

Where do nighttime prowlers go in the day?

Bats Come Home to Roost



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Because bats live clandestine lives, many of their customs remain understudied. Yet research has uncovered that their criteria in choosing homes are very similar to those of humans: they prefer dry, sturdily built, warm and safe places to live

Despite the considerable ecological diversity present among bat species, a vast majority are unable to build their own shelters and have to make use of available roosting sites. It comes as no surprise, therefore, that these very sociable animals are most keen to populate areas that offer plenty of feeding sites and hideaways of various kinds. Their winter roosts include all sorts of cosy subterranean nooks: most frequently caves, underground shelters, mines, and basements, although bats can also hibernate in such strange places as rodent holes or alongside hibernating snakes, 0.7m under the surface. Their summer roosts can be located in hollows and under the bark of trees, inside rock fissures, the attics of people's homes, church towers, breeding boxes set up for birds or bats, inside cracks in bridges or under window shutters.

There are more than 1,100 bat species in the world, 22 of which occur in Poland.



Hans-Peter Stutz/8. European Bat Night

Common noctule bats are not very dexterous in flight, and so most frequently hunt over clearings and treetops



Krzysztof Skrok

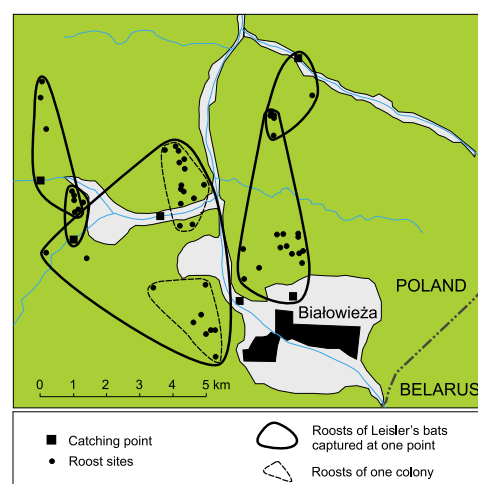
Simplifying things considerably, in terms of the type of roosts they inhabit bats can be classified into two types: sylvan bats (which almost exclusively inhabit natural roosts) and synanthropic bats (which predominantly live in man-made shelters). The former group is more interesting in scientific terms, because it can be seen as a kind of litmus test for the changes that have taken place in our environment over the past several thousand years. But most of the existing research on bats' choice of roosts in European forests has been carried out in forested areas that have been greatly affected by man, are young, or exhibit low diversity. Our research, on the other hand, was carried out in the Białowieża Forest - a 1,500km² area of the Polish-Belarusian borderland that has long been famous as the best-preserved deciduous and mixed forest in the European lowland.

In search of a good home

The research we carried out in both the fully-protected and managed-use portions of the Białowieża Forest compared the behavior

of two bat species: the common noctule bat (*Nyctalus noctula*) and the lesser noctule or Leisler's bat (*Nyctalus leisleri*). These two types were chosen because they have much in common: they are closely related, inhabit the forests of Eurasia and North Africa, and usually choose tree hollows as their reproduction sites. They form their reproductive colonies in May, with the young being born

Even though echolocation constitutes bats' main source of information about their surroundings, they have not lost the ability to see



Distribution of roost trees occupied by colonies of Leisler's bats in Białowieża Forest, located using radio telemetry

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Nets set up over rivers and ponds are the best way to catch bats



Ireneusz Ruczyński

in mid-June. They are migratory species that winter outside the Białowieża Forest. Of course, aside from their similarities they also show some differences: the smaller Leisler's bat (8-20g in body mass) is considered to be closely associated with old-growth forests, while the larger common noctule (17-44g) also lives in considerable numbers in relatively young forest stands.

One might imagine that one tree hollow differs little from the next, and that when choosing where to dwell bats are more concerned with a hollow's "floor-space" than the conditions inside. It turns out, however, that many factors have an influence over which of the available hollows are indeed chosen. A dominant role here is played by weather conditions. Relatively low ambient temperatures and large diurnal fluctuations cause bats to choose warmer roosts, with smaller exit holes. Bat homes also have to be dry and have sturdy walls. These flying mammals clearly prefer oak and ash trees, more rarely making use of hollows in alder, linden, hornbeam, maple, and pine trees. Interestingly, these preferences varied depending on the bats' physiological state: the females of both species most frequently occupied warmer oaks when pregnant or feeding their young, yet eagerly chose hollows in colder ash trees at the end of July, when their young had already taken wing. There is a logical explanation for this - bat pregnancy and growth proceed more rapidly in higher temperatures, but moving into colder hollows after the rearing period allows them to significantly reduce

their energy expenditure. Bats then lower their body temperature, and thereby the pace of their life processes.

Outwitting predators

The hollow occupied by a bat colony has to protect them not only from unfavorable weather conditions, but also from the numerous predators present in the Białowieża Forest, such as the pine marten and perhaps also such nest-robbers as woodpeckers and dormice. To protect themselves bats choose hollows with small exit holes, usually less than 4.5cm in radius - i.e. smaller than the head of the pine martin, thereby minimizing the risk of the hollow being ravaged by at least this one very dangerous type of intruder. At the same time, the preferred hollows are located deep enough from the entrance-way that predators do not stand much chance of dragging bats out with their paws.

There are also interesting differences between the two species in terms of how the hollows they choose were created. Common noctules most frequently employ hollows carved out by woodpeckers, while Leisler's bats most eagerly inhabit what are called natural hollows, formed by decomposition processes in the wood. Ornithological research, in turn, shows that the risk of losing a roost is greater in hollows carved out by woodpeckers than in the case of natural hollows - this is probably because of the woodpeckers themselves, who recognize "their" hollows and revisit them in successive years. They then destroy the roosts of other species: birds



Robert Myslajek

Lesser noctules
or Leisler's bats
are small and weigh
some 15 grams

and bats. We surmise that common noctules, being a larger and more aggressive species, are able to defend themselves from woodpeckers, while the small Leisler's bats may be vulnerable to direct attack. For the latter, the best strategy is to avoid encountering a potential enemy in the first place.

Higher means warmer?

For their reproductive sites, bats choose hollows situated an average of 19 meters above the ground. This is much higher than birds that nest in tree hollows. By way of comparison, the marsh tit (*Parus palustris*) builds its nests at somewhat above 5 meters on average, while the great tit (*P. major*) and

the pied flycatcher (*Ficedula hypoleuca*) build no more than 10 meters above ground. So why do birds choose the upper portions of trees, while birds prefer hollows lower down? Research in the Białowieża Forest has shown that the higher portions of tree trunks are warmed by the sun more strongly, and thus the hollows there are warmer. Birds protect their chicks from heat-loss by lining their nests with down - the temperature of the hollow itself is thus not as crucial as it is for bats, for whom the degree of sunlight and height of a hollow are of key significance.

On the hunt

We installed miniature transmitters (weighing 0.5g) on more than 50 bats and monitored their location night after night for at least several days. All of them chose roosts within 6km of their hunting grounds. Nevertheless, bats moved from one place to another every 2.5 days on average, switching to new homes across a distance of some 700m. The factors usually seen as underlying such behavior include the lower risk of being discovered by predators, fewer parasites in the roosts, and greater opportunities to find roosts with a better microclimate.

As long as we are talking about the hunting grounds of the bats we studied, we can mention that the diets of the two species chiefly include beetles, small flies and moths, although the proportion of beetles is somewhat smaller for Leisler's bats than for common noctules. A more interesting European representative of the *Nyctalus* genus in terms

In order to take measurements of treetop hollows, researchers have to employ climbing techniques. This gives them a chance to take a "bat's-eye" glimpse of the Białowieża Forest



Claine Durnez

Where do nighttime prowlers go in the day?

Where do bats of the genus *Nyctalus* occur in the world? Definitely in those countries, at least, that commemorate them on their postage stamps!



The wild backwoods of the Białowieża Forest are a refuge not only for bison and wolves, but also for “winged” mammals

Ireneusz Ruczyński

of diet is the giant noctule (*Nyctalus lasiopterus*), which also occurs in our country, albeit sporadically (the remains of one specimen were found among the pellets of a barn owl in central Poland). Research by chiropterologists (bat scientists) in Italy and Spain show that this species' diet seasonally includes small passerine birds, such as the copper, robin, or wood warbler. The proportion of birds in this bat's diet particularly increases during the autumn migration (August-November), as 500 million small passerine birds are making their way across the Mediterranean Sea en route to Africa. This bat probably captures its victims in flight, unlike the predatory bats in the tropics and subtropics of South America, Africa, Asia, and Australia, which prey upon birds sleeping on tree branches. But that, as they say, is a different story. ■

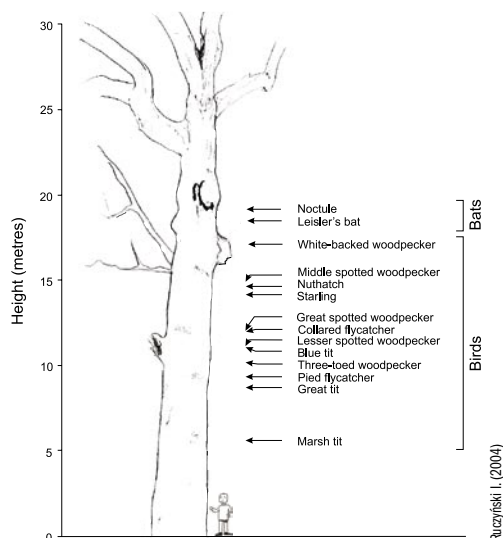
Further reading

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Higher than birds



The average height of roosts used by Leisler's bats and common noctules, compared to the mean height of cavity-nesting birds