

# froglog

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Volume 20, number 4

Conservation news for the herpetological community

## Regional Focus *Sub Saharan Africa*

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Chela Mountain Reed Frog  
(*Hyperolius chelaensis*).  
Photo: W. Conradie.



### Conservation Evidence

Amphibian Conservation  
Call for Evidence



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# froglog

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# Editorial

It has been an exciting couple of months for the ASG since the last edition of *FrogLog*. We have been communicating extensively with our Regional Groups to identify Chairs that will act as ASG focal points for the next quadrennium (four year working period for the IUCN). Almost all groups now have Chairs in place and discussions have begun to identify priorities for each group. As this edition focuses on Sub-Saharan Africa we would like to highlight the new and continuing Chairs from this region. Mark-Oliver Rödel, who served during the last quadrennium, will be continuing to drive forward ASG activities in West Africa. For East Africa, David Moyer will be stepping down and in his place Co-Chairs Victor Wasonga and Simon Loader will be leading the efforts. For Southern Africa, Alan Channing will be handing over to John Measey, and in Madagascar Franco Andreone will be continuing in his Co-Chair role; however, Herilala Randriamahazo will be passing his responsibilities onto the former ASG Madagascar Executive Secretariat Nirhy Rabibisoa. The experience and energy that comes with this team is a great sign of the potential for amphibian conservation in Africa, and we very much look forward to working with everyone in the region. As you will see from the articles included in this edition, there are already many fantastic initiatives in place and plenty of opportunity for further partnerships and investments. We would like to take this opportunity to thank all of those who supported the ASG during the 2009-2012 quadrennium and welcome all the new Chairs for what we hope will be a very productive quadrennium.

In its capacity as a network the ASG strives to reach out to people and organizations working with amphibians to help build partnerships and share information. We are trying to do this in a number of ways, with the lead often coming from our members rather than the Executive Committee. The Amphibian Conservation special edition of *Alytes* (see page 9) is a great example of the type of material that can be produced through such collaborations. We encourage our members to read this edition to get a good sense of some current thinking within the community and hope it leads to constructive and lively debate. The Conservation Evidence initiative that is being run by the University of Cambridge is another great example of how we can come together as a community to share information to further amphibian conservation (please read the article on page 4 to find out how you can get involved in this ASG supported initiative).

As we move forward we will be sharing with you a range of different ideas and projects. How the ASG approaches these will be in direct response to member involvement. The ASG is not just a collection of people in appointed positions but a community, and as the Executive Committee we are here to help you meet your priorities as members.

## *The ASG Executive Committee*



### ASG EXECUTIVE COMMITTEE

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*ASG Co-Chair*

Claude Gascon  
*ASG Co-Chair*

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

### Amphibian Conservation – Call for Evidence

The Conservation Evidence project at the University of Cambridge is focusing on amphibians this year. Conservation Evidence publishes a website, a journal and a series of books providing evidence to support decisions about nature conservation. We are currently developing a new synopsis of evidence on amphibian conservation funded by Synchronicity Earth. This involves listing all possible conservation interventions for amphibians, anywhere in the world, and compiling evidence for the effectiveness of each.

#### WE NEED YOUR HELP

Have you written a paper or report describing the effects of a management intervention to conserve amphibians? Have you tried a novel technique for the conservation of an amphibian species? It could be anything from protecting, restoring or creating habitat to captive breeding and releases. If the intervention was directly tested and its effects monitored quantitatively, we would like to include your evidence in our synopsis.

Please note, we focus entirely on how to protect or boost wild amphibian populations by intervening to restore natural processes or mitigate threats. We do not cover evidence about how species are changing or what is causing their decline.

Conservation Evidence has completed synopses of evidence on bird conservation and wild bee conservation. Another synopsis is almost complete for wildlife conservation in European farmland. These are available on our website [www.conservationevidence.com](http://www.conservationevidence.com) in a searchable database of evidence.



We aim to complete the amphibian synopsis by June 2013. It will then be made available as a searchable database, a book and a free pdf.

Please contact Rebecca Smith [r.k.smith@zoo.cam.ac.uk](mailto:r.k.smith@zoo.cam.ac.uk) if:

- You have evidence of the effectiveness of conservation interventions for amphibians, or
- You would like an electronic copy of the amphibian synopsis once it is available.

### FrogLog Schedule

- January – Special Topical Edition
- April – The Americas
- July – Africa, West Asia, Madagascar, Mediterranean, and Europe
- October – Asia, Russia, and Oceania



Robin Moore / iLCP

# ASG/ARMI Seed Grant Award 2012

## Call for applications:

## The Amphibian Research and Monitoring Initiative Seed Grant Awards **Apply Now!** [www.amphibians.org](http://www.amphibians.org)

We are pleased to announce a new round of ASG/ARMI Seed Grants. ARMI Seed Grants are intended as one-time awards of between \$500 and \$2000 for the support or initiation of research that furthers the Amphibian Specialists Group's mission to conserve biological diversity by stimulating, developing and executing practical programs to conserve amphibians around the world, in addition to determining the nature, extent and causes of amphibian population declines.

To apply for an award your proposed work must be undertaken on amphibian species or issue(s) of concern in the USA. The US Geological Survey's (USGS) Amphibian Research and Monitoring Initiative (ARMI) is particularly interested in funding research on potential stressors of amphibian populations. Applicants interested in applying for a seed grant should download and submit an application form by August 31st, 2012 from the ASG web site [www.amphibians.org](http://www.amphibians.org). Successful candidates will be notified by September 30th, 2012. Do not hesitate to contact Robin Moore if you need clarification or advice. For more information on ARMI please visit <http://armi.usgs.gov/>.

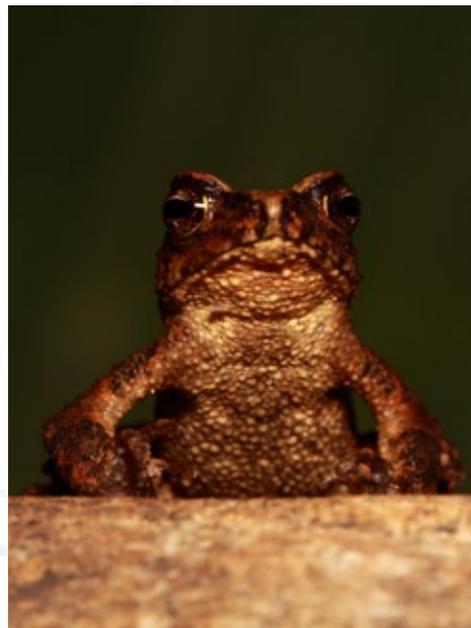


The ASG/ARMI Seed Grant is managed by the Amphibian and Reptile Conservancy, a U.S.-based 501(c)(3) non-profit organization whose mission to assist in and develop amphibian and reptile conservation projects and partner efforts that support the mission and goals of Partners in Amphibian and Reptile Conservation (PARC).

## Lost Frogs Update

Thank you to all those who applied for the Lost Frogs internship advertised in the last edition of *FrogLog*. We are currently in discussion with the last few applicants and hope to shortly announce who will be helping to develop this initiative into an even more successful project for amphibian conservation. In the meantime we are happy to report that there have been a number of rediscoveries recently published from across the world bring the total found to 30 with 219 still lost. As always this list is very much open for debate and we welcome your thoughts and contributions. Please take a look at the list which can be found online and if you know of any updates that need to be made just let us know.

Since May we have learnt about four rediscoveries. The first, and arguably most incredible, is the *Adenomus kandianus* from Sri Lanka which was last observed in 1879. This amazing rediscovery was made by Mendis Wickramasinghe and team during a 2009 field season. Other individuals have been located within the area of the rediscovery, an area officially protected on account of its religious significance, however habitat



*Adenomus kandianus*. Photo: L. J. M. Wickramasinghe.

degradation is occurring at high levels due to uncontrolled use of the site by pilgrims. In order to ensure the long term survival of the species this threat needs to be immediately addressed. The species was listed as Extinct on the Red List, however thanks to funding and a quick assessment by the Amphibian Red List Authority, the species will shortly be down listed.

*Isthmohyla tica*, *Isthmohyla debilis* and *Isthmohyla graceae* were reported as rediscovered in a recent paper (1). The area where the species have been found is currently not under immediate threat from habitat loss as it is part of local/indigenous community land and current land use is extensive agriculture by smallholders. However, the whole area is largely unprotected and the potential for future mining on Cerro Colorado means that these sites need to be monitored closely and plans developed that can be implemented quickly if a threat is identified.

### References

1. A. Hertz et al., *Amphib. Reptile Conserv.* 6, 9(e46) (2012).

## North and Central America and the Caribbean

**Canada** — David Green

**Caribbean** — Rafael Joglar and Patricia Burrowes

**Costa Rica** — Gerardo Chaves

**El Salvador** — Francisco Samuel Álvarez Calderón and Vladlen Henriquez

**Guatemala and Belize** — Carlos Vasquez and Eric Smith-Urrutia

**Honduras** — Franklin Castañeda

**Mexico** — TBC

**Nicaragua** — Javier Sunyer

**Panama** — Roberto Ibáñez and César Jaramillo

**USA** — Mike Lannoo

## Europe, North Africa and West Asia

**Europe** — Inigo Martinez-Solano and Richard Podloucky

**North Africa** — TBC

**West Asia** — Riyad Sadek

## South America

**Argentina** — Esteban Lavilla

**Bolivia** — Claudia Cortez and Arturo Muñoz

**Brazil** — Debora Silvano

**Chile** — Juan Carlos Ortiz and Claudio Soto Azat

**Colombia** — Jose Vicente Rueda and Nicolas Urbina

**Ecuador** — Andres Merino-Viteri

**Guiana Shield** — Philippe Kok and Ross MacCulloch

**Paraguay** — Martha Motte

**Peru** — Rudolf von May

**Uruguay** — Jose Langone and Rafael de Sa

**Venezuela** — Cesar Molina

Over the last two months we have been working with regional ASG groups to identify new Regional Chairs for the upcoming quadrennium. The majority of Chairs are now in place with many groups opting to appoint Co-Chairs. Several new regional groups have been created including Nicaragua and El Salvador. Brazil and Guiana Shields have also been split into two groups along with Europe and North Africa. We are still looking for Regional Chairs for the new North Africa group as well as for Mexico and Japan. If you have any suggestions please contact ASG Program Officer James Lewis at [jplewis@amphibians.org](mailto:jplewis@amphibians.org)

## Mainland Asia

**China** — Pipeng Li and Jiang Jian-Ping

**Former USSR and Mongolia** — Sergius Kuzmin

**Japan** — TBC

**Korea** — Daesik Park and Robert Kaplan

**South Asia** — Karthik Vasudevan and Sanjay Molur

**Sri Lanka** — Anslem de Silva and Madhava Meegaskumbura

**Mainland South East Asia** — Bryan Stuart and Jodi Rowley



# Survey: Joint Objectives in Disaster Risk Reduction and Environmental Conservation

**A**re you contributing to areas of work that demonstrate the links between conservation and human well-being? Are you communicating this work with effective messaging and to relevant stakeholders? IUCN is seeking to work with its Members to document and promote the role of ecosystems as an effective approach for disaster risk reduction (DRR) to key stakeholders. This will enable the Union to build strong synergies for action and impact on the ground as well as influence and engage in development, humanitarian and environmental policy arenas.

In order to strengthen our partnerships for DRR, we need to determine the current involvements, knowledge and experiences present within the Union so as to develop a strategy and identify opportunities for joint action.

As part of this effort, IUCN has worked with The Nature Conservancy (an IUCN Member), the Global Network of Civil Society Organizations for Disaster Reduction and the United Nations University to conduct a global survey that examines how organizations and agencies are approaching the development of priorities in the interface between environmental conservation and disaster risk reduction.

We are looking at if and how;

- (a) Environmental organizations and agencies are developing DRR objectives, and
- (b) DRR organizations and agencies are developing environmental objectives.

Please complete the survey here ([http://www.surveymonkey.com/s/DRR\\_and\\_Env\\_Conserv\\_Survey](http://www.surveymonkey.com/s/DRR_and_Env_Conserv_Survey))

This information will be integrated into a review paper on advice, challenges and opportunities in the development of joint work across DRR and environment conservation objectives. We will ensure the confidentiality of your responses. We will not report or identify any results with respect to specific individuals or organizations; results will only be reported by organization type.

We greatly appreciate your time and contribution to our understanding of how agencies and organizations are meeting these objectives. **The survey will close on 5 August 2012** so please ensure you submit your responses before then.

If you have any questions or comments, or if you experience issues connecting to the internet and would prefer to receive a pdf version of the survey, please email Kaia Boe ([kaia.boe@iucn.org](mailto:kaia.boe@iucn.org)).

Many thanks: Ms. Radhika Murti, Programme Coordinator – Disaster Risk Reduction, IUCN. Ms. Kaia Boe, Project Officer - Disaster Risk Reduction, IUCN. Dr. Michael W. Beck, Lead Scientist - Global Marine Initiative, The Nature Conservancy. Dr. Fabrice Renaud, Head of Section - Environment and Human Security, United Nations University. Dr. Zita Sebesvari, Associate Academic Officer - Environment and Human Security, United Nations University. Mr. Marcus Oxley, Executive Director, Global Network of Civil Society Organizations for Disaster Reduction.

## Other Specialist Group News

If you like *FrogLog* then why not take a look at some of the other IUCN SSC publications produced by Specialist Groups. A full list of specialist groups can be found on the SSC web site at [http://iucn.org/about/work/programmes/species/who\\_we\\_are/ssc\\_specialist\\_groups\\_and\\_red\\_list\\_authorities\\_directory/](http://iucn.org/about/work/programmes/species/who_we_are/ssc_specialist_groups_and_red_list_authorities_directory/).

For starters why not check out the recently published Freshwater Fishes Specialist Groups newsletter at <http://www.wetlands.org/LinkClick.aspx?fileticket=LGbprFUE21s%3d&tabid=201&mid=4596>. The ASG encourages our members to interact with other specialist groups to help build linkages between our activities and



Freshwater Fish Specialist Group Newsletter • 2012 / 1



Frog amphibia, a new species of air-breath described by IUCN member Rajeev Raghavan and colleagues

#### In this issue

- Freshwater Fish Specialist Group Annual Meeting
- Freshwater Fish Specialist Group represented at IUCN SSC Chairs' meeting
- Second Workshop for Evaluation of Extinction Risk of Brazilian Freshwater Fishes
- IUCN Anguillid Specialist Sub-Group
- Welcome and Good bye



develop more comprehensive approaches to conservation action. If you would like any further information on the ASG or our partnerships with other Specialist Groups please contact James Lewis at [jplewis@amphibians.org](mailto:jplewis@amphibians.org).

### GLOBAL RE-INTRODUCTION PERSPECTIVE SERIES

The IUCN SSC Re-introduction Specialist Group (RSG) is planning a 4th issue of its Global Re-introduction Perspective series. We are looking for any amphibian re-introduction articles that can be presented. If you are interested in submitting a case-study please contact Pritpal Soorae at [iucnrsg@gmail.com](mailto:iucnrsg@gmail.com) and past issues of the book can be downloaded at: [http://www.iucnsscrg.org/rsg\\_book.php](http://www.iucnsscrg.org/rsg_book.php)



### Global Re-introduction Perspectives: 2011

More case studies from around the globe Edited by Pritpal S. Soorae



IUCN/SSC Re-introduction Specialist Group (RSG)

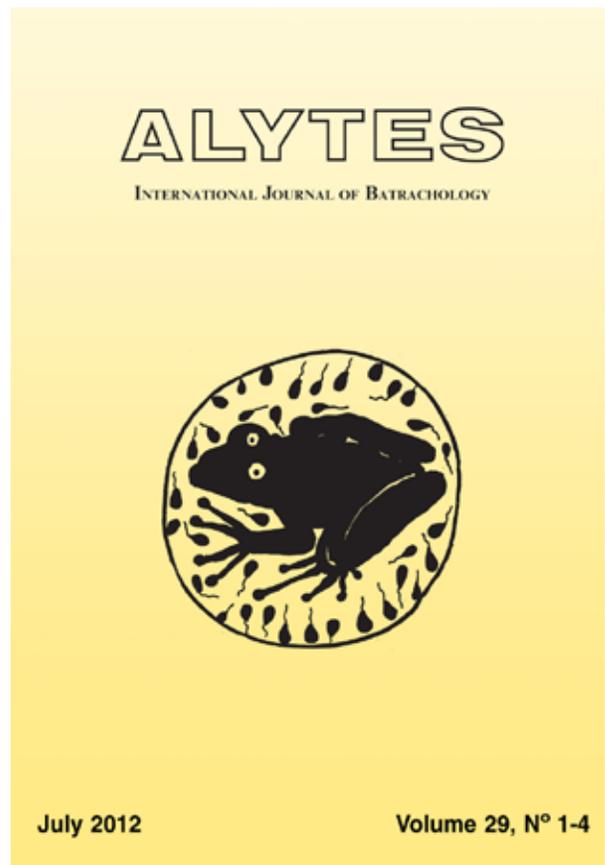


# New Special *Alytes* Issue on Amphibian Conservation

By Ariadne Angulo & Franco Andreone

The journal *Alytes*, published since 1982 by the International Society for the Study and Conservation of Amphibians (ISSCA) and devoted exclusively to this vertebrate group, has recently issued its latest volume (29), a special issue devoted to amphibian conservation. The main focus of the special issue was to address bridging the gap between science and policy; hence, it has sought to emphasize those areas that fall in that often grey interface. This volume is comprised of a compilation of nine solicited papers and two editorials, which fall into the following broad sections: 1) editorials, 2) action plans (frameworks to help translate science into conservation policy), 3) threats (interactions between humans and amphibians), and 4) points of view. The special issue has a broad geographic coverage and it also addresses a variety of subjects (action plans and threats such as invasive species, climate change, mining and trade, national-level conservation and the approaches to the study of chytridiomycosis). We hope that the papers in this special issue can catalyze greater discussion on how science can inform and translate into conservation action.

For more information on how to acquire the special issue or for details on how to subscribe to the journal, please contact Dr. Franco Andreone ([franco.andreone@gmail.com](mailto:franco.andreone@gmail.com)).



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- Lannoo, M.J. 2012. A perspective on amphibian conservation in the United States. *Alytes* 29 (1-4): 133-144.

# Amazing Species - A Call for Species Descriptions

## Call for Species Descriptions

Many of you will remember the call we put out last year for nominations for the “Amazing Species” initiative being spearheaded by the IUCN. If you haven’t come across it already, “Amazing Species” is an extremely popular website that can be found at <http://www.iucnredlist.org/amazing-species>. It’s the simplified and easily digestible way of conveying information from the Red List to a diverse audience, and provides a public platform to raise the profile of any species you may wish to draw more specific attention to (the initiative has nearly 9,000 followers on Twitter). The “Amazing Species” team is also working on a couple of great new initiatives which will use all the factsheets developed over the past two and half a years; one aim being to eventually have at least all popular species accounts written and available to the public. This is a fantastic way to help raise awareness of amphibian conservation issues and we would like to invite you all once again to submit entries via the ASG.

If you would like to nominate an amphibian species it should ideally be in any of the RL categories, but if the species is lacking verified assessments then please do not let this prevent you from submitting your nomination. View this as a great way to raise the profile of your species, as there are lots of visitors to the site who frequently comment on how interesting and useful it is especially as an education tool.

To nominate a species please follow the format below and send a high resolution photograph with permission use granted to [jplewis@amphibians.org](mailto:jplewis@amphibians.org) with the subject heading Amazing Species. An example of a previous “Amazing Species” is presented here along with a list of species already nominated.



Geographical range  
[www.iucnredlist.org](http://www.iucnredlist.org)  
[www.amphibians.org](http://www.amphibians.org)  
 Help Save Species!  
[www.arkive.org](http://www.arkive.org)

### Amazing Species: Yellow-spotted Tree Frog

The **Yellow-spotted Tree Frog**, *Litoria castanea*, is listed as ‘Critically Endangered’ on the IUCN Red List of Threatened Species™. Previously known from two distinct populations in south-eastern Australia, separated by a distance of about 500 km, this species had not been seen since 1980 and was feared to be extinct. However, it was recently rediscovered in a remote creek in the Southern Tablelands region.

The exact causes of the disappearance of the Yellow-spotted Tree Frog are unclear, but the fungal disease chytridiomycosis, which has caused a widespread catastrophic decline in amphibians, is thought to have played a role. Habitat modification and introduced fish predators such as *Gambusia* are also likely to have affected its populations.

Following the rediscovery of this species, a sample of juvenile frogs are being raised at Taronga Zoo. The aim is to set up a long-term captive breeding programme and ultimately reintroduce this amphibian back into other parts of its former range. Scientists are also working with the landowner to conserve the species at the site of its rediscovery, while further survey work may help determine whether the Yellow-spotted Tree Frog still survives in any other locations.



The production of the IUCN Red List of Threatened Species™ is made possible through the IUCN Red List Partnerships: IUCN (including the Species Survival Commission), British Antarctic Survey, Conservation International, NatureServe and Zoological Society of London.

**Introduction:** The introduction needs to provide the scientific name of the species (and common name if there is one). It must cite the Red List category or a provisional listing if it has not yet been published on the Red List. A brief description of distribution and range, together with any interesting feature of the species to be included here.

### Amazing Species: Yellow-spotted Tree Frog

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**Final Paragraph:** Please provide detail of any conservation measures e.g., CITES listing, captive breeding / reintroductions programmes, conservation programme, being undertaken or that should be undertaken.

### SPECIES ALREADY NOMINATED:

- Axolotl *Ambystoma mexicanum*
- Toad mountain frog *Atelopus certus*
- Pirre mountain frog *Atelopus glyphus*
- Limosa harlequin frog *Atelopus limosus*
- Sagalla caecilian *Boulengerula niedeni*
- Burrowes' giant glass frog *Centrolene ballux*
- Miles' robber frog *Craugastor milesi*
- Rabb's fringe-limbed treefrog  
*Ecnomihyla raborum*
- Table mountain ghost frog *Heleophryne rosei*
- LaLoma treefrog *Hyloscirtus colymba*
- Mountain chicken *Leptodactylus fallax*
- Yellow-spotted tree frog *Litoria castanea*
- Golden mantella frog *Mantella aurantiaca*
- Demonic poison frog *Minyobates steyermarki*
- Luristan newt *Neurergus kaiseri*

**Middle Paragraph:** Please list any threats to the species, which can include both immediate and expected

# A Survivor Against All Odds: A New Glass Frog from Manu National Park, Peru, Renews Hope for Amphibian Conservation

By Alessandro Catenazzi

The latest addition to the amphibian fauna of the species-rich eastern slopes of the Andes is a glass frog of the genus *Centrolene* (1). The species is named in honor of Andrew Sabin, in recognition of his long-term support of herpetology and dedication to environmental education. This beautiful and moderately large glass frog is distinguished from other related species by morphological characteristics and a peculiar advertisement call composed of long calls with 8–14 peaked notes (instead of the short tonal note typical of glassfrogs). Moreover, the description is supported by a phylogeny of the genus that shows the placement of the new species and its relationship with congeners.

The new species inhabits fast-running streams in the upper Manu National Park in southeastern Peru. Amphibian communities in this region have collapsed over the past decade, during an epidemic of *Batrachochytrium dendrobatidis* that is the likely cause of the local extinction of most sympatric species of glass frogs (2). In addition to other glass frogs, the two species of harlequin toads, other toad species, several treefrogs and other stream-breeding species have vanished from the otherwise intact montane forests of Manu National Park. *Centrolene sabinii* is a survivor of this epidemic: the species has just been heard again at the type locality last month. Its long and redundant call is a reminder that hope is not lost for frogs, and an admonition to renew our efforts to preserve amphibian diversity.



*Centrolene sabinii* named in honor of Andrew Sabin, in recognition of his long-term support of herpetology and dedication to environmental education. Photo: Alessandro Catenazzi.

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## The Prince Charles Stream Tree Frog

A rare species of Ecuadorian stream frog has been named *Hyloscirtus princecharlesi*, or Prince Charles Stream Tree Frog, in honor of the Prince of Wales. Dr. Coloma discovered the new species in 2008 among preserved museum specimens and immediately recognized the specimens as unique, a new species in the hylid genus *Hyloscirtus*. Dr. Coloma realized that for this rare species to persist in the wild, it would require further scientific and conservation action in the field and in the laboratory.

Dr. Coloma is leading conservation efforts and inviting those interested in supporting the efforts to contact him. To date, [Amphibian Survival Alliance](#) (ASA) partner [Amphibian Ark](#) have helped coordinate the initial press release and are assisting in developing the ex-situ element of the initiative. The ASG, through its partnership with the ASA, is also working with Dr. Coloma and Amphibian Ark to identify potential sources of funding to support any in-situ activities.

If you are interested in being involved in this project please feel free to contact Dr. Coloma at [Centro Jambatu](mailto:centrojambatu@otonga.org) ([centrojambatu@otonga.org](mailto:centrojambatu@otonga.org))



*Hyloscirtus princecharlesi*,  
Photo: L. Coloma.

## African Amphibian Working Group 2012 and IUCN Red List assessment of Threatened African Amphibians

By Simon Loader, Michele Menegon, Fabio Pupin, Ariadne Angulo & John Measey



Photo: Michele Menegon.

**O**n May 28<sup>th</sup> at Museo delle Scienze in Trento, Italy, over 80 people gathered for the 15<sup>th</sup> meeting of the African Amphibian Working Group (AAWG). This meeting had the highest number of participants in the thirty year history of the AAWG. People from all over Africa, Europe, and North America attended to present their research on a range of topics. Highlights included talks on the current status of chytrid presence and absence across Africa (David Blackburn, David Gower, Johannes Penner and Che Weldon) and its likely origin in Africa (David Blackburn). Ecological and conservation studies conducted across East (Patrick Malonza, and James Vonesh), West (Laura Sandberger, and Mareike Hirschfeld) and Southern (Les Minter) Africa were also covered. Taxonomic issues were outlined for a range of groups (Rafael O. de Sá, Eli Greenbaum, Michael Barej, Victor Wasonga, and Elizabeth Scott-Prendini), and broader evolutionary studies on African amphibians were also addressed (Rayna Bell, Lucinda Lawson, Krystal Tolley and John Measey). Jos Kielgast and Bill Branch presented on exciting new work carried out in Democratic Republic of Congo and Mozambique, areas that still remain poorly sampled and understood. We were fortunate to have plenary talks on Madagascar (Franco Andreone), South African Batrachology (Louis du Preez), African caecilian biology (Mark Wilkinson), and a history of

AAWG (Alan Channing). Most importantly, the meeting was an opportunity to celebrate the contributions of Professor John Poynton, one of the premier herpetologists working on African amphibians. Talks were given by colleagues on John's academic contributions (Kim Howell and Don Broadley). We also had the pleasure to hear John give a plenary talk on the fauna of the Afrotropical region of southern and eastern Africa, a topic that he has contributed towards since the start of his scientific career nearly 60 years ago. The contributions of John Poynton will be summarized in a forthcoming issue in the African Journal of Herpetology (Volume 62; Issue 1).

A reassessment workshop of Threatened and selected Data Deficient African amphibians was conducted following the AAWG meeting, given the gathering of a number of African amphibian experts. The aim was to update the Threatened African amphibian assessments in the IUCN Red List of Threatened Species™, as the last comprehensive assessment for this region was carried out in 2002 in Watamu, Kenya. The workshop was funded principally by a grant from the Mohammad Bin Zayed Species Conservation Fund, and further complementary funds were kindly provided by the IUCN Species Survival Commission (SSC) Chair's Office, the



IUCN SSC Amphibian Specialist Group Regional Chair for Southern Africa, John Measey, facilitating amphibian assessments. Photo: Jennifer Luedtke.

IUCN-CI Biodiversity Assessment Unit (BAU) and the Deutsche Gesellschaft für Herpetologie Terrarienkunde, all of which enabled the contributions of African amphibian experts, as well as workshop facilitation and preparatory work in advance of the workshop. In particular, a huge effort was made to obtain point locality data so as to generate the best possible maps for each species. The workshop took place between 1<sup>st</sup> – 4<sup>th</sup> June 2012, with the assessment of West and Central African species taking place between 1<sup>st</sup> – 2<sup>nd</sup> June with approximately 12 attending participants, and Eastern Afrotropical species being reassessed between June 2<sup>nd</sup> – 4<sup>th</sup>, with approximately 15 participants. Over the course of the workshop a total of 165 amphibians were preliminarily assessed (if recently described) or re-assessed, 57 of them corresponding to West and Central African species and 108 corresponding to Eastern

Afrotropical species. In the case of reassessments, several changes have been proposed: for Eastern Afrotropical species, there are 27 uplisting and 16 downlisting proposals, 12 changes in criteria but not category, and 11 calls for a Data Deficient assessment. A total of 42 assessments were maintained with the previous category/criteria combinations. For West and Central African species, there are two proposed uplistings, four downlistings, two changes in criteria but not category, and six proposals for Data Deficient. It is worth noting that there were 12 West and Central African species being assessed for the first time, of which 50% were assessed as Data Deficient and the remaining six were assessed as Critically Endangered (N=1), Vulnerable (N=2), Near Threatened (N=1) and Least Concern (N=2). However, it is quite likely that there will be further proposed changes, as there are a number of instances where additional follow-up is required in terms of accessing additional assessment-relevant information. Once assessments are completed they will be sent for external review; if reviewers agree with the assessments they will then be submitted for consideration to be published on the IUCN Red List of Threatened Species™ ([www.redlist.org](http://www.redlist.org)).

We wish to thank all workshop participants for their effort and input, as well as those experts who were not able to attend the event but who generously provided information in advance of the workshop and/or who are also assisting with the follow-up process. We are also grateful to the organizations that made the workshop possible, from providing funding to assisting with logistics.

The next meeting of the African Amphibian Working Group will take place in Uganda in two to three years' time. Watch for announcements in future issues of *FrogLog*.



The Critically Endangered *Nectophrynoides wendyae*. Photo: Michèle Menegon.

# Conservation of the Western Leopard Toad by a Dedicated Multi-Stakeholder Group in the City of Cape Town

By John Measey<sup>1</sup>, Suretha Dorse<sup>2</sup> & Alison Faraday<sup>3</sup>

**H**abitat change is still the biggest threat to amphibians globally. Of the different types of habitat change, urbanization is probably one of the most heterogeneous changes of an amphibians' environment. Although roads, paved areas and buildings represent amphibian free environments, parks and gardens have the opportunity of holding suitable breeding and foraging habitats for many anuran and urodele amphibians (e.g. 1, 2). In addition, these (often peri-urban) areas are the places where a majority of the human population have their encounters with amphibians, providing conservationists with a unique opportunity to engage in amphibian issues.

The City of Cape Town is situated at the south-westernmost tip of Africa with a population of 3.8 million people. It is a typical African city, with a rapidly increasing population (approximately 50,000 per annum), and going with that the intensification of urbanisation throughout its 2,460 km<sup>2</sup>. However, it is situated in an extra-ordinary area, in the heart of the Cape floristic region: a mega-diverse area with 19 distinct vegetation types and an estimated 3,250 indigenous plants. Perhaps not surprisingly, 17 out of the 19 vegetation types are threatened (CR, EN & VU) in the latest national biodiversity assessment, mostly due to agriculture and the rapid expansion of the city since the 1940s, with little regard for conservation planning (3). The fynbos biome is also the centre of remarkable anuran diversity, and the peak of the endemic diversity happens to centre on the area encompassed by the City of Cape Town (Figure 1).

The Western leopard toad (*Amietophrynus pantherinus*) was first assessed as threatened in 1988. In the City, this toad breeds in the "southern suburbs" coinciding with acid soils of the Sand Fynbos (see Measey & Tolley 2011). Within these areas, this species appears to depend on a level of disturbance to keep water bodies open and foraging areas productive. Like many large bufonids, it undergoes an annual migration to and from large open water-bodies, in which large congregations of adults form during the antipodian winter (typically August). Migrations became notorious as mass mortality events during the 1940s, when roads neighbouring large breeding sites became impassable due to the build-up of toad carcasses. This coincided with the on-going expansion of these peri-urban areas (3), so that over a number of years populations quickly dwindled. More recently, a new threat from a domestic exotic congener, the Guttural toad (*Amietophrynus gutturalis*), has begun to expand its distribution within the City of Cape Town (see Measey & Davies 2011).

The decline of the Western leopard toad did not go unnoticed, and several volunteer groups formed in different areas of its range to raise awareness of the plight of this species and to help avoid casualties during the mass migration events. Each volunteer group operated within discrete peri-urban areas, and there was little involvement from other conservation stakeholders. Despite long hours on wet nights by many individual volunteers, the toad populations continued to decline so that in 2004, this species was listed as Endangered (EN) with much the same set of increasing threats.

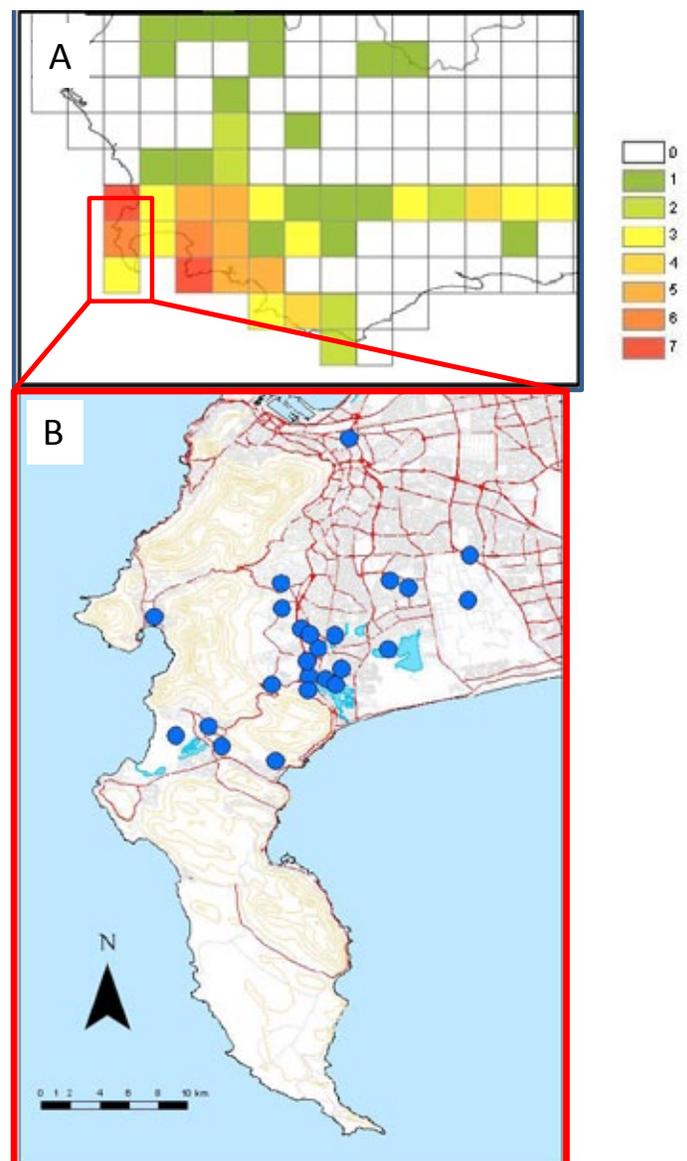


Fig. 1A: The southwestern Cape of South Africa has a remarkable assemblage of anurans demonstrated by the high level of endemicity (<20 quarter degree grid squares). B Despite the Cape Peninsula having a large area of protected land, the Western leopard toad breeds (blue points) in peri-urban areas.

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*endangered*  
the Western Leopard Toad

Fig. 2: The Western leopard toad is a large charismatic bufonid which quickly wins over the help of volunteers. The Western leopard toad Conservation Committee logo emphasises the need for vigilance of this threatened species.

In addition, the conservation messages coming from the different volunteer groups were not consistent and covered only a fraction of the area that the toad inhabited.

In November 2009, the South African National Biodiversity Institute (SANBI) organized a stakeholders meeting, bringing together all parties interested in the conservation of the Endangered Western leopard toad. The objective was to assess conservation actions throughout the range of the species, as well as to plan a co-ordinated effort for future conservation activities. A major result of the meeting was the formation of the Western leopard toad Conservation Committee (WLT-CC), which constituted members from each of the extant volunteer groups as well as representatives from the official conservation bodies: SANBI, CapeNature, South African National Parks and the City of Cape Town. The goal of the WLT-CC is to reduce the threat level of the Western leopard toad through co-ordinated conservation actions from all stakeholders (Figure 2). Actions taken to improve the conservation of this species are considered in the light of aiding the conservation of all small native vertebrates in the region.

The result of a combined approach to conservation of this species has been remarkable. Existing and new volunteer groups became empowered by pooling resources and sharing knowledge with

conservation professionals. Here we highlight some of the achievements through examples, which we believe will make a lasting impact on the conservation of this species.

#### EDUCATION

Through a combined approach of educating homeowners (in whose gardens most toads reside), dispelling myths and misperceptions and teaching school children about the conservation needs of the Western leopard toad, a ground swell of awareness has been generated. Volunteer groups have enlisted schools, scout groups, conservation groups and homeowner associations in their areas to tell residents about the benefits and importance of conserving the animals. For example, in 2011 more than 1,000 school children learned about Lenny the Leopard toad. They also discovered how to prevent toads drowning in their swimming pools; how to cultivate the kind of gardens that suit toads; what to do if they find a toad in the road and how to educate their parents about toads. The talks are aimed at children in Primary Schools and are kept fun and interactive. The Year of the Frog (2010) saw the opening of an automated puppet show in Cape Town's Two Ocean's Aquarium, which is played to thousands of visitors every day, including hundreds of local school children. Consistent and complimentary messages provided in all of these conservation education initiatives, highlight the current and future needs of Western leopard toads.

## CITY OF CAPE TOWN PLANNING GUIDELINES

With limited legislated environmental control over development applications on a local authority level, the City's environmental staff is continually investigating ways of ensuring the effective protection of the Western leopard toad (as well as other threatened species). Mapping of the known breeding sites and the detailed distribution range of the Western leopard toad is carried out on an annual basis by WLT-CC members and forms the basis for informing land use management and development applications assessed by the City's environmental department. This information has been incorporated into the City's GIS tool as part of the Biodiversity Network of the City of Cape Town. In collaboration with the WLT-CC, a Construction Phase Environmental Management Plan and Checklist, as well as a Development Design Checklist was compiled and incorporated into development applications within the distribution range of the Western leopard toad. Inappropriate building plans, such as impermeable boundary walls, are also influenced during the formal approval process while conditions of approval are imposed to regulate and guide future land use where possible. Additionally, brightly coloured stickers on building plans assist in creating awareness and guiding the actions of homeowners and construction teams. The City's environmental department has further signed service level agreements with other line functions responsible for the maintenance of public land within the Western leopard toad's distribution. These agreements changed the operational management of these spaces and watercourses to ensure the protection of the Western leopard toad during crucial periods of their life cycle, and are continuously reviewed in light of the changes in distribution informed by the GIS layer. The City also drives extensive awareness campaigns through their official web site, specific environmental education programmes and the production and distribution of information leaflets and posters.

## HABITAT RESTORATION

Increasing urbanization regularly leads to a reduction of wetland areas, and this is also the case in Cape Town. However, the utilities of wetlands are increasingly recognised, resulting in restoration of areas, which were previously filled in. The City of Cape Town Environmental Resource Management Department provided funding for the restoration of a Western leopard toad breeding site on the Cape Peninsula. The breeding site was historically known as Skilpadsvlei and situated in the Kommetjie area. The wetland was drained and subsequently filled in by the then City Council during the 1940's. Skilpadsvlei used to be the only known breeding site for the Western leopard toad in the Kommetjie area and the restoration project entails the removal of the fill material followed by appropriate indigenous planting to restore as much as possible of the historic wetland system. With on-going awareness campaigns, proper veld management interventions and continued monitoring in partnership with the local community and relevant interest groups, the hope is to see active breeding at this site again within the next few years.

## MIGRATION AWARENESS

As road kill during the annual breeding migration causes hundreds of deaths, awareness before and during the migration is essential. Car bumper stickers, education boards, posters and visible patrols all add to public awareness. In 2011 a series of Toad Traffic Reports aired on two local radio stations. Volunteers conduct recruitment drives annually, usually in local shopping centres. Shoppers are

made aware of the annual migration of the toads across our roads in search of their breeding grounds, and those interested are encouraged to become volunteers. The WLT-CC remains in close contact with volunteer co-ordinators during these periods and ensures service level agreements with city departments are adhered to.

In addition to each of these key areas, the volunteer groups continue to patrol targeted areas during the annual migration of adults, and later the movement from breeding sites by juveniles (typically in December). While the actions of many individuals have helped this threatened anuran in the past, we believe that the co-ordinated action of a greater community through the auspices of the WLT-CC will achieve our ultimate goal of reducing the threat level so that future generations will be able to enjoy this charismatic species.

For more information about the current activities of the WLT-CC, visit the web site: [www.leopardtoad.co.za](http://www.leopardtoad.co.za)

## Acknowledgements

The WLT-CC contains representatives from the City of Cape Town, SANParks, CapeNature, SANBI and co-ordinators for all of the volunteer groups. We extend our thanks to all members, past and present. We acknowledge the importance of the combined efforts of many individuals from each of these organisations in tackling the conservation of all small vertebrates. We extend our special thanks to all of the volunteers who go out on dark wet nights to move toads from the roads.

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# Ex-situ Amphibian Conservation in Southern Africa

By Ian Visser

Since the inception of its Amphibian Conservation Project (ACP) in 2006 the Johannesburg Zoo has taken on an increasingly important role in the relatively new field of South African amphibian conservation.

The ACP was initiated six years ago as part of the Zoo's ongoing effort to increase its overall conservation and research effort, particularly with regard to supporting off-site conservation programs for indigenous threatened animal species. Along with other projects, such as those for the African ground hornbill and the Wattled crane, the ACP provides staff members with an opportunity to get directly involved with a conservation program and broaden the scope of their normal duties as Zoo staff. Special focus is given to the improvement of husbandry skills but exposure to all aspects of the management of such conservation projects is also an important consideration.

As the program developed it also demonstrated its usefulness with regard to establishing valuable links with other research and conservation institutions, in addition to providing a very useful tool for public education. Under the auspices of the African Association of Zoos and Aquaria (PAAZAB) successful partnerships in support of this project have been established between the Johannesburg Zoo, Ezemvelo KwaZulu Natal (EKZN) Wildlife, the National Research Foundation (NRF), the National Zoological Gardens (NZG) and North-West University (NWU). Progress to date is also providing a model for future similar collaborations regarding amphibian conservation in Southern Africa.

Very little ex-situ husbandry research has been carried out on our indigenous frog species to date. At the project's inception the decision was therefore made to initiate research aimed at three threatened species of amphibians, with a view towards selecting one or more of these for further conservation research when the project was judged to have progressed to a satisfactory point. The species chosen were the Western leopard toad *Amietophryne pantherinus*, Table mountain ghost frog *Heleophryne rosei* and Pickersgill's reed frog *Hyperolius pickersgilli*. Once species that had the potential to benefit most from ex-situ conservation work were selected, a congeneric (analogous) species was identified for each, and collection trips for these species soon resulted in the beginning of the Zoo's first indigenous amphibian husbandry program.



Mr. Timothy Netsianda, Amphibian Keeper at the Johannesburg Zoo, with a Giant bullfrog *Pyxicephalus adspersus*. Photo: Ian Visser.

The Natal cascade frog *Hadromophryne natalensis* was chosen as a congeneric species for the Table mountain ghost frog. As both frog species live in cold water streams the larval development phase takes over a year. Results with the Natal cascade frog were correspondingly slow in coming, but within five years research had progressed to the stage that gravid females were produced from tadpoles collected during the course of the program, although breeding success eludes us as yet. Due to the paucity of adult Table mountain ghost frogs to be found in the wild population, as well as other relevant considerations reached after consultation with the Cape conservation authorities, the decision was made to discontinue plans for the target species, with the efforts of in-situ conservation efforts being focused upon further research and monitoring as well as ongoing work being carried out to re-establish the natural flow of the mountain streams upon which this species depends for its existence. Husbandry research will however continue to be carried out with the Natal cascade frog in order to further our

knowledge of this group of amphibians and their breeding behavior for future reference.

The Guttural toad *Amietophryne gutturalis* provided a congeneric species upon which to base research for the Leopard toad. Although the Guttural toad is abundant over much of South Africa, and breeds readily in just about any suitable water body available, it took four years before we were able to observe spawning in our captive population. Once Guttural toads begin breeding they are very prolific, and for the past two seasons a high hatch rate has produced several thousand tadpoles, some of which were allowed to



Curator of Fish, Reptiles and Amphibians at the Johannesburg Zoo. Project Coordinator for an ex-situ conservation and research project for Pickersgill's reed frog.



A female Pickersgill's reed frog. Photo: L. du Preez.

successfully metamorphose. In the interim in-situ efforts by nature conservation authorities have focused upon wetland conservation, eradication of invasive exotic species of fish such as the Common carp (which may feed upon the spawn) and public education, including a successful public awareness program with a large focus on protecting migrating adults as they cross roads when congregating at their spawning grounds at the beginning of the mating season. Again the decision was made not to proceed with plans for the target species as it was felt that current conservation methods are producing positive results. Future efforts may instead be focused upon the recently rediscovered Critically Endangered Amatola toad *Vandijkophrynus amatolicus* about which very little is currently known.

In addition to this, another two species of South African amphibians are currently being considered for ex-situ conservation methods. Further discussion and research is however required before this can commence.



This dedicated research space at the Johannesburg Zoo is on display to the public. Photo: Ian Visser.

The Painted reed frog *Hyperolius marmoratus* was chosen as a congeneric species for Pickersgill's reed frog. It soon proved itself to be amenable to captive husbandry, with initial breeding success being achieved directly after collection and to the F3 generation within three breeding seasons. This was not entirely unexpected, as anecdotal evidence suggests that this common and prolific species is successfully extending its home range by hitchhiking in consignments of garden plants being moved from nurseries in its current area of distribution into other parts of the country.

Work on all three species up to this point provided us with a steep learning curve, not only regarding the husbandry of the various frog species as expected, but also with regards to the development of partnerships in conjunction with the various nature conservation bodies, and the need to take previously unconsidered factors into consideration as the program grew. Having the Amphibian Ark's templates, project criteria and experience at our disposal has been an immense help in this regard.

Following research conducted by EKZN Wildlife and NWU, the Critically Endangered Pickersgill's reed frog was confirmed as being a suitable subject for ex-situ husbandry and breeding research. As PAAZAB had already been in consultation with EKZN Wildlife for some time concerning the possibility of starting such a program, it was subsequently invited to initiate a project in this regard. The project was then checked against the Amphibian Ark project preparation guidelines and found to be justified. We have therefore engaged in the second phase of the program for this species, which began with the acquisition of wild specimens of the target species for the purpose of breeding research, and will conclude with the publication of a comprehensive husbandry manual. The third phase of the program will consist of the establishment of the full ex-situ assurance population, which will be maintained until the opportunity and need to provide stock for release into newly created or rehabilitated habitat is identified.

We are extremely fortunate in that the School of Environmental Sciences & Development at NWU is very involved with amphibian research in Southern Africa, and supports amphibian conservation. As a result a great deal of the preparatory research required for this project is already in progress or has been completed. An EKZN Wildlife researcher currently provides occurrence predictions based upon geographic modeling, and students from NWU then carry out the necessary ground truthing, in addition to several other in-situ research projects pertaining to other aspects of this species' natural history. In this way, at least two new locations where the Pickersgill's reed frog occurs have already been discovered. It currently appears that the primary threat to this species is the extreme limitation, fragmentation and isolation of its areas of occurrence. In addition to this, only one of a total of approximately thirteen occurrence sites lies within a protected area. A second is immediately downhill of a newly built airport and a third is currently destined to be completely destroyed in the course of a large scale harbor construction project within the next three years. Another site is wedged between a water treatment plant and the road adjacent to a low cost housing development, and is so small and insignificant looking that it could be completely destroyed by the illegal dumping of building rubble or another pollution event. Where possible the protection of these sites is therefore also of critical importance. The NRF have undertaken to provide the DNA profiling necessary to establish the relationships between the existing wild populations, which will provide important information that will assist us in making the necessary decisions regarding future collection, captive management and potential release of specimens.

Previous work at the Johannesburg Zoo has provided us with three suitable spaces dedicated to research for our Amphibian Conservation Project, in addition to which a refrigerated shipping container has been purchased and installed on site. Once sufficient funds have been acquired and the container has been suitably modified it will provide us with a fourth area which will be dedicated permanently to the Pickersgill's reed frog program. In addition to this, the National Zoo has recently reported completion of its own dedicated amphibian breeding and research space. The necessary staff training is intended to take place shortly, after which the National Zoo will join the program.

The first batch of 30 wild-caught Pickersgill's reed frogs, a mixture of adults and juveniles, were collected from three sites in March 2012, after the end of the last breeding season. The group has acclimatized well, is healthy and shows good growth, and (most importantly!) has suffered zero losses since the time of collection three months ago. This augurs well for the next breeding season, due to begin in November this year.



The collection team consisting of staff, research students and volunteers. Photo: Ian Visser.



Pickersgill's reed frog occurs in thick reed beds, difficult terrain in which to collect specimens. Photo: Ian Visser.

In addition to our current and potential future husbandry research, other opportunities have presented themselves. As a result of our greater involvement in amphibian conservation, tentative links have been established with other conservation organizations such as Mitsinjo, a community-run conservation organization concerned with husbandry research on the frogs of Andasibe, Madagascar and of course the IUCN SCC Amphibian Specialist Group. Since there is much common ground, in addition to our relative geographic proximity, the fact that we occasionally receive shipments of confiscated Madagascan herpetofauna in Johannesburg, and the need to share skills and resources, it is hoped that we can build ties with amphibian conservation efforts in Madagascar in order to complement each other's efforts.

# Uncovering New Sites of a Cryptic KwaZulu-Natal Endemic

By Jeanne Tarrant



Fig. 1: A juvenile of *Hyperolius pickersgilli* at Mount Moreland, Durban, South Africa. Photo: J. Tarrant.

**P**ickersgill's reed frog *Hyperolius pickersgilli* was discovered and described only in the early 1980s (1). Given this relatively late discovery, and the fact that it occurred in a region that was otherwise well-studied in terms of amphibian research, gives an indication of this species' obscurity. It is a small hyperoliid (max SVL 29 mm; Fig 1) with an inconspicuous cricket-like call (2). It is a habitat specialist, favouring densely vegetated (and as such, inaccessible) coastal wetlands. At the time of its description, it was known from just seven localities. Since then, only a few new sub-populations have been reported, so that as of 2010 the species was known officially from a total of 12 localities, between St Lucia Estuary in the north and Warner Beach in the south (3). Within this range, sub-populations are severely fragmented, and only two (at Umlalazi Nature Reserve and iSimangaliso Wetland Park) are statutorily protected. The remainder of localities occur in areas that are sought after for coastal development, sugarcane and gum plantations (4). As an artefact of these pervasive threats, much of the historical habitat of *H. pickersgilli* is likely to have been destroyed (5).

As a result of its limited distribution and the ongoing threats to much of its habitat, *H. pickersgilli* was Red Listed as Critically Endangered in 2010. The resultant strategy document from that

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assessment (6) recognised *H. pickersgilli* as having the highest conservation priority for any frog species in South Africa and a high priority for monitoring and surveillance. South Africa has few herpetologists and little funding to support the conservation of its amphibian fauna, and so species prioritization is necessary as well as the listing of the associated information needs and the efficient gathering of this information. To address some of these research requirements, Jeanne Tarrant (as part of her PhD research with North-West University, Potchefstroom) and Dr. Adrian Armstrong (Ezemvelo KZN Wildlife), embarked on a three year project to survey the entire range of *H. pickersgilli*. Data of historical records was obtained from the South African Frog Atlas Project (2004) and Biodiversity Database of Ezemvelo KZN Wildlife. All but two of the historically known sites were revisited to verify species presence during the survey period (spring and summer 2010-2011 and 2011-2012). Historical occurrence records were used to model a predicted distribution using MaxEnt and RAMAS GIS for *H. pickersgilli*, which in turn was surveyed during the same period.

Most of the historical sites were revisited and in some cases, suitable habitat has been completely destroyed, including at the type locality and site of original discovery. Some of the sites at which the species still persists are in a precarious state. For example, the site at Isipingo, is in the highly industrialised area of Durban South and is surrounded on all sides by a highly transformed landscape (Fig 2). Another site nearby at Prospecton, discovered during the



Fig. 2: Coastal wetland inhabited by *Hyperolius pickersgilli* at Isipingo, south of Durban. Photo: J. Lewis.

ground-truthing period, has been earmarked for inevitable destruction as part of the massive Durban South Port Development for a new dug-out harbour. This will result in complete loss of habitat, and without intervention, extermination of this sub-population of *H. pickersgilli*. A long-term translocation project requiring the identification, and if needed, rehabilitation of suitable habitat for reintroduction will be necessary to save this population. Aside from *H. pickersgilli*, these wetlands areas host an incredible biodiversity considering the surroundings and give an indication of what much of the area would have once consisted of. Wetlands in which the species is present are often isolated within otherwise highly fragmented habitat.

Despite extensive surveying as a result of the predictive modelling, only a few new subpopulations of *H. pickersgilli* were discovered, indicating both the rarity of the species and the extent of loss of coastal wetlands. These findings include a range extension to the south, and have enabled us to recalculate Area of Occupancy (AOO) and Extent of Occurrence (EOO), which can be used to update the Red List status of the species. The overall population remains severely fragmented, and habitat area, extent and quality is continuing to decline. Decisive conservation action for this species therefore remains a high priority including long-term monitoring and an *ex-situ* breeding programme (the first for a threatened species in South Africa). With support from the Endangered Wildlife Trust and the Amphibian Specialist Group, a Biodiversity Management Plan for Species (BMP-S) will be compiled for *H. pickersgilli*. This will be only the second frog species (following in the footsteps of

the Western leopard toad) in South Africa for which the process will be implemented. This essentially legislates conservation plans and involves the participation of all land-owners and relevant stakeholders. In this case, habitat protection through possible land acquisition and stewardship programmes will pave the way for long-term security of Pickersgil's Reed frog.

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# Hluleka Nature Reserve: Unexpected Amphibian Diversity

By Werner Conradie <sup>1</sup> & Jan Venter <sup>2</sup>

Hidden away on the coast of the former Transkei, lies the treasure of Hluleka Nature Reserve (Fig. 1). It's a small reserve of only 772 hectares, but with an impressive array of colourful frogs. During a recent biodiversity survey conducted by the Eastern Cape Parks and Tourism Agency, in collaboration with the Port Elizabeth Museum (Bayworld), a total of 16 frog species were recorded. Previous to this survey only nine species were known to occur in the reserve and surrounding areas (1). This brings the total number of species for the reserve to 18 (Table 1). The survey significantly increased the knowledge of the biodiversity of the reserve as well as the bigger Wild Coast area.

During the survey, a new population of the Kloof frog (*Natalobatrachus bonebergi*) was discovered in all main tributaries of the Mafusini River (Fig. 1 & 2). The Kloof frog is listed as "Endangered" in the IUCN Red List (2), and its known distribution stretches from southern and central KwaZulu-Natal all the way down the coast to Dwesa-Cwebe Nature Reserve. It is, however, threatened by habitat fragmentation due to housing developments and expanding agriculture, that resulted in highly fragmented populations in which more than 50% of individuals are located in isolated patches. The distances between subpopulations are considered to be too great for dispersal within one generation. The Kloof frog prefers habitats in coastal forests with healthy canopy cover over rocky stream beds, breeding from October to May. Clutches of about 100 eggs are laid in clear jelly masses attached to leaves, rocks or branches overhanging water, either close to or well above the water, to keep them

## ARTHROLEPTIDAE

<i>Arthroleptis wahlbergi</i>	Bush squeaker*	NRR
<i>Leptopelis natalensis</i>	Natal tree frog*	RR

## BREVICEPTIDAE

<i>Breviceps verrucosus</i>	Plaintive rain frog	RR
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## BUFONIDAE

<i>Amietophrynus gutturalis</i>	Guttural toad*	RR
<i>Amietophrynus rangeri</i>	Raucous toad	RR

## HYPEROLIIDAE

<i>Africalus spinifrons spinifrons</i>	Natal leaf folding frog*	NRR
<i>Hyperolius marmoratus verrucosus</i>	Painted reed frog*	RR
<i>Hyperolius pusillus</i>	Water lily frog*	RR
<i>Hyperolius semidiscus</i>	Yellow-striped reed frog*	RR
<i>Kassina senegalensis</i>	Bubbling kassina*	NRR

## PHRYNOBATRACHIDAE

<i>Phrynobatrachus natalensis</i>	Snoring puddle frog*	NRR
<i>Phrynobatrachus mababiensis</i>	Dwarf puddle frog <sup>a</sup>	

## PTYCHADENIDAE

<i>Ptychadena oxyrhynchus</i>	Sharp-nosed grass frog*	NRR
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## PIPIDAE

<i>Xenopus laevis laevis</i>	Common platanna*	NRR
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## PYXICEPHALIDAE

<i>Cacosternum nanum nanum</i>	Bronze caco*	RR
<i>Tomopterna natalensis</i>	Natal sand frog*	NRR
<i>Amietia angolensis</i>	Common river frog*	RR
<i>Natalobatrachus bonebergi</i>	Kloof frog*	NRR

Table 1: Amphibians of Hluleka Nature Reserve.

\* Species collected during this survey

RR = Historical confirmed record

NRR = New confirmed record.

<sup>a</sup> Found tadpole outside of Hluleka NR in Mtagati River gorge. Highly likely to occur in Hluleka NR as well.

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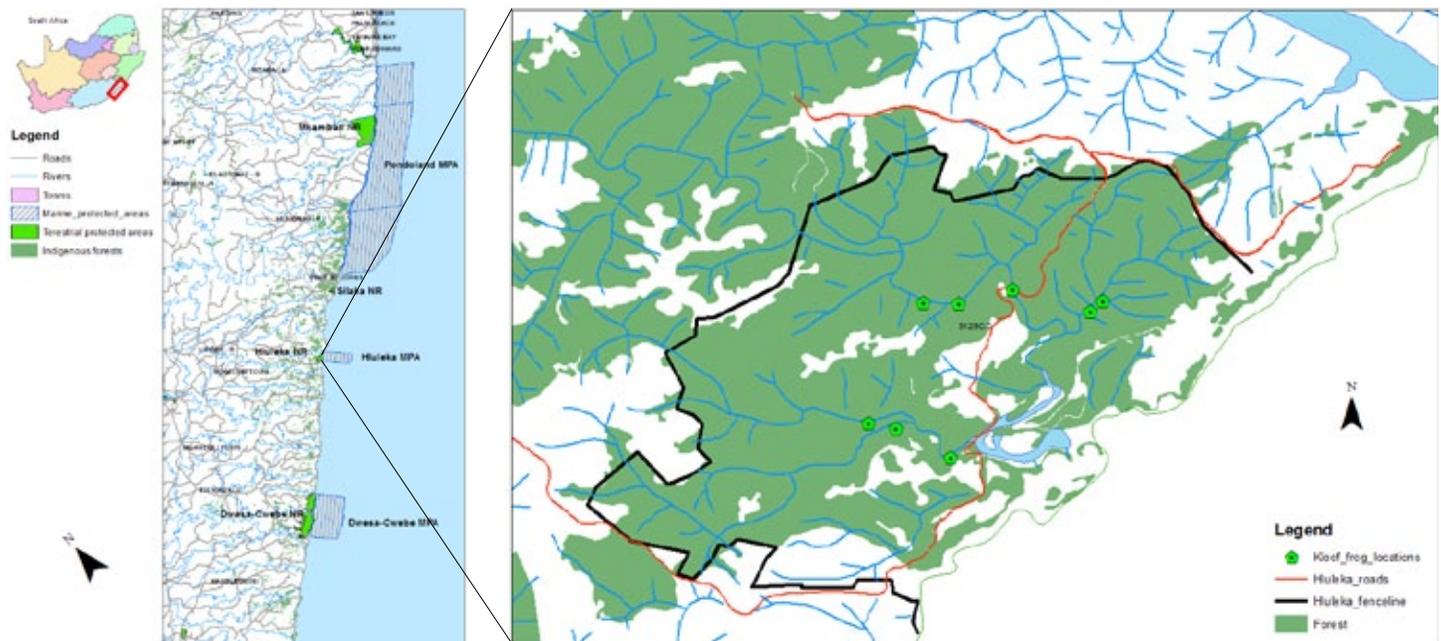


Fig. 1: Locations where the Kloof frog (*Natalobatrachus bonebergi*) was found within Hluleka NR.



Fig. 2: Kloof frog (*Natalobatrachus bonebergi*). Photo: Werner Conradie.



Fig. 3: Natal Lead-folding Frog (*Afrixalus spinifrons*). Photo: Werner Conradie.



Fig. 4: Bush squeaker (*Arthroleptis wahlbergi*). Photo: Werner Conradie.

out of reach of predators. Tadpoles develop inside the jelly mass and after about six days drop into the water below. The females are normally found close to the egg masses, and in dry conditions even urinate over the eggs to keep them moist (3). The Hluleka NR population seems to be thriving and several egg masses, tadpoles, metamorphs and adult frogs were recorded. The Hluleka population will be critically important for the species' long term survival, especially considering the alarming decline of habitat due to inconsiderate land use practises as well as the looming climate change threat.

Other significant records includes a population of Natal leaf-folding frog (*Afrixalus spinifrons*) (Fig. 3), listed as "Near Threatened" by IUCN (4). The Wild Coast population of the frog has been part of a taxonomical problem for the past few decades. Current molecular work regarding this population is underway and will indicate its relationship to the KwaZulu-Natal populations. Furthermore, the Bush squeaker (*Arthroleptis wahlbergi*) record is the most southern record for the species and the genus: *Arthroleptis* in whole (Fig. 4).

These discoveries also highlight that even small protected areas can be critical to biodiversity conservation and that our management of protected areas should be sound at all times. Who knows how ones actions might affect or even destroy these protected areas thus threatening these beautiful creatures?

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## FrogLog Schedule

- January – Special Topical Edition
- April – The Americas
- July – Africa, West Asia, Madagascar, Mediterranean, and Europe
- October – Asia, Russia, and Oceania



Robin Moore / iLCP

# Frogs About Town: Ecology and Conservation of Frogs in Urban Habitats of South Africa

By **Donnavan J. D. Kruger & Louis H. Du Preez**

**T**he global distribution of frogs, together with the human race's own need for water, has resulted in a close association between humans and frogs. The human race has reached a historic turning point, as it is transforming from a mostly agrarian to a predominantly urban species (1). The global human population has grown exponentially over the past two millennia and is expected to reach eight billion by 2025. The world urban population has increased much faster than the rural population, and has now reached a stage where the growth in the rural population has essentially stopped with all future population growth to be expected in the urban environment (1). The picture for South Africa doesn't look much different with 62% of the population living in urban environments and a 1.2% annual increase rate (2).

To date very little research has been done on frogs in the urban environments of South Africa. In the greater Cape Town area, populations of the Western leopard toad (*Amietophrynus pantherinus*) (Fig. 1) and the Micro frog (*Microbatrachella capensis*) (Fig. 2) have been monitored by Cape Nature and a research group based at SANBI. There has also been public involvement in conservation of frogs in the city, with several environmental groups helping to remove Leopard toads from the roads in Cape Town each year to prevent them being squashed in the city traffic.



Fig. 1: The Endangered Western leopard toad, *Amietophrynus pantherinus*. Photo: L. du Preez.



Fig. 2: The Critically Endangered Micro frog, *Microbatrachella capensis*. Photo: L. du Preez.

Urbanization has a number of harmful effects on the ecosystem. These include increased temperature, severe effects on wetlands and water availability, water usage and water quality, habitat destruction or alteration and establishment of exotic plants and animals (3, 4). Urbanization is also one of the main causes of the degradation of freshwater systems in South Africa (5).

In addition to these noticeable changes in the physical structure of the environment, urbanization also causes a striking change in the acoustic environment (6). This change may possibly hinder the capability of male frogs to attract females by decreasing the distance in which males can be heard by females (7). These disturbances in female perception of male calls may lead to reduced breeding success (6).



Fig. 3: Green female pattern of Picker's reed frog, *Hyperolius pickersgilli*. Photo: L. du Preez.

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The newly built King Shaka International Airport, near Durban on the east coast of South Africa, is right next to the Mount Moreland wetland which host one of the largest remaining populations of the Critically Endangered Pickersgill's reed frog (*Hyperolius pickersgilli*) (Fig. 3). This population is exposed to very loud airplane noise and there is a severe threat of chemical pollution from the airport.

Assessing how frogs cope in the urban environment is the first step in conserving South Africa's frog populations where urbanization is taking its toll on the environment. In this new study undertaken by Kruger as a member of the African Amphibian Conservation Research Group he will focus on the Western leopard toad, Pickersgill's reed frog and the city of Potchefstroom as a case study. Frog populations in different levels of urbanisation will be monitored. Potchefstroom does not only provide a vast selection of sites from a rural-urban gradient, it is also a developing city which gives us the opportunity to monitor the early effects of urbanisation on frog populations and how frogs deal with the urban environment.

Our objectives are to 1) assess the breeding distribution of frogs in wetlands along an urban–rural gradient in Potchefstroom; 2) examine community relationships with habitat quality and landscape context; 3) establish if frogs can adapt to the urban environment through changes in their vocalizations, migration patterns and/or reproductive strategies and 4) develop recommendations on how to make existing and future urban developments more frog-friendly in collaboration with town and regional planners.

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## First New Frog Discovery for Angola in 40 Years

By Werner Conradie

Angola is the seventh largest country on the African continent, but has only 97 documented amphibian species. This is low compared to neighbouring Democratic Republic of Congo (218), but higher than Zambia (85) and Namibia (46) (1). The main reasons for this low amphibian diversity is the previous civil unrest in the country (1975–2002) that limited access for scientists to study the country's biodiversity. Angola has diverse habitats ranging from desert in the south to lowland rain forest in the north, providing a complex topography with numerous isolated highlands that is likely to lead to an increase in the number of amphibian species. As the country rebuilds its infrastructure after years of civil war, it is imperative that modern biodiversity surveys and checklists are conducted and developed to improve conservation planning.

During one such biodiversity survey undertaken to south-western Angola, a new species of Reed frog (*Hyperolius*) was discovered in an isolated gorge on the Serra da Chela mountain range south-west of the town of Lubango. The frog inhabited a cascade stream in a small patch of Afromantane forest at an altitude of 2000 meters. What makes this discovery even more unusual is that the male collected was calling from a position half concealed under water, flat



Fig. 1: Chela mountain reed frog (*Hyperolius chelaensis*). Photo: Werner Conradie.

against a rock in slow flowing water. This is unusual for *Hyperolius*, thus it was immediately evident that it represented a new undescribed species. This species was subsequently described and represents the first new frog discovery for Angola in 40 years (2). Prior to this Wulf Haacke discovered a new Dwarf toad (*Poyntonophrynus grandisonae*) in 1971 and subsequently described in 1993 (3).

This is the first step since the civil unrest towards exploring the Angolan amphibian diversity. Further expeditions will most certainly lead to more new discoveries. More importantly, Angola is the type locality for numerous wide spread species (e.g. *Amietia angolensis* (Bocage 1866), *Tomopterna cryptotis* (Boulenger 1882), *Hyperolius nasutus* (Günther 1865), etc.) and poorly known species (*Arthroleptis carquejai* Ferreira 1906, *Hyperolius bicolor* Ferreira 1906, *Hildebrandtia ornatissima* (Bocage 1879), etc.) and as access to Angola becomes easier, ongoing taxonomical problems will be resolved with further studies.

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# Sahonagasy.org: A Web Platform Implementing Information Management and Citizen-Science for the Conservation of Malagasy Amphibians

By Franco Andreone<sup>1</sup>, Scott Loarie<sup>2</sup>, Arie Van der Meijden<sup>3</sup>, Sandra Nieto<sup>4,5</sup> & Miguel Vences<sup>6</sup>

Numerous activities related to amphibian conservation in Madagascar have been recently implemented, and this process was accompanied and managed by the IUCN SSC Amphibian Specialist Group. Among the projects is the establishment of the ACSAM Initiative (A Conservation Strategy for the Amphibians of Madagascar) and the launch of the national official action plan, the Sahonagasy Action Plan (SAP) (1). These projects were successful in identifying and prioritizing areas of thematic interest for the amphibian conservation, improving the awareness among Malagasy decision makers on the need for effective conservation measures and leading to the launch of official chytrid prevention plan (2).

One of the most important points highlighted by the SAP (notably reported in chapter two of the published action plan) was the need for improved exchange of information and coordination of research activities (3). Because specialists of Malagasy amphibians are scattered over various continents, this coordination was thought to be best achieved using an appropriate online-infrastructure. In fact, the free availability of information to all participants and members of the ASG-Madagascar (an informal group not yet structured as a standard society network) is a crucial prerequisite for achieving a wide and concerted participation in the planned actions. For instance, real-time updated taxonomic and distributional information is important to decide on priority areas for rapid assessments, and access to literature is necessary to evaluate the relevance of observations and improve capacity building in Madagascar.

In addition, an increasing number of volunteers, in particular ecotourists, is roaming around in Madagascar. Their photographs (of animals or of peculiar behaviors) and other kinds of observations may provide useful information on the distribution and life history traits of Malagasy amphibians and reptiles, and these contributions are expected to augment with increasing numbers of people interested in visiting the spectacular nature of Madagascar and often specifically targeting the herpetofauna (4). The authors as well as other amphibian specialists regularly receive photographs of Malagasy frogs with precise distributional information with requests for identification. Even if in many cases these photos are from common species in well surveyed areas, sometimes they do constitute



Fig. 1: Welcome page of the Sahonagasy.org web site and the logo of the HerpetoGasy BioBlitz project.

new distribution records. Even records of common species can over time provide an important basis to assess seasonal activity patterns and contribute to long-term monitoring of possible declines. It is thus important to systematically record such original citizen-science information (5).

With the aim of providing such a platform for the sharing of original observations and improving coordination of research and conservation activities on Malagasy amphibians, we built a web site named Sahonagasy.org ([www.sahonagasy.org](http://www.sahonagasy.org)). Here we provide some relevant information about this web site and how its relatively simple modules can contribute to these goals.

## STRUCTURE OF THE WEBSITE

The Sahonagasy (from the Malagasy, *sahona* = frog, *gasy* = Malagasy) web site was originally built and launched in 2007 as a portal of contacts for the ACSAM Initiative. After that, and thanks to a funding of the BIOPAT foundation, it was significantly improved and ameliorated, with augmented number of pages and sections.

The site is linked with the Facebook page of “A Conservation Strategy for the Amphibians of Madagascar” page. With this Facebook interface, we hope to assure a wider audience and increase the contact possibilities.

The welcome page of Sahonagasy.org shortly presents the goals of the website and the ACSAM Initiative (Fig. 1), including features such as a song on the peculiar tomato frog *Dyscophus antongili*, written by the environmentalist and traditional singer A. Sarovy.

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In the “ACSAM” page we found a series of downloadable awareness documents, including the Sahonagasy Action Plan (1), some popular booklets (6) and posters on the frogs, snakes, lizards and chameleons of Ranomafana National Park (by P.S. Gehring, M. Pabijan, M. Rakotoarijaona and R. D. Randrianiaina, prepared and printed in only small numbers in 2010).

The “literature” page provides a list of over 1,600 publications on the Malagasy herpetofauna, including historical and key contributions back to the 19<sup>th</sup> Century. Because herpetological research very often combines research on amphibians and reptiles, also the available bibliography of reptiles has been included. The references include links to PDFs and scans of literature already available. Papers older than 40 years and thus free of copyright are freely available for all, while downloading newer articles requires a password. Especially for Malagasy students access to historical literature is still limited. Although on a more comprehensive level such literature is being scanned and increasingly becomes publically available through the Biodiversity Heritage Library (<http://www.biodiversitylibrary.org>) and even by Google Books, such massive databases are often difficult to search (7), whereas the Sahonagasy database concentrates most of the relevant papers at a single site and thus allows a time-efficient access to students and researchers preparing scientific papers, or M.Sc. or Ph.D. theses, on the Malagasy herpetofauna.

The “Conservation Projects” page provides information on the ongoing projects, which are as follows: captive breeding (8), a project launched to protect the last urban populations of Tomato frog (*Dyscophus antongili*), *Mantella aurantiaca* (9), *Mantella cowani* (10), threatened amphibians of the Ankaratra Massif and disease screening. These sections present basic information of the above-mentioned projects, including objectives and achieved results. They are particularly helpful for people interested in collaboration and to provide advice the stakeholders.

Since its launch, the web site has received a steadily increasing number of visits, to around 500 visits per month currently.

### THE HERPETOGASY BIOBLITZ

The HerpetoGasy BioBlitz (<http://www.sahonagasy.org/herpetogasy-bioblitz>) is a citizen-science effort to harness amateur observations of reptiles and amphibians to enhance our understanding of the distribution and conservation status of Madagascar’s unique fauna. The project represents a regional node of the Global Amphibian BioBlitz (<http://www.inaturalist.org/projects/global-amphibian-bioblitz>) and the Global Reptile BioBlitz (<http://www.inaturalist.org/projects/global-reptile-bioblitz>) efforts presented by the IUCN SSC Amphibian and Reptile Specialist Groups and

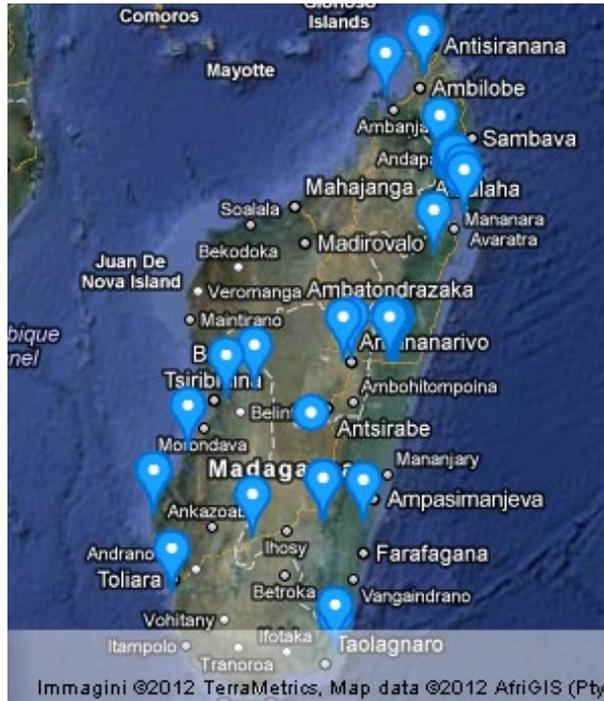


Fig. 2: Map of Madagascar built with Google Earth and implemented with the sites of observations of the amphibians of Madagascar through the HerpetoGasy BioBlitz project.

powered by iNaturalist.org (Figs. 2 and 3).

Most importantly, and as major component for interactive information management, a platform for participation of all volunteers in the distributional mapping for Malagasy amphibians. This platform also includes, from the beginning, the possibility of entering data on reptiles.

The HerpetoGasy BioBlitz further allows uploading photographs stored on other media, such as Facebook and Flickr, as well as photographs uploaded via the iNaturalist iPhone and Android apps. The shared photo enables the identification of each observation to be independently verified by iNaturalist community members and the BioBlitz curators.

By integrating distribution maps from the IUCN Red List assessments, the HerpetoGasy BioBlitz identifies out-of-range observations and therefore serves to assemble preliminary information to assess the status and distribution of amphibians and reptiles. For species not yet assessed or mapped, these observations are also valuable as they serve as a foundation for assessing the rarity and distribution of a species.

Another interesting feature provided by the interface HerpetoGasy BioBlitz is that the distribution data compiled from distribution maps and observations provide a sort of field-guide to each geographic locality or protected area within Madagascar which can be used as education tools. For example, this is the field guide to the 38 amphibians thought to occur in the Betampona Strict Nature Reserve: [LINK](#). The following feature compares an observation of *Guibemantis* with the five members of the genus thought to occur in Toamasina, Madagascar: [LINK](#). To date 277 species, representing about half of Madagascar’s herpetofauna, have been recorded through the contribution of 1127 observations.

### THE BLOG

A blog section has recently been created to allow people to provide their original observations and reports directly from the field. Blog entries can be submitted through the web site, or automatically by email. The aim of the blog is also to allow providing opinions and information of interest for the herpetologists working in Madagascar. We particularly welcome reports by students, researchers and tourists who have visited remote and unusual regions of Madagascar and can provide real-time information of the state of roads and bridges, suitable local guides, precise access trails and similar; such information can be very valuable for future researchers and ecotourists planning to visit such areas.

### FUTURE IMPLEMENTATIONS AND THE USE OF SOCIAL NETWORKS

We plan to implement the website via a direct connection with the



Fig. 3: Example of a contribution to the BioBlitz identified as *Guibemantis bicalcaratus*.

researchers working in Madagascar. A contact with the Réseau de la Biodiversité de Madagascar database (REBIOMA, <http://www.rebioma.net>) will ensure that all verified distributional information becomes automatically available to conservation planning based on the REBIOMA data.

At the same time, we plan to make available unpublished reports provided to the management authorities in Madagascar. This will help ameliorating the information about the areas visited by scientists and tourists. Important extensions could also be the inclusion, in PDF format, of unpublished M.Sc. and Ph.D. theses of Malagasy students and researchers focusing on the amphibian fauna, and fact sheets on all Malagasy amphibians, with distribution maps and photographs. The latter goal is ambitious, especially given the ongoing taxonomic progress with many new species being described every year, but could be achieved in a preliminary way by linking the web site to [amphibiaweb.org](http://amphibiaweb.org).

In the meanwhile, it is also worth pointing out that the future of awareness increase and education may pass through an adequate use of web resources. Not only web sites and portals as here summarized, but also through the reasoned utilization of social networks. The advertising of the Sahongasy.org and ACSAM projects through Facebook has been particularly efficient and allowed to implement the friendships up to 709 persons (data available on 9<sup>th</sup> May 2012). The possibility of sharing photographs, videos, web-articles and rapid opinions has been particularly positive and ensured a better coordination.

#### Acknowledgements

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# The Conservation Effort for Two Critically Endangered Amphibian Species of the Ankaratra Massif, *Boophis williamsi* and *Mantidactylus pauliani*

By F. Rabemananjara<sup>1</sup>, H. Randriamahazo<sup>2</sup>, J. Rahantamalala<sup>3</sup>, H. Rahantalisoa<sup>4</sup>, J.M. Rakotoarisoa<sup>5</sup>, N.H.C. Rabibisoa<sup>6</sup> & F. Andreone<sup>7</sup>



*Boophis williamsi* and *Mantidactylus pauliani* from the Ankaratra Massif. Photo: F. Andreone.

The Ankaratra Massif of central eastern Madagascar has been severely impacted by anthropogenic activities including heavy deforestation and wide spread fires. These rapid and destructive changes are of particular concern to the conservation community as the Massif is an Alliance for Zero Extinction ([www.zeroextinction.org](http://www.zeroextinction.org)) site being home to two Critically Endangered amphibians *Boophis williamsi* and *Mantidactylus pauliani* (1).

IUCN SSC Amphibian Specialist Group Madagascar (ASG), in conjunction with local NGO Vondron'Ivon'ny Fampanandrosoana (VIF), initiated a conservation program in 2010 under the direction of the Sahonagasy Action Plan (regional amphibian action plan)(2) to ensure the survival of these species.

The challenge of the project was to protect both species through a collaborative partnership with the local communities to prevent illegal logging and bush fires while restoring the forests to their natural state. These challenges were addressed through the development of an integrated strategic plan consisting of five components; amphibian surveys, habitat restoration and protection, alternative livelihood initiative, protected area establishment and public awareness.



High mountain savannah stream (Tsimiamianadahy) and forest stream (Maravana) habitats of *Mantidactylus pauliani* and *Boophis williamsi*. Photo: F. Rabemananjara.

## AMPHIBIAN SURVEYS

The first author, along with two M.Sc. students and one Ph.D. student, from the University of Antananarivo, has been leading the amphibian species surveys which focus on the two endemic frogs. The surveys are a continuation of a preliminary monitoring program undertaken in early 2010 and 2011 by Langaha, a herpetological association operating in Madagascar. These surveys consist of a rapid assessment of the two species and an amphibian community population inventory.

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Distribution of seedlings of *Cinnamomum camphora* for the Local Based Community. Photo: VIF.



Fish pond of one fish farmer of the Local Based Community "Soanierana". Photo: VIF.



Distribution of hatchlings for the fish farmers. Photo: VIF.



### HABITAT RESTORATION AND PROTECTION

The habitat and restoration initiative is being led by the Association Lalona based in Ambatolampy at the foot of the Massif. Lalona is currently working closely with eight Local Based Communities (LBC) to provide them with the capacity to develop and run tree nurseries which are located across Ankaratra. To date these LBC have successfully planted 10,000 trees within the buffer zone. It is hoped that this annual number will soon increase to 25,000 trees and ensure that areas currently deforested and at severe risk of erosion are saved.

### ALTERNATIVE LIVELIHOOD INITIATIVE

To help ensure the long term sustainability of the program a comprehensive alternative livelihoods initiative is being implemented with the aim of enabling local communities to be able to invest more time in reforestation and habitat protection activities. The initiative is being spearheaded by VIF who are working closely with local communities to develop fish farming techniques in conjunction with growing of rice in paddies. Since 2011, 24 locals have been provided training in aquaculture techniques and were supported financially to purchase fry. The initiative is developing well with the first fish hopefully being sold later this year at market.

### PROTECTED AREA ESTABLISHMENT

A long term aim of the program is to have a portion of the Massif designated as a protected area. An Environmental Impact Assessment (EIA) and site delineation process undertaken in August 2011 in conjunction with a number of workshops and public consultations have been fundamental to developing an all inclusive approach to the protected areas strategy. The process has been driven forward by the Regional Direction of the Environment and Forest of Vakinankaratra Region with the coordination support by VIF. Each LBC is actively involved in the development of the protected area taking on a specific role relating to its management including forest management and patrolling. Temporary protected status has recently been applied for and now waits for authorization by the Ministry for Environment and Forestry.

### PUBLIC AWARENESS

In conjunction with other activities a public awareness campaign has been initiated. The campaign aims to ensure that all local communities and interested stakeholders are fully aware of the importance of the project and kept informed of developments. The awareness campaign began with a public consultation to review the EIA and site delineation and recent efforts have included the distribution of 500 information brochures.



Workshop with the stakeholders for the new protected area categorization and implementation of the preliminary management transferring.

### CONSERVATION IMPACT

After a year and half of the project, improvements in habitat quality are being observed and the local communities are taking increasing responsibility for the management of the site. The level of illegal deforestation and burning has decreased dramatically and as a result the distribution of *B. williamsi* appears to be increasing.

Over the next 14 months the project team will continue to develop all initiatives currently in place while formalizing the Protected Area status. This process will also include an updated inventory of the flora and fauna of the Massif and a socio-economic study which will be incorporated into a Definitive Environmental Impact Study along with the EIA. The study will be the foundation of a long-term management plan due to be in place by the end of 2012.

### Acknowledgement

This project has been made possible by kind support from the MacArthur Foundation and the Mohamed bin Zayed Species Conservation Fund. Technical support has been provided by the IUCN Amphibian Specialist Group and Conservation International.

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# Ex-situ Amphibian Conservation in the Frog Capital of Madagascar

By Devin Edmonds & Justin Claude Rakotoarisoa

Located in the middle of the eastern rainforest belt of Madagascar is the village of Andasibe. Several protected areas and national parks have been created here to protect the unique biodiversity of this region, which includes more than 100 frog species. Large numbers of tourists visit Andasibe each year and on the most popular days as many as 300 may take a tour of Andasibe-Mantadia National Park, exploring the forest with a guide for its abundant wildlife and unique flora.

The organization Mitsinjo was born through Madagascar's growing ecotourism industry, being launched in 1999 as a guide association by residents of Andasibe village. Realizing the importance and value of the environment and its relation to local sustainable development, Mitsinjo expanded its activities within the following years to include reforestation, community health, agricultural, environmental education, and research components.

With the 2008 launch of the Sahonagasy Action Plan (the national strategy for amphibian conservation in Madagascar developed with and supported by Malagasy government authorities) Mitsinjo began fundraising to establish a biosecure amphibian captive breeding and husbandry research facility. The goal of the project was to build capacity in Madagascar to enact *ex-situ* conservation mea-

asures for frog species which are facing threats that cannot be addressed in time to prevent their extinction. Three priorities were identified:

- Develop the skills and knowledge needed to maintain amphibians in captivity, both within Mitsinjo as well as within other organizations in Madagascar.
- Conduct husbandry research on the more than 90% of frog species in the Andasibe-area which have never been kept or bred in captivity to facilitate future *ex-situ* conservation actions.
- Establish captive assurance colonies of local threatened species to safeguard against extinction, and develop associated reintroduction or population supplementation programs should a future need arise.

Thanks to the generous support of numerous international conservation organizations, the construction of the Mitsinjo captive breeding center was completed in March 2011. Soon after, a Contract of Collaboration was developed with the Amphibian Specialist Group of Madagascar and the Malagasy government authority Le Direction Générale des Forêts. This contract ensures all activities compliment the Sahonagasy Action Plan and comply with Malagasy Law.

Currently, eight Mitsinjo technicians from the Andasibe-area work at the facility. Two are dedicated to live food production with the

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Association Mitsinjo, <http://www.mitsinjo.org/>



*Guibemantis* aff. *albolineatus* "Andasibe" is being kept for husbandry research. Photo: D. Edmonds.



*Boophis pyrrhus* is one of two species which have bred at the facility. Photo: D. Edmonds.

other six working both to culture locally-sourced invertebrate foods and to care for and conduct husbandry research on captive frogs. As of June 2012, there are over 70 terraria within the facility housing eight local frog species. The facility has room to support at least 300 enclosures, all of which are and will be built by hand from glass, aluminum, and silicone sourced within Madagascar. It is expected terraria construction will be completed in early 2013.

Numerous biosecurity measures are taken to ensure the health and safety of the frogs within. Most importantly, all species that are and will be kept at the facility are from the surrounding forests in the Andasibe-area. Additionally, windows, doors, drains and other entrances to the facility are sealed to prevent pests and frogs from entering or exiting. There is a strict entrance policy to reduce the amount of traffic that goes in and out of the building, with personnel changing into dedicated footwear and clothing in a separate entrance room. An isolated quarantine room allows frogs to be acclimated to captivity while their health is assured before being moved to the room housing established populations. Additionally, incoming and outgoing water, waste, and materials are disinfected using heat, desiccation, and/or sodium hypochlorite, and workflow is prioritized with separate technicians caring for different groups of frogs on different days.

So far breeding success has been had with two species, with resulting tadpoles being used in studies on their optimal captive diet, density, and substrate. If large-scale rescue operations are required in the future, as has been the case in many other areas of the world

with the introduction of amphibian chytrid fungus *Batrachochytrium dendrobatidis* (*Bd*), information gained from these initial studies could be applied to closely related species from similar ecological guilds, facilitating future *ex-situ* conservation action in Madagascar.

Mitsinjo now plans to develop an educational and community outreach center which features live frogs displayed in terraria alongside educational graphics. This will help expand our organization's environmental education activities within the Andasibe community, as well as provide ecotourists with an opportunity to view some of the area's often overlooked frog species, and in turn help generate funding for the captive breeding and husbandry research facility. Additionally, Mitsinjo is pursuing funding to develop a long-term monitoring program for the frogs of Andasibe to track change in abundance and species richness over time. This work will compliment Mitsinjo's current participation in the nation-wide *Bd* early detection plan, as well as the husbandry research that is being conducted at the captive breeding center.

We are extremely grateful to the following organizations which have supported the development of the captive breeding and husbandry research facility - Amphibian Ark, the Association of Zoos and Aquariums Conservation Endowment Fund, the Wildlife Conservation Society, Durrell Wildlife Conservation Trust, Cleveland Metroparks Zoo Africa Seed Grant, Tree Walkers International, Biopat, Understory Enterprises, American Frog Day, Conservation International, Toronto Zoo, and Woodland Park Zoo.

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## Save The Frogs! Ghana Spearheading Efforts to Create a New National Park for the Protection of the Critically Endangered Togo Slippery Frog (*Conraua derooi*)

By Gilbert B. Adum\*, Emmanuel Akom, William Oduro, Kerry Kriger, Caleb Ofori-Boateng & Mark-Oliver Rödel

**T**he Togo slippery frog (*Conraua derooi*) is an evolutionarily distinct amphibian that is a close relative of the world's largest frog, the Goliath frog (*Conraua goliath*). The species is wholly forest and stream-dependent, living in fast-flowing water, where all of its life activities (mating, breeding, development) take place. The Togo slippery frog was once abundant in both Togo and Ghana but declined precipitously and was not seen for several decades until it was re-discovered in 2005 in the Togo-Volta region in Togo and Ghana and the Atewa Range Forest Reserve (Atewa Forest) in Ghana. Whereas the Volta region frogs seem to be harvested by locals for food, the Atewa population seemed to be currently unharmed, thus holding the only promise of the perpetuity of the frog. The Atewa Forest has been under threat from mining interests for nearly a century. As far back as 1914, there were plans to mine



STF! Ghana and representatives of NGOs against mining in Atewa meet with King of Akyem Abuakwa, Osagyefo Amoatia Ofori Panin II.

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SAVE THE FROGS! Ghana is West Africa's first non-profit organization dedicated exclusively to amphibian conservation, and is the first international branch of USA-based non-profit SAVE THE FROGS!. The mission of STF! Ghana is to protect Ghana's amphibian populations and to promote a society that respects and appreciates nature and wildlife. Gilbert B. Adum, [gilbert@savethefrogs.com](mailto:gilbert@savethefrogs.com)

the Atewa Forest for its large bauxite deposits. This attempt was hampered by World War I, and so was the second attempt in 1938. As recently as March 2011, Vimetco Ghana (Bauxite) Ltd. conducted comprehensive geological surveys and are expecting to mine the Atewa Forest bauxite to provide aluminium for their Chinese smelter. The slippery frog's population and similar vulnerable flora and fauna face potential extirpation from these mining activities, due to deforestation and siltation of streams.

As a result of these developments, SAVE THE FROGS! Ghana (STF! Ghana: [www.savethefrogs.com/ghana](http://www.savethefrogs.com/ghana)) is doing everything possible to stop mining activities in Atewa and to permanently protect the Atewa Forest as the "Atewa Hills National Park".

STF! Ghana, in collaboration with a coalition of NGOs against mining in Atewa, recently called on the King of Akyem Abuakwa (Osagyefo Amoatia Ofori Panin II) and highlighted the need to create Atewa Forest as a National Park. To this suggestion, the King - who is the custodian of Atewa Forest - gave his word. As part of this visit, we also educated local people who have traditionally managed the Atewa Forest for water production, catchment protection, sustainable timber production, wildlife conservation and recreation to understand how bauxite mining will be incompatible with the sustenance of their livelihoods. The coalition has also organized a news conference in the country's capital and we are currently seeking funding to garner more local media attention through forums on national TV and radio. We have also developed petitions and are collecting signatures from scientists, students and the general public to compel the government to rescind its decision to mine Atewa Forest. On the 4<sup>th</sup> Annual Save The Frogs Day (April 28, 2012), STF! Ghana's efforts to educate the public about amphibians and to create the Atewa Hills National Park were featured in local news headlines.

To further secure the Atewa Forest, which is also under threat from illegal timber harvesting, we are currently seeking funding to implement beekeeping for local people as a win-win approach for alleviating poverty while conserving the environment. STF! Ghana will also soon set up a Chapter at Atewa's local university (i.e the University College of Agriculture and Environmental Studies). We plan to build the capacities of the local undergraduate students in amphibian research and conservation and we hope to secure funding to give the students small grants for them to undertake projects specifically focusing on the conservation of the slippery frog. From our experience of the Chapter at the Kwame Nkrumah University in Kumasi ([www.savethefrogs.com/knust](http://www.savethefrogs.com/knust)), building students' capacity and assisting them with grants is rewarding. Prior to the inception of STF! Ghana at the university, only 10 students on average opted for Wildlife Studies when they entered their third year at the university. Today however, as a result of our pragmatic initiatives, about 40 students have opted to take Wildlife Studies.

Creating the Atewa Hills National Park is STF! Ghana's most urgent campaign. Success would be a huge victory for Ghana's frogs, the people of Ghana and for environmental conservation efforts in general. We welcome financial assistance and volunteer time.

#### **Acknowledgement**

We thank His Royal Majesty, the King of Akyem Abuakwa (Osagyefuo Amoatia Ofori Panin II), who is the custodian of Atewa Forest for all his support. We also thank all SAVE THE FROGS! donors around the world, without whom SAVE THE FROGS! Ghana would not exist. We acknowledge the support of our Board of Directors and all our members.



# Differences in the Effects of Selective Logging on Amphibian Assemblages in Three West African Forest Types

By Caleb Ofori-Boateng, William Oduro, Annika Hillers, Ken Norris, Samuel K. Oppong, Gilbert B. Adum & Mark-Oliver Rödel

**M**aking generalizations about the impact of commercial selective logging on biodiversity has so far remained elusive. This is so because species responses to logging depend on a number of factors, many of which have not been studied in detail. These factors may include the natural forest conditions (forest types) under which logging impacts are investigated but this has been poorly studied.

In a large scale replicate study conducted in south-western Ghana we aimed at clarifying the relationship between logging and forest types on leaf litter frogs. We contrast three distinct and naturally occurring forest types, including wet evergreen, moist evergreen and semi-deciduous forests. Selectively logged sites were compared with primary forest sites for each forest type.

Our results revealed a relationship between logging and diversity in forest types. In the moist evergreen forest, richness and diversity were higher in selectively logged areas compared with primary forest sites (due to the influx of invasive non-forest species). In the wet evergreen forest, richness was higher in logged forest than primary forest, while diversity measures were not different between logged and primary forest sites. In the semi-deciduous forest type, a negative relationship between logging and frog richness and diversity was observed. Here, logged habitats were characterized by a loss of forest specialists and low richness and diversity compared to primary semi-deciduous sites. The timing of logging activity does not seem to be a factor, since these semi-deciduous sites were logged just one year before the moist evergreen sites with comparable intensity to all the other forest types investigated.

We argue that microclimatic differences between logged and primary habitats may be responsible for generating the different patterns of diversity observed. Logging in tropical ecosystem typically involves a significant opening of the forest canopy (1). This can increase the temperature and reduce humidity on the forest floor (2). The semi-deciduous forest sites experiences low rainfall and protracted dry seasons that can significantly increase dryness of understory leaf litter in logged sites and thus result in unsuitable conditions for many small leaf litter frogs. Previous studies suggested that such alteration of the microclimate of the forest floor can pose physiological constraints on some frog species and decrease the number of true forest species in altered habitats (3). In our study, we observed only a single forest specialist species (*Ptychadena* aff. *aequiplicata*) persisting in logged habitats of this forest type. This frog is among the larger species (3.5 – 6.5 cm) and hence presumably more tolerant to lower humidity than the small forest specialists within the genus *Phrynobatrachus* (usually around 2 cm body lengths).



Our results highlight the need to contrast the impacts of logging across different forest types. This can help clarify the relationships between logging and diversity in forest types and improve our understanding of logging effects on tropical biodiversity. For future comparisons of the impact of logging on species to be effective, research must endeavour to include details of forest type, rainfall patterns, logging intensities, and rotation cycles.

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## MORE DETAILS

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## You can call them Snot Otters, but don't call Hellbenders Extinct

**C**all them snot otters, devil dogs, mud cats, mollyhuggers or Allegheny alligators but a team of Ohio conservationists are dedicated to making certain the endangered Eastern hellbender is never called Extinct.

The first release of human-reared hellbenders in Ohio occurred on Jun. 15, 2012 and marks an important step in the Ohio Division of Wildlife's Conservation Plan to reverse the precipitous decline of the species by expanding their range into previously occupied streams to eventually establish multiple self-sustaining populations in Ohio.

The nine released hellbenders were reared in a dedicated hellbender facility at the Columbus Zoo and Aquarium from eggs collected in 2007 by the Oglebay Good Zoo (Wheeling, WV). They were released into a stream in eastern Ohio where hellbenders were once found. The stream was once severely impacted by pollution but has since recovered and is one of the highest quality waterways in the state.

Scientists from the Columbus Zoo and Aquarium and the Ohio Department of Natural Resources released the hellbenders after Zoo veterinarians performed health screenings and surgically implanted radio-transmitters to enable the animals to be tracked. Blood samples and skin swabs will be collected from the released hellbenders at the end of the summer and compared with those collected prior to the release. Veterinarians from the Columbus Zoo and the Wilds have been conducting research on the health of Ohio and West Virginia hellbenders since 2006. Data from this project will inform future hellbender reintroductions in Ohio.

The release of the hellbenders is the culmination of a partnership involving several Ohio institutions and agencies. Since 2006, the Ohio Hellbender Partnership has been regularly meeting to discuss hellbender conservation in the state. The partnership includes representatives of:

- Ohio Division of Wildlife
- Columbus Zoo and Aquarium
- the Wilds
- Oglebay Good Zoo
- Ohio EPA
- Jefferson County Soil and Water Conservation District
- Belmont County Soil and Water Conservation District
- United States Fish and Wildlife Service
- Toledo Zoo
- Akron Zoo
- Ohio University, Eastern

Larval hellbenders from an egg mass collected in Ohio in 2011 are currently being reared at the Columbus Zoo and Aquarium and will be used for future releases. The partnership's capacity to rear hellbenders is being increased through renovations and expansions of facilities in Ohio zoos.

The eastern hellbender (*Cryptobranchus alleganiensis alleganiensis*) is the largest amphibian in Ohio and one of the largest salamanders in the world, reaching a total length of up to 25 inches and weighing nearly three pounds. With their wrinkled body and tiny eyes, the hellbender is supremely adapted to a life spent mostly under large rocks in rivers and large creeks where they feed on crayfish and take in oxygen through their highly vascularized skin.

A 2006-2009 survey of the eastern hellbender in Ohio determined an 82% decline



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The Columbus Zoo and Aquarium is home to more than 10,000 animals representing over 575 species from around the globe. The Zoo complex is a recreational and education destination that includes the 22-acre Zoombezi Bay water park and 18-hole Safari Golf Club. The Columbus Zoo and Aquarium also operates the Wilds, a 10,000-acre conservation center and safari park located in southeastern Ohio. The Zoo is a regional attraction with global impact; contributing more than \$1 million annually to support over 70 conservation projects worldwide. A 501(c)(3) nonprofit organization, the Columbus Zoo has earned Charity Navigator's prestigious 4-star rating.



Scientists from the Columbus Zoo and Aquarium and the Ohio Department of Natural Resources release the hellbenders.

in the relative abundance of individuals in streams where they were found during surveys conducted in the mid-1980s. In

the Ohio watersheds where hellbenders remain, populations consist of only old, large individuals, indicating the lack of successful

reproduction. Most remaining populations in Ohio do not appear self-sustaining and without intervention the hellbender will likely disappear from Ohio waterways.

The hellbender is an important part of Ohio's natural heritage and their presence indicates clean water and healthy habitats. Causes of the hellbender's decline include impoundments (dams), excessive siltation, pollution, disease, and persecution and collection. The species ranges from New York to Georgia and west to Missouri and were once found throughout the Ohio River drainage basin, including the Ohio River. Similar population declines have been noted by researchers throughout the hellbender's range, and the species is considered threatened or endangered in most states.

Funding for this project was provided by the United States Fish and Wildlife Service through a State Wildlife Grant, donations to the Division of Wildlife's Diversity Program, and the Columbus Zoo and Aquarium's Conservation Fund.

## Understanding the Impact of Chemical Pollution on Amphibians

By Andrés Egea-Serrano, Rick A. Relyea & Miguel Tejedo

**A**mphibians are the most threatened vertebrate group in the world, with 41% of all species threatened (1, 2). The hypothesized causes of these declines include habitat loss, climate change, emergent diseases, introduced species, and chemical pollutants. Within the realm of pollutants, there has been a tremendous amount of research during the past decade. To assess what these studies have taught us, we conducted a meta-analysis of amphibian toxicology studies that have used environmentally relevant concentrations (3).

We found that lethal and sublethal effects of chemicals were widespread. Averaged across all pollutants, environmentally relevant concentrations caused a 7.5% decrease in mass, a 14.3% decrease in survival, and a 535% increase of the frequency of malformations (Figure 1). These results agree with previous reviews based on vote-counting methods, but such studies have low statistical power. Because our analysis used statistically powerful meta-analytic techniques,

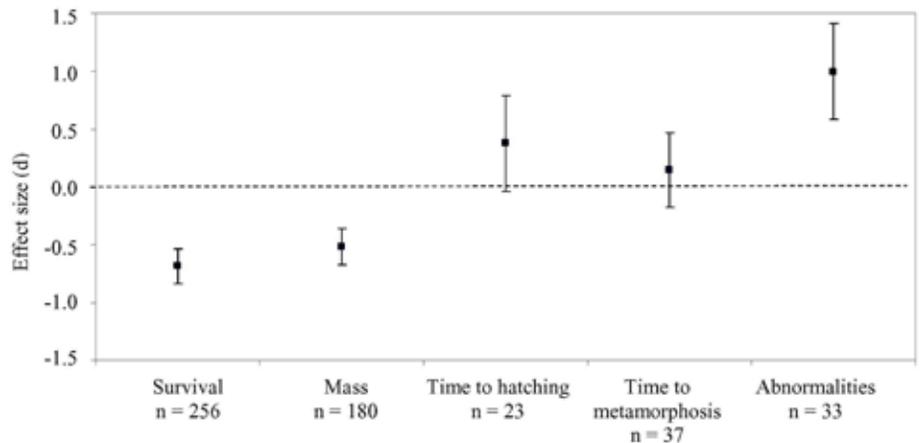


Fig. 1: Mean effect of chemicals on some amphibian life history traits. Error bars: 95% confidence intervals.

and considered only ecologically relevant concentrations, our study represents the first quantitative review to have produced robust and realistic conclusions on the impact of pollution on amphibians, including both the direction of different effects as well as the size of these effects. Moreover, our approach also allowed us to analyze the differences among *a priori* defined groups

such as chemical types, experimental venues, and developmental stages (Figure 2).

Our comparisons among chemical types found that amphibian survival was reduced by exposure to road de-icers, pesticides, wastewater pollutants, and nitrogenous compounds. We also found that amphibian mass was reduced when exposed to nitrog-

enous compounds. Amphibian malformations increased in frequency when exposed to wastewater pollutants.

Our comparisons of experimental venues found that the effect of pollutants on survival was larger in enclosures than in mesocosms or experiments conducted in the laboratory. However, reductions in mass due to pollutant exposure was significant under laboratory conditions but not under mesocosm or enclosure conditions.

Our comparisons of developmental stages found that embryonic and larval exposures

to pollutants both caused reductions in survival and mass, but only embryonic exposures caused significant increases in abnormalities. However, significant differences among developmental stages only arose for mass, with larger impacts when the exposure began in the embryonic stage.

Several other factors including pathogenic organisms and UV-B radiation are increasingly common in the environment and, consequently, they can interact with pollutants. Although some individual studies have shown synergistic interactions between pollutants and other factors, our meta-

analysis of interactive effects on amphibian survival did not detect a significant interaction across all studies that met our criteria.

In conclusion, our meta-analysis of amphibian studies has demonstrated that pollutants present at environmentally relevant concentrations have substantial negative effects on amphibian survival, growth, and abnormalities. As is often the case, there are areas in which more research needs to be done, including more studies on interactions between pollutants and other factors and more studies in more natural experimental venues. In addition, there is a need for more studies that integrate approaches considering physiological, demographic and community scales to determine the real impact that pollutants may have on amphibian populations, especially under a scenario of increased Earth temperatures due to predicted global warming. These effects of pollutants on amphibians are not just a concern for amphibians, but may also apply to other vertebrates (particularly fish).

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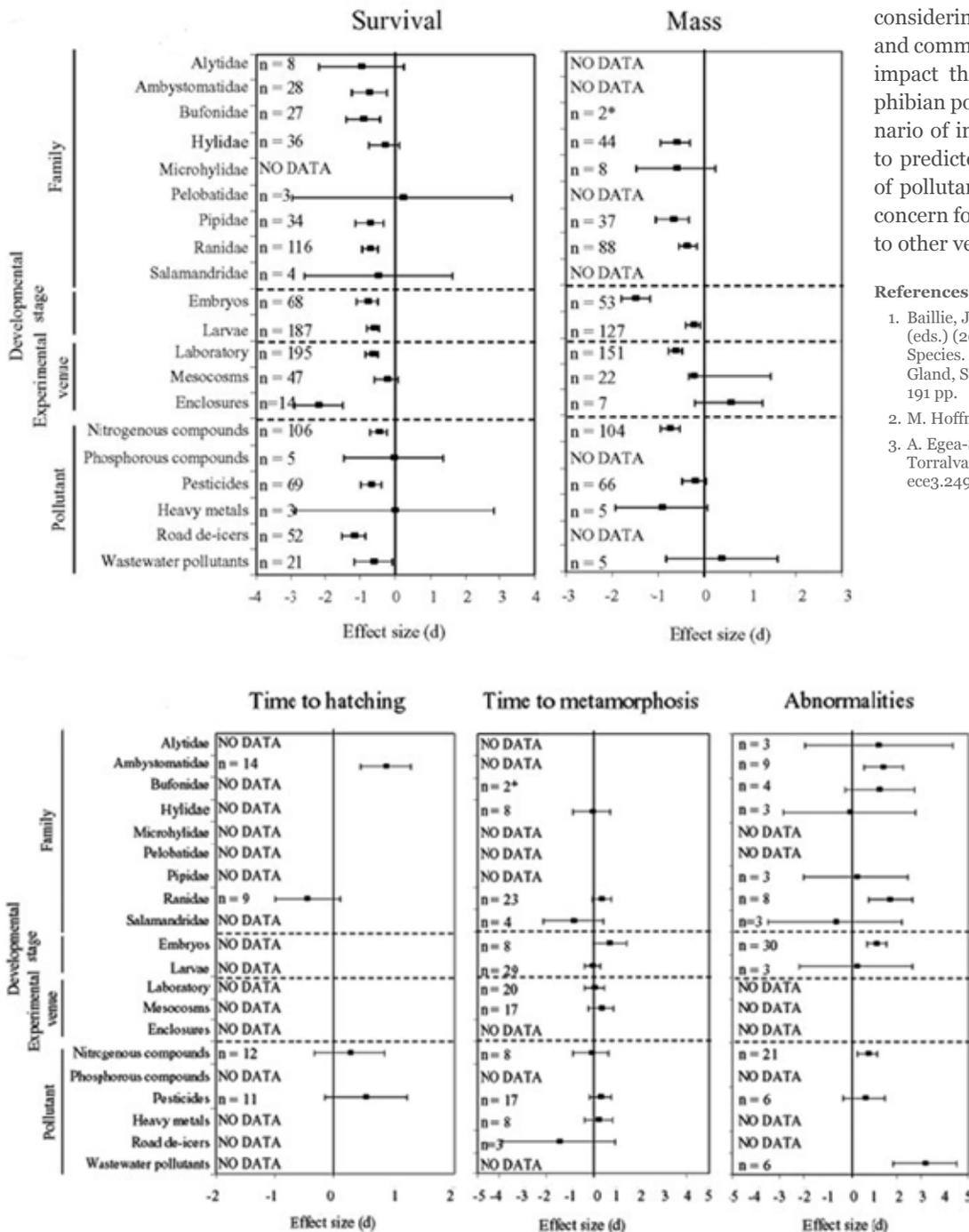


Fig. 2: Mean effect of pollutants on survival, mass, time to hatching, time to metamorphosis, and abnormality frequency for the categories considered for the *a priori* defined groups. Notice the different scales for each variable shown. Error bars: 95% confidence intervals.

## Conservation and Ecology

### Road to evolution? Local adaptation to road adjacency in an amphibian (*Ambystoma maculatum*)

By Steven P. Brady

The global network of roads is the largest human artifact on the planet, and has expanded rapidly across the earth's surface over the last half century. In the United States, an estimated 13.7 million lane km of roads bisect the landscape, and cover approximately 1% of the land, an area equivalent to that of the state of North Carolina. This road network contributes a suite of negative ecological effects on adjacent habitats, ranging from fragmentation to contamination by runoff. In addition to the immediate consequences faced by organisms living in roaded landscapes, road effects may further act as novel agents of natural selection, setting the stage for contemporary evolutionary changes in local populations. Though the ecological consequences of roads are well described, evolutionary outcomes remain largely unevaluated. To address these potential responses in tandem, I conducted a reciprocal transplant experiment on early life stages of the spotted salamander, a pool-breeding amphibian. Specifically, I collected freshly laid eggs from each of five roadside and five woodland pools, and translocated them to evaluate their performance in both types of environments. I found that despite a strong, negative effect of roadside pools on salamander performance, populations adjacent to roads are locally adapted. Specifically, within roadside pools, eggs originating from roadside populations were 25% more likely to survive to hatching



Spotted salamander (*Ambystoma maculatum*) poised on the pavement. Road adjacent populations of this species in northeastern Connecticut are locally adapted to the contaminated roadside pool environment. Eggs originating from roadside populations survive at 25% higher rates than eggs from nearby woodland populations when grown out together in roadside pools. Photo: S. Brady.

than eggs from woodland populations. This suggests that the response of species to human-altered environments varies across local populations, in this case separated by just hundreds of meters, and that adaptive processes may mediate this response. The divergence between populations revealed here demonstrates that even when exposed to novel, harsh conditions induced by human-modified disturbance, these vertebrates are capable of adaptation on contemporary timescales and across small scales of space. These results provide support for an alternative perspective on the dialogue concerning species responses and the environments being reshaped by human activities. However, it remains to be determined whether the adaptation observed in this system will facilitate population persistence given the overall negative effect of roadside pools. The long-term success of such populations will depend on the rate of environmental change in relation to factors such as functional genetic diversity, which may constrain responses.

S. Brady, *Sci. Rep.* **2**, 235 (2012).

### Population structure of an Endangered frog (*Babina subaspera*) endemic to the Amami Islands: possible impacts of invasive predators on gene flow

By Noriko Iwai & Etsuko Shoda-Kagaya

The Otton frog (*Babina subaspera*) is an Endangered species endemic to the Amami Islands, Japan. This frog has high academic value in that it possesses a "fifth finger" with a sharp spine possibly used in male-male combat, but high predation pressure from an introduced carnivore, the Mongoose, has caused declines in the frog populations. This has caused a large



Oton frog (*Babina subaspera*) is a large ranid frog endemic to Japan. Some of the populations were genetically isolated because of the large habitat gap created by the invasive predator, Mongoose. Photo: Noriko Iwai.

habitat gap around an urban area and thus the population segmentation was a concern. We investigated the genetic status of the species and examined the effect of the habitat gap on gene flow among populations. Using five polymorphic microsatellite loci and mitochondrial DNA sequences, we investigated genetic diversity, genetic structure and gene flow in *B. subaspera* populations on the islands of Amami-Oshima and Kakeromajima. Our results revealed that although *B. subaspera* maintains high genetic diversity, genetic differentiation did occur: two populations showed little gene flow with other populations. According to the mitochondrial DNA analysis, the observed genetic differentiation occurred relatively recently. Possible barriers such as mountain ridges, rivers or roads did not result in genetic separation of the populations. These data support the hypothesis that the habitat gap created by an introduced predator prevented the gene flow among *B. subaspera* populations. The effect of invasive predators should not be concerned only on the instant effect of population decline, but longer effect on genetic isolation as well. Since intense elimination project has decreased the invasive Mongoose on Amami-Oshima, *B. subaspera* has recently observed to be back in the gap area. Careful monitoring of population size and genetic diversity should be conducted along with the Mongoose elimination project.

N. Iwai, E. Shoda-Kagaya, *Conserv. Genet.* **13**, 717 (2012).

### Spatial connectivity moderates the effect of predatory fish on salamander metapopulation dynamics

By Bradley J. Cosentino, Robert L. Schooley & Christopher A. Phillips

In predator-prey metapopulations, persistence of prey in patches with predators may depend on the rescue effect in which immigration from nearby sources prevents local extinction. Thus, constraints on spatial connectivity may have important implications for predator-prey coexistence. We tested the hypothesis that metapopulation dynamics of *Ambystoma tigrinum* (Tiger salamander) depend on combined effects of predatory fish and spatial connectivity. Because matrix heterogeneity can influence dispersal, we also considered how a proximate constraint on amphibian dispersal – desiccation risk – scales up to influence metapopulation dynamics for *A. tigrinum*. Occupancy and subsequent turnover patterns were

quantified in a network of 90 wetlands for three years in an agricultural landscape in Illinois. Our previous field experiments demonstrated that desiccation risk varies among matrix habitats, and that individuals orient movements towards habitat with low desiccation risk. We used cost-distance modeling to generate a connectivity metric that accounted for desiccation risk. Occupancy and colonization probabilities were related negatively to fish occupancy and positively to connectivity. Matrix structure had a strong influence on colonization, and the connectivity metric based on desiccation risk was a better predictor of colonization than alternative metrics. The positive effect of desiccation-informed connectivity on colonization was strongest in wetlands with fish, indicating matrix composition can moderate the effects of predation on amphibians. We detected a rescue effect in which extinction probability was related negatively to connectivity, and this effect was strongest in sites with fish. The matrix did not have a strong effect on occupancy or extinction probabilities, and we discuss why matrix effects may vary for different aspects of population turnover. Our results suggest effects of fish predators on metapopulation dynamics of amphibians depend on spatial connectivity, and that immigration may be essential for maintaining persistence of amphibians in systems with fish. This study also demonstrates that the mechanisms underlying dispersal limitation for *A. tigrinum* may include desiccation risk.

B. J. Cosentino, R. L. Schooley, C. A. Phillips, *Ecosphere* 2, art95 (2011), <http://dx.doi.org/10.1890/ES11-00111.1>

### Assessing the use of non-lethal tail clips for measuring stable isotopes of plethodontid salamanders

Joseph R. Milanovich & John C. Maerz

Stable isotopes are increasingly used in ecology to study the diets, trophic position, and migratory patterns of wildlife including herpetofauna. When using stable isotopes, it is important to consider which tissues can or should be sampled, and how selecting tissues may affect the inferences drawn from stable isotope data. Amphibians offer fewer tissues than other larger organisms that can be harvested in sufficient quantity without killing the animal; however, many salamanders have tails that readily autotomize and regenerate. We used three species of plethodontid salamander (*Plethodon cinereus*, *P. metcalfi*, and *Desmognathus quadramaculatus*) to determine whether distal tail tissue had carbon and nitrogen stable isotope values comparable to

commonly used tissues (liver and whole carcass [minus the liver and gonads]) that must be collected lethally. We found that variation in carbon values ( $\delta^{13}\text{C}$ ) within and among tissues was negatively correlated with C:N (an indication of high lipid content). Nitrogen ( $\delta^{15}\text{N}$ ) and Carbon ( $\delta^{13}\text{C}$ ) values (once adjusted for C:N) of tail tissue were positively correlated with values for carcass tissue, and tail  $\delta^{15}\text{N}$  values were positively correlated and biased with  $\delta^{15}\text{N}$  values for liver tissue. Adjusted  $\delta^{13}\text{C}$  values for tail tissue were unbiased and had weaker positive correlations with  $\delta^{13}\text{C}$  values for liver tissue compared to whole carcass. The weak correlation between adjusted  $\delta^{13}\text{C}$  values of tail and liver tissues may reflect differences in turnover rates between the two tissues. Our data show that, with calibration, non-lethal collection of tail clips is a suitable substitute to lethal tissue collection for measuring  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  of plethodontid salamanders.

J. R. Milanovich, J.C. Maerz. *Herpetol. Conserv. Biol.* 7, 67 (2012).

### Field notes on findings of threatened amphibian species in the central mountain range of western Panama

By Andreas Hertz, Sebastian Lotzkat, Arcadio Carrizo, Marcos Ponce, Gunther Köhler & Bruno Streit

Panama's diverse fauna has suffered from severe amphibian population declines since the late 1990's resulting in the disappearance of many species in the high mountains of the western part of the country. During field work along a transect in the Cordillera Central of western Panama between 2008 and 2010, we searched for lost species in remote areas and detected several populations of amphibians which are considered as Endangered or Critically Endangered by the IUCN. Most of these species have suffered from serious population declines, probably due to chytridiomycosis, but all are generally considered to be threatened by habitat loss. We detected 53% of the Endangered and 56% of the Critically Endangered amphibian species that have previously



View over the Cerro Colorado region, with the cone shaped peak of Cerro Sagú in the background. Photo: S. Lotzkat.

been reported from within the investigated area. We report on findings of species that have not been found in Panama for many years, and provide locality data of newly discovered populations. Among these findings are populations of all three species of *Isthmohyla* on the Lost Frogs list of the IUCN SSC Amphibian Specialist Group, which were detected in the Cerro Colorado region in the Serranía de Tabasará. Further studies will have to evaluate the conservation status of these populations. For many reasons, there is a need to create a new protected area at Cerro Colorado, which otherwise run the risk of getting lost as an incredibly diverse and little explored wildlife habitat. The most threatening factors in this context are mining projects and general deforestation.

A. Hertz *et al.*, *Amphib. Reptile Conserv.* 6, 9(e46) (2012).

### Connectivity of local amphibian populations: modeling the migratory capacity of radio-tracked Natterjack toads

By Ulrich Sinsch, Neus Oromi, Claude Miaud, Jonathan Denton & Delfi Sanuy

Many amphibian species are spatially organized in interacting sets of local populations (= metapopulations) rather than in isolated populations or large assemblages with unconstrained gene flux. Knowledge on the spatial equivalent of an amphibian population identified as a target for conservation is crucial for successful management measures. Estimates of the individual variation of annual migratory capacity within a local population allow for (1) a scientifically founded delimitation of core habitats around the breeding site to improve long-term local persistence, and provide (2) a quantitative measure for connectivity among neighboring populations, i.e. the magnitude of potential genetic exchange.

We chose as a model organism the European natterjack toad *Epidalea* (= *Bufo*) *calamita* which is still listed as a "Least Concern" species, but has suffered from range contraction and loss of populations at the northern range limits in the UK and Sweden. The migratory behavior of 143 radio-tracked adults was monitored at eight localities (latitudinal range: 41° - 54°N). The multi-location approach permitted us to assess the geographic variation of migratory distance moved by adults and to model their capacity for dispersal assuming exclusively unidirectional movements. Migratory range did not vary between males and females, but was three times greater in populations inhabiting



Implantation of a radio transmitter (placed on the belly of the narcotized toad) into the abdominal cavity via a ventrolateral incision. Photo: Ulrich Sinsch.

localities with predominantly clay soil than in those dwelling on open sandy soils. We propose that increased migratory activity was promoted by the scarcity of moist shelters, an essential resource for survival. To delimit the core area of a population, we chose the maximum distance from the breeding pond moved by the 50% most sedentary individuals. In contrast, we defined the minimum migratory capacity of the 5% of individuals that moved most as a measure of genetic connectivity among local populations in a metapopulation context.

In central Europe and the UK the protection of areas within a 600 m circle around the breeding site seem to safeguard about 50% of a local population. A distance of 2,250 m between neighboring breeding ponds is considered the upper limit to maintain connectivity. Consequently, in the UK, most populations are isolated by distance and therefore, are prone to local extinction. Populations in Spain, however, have core areas extending to distances of about five km from the breeding pond. Connectivity between neighboring breeding ponds is maintained up to a distance of about 12 km. Thus, future conservation management of the same species should take into account the potential geographic variation of migratory capacity.

U. Sinsch, N. Oromi, C. Miaud, J. Denton, D. Sanuy, *Anim. Conserv.* **15**, in press (2012) doi:10.1111/j.1469-1795.2012.00527.x

## Current and historical drivers of landscape genetic structure differ in core and peripheral salamander populations

By Rachael Y. Dudaniec, Stephen F. Spear, John S. Richardson & Andrew Storfer

With predicted decreases in genetic diversity and greater genetic differentiation at range peripheries relative to their cores, it can be difficult to distinguish between the roles of current disturbance versus historic processes in shaping contemporary genetic patterns. To address this problem, we tested for differences in historic demography and landscape genetic structure of Coastal giant salamanders (*Dicamptodon tenebrosus*) in two core regions (Washington State, United States) versus the species' northern peripheral region (British Columbia, Canada) where the species is listed as threatened. Demographic simulations were consistent with a pattern of post-glacial range expansion, with both ancestral and current estimates of effective population size being much larger within the core region relative to the periphery. However, contrary to predictions of recent human-induced population decline in the less genetically diverse peripheral region, there was no genetic signature of population size change. Effects of current demographic processes on genetic structure were evident using a resistance-based landscape genetics approach. Among core populations, genetic structure was best explained by length of the growing season and isolation by resistance (i.e. a 'flat' landscape), but at the periphery, topography (slope and elevation) had the greatest influence on genetic structure. Although reduced genetic variation at the range periphery of *D. tenebrosus* appears to be largely the result of biogeographical history rather than recent impacts, our analyses suggest that inherent landscape features act to alter dispersal pathways uniquely in different parts of the species' geographic range, with implications for habitat management.

R. Y. Dudaniec, S. F. Spear, J. S. Richardson, A. Storfer, *PLoS ONE* **7**, e36769 (2012).

## Habitat associations of the Coastal giant salamander (*Dicamptodon tenebrosus*) at its northern range limit

By Rachael Y. Dudaniec & John S. Richardson

Knowledge of species-environment associations is critical for the management of threatened amphibian populations facing habitat fragmentation and a restricted range. Thus, variations in site-level habitat relationships may become particularly relevant at local spatial scales, which are frequently the subject of species recovery plans and land management activities. The Coastal giant salamander (*Dicamptodon tenebrosus*) is subject to habitat degradation from logging and human development and is classified as *Threatened* at its northern range limit in British Columbia, Canada. We examined habitat associations for *D. tenebrosus* in relation to relative abundance and presence/absence for 32 streams sampled across the approximately 100 km<sup>2</sup> range of the species in British Columbia. Of 12 environmental variables we measured at 100-m stream reaches and the adjacent riparian zone, *D. tenebrosus* relative abundance was positively associated with stream elevation, forest age, and the percentage of boulders within streams. A higher stream gradient was the best predictor of *D. tenebrosus* presence within a stream reach, with present sites having a 91% higher gradient than absent sites. When excluding sites with low relative abundance, *D. tenebrosus* presence was also predicted by greater forest age surrounding streams and higher site elevation. Our results therefore emphasize the importance of high gradient, high elevation streams for *D. tenebrosus* presence and abundance, with evidence for larger populations in older forest. More broadly, our study suggests that conservation planning for stream-associated amphibians with patchy distributions may be improved by an understanding of species-specific habitat associations at the stream-reach scale.

R. Y. Dudaniec, J. S. Richardson, *Herpet. Conser. Biol.* **7**, 1 (2012).

## FrogLog Schedule

- January** – Special Topical Edition
- April** – The Americas
- July** – Africa, West Asia, Madagascar, Mediterranean, and Europe
- October** – Asia, Russia, and Oceania



Robin Moore / iLCP

## Effects of flow regimes altered by dams on survival population declines, and range-wide losses of California river-breeding frogs

By Sarah J. Kupferberg, Wendy J. Palen, Amy J. Lind, Steve Bobzien, Alessandro Catenazzi, Joe Drennan & Mary E. Power

Widespread alteration of natural hydrologic patterns by large dams combined with peak demands for power and water delivery during summer months have resulted in frequent aseasonal flow pulses in rivers of western North America. Native species in these ecosystems have evolved with predictable annual flood-drought cycles; thus, individuals and populations are vulnerable to disruption of the seasonal synchrony between stable low-flow conditions and reproduction. We evaluated whether altered flow regimes affected two native frogs in California and Oregon (U.S.A.) at four spatial and temporal extents. At the two largest geographic and time scales we examined changes in species distribution over approximately 50 years and compared current population density between 11 regulated and 16 unregulated rivers. At two finer scales, we assessed temporal trends in abundance among populations occupying rivers with different hydrologic histories, and related within-year patterns of early life stage survival to seasonal hydrology. The Foothill yellow

legged frog (*Rana boylei*) breeds only in flowing water and is more likely to be absent downstream of large dams than in free-flowing rivers. Breeding populations are on average five times smaller in regulated rivers than in unregulated rivers. Time series data (range = 8 – 19 years) from five populations of yellow legged frogs and two populations of California red-legged frogs (*R. draytonii*) across a gradient of natural to highly artificial timing and magnitude of flooding indicate that a key flow-regime attribute is variability of flows in spring and summer. Extreme flow fluctuations due to pulsed releases from dams, rapid cessation of spills and natural storm events were strongly correlated with high mortality of embryos and tadpoles by scouring and stranding. Subsequent decreases in densities of adult females followed after a lag corresponding to the time for affected cohorts to reach reproductive maturity. To balance the increasing demands for water and hydroelectric power with conservation of these frogs and other species with similar phenology, dam operations that better mimic natural flow timing are needed.

S. J., Kupferberg, *et al.*, *Cons. Bio.* **26**, 513 (2012).

## Frog population viability under present and future climate conditions: a Bayesian state-space approach

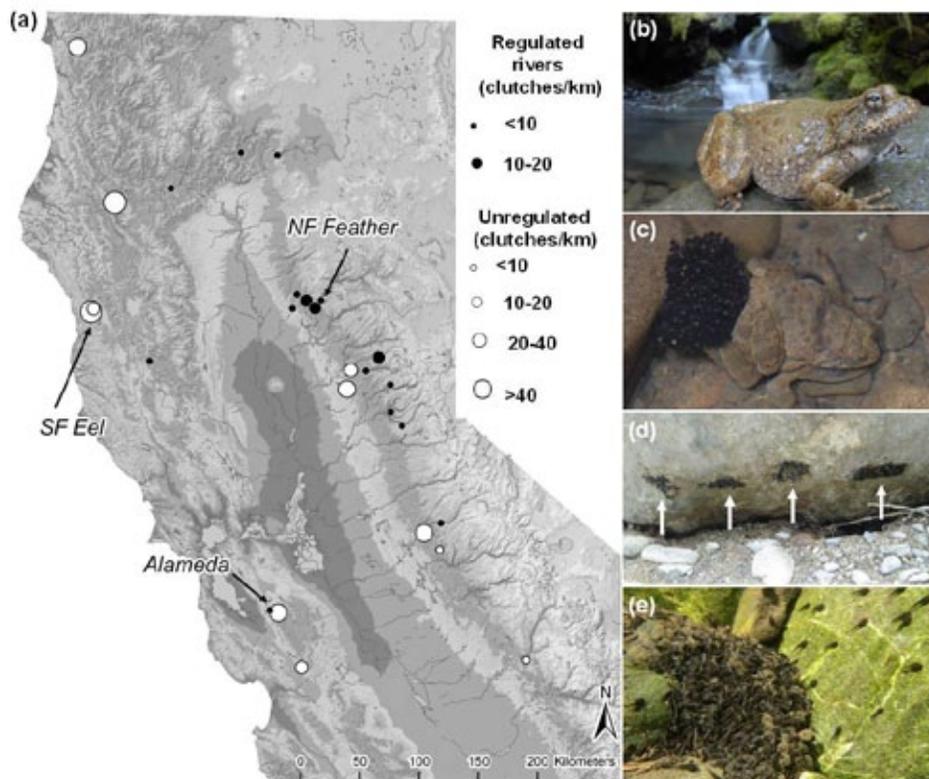
By Rebecca McCaffery, Antti Solonen & Elizabeth Crone

World-wide extinctions of amphibians are at the forefront of the biodiversity crisis, with climate change figuring prominently as a potential driver of continued amphibian decline. As in other taxa, changes in both the mean and variability of climate conditions may affect amphibian populations in complex, unpredictable ways. In western North America, climate



The Columbia spotted frog (*Rana luteiventris*) is a pond-breeding amphibian found at a range of elevations in western North America. In a high elevation population of this species in Montana, USA, we found that future decreases in snowpack are forecast to increase population viability. Photo: Rebecca McCaffery.

models predict a reduced duration and extent of mountain snowpack and increased variability in precipitation, which may have consequences for amphibians inhabiting montane ecosystems. We used Bayesian capture–recapture methods to estimate survival and transition probabilities in a high-elevation population of the Columbia spotted frog (*Rana luteiventris*) over 10 years and related these rates to interannual variation in peak snowpack. Then, we forecasted frog population growth and viability under a range of scenarios with varying levels of change in mean and variance in snowpack. Over a range of future scenarios, changes in mean snowpack had a greater effect on viability than changes in the variance of snowpack, with forecasts largely predicting an increase in population viability. Population models based on snowpack during our study period predicted a declining population. Although mean conditions were more important for viability than variance, for a given mean snowpack depth, increases in variability could change a population from increasing to decreasing. Therefore, the influence of changing climate variability on populations should be accounted for in predictive models. The Bayesian modelling framework



Locations (a) of focal watersheds in California (Alameda Creek, north fork [NF] of the Feather River, south fork [SF] of the Eel River) and average clutch densities (circles) where breeding censuses of Foothill yellow-legged frog (*Rana boylei*) (b) have been conducted in regulated and unregulated rivers. Clutches (c) are attached to rocks, and remain visible if stranded (d) or until hatching (e). Photo: A. Catenazzi & J. Drennan.

allows for the explicit characterization of uncertainty in parameter estimates and ecological forecasts, and thus provides a natural approach for examining relative contributions of mean and variability in climatic variables to population dynamics. Longevity and heterogeneous habitat may contribute to the potential for this amphibian species to be resilient to increased climatic variation, and shorter-lived species inhabiting homogeneous ecosystems may be more susceptible to increased variability in climate conditions.

R. McCaffery, A. Solonen, E. Crone,  
*J. Animal Ecol.* doi: 10.1111/j.1365-  
2656.2012.01992.x (2012).

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### Aspects of the thermal ecology of the European tree frog *Hyla arborea* Linnaeus, 1758 (Anura : Hylidae) in Western France

By Roger Meek

The body temperatures of ectotherms are a key factor in their ecology since many physiological functions are temperatures dependent – e.g. locomotory movement, digestion and growth. However, in amphibians the permeable integument and subsequent high rates of evaporative water loss imposes the dual regulation of attempting to maintain body temperatures that are optimal for physiological processes whilst maintaining water balance. This may constrain body temperature selection but in the presence of water many amphibians are able to bask with evaporative water losses contributing to body temperature control. Thermoregulation and field body temperatures in the European tree frog *Hyla arborea* was measured over a six-year period during overcast and sunny weather in the Vendée of Western France. Body temperatures were higher during sunny weather but there was no difference in body temperature variance. Body temperature variance was lower in comparison to the variance of leaf temperatures in sunlit areas but in agreement with leaf temperature variance in shaded areas irrespective of weather conditions. Regression analysis of body temperatures with leaf temperatures in shade or open locations during both sunny and cloudy weather indicated the closest association was with shaded leaf temperature regardless of weather conditions. However *t*-tests indicated thermoconformity only with shaded leaf temperature when the weather was overcast.

Frogs were located in trees at median distances of 12 – 9.5m from the nearest water mostly in shaded areas, but a smaller number were observed in sunlit areas

during sunny weather in mid-afternoon. The results suggest control of body temperature in *H. arborea* by microhabitat selection, with shaded areas selected to avoid potentially critical high temperatures during sunny weather. However, occasional basking in open locations, even during hot weather, suggests an attempt to elevate body temperature. The mean diurnal body temperatures of *H. arborea* in sunny weather were almost identical to those found in sympatric *Pelophylax lessonae* that were mainly basking beside ponds or on pond surfaces (*mean ± standard deviation* = 25.9±2.5°C, *n* = 23) and higher than in a small sample of *Rana dalmatina* measured whilst foraging in woodland (*mean ± standard deviation* = 24.1±4.6°C, *n* = 9). The ability of *H. arborea* to operate in arboreal habitats presumably reduces predation and competition from sympatric terrestrial anurans, for instance from *Pelophylax lessonae*, which are abundant around water bodies throughout the active year. Based on data from road mortalities longer distance movement takes place during October and November and mostly after rain.

R. Meek, *Bull. Soc. Herp. Fr.* **138**, 1 (2011).



The European tree frog *Hyla arborea* is a heliothermic species regulating body temperatures mostly by closely tracking shaded leaf temperatures. This avoids overheating during sunny weather but occasional basking to elevate body temperatures during cool or overcast weather was also observed.

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### Patterns of amphibian road-kill in the Vendée region of Western France

By Roger Meek

Amphibian life history characteristics in temperate climates make them particularly susceptible to road-kill. Levels of risk may vary and include migratory movements and foraging versus sedentary behaviour. In the Vendée region of Western France amphibians may be active throughout the year with migration a late

autumn event. To test if migration is the main period for road-kill risk, mortalities were monitored over a six-year period (2005 – 2010). In theory risk should be lowest when amphibians are in their aquatic phase, increase during the terrestrial phase and peak when major migration takes place. The notion that species that forage widely outside the migratory period should be a risk was also tested. Finally the study sought to examine spatial and habitat-associated road-kill.

The results indicated a strong temporal aspect to road-kill, which was associated mostly with migratory movements and highest in the common toad *Bufo bufo* (39% of all mortalities) and agile frog *Rana dalmatina* (25.4%) during both migration and summer foraging. The lowest road-kill was found in *Pelophylax lessonae* (4% of total), which was attributed to a sedentary lifestyle around ponds. Three species of urodeles constituted 26% of the sample but these may have been under represented due to rapid carcass deterioration. Greater than expected road-kill was found in *T. marmoratus*, *P. lessonae* and *B. bufo* in urban areas with only *Triturus cristatus* higher than expected on road segments alongside pastureland. Road-kill per kilometre was higher than expected on low traffic roads bordered by woodland and/or wetlands in *R. dalmatina*, *L. helveticus* and *B. bufo*. Generally, mortalities were spatial and clustered mostly in areas that flood during late autumn and winter; the road segment with the highest mortalities is shown in the photographs.

Road-kill was more numerous following rainfall but during dry weather in summer relatively more common in *R. dalmatina* and *P. lessonae*. This was attributed to foraging activity in *R. dalmatina* and movement due to pond desiccation during late summer in *P. lessonae*. Traffic intensity and road-kill on different roads was not correlated and hence traffic volume was not a good predictor of road-kill. Regression analysis was used to test the notion that road-kill is dependent on extent of migratory distance. The dependent variable was total road-kill counts of different species and independent variable migratory distances taken from the literature. A positive regression coefficient (0.09) that differed significantly from 0 and high *r*<sup>2</sup> value (0.87) supported the prediction. In the area shown in the photographs, road vehicles may have killed around 11% of the adult *R. dalmatina* population during 2010 and overall road-kill had greater impact on the biomasses of very large *B. bufo* and *R. dalmatina* during the migratory period. Amphibian road casualties were higher than those of reptiles on the same roads.



Amphibians, particularly urodeles, are active throughout the winter months in Western France. Despite having the lowest traffic volume the road and adjacent habitat shown here had the highest road-kills in the study area, including throughout the winter months.

In reptiles road-kill was in general lower and increased with increases in traffic volume and were not clustered spatially as in amphibians (Meek, R. (2009). Patterns of reptile road-kill in the Vendée region of Western France. *Herpetological Journal* 19, 135 – 142). Temporary road closures on low traffic volume roads with high amphibian mortalities during the migratory period would substantially reduce mortalities.

R. Meek, *Herpet. J.* **22**, 51 (2012).

### The amphibians of the relict Betampona low-elevation rainforest, eastern Madagascar: an application of the integrative taxonomy approach to biodiversity assessments

By Gonçalo M. Rosa, Franco Andreone, Angelica Crottini, J. Susanne Hauswaldt, Jean Noël, Nirhy H. Rabibisoa, Miora O. Randriambahinirime, Rui Rebelo & Christopher J. Raxworthy

The Strict Nature Reserve of Betampona protects one of the last remaining relicts (about 2,228 ha) of low elevation rainforests in eastern Madagascar. Yet little has been previously published about the amphibian fauna of this rainforest. During 2004 and 2007, Betampona was surveyed over a total period of 102 days. Frogs were searched by opportunistic searching, pitfall trapping and acoustic surveys. The survey work confirmed the occurrence of 76 taxa, of which 36 are currently

candidate species and about 30% were first considered as undescribed species. The identification of species included a multidimensional and integrative approach that links morphology, bioacoustics, ecology and genetics. Of these taxa, 24 species are potentially endemic to this low elevation eastern region. Considering the relatively small area of the Betampona forest, and its narrow elevational range, 76 amphibian species represents an unusually high richness compared to other sites in Madagascar. Although the eastern region is now largely deforested, our results reveal the importance of this relict forest, which is protecting a diverse amphibian fauna that includes many potentially endemic species.

G. M. Rosa *et al.*, *Biodivers. Conserv.* **21**, 1531 (2012).

### Waterbody availability and use by amphibian communities in a rural landscape

By Rodica Plăiașu, Raluca Băncilă, Ciprian Samoilă, Tibor Hartel & Dan Cogălniceanu

Rural landscapes in central and eastern Europe provide valuable ecosystem services and support high levels of biodiversity. These landscapes face an increasing pressure from human development and changes in agricultural practices. Pond-breeding amphibians and their breeding habitats are especially vulnerable to land-use changes. We studied waterbody use by amphibians in a rural landscape from Hațeg Geopark, Central Romania, a region where large areas are still under traditional land use. We surveyed 55 waterbodies, and characterized them based on 22 habitat variables, both at the local and



Traditional agricultural landscape in Hațeg Geopark. Photo: Dan Cogălniceanu.

the landscape level. Amphibians were more sensitive to waterbody-related variables than to landscape parameters. Man-made waterbodies had lower species richness than natural ones, but often represent the only breeding habitats available. The low importance of the landscape variables for amphibians is the result of traditional and environment-friendly land management, thus maintaining a mosaic landscape where the optimal terrestrial habitats for amphibians are still well represented.

R. Plăiașu, R. Băncilă, C. Samoilă, T. Hartel, D. Cogălniceanu, *Herpetol. J.* **22**, 13 (2012).

### Amazonian frog diversity and microhabitat use

By Katy Upton, Janna Steadman, Donna Popplewell, Isabel Rogers & Abigail Wills

Upper Amazonian forests offer some of the highest species diversity in the world due in part to their complex habitats created by fluctuating water levels. In the Pacaya-Samiria National Reserve within the upper Amazonian forest of Peru, forty species of anuran belonging to seven families were recorded in 2009 and 2010 over forty survey days. A species accumulation curve indicated that most species present were detected after ten days of surveying. On land, frogs were most frequently observed among leaf litter. In the river, floating rafts of vegetation may be an important mechanism for the dispersal of frogs.

K. Upton, J. Steadman, D. Popplewell, I. Rogers, A. Wills *Herpet. Bull.* **118**, 10 (2011).

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## Pathophysiology in Mountain yellow-legged frogs (*Rana muscosa*) during a chytridiomycosis outbreak

By Jamie Voyles, Vance T. Vredenburg, Tate S. Tunstall, John M. Parker, Cheryl J. Briggs & Erica Bree Rosenblum

The disease chytridiomycosis is one of the causes of catastrophic declines of amphibians around the world. Chytridiomycosis is caused by the pathogen *Batrachochytrium dendrobatidis* (*Bd*), which infects amphibian skin. Although we have a basic understanding of pathogenesis from laboratory experiments, many of the details have not been determined. Furthermore, it is unknown if disease development is similar in wild amphibian populations.

To gain a better understanding of the pathophysiology in wild amphibian populations, we collected blood biochemistry measurements during an outbreak in Mountain yellow-legged frogs (*Rana muscosa*) in the Sierra Nevada Mountains of California. Chytridiomycosis has been studied intensively in this system; *Bd* was initially detected in a small number of individuals and then spread within and



Appearance and behavior of Mountain yellow-legged frogs (*Rana muscosa*) and during a chytridiomycosis outbreak in Sixty Lakes Basin, Sierra Nevada Mountains, California. A) A frog showing clinical signs of severe chytridiomycosis including abnormal posture. B) Dead frogs following a chytridiomycosis outbreak in Milestone Basin. Photo: Vance T. Vredenburg.

between populations in a wave-like pattern, causing mass die-offs in *R. muscosa* populations. We collected morphological and blood biochemistry measurements during the outbreak in order to 1) better understand the pathophysiology of chytridiomycosis; and 2) determine if the physiological effects observed in laboratory inoculation experiments are analogous to disease development in wild amphibians.

We found that pathogen load was significantly associated with disruptions in indicators of fluid and electrolyte balance, such as body mass, protein, hematocrit and electrolyte concentrations. Yet *Bd* load was not associated with indicators of acid-base balance such as blood pH, carbon dioxide and bicarbonate. Some of the indicators of osmotic balance, especially hematocrit, provided evidence of dehydration in diseased frogs, which is a new finding in the study of chytridiomycosis pathophysiology. Even moderate dehydration in association with reductions in blood plasma solute concentrations suggests that frogs with chytridiomycosis have a more pronounced loss of electrolytes than previously estimated.

These findings indicate that disease development is consistent across multiple species and in both laboratory and natural conditions. We recommend integrating an understanding of chytridiomycosis pathophysiology with mitigation practices to improve amphibian conservation. For example, we suggest that electrolyte supplementation could be used in conjunction with antifungal treatments to reduce the risk of mortality when frogs are showing clinical signs of disease. The optimal combination for a particular species may require additional background work (e.g. to determine the best treatments accounting for host life-stage, behavioral and/or ecological characteristics), but the application of well-informed treatment practices is an attainable goal for amphibian conservation biologists.

J. Voyles *et al.*, *PloS ONE* 7, e35374 (2012), doi:10.1371/journal.pone.0035374.

## Ecophysiology meets conservation: understanding the role of disease in amphibian population declines

By Andrew R. Blaustein, Stephanie S. Gervasi, Pieter T.J. Johnson, Jason T. Hoverman, Lisa K. Belden, Paul W. Bradley & Gisselle, Y. Xie

Infectious diseases are intimately associated with the dynamics of biodiversity. However, the role that infectious disease plays within ecological communities is complex. The complex

effects of infectious disease at the scale of communities and ecosystems are driven by the interaction between host and pathogen. Whether or not a given host–pathogen interaction results in progression from infection to disease is largely dependent on the physiological characteristics of the host within the context of the external environment. Here, we highlight the importance of understanding the outcome of infection and disease in the context of host ecophysiology using amphibians as a model system. Amphibians are ideal for such a discussion because many of their populations are experiencing declines and extinctions, with disease as an important factor implicated in many declines and extinctions. Exposure to pathogens and the host's responses to infection can be influenced by many factors related to physiology such as host life history, immunology, endocrinology, resource acquisition, behaviour and changing climates. In our review, we discuss the relationship between disease and biodiversity. We highlight the dynamics of three amphibian host–pathogen systems that induce different effects on hosts and life stages and illustrate the complexity of amphibian – host–parasite systems. We then review links between environmental stress, endocrine–immune interactions, disease and climate change.

A. R. Blaustein *et al.*, *Phil. Trans. R. Soc. Biol.* 367, 1688 (2012).

## Growth, development and incidence of deformities in amphibian larvae exposed as embryos to naphthenic acid concentrations detected in the Canadian oil sands region

By Steven D. Melvin and Vance L. Trudeau

Naphthenic acids (NAs) have been identified as harmful environmental contaminants that influence survival, growth and development of wildlife. Amphibian larvae are particularly susceptible to waterborne contaminants, but little information exists regarding exposure of amphibian embryos or tadpoles to NAs. Our results demonstrate that embryos of *Lithobates pipiens* and *Silurana tropicalis* exposed to 2–4 mg/l of a commercial NA blend suffer significant reductions (32% and 25%, respectively) in growth and development upon hatching. Increased incidences of deformities were observed in exposed individuals of both species, but were only significant in *L. pipiens*. Embryos suffered 100% mortality following exposure to 6 mg/l NAs, and narcosis at lower concentrations. LC50

estimates were 4.10 mg/l for 72-hrs exposure in *L. pipiens* and 4.13, 3.51 and 2.95 mg/l for 24-, 48-, and 72-hrs exposure in *S. tropicalis*. These data suggest that exposure to NAs at environmentally realized concentrations may negatively affect tadpole populations.

S.D. Melvin, V.L. Trudeau, *Environ. Pollut.* **167**, 178 (2012).



Embryos of *Silurana tropicalis* and *Lithobates pipiens* (not shown) exposed to environmental concentrations of naphthenic acid throughout early development experience abdominal air bubbles and kinked tails. Photo: Steven D. Melvin.

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### Oxidation of retinoic acids in hepatic microsomes of wild bullfrogs *Lithobates catesbeianus* environmentally-exposed to a gradient of agricultural contamination

By Janik Thibodeau, Sébastien Filion, Philip Spear, Joanne Paquin & Monique Boily

In the St. Lawrence River valley, high incidences of deformed frogs have been documented in agricultural areas. The malformations observed in wild amphibians are similar to deformities produced in laboratory by experimental manipulation of retinoids, namely retinoic acid (RA), one



Bullfrog in agricultural environment. Photo: Bullfrog project, TOXEN-CIRÉ, UQAM.

of the biologically active form of vitamin A. Earlier studies located in a highly agricultural contaminated watershed (Yamaska River, Québec, Canada) showed unbalanced retinoids in bullfrogs with a high concentration of RA metabolites in plasma. In order to verify the influence of liver on this metabolism, we set an *in vitro* method to test the hepatic microsomal RA oxidation in bullfrogs. Compared to other vertebrates, the RA oxidation in bullfrogs was greater when the substrate 13-*cis*-RA was used instead of *at*-RA. While no relationship was established between the contamination and the RA metabolism in male bullfrogs, the females showed an increased plasma 13-*cis*-4-*oxo*-RA concentration, in step with the sampling sites' agricultural activity. Additional studies will help clarify if a high circulating 13-*cis*-4-*oxo*-RA could compromise the proportion of retinoids to be deposited in the eggs, and consequently, the normal development of the embryos. In both sexes, the liver metabolism as well as the isomerisation processes could influence the circulating RA metabolites in bullfrogs exposed to agricultural contaminants.

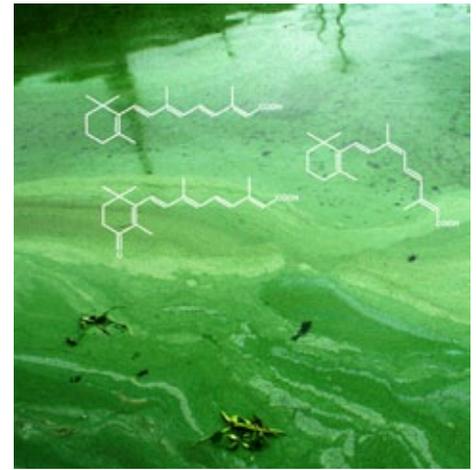
J. Thibodeau, S. Filion, P. Spear, J. Paquin, M. Boily. *Ecotoxicol.* **21**, 1358 (2012).

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### Cyanobacteria blooms produce teratogenic retinoic acids

By Xiaoqin Wu, Jieqiong Jiang, Yi Wan, John P. Giesy & Jianying Hu

Deformed amphibians have been observed in eutrophic habitats, and some clues point to the retinoic acids (RAs) or RA mimics. However, RAs are generally thought of as vertebrate-specific hormones, and no evidence shows that RAs exist in cyanobacteria or algae blooms. By analyzing RAs and their analogues 4-*oxo*-RAs in natural cyanobacteria blooms and cultures of cyanobacteria and algae, we showed that cyanobacteria blooms could produce RAs, which were powerful animal teratogens. Intracellular RAs and 4-*oxo*-RAs with concentrations between 0.4 and  $4.2 \times 10^2$  ng/L were detected in all bloom materials and extracellular concentrations as great as  $2.0 \times 10$  ng/L were measured in water from Taihu Lake, China, which might pose a risk to wildlife through chronic exposure. Further examination of 39 cyanobacteria and algae species revealed that 32 species could produce RAs and 4-*oxo*-RAs ( $1.6$ - $1.4 \times 10^3$  ng/g dry weight, DW), and the dominant cyanobacteria species in Taihu Lake, *Microcystis flos-aquae* and *Microcystis aeruginosa*, produced high amounts of RAs and 4-*oxo*-RAs with concentrations of  $1.4 \times 10^3$  and  $3.7 \times 10^2$  ng/g DW, respectively. Most



Retinoic acids in eutrophic water.

genera of cyanobacteria that can produce RAs and 4-*oxo*-RAs such as *Microcystis*, *Anabaena* and *Aphanizomenon* often occur dominantly in natural blooms. Production of RAs and 4-*oxo*-RAs by cyanobacteria were associated with species, origin location and growth stage. These results represent the first conclusive demonstration of an endogenous production of RAs in freshwater cyanobacteria blooms. The observation of teratogenic RAs in cyanobacteria is evolutionarily and ecologically significant because RAs are vertebrate-specific hormones and cyanobacteria form extensive and highly visible blooms in many aquatic ecosystems.

X. Wu, J. Jiang, Y. Wan, J. P. Giesy, J. Hu, *Proc. Natl. Acad. Sci. USA.* **109**, 9477 (2012).

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### Field and Laboratory Studies of the Susceptibility of the Green Treefrog (*Hyla cinerea*) to *Batrachochytrium dendrobatidis* Infection

By Laura A. Brannelly, Matthew W. H. Chatfield & Corinne L. Richards-Zawacki

Amphibians worldwide are experiencing devastating declines, some of which are due to the amphibian chytrid fungus (*Batrachochytrium dendrobatidis*, *Bd*). Populations in the southeastern United States, however, have not been noticeably affected by the pathogen. The Green treefrog (*Hyla cinerea*) is abundant and widespread in the southeastern United States, but has not been documented to harbor *Bd* infection. This study examined the susceptibility of *H. cinerea* to two strains of *Bd* in the lab and the prevalence of infection in wild populations of this species in southeastern Louisiana. Although we were able to infect *H. cinerea* with *Bd* in the lab, we did not observe any clinical signs of chytridiomycosis. Furthermore, infection

by *Bd* does not appear to negatively affect body condition or growth rate of post-metamorphic individuals. We found no evidence of infection in surveys of wild *H. cinerea*. Our results suggest that *H. cinerea* is not susceptible to chytridiomycosis post-metamorphosis and probably is not an important carrier of the fungal pathogen *Bd* in the southeastern United States, although susceptibility at the larval stage remains unknown.

L. A. Brannelly, M. W. H. Chatfield, C. L. Richards-Zawacki. *PLoS ONE* 7, e38473. doi:10.1371/journal.pone.0038473 (2012).

### First records of limb malformations in wild populations of the Endangered Balearic midwife toad, *Alytes muletensis*

By Samuel Pinya, Valentín Pérez Mellado & Juan José Suárez Fernández

Limb deformities and developmental abnormalities in natural populations of amphibians have been reported for decades but few reports involve deformities in rare and endangered amphibians. The Balearic midwife toad, *Alytes muletensis* (Sanchíz and Adrover 1977), is an endemic and threatened species of the Northeast Mallorca (Balearic Islands, Spain) which has been the focus of a number of studies and conservation efforts. While the early detection and identification of the proximate causes of malformations is an important issue in managing an endangered species, no malformations have previously been reported for *A. muletensis*. During the period 2005 to 2011, in a single locality five different types of malformations were detected: polymelia, micromelia, brachydactyly, syndactyly and bone projection. Although there have been no previous reports of malformations in *A. muletensis*, the observations do not reveal any obvious cause. In the paper it is discussed the proximal causes of

malformations as presence of *Ribeiroia* sp. and other parasites, or a synergistical effect of *B. dendrobatidis* together with pathogens of the genus *Ribeiroia*

S. Pinya, V. Pérez-Mellado, J. J. Suárez-Fernández. *Herp. Rev.* 43, 240 (2012).

### Behavioral, morphological deformities and biomarkers of oxidative damage as indicators of sublethal cypermethrin intoxication on the tadpoles of *D. melanostictus* (Schneider, 1799)

By Muniswamy David, Shambanagouda R. Marigoudar, Vineetkumar K. Patil & Ramesh Halappa

Concerns have been raised that the amphibian larval stages are particularly at risk and may be vulnerable to adverse effects of pesticides. The present study reports acute toxicity of cypermethrin at 24, 48, 72 and 96 h through static renewal bioassay test for *Duttaphrynus melanostictus*. The LC<sub>50</sub> values were 5.15, 4.55, 3.95, and 3.34 µg/L for 24, 48, 72, and 96 h respectively.

At sublethal concentration (0.33 µg/L) behavioral, morphological and biochemical changes were studied. The behavioral and morphological anomalies observed in the present study are typical signs of cyanopyrethroid poisoning. Significant changes were observed in total, soluble and structural proteins. The depletion of all the protein fractions observed in this investigation led to progressive protein oxidation and catabolism of proteins. Decreased protein level has resulted in a marked elevation of free amino acid levels at all time intervals. The induction of catalase, glutathione-S-transferase activities and elevation in the levels of hydrogen peroxide, reduced glutathione, and malondialdehyde eventually lead to oxidative damage of biomolecules, showing that the generation of reactive oxygen species and oxidative stress are involved in the toxicity induced by cypermethrin. Indicating increased susceptibility of tadpoles. Thus, an exposure to cypermethrin at sublethal concentration had catastrophic effect on tadpoles of *D. melanostictus*.

M. David, S.R. Marigoudar, V.K. Patil, H. Ramesh, *Pest. Biochem. Physiol.* 103, 127 (2012).



An amplex of *Duttaphrynus melanostictus* and tadpole. Photo: M. David et al.

## FrogLog Schedule

- January – Special Topical Edition
- April – The Americas
- July – Africa, West Asia, Madagascar, Mediterranean, and Europe
- October – Asia, Russia, and Oceania



Robin Moore / iLCP

## AmphibiaWeb Recent Publication List

This reference list is compiled by Professor Tim Halliday (formerly DAPTF International Director; [tim.r.halliday@gmail.com](mailto:tim.r.halliday@gmail.com)). It lists papers on amphibian declines and their causes and amphibian conservation, with an emphasis on those that describe methods for monitoring and conserving amphibian populations. Tim is always delighted to receive details of forthcoming papers from their authors.

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# General Announcements

## Upcoming Meetings & Workshops

### August

8 – 14. 7th World Congress of Herpetology (WCH), Vancouver.

16 – 19. 10th Annual Symposium on the Conservation and Biology of Tortoises and Freshwater Turtles, Tucson, Arizona.

### September

6 – 15. IUCN World Conservation Congress, Jeju, Korea.

### October

21 - 25, Association of Reptilian and Amphibian Veterinarians 19th Annual Conference, Oakland, California.

## Internships & Employment

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

Biologist I - Brown Tree Snake Researcher - Guam (7/23/12)

Michigan Herpetological Internship - Throughout Michigan and Surrounding States (6/13/12)

Crew Leader - Forest Management and Reptiles and Amphibians in the Ozarks - Missouri (6/6/12)

Field Technicians - Forest Management and Reptiles and Amphibians in the Ozarks - Missouri (6/6/12)

MS Assistantship - University of Wyoming - Wyoming Toad Conservation - Laramie, Wyoming (5/31/12)

Communications Specialist - The Orianne Society - Clayton, GA (5/15/12)

MS Assistantship - Clemson University - Wetland Herpetofauna Research - Clemson, SC (5/8/12)

Desert Tortoise Telemetry Technician - Las Vegas, NV (5/3/12)

Gopher Tortoise Seasonal Field Technician - Southern GA (4/25/12)

Copperhead Research Assistant - Ball State University - South-Central Indiana (4/22/12)

Herpetofaunal Research Intern - Alabama A&M University - Bankhead National Forest, northern AL (4/21/12)

Research Associate - Florida Fish and Wildlife Conservation Commission - Gainesville, FL (4/18/12)

Research Manager - Brown Treesnake Research - Guam (4/11/12)

Volunteer Field Assistants - Ornate Tree Lizard Research - Southeast, AZ (4/3/12)

MS or PhD Graduate Research Assistantship - Oregon State University - Corvallis, OR (4/3/12)

Biological Technician - Reptile and Amphibian Research - Snake River Field Station, Biose, ID (4/1/12)

Zoo Keeper - Herpetology - Houston Zoo - Houston, TX (3/30/12)

# Funding Opportunities

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

## July 2012

**INK Fellows Program - Innovators and Change Makers.** 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. INK prefers Fellows from young economies, but strong candidates from any location will be seriously considered. The application deadline is 15 July 2012.

## International Initiative for Impact Evaluation (3ie) - Replication Grants.

The Replication Program at 3ie accepts applications for replications of influential, innovative, and controversial evaluations from a list of candidate studies. The list includes topics in land reform, dams, agricultural extension, water delivery, and others related to agriculture and natural resources. The objective of the grants is to improve the quality of evidence available for development policy making and program design. 3ie aims to make 5-10 awards of up to US\$15 thousand each. The application deadline is 31 July 2012.

**Scottish Government - Climate Justice Fund.** The Scottish Government announces the first funding round of the Climate Justice Fund, focusing on climate change adaptation in relation to water resources in Malawi, Rwanda, Tanzania, and Zambia. Applications are invited from organizations with a presence in Scotland, either individually or in consortia (e.g., with in-country partners). Grants will range from £400 thousand to £500 thousand for projects of three years. The deadline for applications is 20 July 2012.

**University of Central Asia - Doctoral Studies 2013-2014.** The University of Central Asia (UCA) offers financial support for Central Asian scholars to pursue doctoral studies in environmental sciences, earth sciences, rural development, natural resources management, mountain tourism, and other disciplines at partner universities in North America, Western Europe, and Singapore. Upon graduation, the successful candidates will work as UCA faculty for a minimum of five years. UCA invites applicants from Kazakhstan, the Kyrgyz Republic, and Tajikistan. It will also consider candidates from Uzbekistan, Turkmenistan, Afghanistan, northern Pakistan (Gilgit-

Baltistan and Malakand Division), and western China (Xinjiang province). The application deadline is 31 July 2012.

**Wildlife Conservation Society - Research Fellowship Program, Applications 2012.** The WCS invites applications under its Research Fellowship Program for one-year grants of up to US\$20 thousand. Grant recipients support WCS to implement its priorities for wildlife conservation in developing countries. Applications (in English, French, or Spanish) are invited from conservationists in the early stages of their careers, with preference for projects that support the field research of graduate-level students. The application deadline is 16 July 2012.

## August 2012

**CRDF Global - Zoonotic Diseases in Sub-Saharan Africa.** The U.S. Department of State and the African Biological Safety Association announce the Sub-Saharan Africa Biosafety and Biosecurity Grant Competition. The competition will provide financial assistance for biosafety/biosecurity upgrades at biological labs in Sub-Saharan Africa, with preference given to labs focusing on zoonotic diseases. Up to five recipients will receive grants of US\$10 thousand each. The application deadline is 31 August 2012.

**Critical Ecosystem Partnership Fund (CEPF) - Caribbean Islands Biodiversity Hotspot.** The Caribbean Natural Resources Institute, on behalf of the CEPF, invites letters of inquiry from civil society organizations for projects in biodiversity conservation across the entire Caribbean Islands "hotspot." Participating countries are Antigua and Barbuda; Barbados; Bahamas; Dominica; Dominican Republic; Grenada; Haiti; Jamaica; St. Lucia; St. Kitts and Nevis; and St. Vincent and the Grenadines. The call is for both large and small grants (i.e., above and below US\$20 thousand). The closing date for letters of inquiry is 13 August 2012.

**Critical Ecosystem Partnership Fund (CEPF) - Small Grants for Conservation in the Indo-Burma Hotspot.** BirdLife International, on behalf of the CEPF, invites proposals from NGOs, community groups, and other civil society organizations for actions to conserve biodiversity in the Indo-Burma "hotspot." The current call pertains to Cambodia, Laos, Thailand, and Vietnam. Small grants are up to US\$20 thousand. The deadline for submitting letters of inquiry is 01 August 2012.

**Mekong Program on Water, Environment, and Resilience (M-POWER) - Research Fellowships in Water Resources.** With financial support from AusAID and the CGIAR,

M-POWER aims to award 20-25 fellowships to professionals, researchers, government officials, and others interested in the water resources of the Mekong Region. The program is open to anyone, but preference is for nationals in the six Mekong countries (Cambodia, China, Laos, Myanmar, Thailand, Vietnam). Grants will be about US\$10 thousand each. The application deadline is 09 August 2012.

## New Zealand Ministry of Agriculture and Forestry - Research on Greenhouse Gas Emissions from Livestock, Round 2.

The New Zealand Fund for Global Partnerships in Livestock Emissions Research is an international research fund set up by New Zealand to support the Global Research Alliance on Agricultural Gases. The Fund is open to international scientists, and multi-country consortias are encouraged to apply. Projects can be led by participants from New Zealand or other of the Alliance's 33 member countries, including many developing countries. The deadline for expressions of interest is 27 August 2012.

**Pacific-Asia Travel Association - Grant Applications 2013.** The PATA Foundation makes grants for environmental conservation (including wildlife), cultural heritage, and awareness raising about environmental and cultural heritage. Grants are intended to have a positive impact on tourism and local communities in Asia-Pacific countries. Grants are up to US\$10 thousand. Applicants must have matching funds, as well as letters of support from local PATA chapters. The closing date for applications is 31 August 2012.

**Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) - Awards for Agricultural Research and Science in Africa.** RUFORUM announces the 2012 competition for the Impact Research and Science in Africa (IMPRESSA) Awards. The competition is open to agricultural researchers and scientists in the 29 RUFORUM member universities. Eligibility extends to individuals and teams. Nominations are due by 29 August 2012.

**TED Prize - Nominations 2013.** The winner of the TED Prize ("for a wish that can inspire the world") will receive US\$1 million to implement a large-scale project that requires a global community, network, and significant resources. Nominees can come all fields - culture, arts, technology, entertainment, design, business, science, and global issues. The winner will be chosen on the basis of his/her past accomplishments, and on the strength of his/her wish and execution plan. The TED Prize accepts open nominations and self-nominations. The nomination deadline is 01 August 2012.



# The Herpetologists' League EE Williams Research Grant

The Herpetologists' League is pleased to announce competitive grants for graduate student research for 2013. These awards are named in honor of the late Ernest E. Williams, the first Distinguished Herpetologist of The Herpetologists' League.

## Overview

1. An award (\$1000.00 maximum amount) will be presented to one winner in each category:

Behavior  
Conservation  
Ecology  
Physiology  
Morphology/Systematics

2. See HL web site for application form, complete rules and details: <http://www.herpetologistsleague.org/dox/eewilliamsgrant.pdf>.

3. Entries must be received by 5 PM Mountain Time on 15 December 2012.

4. Send complete application (cover page, proposal, budget, CV,) as a single PDF electronically to: Ann Paterson at [apaterson@wbcoll.edu](mailto:apaterson@wbcoll.edu). Please put "EE Williams Research Grant" in subject line.

5. One letter of support should be sent, preferably by e-mail, directly by the supporter.

6. Proposals will be reviewed by at least two professional scientists, who will provide written feedback by April 2013.

7. Funding dispersed in April 2013 and winners announced at the Herpetologists' League Business Meeting in Albuquerque, New Mexico, 2013.

## *Rules – please read, the rules have changed from last year*

1. The applicant must be a member in good standing of The Herpetologists' League.

2. The applicant must be registered and in good standing in a degree-granting program (MS and PhD candidates eligible).

3. One proposal per applicant per year.

4. Project must be original work, authored and conducted by the applicant.

5. Projects that are already fully supported by other sources are not eligible.

6. The proposal category must be clearly designated. However, HL reserves the right to judge proposals under a category different from that requested based on evaluation of the subject matter and the number of proposals received in each category.

7. Previous winners are NOT eligible for the award in subsequent years.

8. A short report (2 pg) summarizing the results of the project and a reprint or .pdf of any publication arising from the project is due to secretary of HL when available.

## *Preparation guidelines (see website for more details)*

1. Word limit: 1200 words not including citations, budget, cover page or CV.

2. Double spaced, 12 pt font.

3. Margins: 1 inch.

4. Include the cover page provided at the HL website.

5. Include a detailed budget, as well as sources and amounts of current and pending support.

6. Clearly designate the proposal category on the cover page.

7. Arrange in advance for one letter of support to be sent separately by the supporter.

8. Include a two-page CV that includes telephone, e-mail, and mailing addresses.



Photo: David Herasimtschuk.

**UK Department for Environment, Food, and Rural Affairs (Defra)**

**- Darwin Main Projects and Post**

**Projects 2013.** Defra announces Round 19 of the UK Darwin Initiative for biodiversity conservation. Defra invites applications for support of main projects and post projects to commence April 2013. Projects will be expected to contribute to the knowledge base on the links between biodiversity conservation and human welfare and poverty reduction. The program is open to applicants of all nationalities and locations. Grants normally range from £80 thousand to £300 thousand for projects of three years. Matched funding is desirable but not a requirement. The closing date for Stage 1 applications is 13 August 2012.

**United Nations University - International Human Dimensions Program on Global Environmental Change.**

The Secretariat of the International Human Dimensions Program (IHDP) invites articles on the human dimensions of biodiversity and ecosystem services. The contest is open to young scholars internationally (graduate students, PhD students, or postdocs). Scholars from developing countries are particularly encouraged to take part. The IHDP offers five cash prizes, and an opportunity to publish in the DIMENSIONS magazine. The deadline for submissions is 31 August 2012.

**University of Pretoria - Program for Business and Biodiversity.**

The Albert Luthuli Centre for Responsible Leadership at the University of Pretoria offers bursaries for PhD and masters students through its Program for Business and Biodiversity Leadership. Candidates joining the program will carry out research on the relationship between business and biodiversity in Africa. Applicants should have an academic and professional background in environmental management sciences, social sciences, geography, water resources management, development studies, or related disciplines. The bursaries cover the costs of tuition as well as a reasonable living allowance in Pretoria, South Africa. The application deadline is 30 August 2012.

**World Wildlife Fund U.S. - Education for Women Conservationists in the Congo Basin.**

With financial support provided by the Liz Claiborne and Art Ortenberg Foundation, WWF in the USA makes grants that support women in the Congo Basin to pursue a certification, diploma, or technical degree in conservation. The grants are for education-related costs (maximum of US\$10 thousand) for a period of one year. Study can take place anywhere in the world, and it must lead to a certificate, diploma, or degree and begin before December 2012. Eligible countries are the Central African Republic, Congo, Democratic Republic of Congo, and Gabon. The new deadline for applications is 01 August 2012.

**September 2012**

**European Commission (EC) - Community Forest Management in Malawi.**

The EC will make grants to support the "Improved Forest Management for Sustainable Livelihoods Program (IFMSLP)," Phase II, a program of the government of Malawi. The program aims to improve the livelihoods of forest-dependent communities through participatory management of forests in forest reserves and on customary lands. Grants of €300 thousand to €500 thousand will be made to nonprofit organizations in the EU; EU candidate countries; countries of the European Economic Area; ACP countries (including Malawi) and Least-Developed Countries; and international organizations. Reference EuropeAid/133067/M/ACT/MW. The closing date for applications is 06 September 2012.

**European Commission (EC) - Thematic Program for Environment and Sustainable Management of Natural Resources, Including Energy (ENRTP).**

The multi-year ENRTP aims to help partner developing countries implement the environmental and climate dimensions of the EU's 2020 vision. The current call for proposals defines three focus areas: (i) climate change and sustainable energy; (ii) biodiversity; and (iii) forest law enforcement, governance, and trade. Grants will range from €500 thousand to €3 million, varying by focus area. Eligibility extends to non-state actors and private sector organizations in Europe; EU candidate countries; members of OECD/DAC (for projects in least-developed countries); and the developing countries listed in the announcement. Reference EuropeAid/132763/C/ACT/Multi. The deadline for concept notes is 25 September 2012.

**Ford Motor Company in China - Ford Green Awards 2012.**

Ford Motor Company in China annually presents environmental awards. In 2012, Ford will make up to 23 awards in two categories for total funding of 1.5 million yuan (i.e., about US\$100 thousand). Since year 2000, the program has supported 278 environmental non-governmental organizations and individuals in mainland China for projects in environmental protection. The deadline for applications is 10 September 2012.

**Future for Nature Foundation - Future for Nature Award 2013.**

The Future for Nature Award recognizes internationally outstanding efforts to conserve wild animals and plants. Work related to endangered species (IUCN's Red List) is a priority. Candidates for the award should be no older than age 35. Award winners receive €50 thousand and a sculpture. The deadline for applications is 07 September 2012.

**Organization of American States (OAS) - Grants for Sustainable Tourism.**

Through FEMCIDI, the OAS invites proposals for the development of sustainable tourism in Latin America. Themes include mitigation of negative environmental impacts, increased public awareness about the importance of ecological balance in tourist areas, and others. FEMCIDI supports multinational projects, typically ranging from US\$30 thousand to US\$300 thousand per year for a maximum of four years, in OAS member states. The deadline for concept notes is 07 September 2012.

**Research Council of Norway - Cooperation with Russia on Arctic Resources and Environment.**

The Research Council of Norway supports Norwegian researchers to work collaboratively with Russian counterparts in interdisciplinary research related to the environment and natural resources in the Arctic. Issues include climate change, marine pollution, and others. Norway provides up to 12 million NOK for projects of up to three years; Russia provides its support separately. Applications are submitted in English. The deadline for proposals is 05 September 2012.

**United Nations Development Program (UNDP) - Asia-Pacific Development Fellowships.**

The UNDP offers academic fellowships and media fellowships to promote understanding of human development. The academic fellowships aim to support young PhD students from developing countries in the Asia-Pacific region to analyze critical development issues within this year's theme of "Embedding Environmental Concerns into Poverty Reduction and Inclusive Growth." The media fellowships aim to bring people in the Asia-Pacific region to the center of development debates within this year's theme of "Climate Change." The application deadline (both programs) is 15 September 2012.

**University of Nairobi and IDRC - ICTs for Addressing Water-Related Impacts of Climate Change.**

With funding by Canada's IDRC, the University of Nairobi announces research grants to use information and communication technologies (ICTs) for modeling water resources, weather forecasting, climate monitoring, community preparation for risks, and related topics stemming from climate change. The awards are open to citizens of developing countries in Africa, Asia, and Latin America who are graduate-level university students in these regions. The maximum size of support is CA\$15,000 for PhD candidates, and CA\$7,500 for Masters students. Applications (English, French, or Spanish) are due before 14 September 2012.

**UN-Water - "Water for Life" Best Practices Awards, Third Edition.**

UN-Water makes "Water for Life" awards to recognize best practices that can ensure the long-term sustainable management of water resources. The prize is awarded in

two categories: (i) “Best water management practices,” and (ii) “Best participatory, communication, awareness-raising, and education practices.” The award comprises an expenses-paid invitation to participate in the UN event celebrated on World Water Day, plus publicity. The closing date for applications is 15 September 2012.

**U.S. National Science Foundation - Geography and Spatial Sciences Program.** The NSF funds an annual competition for research on the geographic distributions and interactions of human, physical, and biotic systems on the Earth’s surface. Projects on a variety of topics (U.S. and international) qualify for support if they offer promise of enhancing geographical knowledge, concepts, theories, methods, and their application to societal problems and concerns. Past projects include several in the world’s developing countries related to environmental disasters, waste management, marine spatial planning, wildlife conservation, and others. The deadline for regular proposals is 13 September 2012.

#### October 2012

**Explorers Club - Eddie Bauer Grants 2013.** The Eddie Bauer grants support projects in the themes of climate change and the preservation and sustainable use of the Earth’s resources, consistent with the mission of the Explorers Club. The Eddie

Bauer Youth Grant is awarded to one or more eligible students; the Eddie Bauer Expedition Grant funds one or more eligible expeditions. There are no restrictions by nationality. Both categories of grants are for a maximum of US\$25 thousand. The application deadline is 15 October 2012.

**European Commission (EC) - Forest and Biodiversity Governance in Central Asia.** The EC’s Regional Environmental Program for Central Asia announces grants through FLERMONECA for forest and biodiversity governance, including environmental monitoring. The components are: (i) forest law enforcement and governance (FLEG); (ii) ecological restoration and biodiversity conservation; and (iii) environmental monitoring. The program is open to nonprofit organizations and specialized agencies of EU member states, working with partner organizations in Central Asia. Grants will range from €4 million to €4.4 million. Reference EuropeAid/133112/L/ACT/Multi. The deadline for applications is 01 October 2012.

**International Iguana Foundation - Grants for Iguana Conservation.** The International Iguana Foundation makes grants for iguana conservation. Priority is for projects related to survival of endangered iguanas and their habitats, that support established conservation programs, that have participation from the range countries,

and that contribute matching funds. Grants are up to US\$12 thousand. The application deadline is 12 October 2012.

#### November 2012

**Cleveland Metroparks Zoo - Africa Seed Grants and Asia Seed Grants.** Both programs make grants for wildlife conservation and research in their respective regions. The priority is for projects focusing on wildlife and habitat protection, human-wildlife conflict, sustainable environmental practices, capacity building, and conservation biology. There are no application restrictions by nationality. In both programs, the seed grants range from US\$1,000 to US\$3,500. The deadline for pre-proposals is 05 November 2012.

**Explorers Club - Grants for Student Exploration and Field Research 2013.** The Explorers Club makes grants to students for international field projects, including projects focusing on environment and natural resources. The Youth Activity Fund is for high school students and university undergraduates. The Exploration Fund is for graduate and post-graduate students, including early-career post-doctoral students. Grants in both categories are typically from US\$500 to US\$1,500. The application deadline is 01 November 2012.

### Keep In Touch

If you would like to be added to the ASG mailing list, please send an e-mail to [froglog@amphibians.org](mailto:froglog@amphibians.org) with the subject heading “add me to mailing list.” Also, follow us on Facebook for regular updates on the herpetological conservation community and the latest news from the ASG. <http://www.facebook.com/AmphibiansDotOrg>

## FrogLog Schedule

- January – Special Topical Edition
- April – The Americas
- July – Africa, West Asia, Madagascar, Mediterranean, and Europe
- October – Asia, Russia, and Oceania



Robin Moore / iLCP

# 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 bimonthly 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.

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## 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/resources/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

James P. Lewis ([jplewis@amphibians.org](mailto:jplewis@amphibians.org))

## EDITORIAL COMMITTEE

James P. Collins (ASG Co-Chair)

Claude Gascon (ASG Co-Chair)

Phillip J. Bishop (ASG Deputy Chair)

Robin D. Moore (ASG Program Officer)

Craig Hassapakis (Co-editor, Amphibian and Reptile Conservation)

Additional reviewers will be requested as require

## 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 James Lewis at [jplewis@amphibians.org](mailto:jplewis@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 English.

### 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

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### Web site

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Further examples and details can be found on our web site at [www.amphibians.org](http://www.amphibians.org)

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Larva of Vietnam Newt *Tylototriton vietnamensis* at the Amphibian Breeding Station in Hanoi. Photo: T. Ziegler.

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