Are bats karst-dependent?

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Jiri Gaisler and his colleagues have made major contributions to knowledge of bats roosting in the Moravian karst. These include one of the longest running studies of any group of mammals, involving 50 years of monitoring (Gaisler et al. 2003). When we recently reviewed the literature on conservation of cave bats (Furey & Racey, in press), we frequently encountered reference to bats as ‘karst-dependent’. The word ‘dependent’ means ‘reliant on’ or ‘unable to do without’. Here we consider whether the term is correctly applied to bats or whether bats and karst are simply co-located because what bats need in winter is a situation with a low and constant environmental temperature, low light levels and high relative humidity. These physical requirements could be as equally well met in a brick/stone railway tunnel (as in Dielik, Slovakia; P. A. Racey, unpubl.) or an iron ore mine (in Luxemburg; Harbusch et al. 2002) or a concrete tunnel built as a wartime fortification (Kokurewicz 2013) as in a karst cave.

A similar term applied to several terrestrial mammal species is karst-restricted – mammals that are found living above karst and seldom if ever found elsewhere (Table 1). This refers principally to their distribution and for many of these species it remains unclear to what extent their present restriction to karst landscapes is due to the fact that these now frequently represent refugia in agriculturally dominated landscapes. Others such as Trachypithecus langurs use caves for shelter and can therefore be regarded at least as facultative karst dwellers. However, while there are several poorly known bat species with very limited distributions consisting of karst areas e.g. Rhinolophus xinanzhongguoensis (Zhou et al. 2009), we know of few well-documented bats restricted to karst. Examples are Kitti’s hog-nosed bat Craseonycteris thonglongyai found in karstic caves in Burma and Thailand (Puechmaille et al. 2009, 2011), and the great evening bat Ia io, exclusively recorded from karstic caves in Nepal eastwards to China (Csorba et al. 2013). While proving the absence of a species in other habitats is very difficult, the fact remains that few well-studied bat species appear to be known exclusively from karst areas.

The defining characteristic of karst areas – the abundance of calcium as the cation of calcium carbonate – has been suggested as a driver of the use of karstic caves by insectivorous bats. Insects contain little calcium and several studies have shown that calcium levels in the bones of female bats are lowest during lactation, as calcium is transferred to the young in milk (Kwiecinski et al. 1987). This led Barclay (1994, 1995) to suggest that shortage of calcium may be a greater constraint on reproduction in bats than meeting its energy demands and that one of the reasons that they roost in karst caves is that they acquire calcium by licking the walls, which is a common observation (Codd et al. 1999). There has been only one study to test this hypothesis, which was not supported by the evidence, since bats were distributed across all underground sites in a wide range of geological formations and were not concentrated in karst landscapes (Bernard & Davison...
Nevertheless, the fact that Adams et al. (2003) captured more female and juvenile bats over water holes with harder water (indicating higher calcium levels) suggests that environmental calcium is important, particularly for reproducing females and their young.

Although the calcium hypothesis requires further testing, we must presently conclude that bats are roost-dependent and the fact that such roosts are so often provided by karstic caves reflects the global abundance of carbonate in the earth’s crust and its solubility and not a specific dependence.

References


