Tail Loss in Lizards

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Why do some lizards lose their tails? The answer, biologists have long thought, is to elude predators. The ability to shed and regenerate a tail—a common characteristic among most small lizards—is a defense mechanism enabling those lizards to escape the clutches of a predator. The larger the number of different predators, the more likely it is that lizards can lose their tails. But did that ability evolve in response to attacks by a variety of predators or by one in particular?

According to a new study of lizards in Greece and on islands in the Aegean Sea, not all predators are equal when it comes to lizard's tail shedding, a phenomenon scientists call caudal autotomy. In fact, the ability of the Greek lizards to shed their tails can be attributed to just one group of predators, says Johannes Foufopoulos, a University of Michigan vertebrate ecologist and coauthor of a study published in the March 2009 issue of *Evolution.*

Foufopoulos and his colleagues studied more than 200 lizards, from 15 species, most of which were 5 to 8 inches in length. Depending on where they occur, each lizard species faces a variety of predators, including foxes and jackals, shrikes and hawks, and snakes. The scientists surveyed wild lizards for lost tails and conducted laboratory trials. They used calipers to gently pinch the tails to determine the autotomy rate, a measure of the relative ease with which a lizard's tail is shed; the higher the rate, the easier it is to shed a tail.

Which lizards drop their tails, and how readily they do so, varies among species and places, Foufopoulos says. In his study, lizards in the parts of mainland Greece and on the offshore Aegean islands that harbor viperids (venomous snakes) have high autotomy rates. Lizards living in mainland areas or on islands with no vipers do not—they have largely lost the ability to shed their tails. Further, lizards living among many predators shed their tails with ease, whereas those living with only a few did so with greater difficulty.

In the end, though, "the only predators that matter [to the lizards] are vipers," Foufopoulos concludes. "It makes sense that the lizards' primary defense would be aimed against vipers," a family of poisonous snakes that includes North American rattlesnakes. In the eastern Mediterranean, vipers are specialized predators that eat mostly lizards. Whereas mammals and birds have to grab a lizard to kill and eat it, a poisonous snake need only deliver a glancing blow with its fangs, which is sufficient to inject a lethal dose of venom.

That's why the ability to shed a tail is important. By dropping its tail, often within seconds of a poisonous snake's attack, a lizard can prevent the venom from reaching its vital organs. "You lose your tail," Foufopoulos notes, "but you come away with your life. It's a way for lizards to quickly eliminate poison from their bodies." Salamanders and even some mammals, such as chipmunks, can lose all or part of their tails, too. Unlike chipmunks, though, lizards and salamanders can regrow a missing tail, although the new tail often looks different from the old one.

Losing a tail is not without costs. Compared with lizards with tails, those without tails cannot run as fast, and they grow more slowly, lose social standing, and become less attractive to the opposite sex. As a result, Foufopoulos says, lizards develop the ability to slough their tails in response to danger from particular predators, such as poisonous snakes. He thinks that tail-shedding lizards elsewhere in the world probably also shed their tails with ease in areas where poisonous snakes lurk.

Because lizards living on islands with no poisonous snakes have largely lost the ability to shed their tails, Foufopoulos says, the consequences for lizards would be disastrous if vipers or other nonnative predators were introduced into their habitat. Those lizards "are ill-equipped to defend themselves and quickly succumb to invasive snakes," he says. Learning which lizards can shed their tails and which ones cannot has important implications for conservation biologists. Such knowledge can help scientists determine a species' susceptibility to extinction, Foufopoulos adds.

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"Well, there's another four million down the drain."