

Caves & Karst *Natural Inquirer* • Reflection Section Answer Guide

Cave Conundrum

Introduction

Diseases like WNS are one cause of decline in animal populations. What are some other things that might cause an animal's population to decline? *One important factor affecting bat populations and many other species is the loss and degradation of habitat. Other factors causing bat populations to decline could include harm from agricultural chemicals, collisions with man-made objects, and new conditions that result from climate change.*

WNS is caused by a fungus. What are some other types of fungi you know of?

Other fungi students may know of are edible fungi, like shiitake, button mushrooms, truffles, and chanterelles. It is important students realize the diversity of fungal species. Fungi include everything from large mushrooms to molds and yeasts to microscopic parasites of plant cells. It is also important to review with students that not all mushrooms are edible and students should never eat a mushroom in the wild.

How do you think WNS spreads between bats?

A few ways WNS can spread from cave to cave include through human tourism and recreation, migration of bats between caves, and transmission by other organisms, such as other pollinators or bat predators.

Methods

Biologists collected the same data every 2 years. Why is it important to have routine methods in an experiment?

Students should understand the importance of consistency in scientific methods. Traveling consistent routes on a survey reduces the chance that findings are influenced by factors other than the one(s) being studied. Scientists implement measures like standardized routes as control measures to protect their data from experimental error.

Why do you think the scientists used scientific models in this study instead of designing an experiment to do in the field or in a lab?

Modeling is often used in cases in which the experiment cannot be replicated in a lab or field setting. The subject studied in modeling studies is often too large, too long-term, or too complicated for a true experiment. In this case, there is no way the scientists could reasonably or ethically replicate the spread of WNS across the United States over the course of years, so they used modeling to test their hypothesis instead.

If the scientists' models were different from the real trends in bat populations, what might that tell you about the relationship between bat population declines and WNS?

If the models differ from observed trends, students should recall the three statements from the end of the "Introduction" section that would be true only if the real situation followed the modeled scenario. If the two scenarios differ, this means one or more of the conditions for the model are incorrect or incomplete.

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Findings

The results for two populations of northern long-eared bat showed little or no negative impact since WNS was detected in those areas. What do you think are some potential explanations for these results?

Students should realize that part of scientific research is finding explanations for unexpected findings. The populations of Northern long-eared bat that did not experience declines after WNS introduction were also the bat populations reached most recently by WNS. Therefore, the disease may not have been in the area long enough to have an effect on population trends.

Think about the methods the scientists used to get these results. What are some potential sources of error that could affect the results?

Scientists carefully design experiments to minimize error, but scientists can rarely account for or eliminate all sources of error. A source of error in this study could be incomplete or late detection of WNS on surveys, which would result in inaccurate timelines of WNS infection and decline in a population.

What do you think it means that several of the populations were experiencing declines for years before WNS was discovered near them?

Students should be able to make the connection between timing of declines and timing of WNS introduction. If declines were occurring before WNS was discovered in an area, there must be another factor causing bat populations to decline.

Discussion

How might humans contribute to the spread of WNS? *People visit caves for recreation and tourism, and the fungus that causes WNS can attach to the bottom of their shoes or the outside of their clothes. When they leave the cave, and perhaps visit another cave, the fungus can be brought to the new area.*

How does habitat degradation affect hibernating bats?

Bats are affected several ways by habitat loss and degradation. Their caves can be encroached on by human developments and roads. This encroachment can result in more collisions between bats and man-made objects, disturbance of their hibernation schedule, and lowered prey availability (if their prey species are affected by encroachment nearby).

What are some ways scientists could combat the other threats to bat populations?

Other ways to protect bats from population decline include habitat protection, regulation of chemical use nearby, and WNS immunization.