How do Bats React to Cave Gates?

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[Note: The research described in this article was conducted between July and October 2003, while the author was a Master's student at York University in Toronto, Ontario, under the advisement of Dr. Brock Fenton.]

The topic of placing gates at cave entrances to restrict human access generates heated debates. Gates have sometimes caused bats to abandon their roosts, but scientific research into the effectiveness of modern gates is surprisingly limited. So, I decided to tackle the question, "how do bats react to gates?" for my Master's thesis. Many observations on this topic have been made, but scarcely any quantitative studies exist about it, and making management decisions based on assumptions can be risky and unwise.

With partial funding from NSS Conservation and Bat Conservation International grants, and after plenty of sawing, drilling, and nailing to construct wooden mock gates, I found out which sites were likely to offer bats and data, and my field assistant Anna and I loaded up the van and set out on a two-month journey starting in Ontario, Canada and finishing in Tennessee. Getting to caves on the back roads of five states and one province often involved vehicular bush-whacking and other activities that stretched the limits of a mini-van's abilities. We slept in tents or in the mini-van for several hours each morning, then spent our days driving to and scouting our sites and entering data into the computer. Our evenings and nights involved hauling gear and collecting data at the caves. At the caves and mines, we recorded bats' flight speeds, flight behavior, and echolocation and social (communicative) calls with no gate, at permanent metal gates, and with our wooden-mock gates briefly in place. We saw caves with bat activity ranging from zero to something comparable to a locust swarm, as in Aeolus Cave in Vermont. In all, we visited 33 caves and mines (about half had gates) and surveyed the bats during swarming, which is when often-transient groups of bats fly around caves and mines during most of the night, seeking mates and a place to hibernate. We were very fortunate to have biologists and cavers escort us to several of our sites and provide valuable information about others.

Anna Yusa

The author setting up a bat detector to record echolocation calls at a gated Kentucky cave

Bats swarming in a Vermont cave

Genevieve Spanjer

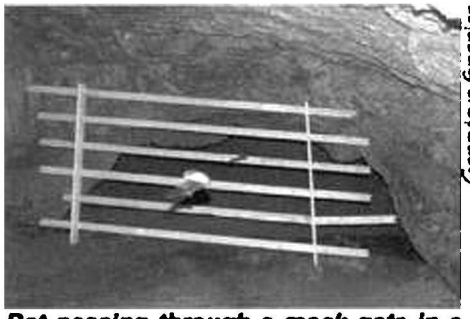
I found that bats always circled (or changed direction abruptly) more, and passed directly through less, at gates than at entrances or passages with no gate. At each site where I put up a mock gate, the number of times a bat circled for every time a bat passed directly through increased in every instance after the gate was in place. Bats circled more at smaller gates, and when more bats were present. Spacing of vertical gate supports, the number of cave/mine entrances, and gate location (entrance or passage) did not statistically affect the bats' behavior. However, although the difference was not statistically significant, bats showed a tendency to circle more and pass less in passages than at entrances. While flight behavior was unmistakably altered, flight speeds and bat calls were not notably different with or without a gate.

The bats we observed reacted most poorly to the mock gates, perhaps because these gates were new, and best to complete absence of a gate. Reaction varied by site, however. We saw bats at Coach Cave (Kentucky) collide with the gate more than at any other site, while the bats at Wolf River Cave (Tennessee) flew directly through the gate much more frequently than bats at other gates. It is important to remember that many factors such as gate size, bat activity, species present, etc. come together to determine bats' responses to any gate. At gates that had bat chutes or small doors not yet closed for the winter, bats seemed to use these open spaces more than the remainder of the gate.

A promising finding was that bat activity levels were higher at gates that had been in place longer, indicating bats may acclimate somewhat to gates and gradually return to gated roosts. Still, it appears that while gates may protect bats in some instances, there is a price for this protection. Even at gates that had been in place for more than 10 years, bats' flight behavior was significantly different than at open entrances and passages.

Many people are concerned with protecting endangered bats, such as the gray bat (*Myotis grisescens*) and the Indiana bat (*Myotis sodalis*). Based on examining echolocation calls (calls of different species have different frequencies and shapes and can therefore often be distinguished through analysis), there were at least two species present at every site we visited, and at least three at most sites. Therefore, it is important to design studies and protection measures that serve *all* bats using a cave, not only those who are already on a protected list. Such inclusive measures will continue to protect the endangered species and may help keep the list from lengthening.

Based on the data we collected in between cooking quesadillas on the camp stove, tying and untying flagging tape, and putting on extra sweaters (standing around in caves, especially the ones up north, gets chilly!), I recommend the following about cave gates, which will hopefully minimize negative impact on bats: 1.) erect in as large an area as possible, 2.) build gates with a bat chute, open top, or further spaced horizontal bars higher up, 3.) place at entrances rather than in passages (unless predators to bats are a known problem), 4.) place on flat ground (not at the base of a hill), and 5.) erect gates gradually whenever possible, giving bats time to adjust. Hopefully, by taking an experimental approach to management measures, assumptions can be replaced with information, and trial-and-error methods can give way to effective conservation tactics.



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Bat passing through a mock gate in a southeastern cave