

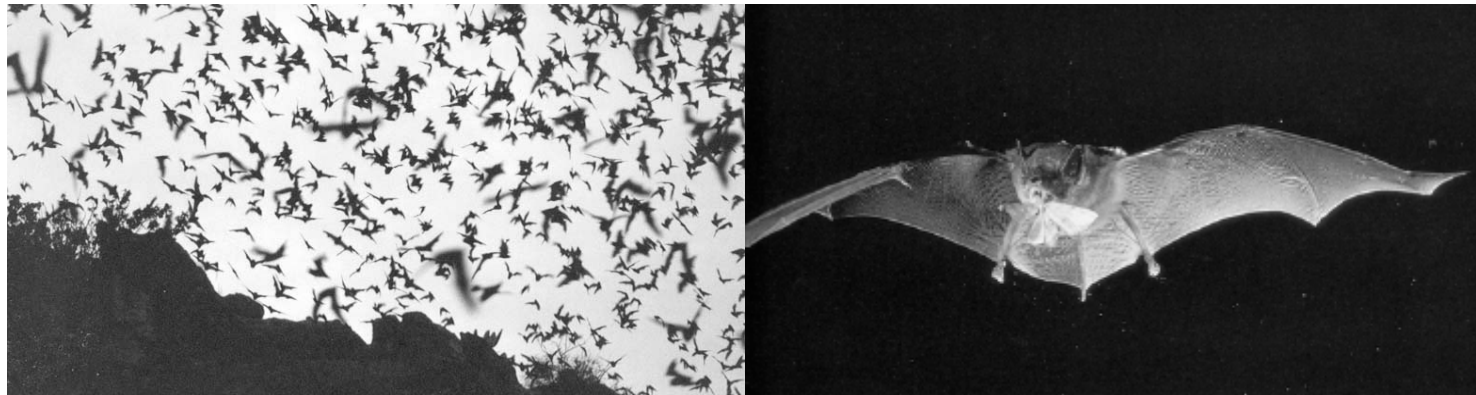
Carlsbad Caverns

National Park Service
U.S. Department of the Interior

Carlsbad Caverns National Park
New Mexico
www.nps.gov/cave



Bat Research: How many bats and other common questions

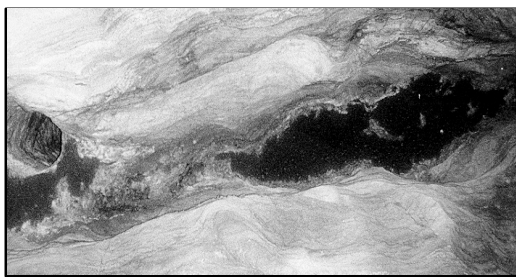


When Counting is More than One, Two, Three...

Many people ask how many bats live in Carlsbad Cavern. It's an age-old question, posed long before it was ever written. For centuries, people living in and visiting these mountains have watched a cloud of bats swirl out of the cave opening every evening. The bats leave their safe sleeping quarters in search of food—insects, like moths, beetles, and mosquitoes. The exit flight may last anywhere from 20 minutes to 2 hours. The cloud of bats may be so thick that it can be seen from miles away as a black streak across the sky or so thin that observers see mere specks across the rising moon. One can't help but wonder, "how many bats are there?" The challenge is in how to figure out an accurate number, or even a good guess. Trying to count the bats emerging from the cave is like trying to count the number of grains of salt coming out of a shaker—too many at once. Besides, this is only one of the questions that bats provoke in curious people. Here are the park's most recent methods for tallying bats and answering other common questions about them.

How Counting Bats Has Changed

For thousands of years, Carlsbad Cavern has provided a Mexican free-tail bat colony with shelter from the weather and predators. The bats leave the safety of the cave to satisfy their hunger for their meals of flying insects. The bats swarm out in a whirling funnel, gaining lift in order to fly out of the deep, bowl-shaped mouth of the cave. They fly out fast and in large numbers, and they continue flying after sunset, long after our unaided eyes can follow them. So, how can we count them? Over the years, several methods were tried. Some approaches were little more than educated guesses that were easily discredited under close scrutiny. Starting in 1996, population trends have been recorded using



infrared photographs taken of the bats roosting in the cave by day. The photo on the left shows sleeping bats as dark patches. Researchers figured the population by estimating the amount of ceiling covered and multiplying it with the likely number of bats per square foot (about 250 to 300). This method gives researchers a sense of how the population fluctuates from month to month and year to year; however, it does not accurately calculate the actual number of bats, only an estimate. Also, photographing the bats in their roost disrupts the bats. As much as possible, researchers try not to disturb their animal subjects as it may cause them to change their behavior. The preferred study method at present uses more advanced technology—infrared thermal imaging and hi-tech computer software!

Current Bat Population Research

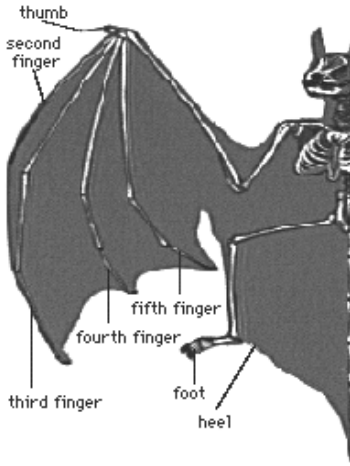
Dr. Kunz's and Dr. Hristov's team counted approximately 400,000 bats emerging from Carlsbad Cavern in June 2005, which is typical of recent years.

Thousands, tens of thousands, a million? Luckily, technology has reached a point where many of the obstacles to figuring the population can be overcome. Using a camera sensitive to temperature variation, a team of researchers led by Dr. Thomas Kunz and Dr. Nickolay Hristov from Boston University records the bats' nightly emergence from the cave. A Mexican Free-tail bat's temperature is about 100°F (39°C). At dusk, the surroundings are generally cooler. Thus, the bats appear on screen as bright specks against a darker background, opposite of how we see them. This information is processed by special software developed by computer scientists at Boston University. Each bat is counted and tracked individually.

With this method, researchers are no longer concerned about the amount of light or the weather conditions. Most importantly, the bats don't even notice that they are being recorded, meaning they shouldn't change their behavior or experience any fear or discomfort.



The Allure of Bats



Do you find bats frightening or disgusting? Fascinating or thrilling? Or maybe cute? Perhaps your reaction to bats is a mix of all these? Whatever your feelings about them, bats are of enormous benefit to humans worldwide and are prompting continuous scientific study.

Bats are a group apart from other mammals in one significant way – they are the only mammals with the ability to fly. A close look at a bat's wing shows that it is merely a thinly-webbed hand with very long fingers. Flight allows bats to take advantage of food sources that other animals can't reach, such as high-hanging fruit and flying insects. Every night Mexican free-tailed bats emerge from Carlsbad Cavern to eat about three tons of insects. Their voracious appetites help control insect populations and reduce crop pests.

Bats benefit us beyond eating insects. Fruit-eating bats spread seeds, boosting a plant's chance of survival. Nectar-feeding bats pollinate flowers, much as bees do. All bats produce guano, another word for bat droppings, which is an excellent natural fertilizer. Even vampire bats help people. They are found only in Mexico and Central and South America and suffer from the worst reputation, but researchers have developed blood thinning medications from substances found in vampire bat saliva. What next?! What great new discovery will result from studying bats? Bats have unique qualities, such as superb and long distance flight, echolocation, ultrasonic hearing, sleeping upside down, and feeding quickly and hungrily on vast quantities of insects. Scientists from several fields are drawn to further examine bats' behavior, physiology, and ecology. At times one person's fear is another's fascination.

More Questions

What species of bats live in the cave?

If this is a maternity colony, where are the males?

What do they eat?



Thanks to the efforts of scientists, like Dr. Kunz, Dr. Hristov and others, we understand the 16 species of bats in the park better than ever. For example, we know that three bat species call the Carlsbad Cavern home. Mexican free-tail bats (*Tadarida brasiliensis mexicana*) have been living here for a long time because their roost is above the huge guano mounds. In 1930, early explorers found a second active bat roost deep within the cave. Fringed myotis (*Myotis thysanodes*) and Cave myotis (*Myotis velifer*) live there in relatively small groups of about 300 to 600 bats. In both locations, female bats use the cave as a secure place to bear and raise their young. So they are called "maternity" colonies. Surprisingly, the Mexican free-tailed bat colony contains many, at times mostly, males. For years, researchers Dr. Troy Best of Auburn University and Dr. Ken Geluso of the University of Nebraska at Omaha have studied the bats in the park with their students. One of their projects involves

netting bats and recording each bat's sex and if it was born that year. In August 2005, the figures showed that over 70% of the bats were male! This is not unusual for a *maternity* colony; the name still fits. It is simply that males think it's a safe haven, too. While still necessary for gathering some data, netting bats, handling and looking at them closely was once the only way to determine species. Again, new technology has changed that. Using a device, called an Anabat bat detector, a bat's echo-location call is translated from ultrasonic to a range people can hear. Then, when attached to a computer with special software, the detector records the call as a pattern on a graph. Outdoors or in a cave, Anabat detectors pick up the calls of bats flying by. Often, it is easy to distinguish one species' call from another. Other projects have shown that Mexican free-tail bats eat mostly beetles and moths. (Bug parts in the guano proved that!) What will be revealed next? And what answers still elude us?

Questions Unanswered

How do they know when it's time to come out?

Where do the bats live in the winter?

Wanted: Someone who speaks **Bat** fluently! Must be willing to work nights.

If only the storybook-character Dr. Dolittle were here to help, he would talk with the bats and we would have all the answers. But the bats can't tell us about their ways. Understandably, we wonder how it is that bats far underground, far from sunlight, could know that the sun is setting and it's time to fly. We can guess but nothing has been proved. A few of the most believable ideas are (1) that the bats have an internal clock that wakes them up, (2) that the bats can sense subtle changes in the air, like shifts in air temperature or pressure, that people are not sensitive to, or (3) that the bats are simply hungry and go out for breakfast. Have any thoughts on how these ideas could be tested?

What is the biggest mystery? It is unknown where the bats spend the winter! We do know that every spring, about April, bats return to Carlsbad Cavern. Females give birth in late June. About five weeks later, the young begin to fly and hunt insects. By late October, the weather has become too cold for their food (insects). So the bats depend on stored fat to survive the migration flight south. But where to?! Are "our" bats joining year-round colonies of Mexican Free-tails in caves in Mexico and Central America? Bats fly too far and fast to track them long distances. Also, they can't be tagged easily the way some animals can. People study bats not only to find answers, but also because sometimes getting there is half the fun!

The Results of Curiosity



Bats continue to draw our attention and fascination. Innovative scientists studying bats have developed medicines, sonar, and computer software and technology that have uses beyond animal research. At a national park, generations may learn about, study, enjoy, and be awed by bats and caves. Even if you don't see the world-famous bats, be assured they are protected.

Ask How to... Adopt a Bat!

All money gained from the bat "adoption" program, funds bat research in the park and education programs about bat protection!



Go to ccgma.org for more information.