# Amphibian population declines

## 30 years of progress in confronting a complex problem

# Déclin des populations d'amphibiens

## 30 ans de progrès face à un problème complexe

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**Cover:** Brown-backed Treefrog, *Leptopelis flavimaculatus*, Amani, Tanzania.
Photo: David M. Green

# Amphibian Population Declines:

30 years of progress in confronting a complex problem

**Redpath Museum, McGill University, Montréal**

September 20th, 2019

Thirty years ago, participants at the 1989 1st World Congress of Herpetology first became concerned that observed declines in amphibian populations might not simply be isolated incidents but could be global in scope and unprecedented in severity. Three decades of research since then has produced an enormous increase in our knowledge of amphibian ecology and new understanding of the complexity of possible causes for population declines. This symposium will draw upon what we have learned over those 30 years and look forward with fresh ideas to address the global decline of biodiversity.

## Organizing Committee

**David M. Green** (Chair)

**Scientific Subcommittee:** Michael J. Lannoo, David Lesbarrères, Erin Muths

**Organizing Subcommittee:** Pablo Menendez, Jessica Ford, Nathalie Jreidini, Eric Guerra-Grenier, Pablo Menendez, Heather Gray, Hervé Maranda.

**With thanks to** Ginette Dessureault and Caroline Leblond (Redpath Museum), sponsors and volunteers.

## Symposium Speakers

**Hugo Cayuela** is a postdoctoral fellow at Laval University, where he is studying demographic processes in relation to life history evolution, the ecology and evolution of dispersal, and population genomic and evolutionary processes.

**Francesco Ficetola** is a Professor in the Department of Environmental Science and Policy at the University of Milan. He combines modeling and genetics to better understand how environmental systems change, which factors determine their modification, and which are consequences across multiple spatial and temporal scales.

**Evan Grant** is stationed at the Patuxent Wildlife Research Center, where he is the principle investigator of the US Geological Survey's Amphibian Research and Monitoring Initiative (ARMI), northeast region. His research focuses on questions relating to amphibian populations, specifically with respect to their landscape-scale ecology and dynamics.

**David M. Green** is a Professor at the Redpath Museum of McGill University, where he studies the evolution, ecology and behaviour of amphibians.

**Paige Howell** is a postdoctoral research associate with Tall Timbers and the Warnell School at the University of Georgia. The focus of her research is on developing statistical models to test ecological theory and evaluate the effects of management actions on animal population dynamics.

**Michael J. Lannoo** is a Professor at Indiana University and an affiliate of the Illinois Natural History Survey at the University of Illinois and the Field Museum of Natural History in Chicago. His research interests include morphological, ecological, and conservation-related questions in vertebrates inhabiting temperate, tropical, and polar systems.

**David Lesbarrères** is an Associate Professor in Biology and Dean of Graduate Studies at Laurentian University, where he studies the impacts of emerging infectious diseases and anthropogenic stressors on amphibian populations.

**Pablo Menendez** is a Ph.D. student at McGill University and holds a faculty position at the Pontificia Universidad Católica del Ecuador. His research work takes a phylogenetic and functional approach towards understanding amphibian vulnerability due to climate change at different temporal and spatial scales.

**Erin Muths** is employed by the US Geological Survey and is a principle investigator for the USGS Amphibian Research and Monitoring Initiative (ARMI). She has worked on amphibian conservation for 24 years with a focus on demography, disease, and conservation.

**Wendy J. Palen** is an Associate Professor of Biological Sciences at Simon Fraser University, where her research focuses on identifying science-based conservation solutions for freshwater and terrestrial ecosystems in the Pacific Northwest and Western Canada.

**Eria Rebollar** is a Research Associate at the Center for Genomic Sciences, Universidad Nacional Autónoma de México (UNAM). She is a microbial ecologist interested in the symbiotic relationships between hosts (animals) and microbial communities (microbiomes) from ecological and evolutionary perspectives.

**Louise Rollins-Smith** is a Professor of Pathology, Microbiology and Immunology at the Vanderbilt University School of Medicine and a Professor of Biological Sciences at Vanderbilt University. She studies disease and immunity in amphibians, including immunological tolerance, effects of immunotoxic chemicals, and immune defenses against ranaviruses and pathogenic chytrid fungi linked to global amphibian declines.

**Benedikt Schmidt** pursues a “dual career” in conservation science and practice working for Info Fauna Karch on amphibian conservation and as a research scientist leading an independent group at the University of Zurich that focuses on the conservation biology of amphibians.

**Kelly R. Zamudio** is a Professor in the Department of Ecology and Evolutionary Biology at Cornell University. She is an evolutionary biologist with specific interests in the microevolutionary processes leading to the origin and maintenance of diversification in vertebrates (especially New World reptiles and amphibians).

**Amanda Zellmer** is an Assistant Professor of Biology at Occidental College, specializing in computational conservation biology, spatial ecology, and biodiversity informatics. Her research focuses on modeling species distributions in response to human-mediated environmental change, including habitat fragmentation, urbanization, and climate change, with a particular emphasis on amphibian populations.

**Breda Zimkus** is the Cryogenics Collections Manager for Genetic Resources at the Museum of Comparative Zoology at Harvard University and a Lecturer in Anatomy at Harvard Medical School. Her research explores the biodiversity, phylogenetics, and conservation of African amphibians, integrating fieldwork, taxonomy, and molecular systematics to interpret patterns of speciation and diversity.

# Program

## Friday Morning, September 20th

### Check-in

**Redpath Museum Lobby**

8:00 AM Doors open. Check-in. Continental breakfast.

### Session I

**Redpath Museum Auditorium**

Moderator: **Erin Muths**

8:50 AM **David M. Green** (McGill University)
Welcome and introduction

9:00 AM **Michael J. Lannoo** (Indiana University)
Somebody's got to stay outside: Understanding shifting amphibian ecological relationships in a world of environmental change

9:20 AM **Wendy Palen** (Simon Fraser University)
30 years later: Revisiting the hypotheses for amphibian declines and the utility of demographic models

9:40 AM **Evan Grant** (US Geological Survey, Patuxent)
Synthesis of drivers of decline in North America (and Europe)

10:00 AM **Amanda Zellmer** (Occidental College)
Clearing up the crystal ball - are projected losses in amphibian habitat suitability going to be as bad as predicted?

10:20 AM **Break**

10:40 AM **Francesco Ficetola** (Università degli Studi di Milano)
Impact of alien species on amphibians

11:00 AM **Pablo Menendez** (Pontificia Universidad Católica del Ecuador and McGill University)
Ecosystem effects of extinctions in highly diverse regions"

11:20 AM **Hugo Cayuela** (Université Laval)
Amphibian dispersal: from individual phenotype to gene flow.

11:40 AM **Paige Howell** (University of Georgia)
Estimating metapopulation abundance to inform conservation of a threatened amphibian

12:00 PM **Lunch**

# Program

## Friday Afternoon, September 20th

### Session II

**Redpath Museum Auditorium**

Moderator: **Michael Lannoo**

1:40 PM **David Lesbarrères** (Laurentian University)
Amphibian disease ecology: are we just scratching the surface?

2:00 PM **Louise Rollins-Smith** (Vanderbilt University)
Amphibian immune defenses against chytrid pathogens linked to global amphibian declines

2:20 PM **Breda Zimkus** (Harvard University)
Chytrid fungus (*Batrachochytrium dendrobatidis*) in African amphibians: a continental analysis of occurrences and modeling of its potential distribution

2:40 PM **Kelly R. Zamudio** (Cornell University)
High variability in infection mechanisms and host responses: A review of functional genomic studies of amphibian chytridiomycosis

3:00 PM **Break**

3:20 PM **Eria Rebollar** (Universidad Nacional Autónoma de México)
Ecology of the amphibian-microbe symbiosis and its role in pathogen protection.

3:40 PM **Erin Muths** (US Geological Survey, Fort Collins)
Effects of disease, temperature, and community on demography in a wild population of temperate amphibians (and why the details still matter)

4:00 PM **Benedikt Schmidt** (Universität Zürich and Info Fauna Karch)
Evidence-based amphibian conservation

4:20 PM **David M. Green**
Wrap-up: Amphibian population declines: where are we now after 30 years?

4:30 PM Discussion

### Social

**Redpath Museum Dawson Gallery (2nd floor)**

5:15 PM **Reception and cocktail**

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