

Six Pixels in 3 Frames Add Up To One Bat

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Over the past 15 years, the bat population at Carlsbad Caverns NP has declined from an estimated six million to around 300,000 bats. This represents a population decline of 95 percent and is cause for great concern among both Park and Regional resource management staff. The cause of the decline appears to be DDT poisoning. In essence, insects pick up minute amounts of DDT from the soils in the vicinity and the DDT is transferred from the insect to the female bat in her normal feeding routine. The DDT, being fat-soluble, is then accumulated in the mother's body and transferred in the mother's milk to the baby bat, who then accumulates the DDT in its fatty tissues. When the young bat begins its migratory flight in the fall, the fat is used up, the DDT is released into the bloodstream, and the young bat undergoes behavioral or physiological changes that ultimately result in its death.

One requirement for addressing the problem is to know how many animals we are dealing with. How does one count huge numbers of bats? The "there's one, there's another" technique certainly won't work. The numbers are just too great. For example, if one counted one object each second, 8 hours/day and 5 days/week, it would take 6 weeks to count to one million. (To count to a billion would require 97 years.) In some cases, as many as six million bats may leave a cave in 2 or 3 hours, and it is literally impossible to count them with any accuracy.

In the past, various methods have been used to estimate bat numbers, but these have all had substantial errors inherent in the technique. One method used is to carefully measure the guano deposits and, by inference, estimate bat numbers. This technique has many of the same built-in errors that deer pellet transects have. Another method is to photograph bats while they rest on the cave ceiling, count the number of bats in a square foot in the photograph and extrapolate this to a total number. Since bats enter crevices which cannot be photographed, and Brazilian Free-tail Bats often hang two or three deep, this method was not satisfactory. In addition, the flashes of light necessary for good photography may adversely affect the bats.

In 1985, the National Park Service let a research and design contract to Comar, Inc. of Dallas, Texas to design a technique to count bats using methods which did not influence the bats' behavior, would not alter the physical environment of the cave, and guaranteed at least 90 percent accuracy. The contract

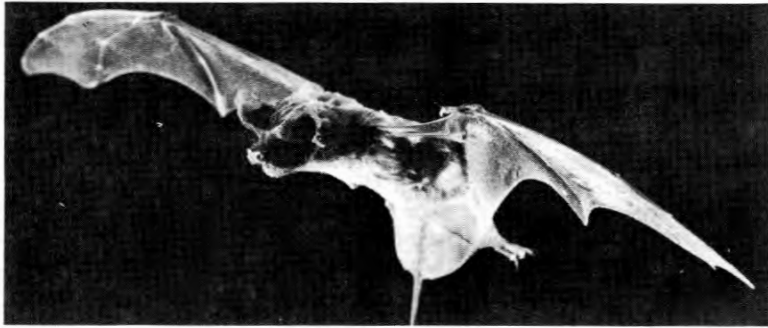
stated that as many as 16 million bats were to be counted in 3 hours. (Braken Bat Cave near San Antonio, Texas is reputed to house as many as 16 million Brazilian Free-tail Bats.) An analysis of existing technology indicated that high-quality video tape could be analyzed, using a frame-grabber and computer to count the bats.

Each bat is assumed to occupy at least six pixels on a screen and each bat must be counted in three consecutive frames of video tape to be considered a bat. We are currently working on photographic techniques using infrared filters and extremely low-light video cameras. Ultimately, we intend to run the program on either Data General or IBM PC computers. The technique appears to work well with Brazilian Free-tail Bats, but needs refinement to count Grey and Indiana Bats, since they frequently "swarm" in

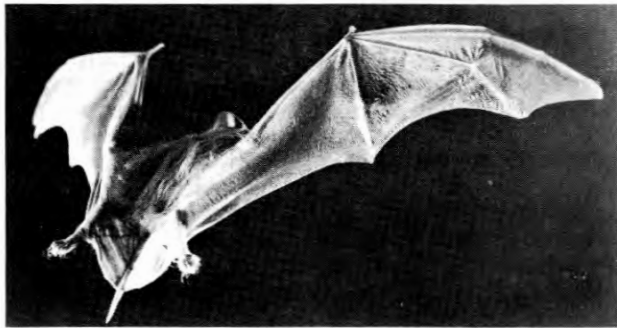
and out of a cave. The computers now have to be programmed to both add bats as they leave the cave and subtract bats who reenter the cave.

The second year's contract is about to be let and by this time next year, not only will these techniques be in place at Carlsbad Caverns NP, but should be available to the scientific community at large. Numerous inquiries about the technique have been received, including speculation on whether this technique could be used to count fish in a fish wier, migratory birds, and caribou. All seem feasible at this time.

We feel this technique will be of great value in determining not only population trends but absolute numbers of bats. The techniques also have considerable potential for other uses where huge numbers of objects need to be counted.



Mexican Free-tail Bat Bats? We count 'em – coming



and going