the only known locality for this species in the north-western part of the country. Lubuskie Lake District is also at the edge of the range of the grey long-eared bat (Pucek and Raczynski, 1983).

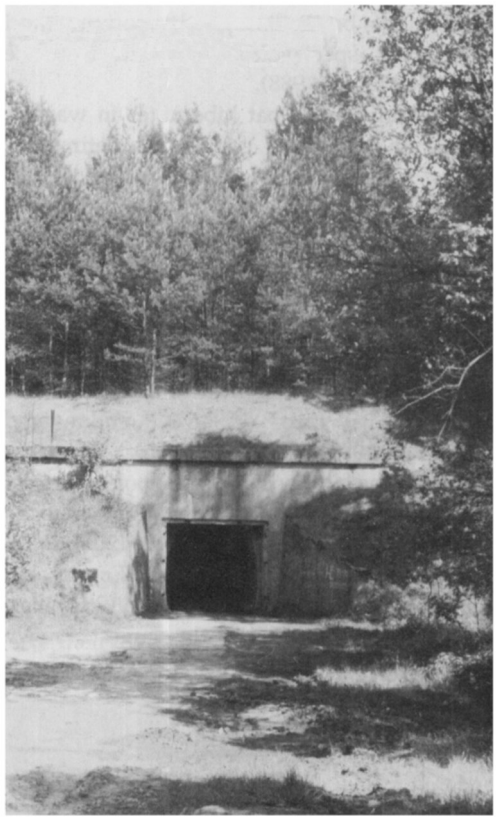
Distribution in the tunnels

The distribution pattern of bats in the tunnels depends on temperature and relative humidity, movement of air, number and kind of shelters and probably the amount of disturbance by people.

The majority of bats hibernate in the northern part. The mean density is about 100 individuals per 100 m of corridor, but in some corridors there are 600–800 bats per 100 m. The environmental conditions are similar to those in natural caves. Dripping water, numerous stalactites, flooded floors and numerous bats make a spectacular sight. The temperature in this part of the system is relatively high, near 8°C, and stable. In the entrance corridor the temperature is variable and subject to considerable fluctuations, particularly near the gateway. The species diversity there is remarkable: bats of all but one species hibernating in the system were found in this corridor. About 2500 bats of 11 species hibernate there and the mean density is about 170 bats per 100 m of corridor. The majority (70 per cent) of the barbastelle population hibernates in this part of the tunnels. This entrance corridor is of great importance to the air circulation in the underground system.

The corridors of the southern part of the system are mostly dry and monotonous. About 2500 bats of 7–9 species hibernate there and the mean density is about 20 bats per 100 m.

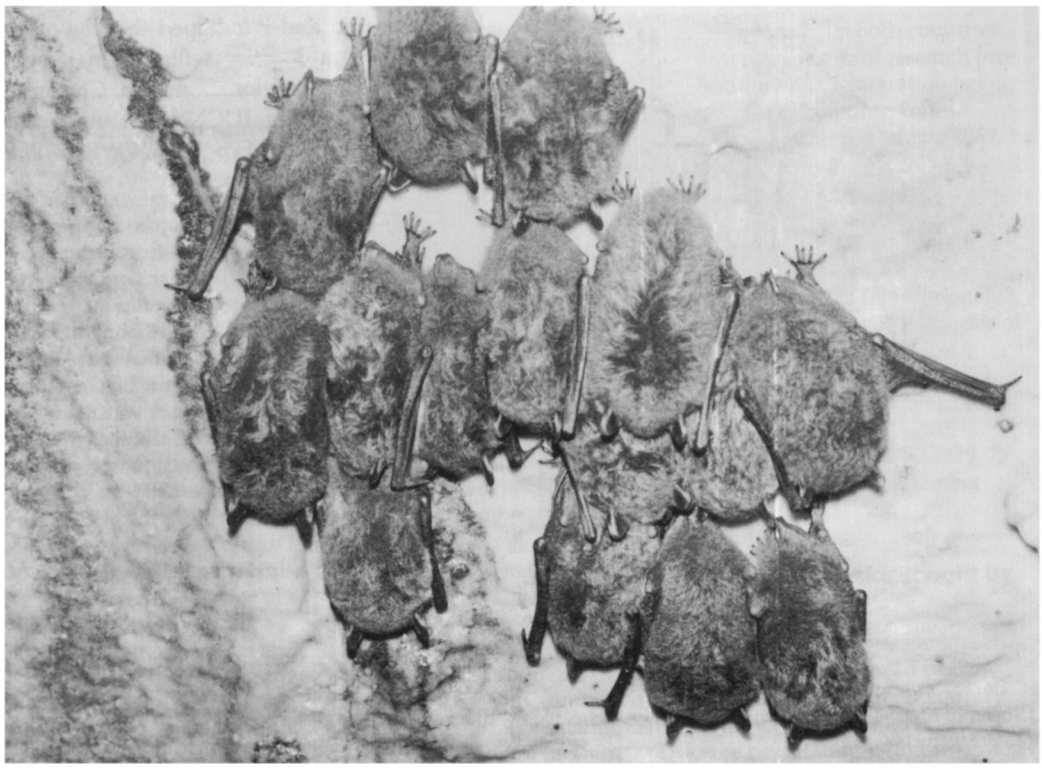
During the summer only small numbers of bats use the tunnels, mainly as daily shelter or as temporary night roosts during hunting. The



The entry gateway (*Z. Urbanczyk*).

bats present are mainly males of Daubenton's bat, barbastelle, serotine, Bechstein's bat, Brandt's bat, brown long-eared bat, pipistrelle and even noctule *Nyctalus noctula*. Only the mouse-eared bat breeds there, a small breeding colony of 100–200 females being found in one surface chamber in the southern part. A transient colony of mouse-eared bats occupies an underground chamber in the period between summer and winter.

These tunnels have been used by bats for probably no more than 35–40 years, but unfortunately we have no information about initial abundance and species diversity. The first studies were started in the mid-1970s (Bagrowska and Urbanczyk, 1976; Bagrowska-Urbanczyk and Urbanczyk, 1983; Urbanczyk, 1984) and more intensive surveys have been done in recent years. Thus we have records of the changes in the numbers of bats hibernating over only a relatively short period of time (Urbanczyk, 1988).



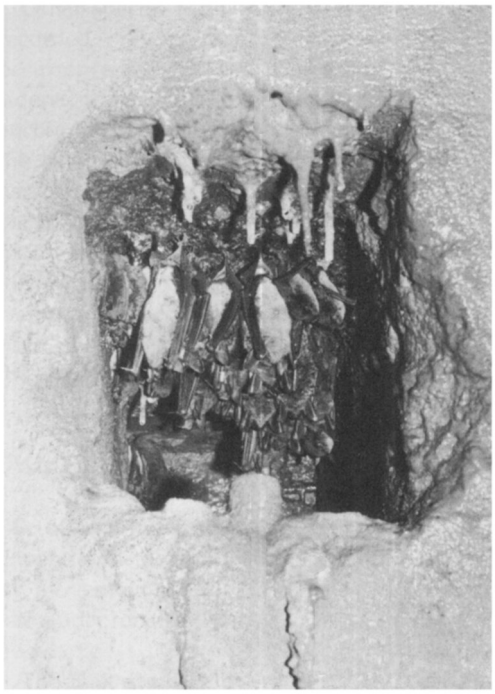
Cluster of *M. daubentoni* (*Z. Urbanczyk*).

In recent years the numbers of bats in the system have fluctuated from year to year, but no species has shown a significant decline. Three species have increased in numbers. Between January 1985 and January 1988 numbers of mouse-eared bat and Natterer's bat increased by 20 and 50 per cent, respectively. Numbers of Daubenton's bat increased until 1986, but thereafter decreased slightly.

Conservation problems

Since 11 August 1980 a part of the underground system has been protected by law, as the Nietoperek Bat Nature Reserve. It includes only a few kilometres of corridors, which contain only about 40 per cent of the bats wintering in the entire system. Only 30 per cent of the mouse-eared bats, 35 per cent of the brown long-eared bats and 35 per cent of the Daubenton's bats hibernate in the protected corridors. There is a clear need to protect the whole system as a bat sanctuary. Stebbings (1988) has suggested protecting the entire system by designating it a European Heritage Site.

Before 1980 the underground tunnels were undisturbed. The establishment of the reserve made the system famous; the bats, the fortification architecture and the unusual underground environment now attract many tourists and adventurers. The tunnels are all open, even those of the reserve. Many people wander or even camp in the corridors and instances of vandalism are frequently observed. Stalactites are destroyed, bonfires and torches are lit, bats are disturbed, or even burnt or killed in other ways. The information boards are quickly destroyed. Although the bats are protected by law in Poland, no one enforces it. This underground system is certainly most interesting and tourism should be acceptable, but it should be controlled. For this purpose a small part of the system, which consists of about 1 km of corridor connecting two bunkers near the village of Kalawa, would



Cluster of *M. myotis* and *M. daubentoni in* one niche (*Z. Urbanczyk*).

seem to be ideal. It is of minor importance to bats, containing only about 100 Daubenton's bats and a few mouse-eared bats. A small exhibition devoted to biology and protection of bats could be set up in one of the bunkers. The rest of the system should be declared a fully protected area where bats are never disturbed, and the main entrance and the other doorways in bunkers that currently provide access should be secured.

Other threats involve utilizing the tunnels for various purposes. Fortunately, the major threat – a plan to use the corridors for the dumping of nuclear waste from power stations (Hutson and Morris, 1986; Racey and Hutson, 1988; Stebbings, 1988) – has been abandoned (A. M. Hutson, pers. comm.).

Potential threats include scientific studies combined with handling, mass banding and collecting of bats for laboratory research. Any activity that may change the microclimatic conditions – drainage, blocking of entrances and ventilation holes, for example – may be a significant threat.

A proposal for protection of the system has been prepared and it is hoped that the nature conservancy authorities will act on it soon. Assistance and advice from the Chiroptera Specialist Group of IUCN's SSC and other organizations, like FFPS and WWF, will be indispensable in this process

Acknowledgments

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