

Road runoff spurring spotted salamander evolution

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Spotted salamanders exposed to contaminated roadside ponds are adapting to their toxic environments, according to a Yale paper in *Scientific Reports*. This study provides the first documented evidence that a vertebrate has adapted to the negative effects of roads apparently by evolving rapidly.

Salamanders breeding in roadside ponds are exposed to a host of contaminants from road [runoff](#). Chief among these is [sodium chloride](#) from [road salt](#), which reaches average concentrations of 70 times higher in roadside ponds compared to woodland ponds located several hundred feet from the road.

"While the evolutionary consequences of roads are largely unknown, we know they are strong agents of [natural selection](#) and set the stage for fast evolution," said Steven Brady, the study's author and a [doctoral student](#) at the Yale School of Forestry & Environmental Studies. "These animals are growing up in harsh environments where they face a cocktail of [contaminants](#), and it appears that they are evolving to cope with them."

Brady found that [salamanders](#) in roadside ponds have higher mortality, grow at a slower rate and are more than likely to develop L-shaped spines and other disfigurements. In roadside ponds, only 56 percent of salamander eggs survive the first 10 weeks of development, whereas 87 percent survive in the woodland ponds. As roadside ponds become more toxic, the surviving salamanders may develop a genetic advantage over their counterparts living in woodland ponds.

The salamanders that survive year after year in the roadside ponds appear to have adapted to the harsh conditions. "The animals that come from roadside ponds actually do better—substantially better—than the ones that originate from woodland ponds when they're raised together," Brady said.

That animals adapt to human activities is not altogether new. For example, fish have begun to mature at smaller sizes in response to commercial fishing. But whereas humans directly utilize fish for consumption, salamanders are just bystanders to human activities. This suggests that the majority of species, which are not specifically targeted for human use, may be experiencing profound evolutionary consequences. And it appears that even species not being driven to extinction—and seldom thought about—are changing.

"This adaptation is certainly encouraging for conservation," said Brady. "But our modern footprint is fundamentally changing species in ways we don't understand and, critically, we don't know if these adaptive responses will keep pace with environmental change."

More information: The paper, "Road to Evolution? Local Adaptation to Road Adjacency in an Amphibian (*Ambystoma maculatum*)," is available at www.nature.com/srep/2012/12012.../full/srep00235.html

Provided by Yale University

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