May 2011 Vol. 96

frogLog

www.amphibians.org

News from the herpetological community

Regional Focus

North and Central America and the Caribbean Edition

Regional updates and latests research.

New regional format for FrogLog.

Eleutherodactylus portoricensis. Photo: R. L. Joglar.

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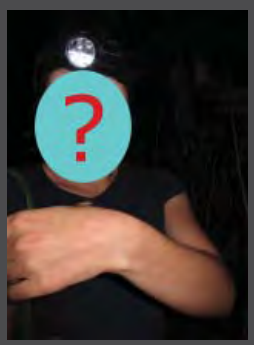

Who's Chairing Your Local ASG?

Find out who the regional chair is for your country and help develop the ASG

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FrogLog

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Ranitomeya variabilis.
Photo: J.L. Brown

Editorial

Welcome to FrogLog volume 96, our first edition with a regional focus. With over 600 members globally the IUCN/SSC Amphibian Specialist Group, through its members and partners, is supporting a vast array of amphibian conservation and research activities. In an effort to help publicize this work we will be focusing on one of our six geographical regions each edition (see page 7 for details on geographic regions). In this edition we will be hearing from ASG members working in North and Central America and the Caribbean and from researchers who might not be directly involved with the ASG but are contributing to our mission.

North and Central America and the Caribbean are an important region for amphibian research and conservation. The largest numbers of threatened species occur in Latin America; Mexico contains the second highest number of threatened amphibian species in the world, and the highest levels of threat are in the Caribbean, where more than 80% of amphibians are threatened or extinct in the Dominican Republic, Cuba, and Jamaica, and an alarming 92% in Haiti. I have never come across so many critically endangered species as I did on a recent expedition to Haiti, where reduced populations cling to survival in small pockets of dwindling forest on remote mountain peaks. It speaks to the urgency of the situation that amphibians are facing and, whether it is habitat loss, disease, pollution, climate change or a combination of threats working together, there has never been a greater sense of urgency in tackling one of the biggest challenges to biodiversity conservation of our time. If we are to stem the tide of amphibian declines and extinctions we must truly work together by sharing our findings, our successes and also our failures – only in this way will we be able to refine our strategies to meet such a daunting challenge.

But people are indeed rising to the challenge. It is inspiring to see the level of activity in amphibian research and conservation in this region, and I was absolutely thrilled to see such an overwhelming response to this edition of FrogLog, with over 40 contributors. It is an outstanding start to the new regional focus, and we look forward to taking a closer look at each region over the coming months and sharing your important work so that we can continue our mission of safeguarding the world's amphibians.

Robin Moore
ASG Program Officer

Froglog

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ASG Updates

Here at the IUCN/SSC Amphibian Specialist Group we frequently receive enquiries regarding the work of the ASG and how you can become a member. As the ASG membership continues to grow and more people join the FrogLog community we thought it might be an opportune moment to answer some of your most commonly asked questions.

What is the ASG?

The Amphibian Specialist Group is a global network of dedicated experts who donate their time and expertise to create a community from where practical amphibian conservation can be advanced based on a solid foundation of science. This global network consists of over 600 members in over 40 Regions/ Countries enabling the ASG to act on a global scale.

The mission of the ASG is to strive to conserve biological diversity by stimulating, developing, and executing practical programs to conserve amphibians and their habitats around the world. This is achieved by supporting a global web of partners to develop funding, capacity and technology transfer to achieve shared, strategic amphibian conservation goals.

Who are the ASG Chairs and what is their role?

The ASG is Co-Chaired by Dr. James P. Collins and Dr. Claude Gascon. The Co-Chairs provide leadership and strategic direction of the ASG, maintaining overall responsibility for the governance, conduct and administration. The Co-Chairs are actively involved in pursuing the advancement of the ASG through collaborative relationships amongst diverse organizations.

Who are the Program Officer and Coordinator and what are their roles?

Frequently the first point of contact with the ASG will be with either the Program Officer (Robin D. Moore, rdmoore@amphibians.org) or the Program Coordinator (James P. Lewis, jplewis@amphibians.org). The Program Officer oversees ASG programs such as implementation of conservation activities including protecting and restoring critical habitats for amphibians worldwide and campaigns such as the Search for Lost Frogs. The Program Officer works with partners around the world to develop and implement these programs, and is the best person to contact when developing amphibian conservation initiatives that fall within the mission of the ASG.

The role of the Program Coordinator is to facilitate communication within the ASG network and to help promote public awareness of the importance of amphibian conservation. In addition to communication responsibilities the coordinator is also directly involved in grant management and a number of administrative processes relating to the efficient management of the ASG. The coordinator will often be the first point of contact for general enquires relating to the ASG and for enquires relating to FrogLog publications and the ASG website.

How do I join the ASG and what would my role be?

The appointing of members to Regional or Country ASG is undertaken through nomination by the Chair of that area. An individual's nomination to the ASG will then be based on his/her interest in being part of the ASG, their willingness to contribute to the group and the ASG mission, and their expertise within the amphibian community. As within any such organization, diversity of expertise is a benefit and for that reason the nomination of seasoned herpetologists through to early stage students are actively encouraged. The ASG is not an exclusive group, however a certain level of expertise is required in order to ensure that the group maintains its role as an advisory authority in the field of amphibian conservation.

Who is my regional chair and what is their role?

To see who your regional chair is check the map on page 6-7 or visit the ASG website network page http://www.amphibians.org/ASG/Network.html. ASG Regional/Country Chairs are influential representatives of the highest level of scientific rigor and credibility with regard to the conservation of amphibians within their remit. This places a very high degree of responsibility and accountability on all those agreeing to take on the role of a Regional/Country Chair. This role has to date been the focal point for any enquires relating to amphibian conservation in their area and maintains responsibility for the overall strategy of their group.

Do you provide funding for Amphibian Conservation?

The ASG occasionally has grants available, including Funds for Habitat Conservation, ARMI Seed Grants (see page 42 for further details), and the ASG Seed Grants.

The Funds for Habitat Conservation support organizations working to protect critical amphibian habitat worldwide. This fund is specifically for direct conservation action, not research (although some funds can be earmarked for survey work if this is an integral component of the overall project). More information can be found at www.amphibians.org/Funding .

ASG Seed Grants are one-time awards of between $500 and $3000 for research that furthers the Amphibian Specialists Group's mission. This award is currently closed but will be announced through FrogLog when open for applications.

Do you have a website?

Yes and we are in the process of building a new one. The current website can be found at www.amphibians.org and we are hoping to have the new one up and running within the next couple months. The new website will have significantly more features to encourage involvement from Regional Groups and members. In addition to all of the current features there will be an available space for each Regional/Country Group to have its own page on the website. This is an ideal platform for groups to publicize their work and provide important information regarding local amphibian conservation actions and needs.

Can you help publicize the work of my amphibian project/conservation efforts?

Yes and it would be our pleasure. There are three main tools the ASG can use to help publicize your work; 1) ASG Website, 2) FrogLog and 3) Facebook. Each resource has its own value and audience so please contact us to discuss options.

Why do you have a Facebook page/why should I join?

Social media is an important tool in raising public awareness and communicating to a global audience in addition to facilitating the exchange of ideas and information among a community of like-minded individuals. The ASG Facebook page is growing on a daily basis and has proven to be a great resource for many herpetologists. You do not have to be a Facebook user to view our page so why not take a look to see what's happening. We have had species identified, grants advertised and information requests answered, all on the Facebook page. The effectiveness of our Facebook page is dependent on our members, so please join, get your friends to join as well, and help publicize the work of the ASG, our members and all those working to conserve amphibians.

I want to join the ASG mailing list but don't want to be receiving endless emails from you.

Email jplewis@amphibians.org with the subject heading "add me to mailing list" and don't worry, we only send out 1 email a week on this list serve.

Tell me more about FrogLog.

FrogLog (which you are currently reading) is the bimonthly ASG publication. FrogLog aims to:

- Provide an update on global and regional ASG activities
- Present synopses of recent amphibian-related studies
- Facilitate keeping up-to-date with recent amphibian related publications
- Inform readers about upcoming events, funding opportunities etc. through general announcements

FrogLog is not a scientific peer reviewed journal but rather a resource, for ASG members and amphibian conservationist in the wider community, to use in order to keep abreast of current research and activities within the community.

In an effort to do our part for the environment, FrogLog has joined the world of Issuu, an online publication community that presents publications in an easy and enjoyable format for online reading. Visit http://issuu.com/amphibiansdotorg to see the most recent copy of FrogLog. We are also in the process of uploading all the previous editions of FrogLog on to Issuu in time for our 100th edition.

All enquires regarding FrogLog should be directed towards froglog@amphibians.org or jplewis@amphibians.org.

What is Conservation Internationals role in the ASG?

Robin Moore and James Lewis are based at Conservation Internationals Office in Arlington, Virginia. CI has been a long term supporter of the ASG by providing office space and support for the Program Officer and Coordinator as we work to further the mission of the ASG, in addition to facilitating the implementation of projects through access to a network of conservation practitioners around the world.

Are you responsible for the Red Listing process?

The ASG is involved in the conservation assessment process through its Amphibian Red List Authority (RLA), and all enquiries relating to this process should be directed towards Ariadne Angulo, IUCN SSC Amphibian Red List Authority Focal Point. The ASG supports the Amphibian RLA's activities, and we are currently developing an online amphibian assessment forum which will be hosted on the ASG website

If you have a question that hasn't been addressed here please free to contact us and we will do our best to get back to you as soon as possible.

Regional Amphibi

1 - North and Central America and the Caribbean

Canada
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Co-Chair: Patricia Burrowes, email: paburrowes@uprrp.edu
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Co-Chair: Geoff Hammerson,
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4 - Sub-Saharan Africa

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Korea

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Co-Chair: Sanjay Molur, email: herpinvert@gmail.com

Sri Lanka

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Co-Chair: Madhave Meegaskumbura,
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5 - Continued

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Thailand

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Myanmar

Deputy Chair: Guinevere Wogan, email: frog.girl@gmail.com

6 - Maritime Southeast Asia and Oceania

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Melanesia

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Philippines

Chair: Arvin Diesmos, email: arvin.diesmos@gmail.com

Malaysia

Chair: Jeet Sukumaran, email: jeet@ku.edu

Haiti: An unlikely haven for amphibians

By Robin D. Moore

When the Alliance for Zero Extinction (www.zeroextinction.org) declared the Massif de la Hotte in Haiti as the site with the highest number of site-restricted species in the world, it sent some ripples through the conservation community. We do not often hear Haiti and biodiversity under the same breath, but with over a dozen critically endangered or endangered amphibian species found nowhere else in the world, the Massif was suddenly a site of global conservation concern. If the remnant patches of forest that cling on to the jaggy karstic mountainsides were to be stripped completely, the extinction of these, and other, species would be imminent.

A lone tree stands as a testament to the forest that once stood in this area in the buffer zone of Pic Macaya National Park. Photo: R. D. Moore/iCLP.

I first visited the area soon after the AZE announced these findings, but it wasn't until I visited the area in the rainy season with, among others, Blair Hedges from Pennsylvania State University, Carlos Manuel Rivera from Philadelphia Zoo and Miguel Landestoy, a talented naturalist and photographer from the Dominican Republic in October last year that I really got a sense of the diversity of the area. In under a week in the field we were able to record some 25 of the Country's 49 native amphibians, almost all of which are threatened, and half a dozen of which had not been recorded in some two decades.

The findings were a symbol of hope in a country ravaged by environmental degradation and suffering the cascading consequences to human wellbeing that come along with that. Drought, floods and massive erosion are a way of life. We have now secured funding from the MacArthur Foundation to embark on an ambitious three-year project to work with the Societe Audubon Haiti and other local and international partners to develop incentives to keep people from cutting down the last trees on Haiti. It is a daunting task, but as long as the forests are standing and the frogs and chirping, we have a reason to try.

Ventriloqual frog, *Eleutherodactylus dolomedes*, a Critically Endangered species in Macaya Biosphere Reserve on the Massif de la Hotte, Haiti. Only known from a few individuals and last seen 1991. Photo: R. D. Moore/iLCP.

Amazing Species - A call for species descriptions

Call for Species Descriptions

The ASG has recently been approached by Rachel Roberts of the IUCN Species Survival Commission, requesting "Amazing Species" nominees. This is a fantastic way to help raise awareness of amphibian conservation issues and we would like to invite you all to submit entries via the ASG.

The "Amazing Species" has evolved from the IUCN Species of the Day website. The website was very successful and finished the end of the year with a dedicated following of over 4,000 users on the social networking site Twitter. The website also attracted interest from a UK publishing company, which is now producing a wonderful coffee table book of all of last year's profiles which will be available later this year. The website can be found at http://www.iucnredlist.org/amazing-species.

If you would like to nominate an amphibian species it should ideally be in any of the RL categories, but if you are in a group lacking verified assessments then please do not let this prevent you nominating species. 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 instructions below and send a high resolution photo and permission granted to use that photo to jplewis@amphibians.org or jplewis@conservation.org with the subject heading Amazing Species. An example of a previous "Amazing Species" is attached. We hope that if there are enough applications we will be able to use this information on the ASG website and Facebook page in addition to the "Amazing Species" website to help further raise awareness.

Atelopus limosus. Photo Brian Gratwicke.

Amazing Species: Limosa Harlequin Frog

The Limosa Harlequin frog, *Atelopus limosus*, is listed as 'Endangered' on the IUCN Red List of Threatened Species. Endemic to the mountains of central Panama, this species has a brown lowland color form and a black and yellow chevron-patterned upland color form.

Much of this species range is protected by the Chagres National Park, but one of the main threats to this species is a fungal pathogen, *Batrachochytrium dendrobatidis*, (*Bd*). This disease does not respect protected area boundaries and has wiped out more than 30 harlequin frog species in Central and South America.

The fungus arrived in central Panama in 2008 and beat the Panama Amphibian Rescue and Conservation Project to Cerro Brewster during the project's initial expedition in 2009. The project is currently holding a small number of upland and lowland color forms are being held in captivity as an assurance population in Panama. However, by the end of 2010 this species was not secure in captivity, and dwindling wild populations of both upland and lowland color forms of this species make it increasingly difficult to find. Help this frog today at www.amphibianrescue.org.

Atelopus limosus text submitted by Brian Gratwicke and Lindsay Renick Mayer

Regional Updates

North and Central America and the Caribbean

As a new FrogLog feature each edition will have a section devoted to one of six broad ASG geographical zones (see pg 6-7). This provides the local ASG groups within those zones an opportunity to showcase their conservation efforts and publicize issues of concern, in this edition the focus is North and Central America, and the caribbean, a zone consisting of eight ASG groups; Canada, Caribbean, Costa Rica, Guatemala and Belize, Honduras, Mexico, Panama and USA.

USA

In the United States, amphibian conservation efforts are occurring nearly everywhere, at local, state, regional, and national levels, by people working in association with a variety of amphibian conservation organizations as well as by people working without such affiliations. As a result, the biology, distribution, and status of the roughly 300 species of United States amphibians is well documented, although many gaps in our knowledge remain. Funding for amphibian conservation efforts has also been relatively good, although that may soon change. In addition to the joint meeting of our (New World) three major herpetological societies (American Society of Ichthyologists and Herpetologists, Society for the Study of Amphibians and Reptiles, and the Herpetologist's League), where conservation papers are presented and discussed, several other groups meet on an annual basis. PARC (Partners in Amphibian and Reptile Conservation) regional working groups and state chapters meet on an annual basis. PARC's approach has been bottom up (with local concerns building to national concerns), complimenting the ASG's global perspective. PARC and the ASG have been partnering on the Amphibian Seed Grant Program. The California-Nevada DAPTF (Declining Amphibian Population Task Force) working group is the sole remaining U.S. regional DAPTF group; they also meet annually. In response to working in a remote area (the northern Great Plains), DARN (Dakota Amphibian and Reptile Network) has formed, and they, too, meet once a year.

The biggest threats to amphibian conservation efforts come from recently realized and proposed state and federal funding cuts brought about by the latest global financial crisis and the U.S. political response. Because of the philosophies of those promoting the budget cutting, a subset of the staff and programs currently supporting amphibian conservation efforts will be vulnerable. At a recent regional amphibian and reptile conservation meeting, we estimated that at least half of the > 100 people in attendance could lose jobs or funding in the next two years.

Michael J. Lannoo (Co-Chair) United States Amphibian Specialist Group

Costa Rica

Recent activities carried out in support of the implementation of the Costa Rican Amphibian Conservation Strategy

Workshop - Amphibian IUCN Red List and Conservation Strategy Update. August 3-4, 2010

The purpose of this workshop was to update recent information regarding new species, rediscovery of a presumed extinct species and population trends of other species, and to discuss the implementation of the Conservation Strategy.

Recommendation were made to change the IUCN Red List information on 51 of 200 species as follows: 1) three species were rediscovered, one that was declared extinct (*Incilius holdridgei*) and two presumed extinct (*Isthmohyla tica* and *Craugastor fleishmanni*), 2) four new species were described for the country, one of which is now possibly extinct (*Atelopus chirripoensis*) and two species previously not known for the country were added, one of which is introduced (*Eleutherodactylus coqui*), 3) five species changed their conservation status, three change from Data Deficient (DD) to low-risk categories and the other two lower their conservation risk levels, 4) thirty-one species had new information on collection sites and population trend, seven listed as Critical Endangered (CR) have increased their population and 5) it was established that three species are probably extinct, two have uncertain presence in the country, and one uncertain species was eliminated because their known distribution does not reach Costa Rica and the status of one species was corrected from native to introduced.

During the workshop the progress of actions set out in the Conservation Strategy were discussed with the following results: 20 actions have been completed (48%), 11 are being met (22%) and other 11 (22 %) have not been made. Participants agreed to work to fulfill all actions, emphasizing three: write a book on the State of Conservation of the Amphibians of Costa Rica, that will be used as a base to include species information on internet pages such as AmphibiaWeb; make a list of sites that keep amphibians in captivity and keep working on animal welfare protocols. More detailed information about this workshop can be found at http://www.cbsg.org/cbsg/workshopreports/26/anfibios.pdf

Education material produced by the Costa Rican Amphibian Specialist Group

Communication

Sixteen banners with amphibian natural history and conservation information have been displayed to the public at different events in the universities and the national zoo to raise public awareness of amphibians, their conservation status and the threats that affects them.

Financial support requested

One major activity recommended in the Conservation Strategy is to make an Amphibian ex situ Conservation course and Conservation Strategy Workshop for Mesoamerica. Because of limited financial resources of many of the potential participants, we are seeking for financial support to bring them here to attend the activity.

Federico Bolanos (Chair), Jorge Rodriguez & Yolanda Matamoro H (Members) Costa Rican Amphibian Specialist Group

Caribbean

As co-chairs of the Caribbean ASG we have aimed to encourage a network of collaboration between herpetologists, government and non-government personnel involved in the protection of wildlife. Our emphasis has been Puerto Rico because this is where we live, but we have made efforts to expand this model to the Lesser Antilles and the Dominican Republic in several opportunities.

In April, 2008, the 2nd Dominica workshop on "Addressing the Threat to Caribbean Amphibians: Prevention of Chytrid Spread and Early Surveillance Measures" was, organized by Andrew Cunningham with the sponsorship of Darwin Initiative, The Dominican Government, the Zoological Society of London (ZSL), Flora and Fauna International, Chester Zoo and Durrell Wildlife Conservation Trust. At this meeting, delegates from the Forest Service, biologists, epidemiologists, and conservationists from several Lesser Antilles islands, Trinidad, Saint Croix, Puerto Rico, and the United Kingdom, convened to discuss the status of amphibians in this region, and potential measures to prevent disease spread and promote conservation efforts. The workshop served as a venue to present the concept of the ASG's to all the delegates, and advanced the formation of a Lesser Antilles Chapter. We established an email listserve to communicate via the Internet, share relevant scientific literature and help each other work toward the ASG goals.

In the Dominican Republic, we collaborated with Marcelino Hernandez, shared our standarized monitoring protocol and conducted fieldwork in the Cordillera Central. This work resulted in baseline population data for the localities of Ebano Verde (1440 m) and Valle Nuevo (2500 m) and the first records of chytrid for the Dominican Republic in three species of anurans: *Eleutherodactylus pituinus*, *E. patriciae* and *Osteopilus vastus* (Joglar et al. 2007).

After the 2nd Congress of Puerto Rican Herpetology in 2008, we formed the local ASG chapter for Puerto Rico and managed to disseminate our preoccupation and goals to the local media with coverage in local newspapers, radio and TV. Since then, the Puerto Rican chapter members organized a network of trained personnel working independently in priority geographic areas, and agreed on a protocol of standardized amphibian field monitoring methods that would yield comparable data. These data were shared via an official website of the group (Wikispace), allowing for analyses that may help us identify patterns and trends in the Caribbean. As a group we started out with a lot of enthusiasm, and data was entered for two years. In addition we organized several activities sponsored by the local "Proyecto Coqui" aimed to educate the general public and raise awareness towards amphibians. Regretfully, the initial stamina that characterized the group has subsided mainly due to changes in personnel, and lack of the time and energy needed to keep a group like this active. However, after the Amphibian Conservation Needs Assessment Workshop in the Dominican Republic in March 2011, we expect to renovate the Puerto Rican ASG and re-initiate collaborative work towards amphibian conservation.

Patricia A. Burrowes and Rafael L. Joglar (Co-Chairs) Caribbean Amphibian Specialist Group

Jamica - A team from the University of the West Indies, Mona, is conducting an island-wide survey of Jamaica's amphibians and is testing for two common amphibian pathogens. Jamaica has the dubious honor of being home to fourteen globally Endangered or Critically Endangered frogs out of its 21 endemics. Ongoing logging and development appears to be the primary threat to the endemic frogs. Prior to our work, six species had not been recorded since the mid-1980's. We found healthy populations of two of these species, *Eleutherodactylus alticola* and *E. griphus*, and have extended the known ranges of both species. Both of these frogs are tolerant of degraded habitat, an encouraging sign for their continued persistence. We have yet to detect the other species, despite intensive surveys in the known ranges of three of the four. In total, we have found fifteen of the endemics. Continued monitoring and habitat protection will be necessary to secure the future of Jamaica's unique frog assemblage.

Iris Holmes

FrogLog Schedule 2011-2012

July 2011 - Sub Saharan Africa
September 2011 - Mainland Asia
November 2011 - Maritime Southeast Asia and Oceania
January 2012 - South America
March 2012 - Europe, North Africa and West Asia
May 2012 - North and Central America and the Caribbean
July 2012 - Sub Saharan Africa
September 2012 - Mainland Asia
November 2012 - Maritime Southeast Asia and Oceania

Amphibian Conservation Needs Assessment Workshop for the Caribbean

By Kevin Johnson

In March 2011, Amphibian Ark staff facilitated two Amphibian Conservation Needs Assessment workshops in Santo Domingo, Dominican Republic, in the Caribbean. The first workshop, which also included the updating of many Red List Assessments, focussed on species from Haiti, the Dominican Republic and Jamaica. The second workshop assessed the amphibians of Puerto Rico and Cuba, plus a few species from the Lesser Antilles.

Participants at the joint Amphibian Red List and Conservation Needs Assessment workshop, covering species from Haiti, Dominican Republic and Jamaica. Photo: Luis Diaz.

During the nine days, sixteen field experts and observers worked with staff from the AArk, IUCN Amphibian Specialist Group and Conservation International, with various sub-groups being formed as necessary to tackle multiple assessments at the same time.

One hundred and seventy-eight amphibian species were assessed for their conservation needs of which, 54 species occur in Haiti, 44 in the Dominican Republic, 24 in Jamaica, 62 in Cuba, 22 species in Puerto Rico and 6 from the Lesser Antilles. The assessment process resulted in the following recommendations: 25 species in need of ex situ Rescue programs; 112 species could still be saved in the wild with in situ conservation action; 41 species require further in situ research to determine more about the species population status and/or the threats they face; 78 species are currently undergoing, or are proposed for specific ex situ research that contributes to the conservation of the species, or a related species; 90 species that are suitable for either in situ or ex situ conservation education programs; and 26 species recommended for cryopreservation. Only twelve species were not recommended for any conservation action. The breakdown of these species by country can be seen in table 1.

	Haiti	Dominican Republic	Jamaica	Cuba	Puerto Rico	Lesser Antilles*
Rescue	10	4	1	3	7	1
In situ conservation	41	29	4	45	6	
In situ research	17	8	10	8	1	4
Ex situ research	20	17	6	41	8	2
Conservation education	20	20	6	34	22	5
Cryopreservation	10	4	1	3	7	1
No conservation action required	2	1	8	1		

Table 1. Amphibian conservation needs assessment workshop outcomes.
* (only 6 species assessed)

We are currently identifying additional field experts in the Lesser Antilles and Trinidad & Tobago to help complete the assessments for those islands. Data sheets will be updated as additional assessments are made.

The more detailed conservation action reports can be found on Amphibian Ark's data portal, www.amphibianark.org/assessmentresults.htm

During the workshop we reviewed the results of the species assessments for each country and discussed options for following up with various conservation actions identified during the workshop. Volunteers were identified in each country to be the focal point for continued actions, assessment updates, and to encourage amphibian conservation activities for the countries. These volunteers are: Susan Koenig and Iris Holmes for Jamaica; Rafael Joglar for Puerto Rico; Sixto Inchaustegui for the Dominican Republic; Luis Díaz and Ariel Rodríguez for Cuba and Joel Timyan for Haiti.

We also spent several hours on the last day of the workshop discussing ex situ amphibian husbandry issues, with many examples of both simple and sophisticated facilities being

shown and discussed. Participants found this particularly helpful, and they gained many good ideas to put into practice at their own facilities.

Workshop participants enjoyed three trips during the workshop: a night walk around Parque Zoológico Nacional (ZooDom); a field trip to a wonderful cloud forest in the 23 km2 protected area Reserva Científica de Ebano Verde; and a night trip to the Santo Domingo Botanical Gardens. Several frog, lizard and snake species were found during these trips, as well as a couple of huge tarantulas. We'd like to extend our thanks to Adrell Núñez from ZooDom and Miguel Landestoy for their hospitality in providing these trips for us, thereby allowing us all to experience a little of the local flora and fauna.

We'd also like to thank the Mohamed bin Zayed Species Conservation Fund, which provided the funds to support this workshop.

Maquito group 2, R. Jogler - The second Amphibian Conservation Needs Assessment workshop included participants with expertise in species from Cuba, Puerto Rico and the Lesser Antilles. Photo: Rafael Joglar.

IUCN Red List Assessment workshop for Amphibians of Jamaica and Hispaniola

By Ariadne Angulo and James Lewis

Within the context of a joint workshop between Amphibian Ark and IUCN, a Red List reassessment workshop for the amphibians of Jamaica and Hispaniola (Dominican Republic and Haiti) was held in Santo Domingo in March 2011. The Red List assessment process was undertaken over the course of four days, with the participation of 12 experts and two facilitators from the IUCN Amphibian Specialist Group and Amphibian Red List Authority and two facilitators from Amphibian Ark for the Amphibian Ark Conservation Needs Assessment.

A total of 63 species were reassessed against the IUCN Red List Categories and Criteria and their distribution maps were revised, with 16 reassessed species for Jamaica and 47 reassessed species for Hispaniola. Additional information resulting from the Amphibian Ark Conservation Needs Assessment was also included in the Conservation Actions field of IUCN assessments. A minimum of seven category changes have been proposed as a result of these reassessments, but they require several subsequent review processes before they can be formalized. There was insufficient information available to assess/reassess 30 species, and these will be assessed at a later date.

All reassessments resulting from this workshop will be posted on a soon-to-be implemented online discussion forum dedicated to amphibian assessments, so that both experts present at the workshop and those who were not able to attend have a chance to make final revisions to assessments before they are sent out for review.

We wish to thank Amphibian Ark for making this joint workshop possible, and very especially Kevin Johnson, for coordinating and organizing this event. We are also grateful to Adrell Núñez (ZooDom), Cristian Marte and Eveling Gabot, for organizing a herpetological night out at the zoo for workshop participants.

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Find out more about Amphibian Ark workshops on page 58 or visit http://www.amphibianark.org

New Hope for Dominican Frogs: PROYECTO RANA RD.

By Sixto J. Incháustegui

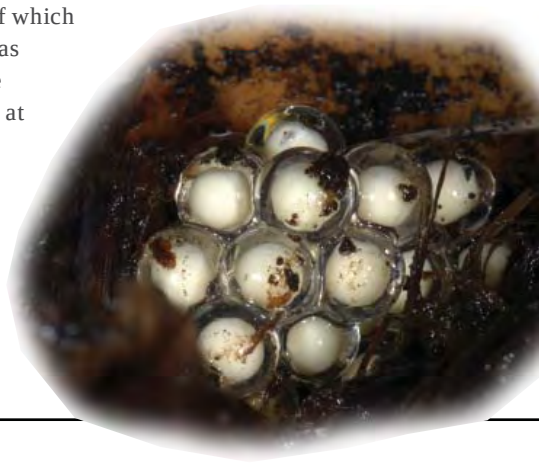
The Caribbean region is considered among the top five biodiversity hotspot. Hispaniola contributes in great extent to this, due to the high number of endemic fauna and flora that it possess. One of the taxa contributing more to this are the amphibians, with nearly 100 % endemic species. At the same time, Cuba and Haiti are among the 20 countries of the world with highest numbers of threatened amphibian species (47 and 46 species), and Haiti and the Dominican Republic are the two top countries of the world with highest percentage (92, 86) of threatened species (Stuart et al, 2008). This high amphibian diversity is due mainly to a single genus, *Eleutherodactylus*, which laid eggs on land and has direct development. The physiography of Hispaniola with mountain ranges running east to west and the intermountain valleys and lowlands has allowed for a magnificent radiation and speciation of this group of frogs. In particular, many are mountain species, with small geographic distribution. Hispaniola has the highest mountains in the insular Caribbean, the highest reaching above 3,000 m asl. Some of the species, like *Eleutherodactylus patriciae* are confined to high elevations of the Cordillera Central, reaching above 3,000 m asl.

Amphibians in the Dominican Republic are poorly known, as it is reflected in the latest book on the Natural History of West Indies Amphibians and Reptiles (Henderson and Powell, 2009). But still, they are much less known by the general citizen, and by many, feared. Endangering factors are not, in any case, cause by direct human actions to the individuals. They have no market value and are in most cases away from humans. Most species are not even known to exist, and in general, all frogs have a single common name, “maco”, a Dominican word for frog of pre-Columbian origin. Threats, then, come mostly from habitat destruction, to which now potential climate change impacts most be added. The results of the 2004 Global Amphibian Assessment (GAA) have shown that amphibians are the single most endangered vertebrate group at present, and among them, sadly as number one fauna assemblage, the Hispaniolan species. These results are telling us, that rapid actions must be taken if we want to support this important group of animals. Many of the species are protected within the national parks and protected areas, but there is not a national assessment of the situation.

The Dominican Government, taken all this into consideration, and through the Minister of Higher Education, Science and Technology FONDOCYT, (National Fund for Innovation and Scientific-Technical Development) approved a three year project, PROYECTO RANA-RD (DR-FROG Project – Dominican Republic Frog Project). This project (FONDOCYT 2008-1-A2-102) is implemented through Grupo Jaragua and the National Museum of Natural History of Santo Domingo. The leading team is integrated by Sixto J. Incháustegui (Grupo Jaragua and ASG/IUCN), Luis M. Diaz (Museo de Historia Natural de La Habana, Cuba and ASG/IUCN), Nils Navarro (Sociedad Cubana de Zoología) and Cristian Marte (Museo Nacional de Historia Natural de Santo Domingo). Among students, it is worthy to mention outstanding student Marcos Rodriguez.

PROYECTO RANA-RD seeks to review the conservation status of the Dominican frogs; to establish 3 field long term monitoring stations; to develop a participatory conservation action plan; and produced the manuscript of a book on the amphibians of the Dominican Republic. While achieving this, broad education actions should be taken at the national level about the importance and need for amphibian conservation and the creation of capacity building for amphibian biology and conservation.

First field campaign was carried on 2010, and preliminary results presented in the VII Caribbean Biodiversity Congress (Incháustegui et al, 2010; Navarro et al, 2010; Landestoy et al, 2010). Work was carried in 20 field stations, allowing collecting and photographing 27 of the 44 species present in the country, of which 13 were recorded. This has allowed to increment the collection of amphibians at the National Museum of Natural History of Santo Domingo. Secondarily, field work is also collecting data and specimens of reptiles. All together, a database of over 4,000 photos



in raw files, both in the wild and in the laboratory, is already available. New species have also been discovered and are in the process of being described.

First field trip was to the type locality of *Peltophryne fluviatica* in the north west of the Dominican Republic. This toad was first described by Schwartz in 1971 and has not been collected thereafter (Hedges and Diaz, 2010). Unfortunately, we could not find it. The type locality was visited, but no evidence of the toad was found. Other herpetologist have search for it, with the same results. Nonetheless, it is expected that under heavy rains the species would be found. Another trip was to the other side of the country, the eastern Dominican Republic, near Higuey , where *Eleutherodactylus ruthae* was collected and recorded. This frog belongs to a group of now seven recognized species which excavate underground burrows, from which males call, and females deposit their eggs. Very little is known about the natural history of these species. This frog had not been collected since 1963 (Hedges and Diaz, 2010).

The two most relevant amphibian assemblages are those of the Cordillera Central and the Sierra de Bahoruco, and thus, were the two geographic areas where major efforts were carried. The Cordillera Central has 16 known species, of which 10 are endemic to this mountain range, living between 600 and 3,000 masl. Five are critically endangered (CR), 7 endangered (EN) and 1 is vulnerable (1). We collected and photograph 9 of these species. These include the highest living frogs of the insular Caribbean. Sierra de Bahoruco has 16 known species, of which 11 are endemics. Six are critically endangered (CR), 4 are endangered (EN) and 3 vulnerable (VU). We were able to collect and work with 12 species.

PROYECTO RANA RD offers new hopes for the conservation of amphibians in the Dominican Republic. For the first time, a project of this nature is being fully financed by the Dominican Government. It is also the first time that broad educational campaign for amphibians conservation are to be taken, and most relevant, a Conservation Action Plan is to be produced by the end of the third year (2012). The information being produced will serve to support the production of educational materials, as well as the action plan.

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Literature Cited

Henderson, R. W. and R. Powell. 2009. Natural History of West Indian Reptiles and Amphibians. Gainsville, florida. University Press of Florida.

Hedges, S.B. and L. M. Díaz. 2010. The conservation status of amphibians in the West Indies. Pp. 31–47 in A. Hailey, B. Wilson, and J. Horrocks (Eds.), Conservation of Caribbean Island Herpetofaunas Volume 1: Conservation Biology and the Wider Caribbean. Brill, Leiden, The Netherlands.

Incháustegui, S. J. et al. 2010. Nuevos aportes científicos de los recientes inventarios que forman parte del proyecto "Anfibios Amenazados y Cambio climático en la República Dominicana – FONDOCYT 2008-1-A2-102. Resumen. VII Congreso Biodiversidad Caribeña. Santo Domingo, Dominican Republic.

Landestoy, M. A. et al. 2010. Nuevas aportaciones sobre las ranas excavadoras de la Hispaniola (Anura: Eleutherodactylidae), un grupo poco conocido y amenazado de extinción. Resumen. VII Congreso Biodiversidad Caribeña. Santo Domingo, Dominican Republic.

Navarro, N. et al. 2010. Caracterización de la colección herpetológica del Proyecto Rana-RD, República Dominicana. Resumen. VII Congreso Biodiversidad Caribeña. Santo Domingo, Dominican Republic.

Stuart, S. et al. 2008. Threatened Amphibians of the World. Lynx Edicions, Barcelona, Spian. IUCN, Gland. Switzerland and Conservation International, Arlington, Virginia, USA.

Photographs
Top Left: *Eleutherodactylus patriciae* EN
Middle Left: *Eleutherodactylus ruthae* EN
Bottom Left: *Eleutherodacytuls wetmorei* clutch of eggs VU
Top Right: *Eleutherodactylus leoncei* CR
Middle Right: *Eleutherodactylus jugans* CR
Bottom Right: *Eleutherodactylus wetmorei* VU
Photos: Proyecto Rana-RD/Luis M.

Puerto Rico: An island rich in amphibians subject to many threats.

By Patricia A. Burrowes and Rafael L. Joglar

Puerto Rico has 25 species of amphibians, 19 native, and six are introduced (Joglar, et al. 2007). In comparison with the other islands in the Caribbean and the world, Puerto Rico has the highest number of species of amphibians per area (Duellman,1999a,b; Joglar, 2005). However, the number of families and genera of native amphibians is low, with only two families (Leptodactylidae and Bufonidae) and three genera (*Eleutherodactylus, Leptodactylus* and *Peltophryne*) present. Most of the native species belong to the genus *Eleutherodactylus* (89.5%) and to the family Eleutherodactylidae (85.5%). Endemism is high; most native species (15/19 =78.9%) are endemic to Puerto Rico (Mona Island included); however, four additional species are endemic to the Greater Puerto Rican Bank, as they are also found in the Virgin Islands and on other islands that were connected to Puerto Rico in the past. Six species of amphibians have been introduced in Puerto Rico since the 1920s (Joglar, 2005; Joglar et al. 2007), including *Lythobates catesbeiana*, a potential vector of diseases such as the pathogenic chytrid fungus, *Batrachochytrium dendrobatidis* (= *Bd* hereafter).

Puerto Rico is not an exception to the global amphibian crisis and species extinctions and population declines have been noticed since the 1970s (Burrowes et al. 2004). *Eleutherodactylus karlschmidti, E. jasperi,* or *E. eneidae* have not been found since 1976, 1981 and 1990, respectively, in spite of continuous field expeditions. An interesting population effect is observable at elfin forests (867 m) in El Yunque Forest where *E. portoricensis* and *E. coqui* seem to be recovering from population declines observed in the early 1990s. However, both species continue to decline at mid-elevations, approximately 200 meters lower (Longo and Burrowes, 2010). Populations of three other species (*E. wightmanae, E. richmondi* and *E. locustus*) have not recolonized some areas at El Yunque where they were abundant in the past. Fortunately, these species still occur in other forests of the island, where we monitor them regularly. For these threatened species, we have started a captive breeding program in collaboration with the Central Florida Zoo, following conservation initiatives by the Amphibian Conservation Action Plan (ACAP) and the Amphibian Ark. We expect to succeed in reproducing these species while learning about their life history requirements, in order to come up with management strategies that may help their recuperation in the wild.

Since 2000, we have been studying the potential causes of amphibian declines in Puerto Rico, and have proposed a cyclic synergistic interaction between climate change (increased dry periods) and disease (chytridiomycosis) as an explanation for the patterns observed. We have shown that frogs carry higher *Bd* infection loads during the dry season, and in laboratory experiments only frogs infected with *Bd* under dry conditions that lead to clumping in humid patches, die from chytridiomycosis (Longo et al. 2010). In addition we have found that adult *Eleutherodactylus coqui* infected with *Bd* have lower probability of survival and have a smaller body size than non-infected frogs, suggesting that there is a fitness cost to *Bd* infections even in populations that may persist with this pathogen (Burrowes et al. 2008a; Longo and Burrowes, 2010).

Fieldwork involving amphibian monitoring and chytrid detection suggests that *Bd* is abundant throughout the highland forests of Puerto Rico (Burrowes et al, 2008b), with prevalence levels of approximately 50 % per population on a given sampling night (Longo and Burrowes, 2010). However, in the lowlands, *Bd* prevalence is low (10 %) among common endemic *Eleutherodactylus* species and low *Bd* infection loads 0-1 zoospore genomic equivalents (Burrowes, unpublished).

Eleutherodactylus portoricensis. Photo: R. L. Joglar

Other concerns are particular to a recently described species, *Eleutherodactylus juanariveroi* (Ríos-López and Thomas, 2007) because it is restricted to a small area of development-threatened wetlands in the northern part of the island, and *E. portoricensis*, a highland species infected with *Bd* that has continued to constrain its range to higher elevations (> 800 m), presumably in response to temperature increase in the past 15 years. Results of monitoring efforts by local herpetologists reveal drastic declines in mountain forests between 600-800 m where it was common in the past.

In light of the high amphibian diversity in Puerto Rico, it is especially worrisome to observe extinctions, declines, and population extirpations in the lifetime of herpetologists that have witnessed these changes in

the past 40 years. More research and education activities leading to conservation actions are needed in order to reverse this trend and protect the frogs of Puerto Rico, which represent not only, an important ecological guild, but also a cultural symbol for the island.

Acknowledgements

Funding for our work has been provided mostly by Proyecto Coqui, NSF-AMP sponsorship to students, and the University of Puerto Rico DEGI. We are grateful to many students who have worked with us in field monitoring and in the laboratory experiments that have led to the findings reported herein.

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Literature Cited

Burrowes, P.A., Joglar, R. L., and Green, D. E. (2004) Potential Causes of Amphibian Declines in Puerto Rico. Herpetologica. 60(2):141–154.

Burrowes, P. A., Longo, A. V., and Rodríguez, C. A. (2008a) Fitness Cost of *Batrachochytrium Dendrobatidis* Infection in *Eleutherodactylus Coqui*, and Comments on Habitat-Related Risk of Infection. Herpetotropicos 4(2):51-57.

Burrowes, P. A., Longo, A. V. , Joglar, R. L. , and Cunningham, A. A. (2008b) Geographic distribution of *Batrachochytrium dendrobatidis* in Puerto Rico. Herpetol. Rev. 39(3):321–324.

Duellman, W.E., Ed. (1999a)Patterns of Distributions of Amphibians. A Global Perspective. The Johns Hopkins University Press, Baltimore.

Duellman, W.E. (1999b): The West Indies and Middle America: contrasting origins and diversity. In: Caribbean Amphibians and Reptiles, p. 357–369. Crother, B.I. (Ed.), Academic Press, a Division of Hartcourt Brace and Company, San Diego, California.

Joglar, R.L. (2005) Anfibios. *In*: Biodiversidad de Puerto Rico. Vertebrados Terrestres y Ecosistemas. Serie de Historia Natural, p. 39-96. Joglar, R.L. (Ed.), Editorial Instituto de Cultura Puertorriqueña, San Juan, Puerto Rico.

Joglar, R. L., Álvarez, A. O., Aide, T. M., Barber, D., Burrowes, P. A., García, M. A., León-Cardona, A., Longo, A. V., Pérez-Buitrago, N., Puente, A., Rios-López, N., and Tolson, P. J. (2007) Conserving the Puerto Rican herpetofauna. Applied Herpetology 4:327-345.

Longo, A. V., and Burrowes, P. A. (2010). Persistence with chytridiomycosis does not assure survival of direct-developing frogs. EcoHealth 7(2):185–195.

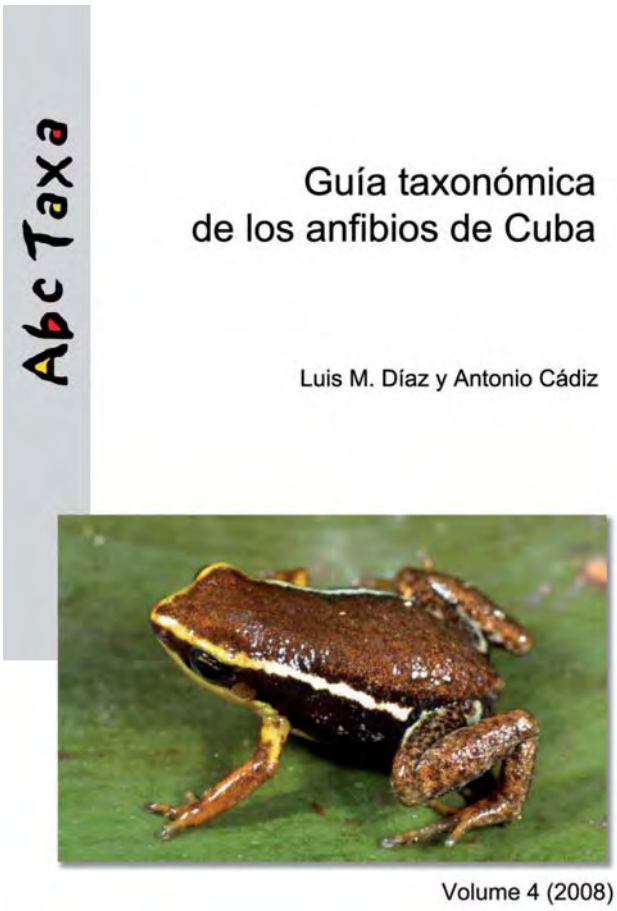
Longo, A. V., Burrowes, P. A., and Joglar, R. L. (2010) Seasonality of *Batrachochytrium dendrobatidis* infection in direct-developing frogs suggests a mechanism for persistence. Dis. Aquat. Org. 92:253–260.

Ríos-López, N., Thomas, R. (2007) A new species of palustrine *Eleutherodactylus* (Anura: Leptodatylidae) from Puerto Rico. Zootaxa 1512: 5 1-64.

A new guide to the identification of Cuban frogs and toads

By Luis M. Díaz

The book *Guía Taxonómica de los Anfibios de Cuba* (*Taxonomic Guide to the Amphibians of Cuba*) (Díaz and A. Cádiz, 2008), was published as the volume 4 of *Abc Taxa* (www.abctaxa.be). The book has 294 pages, 9 chapters, 26 color plates, 101 figures, 69 maps, a glossary, 190 bibliographic citations, and 1 CD with the voices of 66 different taxa. This guide covers all the Cuban species known at the moment of its publication and was designed as a tool for conservation. The mean goal is to provide basic information for species identification in the field, which is a real problem and limitation on the island. Identification of species is not only provided for adult frogs but also tadpoles, eggs (at least for some species) and acoustic emissions (basic descriptions and a supplementary CD with direct reference to species rounds through 86 tracks). For the first time the tadpoles, eggs, and advertisement calls of many species are described in this book. Tadpole descriptions are based in wild observed and collected individuals, not on captive reared larvae. We recognized that information is preliminary in many cases, but it constitutes the only available baseline reference until further contributions goes deeper. The photographs of almost all species and subspecies are available in the book, although *Peltaphryne longinasus ramsdeni* and *Eleutherodactylus staurometopon* are exceptions. Three species (*Eleutherodactylus emiliae*, *E. maestrensis*, and *E. albipes*) are absent in the CD, and also the subspecies *Peltaphryne longinasus ramsdeni*. A recent taxonomic revision (Hedges *et. al.*, 2008) raised the subespecies *Eleutherodactylus varians olibrus*, *E. v. staurometopon*, and *E. zugi erythroproctus* to the species level, but at the time of publication the book still retained the previous status and the authors declared their criteria to assume the decision. Therefore instead of the 65 currently recognized species (Frost, 2010), the book list 62. Since the



taxonomic status of some taxa and populations is fast changing, new species are in the process of being decribed and more information on natural history is already available, an updated (at least online) version of this book will be necessary in one or two years.

Chapter 1 is an introduction with brief information about the composition of the Cuban anuran fauna, the origin, history of amphibian research in Cuba, the significance of this animals in the folklore, how to use the book, and comments on current status of taxonomy.

Chapters 2 and 3 gives a general information about geography, mean habitats, and general patterns of amphibian distribution. The reader may have a first approach to which regions of the island have the highest or lowest anuran diversity, and basic information on how amphibian communities are structured in the book's described habitats.

Chapters 4 is intended to provide basic information about amphibian transportation, handling, and ethics.

Chapter 5 deals with curatorial work in the field, collections, how to preserve adults and tadpoles, and how to obtain useful information to document specimens.

Chapter 6 is focused on the identification of adult frogs and toads in each of the four families represented in the island (Bufonidae, Eleutherodactylidae, Hylidae, and Ranidae). The introduction to this chapter provides information about anuran morphology and chapter structure. For each species the following information is available: 1) species scientific name, 2) reference to color plates, 3) a cross reference to other parts of the book where complementary information is available (eggs, tadpoles, bioacoustic descriptions, and CD track) by using a symbol system that was explained in Chapter 1, 4) species description, 5) similar species (for comparative purposes), 6) distribution (a map with puntual distributional records is shown), 7) ecological synopsis, and 8) commentaries on taxonomy if needed. This chapter provides an easy to use key for identification of families and genera.

Chapter 7 is dedicated to eggs and tadpoles. Information on the eggs of some species is absent, however the reader is provided with preliminary, but still useful, information about different clutches and reproductive modes in Cuban amphibians. For tadpoles more complete information was available, and despite larval plasticity and variation, Guide users will have the first reference to early stages of development. This is very important because many times adults are virtually absent around breeding sites, while tadpoles remain for a longer period of time. Tadpoles also need different conservation strategies than those of adults. They exist in quite distinct habitats with particular environmental pressures which are also different to those of adults. This chapter provides the second key of the Guide, which is intended to make possible the identification of tadpoles to the level of families and genera.

Chapter 8 is a little more complicated to understand for a wider number of book users and is mostly applicable in the lab. However, because species identification is usually extended to the laboratory and sound recordings is a common practice among ¨froggers¨ (researchers and amateurs), the chapter provides complementary information with taxonomic value. Only preliminary information exist for some species, which is based on just a few recordings, but might represent a starting point (the only in many cases) for more elaborated studies. Sonagrams and oscillograms are shown for 95% of species. Besides advertisement call descriptions, information on other calls (distress, release, alarm) is available for some Cuban frogs. In some species, advertisement call variations is documented and even believed to be associated to undescribed cryptic species.

Images kindly provided by: Volume 4 of Abc Taxa, the series of the Belgian National Focal Point to the Global Taxonomy Initiative produced with the financial support of the Belgian Development Cooperation.

Chapter 9 is dedicated to amphibian conservation. The chapter has an introduction to the global and regional context, after which is provided general information on the status of species conservation in Cuba.

The book is available online at the web site of *Abc Taxa*. Hard copies have already been distributed in almost all of the Cuban protected areas, universities, museums, and other institutions involved with the amphibian conservation.

Authors of this book are indebted to the Belgian Focal Point to the Global Taxonomy Initiative (especially to Yves Samyn) and the Royal Belgian Institute of Natural Sciences for the acceptance, support, and publication of this contribution.

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Díaz, L.M. & Cádiz, A. 2008. Guía taxonómica de los anfibios de Cuba. *Abc Taxa*, vol. 4, pp. 294 + CD (audio).

Protecting the Cuban Long Nosed Toad

By Luis M. Díaz

The Cuban Long Nosed Toad (*Peltophryne longinasus*) is currently evaluated as endangered (EN), following the IUCN categories and criteria (Hedges and Díaz, 2004). In the recent Amphibian Conservation Needs Assessments for Cuba (April 27–30, 2011) by Amphibian Ark in Dominican Republic, *P. longinasus* was identified as one of the two Cuban anurans with the highest priority for ex situ conservation actions. This toad is the first species in which the chytrid fungus have been found in Cuba (Díaz et al., 2007). Other threats for the species are the historical loss of suitable habitats and the very limited range of distribution.

In 2010, AArk gave a Seed Grant for the protection of *P. longinasus* in Cuba. The project is ongoing, and a new facility for ex situ research will be working soon. New experiences derived from this project will let the opportunity to complete a practical handbook about the biology and captive management of *P. longinasus*. A preliminary success with the captive breeding of species was reported by Díaz and Cádiz (2007). We identified as limiting factors for the proper maintenance of this species: 1) the quality of water (soft water is required in correspondence with the species' habitat), 2) proper lighting with UV emisions (the species is diurnal, and individuals use to bask), and 3) proper temperatures (low temperatures in P. l. dunni, around 18–23°C in the water; 25–26°C in *P. l. longinasus* and *P. l. cajalbanensis*). We are currently working in dilucidate if the four subspecies of *P. longinasus* are really full species. Our recent observations suggest that natural histories differ considerably among populations, and it can affect the development of ex situ protocols. Also, the current assessment of species based on the IUCN categories and criteria can change after any taxonomic arrangement. The subspecies *P. l. dunni*, that was the best known population in the past, have been declining dramatically and there are only few streams with breeding individuals and tadpoles.

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Peltophryne longinasus. Photo by Luis M. Diaz

Results of the Cuban amphibians Red List Assessment

By Ariel Rodriguez

With 62 species known to date and an astonishing 95% endemism, Cuba is home of nearly one third of all Antillean species (AmphibiaWeb 2011). Despite recent advances that include the publication of a picture book (Rodríguez-Schettino 2003), a sound guide (AlonsoRodríguez & Márquez 2007), and a taxonomic catalogue (Díaz & Cádiz 2008), still knowledge about amphibian diversity in Cuba remains scarce and recent studies suggests that the actual number of species is underestimated (Rodríguez et al. 2010).

Since 2008 a project involving 61 Cuban experts from 17 institutions has been conducting a red list assessment process for all native terrestrial vertebrates including amphibians and using IUCN criteria and categories

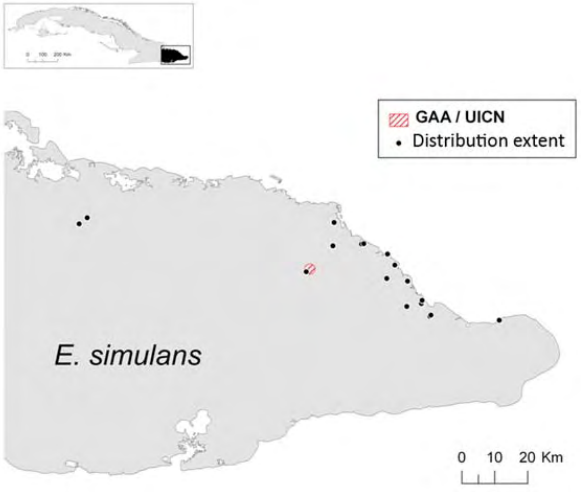

Figure 1. An example of the distribution update obtained during the Cuban Red List Assesment. The distribution of Eleutherodactylus simulans is displayed both, as reported by IUCN (cross hatched) and as updated by the Cuban RLA.

Figure 2. Endangered species from Cuba: *Eleutherodactylus symingtoni* (top) and *Peltophryne longinasa* (bottom).

(IUCN 2008). Such an endeavor had never before been attained in Cuba and the results will surely provide crucial information for many agencies and institutions involved in the conservation and sustainable use of the Cuban biodiversity.

The amphibian chapter re-assesses the current IUCN status of native species using updated information on geographic distribution and habitat status. A database of occurrence localities was compiled using previously published information and field data obtained by contributors. This update resulted in significant distribution extents for many taxa previously considered severely restricted (Figure 1). Individual species assessments were conducted by experts and presented in a three days workshop held in Havana in December 2009.

In total, 27 species were considered threatened in different categories: one species as Critically Endangered (*Eleutherodactylus blairhedgesi*), three as Endangered (*E. symingtoni*, *Peltophryne cataulaciceps*, and *P. longinasa*) and 23 species as Vulnerable. Most of the species were considered threatened due their restricted geographic distributions (intrinsic factors) and only for two species (*Eleutherodactylus symingtoni* and *Peltophryne longinasa*, Figure 2) was an evidence of decline in the number of known locations. The many changes in relation to the global IUCN RedList (IUCN 2011) were the result of improvements on geographic distribution and knowledge on habitat trends and not derived from changes in population status, which is not known for the majority of Cuban species. Most of the species had populations within protected areas and the areas with the greatest numbers of threatened species are the Turquino and La Bayamesa national parks (Figure 3).

The results of the Cuban RedList assesment of amphibians and other vertebrates will soon be published as Red Book and will be available on internet through the Cuban Clearing-house Mechanism website. This first Cuban assessment is intended to be continuously updated and hence should be considered as another step towards an accurate evaluation of the conservation status of the Cuban amphibians.

Figure 3. Threatened species richness in protected areas of Cuba (areas without threatened species are not shown).

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Literature Cited

Alonso, R., A. Rodríguez & R. Márquez (2007) Sound Guide of the Amphibians from Cuba. ALOSA sons de la natura, Audio CD & booklet, 46 pp.

AmphibiaWeb, (2011) AmphibiaWeb: information on amphibian biology and conservation. AmphibiaWeb, Berkeley. Accessed on May 2011.

Díaz, L. M. & A. Cádiz (2008) Guía taxonómica de los anfibios de Cuba. ABC Taxa, 4, 1.

IUCN (2008) Guidelines for Using the IUCN Red List Categories and Criteria. Version 7.0. Prepared by the Standards and Petitions Working Group of the IUCN SSC Biodiversity Assessments Sub-Committee.

IUCN, (2011) The IUCN red list of threatened species. International Union for Conservation of Nature and Natural Resources. Accessed on May 2011.

Rodríguez-Schettino, L. (2003) Anfibios y reptiles de Cuba. Vaasa, Finland: UPC Print.

Rodríguez, A., M. Vences, B. Nevado, A. Machordom & E. Verheyen (2010) Biogeographic origin and radiation of Cuban Eleutherodactylus of the *auriculatus* species group, inferred from mitochondrial and nuclear gene sequences. Molecular Phylogenetics and Evolution, 54, 179.

Anthropogenic Noise: Yet Another Fight for Frogs?

By Kristine Kaiser

As human encroachment into habitats becomes endemic, so does anthropogenic noise associated with human habitation. Amphibians are among the most vocal vertebrates, and competing noise can be problematic for individuals attempting to attract mates. Noise can be detrimental to birds (Slabbekoorn and Peet, 2003), but only recently have studies examined the responses of frogs to exogenous noise. Such studies have shown that noise affects both female mate preferences (Bee and Swanson, 2007) and male calling behavior (Kaiser and Hammers, 2009; Parris et al., 2009).

Calling is the most energetically expensive activity frogs undertake (Wells and Taigen, 1989). Thus, frogs that respond to noise by

Figure 1. *Dendropsophus microcephalus* calling from vegetation next to pond. Photo: K. Kaiser.

increasing vocal output (e.g., the number or length of calls; Kaiser and Hammers, 2009; Parris et al., 2009) can incur physiological costs which may have profound effects on animals.

I recently co-published a study on the effect of anthropogenic noise on calling behavior in the Central American treefrog *Dendropsophus microcephalus* (Figure 1; Kaiser et al., 2011). We first characterized males' vocal response to noise. We worked at Las Cuevas Research Station (LCRS) in the Chiquibul Forest Reserve, Belize, from June – August 2008. LCRS, in the middle of the Maya Mountains, is surrounded by one of the largest pieces of intact forest remaining in Central America (Figure 2). Due to the location and the lack of maintained roads in the area, the only vehicle traffic here is LCRS traffic. As a result, frogs here are largely naïve to anthropogenic noise.

To determine male *D. microcephalus* response to noise, we recorded frogs' response to each of the following for three minutes: pre-stimulus, anthropogenic noise, white noise, silent stimulus, and post-stimulus (negative control). Frogs responded to noise – both anthropogenic and control white noise – by increasing call rates relative to silent and pre- and post-stimulus treatments.

We then tested whether this increased call rate and the increased energetic expenditure required to do so, affected chorus tenure, or the number of nights in a chorus, or the length of the chorus. To monitor the impacts on chorus tenure, we marked all male *D. microcephalus* at our study ponds (Kaiser et al., 2009). Each night, we monitored when the frog chorus began and ended, and which individuals were present at the ponds. At our experimental site, we broadcast engine noise for at least one hour during the frog chorus each night.

The effect calling increases had on chorus tenure was striking. Frogs that were subjected to noise returned to the pond less frequently and for a shorter time from initial to final capture. Moreover, although choruses began at both ponds at the same time, frogs that were subjected to noise had shorter choruses – ending on average an hour earlier, but up to three hours earlier than choruses at the pond where no noise was broadcast.

A decrease in chorus tenure is not trivial, as chorus tenure is the best predictor of male mating success in many frogs (Ryan et al., 1981). Frogs which call more expend more energy, which likely must be made up by foraging between choruses. A decrease in chorus tenure can lead to a decrease in an individual's chance of mating. This effect is likely not limited to *D. microcephalus*: recent studies have shown that other species increase vocal output in response to noise (Sun and Narins, 2005; Parris et al., 2009).

Moreover, the shortening of the chorus may be particularly detrimental to population viability: females typically arrive at breeding ponds much later than males do. In the case of *D. microcephalus*, females generally arrive well after the average end of chorusing at the noise-exposed site (Bevier, 1997). Over time, females may or may not be able to shift arrival times; in many cases, however, females' response to altered chorus dynamics will likely determine population-level effects.

While species have myriad ways of coping with complex acoustic environments, anthropogenic noise may present new challenges for frogs to which they may not readily adapt. Thus, for frogs which attract mates acoustically, explicit consideration for conservation of the acoustic environment should be made when enacting conservation action plans in regions where human encroachment is imminent. Indeed, such protection may be almost as important as protection of the physical environment.

Acknowledgements

I thank my co-authors and field assistants and the staff of LCRS. This work is dedicated to Nicodemus "Chapal" Bol, who recently passed away; without Chapal, my research would not have been possible. He is missed. Funding was provided by the Columbus Zoo. Permits were issued by the Belize Forest Department. M. Gridi-Papp assisted with experimental design.

Figure 2. View from the observation tower, one of the high points around LCRS. LCRS is surrounded by broadleaf evergreen forest covering karst hills. Photo: K. Kaiser.

Literature Cited

Bee, M. A. & Swanson, E. M. (2007). Auditory masking of anuran advertisement calls by road traffic noise. Animal Behaviour 74, 1765-1776.

Bevier, C. R. (1997). Utilization of energy substrates during calling activity in tropical frogs. Behavioral Ecology and Sociobiology 41, 343-352.

Kaiser, K., Alloush, M., Jones, R. M., Marczak, S., Martineau, K. & Oliva, M. (2009). Use of visual implant alpha (VIAlpha) Fluorescent tags in a small hylid frogs with a new technique for application. Herpetological Review 40, 421-422.

Kaiser, K. & Hammers, J. L. (2009). The effect of anthropogenic noise on male advertisement call rate in the neotropical treefrog, *Dendropsophus triangulum*. Behaviour 146, 1053-1069.

Kaiser, K., Scofield, D. G., Alloush, M., Jones, R. M., Marczak, S., Martineau, K., Oliva, M. & Narins, P. M. (2011). When sounds collide: the effect of anthropogenic noise on a breeding assemblage of frogs in Belize, Central America. Behaviour 148, 215-232.

Parris, K. M., Velik-Lord, M. & North, J. M. A. (2009). Frogs call at a higher pitch in traffic noise. Ecology and Society 14, 25.

Ryan, M. J., Tuttle, M. D. & Taft, L. K. (1981). The costs and benefits of frog chorusing behavior. Behavioral Ecology and Sociobiology 8, 273-278.

Slabbekoorn, H. & Peet, M. (2003). Birds sing at a higher pitch in urban noise. Nature 424, 267-267.

Sun, J. W. C. & Narins, P. M. (2005). Anthropogenic sounds differentially affect amphibian call rate. Biological Conservation 121, 419-427.

Wells, K. D. & Taigen, T. L. (1989). Calling energetics of a neotropical treefrog, *Hyla microcephala*. Behavioral Ecology and Sociobiology 25, 13-22.

Guatemalan Salamander Diversity

By Jonathan A. Campbell, Eric N. Smith, Jeffrey W. Streicher, Manuel E. Acevedo and Edmund D. Brodie, Jr.

Nuclear Central America, with Guatemala at its core, harbors a diverse array of salamanders, most of which are endemic (Wake and Lynch, 1976). Despite considerable effort devoted to the salamanders of Guatemala, our knowledge remains in a surprisingly rudimentary state. Schmidt (1936) reported 15 species of salamanders from Guatemala, Stuart (1943) added three species to this list, and since then new discoveries have been frequent (e.g., Brodie and Campbell, 1993; Campbell and Smith, 1998; Elias and Wake, 1983; Lynch and Wake, 1975, 1978; Vásquez-Almazán et al., 2009; Wake and Campbell, 2000; Wake and Elias, 1983; Wake and Lynch, 1976). However, for some years, we have been aware of many additional new species of salamanders from Guatemala. Sixteen of these species in the genera *Bolitoglossa* and *Dendrotriton* are described in Campbell et al. (2010). This study was based on fieldwork conducted in the highlands of Guatemala during the last 40 years.

The topography, climate, and vegetational cover of Guatemala are complex. Guatemalan faunal provinces were proposed by Stuart (1943) based on salamander distributions, and these provinces were modified by Campbell and Vannini (1989) based on a comprehensive analysis of the Guatemalan herpetofauna (Fig. 1). The new species of salamanders recently described by Campbell et al. (2010) include 6 from the Cuchumatan, 4 from the Chimaltenangan, 1 from the Fuegan, 2 from the Jalapan, 2 from the Minan, and 1 from the Merendón areas.

One of the obstacles previously hampering taxonomic work with the *morio*-group of salamanders was the holotype for the species has been lost. Campbell et al. (2010) designated a neotype for *B. morio* (Fig. 2), and resurrected *B. omniumsanctorum* (Fig. 3) from the synonymy of *B. morio*.

Distinctive new species of the genus *Bolitoglossa* from various highland regions of Guatemala, including dry pine-oak forests of the Guatemalan Plateau; high mixed conifer-broadleaf forests of the Sierra de los Cuchumatanes, mesic seasonal broadleaf forest of the southeastern highlands, cloud forest of the Sierra de las Minas, and rainforest of the foothills of eastern Guatemala.

Bolitoglossa ***kaqchikelorum*** (Fig. 4) is known from the extreme eastern portion of the Guatemalan Plateau, including the highlands bordering the western side of Guatemala City and near Antigua.

Bolitoglossa ***pacaya*** (Fig. 5) occurs in the highlands that extend unbroken below the 1500 m contour from Volcán de Pacaya northeast around the western edge of Lago Amatitlán to western Depto. Guatemala at elevationals of 1700–2300 m. It inhabits humid hardwood or pine-oak forests. The type-locality, Volcán de Pacaya, lies about 50 km almost due south of Guatemala City. Most *B. pacaya* were found in bromeliads growing on hardwood trees. A few individuals were encountered in bromeliads on pines, on the ground beneath rotting logs, or deep in crevices along dirt banks. Individuals were taken in bromeliads 2–10 m above the ground in both the rainy and dry seasons.

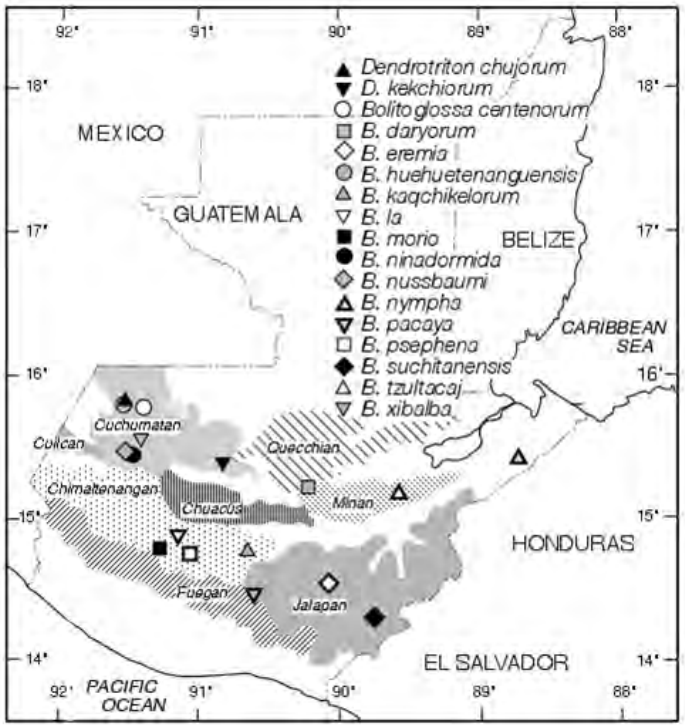

Figure 1. Selected highland faunal regions of Guatemala (after Campbell and Vannini, 1989), showing type-localities for salamander species described herein and neotype of *Bolitoglossa morio*.

Bolitoglossa ***eremia*** (Fig. 6) is restricted to the isolated Miramundo Highlands, This species inhabits montane hardwood forest at elevations of 2360–2660 m. When irritated or injured, this species exudes a yellow tail secretion. This species was most frequently found on the ground under large rotting logs. However, during wet periods individuals were found under smaller fallen limbs and even large chips of wood. Several salamanders were encountered in September in rotting tree trunks 10–25 cm above the ground and another individual found in July was excavated from a deep crevice along a dirt bank.

Bolitoglossa ***suchitanensis*** is restricted to Volcán Suchitán in the department of Jutiapa. The volcano reaches 2042 m and is covered mostly with secondary growth, particularly at lower elevations. This species is one of the most geographically restricted species of *Bolitoglossa*, known only from 1850 to 1990 m on Volcán Suchitán, but probably occurrs to the summit at 2042 m. The upper slopes of the volcano where *B. suchitanensis* was collected support a relatively humid broad-leaf forest with abundant mosses and epiphytes. The type-specimen was collected buried in moss on a log and other specimens were collected beneath rotting logs, in damp leaf litter, or at night (1900–2300 h) actively climbing on branches, ferns, or leaves in secondary vegetation 0.6–1.6 m above the ground.

Bolitoglossa ***daryorum*** (Fig. 7) is known from the western portion of the Sierra de las Minas at elevations of 2400–2760 m in cloud forest. The specific epithet is a patronym for the exceptional Dary family of Guatemala, who have done so much to further conservation in that country. Mario Dary Rivera

(1928–1981), founded the School of Biology at the Universidad de San Carlos of Guatemala as well as the Biotopo Universitario para la Conservación del Quetzal, which is inhabited by this new species of salamander. He later became Rector of the Universidad de San Carlos of Guatemala. Juan Mario Dary Fuentes, his son, has followed strongly in his father's path, rising to become the Guatemalan Minister of Environment and Natural Resources. Most of these slamanders were encountered on the ground, but 2 individuals were found in rotting vertical trunks about 2 m above the ground.

Bolitoglossa ***tzultacaj*** is known only from the southern slopes of the Sierra de las Minas near the junction of the departments of Zacapa, Izabal, and Alta Verapaz. The forest at 1800 m is an admixture of pine-oak forest and cloud forest vegetation, which prevails at higher elevations.

Bolitoglossa ***la*** (Fig. 8) is known from near Chichicastenango, the northern edge of the Guatemalan Plateau, and the extreme western portion of the Sierra de Chuacús. Localities are drained by the upper tributaries of the Río Chixoy and are separated from each other by less than 20 km airline. The elevational range is 2100–2390 m in pine-oak forest. In the vicinity of Chichicastenango, the species has been found most frequently in bromeliads up to heights of 6–7 m above the ground. A small series of specimens taken near Santa Rosa Chucuyub were encountered in or beneath rotting logs following rainy periods.

Bolitoglossa ***nussbaumi*** is known only from the type-locality near Todos Santos in the Sierra de los Cuchumatanes. The specific epithet is a patronym for Ronald A. Nussbaum, the leading authority on caecilians, who joined us on several trips to Guatemala and was tireless in his pursuit of salamanders. Individuals of the type-series were collected from within and beneath rotted wood in a wooded ravine of a relatively dry forest containing pines, scattered oaks, laurels, and abundant brushy vegetation along open edges.

Bolitoglossa ***centenorum*** is known only from the type-locality near San Mateo Ixtatán in the Sierra de los Cuchumatanes. The specific epithet is a patronym in honor of the Centeno family of Guatemala. Members of this family have done much to further education and appreciation of nature. Ing. Héctor A. Centeno, Rector emeritus (1992–2001) of the Universidad del Valle de Guatemala, has served in many positions, including Vice-presidential Advisor for Science and Technology and founder of the environmental and conservation organization Fundación Defensores de la Naturaleza. His son, Lic. Marco Vinicio Centeno, is founder of the Sociedad Guatemalteca de Ornitología, is a member of the Mesa Nacional de Aviturismo, and teaches biology at the Universidad del Valle de Guatemala. Individuals of the type-series were collected from beneath rotting logs.

Bolitoglossa ***ninadormida*** (Fig. 9) is known from several highland localities in the Sierra de los Cuchumatanes, including near Todos Santos and near San Juan Ixcoy. This species has been collected in rotting trunks in a fir (*Abies*) and cypress (*Cupressus*) forest at 1600–1800 hr.

Bolitoglossa ***huehuetenanguensis*** (Fig. 10) occurs at near San Mateo Ixtatán in the Sierra de los Cuchumatanes at elevations of 2450 to 2800 m. The type-series was collected mostly from within and beneath rotted wood and a few individuals were taken under rocks. Most of the trees had been felled in the area and salamanders were also encountered under the loose bark at the base of stumps.

Bolitoglossa ***psephena*** is known only from the highlands often referred to as the María Tecúm or the Tecún Umán Ridge. It inhabits montane wet forest that has abundant pines, cypress, firs, oaks, alders, and laurels. The type was taken at about 2500 m but the highest elevation attained in the area is the crest of the Tecún Umán Ridge at 3400 m. Relatively good patches of forest are still present.

Bolitoglossa ***xibalba*** (Fig. 11) is relatively widespread, occurring at various localities in the Sierra de los Cuchumatanes and the Montañas del Cuilco. The elevational range is 1980–2760 m in wet montane forest. Most specimens were found under bark or moss at the base of rotting tree trunks. Individuals from the Montañas de Cuilco were taken between 19:30–21:00 hrs 50–120 cm above the surface of the ground on leaves along the side of a trail.

Bolitoglossa ***nympha*** (Fig. 12) is a species belonging to a group of diminuitive, short-tailed salamanders including *Bolitoglossa rufescens* and *Bolitoglossa occidentalis*. It occurs in the Merendón region along the Guatemala-Honduras border at moderate elevations of 200 to 1200 m. Most specimens were found after dark sitting on leaves of low vegetation. The majority of individuals were taken less than a meter from the ground, but a few were encountered 1.6–2.0 m high. Nights following afternoon showers were especially productive in finding these salamanders, although they were also active during light night rains or mists. Although they might be found practically anywhere in the forest, they appeared to be more abundant in the humid environments presented by streamside vegetation.

A new species of *Dendrotriton* is described from the mixed conifer-broadleaf forest of the northern Sierra de los Cuchumatanes and another from the cloud forest of the eastern extension of the Cuchumatanes.

Dendrotriton ***chujorum*** (Fig. 13) was found along the road from Nentón to San Mateo Ixtatán in the northern portion of the Sierra de los Cuchumatanes. The slopes from where it was collected are drained by the upper tributaries of the Río Grijalva and are covered by small remnants of a mostly hardwood forest that is conspicuously drier than the forest at higher elevations or on opposing slopes of this range. All specimens were taken from bromeliads 3–10 m above the ground.

Dendrotriton ***kekchiorum*** (Fig. 14) was taken in the mountains to the north of Uspantán, in the eastern portion of the Sierra de los Cuchumatanes. The holotype was collected on a rainy evening at about 1900 h at an air temperature of 12˚C. The specimen was sitting about 1 m above the ground on a fern along a small forest path.

In addition to the new forms described in Campbell et al. (2010), we are aware of many undescribed species of Guatemalan salamanders that will be the subject of future studies. Given this knowledge, we suspect that salamander diversity in Nuclear Central America is still greatly underestimated.

Figure 2. *Bolitoglossa morio*, UTA A-38614, adult male, 43.2 mm mm SL, from 3.7 km S Santa María Visitación, 2200 m. This is the type-locality of designated neotype. Photo: J. A. Campbell.

Figure 3. *Bolitoglossa omniumsanctorum*. UTA A-48710, adult female, 69.5 mm SL; Montañas del Cuilco: a Pajonada a Cumbre del Papal, 2650-2870 m, Huehuetenenago, Guatemala. Photo: E. N. Smith.

Figure 6. *Bolitoglossa eremia*. (Upper) UTA A-38631, adult male paratype, 42.3 mm SL; near Miramundo, 2550 m, Jalapa, Guatemala. Photo: J. A. Campbell.

Figure 8. *Bolitoglossa la*. UTA A-38663, adult female paratype, 47.1 mm SL, from 3.0 km SSE Chichicastenango, valley between Paxot and Camanibal, 2100 m, El Quiché, Guatemala. Photo: E. D. Brodie, Jr.

Figure 10. *Bolitoglossa huehuetenanguensis*. UTA A-51320, adult female holotype, 56.8 mm SL; 14.0 km NW junction of San Mateo Ixtatán-Barillas road to Nentón, 2780 m, Huehuetenango, Guatemala. Photo: J. A. Campbell.

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Figure 4. *Bolitoglossa kaqchikelorum*. UTA A-60365, ca. 40 mm SL; Cerro Alux, 2107 m, Departamento de Guatemala, Guatemala. Photo: E. N. Smith.

Figure 5. *Bolitoglossa pacaya*. UTA A-33641, male holotype, 45.3 mm SL, from 4 km (airline) SSE San Vicente Pacaya, W slope Volcán Pacaya, 2000-2050 m. Photo: J. A. Campbell.

Figure 7. *Bolitoglossa daryorum*, UTA A-59729, adult female holotype, 52.0 mm SL; Biotopo del Quetzal, Plan de Geomaya, 2235 m, Baja Verapaz, Guatemala. Photo: E. N. Smith.

Figure 9. *Bolitoglossa ninadormida*. UTA A-58562, adult female holotype, 57.1 mm SL; near Todos Santos Cuchumatán, Carretera entre Chiabal and El Rancho, Huehuetenango, Guatemala, ca. 3200 m. Photo: J. A. Campbell.

Figure 11. *Bolitoglossa xibalba.* UTA A-34546, adult female holotype, 7.0 km by road SW San Juan Ixcoy, Huehuetenango, Guatemala, at 2750 m elevation (15.570678° N, 91.441228° W). Photo: E. D. Brodie, Jr.

Figure 12. *Bolitoglossa nympha.* UTA A-45328, adult female holotype, 38.4 SL; E of San Miguelito, along tributary of Río Bobos, between 510-550 m; Sierra de Caral, Municipio de Morales, Izabal, Guatemala. Photo: J. A. Campbell.

Figure 13. *Dendrotriton chujorum.* UTA A-51391, adult female holotype, 27.6 mm SL, from 14.0 km (by road) on road to Nentón NW of the junction with the San Mateo Ixtatán to Barillas road, at 2780 m elevation (15.892222° N, 91.564167° W), Huehuetenango, Guatemala. Photo: J. A. Campbell.

Figure 14. *Dendrotriton kekchiorum,* UTA A-51086, adult female holotype, 34.2 SL; from between El Chimel and San Pablo El Baldío, Quiché, Guatemala, at 2100 m. Photo: E. N. Smith.

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Literature Cited

Brodie, E. D., Jr., and J. A. Campbell. 1993. A new salamander of the genus *Oedipina* (Caudata: Plethodontidae) from the Pacific versant of Guatemala. Herpetologica 49: 259–265.

Campbell, J. A., E. N. Smith, J. Streicher, M. E. Acevedo, and E. D. Brodie, Jr. 2010. New Salamanders (Caudata: Plethodontidae) from Guatemala, with miscellaneous notes on known species. Misc. Publ. Mus. Zool. Univ. Michigan 200: 1–60.

Campbell, J. A., and E. N. Smith. 1998. New species of *Nototriton* (Caudata: Plethodontidae) from eastern Guatemala. Scientific Papers, Natural History Museum, The University of Kansas 6: 1–8.

Campbell, J. A., and J. P. Vannini. 1989. Distribution of amphibians and reptiles in Guatemala

Elias, P., and D. B. Wake. 1983. *Nyctanolis pernix*, a new genus and species of plethodontid salamander from northwestern Guatemala and Chiapas, Mexico. Pp. 1–12 in A. G. J. Rhodin and K. Miyata (eds.), Advances in Herpetology and Evolutionary Biology: Essays in Honor of Ernest E. Williams. The Museum of Comparative Zoology, Cambridge, Mass.

Lynch, J. F., and D. B. Wake. 1975. Systematics of the *Chiropterotriton* bromeliacia group (Amphibia: Caudata), with descriptions of two new species from Guatemala. Contributions in Science, Natural History Museum of Los Angeles County 265: 1–45.

Lynch, J. F., and D. B. Wake. 1978. A new species of *Chiropterotriton* (Amphibia: Caudata) from Baja Verapaz, Guatemala, with comments on relationships among Central American members of the genus. Contributions in Science, Natural History Museum of Los Angeles County 294: 1–22.

Schmidt, K. P. 1936. Guatemalan salamanders of the genus *Oedipus*. Zoological Series of Field Museum of Natural History 20: 135–166.

Stuart, L. C. 1943. Taxonomic and geographic comments on Guatemalan salamanders of the genus *Oedipus*. Miscellaneous Publications, Museum of Zoology, University of Michigan 56: 1–37.

Vásquez-Almazán, C. R., S. M. Rovito, D. A. Good, and D. B. Wake. 2009. A new species of *Cryptotriton* (Caudata: Plethodontidae) from eastern Guatemala. Copeia 2009: 313–319.

Wake, D. B., and J. A. Campbell. 2000. A new species of diminutive salamander (Amphibia: Caudata: Plethodontidae: *Nototriton*) from the Montañas del Mico of Guatemala. Proceedings of the Biological Society of Washington 113: 815–819.

Wake, D. B., and P. Elias. 1983. New genera and a new species of Central American salamanders, with a review of tropical genera (Amphibia, Caudata, Plethodontidae). Contributions in Science, Natural History Museum of Los Angeles County 345: 1–19.

Wake, D. B., and J. F. Lynch. 1976. The distribution, ecology, and evolutionary history of plethodontid salamanders in tropical America. Science Bulletin, Natural History Museum of Los Angeles County 25: 1–65.

Wake, D. B., and J. F. Lynch. 1982. Evolutionary relationships among Central American salamanders of the *Bolitoglossa franklini* group, with a description of a new species from Guatemala. Herpetologica 38: 257–272.

Climbing for Chytrid: An Aerial Pursuit for Answers in Honduras

By Jonathan E. Kolby

Cusuco National Park (Cusuco) is a biological gem, situated in the Sierra Merendón of northwestern Honduras, close to the border with Guatemala. The park is quite small, approximately 200 square kilometers, but presents a beautiful mosaic of montane cloud forest, tree fern gullies, and crystal clear rivers and waterfalls. Cusuco is biologically rich, providing habitat for as many as 100 species of reptiles and amphibians, some of which are endemic to the park. I began studying the herpetofauna of Cusuco in 2006 to conduct biodiversity surveys with the British organization Operation Wallacea. During my first field season, I was unaware that some of the IUCN critically endangered amphibian species in this park were said to be experiencing enigmatic decline and it was not until 2007 that I reviewed these assessments and decided to return to conduct the first survey for the presence of amphibian chytrid fungus, *Batrachochytrium dendrobatidis* (hereafter "chytrid").

Adult bromeliad frog (*Bromeliohyla bromeliacia*). Photo: J. E. Kolby

The results were alarming, revealing the widespread presence of chytrid throughout the park, and an especially high prevalence of infection in the critically endangered species reported to be in decline (*Duellmanohyla soralia*, *Plectrohyla dasypus*, *Ptychohyla hypomykter*) (Kolby et al. 2010). Compelled but not satisfied with these findings, I wanted to know if there might be places within an exposed forest where amphibians might be protected from chytrid. How about bromeliads? These unique epiphytic plants can collect a considerable volume of rainwater and seemed like the perfect natural refugia; they could protect amphibians from chytrid both physically (by distance away and height above terrestrial water bodies) and chemically (elevated acidity).

So up into the trees it was! In 2009, a colleague (Merlijn Jocque) and I participated in a training course to become certified tree climbers to pursue this arboreal endeavor. We returned to Honduras that summer and conducted an extensive arboreal investigation for the presence of chytrid in amphibians collected from bromeliads. One of two bromeliad treefrog species present in Cusuco, *Bromeliohyla bromeliacia*, became the target of this new study. Not only do adult frogs take refuge in the bromeliads by day, but the eggs are also deposited within the plants' water-holding leaf axils where the larvae are able to survive even when very little water remains. After completing two rewarding months of field work and scaling over a dozen trees, I emerged with moldy clothes, a broken tooth, and disheartening results. Almost one-third of all bromeliad frogs sampled tested positive for chytrid, regardless of bromeliad height, distance from water, and the stark contrast between river and bromeliad water conditions. Not only was this worrying for the sake of the bromeliad frogs, but for all amphibians which are not directly associated with terrestrial water bodies, as these bodies are widely considered to be the environmental reservoirs for infectious chytrid zoospores.

So how can bromeliad frogs and their tadpoles which rarely enter the splash zone of streams and rivers, infrequently wander to the ground, and are unlikely to engage in physical contact with species emerging from contaminated rivers still become infected with chytrid? Might chytrid have been introduced into these bromeliads by drops of contaminated water carried by flying insects, on the feet or feathers of waterbirds, or possibly even by wind-dispersed rain during tropical storms? A few more trips into the trees will hopefully begin to answer some of these questions and reveal some of the missing puzzle pieces. As of now, your guess is as good as mine, but one thing is certain; all amphibians should be considered vulnerable to chytrid exposure, not just those with terrestrial aquatic life stages. Until we develop a more comprehensive understanding of the range of dispersal pathways exploited by chytrid, all bodies of freshwater should be considered potential sources of chytrid infection, whether it be a puddle of rainwater on the forest floor, a water pocket in a bromeliad 50 meters up a tree, or a raging river. As demonstrated here in Cusuco, even isolated bodies of ephemeral water some distance away from rivers and high within the rainforest canopy cannot provide amphibians safe haven from this devastating epidemic.

Acknowledgements

From the inception of this project in 2007, funding for fieldwork and laboratory analyses has been provided by the National Geographic Society (Young Explorers Grant), Critical Ecosystems Partnership Fund (CEPF), the Mohamed bin Zayed Species Conservation Fund, Rufford Small Grants for Nature Conservation, Chicago Zoological Society/Chicago Board of Trade Endangered Species Fund, the Columbus Zoo and Aquarium, Omaha's Henry Doorly Zoo, North of England Zoological Society (Chester Zoo), Declining Amphibian Task Force and Idea Wild.

References

Kolby, J.E., Padgett-Floher, G.E., Field, R. (2010) Amphibian Chytrid Fungus Batrachochytrium dendrobatidis in Cusuco National Park, Honduras. Diseases of Aquatic Organisms 92:245–51.

Other species threatened by chytrid in Cusuco include the IUCN critically endangered *Plectrohyla dasypus* (top) and *Plectrohyla exquisita* (middle), both of which are endemic to the park. Cloud forest habitat within Cusuco National Park, Honduras (bottom). Arboreal sampling for chytrid in Cusuco (right). Photos: J. E. Kolby

Searching for lost frogs of the *Craugastor rugulosus* group: Understanding their dissapearence and assesing their current population status.

By Héctor Zumbado-Ulate , Adrián García-Rodríguez, Gerardo Chaves and Gilbert Alvarado.

The *Craugastor rugulosus* clade is formed by 34 species that extend from Mexico to Panama (Campbell and Savage 2000, Hedges et al. 2008, Ryan et al. 2011). Species occur from sea level to above 2000 m elevation but mostly in highlands above 1000 m (Savage 2002). All the species are mainly nocturnal as adult and inhabit rocky flowing streams where are usually found on boulders, sand banks or leaf litter (Savage 2002, Ryan et al. 2008).

Amphibian decline events in Mesoamerica have greatly affected this clade (McCranie and Wilson 2002, Bolaños 2009). In Costa Rica, six of the eigth native species have not been seen for at least one decade (IUCN 2009). The only known stable populations belong to the species *Craugastor ranoides* in the northwest part of the country (Sasa and Solorzano 1995, Puschendorf et al. 2005, Zumbado-Ulate et al. 2007). Recently one specimen of *Craugastor fleischmanni* was found in Cordillera Volcánica Central (Ryan et al. 2011), where several species of this group occurred in the past.

Currently, we are conducting anuran surveys using baseline ecological niche modeling tecniques to predict potential distributions of lost species (García-Rodríguez unpublished information). Field work for the *C. rugulosus* group have been focused in Cordillera Volcánica Central due to the historical home range of four target species in this area. However, new searching locations will be included to look for the other species of the complex.

All of the voucher specimens of this group deposited in the Museum of Zoology of Universidad de Costa Rica will be examined in the near future. We will use both histologic and real time PCR approaches to detect the chytrid fungus *Batrachochytrium dendrobatidis* in order to find some clues to understand the fast ocurring decline suffered by the species of this clade.

Acknowledgements:
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Literature Cited

Bolaños, F. 2009. Situación de los anfibios de Costa Rica. Biocenosis 22:95-108.

Campbell, J.A. & Savage J.M. (2000). Taxonomic reconsideration of Middle American frogs of the *Eleutherodactylus rugulosus* group (Anura: Leptodactylidae): a reconnaissance of subtle nuances among frogs. Herpetological Monographs 14:186-292.

Hedges, S.B., Duellman, W.E. & Heinicke, M.P. (2008). New World direct-developing frogs (Anura: Terrarana): Molecular phylogeny, classification, biogeography, and conservation. Zootaxa 1737:1-182.

IUCN. (2009). IUCN Red List of Threatened Species. Version 2009.1. <www.iucnredlist.org>.

McCranie, J.R. & Wilson, L.D. (2002). The Amphibians of Honduras. Society for the Study of amphibians and Reptiles. 625 pp.

Puschendorf, R., Chaves, G., Crawford, A.J. and Brooks, D.R. (2005). *Eleutherodactylus ranoides.* Dry forest population, refuge from decline? Herpetological Review 36:53.

Ryan, M.J., Bolaños, F. & G. Chaves. (2011). Museums help prioritize conservation goals. Science 2010:1272-1273.

Ryan, M.J., Savage J.M, Lips, K.R. & Giermakowski J.T. (2011). A New Species of the *Craugastor rugulosus* Series (Anura: Craugastoridae) from West-Central Panama. Copeia 2010:405-409.

Ryan, M.J., Lips, K.R. & Eichholz, M.W. (2008). Decline and extirpation of an endangered Panamanian stream frog population (*Craugastor punctariolus*) due to an outbreak of chytridiomycosis. Biological Conservation 141:1636-1647.

Sasa, M. &Solórzano, A. (1995). The reptiles and amphibians of Santa Rosa National Park, Costa Rica, with comments about the herpetofauna of xerophytic areas. Herpetological Natural History 3:113-126.

Savage, J.M. (2002). The Amphibians and Reptiles of Costa Rica: a Herpetofauna Between Two Continents, Between Two Seas. The University of Chicago Press. 909 pp.

Zumbado-Ulate, H., Puschendorf, R. & Chavarría, M.M. (2007). *Eleutherodactylus ranoides* (NCN) Distribution. Herpetological Review 38:184–185.

Figure 1. Craugastor ranoides. Adult female. Photo: R. Puschendorf.

Forensic Taxonomy and the "new fossils" in Amphibian Biology

By Joseph Mendelson

Museum collections are about permanence. They are about the permanence of documentation of a time, place, and ultimately of an artifact or specimen of any sort. This information of time and place and object allows academics to interpret the specimen in context. Natural history museums, the type of museum where has been my experience, document the natural world. I am a herpetologist, specializing in amphibian taxonomy. If you've ever noticed in field guides or museum or zoo, those unpronounceable scientific names that accompany the illustration or display, well then you know me. I'm the guy (or one of them, anyway) that conjures those unpronounceable names and ascribes them to species newly discovered by science. My career has been built helping to catalog the amphibians of the world and bringing taxonomic order to the world by following the simple edict of "one species – one name."

Museum collections are also about discovery—that most joyous of scientific endeavors. *Eureka, I have found it!* Museum displays allow the public and students to discover more about the world about them. Museum research collections allow historians and scientists of all sort to discover new objects and, with them, new insights into their academic endeavor. Because museums dutifully time-stamp everything, then everything can be evaluated in its appropriate historical context. This is very important for cultural perspectives; for example, something such as art or literature considered "obscene and vulgar" in 1934 may seem benign now. Without that time-stamp, the cultural context is diminished. The same is true in the sciences of paleontology and anthropology, as it is of crucial importance if *Tyrannosaurus rex* pre-dated or post-dated some other dinosaur, or when and where Neanderthal humans made their exit from existence. Did the overlap geographically and temporally with our own species, *Homo sapiens*? These all are interesting and important questions about the history of our natural world. As much as I was enthralled with the "discovery" aspect of my career, I never foresaw the aching poignancy of the museum time-stamp in my career that is now apparent.

I have spent half of my career working in natural history museums, and all of my career closely associated with them as a constant user of those collections. I mostly study Central American frogs, having named about three dozen new species of them. Museum collections allow me to compare the anatomy and DNA of specimens from, for example, southern Mexico and northern Nicaragua side-by-side on my lab bench. Are they the same, or are they different? Really, that's all I do every day. There is no other way to do this sort of science. For my research, the importance of specimens is all about sample size as it is impossible to distinguish individual variation from species-level differences without an adequate understanding of basic levels of individual variation, including real patterns of geographic and sexual variation. The date of collection of these specimens was never of any particular importance to me, until I started to notice that the specimens in the jars represented populations that no longer exist in the wild. They are gone, and all we will ever know of them is these preserved specimens. This was sobering enough, to realize that there no longer are Horned lizards in my hometown of Poway, California, when my boyhood memory and the museum record clearly indicate they were common there until the late 1970s. But, the same reality took a major leap for the worse, when I realized that the same museum shelves I wander every day held specimens of entire species recently gone extinct. Extinction is the very embodiment of permanence. In reviewing the thousands of frog specimens that I have considered in my career, I found that I was naming new species not based on eureka moments in the rainforest, but based on preserved specimens of species that have very recently gone extinct. These specimens were collected during my own lifetime, and by herpetologists I have met; I have a temporal connection with these specimens, even if I did not collect them myself. I never had poignant moments in natural history collections, until now, because the samples there were always intended to be mere subsamples of ongoing, renewable, timeless, vibrant populations in nature that were collected merely to help us catalog the Earth's wondrous biodiversity. Paleontology collections, we all know, represent the extinct past of our natural history. Paleontologists may yearn for the time-travel experience to see their study subjects alive, but I doubt they feel much emotion in cataloging that biodiversity based on fossils. After all, it's clear that humans played no role in that mass extinction. Now I have emotions about natural history collections.

My career transitioned sharply a few years ago, when I realized that museum specimens collected as recently as the 1980s are "the new fossils" as they represent entire species that have gone extinct within our lifetime. Dozens and dozens of them. Suddenly and awfully, that dutiful museum time-stamp became a simultaneous epitaph, representing the last time this species was seen alive on the planet. No longer did the specimens on the shelves represent ongoing, vibrant populations in nature. As I discovered species new-to-science among them, I sensed that my career of discovery had taken a morbid turn. I needed a name for this new twist in my career in taxonomic discovery. The term "paleontology" literally refers to ancient times, so that would not work. I finally settled on the term Forensic Taxonomy, because that is what I am now doing—assigning a name to recently deceased victims/species. At the scene of a murder, it seems that one of the first priorities of the crime investigation professionals is to determine the name of the victim. This crucial piece of information does not, of course, change the fact that they have been murdered, but it is important nonetheless. I guess that's what I do in my career anymore—assign names to recently extinguished species of frogs. I know it is important, but it is not the joyful experience of discovery that I envisioned when I embarked on a career in amphibian taxonomy. I am a Forensic Taxonomist. I am not a Paleontologist.

The crisis of global amphibian extinctions is very real, and it is of scope and scale that certifiably qualifies it as a mass extinction event, comparable to the history of dinosaurs or the Pleistocence megafauna such as Wooly Mammoths. The IUCN Amphibian Specialist Group is an important task force to confront this disaster.

Scaling a Global Plan into National Strategies for Amphibian Conservation

By Don Church

In 2005, the Species Survival Commission (SSC) of the International Union for Conservation of Nature (IUCN) and Conservation International (CI) convened the Amphibian Conservation Summit to develop the Amphibian Conservation Action Plan (ACAP) (Gascon et al. 2007). The IUCN/SSC Amphibian Specialist Group (ASG) was formed in 2006 and an early goal was to translate the global plan of action into national and regional plans that would more specifically address what work is needed at local scales. These national and regional plans put the amphibian conservation issues into more local contexts of what is at stake and what needs to be done, thereby giving national resource management agencies and non-governmental organizations (NGOs) a clearer idea of what conservation actions need to be taken. A recent review by Gascon et al. (in press) of strategies in development and completed indicates that conservation planning at the scale of nations and regions reconciles some debates on what actions are of highest priority for global amphibian conservation regionally, and illustrates how priorities vary geographically. Although there are different emphases among the action plans, four priorities emerged as clear frontrunners for the countries and regions with completed or developing action plans:

1. Habitat protection implementation
2. Infectious-disease research
3. Captive breeding as both a research area and as an action item, particularly for species threatened by infectious disease
4. Improved understanding of amphibian species richness, distributions, and ecology.

These themes were not always identified as priorities, but at least one was a top priority within every action plan to date. Unfortunately, conservation action in the field has not occurred broadly, partly due to a lack of follow up in engaging governments and NGOs to utilize the plans. A review of conservation successes in response to national and regional planning indicated that workshops designed to develop plans should involve governments and local NGOs as much as possible, and try to demonstrate how some management priorities for amphibians can be easily achieved.

Literature Cited

Gascon, C., Collins, J. P., Moore, R. D., Church, D. R., McKay, J. E., & Mendelson, J. (editors), 2007. Amphibian Conservation Action Plan. IUCN/SSC Amphibian Specialist Group, The World Conservation Union (IUCN), Gland, Switzerland and Cambridge, UK. 64 pp.

Full article: Gascon, C. et al, In press. Scaling a global plan into regional strategies for amphibian conservation. Alytes.

Calling all Sub-Saharan Africa Herpetologists

The July edition of FrogLog will be focusing on the Sub-Saharan Africa ASG region as depicted on page 6-7. If you are working in this area and are interested in submitting an article please contact James Lewis at jplewis@amphibians.org. Articles must be received by 25 June for inclusion.

Altiphrynoides malcomi in the Bale Mountains of Ethiopia. Photo R. D. Moore/iLCP

Northeast Partners in Amphibian and Reptile Conservation (NEPARC)

Annual Meeting registration is now open!

*** Early Registration deadline June 15th***

Arlington Echo Outdoor Education Center, Millersville, Maryland
August 17 - 18, 2011

- Early Registration (before June 15, 2011): $85
- Late Registration: $99

Meeting registration fees are low to encourage participation by all new and existing members of the NEPARC community. Registration fee includes all meals for both days (with the exception of dinner on the 18th). Low cost lodging on-site; off-site lodging options available. Please consider donating items for the silent auction and contributing to the NEPARC photo project. (See the NEPARC website (www.pwrc.usgs.gov/neparc) for details.)

CALL FOR POSTER ABSTRACTS - Deadline for poster abstracts is July 15th

Abstracts are invited for poster presentations at the 12th annual meeting of the Northeast Partners in Amphibian and Reptile Conservation (NEPARC) to be held August 17-18, 2011, at the Arlington Echo Outdoor Education Center, Millersville, Maryland (www.arlingtonecho.org). NEPARC is an active, diverse, and inclusive partnership dedicated to the conservation of amphibians and reptiles and their habitats throughout northeastern North America. Annual meetings are an ideal forum to share current research and conservation initiatives, participate in working group sessions, and to network with like-minded herp enthusiasts in the Northeast. Please visit www.pwrc.usgs.gov/neparc to learn more about NEPARC's mission and current conservation initiatives. --

A call to amphibian biologists to share innovative ideas to minimize loss of species under climate change

By L.P. Shoo, D.H. Olson and J-M. Hero

Climate change is likely to exacerbate ongoing threats to amphibian populations such as disease, habitat loss, pollution and over-utilization. Existing conservation strategies will remain relevant, but additional management actions may be needed to reduce emerging impacts of climate change. There are currently few practical examples where novel management actions have been enacted and properly evaluated for feasibility and effectiveness.

In a recent paper published in the Journal of Applied Ecology, an international team of amphibian biologists assemble a preliminary set of local-scale management actions that are specifically relevant to minimizing loss of amphibians at risk (Shoo et al., 2011). We focus heavily on poorly tested but potentially valuable engineering solutions designed to ameliorate impacts and provide more effective recovery of amphibian populations under uncertain climate (e.g. temperature extremes and variable rainfall).

For example, in South Australia, it has been demonstrated that portable irrigation frames can be used to increase water availability at breeding sites for the terrestrial toadlet *Pseudophryne bibronii* resulting in increased calling activity, matings and egg laying (Mitchell, 2001). There is potential to trial such interventions for other geographically restricted terrestrial-breeding frogs for example Central American rain frogs that undergo population crashes during extended periods of dry weather (Pounds, Fogden and Campbell, 1999).

In the arid USA southwest, wind- and solar-powered pumps have been used to retain water levels in constructed and earthen stock ponds – an action that has been essential in maintaining the threatened Chiricahua leopard frog *Lithobates chiricahuensis* during dry periods. Other options include retention or supplementation of natural and artificial shelters (e.g. logs, cover boards) to reduce desiccation and thermal stress; manipulation of canopy cover over ponds to reduce water temperature; and, creation of hydrologically diverse wetland habitats capable of supporting larval development under variable rainfall regimes.

Portable irrigation frames manipulate water potentials at breeding sites for the terrestrial-breeding toadlet *Pseudophryne bibronii* in South Australia. Photo: Nicola Mitchell

Terrestrial toadlets (*Pseudophryne bibronii*) in amplexus. Photo: Nicola Mitchell

The threatened Chiricahua leopard frog *Lithobates chiricahuensis*. Photo: Bruce Christman

Our intention is not to engender false hope and complacency toward stemming the overarching problem of environmental deterioration (Pounds et al., 2006). However, human-induced emissions of greenhouse gases have already committed the Earth to warmer global temperatures and associated changes in the climate system through the 21st century (Meehl et al., 2007). Therefore, innovative strategies are needed to reduce the impact of emerging changes on animal and plant communities. We encourage amphibian biologists to help build a knowledge bank of effective management interventions. We are establishing a web portal to facilitate this process (soon available at: http://www.parcplace.org). For inclusion on this webpage, send your innovative climate change adaptation management strategies for amphibians to Dede Olson: dede.olson@oregonstate.edu. Photographs are encouraged, along with a text explanation including geographic area of use, habitat type, and amphibian species likely to benefit from the action.

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Literature Cited

Meehl, G.A., Stocker, T.F., Collins, W.D., Friedlingstein, P., Gaye, A.T., Gregory, J.M., Kitoh, A., Knutti, R., Murphy, J.M., Noda, A., Raper, S.C.B., Watterson, I.G., Weaver, A.J., Zhao, Z.-C. (2007) Global climate projections. In Climate Change 2007: The Physical Science Basis, S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller, eds. (Cambridge, United Kingdom and New York, NY, USA, Cambridge University Press), pp. 747-845.

Mitchell, N.J. (2001) Males call more from wetter nests: effects of substrate water potential on reproductive behaviours of terrestrial toadlets.

Proceedings of the Royal Society of London B, 268, 87-93.

Pounds, A.J., Fogden, M.P.L., and Campbell, J.H. (1999) Biological response to climate change on a tropical mountain. Nature, 398, 611-615.

Pounds, J.A., Carnaval, A.C., Puschendorf, R., Haddad, C.F.B., and Masters, K.L. (2006) Responding to amphibian loss. Science, 314, 1541.

Shoo, L.P., Olson, D.H., McMenamin, S.K., Murray, K.A., Van Sluys, M., Donnelly, M.A., Stratford, D., Terhivuo, J., Merino-Viteri, A., Herbert, S.M., Bishop, P.J., Corn, P.S., Dovey, L., Griffiths, R.A., Lowe, K., Mahony, M., McCallum, H., Shuker, J.D., Simpkins, C., Skerratt, L.F., Williams, S.E., Hero, J-M. (2011) Engineering a future for amphibians under climate change. Journal of Applied Ecology, 48, 487-492.

Solar-powered pumps and cattle exclosures retain water levels and habitat for the Chiricahua leopard frog *Lithobates chiricahuensis* in New Mexico. Credit: Bruce Christman

Complete management scheme of populations: the usage of physiological indicators to assess the impact of habitat availability and fragmentation.

By Agnès Janin, Jean-Paul Léna and Pierre Joly

Habitat loss and fragmentation are today largely identified as large threats to amphibian populations (Cushman 2006). Unfortunately, tools to evaluate healthiness of populations are not fully developed, since distribution data are very often used in landscape-scale studies. However, conservationists and researchers need to identify populations in danger before extinction. We proposed and investigated three scenarios to assess the respective effects of habitat availability and fragmentation on common toad (*Bufo bufo*) populations: (1) survey of occurrence on a large sample of ponds which is time consuming but not financial consuming, (2) survey of body condition, a physiological indicator directly related to fitness in amphibians, evaluated in a sub-sample of populations, which is less time consuming and not financial consuming, (3) survey of hormonal status, potentially related to fitness in a non-linear way, in a very reduced sample of populations, which is also less time consuming but financial consuming. The objectives of our work (see in details Janin et al. 2011) were first to estimate respective effects of habitat availability and fragmentation on toad occurrence and physiological state and, second, to examine whether these approaches lead to a different interpretation of landscape effects, notably in order to draw a complete management scheme of landscape surrounding amphibian populations. We notably discuss how fragmentation is likely to affect the different types of movement of amphibians: supplementation ones (movements between multiple habitat fragments in order to acquire a sufficient amount of resources), complementation ones (seasonal migrations between two different habitats required to complete complex life cycle) and dispersal ones (change of population for reproduction) (Fig. 1) and what proxies (occurrence, physiological indicators, ...) are linked to each types of movements (Dunning et al., 1992).

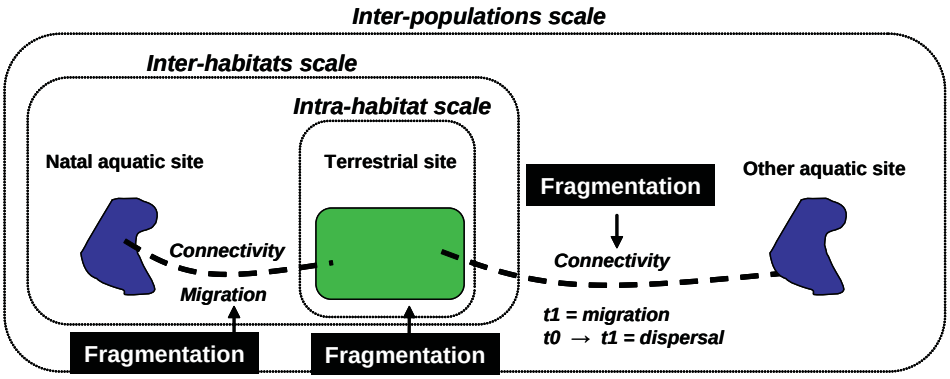

Figure 1. Different influences of fragmentation according to the different movement scales of amphibian species with aquatic larvae: the intra-habitat scale affecting supplementation movements; the inter-habitats scale affecting complementation movements; the inter-populations scale at which take place dispersal events.

Our study was conducted in lowlands of the Rhone-Alps region (south-eastern France) (Janin et al., 2009). We investigated landscape structures with special emphasis to the landscape

structure of forested areas that constitute the usual habitat of toads apart from the reproductive period. We thus focused on forest availability and forest fragmentation using respectively the area of forested grounds around ponds and the number of forest fragments as landscape descriptors. The influence of those descriptors was examined at three spatial scales (500 m, 1 km and 2 km from the focal pond) given the range of migration distances reported for the common toad. We surveyed the occurrence of toads in 2006 by visiting the 212 selected ponds (scenario 1). In 2007, we first measured body condition of 315 males in a sub-sample of 17 populations (scenario 2), and we determined urinary corticosterone concentration of 81 males and 74 females from a reduced sample of 8 populations (scenario 3). Body condition was assessed through the classical measurement of both snout-urostyle length and body mass. We determined the corticosterone level (i.e. the main glucocorticoids released by amphibians) in urine samples to assess the physiological response to stress. Urinary dosage allows to assess both medium and long-term experience of stress, conforms to conservation standards in avoiding invasive sampling and urine sampling is relatively easy since the toads respond to handling by a micturition reflex. For estimating basal Urinary Corticosterone Metabolites UCM, urine was sampled immediately after capture. We used corticosterone Enzyme-Immuno Assay (EIA) kits (N° 500651, Cayman Chemical) to measure UCM concentrations.

Our study showed first that occurrence was negatively affected only by habitat availability at the largest spatial scale (2000 m) whereas the both physiological state indicators studied at the population scale are significantly altered by both habitat availability and fragmentation at the finest spatial scale (500 m). Results obtained with occurrence (scenario 1) and physiological state (scenarios 1 and 2) approaches substantially diverge, which highlights the need to also investigate proximal processes to deeply understand how populations are threatened by landscape modifications. We suggest that toad physiological state mainly depends on within population processes such as competition, edge effect and supplementation process that is expected to plays a major effect, while occurrence data are also heavily influenced by inter-population processes through dispersal and rescue effect taking place at larger spatial scale. The use of physiological state indicators, particularly of body condition (scenario 1), powerful and easy to obtain, could be particularly relevant to detect early warnings of population decline allowing a management before extinction. We propose a complete framework for population conservation at multiple scales integrating both ultimate causes and proximal mechanisms of population decline (Fig. 2).

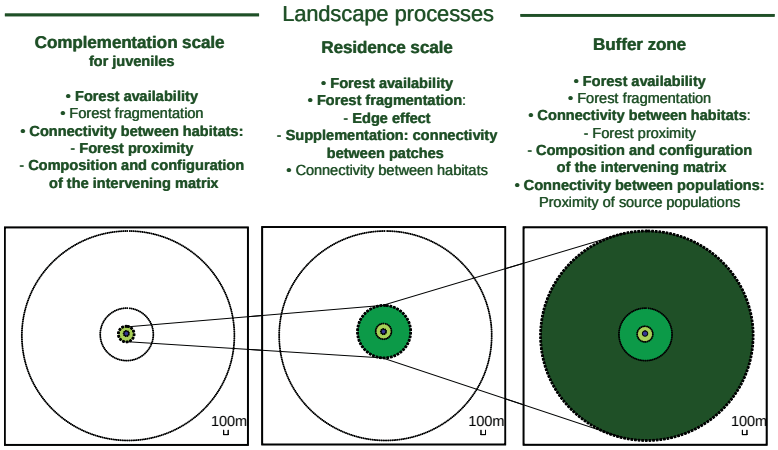

Figure 2. Different scales of landscape management involved in amphibian conservation at a single pond. From the left to the right, the scales of (a) juvenile recruitment very close to the pond at which early growth and first migration go off (b) maintenance area within which most of the individuals of the population live and finally (c) persistence area that includes habitat terrestrial patches that are distant from the pond (with high migration costs) where a restricted part of the population can lives and that can constitutes sources allowing individuals from distinct local population to contribute to rescue effects.

Acknowledgments

We are grateful to all voluntary participants to data collection who assisted us always with good cheer and professionalism. The study was funded by the Rhone-Alps Region.

Literature Cited

Cushman, S.A., 2006. Effects of habitat loss and fragmentation on amphibians: A review and prospectus. Biological Conservation 128, 231-240.

Dunning, J.B., Danielson, B.J., Pulliam, H.R., 1992. Ecological processes that affect populations in complex landscapes. Oïkos 65, 169-175.

Janin, A., Lena, J.P., Ray, N., Delacourt, C., Allemand, P., Joly, P., 2009. Assessing landscape connectivity with calibrated cost-distance modelling: predicting common toad distribution in a context of spreading agriculture. Journal of Applied Ecology 46, 833-841.

Janin, A., Lena, J.P., Joly, P., 2011. Beyond occurrence: Body condition and stress hormone as integrative indicators of habitat availability and fragmentation in the common toad Limnologica. Biological Conservation 144(3), 1008-1016.

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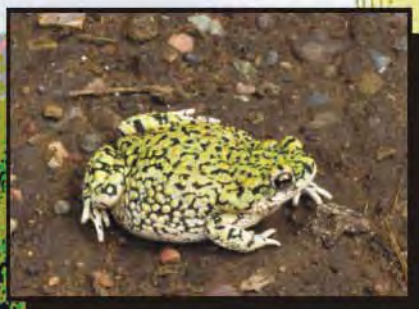

Southeastern Arizona is a natural setting for these meetings and workshops, as it boasts the largest diversity of reptiles and amphibians in the western United States, including 35 species of lizards (the most in the US), 43 snakes, 5 turtles and tortoises, and 15 species of amphibians.

For the latest information go to www.SWPARC.org.

Taruga, a new tree-frog genus endemic to Sri Lanka

By Madhava Meegaskumbura

Using molecular, morphological and life history data, we have identified an endemic lineage of frogs from Sri Lanka, which we have identified as a new genus – *Taruga* (Meegaskumbura et al., 2010).

Previously 15 genera of frogs were recognized from Sri Lanka out of which 3 are endemic. *Taruga* is currently the only genus of endemic frogs among the tree-frogs (Rhacophoridae). Within Rhacophoridae, now there are three genera: *Pseudophilautus*, *Polypedates* and *Taruga*. Curiously, all genera of Sri Lankan endemic frogs are species depauperate and have only 1-4 species contained within them.

We used molecular phylogenetic analyses using six genes (three nuclear and three mitochondrial DNA), morphological analyses of adults and tadpoles and CT scanning of type specimens to analyze osteology in describing *Taruga*.

The best character to distinguish the adults of *Taruga* from *Polypedates* are a set of prominent cone-like projections around the vent. Furthermore, the supratympanic fold of Taruga is straighter than those in *Polypedates*. The snout of *Taruga* is very much acute than that of *Polypedates*.

Considering tadpoles, the vent of *Polypedates* forms a tube between left leg and tail, and in *Taruga*, there is no such tube, only an opening between leg and tail. There are also several more features of the mouth cavity, such as the number of projections on the tongue, shape of the tongue etc. that helps to distinguish *Taruga* from *Polypedates*.

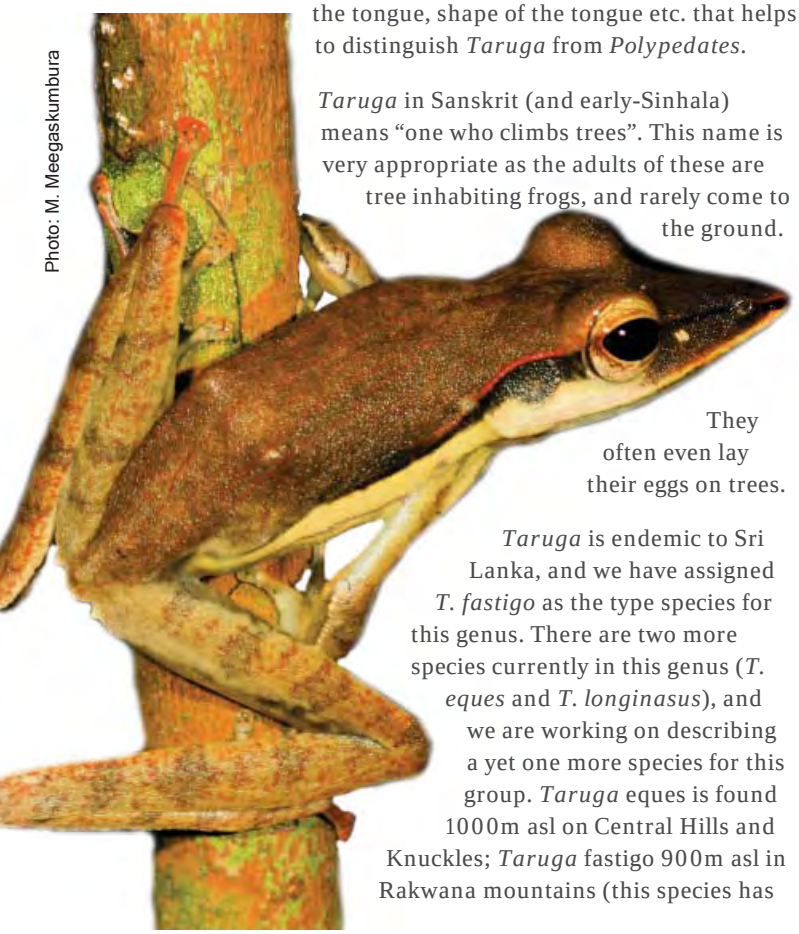

Photo: M. Meegaskumbura

Taruga in Sanskrit (and early-Sinhala) means "one who climbs trees". This name is very appropriate as the adults of these are tree inhabiting frogs, and rarely come to the ground. They often even lay their eggs on trees.

Taruga is endemic to Sri Lanka, and we have assigned *T. fastigo* as the type species for this genus. There are two more species currently in this genus (*T. eques* and *T. longinasus*), and we are working on describing a yet one more species for this group. *Taruga* eques is found 1000m asl on Central Hills and Knuckles; *Taruga* fastigo 900m asl in Rakwana mountains (this species has the most restricted range); *Taruga longinasus*: below 600m in the wet-zone lowlands of Sri Lanka (this has the largest range).

Photo: M. Meegaskumbura

All three frogs need shade in the form of a canopy to survive, and shallow and slow flowing streams or puddles to breed.

The female of the species builds a foamy nest overhanging water where eggs develop for a few days, after which tadpoles fall into water where they undergo further development until metamorphosis occurs. The juvenile frogs that emerge from water return to an arboreal life, on trees.

Sri Lanka is now known to contain clade level endemicity despite many land-bridge connections with India (Bossuyt et al., 2004). *Taruga* is yet another such deeply divergent clade.

Acknowledgements

The Department of Wildlife Conservation and Forest Department gave us permission to work on these frogs, we thank them profusely for that. We are very grateful to Robert F. Inger and Harold Voris (Field Museum of Natural History, Chicago, USA); and Peter K. L. Ng and Kelvin Lim (Raffles Museum of Biodiversity Research, National University of Singapore) for the loan of tissue samples of the Southeast Asian taxa included in this study; and to Carla Cicero and Theodore Papenfuss (Museum of Vertebrate Zoology, University of Berkeley, California, USA), and The California Academy of Sciences, USA, for providing many important tissue samples.

You can download this paper from: http://web.mac.com/madhavameegaskumbura or contact first author Madhava Meegaskumbura at madhava_m@mac.com.

Literature Cited

Bossuyt, F., Meegaskumbura, M., Beenaerts, N., Gower, D. J., Pethiyagoda, R., Roelants, K., Mannaert, A., Wilkinson, M., Bahir, M. M., Manamendra-Arachchi, K., Ng, P. K. L., Schneider, C. J., Oommen O. V., and Milinkovitch, M. C. (2004) Local Endemism Within the Western Ghats–Sri Lanka Biodiversity Hotspot, Science 306: 479-481.

Meegaskumbura, M., Meegaskumbura, S., Bowatte, G., Manamendra-Arachchi, K., Pethiyagoda, R., Hanken, J. and Schneider C.J. (2010) *Taruga* (Anura: Rhacophoridae), a new genus of foam-nesting tree frogs endemic to Sri Lanka. Ceylon Journal of Science (Biological Science), 39(2): 75-94.

The Establishment of a Global Ranavirus Reporting System

By Amanda Duffus and Dede Olson

Amphibian declines on a global scale can no longer be pushed aside, nor can the causes behind them. Concerted efforts are now being made in a variety of different ways to understand the root causes of these declines, what their effects are, and how they interact. An area which has received much attention is infectious diseases, specifically emerging infections and the disease that they cause.

Image provided by Jesse Brunner

Currently, there are two major infections recognized to affect amphibian populations with potentially a global impact. Both *Batrachochytrium dendrobatids* (*Bd*), also known as the amphibian chytrid fungus, and ranavirus infections have been listed as notifiable infections/diseases of amphibians by the Office International des Epizooties (OIE, World Animal Health Organization).

Although ranavirus infections in amphibians have been known since the 1960s, infections were not associated with disease or death. It is not until relatively recently (~20 – 25 years) that ranaviruses began to emerge in wild and captive populations of amphibians resulting in large scale morbidity and mortality events in both anurans and urodeles of all life history stages. Since then, ranavirus detections have not only increased in geographic scope, but also relative to the number of species that are known to be affected. While this has potentially severe ramifications for amphibian populations, there has been relatively little coordination between researchers who are scattered around the globe to investigate the issues collectively.

The first major infectious disease to receive a great deal of worldwide attention has been *Batrachochytrium dendrobatids* (*Bd*). In 2007, a web database was established in cooperation with Imperial College, London and the US Forest Service to track the global distribution of Bd. This site has been a successful endeavor, with over 52,000 entries contributed by many different researchers around the globe (www.bd-maps.net) and has proved to be an invaluable resource for many different user groups.

We now hope to do a similar collaborative effort to document ranaviruses, which are also emerging infections in amphibians on a global scale. Currently, there is no centralized data base that monitors the distribution of ranaviruses, or collects other relevant information to infections and mortality events associated with the virus. The US Forest Service in partnership with Imperial College and Partners in Amphibian and Reptile Conservation (PARC) is hoping to develop such a reporting system and informational website. Our goal is to provide an informative, yet user friendly site. Now, we seek input from researchers, policymakers, and other potential users for their insights.

To streamline the process we are seeking responses to the following questions:

1. What capabilities would you like to see in a ranavirus reporting website/database?
2. How/if you would use the website/database?
3. What types of data would you like to see included, please indicate if they are necessary and/or useful in your view.
4. What are your concerns about the data that you provide and what possible pitfalls can you foresee?

Notes:

- To avoid potential misuse of this site, the release of data on sensitive species will be addressed.
- Although ranaviruses affect several other taxonomic groups, our current focus during the development of this reporting system will be on amphibians; we will discuss expansion of it to other taxa at a later time.
- Since there are many different types and strains of ranaviruses that are known to infect amphibians (and other taxonomic groups), molecular data will be incorporated into the data base to address viral phylogeny issues.

In order for this process to be completed in a timely manner, we ask that your replies be concise, constructive and returned to Dr. Amanda Duffus (aduffus@gdn.edu) or by post (address below) by June 24th, 2011, so that responses can be compiled and used by the Advisory Panel. The Advisory Panel consists of individuals from US Forest Service, Imperial College, PARC and other internationally recognized ranavirus experts.

This summer, the First International Symposium on Ranaviruses is being held during the Joint Meeting of Ichthyologists and Herpetologists (July 8, Minneapolis, MN, USA). This is the first time that a an international gathering of ranavirus experts, who work on many different taxa, will be discussion the threat that this group of pathogens pose to the animals that they infect. The list of presenters at the symposium is truly international, containing speakers from 3 different continents, all recognized to be leading experts in their fields.

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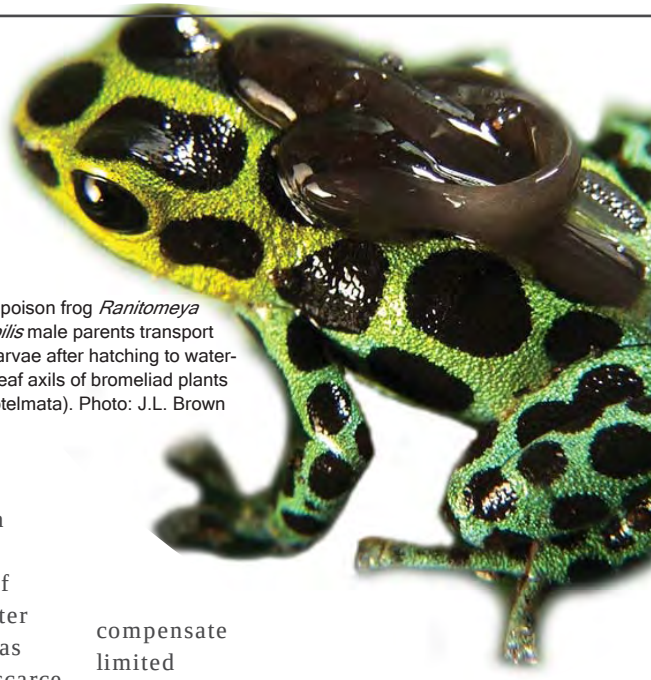
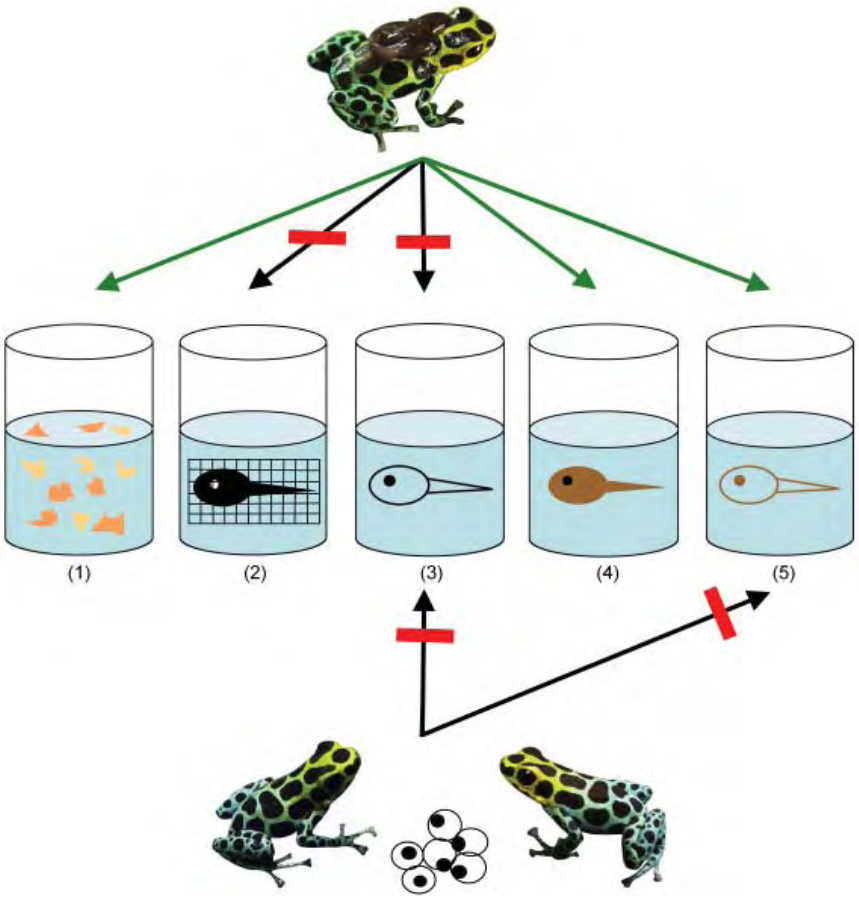
The smell of success: choice of larval rearing sites by means of chemical cues in a Peruvian poison frog

By Lisa M. Schulte, Justin Yeager, Rainer Schulte, Michael Veith, Philine Werner, Lothar A. Beck and Stefan Lötters



In the poison frog *Ranitomeya variabilis* male parents transport their larvae after hatching to water-filled leaf axils of bromeliad plants (phytotelmata). Photo: J.L. Brown

Parental care is a common strategy among vertebrates to assure successful reproduction. Especially anuran amphibians have evolved a remarkable diversity of reproductive methods, often associated with parental care such as egg guarding and tadpole transport (Summers and McKeon 2004). Numerous studies have demonstrated high levels of parental care in poison frogs (*Aromobatidae, Dendrobatidae*) that involve the transport of single tadpoles from egg deposition sites to phytotelmata (small water bodies in plants such as leaf axils of bromeliads; e.g. Zimmermann and Zimmermann 1988; Summers and McKeon 2004; Lötters et al. 2007; Poelman and Dicke 2007; Wells 2007; Brown et al. 2008a; Brown et al. 2008b). This behaviour minimizes the risk of predation associated with larger water bodies (Aspbury and Juliano 1998) as well as competition for the already scarce food resources (Summers 1990). In several species cannibalistic behaviour between tadpoles in the same pool could be shown. That way the tadpoles are able to eliminate competitors and also compensate limited food resources in phytotelmata (Summers 1990; Caldwell 1993; Wells 2007).

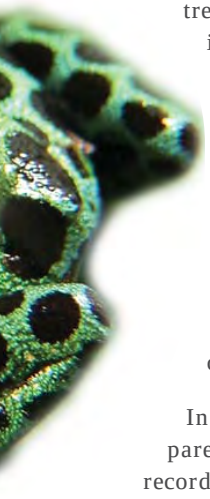


The pool-choice experiments for tadpole and egg deposition using cups as artificial phytotelmata carried out by Schulte and colleagues. Cups contained (1) fish food, (2) a cannibalistic tadpole in a cage, (3) chemical cues of cannibalistic tadpoles (cup wrapped), (4) an omnivorous tadpole or (5) chemical cues of omnivorous tadpoles (cup wrapped). The green arrows show which kinds of cups were used by the frogs for tadpole (above) and egg depositions (below) beside each time 'clean' water, while the red crossed arrows show cups avoided by nurse frogs.

To avoid predation by previously deposited tadpoles the adult frogs examine phytotelmata before the deposition of a new larvae and avoid already occupied pools (Weygoldt 1980; Zimmermann and Zimmermann 1984; Summers 1990; Brust 1993; Caldwell and de Araújo 1998; Caldwell and de Oliveira 1999; Summers 1999; Poelman and Dicke 2007; Brown et al. 2008a; Brown et al. 2008b; Stynoski 2009). Potential cues which frogs may use to identify occupied pools may be movement, visual identification or chemical cues. Because the tadpoles of many species lack a special visual display or movement to the frogs, or even tend to hide at the bottom of the phytotelmata, it may be hypothesized that chemical cues play a role in the identification and avoidance of predatory tadpoles.

The poison frog species *Ranitomeya variabilis* from the lower Amazonian versant of the northern Andes of Peru oviposits in phytotelmata and transports its larvae singly into different phytotelmata after hatching (Brown et al. 2008a). We tested experimentally if the adult frogs of this species are able to recognize larval cues and use them to avoid deposition with cannibalistic tadpoles. We established our experiments in a late-stage secondary forest in Peru, where we hang up pairs of dark, non-transparent plastic cups (to impair visual inspection), which served as artificial phytotelmata. This pairwise

setup consisted of one cup with 25 ml clean water and one cup with 25 ml tadpole-treated water. Tadpoles were held in captivity in originally clean water for producing tadpole-treated water. This water was taken and mixed for the use in the field. Cups in the field were checked with a small flashlight for newly-deposited clutches and tadpoles every other day and both, clean and tadpole-treated water was changed afterwards.



In total 41 larval depositions by parent *Ranitomeya variabilis* were recorded, 30 of which were in clean water indicating a significant avoidance of tadpole treated water. Results for egg depositions were similar. Thirty-two of 34 clutches were placed in clean water versus water treated by cannibalistic larvae, showing that the avoidance of water treated by cannibalistic larvae was even stronger for egg than for tadpole depositions.

To determine whether the results were similar when the cannibalistic tadpoles were present to those where just their chemical cues were used, we also placed pairs of transparent plastic cups in our study site. Each cup was equipped with a cage and in one cage of each pair we placed a tadpole of *R. variabilis*, while the other one stayed empty. We saw a similar trend as in the experiments with only chemical cues of cannibalistic tadpoles: of 36 larvae deposited, 26 were deposited in clean water vs. pools containing cannibalistic larvae.

Furthermore, we tested if the frogs can even distinguish between tadpoles with different feeding strategies. Deposition of tadpoles with non-cannibalistic tadpoles could be advantageous as these could serve as prey items. On the other hand, competition risk could also increase within the small phytotelmata. In terms of egg deposition, non-cannibalistic tadpoles may pose a potential threat, as larvae of several anuran species have been shown to feed on anuran eggs (Jungfer and Weygoldt 1999).

We conducted the same experiments as with the cannibalistic tadpoles, with non-cannibalistic tadpoles of the *bufonid* toad *Rhinella poeppigii*. Chemical cues of these tadpoles presented to the frogs were not avoided for tadpole deposition, as only nine of 24 larvae were deposited in clean water. This result is significantly distinct from the result of the chemical-cues of cannibalistic tadpoles experiment. However *R. variabilis* reacted differently with regard to oviposition preferences. Here, 13 of 14 clutches were deposited in clean water, showing a significant avoidance of the non-cannibalistic tadpoles despite to egg-deposition. When *R. poeppigii* were present in the pools, results for tadpole deposition were the similar (23 of 39 larvae depositions in clean water), while clutches were not deposited at all.

Due to the unambiguous deposition decisions we can make the following conclusion: In *R. variabilis*, chemical cues play a role in the identification and avoidance of predatory tadpoles in phytotelmata. These findings strongly suggest that these frogs act by means of chemical cues and that chemical recognition of predators is more effective than identification by physical or visual cues because even hidden predators can be detected. Moreover we could see that they reacted differently to cannibalistic versus non-cannibalistic tadpoles and that they also took independent decisions for tadpole and egg depositions.

The study adds to the growing understanding of parental care in poison frogs and, more generally, the functions of chemical cues in amphibians. It adds a unique component to the general knowledge of reproductive habitat selection in anurans, specifically those with advanced parental care of a well-studied group of poison frogs (*Dendrobatinae*). Our results raise questions regarding the nature of the chemical cues themselves. What compounds are involved and which species are able to produce them? Are species adapted only to recognize cues of sympatric species, or are cues generalized across close relatives? Furthermore the mechanism of cue recognition is unknown. Answering these questions would represent a substantial advancement in our understanding of the evolution and utilization of chemical communication in amphibians.

Full article: Animal Behaviour (2+_011), doi:10.1016/j.anbehav.2011.02.019

Literature Cited

Aspbury, A. S. & Juliano, S. A. 1998. Negative effects of habitat drying and prior exploitation on the detritus resource in an ephemeral aquatic habitat. Oecologia, 115, 137-148.

Brown, J. L., Morales, V. & Summers, K. 2008a. Divergence in parental care, habitat selection and larval life history between two species of Peruvian poison frogs: an experimental analysis. Journal of Evolutionary Biology, 21, 1534-1543.

Brown, J. L., Twomey, E., Morales, V. & Summers, K. 2008b. Phytotelm size in relation to parental care and mating strategies in two species of Peruvian poison frogs. Behaviour, 145, 1139-1165.

Brust, D. G. 1993. Maternal brood care by Dendrobates pumilio: a frog that feeds its young. Journal of Herpetology, 27, 96-98.

Caldwell, J. P. 1993. Brazil nut fruit capsules as phytotelmata: interactions among anuran and insect larvae. Canadian Journal of Zoology, 71, 1193-1201.

Caldwell, J. P. & de Araújo, M. C. 1998. Cannibalistic interactions resulting from indiscriminate predatory behavior in tadpoles of poison frogs (Anura: Dendrobatidae). Biotropica, 30, 92-103.

Caldwell, J. P. & de Oliveira, V. R. L. 1999. Determinants of biparental care in the spotted poison frog, *Dendrobates vanzolinii* (Anura: Dendrobatidae). Copeia, 1999, 565-575.

Jungfer, K. H. & Weygoldt, P. 1999. Biparental care in the tadpole-feeding Amazonian treefrog *Osteocephalus oophagus*. Amphibia-Reptilia, 20, 235-249.

Lötters, S., Jungfer, K.-H., Henkel, F.-W. & Schmidt, W. 2007. Poison Frogs: Biology, Species & Captive Husbandry. Frankfurt: Chimaira.

Poelman, E. H. & Dicke, M. 2007. Offering offspring as food to cannibals: oviposition strategies of Amazonian poison frogs (*Dendrobates ventrimaculatus*). Evolutionary Ecology, 21, 215-227.

Stynoski, J. L. 2009. Discrimination of offspring by indirect recognition in an egg-feeding dendrobatid frog, *Oophaga pumilio*. Animal Behaviour, 78, 1351-1356.

Summers, K. 1990. Paternal care and the cost of polygyny in the green dart-poison frog. Behavioral Ecology and Sociobiology, 27, 307-313.

Summers, K. 1999. The effects of cannibalism on Amazonian poison frog egg and tadpole deposition and survivorship in Heliconia axil pools. Oecologia, 119, 557-564.

Summers, K. & McKeon, C. S. 2004. The evolutionary ecology of phytotelmata use in Neotropical poison frogs. Miscellaneous Publications Museum of Zoology University of Michigan, 193, 55–73.

Wells, K. D. 2007. The Ecology and Behavior of Amphibians. Chicago: University Of Chicago Press.

Weygoldt, P. 1980. Complex brood care and reproductive behaviour in captive poison-arrow frogs, *Dendrobates pumilio O*. Schmidt. Behavioral Ecology and Sociobiology, 7, 329-332.

Zimmermann, H. & Zimmermann, E. 1984. Durch Nachzucht erhalten: Baumsteigerfrösche *Dendrobates quinquevittatus* und *D. reticultus*. Aquarien Magazin, 18, 35-41.

Zimmermann, H. & Zimmermann, E. 1988. Etho-Taxonomie und zoogeographische Artengruppenbildung bei Pfeilgiftfröschen (Anura: Dendrobatidae). Salamandra, 24, 125-160.

Conserving amphibian communities in urban landscapes

By Andrew J. Hamer and Kirsten M. Parris

Urbanization currently threatens over one-third of amphibian species worldwide via three key ecological processes: habitat loss, habitat fragmentation and isolation, and habitat degradation (Hamer & McDonnell 2008). Ponds and wetlands are often destroyed due to urban development, or existing ponds can have their hydrology modified and exotic species introduced (Kentula et al., 2004; Pearl et al., 2005), and the upland terrestrial habitat can be removed or fragmented by roads and other urban infrastructure (Hamer & McDonnell, 2008). It is therefore evident that urbanization is contributing to declines in amphibian populations. We assessed the impact of urbanization on amphibian communities in the Greater Melbourne area, Australia, by considering the number of frog species breeding (i.e. species richness) at 65 ponds (Hamer & Parris, 2011). This study was conducted to determine which variables contributed the greatest to patterns of species richness and the composition of larval amphibian communities at ponds, and to investigate how individual species respond to habitat change along an urban-rural gradient. Understanding patterns of species distribution will enable effective conservation strategies to be developed for amphibians in urban landscapes.

Figure 1. Opposite ends of the urbanization gradient. (a) ornamental pond in a city park, (b) remnant wetland on the urban fringe in the Greater Melbourne area, Australia, October 2007.

Methods

We used a variety of aquatic sampling methods to survey the tadpole communities in the ponds to maximize the probability of detecting a species, including bottle traps, fish traps, dip-netting and visual observations. A suite of habitat variables was recorded at ponds such as the proportion cover of aquatic vegetation, degree of pond shading, water conductivity, the density of predatory fish (primarily the mosquitofish *Gambusia holbrooki*), hydroperiod (permanent or ephemeral) and pond-edge perimeter, all of which have been shown in previous studies to affect amphibian communities (Hamer & McDonnell, 2008). We also measured the density of human residents within 1 km of a pond using Victorian Government census data, and the proportion of land mapped as green open space, such as parks, gardens and remnant vegetation.

Survey Results

Species richness - During the aquatic surveys conducted between 2007 and 2009, we detected the tadpoles of six frog species, including the common eastern froglet (*Crinia signifera*), Victorian smooth froglet (*Geocrinia victoriana*), southern bullfrog (*Limnodynastes dumerilii*), striped marsh frog (*Lim. peronii*), Haswell's froglet (*Paracrinia haswelli*) and the southern brown tree frog/whistling tree frog complex (*Litoria ewingii/verreauxii*). All of these species are considered to be common throughout their range in Victoria. We found that ponds surrounded by a high amount of green open space were more likely to have high species richness, whereas ponds surrounded by a high density of human residents were likely to have low species richness. This is most likely due to the availability of terrestrial habitat and landscape connectivity surrounding ponds, and because of the extent of urban development and disturbance around ponds, respectively. There were few species detected at ponds with high water conductivity, high densities of predatory fish, and ponds that were shaded and had a low proportion cover of aquatic vegetation. The larvae of few amphibian species are able to tolerate high water conductivity, while predatory fish such as mosquitofish can rapidly reduce or eliminate larval populations in ponds. Aquatic vegetation provides refuge sites for tadpoles to escape fish predators, however, which may explain why more species were observed

in vegetated ponds. Shaded ponds tend to have lower primary productivity due to the reduced amount of sunlight they receive and lower water temperature, which can result in less food available for tadpoles.

Community composition - The distribution of species was arranged along two environmental axes. Axis 1 described an urbanization gradient from shaded ponds containing few aquatic plants and high densities of predatory fish, and surrounded by high human densities and a low proportion of green open space towards the city center (Fig. 1a), to sunny, well-vegetated ponds containing low densities of predatory fish and surrounded by low human densities and a high amount of open space towards the urban fringe (Fig. 1b). Three species were positively associated with the less-urbanized end of axis 1 (common eastern froglet, southern bullfrog and Haswell's froglet; Fig. 2), whereas two species were positively, though only partly, associated with urbanization (striped marsh frog and the southern brown tree frog/whistling tree frog complex). Axis 2 described a gradient of water quality, from ponds with low to high water conductivity. No species were associated with the high conductivity end of axis 2.

Conservation Implications

These results indicate that we need to consider the local habitat at ponds and landscape factors when devising management strategies for frog communities in urban areas. For example, management actions at the regional scale can include restoring habitat and maintaining habitat connectivity around ponds and wetlands, while at individual ponds we can improve water quality through the capture and control of stormwater runoff, and eliminate predatory fish by periodically drying ponds. Draining ponds, however, needs to be timed appropriately to avoid killing any tadpoles that may be present. Based on the breeding periods of the frog species we recorded reproducing at ponds, this action should be restricted to early autumn – early winter (March – June). We also need to be cautious about using urban ponds to fulfil the dual role as amphibian habitat and for stormwater management, as they may appear to be attractive to amphibians as breeding sites, but be filled with water contaminated by chemicals, oils and nutrients washed in via runoff from impervious surfaces, such as roads, pavements and parking lots. To avoid amphibians encountering "habitat traps" in urban landscapes, such as stormwater retention ponds, we need to create ponds and wetlands that do not receive stormwater runoff directly from urban sources, but from small localized catchments in green open spaces. Creating, restoring and maintaining clusters or networks of ponds and wetlands in urban landscapes, connected by terrestrial habitat to enable amphibians to move between them, should guarantee the persistence of amphibian communities.

Figure 2. Haswell's froglet (*Paracrinia haswelli*), an "urban-sensitive" species. Photo by Peter Robertson © Museum Victoria.

Current Related Research

Experimental translocation of tadpoles for conservation of urban frogs - we propose to captively-breed frogs at the University of Melbourne, and experimentally translocate tadpoles to a number of suitable but unoccupied wetlands in the Greater Melbourne area. If our translocations are successful, we will assist the conservation of pond-breeding frogs in the Greater Melbourne area by (re-)establishing populations at suitable sites that may be unoccupied because of isolation by roads and urban infrastructure (Parris, 2006).

Optimal management of threatened amphibian populations in urbanizing landscapes – this project will identify habitat management strategies which minimize the probability of local extinction of populations of the endangered growling grass frog (*Litoria raniformis*) in urbanizing areas around Melbourne.

Amphibian use of stormwater retention ponds – this project will determine which frog species use stormwater retention ponds in the Greater Melbourne area, what habitat attributes influence their use by individual species, and whether they can contribute to amphibian conservation.

Acknowledgements

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Literature Cited

Hamer, A. J. & McDonnell, M. J. (2008). Amphibian ecology and conservation in the urbanising world: a review. Biological Conservation 141:2432-2449.

Hamer, A. J. & Parris, K. M. (2011). Local and landscape determinants of amphibian communities in urban ponds. Ecological Applications 21:378-390.

Kentula, M. E.; Gwin, S. E.; Pierson, S. M. (2004). Tracking changes in wetlands with urbanization: sixteen years of experience in Portland, Oregon, USA. Wetlands 24:734-743.

Parris, K. M. (2006). Urban amphibian assemblages as metacommunities. Journal of Animal Ecology 75:757-764.

Pearl, C. A.; Adams, M. J.; Leuthold, N.; Bury R. B. (2005). Amphibian occurrence and aquatic invaders in a changing landscape: implications for wetland mitigation in the Willamette Valley, Oregon, USA. Wetlands 25:76–88.

We are pleased to announce a new round of ARMI Seed Grants. The Amphibian Conservation Seed Grant is sponsored by Conservation International and United States Geological Survey, both long-time partners of PARC (Partners in Amphibian and Reptile Conservation), and is managed by the Amphibian and Reptile Conservancy (ARC, formerly known as Friends of PARC). ARC's mission is to promote amphibian and reptile conservation and efforts that support the mission of PARC and their goals.

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.

The criterion for these awards is that the proposed work should be done on species or issues of concern in the USA. ARMI is particularly interested in funding research on potential stressors of amphibian populations. Do not hesitate to contact Robin Moore if you need clarification or advice. Proposals of no more than 4 pages should be addressed to: Robin Moore, Programs Offcer, ASG at rdmoore@conservation.org. For more information on the US Geological Survey's (USGS) Amphibian Research and Monitoring Initiative (ARMI) ARMI please visit http://armi.usgs.gov/ARMIAWARDS.

Historical disease prevalence, and current survival rates of a threatened amphibian (*Anaxyrus canorus*) with respect to chytrid infection intensity.

Celeste M. Dodge, Vance T. Vredenburg, Cathy Brown, Amy Lind, Heather Mckenny and Steve M. Ostoja

This research is aimed at quantifying the effects of *Batrachochytrium dendrobatidis* (*Bd*) on the Yosemite toad (*Anaxyrus canorus*) which has enigmatically declined in California's Sierra Nevada, an area where *Bd* has imperiled other species. This work represents my master's thesis under Dr. Vance Vredenburg, and a collaboration with three government agencies. Our species comprehensive approach initiates an urgent line of inquiry. Despite the known negative impacts of *Bd* on its sister species, Anaxyrus boreas, the *Bd* susceptibility of *A. canorus* has not been tested. We hypothesize that (i) *A. canorus* populations suffered *Bd* epidemics beginning in the 1970's, and (ii) that remaining *A. canorus* populations, where *Bd* is now endemic, suffer chronic negative effects.

Historical *A. canorus Bd* prevalence was examined by PCR, which revealed an epidemic-like pattern of *Bd* concurrent with observed die-offs during the 1970's. The USGS and NPS will collect swabs to help map current *A. canorus Bd* prevalence. Adult toad survival rates will be analyzed with respect to *Bd* infection intensity by mark and recapture in collaboration with a USFS project that started in 2006. Individuals are marked with PIT tags, and repeatedly tested for *Bd* infection intensity. The effect of *Bd* on juveniles will be determined by an in lab susceptibility experiment, in which subjects will be measured for growth rate, infection level, number of antifungal bacteria, and subsequent survival rates through metamorphosis.

Only when population stressors have been identified can this species can be protected from extinction. Novel research has identified the lethal Bd infection threshold for some amphibians. We aim to identify whether *A. canorus* has a similar threshold, as preventing extinctions of susceptible species may involve curbing infection intensities below such thresholds.

The legacy of an emerging disease: post-epizootic pathogen persistence in alpine lakes

Maxwell B. Joseph

Amphibians face many threats worldwide including habitat loss, invasive species, pollution, and overexploitation, but these threats tend to be concentrated in areas that are heavily impacted by human activities. Recently, a fungal disease known as *chytridiomycosis* has driven catastrophic population declines and extinctions even in relatively undisturbed parts of the globe. In remote and federally protected alpine ecosystems of California, this disease is currently decimating native amphibians, driving some species closer to extinction every year. My research focuses on the ecology of this disease-causing fungus (*Batrachochytrium dendrobatidis*), and the factors that allow it to be so deadly. One possibility is that the survival and reproduction of the fungus does not depend entirely on amphibians. To assess this possibility, I am investigating whether the fungus persists in alpine lakes of the Sierra Nevada after it eliminates all amphibian hosts.

Reintroductions of uninfected frogs to lakes where populations have been previously extirpated provide the most direct test of this possibility. Knowing whether the fungus persists will broaden our understanding of how *B. dendrobatidis* causes extinctions, while directing future conservation efforts in the Sierra Nevada mountains and elsewhere. Furthermore, if *B. dendrobatidis* does not require amphibian hosts to persist, then researchers may currently be unaware of the true scope of the impacts of the recent chytridiomycosis pandemic.

Amphibian success across a gradient of predation pressure – introduced fish in mountain lakes

Rosemary Hartman

I will be studying effects of introduced trout on the cascades frog (*Rana cascadae*, a species of special concern in California), as well as the long-toed salamander (*Ambystoma macrodactylum*, a declining amphibian) and their food web in the Klamath Mountains of Northern California. Although the presence of fish often extirpates amphibians such as *Rana muscosa*, *Rana cascadae* are occasionally found breeding in lakes with fish present, and I plan to examine what fish densities and lake characteristics allow this co-occurrence, as well the impacts of fish on the amphibians' food web. I propose to study food webs and community structure along a gradient of fish densities to see if native amphibians extirpated at high fish density can coexist with low fish densities. I will also test whether refuges allow greater coexistence. Finally, I will test whether fish have indirect effects on populations of amphibians and their prey in nearby fishless ponds. This summer, my crew of undergraduate interns and I will survey 20 lakes in the Trinity Alps Wilderness area for trout, amphibians, and invertebrates, both in the main lake and nearby fishless ponds. Analyzing abundance of amphibians and their prey along a gradient of densities allows me to recommend stocking levels to California Department of Fish and Game for the greatest benefit to biodiversity with the least controversy from recreational fishermen. The ARMI seed grant will allow me to pay for transportation to and from my field site, purchase sampling equipment, and feed my interns while in the field. Thank you for your support.

Recent Publications

Discoveries and Rediscoveries

Discovery of the fifth population of a threatened and endemic toad of the Brazilian Cerrado, Proceratophrys moratoi (Anura, Cycloramphidae).

By Maffei, F. et al.

Proceratophrys moratoi is a small toad endemic to the Cerrado of São Paulo State, southeastern Brazil. Occurs in open areas of low vegetation near small streams and swamps in areas of sandy soil. On October 2009, *P. moratoi* males were recorded vocalizing in a Cerrado remnant at Avaré Municipality, São Paulo State. The males were calling on the soil, in small burrows dug at the base of Brachiaria sp., in an area of very compacted bare soil. This toad is present in the list of endangered species in Brazil and São Paulo State, being included in the categories "Criticallly Endangered" and "Vulnerable", respectively. Until then, this species was known the other four areas: municipalities of Botucatu, Brotas, São Carlos and Bauru. All areas located in a perimeter of less than 120km. The present record is the fifth P. moratoi known population. The new locality is close to the type locality, Botucatu (~45 km), where the species has not been recorded over 10 years. The native vegetation areas of the biome Cerrado in São Paulo State are highly threatened as a consequence of the devastation that occurred in recent decades. The occurrence of this species is particularly restricted, but this new finding suggests that further searches may lead to the discovery of new populations in this intermediate area.

Full article: Maffei, F. et al. (2011) Discovery of the fifth population of a threatened and endemic toad of the Brazilian Cerrado, Proceratophrys moratoi (Anura, Cycloramphidae). Herpetol. Notes: 4; 95-96.

Photo: F. Maffei

Conservation and Ecology

The origin of tiger salamander (*Ambystoma tigrinum*) populations in California, Oregon, and Nevada: introductions or relics?

By Jarrett R. Johnson, Robert C. Thomson, Steven J. Micheletti, and H. Bradley Shaffer.

Whether intentionally or accidentally introduced, exotic species have the capacity to dramatically disrupt native communities. In central California, tiger salamanders (*Ambystoma tigrinum*) have been introduced as a by-product of the sport fishing bait industry. Some of these introductions are relatively well known and have resulted in the formation of hybrids with the imperiled native California tiger salamander (*A. californiense*). Other populations of *A. tigrinum*, particularly in

Photo: J. R. Johnson

the northern and eastern parts of the state, remain poorly characterized and are present in regions where relictual amphibian populations of other species have persisted, suggesting that these might be relictual, native *A. tigrinum*. We used genetic sequence data to determine the provenance of all known extralimital *A. tigrinum* populations in California and adjacent Oregon and Nevada through comparison with reference samples from the native range of *A. tigrinum*. Our results suggest that *A. tigrinum* have been introduced in Northern California, Southern California and the Sierra Nevada, originating from multiple sources across the Great Plains of the US. Furthermore, two populations near the California-Oregon border are most closely related to *A. tigrinum* populations from Washington and Oregon and may represent native tiger salamander lineages.

Full article: Johnson, J. R. et al. (2011) The origin of tiger salamander (*Ambystoma tigrinum*) populations in California, Oregon, and Nevada: introductions or relics? Conservation Genetics: 12; 355-370.

Regional decline of an iconic amphibian species determined by patterns of land use and invasive species distributions.

By Pieter T. J. Johnson1, Valerie J. McKenzie1, Anna C. Peterson1, Jacob L. Kerby, Jennifer Brown, Andrew R. Blaustein and Tina Jackson

In the western USA, growing evidence suggests dramatic declines in the abundance and geographic distribution of the northern leopard frog (*Lithobates pipiens*), historically one of the most widespread frogs in North America. To assess the status of leopard frogs in Colorado and evaluate causes of decline, we coupled statewide resurveys of 196 historically occupied sites with intensive sampling of 274 wetlands stratified by land use. Resurveys of wetlands historically occupied by leopard frogs indicated that population declines in Colorado are regionally variable; the lowest frequency of contemporary observations occurred in eastern Colorado (2-28%), coincident with widespread land development and colonization by non-native bullfrogs (*Lithobates catesbeianus*). Introduced fishes and bullfrogs (local scale) and urbanization (landscape scale) reduced the likelihood of leopard frog occurrence, whereas wetland area was positively associated with detection. Although the pathogenic chytrid *Batrachochytrium dendrobatidis* (*Bd*) was not included in the best-supported models, the negative relationship between leopard frogs and elevation suggests *Bd* could be a contributing factor in declines of frogs in montane areas. Our results highlight the importance of considering multiple, competing hypotheses to explain species declines, particularly when implicated factors operate at different spatial scales.

Full article: Johnson, P. T. J. et al. (in press) Regional decline of an iconic amphibian associated with elevation, land-use change, and invasive species. Conservation Biol: (pieter.johnson@colorado.edu)

Photo: Mark Bowman

Eight years of Giant Bullfrog (*Pyxicephalus adspersus*) research revealed

By Caroline A. Yetman

The Giant Bullfrog (*Pyxicephalus adspersus*) is one of the world's largest, most aggressive and elusive anurans. In 2001 the species was listed as Near-Threatened in South Africa after population declines of 50-80% were caused mainly by habitat loss in Gauteng Province. In 2003 a research project was initiated on various aspects of the bullfrog's ecology. The project would culminate in the compilation of a comprehensive conservation management plan for the species. Results from an ecological niche model that was used to predict the bullfrog's geographic range, have important implications for this species' global conservation status. Estimates of bullfrog population genetic structure and gene flow in the eastern interior of South Africa should strongly influence the meta-population management of bullfrogs at inter- and intra-provincial scales. Five summers spent radio- or spool-tracking adult bullfrogs in Diepsloot, Gauteng, provided crucial information for the physical protection and monitoring of breeding populations. Three summers of mark-recapture research generated long-overdue bullfrog demographic and life history information. This diverse and challenging research has cleared various misconceptions about Africa's fascinating Giant Bullfrog. Ordinary citizens can contribute significantly towards improved conservation of this species in southern Africa.

Articles: Yetman, C. A. & Ferguson, J. W. H. (2011) Spawning and non-breeding activity of adult giant bullfrogs (*Pyxicephalus adspersus*). African. J. Herpetol: 60; 1-17.

Yetman, C. A. & Ferguson, J. W. H. (2011) Conservation implications of spatial habitat use by adult giant bullfrogs (*Pyxicephalus adspersus*). J. Herpetol: 45; 56-62. (cayetman@zoology.up.ac.za)

Viability analysis of a threatened amphibian population: modelling the past, present and future.

By Enrico Di Minin and Richard A. Griffiths

Few long-term data sets that provide the demographic and environmental data demanded by population viability analyses are available, making it very difficult to explore the impact of management actions on large temporal scales. We used an unprecedented 37-yr data set and RAMAS Metapop to model the persistence of natterjack toads (*Epidalea* [Bufo] *calamita*) on a heathland in southern Britain under different threat and management scenarios. A retrospective analysis showed that the best fit between the predicted population trajectories and the real population was achieved when management was modelled through a considerable increase in carrying capacity each year. However, models showed that even with continued management the population will still be under high risk of extinction if other environmental factors remain unchanged. Sensitivity analyses and simulated management scenarios indicated that the population was most sensitive to changes in the survival of juvenile (i.e. 1-2 yr old) toads. Furthermore, as a result of reduced recruitment, the risk of extinction was predicted to increase if the frequency and severity of pond desiccation increased as a result of climate change. When juvenile survival was increased in combination with low frequency and severity of pond desiccation, low levels of extinction risk were predicted regardless of the carrying capacity. The results suggest that amphibian populations that are responding to management against a background of natural fluctuations may remain vulnerable to extinction for several decades. The risk of extinction may continue to increase if ongoing habitat management fails to offset reductions in recruitment and juvenile survival caused by environmental change.

Full article: Di Minin, E. & Griffiths, R.A. 2011. Viability analysis of a threatened amphibian population: modelling the past, present and future. Ecography 34: 162-169.

Natterjack toad (*Epidalea* [Bufo] *calamita*). Photo: R. A. Griffiths

Indirect effects of introduced trout on Cascades frogs (*Rana cascadae*) via shared aquatic prey.

By Maxwell B. Joseph, Jonah Piovia-Scott, Sharon P. Lawler and Karen L. Pope.

The introduction of trout to montane lakes has negatively affected amphibian populations across the western United States. In northern California's Klamath–Siskiyou Mountains, introduced trout have diminished the distribution and abundance of native Cascades frogs (*Rana cascadae*). Such impacts are primarily attributed to predation on tadpoles, but if trout consume larval aquatic insects that are available to adult frogs only after emergence, resource competition may negatively affect frogs that persist with trout by reducing prey availability. We compared stomach contents of *R. cascadae* between lakes with trout and lakes from which introduced trout were removed. In lakes with trout, frogs consumed a smaller proportion of adult aquatic insects, and trout consumed the larvae of aquatic insects that are, as adults, eaten by *R. cascadae*. Across study lakes, fish density was negatively related to caddisfly (Trichoptera) consumption, but positively related to grasshopper (Orthoptera) consumption by frogs. At lakes with greater aquatic habitat complexity, frogs consumed more water striders (Hemiptera: Gerridae) and terrestrial spiders (Araneae). Reductions in the availability of emerging aquatic insects may cause *R. cascadae* to consume more terrestrial prey where trout are present. Similar compensatory diet shifts could occur for other terrestrial predators, with consequences for energy transfer between lakes and terrestrial food webs.

Full article: Joseph, M. B. et al. (2011) Indirect effects of introduced trout on Cascades frogs (*Rana cascadae*) via shared aquatic prey. Freshwater Biol: 56; 828-838.

Predators and invasive plants affect performance of amphibian larvae.

By Watling, J. I. et al.

Exotic ecosystem engineers induce structural and qualitative habitat changes in invaded landscapes, yet studies rarely examine the effects of both of these changes on native taxa. We used a factorial experiment in natural, predator-containing environments to determine whether performance of amphibian larvae was affected by predators and/or changes in habitat structure or chemistry associated with the invasive shrub Amur honeysuckle (Lonicera maackii). Invertebrate predators significantly reduced survival of American toad (Anaxyrus americanus) larvae, whereas tadpole development was accelerated in pools inoculated with the chemical signature of L. maackii. The significant effect of L. maackii chemistry on A. americanus larvae suggests that invasive species may have non-intuitive effects even on native taxa with which they share no trophic connection, and may represent cryptic components of the multiple, interactive drivers of biodiversity change.

Full article: Watling, J. I. et al. (2011) Predators and invasive plants affect performance of amphibian larvae. Oikos: 120; 735-739.

Integrating species traits with extrinsic threats: closing the gap between predicting and preventing species declines.

By Kris Murray, Dan Rosauer, Hamish I. McCallum, and Lee F. Skerratt.

In studies of extinction risk, it is often insufficient to conclude that species with narrow ranges or small clutch sizes require prioritized protection. To improve conservation outcomes, we also need to know which threats interact with these traits to endanger some species but not others. In this study, we integrated the spatial patterns of key threats to Australian amphibians with species' ecological/life-history traits to both predict declining species and identify their likely threats. In addition to confirming the importance of previously identified traits (e.g., narrow range size), we find that extrinsic threats (primarily the disease *chytridiomycosis* and invasive mosquitofish) are equally important and interact with intrinsic traits (primarily ecological group) to create guild-specific pathways to decline in our model system. Integrating the spatial patterns of extrinsic threats in extinction risk analyses will improve our ability to detect and manage endangered species into the future, particularly where data deficiency is a problem.

Full article: Murray, K. A. et al. (2010) Integrating species traits with extrinsic threats: closing the gap between predicting and preventing species declines. Proc. R. Soc. B: 278; 1515-1523. (k.murray1@uq.edu.au)

Elevational patterns of species richness, range and body size for spiny frogs.

By Junhua Hu, Feng Xie, Cheng Li and Jianping Jiang

Spiny frogs of the subfamily Painae (Anura: Dicroglossidae) are widespread, but endemic to Asia. They branched into two tribes, Paini and Quasipaini. We explored the frog richness-altitude relationship, and also sought to test Rapoport's altitudinal rule and Bergmann's rule for spiny frogs. The species richness of spiny frogs across four different altitudinal band widths (100 m, 200 m, 300 m and 400 m) all showed hump-shaped patterns along altitudinal gradient. The peak of Quasipaini species richness occurred at lower elevations than the maxima of Paini. The area did not explain a significant amount of variation in total, nor Paini species richness, but it did explain variation in Quasipaini. Species altitudinal ranges did not expand with an increase in the midpoints of altitudinal ranges. A significant negative correlation

Adult Cascades frog (*Rana cascadae*) in Rattlesnake Canyon, Trinity Alps Wilderness, California. Photo: M. B. Joseph.

between body size and elevation was exhibited. Our findings demonstrate that Rapoport's altitudinal rule is not a compulsory attribute of spiny frogs and also suggest that Bergmann's rule is not generally applicable to amphibians. The study highlights a need to explore the underlying mechanisms of species richness patterns, particularly for amphibians in macroecology.

Full article: Hu J., Xie F., Li C. & Jiang J. 2011. Elevational patterns of species richness, range and body size for spiny frogs. PLoS ONE. DOI: 10.1371/journal.pone.0019817.

For species of the subfamily Painae (Anura: Dicroglossidae) with spine, spines scattered on the ventral region in Quasipaini tribe (left); two patches of spines on the breast in Paini tribe (right). Photo by Jianping Jiang.

Heterozygosity-fitness correlations among wild populations of European tree frog (*Hyla arborea*) detect fixation load

By Emilien Luquet & Sandrine Plénet

Photo: M. Luquet

Quantifying the impacts of inbreeding and genetic drift on fitness traits in fragmented populations is becoming a major goal in conservation biology. Such impacts occur at different levels and involve different sets of loci. Genetic drift randomly fixes slightly deleterious alleles leading to different fixation load among populations. In contrast, inbreeding depression arises from highly deleterious alleles in segregation within a population and creates variation among individuals. A popular approach is to measure correlations between molecular variation and phenotypic performances. This approach has been mainly used at the individual level to detect inbreeding depression within populations and sometimes at the population level but without consideration about the genetic processes measured. For the first time, we used in this study a molecular approach considering both the interpopulation and intrapopulation level to discriminate the relative importance of inbreeding depression versus fixation load in isolated and non-fragmented populations of European tree frog (*Hyla arborea*), complemented with interpopulational crosses. We demonstrated that the positive correlations observed between genetic heterozygosity and larval performances on merged data were mainly caused by co-variations in genetic diversity and fixation load among populations rather than by inbreeding depression and segregating deleterious alleles within populations. Such a method is highly relevant in a conservation perspective because, depending on how populations lose fitness (inbreeding versus fixation load), specific management actions may be designed to improve the persistence of populations.

Full article: Luquet, E. et al. (2011) Heterozygosity-fitness correlations among wild populations of European tree frog (Hyla arborea) detect fixation load. Molecular Ecology: 20; 1877-1887. (emilien.luquet@gmail.com) www.emilien-luquet.com

American bullfrog invasion in Argentina: where should we take urgent measures?

By Nori, J.; Akmentins, M; Ghirardi, R. Frutos, N. & Leynaud G.

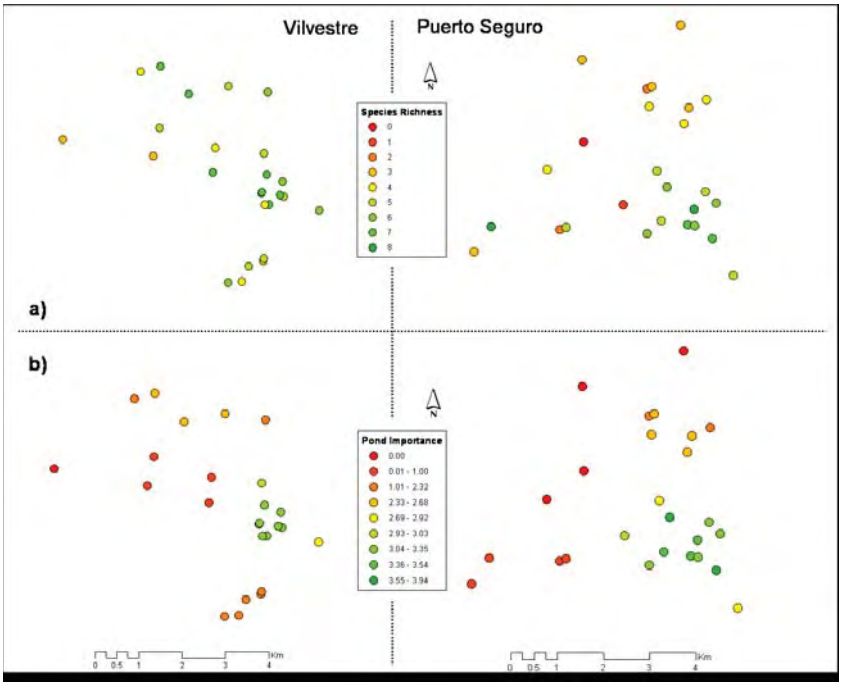
Argentina is the country with the most geographically extended biological invasion of the American bullfrog (*Lithobates catesbeianus*) in South America after Brazil. We used a maximum entropy ecological niche modeling algorithm (using records of the native range of American bullfrog) to project the model onto the whole of Argentina. We determined the most suitable habitats for this invasive alien species and where we consider urgent measures should be taken. Our projections showed good agreement with known feral populations of American bullfrog in Argentina. By implementing the "Multivariate Environmental Similarity Surface" analysis, we be able to determine that factors such as low precipitations or highest altitudes could be limiting the species' ability to invade the west and south of the country. We suggest that strategies should focus on detecting established feral populations of the American bullfrog and preventing further introductions or range expansion of feral populations in the northeast portion of the country. Lastly, we report a new feral population of bullfrogs in Argentina.

Full article: Nori, J. et al. (2011) American bullfrog invasion in Argentina: where should we take urgent measures? Biodiversity & Conservation: 20; 1125-1132. (javiernori@gmail.com)

The pond network: Can structural connectivity reflect on (amphibian) biodiversity patterns?

By Raquel Ribeiro, Miguel A. Carretero, Neftalí Sillero, Gonzalo Alarcos, Manuel Ortiz-Santaliestra , Miguel Lizana and Gustavo A. Llorente

Landscape connectivity is considered pivotal for the long term conservation of any organisms' populations. Amphibians are the most threatened vertebrates around the globe, in Europe mostly due to habitat alteration, and to their particular life cycle. Pond breeding amphibians are considered to be organised in metapopulations, enhancing the importance of landscape connectivity in this group of animals. We sampled the amphibian species present in two pond groups in Arribes del Duero Natural Park (Central Western Spain). We applied the graph theory framework to these two pond networks in order to determine the importance of each pond for the entire network structural connectivity. We related the pond importance for connectivity with the species richness present in each pond. We tested if connectivity (partially) determined the presence of the amphibian species sampled using logistic regression. The results show that the structural connectivity of the pond network impacts on the amphibian species richness pattern and that the importance of the pond for the connectivity of the network is an important factor for the presence of some species. Our results, hence, attest the importance of (structural) landscape connectivity determining the pattern of amphibian (functional) colonization in discrete ponds.



Species richness (a) and pond importance using a distance threshold of 1000 m (b) for each pond in both study areas.

Full article: Ribeiro R., Carretero M.A., Sillero N., Alarcos G., Ortiz-Santaliestra M., Lizana M. and Llorente G. A. 2011. The pond network: can structural connectivity reflect on (amphibian) biodiversity patterns? Landscape Ecology 26: 673-682.

Diseases

First record of the chytrid fungus *Batrachochytrium dendrobatidis* in North Africa.

By El Hassan El Mouden, Slimani Tahar, David Donaire, Saioa Fernández-Beaskoetxea, Matthew C Fisher, Jaime Bosch.

The chytrid fungus, *Batrachochytrium dendrobatidis* (*Bd*), has a global distribution and has been identified in all continents except for the amphibian-free Antarctic. *Bd* has a widespread distribution across European Mediterranean biome, however little is known about the distribution of the fungus in North Africa. The presence of *Bd*-infected populations of amphibians in the south of Spain suggests that the chytrid has the capacity to survive in nearby northern regions of Morocco. We sampled 203 amphibian specimens representing 6 families and 9 species collected from 51 sites across Morocco (28 sites on the Rif Mountain, 11 sites on the middle Atlas Mountain and 12 sites on the Gharb plain and Mammora forest) during 2006-2009. *Bd* was detected at four (6%) of the 51 sites surveyed with a prevalence of infection ranged from 0 to 100% and a mean intensity of infection of 122 zoospore genome equivalents. This is the first report of *Bd* in the North Africa and further research is needed to determine its impact on the species inhabit this region.

Full article: El Mouden EH, Slimani T, Donaire D, Fernández-Beaskoetxea S, Fisher MC, Bosch J, 2011. First record of the chytrid fungus *Batrachochytrium dendrobatidis* in North Africa. Herpetological Review 42, 71-75

The ecology and emergence of diseases in freshwaters

By Pieter T. J. Johnson and Sara H. Paull

Freshwater ecosystems represent an interaction nexus between environmental change and a wide variety of infectious diseases. However, few studies have explicitly examined patterns of disease in freshwaters and how they are changing over time. To determine whether water-related diseases in wildlife are increasing, we used generalised additive models to

quantitatively assess trends in the scientific literature (1970-2009) for major freshwater groups, including amphibians, molluscs, crayfishes, fishes, mammals, reptiles and birds. We further examined what types of pathogens were primarily responsible for observed patterns and whether recurrent groups or transmission modes could be identified. After correcting for research effort and temporal autocorrelation, reports of disease increased significantly increases in amphibians, fishes and crayfish, a significant decrease in molluscs and freshwater mammals, and no significant change in freshwater reptiles or birds. Reports of infection in amphibians were dominated by helminths and chytridiomycetes, in crayfish by viruses and fungi, in molluscs by trematodes, in birds and fishes by viruses, protists and helminths, and in reptiles and mammals by helminths and bacteria. Managing freshwater ecosystems to reduce or minimize human and wildlife disease risk – arguably one of the most significant ecosystem services – will require enhanced incorporation of ecological approaches alongside medical and veterinary tools.

Full article: Johnson, P. T. J. & Paull, S. H. (2011) The ecology and emergence of diseases in fresh waters. Freshwater Biol: 56; 638-657. (pieter.johnson@colorado.edu)

Detection of *Batrachochytrium dendrobatidis* in anurans of Cape Cod National Seashore, Barnstable County, Massachusetts, USA.

By Tupper, T.A., Streicher, J.W., Greenspan, S.E., Timm, B.C. and R.P. Cook.

The pathogenic chytrid fungus *Batrachochytrium dendrobatidis* (*Bd*) is known to occur in several regions of the northeastern United States. In a recent article, Tupper et al. (2011) extended this distribution to include several localities in Barnstable County, Massachusetts. To test for *Bd* presence the authors salvaged dead frogs and toads from roads in and around Cape Cod National Seashore during the summer of 2009. These collections resulted in a sampling of 117 anurans that included the following species: Fowler's toads (*Anaxyrus fowleri*), bullfrogs (*Lithobates catesbeianus*), green frogs (*Lithobates clamitans*), spring peepers (*Pseudacris crucifer*), and eastern spadefoot toads (*Scaphiopus holbrooki*). Using molecular assays the authors found that *Bd* was present at 3 of the 4 towns sampled. However, with a single exception, they only detected the fungi on skin samples originating from bullfrogs and green frogs. This finding is likely explained by the aquatic life history of the genus *Lithobates* and the water mediated dispersal of *Bd* zoospores. Given the apparent ubiquity of *Bd* at Cape Cod National Seashore, the authors suggest that consistent and detailed monitoring in several species is necessary to assess the impact of the fungal pathogen on the amphibians inhabiting this National Park.

Full article: Tupper, T.A., Streicher, J.W., Greenspan, S.E., Timm, B.C. and R.P. Cook. 2011. Detection of *Batrachochytrium dendrobatidis* in anurans of Cape Cod National Seashore, Barnstable County, Massachusetts, USA. Herpetological Review 42: 62–65.

Effects of temperature and hydric environment on survival of the Panamanian golden frog infected with a pathogenic chytrid fungus.

By Bustamante, H. M. et al.

Considerable controversy exists concerning whether or not climate changes (particularly global warming) are causing outbreaks of a lethal amphibian pathogen, the chytrid fungus Batrachochytrium dendrobatidis. In this study, groups of Panamanian golden frogs (*Atelopus zeteki*), a critically endangered amphibian thought to be nearly extinct in Panama, were exposed to varying dosages of zoospores of *Batrachochytrium dendrobatidis*, temperatures and hydric environments in order to learn whether this species is susceptible to this pathogen and, if so, how environmental factors affect survival. This pathogen proved to be highly lethal for *Atelopus zeteki*. Frogs exposed to a dosage of 100 *Bd* zoospores survived significantly ($p < .0001$) longer than those that had been exposed to 10(4) or 10(6) zoospores. Exposed frogs housed at 23° C survived significantly ($p < .0001$) longer than those that were housed at 17° C. Exposed frogs held in dry conditions survived significantly longer than those in wet conditions ($p < .0001$). As a laboratory study, these results do not directly test hypotheses about the relation between climate change and the decline of these frogs in the field, but they inform the discussion about how environmental conditions can have an impact on the interaction between a susceptible amphibian and this pathogen. These data do not support the contention that rising global temperatures are necessary to cause death of amphibians infected with this pathogen because the pathogen was equally lethal at 17 as at 23 °C and frogs at the warmer temperature lived significantly longer than those at the cooler one.

Full article: Bustamante, H. M. et al. (2010) Effects of temperature and hydric environment on survival of the Panamanian golden frog infected with a pathogenic chytrid fungus. Integrative Zool: 5; 143-153.

Lower Left: Cranberry wetland and dune system in the Provincelands of Cape Cod National Seashore. Credit: R. Flaherty
Lower Right: Fowler's toad (*Anaxyrus fowleri*) in the Provincelands of Cape Cod National Seashore. Credit: J. Streicher

Survey for the Pathogenic Chytrid Fungus, *Batrachochytrium Dendrobatidis,* in Southwestern North Carolina Salamander Populations.

By S. Conor Keitzer, Reuben Goforth, Allan P. Pessier, and April J. Johnson

Stream-breeding salamanders are abundant predators in headwater streams of the Appalachian Mountains and are currently threatened by a number of potential factors. Among these potential threats is the pathogenic chytrid fungus, *Batrachochytrium dendrobatidis* (*Bd*). While evidence from experiments and surveys demonstrates that *Bd* is capable of infecting and causing disease in stream-breeding salamanders, it appears to have a low prevalence in North American headwater amphibian populations. However, our current knowledge regarding the distribution, prevalence, and virulence of *Bd* is relatively limited for many species and watersheds, which hampers any assessment of the potential threat of *Bd*. We conducted surveys from June 10 through July 23, 2009 in six headwater streams located in the southeastern Appalachian Mountains at the Coweeta Hydrologic Laboratory in southwestern North Carolina to examine the prevalence of *Bd* in stream-breeding salamander populations from the Coweeta watershed. We found no evidence of *Bd* from ventral skin swab samples of adult and larval plethodontid salamanders (n = 278) analyzed with real-time polymerase chain reaction. These results provide support for the apparently low prevalence of *Bd* currently in North American headwater stream salamander populations.

Full Article: Keitzer, S. C. et al. (2011) Survey for the pathogenic chytrid fungus Batrachochytrium dendrobatidis in southwestern North Carolina salamander populations. J. Wildlife Diseases: 47; 455-458. (skeitzer@purdue.edu)

Chytrid Fungus Not Found in Preliminary Survey of Lowland Amphibian Populations Across Northwestern Borneo

By Kristine Kaiser and T. Ulmar Grafe

Although the pathogen *Batrachochytrium dendrobatidis* (*Bd*) has been implicated in declines around the globe, much of the sampling for this fungus has been carried out in North America, Australia, and Europe. Southeast Asia has been comparatively underrepresented in the literature for positive or negative screenings for *Bd*. We undertook a preliminary screening of lowland sites in Sarawak (East Malaysia) and Brunei Darussalam. We collected a total of 23 skin swabs from 16 species of adult frogs in five taxonomic families. Swabs were stored in 70% ethanol until extraction. All samples were tested using rt-PCR. Samples were run in triplicate. We found no evidence of *Bd* in our samples: no sample tested positive in triplicate, and no single well tested positive for *Bd*. Lack of evidence of *Bd* may be potentially explained in several ways. First, because this was a preliminary study, our sample size was small; in addition, we sampled only lowland sites. Although the fungus can live in such warmer climates, it thrives at cooler temperatures than are found in these regions. Finally, it is possible that *Bd* is simply not present, and has not reached the island of Borneo. We thus suggest that *Bd* monitoring should continue in the lowlands in these regions and be expanded into upland regions more suited to Bd, and that proper biosecurity protocols should be handled when entering new sites.

Full article: Kaiser, K. & Grafe, T. U. (2011) Chytrid fungus not found in preliminary survey of lowland amphibian populations across northwestern Borneo. Herpetol. Review: 42; 59-61. (kristinekaiser@gmail.com)

Ranavirus infection in die-offs of vernal pool amphibians in New York, USA.

By Jesse L. Brunner, Kenneth Barnett, Corbin J. Gosier, Stacy A. McNulty, Michael J. Rubbo and Mary Beth Kolosvary.

During routine monitoring of vernal pools for amphibian breeding from May through early July in 2008 and 2009, we noted die-offs in several vernal pools in four locations in New York: the Albany Pine Bush, the Huntington Wildlife Forest in the Adirondack Mountains, the Teatown Lake Reservation in the lower Hudson Valley, and the Mohonk Preserve in the Shawangunk Mountains. Ranaviruses were detected with PCR and/or by virus isolation in each of these locations in larval Spotted and Jefferson Salamanders (*Ambystoma maculatum* and *A. jeffersonianum*) and Wood Frog tadpoles (*Lithobates sylvaticus*), as well as from the toe of an apparently healthy adult, female Green Frog (*L. clamitans*). The eight viruses that were sequenced were identical to Frog virus 3 in a 471 pb region in the 5' region of the major capsid protein gene. It is worth noting that at least some tadpoles escape these epidemics. One small pool in the Adirondacks experienced an apparently catastrophic die-off in June 2008, but *L. sylvaticus* metamorphs emerged in mid July. This pond and several others in the Adirondacks and in the Hudson Valley experienced die-offs for ≥ two years.

Full article: Brunner, J. L. et al. (2011) Ranavirus infection in die-offs of vernal pool amphibians in New York, USA. Herpetol. Review: 42; 76-79.

Ranavirus-infected wood frog tadpole with edema and petichial hemorrhaging Photo: K. E. Barnett

First case of chytridiomycosis in an adult specimen of a native anuran from Uruguay.

By Cecilia Bardier, Romina Ghirardi, Michael Levy and Raúl Maneyro

In Uruguay, the amphibian chytrid fungus *Batrachochytrium dendrobatidis* (*Bd*) was first detected in a captive population of *Lithobates catesbeianus* which suffered a massive death of metamorphs at a commercial farm, and later in native wild species larvae, but it was not confirmed in adults of any native species. In June 2009, two wild adult males of *Pleurodema bibroni* were collected in Cerro Verde (33.945833°S, 53.508611°W, Rocha, Uruguay). Samples for DNA analysis (qPCR) to detect Bd were taken. One of them turned out positive and histological analysis of the skin of the animal also confirmed the infection. Therefore the infection by Bd is diagnosed for the first time in wild adults of this species in Uruguay, which has been considered Near Threatened by the Red Lists and also Threatened at a country level. The pathogen was detected 100 km northeast of the nearest record inside a Protected Area, which is both alarming and suggests that measures for control and prevention of human-mediated Bd dispersal warrant consideration. This is particularly important because populations of other native species from the area, such as *Melanophryniscus montevidensis* (IUCN RED LIST: Vulnerable), may be at risk.

Skin section of a sppecimen of *Pleurodema bibroni*, collected from Cerro Verde Protected Area (Rocha Department, Uruguay), showing empty *Batrachochytridum dendrobatidis* zoosporangia (EZ) and zoosporangia containing zoospores (Z), one with a discharge tube (DT). Scale bar: 20µm.

Full article: Bardier, C. et al. (2011) First case of chytridiomycosis in an adult specimen of a native anuran from Uruguay. Herpetol. Review: 42; 65-66. (ceciliabardier@gmail.com)

Influence of lung parasites (*Rhabdias pseudosphaerocephala*) on growth rates of free-ranging and captive adult cane toads (*Bufo marinus*).

By Crystal Kelehear, Gregory P. Brown and Richard Shine

Many parasites affect viability of their hosts, but detailed studies combining empirical data from both the field and the laboratory are limited. Consequently, the nature and magnitude of such effects are poorly known for many important host-parasite systems, including macroparasites of amphibians. We examined the effects of lungworm (*Rhabdias pseudosphaerocephala*) infections in cane toads (*Bufo marinus*) within their invasive Australian range. The host-specificity of this parasite suggests that it might serve as a biological control agent for toads in Australia, if infection proves to reduce toad viability. Mark-recapture studies in the field (near Darwin, Northern Territory) revealed lowered growth rates in infected adult toads when compared to uninfected toads, and a laboratory experiment confirmed causality: experimental infection with *R. pseudosphaerocephala* reduced toad growth rates. In combination with previous work on the current host-parasite system, it is now evident that nematode lungworms reduce viability of both newly metamorphosed and adult cane toads, and do so in the field as well as in the laboratory. *Rhabdias pseudosphaerocephala* may be a valuable component of a biological control strategy for cane toads in Australia.

Rhabdias pseudosphaerocephala inside a cane toad lung. Photo: Crystal Kelehear.

Full article: Kelehear, C., Brown, G. P. & R. Shine. (2011). Influence of lung parasites (*Rhabdias pseudosphaerocephala*) on growth rates of free-ranging and captive adult cane toads (*Bufo marinus*). Oecologia 165: 585-592. DOI: 10.1007/s00442-010-1836-5

Seasonal Pattern of *Batrachochytrium dendrobatidis* Infection and Mortality in Lithobates areolatus: Affirmation of Vredenburg's "10,000 Zoospore Rule"

By Vanessa C. Kinney, Jennifer L. Heemeyer, Allan P. Pessier and Michael J. Lannoo

To fully comprehend chytridiomycosis, the amphibian disease caused by the chytrid fungus *Batrachochytrium dendrobatidis* (*Bd*), it is essential to understand how *Bd* affects amphibians throughout their remarkable range of life histories. Crawfish Frogs (*Lithobates areolatus*) are a typical North American pond-breeding species that forms explosive spring breeding aggregations in seasonal and semipermanent wetlands. But unlike most species, when not breeding Crawfish Frogs usually live singly—in nearly total isolation from conspecifics—and obligately in burrows dug by crayfish. Crayfish burrows penetrate the water table, and therefore offer Crawfish Frogs a second, permanent, aquatic habitat when not breeding. Over the course of two years we sampled for the presence of *Bd* in Crawfish Frog adults. Sampling was conducted seasonally, as animals moved from post-winter emergence through breeding migrations, then back into upland burrow habitats. During our study, 53% of Crawfish Frog breeding adults tested were positive for *Bd* in at least one sample; 27% entered breeding wetlands *Bd* positive; 46% exited wetlands *Bd* positive. Five emigrating Crawfish Frogs developed chytridiomycosis and died. In contrast, all 25 adult frogs sampled while occupying upland crayfish burrows during the summer tested *Bd* negative. One percent of postmetamorphic juveniles sampled were *Bd* positive. Zoospore equivalents/swab ranged from 0.8 to 24,436; five out of eight frogs with zoospore equivalents near or > 10,000 are known to have died. In summary, *Bd* infection rates in Crawfish Frog populations ratchet up from near zero during the summer to over 25% following

overwintering; rates then nearly double again during and just after breeding—when mortality occurs—before the infection wanes during the summer. *Bd*-negative postmetamorphic juveniles may not be exposed again to this pathogen until they take up residence in crayfish burrows, or until their first breeding, some years later.

Full article: Kinney, V. C. et al. (2011) Seasonal pattern of *Batrachochytrium dendrobatidis* infection and mortality in *Lithobates areolatus:* affirmation of Vredenburg's "10,000 zoospore rule". PLoS One: 6; e16708. (mlannoo@iupui.edu)

Crawfish Frog (*Lithobates areolatus*) Photo: M. J. Lannoo

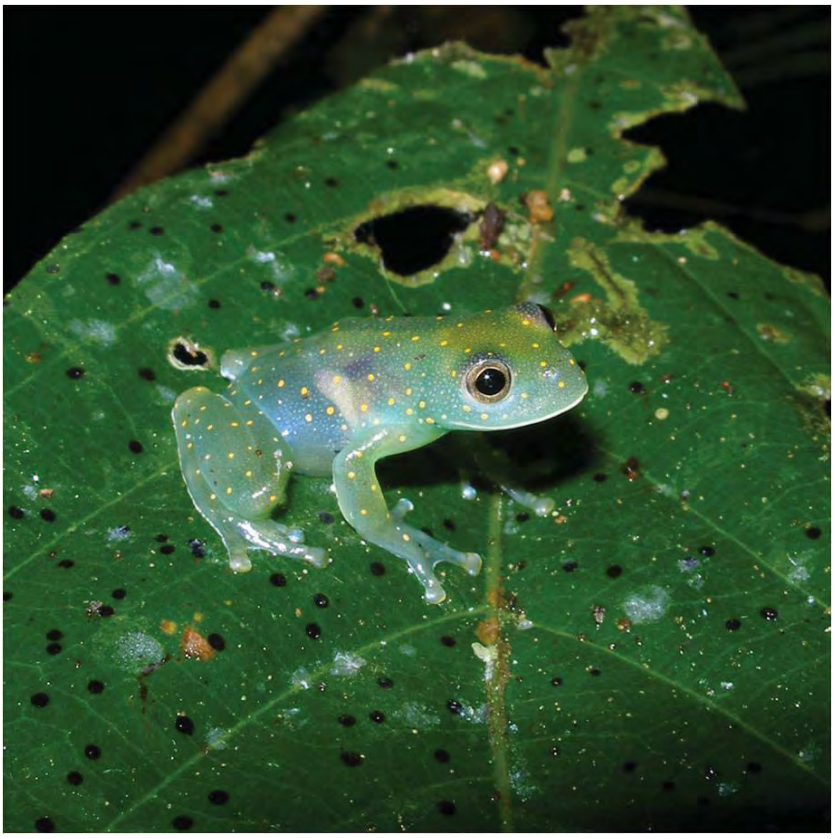
Mitigating Amphibian Disease: Strategies to maintain wild populations and control chytridiomycosis

By Douglas C. Woodhams, Jaime Bosch, Cheryl J. Briggs, Scott Cashins, Leyla R. Davis, Antje Lauer, Erin Muths, Robert Puschendorf, Benedikt R. Schmidt, Brandon Sheafor and Jamie Voyles.

Rescuing amphibian diversity is an achievable conservation challenge. Disease mitigation is one essential component of population management. Here we assess existing disease mitigation strategies, some in early experimental stages, which focus on the globally emerging chytrid fungus *Batrachochytrium dendrobatidis*. We discuss the precedent for each strategy in systems ranging from agriculture to human medicine, and the outlook for each strategy in terms of research needs and long-term potential.

We find that the effects of exposure to *Batrachochytrium dendrobatidis* occur on a spectrum from transient commensal to lethal pathogen. Management priorities are divided between (1) halting pathogen spread and developing survival assurance colonies, and (2) prophylactic or remedial disease treatment. Epidemiological models of chytridiomycosis suggest that mitigation strategies can control disease without eliminating the pathogen. Ecological ethics guide wildlife disease research, but several ethical questions remain for managing disease in the field.

Because sustainable conservation of amphibians in nature is dependent on long-term population persistence and co-evolution with potentially lethal pathogens, we suggest that disease mitigation not focus exclusively on the elimination or containment of the pathogen, or on the captive breeding of amphibian hosts. Rather, successful disease mitigation must be context specific with epidemiologically informed strategies to manage already infected populations by decreasing pathogenicity and host susceptibility. We propose population level treatments based on three steps: first, identify mechanisms of disease suppression; second, parameterize epizootiological models of disease and population dynamics for testing under semi-natural conditions; and third, begin a process of adaptive management in field trials with natural populations.



Cochranella euknemos Fringe-Limbed Tree Frog, Ranita de Cristal, Panama. Photo: Douglas C. Woodham

Full article: Woodhams, D. C. et al. (in press) Mitigating amphibian disease: strategies to maintain wild populations and control chytridiomycosis. Frontiers in Zoology: (dwoodhams@gmail.com)

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This reference list is compiled by Professor Tim Halliday (formerly DAPTF International Director) (tim.halliday@homecall.co.uk). It lists papers on amphibian declines and their causes and papers on 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.

AmphibiaWeb: Information on amphibian biology and conservation. [web application]. 2011. Berkeley, California: AmphibiaWeb. Available: http://amphibiaweb.org/. (Accessed: May 9, 2011).

April 2011

Carvalho, S. B. et al. (2011) Incorporating evolutionary processes into conservation planning using species distribution data: a case study with the western Mediterranean herpetofauna. Diversity & Distributions: 17; 408-421. (silviacarvalho@mail.icav.up.pt)

Garland, S. et al. (2011) Comparison of sensitivity between real-time detection of a TaqMan assay for *Batrachochytrium demndrobatidis* and conventional detection. Diseases of Aquatic Organisms: 94; 101-105. (stephen.garland@jcu.edu.au)

Gibble, R. E. & Baer, K. N. (in press) Effects of atrazine, agricultural runoff, and selected effluents on antimicrobial activity of skin peptides in *Xenopus laevis*. Ecotoxicology & Environmental Safety: (baer@ulm.edu)

Goodman, B. A. & Johnson, P. T. J. (2011) Ecomorphology and disease: cryptic effects of parasitism on host habitat use, thermoregulation, and predator avoidance. Ecology: 92; 542-548. (pieter.johnson@colorado.edu)

Hamer, A. J. & Parris, K. M. (2011) Local and landscape determinants of amphibian communities in urban ponds. Ecol. Applications: 21; 378-390. (a.hamer@unimelb.edu.au)

Hayes, T. B. et al. (in press) Demasculinization and feminization of male gonads by atrazine: consistent effects across vertebrate classes. J. Steroid Biochem. Mol. Biol:

Hu J. et al. (in press) Elevational patterns of species richness, range and body size for spiny frogs. PLoS ONE: (hujh1982@gmail.com)

Jablonowski, N. D. et al. (2011) Still present after all these years: persistence plus potential toxicity raise questions about the use of atrazine. Environ. Science & Pollution Research: 18; 328-331. (n.d.jablonowski@fz-juelich.de)

Johnson, L. R. & Briggs, C. J. (2011) Parameter inference for an individual based model of chytridiomycosis in frogs. J. Theoretical Biol: 277; 90-98.

Joseph, M. B. et al. (2011) Indirect effects of introduced trout on Cascades frogs (Rana cascadae) via shared aquatic prey. Freshwater Biol: 56; 828-838. (maxwell.b.joseph@colorado.edu)

Luquet, E. et al. (2011) Heterozygosity-fitness correlations among wild populations of European tree frog (*Hyla arborea*) detect fixation load. Molecular Ecology: 20; 1877-1887. (emilien.luquet@gmail.com)

Márquez, M. et al. (2011) Immunological clearance of *Batrachochytrium dendrobatidisinfection* at a pathogen-optimal temperature in the hylid frog *Hypsiboas crepitans*. EcoHealth: 7; 380-388. (mlampo@gmail.com)

Murray, K. A. et al. (2011) Integrating species traits with extrinsic threats: closing the gap between predicting and preventing species declines. Proc. R. Soc. B: 278; 1515-1523. (k.murray@uq.edu.au)

Nations. S. et al. (2011) Acute effects of Fe2O3, TiO2, ZnO and CuO nanomaterials on*Xenopus laevis*. Chemosphere: 83; 1053-1061. (shaylobo42@hotmail.com)

Nori, J. et al. (2011) American bullfrog invasion in Argentina: where should we take urgent measures? Biodiversity & Conservation: 20; 1125-1132. (javiernori@gmail.com)

Ortiz-Santaliestra, M. E. et al. (2011) Influence of a combination of agricultural chemicals on embryos of the endangered gold-striped salamander (*Chioglossa lusitanica*). Arch. Environ. Contam. Toxicol: 60; 672-680. (manucle.ortiz@uclm.es)

Porter, K.L. et al. (2011) Effects of 4-tert-octylphenol on *Xenopus tropicalis* in a long term exposure. Aquatic Toxicol: 103; 159-169. (karen.porter@amedd.army.mil)

Ribeiro, R. et al. (2011) The pond network: can structural connectivity reflect on (amphibian) biodiversity patterns? Landscape Ecology: 26; 673-682. (raquel.ribeiro@mail.icav.up.pt)

Richter-Boix, A. et al. (2011) Genetic analysis of differentiation among breeding ponds reveals a candidate gene for local adaptation in *Rana arvalis*. Molecular Ecology: 20; 1582-1600. (alex.richter@ebc.uu.se)

Sztrum, A. A. et al. (2011) Nickel toxicity in embryos and larvae of the South American toad: effects on cell differentiation, morphogenesis, and oxygen consumption. Envtl. Toxicol. & Chem: 30; 1146-1152. (herkovit@retina.ar)

Todd, B. D. et al. (2011) Does maternal exposure to an environmental stressor affect offspring response to predators? Oecologia: 166; 283-290. (btodd@ucdavis.edu)

Veysey, J. S. et al. (2011) Comparative influence of isolation, landscape, and wetland characteristics on egg-mass abundance of two pool-breeding amphibian species. Landscape Ecology: 26; 661-672. (veysey.00@alum.dartmouth.org)

Watling, J. I. et al. (2011) Predators and invasive plants affect performance of amphibian larvae. Oikos: 120; 735-739. (watlingj@ufl.edu)

Woodhams, D. C. et al. (in press) Mitigating amphibian disease: strategies to maintain wild populations and control chytridiomycosis. Frontiers in Zoology: (dwoodhams@gmail.com)

March 2011

Adams, M. J. et al. (2011) Non-native species impacts on pond occupancy by

an anuran. J. Wildlife Management: 75; 30-35.

Aziz, M. N. B. A. et al. (2011) Dynamics of chytridiomycosis in a Tasmanian frog community. Herpetol. Review: 42; 53-57. (h.mccallum@griffith.edu.au)

Bardier, C. et al. (2011) First case of chytridiomycosis in an adult specimen of a native anuran from Uruguay. Herpetol. Review: 42; 65-66. (ceciliabardier@gmail.com)

Bell. B. D. (2011) Breeding phenology of Leiopelma pakeka: a threatened frog never found breeding in the wild. Herpetol. Review: 42; 29-32. (ben.bell@vuw.ac.nz)

Brunner, J. L. et al. (2011) Ranavirus infection in die-offs of vernal pool amphibians in New York, USA. Herpetol. Review: 42; 76-79. (jesse.brunner@wsu.edu)

Bustamante, H. M. et al. (2010) Effects of temperature and hydric environment on survival of the Panamanian golden frog infected with a pathogenic chytrid fungus. Integrative Zool: 5; 143-153. (careyc@colorado.edu)

Cabrera-Guzmán, E. et al. (2011) Can we use the tadpoles of Australian frogs to reduce recruitment of invasive cane toads? J. Applied Ecol: 48; 462-470.

Conlon, J. M. et al. (2011) Host defense peptides in skin secretions of the Oregon spotted frog *Rana pretiosa*: implications for species resistance to chytridiomycosis. Dev. Comp. Immunol: 35; 644-649. (jmconlon@uaeu.ac.ae)

Daly, E. W. & Johnson, P. T. J. (2011) Beyond immunity: quantifying the effects of host anti-parasite behavior on parasite transmission. Oecologia: 165; 1043-1050. (pieter.johnson@colorado.edu)

D'Amen, M. et al. (2011) Will climate change reduce the efficacy of protected areas for amphibian conservation in Italy? Biol. Conservation: 144; 989-997. (madmen@uniroma3.it)

da Silva, F. R. & Rossa-Feres, D. de C. (2011) Influence of terrestrial habitat on the diversity and temporal distribution of anurans in an agricultural landscape. J. Tropical Ecol: 27; 327-331. (bigosbio@yahoo.com.br)

da Silva, H. R. et al. (2011) Selecting a hiding place: anuran diversity and the use of bromeliads in a threatened coastal sand dune habitat in Brazil. Biotropica: 43; 218-227. (heliorsilva@gmail.com)

Daversa, D. et al. (2011) First survey of the chytrid fungus, *Batrachochytrium dendrobatidis*, in amphibian populations of Gabon, Africa. Herpetol. Review: 42; 67-69. (ddaversa@gmail.com)

Davis, A. K. & Maerz, J. C. (2011) Assessing stress levels of captive-reared amphibians with hematological data: implications for conservation initiatives. J. Herpetol: 45; 40-44.

Di Minin, E. & Griffiths, R. A. (2011) Viability analysis of a threatened amphibian population: modelling the past, present and future. Ecography: 34; 162-169. (r.a.griffiths@ukc.ac.uk)

El Mouden, E. H. et al. (2011) First record of the chytrid fungus *Batrachochytrium dendrobatidis* in North Africa. Herpetol. Review: 42; 71-75. (bosch@mncn.csic.es)

Fuller, T. E. et al. (2011) Linking the distribution of an invasive amphibian (*Rana catesbeiana*) to habitat conditions in a managed river system in northern California. Restoration Ecol: 19; 204-213. (tfuller@dfg.ca.gov)

Funk, W. C. et al. (2011) Population genetics of introduced bullfrogs, *Rana* (Lithobates) *catesbeianus*, in the Willamette Valley, Oregon, USA. Biol. Invasions: 13; 651-658. (chris.funk@colostate.edu)

Gonynor, J. L. et al. (2011) A preliminary survey of *Batrachochytrium dendrobatidis*exposure in hellbenders from a stream in Georgia, USA. Herpetol. Review: 42; 58-59. (jgonynor@uga.edu)

Grafe, T. U. et al. (2011) Putting toe clipping into perspective: a viable method for marking anurans. J. Herpetol: 45; 28-35.

Gratwicke, B. et al. (2011) *Batrachochytrium dendrobatidis* not detected on amphibians from two lowland sites in Gabon, Africa. Herpetol. Review: 42; 69-71. (brian.gratwicke@gmail.com)

Heimes, P & Aguilar, R. (2011) *Plectrohyla hazelae* (Taylor, 1940) not extinct. Herpetol. Review: 42; 41-42. (heimes@hotmail.com)

Janin, A. et al. (2011) Beyond occurrence: body condition and stress hormone as integrative indicators of habitat availability and fragmentation in the common toad. Biol. Conservation: 144; 1008-1016. (agnes.janin@univ-lyon1.fr)

Johnson, J. R. et al. (2011) The origin of tiger salamander (*Ambystoma tigrinum*) populations in California, Oregon, and Nevada: introductions or relics? Conservation Genetics: 12; 355-370. (jarrett.johnson@wku.edu)

Johnson, P. T. J. et al. (in press) Regional decline of an iconic amphibian associated with elevation, land-use change, and invasive species. Conservation Biol: (pieter.johnson@colorado.edu)

Johnson, P. T. J. & Paull, S. H. (2011) The ecology and emergence of diseases in fresh waters. Freshwater Biol: 56; 638-657. (pieter.johnson@colorado.edu)

Kaiser, K. & Grafe, T. U. (2011) Chytrid fungus not found in preliminary survey of lowland amphibian populations across northwestern Borneo. Herpetol. Review: 42; 59-61. (kristinekaiser@gmail.com)

Karraker, N. E. & Gibbs, J. P. (2011) Contrasting road effect signals in reproduction of long- versus short-lived amphibians. Hydrobiologia: 664; 213-218. (karraker@hkucc.hku.hk)

Keitzer, S. C. et al. (2011) Survey for the pathogenic chytrid fungus *Batrachochytrium dendrobatidis* in southwestern North Carolina salamander populations. J. Wildlife Diseases: 47; 455-458. (skeitzer@purdue.edu)

Kelehear, C. et al. (2011) Influence of lung parasites on the growth rates of free-ranging and captive adult cane toads. Oecologia: 165; 585-592. (crystal.kelehear@sydney.edu.au)

Kinney, V. C. et al. (2011) Seasonal pattern of *Batrachochytrium dendrobatidis* infection and mortality in Lithobates areolatus: affirmation of Vredenburg's "10,000 zoospore rule". PLoS One: 6; e16708. (mlannoo@iupui.edu)

Kvamryd, M. et al. (2011) Early life progestin exposure causes arrested oocyte development, oviductal agenesis and sterility in adult *Xenopus tropicalis* frogs. Aquatic Toxicol: 103; 18-24. (moa.kvarnryd@ebc.uu.se)

Leach, D. J. (2011) Efficacy of small

diameter pipe-trap refugia for capturing metamorph treefrogs. Herpetol. Review: 42; 47-49. (djl8r4@gmail.com)

Liu, W.-Y. et al. (2011) Impacts of the herbicide butachlor on the larvae of a paddy field breeding frog (*Fejervarya limnocharis*) in subtropical Taiwan. Ecotoxicology: 20; 377-384. (biyckam@thu.edu.tw)

Maffei, F. et al. (2011) Discovery of the fifth population of a threatened and endemic toad of the Brazilian Cerrado, *Proceratophrys moratoi* (Anura, Cycloramphidae). Herpetol. Notes: 4; 95-96. (maffei.fabio@gmail.com)

Martínez-Silvestre, A. et al. (2011) Incidence of pigmented skin tumors in a population of wild Montseny brook newt (*Calotriton arnoldi*). J. Wildlife Diseases: 47; 410-414. (crarc_comam@hotmail.com)

Mendelson, J. R. (2011) Shifted baselines, forensic taxonomy, and Rabb's fringe-limbed treefrog: the changing role of biologists in an era of amphibian declines and extinctions. Herpetol. Review: 42; 21-25. (jmendelson@zooatlanta.org)

Ortiz-Santaliestra, M. E. et al. (2011) Realistic levels of a fertilizer impair Iberian newt embryonic development. Herpetologica: 67; 1-9.

Osbourn, M. S. et al. (2011) Use of fluorescent visible implant alphanumeric tags to individually mark juvenile ambystomatid salamanders. Herpetol. Review: 42; 43-47. (osbournm@missouri.edu)

Paull, S. H. & Johnson, P. T. J. (2011) High temperature enhances host pathology in a snail-trematode system: possible consequences of climate change for the emergence of disease. Freshwater Biol: 56; 767-778. (sarah.paull@colorado.edu)

Paoletti, D. J. et al. (2011) Responses of foothill yellow-legged frog (*Rana boylii*) larvae to an introduced predator. Copeia: 161-168.

Perry, G. & Farmer, M. (2011) Reducing the risk of biological invasion by creating incentives for pet sellers and owners to do the right thing. J. Herpetol: 45; 134-141.

Raithel, C. J. et al. (2011) Assessing long-term population trends of wood frogs using egg-mass counts. J. Herpetol: 45; 23-27.

Reeder, N. M. M. et al. (2011) Survey of the chytrid fungus *Batrachochytrium dendrobatidis* from montane and lowland frogs in eastern Nigeria. Herpetol. Notes: 4; 83-86. (david.c.blackburn@gmail.com)

Roloff, G. J. et al. (2011) Factors associated with amphibian detection and occupancy in southern Michigan forests. J. Herpetol: 45; 15-22.

Romansic, J. M. et al. (in press) Individual and combined effects of multiple pathogens on Pacific treefrogs. Oecologia: (jmromansic@gmail.com)

Shoo, L. P. et al. (2011) Engineering a future for amphibians under climate change. J. Applied Ecol: 48; 487-492. (l.shoo@uq.edu.au)

Tingley, R. et al. (2011) Establishment success of introduced amphibians increases in the presence of congeneric species. American Naturalist: 177; 382-388. (reid.tingley@gmail.com)

Tupper, T. A. et al. (2011) Detection of *Batrachochytrium dendrobatidis* in anurans of Cape Cod National Seashore, Barnstable County, Massachusetts, USA. Herpetol. Review: 42; 62-65. (streicher@uta.edu)

Yetman, C. A. & Ferguson, J. W. H. (2011) Spawning and non-breeding activity of adult giant bullfrogs (*Pyxicephalus adspersus*). African. J. Herpetol: 60; 1-17. (cayetman@zoology.up.ac.za)

Yetman, C. A. & Ferguson, J. W. H. (2011) Conservation implications of spatial habitat use by adult giant bullfrogs (*Pyxicephalus adspersus*). J. Herpetol: 45; 56-62. (cayetman@zoology.up.ac.za)

Keep In touch

If you would like to be added to the ASG mailing list, please send an email to froglog@amphibians.org with the subject heading "add me to mailing list".

Also follow us on Facebook for regular updates on the herpetological community and the latest news from the ASG.

http://www.facebook.com/AmphibiansDotOrg

SAVE THE DATE - Midwest Partners in Amphibian and Reptile Conservation

Annual Meeting ☆ August 5-7, 2011

Successful Training for Conservation of Midwestern Amphibians and Reptiles

☆ Invited Talks
☆ Poster Session
☆ Silent Auction

Field Trip:
☆Nearby Ozark Forested Hills
☆Black River Floodplain

Meeting Site:
Wilderness Lodge Resort
PO Box 90
Lesterville, MO 63654

Wilderness Lodge is located 105 miles from St. Louis and 85 miles from Cape Girardeau in Southeast Missouri. It sits adjacent to the Black River. (http:\\www.wildernesslodgeresortltd.com)

Amphibian Ark Conservation Needs Assessment workshops

By Kevin Johnson

The Amphibian Ark (AArk, www.amphibianark.org) is a joint initiative of three principal partners: the World Association of Zoos and Aquariums (WAZA, www.waza.org), the IUCN/SSC Conservation Breeding Specialist Group (CBSG, www.cbsg.org), and the IUCN/SSC Amphibian Specialist Group (ASG, www.amphibians.org/ASG/).

Our vision is the world's amphibians safe in nature, and our mission is ensuring the global survival of amphibians, focusing on those that cannot currently be safeguarded in nature.

The global conservation community has formulated a response to the global amphibian extinction crisis in the Amphibian Conservation Action Plan (www.amphibianark.org/pdf/ACAP.pdf), and an integral part of that response is the Amphibian Ark, in which species that would otherwise become extinct will be maintained in captivity until the threats facing them can be mitigated and they can be secured in the wild. Without immediate captive management as a stopgap component of an integrated conservation effort, hundreds of amphibian species could become extinct.

Amphibian Ark staff help coordinate ex situ programs implemented by partners around the world, with the first emphasis on programs within the range countries of the species. We are always aware of our obligation to couple ex situ conservation measures with the necessary efforts to protect or restore species in their natural habitats.

Our Taxon Officers help to coordinate all aspects of implementation within the AArk initiative, and assist AArk partners in identifying priority taxa for in situ or ex situ conservation work. An initial part of this process involves evaluating species to identify those that are most in need of various types of in situ or ex situ management, and this evaluation work is generally carried out at an Amphibian Conservation Needs Assessment workshop (www.amphibianark.org/conservation_needs_workshops.htm).

In February 2006 CBSG and WAZA convened an Amphibian Ex Situ Conservation Planning Workshop, in El Valle de Anton, Panama (www.amphibianark.org/panama_report.htm). During this workshop a taxon selection and prioritization working group comprising thirteen amphibian experts from around the world, developed a decision tree for the selection and prioritization of taxa for ex situ conservation work.

This decision tree was subsequently used at a number of in-country workshops, and has undergone several phases of modification and improvement, based on feedback from workshop participants. It includes a series of questions with weighted scores which help to assign levels of priority for various conservation actions. In 2009, the process underwent a significant review, which saw it changed from a taxon selection and prioritization process, to a process for assessing amphibian species for a wider variety of both in situ and ex situ conservation actions. More detailed information about the AArk Conservation Needs Assessment process, including the questions that are asked for each species during the assessment can be found in a document on the AArk web site, www.amphibianark.org/pdf/Aark material/AArk Conservation Needs Assessment tool.pdf.The document is also available in Spanish, www.amphibianark.org/pdf/Aark material/AArk Conservation Needs Assessment tool Español.pdf

All amphibian species that are assessed during the workshops are automatically assigned to one or more of conservation actions, based on the collective knowledge of the field experts for each species. Within each conservation role, species are listed from highest to lowest priority, based on scores that are assigned to questions used in the assessment.

Amphibian Conservation Needs Assessment workshops are carried out in the range country, using the collective expertise of the local ASG Chair and appropriate field experts to compile species-level knowledge for all species in the country and including representatives from ex situ community and local, regional and national government bodies wherever possible.

During the conservation needs assessment workshops, each species is assessed, with all data captured in the conservation needs assessment tool. At

the end of each workshop, reports are generated for each of the individual conservation actions, and these reports and all data collected during the workshop are distributed to all participants. The data collected at each workshop is also made available to the wider amphibian conservation community on AArk's portal, www.amphibianark.org/assessmentresults.htm

Since 2006, we have facilitated assessment of the conservation needs of 2,407 (38%) of the world's amphibian species through nineteen national or regional workshops. During the remainder of 2011 we are planning workshops in Singapore and Vietnam/Laos/Cambodia, with discussions also underway regarding workshops in Ecuador and North America. We have developed a list of countries that have a high biodiversity of amphibian species, combined with a high level of threats being faced by these species. We are keen to work with amphibian experts in a number of priority countries, to help assess the conservation needs of their amphibians, especially in China, India, Papua New Guinea, the Philippines, Cameroon, Honduras, Tanzania, Congo D.R. and Bolivia. If you would like to discuss conservation needs assessment of amphibian species in your country, please contact either Kevin Zippel (kevinz@amphibianark.org) or Kevin Johnson (kevinj@amphibianark.org).

Upcoming Meetings & Workshops

May

Second Mediterranean Congress of Herpetological Marrakech, Morocco, 23-27 May 2011. Details at: http://www.ucam.ac.ma/cmh2/En_General_Infos.html.

July

Joint Meeting of Ichthyologists and Herpetologists Minneapolis, USA, 6-11 July 2011. Details at http://www.dce.k-state.edu/conf/jointmeeting/.

IX Latin American Congress of Herpetology Curitiba, Brasil, 17-22 July 2011. http://www.seh-cc.org/blogs/blog2.php/2010/11/11/ix-latinamerican-congress-of-herpetology

August

Midwest Partners in Amphibian and Reptile Conservation Annual Meeting, Lesterville, MO. August 5-7, 2011.

Northeast Partners in Amphibian and Reptile Conservation Annual Meeting, Arlington Echo Outdoor Education Center, Millersville, Maryland. August 17 - 18, 2011

Partners in Amphibian and Reptile Conservation (SW PARC) and Current Research on Herpetofauna of the Sonoran Desert V (CRHSD V) Tucson, Arizona. August 10 - 16, 2011.

September

SEH-Conservation Committee Herpetofauna monitoring course Luxembourg, 24-25 September 2011. Details at http://www.seh-cc.org.

16th European Congress of Herpetology and 47. Deutscher Herpetologentag (DGHT) Luxembourg and Trier, 25-29 September 2011. Details at http://www.symposium.lu/herpetology/.

October

Conservation Needs Assessment workshop Singapore. October 17-18, 2011.

Amphibian husbandry/conservation workshop Singapore. October 19-21, 2011.

Internships & Employment

The following information can be found at http://www.parcplace.org/jobs.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.

USGS Desert Tortoise Research Technician, Henderson, NV

Postdoctoral Researcher in Evolutionary Biology and Behavioral Ecology - Florida State University, Tallahassee, FL

USGS Python Technician, Key Largo, FL

Wildlife Biologist and Assistant Wildlife Biologist Positions at the University of Arizona, Tucson, AZ

Director of Conservation Economics and Finance - Defenders of Wildlife, Washington D.C.

Director of Conservation Planning - Defenders of Wildlife, Washington D.C.

WRD Program Manager - Georgia Wildlife Resources Division, Brunswick, GA

Herpetology Field Technician - Green Diamond Resource Company, Korbel, CA

Amphibian field Technicians (3), Northwestern Oregon

Field Herpetology Technicians/ Research Associate - Swaim Biological, Inc. San Francisco Bay Area, California

Research Technician - Blandings Turtle Research, Massachusetts

MS Position with Aquatic Herps/Spotted Turtles in Managed Forests, Clemson University, SC

Biodiversity Paid Internship - Amphibian Assisted Reproduction, The Memphis Zoo, Memphis, TN

Field Assistants (2-3) - behavior and ecology of the lizards, Great Abaco Island, Bahamas

Summer Herpetological Internship Opportunity, Lower Michigan

Postdoc position - Amphibian pathogens and their impact on biodiversity, Station d'Ecologie Experimentale, Moulis, France

Field Assistant - Canopy research on herpetofauna, Singapore and the Philippines (Southeast Asia)

Volunteer/Intern Herpetological (Glass Lizard) Field Technician, College of Charleston, Charleston, SC

Graduate RA Positions - Lizard Behavior and Physiology, Indiana State University

Student Research Opportunities - Indiana-Purdue University Fort Wayne, Fort Wayne, IN

Master's Student Opportunities - Garter Snake Ecology, University of Texas at Tyler - Tyler, TX

Graduate Research Studies in Sustaining Hardwood Ecosystems, Purdue University, West Layfayette, Indiana

If you have any upcoming events, internships, employment opportunities or recent publications that you would like announced in FrogLog, please send details to James Lewis at jplewis@amphibians.org.

The Herpetologists' League

EE Williams Research Grant

The Herpetologists' League is pleased to announce competitive grants for graduate student research for 2012. 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 2011.

4. Send complete application (cover page, proposal, budget, CV,) as a single PDF electronically to: Erin Muths at muthse@usgs.gov. 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 2012.

7. Funding dispersed in April 2012 and winners announced at the Herpetologists'League Business Meeting in Vancouver, British Columbia, 2012.

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.

Maryland Amphibian & Reptile Atlas

www.marylandnature.org/mara

The **Maryland Amphibian and Reptile Atlas (MARA)** is a five-year, joint project of the Natural History Society of Maryland and Maryland Department of Natural Resources.

We need **YOUR** help!

Volunteers are needed to document the statewide distribution of Maryland's amphibians and reptiles.

Submit any amphibian & reptile sightings!

The goal of the MARA project is to document the current distributions of Maryland's amphibian and reptile species using a systematic and repeatable approach. The Atlas will establish a baseline for future efforts to determine changes in the distribution of amphibians and reptiles in Maryland. The information gained through your volunteer effort will be used to promote the conservation and protection of Maryland's 90+ species of frogs, toads, turtles, lizards, snakes, and salamanders.

How to get involved in the project

MARA Observer: email photos and location (street address or nearest intersection) of any amphibian or reptile encountered directly to the statewide coordinator (atlas@marylandnature.org) or your county coordinator. These may be animals you encounter at your home, crossing the road, or while walking around a neighborhood park. Photos of remains (roadkill) and the shed skins of snakes can be included in the Atlas.

MARA Surveyor: contact your county coordinator about areas in your county that need surveys. Volunteer to survey the block or quad in which you live.

To learn more contact the Statewide Coordinator, Heather Cunningham, Ph.D, hcunningham@marylandnature.org

Funding Opportunities

We are pleased to announce, in partnership with Partners in Amphibian and Reptile Conservation (PARC; wwwparcplace.org) a new round of ARMI Seed Grants. Please see page 42 for more details.

Funds for habitat Protection -- The ASG supports organizations working to protect critical amphibian habitat worldwide. This fund is specifically for direct conservation action, not research (although some funds can be earmarked for survey work if this is an integral component of the overall project). Criteria and examples of funded projects can be found at http://www.amphibians.org/ASG/Funding.html .

Rolex are looking to support individuals working on innovative environmental/species based projects through their Rolex Awards for Enterprise. Successful applicants will receive US$100,000, a Rolex chronometer, and the benefits of international publicity as a Rolex Laureate or Associate Laureate. To date, Rolex have supported more than 30 projects focused on the environment and have identified more than 60 threatened species that these projects have impacted. Indeed a number of SSC members are already Rolex Laureates and/or Associate Laureates. To help promote the program to our network we have placed a clickable link on the species pages of the Red List website as well as a news story that can be accessed from the home page (See: http://www.iucnredlist.org/news/rolex-awards-for-enterprise).

The conservation leadership Programs website provides a comprehensive overview of a large array of funding available http://www.conservationleadershipprogramme.org/OtherFundingOptions.asp

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

May 2011

Australian Aid (AusAID) -- Leadership Awards 2011. The Australian Leadership Awards support host organizations in Australia to invite professionals from developing countries in partnership and age arrangements. Programmatic areas include environment, food security, water, and others. Eligible countries are in Asia-Pacific, Latin America and Caribbean, Africa, and the Middle East. The application deadline is 31 May 2011 (or dates specified by participating countries).

DFID/ESRC Growth Program -- Call for Proposals. The UK's Department for International Development (DFID) and the UK's Economic and Social Research Council (ESRC) co-sponsor the DFID/ESRC Growth Programme. The program funds research on issues of inclusive economic growth in low-income countries, including a theme on "Agriculture and Growth." Up to 30 research projects will be supported, with an average size of £370 thousand, for periods of one to three years. The program is open to UK and non-UK institutions. Applicants submit their proposals through an online system; registration is recommended at least four weeks prior to the deadline of 26 May 2011.

Otto Kinne Foundation -- Prize in Terrestrial Ecology 2011. The Otto Kinne Foundation invites nominations from research ecologists worldwide for the Ecology Institute Prize of €6 thousand. The prize will be awarded to a terrestrial ecologist distinguished by outstanding and sustained scientific achievements. The deadline for nominations is 30 May 2011.

Renewable Energy and Energy Efficiency Partnership (REEEP) -- 8th Call for Proposals. REEEP will fund approximately 30 projects that aim to overcome key barriers to the uptake of renewable energy and energy efficiency. REEEP also plans to support a few projects that target smart grids, reforms of fossil fuel subsidies, and low-carbon transportation. The geographical scope is Brazil, China, India, Indonesia, South Africa, and other selected sub-Saharan African countries. Grants are up to €150 thousand per project. For new projects, applicants submit concept notes before 15 April 2011. For applications to scale-up past projects -- and for proposals submitted by governments, regulators, and development financial institutions -- the single deadline for proposals is 27 May 2011.

Rothamsted International -- Agricultural Research 2011. Rothamsted funds international fellowship grants in collaboration with UK agricultural scientists. Applicants should be mid-career post-doctoral scientists in developing or emerging countries. Rothamsted will also consider candidates without higher degrees, but with equivalent research experience. The next deadline is 29 May 2011.

University of California at Davis -- Borlaug LEAP Grants for Agricultural Research 2011. The Borlaug Leadership Enhancement in Agriculture Program (LEAP) supports thesis research of graduate students from developing countries who show promise as leaders in agriculture and related disciplines. Each LEAP participant works with a mentor in the Consultative Group on International Agricultural Research, and another mentor at a U.S. university. LEAP currently invites applications in two program areas: one is restricted to applicants from Sub-Saharan Africa, and the other is open globally. The deadline for applications in both programs is 18 May 2011.

June 2011

Ashoka Changemakers and eBay Foundation -- Employment Opportunities for Disadvantaged Populations. Ashoka and eBay invite ideas on market-based solutions that create economic opportunity and generate employment for disadvantaged populations. The scope of the competition is global, corresponding with eBay's launch of "The Opportunity Project." Each of five winners will receive a cash prize of US$50 thousand. TVG Note: Examples may include innovative approaches to waste recycling, energy projects, and other activities related to creating jobs in environment and natural resources. The deadline for submissions is 15 June 2011.

BBC World Challenge -- Global Competition 2011. World Challenge 2011 is jointly organized by BBC World News Limited and Newsweek to identify projects and small businesses from around the world that feature exceptional enterprise and innovation at a grassroots level. The categories include sustainable farming, energy, water, and environment (among others). The winner will receive a grant of US$20 thousand; the second and third finalists will each receive grants of US$10 thousand. The closing date for nominations is 19 June 2011.

European Commission (EC) -- Food Security in Guinea-Bissau. The EC will fund projects to reduce food insecurity in Guinea-Bissau to include support for agricultural cooperatives; improved seed production; and strengthening of horticulture, fisheries, oil palm, livestock, etc. Eligibility extends to nonprofit organizations in Guinea-Bissau, EU member states, and inter-governmental organizations. Reference EuropeAid/131181/L/ACT/GW. Closing date is 24 June 2011.

European Commission (EC), Kolarctic -- 2nd Call for Proposals. Kolarctic supports cross-border strategies between Russia, Finland, Sweden, and Norway in the Barents region of the Arctic. Projects may include issues related to environment and natural resources. Each proposal must have at least one actor from the EU (Sweden, Finland) and at least one from Russia. Eligibility requirements, and the rules on Lead Partners and partners, are explained in the call for proposals. The deadline is 13 June 2011.

European Commission (EC) -- Water Management in the Mediterranean. The EC announces funding of EUR 15 million for demonstration projects in Sustainable Water Integrated Management in the Mediterranean (SWIM). The EU collaborates with ENPI-South countries of Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Palestinian Authority, Syria, and Tunisia. Focus areas are water governance; water and climate change; water financing; water demand management and efficiency; municipal waste; municipal wastewater; and industrial emissions. Proposals are welcomed from partnerships of NGOs, government entities, and institutes and universities in EU countries and ENPI-South countries -- and from inter-governmental organizations. The closing date for proposals is 14 June 2011.

Oceania Development Network -- Research on Urbanization in the Pacific. The Oceania Development Network announces its biennial research competition for Pacific Island scholars. The theme of the current competition focuses on regional issues of urbanization, including relationships with poverty and environmental degradation (among others). Grants are up to US$10 thousand. Proposals are due 30 June 2011.

Roger Williams Park Zoo -- Sophie Danforth Conservation Biology Fund 2011. The Sophie Danforth Conservation Biology Fund makes grants of up to US$1 thousand to protect threatened wildlife and habitats worldwide. Priority is for projects that demonstrate a multi-disciplinary approach to ecosystem conservation, and that involve in-country collaborators. Applicants can be of any nationality. Applications must be received before 01 June 2011.

UK Darwin Initiative -- Main Projects and Post Projects, Round 18. The UK's Defra (Department for Environment, Food, and Rural Affairs) announces the 18th round of funding for the Darwin Initiative, which makes grants for biodiversity research in support of three international conventions. The current call is for Main Projects and Post Projects. Applications are invited from institutions in the UK and its Overseas Territories. Due to recent changes in the Darwin program, Defra urges applicants to carefully study the guidance it provides. For Main Projects, the closing date for Stage 1 applications is 20 June 2011. For Post Projects, the closing date is 13 June 2011. Main Projects Post Projects

UNESCO with L'Oreal Corporate Foundation -- Young Women in Life Sciences 2012. The UN's Educational, Scientific, and Cultural Organization (UNESCO) and L'Oreal co-sponsor annual Fellowships for Young Women in Life Sciences. A maximum of three young women (under age 35), from each of five geo-cultural regions of the world, are awarded research grants in biology, biotechnology, agriculture, and other life sciences. Each fellowship is up to US$20 thousand for one year, renewable for a second year. Special attention is given to applications from the least-developed countries. The closing date is 30 June 2011.

July 2011

Organization of American States -- Technical Cooperation Projects 2011. The Technical Cooperation Fund of the OAS is FEMCIDI. Among several themes, it supports national and multi-country projects in environment and sustainable development. The Fund makes grants to government organizations and nonprofit organizations in the OAS member states of Latin America and the Caribbean. Concept notes are submitted to FEMCIDI's national liaisons before 31 July each year.

Pro Natura Fund -- Grants 2011. The Fund makes grants in biodiversity conservation in Japan and developing countries. The application for international grants (i.e., from the developing countries) is 01 June through 31 July each year. The Fund reminds applicants to check the guidelines each year to confirm the latest details.

Swiss Forum for International Agricultural Research -- SFIAR Award 2011. SFIAR annually awards a prize for innovative agricultural research to scientists currently or previously working for a Swiss institution in agricultural research for development, with with appropriate ages in developing countries. The SFIAR Award is CHF 10 thousand restricted to research teams. Applications close 04 July 2011.

August 2011

European Commission (EC) -- Marie Curie International Incoming Fellowships 2011. The Marie Curie International Incoming Fellowships (IIF) are for researchers external to Europe (of any nationality) to work in a European research team. The application deadline is 11 August 2011.

September 2011

American Orchid Society -- Prizes for Orchid Conservation 2011. The American Orchid Society sponsors the Conservation Recognition Awards to honor outstanding work in orchid conservation. One prize focuses on conservation in North America; the other has no geographical limitations. Prizes are US$500. Closing date for nominations is 01 September each year.

British Ecological Society – Funding for African Ecologists 2011. The BES funds an overseas bursary and an overseas fellowship to support ecological science in Africa. The grants are made to citizens of African countries and associated islands. Bursary grants are up to £7 thousand for 18 months. Fellowship grants are up to £15 thousand for up to 36 months. Applications are due 01 September each year.

Erik Hosking Charitable Trust -- Photos, Painting, Illustration, and Writing for Conservation 2011. The Erik Hosking Trust supports projects of scientific and conservation value on birds and other subjects of natural history through the media of writing, photography, painting, and illustration. Grants of up to £750 may be awarded to suitable

candidates from any country. Application deadline is 30 September each year.

Otto Kinne Fellowships 2011. The Otto Kinne Foundation (Germany) supports promising young environmental scientists in eastern Europe for research that includes the protection and management of species and natural environments. Eligible countries are Albania, Armenia, Azerbaijan, Belarus, Bosnia, Bulgaria, Croatia, Czech Republic, Estonia, Georgia, Hungary, Latvia, Lithuania, Macedonia, Moldavia, Montenegro, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, and Ukraine. Nominations are invited from research ecologists worldwide. The closing date is 30 September 2011.

Philip Henman Trust for UK Development Projects – Grants 2011. The Philip Henman Trust makes grants to UK-based development organizations, with few restrictions on thematic areas. Support is normally between £3 thousand and £5 thousand per year, with a maximum total of £25 thousand. The closing date for applications is 10 September 2011.

Polden-Puckham Charitable Foundation – Grants 2011. The Foundation funds projects in the area of social and environmental justice implemented by UK organizations, including for international projects. The next deadline for applications is 15 September 2011.

Royal Botanic Gardens, Kew -- Small Grants 2011. Through the Bentham-Moxon Trust, Kew Gardens (UK) makes 30 to 40 small grants per year to botanists and horticulturalists for plant collection and field research; international visits or work at Kew; travel and conferences; and other project support. Grants must involve a developing country. The closing date for applications is 30 September.

Tyler Prize for Environmental Achievement – Nominations 2011. This is an annual prize of US$200 thousand for exceptional accomplishments in environmental science, energy, or medicine. The nomination deadline is 15 September each year.

U.S. Agency for International Development (USAID) -- Global Development Alliance 2011. USAID invites applications for public-private partnerships in its programs for agriculture, climate change, water management, disaster preparedness, and others. Partners are businesses and NGOs in countries where USAID has field missions, with exceptions for multi-country initiatives. Partners contribute resources (in the form of personnel, facilities, materials, and money) in a 1:1 match with USAID. Past awards range from US$50 thousand to US$10 million. Reference M/OAA/GRO/EGAS – 11-002011. TVG Note: "Funds for NGOs" provides a convenient summary of how to apply at this . Concept notes are accepted through 30 September 2011.

U.S. National Science Foundation -- International Research Fellowships 2011. The NSF supports U.S. scientists and engineers in the early stages of their careers to engage in international collaborative research. Past fellowships include some with partner institutions in developing countries in areas such as ecology, climate change, and others. Proposals are due 13 September 2011.

October 2011

King Baudouin Foundation -- Marie Antoinette Carlier Fund 2011. The Marie Antoinette Carlier Fund funds projects in water, education, and health in Burundi and the Democratic Republic of Congo (DRC). The Fund does not make open calls for proposals. Rather, it reviews recommendations by intermediaries, who must be approved by the Fund. Applications are submitted in French only, with closing date 31 October.

If you have any funding opportunities that you would like announced in FrogLog, please send details to James Lewis at jplewis@amphibians.org

Instructions to Authors

FrogLog publishes a range of articles on any research, discoveries or conservation news relating to amphibians. We encourage authors describing original research to first make submissions to a refereed journal and then, if appropriate, to publish a synopsis in FrogLog. Submissions to FrogLog should be in English, in the region of 1000 words, unless previously discussed with the editorial team, and follow the format of FrogLog 83 and above.

All graphics supplied for publishing should be submitted as separate files, ideally in original jpg format or alternative commonly used graphical format. Please ensure that the highest quality image is sent to allow for optimal reproduction.

Tables and charts may be included at the end of a word document with clear indication as to the appropriate title/legend.

All titles and legends should be listed one after the other, as part of the text document, separate from the figure files. Please do not write a legend below each figure.

Submission must include all authors first and surname which will be printed at the beginning of the published document.

Each submission will be referenced as follows at the back of the edition:

Tingley, R., Phillips, B. L. & Shine, R. (2011) Alien amphibians challenge Darwin's naturalization hypothesis. *FrogLog* 95. Author Contact: reid.tingley@gmail.com.

If you require further information on author affiliations, provide directly under this reference.

Examples of submissions can be found in previous editions of FrogLog and include:

- News and Comments
- Correspondence
- Obituaries
- Opinion
- Futures
- News & Views
- Insights, Reviews and Perspectives
- Upcoming meetings
- Recent Publications
- Books Releases
- Careers

Submission should be sent to froglog@amphibians.org.

Please name all files as follows, first author surname_brief title description_content i.e. tingle_darwins naturalization_paper, tingle_darwins naturalization_figure 1.

Students

The ASG has a particular interest in highlighting the vast amount of work being undertaken by students around the world and we invite students to submit synopsis of their thesis where appropriate.

Coming up in FrogLog Vol. 97

Sub-Saharan Africa Special

Sub-Saharan ASG Update

Sabin Award Winners 2011

ASG seed grant award winners

Recent Publications

and much more.....

July 2011

Photo: Robin D. Moore/iLCP