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### Cave salamanders find bats make tasty treats

By Karen Klinka  
The Oklahoman

For Jim Stout, donning a wet suit to stand in chest-deep, frigid water inside a dark, bat-filled cave is just as good as playing golf. Stout, supervisor of the Herpetarium at the Oklahoma City Zoo, said the countless weekends he and colleague Dante Fenolio spent in an isolated cave in northeast Oklahoma during the past two years has resulted in the publication of a scientific article in one of the world's leading scholarly journals, the Proceedings of the Royal Society of London: Biological Sciences.

The paper deals with Fenolio's discovery that a rare species of blind, cavedwelling grotto salamander has switched from its customary carnivorous diet of bugs and shrimp to eating nutritious bat guano, Stout said in a recent interview.

For years, cave biologists thought that bat droppings were the food supply for the fungus, small shrimp and insects living in the cave, and that those creatures were what the predatory salamanders ate, Stout said.

"Because bats don't fully digest their food, their guano was pretty nutritious, and actually had more calories than the tiny shrimp," Stout said. "In effect, by eating the bat droppings, the salamanders have cut out the middle man."

The finding is the first report of "poop-eating" among salamanders or any amphibian, Stout said.

At the time of the study, Fenolio, an expert in salamanders, was working on his master's degree at the University of Oklahoma in Norman, Stout said.

Fenolio is now at the University of Miami, Fla., where he is working on his doctorate.

In addition to Stout, Fenolio's co-authors on the journal article are G.O. Graening, a cave biologist with the Nature Conservancy in Arkansas, and Bret A. Collier of Texas A&M University's department of wildlife and fisheries sciences in College Station, Texas.

Stout said the group's original mission was a two-year population ecology study of a federally protected cave in Delaware County.

The cave research made a nice change from his "day job" working with captive animals at the zoo, Stout said.

"For me, studying and working with reptiles and amphibians is as good as playing golf," he said. "It's an enjoyable pastime."

Stout said about 15,000 grey bats live in the cave, from May to October.

"Except for the bats, the cave is a pretty sterile environment, and the grotto salamander population was larger than we thought the cave could support," Stout said. "Things didn't add up at first."

The researchers also noticed a significant drop in the grotto salamander population when the migrating bats were not there.

"We suspect when the bats are gone, the salamanders either move to find another food source, or they're staying there and eating something else that we don't know about, or maybe they just don't feed for those batfree months," Stout said.

Stout said the study group tested the bat guano to determine its nutritional content.

"I'm really a snake guy, and I learned more about bats than I ever wanted to know," he said.

For comparison purposes, the researchers also tested the nutritional content of the tiny fresh-water shrimp from the cave and Big Mac burgers from McDonald's, Stout said.

The nutritional tests showed the bat droppings contained 54 percent protein, compared with 44 percent for the shrimp and 23 percent for the Big Mac.

Fat content was 1 percent for the guano, 8 percent for the shrimp and 33 percent for the Big Mac.

"For the record, the guys who did the nutrition testing ate what was left of the Big Macs, and they didn't eat the bat guano," Stout said.



Oklahoma City Zoo herpetologist Jim Stout works with a Tiger Ratsnake in the zoo's Herpetarium. Photo by Paul Hellstern



A grotto salamander. Photo provided by Dante Fenolio

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