

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/287209463>

# Saving salamanders; Approaches as diverse as the animals themselves

Article · April 2014

CITATIONS

0

READS

194

8 authors, including:



**Jaime Garcia Moreno**  
BirdLife Netherlands

77 PUBLICATIONS 2,895 CITATIONS

[SEE PROFILE](#)



**Benjamin Tapley**  
ZSL

79 PUBLICATIONS 404 CITATIONS

[SEE PROFILE](#)



**Carly Waterman**  
Zoological Society of London

27 PUBLICATIONS 936 CITATIONS

[SEE PROFILE](#)



**Karla Pelz Serrano**  
Metropolitan Autonomous University

8 PUBLICATIONS 40 CITATIONS

[SEE PROFILE](#)

Some of the authors of this publication are also working on these related projects:



Captive husbandry and breeding of *Gonyosoma boulengeri* [View project](#)



Green Salamander Conservation in NC [View project](#)

# FrogLog

www.amphibians.org

Volume 22, number 2

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

Peru National Park  
Breaks Biodiversity  
Record

Rediscovery of a  
“Lost” Andean Toad

Frog Friendly  
Coffee

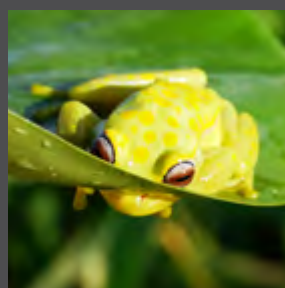
Recent Publications

And Much More!

*Ceratophrys cornuta* is one of many amphibians living on the forest floor in Manu's lowland rainforest. Photo by J. Jacobs.



Saving  
Salamanders



The Story Behind  
the Photo



# FrogLog

## CONTENTS



3 Editorial

### NEWS FROM THE AMPHIBIAN COMMUNITY

- 4 The Frog Next Door: Amphibian Portraits from Around the World
- 5 Report on ASG Peru Activities 2013-February 2014
- 6 Report on Amphibian Red List Authority Activities 2013-March 2014
- 7 Earth Day 2014: Protecting Herpetofauna Habitat in the Peruvian Amazon
- 9 Challenges and Opportunities in Salamander Conservation
- 12 Saving Salamanders; Approaches as Diverse as the Animals Themselves
- 16 Building National Capacity in *Ex-situ* Amphibian Management
- 18 So in India, even Frogs like Spice in their food!
- 19 Pura Vida Bracelets and Amphibian Survival Alliance Design a Future for Amphibians
- 21 Throw Frogs a Log
- 23 Brake for Wildlife
- 24 2014 Year of the Salamander Campaign Has Been Busy!
- 25 Salamander News from the Year of the Salamander

### REGIONAL EDITION— The Americas

- 40 Lost Frogs Offer Conservation Hope: A Story of Rediscovery in Ecuador
- 43 Peru's National Park Protects 156 Species of Amphibians From the Andes to the Amazon
- 48 Puddles of Possibilities
- 50 Frog Friendly Coffee, an Alternative for the Conservation of Threatened Amphibians in Colombia
- 53 Conservation of Lake Lerma Salamander
- 54 Two Central Texas Salamanders get Endangered Species Act Protection
- 56 Preserving the Endangered Marsupial Frogs of the Genus *Gastrotheca* in Argentina
- 60 Amphibian Taxonomy and Conservation in Panama and Bolivia
- 63 Destruction of Type Locality, New Records and Distribution of *Melanophryniscus cupreuscapularis*
- 66 Golden Frog Conservation Workshop
- 67 First Record of Amphibians in Walter Thilo Deininger Protected Natural Area in El Salvador
- 70 Dia del Coqui: Celebrating Puerto Rico's Unique Amphibians
- 72 A Search for Rare and Ancient Plants
- 74 The Story Behind the Photo...

Recent Publications 78 | Events 86 | Internships & Employment 86  
Funding Opportunities 86 | Author Instructions 90

Follow the ASG on Facebook  
[www.facebook.com/amphibiansdotorg](http://www.facebook.com/amphibiansdotorg)

# Editorial

**W**ith the Year of the Salamander well underway, I have come to realize that the ways people work to protect amphibians are just as unique and fascinating as the very species that are the focus of their efforts. And this is true for all amphibians and not just salamanders. The many different ways in which organizations and individuals go about saving amphibians never ceases to amaze me and leads me to believe that almost anything is possible despite the daunting odds.

As you begin to flip through the pages of this edition of *FrogLog*, you will see that amphibians and their habitats can be saved through novel partnerships and by working together with government, NGOs, industries and landowners alike. They can also be saved through the development and implementation of conservation action plans and by teams of individuals carrying out extensive monitoring and surveying.

And while data themselves might not be sexy to most people, keeping amphibian extinction risk assessments updated can also save amphibians. How? Because realities on the ground are constantly changing, and extinctions can be averted if the species that are more at risk are quickly identified as such and conservation action is targeted in an efficient and timely manner.

But there are also simple actions featured in these pages that each of us can do everyday to make a difference.

What if the cup of coffee you may be reaching for while you read this was frog friendly and carried a message of hope for Endangered and Critically Endangered amphibians in Colombia?

What if a simple animal escape device in backyard pools could prevent an untold number of unnecessary frog, toad and salamander deaths?

What if data collected from puddles in the form of ephemeral pools in your own neighbourhood could contribute to the conservation of critical habitats?

And if these stories are still not inspiring enough, when you are done reading *FrogLog*, don't forget to download your free copy of "[The Amphibians](#)." This visually stunning new eBook is a celebration of the diversity of amphibians in The Americas and around the world that has been brought to you through a creative collaboration between the Amphibian Survival Alliance and Meet Your Neighbours. You will quickly find yourself renewing your passion to protect even the most common of amphibians.

## *Candace M Hansen* *Editor-in-chief*

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



# FrogLog

ASG Secretariat

Claude Gascon

ASG Co-Chair

Phillip J. Bishop

ASG Co-Chair

Sally Wren

ASG Program Officer

Jos Kielgast

ASG Program Officer

Helen Meredith

ASG Program Officer

Ariadne Angulo

Amphibian RLA Coordinator

Jennifer Luedtke

Amphibian RLA Deputy

Coordinator



*FrogLog* Editorial Committee

Candace M. Hansen

Editor-in-chief

Craig Hassapakis

Consulting Editor

Laurence Jarvis

Recent Publications Editor

*FrogLog* Editorial Board

Claude Gascon

Phillip J. Bishop

Don Church

Ariadne Angulo

James P. Lewis

Candace M. Hansen

Editorial Office  
Global Wildlife Conservation  
PO Box 129, Austin, TX 78767, USA  
[froglog@amphibians.org](mailto:froglog@amphibians.org)

## The Frog Next Door: Amphibian Portraits from Around the World

**T**he *Amphibians* is a stunning new eBook featuring photographs of amphibians against a luminous white background from around the world, brought to you through a novel collaboration between the Amphibian Survival Alliance and Meet Your Neighbours, a worldwide photography project reconnecting people with the wildlife on their own doorsteps.

Of the photographic technique featured throughout the book, Meet Your Neighbours Co-Founder Clay Bolt says: "A brilliantly-lit white background removes the context, encouraging appreciation of the subject as an individual rather than a species. Their own form constitutes the composition. Seen this way, animals and plants we thought we knew reveal another side of themselves, encourage a second glance, perhaps even renewed interest".

*The Amphibians*, which opens with introductions by Clay Bolt and ASA Conservation Officer Dr. Robin Moore, is a visual treat of kaleidoscopic colours and tantalizing textures – a true celebration of the beauty and diversity of frogs and salamanders, and an invitation to reconnect with these wonderful creatures. Please enjoy, and share widely.

Download *The Amphibians* eBook today for free at: <http://www.amphibians.org/the-amphibians-ebook>



Download Our **FREE** eBook  
**THE AMPHIBIANS**

Click Here to Get Your Copy!





# Report on ASG Peru Activities 2013-February 2014

By Ariadne Angulo & Giuseppe Gagliardi

Last year (2013) has been a busy one for the Peru branch of the Amphibian Specialist Group (ASG). One of the initiatives we proposed as new Co-Chairs was to test-drive a new online assessment tool (the Amphibian Assessment Forum, see <http://www.amphibians.org/redlist/forum/>) with a pilot project of amphibian species highlighted for reassessment in von May et al. (2008). With the help of Laurence Jarvis, who moderated the Peru forum, compiled new data and collated expert contributions, and updated the amphibian assessments in question, we are now close to completing the assessment process for those species posted on the forum.

Following this experience, three ASG Peru members (A. Angulo, J. Icochea, and R. von May) presented a proposal for a field project to the Mohamed bin Zayed Species Conservation Fund (<http://www.speciesconservation.org/>). The proposed project, which focuses on two Critically Endangered anurans in the cloud forest of central Peru, was recently selected for funding and it was one of eight amphibian projects selected for that particular grant solicitation period. ASG Peru will carry out this project in collaboration with the Yanachaga-Chemillén National Park, an official partner in the project. ASG Peru looks forward to developing this project over the course of 2014 with its key Park partners.

An ASG Peru meeting was convened on December 30, 2013 to discuss various issues of interest to move the ASG forward in Peru, including matching priorities with capacities. A draft agenda was circulated by email prior to the meeting so that members who were not able to attend the meeting had the capacity to provide feedback prior to the meeting. Three ASG members attended the meeting, including the two Co-Chairs, and two members wrote in with suggestions ahead of time. Some key decisions include increasing membership participation by requesting each member to take responsibility for collating data for one priority species, opening the group to new members and assigning new members specific projects to help the group address its many information needs, and the development of discussion forums where one key research or policy question is open for debate for a certain period of time (with the intent of using these questions as guidance when resources become available to develop a national amphibian conservation strategy).

Earlier this year, a Red List training workshop was held between 9 and 11 January, 2014 in Iquitos, Peru, under the aegis of the Instituto de Investigaciones de la Amazonía Peruana (IIAP), the IUCN Species Survival Commission (IUCN SSC), ASG Peru and the Amphibian Red List Authority (Amphibian RLA). The workshop spanned three full days and was attended by 29 participants from five institutions. Fifteen participants were undergraduate students from a local university and were selected to attend through an application process; the other applicants (university professors, government representatives, researchers and postgraduate students) were personally invited to attend. Taxonomic expertise at the workshop covered amphibians, reptiles, fishes, birds, mammals and plants, with a focus on Amazonian biodiversity.

ASG Peru's first publication as such was formally published in 2008 and was a landmark collective collaboration at the national level, with the participation of 27 scientists (see von May et al.



Participants at the January Red List training workshop at IIAP, Iquitos, Peru. Photo: Ricarte Sánchez.

2008). This study focused on 83 threatened and potentially threatened amphibians, and identified that the habitat of 40% of the species assessed needs formal protection. ASG Peru's second paper was recently published by Catenazzi *et al.* (2013, and see p. 44 in this issue). The study is also a landmark as it sets Peru's Manu National Park at the top of the list of natural protected areas in terms of amphibian and reptile species richness.

Finally, in late February 2014 the ASG Peru membership was invited to provide expert input into the government's list of threatened species and draft legislation proposal on this matter. ASG members sent representatives of the Dirección General Forestal y de Fauna Silvestre (DGFFS) from the Ministry of Agriculture and Irrigation (MINAGRI for its acronym in Spanish) detailed feedback to help improve both the legislation and the list. In this way, ASG Peru is supporting amphibian conservation at the legal and policy levels, with the hopes that this will improve protection of threatened amphibians at the national level.

We look forward to continuing to work with our membership and to bringing new members on board, to increase both our coverage and our impact on amphibian research and conservation in Peru, as well as continuing to support the Red List assessment process and future training on the IUCN Red List Categories and Criteria in Peru.

## Acknowledgements

We wish to thank each and every ASG Peru member and supporter who has contributed to mobilizing the group's activities in the past year, and the Mohamed bin Zayed Species Conservation Fund for giving us the opportunity to study and seek the protection of two Critically Endangered amphibians. Thanks to Rudolf von May for his comments on an earlier version of this report.

## References

1. Catenazzi, A., E. Lehr, and R. von May. 2013. The amphibians and reptiles of Manu National Park and its buffer zone, Amazon basin and eastern slopes of the Andes, Peru. *Biota Neotropica* 13 (4): 1-15. [<http://www.biotaneotropica.org.br/v13n4/en/abstract?inventory+bn02813042013>]
2. von May, R., A. Catenazzi, A. Angulo, J.L. Brown, J. Carrillo, G. Chávez, J.H. Córdova, A. Curo, A. Delgado, M.A. Enciso, R. Gutiérrez, E. Lehr, J.L. Martínez, M. Medina-Müller, A. Miranda, D.R. Neira, J.A. Ochoa, A.J. Quiroz, D.A. Rodríguez, L.O. Rodríguez, A.W. Salas, T. Seimon, A. Seimon, K. Siu-Ting, J. Suárez, C. Torres & E. Twomey. 2008. Current state of conservation knowledge on threatened amphibian species in Peru. *Tropical Conservation Science* 1(4): 376-396. [[http://tropicalconservationscience.mongabay.com/content/v1/08-12-01-Von\\_May\\_et\\_al\\_376-396.html](http://tropicalconservationscience.mongabay.com/content/v1/08-12-01-Von_May_et_al_376-396.html)]

Ariadne Angulo ([aangulo@amphibians.org](mailto:aangulo@amphibians.org)). Giuseppe Gagliardi ([giuseppegagliardi@yahoo.com](mailto:giuseppegagliardi@yahoo.com))

# Report on Amphibian Red List Authority Activities 2013-March 2014

By Ariadne Angulo, Jaime Garcia Moreno & Jennifer Luedtke



Red List training and assessment workshop, 12-16 August, 2013, Chengdu, China. Photo: Jia-tang Li.

The IUCN SSC Amphibian Red List Authority (Amphibian RLA) is the branch of the Amphibian Specialist Group (ASG) responsible for maintaining the amphibian extinction risk assessments on The IUCN Red List of Threatened Species. In this report we summarize the Amphibian RLA's activities for 2013 until March 2014.

The new 2013-2016 IUCN quadrennium provided an important opportunity to revise the structure and functioning of the IUCN SSC Amphibian Red List Authority (RLA). In this context, the Amphibian RLA is being re-structured into regional or national working groups, led by Tier I RLA members, which are taking stewardship of assessments in their respective regions.

Most of the 2009-2012 RLA members have continued their membership and we have increased our geographic coverage by bringing in new Amphibian RLA members for West & Central Asia (Uğur Kaya), Colombia (Juan Manuel Daza and Mauricio Correa), Mesoamerica (Justin Nowakowski and Tom Devitt), Southeast Asia (Jodi Rowley), Mainland South Asia (Chun Kamei) and West Africa (Nono Gonwouo, Tier I RLA with Annika Hillers). Current regions and membership can be accessed at <http://www.amphibians.org/redlist/membership/>, and we are working to expand our geographic coverage even further. We invite interested parties to contact us directly.

In early-mid 2013, the Amphibian RLA Central Coordination Team was expanded to include the Deputy Amphibian RLA Coordinator, Jennifer Luedtke, and the Amphibian Survival Alliance Director of Conservation and Partnerships, Dr. Jaime Garcia Moreno. This development has given us an increased capacity to address training, support and assessment review needs, but also the ability to expand the Amphibian RLA's membership to include institutional partners able to take on the stewardship of assessments for species in their respective region or country. As a direct result, in 2013, the Amphibian RLA signed agreements with three partners: Chengdu Institute of Biology (CIB) in China, Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO) in Mexico, and Smithsonian Conservation Biology Institute (SCBI) in Panama. Other potential partnerships are being discussed with institutions in Colombia, northern Central America, the Caribbean

(Carib-PARC), North America, the Philippines (Kansas University and University of Oklahoma) and the UK.

To equip our new partner institutions and new individual RLA members to update amphibian assessments, remote training on the Red List methodology and associated tools was completed by 23 Amphibian RLA members, 10 interns and two Amphibian RLA institutional partners from 2013 to date. In addition, four Red List training workshops were conducted in 2013-early 2014, both directed at RLA members (Sydney, Australia and Chengdu, China) and the wider scientific community (Salvador, Brazil and Iquitos, Peru).

To facilitate collaboration between RLA members and the wider herpetological community on the assessment or reassessment of amphibian species, the Amphibian RLA launched a new and improved Amphibian Assessment Forum online platform (<http://www.amphibians.org/redlist/forum/>). This tool was developed in collaboration with ASG and iNaturalist. Four regional or national-themed forums are already in place (see <http://www.amphibians.org/redlist/forum/>), with an additional two in the process of being set up (Panama and Philippines). The Amphibian RLA is looking into creating more forums as more working groups are set up and new institutional partners join the Amphibian RLA.

Last year saw a total of 412 amphibian extinction risk assessments and reassessments submitted and published on the IUCN Red List of Threatened Species. A total of 205 amphibian assessments and reassessments have already been submitted for Red List version 2014.1. While this is a significant improvement from previous years, the work is far from over. The number of assessments that need to be reassessed by the end of 2014 is well over 4,400. This high number is due to the 10-year lifespan of IUCN assessments, and most amphibian assessments were published in the 2004 Global Amphibian Assessment initiative. In addition, over 800 newly described species also need to be assessed for the first time.

The size of our task this year highlights the need for increased resources, increased participation and a sustainable strategy to maintain the *Amphibians on the Red List* database updated. The Amphibian RLA has therefore ventured into the realm of online crowd-funding to seek support for its activities, and in this context, on 11 February 2014, the George Rabb amphibian assessment mini-fundraising campaign was launched. This appeal for funds was sent to ASG members in developed countries, and was supported by a secure web platform for the receipt of donations (<http://www.amphibians.org/support/redlisting>). A total of USD\$ 1,925 was received as a result of this campaign, with 98% of the funds coming from the original challenge. The Amphibian RLA is currently working on developing another mini-fundraising campaign, this time directed to the general public. We envision launching this campaign by mid-2014.

The Amphibian RLA is always keen to hear of ASG members who might be interested in leading or contributing to the amphibian assessment update process. If you or anyone you know is interested in working with us, please contact a member of the Amphibian RLA Central Coordination Team:

Ariadne Angulo ([ariadne.angulo@iucn.org](mailto:ariadne.angulo@iucn.org))

Jaime Garcia Moreno ([Jaime.GARCIAMORENO@iucn.org](mailto:Jaime.GARCIAMORENO@iucn.org))

Jennifer Luedtke ([Jennifer.LUEDTKE@iucn.org](mailto:Jennifer.LUEDTKE@iucn.org))



# Earth Day 2014: Protecting Herpetofauna Habitat in the Peruvian Amazon



El Cono, Sierra del Divisor, Peru. Photo: Diego Pérez/CEDIA.

By Joe Lowe

Peru's Sierra del Divisor Range, located deep within the Amazon Basin, is a rugged interruption to the region's otherwise level landscape. It is also home to a unique collection of tropical herpetofauna, including 68 amphibian and 41 reptile species. And likely there are more. A rapid biological assessment led by the Chicago Field Museum in 2005 resulted in the discovery of several potentially new amphibians, most notably a new species in the *Eleutherodactylus* genus.

"We expect that with additional surveys, especially during the wet season and in the southern portions of Sierra del Divisor, the regional count will surpass 200 herpetofauna species," wrote Moisés Barbosa de Souza and Carlos Fernando Rivera Gonzales, co-authors of the Field Museum's 2006 report, who rank the Sierra del Divisor as a high conservation priority for amphibians.

Threatened species in the Sierra del Divisor include the Yellow-spotted turtle (*Podocnemis unifilis*), one of the largest turtles found in South America. Overhunting and uncontrolled egg harvesting of the species have led to its Vulnerable listing by the IUCN.

To protect the Yellow-spotted turtle and other local herpetofauna, Rainforest Trust has launched a campaign to preserve 100,000 acres of the Sierra del Divisor for Earth Day. This campaign is part of a larger effort to protect the Sierra del Divisor from imminent threats, including oil and mining development, road and pipeline construction, hunting, and illegal logging.

Working with its Peruvian partner, CEDIA, Rainforest Trust will create a Sierra del Divisor National Park, a White Sands National Reserve, and obtain land titles for 57 communities that will form a buffer zone around the protected areas. In total, 5.9 million acres

will be protected over four years.

"The areas we are working to protect will provide critical refuge for the region's herpetofauna," said Dr. Paul Salaman, CEO of Rainforest Trust. "Our Earth Day campaign is a way for us to build awareness about threats facing the Sierra del Divisor while working to ensure they are prevented. It's also a chance for supporters to have a major impact since we can protect acres in the Sierra del Divisor for only 50¢"

To learn more about Rainforest Trust Earth Day efforts: [www.rainforesttrust.org/acres-for-50cents](http://www.rainforesttrust.org/acres-for-50cents)



Yellow-spotted river turtle. Photo: Geoff Gallice.





*Art has the power to raise awareness and inspire personal action*

# HOW CAN I HELP?



**The mission of the Disappearing Frogs Project is to apply the power of Art in support of scientific, educational and community efforts focused on the preservation of amphibians.**

**Want to Start Something Really Fabulous in your Town?**

## WHO?

Individuals who want to take action by bringing attention to the fact that Amphibians/frogs are in great danger of extinction.

## WHAT?

- 1) Using ART as a vehicle to bring awareness to environmental issues.
- 2) If you are moved by the message that Amphibians are special and need protection from extinction
- 3) If you want to join others to create an ART EVENT that invites and encourages artists to get involved, then please

## CONTACT?

**Terry Thirion, Project Director (704-334-0800)**  
DISAPPEARING FROGS PROJECT  
<http://www.amphibians.org/disappearingfrogsproject>  
[tthirion@aol.com](mailto:tthirion@aol.com)  
or [NCSaveTheFrogs@gmail.com](mailto:NCSaveTheFrogs@gmail.com)

The primary causes of amphibian extinctions are pollution, loss of habitat, climate change, invasive species, road mortality, over-harvesting for the pet and food trades and the infectious disease, Chytridiomycosis, spread by human activity. You can help.

- Reduce your carbon footprint! What is good for the planet is good for frogs.
- Use less water where you can. For example, turn off the tap while you brush your teeth. When we use less, less needs to be treated.
- Slow down or refrain from driving in rural areas on rainy, spring or summer nights – frogs crossing.
- Watch what you throw away — and where you throw it away — to keep frog habitats trash-free. The water that ends up in storm drains often travels through forests and grasslands and dumps into wetlands – all prime frog habitats.
- The water table on which we all depend, collects a lot of the chemicals we flush down our drains or toilets, despite our best efforts to treat the water. Properly dispose of paint, cleaning products, solvents and out of date drugs.
- Chemical pesticides and herbicides used on lawns and in agriculture wash into streams harming frogs and causing mutations.
- Eat local, organic foods when possible.
- Use native plants and grass in your yard, which require less water and chemicals.
- If you choose a frog as a pet, purchase from a local breeder and never release it into the wild.
- Do not purchase wild caught frogs for eating or dissection.
- Vote in favor of the environment.

### Please Consider a Financial Contribution

Contributions are tax-deductible. Disappearing Frogs Project is affiliated with Amphibian Survival Alliance, the world's largest partnership for amphibian conservation.



Thank you!

**DISAPPEARING FROGS PROJECT**  
**ART AWARENESS ACTION**



Photo: Jaime García Moreno.

## Challenges and Opportunities in Salamander Conservation

By Jaime García Moreno

“An animal shaped like a lizard and with a body starred all over. It only comes out during heavy showers and can never be seen when it is dry. It is so cold that, just like ice, it can extinguish fire on contact...” So began Pliny the Elder’s description of the salamander two thousand years ago. Since then, many more legends have developed around salamanders, including many related to fire. In some places people still look at salamanders with awe and even throw them in to the fire, afraid of their magic powers.

Our knowledge of salamanders has improved since the times of Pliny, and we currently count some 670 described species of salamanders. This means that about every 11<sup>th</sup> amphibian species is a salamander. Unlike frogs and caecilians, the highest species richness of salamanders is not in the tropics: they are pretty much absent from Africa, Oceania, much of tropical Asia and most of South America. This is a mostly temperate group that can be found in North America, Europe and Northern Asia, with the Appalachian Mountains forming a real diversity hotspot. The countries with most species are the US (174 species) and Mexico (135 species); the Central American countries together are home to 160 species, and there are more species in Guatemala (63 species) or Costa Rica (49

species) than in all of Europe, where 36 species can be found. In Asia, China (64 species) and Japan (27 species) are the most diverse countries.



Photo: Jaime García Moreno.





Photo: Jaime García Moreno.

Sadly, salamanders are in trouble all across their range. Nearly every other salamander species in the world falls under one of the threat categories of the IUCN Red List of Threatened Species™. Moreover, because there are also several species for which little is known, only one out of three salamander species is really considered to be in a healthy situation. In some countries the situation is really alarming: in Mexico, only 15 of the species that live in the country are considered to be healthy or, in other words, nine out of ten salamander species that occur in Mexico face some problems, with a full 96 species classified as Threatened. In Guatemala the figures are similar, with seven out of every eight species living in Guatemala facing conservation problems. It is very likely that



Photo: Jaime García Moreno.

some species in Mexico and Guatemala could already be extinct at the same time that new species are still being discovered in both countries. Earlier this year researchers in Mexico City announced they had failed to find a single axolotl (*Ambystoma mexicanum*); unfortunately it is not the only *Ambystoma* species on the brink of extinction in Mexico. Habitat destruction and degradation are the biggest problems encountered by salamanders in the New World. For many terrestrial species with very small distributions, cutting down the patches of forest where they occur can quickly lead to extinction. For the more aquatic species, habitat degradation is an enormous challenge, as water is managed for human consumption and the watersheds are often polluted and filled with invasive species like Nile perch (*Tilapia* sp.) that do not seem to go well together with the salamanders.

In Europe every third species is classified as Threatened. Some European salamanders have been declining since the 1980s due to reduction and fragmentation of habitat caused by the diversion of water for agricultural purposes, pollution, as well as the introduction of fishes - conditions not too different to what we find in the Americas. In addition, some species like the Sardinian newt (*Euproctotus platycephalus*) are known to be having problems with *Batrachochytrium dendrobatidis* (*Bd*), which is also known to affect some species in the Americas and could be involved in some of the declines seen in Mexico and Central America. Of great concern in Europe is the recent detection of a new species of fungus (*B. salamandrivorans*) that seems to be responsible for the sudden dramatic population declines seen in the Fire salamanders (*Salamandra salamandra*) of the Netherlands; last January it was announced that the new fungus has now been detected in Belgium.



Photo: Jaime García Moreno.



The picture for salamanders in Asia is not much better. Every other Chinese salamander is considered Threatened (23 out of 44 species), and in Japan the situation is not much better (10 out of 23 species). All four salamanders known from Taiwan are considered threatened, with one already locally extinct on the island.

While things look difficult for many salamanders, there are some positive developments that could be replicated. For example, based on a combination of niche modelling and careful study of collected specimens from different museums, Mexican scientists have discovered populations of some highly threatened species in Veracruz state. In addition to that, two "lost salamanders" of the genus *Chiropetrotriton* were rediscovered in 2010, after being missing for 70 years. Other studies in that region have shown that some salamanders can persist in shade-coffee plantations. In Guatemala, the recently set up Sierra Caral reserve protects several salamanders and frogs. In Europe, in addition to improving our understanding on the spread and dynamics of the chytrid fungi, there has also been an attempt to develop assisted breeding programs - thus, the Dutch have set up *ex-situ* assurance colonies of their fire salamander, and an assisted breeding program is being started for the Sardinian Newt. Some policy tools are starting to consider amphibians: the Bern Convention has embraced a conservation action plan for the Crested newt complex (*Triturus cristatus*, *T. carnifex*, *T. dobrogicus*, *T. karelinii*), and the European Commission, through its

LIFE initiative, supported some efforts to restore habitats used by Crested newts in Finland and Estonia, and to create a metapopulation structure of this species in the Netherlands. It also supported actions in support of the Southern crested newt (*T. carnifex*) and Spectacled newt (*Salmandrina terdigitata*) in Italy. In addition the EU Habitats Directive now include the conservation status of herpetofauna and urges conservation measures from its Member States, and through the implementation of its complementary Water Framework Directive it is expected that it will help secure the conditions needed by water-dependent amphibians.

These examples demonstrate that in spite of the difficulties faced by these fantastic creatures we cannot give up. Thanks to these and other efforts some salamanders have a brighter future today than they did yesterday. Other encouraging case studies are presented in more detail in an accompanying article in this volume. Education seems to be, as often is the case, an area that deserves more attention. In this regard, perhaps we need to imitate the Japanese, who have fully embraced the giant salamander as an iconic creature that deserves attention. We need to learn how to inspire similar feelings on the different communities that share their environments with these amazing creatures, and since many of them are restricted to very small areas, we need to involve them and turn them into the guardians of these unique and wonderful creatures.



Photo: Jaime García Moreno.



# Saving Salamanders; Approaches as Diverse as the Animals Themselves

By Candace M Hansen, Jaime García-Moreno, Robin Moore, Ben Tapley, Carly Waterman, Karla Pelz Serrano, JJ Apodaca & James P Lewis



Lake Lerma Salamander, *Ambystoma lermaense*. Photo: Karla Pelz Serrano.

**A**s we move further into the Year of the Salamander we wanted to celebrate some of the great efforts underway around the world to help save these incredible creatures. Here we showcase a number of projects that utilize different, and sometimes innovative, approaches to addressing conservation challenges. In all the cases the success is dependent upon a collaborative effort, an approach that is the foundation of the Amphibian Survival Alliance. During the Year of the Salamander, the ASA is committed to helping highlight the plight of Salamanders around the world and through the Alliance implement action to address some of these challenges. It is hoped that when the next Year of the Salamander comes around that we will have an even longer list of salamander success stories to showcase.

## SAVING HABITAT AND SPECIES THROUGH PARTNERSHIPS

**Focal Species:** Moss salamander, *Nototriton brodiei* (Critically Endangered) and Wake's hidden salamander, *Cryptotriton wakei* (Critically Endangered).

**The Challenge:** *Habitat fragmentation* - One of the richest concentrations of salamanders in Central America occurs in the the Sierra Caral, an isolated massif that rises from Caribbean coast of Guatemala to 1,100 meters above sea level just a stone's throw from the border with Honduras. The wet forests are home to one of the world's largest arboreal salamanders, Doflein's salamander, *Bolitoglossa dunnii*, which grows to an impressive 11.5 cm from snout to vent and is classified as Near Threatened. This salamander lives alongside the Moss salamander, *Nototriton brodiei* (Critically Endangered), Wake's hidden salamander, *Cryptotriton wakei* (Critically Endangered), Mushroom tongue salamander, *Bolitoglossa odonnelli* (Endangered) and Dunn's climbing salamander, *Bolitoglossa dunnii* (Endangered) and the newly discovered *B. nympha*. Despite the importance of this area there has historically been a lack of any real protection, and the forests of the Sierra Caral were becoming increasingly fragmented in favor of land for cattle ranching.

**What was done to address the challenge:** In 2010, when 2,400 hectares of forest came up for sale, it presented a challenge and an opportunity to acquire and protect a critical tract of salamander habitat. In an effort led by local NGO FUNDAECO and supported



Arboreal salamander, *Bolitoglossa dofleini*. Photo: Robin Moore.

by numerous international conservation groups, the area was successfully purchased, registered as a private nature reserve, and set aside for protection and management.

**Next steps:** FUNDAECO continue to urge National Congress to declare a broader Protected Area in the Sierra Caral, and it is hoped that this success story will provide a model that can be replicated in other important habitat for threatened salamanders in Guatemala and beyond.

## SAVING A SPECIES FROM OVERHARVESTING

**Focal Species:** Chinese giant salamander, *Andrias davidianus* (Critically Endangered).

**The Challenge:** *Overharvesting*—The Chinese giant salamander is the world's largest living amphibian, reaching lengths of over 1.8 m. It belongs to a small and ancient group of salamanders that diverged from their closest relatives during the Jurassic period over 170 million years ago. Although revered by the Chinese for thousands of years, Chinese giant salamanders are threatened today by over-harvesting for human consumption. They are taken from the wild and farmed as both a luxury food item and an important source of Chinese traditional medicines. Overharvesting has had a catastrophic effect on the wild population, which is estimated to



Chinese giant salamander, *Andrias davidianus*. Photo: Ben Tapley/ZSL

have declined by 80% since 1960. Disease and the destruction and degradation of the streams and pools it inhabits are also having a negative impact.

**What was done to address the challenge:** The Chinese giant salamander is ranked 2<sup>nd</sup> on the Zoological Society of London's EDGE amphibians list, which prioritizes Evolutionarily Distinct and Globally Endangered (EDGE) species for conservation attention. ZSL brought local and international stakeholders together in 2010, to develop a strategy for saving wild populations of Chinese giant salamanders. This strategy is now being implemented by ZSL and partner organizations, the Kunming Institute of Zoology, Shaanxi Normal University and Guiyang University with support from the Darwin Initiative.

**Next steps:** As the project develops the following will be undertaken to ensure the long-term survival of the species: range-wide ecological and community interview surveys to establish the current distribution and threats facing wild Chinese giant salamanders and build an evidence base for long-term monitoring; genetic analysis to understand the relationship between salamanders in different river systems; identifying disease threats and working with farmers to improve biosecurity in farms; establishing a conservation breeding facility in China; raising awareness among key stakeholders and the general public; and strengthening capacity of partner organizations to undertake long-term conservation of this iconic species.

## SAVING A SPECIES THROUGH CONSERVATION ACTIONS PLANS

**Focal Species:** Lake Lerma salamander, *Ambystoma lermaense* (Critically Endangered).

**The Challenge:** Habitat has been degraded in the last 100 years and now there is only a small portion left of what once was the largest wetland in central Mexico. The Cienagas de Lerma consists now of three independent water bodies covering about 3,000 ha on the outskirts of the city of Toluca, at 2,600 m asl. This is what is left of the once huge wetlands in central Mexico: it is estimated that wetlands occupied over 100,000 ha in Mexico and over 30,000 ha in

Toluca, west of Mexico City. The area of Lerma is itself of interest because it is one of the last examples of high elevation wetlands along the central Mexican highlands. It is not only the last habitat for the Lerma salamander, but also for several other species including endemic fish, birds, mammals and plants and is an important stopover area for waterfowl which number up to 100,000 individuals at peak time. One bird endemic to the area, the Slender-billed grackle (*Quiscalus palustris*), went already extinct in the early 20<sup>th</sup> century. This area is also important to recharge the water level of the region and also to avoid floods in the surrounding areas. In former times, this salamander and other amphibians from the area were part of the diet of the local people. The current area has pressures from urban and agricultural developments, water exploitation and pollution.

**What was done to address the challenge:** Fortunately, since 1991 the Mexican authorities have been working towards the conservation and recovery of the area. A National Park comprising 1,400 ha was established in 1,999, and the same year the area was recog-



Lake Lerma salamander, *Ambystoma lermaense*. Photo: Karla Pelz Serrano.



nized by CONABIO (National Commission on Biodiversity) as a priority for biodiversity conservation. BirdLife has also recognized the area as an Important Bird Area, and in 2002 the area was recognized as a Federal Natural Protected Area. A decree by the authorities has forbidden any discharges into the system or the deviation of the water flow, and a management plan is being developed by the CONANP (National Commission of Natural Protected Areas). Since 2004 the area has been recognized as a Ramsar site by the Convention on Wetlands.

**Next steps:** Karla Pelz Serrano, a conservation biologist and EDGE Fellow is currently working in the restoration project of the remnant of what was once the largest wetland in central Mexico. This is still the habitat of many endemic species such as the Lake Lerma salamander. Karla's focus is on research projects that evaluate the conservation status of some species of the wetland in order to generate Conservation Action Plans to ensure the survival of the species. She will also be using conservation genetics as a tool to assess the conservation status of Threatened species. As part of her EDGE Fellowship she will be working on the development of the conservation strategy for the Lake Lerma salamander in particular.

### WORKING WITH INDUSTRY TO SAVE A SPECIES

**Focal Species:** The Red Hills salamander, *Phaeognathus hubrichti* (IUCN Endangered, USFWS Threatened).

**The Challenge: Restricted habitat and economic pressures** - The southeastern United States is home to a staggering variety of salamander species. Unfortunately, it is also home to some of the most imperiled salamanders on the planet. One such species is the Red Hills salamander (*Phaeognathus hubrichti*), which is considered to be Endangered by the IUCN and threatened by the USFWS. The Red Hills salamander is one of the largest lungless salamanders (Family Plethodontidae) in the world, reaching nearly 1 ft. (0.3 m) in length. Despite this incredible size, the Red Hills salamander was not discovered until 1960, most likely due to the fact that they spend the vast majority of their lives within an intricate burrow system. They are so dependent on their burrows that they have evolved numerous interesting adaptations to life underground, such as a prehensile tail, reduced legs, modified eyelids and ears, extra vertebrae, a reinforced skull, and an efficient system of feeding only at their burrow entrances. Creating and living in these burrows make them dependent on a small band of silt and clay stone in Alabama's Red Hills region. Like many specialist species, their dependence

on a distinctive habitat subjects them to a high level of risk. In the case of the Red Hills salamander, the region that encompasses their small geographic range has experienced a great deal of habitat destruction and conversion by timbering operations.

**What was done to address the challenge:** Despite having federal protection under the Endangered Species Act since 1976, populations of the Red Hills salamander have continued to decline, in several cases populations have even become extirpated. Those habitat patches that have received short-term protection in the form of USFWS Habitat Conservation Plans (HCPs) are heavily fragmented, as HCPs generally tend to mitigate losses rather than foster recoveries. Until relatively recently, the Red Hills salamander lacked any long-term protection. Thanks to a combined effort from the State of Alabama's Forever Wild Program and The Nature Conservancy (TNC), around 4,000 acres were purchased in 2010 and have now been placed into permanent protection.

**Next steps:** The relatively high price of land in the region makes the acquisition of large tracts of habitat unlikely. However, current partnerships between conservation organizations, governmental agencies, and local land-owners are creating the potential for large amounts of habitat to be placed into long-term protection via conservation easements. This effort will require a robust educational outreach effort and continued collaboration between stakeholders.

### THE IMPORTANCE OF MONITORING

**Focal Species:** The Fire salamander (*Salamandra salamandra*) is considered globally a common species (Least Concern). Though common throughout much of Europe, in the Netherlands it can only be found in Limburg, the southernmost part of the country. It was considered locally threatened in the Netherlands, and now it is seen as being on the edge of local extinction.

**The Challenge: a new fungus**—The Dutch organization RAVON, through its large network of volunteers, monitors regularly the status of populations of amphibian species in the Netherlands (and also of reptiles and fish), following a monitoring scheme that was



Red Hills salamander, *Phaeognathus hubrichti*. Photo: J.J. Apodaca.



Red Hills salamander, *Phaeognathus hubrichti*. Photo: J.J. Apodaca.

jointly developed with the Dutch Central Office of Statistics. Thanks to these very well structured protocols, RAVON was able to notice that the population of fire salamanders in Limburg had collapsed by over 95% since 2004, and particularly in 2011 and 2012. In 2008 three dead animals were found, but alarms really started ringing when 15 dead animals were collected in the 2010 field season. Up until 2012 the causes for the decline were unclear and enigmatic, as no such declines were seen in the nearby Belgian or German populations. After some intensive research it is now clear that the salamanders were the victims of a fungal disease, caused by the newly described *Batrachochytrium salamandrivorans* that kills the animals after a few weeks of infection.

**What was done to address the challenge:** First of all, a very intense and focused research program was set up to understand what was behind the declines. Attention was paid not just to potential diseases, but also water and soil quality, potential inbreeding, the possibility that animals were being illegally captured, or the effect of pesticide residues. In late October 2012 it even looked as if animal diseases were going to be ruled out, and RAVON, following a precautionary principle, captured nearly 40 of the remaining animals to establish a captive breeding program. When some of the captured animals started to die, they were brought under close

surveillance at the University of Ghent. Half of the animals died in captivity, but this provided the necessary clues for researchers to identify the culprit.

**Next steps:** Monitoring by RAVON was an essential step for discovering the fungus. In 2013 several living salamanders were detected in different forest patches in the Netherlands. Unfortunately the fungus has been detected in Belgium, as was announced in January this year. As for the captive animals, after a quarantine period the surviving animals were brought to two separate captive breeding facilities in the Netherlands, in Nijmegen and in Born Castle, where they have already reproduced successfully. Some of the 120 young animals in Nijmegen will be moved to the DoeZoe in Leens in the northern province of Groningen. With the new fungus in the Dutch forests, there is a need to educate the forest visitors about the salamanders and the fungus, and the measures they can take to minimize the spread of the disease.



Fire salamander, *Salamandra salamandra*. Photo: Robin Moore.





The Endangered black microhylid frog *Melanobatrachus indicus* is a target species for conservation breeding initiatives.

## Building National Capacity in *Ex-situ* Amphibian Management

By <sup>1</sup>Brij Kishor Gupta, <sup>1</sup>Bishan Singh Bonal, <sup>2</sup>Tim Wright, <sup>2</sup>Andrew Routh, <sup>2</sup>Matthias Goetz, <sup>3</sup>Karthikeyan Vasudevan & <sup>4</sup>Benjamin Tapley

**W**orldwide, amphibian populations are declining (1), and India has more threatened species of amphibian than any other country in the Indo Malayan realm (2). The Western Ghats and Eastern Himalaya are recognised biodiversity hotspots, with high levels of amphibian endemism (3,4). The amphibians of the Western Ghats are enigmatic and new species are being described with astonishing frequency, it is estimated that just 50% of amphibians in the South Asian region have been described (5) with new amphibian genera being described as recently as 2013 (6).

Indian zoos could play a pivotal role in the conservation management of the country's threatened amphibians. In addition zoos are ideally placed to educate the visiting the public about amphibians and the threats that they face. Currently amphibians are underrepresented in Indian zoos and *Tylostrotion verrucosus* is only maintained by one institution, **Padmaja Naidu Himalayan Zoological Park** in Darjeeling. The Central Zoo Authority recognises the need to increase capacity for zoos to house amphibians.

In December the Central Zoo Authority, with the assistance of Durrell Wildlife Conservation Trust and the Zoological Society of

London, delivered a workshop in Guwahati, Assam. The aim of the workshop was to build national capacity in amphibian management. Twenty four delegates from all over India representing 22 institutions attended the four day workshop, which highlighted the specific requirements of amphibians in the design and management of *ex-situ* facilities. Participants developed hands-on skills in enclosure design, the management of water flow and quality, tem-



The Critically Endangered Road skinned frog *Indirana phrynoderma* is endemic to the Western Ghats and another target species for conservation breeding initiatives.

<sup>1</sup>Central Zoo Authority, Annexe-VI, Bikaner House, Shahjahan Road, New Delhi, 110011 India <sup>2</sup>Durrell Wildlife Conservation Trust, Les Augrès Manor La Profonde Rue, Trinity, Jersey JE3 5BP <sup>3</sup>Laboratory for Conservation of Endangered Species, Sai Hills Colony, Rambagh Colony, Hyderabad, Andhra Pradesh 500030, India <sup>4</sup>Zoological Society of London, Regent's Park, London, United Kingdom NW1 4RY

perature and light within the captive facility and the principles of amphibian nutrition, reproduction, biosecurity and conservation-education.

The potential contribution that *ex-situ* amphibian management can make to *in-situ* amphibian conservation was also covered and participants began to prioritise species and prepare a plan for coordinated conservation breeding for Indian amphibians. The ecology and biology of many amphibians in India remain unknown, it is therefore potentially difficult to keep, establish and breed Indian amphibians. There is a real need for the zoo professionals to go out and study their species in the field before embarking on the captive breeding programs. As a first step the participants selected a series of targeted model species for the zoos to practice husbandry techniques with, a vital first step for Indian zoos.

#### References

1. R.A. Alford, S.J. Richards. 1999. Global amphibian declines: a problem in applied ecology. *Annual Reviews in Ecology and Systematics*. 30: 133–165.
2. S.N. Stuart, M. Hoffmann, J.S. Chanson, N.A. Cox, R. Berridge, P. Ramani, B.E. Young, Eds., *Threatened Amphibians of the World*. (Lynx Ediciones, with The World Conservation Union, Conservation International, and Nature Serve, Barcelona, 2005)
3. N. Myers, R.A. Mittermeier, C.G. Mittermeier, G.A.B. da Fonseca, J. Kent. 2000. Biodiversity hotspots for conservation priorities. *Nature* 403: 853–858.
4. N.R. Gunawardene, A.E.D. Daniels, I.A.U.N. Gunatilleke, C.V.S. Gunatilleke, P.V. Karunakaran, K.G. Nayak, S. Prasad, P. Puyravaud, B.R. Ramesh, K.A. Bubramanian & G. Vasanthi . 2007. A brief overview of the Western Ghats – Sri Lanka biodiversity hotspot. *Current Science*. 11: 1567–1572
5. S. Molur. 2008. South Asian amphibians: taxonomy, diversity and conservation status. *International Zoo Yearbook*. 42: 143–157.
6. R.K. Abraham, R. Alexander Pyron, B.R. Ansil, A. Zachariah, A. Zachariah. 2013. Two novel genera and one new species of treefrog (Anura: Rhacophoridae) highlight cryptic diversity in the Western Ghats of India. *Zootaxa* 3640: 177–199.



Participants getting to grips with water testing.



Workshop participants.



# So in India, even Frogs like Spice in their food!

By Arun Kanagavel & Sethu Parvathy,

While undertaking social surveys in the Western Ghats of India, local communities stated that frogs encountered at cardamom plantations were killed, as they were known to eat ripe cardamom. Usually larger-sized frogs, those resembling the Common Indian toad (*Duttaphrynus melanostictus*), *Indirana* sp., *Rhacophorus pseudomalabaricus* and *R. malabaricus* were killed. These frogs were locally known as “chori tavala” (frog with warts) and “pacha tavala” (green-colored frog). Individuals from local communities or those already working in the plantations were hired to capture and kill these frogs for a payment of INR 15-50 per frog.

During a formal questionnaire survey undertaken at Munnar, Valparai and Topslip in the Anamalai Hills of the southern Western Ghats to understand the perceptions of local communities towards amphibians, eight individuals out of 99 interviewed, stated that *R. malabaricus*/*R. pseudomalabaricus* and frogs resembling *Indirana* sp/toads ate cardamom. Of 26 respondents in Munnar, nearly 10 also stated that they mostly encountered the Green gliding frogs in cardamom plantations (Fig. 1).

During a follow-up informal interview survey, respondents stated that that the frogs came to eat cardamom only when they were ripe, which coincided with the monsoon season in Kerala. A respondent stated that these frogs would stretch their tongue, plucking the ripe cardamom in the process. They stated that cardamom seeds were seen in the frog’s belly. However, another respondent stated that frogs did not eat cardamom but merely sucked on the fruits’ membranous aril. “Chera Pambu” (Rat snake) at these plantations were not killed as they were known to feed on the cardamom feeding frogs.

The only published record of the perception that frogs ate cardamom is an account from the *Notes on Cardamom Cultivation* authored by T.C. Owen in 1883 which states that cardamom was collected before they were fully ripe to “partly save the fruit from being eaten

by snakes, frogs and squirrels.” Though there is no proof that frogs actually eat cardamom, this issue raises concern towards the killing of endemic and Critically-Endangered frogs like the Anamalai gliding frog *R. pseudomalabaricus* and the Toad-skinned frog *I. phrynoderma* (Image 1) along with common ones found in this region.

This study is financially supported by the ZSL EDGE Fellowship to Arun Kanagavel under the project “Enhancing the knowledge and awareness for the conservation of the Toad-skinned Frog (*Indirana phrynoderma*) at Anamalai Tiger Reserve.”



Amphibians like the Critically Endangered Toad-skinned frog *Indirana phrynoderma* could be killed when encountered at cardamom plantations. Photo: Arun Kanagavel.

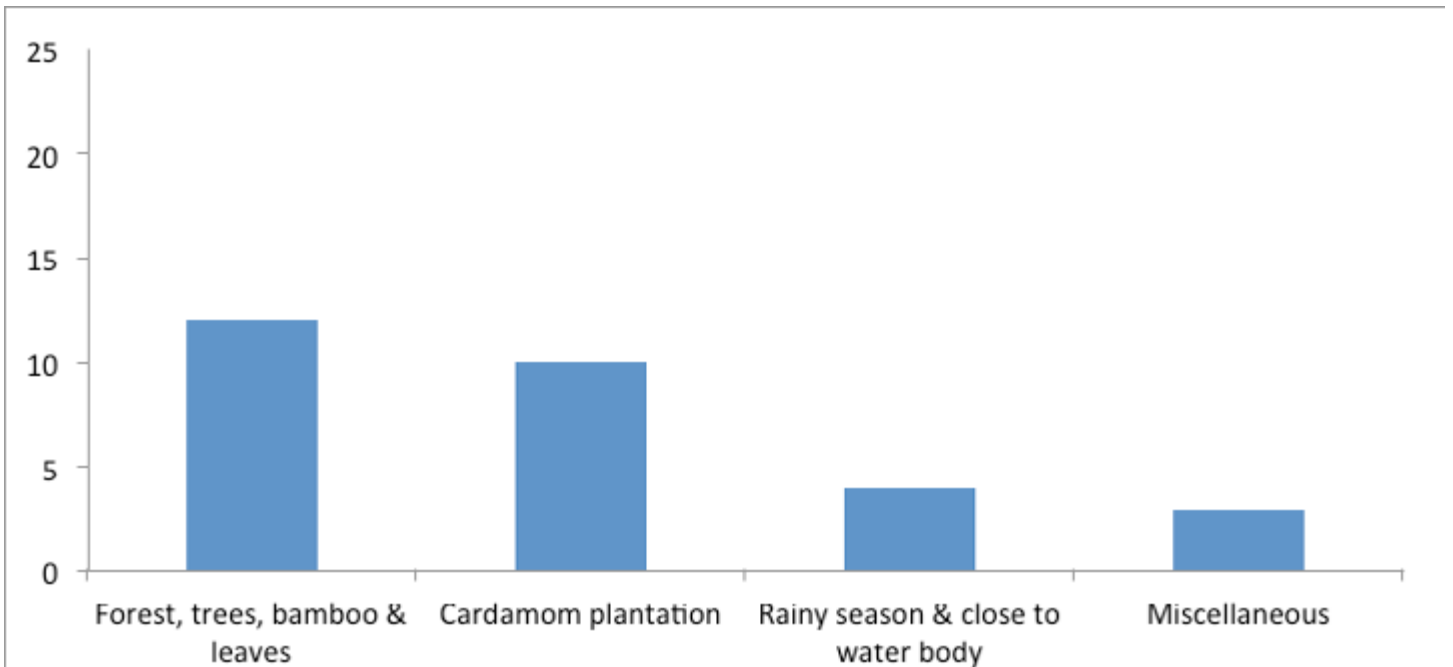


Fig 1. Habitats associated to Gliding frogs *Rhacophorus pseudomalabaricus*/*R. malabaricus* by local communities in Munnar, Western Ghats, India. Miscellaneous=Fields, Banana Plantations and inside houses.

# Pura Vida Bracelets and Amphibian Survival Alliance Design a Future for Amphibians

By Candace M Hansen & Bianca Kofman



**M**any critical habitats for amphibians lie in private hands throughout the Tropics, and are at imminent risk of destruction because of lack of restrictions on deforestation and degradation. Almost half of the world's 7,000 amphibian species are already in decline, and this is set to rise as the destruction of their habitat continues. Over 800 threatened amphibian species are found solely outside of reserves and, as such, are afforded no protection at all.

There is a silver lining, however. Because so many of these species live within a very restricted geographic range or even a single locality, a rare opportunity for conservation presents itself. Entire species can be safeguarded through the strategic protection of relatively small tracts of core habitat.

"Land purchase, where possible, can be a valuable approach to habitat protection because it places ownership and management responsibility directly in the hands of the in-country partner organization. We have found this to be effective in ensuring the long-term protection and management of key sites for amphibians, which typically have small home ranges in the tropics and therefore can be protected with the strategic acquisition of small tracts of land," says Don Church, Executive Director of the Amphibian Survival Alliance.

Protecting key habitats and empowering local communities can save entire species saved from impending extinction with relatively modest and focused investments. The Amphibian Survival Alliance provides the financial support necessary to allow local organizations to purchase and manage these critical lands.

Empowering local people is also one of the driving forces behind the ASA's newest partner, 1% for the Planet business member Pura Vida Bracelets.

Almost three years ago, two friends, Paul Goodman and Griffin Thall, created Pura Vida Bracelets after stumbling across amazing hand-made bracelets in Costa Rica while on a surf trip. Each bracelet sold helps to provide full-time jobs to over 30 local artisans in Costa Rica. Additionally, Pura Vida Bracelets wanted to do more than just help the artisans in Costa Rica, and developed the "Char-

ity Collection" to give back! Through this collection, Pura Vida Bracelets has been able to raise thousands of dollars for over 150 different charities to date.

"The Charity Collection has grown to more than we even imagined and we're so happy that we are able to support and give back to so many deserving organizations and causes," says Bianca Kofman from Pura Vida Bracelets. The hard work that goes into making each bracelet represents the dedication and respect for the beautiful land that we all live in.

The new partnership between Pura Vida Bracelets and the Amphibian Survival Alliance will empower local artisans to earn a livelihood and it helps to protect habitats and species upon which we all depend.

Visit the [Pura Vida Bracelets website](#) today to purchase your very own "Leaping to the Rescue" bracelet and proudly display your dedication to saving amphibians around the globe. The colors of the bracelet are reminiscent of the bright colors of amphibians found throughout the Tropics.

One dollar from the sale of each \$5.00 bracelet is donated to the Amphibian Survival Alliance to support amphibian conservation efforts on the ground.

It is important to remember, you are not just buying a product, you are buying a cause and a way of life. The phrase "Pura Vida" means pure life in Spanish. Enjoying life slowly, celebrating good fortune and not taking anything for granted embodies the Pura Vida Lifestyle. It's about being free and loving life to its fullest with no regrets or taking anything for granted; it's an attitude. Pura Vida directly translates into "Pure Life," simple as that!







## Amphibian Conservation Research Symposium 2014

10<sup>th</sup> and 11<sup>th</sup> May  
Zoological Society of London

Invited speakers:

Jaime Garcia Moreno (Amphibian Survival Alliance)  
An Martel and Frank Pasmans (University of Ghent)  
John Buckley (Amphibian and Reptile Conservation)

Full more details and to register or submit an abstract visit  
<http://amphibianresearch.org/symposium.html>

or email

[amphibiansymposium@gmail.com](mailto:amphibiansymposium@gmail.com)

Abstract submission deadline: 11<sup>th</sup> April

Registration deadline: 25<sup>th</sup> April

Full price: £50

Students: £35

10% discount for BHS and ISSCA members



# FROG LOG<sup>®</sup>

## Critter Saving Escape Ramp

### Throw Frogs a Log

By Rich Mason & Therese Tepe

**O**n accident, much like Rich Mason, we became aware that swimming pools are a tempting and fatal place for frogs and, too occasionally, other amphibian and wildlife species. Unlike Rich, however, when we found out about the saga playing out in pools worldwide, there were available solutions. In 2004, Rich set out to create a device for pools that would enable almost all wildlife that fell in to be able to get back out before drowning or dying of chlorine poisoning.

What followed was the creation of the FrogLog. The FrogLog shares the same name as this publication and works towards a similar mission of protecting amphibians. It was only natural for us to strike up a beautiful partnership! The FrogLog Co became an official Amphibian Survival Alliance (ASA) partner in March 2014.

#### HERE'S RICH'S AND THE FROGLOG STORY

In June of 2004, Rich's good friends, who had recently built an in-ground swimming pool on their wooded lot near Baltimore, Maryland, called to let him know frogs were dying in their pool. Nearly every day, between one and several frogs and toads were removed from their pool; some were alive but others were dead in the skimmer basket. One morning, after a warm rainy night, an astonishing 53 frogs and toads were found in the pool. He spoke with other friends with swimming pools and heard similar stories. In addition to frogs, there was the occasional mole, mouse, baby bird, opossum, turtle, salamander, squirrel, bat, chipmunk and more.

As a wildlife biologist, Rich found this information troubling and decided to seek a solution. There were a few products already on the market but he found that all had shortcomings. He decided to build his own device. Foam and fabric material was gathered, the

sewing machine was pulled out and the resulting floating device with a mesh tether was constructed and placed in the pool.

For the first few days they did not find any dead animals in the pool. However, they could not tell just how effective the device was since there was no way to know how many animals had fallen in. To better document the efficiency of the FrogLog, a funnel trap was placed at the top of the device to catch all the animals that climbed up and out of the pool.



Photo: Rich Mason.

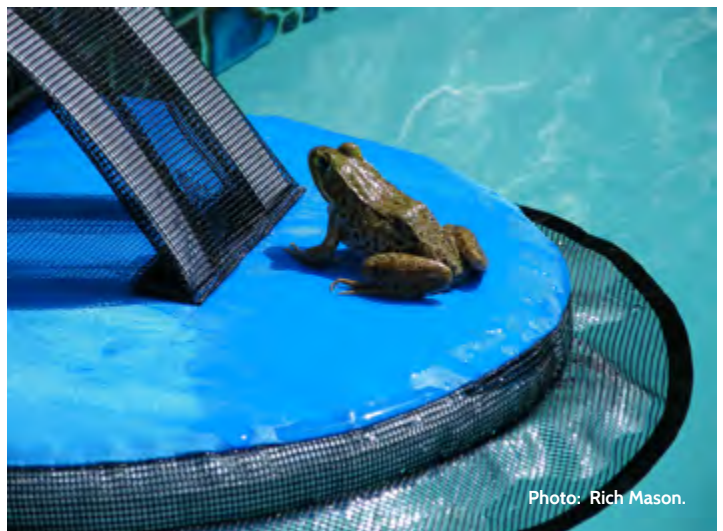


Photo: Rich Mason.

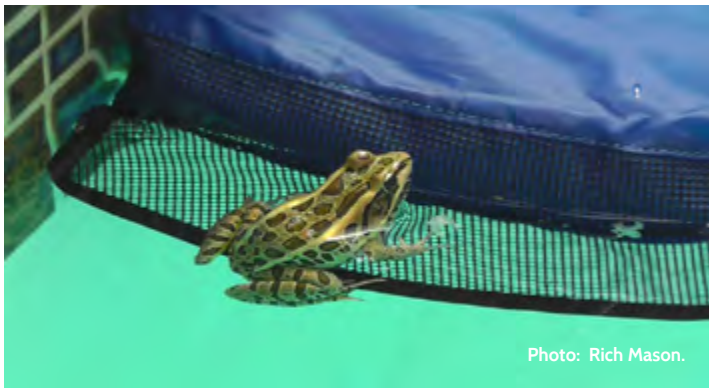


Photo: Rich Mason.





Photo: Rich Mason.

During a 23-day period in late summer and early fall, 47 American toads (*Bufo americanus*) and three Green frogs (*Rana clamitans*) were removed alive from the funnel trap. Two dead American toads were found in the skimmer basket. During this brief test period, the Froglog was 94% effective at allowing trapped amphibians to climb out of the pool.

### KICKSTARTER CAMPAIGN FOR RESEARCH AND DEVELOPMENT

By finalizing a product and making the FrogLog available to the public, Rich's company has helped thousands of owners of pools avoid large fatalities of wildlife. But, they aren't stopping there and they are back to the drawing board to enhance the model through research and development. They just wrapped up their successful campaign on Kickstarter to raise \$1,500 to add features to the current product and to create options for larger wildlife such as rabbits and basement window wells.

### WHERE TO NEXT

The FrogLog Co is interested in working with the pool industry and conservation community on promoting pool owners to conserve native animals. Thousands of pools now have the FrogLog, but millions of pools remain without. They are also looking to work with scientists to document and better understand this issue as little research has been done. They are very interested in working with researchers or grad students to better understand this problem and begin to estimate the impact; similar to what has been done to estimate the bird and small wildlife impact from outdoor and feral cats, cell tower impact to migrating birds, and the impact of glass windows to birds.

### HOW TO HELP WILDLIFE IN YOUR POOL - ADVICE FROM THE FROGLOG CO

- Use a swimming pool animal escape device such as the FrogLog.
- Enclose a pool with a screen to exclude frogs, mice and other small animals from access to pools. This, however, is an expensive solution.

- Use a pool cover, especially at night, to reduce, but not eliminate, frog access to pools. Small animals will still crawl under the cover. In addition to a cover, install an animal escape device.
- Install a solid wooden fence around the pool to reduce animal access. Install metal flashing or screen around the base of a chain link or open picket fence to reduce amphibian access.
- Use a non-toxic method to sanitize the water such as ionization. This will reduce the animal exposure to toxic chemicals but still not prevent animals from drowning.

### ASA PARTNERSHIP

The FrogLog Co and ASA are working together to spread the word about each other's missions. We hope that by combining our reach we will be able to accomplish more for the protection of amphibians. In addition, The FrogLog Co will give 20% of the sales of the FrogLog product to ASA from purchases made from ASA's SHOP page. If you, or an acquaintance with a pool, are in need of a FrogLog, please find them here: <http://www.amphibians.org/shop>. ASA will receive 20% of sales generated through the ASA web site.



Photo: Rich Mason.

# Brake for Wildlife

By Wendy Collinson

The Endangered Wildlife Trust's Wildlife & Transport Programme (EWT-WTP) needs your help recording roadkill data and has launched the Roadwatch South Africa smartphone app to make your participation in their Roadkill Research and Mitigation Project easier.

To take part simply type this link into the Safari browser on your Android platform phone: <http://www.prismsw.com/roadwatch/android/RoadWatchSouthAfrica.apk>

We are hoping that the app will be available on the Apple platform shortly. If, during your travels, you spot any roadkill on our roads please record your sighting via the app and the EWT-WTP will use the data you share in their work to reduce the impacts of transport on our wildlife.

You can also send your sightings to us at [roads@ewt.org.za](mailto:roads@ewt.org.za). We need the location (preferably GPS co-ordinates), species seen and date.

Thousands of collisions occur annually between vehicles and wildlife or domestic livestock. If animals are hit they can cause extensive damage to vehicles and/or serious or fatal injury. This has negative consequences for both people as well as South Africa's wildlife. Species most at risk are nocturnal species such as Civet and Bat-eared foxes as they are less visible to drivers; owls which hunt mice feeding on or next the road; slow moving species such as tortoises and chameleons; snakes sunning themselves on the roads; and those that are blinded by headlights such as hares and many antelope.

In addition to the many thousands of animals killed on our roads every year, many South African road users are injured or killed as a result of collisions with wildlife each year and almost R1.4 billion worth of damage to vehicles is reported from these incidents.

Data submitted by volunteers has already enabled us to identify some areas of concern and initiate projects aimed at reducing the incidence of roadkill in those areas. Your data will enable us to cover a much wider geographical range and work towards ensuring

the environmental sustainability of the country's transport infrastructure.

We challenge you to record as much roadkill data as possible and send it to us... and we further challenge you to become a GivenGain activist and pledge your support with a donation for this project.

The Brake for Wildlife will start on 1<sup>st</sup> March and with the draw for the most entries taking place in November. The EWT has a fantastic Hamper full of exciting EWT goodies for the person who collects the most data, with great prizes for second and third place.

Regular updates of the challenge will be posted on the EWT Facebook page and you can follow us on Twitter (@EwtRoads).

In 2012 the Endangered Wildlife Trust merged two of its successful programmes, the Roadkill Research and Mitigation Project and the highly successful, ground-breaking Airport Wildlife Programme (AWP) to form the Wildlife & Transport Programme (WTP). Based on expressed interest from key role-players in various transport sectors, and the increasing need to address biodiversity conservation in the rapidly growing, but potentially impactful transport industry, the EWT decided to build on its experience working in the aviation sector to increase the scope of the AWP to encompass the broader transport industry. This will ensure a more integrated and comprehensive conservation approach.





# 2014 Year of the Salamander Campaign Has Been Busy!



**P**lease check out our Year of the Salamander website at [www.yearofthesalamander.org](http://www.yearofthesalamander.org)! You can view or download the State of the Salamander document as well as our monthly newsletters and calendars. We are continuing to accept submissions for our monthly photo contest, so it is not too late to enter! Don't forget to get your Year of the Salamander 2014 gear at the PARC Store ([www.cafepress.com/parcstore](http://www.cafepress.com/parcstore)). The merchandise features the Year of the Salamander winning logo and a 2014 print wall calendar (the photos are amazing!).

## OUTREACH AND EDUCATION PAGE NOW AVAILABLE!

A new page dedicated to Year of the Salamander outreach and education activities has been added! It contains face painting templates and notecards, slide show and script, posters, and an educational packet for naturalists and teachers. We will be updating that page to include links to additional educational resources available, so please check back! We also have an active social media campaign, including facebook and twitter. Like us on facebook to participate in Mystery Mondays, trivia challenges and coming soon will be Salamander Saturdays.

## VIDEO CONTESTS - NEW!

The Year of the Salamander campaign has a new opportunity to get involved with the Year of the Salamander through two new video contests: "Salamanders Matter" and "Salamanders Are ...". For the "Salamanders Matter" contest we are looking for short videos (less than 4 minutes) that will help raise awareness to the general public about salamanders around the world. For the "Salamanders Are ..." we are looking for very short clips (less than 10 seconds) that we will choose from to create a compilation video for the Year of the Salamander. Please check out our Video Contest Page on the website to find out more details about these contests and how to participate! ([www.yearofthesalamander.org](http://www.yearofthesalamander.org))

*Have you ever wanted to visit the Namib Desert?*

**Herpetological Association of Africa**

**The 12th Conference**

**Gobabeb Research & Training Centre, Namibia**

**Wednesday 19th to Saturday 22nd November 2014**

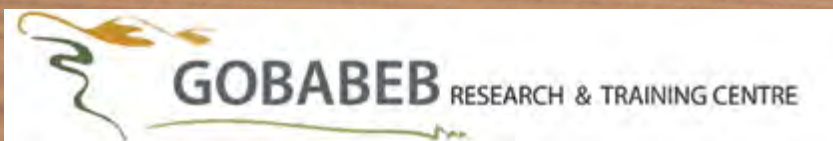
**Limited places**

**Registration closes: 31 May 2014**

[www.africanherpetology.org](http://www.africanherpetology.org)



*Ex Africa semper  
aliquid novi*





# Salamander News

No. 4

April 2014

www.yearofthesalamander.org

## The Southern Appalachians: Salamanders Galore!

Patrick Brannon, Highlands Biological Station, Highlands NC



Red Salamander (*Pseudotriton ruber*); photo by Steve Tilley.

The southern Appalachian Mountains boast some of the highest levels of biological diversity in the temperate world, and one of the most diverse groups is salamanders. More salamander species exist here than perhaps anywhere else in the world, and nowhere are they more abundant (see map below). More than 45 species of salamanders representing five families occur in western North Carolina alone.

Salamanders are often the most abundant group of forest-floor vertebrates, and play significant ecological roles as predators on a variety of invertebrates, and also as prey for snakes, shrews, birds, and even each other.

Salamander biomass in the southern Appalachians can exceed that of all other vertebrate predators combined, with densities as high as 2 salamanders per square meter!

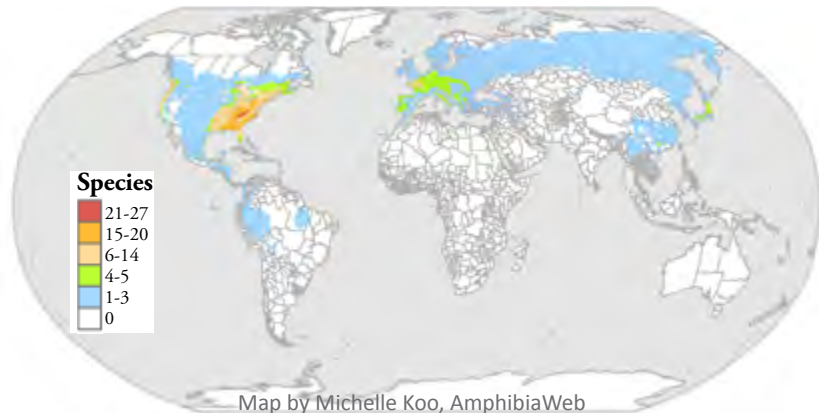
Environmental moisture is essential for the survival of salamanders because most species lack lungs and respire directly through their skin. The region is considered to be a temperate rainforest, and its cool, wet climate provides an ideal environment in which salamanders may live and reproduce. Salamanders are most abundant in old-growth forests, where large amounts of rotting logs and moisture-conserving leaf litter provide optimal microhabitats for terrestrial species.

Part of the reason why there are so many kinds of salamanders in the southern Appalachian region is the wide range of elevations (around 1000 to 6000 feet, 600–1800 m). This altitudinal variability mimics the latitudinal changes you would experience traveling north to Canada, only over a much shorter geographic distance. Animals common to the southeastern U.S. thrive in the foothills, while species common to northern states find suitable

*Continued on p. 5*

Inside:	page
Photo Contest & Calendar	2
Video Contest!	3
Year of the Salamander Partners	4
Cheat Mountain Salamanders	6
Kentucky Wetlands Study	7
Tremont Citizen Scientists	8
Orianne - Observers Wanted	9
Forestry and Salamanders	10
Family of the Month	13
Wilderness Ranger Story	14

### Global Salamander Species Richness



sponsored by **PARC - Partners in Amphibian and Reptile Conservation**





## Get Your April Photo Contest Calendar - Free!

Keeping a Northern Dusky Salamander (*Desmognathus fuscus*) like this one happy requires cool, clear water. Photographer Noah Charney captured the essence of both salamander and habitat in this month's winning photo. Download the March calendar to get the big picture and see the gorgeous runner-up at <http://www.parcplace.org/images/stories/YOSal/YoSalCalendarApril.pdf>.

### Call for Photos for the 2014 Year of the Salamander Calendar Photo Contest

We are seeking close-up, digital photos of salamanders, preferably in their natural habitats or within an educational or conservation context. One winner will be selected each month to be the featured photo as part of the Year of the Salamander online calendar. Runner-up photos will also be included in the calendar. In addition, all submitted images will be considered for use in the Year of the Salamander monthly newsletter and website as well as other Year of the Salamander-related conservation, outreach, and educational efforts. Give us your best shot! For more information and for entry details, please visit <http://www.parcplace.org/images/stories/YOSal/YOSphotocontest.pdf>.



Yet another beautiful Appalachian Salamander from the Photo Contest: the White-spotted Slimy Salamander (*Plethodon cylindraceus*), by Marty Silver.

### Are Sirens calling you?

We especially need photos of some of our more elusive salamanders, the sirens, mudpuppies, amphiumas, and torrent salamanders, as well as species in the family Hynobiidae, and *Triturus* newts. If you have a good shot of any of these species that you're willing to enter in the photo contest, send them on in!

### Salamander Art Exhibit Seeks Artists! - Deadline April 13

Partners in Amphibian and Reptile Conservation (PARC) has designated 2014 the Year of the Salamander to bring awareness to conservation issues surrounding these amazing amphibians. As an official partner of PARC, **Art.Science.Gallery.** (Austin, TX) is pleased to announce our *open call for a group exhibition of artworks inspired by salamanders!* We are seeking original artworks about salamanders, including, but not limited to works that address the role of salamanders in the natural and changing world, including aesthetic, cultural, economic, educational and scientific aspects of their biology and natural history. Works may also explore data sets about salamander populations, species relationships or biogeography. This exhibition will be held May 24 - June 22, 2014, and is intended to enhance public understanding of salamanders, their diversity, and the importance of science and conservation. Please visit [www.ArtScienceGallery.com](http://www.ArtScienceGallery.com) for details; the submission deadline is **April 13, 2014.**



**April Newsletter Content Coordinator:** Kirsten Hecht  
**Design and layout:** Kathryn Ronnenberg

**Salamander News Facilitator:** Tom Gorman  
**Year of the Salamander Committee Chair:** Mary Beth Kolozsvary

## Announcing two Year of the Salamander video contests!

### Here's how you can participate!

Partners in Amphibian and Reptile Conservation and conservation groups from around the world have designated 2014 as the Year of the Salamander. Through this unprecedented partnership, organizations and individuals will work together to raise awareness of salamanders as well as scale up global salamander conservation, education and research efforts.

Here's your chance to get involved with the Year of the Salamander through **two new video contests**:

**Contest 1: "Salamanders Matter"** video campaign! Make a video that will help raise awareness to the general public about salamanders around the world!

You may want to make a video on:

- Why salamanders are important to people and natural systems;
- What people can do to conserve salamanders;
- Why salamanders are important to you; or
- "Public service announcements" (e.g., watching out for salamanders on the roads during migration).

But you are not limited to just these ideas!

We're looking for videos that not only convey salamander conservation messages, but that also reflect your passion for these amazing species. They can be edited and polished videos, or rough cuts shot from your phone out in the field.

Whether it is animation, live action, an original song, or something completely different, be sure to tell your story in a clear and creative way. Be sure to also come up with a unique and creative name for your video entry.

**Deadline** for the "Salamanders matter" contest is **July 31, 2014**.

**Contest 2: "Salamanders are ..."** video campaign! Make a video that will reflect your passion for these amazing species and help get others around the world excited about salamanders!

So what do you have to do?

1. Grab your cell phone or camera.
2. Record a very short clip (no more than 10 seconds in length) of you saying, "Salamanders are ..." and then fill in the blank with whatever you think salamanders are!
3. Then email us your clip for a chance to be featured in the official Year of the Salamander "Salamanders are ..." compilation video to be released on July 1, 2014!

**Deadline** for the "Salamanders are ..." is **May 1, 2014**.

Complete guidelines and contest details are posted on the Year of the Salamander webpage ([www.yearofthesalamander.org](http://www.yearofthesalamander.org)). If you have any questions, please email us at: [yearofthesalamander@gmail.com](mailto:yearofthesalamander@gmail.com).



Salamanders Matter

...to aquatic, riparian, and terrestrial ecosystems, and the interconnections among them. Blue Ridge Two-lined Salamander, *Eurycea wilderae*, by Mark Spangler, Year of the Salamander Photo Contest.



Salamanders are...watching you!

Spotted Salamander, *Ambystoma maculatum*, by Marty Silver, Year of the Salamander Photo Contest.



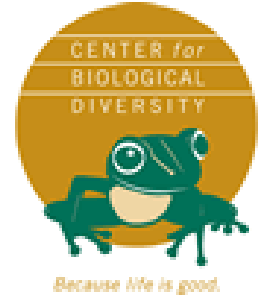
## Year of the Salamander Collaborating Partners

The Year of the Salamander Planning Team is pleased to welcome the following organizations to our growing list of collaborating partners:

### Center for Biological Diversity

[www.biologicaldiversity.org](http://www.biologicaldiversity.org)

At the Center for Biological Diversity, we believe that the welfare of human beings is deeply linked to nature—to the existence in our world of a vast diversity of wild animals and plants. Because diversity has intrinsic value, and because its loss impoverishes society, we work to secure a future for all species, great and small, hovering on the brink of extinction. We do so through science, law and creative media, with a focus on protecting the lands, waters and climate that species need to survive. We want those who come after us to inherit a world where the wild is still alive.



### Great Smoky Mountains Institute at Tremont

[www.gsmit.org](http://www.gsmit.org)

Great Smoky Mountains Institute at Tremont provides in-depth experiences through education programs that celebrate ecological and cultural diversity, foster stewardship, and nurture appreciation of Great Smoky Mountains National Park. “Connecting people and nature” summarizes our mission, which we accomplish by providing hands-on learning experiences in the

National Park, helping people develop: a greater sense of place; a deepened appreciation and awe for the diversity of life and people; and an ethic of stewardship that follows them home.

### Highlands Biological Station

[www.highlandsbiological.org](http://www.highlandsbiological.org)

More species of salamanders exist in the southern Appalachian Mountains than anywhere else in the world, and nowhere are they more abundant. For more than 85 years the Highlands Biological Station, located in Highlands, North Carolina has served as a world-renowned facility for salamander research. Throughout the years, many classic studies of have been conducted by numerous researchers through HBS and in the surrounding Nantahala National Forest. Dr. Richard Bruce, director of the Station from 1972-1999, published prolifically during and after his tenure at HBS on various aspects of salamander biology. For decades, Highlands Biological Station has also offered the popular summer field courses “Biology of Plethodontid Salamanders” and “Conservation Biology of Amphibians,” and continues to serve as an important base of operations for the work of many graduate students and visiting scientists.



**THE BIODIVERSITY GROUP**  
focusing on life overlooked



[BiodiversityGroup.org](http://BiodiversityGroup.org)

### The Biodiversity Group

[www.biodiversitygroup.org](http://www.biodiversitygroup.org)

The Biodiversity Group is an international team of wildlife biologists, educators, and photographers dedicated to preserving the smaller majority of animal life on Earth. Rooted in the science of ecology, we illuminate little known communities of animals in shrinking wild places. Salamanders embody the kind of poorly known but ecologically and scientifically important organisms that we study. At our study sites in Ecuador, we are in the process of documenting the diversity of terrestrial salamanders (family Plethodontidae), which is only beginning to be understood. The ultimate goal is to help manage and protect important habitats across the landscape, ensuring the continued survival of the diversity of salamanders and other organisms that form the ecosystems.

If you are interested in contributing to the Year of the Salamander efforts, please send an email to [yearofthesalamander@gmail.com](mailto:yearofthesalamander@gmail.com) with a brief description of your organization and its efforts. Our full list of partners can be found at <http://www.parcplace.org/news-a-events/2014-year-of-the-salamander/68-uncategorised/281-year-of-the-salamander-partners.html>

**Southern Appalachians**, continued from p. 1 environments at higher elevations.

The southern Appalachians are also very old, giving plenty of time for a variety of salamanders to emerge. During the Pleistocene (about 10,000 years ago), when glaciers covered much of North America, this region served as a refuge for many organisms. When the glaciers finally retreated, many species remained within habitat “islands” on different mountain peaks. The longer populations remained geographically isolated, the more they diverged genetically and morphologically to become distinct species.

A good example of species diversification is the Jordan’s Salamander (*Plethodon jordani*), a common species that once occurred as one continuously distributed population, but later became fragmented along different mountain ranges as the region’s climate began to change. Subsequently, it diverged into three distinct species with unique physical characteristics. In parts of the southern Blue Ridge it became the solid-black Gray-cheeked Salamander (*P. metcalfei*), while in extreme western NC the Red-legged Salamander (*P. shermani*) occurs. True Jordan’s Salamanders are currently found only in Great Smoky Mountains National Park, and have red cheek patches.

Additional species may also arise if two previously isolated, but closely related, groups come back into contact and interbreed. At a few isolated locations in the southern Appalachians we find narrow “hybrid zones.”



Above, top: A Jordan’s Salamander, *Plethodon jordani*, the base species, (photo by Marty Silver, Year of the Salamander Photo Contest), and below, one of its offshoot species, the Red-legged Salamander, *P. shermani* (photo by Madelyn Messner, Year of the Salamander Photo Contest).



Black-bellied Salamander (*Desmognathus quadramaculatus*); photo by Patrick Brannon.

Hybrid salamanders possess genetic and physical traits of both species, but there is usually a gradient between the distributions of the two parent populations, usually associated with elevation.

The number of species of salamanders in the southern Appalachians continues to grow, as modern DNA testing has allowed biologists to distinguish identical-looking populations into separate species. Discoveries of previously unknown salamanders are very rare, but in 2009 a never-before-seen species, the Patch-nosed Salamander (*Urspeleperpes brucei*), was described. It is the smallest species of salamander in the United States, and is the first new genus of four-legged creature discovered in more than 50 years!

facebook

Follow all of the Year of the Salamander news and happenings on Facebook (<https://www.facebook.com/YearOfTheSalamander2014>) and Twitter (@YOSal2014).





## Helping Cheat Mountain Salamanders in West Virginia's Canaan Valley

by Thomas Barnes

The Cheat Mountain Salamander (*Plethodon nettingi*), a federally threatened species that is unique to West Virginia, may have a shot at recovery, thanks to conservation efforts that are underway at the U.S. Fish and Wildlife Service's Canaan Valley National Wildlife Refuge.

One of two vertebrates native only to the Mountain State, Cheat Mountain salamanders are found only on Cheat Mountain and nearby mountaintops with mixed spruce stands. One of the primary threats to the species is the loss and degradation of its high elevation Red Spruce (*Picea rubens*) and northern hardwood forest habitat. The salamander was listed as threatened under the Endangered Species Act in 1989 after many of the Red Spruce forest stands that this species depends on was lost to logging and forest fire.

"Originally, the Canaan Valley National Wildlife Refuge was covered in Red Spruce and Balsam Fir," says Marquette Crockett, a wildlife biologist at the refuge. "After most of the conifer forest was logged, the organic soils burned. This changed the entire ecosystem, and mostly hardwoods came back."

The four-inch-long salamanders are primarily active on humid evenings, when they forage for invertebrates. Despite living for approximately 20 years, the salamanders rarely venture outside their territories, which are around 48 square feet. Perhaps the biggest threat to Cheat Mountain Salamanders is competition from Eastern Red-backed Salamanders (*Plethodon cinereus*), which can tolerate the drier and warmer conditions found in hardwood forests.

Efforts are underway to preserve the cool and damp conditions these salamanders depend on. The Canaan Valley National Wildlife Refuge is working with the Central Appalachian Spruce Restoration Initiative (CASRI) to connect pockets of spruce forest.

"We plant spruce trees to enlarge and connect existing stands of spruce in hopes that the habitat will be more conducive for salamander populations to expand," says Crockett.

In 2013, CASRI planted more than 53,000 seedlings—8,000 on the refuge alone. Habitat management also includes cutting of hardwood trees that compete with Red Spruce. One example is the American Beech (*Fagus grandifolia*), which now has a disease that causes it to sprout thickly and outcompete spruce seedlings.

These conservation measures are paying off. Since 2001, Service biologists have monitored at least three salamander populations on the refuge. According to these surveying efforts, populations of these rare salamanders have remained stable over the last 10 years. Biologists survey transects in the rocky red spruce habitat, while counting salamanders, weighing and measuring them, and determining if they are juveniles or adults. They also collect tissue samples for a DNA analysis to determine the genetic differences among the populations of Cheat Mountain salamanders.

The salamander joins other regionally rare wildlife making their homes in mountain spruce forests, from the recently recovered West Virginia Northern Flying Squirrel (*Glaucomys sabrinus fuscus*), to the Snowshoe Hare (*Lepus americanus*), to the Saw-whet Owl (*Aegolius acadicus*). With efforts underway to conserve the high-elevation spruce habitat and expand salamander population monitoring, things are looking up for the amphibian.

"This has been really encouraging work," says Crockett. "So far, our refuge populations have remained stable and we even found one new population no one knew was there."

*Thomas Barnes is a communication intern in the U.S. Fish and Wildlife Service's Northeast Regional Office in Hadley, Massachusetts.*



Cheat Mountain Salamanders, less than 5 inches (12.7 cm) long, can be found during the day under rocks and logs, or in rock crevices below the ground. At night, especially during rainy weather, they forage on the forest floor and occasionally climb trees or plants. (Photo: Kent Mason)

## Vernal Pools, Constructed Wetlands, and Salamander Conservation

by Chelsea Kross, Eastern Kentucky University

A vernal pool is a temporary water source that provides distinctive habitat for plants and animals. Vernal pools are important habitat for salamanders because they are fishless and contain fewer predators than permanent water sources, offering adult salamanders a relatively safe place to lay eggs and for larvae to develop. For example, Jefferson, Spotted, Marbled, and Four-toed salamanders often use vernal pools. In the late fall, Marbled Salamanders (*Ambystoma opacum*) lay eggs in the dry bed of the pool and guard them until the eggs hatch when the pool fills with water from winter rains. Spotted and Jefferson salamanders (*A. maculatum* and *A. jeffersonianum*) migrate to vernal pools during early spring to lay eggs, which are often attached to sticks or leaves. Four-toed Salamanders (*Hemidactylium scutatum*) lay eggs under moss along the edge of a vernal pool and the female guards the eggs until they hatch and fall into the water.



Marbled Salamander. (Rob Denton)

The loss of vernal pools can have negative impacts on salamander diversity and persistence in an ecosystem. Because of land-use change and historic wetland loss, wetland construction has become an important tool for the conservation of amphibians. On the Daniel Boone National Forest in eastern Kentucky, hundreds of wetlands have been constructed along ridge tops. However, most of the constructed wetlands serve as permanent water sources in an ecosystem where permanent water was once absent, and many have been constructed near vernal pools. The proximity of the two wetland habitat types allows for a comparison of which amphibians use the wetlands and whether the constructed wetlands are functioning similar to the vernal pools. Master's students in the Richter lab at Eastern Kentucky University conducted minnow trap and dip-net surveys in both habitats and found that two fairly distinct amphibian communities occupy the different wetland types. The constructed wetland community contained amphibians that require a more permanent water source and are top amphibian predators, e.g., Eastern Newts (*Notophthalmus viridescens*), Bullfrogs (*Lithobates catesbeianus*), Green Frogs (*L. clamitans*); the vernal community contained amphibians that do not require permanent water, e.g., Marbled Salamanders, Four-toed Salamanders). The close proximity of the two habitats and the abundance of constructed wetlands have led to increased interactions (such as predation) between the different communities, which might be negatively affecting the vernal community. Altering the constructed wetlands to mimic the hydrology of the vernal pools would benefit the natural amphibian community. A reduction in the number of permanent wetlands could reduce interactions between the two communities and lower the abundance of amphibian predators along the ridge tops. Understanding the historic landscape and hydrology of wetlands is important for the conservation of wetland species, and such knowledge should be used in wetland design and construction. Although the constructed wetlands are not suitable for the natural amphibian community, land managers and scientists are currently working together to refine construction techniques to further amphibian conservation.



Bowl-shaped constructed wetland. (Stephen Richter)



A vernal pool with minnow trap array. (Chelsea Kross)



## Tremont's Citizen Scientists answering the Park Service's Call to Action

by Tiffany Beachy, Citizen Science Coordinator,  
Great Smoky Mountains Institute

Great Smoky Mountains Institute at Tremont is located in one of the best outdoor classrooms EVER...a national park! We get to work, learn, and play in a campus that encompasses more than 500,000 acres. As a partner to the National Park Service here in the Smokies, our mission of connecting people with nature melds well with their mission to preserve and protect this great natural area, its historic resources and wildlife for the enjoyment of future generations. One way we get people involved is through our citizen science programs.

Tremont has a number of programs involving amphibians, birds, butterflies, phenology, lichens, and now otters. Children's eyes widen when we describe the project they are about to experience firsthand. They really get to be scientists for a day; they really get to contribute to a big project. It suddenly morphs from just another class activity to an important scientific mission—and they are invited to participate! We collect data, review our results, discuss implications, and make connections.

Our salamander programs include both aquatic and terrestrial habitat projects. Using leaf litter traps, volunteers and visiting school children collect data on salamanders and environmental variables in six streams. Over 3700 captures of stream salamanders were recorded over a ten-year period. In 2006, we also started a terrestrial salamander monitoring program. This study not only generates long-term salamander and habitat data at four sites, but has also been used to compare the effectiveness of different types of cover objects for attracting salamanders. In addition, we monitor Spotted Salamanders at seven ephemeral wetlands.

"My volunteer experiences have strengthened my connections with science and nature," says Keane, who has been citizen science volunteer with his family since 2002. "I am currently pursuing a career in environmental science." After volunteering on various projects for several years, Keane worked as a citizen science intern for two summers. His experiences have prepared him for a successful future in conservation.

Keane's dad Richard has enthusiastically headed up 'Team Pigpen,' an ad hoc group of volunteers who have monitored Pigpen Branch, one of our aquatic salamander transects, for about 10 years. "The experiences of our family and friends at our stream has undoubtedly been an influence in my sons' choices of scientific career paths.



Students at the Institute weigh a salamander as part of their field experience.



Students examine a leaf litter trap for salamander and invertebrates in one of the study streams.

I am thankful for the kind of opportunities Tremont's citizen science program has afforded our family."

While not all of our participants will become professional scientists or conservationists, we hope that the connections they made at Tremont will leave a lasting impression on their hearts and minds, instilling in them a conservation ethic and a renewed desire to play outside.



## Orienne Asks Citizens to Help Create “Snapshot” of Amphibian Breeding Times

The Orienne Society is asking for help to gather information on the timing of Wood Frog and Spotted Salamander breeding through a citizen science project “**Snapshots in Time**”, which launched in early 2014.

“Scientists recognize that many species are changing their yearly patterns because of changes in climate,” says Dr. Stephen Spear, Associate Conservation Scientist with The Orienne Society. “However, scientists can’t be everywhere at once to monitor these changes – but Citizen Scientists can. Through them, this project will help us figure out if these changes are occurring with two widespread amphibians, and what that means for their ability to continue to survive and reproduce under changing conditions.”

But why is this information important? According to Dr. Spear, pinpointing locations where the timing of breeding is changing due to climate change could someday help protect these species, as well as others.

“If we discover that these two amphibians are not reproducing successfully due to faster pond drying times, we can look at ways to improve these wetlands to maintain habitat for not only our focal species, but the rarer amphibians that occur there as well,” says Spear.



What Dr. Spear is describing is using private citizens from all walks of life to complete what is commonly referred to as a “phenology” research project. Phenology, by definition, is the study of cyclic and seasonal natural phenomena, especially in relation to climate and plant and animal life. What Dr. Spear and The Orienne Society are trying to accomplish is to determine what changes may be occurring in the timing of breeding for the Wood Frog and Spotted Salamander.

Dirk Stevenson, Assistant Conservation Scientist with The Orienne Society relates “Encountering Wood Frogs and Spotted Salamanders or evidence of these species in

the field is always exciting. Rolling a pond-side log to see the bright orange spots of a plump Spotted Salamander, or hearing the duck-like chuckling sounds of a sizeable Wood Frog chorus, are always memorable natural history experiences.”

Both of these amphibians breed following heavy rains during winter–spring that flood woodland depressions and various other types of short-lived, “wet-weather” ponds that lack fish. The Orienne Society hopes to recruit citizens to monitor these areas and report when they observe signs of Wood Frog or Spotted Salamander breeding.

While scientists are encouraged to submit observation data, The Orienne Society hopes to entice people of all ages and backgrounds to participate, not just those who are enthusiastic about reptiles and amphibians, but everyone who enjoys the outdoors and wants to learn more about the ecology of these species. With this study, you can make your observations count toward a scientific review of these species’ breeding patterns. This will benefit our knowledge of these animals, and also provide you an opportunity to better acquaint yourself with the amphibian life in your own backyard.

To learn more about this project, log on to [www.oriennesociety.org](http://www.oriennesociety.org), and download datasheets, range maps for the species, and species identification guides so that you can participate and provide valuable data for your region!





## Clearcuts Can't Keep Cinereus Down

by Carola A. Haas,  
Virginia Tech

Two or three decades ago, studies raised the concern that clearcutting was responsible for dramatic declines in populations of plethodontid salamanders in the eastern US. Based on what is known about these animals, this explanation seemed reasonable. Salamanders in the family Plethodontidae are lungless, and because they rely primarily on respiration through their skin, they require habitats that are consistently moist. Their digestive efficiency peaks at relatively cool temperatures (around 15°C), and their metabolic demands increase with temperature, so they suffer from a negative energy balance at high temperatures. The cool, moist environment of a forest floor with extensive leaf litter is the ideal habitat for Eastern Red-backed Salamanders (*Plethodon cinereus*) and many other members of this family.

Concerns about tropical deforestation and large-scale logging of old-growth forest in the Pacific Northwest led several national conservation groups to begin anti-clearcutting campaigns. This sentiment had major effects on Appalachian forest management, resulting in passage of the Maine Forest Practices Act, and severely reducing the use of clearcuts on many National Forests. Although it seemed clear that clearcuts did reduce populations of terrestrial salamanders, there was very little known about how shifts to other forestry practices would affect salamanders.



Examining the effects of a range of silvicultural treatments on terrestrial salamanders has been ongoing since 1994.

In 1993, we began collaborating with Dave Smith and Shep Zedaker, from Virginia Tech's Forestry Department, who had initiated an experimental study comparing alternative management techniques. Conducting replicated, randomized experiments at the scale of a forest stand is not easy, so we jumped on the opportunity. We applied seven management alternatives to forest stands on Jefferson National Forest (VA) and MeadWestvaco's Wildlife and Ecosystem Research Forest in West Virginia, now owned by Penn Virginia. Our goal was to follow them through a rotation (80-100 years), to examine the effects on salamanders, understory plants, and timber regeneration. Funding was provided by the US Forest Service's Ecosystem Management Program, the USDA National Research Initiative Grants, and MeadWestvaco.

In order to fund such a large-scale and long-term project we have sampled in intermittent bursts, bringing on graduate students for 2-3 years of sampling every 5 years or so. Undergraduate volunteers at Virginia Tech have allowed us to collect continuous data (for over twenty years) on salamander populations at the sites close to campus. Our results have sometimes been counter-intuitive. While we expected that salamander populations would be less disturbed under forest management practices that retained most of the tree canopy (such as a group-selection harvest and high-leave shelterwood harvests), we found that in the first ten years after harvest, salamander populations declined just as rapidly on sites with "partial harvests" as they did on clearcuts. Our colleagues in forestry estimated that soil erosion rates were lowest on the clearcut plots because they required fewer skid trails to access the timber and there was only one entry in 100 years, whereas shelterwood and group selection harvests require more. This has implications for stream salamanders that may be affected by sedimentation. By 15-20 years after harvest, salamander populations had still not recovered to



Northern Dusky Salamanders (*Desmognathus fuscus*) are common plethodontid species observed in the Appalachian region.



Eastern Red-backed Salamanders were the most common salamander captured.

pre-harvest levels in most treatments, but they had reached an indistinguishable level in the group-selection harvest treatments. However, re-entering the shelterwood stand for scheduled management operations caused salamander populations to decline drastically, similarly to the decline after a clearcut. Public pressure against any timber harvest on National Forest land, and the loss of local timber operators, has made it increasingly hard for us to get the forest management treatments applied to continue this research. We are currently in one of our unfunded phases, but hope to be able to continue the research through a stand re-entry of the group selection treatments, and to learn more about the effects of stand re-entry on erosion and soil compaction.



Salamanders such as this northern Red Salamander, *Pseudotriton ruber*, were brought to the lab for measurements and released at the point of capture.



## Get your Year of the Salamander 2014 Gear!

Go online to the PARCStore (<http://www.cafepress.com/parcstore>).

Ready to gear up for Year of the Salamander? We've got you covered!

At the Café Press PARCStore, you can find just about any style of t-shirt, sweatshirt, or hoodie, for men, women, or children. But don't stop there - you'll find a messenger bag, field bag, aluminum water bottle, even a beach towel (in case you want to join the salamanders crawling out of that primeval sea).



And take a look at the beautiful **Year of the Salamander Wall Calendar**, full of fantastic salamander photos for every month of your year!

Proceeds from sales go to the Year of the Salamander Conservation grant, managed by Amphibian and Reptile Conservancy, a not-for-profit organization that helps support PARC activities, such as public education, publications, and research.



### Outreach and Education Materials – NOW AVAILABLE!

For educators and naturalists, we now have outreach and education products that were created specifically for the Year of the Salamander on our website ([www.yearofthesalamander.org](http://www.yearofthesalamander.org))! We have **face painting templates and notecards, a slide show and script, posters, and an educational packet** for naturalists and teachers. We will continue to update the page with additional materials, as well as links to other educational resources. **Please check it out!**

If you have unit materials, educational program information, or PowerPoint presentations you are willing to share them, please send them to [yearofthesalamander@gmail.com](mailto:yearofthesalamander@gmail.com). We are also hoping to include videos! Please provide your name, the name of your school/nature center or organization, and location. If you did not create the materials, please be sure to tell us where you found them.



## Migration Tracker - Join Us this Spring!

Each year our lab in the Ecology and Evolutionary Biology department at the University of Connecticut collects amphibian observation data from researchers and citizen scientists throughout the eastern United States. We are particularly interested in the spring breeding migration of Spotted Salamanders (*Ambystoma maculatum*), in addition to Wood Frogs (*Lithobates sylvaticus*) and Spring Peepers (*Pseudacris crucifer*). Spotted Salamanders migrate to their breeding ponds in large numbers during warm, rainy nights. This is usually the only time of year that these secretive, fossorial species are seen. There are a number of programs in various states that encourage people to not only witness the migration, but also help salamanders and other amphibians safely cross roads. We ask folks who see salamanders in their community to share their observations with us via **email** at [urban.lab.uconn@gmail.com](mailto:urban.lab.uconn@gmail.com) or through the form on our **website**. The data we collect 1) is uploaded to a **Google map** and color-coded by date to show overall trends in the timing of migration, and 2) allows us to examine what environmental factors might trigger migration events—for example, temperature and precipitation.

**Email:** [urban.lab.uconn@gmail.com](mailto:urban.lab.uconn@gmail.com)

**Website:** <http://hydrodictyon.eeb.uconn.edu/people/urban/tracker.html>

**Google Map:** <https://maps.google.com/maps/ms?msid=214851865952293876825.0004eefde6632301e7528&msa=0&ll=37.439974,-82.353516&spn=28.236708,30.27832&dg=feature>

[4851865952293876825.0004eefde6632301e7528&msa=0&ll=37.439974,-82.353516&spn=28.236708,30.27832&dg=feature](https://maps.google.com/maps/ms?msid=214851865952293876825.0004eefde6632301e7528&msa=0&ll=37.439974,-82.353516&spn=28.236708,30.27832&dg=feature)

Spotted Salamander eggs in a Connecticut vernal pond.



Adult Spotted Salamander in Connecticut.



### Upcoming Meetings & Events

**Salamanders of Connecticut**, April 9, 6:30 pm, Blackstone Library, Branford, CT. Menunkatuck Audubon Society. See <**DEEP link**> for details.

**Salamander Art exhibit deadline**, April 13. Submissions of original art about salamanders for an exhibit at Art.Science.Gallery, Austin, TX. See [www.ArtScienceGallery.com](http://www.ArtScienceGallery.com) for details.

**Earth Day Exploration**, April 19, 10 am-3 pm, with salamanders! Florida Museum of Natural History, Gainesville, FL.

**Year of the Salamander Education Celebration**, April 22, 11:00 am-2:30 pm, Siena College, Loudonville, NY. Live salamanders, hands-on activities, interactive displays, and Ask the Experts. More info: [mkolozsvary@siena.edu](mailto:mkolozsvary@siena.edu)

**Search For Salamanders**, April 25 & May 23, 6-8 pm, Horseman's Shelter, Edison Woods MetroParks, Erie County, OH. [www.activityreg.com](http://www.activityreg.com)

**1er Festival Oaxaqueño de los Anfibios**, April 25-28, Oaxaca City, Oaxaca, Mexico. See Facebook <**link**> for more info.

**6th Conference on the Biology of Plethodontid Salamanders**, May 18-20, Tulsa, OK. More info at <http://plethodontids2014.weebly.com/>

**Salamander Open Center Day**, May 24, 9 am-3pm, Sessions Woods Conservation Education Center, Burlington, CT. See <**DEEP link**> for details.

**Salamander Art Exhibit**, May 24 – June 22, Art.Science.Gallery, Austin, TX. An informal class, Herpetology 101, will be given as part of the exhibition.

**EuryceAlliance Scientific Working Group 3rd meeting**, May 30, hosted by Art.Science.Gallery, Austin, TX.

**Biology of Plethodontid Salamanders course**, June 9-21, Highlands Biological Station, Highlands, NC. More info at [www.highlandsbiological.org](http://www.highlandsbiological.org)

## 2014 Year of the Salamander & 50th Anniversary of the Wilderness Act—A short story from a Wilderness Ranger



I was working the Wilderness Ranger ‘beat’ at the beautiful but highly used Alpine Lake in the Sawtooth Wilderness. I came upon a particularly nasty campfire ring and sighed at the human-created disturbance that I would soon be cleaning up and naturalizing. Ugh.

I began the clean-up process, disappointed at the careless mess someone had left in such a beautiful place. However, my attitude quickly turned to awe as I overturned one of the rocks lining the illegal campfire ring. There, in the disturbed, charred aftermath of the fire ring was a creature of pure beauty: a shiny Long-toed Salamander (*Ambystoma macrodactylum*).

I realized that what I was seeing was a nasty fire-pit, but this perfect little life form saw it as a respite. How quickly my perspective changed! I whispered, “Sorry little one,” and “thanks” as I carefully returned the rock to shelter the tiny inhabitant of the Alpine Lake drainage.

*Photos and story by Katy Nelson, Wilderness Ranger, Sawtooth National Recreation Area, Stanley, ID. Submitted by Barbara Garcia, Deputy Area Ranger*



More Appalachian Salamanders from the Year of the Salamander Photo Contest



**Above:** Black-bellied Salamanders, *Desmognathus quadramaculatus*, which range from the mountains of Georgia to West Virginia, are highly aquatic and sometimes eat other salamanders. Photo: Madelyn Messner. **Right:** The Cave Salamander, *Eurycea lucifuga*, is not unique to the Appalachians, but is common in its required habitat, limestone caves, within the region. Photo: Matt Hamilton.





## Family of the Month: Plethodontidae

The Plethodontidae, the Lungless or Woodland Salamanders, are the most diverse family of salamanders, and one of the most wide-spread, with species in the Americas, southern Europe, Sardinia, and South Korea. They are lungless, so all gas exchange (respiration) takes place through its moist skin or mouth; consequently they need a moist environment to breathe, such as under logs and leaves. Well-known members of this family include the Eastern Red-backed Salamander (*Plethodon cinereus*), which is 3–4 inches (8–10 cm) long and is native to northeastern North America. The similar-looking Western Red-backed Salamander (*Plethodon vehiculum*) occurs on the Pacific Coast of North America and is slightly larger, growing to over 4 inches (10 cm). Both the Eastern and Western Red-backed Salamanders are completely terrestrial. Unlike these two species, the Northern Dusky Salamander (*Desmognathus fuscus*) is semi-aquatic; its larvae develop in the water and adults and juveniles live within a few feet of streams and springs.



©Mark Tegges

Despite their name, Eastern Red-backed Salamanders do not always have red or orangish stripes on their backs. The dorsal stripe may be tan or yellowish, or missing altogether, as in the unstriped “lead-backed” morph shown above.



©Daniel Hocking

A Northern Dusky Salamander (*Desmognathus fuscus*).

### Family: Plethodontidae

Featured species: Eastern Red-backed Salamander (*Plethodon cinereus*), Northern Dusky Salamander (*Desmognathus fuscus*).

Also known as:	Lungless or Woodland Salamanders
Number of Species:	The largest and most diverse family, with over 440 species in 27 genera.
Region / Habitat:	<ul style="list-style-type: none"> <li>- Species occur in the Americas, southern Europe, Sardinia, and South Korea</li> <li>- In 2005, the discovery of a new species, Korean Crevice Salamander (<i>Karsenia koreana</i>), in Asia came as a big surprise, because until this discovery members of this family were thought to not occur in this region.</li> <li>- Members of this family use a wide range of habitats: some species are strictly aquatic, some live in caves or underground springs (many <i>Eurycea</i> spp.), some are riparian associates, some are strictly terrestrial (<i>Ensatina</i>, <i>Batrachoseps</i>, <i>Hydromantes</i>, and many <i>Plethodon</i> spp.), and some species are even arboreal (<i>Aneides lugubris</i>) and may live in bromeliads (<i>Bolitoglossa</i> spp.).</li> </ul>
Physical Characteristics:	<ul style="list-style-type: none"> <li>- all gas exchange takes place through skin or mouth-cavity respiration</li> <li>- generally have elongated bodies and short limbs</li> <li>- body length can range from 1 inch to over 10 inches (2.5 to 25.5 cm)</li> <li>- their long tails can be regenerated</li> </ul>
Behavior / Development	<ul style="list-style-type: none"> <li>- development varies by species; some have an aquatic larval stage while others have direct development</li> <li>- females usually practice brood care or the protection of young</li> </ul>
Fun Fact:	The Eastern Red-backed Salamander is the most abundant forest vertebrate in some areas, with the biomass (or weight) of all Red-backed Salamanders combined being greater than any other vertebrate!

## Great Smoky Mountains Salamander Ball

Presented by Discover Life in America  
Saturday, September 13, 2104, 7 – 10 pm  
Knoxville Zoo, Knoxville, TN

Come one, come all to the Salamander Ball!

The Great Smoky Mountains Salamander Ball is a masquerade ball and fundraising event based on the children's book of the same name by Lisa Hortsman. Attendees are encouraged to dress in costumes emulating Smoky Mountain wildlife. Entertainment will feature:

- A Smokies Salamander beauty pageant
- Hors d'oeuvres and beverages
- Live band and dancing
- A display of beautiful, Smoky Mountain salamanders
- A unique silent and live auction
- A very special visit from "Big Red" the salamander
- Kids' area
- Fun for the whole family

This event benefits Discover Life in America and the Smokies' All Taxa Biodiversity Inventory. DLIA's mission is to discover and understand America's species through science and education for conservation. DLIA's flagship project, the ATBI, is a joint effort with the NPS to identify and record every single species within Great Smoky Mountains National Park. To date DLIA has assisted in adding 7,636 new species to the park's records.

—Todd P. Witcher, DLIA



Big Red, the Salamander Ambassador, entertains attendees at last year's ball in April, 2013.



## Fire Salamander Photo Book Project

Fire salamanders: they show the most diverse and exotic color patterns of any West Palearctic amphibian. The six currently recognized species are characterized by a black ground color and yellow, orange and/or red spots and stripes. The completely black alpine salamanders are part of these species, although they lack the charismatic yellow spots. Surprisingly, the causes of this enormous variation in color patterns are not well understood.

Fire salamanders are threatened. Populations in the Netherlands and Belgium are disappearing due to a recently-identified fungal disease. We currently do not know how far this fungus will spread, and the impact it will have on salamander populations. Throughout the distribution of most fire salamander species, unfortunately other threats can be observed, too, often related to land use change or loss of breeding streams or ponds. Disappearance of these iconic amphibians would be catastrophic; they not only present intrinsic value, but also form a significant part of local food chains. On the verge of these potential changes it is extremely important to document these animals in an extensive way.

Wouter Beukema and Monne Tuinhout, a herpetologist and a professional photographer, have taken on the task of creating a photo book about fire salamanders throughout their distribution, in collaboration with the RAVON Foundation (Reptile, Amphibian and Fish Conservation Netherlands). Childhood friends, they team up again to portray fire salamander diversity, habitats, and the scientists and conservationists who work with these species in an innovative and comprehensive way. To achieve this goal, they have started a crowd funding campaign. While support for the campaign is increasing, they still need every bit of help they can get to realize this initiative!

Check out the Indiegogo crowd funding campaign and Facebook page of the project:

<http://www.indiegogo.com/projects/fire-salamander-photo-book>

<https://www.facebook.com/firesalamanderbook>



## Lost Frogs Offer Conservation Hope: A Story of Rediscovery in Ecuador



A young Tandayapa Andean toad (*Andinophryne olallai*) from Manduriacu. Photo: Ryan Lynch.

By Ryan L. Lynch

In late 2012, I led a team of U.S. and Ecuadorian scientists working with the international non-profit The Biodiversity Group and Ecuadorian institution Pontificia Universidad Católica del Ecuador on a rapid biological assessment of a remote and never before surveyed cloud forest property in northwest Ecuador. During the first night of surveying the pristine streams that run through the property, our team made a remarkable discovery; a population of the Lost and long thought extinct Tandayapa Andean toad (*Andinophryne olallai*). Prior to the rediscovery, the only other observation of the species was a single record from the original species description in 1970!

The rediscovery of the Tandayapa Andean toad in Ecuador represents the most recent species rediscovery in a growing list of globally Lost and found frog species. The Lost species list (available here: <http://www.amphibians.org/lostfrogs>), which is maintained as part of the Search for Lost Frogs initiative launched by Conservation International, IUCN SSC Amphibian Specialist Group and Global Wildlife Conservation in 2010, documents the survival of frog species not seen in over a decade and thought to be potentially extinct in the wild. With 251 species included in the search, the initiative aims to update our knowledge of the global amphibian extinction crisis and revive hope in amphibian conservation worldwide.

The concerted effort to rediscover Lost and thought extinct amphibian species across the world comes at just the right time. Amphibian population declines and species extinctions are at the forefront of the global biodiversity crisis, with nearly a third of the world's amphibian species currently listed as threatened, and roughly 170 species thought to have gone extinct in the last few decades alone. The leading causes for these declines include habitat loss, disease and climate change. With each of these factors expected to continue into the foreseeable future, the number of species extinctions is only expected to rise.

### HENCE THE NEED FOR HOPE

While most facts point to an ominous future for amphibians worldwide, the occasional rediscovery of Lost and thought extinct species offers a glimmer of hope for the future of amphibians and opens a window of opportunity for conservationists. Just as with species listed as critically endangered, the rediscovery of Lost and thought extinct species is something that grabs the attention and imagination of people around the world. When given the opportunity to protect either a recently rediscovered species after a 40 year disappearance versus a species that is commonly observed, the general public will usually choose the former. The opportunity to garner positive attention and public support following a rediscovery of a Lost and thought extinct species is something that researchers and conservationists must be conscious of during the interna-

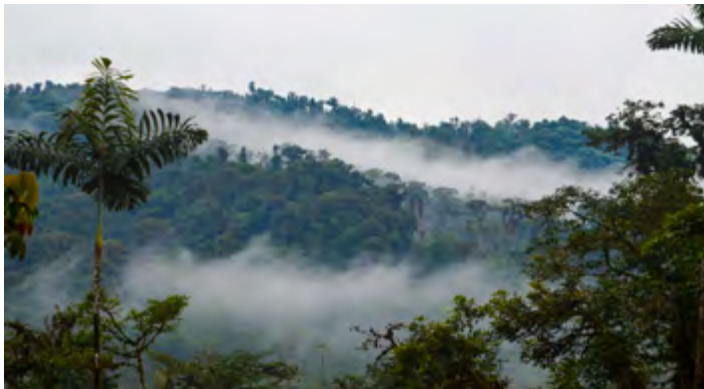


tional Search for Lost Frogs.

Since its inception three and a half years ago, the Search for Lost Frogs has already made a number of significant species rediscoveries across the globe. In fact, 31 of the 251 Lost species (~12%) have been rediscovered since 2010, including species that were already listed as Extinct by the IUCN. Examples include: the Hula painted frog (*Discoglossus nigriventris*) in Israel that disappeared for 57 years, Holdridge's toad (*Incilius holdridgei*) in Costa Rica that disappeared for 24 years, and the aforementioned Tandayapa Andean toad in Ecuador that disappeared for 43 years. Each of these rediscoveries received considerable national and international attention. The publicity that comes from such rare rediscoveries, if properly utilized, offers researchers and conservationists a unique opportunity to gain widespread conservation support for species and habitats of high conservation importance. Below, using our story of the Tandayapa Andean toad as an example, I illustrate how the rediscovery of a Lost species can promote conservation efforts in neglected areas that need it most.

### LOST AND FOUND IN ECUADOR

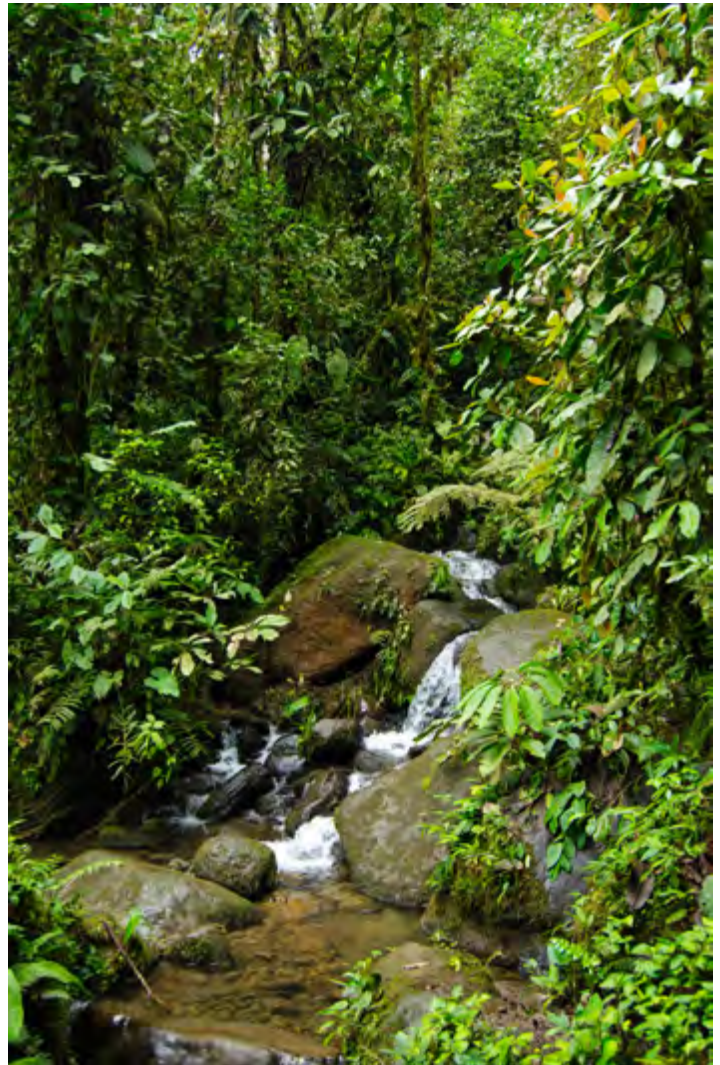
After more than thirty years without a single sighting of the Tandayapa Andean toad in Ecuador, a group of scientists decided to make a serious attempt to rediscover the species at its type locality in Tandayapa – a mid-elevation cloud forest site only an hour and a half from the capital city of Quito. The team, made up of professional herpetologists, put in more than 150 search hours over a series of visits to the areas in and around Tandayapa. Despite their efforts, no individuals were ever found; it was assumed that the species had either gone extinct or had an extremely low likelihood of survival.



Cloud forests of Manduriacu, Imbabura Province, Ecuador. Photo: Ryan Lynch.

Then, a number of years later in October 2012, I led a herpetofauna survey in the cloud forests that border the Manduriacu River in the Province of Imbabura; 40 km northwest of Tandayapa. The site is located within the world's most threatened and biodiverse biological hotspots (Tropical Andes Biological Hotspot), an area that clearly should be protected, but no surveys had ever been conducted on the property. The primary goal of the survey was to put together a comprehensive species list, with the hopes of potentially finding something special that would give us leverage in protecting the surrounding forests before they disappear.

The site sits in southwest Imbabura, an area that is threatened by rapidly expanding anthropogenic disturbances. Logging is the primary source of income for many families in the region, many of the rivers are currently being dammed, and the area is surrounded by copper mining concessions. Eighteen km to the east sits the town



An example of the small streams that run through Manduriacu and act as the primary habitat for the Lost Tandayapa Andean toad (*Andinophryne olallai*). Photo: Ryan Lynch.

of Junin, the site of one of the largest mining concessions in all of Ecuador that is said to contain upwards of 40% of the country's mineral wealth. To say that the forests and wildlife species found in the region are under siege is an understatement.

Our herpetofauna survey of Manduriacu took place over a three day period. During the first nocturnal Visual Encounter Survey that ran along a small running stream we discovered a pair of rare and initially unidentifiable toad species. I recognized the toads as being from the bufonidae family, but was unable to identify them to species. Realizing the rarity of our find our team took photos, videos, and data on the individuals before returning to Quito. Upon closer inspection of the photos it became apparent that we had discovered two individuals of the Lost and thought extinct Tandayapa Andean Toad; shockingly, this made us the first individuals to lay eyes on the species since 1970.

Over the course of the next year our team of researchers conducted a series of population surveys in Manduriacu in order to better understand the species biology and conservation status. Fortunately, our surveys determined that the Manduriacu population of the Tandayapa Andean toad was indeed healthy, with the presence of all age classes across numerous different stream systems. However, the downside was that the total known area of occurrence remained extremely small (<1 km<sup>2</sup>). With the realization that the forests of Manduriacu may house the only remaining



population of the species, we knew that the protection of the surrounding forests would be crucial for the long term survival of the species, and something we should stress when releasing news of our rediscovery.

### REDISCOVERY BRINGS FAME AND SUPPORT

When our publication of the rediscovery went public on February 9<sup>th</sup> 2013, the Amphibian Survival Alliance (ASA) simultaneously released a press release and announced the rediscovery of the Lost Tadayapa Andean toad. The news of the rediscovery spread like wildfire, with headlines like “Biologists find ‘Extinct’ toad alive and well” and “Hide and Seek: 43 years to rediscover the Tadayapa Andean toad.” *National Geographic News* wrote a short piece on the rediscovery that reached 4,500 people, and the ASA press release received another 1,300. The story also spread online on blogs and social media outlets like Facebook, where stories of the rediscovery were liked and shared by many thousands of people across the world. In Ecuador, the Ministry of Environment, the U.S. Embassy, and a number of major news agencies (El Comercio, La Hora, Ecuavisa, and 108 different radio stations) also covered the rediscovery and its importance to the country that likely reached a large percentage of the Ecuadorian population.

The media exposure the rediscovery brought via all of the different media outlets around the world made the Tadayapa Andean Toad and Manduriacu, both previously unknown to all but a few, recognizable names. The rarity of the species and the importance of the Manduriacu forests and the threats it faces were suddenly issues of concern for individuals in all parts of the globe. We’ve had a number of national and international organizations voice their support for the protection of Manduriacu, and have also initiated discussions with a number of funding agencies that are potentially interested in providing financial support to protect the forests of Manduriacu that surround the Tadayapa Andean Toad population before they disappear for good.

While no concrete conservation actions to protect the Tadayapa Andean toad and the Manduriacu forests have been made yet, the pure volume of people and organizations that have voiced their support is promising. Within one year, the Tadayapa Andean toad went from being thought potentially extinct to being on the front page of many newspapers and websites around the world. Despite the fact that more than half of the amphibian species we’ve documented from Manduriacu are threatened, none of the publicity and



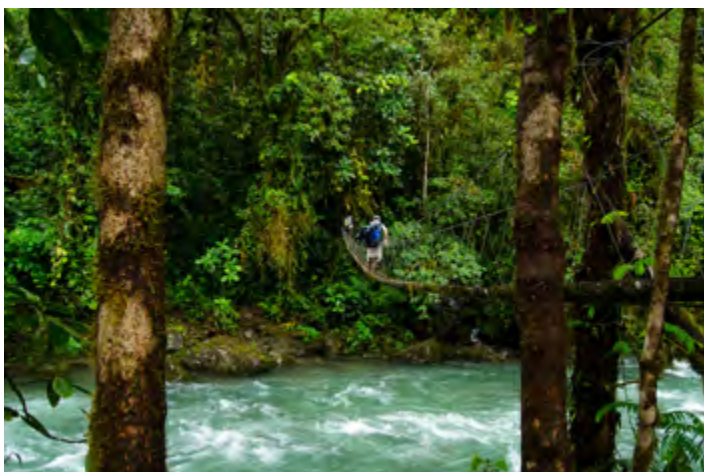
Adult Tadayapa Andean toad (*Andinophryne olallai*) encountered during a nocturnal Visual Encounter Survey in Manduriacu. Photo: Diego Pallero.

overnight conservation support would have been possible without the rediscovery of an internationally Lost frog.

If more individuals take up the Search for Lost Frogs there’s a better chance that more Lost and thought extinct species will turn up. And although not a common occurrence, the more Lost species that do turn up, the more hope and support for international amphibian conservation and habitat we’ll likely see. The rediscovery of Lost species sends a powerful wake-up call to the world and can lead to coordinated efforts to prevent further declines and extinctions. So regardless of whether you’re a researcher, conservationist, or just an individual wanting to make a big impact, head on over to the ASA website to see if there is a Lost species waiting to be rediscovered near you.

### Acknowledgements

I would like to thank my fellow researchers Sebastian Kohn, Fernando Ayala-Varela, Paul S. Hamilton, and Santiago R. Ron for their assistance with this project, Juan and Monica Kohn for purchasing the property in Manduriacu, Diego Pallero for providing access to his photographs, Robin Moore and Candace M. Hansen for assistance with this article, and all of the individuals and media outlets for widely sharing our news and helping us spread word of the conservation importance of Manduriacu.



Researchers crossing the Manduriacu River to reach the site of the only known living population of the Tadayapa Andean toad (*Andinophryne olallai*). Photo: Ryan Lynch.



Adult Tadayapa Andean toad (*Andinophryne olallai*) from Manduriacu, Imbabura Province, Ecuador. Photo: Ryan Lynch.



The orange throat of *Bryophryne hanssaueri*, an inhabitant of the cloud forests just below the treeline from 3,200 to 3,500 m. Photo: A. Catenazzi.

## Peru's National Park Protects 156 Species of Amphibians From the Andes to the Amazon

By Alessandro Catenazzi, Edgar Lehr & Rudolf von May

**W**e recently compiled a list of all amphibian and reptile species known to occur in Manu National Park and its buffer zone in southeastern Peru (Catenazzi et al. 2013). We found that Manu is the natural protected area with the highest number of amphibian and reptile species on Earth. We reported the occurrence of 155 species of amphibians and 132 species of reptiles, five more amphibians and 11 more reptiles than Yasuní National Park in Ecuador, the protected area that previously ranked first in herpetological diversity (Bass et al. 2010). Both Manu and Yasuní protect large areas of undisturbed Amazon lowland rainforest, but Manu National Park also protects high-elevation cloud forests and high-elevation grasslands on the eastern slopes of the Andes.

The list is far from being complete. The cumulative number of species for Manu has increased sharply over the past 40 years, and it does not seem to be nearing a plateau. Furthermore, only a small portion of the park is easily accessible and has been sampled appropriately. A significant portion of Manu's exuberant biodiversity is still unknown. We expect additional discoveries, from new geographic distribution records to new species. For example, new species are expected to occur among highly endemic species in poorly explored high-elevation habitats, or among cryptic species in geographically widespread groups of treefrogs and terrestrial-breeding frogs. The increased use of DNA analysis, study of frog calls, and other integrative taxonomy techniques will similarly contribute to

increase the number of amphibians known for Manu.

Case in point, here we revise our list, barely four months after its publication. One revision concerns the placement of *Dendropsophus allenorum* into synonymy of *D. timbeba* (Orrioco et al. 2013); the list should be revised with the latter name. Another change concerns



The scientific name of Manu's poison frog (*Ameerega macero*) refers to the Matsigenka word for frog. Photo: A. Catenazzi.





*Bolitoglossa cf. caldwellae* is common in the submontane forest at the foothills of the Andes. Photo: A. Catenazzi.

the cryptic *Bolitoglossa* of the western Amazon. Many of the populations along the Andean foothills had previously been identified as *B. altamazonica*. A recent publication by Brcko and colleagues (2013) describes several new *Bolitoglossa* from the western Amazon and provides a key to identify Brazilian *Bolitoglossa*. The use of the key on specimens from Manu suggests that the species is *B. caldwellae*, and not *B. altamazonica*, although further studies are needed to confirm the identification. The third change is the most exciting:



The glassfrog *Cochranella nola* is the latest addition to the herpetofauna of Manu National Park. Photo: A. Catenazzi.

the addition of a new species to the list, the glassfrog *Cochranella nola*. Therefore, the number of amphibian species in Manu NP and its buffer zone is now 156.

Scientific research conducted over the past four decades have recognized Manu National Park as a globally irreplaceable site. Herpetologists first surveyed the region in the 1970's (Duellman 1976, 1978), primarily along the road that connects the city of Cusco to villages in the Kosñipata Valley. Starting in the 80's, research was broadened to include remote lowland rainforest locations inside the park such as Cocha Cashu Biological Station (Rodríguez and Cadle 1990, Rodríguez 1992). Subsequent herpetological expeditions have continued to reveal new species of amphibians and reptiles, especially in the endemic-rich cloud forest and high-Andean grasslands. For example, one of the most recent discoveries was the glassfrog *Centrolene sabini* (Catenazzi et al. 2012), the world's 7000<sup>th</sup> known amphibian species according to AmphibiaWeb ([www.amphibiaweb.org](http://www.amphibiaweb.org)).

Herpetological surveys at high elevations of Manu National Park and its surroundings led to the discovery of several new species of strabomantid frogs including two species of *Bryophryne* (Lehr and Catenazzi 2008, 2009a) and one species of *Noblella* (Lehr and Catenazzi 2009b). Moreover, one species of *Noblella* and two species of *Psychrophrynella* still need to be scientifically described from Manu National Park (Catenazzi et al. 2013). Among the endemic *Bryophryne*, *B. hanssaureri* can easily be distinguished from the other two species *B. cophites* and *B. nubilosus* by having females with an orange throat. *Noblella pygmaea* is among the smallest frogs





The terrestrial-breeding *Noblella pygmaea* is the smallest frog of the Andes, and probably the smallest vertebrate living above 3000 m. Photo: A. Catenazzi.

in the world (females have a maximum snout-vent length of 12.4 mm and males 11.1 mm), the smallest frog of the Andes, and the smallest vertebrate above 3000 m elevation. Thirty-eight species of strabomantid frogs are currently known to occur in Manu National Park, presenting 24.5% of the 156 species of amphibians recorded within this national park.

The cloud forests are fascinating environments, where the ever-present mists envelop a large number of plants and animals presumably adapted to live in a cold and permanently humid environment. Much of our herpetological work was conducted at Wayqecha Biological Station, a field station owned by the Amazon

Conservation Association ([www.acca.org.pe](http://www.acca.org.pe)). This station protects nearly 600 ha of a mosaic of cloud forest, scrub and grassland habitats, and hosts a growing number of scientists studying the biological diversity and the effects of global climate change on these delicate ecosystems. Despite living inside the park and in private conservation areas, Manu's cloud forest amphibians are not protected from many factors that threaten Andean amphibians, such as habitat modification, over-grazing, the effects of global warming and the recent arrival of the highly virulent pathogenic fungus *Batrachochytrium dendrobatidis*. Epizootics of chytridiomycosis are the suspected cause of population declines and extinction for many



The toad *Rhinella manu* is endemic to the cloud forest of Manu NP and the adjacent Kosñipata valley. Photo by A. Catenazzi.



A female of *Pristimantis danae* with froglets hatching from her egg nest. Photo: A. Catenazzi.





*Ceratophrys cornuta* is one of many amphibians living on the forest floor in Manu's lowland rainforest. Photo by J. Jacobs.

high-elevation frog species in Manu (Catenazzi et al. 2011).

The latest addition to the herpetofauna of Manu, the glassfrog *Cochranella nola* was previously known only from Bolivia. This species was captured and recorded in January 2014 by A. Catenazzi and A. Tito during surveys in streams at 1000 m elevation. Populations of this species have also been recorded by University of Glasgow Ph.D. student A. Whitworth, within the foothills of the Andes at the

Manu Learning Centre (71°23'28"W 12°47'21"S) research station, owned and operated by the Crees Foundation ([www.crees-manu.org](http://www.crees-manu.org); A. Whitworth pers. communication). These two locations in the buffer zone of Manu NP represent the first record of *C. nola* in Peru, and a considerable range extension from the type locality in the Departamento Santa Cruz in Bolivia (Lötters and Köhler 2000).

The lowland portion of Manu NP protects rainforest areas below 500 m a.s.l., including the entire watershed of the Manu river. The buffer zone of the park also protects vast lowland rainforest areas including Los Amigos river watershed, part of which is protected by the Los Amigos Conservation Concession. Previous research showed that some lowland localities in and around Manu and its buffer zone generally house between 70 and 80 amphibian species (von May et al. 2009, von May et al. 2010). The Amazon Conservation Association's Los Amigos Biological Station (a.k.a. CICRA station), is currently known to house 86 amphibian species, representing the highest species richness recorded in a single locality in the region (data from surveys conducted in an area of about 500 ha between 2001 and 2012). Surveys at Los Amigos also resulted in the discovery of a new species, *Pristimantis divinae* (Lehr & von May 2009).

The number of species recorded in Manu is exceptional if we consider that the national park represents only 0.01% of the planet's land area, but houses 2.2% of all amphibians known worldwide. Manu is also known for other long-held records of biodiversity: more than 1,000 species of birds (about 10% of the world's bird species) and more than 1,200 species of butterflies have been re-



Likely a victim of epizootics of chytridiomycosis, *Atelopus erythropus* has not been seen in Manu since 1999. Photo taken in 1999 by A. Catenazzi.



corded in the park. Manu NP was established in 1973, recognized as a Reserve of Biosphere by the UNESCO in 1977, and pronounced a World Heritage Site in 1987.

### Acknowledgements

Our work in the region was supported with funds from the Amazon Conservation Association, the National Science Foundation, the Rufford Small Grants Foundation, the Chicago Board of Trade Endangered Species Fund, the Amphibian Specialist Group, the Fondation Mathy-Dupraz, the Swiss Academy of Natural Sciences, the Wildlife Conservation Society, and the National Geographic Society. We are very grateful to the administration of Manu NP, park rangers, staff at Wayqecha and Los Amigos and many field assistants for their hospitality, logistic support and dedication in sampling amphibians in the field.

### References

1. M.S. Bass, M. Finer, C.N. Jenkins, H. Kreft, D.F. Cisneros-Heredia *et al.*, Global conservation significance of Ecuador's Yasuni National Park. *PLoS ONE* 5, e8767 (2010). doi:10.1371/journal.pone.0008767.
2. I.C. Brcko, M. S. Hoogmoed and S. Neckel-Oliveira, Taxonomy and distribution of the salamander genus *Bolitoglossa* Duméril, Bibron & Duméril, 1854 (Amphibia, Caudata, Plethodontidae) in Brazilian Amazonia. *Zootaxa* 3686: 401–431 (2013).
3. A. Catenazzi, E. Lehr, L.O. Rodriguez and V.T. Vredenburg, *Batrachochytrium dendrobatidis* and the collapse of anuran species richness and abundance in the upper Manu National Park, Peru. *Conservation Biology* 25: 382–391 (2011).
4. A. Catenazzi, E. Lehr and R. von May, The amphibians and reptiles of Manu National Park and its buffer zone, Amazon basin and eastern slopes of the Andes, Peru. *Biota Neotropica* 13: 269–283 (2013).
5. A. Catenazzi, R. von May, E. Lehr, G. Gagliardi-Urrutia, and J.M. Guayasamin, A new, high-elevation glassfrog (Anura: Centrolenidae) from Manu National Park, southern Peru. *Zootaxa* 3388: 56–68 (2012).
6. W.E. Duellman, Centrolenid frogs from Peru. *Occas. Papers Mus. Nat. Hist., Univ. Kansas* 52: 1–11 (1976).
7. W.E. Duellman, New species of Leptodactylid frogs of the genus *Eleutherodactylus* from the Cosñipata Valleu, Perú. *Proc. Biol. Soc. Washington* 91: 418–430 (1978).
8. W.E. Duellman, A. Catenazzi, D. C. Blackburn, A new species of marsupial frog (Anura:Hemiphractidae: *Gastrotheca*) from the Andes of southern Peru. *Zootaxa* 3095: 1–14 (2011).
9. E. Lehr, E, and A. Catenazzi, A new species of *Bryophryne* (Amphibia: Strabomantidae) from southern Peru. *Zootaxa* 1784:1–10 (2008).
10. E. Lehr, and A. Catenazzi, Three new species of *Bryophryne* (Anura: Strabomantidae) from the Region of Cusco. *South American Journal of Herpetology* 4:125–138 (2009a)
11. E. Lehr, and A. Catenazzi, A new species of *Nobliella* (Amphibia: Strabomantidae): the smallest frog of the Andes. *Copeia* 2009:148–156 (2009b)
12. E. Lehr and R. von May, A new species of *Pristimantis* (Anura: Strabomantidae) from the Amazonian lowlands of southern Peru. *J. Herpet.* 43:485–494 (2009). <http://dx.doi.org/10.1670/08-202R.1>
13. S. Lötters and J. Köhler, *Cochranella nola* (Anura: Centrolenidae): natural history notes, distribution, and advertisement call. *Herpetological Natural History* 7: 79–81 (2000).
14. V. G. D. Orrico, W. E. Duellman, M. S. B. Souza, and C. F. B. Haddad, The taxonomic status of *Dendropsophus allenorum* and *Dendropsophus timbeba* (Anura: Hylidae). *J. Herpetol.* 47: 615–618 (2013)
15. L.O. Rodríguez, Structure et organisation du peuplement d'anoures de Cocha Cashu, Parque National Manu, Amazonie Péruvienne. *Terre et Vie* 47: 151–197 (1992).
16. L.O. Rodríguez, and J. E. Cadle, A preliminary overview of the herpetofauna of Cocha Cashu, Manu National Park, Peru. In: *Four Neotropical Rainforests* (Gentry, A.H., ed.). Yale Univ Press, New Haven, 1990) p. 410–425.
17. R. von May, K. Siu-Ting, J. M. Jacobs, M. Medina-Müller, G. Gagliardi, L. O. Rodríguez and M. A. Donnelly, Species diversity and conservation status of amphibians in Madre de Dios, Perú. *Herpet. Cons. Biol.* 4:14–29 (2009).
18. R. von May, J. M. Jacobs, R. Santa Cruz, J. Valdivia, J. Huamán and M. A. Donnelly, Amphibian community structure as a function of forest type in Amazonian Peru. *J. Trop. Ecol.* 26:509–519 (2010). <http://dx.doi.org/10.1017/S0266467410000301>



The monkey frog *Phyllomedusa camba* is found in bamboo forests and floodplain forests in the lowlands and Andean foothills of Manu. Photo: R. von May.



Female of the endemic species *Bryophryne cophites* attending her eggs. Photo by A. Catenazzi.



# Puddles of Possibilities

By Courtney Anderson & Ashley LaVere

**E**phemeral pools are isolated seasonal wetlands formed by depressions in the terrain that are temporarily filled by rain-water, stream overflow or ground water for periods of time extending anywhere from a few months to a few years. These pools are generally found in woodland forests along a floodplain, under a bluff, or in other low-lying areas, but they can also be found in the most unlikely of places such as in a ditch on the side of the road or in the middle of an open field. Like most things in nature, ephemeral pools come in a variety of shapes and sizes ranging from the depth and size of a shallow lake to the dimensions of a small puddle (1).

## A POOL OF PLENTY

Some ephemeral pools may be small in size, but they are all large in life. Since they do not permanently retain water, they are unable to support fish or other large predatory species. This makes ephemeral pools a unique habitat and a safe haven for the larval developmental stages of many amphibious and invertebrate organisms. Specific inhabitants of these pools vary throughout the United States, depending upon the regional climate and the ecosystem surrounding the pool. In North Carolina, however, the most common organisms to find in or immediately around ephemeral pools are salamanders, newts, frogs and a variety of invertebrates. Certain species of these amphibians and invertebrates, such as marbled salamanders and caddisflies, rely on ephemeral pools for breeding purposes and ultimately the success of their population. These pools also support a variety of plant communities along its banks such as the Jack-in-the-pulpit and marsh fern. These distinctive habitats are a sanctuary for biodiversity and productivity; thriving with all sorts of life (1).

## PRECIOUS PUDDLES

The fleeting nature of ephemeral pools makes them easily belittled in the eyes of most people. Why try and protect something that will eventually diminish? It's true that they are short lived, but it is not about how long they exist, it's about the sheer amount of life



Fig. 2. An upland chorus frog egg mass attached to the end of a leaf stem found in an ephemeral pool on the Wall Place Preserve in Greensboro, North Carolina. Photo: Ashley LaVere.

they bring into existence. Ephemeral pools are responsible for the development and transformations of several amphibian and invertebrate larval forms. Without these breeding pools, populations of those that depend on them would decline rapidly and possibly result in local extinction. As a breeding habitat, ephemeral pools not only fill their waters with life, but they also supply the surrounding ecosystem with adult forms as the juveniles take their first steps, first hops, or first flights out from the shallow waters and onto dry land. Ephemeral pools may dry up, but their impression in the surrounding environment will sustain and one day, it may once more be filled with water. The possibilities are endless (1).

## PUDDLES IN PERIL

Like all wetland ecosystems, ephemeral pools are quite fragile, and their small size makes them even more vulnerable. Seemingly minor alterations to the habitat can have drastic effects on the success of the pool. Ephemeral pools are also intricately connected to the forests around them, so changes that seem to have no effect on the pool may, in fact, seriously degrade the habitat.

By far the largest threat to ephemeral pools is physical disturbance. These areas are often not recognized as important habitat (it is just a swampy, low spot, right?) and are filled in to prevent water from collecting or are built over completely. Development has taken a brutal toll on pools throughout the country. One complicating factor in protecting these habitats is that the pools themselves are not the only areas that need attention. The species that utilize the pools mainly live in the surrounding forest and only converge on the pools for breeding, meaning that vast areas of adjacent woodland need also be protected. Additionally, many pools have been shown to be associated with neighboring pools within the same woodland and, therefore, corridors between the pools can also be vital zones (2). Diversion of water by ditching alters the hydrology and can dry up pools prematurely, killing inhabitants before they can metamorphose. Human additives, such as chemical fertilizers, insecticides, and foreign species of plants and animals, can disrupt

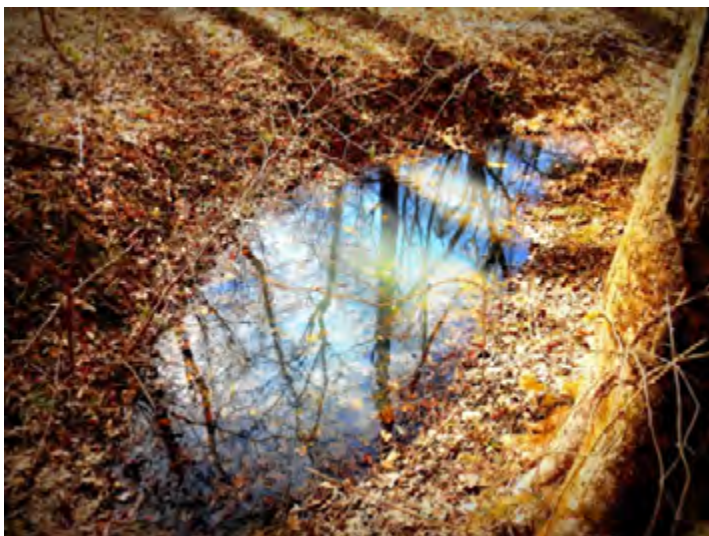


Fig. 1. A beautiful ephemeral pool found at Wall Place Preserve in Greensboro, North Carolina. Photo: Ashley LaVere.

the dynamics of the entire ecosystem (3).

### PINPOINTING POOLS

As we came to understand the numerous threats facing this special habitat, we decided to do our part to protect them. We are currently studying ephemeral pools in our local area of Guilford County, NC, which is a highly urbanized area of the state. In general, ephemeral pools are difficult to protect due to their small size and temporary nature, which makes them tricky to locate. One considerable stride toward effective conservation of these pools—and, therefore, the species that depend upon them—is to know where they are.

Using topographic maps, hydrology maps, and extensive collaboration with local naturalists, we are locating as many pools in the county as possible and compiling them on a map to be distributed to local conservation groups. A report is to then be provided with management recommendations. We have also assembled a land-owner packet, full of valuable information about ephemeral pools, their importance, and how to contribute to their continued success. Data is being taken at each identified site in an attempt to better describe this unique habitat. We hope to use that data to characterize the areas where pools can be found, so that they could be more quickly and easily located and identified using GIS technology.

### PERSPECTIVES FOR THE FUTURE

The implications of this investigation are substantial. Not only would it contribute in the conservation of critical habitat within the county, the information gathered throughout will expand public awareness of this habitat and its species and potentially improve location techniques.



Fig. 4. UNCG student, Courtney Anderson, looks for salamander larvae in a prospective ephemeral pool. Photo: Ashley LaVere.

### Acknowledgements

We would like to thank the North Carolina Herpetological Society and the Biology Department of the University of North Carolina at Greensboro for funding for this project. We thank the Guilford County Open Space Committee for their wonderful assistance. We would also like to thank Ann Somers, Catherine Matthews, and Bill Markham for their advice, comments, and contributions.

### References

1. Pennsylvania Natural Heritage Program, Vernal Pools, <http://www.naturalheritage.state.pa.us/VernalPools.aspx> (2013).
2. J. Wallace, N. Tarr, Conservation Recommendations for Priority Terrestrial Wildlife Species and Habitats in North Carolina (North Carolina Wildlife



Fig. 3. A Marbled salamander larvae in its early stages of development found in an ephemeral pool on the Blue Moon Preserve in Greensboro, North Carolina. Photo: Dennis Burnette.





# Frog Friendly Coffee, an Alternative for the Conservation of Threatened Amphibians in Colombia

By <sup>1,2,5</sup>Victor F. Luna-Mora & <sup>1,2</sup>Manuel Gilberto Guayara-Barragan

Local communities participation is a key point in species conservation projects that are being made in different parts of the world; every day more successful strategies and projects show that local communities are being appropriating knowledge giving value to biodiversity conservation, species and their habitats, so that it can be guaranteed that these actions last through time and space.

Nevertheless, in great biodiversity and ecosystemic significant areas, new challenges and problems of economic, social and cultural levels, generate crossroads for local communities and actors involved in conservation process, which joined to current problems such as low economic resources for searching, short terms of financing, lack of legal frame for threatened species protection, etc. show a gray panorama to maintain the biological diversity and its ecological process.

“Coffee Friend of Tolima’s oisonous Frogs” borns due to the necessity of join two species conservation strategies of endemic amphibia in endangered extinction at the north of Tolima department (*Andinobates tolimensis* and *Andinobates dorisswansonae*); with sus-



Instrument for conservation: poison frogs of Tolima. a) *Andinobates tolimensis*, b) *A. dorisswansonae*. Photo: Victor F. Luna-Mora, Cristian A. Gallego Carmona.

tainable agricultural practices implementation, through participative training, education and researching. This will allows a farmer’s life quality improvement and will generate conservation agreements to protect and renovate andean forest remnants; thus, a flagship product of colombian economy like coffee is, carries a message from Andean mountains to the world regarding biological protection and a sustainable development of a small coffee area.

Tolima’s poison frog (*Andinobates tolimensis*) and Swainson’s poison frog (*A. dorisswansonae*), are two endemic species, sympatric and in endangered extinction (Endangered and Critical Endangered respectively); due mainly to the impact of agricultural activi-

<sup>1</sup>IUCN-SSC Amphibian Specialist Group, Regional Colombia. <sup>2</sup>Fundación Herencia Natural-Colombia. <sup>3</sup>Grupo de investigación en biodiversidad y dinámica de ecosistemas tropicales, GIBDET, Universidad del Tolima. (Corresponding author email: [victorfl05@gmail.com](mailto:victorfl05@gmail.com))

ties unsustainable like extensive animal breeding, exotic tree crops and the influence of coffee dominant crop in the región which since 90's has cause an acelerated destruction of original ecosystems. In consequence, the rural landscape is dominated by coffee crops, pastures and subandean forest patches highly fragmented, isolated and reduced to small remnants on the river's Banks and steep slopes (1).



Loss of habitat due to coffee crops and forest destruction. Photo: Victor F. Luna-Mora.

Before restricted potential hábitats distribution and farmers precarious social-economic conditions, as a result of deep agricultural crisis in Colombia, which increases ecosystems threats and pressures, species and their ecological process, "Coffee Friend of Tolima's poisonous frogs" appears like an initiative that has been constructed with an active participation of local communities, in search of viable economic options, defense of territory, food sovereignty and protection of natural resources, invaluable to the survival of life as is wáter. This participative construction is based on the premise "hungry no conservation" which was the reason for Fundacion Herencia Natural's borning, a non gubernamental organization that meets colombian young researchers interés from different professional and geographical áreas in colombian biological diversity protection. This organization has counted with support and training funds for young conservationists as Conservation



Instruments for empowering local communities with scientific information. Photo: Victor F. Luna-Mora.

Leadership Programme and Mohammed Bin Zayec Conservation Species Fund, through seed funds that have enable research development, identify threats and develop strategies for the short and médium terms in this priority área due to its great diversity species and endemism.

Since in countries rich in biological diversity as Colombia, one strategy doesn't guarantee species conservation, and a problem can be seen from different perspectives; there are many challenges that arise daily, a sinergy of actions is still needed on behalf of conservation. It is not enough land purchase or generate the first reserve of amphibians in Colombia, if their goal is due to individual economic interests instead a continuous and coordinated work with other local actors as communities, city halls, universities and ONG's, that work together around one common goal. Otherwise to have island of forest in a landscape matrix dominated by grasslands.

Thus, this iniciative has three major components: participative research, education and training, which have led to progress in this long process is just beginning, learning and unlearning through mistakes committed, with the firm conviction that "working together can go further." Participating research, that is the practice of making science together, respects the local knowledge, change the way of relating to the community as a data source to be treated as co-researchers in the generation of knowledge that, constructed together, strengthens significantly any process in a territory (2). Through this process it has been found a higher valuation for the land, their work and their role as food farmers generators to million of people in colombian cities; furthermore, the adoption of some practices between researchers and farmers such as conservation agreements and monitoring of species of poisonous frogs for the identificación and priorization of important áreas to protect, preserve and renovate as wáter sources and wáter births, provides an important step in future shares connection of forest remnants and generation of biological corridors. Finally, a result of great importance for the continuity of the process is obtaining new generations of children and youth with environment awareness which accompany the investigations carried out by researches "environmental performers."

For the second component was taken as starting point the sensitization of some charismatic group for the community and environment education as a key tool to achieve changes in communities



Practice of making science together and new generations "environmental performers." Photo: Manuel G Guayara, Victor F. Luna-Mora.



perception respect to the current problems and challenges, thus cultural, playful and pedagogical activities developed, around territory protection and natural sources, incorporating basic ecological contents for the development of new ways of approaching reality through educational and social strategies that include science interdisciplinarity (3). Furthermore, as part of this strategy of education emphasis has been made on the disclosure of scientific information through a conversational, clear and easy to understand language that can reach more people and publish at local, regional and national levels. It's necessary to empower local communities with scientific information that every day researchers generate and that a high percentage doesn't return to the study site where it acquires a large value. Currently, in Tolima's Department such as several departments in Colombia, conflicts arise from the energetic mining exploitation, specially in the study area of open sky mining gold extraction creates a major environmental and human risk, due to the use of various chemical contaminants including cyanide a poison highly polluting. For this reason the knowledge of endemic species and endangered extinction have great value in the process of defending territory.



The endemic species instrument for defending territory. Protest mining gold extraction in Tolima. Photo: Victor F. Luna-Mora.

At a social level, one of the biggest impacts that has had initiative its the development of training workshops and training of farmers and their families, so that this will submit tools and new knowledge to improve quality crops, a better environment and community quality life which has been an enriching experience to personal and collective level; with the support of Instituto de Investigaciones Alexander Von Humboldt and Corporacion Autonoma Regional del Tolima (CORTOLIMA) it was generated training processes in environmental protection that meets national and international standards. Otherwise, it has encouraged the regional market and has eliminated intermediaries that increase the costs of marketing and production, by fostering a fair market and a remuneration of the profits that are invested in meeting community needs.

An initiative gaining strenght among communities of this región and other neighboring communities who have learned about the process, it's the generation of a environmental friendly label with frogs, that currently conducts Fundacion Herencia Natural, that unlike the generated for birds provides standards of protection and responsible use of wáter sources, riparian forests and associated biodiversity crops due to the characteristics of amphibians double life that allows them to be very important ecological indicators for

ecosystem. There are many challenges that we have to face in order to achieve effective conservation actions for threatened species in our countries its worth generate joint strategies with local communities, since these last in time and don't depends on presence of the investigator. Similarly the empowering scientific information is a valuable tool that should be in the service of communities since in many cases it's there where a great value acquires.

### Acknowledgments

To communities of northern towns of departamento del Tolima specially to Asociación Tienda Comunitaria La Esmeralda, Pibe, Lucia y Armando. To each person who has contribute with the development of this initiative: Cristina Mora, María Camila Morales, Brigitte Baptiste, Mateo Gutiérrez, Javier Enrique García, Jaime Alfonso Ortiz, Leidy Tatiana Suarez, Robyn Dalzen, Stuart Paterson, Patricia Manzanares, Carolina Pinto, Jorge Enrique Cardozo, José Vicente Rodríguez, Alejandro Guayara, Alicia Fonseca. To organizations that have provided support and funding for the development of research: Conservation Leadership Programme, Mohammed Bin Zayed Conservation Species Fund, Instituto Alexander von Humboldt, Conservación Internacional Colombia, Cortolima, Universidad del Tolima.

### References

1. V. F Luna-Mora, M. Guayara-Barragán. Evaluation Amphibians Threateneds in Key Sites in Colombia. Final Report. Future Conservationist Awards 2008 (Natural Heritage Foundation, Bogotá DC, 2010).
2. Z. Calle. Investigación participativa para la restauración ecológica. Centro para la investigación en sistemas sostenibles de producción pecuaria CIPAV. 2013.
3. J. N. Urbina-Cardona, P. A. Burrowes, M. Osorno, A. J. Crawford, J. A. Velasco, S. V. Flechas, F. Vargas-Salinas, V. F. Luna-Mora, C. A. Navas, M. Guayara-Barragán, W. Bolívar-G, P. D. A. Gutiérrez-Cárdenas, & F. Castro-Herrera. Prioridades en la conservación de anfibios ante su crisis global: hacia la construcción del plan de acción para la conservación de los anfibios de Colombia. Pp. 10-19. In: libro de memorias III Congreso Colombiano de Zoología, "creando un clima para el cambio: la biodiversidad, servicios para la humanidad" (Botero-Delgadillo, E. & Moreno-Ballesteros, M.I., eds.). Asociación Colombiana de Zoología. Bogotá, Colombia. 2011.



Coffee training workshops. Photo: Manuel G. Guayara-Barragan.

# Conservation of Lake Lerma Salamander

By Karla Pelz Serrano

The Lake Lerma salamander (*Ambystoma lermaense*) is endemic to central Mexico, particularly the Cienegas of Lerma (it is only found in these wetlands). The Lake Lerma salamander is a very distinct species having the characteristic of being reproductive at the larvae stage of its development—completion of metamorphosis into the terrestrial stage to reproduce is not needed and is called “neoteny.” Few salamander species show this unique characteristic, making it important evolutionarily.

The Lerma salamander is in danger of extinction because its habitat has been reduced 90% from its original size. To develop a recovery and conservation action plan for this species principal causes that threaten populations are summarized: 1) water pollution, 2) habitat loss, 3) invasive species, and 4) diseases.

Little information about the status and ecology of the Lerma salamander exists, therefore, surveys are being conducted among the Cienegas of Lerma to assess the presence of Lerma salamander populations in helping develop an occupancy model and a distribution map for the species. In addition, evaluation of the size, and genetic structure of Lerma salamander populations as well as the occurrence of diseases such as *Ranavirus* and *Batrachochytrium* sp. are being appraised.

Work with the communities that surround the wetlands, and still live off of the resources this ecosystem provides, is an important part of the conservation strategy in raising awareness of the importance of protecting the Lake Lerma salamander and its habitat. With the information that the above ongoing research will provide, a developing action plan for the recovery and long-time conservation of the Lake Lerma salamander can be formalized.

Since a major part of the problem that the Lerma salamander faces is habitat loss and water pollution, research should also include a habitat restoration component. Thus, collaborative work with other colleagues at the Universidad Autonoma Metropolitana (UAM) to mitigate the causes that currently are threatening not only Lake Lerma salamander populations, but also other endemic species such as the Black-pollled yellowthroat (*Geothlypis speciosa*), and the Lerma chub (*Algansea barbata*), are being worked toward.

In closing, together with other researchers at the UAM we are working to decrease water pollution, reduce habitat loss and increase awareness for the conservation of the Cienegas of Lerma and the species that they harbor as well as developing a workable and sound action plan for the conservation of the Lake Lerma Salamander (*Ambystoma lermaense*).

Those interested in helping with these activities and this species should contact: [k.pelz@correo.ler.uam.mx](mailto:k.pelz@correo.ler.uam.mx)



Lake Lerma Salamander, *Ambystoma lermaense* (above) and habitat (below). Photos: Rurik List.





# Two Central Texas Salamanders get Endangered Species Act Protection

By Collette L. Adkins Giese

The U.S. Fish and Wildlife Service protected the Georgetown and Salado salamanders under the Endangered Species Act. As with the Jollyville Plateau and Austin blind salamanders protected last year, February's decision was spurred by a landmark settlement with the Center for Biological Diversity in 2011 that is expediting federal protection decisions for 757 imperiled species across the country.

"Saving these salamanders will also protect the precious springs that give drinking water and recreation to Texas communities," said Collette Adkins Giese, a Center lawyer who works to save imperiled amphibians and reptiles. "These rare salamanders are found nowhere on Earth except central Texas, and right now they're facing extinction. Endangered Species Act protection will give them a fighting chance."

The Georgetown and Salado salamanders live in springs in Bell and Williamson counties in central Texas. These fully aquatic animals require clean, well-oxygenated water and are threatened by activities that disturb their surface springs, pollute their water or reduce its flow to their underground aquatic habitats.

Although the Service previously proposed to list the Georgetown and Salado salamanders as "Endangered" under the Endangered Species Act, the agency in February instead protected them as "threatened." The new rule recognizes state and local regulatory actions taken to benefit water quality, including Georgetown's recently enacted ordinances, but finds that the salamanders still face unaddressed threats to their survival.

"I'm glad these salamanders are finally protected, but disappointed the Fish and Wildlife Service is backtracking on the level of protection," said Adkins Giese. "The Endangered Species Act has been more than 99 percent effective at saving species, but it needs to be utilized to its fullest extent if it is going to save these and other rare species that are the wild heritage of central Texas."

The salamanders have spent years waiting in line for federal protection. As part of an agreement with the Center, the Service agreed to issue protection decisions for these and two other central Texas salamanders by the end of 2013. In August the Service issued final rules listing the Jollyville Plateau and Austin blind salamanders as "endangered" and designating critical habitat. But the Service delayed its final decision on the Georgetown salamander and Salado salamander until February due to "substantial disagreement" over available data and to consider the city of Georgetown's final ordinances for water quality and urban development.

A total of 107 imperiled species from around the country have gained Endangered Species Act protection so far in response to the 2011 agreement with the Center, and another 28 have been proposed for protection.

## SPECIES HIGHLIGHTS

**Salado salamander** (Bell County): The Salado salamander is just two inches long and has reduced eyes compared to other spring-dwelling salamanders in north-central Texas. It is known historically from four springs near Salado, Bell County: Big Boil-



Georgetown salamander (*Eurycea naufragia*) in its natural habitat. Photo via [Wikipedia](#).

ing Springs, Li'l Bubbly Spring, Lazy Days Fish Farm Spring and Robertson Springs. These springs bubble up through faults in the northern segment of the Edwards Aquifer and associated limestones along Salado Creek. The salamander is extremely rare and has been observed just a few times over the past several decades, despite intensive survey efforts. Although most of Bell County is still considered rural, the area is experiencing rapid human population growth. The Salado salamander's restricted range makes it vulnerable to groundwater contamination and potentially catastrophic hazardous-materials spills.

**Georgetown salamander** (Williamson County): The Georgetown salamander is characterized by a broad, relatively short head with three pairs of bright-red gills on each side behind the jaws, a rounded and short snout and large eyes with gold irises. It's known from springs along five tributaries to the San Gabriel River and three caves in Williamson County, Texas. The recharge and contributing zones of the northern segment of the Edwards Aquifer supply the water that feeds these springs. These zones are found in portions of Travis, Williamson, Bell, Burnet, Lampasas, Mills and Hamilton counties. The salamander is threatened by water pollution and low water flows. The Service determined in 2001 that the salamander deserves federal protection; the Georgetown salamander has waited more than a decade for the Service to finalize today's listing.

---

The Center for Biological Diversity is a national, nonprofit conservation organization with more than 675,000 members and online activists dedicated to the protection of endangered species and wild places.

Secretaría de Medio Ambiente e Historia Natural  
 RED para la Conservación de Anfibios en Chiapas  
 Zoológico Regional "Miguel Álvarez del Toro"  
 H. Ayuntamiento Constitucional de Berriozábal  
 Universidad de Ciencias y Artes de Chiapas  
 Comisión Nacional para el Conocimiento y Uso de la Biodiversidad  
 Sociedad Herpetológica Mexicana, A. C.  
 Universidad Politécnica de Chiapas  
 Alianza para la Supervivencia de los Anfibios  
 H. Ayuntamiento Constitucional de San Cristóbal de las Casas  
 Universidad Tecnológica de la Selva  
 Universidad de Guadalajara



Del 3 al 8  
 de Mayo de 2014

28  
 de Abril  
 Día Mundial  
 de los  
 Anfibios

- 2º Congreso Nacional de Anfibios  
 Conferencias magistrales / Ponencias (oral y cartel) / Talleres
- 4ª Exposición Fotográfica "Anfibios Mexicanos"
- Concursos de fotografía, dibujo y anfibios robóticos
- Evento cultural alusivo a los anfibios
- Actividades interactivas y talleres para niños y público en general
- Salida de campo para la observación de anfibios
- Paseo y carrera ciclista por los anfibios

**Contacto**  
 Red De Anfibios En Chiapas   
 @REDdeANFIBIOS   
 redanfibioschiapas@hotmail.com

**Descargas**  
[www.semahn.chiapas.gob.mx](http://www.semahn.chiapas.gob.mx)  
[www.semahn.chiapas.gob.mx/portal/anfibios](http://www.semahn.chiapas.gob.mx/portal/anfibios)

Berriozábal, Chiapas.





# Preserving the Endangered Marsupial Frogs of the Genus *Gastrotheca* in Argentina



Metamorphic of *Gastrotheca gracilis*. Photo: Laura C. Pereyra.

By <sup>1</sup>Mauricio S. Akmentins, <sup>1</sup>Laura C. Pereyra, <sup>1</sup>Cecilia G. García, <sup>2</sup>Yanina V. Bonduri, Pablo M. Contreras & <sup>3</sup>Martín Lépez

Since the rediscovery of the southernmost species of the hemiphractid marsupial frog *Gastrotheca gracilis* after 20 years without registries in the wild, the conservation awareness of the three endemic species of marsupial frog inhabiting Argentina has become more important. The remarkable reduction in the localities of occurrence of *G. gracilis* and without any sightings in the wild of *G. christiani* since 1996 and *G. chrysosticta* since 1993 were the main reasons for increasing the threat status of these species from Vulnerable to Endangered in the last Argentinean Red List assessment (1).

In mid-2013, we initiated a conservation project focused on the three endemic species of marsupial frog of genus *Gastrotheca* present in Argentina. This project was one of the winners of the Future Conservationist Award 2013 granted by the Conservation Leadership Programme (CLP) and it is part of a long-term program for the conservation of amphibian diversity of Yungas Andean forests in north-western Argentina. While this project is still underway, some notable results have been obtained to date.

One of the most concerning issues about the two rediscovered populations of *Gastrotheca gracilis* is the lack of effective habitat protection; despite the fact that one of these populations occurs in a provincial natural protected area (2). Fortunately, two new popula-

tions of *G. gracilis* were recorded during the project's field search in Campo de los Alisos National Park. This finding represent an excellent opportunity for preserving this marsupial frog species, due to the fact that Campo de los Alisos has been recently declared a national protected area and currently are in the management plan developmental stage. The recording of *G. gracilis* in Campo de los Alisos gave us the opportunity to include this amphibian as a top priority species for conservation and some conservation measures were recommended for its Conservation Action Plan in this pro-



14.10.2013 09:03

A helping hand: taking samples for detection of *Bd* on an adult male of *Gastrotheca gracilis* in Campo de los Alisos National Park, Tucumán, Argentina. Photo: Yanina V. Bonduri.

<sup>1</sup>Centro de Investigaciones y Transferencia de Jujuy (CIT-JUJUY), CONICET-UNJu, Jujuy, Argentina - Instituto de Bío y Geociencias del NOA, Universidad Nacional de Salta, Salta, Argentina. <sup>2</sup>Profesional Asistente de Planta Permanente en el Programa SiPAP (Sistema Provincial de Áreas Protegidas), Secretaría de Ambiente, Ministerio de Ambiente y Producción Sustentable de la Provincia de Salta, Salta, Argentina. <sup>3</sup>Museo Botánico Córdoba, Universidad Nacional de Córdoba, Córdoba, Argentina.



Adult male of *Gastrotheca gracilis*. Photo: Mauricio S. Akmentins.

tected area.

The recent records of adults of *Gastrotheca gracilis* made it possible to document the male's advertisement call. The formal description of the advertisement call of this species is a valuable monitoring tool. Because of the secretive life habits of marsupial frogs, it might be more plausible to find individuals by the detection of calling activity than by standard monitoring techniques like visual encounter surveys. Also, positive identification of this species from aural surveys, allows the employment of passive monitoring techniques like automatic recording systems or "frogloggers."

But not all was good news for *Gastrotheca gracilis* because a new threat has been detected for the species. To date the only documented threat to marsupial frog populations in Argentina was habitat destruction, eliminating a local reproductive aggregation of frogs, of the related *G. christiani* near Calilegua National Park (3). Since the rediscovery of *G. gracilis* in 2011, two reproductive sites of the species were monitored yearly at Los Sosa Provincial Reserve in Tucumán province, but in January 2014 one of the reproductive sites was completely destroyed by domestic pigs causing massive mortality of the tadpoles. Injuries in some dead tadpoles indicated direct predation by pigs. This threat had not been detected previously and confirms the lack of effective protection of the populations of *G. gracilis* in Los Sosa Provincial Reserve.

In January 2014 we observed several reproductive locations (sites) in the vicinity of "La Banderita" situated between Tucumán

and Catamarca provinces (the other rediscovered population in 2011 and type locality of *Gastrotheca gracilis*). Here, numerous temporary springs were used by marsupial frog females to lay her tadpoles. While the populations seem to be relatively stable in this locality, they are still under considerable risk due to some habitat alterations detected such as road maintenance activities, wild fires and deforestation. The creation of an effective protected area in "La Banderita" would be highly desirable in order to preserve the southernmost population of marsupial frogs in America.

Despite the intensive field searches, no new records of the other two missing species were made. The search areas in order to find *Gastrotheca christiani* populations were focused in Calilegua National Park in Jujuy province, whereas Baritú National Park and Nogalar de los Toldos National Reserve in Salta province were the areas searched for *G. chrysosticta*. Collaborative work with the National Park Administration of Argentina was one of the main objectives, because this governmental agency is one of the principal stakeholders to ensure the long-term preservation of the marsupial frogs and its natural habitat. Some of the proposed activities included the training of the park ranger staff in amphibian diversity identification and the supplying of field guides to help in the recognition of marsupial frogs; this might afford the best opportunity for new sightings of the missing species in the future.

We are currently working on the project activities described above but our short term objective is to disseminate the collected



information and to further increase awareness of the conservation status of the Argentinean marsupial frogs.

The rediscovery of *Gastrotheca gracilis* gives us some hope that the other two species of marsupial frog of Argentina are still extant (4). But, it is vital to continue with the field searches, particularly of the Calilegua's marsupial frog, *Gastrotheca christiani*, one of the 250 acclaimed "lost frogs" of the IUCN Amphibian Specialist Group's list. This direct conservation action must be developed in combination with a proactive campaign to increase public awareness of the importance to preserve these charismatic frog's and their essential habitat in the Yungas Andean forests of north-western Argentina.

We believe that reassessment of the Red List categories of the three Argentinean species (genus *Gastrotheca*) needs to be reconsidered and evaluated. Based on the newly compiled information we have collected, the status should be changed from Vulnerable to Endangered for *G. gracilis*, from Endangered to Critically Endangered in *G. christiani* and in *G. chrysosticta*, from Vulnerable to Critically Endangered. All category adjustments suggested here are justified under the criteria A2 (5) and the proposal of the Critically Endangered category for the two missing species is a precautionary approach.

#### Acknowledgments

Funding support for this conservation project came from the Future Conservationist Award 2013 granted by the Conservation Leadership Programme (CLP). Permits for field work in Argentina were provided by Delegación Técnica de Parques Nacionales Regional Noroeste, Argentina and Environmental Provincial Agencies. We thank to Dr. Marcos Vaira for his guide as project's advisor and field work assistance.

#### References

1. M. Vaira, et al., *Cuad. herp.* 26, 131 (2012).
2. M.S. Akmentins, et. al. *Cuad. herp.* on-line first: <http://ppct.caicyt.gov.ar/index.php/cuadherpetol/article/view/3384/3589> (2014).
3. M. Vaira, L. Ferrari, M. S. Akmentins, *Herpetology Notes* 4, 279 (2011)
4. M.S. Akmentins, L.C. Pereyra, M.Vaira, *Animal Conservation*. 15, 142 (2012).
5. IUCN Standards and Petitions Subcommittee. Guidelines for using the IUCN Red List categories and criteria. Version 8.1. Prepared by the Standards and Petitions subcommittee in March 2010; <http://intranet.iucn.org/webfiles/doc/SSC/RedList/RedListGuidelines.pdf>.



Panoramic view of the reproductive site destroyed by domestic pigs in Los Sosa Provincial Reserve, Tucumán, Argentina. A: reproductive site in January 2012. B: reproductive site after habitat destruction in January 2014. Photo: Mauricio S. Akmentins.



Tadpole of *Gastrotheca gracilis*. Photo: Mauricio S. Akmentins.



Team members and park rangers during field work in Campo de los Alisos National Park in December 2013. Photo: Pablo Contreras.





Temporary spring used as reproductive habitat by marsupial frogs in "La Banderita," type locality of *Gastrotheca gracilis*. Photo: Mauricio S. Akmentins.



Workshop about amphibian diversity and species recognition with the park ranger staff of Campo de los Alisos National Park in December 2013. Photo: Mauricio S. Akmentins.



Workshop about amphibian diversity and species recognition with the park ranger staffs of Baritú National Park and Nogalar de los Toldos National Reserve in November 2013. Photo: Mauricio S. Akmentins.





Fig. 1. Only recently that *Duellmanohyla uranochroa* can be seen more frequently at La Fortuna Forest Reserve again. Photo by A. Hertz.

## Amphibian Taxonomy and Conservation in Panama and Bolivia

By Andreas Hertz, Martin Jansen, Arne Schulze & Gunther Köhler

**N**owadays, everyone may agree that habitat loss is by far the biggest threat to tropical amphibians. Thus, the most effective way of amphibian conservation would be the uncompromising protection of their natural habitats. However, this is as good as impossible since the ongoing exploitation of natural resources for a growing world population leads to a perennial conflict of interests between man and the conservation of nature. The only solution to on the one hand, protect and preserve our biodiversity and on the other respond to the wishes and needs of the human population is to develop an effective conservation management. Having realized this, it is crucial to have a better idea how many species there are on earth and to know their phylogenetic status within the specific taxonomic group. Furthermore, we need to know how particular species are distributed, which individual habitat preferences they have, and how populations and subpopulations are developing. All this information combined allow for the assessment of the conservation status of species as applied by The IUCN Red List of Threatened Species (1).

Natural history museums play a decisive role in collecting and processing such data. Their scientific collections, assembled over centuries with detailed information about where and when a par-

ticular specimen was collected, are a window to the past showing the status of species, populations and habitats at a particular point in time and space. Moreover, natural history museums are almost the only employer for well-trained taxonomists who are experts in a particular group of organisms, from a specific part of the world.

One of these research museums is the Senckenberg Research Institute and Natural History Museum in Frankfurt, Germany, whose herpetology section has a main focus on the herpetofauna of tropical America. So far, long-term cooperations with institutions and researchers in Mexico, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, Panama, Peru, Venezuela, Paraguay, and Bolivia have lead to a series of expeditions to those countries. Aside from numerous publications in international journals, our work in Latin America has resulted in the publication of several books on the diversity, taxonomy, and identification of the Central American herpetofauna, as well as several regional identification guides. One of the more prominent works is a monograph on the amphibians of Central America (2). Particularly, Bolivia and Panama have been visited repeatedly with the intention to study amphibian species and populations.

Work in Panama began in 2006 after chytridiomycosis had caused catastrophic population declines among Panamanian amphibian communities. Declines were especially severe in mountainous regions of western Panama and the loss of amphibian diversity was



Fig. 2. Little is known about the situation of *Hyloscirtus colymba* populations in the wild. In Veraguas the number of calling males seems to increase. Photo by A. Hertz.

exceptionally well documented (e.g., 3, 4, 5). At that time, it was uncertain if any declining amphibian species would survive in their natural environment and where and why single populations might persist.

Indeed, some surviving populations were found and the species had experienced severe declines (6). In some species there was an increase in number of calling males: based on audio transects done repeatedly over a longer time period, for example for a population of *Duellmanohyla uranochroa* (Fig. 1) at La Fortuna Forest Reserve between 2008 and 2013 and for a population of *Hyloscirtus colymba* (Fig. 2) at Alto de Piedra between 2008 and 2010. Moreover, the previously poorly studied Tabasará mountain range in the Comarca Ngöbe-Buglé turned out to be especially rich in endangered amphibian species; however, this is an area without nature reserves that suffers from ongoing deforestation (6).

Unfortunately, other species were not found despite extensive search efforts at or near historic localities and at other sites with appropriate habitat. Among these are several species of the genus *Craugastor*, mainly of the *Craugastor punctariolus* Species Series (7), the members of which seem to be especially susceptible to chytridiomycosis.

Fortunately, one species of that series, *C. azueroensis*, seems not to be effected by chytridiomycosis yet, and it is assumed that the highlands on the Azuero peninsula may serve as a natural refuge from chytrid (8).

Other species not relocated in Panama include *Atelopus chiri-quiensis* among other bufonids, *Isthmohyla calypsa*, and *Lithobates vibicarius*. Certainly, the extinction risk for certain species and species groups is still high in western Panama. However, further research

is indispensable to monitor the population trends of amphibians in western Panama.

Work on amphibian communities in Bolivia's lowland habitats in 2005 was different from Panama as considerably less previous work had been done. Thus, a preceding period of exhaustive data sampling of Bolivia's anurans, aiming mainly on previously unknown aspects like larval morphology, collection of fresh tissue material, and advertisement call recordings was needed. In particular, the Chiquitano region proved to be especially species rich (9). An integrative taxonomic approach using molecular, bioacoustic and morphological data revealed a hidden diversity of the lowland anurans in Bolivia (10).

Many species that were presumed to be single widespread species distributed over large parts of South America turned out to be part of species complexes with the respective species having actually smaller distribution areas and thus are more likely to qualify for a more threatened IUCN Red List category (Fig. 3).

In view of amphibian conservation, Bolivia's biogeographic position in a climatic transition zone between the humid forests of the Amazon and the Dry Chaco may entail further threats for its amphibian fauna in the form of prolonged dry seasons as an effect of climate change. For example, more than five months recorded without precipitation during the 2006 dry season resulting in a decline of anuran communities at a study site in the Chiquitano region (11).

It can be assumed that extreme weather phenomena will become more frequent as a result of global warming. Therefore, a recent focus of our research is the development of automated acoustic monitoring methods (Fig. 4) to observe population trends and to



detect the effects of climate change on frog populations (12).

#### References

1. IUCN Red List of Threatened Species. Version 2013.2. (IUCN, 2014; www.iucnredlist.org)
2. G. Köhler, *Amphibians of Central America*. (Herpeton, Offenbach, Germany, 2011).
3. K.R. Lips, *Conserv. Biol.* **12**, 106 (1998).
4. K.R. Lips, *Conserv. Biol.* **13**, 117 (1999).
5. K.R. Lips *et al.* *PNAS* **103**, 3165 (2006).
6. A. Hertz, *et al.* *Amphib. Rept. Conserv.*, **6**, 9 (2012).
7. S.B. Hedges *et al.* *Zootaxa* **1737**, 1 (2008).
8. G. Köhler, A. Batista, A. Carrizo, A. Hertz, *Herp. Notes*, **5**, 157 (2012).
9. A. Schulze, M. Jansen, G. Köhler, *Salamandra*, **45**, 75 (2009).
10. M. Jansen, R. Bloch, A. Schulze, M. Pfenninger, *Zoologica Scripta*, **40**, 567 (2011).
11. M. Jansen, A. Schulze, L. Werding, B. Streit, *Salamandra*, **45**, 233 (2009).
12. M. Jansen, *Herp. Notes*, **2**, 143 (2009).



Fig. 3. The widespread *Dendropsophus nanus* is most probably composed of several species in a cryptic species complex. Photo: M. Jansen.



Fig. 4. Long-term sound recorder installed at a lagoon near the Ecological Research Station Chiquitos (in the background), Bolivia. Photo: M. Jansen.

# Destruction of Type Locality, New Records and Distribution of *Melanophryniscus cupreuscapularis*

By Jorge A. Céspedes & Ana M. Arias



Distribution of *Melanophryniscus cupreuscapularis* in Argentina.

*Melanophryniscus cupreuscapularis* was described from the “Perichón” locality, in the capital department of Corrientes province of Argentina and the Itati locality, in Itati department. Both localities are located in the northwest triangle of the Corrientes province. This species, like other species of the *Melanophryniscus* genre, presents very restricted distribution and scarce populations.

For this reason, this species was considered as “Vulnerable” in “Categorización de Anfibios de Argentina”(1) and in “Categorización del estado de Conservación de los anfibios de la República Argentina” (2). In “The conservation status of Argentinian amphibians. Collected DAPTF (Declining Amphibian Populations Task Force) Working Group Reports: Ten Years” (3) and in “Threatened Amphibians of the World” (4) the species was determined as “Insufficiently known.”

This species was considered vulnerable (5) consider the species as “Vulnerable” and in the 2013 IUCN Red List of Threatened Species, 2013.1 Version (6); it is considered as “Near Threatened.”

In the present work, we report voucher specimens for four new localities: Ramada Paso in the Itati department, for the San Luis del Palmar city in the same name department, for the Empedrado local-

ity, Empedrado department and for the “San Juan Mini” farm in the Concepcion department. All of the mentioned localities are located west to the Ibera System, in the northwest triangle of the Corrientes province (Map 1) (Appendage 1), the data for the Beron de Astrada and Bella Vista localities corresponds only to auditory records (7).

This information acquires great relevance for the conservation of this species due to the recent destruction of the Perichon locality’s natural environment (Fig. 1 and 2), from which the species was described. Both short and floodable grasslands and woods mogotes were swept, with the goal of selling the lands at low prices and for the construction of the “Corsodromo” of Corrientes city with touristic goals (Fig. 3, 4, 5 and 6).

This species, more of a walking than a jumping one, feeds primarily on formicids and collembolan (Dure and Kehr, 2006). During mating season, males sing in the ground, near bodies of semi-permanent water all day long, after strong storms, waiting for females to perform amplexus and, along with them, head to the water body. The eggs are disposed of at the bottom of water bodies of no more than 10 centimeters deep, where embryos and larvae develop.



Fig. 1 and 2. Natural environment of the type locality of *Melanophryniscus cupreuscapularis*.

Laboratorio de Herpetología, Anatomía Comparada de los Cordados, Departamento de Biología. Facultad de Ciencias Exactas y Naturales y Agrimensura. Universidad Nacional del Nordeste, Av. Libertad 5470, CP 3400, Campus Universitario Corrientes, Corrientes, Argentina.





Fig. 3 and 4. *Melanophryniscus cupreuscapularis* type locality destroyed by clearcutting for the construction of the Corredor de Corrientes city, Argentina.

This anuran, of small size and aposematic coloration (Fig. 7 and 8), has not suffered commercial extractions as its sister species *Melanophryniscus fulvoguttatus* and *Melanophryniscus klappenbachii* and is considered as “Threatened” (5), along with the destruction

of its habitat, given that also Itati, San Luis del Palmar and Concepcion localities have grown and been urbanized in the last years.

Most of the species of this genre have, as *M. cupreuscapularis*, very restricted distributions, suffering, in Argentina, the same situation due to the deterioration of their type localities and natural environment: *Melanophryniscus estebani*, in La Carolina, caused by the village’s old mine, and *Melanophryniscus* sp. of Sierra de la Ventana, located south of Buenos Aires province, due to the disappearance of the mountain range because of the commercial use of the rocks and the large amount of garbage that comes from the large cities of the province.



Fig. 5 and 6. *Melanophryniscus cupreuscapularis* type locality destroyed by logging for the lands sale at low costs, Corrientes city, Argentina.

#### References

1. Lavilla E.O., M.L. Ponssa (Coordinadores), D. Baldo, N. Basso, A. Bosso, J. Céspedes, J.C. Chebez, J. Faivovich, L. Ferrari, R. Lajmanovich, J.A. Langone, P. Peltzer, C. Úbeda, M. Vaira y F. Vera Candioti. In: Categorización de los Anfibios de Argentina. Editado por Lavilla, Richards y Scrocchi, y la Asociación Herpetológica Argentina (Categorización de los Anfibios y Reptiles de la República Argentina. Asociación Herpetológica Argentina. 97 p. (2000).
2. Schaefer E.F., M.I. Dure y J.A. Céspedes. In: Asociación Herpetológica Argentina. Categorización del estado de conservación de los Anfibios y Reptiles de la República Argentina. *Cuadernos de Herpetología* 26 (Sup.) pp. 131-214. (2012).
3. Lavilla E.O., M.L. Ponssa (Coordinadores), D. Baldo, N. Basso, A. Bosso, J. Céspedes, J.C. Chebez, J. Faivovich, L. Ferrari, R. Lajmanovich, J.A. Langone, P. Peltzer, C. Úbeda, M. Vaira y F. Vera Candioti. The conservation status of Argentinian amphibians. Collected DAPTF Working Group Reports: Ten Years in Walton Hall, Milton Keynes. USA. (Declining Amphibians Populations Task Force (DAPTF). Open University, Milton Keynes. pp. 50-54. (2006).
4. IUCN Red List of Threatened Species. Version 2013.1. (IUCN: www.iucnredlist.org). (2013).
5. Lavilla E.O. and H. Heatwole. Status of Amphibian conservation and decline in Argentina. In Heatwole, H., Ed., Surrey Beatty & Sons, Australia. (Amphibian Biology. Volume 9. Status of Decline of Amphibians. Western Hemisphere. Part 1. Paraguay, Chile and Argentina. pp. 30-78. (2010).
6. Céspedes J. and J. Langone. In S. Stuart, M. Hoffmann, J. Chanson, N. Cox, R. Berridge, P. Ramani, B. Young and IUCN (Editors). Conservation International. *Threatened Amphibians of the World*. Lynx Edicions, Barcelona and Gland & Arlington. 759 p. (2008).
7. Zaracho, V.H., J.A. Céspedes, B.B. Álvarez y E.O. Lavilla. *Guía de Identificación de Anfibios de la Provincia de Corrientes (Argentina)*. Editado por: FUNDACIÓN “MIGUEL LILLO” y UNNE. 182 p. (2012).
8. Dure M.I. and A. I. Kehr. *Herpetological Review* 37(3): 378. (2006).





Fig. 7. Dorsal view of the Holotype of *Melanophryniscus cupreuscapularis*.

**Appendage 1. *Melanophryniscus cupreuscapularis* specimens used for this work**

UNNEC 002137 – 002147 Col.: Alberto Silva, Camba Punta, Corrientes Capital. 29-12-1989; UNNEC 002883 Col.: Gilberto Avalos, San Luis del Palmar, Corrientes. 14-06-1993; UNNEC 003049, 003163, 003182, 003183, 004124, 004218, 004219, 004221 Col.: Céspedes, Jorge and Roberto Aguirre, Perichón, Corrientes, Capital. 25-09-1994; UNNEC 004853 – 004875. Col.: Céspedes, Jorge. Perichón, Corrientes, Capital. 01-05-1996; UNNEC 005232 – 005233. Col.: Céspedes, Jorge. Perichón, Corrientes, Capital. 06-02-1997; UNNEC 005284 – 005287. Col.: Morand, Mariana and Céspedes, Jorge. Perichón, Corrientes, Capital. 25-05-1997; UNNEC 005371 – 005384, Col.: Céspedes, Jorge. Perichón, Corrientes, Capital. 15-04-1997; UNNEC 005513, 005516 – 005518. Col.: Morand, M. and Céspedes, J. Perichón, Corrientes, Capital. 25-04-1997; UNNEC 005600 – 005601. Col.: Morand, M. and Céspedes, J. Perichón, Corrientes, Capital. 25-05-1997; UNNEC 005740. Col.: Morand, M., Perichón, Corrientes, Capital. 12-02-1998; UNNEC 005741–005742. Col.: Morand, M. Perichón, Corrientes, Capital. 01-04-1998; UNNEC 005743. Col.: Morand, M. Perichón, Corrientes, Capital. 24-03-1998; UNNEC 005745 – 005746. Col.: Morand, M. and Céspedes, J. Perichón, Corrientes, Capital. 16-04-1997; UNNEC 005759 – 005762. Col.: Morand, M. and Céspedes, J. Perichón, Corrientes, Capital. 22-12-1997; UNNEC 005826 – 005831. Col.: Céspedes, J. Perichón, Corrientes, Capital. 06-04-1998; UNNEC 005962 –005963. Col.: Morand, M. Perichón, Corrientes, Capital. 12-02-1998; UNNEC 005964 –005965. Col.: Morand, M. Perichón, Corrientes, Capital. 04-03-1998; UNNEC 005966 –005967. Col.: Morand, M. Perichón, Corrientes, Capital. 04-03-1998; UNNEC 006727. Col.: Céspedes, J.; Barboza, Noelia and Sandoval, María. Perichón, Corrientes, Capital. 17-09-1990; UNNEC 007322 – 007324. Col.: Céspedes, J. Empedrado, Empedrado, Corrientes. 15-04-1998; UNNEC 008074 – 008080. Col.: Gilberto Avalos, San Luis del Palmar, Corrientes. 14-06-1993; UNNEC 008111. Col.: Céspedes, J. and R. Aguirre,

Perichón, Corrientes, Capital. 24-05-1994; UNNEC 010218, 010222. Col.: Falcione, Camila and Ingaramo, Maria, Estancia San Juan Miní, Concepción, Corrientes. 26-10-2008; UNNEC 010542. Col.: Ingaramo, M., Ramada Paso, Itatí, Corrientes. 29-01-2009; UNNEC 010652 – 010653. Col.: Ingaramo, M., Estancia San Juan Miní, Concepción, Corrientes. 26-11-2009.



Fig. 8. Ventral view of the Holotype of *Melanophryniscus cupreuscapularis*.



# Golden Frog Conservation Workshop

By Brian Gratwicke

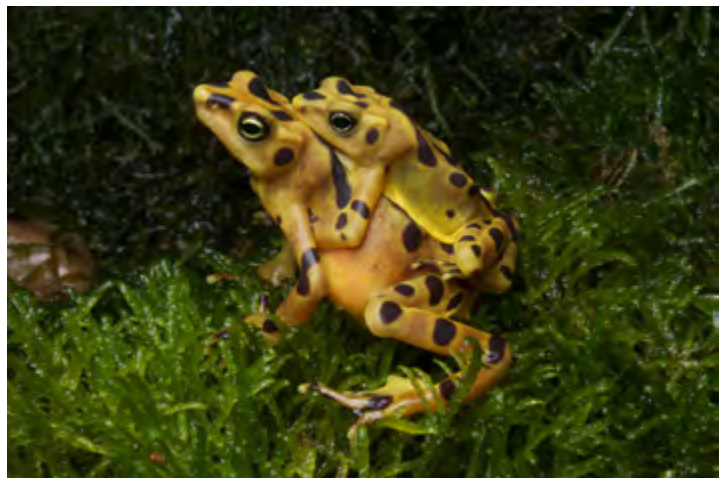
There are two closely related species of golden frogs that live in Panama. The Panamanian golden frog *Atelopus zeteki*, is a species historically found in the region around El Valle de Anton. Wild populations of *A. zeteki* declined precipitously when the frog-killing fungus *Batrachochytrium dendrobatidis* (*Bd*) arrived in El Valle in 2006 our last confirmed record in the wild was in 2009. The Variable harlequin frog *Atelopus varius* also comes in a golden color form that has been referred to as a golden frog, but it ranges much more widely through central Panama and Costa Rica. It has declined precipitously but it persists in low numbers at a few sites throughout its former range. Small captive populations of both species are maintained and bred in Panama at the El Valle Amphibian Conservation Center and a large captive collection of golden frogs was established in the US in 2001 prior to the *Bd* epidemic. The US collection is managed by the Maryland Zoo in Baltimore as part of an American Zoo and Aquarium Association Species Survival Plan.

We brought together 40 key individual stakeholders and experts from amphibian conservation research groups, NGOs and relevant government ministries and departments at the Hotel Campestre in El Valle, Panama November 19-22, 2013. Our overarching goal was to identify and address critical issues necessary to conserve golden frogs in Panama, to foster collaboration and information-sharing and to develop a roadmap for a large, forward-looking collaborative conservation effort. The vision statement developed by participants “*We are saving a national treasure, returning the Panamanian golden frog to nature.*” Our top 10 goals were to:

- Create capacity for and maintain sustainable captive populations of *Atelopus zeteki* and *A. varius* in Panama, with a business plan in place.
- Identify an organizational coordination structure to meet the needs of all stakeholders.
- Establish a working / coordinating group to drive / lead Panamanian golden frog conservation efforts.
- Develop a community engagement / education strategy.
- Develop a research plan for *in-situ* mitigation and surveillance of chytrid fungus in the environment.
- Identify suitable habitat areas (protected and private) that could serve as golden frog reintroduction sites.
- Develop a chytrid fungus mitigation research program for reintroduction of Panamanian golden frogs to the wild.
- Identify data needs for the development of population viability models to inform conservation planning.
- Develop studies to understand and meet the nutritional needs of Panamanian golden frogs in captivity.
- Create and sign an agreement (MOU) to solidify and ensure the commitment of all parties to Panamanian golden frog conservation.



Golden Frog PHVA meeting participants, Hotel Campestre, El Valle Nov 2013. Photo: Brian Gratwicke.



The Panamanian golden frog (*Atelopus zeteki*). Photo: Brian Gratwicke.

We thank Phil Miller and Bob Lacy of the IUCN Conservation Breeding Specialist Group who facilitated the meeting, and we thank the Anela Kolohe Foundation and the Shared Earth Foundation for funding to make this meeting possible. A full report is being prepared that will be a road map to guide our future efforts and it will be available online at [www.cbsg.org](http://www.cbsg.org).

# First Record of Amphibians in Walter Thilo Deininger Protected Natural Area in El Salvador

By <sup>1</sup>Emanuel S. Morán

Covering only 20,095 km<sup>2</sup>, El Salvador is the smallest country in the Americas. The limited data on the distribution of amphibians in the El Salvador means that there is still much to be discovered, especially within the network of protected areas.

The different ecosystems in the country, ranging from coastal forests to mountain forests, estimating that the richest ecosystem focuses on deciduous forests (dry forests) (1). Of the 34,000 ha of deciduous forest in the country, only 9,700 ha are afforded some level of protection under the law of Natural Protected Areas (2). Two thousand, five hundred and twenty one hectares fall within the Tropical Deciduous Forest Conservation Area, Costa Balsamo, within the Walter Thilo Deininger Protected Natural Area (3).

The Walter Thilo Deininger Protected Natural Area (WTD), located in the southern part of the central region of canton San Diego, La Libertad, covers an area of 732 ha with an altitudinal range of 20-280 m. The WTD comprises of tropical semi-deciduous broad leaf lowland forest, tropical deciduous forest, tropical broadleaf-evergreen forest and alluvial lowland, with the Chanseñora and Amayo Rivers supporting riparian forest (Fig.1, 2).

Thirteen species of amphibians from seven families in two orders (Anura and Caudata) were identified within WTD demonstrating a uniqueness of this area (Table 1). From this research, two scientific notes have been published on *Oedipina taylori* and *Hypopachus variolosus*.

*Oedipina taylori* is a salamander native to Guatemala, Honduras and El Salvador with an altitudinal range of 1-140m. However a recent observation of the species in WTD recorded the individual at 25 m, well outside its normal distribution and suggesting its possible existence in other coastal forests on the Pacific slope of Guatemala and El Salvador (4).

The distribution of *Hypopachus variolosus* also appears to be broader with an observation made at 28 m where former distributions identified the species being restricted between 200-1,800m in El Salvador (5).



Fig. 2. River Amayo of Protected Nature Area Park Walter T. Deininger. Photo: Emanuel S. Morán.

The uniqueness of WTD includes the habitats that are found within the area, the lack of human interference and the presence of 39% of amphibians of El Salvador.

Although our research was conducted in protected habitat, there are a variety of threats that currently affect WTD. Urban expansion, tourist developments, the use of pesticides for agriculture and forest fires caused as a result of agricultural burning practices, are all putting increasing pressure on WTD.

These findings increase our understanding of the ecology and distribution for amphibians in El Salvador especially with regards to the dry forests of the region. Our work helps sets the stage to further advance the study of amphibians and makes active steps towards developing a better understanding of how to manage the different habitats in El Salvador.



Fig. 1. Panoramic vista of Protected Nature Area Park Walter T. Deininger. Photo: Emanuel S. Morán.

Family	Species
<i>Plethodontidae</i>	<i>Oedipina taylori</i>
<i>Bufo</i> nidae	<i>Incilius coccifer</i>
	<i>Incilius luetkenii</i>
	<i>Rhinella marina</i>
<i>Craugastoridae</i>	<i>Craugastor rupinius</i>
<i>Hylidae</i>	<i>Scinax staufferi</i>
	<i>Smilisca baudinii</i>
	<i>Trachycephalus typhonius</i>
<i>Leptodactylidae</i>	<i>Engystomops pustulosus</i>
	<i>Leptodactylus fragilis</i>
	<i>Leptodactylus melanonotus</i>
<i>Microhylidae</i>	<i>Hypopachus variolosus</i>
<i>Ranidae</i>	<i>Lithobates forreri</i>

Table 1. Record of amphibians in Park Walter Thilo Deininger.

<sup>1</sup>IUCN SSC Amphibian Specialist Group, Regional Member (El Salvador): stanley\_hidalgo@yahoo.com



## References

1. Herrera, N.V., Henríquez, R., Vaquerano. *Mesoamericana. Boletín de la sociedad Mesoamericana para la Biología y la Conservación*. **10**,(4) (2006).
2. Herrera, N. Estudio Ambiental: Estado de Conservación del Complejo de Güija, (Informe Final de Consultoría: Ministerio de Medio Ambiente y Recursos Naturales, Centro Nacional de Registros, San Salvador, 2005)
3. Ruballo, N. E., Morán. *Rev. Biodiversidad Neotropical* **3**(1): 65-68.
4. Morán, Emanuel, S. Henríquez, E., Vladlen. Ruballo, E, Néstor. *Rev. Biodiversidad Neotropical* **3**(1): 65-68
5. Köhler, G. Veselý, M. E., Greenbaum. Eds. *The Amphibians and Reptiles of El Salvador*. Krieger Publishing Company, Melbourne, FL. (2006)

## Acknowledgments

Would to thank a Nestor Ruballo and Eduardo Leiva the volunteers who have helped to make the study in WTDP, and Ana María Vasquez as the advisor in the document.



Common toad (*Rhinella marina*). Photo: Emanuel S. Morán.



Yellow toad (*Incilius luetkenii*). Photo: Emanuel S. Morán.



Ravine frog (*Craugastor rupinius*). Photo: Emanuel S. Morán.



Leopard frog (*Lithobates forreri*). Photo: Emanuel S. Morán.



Wetland frog (*Scinax staufferi*). Photo: Emanuel S. Morán.





Worm salamander (*Oedipina taylori*). Photo: Emanuel S. Morán.



Mick frog (*Trachycephalus thyphonius*). Photo: Emanuel S. Morán.



Espumera frog (*Leptodactylus melanonotus*). Photo: Emanuel S. Morán.



Arboricola frog (*Smilisca baudinii*). Photo: Emanuel S. Morán.





*Eleutherodactylus cooki*. Photo: Norman Greenhawk.

## Dia del Coqui: Celebrating Puerto Rico's Unique Amphibians

By Norman Alastor Greenhawk

Visitors to Puerto Rico will likely carry home with them many memories, from the rain forests to the beaches to the amazing food, but it is likely that everyone will tell their friends and family about the noisy Coqui (*Eleutherodactylus coqui*) that makes the nights on the island unlike anywhere else on the planet. Anyone curious enough to seek out the calling male would likely be surprised that such a loud noise could come from such a tiny frog.

Although *E. coqui* is IUCN listed as “Least Concern,” and has in fact become a nuisance in places like Hawaii where it has been introduced, several of Puerto Rico’s endemic *Eleutherodactylus* species are threatened to various degrees, from IUCN Vulnerable to Critically Endangered. It is the same story in Puerto Rico as it is elsewhere climate change, habitat fragmentation and degradation, and chytridiomycosis are killing many of Puerto Rico’s frogs.

### IT STARTED IN PANAMA...

I volunteered at the Smithsonian Tropical Research Institute’s Panama Amphibian Rescue and Conservation Project in 2012 and again in 2013. The Golden frog (*Atelopus zeteki*) is an endemic species of frog that is currently considered extinct in the wild. Much like the coqui in Puerto Rico, the Golden frog is a symbol of Panama, and images of it adorn hats, t-shirts, lottery tickets and it is even the inspiration for tattoos.

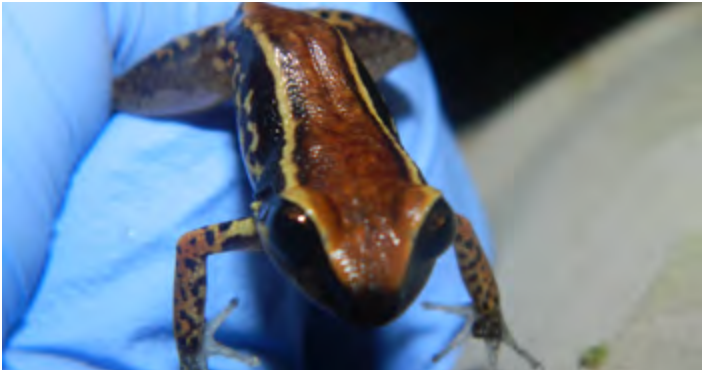
There is even a holiday dedicated to *A. zeteki*, Dia de Rana Dorada, on August 14<sup>th</sup>. In 2012, I was able to help Angie Estrada, Jorge Gurell, and the staff of PARC with STRI’s activities for Golden frog Day. While the myriad of families with children that attended the events at Gamboa zoo seemed to enjoy themselves, I was initially skeptical. With so many species in need of conservation, and the



*Eleutherodactylus cooki*. Photo: Norman Greenhawk.

demand for funding always outpacing the supply, I found it silly to spend time, effort, and money to have a day for a frog. Wouldn’t it have been better for the money to go directly to the *ex-situ* breeding program for *Atelopus* frogs that STRI was running?

Upon my return in 2013, I was viewing the world of conservation through different eyes. I was on a trip paid for by Earthwatch, and my objective was not only to gain more experience with amphibian conservation, but to study ethnoherpetology—how various cultures interacted with reptiles and amphibians. Perhaps it was this aspect of my trip that made me look at Dia de Rana Dorada in a new light. I came to see Dia de Rana Dorada not as a spurious waste of resources, but a genuine celebration of that which we are missing so often in today’s world—a connection with nature. Here is a culturally significant animal, a frog no less, being celebrated and the holiday in its honor was being used by STRI as an event to increase awareness about Panama’s conservation issues.



*Eleutherodactylus richmondi*. Photo: Norman Greenhawk.

Additionally, I noticed the immense pride that the people took in their frog. In some of the rural towns I visited, people refused to believe that the frog was extinct in the wild and would claim, with a prideful smile, that the frog still exists in the local mountain forests. At the Gamba events, people were genuinely disappointed that PARC didn't have any *A. zeteki* for them to see. Children made Golden frog masks and pretended to be frogs.

### ...AND WE NEED IT IN PUERTO RICO

Puerto Rico is a great place to live, but Puerto Rico has problems. Massive unemployment, a nebulous status in relation to the US, a recent downgrading of the island's credit-rating to junk-bond status, a culture being altered rapidly—all of these pressures are weighing on the island. But two other issues—ecological degradation and the massive emigration of educated young people—are my primary focus of concern. After seeing the success of Panama's Golden Frog Day first hand, I began to ask myself—why don't we have a day for the coqui?

The more I pondered this, the more I became convinced that a "Dia del Coqui" is exactly what Puerto Rico needs. *E. coqui* is endemic to Puerto Rico, and is a major symbol of Puerto Rican culture. From Taino petroglyphs to kitschy tourist memorabilia, images of the coqui abound. There is a saying here, "I'm as Puerto Rican as the coqui." In total, Puerto Rico has 17 species of *Eleutherodactylus* frogs, and although only two species make the namesake mating call, they are collectively referred to as "Coquis."

Puerto Rico has a love of frogs, to be sure, but education about environmental and conservation issues is lacking. Many misconceptions abound; one commonly heard tale that shows the cultural pride in coquis is the often-told myth that if coquis leave the island of Puerto Rico, they will die (the people of Hawaii can attest to the falsehood of this idea). So a festival, a day, dedicated to this little frog can, and should, be more than just a happy get together. It should be educational, helping people who have little to no actual contact with nature see the species that they share their own backyard with. It should be cultural, and help to reinforce the pride that people in the natural features of their island, such as the coquis and El Yunque rainforest. It should also be a socially cohesive event, allowing everyday people the chance to develop relationships with personnel of the various government agencies and NGOs in charge of managing Puerto Rico's protected areas.

### STARTING SMALL...

The first "Dia del Coqui" is actually going to be a weekend-long celebration. I met with the director of the Jardín Botánico y Cultural in Caguas, Puerto Rico, and by the end of the meeting, the popular botanical garden was booked as the venue for the entire weekend of September 26-28, 2014. The director shared my view—that for all



*Eleutherodactylus coqui*. Photo: Norman Greenhawk.

the celebrations on the island, it should be obvious that our unique frogs, which are held in such high regard by the people of the island, should have a holiday of their own.

Between now and September there is much to be done, and I'm hurrying around with a small group of interested university students, attempting to secure sponsors, attract local artisans, and gain the help and partnership of other conservation organizations. So far the US Fish and Wildlife Service has given their support of the project, and the Sierra Club of Puerto Rico is helping to spread the word. Professors at the Universidad de Puerto Rico have voiced their support as well.

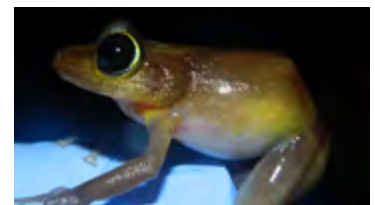
If all goes as planned, I hope to attract between 1,000-2,000 people for the event. There will be the usual attractions of a festival—crafts for sale, music, and games. But more importantly, there will be education and outreach—tables for any and all conservation organizations that wish to have a space, displays of animals in appropriate setups, educational talks, and a closing symposium open to the public.

### ...BUT GROWING

I feel as though I'm on the right track. As I travel about the island trying to gain support of not only environmental groups, but from individuals, business owners, and artisans, the response has been entirely positive. Not one person has said, "Why would you do something like this?" Instead, everyone tells me, "We need this."

After the festival, I intend to introduce a bill to the legislative assembly of Puerto Rico to request that Dia del Coqui be recognized as a national holiday, a day to become part of the cultural zeitgeist. I also plan to meet with conservation organizations to organize long-term management of the day, as well as with the botanical gardens to secure the grounds for future celebrations.

Lastly, I want to step away. Puerto Rico loses too many of its ambitious, educated young biologists who have no career prospects on the island. If Dia del Coqui becomes an event entrenched in the yearly life of the island, I don't want to run it forever. I want someone else, someone who loves this island's frogs and people as much as I do, to take the baton from me and make it even better. And I want it to become a springboard that opens up opportunities for those who went to college to make this island a better place. I want people who attend the festival to not only love to coquis, but to see that as go the coquis, so goes the rest of Puerto Rico. I want them to ponder— if ever the day comes that the coquis stop calling, will Puerto Rico still be Puerto Rico?





# A Search for Rare and Ancient Plants



Kevin, Michael, Helen, Valentino, Marvin, Darius, Willie, Patrick, and Freddy among wild *Zamia decumbens*. Photo: Kevin Wells.

By Kevin Wells

**C**aves, mud, frogs, thorns, parrots, mosquitoes, Mayan artifacts, pounding rain, solitude, blisters, prehistoric plants and the list goes on and on.... did I mention mud? Expeditions into the jungle are always a mixed bag. The columns of positives vs. negatives are usually both quite long. Nonetheless, few return from such trips without saying something about how amazing the experience was, and indeed that was exactly the conclusion I came to after my most recent expedition.

On February 20, 2014, Helen Campbell (Operations Manager) and I (Kevin Wells, Research Coordinator) had the fortunate opportunity to represent Ya'axché Conservation Trust as we accompanied a professional research team of botanists from the Montgomery Botanical Center in Miami and Belize Botanical Gardens in Belize on a 4-day expedition into the Columbia River Forest Reserve in southern Belize. The goal was to collect samples from a particular species of extremely slow-growing cycad plant, *Zamia decumbens*. This species had formerly been listed as *Zamia prasina*, and this discovery of *decumbens* as a new species has quickly circulated in the scientific community. These plants are highly prized by collectors and despite having been on earth since the Jurassic period (in abundance), some populations are extremely small. In fact, there are estimated to be just several hundred *Zamia decumbens* specimens left in the wild. Therefore, the goal of this expedition was to collect samples for DNA analysis, to catalog new populations, and also to collect seeds in order to expand an *ex-situ* collection of the species, a necessary measure for an organism so rare.

One of the unique characteristics of this plant, and one that made this expedition much more fascinating, is the fact that they only live at the bottoms of sinkholes or at the entrances of caves (or very rarely, on top of shaded hills) where there is essentially no rainfall and very well-drained soil. For this reason they are called the Sinkhole Cycad. So our survey sites just happened to be places that

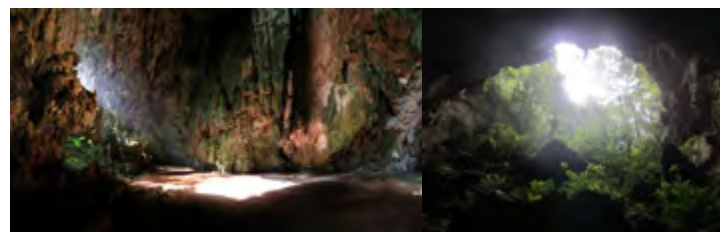


Specimens of *Zamia decumbens* growing in the sinkholes and cave entrances. Photo: Michael Calonje (L) and Kevin Wells (R).

would have taken our breath away anyway.

In short, the expedition was a definite success, almost as much as the one conducted in 2008 in which *Z. decumbens* was discovered to be a new species. Leaflets were successfully collected for DNA analysis, seeds were collected for the *ex-situ* collection, and potentially best of all, a new cave was explored containing about 50 specimens, which, for a plant whose total population in the wild is probably in the range of 300-500, was a fantastic find. Some had leaves over 3-4 feet long, belonging to plants that are likely hundreds of years old.

And no expedition to the jungle would be complete without a bit of side-project surveying, in this case the goal was reptile and amphibian populations.



Unforgettable scenery at the research sites. Photos: Kevin Wells (L) and Patrick Griffith (R).

Kevin Wells, Research Coordinator, Ya'axché Conservation Trust, Punta Gorda, Belize [www.yaaxche.org](http://www.yaaxche.org)

The challenges of the expedition were more than made up for by the places we visited, which left us speechless, and the successful high quality work which was carried out by the professional botanists.

#### Acknowledgements

We would like to sincerely thank Patrick Griffith, Michael Calonje, Willie Mesh, Freddy Tut, Darius, Valentin and everyone else who helped on the expedition.



Array of herpetofauna found on the Cycad Expedition. Photos: Kevin Wells.



# The Story Behind the Photo...

By Katy Upton

I often think a photo can say a thousand words, they are able to tell stories in an instant, as a result they are often used in social media by many of us to convey feelings and create emotions. This is something I do often when telling people about my research which is what I will do now...

One photo I use regularly is of a frog with its head poking through a hole in a leaf. I don't know why but this is one of my favorite photos. Frogs seem to have so much character and this photo says it all! The following series of photos shows what happened leading up to this one... It took several attempts to get a good photo as I was

laughing so hard.

I often post or tweet photos of animals in their natural habitats, this means those at home can see them as I do. Sometimes this can be extremely difficult. Below is a photo I took of a Northern caiman lizard, and following this is one of me trying to take the photo!



Another difficulty we face when taking the photo in situ is that the light can be bad, it might be raining or the animal may just hop away. One way to counter this is to create a mini "habitat" using leaves to mimic the forest floor as I did with the set of photos below!



My research as you may have guessed is based in the Amazonian rainforest of Peru. I work in the Pacaya-Samiria National Reserve, where flooding causes around 95% of the reserve to be under water in the high water period.

Obviously flooding can have huge impacts on the species living in the reserve, so one part of my research involves looking into these impacts on the amphibians, in particular, on the floating meadows of water plants float on the surface of the water and are







The final collection of photos displays the diversity of anuran species which I encounter daily while conducting my surveys.

### Acknowledgements

I would just like to thank all the volunteers from Operation Wallacea, DICE and Earthwatch who helped with many of the surveys. As well as my supervisors Prof. Richard Griffiths and Dr. Richard Bodmer; and the Pacaya-Samiria Reserve Authority for permissions to conduct the research. Photo credits are all Katy Upton, except the *Dendropsophus triangulum* photo (Sophie Rost) and the picture of Katy taking a photo (Emma Mae Docherty).

home to many amphibian species. Our floating meadow surveys can be very eventful as the following photo shows. The surveys are always conducted at night using head torches to spot the frogs while trying to keep the boat steady!



The flooding can cause amphibians to move into other habitats, for example into the floating meadows or the canopy, so I have also been trying to find out where the different species go during the different seasons. The following photos show my guide tree-climbing to search a bromeliad six meters off the ground. Within this one bromeliad we found five individual frogs of three different species! One of them is shown below and I have not yet been able to identify this individual.



For every amphibian we catch we record as much information as possible for later analysis.

This often involves measuring and weighing them as well as recording age and sex. This is a young *Hypsiboas geographicus* which unusually was sitting still for me to weigh and photograph.











## Conservation and Ecology



A male glass frog (*Centrolene savagei*) from the cloud rain forest of the Andes in Colombia guarding its egg clutch.

Photograph by Santiago Castroviejo-Fisher.

Neotropical diversification seen through glassfrogs

Santiago Castroviejo-Fisher, Juan M. Guayasamin, Alejandro Gonzalez-Voyer & Carles Vilà

**A**im: We used frogs of the clade Allophryniidae (Centrolenidae + Allophryniidae; c. 170 species endemic to Neotropical rain forests) as a model system to address the historical biogeography and diversification of Neotropical rain forest biotas.

Location: Neotropical rain forests.

Methods: We used an extensive taxon (109 species) and gene (seven nuclear and three mitochondrial genes) sampling to estimate phylogenetic relationships, divergence times, ancestral area distributions, dispersal–vicariance events, and the temporal pattern of diversification rate.

Results: The Allocentroleniinae started to diversify in the Eocene in South America and by the early Miocene were present in all major Neotropical rain forests except in Central America, which was colonized through 11 late range expansions. The initial uplifts of the Andes during the Oligocene and early Miocene, as well as marine incursions in the lowlands, are coincidental with our estimates of the divergence times of most clades of Allocentroleniinae. Clades with broad elevational distributions occupy more biogeographical areas. Most dispersals involved the Andes as a source area but the majority were between the Central and the Northern Andes, suggesting that the Andes did not play a major role as a species pump for the lowlands. The diversification of glass frogs does not follow a south-to-north pattern of speciation for Andean clades, and the establishment of a transcontinental Amazon drainage system is coincidental in time with the isolation of the Atlantic Forest glass frogs. Diversification analyses indicated that a model of constantly increasing diversity best fits the data,

compatible with the ‘evolutionary museum’ hypothesis or ‘ancient cradle’ hypothesis.

Main conclusions: Our work illustrates how the different geological and climatic historical events of the Neotropics shaped, at different levels of the phylogeny, the diversity of a species-rich clade, highlighting the importance of studying large evolutionary radiations at a continental scale.

S. Castroviejo-Fisher, J. M. Guayasamin, A. Gonzalez-Voyer, C. Vilà, *Journal of Biogeography* 41, 66–80 (2014).



Individually identifiable green and black poison dart frogs (*Dendrobates auratus*). Photo: M. V. Cove.

Pairing noninvasive surveys with capture-recapture analysis to estimate demographic parameters for *Dendrobates auratus* (Anura: Dendrobatidae) from an altered habitat in Costa Rica.

Michael V. Cove & R. Manuel Spínola

**A**mphibian populations are in decline worldwide. Monitoring programs are important, but many studies use invasive techniques to handle, mark, and identify individuals. We recommend a non-invasive technique in which individuals can be identified from photographs based on individual markings for capture-recapture analyses. As a case study, we examined the population dynamics of *Dendrobates auratus* at a highly altered habitat in northern Costa Rica. We applied the robust design to the capture-recapture data from the photographs of individual frogs at two 25-m transects, a parking lot and a gravel walkway. From these data, we estimated parameters for survival, emigration, immigration, abundance, and capture probability. The observed mean density estimate of  $2.62 \pm 0.60$  individuals (CI = 1–4) per 100 m<sup>2</sup> is the first statistically rigorous estimate for this species in altered habitats. These results suggest that this species might be able to tolerate human-altered habitats and may be less susceptible to population declines than previously suggested. Our non-invasive methodology to obtain robust abundance and demographic parameter estimates is also applicable to

citizen-science surveys for a variety of taxa of amphibians and reptiles that are individually identifiable.

M. V. Cove, R. M. Spínola, *Phyllomedusa: Journal of Herpetology* 12, 107–115 (2013).

Potential effects of climate change on the distribution of an endangered species: *Melanophryniscus montevidensis* (Anura: Bufonidae)

Carolina Toranza & Raúl Maneyro

**S**pecies distributions are linked with climate. Among the effects predicted by the Intergovernmental Panel on Climate Change are changes in precipitation patterns and increases in mean temperatures—factors potentially having a major impact on threatened, rare, and endemic species. Using models to forecast possible changes in the distributions of different species under different climate-change scenarios, we can identify probable impacts on species and build effective conservation strategies. We modeled the effects of various climate-change scenarios on the geographical distribution of the regionally endemic bufonid, *Melanophryniscus montevidensis*, categorized as vulnerable by the IUCN and as endangered by the Uruguayan Red List of amphibians. Ecological niche models were generated to describe the present and possible future distributions of this species in 2050 and 2080, given severe (A2) and moderate (B2) climatic changes. Legacy data for *M. montevidensis* were obtained from Uruguayan biocollections and climate data were acquired from the WorldClim database. At present, *M. montevidensis* should occur along the Atlantic Uruguayan coast and a small section of the southern Brazilian coast. However, changes in climate may lead to a loss of suitable environmental conditions for this toad; thus, this endangered species is vulnerable and in urgent need of protection.

C. Toranza, R. Maneyro. *Phyllomedusa* 12, 11–20 (2013).



*Melanophryniscus montevidensis*. Photo: Raúl Maneyro.



The Spectacled toad (*Duttaphrynus melanostictus*) (A) and the Marshland frog (*Fejervarya limnocharis*) (B) are common anuran species in agricultural lowland and foothill areas in Taiwan. Photo: G. Norval.

Notes on the diets of five amphibian species from southwestern Taiwan

Gerrut Norval, Shao-Chang Huang, Jean-Jay Mao, Stephen R. Goldberg & Yi-Ju Yang

The stomach contents of 156 anuran specimens, of five species, from the families, Bufonidae, Dicroglossidae and Microhylidae, that had been accidentally collected in pitfall traps, were examined to contribute to the understanding of the diets of these anuran species. Three thousand four-hundred and six prey items, from 21 orders of six classes were recorded, and ants (Formicidae) were the most numerous prey items in the diets of all five anuran species. *Fejervarya limnocharis* had the broadest dietary niche breadth, followed by *Duttaphrynus melanostictus*, *Microhyla fissipes*, *Micryletta stejnegeri*, and *Microhyla heymonsi*, in that order. There were also substantial dietary overlaps among the anurans described herein, and the degree of overlap ranged from ca. 80% to ca. 95%. The results of this study provides further support for the suggestion that *Duttaphrynus melanostictus* and *Fejervarya limnocharis* are dietary generalists that opportunistically prey on whatever prey of suitable size is present in any given habitat. As for the microhylids, the results of this study support the conclusion that members of the genus *Microhyla* are ant-specialists. The results of this study also suggest that all five species are predators of primarily terrestrial arthropods. Future dietary niche partitioning and competition studies should attempt to identify the major prey

categories to the species, or at least genus levels, because there may be variations in the species, even of the same order, in the diets of anurans.

G. Norval, S. C. Huang, J.J. Mao, S.R. Goldberg, Y.J. Yang, *Alytes* 30, 1-4 (2014).

Predation attempt of *Hypsiboas boans* (Anura: Hylidae) by *Helicops angulatus* (Squamata: Dipsadidae) with notes on defensive behavior

Ricardo Rocha & Adrià López-Baucells

Anurans have evolved a wide array of defensive strategies to augment their survival probability when attacked by predators. Herein, we report a predation attempt of *Helicops angulatus* (Linnaeus, 1758) (Dipsadidae: Xenodontinae) upon *Hypsiboas boans* (Linnaeus, 1824) (Anura: Hylidae), in Central Amazon, Brazil and present details on the defensive behavior exhibit by the attacked frog. This note reports the first observed trophic interaction between both species and the first evidence of distress calls emitted by *H. boans* upon attack by a natural predator.

R. Rocha, A. López-Baucells, *Alytes* 30, 1-4 (2014).

Monitoring of *Salamandrina perspicillata* (Savi, 1821) and *Rana italica* Dubois, 1937, twenty years later (Amphibia: Salamandridae, Ranidae)

Roberto Sindaco & Cristina Grieco

The status of the Italian endemics *Salamandrina perspicillata* and *Rana italica* at the northern edge of their ranges is ascertained comparing intensive surveys carried out by F. Barbieri in the nineties and repeated by the authors about twenty years later. Results show that the status of *S. perspicillata* is stable, while populations of *Rana italica* have increased in the past decades.

R. Sindaco, C. Grieco, *Alytes* 30, 1-4 (2014).

The amphibians and reptiles of Manu National Park and its buffer zone, Amazon basin and eastern slopes of the Andes, Peru

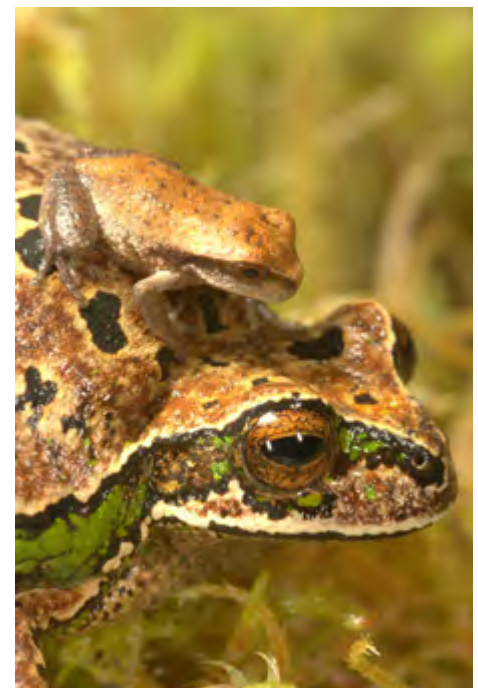
Alessandro Catenazzi, Edgar Lehr & Rudolf von May

We compiled a list of all amphibians and reptiles known to occur within Manu National Park, Peru and its buffer zone, located in one of the world's biodiversity hotspots. Covering approximately 0.01% of the planet's terrestrial surface, this protected area preserves 155 species of amphibians and 132 species of reptiles,

corresponding to 2.2% and 1.5% respectively of the known diversity for these groups. Moreover, Manu National Park preserves natural habitats and populations of one critically endangered (*Atelopus erythropus*), three endangered (*Bryophryne cophites*, *Pristimantis cosnipatae* and *Psychrophrynella usurpator*), three vulnerable amphibians (*Atelopus tricolor*, *Gastrotheca excubitor*, *Rhinella manu*) and two vulnerable reptiles (*Chelonoidis denticulata*, *Podocnemis unifilis*), according to the threat categories of the IUCN Red List. This report is publication No. 2 of the Amphibian Specialist Group Peru network.

A. Catenazzi, E. Lehr, R. von May. *Biota Neotropica* 13, 1-15 (2014).

<http://www.biotaneotropica.org.br/v13n4/pt/abstract?inventory+bn02813042013> ISSN 1676-0603



Female and newborn of marsupial frog *Gastrotheca excubitor*, an endemic species found in grasslands and montane scrub in the high Andes of Manu National Park. Photo: A. Catenazzi.

Forest loss and the biodiversity threshold: An evaluation considering species habitat requirements and the use of matrix habitats

Candelaria Estavillo, Renata Pardini & Pedro Luís Bernardo da Rocha

Habitat loss is the main driver of the current biodiversity crisis, a landscape-scale process that affects the survival of spatially-structured populations. Although it is well-established that species responses to habitat loss can be abrupt, the existence of a biodiversity threshold is still the cause of much controversy in the literature and would require that most species respond



similarly to the loss of native vegetation. Here we test the existence of a biodiversity threshold, i.e., an abrupt decline in species richness, with habitat loss. We draw on a spatially-replicated dataset on Atlantic forest small mammals, consisting of 16 sampling sites divided between forests and matrix habitats in each of five 3600-ha landscapes (varying from 5% to 45% forest cover), and on an a priori classification of species into habitat requirement categories (forest specialists, habitat generalists and open-area specialists). Forest specialists declined abruptly below 30% of forest cover, and spillover to the matrix occurred only in more forested landscapes. Generalists responded positively to landscape heterogeneity, peaking at intermediary levels of forest cover. Open area specialists dominated the matrix and did not spillover to forests. As a result of these distinct responses, we observed a biodiversity threshold for the small mammal community below 30% forest cover, and a peak in species richness just above this threshold. Our results highlight that cross habitat spillover may be asymmetrical and contingent on landscape context, occurring mainly from forests to the matrix and only in more forested landscapes. Moreover, they indicate the potential for biodiversity thresholds in human-modified landscapes, and the importance of landscape heterogeneity to biodiversity. Since forest loss affected not only the conservation value of forest patches, but also the potential for biodiversity-mediated services in anthropogenic habitats, our work indicates the importance of proactive measures to avoid human-modified landscapes to cross this threshold.

C., Estavillo, R., Pardini, P. Rocha. Forest loss and the biodiversity threshold: an evaluation considering species habitat requirements and the use of matrix habitats. *PLoS ONE* 8, e82369. doi:10.1371/journal.pone.0082369

(Almost) no trend in brown frog (*Rana arvalis* and *Rana temporaria*) breeding phenology in southern Sweden 1990-2010

Jon Loman

The breeding phenology of *Rana temporaria* and *R. arvalis* was studied during 1990-2010 and analyzed for trends. Two approaches were used. One, that put equal weight on data from all years, found no trend for either species. The other approach gave more weight to those years when more ponds were studied. This found no trend for *R. temporaria* but a trend towards earlier breeding for *R.*

*arvalis*. Both species tended to breed earlier in years with high February and March temperatures. These temperatures were both correlated to the NAO (North Atlantic Oscillation) index which thus in turn was negatively correlated to the date of frog breeding. A lack of a long term trend could indicate no change in climate or that frogs are more governed by date than by spring temperature. The present study supports only the first hypothesis as there was no temperature trend during the study years.

J. Loman, *Alytes* 30, 1-4 (2014).



Giant spiny frog (*Quasipaa spinosa*) in Hong Kong. This species is currently listed as Vulnerable on IUCN Redlist, threatened by ongoing harvest pressure in China. Photo: Nancy Karraker (University of Rhode Island).

Demography of *Quasipaa* frogs in China reveals high vulnerability to widespread harvest pressure

Hon-Ki Chan, Kevin T. Shoemaker & Nancy E. Karraker

Over 20 species of amphibians are being harvested in Asia with local consumption exceeding the volume of international export in some countries. Over-harvesting is a particular concern for large-bodied species as their life history traits often make them prone to population depletion. *Quasipaa spinosa* is a large, stream-dwelling frog that is considered a delicacy in China. The demand for its meat is high, with domestic trade amounting to USD 32 m in one province alone in one year. Although it is known that populations of *Q. spinosa* have been heavily depleted, no information on the demography of wild populations has been available to assess declines and vulnerability to ongoing exploitation. We studied *Q. spinosa* in Hong Kong, China, where populations are protected from hunting and habitat is largely unaltered. Results from a population viability analysis suggest that these populations are highly vulnerable to hunting activity; hunted populations were associated with much lower expected abundance and substantially higher risk of extirpation than populations free from

harvesting pressure. Harvesting confers at least 59% reduction of abundance in 5 years. Based on ongoing harvesting of this species from the wild and our determination that relatively low levels of harvesting can lead to population extirpation in the short term, we call for the establishment of protection measures (State Protected Animal status) for this species throughout China and advocate for strengthened enforcement of existing regulations in nature reserves and other protected areas. Some currently harvested amphibians in China, including other species of *Quasipaa*, are probably similarly threatened by unregulated harvesting activities and we recommend that their status and vulnerability to harvesting be carefully reviewed.

H.-K. Chan, K.T. Shoemaker, N.E. Karraker. *Biol. Cons.* 170, 3-9 (2014). <http://dx.doi.org/10.1016/j.biocon.2013.12.014>



A) *Bolitoglossa colonnea* from Veraguas province. B) *Bolitoglossa lignicolor* from the Comarca Ngöbe-Buglé. Photos: A. Hertz

New distribution records and variation of the two common lowland salamanders *Bolitoglossa colonnea* (Dunn, 1924) and *B. lignicolor* (Peters, 1873) in Panama (Amphibia: Caudata: Plethodontidae)

Andreas Hertz, Sebastian Lotzkat & Gunther Köhler

The two plethodontid salamanders *Bolitoglossa colonnea* and *B. lignicolor* are among the more frequently seen salamanders in western Panama. Both inhabit humid lowlands and mid-elevations of the Cordillera de Talamanca and Cordillera de Tabasará. *Bolitoglossa colonnea* is primarily distributed along the Caribbean versant of the central mountains of lower Central America, whereas *B. lignicolor* is found exclusively on the Pacific side of the cordilleras of southwestern Costa Rica and western Panama. The distribution areas of both species overlap in the Golfo Dulce region in southern Costa Rica and in the Fortuna depression in western Panama, where *B. colonnea* is found on the Pacific side. New findings allowed us to revise the geographic distribution of both species in Panama. We close the

widest gap in the known distribution of *B. colonneae* with a first record for the province of Veraguas and extend its known vertical distribution to a third life zone. For *B. lignicolor* we present additional localities in the province of Chiriquí and the first record from the Comarca Ngöbe-Buglé that close the gap between extreme western Panama and the Azuero Peninsula. Moreover, we define some historical collection sites for *B. lignicolor*, including the type locality. We further present morphological, molecular, and coloration data for both species.

A. Hertz, S. Lotzkat, G. Köhler, *Check List* 9, 83 (2013).

Notes on *Nyctimystes* (Anura: Hylidae), tree frogs of New Guinea, with descriptions of four new species

James I. Menzies

Based on six common characters, 15 species of *Nyctimystes* are segregated as the *Nyctimystes cheesmanae* group, but without implying monophyly. Four of them are herein described as new species. The diagnostic features of each new species are described and the male advertisement calls of six other species are compared. Other known populations are also described but are not allocated to any species, as the information about them is deficient. Some notes on previously described species are included.

J. I. Menzies, *Alytes* 30, 1-4 (2014).

Mechanisms and consequences of developmental acceleration in tadpoles responding to pond drying

Ivan Gomez-Mestre, Saurabh Kulkarni & Daniel R. Buchholz

Amphibians with aquatic larvae maximize larval growth under benign conditions but accelerate development in response to decreased water levels in order to reach metamorphosis before the pond dries out. We studied the physiological mechanisms that enable such developmental acceleration in western spadefoot toad tadpoles (*Pelobates cultripes*). Tadpoles of this species grow to be quite large (115 mm, 6 g) and have an extended larval period (often > 6 months). However, *P. cultripes* tadpoles have a high degree of developmental plasticity and can metamorphose on average 30% earlier when facing risk of desiccation. We showed that developmental acceleration is achieved by increasing the levels of both corticosterone and thyroid hormone, which synergize with each other to trigger an early metamorphosis. Moreover, we found through qPCR that tadpoles exposed to decreased water levels also increased the expression of the thyroid hormone receptor TR $\beta$ , and thus

they also increased tissue sensitivity and responsiveness to thyroid hormone, in addition to increasing the hormone level itself. However, developmental acceleration comes at some cost. Accelerating tadpoles resulted in smaller juveniles and entailed allometric morphological changes such as shorter hind limbs. Moreover, developmental acceleration also caused increased oxidative stress, which required increased activity of antioxidant enzymes to prevent oxidative damage.

I. Gomez-Mestre, S. Kulkarni, D.R. Buchholz, *PLoS One* 8, e84266. (2013).



Western spadefoot toad tadpole (*Pelobates cultripes*). Photo: I. Gomez-Mestre.

Physiological response of *Bufo viridis* (Laurenti, 1768) populations across an aridity gradient

Joy Hoffman

*Bufo viridis* (also known as *Pseudepidalea viridis*), a semi-terrestrial anuran found in climates ranging from temperate to semi-desert, has both behavioral and physiological defences against the threat of dehydration; it is also able to tolerate a wide range of salinities. We examined the prediction that those populations inhabiting drier environments will have a compensatory physiological response to dehydration. To that end we compared laboratory-acclimated samples of toads collected from three sites in Israel, one in north-west Italy, and one in Kyrgyzstan differing in the level of annual rainfall in their natural habitats. When kept on damp soil without access to free water, measurements of changes in body mass, plasma osmolality, and the concentrations of urea and major electrolytes in the plasma revealed no significant differences in the physiological responses of toads from the different sites. This contrasts with the negative correlation that had previously been found between the frequency of a behavioral, water-seeking response and annual rainfall at these same sites. The results are discussed in the light of what is known about the evolutionary history of the species. It is suggested that, because drought resistance and euryhalinity are both features of general osmotic stress tolerance, these properties may have

evolved initially in the species' area of origin as a response to fluctuations in the salinity of inland water bodies; later, when the species migrated into arid regions, it was an exaptation enabling the toads to tolerate water shortage.

J. Hoffman, *Alytes* 30, 1-4 (2014).



Female of *Rana boylei* heading to a breeding site in the South Fork of the Eel River at the University of California Angelo Coast Range Reserve in Mendocino County, California. Photo: A. Catenazzi.

The importance of thermal conditions to recruitment success in stream-breeding frog populations distributed across a productivity gradient

Alessandro Catenazzi & Sarah J. Kupferberg

There is a pressing need to predict the impact of broad scale environmental changes on living animals. Recent research has shown that combining ecophysiology, climate, topography and other ecosystem-level traits improves our ability to predict a species' vulnerability to climate change. Our study integrates a key ecophysiological trait, behavioral thermoregulation, in the study of an ectotherm's response to temperature during development. Our focal species is the frog *Rana boylei*, endemic to rivers of California and Oregon. These frogs are absent from more than half their historic range, especially in rivers where flow regime is altered by dams and thermal regime is shifted due to hypolimnetic releases of cold water from reservoirs. Our empirical approach was to quantify the thermal quality of habitats by relating the thermographs of free-flowing and dammed reaches in a northern California watershed in relation to the thermal preferences of tadpoles. We then reared tadpoles in streams that were colder, warmer or close to selected temperatures. We found that the amount and quality of food mediated temperature effects on mortality, with availability of high protein diatoms offsetting the effects of suboptimal temperatures.

Developing organisms, such as tadpoles, are especially sensitive to thermal stress. Therefore, the advantages of operating near the physiological optimum should be stronger than in adults. Moreover,



population viability analyses of *R. boylii* have shown that survival of pre-metamorphic stages determines long-term population dynamics. We tested the hypothesis that landscape distribution of populations is in equilibrium with the thermal quality of the habitat. The mean temperature selected by tadpoles in a thermal gradient was  $19.60 \pm 0.6$  °C. Survival to metamorphosis was highest when July mean water temperature deviated little (<2 °C) from preferred temperature. Similar to results from the rearing experiment, results from a principal components analysis exploring the effects of primary productivity, timing, and extent of warming, show that population density peaked in river reaches that matched tadpole thermal preferences. Populations were dense ( $\geq 125$  breeding females/km) where July water temperatures averaged 17.5–19 °C in 2010, a relatively cool summer. Below 16 °C, frogs were sparse in streams with open canopy, and absent in shaded streams. Integration of thermoregulatory behavior with ecological context can thus be useful to forecast recruitment when the thermal regimes of rivers are altered by anthropogenic factors.

A. Catenazzi, S.J. Kupferberg, *Biol. Cons.* 168, 40-48 (2013).

---

### The biodiversity data knowledge gap: Assessing information loss in the management of Biosphere Reserves

Andrea Pino-Del-Carpio, Arturo H. Ariño, Ana Villarroya, Jordi Puig & Rafael Miranda

The knowledge of biodiversity within an area is vital if we want to develop adequate conservation strategies. Biosphere Reserves are purposefully established for the sustainable use of their resources, and therefore their biodiversity should be well known. We compared and evaluated information available for Mexican Biosphere Reserves on threatened and non-threatened vertebrate species records from three different sources – the corresponding Biosphere Reserves management plans (MPs), the Global Biodiversity Information Facility index (GBIF), and scientific literature, in order to find potential knowledge gaps. Our results suggest that there were varying gaps in information among sources according to vertebrate group. For each group of vertebrate species, management plans held the largest subsets of information but were not complete, ranging from 89.6% of the combined known species of birds to 70% for amphibians and freshwater fishes. However, both GBIF and literature included data absent from MPs, and GBIF included data not otherwise available, proving it as important as literature or

other data sources (e.g., field data) used for crafting such plans. Moreover, we found references to threatened species that were not listed in the MPs, reaching to as many as 50% of the total known species of fish. Species information shared by all three sources ranged from 28% for amphibians to 72.5% for birds. Conservation efforts should therefore take into account that possibly less charismatic taxa such as amphibians, reptiles and freshwater fish lack more information than birds or mammals. The disparity observed in the vertebrate species information constitutes an information gap that could (or should) be solved by scientists and managers alike.

A. Pino-Del-Carpio, A.H. Ariño, A. Villarroya, J. Puig, R. Miranda, *Biol. Cons.* (2013), <http://dx.doi.org/10.1016/j.bioccon.2013.11.020>.



European tree frog (*Hyla arborea*), a wide-ranging anuran species, common in Romania, but in significant decline throughout its Western European distribution. Photo: Dan Cogălniceanu.

Moving into protected areas? Setting conservation priorities for Romanian reptiles and amphibians at risk from climate change

Viorel D. Popescu, Laurențiu Rozyłowicz, Dan Cogălniceanu, Iulian Mihăiță Niculae & Adina Livia Cucu

Rapid climate change represents one of the top threats to biodiversity, causing declines and extinctions of many species. Range shifts are a key response, but in many cases are incompatible with the current extent of protected areas. In this study we used ensemble species distribution models to identify range changes for 21 reptile and 16 amphibian species in Romania for the 2020s and 2050s time horizons under three emission scenarios (A1B = integrated world, rapid economic growth, A2A = divided world, rapid economic growth [realistic scenario], B2A = regional development, environmentally-friendly scenario) and no- and limited-dispersal assumptions. We then used irreplaceability analysis to test the efficacy of the Natura 2000 network to meet conservation targets. Under all scenarios and time horizons, 90% of the species

suffered range contractions (greatest losses under scenarios B2A for 2020s, and A1B for 2050s), and four reptile species expanded their ranges. Two reptile and two amphibian species are predicted to completely lose climate space by 2050s. Currently, 35 species do not meet conservation targets (>40% representation in protected areas), but the target is predicted to be met for 4–14 species under future climate conditions, with higher representation under the limited-dispersal scenario. The Alpine and Steppic-Black Sea biogeographic regions have the highest irreplaceability value, and act as climate refugia for many reptiles and amphibians. The Natura 2000 network performs better for achieving herpetofauna conservation goals in the future, owing to the interaction between drastic range contractions, and range shifts towards existing protected areas. Thus, conservation actions for herpetofauna in Romania need to focus on: (1) building institutional capacity of protected areas in the Alpine and Steppic-Black Sea biogeographic regions, (2) facilitating natural range shifts by improving the conservation status of herpetofauna outside protected areas, specifically in traditionally-managed landscapes and abandoned cropland.

V.D. Popescu, L. Rozyłowicz, D. Cogălniceanu, I.M. Niculae, A.L. Cucu, *PLoS ONE* 8, e79330. doi:10.1371/journal.pone.0079330 (2013).

---

### The status of the nomen *Hyperolius guttatus* Peters, 1875 (Amphibia: Anura) and allied nomina

Thierry Frétey, Alain Dubois & Annemarie Ohler

The nomenclatural status of the nomen *Hyperolius guttatus* Peters, 1875 was investigated. The specimens on which the original description was based were collected at Bootry in Ghana and in Cameroon, but their precise collection localities are unknown. We established the chronology of the successive taxonomic allocations of the specimens from Ghana and Cameroon. The study of old documents allowed us to identify, without ambiguity, the type locality of *Hyperolius guttatus* in the Cameroon as the vicinity of Douala. This also applies to several other species of anurans and snakes described in the same publication, which are listed in the Appendix. An analysis of the colour pattern and of morphometrical characters allowed us to compare the specimen of *Hyperolius guttatus* from the Cameroon with the other species of *Hyperolius* living in the same region, and to ascertain the status of this nomen. *Hyperolius guttatus* is proposed as the nomen of a subspecies of *Hyperolius concolor* from Cameroon. The syntypes

from Boutry (Ghana) are confirmed to be *Hyperolius fusciventris burtonii*. We re-describe the type specimens of *Hyperolius guttatus* Peter, 1875 and *Hyperolius pulcher* Ahl, 1931 to present evidence for the synonymy.

T. Frétey, A. Dubois, A. Ohler, *Alytes* 30, 1-4 (2014).

---

Carotenoid supplementation enhances reproductive success in captive strawberry poison frogs (*Oophaga pumilio*).

Matthew B. Dugas, Justin Yeager & Corinne L. Richards-Zawacki

**A**mphibians are currently experiencing severe declines in biodiversity. One impediment to conservation of amphibian species is that their requirements for successful reproduction are often poorly understood. Here, we show that supplementing the diet of prey items (fruit flies) with carotenoids has strong positive effects on the reproduction of captive strawberry poison frogs (*Oophaga pumilio*), increasing the number of metamorphs produced by breeding pairs. This improved reproduction most likely arises via an increase in the quality of both the fertilized eggs from which tadpoles develop and trophic eggs that are fed to tadpoles by mothers. Frogs in this colony had previously been diagnosed with a Vitamin A deficiency, and carotenoid supplementation may have resolved the issue. Our results support growing evidence of the importance of carotenoids in vertebrate reproduction and highlight the many ways in which nutrition constrains captive populations.

M. B. Dugas, J. Yeager, C. L. Richards-Zawacki, *Zoo Biol.* 32, 655-658 (2013).



*Rhacophorus lateralis*. Photo by: Sandeep Das.

### Diversity and Conservation of Amphibians in South and Southeast Asia

By Suman Pratihar, Howard O. Clark, Jr., Sushil Dutta, Muhammad Sharif Khan, Bidhan Ch. Patra, Kanishka D. B. Ukuwela, Abhijit Das, Li Pipeng, Jiang, Jianping, James P. Lewis, B.N. Pandey, Abdhur Razzaque, Craig Hassapakis, Kaushik Deuti & Sandeep Das

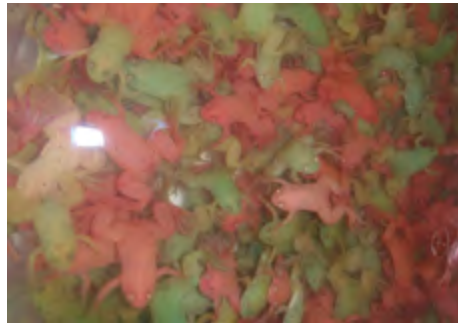
**T**he southern and southeastern parts of Asia host high amphibian biodiversity and comprise four biodiversity hotspots. 285 amphibian species are endemic to South Asia, 342 are distributed in India and 119 in Sri Lanka. Here we document the distribution, threats, and conservation status of amphibians in the major countries

of southern and southeastern Asia (India, Bangladesh, Sri Lanka, Pakistan and China) and list smaller countries with species numbers. Conservation is an umbrella concept that is fundamental yet paradoxical. Training programs, workshops for students, bio-banking, and the publication of field guides in local languages are urgently needed to conserve amphibian biodiversity in this part of the world.

Suman Pratihar *et al.*, *SAURIA*, 36, 9 (2014).

---

### Diseases and Toxicology



African clawed frogs (*Xenopus laevis*) sampled for *Bd* and ranavirus infection upon importation from Hong Kong.

Photo: Jonathan Kolby.

### First evidence of amphibian chytrid fungus (*Batrachochytrium dendrobatidis*) and Ranavirus in Hong Kong amphibian trade

Jonathan E. Kolby, Kristine M. Smith, Lee Berger, William B. Karesh, Asa Preston, Allan P. Pessier & Lee F. Skerratt

**T**he emerging infectious amphibian diseases caused by amphibian chytrid fungus (*Batrachochytrium dendrobatidis*, *Bd*) and ranaviruses are responsible for global amphibian population declines and extinctions. Although likely to have been spread by a variety of activities, transcontinental dispersal appears closely associated with the international trade in live amphibians. The territory of Hong Kong reports frequent, high volume trade in amphibians, and yet the presence of *Bd* and ranavirus have not previously been detected in either traded or free-ranging amphibians. In 2012, a prospective surveillance project was conducted to investigate the presence of these pathogens in commercial shipments of live amphibians exported from Hong Kong International Airport. Analysis of skin (*Bd*) and cloacal (ranavirus) swabs by quantitative PCR detected pathogen presence in 31/265 (11.7%) and in 105/185 (56.8%) of amphibians, respectively. In addition, the water in which animals were transported tested positive for *Bd*, demonstrating the risk of pathogen pollution by the disposal of untreated wastewater. It is uncertain whether *Bd* and ranavirus remain

contained within Hong Kong's trade sector, or if native amphibians have already been exposed. Rapid response efforts are now urgently needed to determine current pathogen distribution in Hong Kong, evaluate potential trade-associated exposure to free-ranging amphibians, and identify opportunities to prevent disease establishment.

J. E. Kolby, K. M. Smith, L. Berger, W. B. Karesh, A. Preston *et al.*, First Evidence of Amphibian Chytrid Fungus (*Batrachochytrium dendrobatidis*) and Ranavirus in Hong Kong Amphibian Trade. *PLoS ONE* 9, e90750. doi:10.1371/journal.pone.0090750 (2014)

---

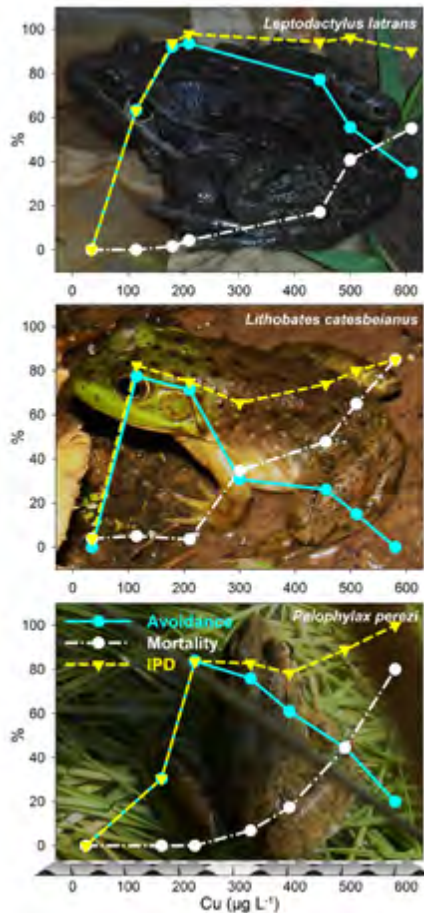
The interactive effects of chytrid fungus, pesticides, and exposure timing on gray treefrog (*Hyla versicolor*) larvae

Shane M. Hanlon & Matthew J. Parris

**I**n nature, aquatic organisms are often exposed to a wide variety of perturbations including pathogens and chemical contaminants. Despite the co-occurrence of such stressors, few studies have examined the effects of chemical contaminants on host-pathogen dynamics. We tested the individual and combined effects on gray treefrog (*Hyla versicolor*) tadpoles of two commonly used pesticides (Roundup® and Sevin®) and the pathogenic fungus *Batrachochytrium dendrobatidis* (*Bd*). A fully factorial design was used, and tadpoles were exposed to *Bd*, Roundup, or Sevin alone, or a combination of *Bd* and either pesticide at three points throughout larval development (early, middle, late). We predicted that pesticides would mediate the effect of *Bd* on tadpoles and reduce the likelihood of negative consequences of infection and that timing of exposure would influence these effects. Tadpoles exposed to *Bd* at the middle point experienced higher survival through metamorphosis than those exposed to *Bd* at the early or late points, while tadpoles exposed to Sevin at the early point experienced reduced survival compared with those exposed to Roundup or no-pesticide control at the same exposure point. Roundup ameliorated the effects of *Bd* on survival compared with tadpoles exposed to *Bd* alone, while there was no interactive effect of Sevin on survival. In addition, Sevin reduced mass of new metamorphs compared with Roundup and reduced snout-vent length compared with all other treatments. The present study supports the hypothesis that pesticides can mitigate the effects of *Bd* on amphibian hosts and that such effects may depend on the timing of exposure.

S.M. Hanlon, M.J. Parris, *Environ. Toxicol. Chem.* 33, 216-222 (2014).





Concentration-response curves for avoidance and mortality responses, and of the estimated PID (exposed population immediate decline) of tadpoles of three species of amphibians exposed to copper. In the lower part is a schematic diagram of the seven-compartmented non-confined static avoidance assay system. Photos, from top to bottom: C. Shinn; B. Glorioso; I. Lopes.

#### Copper-driven avoidance and mortality in temperate and tropical tadpoles

Cristiano V.M. Araújo, Cândida Shinn, Matilde Moreira-Santos, Isabel Lopes, Evaldo L.G. Espindola & Rui Ribeiro

If one were a tadpole in a contaminated environment and had the ability to sense the contamination before it had a negative effect, wouldn't one choose to look for a better environment? Studies show that chemical contamination often threatens amphibians directly via lethal or sublethal effects, but it most probably poses an additional, even more frequent indirect threat: habitat disturbance that impairs habitat quality. With this in mind, we tested the potential role of copper, a worldwide and reference contaminant, to act as a habitat disturber to tadpoles of three species of amphibians: a South American species, *Leptodactylus latrans*, a North American species, *Lithobates catesbeianus*, and a European species, *Pelophylax perezi*. Estimation of the immediate local population decline was

based on two responses: avoidance and mortality. Tests were performed during 12 hours with tadpoles of ±1 cm length in a static seven-compartmented chamber with a copper gradient (20 to 600 µg L<sup>-1</sup>) through which tadpoles could freely move, i.e., a non-forced exposure system. Tadpoles of all three species detected and avoided copper at a concentration as low as 100 µg L<sup>-1</sup>. Avoidance played an exclusive role for the estimation of the population decline at the lowest concentrations (up to 200 µg L<sup>-1</sup>), when mortality was unimportant (Fig. 1). On the other hand, at the highest concentrations (>450 µg L<sup>-1</sup>) mortality was the main response determining the population decline as the ability to avoid contamination was impaired. Copper concentrations estimated to cause an immediate population decline to 50% of the exposed populations were 93, 106, and 180 µg L<sup>-1</sup> for *L. latrans*, *Li. catesbeianus* and *P. perezi*, respectively. Results indicate that contaminants might, therefore, act as environmental disturbers by generating low quality habitats which in turn can trigger avoidance of tadpoles.

C.V.M. Araújo *et al.*, *Aquat. Toxicol.* 146, 70-75 (2014).



Tomato frog (*Dyscophus guineti*) sampled for *Bd* infection upon importation from Madagascar to the USA. Photo: Jonathan Kolby.

#### Presence of the amphibian chytrid fungus *Batrachochytrium dendrobatidis* in native amphibians exported from Madagascar

Jonathan E. Kolby

The emerging infectious disease chytridiomycosis is driven by the spread of amphibian chytrid fungus (*Batrachochytrium dendrobatidis*, *Bd*), a highly virulent pathogen threatening global amphibian biodiversity. Although pandemic in distribution, previous intensive field surveys have failed to detect *Bd* in Madagascar, a biodiversity hotspot home to hundreds of endemic amphibian species. Due to the presence of *Bd* in nearby continental Africa and the ecological crisis that can be expected following establishment in Madagascar, enhanced surveillance is imperative. I sampled 565 amphibians commercially exported from Madagascar for the presence of *Bd* upon importation to the USA, both to assist early detection efforts and demonstrate

the conservation potential of wildlife trade disease surveillance. *Bd* was detected in three animals via quantitative PCR: a single *Heterixalus alboguttatus*, *Heterixalus betsileo*, and *Scaphiophryne spinosa*. This is the first time *Bd* has been confirmed in amphibians from Madagascar and presents an urgent call to action. Our early identification of pathogen presence prior to widespread infection provides the necessary tools and encouragement to catalyze a swift, targeted response to isolate and eradicate *Bd* from Madagascar. If implemented before establishment occurs, an otherwise likely catastrophic decline in amphibian biodiversity may be prevented.

J.E. Kolby, Presence of the Amphibian Chytrid Fungus *Batrachochytrium dendrobatidis* in Native Amphibians Exported from Madagascar. *PLoS ONE* 9, e89660. doi:10.1371/journal.pone.0089660 (2014).

#### *Ex situ* Diet Influences the Bacterial Community Associated with the Skin of Red-Eyed Tree Frogs (*Agalychnis callidryas*)

Rachael E. Antwis, Rachel L. Haworth, Daniel J.P. Engelmoer, Victoria Ogilvy, Andrea L. Fidgett & Richard F. Preziosi

Amphibians support symbiotic bacterial communities on their skin that protect against a range of infectious pathogens, including the amphibian chytrid fungus. The conditions under which amphibians are maintained in captivity (e.g., diet, substrate, enrichment) in *ex-situ* conservation programmes may affect the composition of the bacterial community. In addition, *ex-situ* amphibian populations may support different bacterial communities in comparison to in-situ populations of the same species. This could have implications for the suitability of populations intended for reintroduction, as well as the success of probiotic bacterial inoculations intended to provide amphibians with a bacterial community that resists invasion by the chytrid fungus. We aimed to investigate the effect of a carotenoid-enriched diet on the culturable bacterial community associated with captive Red-eyed tree frogs (*Agalychnis callidryas*) and make comparisons to bacteria isolated from a wild population from the Chiquibul Rainforest in Belize. We successfully showed carotenoid availability influences the overall community composition, species richness and abundance of the bacterial community associated with the skin of captive frogs, with *A. callidryas* that were fed a carotenoid-enriched diet supporting a greater species richness and abundance of bacteria than those fed a carotenoid-free diet. Our results suggest

that availability of carotenoids in the diet of captive frogs is likely to be beneficial for the bacterial community associated with the skin. We also found wild *A. callidryas* hosted more than double the number of different bacterial species than captive frogs with very little commonality between species. This suggests frogs in captivity may support a reduced and diverged bacterial community in comparison to wild populations of the same species, which could have particular relevance for ex situ conservation projects.

R.E. Antwis, R.L. Haworth, D.J.P. Engelmoer, V. Ogilvy, A.L. Fidgett *et al.*, *PLoS ONE* 9, e85563. doi:10.1371/journal.pone.0085563 (2014).



A gravid female *Litoria rheocola* sitting on a leaf. Photo: Sarah J. Sapsford.

Elevation, temperature and aquatic connectivity all influence the infection dynamics of the amphibian chytrid fungus in adult frogs

Sarah J. Sapsford, Ross A. Alford & Lin Schwarzkopf

Infectious diseases can cause population declines and even extinctions. The amphibian chytrid fungus, *Batrachochytrium dendrobatidis* (*Bd*), has caused population declines and extinctions in amphibians on most continents. In the tropics, research on the dynamics of this disease has focused on amphibian populations in mountainous areas. In most of these areas, high and low elevation sites are connected by an assemblage of streams that may transport the infectious stage of the pathogen from high to low elevations and also this pathogen, which grows well at cool temperatures, may persist better in cooler water flowing from high elevations. Thus the dynamics of disease at low elevation sites without aquatic connections to higher elevation sites, i.e. non-contiguous low elevation sites, may differ from dynamics at contiguous low elevation sites. We sampled adult Common mist frogs (*Litoria rheocola*) at six sites of three types: two at high (> 400 m) elevations, two at low elevations contiguous with high elevation streams, and two at low elevations non-contiguous with any high elevation site. Adults were

swabbed for *Bd* diagnosis from June 2010 to June 2011 in each season, over a total of five sampling periods. The prevalence of *Bd* fluctuated seasonally and was highest in winter across all site types. Site type significantly affected seasonal patterns of prevalence of *Bd*. Prevalence remained well above zero throughout the year at the high elevation sites. Prevalence declined to lower levels in contiguous low sites, and reached near-zero at non-contiguous low sites. Patterns of air temperature fluctuation were very similar at both the low elevation site types, suggesting that differences in water connectivity to high sites may have affected the seasonal dynamics of *Bd* prevalence between contiguous and non-contiguous low elevation site types. Our results also suggest that reservoir hosts may be important in the persistence of disease at low elevations.

S.J. Sapsford, R.A. Alford, L. Schwarzkopf, *PLoS ONE* 8, e82425 (2013).

<http://dx.plos.org/10.1371/journal.pone.0082425>

Thermal physiology, disease, and amphibian declines in the eastern slopes of the Andes

Alessandro Catenazzi, Edgar Lehr & Vance T. Vredenburg

Rising temperatures, a widespread consequence of climate change, have been implicated in enigmatic amphibian declines from habitats with little apparent human impact. The pathogenic fungus *Batrachochytrium dendrobatidis* (*Bd*), now widespread in Neotropical mountains, may act in synergy with climate change causing collapse in thermally stressed hosts. We measured the thermal tolerance of frogs along a wide elevational gradient in the Tropical Andes, where frog populations have collapsed. We used the difference between critical thermal maximum and the temperature a frog experiences in nature as a measure of tolerance to high temperatures. Temperature tolerance increased as elevation increased, suggesting that frogs at higher elevations may be less sensitive to rising temperatures. We tested

the alternative pathogen optimal growth hypothesis, that prevalence of the pathogen should decrease as temperatures fall outside the optimal range of pathogen growth. Our infection-prevalence data supported the pathogen optimal growth hypothesis, because we found that prevalence of *Bd* increased when host temperatures matched its optimal growth range. These findings suggest that rising temperatures may not be the driver of amphibian declines in the eastern slopes of the Andes. Zoonotic outbreaks of *Bd* are the most parsimonious hypothesis to explain the collapse of montane amphibian faunas; but our results also reveal that lowland tropical amphibians, despite being shielded from *Bd* by higher temperatures, are vulnerable to climate-warming stress.

Catenazzi, A., E. Lehr and V. T. Vredenburg. *Cons. Biol.* 28, 509-517 (2014).



*Pristimantis lindae* is a terrestrial-breeding frog that lives in the Andean cloud forest. Photo: Alessandro Catenazzi.

### Call for recent publication abstracts

If you would like to include an abstract from a recent publication in this section of *FrogLog* please email: [froglog@amphibians.org](mailto:froglog@amphibians.org). We also encourage all authors of recent publications to inform Professor Tim Halliday (formerly DAPTF International Director) ([tim.r.halliday@gmail.com](mailto:tim.r.halliday@gmail.com)) of their publication in order for it to be referenced on the AmphibiaWeb latest papers page. The full list of latest papers from AmphibiaWeb is also included in every edition of *FrogLog* following the recent publications abstract section.



# General Announcements

## Events

The following information can be found at: <http://www.parcplace.org/news-a-events/meeting-and-events-calendar.html>

### March 2013

22 - 23 - 4<sup>th</sup> Box Turtle Conservation Workshop - North Carolina Zoological Park, Asheboro, NC

### April 2013

19 - 21 - Joint meeting of North Carolina PARC and the North Carolina Herpetological Society - NC Zoo, Asheboro, NC

19 "Lizard Watching Hotspots" - Anza-Borrego Desert Natural History Area Library, Borrego Springs, CA

### May 2013

13 - 24 - Graduate and Professional Course - Species Monitoring and Conservation: Reptiles - Smithsonian Conservation Biology Institute, Front Royal, VA, USA

13 - 24 - Coastal Herpetology Course - University of Southern Mississippi, Gulf Coast Research Laboratory, Ocean Springs, MS

31 - June 1 - Colorado PARC Field Trip, Bonny Lake State Park

### June 2013

12 - 15 - 8<sup>th</sup> Annual Great Basin Kingsnake Survey - Great Basin National Park, Baker, NV.

15 - Colorado PARC Field Trip for Herps of the Palmer Divide, Castlewood Canyon State Park

15 - 16 - Orianna Society "Places You've Never Herped" Field Survey - Tallulah Gorge State Park, GA

### July 2013

8 - 12 - 2013 Spotted Frog Survey - Indian Valley, NV.

8 - 10 - Southwest PARC Annual Meeting - University of New Mexico, Albuquerque, NM.

10 - 15 - Joint Meeting of Herpetologists and Ichthyologists - Hosted by University of New Mexico Museum of Southwestern Biology - Albuquerque Convention Center, Albuquerque, NM

16 - World Snake Day!

### August 2013

2 - 4 - Midwest PARC Annual Meeting - Forest Beach Migratory Preserve, Port Washington, WI.

### October 2013

7 - Effects of Wildland Fire and Fire Management on Amphibians and Reptiles Symposium - 20<sup>th</sup> Annual Conference of the Wildlife Society - Milwaukee, WI - web

## Internships & Employment

The following information can be found at: <http://www.parcplace.org/resources/job-listings.html>.

Herpetology jobs are posted as a service to the herpetological community. If you would like to list a job opening for your organization, please send the announcement to: [herpjob@parcplace.org](mailto:herpjob@parcplace.org)

### Field Technician, Western Rattlesnake Sampling

Putnam County, Florida (Posted to PARC 03/13/14, Closing March 25, 2014)

### Spotted Turtle Field Assistant (unpaid)

Putnam County, Florida (Posted to PARC 03/03/14, Needed mid March - April 2014)

### M.Sc. Research Assistantship, Box Turtle Ecology and Conservation, University of Rhode Island

Fire Island National Seashore (Posted to PARC 03/03/14, Closing 03/24/14)

### US Fish and Wildlife Service Directorate Resource Assistant Fellowships (including Bog Turtle Internship)

Various Locations (Posted to PARC 02/28/14, Closing 03/12/14)

### Unpaid Tropical Salamander Research

Panama (Posted to PARC 02/28/14, Closing 03/15/14)

### Temporary field technicians - hellbenders

Corydon, IN (Posted to PARC 02/27/14, Closing 03/21/14)

### Regional Species Conservation Biologist

Panama City FL, (Posted to PARC 02/18/14, Closing 03/04/14)

### Herpetological field assistant (unpaid)

Los Amigos Biological Station, Madre de

Dios, Peru (Posted to PARC 02/11/14, Closing 04/15/14)

### Field Biologist - The Biological Monitoring Program Riverside, California (Posted to PARC 01/23/2014, open till filled)

Unpaid Herpetological Researcher / Educator Internship Opportunities (2) Midewin National Tallgrass Prairie, Wilmington, IL (Posted to PARC 01/8/2014, Closing 4/1/2014)

### Unpaid Volunteer Ornate Box Turtle Telemetry Technician Nachusa Grasslands, Franklin Grove, IL (Posted to PARC 01/8/2014, Closing 4/30/2014)

## Funding Opportunities

The following information is kindly provided by the Terra Viva Grants Directory, for more information please visit: <http://www.terravivagrants.org/>

### March 2014

**Biodiversity Foundation -- Support for International Projects 2014.** The Biodiversity Foundation (Spain) makes grants for projects in biodiversity, climate change, and sustainable development. The Foundation supports conservation field projects, research, education and training, and public awareness in Spain and internationally. Each program component has a different application deadline. The closing date for grants to support international collaboration and activities is 07 March 2014. [Link](#)

**British Academy and the Royal Society -- Newton International Fellowships.** The Newton International Fellowships scheme invites researchers worldwide to apply for two years of post-doctoral support at UK institutions. The Fellowships are made in the physical, natural, and social sciences and humanities. Successful Newton Fellows may be eligible to apply for follow-up funding. The next application deadline is 10 March 2014. [Link](#)

**Chester Zoo -- Grants for Research and Conservation.** Chester Zoo supports a variety of small conservation projects each year to conserve threatened species worldwide. Grants support training and education, species monitoring, habitat protection, and other aims consistent with the Zoo's activities and support. Applications are accepted during three review periods that conclude 31 March, 30 June, and 31 October of each year. [Link](#)

**Commonwealth Foundation -- Grants to Support Participatory Governance.**

The Commonwealth Foundation invites grant applications from registered and national civil society organizations in Commonwealth countries and territories. The theme is "Team Commonwealth," aligned with the Foundation's focus on participatory governance. Note: This could include participatory governance in subjects related to natural resources, e.g., water, forests, etc. Grants are up to £30 thousand per annum for up to three years. The deadline for preliminary applications is 03 March 2014. [Link](#)

**European Commission (EC) -- Grants for Climate Change in Namibia.**

The EC seeks to fund solutions for energy efficiency that contribute to climate change adaptation and mitigation in rural areas of Namibia. Small grants are €50 thousand to €100 thousand for projects of one to three years. Large grants are €300 thousand to €1 million (adaptation), and €500 thousand to €1.5 million (mitigation), for projects of two to four years. All grants are subject to cost shares. The program is open to non-state organizations, parastatals, local authorities, and private enterprises in Namibia and EU member states, as well as qualifying international organizations. Reference EuropeAid/135365/DD/ACT/NA. The closing date is 27 March 2014. [Link](#)

**European Commission (EC) -- Research and Innovation Partnership with India.**

The EU-India Research and Innovation Partnership will promote European-Indian clusters for research and innovation in sectors that include environment, biotechnology, energy, and others. The program is open to applicants from India, members of the South Asian Association for Regional Cooperation, and Europe (including EU candidate countries and the EEA). Grants are up to €333 thousand, subject to cost shares. Reference EuropeAid/135474/DD/ACT/IN. The deadline for concept notes is 21 March 2014. [Link](#)

**INK Fellows Program -- Innovators and Change Makers 2014.** The INK Fellows Program brings together young innovators and change makers from India and other emerging economies in a supportive peer group, and offers them media exposure to accelerate their ability to impact society. Candidates range from ages 18 to 40 in any professional field. Past Fellows represent activities in bamboo construction, control of oil pollution, rice agriculture, wildlife photography, and many others. The application deadline is 30 March 2014. [Link](#)

**Institute of Current World Affairs -- Fellowships 2014-2015.**

The ICWA makes grants to support Fellows who carry out self-designed independent studies for a minimum of two years in the developing world. U.S. citizenship is not a requirement, but candidates must show strong and credible ties to U.S. society. Areas of particular interest to ICWA include the Arab Middle East and Southeast Asia (especially Indonesia), but candidates may seek fellowships in any country. Among the fellowship categories, the "Forest and Society" fellowships explore the relationship of forest resources to the complex of human factors bearing on their conservation and management. The next deadline for letters of interest is 01 March 2014. [Link](#)

**Latin American and Caribbean Environmental Economics Program (LACEEP) -- 18th Call for Grant Proposals.**

With support from Canada's IDRC and the Inter-American Development Bank, LACEEP makes research grants in environmental and resource economics. The program is aimed at junior researchers who are citizens of any country in Latin America or the Caribbean, and who have prior training in economics. Proposed budgets should not exceed US\$15 thousand for research projects of one year. The next deadline for preliminary proposals is 11 March 2014. [Link](#)

**New England Biolabs Foundation -- Grants for Grassroots Conservation.**

The New England Biolabs Foundation makes grants to grassroots and charitable organizations to support conservation of biological diversity; ecosystem services; community food security; and marine environment. The geographical scope focuses on Belize, Guatemala, and Honduras in the Gulf of Honduras; Bolivia, Ecuador, and Peru in the Andean region; and Ghana and Cameroon in West Africa. The Foundation occasionally makes grants in a few other countries where it has previous experience. Maximum grant size is US\$10 thousand. In 2014, the deadlines for letters of inquiry (English, Spanish) are 07 March 2014 and 14 July 2014. [Link](#)

**Royal Society -- International Exchanges 2014.**

The Royal Society's International Exchanges Scheme makes grants to UK scientists who seek new international collaborations. The scheme covers all areas of the life and physical sciences, except clinical medicine. For the standard program (i.e., not specific to countries and/or focal areas), the deadlines in 2014 are 13 March, 01 July, and 28 October. [Link](#)

**Sustania -- 100 Sustainable Solutions, 2014 Edition.** Sustania invites innovative solutions from around the world that present readily available projects,

initiatives, and technologies at the forefront of sustainable transformation. Sustania features innovation from traditional western hubs as well as from the developing world in sectors that include energy, resources, and food (agriculture) -- among others. The finalists receive publicity online, at the awards ceremony, and in a published guide. The deadline for submissions is 14 March 2014. [Link](#)

**Swedish Secretariat for Environmental Earth System Sciences (SSEES) --**

**Grants for International Research on Global Change.** In collaboration with the International Council for Science (ICSU), the SSEES announces funding to link researchers in Sweden with partners in Africa, Asia-Pacific, and Latin America and the Caribbean in the framework of the research initiative "Future Earth." Swedish scientists apply for SEK 90 thousand in order to produce draft proposals in collaboration with partners in the developing regions. Applicants can contact ICSU's Regional Offices for information about regional research priorities. The application deadline is 31 March 2014. [Link](#)

**United Nations Development Program --**

**Equator Prize 2014.** The Equator Initiative, administered by UNDP, announces the 2014 Equator Prize to recognize twenty-five local sustainable development solutions for people, nature, and resilient communities in developing countries served by UNDP. The program is open to community-based and local groups, operating in rural areas, which have been in existence for at least three years. Each winner will receive US\$5 thousand, and each "special recognition" winner will receive an additional US\$15 thousand. The deadline for nominations (in 16 languages) is 22 March 2014. [Link](#)

**U.S. Agency for International Development -- Forest Management in**

**India.** USAID-India announces funding for organizations in India through its program, Innovations for Forest Resource Management (InFoRM). The program will contribute to fuelwood management, forest management, and increased income for local communities. Grants will range from US\$200 thousand to US\$4 million for periods of one to four years. Funding Opportunity RFA-386-14-000002. The application deadline is 13 March 2014. [Link](#)

**April 2014**

**Brazilian Government -- Science Without Borders "Young Talent" 2014.**

Science Without Borders is a joint effort of Brazil's Ministry of Education (MEC) and Ministry of Science and Technology (MCT). The program aims to place Brazilian students and researchers in top universities



worldwide. The program also makes grants to attract talented young researchers from outside the country to work in Brazil. Grants in the “Young Talent” program are for one to three years in the priority areas of Science Without Borders -- including sustainable agriculture, renewable energy, disaster prevention, biodiversity and bio-prospecting, marine sciences, and others. The application deadlines are 07 April 2014, 23 June 2014, and 15 September 2014. [Link](#)

**European Commission (EC) -- Sustainable Ecosystem Services in the Baltic Sea Region.** The Joint Baltic Sea Research and Development Program (BONUS) is implemented by several EU member states in collaboration with Russia to support the region’s sustainable development. BONUS 2014 calls for research on integrated coastal management, maritime risk analysis, water and air pollution, and other themes in ecosystem services. The program will fund projects of €2 million to €3 million for up to three years. The proposal deadline is 16 April 2014. [Link](#)

**Fresno Chaffee Zoo -- Grants by the Wildlife Conservation Fund.** The Fresno Chaffee Zoo Wildlife Conservation Fund makes grants for wildlife conservation and research that focuses on rare, threatened, and endangered animals and their habitats. The priority is for in situ conservation projects. Most grants range from US\$1 thousand to US\$2 thousand. The principal investigator must be associated with a recognized institution. The application period is 01 February through 01 April of each year. [Link](#)

**University for Peace -- Masters Programs 2014-2015.** The masters programs at UPEACE are open to applicants worldwide. Themes include environmental security and governance (including a specialization in climate change), sustainable natural resources management, and several others. The university offers partial tuition waivers in some cases. The deadline for applicants needing financial assistance is 25 April 2014. [Link](#)

**Swiss Re -- Leadership Prize in Watershed Management, Developing and Emerging Countries.** The International ReSource Award for Sustainable Watershed Management is a prize for leadership in implementing sustainable watershed management in developing and emerging countries. The prize money is US\$150 thousand allocated to one or more projects. Eligibility for the Award extends to NGOs, private organizations, scientific and public institutions, and similar bodies.

The application deadline is 30 April 2014. [Link](#)

**U.S. Fish and Wildlife Service -- Grants for Conservation in Latin America and Caribbean 2014.** In fiscal year 2014, the Wildlife Without Borders program for Latin America and Caribbean invites proposals that address the human dimensions of species and ecosystem conservation in three regions: Central America; the tropical Andes (western Amazon); and the Caribbean region (activities in two or more countries or islands). Focus areas include the protection of threatened conservation landscapes, illegal wildlife trafficking and the human-jaguar conflict, and training programs for young conservation professionals. Eligibility is unrestricted for grants that will range from US\$15 thousand to US\$25 thousand. Funding Opportunity F14AS00076. The application deadline is 15 April 2014. [Link1](#) [Link2](#)

**Veolia Environnement Foundation -- Student Solidarity Awards 2014.** The Student Solidarity Awards are aimed at student associations in schools and universities in France and other countries around the world where the Veolia group is present. The awards are for innovative approaches in themes that include environmental conservation, development aid, and workforce development. An application requires support from an employee of Veolia. Three contest winners will divide €15 thousand in grants. The closing date for entries is 30 April 2014. [Link](#)

**May 2014**

**Open Society Initiative for West Africa (OSIWA) -- Grants to Strengthen Frameworks for Managing Natural Resources.** OSIWA works to promote political and economic governance that contributes towards justice and human rights in West Africa. The 2014 call for proposals includes an objective to improve frameworks for managing natural resources in the following countries: Ghana, Guinea, Liberia, Niger, Nigeria, Senegal, and Sierra Leone. OSIWA makes most of its grants to local organizations in West Africa, although it will also fund other types of organizations in rare and limited circumstances. There is no maximum grant size. The application deadline is 30 May 2014. [Link](#)

**June 2014**

**BBVA Foundation -- Awards in Frontiers of Knowledge, Nominations 2014.** The BBVA Foundation annually makes awards to recognize innovative

and fundamental advances in science, culture, and collaboration. Thematic areas include ecology and conservation biology; climate change; and development cooperation (among others). BBVA awards €400 thousand plus a diploma and a commemorative artwork in each prize category. The awards are open to individuals and organizations of any nationality. The deadline for nominations is 30 June 2014. [Link](#)

**Brazilian Government -- Science Without Borders “Young Talent” 2014.** Science Without Borders is a joint effort of Brazil’s Ministry of Education (MEC) and Ministry of Science and Technology (MCT). The program aims to place Brazilian students and researchers in top universities worldwide. The program also makes grants to attract talented young researchers from outside the country to work in Brazil. Grants in the “Young Talent” program are for one to three years in the priority areas of Science Without Borders -- including sustainable agriculture, renewable energy, disaster prevention, biodiversity and bio-prospecting, marine sciences, and others. The application deadlines are 07 April 2014, 23 June 2014, and 15 September 2014. [Link](#)

**Chester Zoo -- Grants for Research and Conservation.** Chester Zoo supports a variety of small conservation projects each year to conserve threatened species worldwide. Grants support training and education, species monitoring, habitat protection, and other aims consistent with the Zoo’s activities and support. Applications are accepted during three review periods that conclude 31 March, 30 June, and 31 October of each year. [Link](#)

**July 2014**

**German Academic Exchange Service (DAAD) -- Post-Graduate Studies with Relevance to Developing Countries 2014-2015.** The German Academic Exchange Service (DAAD) supports young professionals to study in development-related fields at German universities. Subject areas include energy, environmental management, water resources, and others. DAAD provides scholarships to participants from developing countries. The deadline to apply for DAAD scholarships (at the German embassies) is 31 July each year, although applicants need to confirm this. [Link](#)

**New England Biolabs Foundation -- Grants for Grassroots Conservation.** The New England Biolabs Foundation makes grants to grassroots and charitable organizations to support conservation of

biological diversity; ecosystem services; community food security; and marine environment. The geographical scope focuses on Belize, Guatemala, and Honduras in the Gulf of Honduras; Bolivia, Ecuador, and Peru in the Andean region; and Ghana and Cameroon in West Africa. The Foundation occasionally makes grants in a few other countries where it has previous experience. Maximum grant size is US\$10 thousand. In 2014, the deadlines for letters of inquiry (English, Spanish) are 07 March 2014 and 14 July 2014. [Link](#)

**Royal Society -- International Exchanges 2014.** The Royal Society's International Exchanges Scheme makes grants to UK scientists who seek new international collaborations. The scheme covers all areas of the life and physical sciences, except clinical medicine. For the standard program (i.e., not specific to countries and/or focal areas), the deadlines in 2014 are 13 March, 01 July, and 28 October. [Link](#)

A hand holding a paintbrush is painting a frog. The frog is grey with black spots and a yellow-green patch on its back. The text 'calling all bloggers!' is written in green, 'want to write for amphibians.org?' is in black, and the 'asa' logo (amphibian survival alliance) is in the bottom right corner.

calling all bloggers!  
want to write for amphibians.org?



## *FrogLog Schedule*

- January** – Special Topical Edition
- April** – The Americas
- July** – Africa, West Asia, Madagascar, Mediterranean and Europe
- October** – Asia, Russia and Oceania





# INSTRUCTIONS TO AUTHORS

## Background

*FrogLog* has been one of the leading amphibian conservation community newsletters since the early 1990's. Over the years it has been affiliated with different groups but has always strived to help inform the community. In 2005 *FrogLog* became the official newsletter of the IUCN SSC Amphibian Specialist Group and is produced on a quarterly basis.

As the ASG's newsletter members are encouraged to contribute to *FrogLog*'s content and direction. To aid in this process each edition of *FrogLog* focuses on one of the six broad geographical zones identified by the ASG. The publication schedule is as follows:

- January—Special Topical Edition
- April—The Americas
- July—Africa, West Asia, Madagascar, Mediterranean and Europe
- October—Asia, Russia and Oceania

*FrogLog* invites contributions of research, reviews on current management and conservation issues, methods or techniques papers and, editorials. We also actively encourage submissions describing the current activities relating to projects and academic institutions in order to help inform the community as to the general state of current research and conservation activities.

---

## PUBLICATION

*FrogLog* is published online at: [www.amphibians.org](http://www.amphibians.org) and is Open Access.

## REVIEW

All contributions should ideally be channeled through Regional ASG Chairs, the details for which can be found at <http://www.amphibians.org/asg-members/>. If for some reason this cannot be done, contributions will be reviewed by at least one individual within the ASG. *FrogLog* is not a peer-reviewed publication and the onus for submitting accurate information remains with the authors.

## PRODUCTION EDITOR

Candace M. Hansen: [cmhansen@amphibians.org](mailto:cmhansen@amphibians.org)

## EDITORIAL COMMITTEE

Candace M. Hansen  
Craig Hassapakis  
Laurence Jarvis  
James P. Lewis

Additional reviewers will be requested as required.

## SUBMISSION OF MANUSCRIPTS

Manuscripts can only be received as electronic files. Text should be submitted in MS Word format and may contain tables, but figures should be sent as a separate attachment where possible. All documents should be sent to [froglog@amphibians.org](mailto:froglog@amphibians.org). Each file should be labeled in a style that illustrates clear association, i.e., authors\_name\_ms and authors\_name\_figure1.

## GUIDELINES FOR AUTHORS

All manuscripts must be written in Standard US English. For example, "colour"

should be spelled "color."

## TITLE

Titles should ideally be no more than 15 words.

## AUTHORS

Authors names should be written in full as follows: By James P. Lewis & Robin D. Moore

## MAIN BODY OF TEXT

Use Georgia 11-point font. Genus and species names should be in italics as should the abbreviation for *Batrachochytrium dendrobatidis*, *Bd*. Suggested headings include Acknowledgements, Author Details, and References and Notes.

## AUTHOR DETAILS

Author details may be provided, including affiliations and contact details.

## FIGURES

Figures should be numbered and include brief, concise legends. Where photographs or illustrations are used please state whom the image should be credited to, e.g., Photo: James P. Lewis. Graphics should preferably be submitted in tiff or jpeg format in the highest possible quality. Resolution should be at least 300 dpi at the final size.

## TABLES

Tables may be included within the text file and should be numbered and include brief, precise legends.

## CITATION OF LITERATURE

*FrogLog* uses a numbering system for references and notes. This allows explanatory or more detailed notes to be included with the references. Journal names are abbreviated using common abbreviations to save space.

### Journals/Periodicals

1. E. Recuero, J. Cruzado-Cortés, G. Parra-Olea, K. R. Zamundio, *Ann. Zool. Fenn.* 47, 223 (2010).

### Books

2. J. Gupta, N. van der Grijp, Eds., *Mainstreaming Climate Change in Development Cooperation* (Cambridge Univ. Press, Cambridge, UK, 2010).

### Technical reports

3. G.B. Shaw, Practical uses of litmus paper in Möbius strips (Tech. Rep. CUCS-29-82, Columbia Univ., New York, 1982).

### Paper presented at a meeting

4. M. Konishi, paper presented at the 14th Annual Meeting of the Society for Neuroscience, Anaheim, CA, 10 October 1984.

### Published Online Only

5. N.H. Sleep, *Geochem. Geophys. Geosyst.*, 10, Q11010 (2009); DOI:10.1029/2009GC002702.

### Web site

6. National Oceanic and Atmospheric Administration, Beaufort Wind Scale, <http://www.spc.noaa.gov/faq/tornado/beaufort.html> (2012).

**SPECIAL NOTE:** Use only one space after all punctuation marks (this includes only one space after "periods" at the end of sentences).

Further examples and details can be found on our web site at: [www.amphibians.org/froglog/guidelines/](http://www.amphibians.org/froglog/guidelines/)

**Disclaimer** - Publisher, editors, reviewers and authors do not accept any legal responsibility for errors, omissions or claims, nor do they provide any warranty, express or implied, with respect to information published in *FrogLog*. The opinions represented in *FrogLog* articles do not necessarily represent those of the ASG nor any of its partners.

Coming up in *FrogLog* 111

*Tell Us Your Story!*

Regional Updates from Africa, West Asia, Madagascar,  
Mediterranean, and Europe

Recent Publications

Grants

and Much More...

July 2014

*Gephyromantis silvanus*. Photo: Molly Bletz.