

Kosztowne wybudzenia z odrętwienia u hibernujących nietoperzy oraz czynniki je wywołujące

Factors that trigger costly arousal from torpor in hibernating bats

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Keywords:

hibernation, torpor, arousal, factors, costs, bats, *Chiroptera*



Abstract

During hibernation, animals, such as bats, must survive mainly on the fat that they collected during the autumn. Due to the ability to fall into the state of torpor, they dramatically reduce their energy expenditure during hibernation. Arousal from the torpor is part of this wintering strategy, but it also represents the highest cost of hibernation. The activity of people in the undergrounds and the associated generated noise, the emitted light, or the increased ambient temperature causes the bats to stimulate and consequently awaken them from hibernation. Because arousal from torpor is the highest cost of hibernation, increasing their frequency will deplete the bat's energy budget, and can further increase their mortality. For these reasons, the presence of people in bats wintering sites should be limited to a minimum.

Introduction and materials

Temperate zone bats, like many mammals, have the ability to fall into the so-called torpor. In this state, the animals reduce the rate of metabolism (MR) and body temperature (T_b) well below the values observed in the normotherm (Ruf and Geiser 2015). Torpors can take the form of a daily torpor, but usually last less than 24 hours, and their episodes usually appear during periods of inactivity. Bats have the ability to 24 hours torpors throughout the year, but in winter they lengthen it, showing the so-called hibernation torpor. During hibernation, animals MR is reduced by about 95% compared to those shown in norms (Geiser 2004). This leads to significant reductions in energy expenditure, and bats are able to survive for up to several months without food, using only fat collected in the fall (Thomas et al. 1990).

A single episode of hibernation torpor in bats can last from a few to a dozen days. Animals interrupt hibernation torpor to expel harmful metabolites, make up water, or sleep deficit (Ben-Hamo et al., 2013). Arousal during hibernation lasts only

a few percent of the entire hibernation period. Nevertheless, the total cost arousal from torpor in hibernating bats accounts for more than 70% of total energy expenditures during hibernation (Thomas et al. 1990).

The lecture is a summary of knowledge about the most important triggers for arousal from torpor in hibernating bats. It is based on research published in international scientific journals.

Results and discussion

In addition to the natural reasons for interrupting the torpor, the activity of people in the vault also causes interruptions in hibernating bats. As stated, not only capture of bats, but also light and sound stimulation, or a slight increase in temperature stimulates bats to arousal from hibernation torpor (Speakman et al. 1991). As a consequence of the presence of people in the underground at least part of the bats wake up. As stated, the greatest increase in bat activity occurs only a few hours after people leave bat wintering site. This shows that bats awakened by humans as a result of their activity are likely to wake up more bats (Thomas 1995).

Conclusions

Due to the stimulating effect of people on arousal from torpor in hibernating bats, their activity in winter should be limited. Objects that are important places of hibernation should be closed with special grids that prevent people from penetrating the caves. In hibernation, from the beginning of December to the end of March, access to bat wintering site should be only provided by researchers. During the study in the hibernation place, the number of participants should be limited to a minimum and the light should be used only in the necessary situations.