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New Salamanders And Other Biotreasures Discovered In An Increasingly Toxic Costa Rica

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Costa Rica has added three more to the 40 species of salamander already known to live in this awesomely biodiverse country. Two of the newly debuted amphibians are pinky-sized members of the nocturnal Bolitoglossa genus, the third is a Nototriton, a dwarf, measuring only 3 cm (just over an inch) in length. They are all pretty small, but the discovery is big. "Finding so many new species in one area is exciting, particularly as this is probably the only place in the world you can find these animals," said Alex Monro, who led three expeditions of scientists from London's Natural History Museum to La Amistad National Park, where the creatures were found.

La Amistad is a UNESCO World Heritage Site near Costa Rica's border with Panama. In all, the salamanders were among some 5,000 plants and animals the researchers recorded, and the investigators are far from finished. "It shows we still have a lot to learn about the variety of wildlife in this region. We have four more expeditions planned this year. Who knows what we could find when we go back?" said Monro. In all the world, there are around 300 species of salamanders, most living in the Northern Hemisphere, but precious few have turned up since five new ones were found in east-central Mexico in 1998. La Amistad has few roads, difficult terrain, and is therefore relatively unexplored. It has been estimated that the area is home to two-thirds of all Costa Rica's native species. La Amistad is the largest rain forest reserve in Central America.

The small probability that the new salamanders exist anywhere else on earth owes, said Monro, to the fact that "these particular species will have very small ranges. This area hadn't been explored, so they just weren't known before." Ballistic tongues All the new creatures are striking, the Nototriton for its tiny size, the others for their coloration. One, measuring around eight cm, is deep brown with a pale cream underside, the other has a bright red back and yellow splotches on a band of black running along the sides. They are slow moving, "but they have this ballistic tongue that shoots out at incredible speeds and wraps around prey," the scientist said. These tongues have achieved a fame of their own.

In March, scientists announced that the tongue of the giant palm salamander Bolitoglossa dofleini produces the greatest burst of power, over 18,000 watts per kg of muscle, of any animal muscle in the world. The Central American salamander shattered the record of 9,600 watts previously held by the Colorado River Toad. Stephen Deban of the University of South Florida, not part of the current investigations, was instrumental in measuring the power of the tongues using implanted electrodes and high-speed video. He said the bony tongue is launched with an initial burst of energy like an arrow shot from a bow. Elastic fibers in the salamander's mouth stretch to store the muscular energy and then release it all at once, sending the tongue flying forward. This mechanism has been seen elsewhere in animals, the aforementioned frog, the chameleon, and even in the legs of turkeys, but none approaches the power of the salamander.

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Herpetologist Eduardo Boza of the Universidad de Costa Rica (UCR) added for reporters that the Bolitoglossa, with 21 species, is the most diverse salamander group in Costa Rica. Boza expects future trips to reveal even more species of Bolitoglossa. In some cases, as few as five specimens of a species have been found. "Costa Rica is one of the best studied countries in the world at the level of herpetology, but despite this we are still describing new species," he said. Discovery of the animals should not be taken to mean that their numbers are increasing.

A 2004 survey showed that nearly one-third of 5,743 described amphibian species were in decline. At least nine species disappeared between 1980 and 2004. Perhaps the most famous disappearance was that of Bufo periglenes, the golden toad, once the icon of Costa Rica's Monteverde Cloud Forest Reserve. It has not been seen since 1989, despite extensive searches. Still, the London Natural History Museum's expeditions have been worth the candle. In addition to the salamanders, two suspected new frog species and several heretofore unknown plants have been identified by the UK's Darwin Initiative-funded project, and it is hoped that the research will turn up more evidence on the causes of the amphibian decline, so far variously attributed to global warming, habitat loss, pollution, and the lethal fungus chytrid (see NotiCen, 2006-01-19). "If this is a response to climate change," Monro told reporters, "then we would expect amphibians to be shifting their range upward as it gets warmer, and there is evidence of that. We have already documented a significant increase in elevation from one frog species."

Finding these very small creatures at any elevation is no easy task and is made no easier by their being, in the cases of two of the salamanders, nocturnal. The workers marked out survey areas during the day and then returned to them at night, picking through leaf litter and moss. "They had to tease apart mosses and loose bark and look all around in very close detail. In a night, they will have probably done only a few trees and maybe a hundred meters of pathway," said Monro. This in a park of 198,000 ha, an extension Monro finds amazing since Central America is so densely populated. He credits the inhospitability of the terrain with preserving the area. It is remote, and "it's very steep, very wet forest, and there are no roads, partly because it would be so difficult to put them in," he said. This is the most favorable environment for these amphibians. They do not live in water at any time in their life cycle, lack lungs, and breathe through their skin.

The investigators plan four more forays into Costa Rica's pristine and exquisitely sensitive wilds with the intention of teasing out even more of nature's secrets from among the mosses and molds. But this work will go on against a background of mounting environmental degradation in the country that may soon impinge on the regions Monro has described as a "paradise." Agrochemicals a threat Scientists elsewhere in Costa Rica are warning that increasing dependence on agrochemicals is harming the country's natural resources.

Costa Rica ranks highest in Central America in its use of these chemicals, according to a recent State of the Nation Report by the research organization Estado de la Nacion. Said Fabio Chaverri, director of the Universidad Nacional's School of Environmental Studies, "We have switched to 'dessert' agriculture. Where once we produced rice and beans, now we have turned to an export agriculture that demands large quantities of pineapples, coffee, and bananas." Another of the school's environmentalists, Elba de la Cruz, said, "Since 1990, our cultivated area has remained constant, around 11%, but our use of chemicals per hectare has shot upward. It's completely

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disproportionate," she said of the substances, which she called the most toxic in the business. "Eighty percent of the herbicides imported into Costa Rica are highly toxic to the environment, both on land and water." Last December, the university held a meeting of biologists on the subject, at which the scientists warned the country may be approaching the point of no return. If the use of these substances remains unchecked, the result will be "serious ecological damage,"

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