

THE WOLF IN THE WEST

BRAZIL'S AMAZON

LIVING WITH LIONS

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WHERE ARE THE
CLOWNS?



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Where are the Clowns?

Ecuador's Harlequin Frogs
Bring Attention—and Action—to
South America's Vanishing Amphibians

Story and photos
by Charles Bergman

Some people don't care for frogs. Or so I've heard. It's an attitude I've never understood. The frog we have just spotted in a shaded bush along a fast river in Ecuador is so beautiful, and so charming, even a hardened frog-o-phobe would, I'm sure, find it irresistible.

With its sun-and-shade colors of DayGlo® yellow against black stripes and spots, it is easily among the most stunning of Latin American frogs. And that's saying a lot, because the Neotropics are home to some of the world's most spectacular specimens. This one looks like it's dressed in motley, which is why it's called a harlequin frog.

As the amphibian takes long-legged steps on his branch, he flashes a shocking red palm on each foot, like sudden traffic lights. "Their feet are like semaphores," says David Salazar, a biologist from Pontificia Universidad Católica de Ecuador—la PUCE—in Quito. "They use their red feet to communicate with each other over the noise of the river."

One of Ecuador's rarest creatures, it is a small animal with a big message about the growing crisis facing amphibians in Latin America, and elsewhere. The frog with the red feet belongs to a genus of handsome Latin American toads—*Atelopus*. These toads look more like frogs, and they live along rivers and streams, often at high elevations, from Costa Rica to Peru.

Of the 113 known species of harlequin frogs, only 52 have been studied enough to determine their status. According to recent research, 42 of those species—about 80 percent—are in decline. Only 10 of the 113 species can be found in any significant numbers in the wild.

We have been surveying this newly discovered species on a steep slope of the eastern Andes, near the Ecuadorian border with Peru. For now, the frog is known simply as "*Atelopus* sp. 13," meaning that, among the harlequin frogs, it is the thirteenth species yet to be formally described and given a scientific name. Salazar and a team of biologists working under Luis Coloma suspect that *Atelo-*

pus sp. 13 may become extinct before it ever gets a more specific name.

A professor and researcher at la PUCE, Coloma is perhaps the foremost authority on amphibians in South America. He is soft-spoken, but does not mince words, "Extinction is a catastrophe in Ecuador." Twenty-six frog and toad species have disappeared from Ecuador since the 1980s. "And those are only the ones we know of. It could be much higher," he adds.

Each year, another 5 to 8 new species of frogs are discovered in Ecuador. Scientists have listed 170 species as endemic to the country, which means they do not exist anywhere else. Coloma believes there could be a total of 500 to 600 frog species. "We're afraid we can't find them fast enough to save them."

For Coloma, it's a national crisis. A national treasure is disappearing. "Ecuador is a nation of frogs," Coloma says with a laugh. "*Un país de sapos.*"

It's an inside joke that captures the country's witty cynicism. In Ecuadorian Spanish, "sapo" means frog (or toad), but it is also the term for a fool, or a corrupt politician.

A long-legged biologist with a gentle manner and a couple of body piercings, David Salazar loves reptiles, but finds the work on Ecuador's amphibians compelling. His job on this project is to study Number 13's population dynamics.



Every day, and most nights, he hikes along the river looking for frogs. He can identify many of them individually by their patterns of stripes and spots.

His surveys have him worried. He estimates there are 150 frogs in this population. As we watch, the male sings a faint trilling song, trying to attract a female. There aren't many around. "We can find only fifteen to twenty females in the whole population," Salazar says.

Just up the river, another biologist, Paula Peña, has found a female and a male in a froggy mating embrace called "amplexus." When a singing male attracts a female to his territory, he jumps onto her back and holds on tight. Usually much smaller than the female, the male stays astride until she deposits her eggs. Then, he fertilizes them.

Sometimes, a male will jump one of the large males. When this happens, the bigger male will give a release call, as if to say, "Hey, get off of me."

We find the pair of amplexing frogs among the stones in swift currents. They have been like this for at least a week. Peña wants to see them lay and fertilize their eggs. It's never before been documented in this species.

As we watch, the female starts walking up the river, stone by slippery stone. Her underside is bright red. The male on her back is clearly a heavy load. We follow her up the river for more than an hour, growing increasingly excited with the

The harlequin frogs of Central and South America are so-named because they display vivid colors, like those worn by characters in European comedy and pantomime of the 1500s. *Atelopus* sp. 13 (above and pages 32–33) is a relatively newly discovered species in the Ecuadorian Andes. Certain anatomical features and behaviors place these animals in the true toad family, but they are popularly called frogs.

hope that she is looking for a suitable spot to lay her eggs.

The biologists want to establish a captive-breeding program for this species, so understanding the frogs' breeding biology is crucial. With so few females in the population, this one may almost literally be carrying the future of the species on her back.

Suddenly, the female loses her footing, and the frogs plunge head over teacups down a chute of water. We search every crack and crevice along the river. The frogs have vanished. As we search, I remember what Coloma has told me about the prospects for these frogs. "My guess? They'll go extinct."

Why are frogs vanishing, and what can be done about it? The IUCN Global Amphibian Assessment has outlined the known threats (www.globalamphibians.org/threats.htm). In the case of the harlequin frogs, several factors may be working in insidious conjunction.



Biologists Paula Peña (above) and David Salazar (left) are studying *Atelopus* sp. 13 (opposite) to determine the number of frogs in the population and the species' ecology. Since the 1980s, 26 frog and toad species have disappeared in Ecuador. Amphibian experts fear that more will become extinct before they are even identified.

The most obvious suspect is habitat loss. According to Coloma, Ecuador has the highest deforestation rate in Latin America. While the loss of the Amazonian rain forest gets most of the attention in the press, logging is especially heavy in western Ecuador. "The Pacific forests are a disaster," he says.

Yet many frogs, and *Atelopus* in particular, have disappeared from seemingly intact areas. *Atelopus* sp. 13, for example, lives in relatively undisturbed habitat. "We think there may be something in the water," Coloma says, and that something is called chytrid.

Attention has increasingly focused on the fungal disease chytridiomycosis—amphibian chytrid, for short—caused by *Batrachochytrium dendrobatidis*. Chytrid fungus attacks the keratin in the mouthparts of tadpoles and in the skin of terrestrial adults. The fungus has been detected in 14 species of *Atelopus*, from Costa Rica to



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Peru, including four species that have not been seen in years. Experts predict that once chytrid moves into an area, most frog populations decline. In tropical mountain sites, a 50 percent loss of species and 80 percent loss of individuals can be expected.

Chytrid fungus occurs naturally in the wild, but in the past it did not decimate frogs. It is believed to have originated in South Africa, and only recently been spread around the world. Coloma suspects that global warming, or perhaps ultraviolet radiation, may impair the frogs' defenses against the fungus. Temperatures in Quito have risen sharply since 1907, up an average of 2 degrees Celsius. This is significantly higher than the global average temperature rise of 0.6 degrees Celsius. Ultraviolet radiation, which is associated with increased incidence of skin cancer in humans, has also



ECUADOR'S "LIFE RAFT"

Ecuador is incredibly rich in amphibians, with at last count, 455 species. Paradoxically, Ecuadorian frogs and toads are among the most threatened on Earth. Scientists estimate that no fewer than 140 species are at risk of extinction, 25 of which may have gone extinct already. Most of these threatened creatures live in the Andes region. In recent decades, this majestic "avenue of volcanoes" has been severely affected by abnormal temperature and rainfall patterns, the presence of lethal frog pathogens such as chytrid fungus, nearly uncontrolled habitat destruction, and other natural and man-made problems.

In the wake of the disappearance of many of the native harlequin frogs, our scientific team at Pontificia Universidad Católica del Ecuador (la PUCE) is leading a multimillion-dollar, challenging, and ambitious project called "Life Raft for Frogs: A Strategic Plan for the Conservation of the Ecuadorian Am-

phibians under Risk of Extinction." This "Life Raft" includes five major, interrelated programs: the monitoring and study of native amphibians, improvement in local expertise, management of all endangered species, educa-



tion and public awareness, and sharing of information. Already, la PUCE has raised awareness about the importance of amphibians and their dramatic population declines through a public exhibit, "Sapari," in Quito, the capital of Ecuador. The exhibit attracted 105,000 visitors in 90 days.

La PUCE is also developing intensive, secure captive-breeding programs for critically endangered species—among them, harlequin frogs and marsupial frogs. (Marsupial frogs are so named because the females incubate their young in dorsal pouches.)

We hope that these efforts will gain more worldwide support and serve as inspiration for immediate actions elsewhere to help these enchanting animals that sing to nature and life. For more information on the "Life Raft," log on to AmphibiaWebEcuador (<http://www.puce.edu.ec/zoologia/vertebrados/amphibiawebec/index.html>).

Luis A. Coloma

The crisis facing frogs and toads is not confined to Ecuador (opposite, *Atelopus* sp. 13). Amphibians in general are disappearing from many habitats around the world. Among the most important factors are habitat destruction and modification, environmental factors such as pollutants and climate change, and disease.

been on the rise. Coloma's lab is researching both of these possibilities in frog declines.

Not only is Coloma concerned about bringing much-needed attention to the frog crisis in Ecuador, but his lab is also taking innovative action to save them. In a pioneering project, Coloma's lab has developed a conservation program to breed endangered Ecuadorian frogs in captivity (see "Ecuador's 'Life Raft,'" above). They now have ten species in the project, mostly breeding them in their lab in Quito. "The idea," says Coloma, "is to have all one hundred forty endangered species in the project."

One night while we are on the river, Salazar uses cotton swabs to swipe the skin of several frogs. The samples will be tested back in Quito. He is looking for chytrid fungus.

When *Atelopus* sp. 13 was first found in 2003, Salazar tells me, one of the frogs was acting sick. It soon died. In the lab, it tested positive for chytrid. "We have found several frogs since that died of chytrid," Salazar says. "It may be the cause of the suspected decline of this species."

In his laboratory at the university, Luis Coloma leads me into a locked room crowded with wooden cabinets. He opens one of them. It is full of glass jars with dead frogs floating in formaldehyde. The cabinet contains specimens of every known frog that's gone extinct in Ecuador.

Coloma hands one of the jars to me. Inside are specimens of jambato toads. The Andean town of Ambato may have been named for the toads, which were once abundant from the market town of Otavalo to Mount Chimborazo, Ecuador's highest peak. The label on this jar indicates these specimens were collected at Cotopaxi, a volcano south of Quito.

People in Quito regularly would see jambato toads in their gardens. In 1981, scientists estimated the density of these frogs in one area at 50 per square meter. The species was last observed in 1988, only seven years later.

Big and black, the jambato toad, *Atelopus ignescens*, was named for its red belly—the flaming, ignited harlequin. I look carefully at the frogs in the jar, their red bellies faded to dull beige. Coloma and his team hope that their studies will help solve the mystery of the country's vanishing frogs.

"The last jambato toad," Coloma says, "died of chytrid fungus." His quiet tone belies his role as champion for the beautiful but beleaguered frogs of Ecuador.

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