How Snakes Survive Starvation

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University of Arkansas researcher Marshall McCue studied Western timber rattlesnakes and two other species and found that they could lower their standard metabolic rates - a trait never seen before in vertebrates. Photo by James VanDyke.

Starving snakes employ novel survival strategies not seen before in vertebrates, according to research conducted by a University of Arkansas biologist. These findings could be used in conservation strategies to determine the health of snake populations.

"These animals take energy reduction to a whole new level," said Marshall McCue, a graduate student in biological sciences in the J. William Fulbright College of Arts and Sciences. He reported his findings in the journal *Zoology*.

While scientists knew that some snake species could survive for up to two years without a meal, no studies have examined the physiological

changes that take place when a snake goes for prolonged periods without food. McCue examined three snake species - the ball python, the ratsnake and the western diamondback rattlesnake - to study their responses to prolonged periods without food.

The 62 snakes studied went about six months without eating - a time period that could well be duplicated in the wild, where food supplies can be scarce. McCue then looked at physiological, compositional and morphological changes in the snakes.

The results showed that the snakes could lower their standard metabolic rates, some by up to 72 percent.

"Snakes already had low energy demands. We didn't know they could go lower," McCue said.

Another surprising finding: The snakes continued to grow despite the lack of food - a counterintuitive finding, but a measurement that again does not appear in the research literature.

"To me, this suggests that there must be a strong selective advantage to growing longer," McCue said. It also means the snakes have become extremely efficient in their ability to use available resources.

To illustrate the strategies employed by snakes to combat starvation, McCue uses an economic analogy of supply and demand.

"When you're cut off from resources, you are an organism that still needs to expend energy," he said. The "demand" end is met by decreasing their metabolic rate. The "supply" end must be met by frugal use of resources they have at hand for energy, which comes from within.

The body composition of snakes includes water, ash, protein, fats and

carbohydrates. McCue found that the snakes used up selected fat stores first during starvation, but he also found crucial differences between the snake species. The ratsnakes, which typically have a more abundant rodent supply in their natural environment, began to break down proteins faster than the pythons or rattlesnakes.

"The protein use was higher in the snakes less well adapted to starvation," McCue said.

Snakes are relatively new on the world scene, having been around for about 100 million years. Yet they currently comprise about half of all reptile species.

"Snakes are very evolutionarily successful," McCue said. Understanding the physiology that allows them to succeed in low-energy environments will help scientists further their understanding of the snakes' evolution and their adaptation to their current ecosystems.

Source: University of Arkansas