Issue 122 (February 2021)
ISSN: 1026-0269
eISSN: 1817-3934

FrogLog

Volume 28, number 1

www.iucn-amphibians.org
www.amphibians.org

Promoting Conservation, Research and Education for the World's Amphibians

Documenting Threatened Species in Brazil: A Conservation Photography Project

Newly Discovered Frog is a Transparent Twin with a Strange Song

Ancient Sedentary Frogs Move Over 350kms in a Day

... and so much more!

Bolitoglossa paraesnsis. Photo: Pedro Peloso.

FrogLog

CONTENTS

NEWS FROM THE AMPHIBIAN COMMUNITY

Please consider the environment before printing this publication.
Reduce, reuse, recycle.

Warming-induced shifts in amphibian phenology and behavior lead to altered predator-prey dynamics

Long-toed Salamander larvae (*Ambystoma macrodactylum*). Photo: Fabian G. Jara.

Fabian G. Jara, Lindsey L. Thurman, Pierre-Olivier Montiglio, Andrew Sih & Tiffany S. Garcia

Climate change induced phenological variation in amphibians can disrupt time-sensitive processes such as breeding, hatching, and metamorphosis, and can consequently alter size-dependent interactions such as predation. Temperature can further alter size-dependent, predator-prey relationships through changes in species' behavior. We thus hypothesized that phenological shifts due to climate warming would alter the predator-prey dynamic in a larval amphibian community through changes in body size and behavior of both the predator and prey. We utilized an amphibian predator-prey system common to the montane wetlands of the U.S. Pacific Northwest: the Long-toed Salamander (*Ambystoma macrodactylum*) and its anuran prey, the Pacific Chorus Frog (*Pseudacris regilla*). We conducted predation trials to test if changes in predator phenology and environmental temperature influence predation success. We simulated predator phenological shifts by using different size classes of the long-toed salamander representing an earlier onset of breeding, while using spring temperatures corresponding to early- and mid-season larval rearing conditions. Our results indicated that the predator-prey dynamic was highly dependent upon predator phenology and temperature, and both acted synergistically. Increased size asymmetry resulted in higher tadpole predation rates and tadpole tail damage. Both predators and prey altered activity and locomotor performance in warmer treatments. Consequently, behavioral modifications resulted in decreased survival rates of tadpoles in the presence of large salamander larvae. If predators shift to breed disproportionately earlier than prey due to climate warming, this has the potential to negatively impact tadpole populations in high-elevation amphibian assemblages through changes in predation rates mediated by behavior.

F. G. Jara, L. L. Thurman, P.-O. Montiglio, A. Sih & T. S. Garcia, *Oecologia* 189, 3 (2019):803-813. DOI 10.1007/s00442-019-

Panamanian Golden Frog (*Atelopus zeteki*). Photo: Jeremy Cohen.

An interaction between climate change and infectious disease drove widespread amphibian declines.

Jeremy M. Cohen, David J. Civitello, Matthew D. Venesky, Taegan A. McMahon & Jason R. Rohr

Climate change might drive species declines by altering species interactions, such as host–parasite interactions. However, few studies have combined experiments, field data, and historical climate records to provide evidence that an interaction between climate change and disease caused any host declines. A recently proposed hypothesis, the *thermal mismatch hypothesis*, could identify host species that are vulnerable to disease under climate change because it predicts that cool- and warm-adapted hosts should be vulnerable to disease at unusually warm and cool temperatures, respectively. Here, we conduct experiments on *Atelopus zeteki*, a critically endangered, captively bred frog that prefers relatively cool temperatures, and show that frogs have high pathogen loads and high mortality rates only when exposed to a combination of the pathogenic chytrid fungus (*Batrachochytrium dendrobatidis*) and high temperatures, as predicted by the thermal mismatch hypothesis. Further, we tested various hypotheses to explain recent declines experienced by species in the amphibian genus *Atelopus* that are thought to be associated with *B. dendrobatidis* and reveal that these declines are best explained by the thermal mismatch hypothesis. As in our experiments, only the combination of rapid increases in temperature and infectious disease could account for the patterns of declines, especially in species adapted to relatively cool environments. After combining experiments on declining hosts with spatiotemporal patterns in the field, our findings are consistent with the hypothesis that widespread species declines, including possible extinctions, have been driven by an interaction between increasing temperatures and infectious disease. Moreover, our findings suggest that hosts adapted to relatively cool conditions will be most vulnerable to the combination of increases in mean temperature and emerging infectious diseases.

J. Cohen, D. Civitello, M. Venesky, T. McMahon, J. Rohr, *Global Change Biology*, **25**(3), 927-937 (2019).

***Proteus anguinus*. Photo: Domin Dalessi.**

Composition of the cutaneous bacterial community of a cave amphibian, Proteus anguinus

Rok Kostanjšek, Ylenia Prodan, Blaž Stres & Peter Trontelj

The European Cave Salamander Proteus anguinus is a charismatic amphibian endemic to the concealed and inaccessible subterranean waters of the Dinaric Karst. Despite its exceptional conservation importance not much is known about its ecology and interactions with the groundwater microbiome. The cutaneous microbiota of amphibians is an important driver of metabolic capabilities and immunity, and thus a key factor in their wellbeing and survival. We used high-throughput 16S rRNA gene sequencing based on seven variable regions to examine the bacteriome of the skin of five distinct evolutionary lineages of *P. anguinus* and in their groundwater environment. The skin bacteriomes turned out to be strongly filtered subsamples of the environmental microbial community. The resident microbiota of the analyzed individuals was dominated by five bacterial taxa. Despite an indicated functional redundancy, the cutaneous bacteriome of *P. anguinus* presumably provides protection against invading microbes by occupying the niche, and thus could serve as an indicator of health status. Besides conservation implications for *P. anguinus*, our results provide a baseline for future studies on other endangered neotenic salamanders.

R. Kostanjšek, Y. Prodan, B. Stres, P. Trontelj, *FEMS Microbiol. Ecol.* **95**, fiz007 (2019) https://doi.org/10.1093/femsec/fiz007