Scientists document salamander decline in Central America

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The terrestrial salamander Pseudoeurycea goebeli, one of the commonest 40 years ago on the cloud forest slopes of the Tajumulco volcano, has now disappeared. This specimen was photographed at a neighboring volcano, Chicabal, only 50 kilometers to the east of Tajumulco, where the salamander is much reduced in population. Credit: Sean M. Rovito/UC Berkeley

The decline of amphibian populations worldwide has been documented primarily in frogs, but salamander populations also appear to have plummeted, according to a new study by University of California, Berkeley, biologists.

By comparing tropical salamander populations in Central America today with results of surveys conducted between 1969 and 1978, UC Berkeley researchers have found that populations of many of the commonest

salamanders have steeply declined.

On the flanks of the Tajumulco volcano on the west coast of Guatemala, for example, two of the three commonest species 40 years ago have disappeared, while the third was nearly impossible to find.

"There have been hints before - people went places and couldn't find salamanders. But this is the first time we've really had, with a very solid, large database, this kind of evidence," said study leader David Wake, professor of integrative biology at UC Berkeley and curator of herpetology in the campus's Museum of Vertebrate Zoology.

Frog declines have been attributed to a variety of causes, ranging from habitat destruction, pesticide use and introduced fish predators to the Chytrid fungus, which causes an often fatal disease, chytridiomycosis.

These do not appear to be responsible for the decline of Central American salamanders, Wake said. Instead, because the missing salamanders tend to be those living in narrow altitude bands, Wake believes that global warming is pushing these salamanders to higher and less hospitable elevations.

"We are losing some of these treasures of high-elevation and mid-elevation cloud forests in Central America," he said. "It is very worrying because it implies there are severe environmental problems."

Because several of the sampled salamander populations were in protected reserves, one message is that threatened species cannot be protected merely by putting a fence around their habitat. Global warming is affecting species even in protected areas - a phenomenon also documented among small mammals in Yosemite National Park by Museum of Vertebrate Zoology scientists.

Wake and long-time colleague Ted Papenfuss, a herpetologist in the museum, along with UC Berkeley graduate student Sean M. Rovito, Gabriela Parra-Olea of the Universidad Nacional Autónoma de México and Carlos R. Vásquez-Almazán of the Universidad de San Carlos in Guatemala City, report their findings this week in the Online Early Edition of the journal Proceedings of the National Academy of Sciences.

Missing frogs are easy to spot, Wake said, because they gather in ponds to breed, or they can be caught in the glare of a flashlight at night. Many salamanders, however, in particular the Plethodontid salamanders, which comprise two-thirds of all species worldwide, are secretive, living under logs and rocks. Nevertheless, anecdotal accounts have pointed to a salamander decline and an amphibian decline, in general.

Wake and Papenfuss had good records of salamander abundance along a transect up the southern slope of Volcán Tajumulco with which to compare current populations, which they resurveyed in 2005 and 2006. In addition, they compared salamander populations today at six sites in Mexico to data that Wake and Papenfuss have collected since the mid-1970s.

In Guatemala, those salamanders with narrow elevational niches and living exclusively under logs were most affected, while salamander "generalists" able to live in a variety of habitats, from leaf axils and bromeliads to moss mats, bark and burrows in the soil, were in about the same abundance as before. There was little evidence of Chytrid fungus, and habitat quality is generally similar to what it was in the 1970s. A nearby volcano with several of the same affected species is a nature reserve, and surprisingly, only a single salamander was discovered on two trips.

"We think global warming is a factor, pushing organisms up to higher

elevations where the habitat is wrong for them," Wake said. "The ones that were already high up have taken the hit."

In Mexico, the decline was most evident in Cerro San Felipe, a reserve in Oaxaca, among species living around 2,800-3,000 meters, which is the maximum height of mountains in the range. There, Papenfuss said, the commonest species, Pseudoeurycea smithi, has virtually disappeared. Where he had formerly uncovered hundreds in a single morning, he has found only one or two in last 10 years.

"It may be that those species are being pushed right off the tops of the mountains," Wake said.

The problem extends all the way to Mexico City. North of the capital, in the Parque Nacional El Chico in Hidalgo, formerly "a paradise for salamanders," populations are radically reduced.

Wake noted that species that depend on salamanders, such as a salamander-eating snake, have also declined significantly.

"The problem is, these animals used to be a very important element of mid- and high-elevation communities," he said. "They probably were the commonest vertebrates. In North American forests, it has been documented that salamanders are not only the commonest vertebrate, but by biomass have the greatest weight in the ecosystem. You can't remove something like that without a profound effect on the ecosystem."

Source: University of California - Berkeley

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