CONSERVATION ENDOWMENT FUND

Lowland *Atelopus* of Western Colombia: Coexistence with *Batrachochytrium dendrobatidis* or Prelude to Extinction?

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HARLEQUIN FROGS

By Sandra Victoria Flechas
Grupo de Ecofisiología del Comportamiento y Herpetología (GECOH), Universidad de los Andes

Conservation strategies focused on amphibians threatened by chytridiomycosis, a disease caused by the microscopic fungus Batrachochytrium dendrobatidis (Bd), have sought mainly to prevent the spread of the pathogen to healthy populations and establish *ex-situ* programs, yet solving the problem may require prophylactic treatments and an eventual cure. Since the discovery of cutaneous bacteria with strong antifungal properties, increasing effort has focused on finding a cure using beneficial microorganisms that live in the hosts' skin.

One of the more severely impacted groups of amphibians is the genus *Atelopus* (*Anura: Bufonidae*), also known as harlequin frogs, with 80 percent of species listed as critically endangered. In Colombia nearly all of the 33 species of *Atelopus* have declined sharply, yet four lowland species are persisting at 0 – 600 m elevation. For one species, *A. elegans* from Gorgona Island, we know that the pathogen has been present for at least four years without causing obvious disease or declines. Among the various possible factors that may account for the continued existence of the lowland *Atelopus* from Colombia despite *Bd* infections, we hypothesized that cutaneous bacteria may be playing an important role. While most research on the immune-like properties of the cutaneous microflora of amphibian skin has been conducted in temperate zones, the vast majority of amphibian diversity lies in the tropical realm, especially in South America. If, as in most groups of organisms, the tropics contain a higher diversity of cutaneous bacteria, we may expect to find a greater pool of potentially beneficial bacteria at lower latitudes.

The aim of our study was to test whether the three species of *Atelopus* host cutaneous bacteria capable of inhibiting *Bd* growth, which may have permitted the coexistence between frogs and the pathogen. A total of 148 bacterial morphotypes were isolated from the frogs' skin. Of these, 38 showed different degrees of inhibition in the growth inhibition tests. Individuals of *A. elegans* from Gorgona Island host bacteria with stronger inhibitory activity against *Bd*, followed by *Atelopus limosus* and *A. spurrelli*. Those bacteria with strong anti-*Bd* action seem to be good candidates to be used in bioaugmentation experiments seeking to protect threatened Neotropical amphibian species. In parallel with experimental tests of bacteria, we have also started an *ex-situ* program focusing first on *A. limosus*. These *ex-situ* efforts are already showing signs of success. We have eight clutches and the small tadpoles are healthy and developing in very good conditions.