froglog

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News from the herpetological community

Regional Focus

South America

100th Edition

INSIDE

Paintings of *Ameerega yoshina* (orange and red morphs) from a Field Guide to Aposematic Poison Frogs (Dendrobatidae) of the Andean Countries: Colombia, Bolivia, Ecuador, Peru and Venezuela © 2012 Ted R. Kahn

"Lost" Frogs - Phase II

Which species do you think should be in the Top Ten?

Leaping Ahead of Extinction

What's your plan?

The Sabin Award for Amphibian Conservation

Thanks to a generous donation from Andrew Sabin, the IUCN SSC Amphibian Specialist Group (ASG) announces the fifth annual award to recognize individuals who have made a significant contribution to promoting the conservation of globally threatened amphibians. The award of US$25,000 is open to individuals from all disciplines relevant to amphibian conservation and research anywhere in the world. Nominations of individuals from developing countries are highly encouraged.

Nomination forms and supporting information can be found on the ASG web site at http://www.amphibians.org/asg/grants/. The closing date for nominations is the 29th January 2012.

Robin Moore / iLCP

Taking the pulse of the planet's biodiversity: a new tool for tracking changes in amphibian abundance

The Living Planet Index : A call for support

The Living Planet Index (LPI) is a measure of the state of the world's biological diversity based on population trends of vertebrate species from around the world. The Amphibian Survival Alliance (ASA), in collaboration with the Zoological Society of London and WWF, aims to develop a new index of amphibian population change. To find out more about the LPI download the fact sheet here static.zsl.org/files/1-2-1-living-planet-index-1062.pdf or contact Jaime Garcia Moreno (jaime.garciamoreno@iucn.org) or Phil Bishop (phil.bishop@iucn.org) to find out how you can get involved in this innovative initiative.

FrogLog

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Editorial

Welcome to the 100th edition of FrogLog. A little over 20 years ago the first edition of FrogLog was published by the Declining Amphibian Populations Task Force (DAPTF). A free publication, FrogLog provided a summary of field studies, announcements, grant support, and recent publications. In August 2006 the 76th edition of FrogLog was published by the newly formed IUCN SSC Amphibian Specialist Group. Since then we have tried to build on the great work undertaken by the DAPTF and have continued to develop FrogLog to meet the needs of our members and the wider community interested in amphibian conservation and research.

With the current FrogLog format we are hoping to provide an insight into regional activities and provide opportunities for individuals and groups to tell their stories. FrogLog articles range from detailed project updates and notes on the ecology of species, to stories from the field, which often read like an adventure novel.

This edition is a prime example of what we are trying to achieve. The ASG Updates provide a general overview of some of the projects in which we are currently involved, specifically within the region of focus but also globally, allowing us to highlight some of the upcoming projects of our partners, such as Amphibian Ark's "Leaping Ahead of Extinction" event this February 29th (see page 18).

The Regional Focus section was introduced to provide members an annual platform to publicize their inspiring efforts. In this South American edition we have updates from a number of groups from Argentina to Venezuela with several fantastic submissions from non-ASG members whose work we are proud to publish. The Global section provides further opportunity for individuals and groups to publicize their efforts throughout the year. In this edition we have articles from Costa Rica, China, and India to name but a few.

We hope that the development of FrogLog will continue to be dynamic and meet the needs of our members and the wider community and thank all those who have played a part in keeping FrogLog alive for the last 20 years. Here's looking forward to the next 20!

James P. Lewis

ASG Program Coordinator

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News in Brief

Amphibian Sp

Helping to Protect Amph

The IUCN SSC Amphibian Specialist Group (ASG) 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. The ASG is directly involved in supporting the activities of a number of amphibian conservation projects around the world. Here you can see a few updates from projects we are currently supporting and other news of interest. More information on ASG supported projects and the work of ASG members and partners around the world can be found on our web site at www.amphibians.org.

Europe, North Africa and West Asia

The 101st edition of FrogLog due out in March will be focusing on Europe, North Africa and West Asia. If you would like to publicize your amphibian conservation efforts please contact the appropriate regional chair (http://www.amphibians.org/resources/asg-members/#zone3) or James Lewis at jplewis@amphibians.org.

Global

Amphibian Ark (AArk) is pleased to announce an exciting new international promotion, to coincide with Leap Day (February 29th) 2012. The event is called "Leaping Ahead of Extinction: A celebration of good news for amphibians in 2012", and the focus is to promote institutions that are managing amphibian rescue or supplementation programs. Read more on page 18.

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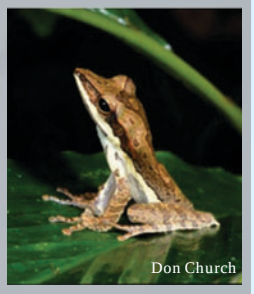
Sri Lanka



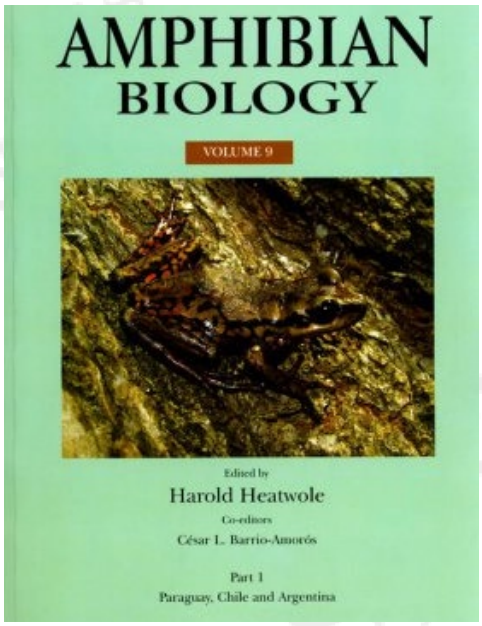
The ASG is actively supporting the development of an amphibian habitat monitoring and habitat restoration program in Morningside, Sri Lanka through a grant part funded by the Save Our Species program. Read more about this incredible region that is currently under threat and the importance of the program on page 12.

Madagascar

A New Amphibian Captive Breeding Center Opens in Madagascar. Led by the Mitsinjo Association, with support from Malagasy authorities, the ASG and a range of other NGOs. Although chytrid has not yet been detected in Madagascar, seven of the country's amphibian species are already designated as Critically Endangered, and therefore at high risk of extinction if disease outbreaks should occur. The amphibian center will establish captive populations of the most threatened species as a reserve in case the fungus reaches the island. Read more on page 15.

ASG Bulletin Board

Amphibian Biology - series update



The Series "Amphibian Biology" is bringing out four volumes (Vols. 9-11) that deal with the decline and conservation of amphibians and which should be of interest to readers of Froglog. The series continues to develop and qualified persons interested in contributing manuscripts for the following countries or Parts, should contact Harold Heatwole, Dept. Biology, NC State University, Raleigh, NC 27695-7617, USA or email: harold_heatwole@ncsu.edu - *Islands of the Indian Ocean, Middle East, Sub-Saharan Africa and Islands of the Atlantic Ocean (Togo has been assigned) Australia, New Zealand and Islands of the Pacific Ocean.* Read more on Page 66.

Recent Pubs. added to the web site

The ASG library (http://www.amphibians.org/resources/publications/)continues to grow with the addition of the regional action plan from China. We are currently working with ASG China to translate this into english and as soon as this has been completed it will be available online.

If you have any publications that you feel should be included on the ASG web site please contact James Lewis at jplewis@amphibians.org. We are particularly interested in collating all amphibian action plans and encourage all regional groups who have produced such a document to contact us with details.

The Sabin Award for Amphibian Conservation

Thanks to a generous donation from Andrew Sabin, the ASG announces the fifth annual award to recognize individuals who have made a significant contribution to promoting the conservation of globally threatened amphibians. The award of US$25,000 is open to individuals from all disciplines relevant to amphibian conservation and research anywhere in the world. The deadline for nominations is Sunday 29th January 2012.
Please see http://www.amphibians.org/resources/grants/ for more information.


Robin Moore / iLCP

Amphibian Red List Internship Available

The Amphibian Red List Authority seeks a volunteer intern to assist with maintenance and update of the amphibian conservation assessment database in the IUCN Red List of Threatened Species. The intern will receive formal training in the IUCN Red List Categories and Criteria, IUCN's Species Information System (SIS) database and IUCN's mapping standards. The internship will involve helping update the amphibian database and liaising with experts as needed to complete draft assessments. Potential interns should have a good understanding of amphibian taxonomy, declines and conservation, strong internet-search and data-mining skills. Familiarity with GIS and operating and managing web systems as well as knowledge of the IUCN Red List Categories and Criteria will be an asset. All interns must have an advance level of English, both spoken and written. While this is an unpaid internship, the intern will receive a copy of Threatened Amphibians of the World at the end of the internship. For more information please contact Ariadne Angulo - ariadne.angulo@iucn.org.

The Search for "Lost" Frogs Next Steps

By Robin D. Moore

On August 9, 2010, the Amphibian Specialist Group and Conservation International, with support from Global Wildlife Conservation, announced the launch of the Search for "Lost" Frogs – an unprecedented global search for amphibian species not seen this century – some not seen in close to two centuries! ASG members were pivotal in compiling the preliminary list of 100 "Lost" species. Over the proceeding months, thirty-three teams comprising 126 researchers were supported in 21 countries with one goal in mind: to find the lost amphibians. Teams battled landslides and severe rains in Mexico, scoured steamy jungles in the Ivory Coast and waded up rivers in Borneo in an unprecedented unified global search for "Lost" species.

The Search for "Lost" Frogs captivated the public in a way that I never imagined, with the initial announcement being picked up by some 150 news articles with over 200 million potential viewers. From here interest in the search snowballed as regular updates from the field spoke of the unwavering persistence and optimism required to brave the elements in the name of science. While most teams, after days and even weeks in the field, came home exhausted and empty-handed, it wasn't long before the good news started coming in. Some fifteen species last seen between 15 and 136 years ago were reported in the Democratic Republic of Congo, Ivory Coast, India, Mexico and Haiti – and as the first phase of the search neared its close came the first "top ten" find: the Rio Pescado Stubfoot Toad in Ecuador, *Atelopus balios*. A total of six press releases generated 650 news articles in 20 countries with over a billion potential viewers.

The first phase of the Search for "Lost" Frogs concluded in February 2011, but this did not deter researchers from continuing their search. In June, some eight months after searches began for the species, the elusive rainbow toad of Borneo - *Ansonia*

The original "Top Ten" Most Wanted poster. Three of the "Top Ten" have already been found and there is still hope in finding others. This poster was a fundamental tool in capturing the world's media attention and provided a clear overview of the project to the general public.

Rio Pescado Stubfoot Toad, *Atelopus balios*, Ecuador

Last seen: 1995
Rediscovered: October 2010


Eduardo Toral-Contreras

The Rediscovery

After 15 years without records, a field party from Museo de Zoología, Pontificia Universidad Católica del Ecuador led by Santiago Ron found in October 2010 the only know population of A. balios in Ecuador. They received help from a family of peasants who gave convincing accounts of recent sightings of the species. A single adult individual was found during a nocturnal search. The frog was along a river over a leaf 50 cm above ground. The individual was apparently healthy.

Next Steps

Protecting the land where A. balios occurs is of high priority because farmers, who have little awareness of the importance of the population, currently own the land. We are currently in discussions with partners about how we can ensure the protection of this habitat. The vegetation in the region is dominated by secondary forest and land devoted to agriculture and cattle rising. An additional priority is monitoring the population to have a better understanding of its size and composition by reproductive stage and sex. Based on that information it could be determined if the population requires to be managed ex situ at the facilities of Balsa de los Sapos in Quito.

Sambas Stream Toad, *Ansonia latidisca*, Borneo
Last Seen: Late 1920s
Rediscovered: June 2011


Indraneil Das

Summary
Ansonia latidisca is a bufonid amphibian, which, until 2011, was known from three individuals from two locations in north-western Borneo, namely, western Kalimantan and western Sarawak. The only published literature is the original description of Inger (1966), who referred it as a montane species. Interest stimulated by the Search for "Lost" Frogs Campaign lead to intense field work by Dr Indraneil Das and his graduate students Pui Yong Min andOng Jia Jet at one of these sites, Gunung Penrissen. Following support from the campaign for preliminary searches, this research was continued under sponsorship of Shell grant, through the Institute of Biodiversity and Environmental Conservation, Universiti Malaysia Sarawak. This led to the rediscovery of the species in June 2011, when three individuals were located along a stream at a higher elevation than expected.

Next Steps
In the coming year field work will focus on gathering ecological information on the species, as part of an M.Sc. thesis by Mr. Ong Jia Jet, a graduate student at UNIMAS under the supervision of Dr Das. In September, the Trustees of The Rufford Small Grants Foundation approved a RSG grant of £5,500, towards a project entitled, "Ecology and conservation of Ansonia latidisca, the Bornean Rainbow Toad, at Gunung Penrissen, Sarawak, Malaysia", to further understand the biology and ecology of this unknown toad. This research will be key to determining the status and threats to the species. In addition, a small group is being kept in the lab to make behavioral observations – to date the only calls known from the species have been from this population. According to Dr Das the calls are somewhat low-pitched and are therefore may be hard to hear in the field.

Hula painted frog, *Discoglossus nigreventer*, Israel
Last Seen: 1955 and listed as Extinct
Rediscovered: November 2011


© Professor Heinrich Mendelssohn, Tel-Aviv University.

The Rediscovery
In the early 1950s, Hula lake and surrounding marshes were drained as a way of tackling malaria. Among other environmental problems, draining the lake led to the near extinction of an entire ecosystem and the unique endemic fauna of the lake, and in 1996 the Hula painted frog was declared extinct by the IUCN. Only three adult Hula painted frogs had ever been found. Two of these were collected into captivity in the 1940s, but the larger one ate the smaller one, leaving just one specimen to remember the species by. Subsequent expeditions to find the species were unsuccessful.

Until, one morning in November 2011, Nature and Parks Authority warden Yoram Malka was conducting his routine patrol of the Hula Nature Reserve when something jumped from under him. He lunged after it and caught it: he was holding in his hand a male frog - the first Hula painted frog seen in over 50 years. Two weeks later a female was found in swampy weeds, twenty centimeters deep, and at 13 grams weighs only half of her male counterpart.

Next Steps
The rediscovery of the Hula painted frog has taken the species from being a symbol of extinction to a symbol of optimism in what is clearly an important area for biodiversity. The frog lives within the Hula Reserve, and aquatic ecologist Dana Milstein believes that the frog's rediscovery is linked to environmental improvements in the reserve. According to Dr Milstein, "in recent years, the water quality has improved, after they started to pour water from fish ponds and nearby springs into the reserve". As conditions continue to improve it is hoped that the frog will serve as an inspirational success story for ecological restoration; in the meantime, Nature and Parks aim to assess the status of the frog within the reserve.

latidisca - last seen in 1926 and one of the "top ten" "Lost" species, was rediscovered. In November, a Park Ranger conducting his daily rounds of Ha'Hula lake in Israel could barely believe his eyes when he stumbled upon the Hula painted frog – *Discoglossus nigriventer* – a species last seen in 1955 and pronounced extinct after the draining of its habitat – a truly staggering rediscovery that brought the total "top-ten" finds to three.

We are also in the process of developing the "Lost" Frogs web page on http://www.amphibians.org/our-work/lostfrogs/ to maintain a dynamic and current online list of "Lost" species. Again, we look to you, the experts, to tell us when you believe a species is "Lost" and when a species can be struck off this list. Species on the list should not have been seen in the past decade and its continued survival should be in question.

The goal of the Search for "Lost" Frogs was to deliver an important message about the plight of amphibians in an engaging and inspiring package. Tapping into a sense of exploration and discovery, the Search for "Lost" Frogs resonated with the public. The success of the campaign was thanks to the passion, enthusiasm and dedication of the amphibian community – the scientists who helped compile the list and the researchers who endured days and weeks in the field searching for the proverbial needle in the haystack.

Three of the "Top Ten" Most Wanted Amphibians have already been found, we are now looking for your help to identify three more species which can take their place on the "Top Ten" Most Wanted list. Please email rdmoore@amphibians.org with your nomination including the name of the species, last time seen, available images/video or illustrations, any known searches and plans for future searches, and a sentence explaining why this species deserves to be in the "top ten".

As we enter phase II of the campaign under the umbrella led by the ASG, we would like your help in refreshing the top-ten list by adding three species you think deserve to be highlighted to replace those that have been found. We are therefore inviting you, before February 14 2012, to nominate which species you believe deserves to be in the top ten and why. We appreciate the subjectivity of this list – it is designed as a tool for engaging the public and therefore we will select particularly iconic, unusual or ecologically important species and will try to achieve a good global spread of selected species. Please email me with your nomination including the name of the species, last time seen, available images/video or illustrations, any known searches and plans for future searches, and a sentence explaining why this species deserves to be in the "top ten". We will announce the new "top ten" on February 29.

The continued and wide support of this campaign demonstrates not only the public awareness value of such efforts but also the potential scientific value. By sharing information on searches, the community can help to ensure that indicators such as the IUCN Red List, and other similar indicators, are incorporating the most comprehensive information available. In the case of the "Lost" species this includes being able to record the amount of effort that is put into searching for a species and where those searches have taken place. By recording this information through the Search for "Lost" Frogs we are better able to provide supporting evidence on the actual status of species and take appropriated action.

We look forward to working with you to keep the Search for "Lost" Frogs alive and keep the rediscoveries coming, and welcome your feedback – please do not hesitate to email me (rdmoore@amphibians.org) with any questions. While we do not currently have funds to support teams searching for "Lost" frogs we are seeking sponsors interested in supporting field teams and hope to be able to support future efforts to find "Lost" species.

Conservation and biogeography of threatened Amphibians of Eastern Sinharaja

By Madhava Meegaskumbura, Suyama Meegaskumbura, Nimal Gunatilleke, Kelum Manamendra-Arachchi, Gayan Bowatte, Tharindu Gunathilaka and Champika Bandara

Fig. 1. *Ps. procax*, a Critically Endangered, forest dwelling species, restricted to Eastern Sinharaja.

Despite some recent remarkable discoveries of new species (Manamendra-Arachchi and Pethiyagoda, 2005; Meegaskumbura and Manamendra-Arachchi, 2005), Sri Lanka has already lost 21 species of amphibians, this is about half the confirmed extinctions in the world. Nineteen of these Sri Lankan amphibians belong to genus *Pseudophilautus* (Meegaskumbura et al. 2007), all of which are terrestrial direct developers and many of which are habitat specialists, often requiring the shade of a canopy covered forest for survival. Eighty six percent of the currently known 67 *Pseudophilautus* species described from Sri Lanka are

Fig. 2. *Ps. papilosus*, a Critically Endangered, forest dwelling species, restricted to Eastern Sinharaja.

Fig. 3. *Ps. lunatus*, a Critically Endangered, forest dwelling species, restricted to Eastern Sinharaja.

Fig. 4. *Ps. simba*, a Critically Endangered, leaf litter dwelling species, restricted to Eastern Sinharaja.

Fig. 5. *Ps. limbus*, currently designated as Critically Endangered, but has a wide extent of occurrence, lowland to Rakwana hills.

Fig. 6. *Ps. poppiae*, an Endangered, forest dwelling species, restricted to Eastern Sinharaja.

Fig. 7. *Ps. ocularis*, an Endangered, forest dwelling species, restricted to Eastern Sinharaja.

Fig. 8. *Ps. auratus*, an Endangered, forest and open-area dwelling species, occur in Eastern Sinharaja.

Fig. 9. *Ps. decoris*, an Endangered, forest dwelling species, restricted to Eastern Sinharaja.

Fig. 10. *Ps. regius*, a Data Deficient species, lives in open areas and has a wide distribution.

Fig. 11. A satellite picture of Morningside area showing the amount of fragmentation to the habitat.

Fig. 12. Road, open grasslands and regenerating forest patches.

threatened with extinction (CR, EN or VU, IUCN Red List Categories) or are extinct (EX). Eastern Sinharaja (ES) harbors 10 *Pseudophilautus* species of which 5 are Critically Endangered (*Ps. procax, Ps. papillosus, Ps. lunatus, Ps. simba* and *Ps. limbus*), 4 are Endangered (*Ps. poppiae, Ps. ocularis, Ps. auratus* and *Ps. decoris*) and 1 is Data Deficient (*Ps. regius*) (Fig 1-10); seven of the ten species are endemic to ES, highlighting the importance of ES as a refuge for threatened frogs (Fig. 11 & 12). Many of the *Pseudophilautus,* including the seven ES forms are point endemics (very restricted distributions). The point endemic nature of *Pseudophilautus* is due to a combination of the following characteristics: terrestrial direct development, habitat specialization, requirements of unique climatic conditions and constraints to reproduction.

Through *ex-situ* and *in-situ* observational studies (Bahir et al. 2005) and molecular phylogenetic analyses (Meegaskumbura et al. 2002) it is confirmed that all *Pseudophilautus* species show direct development. These frogs also show two major reproductive behaviors: soil nesting (most species; Fig. 13) and arboreal nesting (only seen in three species; Fig. 14); both these behaviors are observed in ES *Pseudophilautus* species.

Fig. 13. *Ps. hallidayi* laying eggs, shown to exemplify soil nesting behavior.

Seven of the ES species, especially the Critically Endangered forms are only found in canopy-covered forests. Three of the ten species are found both in canopy covered forest and grasslands. The forest species specialize further by selecting certain perching heights and microhabitats (distance from water) within the forest strata. Species that survive in grassland take refuge amongst litter and grass tufts.

Fig. 14. *Ps. femoralis* female with egg clutch on leaf, soon after egg deposition, shown here to exemplify leaf nesting. The leaf nesting species in Eastern Sinharaja is *P. poppiae*, which is closely related to *Ps. femoralis.*

Recent microclimate monitoring work by us for temperature (Fig.15), relative humidity (Fig.16), light intensity and UV-radiation daytime fluctuations are dramatically different for forest habitats (includes natural and regenerating forests) and degraded grasslands and roads. However, the nighttime, fluctuations were more or less similar in all habitats. Some of the forest species, do not hide but lay on leaf surfaces, exposed to the subdued light and UV rays (in small amounts, UV is important for frog metabolism) that filters through the canopy, this they will never be able to do in an open habitat due to extreme conditions. So it seems that daytime climatic conditions, that are regulated by the particular habitat types is important in species distribution, rather than the night time conditions. When restoration of habitats is attempted, to help conserve amphibians, the conditions needed during the daytime should be closely considered.

When the distribution of Eastern Sinharaja *Pseudophilautus* are traced on a molecular phylogenetic tree (that of Meegaskumbura and Manamendra-Arachchi, 2011) it is apparent that they are distinct evolutionary lineages representative of the major clades of *Pseudophilautus* in Sri Lanka. The basal nature of several of the clades and the high endemicity suggest that ES is a montane refugium and a center of endemism. Moreover, sister species of some of the Eastern Sinharaja *Pseudophilautus* are found in Lower Sinharaja (Kudawa) region (eg. *P. decoris* and *P. mittermeieri*, *P. procax* and *P. abundus*, *P. papillosus* and *P. reticulatus* sister species pairs). This shows the importance of maintaining the quality of habitat of Eastern Sinharaja and also the connectivity between Eastern and lower Sinharaja.

Several species that were not discovered in extensive surveys that were carried out from 1996-2004, have now arrived in ES. These

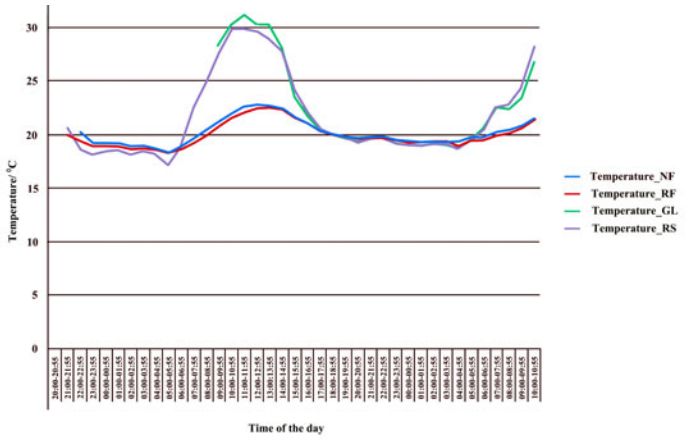


Fig. 15. Graph depicting the daily fluctuation of temperature in Natural Forests (NF) regenerating forests (RF), Grassland (GL) and Road-side (RS).

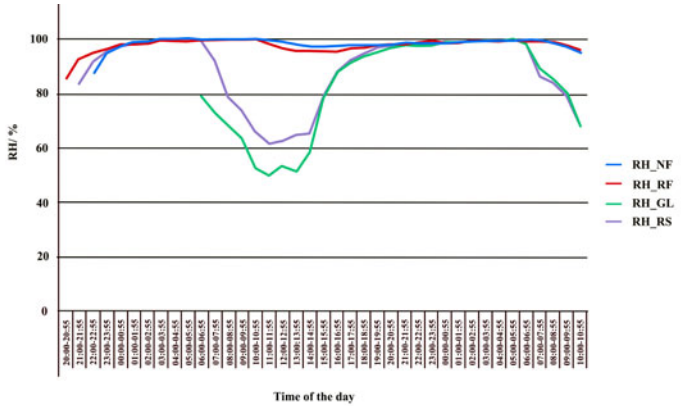


Fig. 16. Graph depicting daily fluctuation of relative humidity in Natural Forests (NF) regenerating forests (RF), Grassland (GL) and Road-side (RS).

are *Pseudophilatus rus* (LC: least concern, IUCN category; Fig. 17), *Ps. hallidayi* (VU; Fig.18) and *Ramanella obscura* (LC; Fig. 19); all these species are not threatened. If these species already occurred in Eastern Sinharaja prior to 2004, we should have found them, as they are common species where they occur (non threatened IUCN statuses also suggests this). However in 2005, *Ps. rus* was observed on the roadside to Morningside Bungalow; *Ps. hallidayi* was observed near Morningside Bunglow and *R. obscura* was observed in a regenerating forest patch; however at the time, their population size was low. By 2011, *Ps. rus*, was very common and occupied all habitat types; *R. obscura* and *Ps. hallidayi* were still a small population. In 2011, a dramatic drop of *Taruga fastigo* (CR) (Meegaskumbura et al. 2010), and *Ps. decoris* population was also observed.

The issues discussed and the trends delineated portend a bleak future for the *Pseudophilautus* and other endemic animals of ES. The entire Sinharaja, together with ES, provides a gradual gradient for animals to disperse, especially with climatic change. In the event of a warming event, mid-elevation species can migrate over to ES, if they are to track colder climates.

Thus the maintenance of this altitudinal habitat gradient is critically important for the conservation of both ES and lowland rainforest forms of Sinharaja. To ensure the non-establishment of invasive species, and to facilitate the ES endemic species, immediate action is needed to connect many of the scattered forest fragments through research driven reforestation programs. Activity, such as road building, encroachments, new plantations, which destroys connectivity in ES area should be minimized, while research activities and reforestation work is maximized. We have now started a long-term monitoring study in Morningside, which is being extended to an effort to restore critically important habitats.

Acknowledgements

IUCN SSC Amphibian Specialist Group, Global Wildlife Conservation, Conservation International, Rohan Pethiyagoda, Don Church, Robin Moore and James Lewis, are acknowledged for facilitating and supporting this work. The Department of Wildlife Conservation and Forest Department of Sri Lanka are gratefully acknowledged for permission to carry out the monitoring work.

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Fig. 17. *Ps. rus*, a least concern species, which is a recent arrival at Eastern Sinharaja.

Fig. 18. *Ps. hallidayi*, a vulnerable species, inhabiting rocky areas (also live close to human dwellings); a recent arrival at Eastern Sinharaja.

Fig. 19. *Ramanella obscura*, a least concern species that often tolerates human made conditions well, a recent arrival at Eastern Sinharaja.

New Amphibian Captive Breeding Center Opens in Madagascar

By Nirhy Rabibisoa & Justin Claude Rakotoarisoa

As local herpetologists we have witnessed the habitats of amphibians in Madagascar shrink due to pressure from forest clearing, bushfire, slash-and-burn farming, mining, oil exploration and road construction.

More than 99 percent of Madagascar's amphibians are found nowhere else on Earth, and according to the International Union for Conservation of Nature (IUCN), one-quarter of these species are classified as threatened with extinction.

Fortunately, there is now a critical resource to help the frogs fight back: a new amphibian captive breeding center.

Led by the Mitsinjo Association, with support from Malagasy authorities, IUCN's Amphibian Specialist Group and a range of other NGOs, construction of the captive breeding facility began in November, 2010 through the Association of Zoos and Aquariums Conservation Endowment Fund. During the past 15 months, staff training and husbandry research on local frog species has been conducted in collaboration with, and support from, Conservation International, Cleveland Metroparks Zoo, the Woodland Park Zoo, Amphibian Ark, and Durrell Wildlife Conservation Trust.

The Mitsinjo captive breeding facility was constructed in response to the growing threat of the chytrid fungus that has decimated amphibian populations worldwide. Although chytrid has not yet been detected in Madagascar, seven of the country's amphibian species are already designated as Critically Endangered, and therefore at high risk of extinction if disease outbreaks should occur. The amphibian center will establish captive populations of the most threatened species as a reserve in case the fungus reaches the island.

The Mitsinjo amphibian captive breeding facility in Andasibe, Madagascar. (© CI/Photo by Nirhy Rabibisoa)

Amphibians provide many important services to humans, such as controlling insects that spread disease and damage crops, and helping to maintain healthy freshwater systems. In 2008, CI-Madagascar organized the development of the Sahonagasy Action Plan (SAP), a national plan for amphibian conservation. This plan emphasized the emerging threat posed by the chytrid fungus and the need to develop the capacity within Madagascar to detect and monitor the disease, and to develop in-country breeding facilities for disease-free frog populations. Captive breeding will also help to combat the combined action of habitat destruction, illegal and unsustainable collection for the international pet trade, and the impacts of climate change.

The facility currently houses about 33 frogs representing six species from the Andasibe region, namely: *Mantidactylus betsileanus*,

Heterixalus punctatus in Madagascar. (© Photo by Devin Edmonds)

Boophis pyrrhus, *Heterixalus betsileo*, *Heterixalus punctatus*, *Blommersia blommersae*, and *Guibemantis* sp.

Until now, no one in Madagascar had the knowledge or capacity to breed these frogs in captivity. As a result, the Mitsinjo team will first focus on breeding common species that have similar habits and habitats to threatened species as husbandry skills are developed. Once these captive-breeding techniques have been mastered, the team will deal with the more threatened species. This captive breeding program also provides an opportunity to gather information on the life history of these frogs.

There are many challenges to this kind of work. Besides the strict hygiene standards and the risk of disease transmission between the frogs, feeding the frogs is an especially difficult skill to learn. Live food is critical for the frogs' survival, but it can be difficult to determine the precise quantity and nutritional balance that the animals need. This skill is, of course, crucial for the success of the center. The team's captive breeding specialist has so far trained six technicians to caring for live frogs.

Although still in the early stages of this project; it is planned to eventually develop educational programs that will showcase the value of Madagascar's frogs and their habitats to local people, and generate money through ecotourism.

In the coming year, the team hopes to increase the number of species bred at the facility — bringing us all a step closer to safeguarding the future of these fascinating creatures.

Author detials: Nirhy Rabibisoa is the Executive Secretary for the ASG, Madagascar. Justin Claude is the technician lead at the Mitsinjo Captive breeding Center (email: babakotokely@gmail.com).

Protection of critical amphibian habitat through novel partnerships in Colombia

By Robin D. Moore

Over the past six years the ASG has been supporting partners around the world to protect critical amphibian habitat, combating habitat loss, one of the primary drivers of amphibian declines and extinctions. The Global Amphibian Assessment highlighted Colombia as the country with the second highest number of amphibian species in the world and the most threatened species and, as a result, it has been the focus of much of our habitat protection efforts. We have worked with a variety of International partners to support local partner Fundacion ProAves in the creation of six new protected areas, safeguarding more than two-dozen threatened amphibian species.

Our first project was developed in December 2005 when we were approached with an opportunity to create a new 650 hectare Reserve in the Sierra Nevada de Santa Marta. Identified by the Alliance for Zero Extinction (www.zeroextinction.org) as the second highest priority site for species conservation, containing six threatened amphibians and three birds found nowhere else, the site was a clear priority for protection. Swift action and a novel partnership with the American Bird Conservancy allowed Fundacion ProAves to acquire the area, which had been slated for development, and create El Dorado Reserve. Shortly after the creation of the reserve two harlequin toad species - *Atelopus laetissimus* and *A. nahumae* – were found after 16 years without being recorded. Another more recent rediscovery within the Reserve, of the red-crested tree rat (*Santamartamys rufodorsalis*) after 113 years without being seen, is a reminder of how elusive nature can be.

El Dorado provided an effective model for the protection of amphibian habitat through a novel partnership, and was soon followed up with the creation of another 530 hectare Reserve home to 11 threatened amphibian species in the Central Cordillera in Colombia. The Reserve, named La Forzoso, is once again owned and managed by Colombian partner Fundación ProAves. Habitat protection is often opportunistic, and a third Reserve was created in response to an emergency situation for two highly threatened poison-dart frogs. Twenty hectares of habitat critical for the species was acquired and a new Reserve, named Ranita Dorada or "Little Golden Frog" after one of the species it was designed to protect, was successfully created. It encompasses an isolated wet subtropical forest fragment in a region dominated by coffee and pasturelands in the department of Tolima. This important and timely project was born out of a partnership between the ASG, IUCN Netherlands, Dendrobatidae Nederland, Conservation International, and Fundacion ProAves.

New Granada Cross Banded treefrog, *Smilisca phaeota*, in the Choco of Colombia. Photo: Robin Moore / iLCP.

More recently, the ASG has supported the creation of a new 1,175 hectare reserve for a species of red-eyed toad believed to be new to science. With its habitat in the process of being cleared for cattle ranching upon its discovery, the species could have been lost before it was even described. Fundación ProAves approached the ASG with the opportunity to support the acquisition and protection of the species' core habitat. Swift and decisive actions led to the purchase of 1,175 hect-

Glass frog, *Nynphargus grandisone*. Robin Moore / iLCP

ares of forest, ensuring the survival of the species and many others that call the area home. Facilities have now been constructed for Reserve Staff and visiting Researchers and in March 2011 a workshop was conducted to train promising Colombian students in amphibian research techniques.

Most recently, the ASG has supported, in partnership with the American Bird Conservancy, the creation of a new Reserve to protect core habitat for the Critically Endangered and iconic golden poison frog – *Phyllobates terribilis*.

Critical Amphibian Habitat Wanted

The ASG continues to expand support for the protection of critical amphibian habitat to the rest of Latin America, Africa and Asia, and we urge researchers and conservationists to let us know of opportunities for curbing habitat loss, one of the biggest threats to amphibians worldwide.

A sign denotes the creation of Ranita Dorado, a new Reserve for amphibians. Photo: Fundación ProAves.

Leaping Ahead of Extinction

By Kevin Johnson

Amphibian Ark (AArk) is pleased to announce an exciting new international promotion, to coincide with Leap Day (February 29th) 2012. The event is called "**Leaping Ahead of Extinction: *A celebration of good news for amphibians in 2012***", and the focus is to promote institutions that are managing amphibian rescue or supplementation programs. These programs should have been recommended either during an AArk conservation needs assessment, or by national governments or field experts. We are especially focusing on programs that have, or are currently, involved with *in situ* releases, head-starting etc. to enforce the important connections between *ex situ* and *in situ* conservation activities.

What will happen?

We're encouraging members of the public to visit their closest zoo or other organization with amphibian programs, on or around Leap Day 2012, to learn more about the important amphibian conservation programs that they are involved with. We are promoting the event via international media releases, on the Leaping Ahead of Extinction web page (www.LeapDay2012.org), in our newsletter and Facebook page (www.facebook.com/AmphibianArk), and through regional and national zoo associations and amphibian groups.

As with our very successful 2008 Year of the Frog campaign, institutions do not have to be involved in rescue programs to participate in this campaign. We want to raise as much awareness as we can about the amphibian crisis with as many members of the public as possible, so all are welcome.

Some institutions are planning special events to coincide with the Leap Day event, including frog photographic displays, learning about how to conserve frogs, behind-the-scenes tours of amphibian facilities and special keeper presentations about the global amphibian crisis and what is being done to save amphibians. Information about special events at participating institutions can be found on our Leap Day activities page (www.amphibianark.org/leap-day-activities/).

Updates from some of the amphibian conservation programs being run in institutions participating in the Leap Day promotion cam be seen on the program update page on our web site (www.amphibianark.org/updates-from-participating-institutions/) and details for many other *ex situ* amphibian programs

Participating institutions

To date, 46 institutions in 15 countries have confirmed that they will be holding Leap Day events. A list of the participating institutions can be found on the Leaping Ahead of Extinction web page,

Why not visit the closest participating institution to you on or around Leap Day (February 29th), to learn more about their amphibian conservation programs, and what they are doing in response to the global amphibian crisis? You'll also be showing your support for these institutions and their commitment to amphibian conservation.

For more information:
Visit our web site www.amphibianark.org/leap-day-2012/ or contact Kevin Johnson, kevinj@amphibianark.org .

amphibian ark

2012 Amphibian Ark calendars are now available!

The twelve spectacular winning photos from Amphibian Ark's international amphibian photography competition have been included in Amphibian Ark's beautiful 2012 wall calendar. The calendars are now available for sale, and proceeds from sales will go towards saving threatened amphibian species.

SALE

Now only $5

Pricing for calendars varies depending on the number of calendars ordered – the more you order, the more you save! Orders of 1-10 calendars are priced at **US$15 each**, orders of between 11-25 calendars drop the price to US$12 each, and orders of 26-99 are priced at just US$10 each. These prices do not include shipping.

As well as ordering calendars for yourself, friends and family, why not purchase some calendars for re-sale through your retail outlets, or for gifts for staff, sponsors, or for fund-raising events?

Order your calendars from our web site:
www.amphibianark.org/calendar-order-form/

Remember – as well as having a spectacular calendar to keep track of all your important dates, you'll also be directly helping to save amphibians, as all profits will be used to support amphibian conservation projects.

www.amphibianark.org

South America

Each edition of FrogLog focuses on one of the six geographical areas as outlined in FrogLog 96 (pg 6-7). This format provides regional ASG's with an opportunity to showcase their conservation efforts and publicize issues of concern. In this edition we focus on South America, a zone consisting of ten ASG regional groups.

Argentina

The recent history of Amphibian conservation in Argentina shows a mosaic of disappointing results and others who provide high expectations. The first collective action took place in late 1990, when the majority of the then active batracologists met in three workshops which resulted in the assessment of the conservation status of amphibians in the country, followed by the analysis of threats and a more comprehensive look on those species that had been categorized as Data Deficient (Lavilla et al., 2000; 2002; Lavilla, 2001). These local actions were followed by the meetings sponsored by the Global Amphibian Assessment that culminated in a workshop in Puerto Madryn in October 2003, ending in the subsequent dissemination of its results via world wide web.

Screenshots from www.youtube.com of Argentina's public television shows discussing amphibian conservation with Regional ASG Chair Dr. Esteban Lavilla. Links to these and other videos can be found in the literature cited list.

Ten years later, and thanks to the hard work of numerous biologist on amphibian conservation issues in the country, there was a workshop for the re-assessment of Argentinean amphibians with the participation of 30 specialists. Its results will be published in a special issue of "Cuadernos de Herpetología", the Journal of the Argentinean Herpetological Association, planned for mid 2012, but see the summary of results in this issue of Froglog, by M. Vaira. Next, in October 2010, 17 specialists participated in a second workshop to assess the conservation needs of amphibians in Argentina conducted by local and UK specialists; the results included the selection of 70 species that can be used in the development of programs for research, conservation and / or awareness. Finally, in July 2011, a third workshop on methodologies for breeding ex - situ, dictated by local and UK, USA and Mexico specialists, included the participation of 21 researchers and technicians from Argentina, Bolivia, Uruguay, Colombia, Ecuador, Paraguay, Peru, Bolivia and Chile.

Furthermore, diverse specialists conduct several lines of research on a variety of topics (studies on diverse genera and species, the analysis emerging diseases, the impact of the agriculture on frogs, etc.), and focusing on different geographic areas (i.e. the continuous monitoring of the mountain forest, the Puna and the high mountains in the Northwest, the semi-arid lowlands of the Great Chaco, the Atlantic forest of Misiones province, the Austral Andean Forest and Patagonia). Some of these activities and results were synthesized in Lavilla and Heatwhole (2010).

Finally, a considerable effort was made to present the problem of amphibian conservation to the community. In this field, we are pleased to have issued a program on public television at national level (see links below), and a second one is already recorded and in edition process, to be broadcasted earley in 2012 in Paka-Paka, a channel for children of Argentina's public television.

E. O. Lavilla (Chair) Argentina Amphibian Specialist Group . Fundación Miguel Lillo – CONICET, San Miguel de Tucumán, Argentina (eolavilla@gmail.com)

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http://www.youtube.com/watch?v=ET4MdAJHHcc&feature=relmfu

Brazil and Guiana Shield

The present Brazilian Red List was published in 2003 and 2004. The Brazilian government is currently coordinating the assessment of all Brazilian vertebrates (over 7,000 species), which is planned to be finished by 2014. IUCN methodology is being followed for all assessments with workshops being facilitated by at least one Red List Authority.

The amphibian assessments (~900 species) are being carried out by a partnership between the National Centre for Research and Conservation of Amphibians and Reptiles (RAN-ICMBio) and the scientific community. The scientific coordinator is Celio F. B. Haddad, a professor at Universidade Estadual Paulista. Assessments are planned to be carried out in four workshops, three of which have already occurred in 2010 and 2011. After the last workshop, which is planned for June 2012, the complete list of Brazilian endangered amphibians will be published.

In the first workshop, carried out in October, 2010, 21 researchers from 15 academic institutions assessed 91 species presently considered endangered in at least one red list (IUCN, Brazilian list or state lists), as well as a few Data Deficient (DD) species. In the second workshop, held in June, 2011, 25 specialists from 18 academic institutions assessed 254 species, many of them DD in the Brazilian and IUCN red lists. In the third workshop, held in December, 2011, 22 researchers from 14 institutions assessed 285 species, most of them Least Concern (LC) in the IUCN red list. As a result of these workshops, 630 Brazilian amphibians were already assessed: one Extinct, 14 Critically Endangered, 8 Endangered, 17 Vulnerable, 27 Near Threatened, 146 DD, 406 LC, and 11 Not Assessed.

Marcio Martins[1] (Co-Chair) Brazil and Guiana Shield Amphibian Specialist Group ,Yeda Bataus[2], Célio F. B. Haddad[3], and Vera Luz[2]

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Peru

Peru's Amphibian Specialist Group currently has over 20 members, but the estimated number of herpetologists working in the country is somewhere between 150 and 200 people. With such a growing community of professionals working on the amphibians and reptiles of Peru a logical next step would be to give a voice to this community, and to help inform and coordinate research and conservation actions, increase capacity building and outreach through the creation of a professional society with a focus on Peruvian herpetofauna.

In this regard we would like to report that the long-awaited Asociación Peruana de Herpetología (APH; Peruvian Association of Herpetology) was legally established in 2011. The APH's mission is to promote those scientific activities that facilitate the development of knowledge on amphibians and reptiles in Peru and contribute to the advancement of international herpetology. The APH's founding members are associated with several academic institutions, including universities in four different regions in Peru, as well as non-profit organizations and natural history museums, and 90% of them are ASG members. We expect that the interactions among members of the APH will increase opportunities for collaboration among both national and foreign colleagues, development of research proposals and study plans throughout the country. We also see the APH as a potential catalyst for increasing ASG activities. We look forward to seeing a significant growth in membership during the forthcoming years, once the society's basic physical infrastructure is established. Given that the APH is a new not-for-profit organization, its current main constraint to become fully functional is start-up funding and completion of financial paperwork. Once the financial setup is complete, an announcement will be made on various listservers and membership applications will then be more than welcome to endorse the society in the near future.

Another, general interest news pertains to the discovery and description of new species: about 20 new amphibian species living in Peru were described during the past two years (2010–2011). These new species belong to nine frog genera, with *Atelopus*, *Bryophryne*, *Hypsiboas*, *Gastrotheca*, *Pristimantis*, and *Ranitomeya* containing two or more new taxa (AmphibiaWeb 2011). It is particularly noteworthy that a total of nine new species of harlequin frogs (*Atelopus*) found in Peru have been described during the past ten years (2002–2011). Though we primarily view these discoveries as good news, it is disturbing to recognize that harlequin frog populations continue to decline, become locally extirpated, or become extinct in the wild. This has been the case of one such new species, *Atelopus patazensis* (Venegas et al. 2008), which was originally found in 1999 in a montane region in northern Peru. Analysis of skin tissue from deceased individuals confirmed the infection by the fungus *Batrachochytrium dendrobatidis* (*Bd*). Individuals of this species, which had not been seen for over ten years, were recently found in the type locality (IUCN SSC Amphibian Specialist Group 2011). Other *Atelopus* species haven't been seen after similar periods, even though intensive surveys in suitable habitat have been undertaken (Catenazzi et al. 2011).

Amphibian populations at other montane regions of Peru have also experienced dramatic declines, as highlighted in a study recently published by Catenazzi et al. (2011). These declines, which were documented based on intensive surveys between 1999 and 2009 in a national park, were more pronounced in stream-dwelling and arboreal species than in terrestrial species. Infection with *Bd* was implicated in the observed species' disappearance and population declines in the national park and other montane regions in Peru (Catenazzi et al. 2010; Catenazzi et al. 2011).

In spite of this news, one challenge that remains a top priority is to increase the capacity to document Peru's amphibian diversity—and biodiversity in general. During recent years, roughly half of the recently described species were found at mid to high elevations in montane forests or puna grasslands, whereas most of the remaining species have been found in lowland Amazon forests. The increased application of integrative approaches, namely combining molecular phylogenetics, morphology, bioacoustics, and ecology (Padial and De la Riva 2009; Brown et al. 2011; Funk et al. 2011), will improve our knowledge of as yet-undocumented cryptic species richness in the country.

Recent studies suggest that amphibian species richness is grossly underestimated (Fouquet et al. 2007; Vieites et al. 2009), and one study in particular suggests that one such hotspot for cryptic species richness is the Amazon basin (Funk et al. 2011). After Brazil, Peru is the second country with the largest expanse of Amazonian forest (about 61% of the country is comprised of Amazonian rainforests; IIAP 2011), so the implications for its biodiversity and its conservation are considerable. There are many so-called widespread Amazonian species which could potentially harbour cryptic species that may

be more circumscribed and restricted than the nominal species that they have been associated with (Angulo and Icochea 2010), and may be potentially threatened by local processes.

While there are some efforts being directed at uncovering this hidden species richness, there are comparatively less studies addressing the current conservation status or change in status of Peruvian amphibians. So far, the most comprehensive, collaborative study addressed the status of 83 species (von May et al. 2008), 44 of which were already assessed as threatened in the IUCN Red List of Threatened Species and/or the Peruvian legislation, but 39 species still require a reassessment in view of new information on threats. This study was a landmark contribution not only in terms of the number of species covered, but also in terms of collaboration: 27 authors were involved, 14 of which (ca 52%) are current ASG members. Although it is encouraging to see the community come together in the realization of this study, it is also of concern to evidence the large number of species that need to be reassessed in view of new data on threats.

In this context, the Peruvian government has been coordinating the update of the list of threatened species and associated legislation for the past two years. Herpetologists have been working together in an effort to harmonize both global and national lists for endemic species, and while there have been challenges throughout this process we believe that the establishment of the APH may facilitate similar efforts in the future.

Rudolf von May (Chair) & Ariadne Angulo[1] (Member) Peru Amphibian Specialist Group.

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Uruguay

Amphibian Conservation-Uruguay: update on the last four years.

A meeting was called in November 2007, all individuals and institutions working on amphibian biology and conservation were invited. The meeting took place on December 15, 2007 at the Museo Nacional de Historia Natural in Montevideo. The meeting was attended by Francisco Kolenc, Diego Nuñez, Gabriel Laufer, Claudio Borteiro, Diego Arrieta, and Raul Maneyro, in addition to the co-conveners José Langone and Rafael de Sá, co-chairs of IUCN Amphibian Specialist Group, Uruguay. Rafael de Sá presented and discussed the outcomes of the Amphibian Conservation Summit that resulted in the Amphibian Action Plan; highlighting concerns and proposed actions to be discussed in the context of amphibian conservation in Uruguay. Concerns included climate change, pollution, emerging infectious diseases, invasive species, and commercial over-exploitation.

The discussion of activities to be developed by scientists in Uruguay centered on: understanding the causes of the declines, documentation of biological diversity, develop and implement a national conservation plan, and develop emergency response plans. The participants noted that degradation and loss of quality and quantity of habitat is a problem for some species in Uruguay but that commercial use is limited and, consequently has a lower priority threat for native species. A lack of clear commitment to monitor and manage amphibian populations by government agencies is a serious concern. With regards to potentially invasive species, the group reported that *Lithobates catesbeianus*, *Xenopus*, and *Ambystoma* are being bred in Uruguay. Among them, *L. catesbeianus* has established wild populations in the Departments of Canelones (locality of Pando), Cerro Largo, and Soriano; these coincide with areas where captive breeding of the species was established for commercial purposes. The participants identified two priorities to be pursued: the elimination of all wild populations of *L. catesbeianus* (the presence of the populations in private lands may make this goal difficult to achieve) and the early identification, presence, and impact of *Batrachochytrium dendrobatidis* in native species.

Update and outcomes: (1) In recent years, populations of *Pleurodema bibroni*, a species that has not been found since 1995, was found in the Department of Rocha; efforts should be directed to purchase or secured the land where this population is found to ensure long-term conservation of the habitat and species. (2) two Ph.D. theses related to *Batrachochytrium dendrobatidis* are currently under way:

(a) Borteiro, Claudio. "Quitridiomicosis en anfibios de Uruguay: distribución geográfica, epidemiología y declinación de especies amenazadas"

(b) Laufer, Gabriel: "Invasión de rana toro (*Lithobates catesbeianus*) en Uruguay: influencia de la quitridiomicosis"

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FrogLog Schedule

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

Robin Moore / iLCP

Rediscovery of the endemic marsupial frog *Gastrotheca gracilis* and conservation status of the genus *Gastrotheca* in NW Argentina

By Mauricio S. Akmentins, Laura C. Pereyra & Marcos Vaira

The three species of Gastrotheca known in Argentina are strictly endemic to NW subtropical Yungas Andean forests (Lavilla & Heatwole, 2010), limited to the eastern slopes of the Andes between 700 and 2600 m.s.l. (Akmentins et al. 2011). These frog species have the southernmost distributional range of the neotropical marsupial frogs of the family Hemiphractidae (Frost, 2011). These frogs are highly cryptic, habitat specialist species, associated with rock crevices and tree hollows (Laurent et al. 1986).

According to the first global evaluation, *G. christiani* was assessed as Endangered, and both *G. gracilis* and *G. chrysosticta* as Vulnerable. Their assessment was largely based on the extent of occurrence less than 5000 km^2, that all individuals are registered in fewer than five locations, and persisting decreases in the extent and quality of its habitat (IUCN, 2011).

The conservation status of the Argentinean marsupial frogs is a matter of major concern due to a sudden lack of records in the past two decades, and also due to the increasing threats reported in the Yungas Andean forest such as, selective logging of valuable woody species, clear cutting of primary forest and afforestation with exotic species, extensive cattle raising, oil prospection and exploitation, and development of civil engineering projects (Lavilla et al. 2000; Lavilla, 2001; Brown et al. 2006; Lavilla & Heatwole, 2010).

In order to evaluate the conservation status of the genus *Gastrotheca* in Argentina, we have conducted surveys since 2007 employing standard inventory techniques for forest-dwelling frogs. Field work has been conducted in the historic area of distribution of the three species. In February 2011 we located tadpoles and metamorphs of *G. gracilis* (Fig. 1) in a well surveyed locality on the road to Tafí del Valle, Tucumán province. Almost simultaneously with the rediscovery in Tucumán, tadpoles of *G. gracilis* were registered at the type locality in La Banderita, Catamarca province by a colleague (J. N. Lescano, pers. comm.). These findings represent the first record of *G. gracilis* after 20 years (Akmentins et al. 2011).

Current status of the other two species of marsupial frogs is unknown. There is particular concern with regards to *G. christiani*, which is the only Argentinean species with complete development of the larvae in the dorsal pouch of the females (Laurent, 1986). The concern for this species is mainly due to a well documented case of extirpation of a reproductive aggregation near Calilegua

Figure 1. Juvenile of *Gastrotheca gracilis* rediscovered in Barranca del rio Los Sosa, Argentina on 21 February, 2011 after 20 years of no records of the species in the historic locality. Photo: Mauricio Akmentins.

National Park in Jujuy province due to complete habitat loss as a result of maintenance on a dirt road in 1996 (Vaira, 2003, Vaira et al. 2011). After this incident, this locality and other historic occurrence localities were surveyed continuously from 1996 to date with no records of frogs in the area. The same pattern was observed in *G. chrysosticta*, with no records despite extensive exploration on historical localities in the last four years (Akmentins et al. 2011).

Given the lack of current records we carried out a comprehensive compilation of literature, museum collections and unpublished records to obtain a time series of sighting records of the Argentinean marsupial frogs. This search resulted in a total of 19 localities of occurrence; most of them have been identified between 1967 and 1981. The resulting time series of sighting records was used in a number of probabilistic methods and population trend analysis to assess the conservation status of these marsupial frog species. The results of these methods suggest that the three species have suffered declines and are close to extinction (Akmentins et al. 2011). Yet it would be premature to declare that these species are extinct. Although there has been intensive field work in several areas over the last 15 years there has been a lack of new records, suggesting that the original distributions of *Gastrotheca* in Argentina may have shrunk.

We have an incomplete understanding of the biases associated with our historical data. A major problem is confounding the restricted distribution of the species with discrete survey effort. Museum records of these species were mainly located at mid-altitude sites of montane areas near unpaved roads. However, higher elevation areas in Yungas are also relatively under-surveyed compared to mid-altitude sites due to logistic problems associated with the survey of these areas. Since marsupial frogs are not limited by the availability of standing water, these species require large scale surveys to ensure that all potentially suitable habitats are properly searched. Most of the Yungas forest area where the species probably inhabit are difficult to access, and as result, few surveys have been undertaken in those areas and extensive regions still need to be studied (Vaira, 2002).

Since the three species of marsupial frogs of Argentina are endemic to the Yungas forest, habitat loss and fragmentation of forests have the potential to create habitat barriers, and a major concern in the ability of recolonization by the species. If dispersal success depends on the attributes of the landscape that may impede movement, even a small loss of habitat will have great impact on the probability of survival of the species. Detailed studies of the use of secondary forest have not been undertaken in detail; however, at least some populations are known to occupy historically, secondary forest and even moderately disturbed sites like roadsides of dirt roads. If marsupial frogs have poor dispersal ability in such human-altered landscape, extensive clearance of primary forests may reduce the recolonization of these historic areas. Nevertheless, it will be important to track fragmentation trends in primary forest, to identify potential future barriers to dispersal and recolonization.

There is a certain lack of knowledge about the biology and ecology of these marsupial frog species, and therefore it is difficult to assess the possible effects of known threats to amphibian diversity, such as habitat loss, climate change and chytridiomycosis on the Argentinean populations of *Gastrotheca* (Hof et al. 2011). It is clear that much research remains to be done, but there is also a limited time to take appropiate conservation measures. Meanwhile, the integration of early awareness gained from the assessment we conducted and intensive surveys can better aid to develop conservation actions to protect the species. Finally, immediate conservation efforts for these marsupial frog species should be focused on monitoring *G. gracilis* populations and boosting intensive field surveys in the historic localities of *G. christiani* and *G. chrysosticta*.

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The conservation status of Amphibians of Argentina

By Marcos Vaira & E.O. Lavilla

Ten years after the first assessment of the amphibians of Argentina (Lavilla et al. 2000), thirty batrachologists from different academic institutions covering the whole country conducted a new workshop to reevaluate the status of the amphibian fauna, using new compiled taxonomic information, geographic distribution, and ecological data on the species diversity. Of the 175 species of anuran amphibians in Argentina, 73 were assessed as either threatened or Data Deficient (DD) during the workshop. This represented a 10% decrease in the number of species in these categories, compared to the previous assessment in 2000, primarily due to a decrease in the number of DD species (Fig. 1). The decline in DD species illustrates the substantial increase in research over the last 10 years on areas and species previously poorly or completely unknown in Argentina. However it should also be noted that there was also an increment in the number of Critically Endangered and Endangered species (Fig. 1).

Habitat loss was the main threat to amphibians in Argentina ten years ago (Lavilla, 2001), and although there are new pressures and differential risks depending on the groups, this, and similar factors like ecosystem degradation, disturbance and destruction continue leading the ranking of threats. In many cases habitat destruction has occurred recently or is ongoing, making it challenging to ascertain the magnitude of the impact on amphibian populations (Vaira, 2003; Fox et al. 2005; Barrionnuevo & Ponssa, 2008; Vaira et al. 2011). The production and exportation of commodities, such as soy beans, between 2001-2003 played a significant role in helping Argentina overcome a deep economic crisis. These activities however also had a direct impact on the environment and provide an additional complexity to regional conservation efforts.

Invasive alien species in Argentina certainly pose a threat although no detailed studies have yet been undertaken, there have however been a few reports on predation by trout and bullfrog (i.e. Sanabria et al. 2005; Pereyra et al. 2006; Brunetti, 2008; Akmentins et al. 2009; Barraso et al. 2009). The chytrid fungus has also been detected in several species tested by histological determination (i.e. Herrera et al. 2005; Arellano et al. 2006; 2009; Barrionuevo & Mangione, 2006; Fox et al. 2006; Ghirardi et al. 2009; 2011), and the need for further studies is evident. Finally, for most of the species at risks the available information is limited, but the declines and disappearances reported (i.e. Barrionuevo & Ponssa, 2008; Akmentins et al. 2011) show the need to make quick decisions and suggests the need to prioritize certain actions and focus on selected areas.

It is clear that much research remains to be done, but also the time left to accomplish such tasks is limited. To obtain the information, immediate intensive monitoring is needed to address quantitative amphibian population fluctuations and to examine the present-day status of Argentinean amphibians, as indicated by the recent appraisal. These results will be published soon, in a special number of *Cuadernos de Herpetología*; in the meantime, the results of the last assessment of the amphibians of Argentina, compared to those of 2000 are summarized in Figure 1.

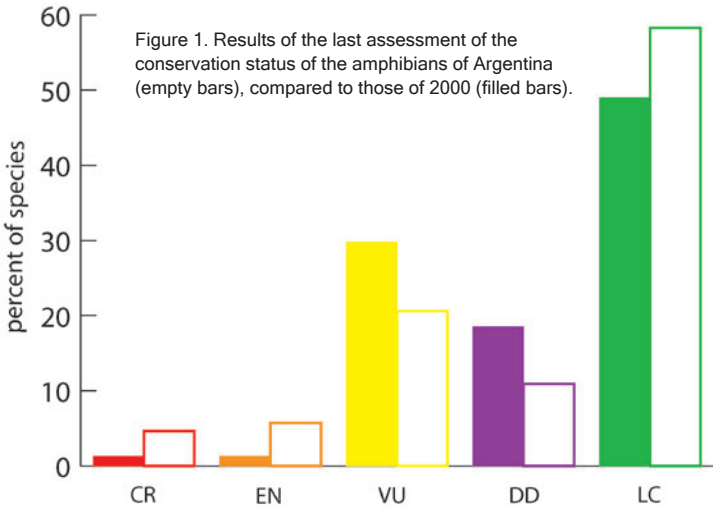

Figure 1. Results of the last assessment of the conservation status of the amphibians of Argentina (empty bars), compared to those of 2000 (filled bars).

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Bolivian amphibian Initiative and the conservation work in Bolivia

By Arturo Muñoz

Figure 1. *Telmatobius culeus* a critically endangered amphibian. Photo: Arturo Muñoz.

The level of Bolivian biodiversity is very high and, looking at amphibians, we see that the country holds more than 270 species of which more than 60 are endemic and 34 are listed as threatened on the IUCN Red List and 54 in the Bolivian Red Book of Bolivian vertebrates* (Aguayo 2009, IUCN 2011). The Bolivian Highlands do not hold too many species but a high percentage are endemic to the country and a high number are also endangered. Our knowledge about these amphibians is very poor and in some situations they are known just from the type specimens. There are several threats facing the Bolivian amphibians mainly in terms of loss of habitat, pollution, exotic species, harvesting and recently Chytrid.

The Bolivian Amphibian Initiative was created to work for the conservation of Bolivian amphibians with a focus on high Andean species. A major aim of the initiative is to increase the data on endangered amphibians in Bolivia through fieldwork focused on monitoring and protection. We are monitoring populations, together with local communities, throughout the year to better understand the dynamics of these species. These data are providing us with interesting information - some species are in good condition but others which were once common such as *Telmatobius yuracare, Telmatobius espadai, Telmatobius edaphonastes*, are no longer being found. We are also working with new methods to monitor some species - this is the case with the Critically Endangered Titicaca water frog *Telmatobius culeus*, where we are combining different methods for this completely aquatic frog. These methods are providing us with data that will allow us to prioritize our efforts in amphibian conservation in Bolivia. From a total of more than 40 localities assessed all across Bolivia we focused in the Andean area where most of the endangered species are present. From the different areas we visit, we are collecting Chytrid samples to see the real situation in the whole of Bolivia that will allow us to take the next steps.

Figure 2. Capacity building, the high Andean amphibian conservation course 2011. Photo: Arturo Muñoz.

Capacity building is another area where we are working. Through amphibian conservation workshops we are training students, young biologists, veterinarians and those working in related fields. We are also working directly with stakeholders in the field and also in our facilities. We have organized training workshops designed specifically for park rangers and local community members who also take part in our fieldwork. Some of the stakeholders are now working very closely with us and are providing very important data to the project.

Courses designed mainly for Bolivian biologists and students have brought together more than 45 people from different areas of Bolivia and other countries such as Peru and Brazil. We also co-organized and supported the international amphibian conservation course in 2009 at Lake Titicaca and the amphibian husbandry and conservation course which took place this year in Argentina organized by Durrell Wildlife Conservation Trust, Asociación Latinoamericana de Parques Zoológicos y Acuarios, fundación Temaiken and Amphibian Ark. This course provided us with an opportunity to share our successes and failures with other projects who might face similar situations.

Raising awareness is one of our primary objectives and we are working closely with some local communities where we have different educational activities. As they are also part of the project this will have a better impact once we start working towards changing attitudes towards conservation.

*The Bolivian Red Book of Bolivian vertebrates uses similar classification terms to the IUCN Red List however the selection criteria are different hence the variation in Red List and Red Book numbers.

Figure 3. Our captive breeding facilities holding endangered species of amphibians. Photo: Arturo Muñoz.

We organize educational activities in different schools in the cities and small towns where we show students the amphibian world. Another way to inform people about amphibians is through the Natural history Museum, Alcide d'Orbigny, through which we have about 700 visitors per month. Here we have our amphibian exhibition with information and interactive games relating to amphibians, and also show the work that the Bolivian Amphibian Initiative is developing. Media is an important way to publicize the amphibian situation and we make full use of Bolivian newspapers, general magazines, telephone cards, calendars, books and postcards, radio and TV programs where we share all aspects of the current amphibian situation. We are also using the media through our website http://bolivianamphibianinitiative.org and blog http://bolivianamphibianinitiative.blogspot.com which gives the latest news from the project.

Captive breeding is our most recent component - trying to understand and learn how to keep in captivity and breed different species of aquatic frogs of the genus *Telmatobius*, most of which are listed as threatened on the Red List. At the moment we are working with at least five species, next year we are going to extend our work to almost all the *Telmatobius* of Bolivia. We are using one as a model species and we are learning a lot about its natural history, reproductive strategies and habitat requirements. With our new captive facilities improvements including, better control of water quality, temperatures and biosecurity levels we are now trying to breed more species. We have successfully bred one species (*Telmatobius hintoni*) and are now trying to breed three others, among these the Critically Endangered Titicaca water frog *Telmatobius culeus*. All these experiences have allowed us to obtain very interesting data and our research on our captive population will continue enabling us to develop tools that we hope to be able to later use to study wild populations. We currently have some populations that are confirmed with Chytrid so we are testing treatments on some of our frogs to see if it will be possible to treat new frogs that will arrive infected with this disease.

Working together with other organizations and conservationists is very important and this is the reason why we are joining efforts with some national and international institutions such as Durrell Wildlife Conservation Trust which is supporting us with its experience and we are also coordinating our work with Denver Zoo on the Critically Endangered *Telmatobius culeus*. We are working with different internships, volunteers and thesis work with national and international universities as well as people who want to support the conservation of Bolivian amphibians. All of this will allows us to have a greater impact towards the important work of saving these species.

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Figure 4. Education activities in the field with kids from local communities. Photo: Arturo Muñoz.

Frogs from the end of the world: conservation, alliances and people action in the Valdivian Coastal range of Chile

By José J. Nuñez, Jorge Valenzuela, Felipe E. Rabanal & Leonardo Alarcón

The evergreen forests of the Coastal range of Chile (35°45'S–43°20' S) are extremely valuable because their highly endemic flora and fauna document ancient relationships with Australia and New Zealand dating back to the early Tertiary. Geological studies have shown that this area had wide ice-free areas during periods of the Pleistocene and Quaternary glaciations (Hinojosa et al. 2006) providing areas in which the biota may have represented the sources for the recovery of regional biodiversity following deglaciation (Nuñez et al. 2011). Unfortunately, it is also one of the most under-protected areas of Chile, particularly the Valdivian Coastal area (40–42°S), in which deforestation, drainage, animal husbandry, and contamination of rivers are causing rapid forest degradation and irreversible destruction of the original habitat. Worse, hydroelectric dams, paper industry, fast growth exotic plantation, and the development of extensive roads to increase tourism, are currently some of the most important problems facing the Valdivian Coastal rainforests.

Nowadays, this region provides habitat for 23 frog species (38% of the amphibian biodiversity of Chile; Rabanal and Nuñez 2009), all of which are strongly associated with native forest environments, and four of them (*Alsodes norae, Eupsophus migueli, Insuetophrynus acarpicus,* and a new species of *Eupsophus* (*E.* aff. *roseus*, currently submitted article) are limited only to the Valdivian coastal range (see map).

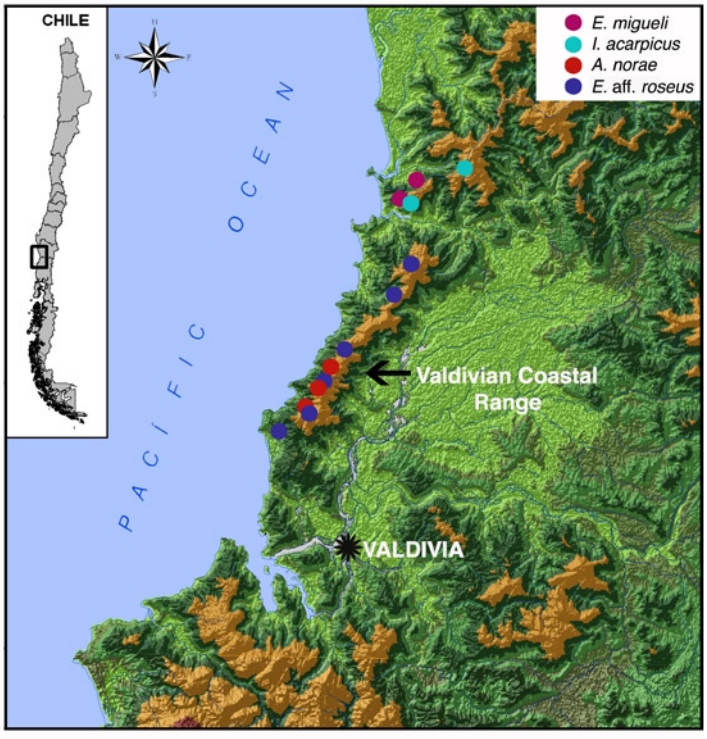

Figure 1. Distribution map of the four endemic frog species from the Valdivian Coastal Range, De Los Ríos region, Chile.

In an effort to develop a long-term conservation partnership, including scientific research, practical species identification, and community education dedicated to saving the Valdivian coastal amphibians and to preserve their habitat, the Centro de Estudios y Conservación del Patrimonio Natural (www.cecpan.org), the Environmental Secretary of Región de Los Ríos (www.mma.gob.cl), and herpetologists from the Universidad Austral de Chile, are developing a monitoring program for the purpose of establishing population and habitat baselines and trends of amphibians in the Valdivian Coastal rainforests.

Why is it important to conserve these species?

Worldwide, amphibians are declining, often as a consequence of degradation or loss of habitat. Similar is occurring in the Valdivian Coastal range, where too little is known about their amphibians, making it then difficult to quantify the effects of such losses. *Insuetophrynus acarpicus* (Critically Endangered, IUCN 2011) inhabits a narrow geographic range (about 40 km^2) without protected areas, and where the human population is currently expanding and strongly modifying the environment. *Eupsophus migueli* (Endangered, IUCN 2011) was abundant in the past but nowadays is a rare species. Loss and fragmentation of habitat due to forestry activities and the introduction of livestock and exotic arboreal species are currently considered the most significant threats to this species. Finally, due to the recent description, most aspects of the biology and population status of *Alsodes norae* and *E.* aff. *roseus* remain unknown, but due to them both inhabiting similar environments and therefore sharing the same risks of *I. acarpicus* and *E. migueli* (although they are not syntopic), their conservation status could potentially be at least Endangered.

Action plans: baselines, awareness, and education

We are focused on the integration of three major activities: baseline surveys, awareness campaigns, and community education. The first part refers mainly to geographical analysis of important biological and ecological features as well as key socio-economic factors affecting amphibians. We hope that by mapping these areas we can improve the conservation recommendations that will be presented to the Environment Authorities of Chilean Government. To raise public awareness and the understanding of the importance of the amphibians and habitats of Valdivian Coastal range, we are working with the communities in Valdivia city, as well as some indigenous communities located on the Costal range area. The work consists mainly of giving talks about native amphibians, how to recognize them, and their role in the ecosystems. A particular focus is currently developed towards children carrying out activities and events with schools such as interactive talks, frog videos and ecological field visits. With these methods we expect to excite the imagination and involve people in conserving their natural and cultural heritage.

Figure 2. Top left: *Alsodea norae*. Top right: *Eupsophus migueli*. Bottom left: *Eupsophus* aff. *roseus*. Bottom right: *Insuetophrynus acarpicus*. Photo: Felipe Rabanal.

Historic and cultural context

Human settlement in Central-Southern Chile occurred over 13,000 years before present (Dillehay 2004) with nomad populations across the Coastal, Central Valley and Andes Cordillera. Since 6,000 BP, settlements associated mainly with the exploitation of marine species have arisen with important archaeological sites near to Valdivia (Pino and Navarro 2005). Close to 2,000 BP a new inhabitant in the region arose, this time associated with pottery, including amphibian figures (Adan et al. 2004). During many digs at archaeological sites or "pitrenes", the anthropologist Ricardo Alvarez heard calls of frogs in nearby forests. These forests are essentially ecologically comparable to the forests of 2,000 years ago and Alvarez suspects that the frogs he was hearing were the same species that were represented in the pottery artifacts. The study and elucidation of these findings (data unpublished) are significant and relevant to our understanding of the relationships between the ancestral human cultures of Southern Chile and the amphibian fauna.

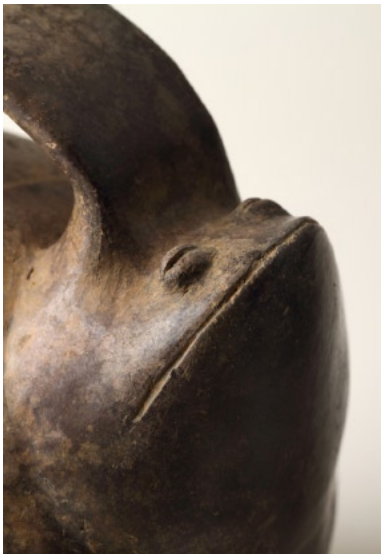

Figure 3. Pottery with a frog figure from ancestral people in Southern Chile. V. Rivas ©, sitio arqueológico Villa JMC-01, Labranza, Proyecto Fondart 21551-2 (Mera and Munita 2011).

We still have time

We are aware that it is impossible to protect all areas that should be designated for biodiversity conservation, but we still have time to save some critical habitats for amphibians of the Valdivian Coastal rainforests. As professional herpetologists and taxonomists, we cannot keep quiet with the rate at which this area is being devastated, moreover, when the drama of narrow frog distribution support the hypothesis of the persistence of small populations in the area that remained trapped since the Quaternary period and did not expand after the ice retreated. Thus, it is likely that further new species of frogs could be discovered as research continues, probably because single widespread species actually represent multiple cryptic species having smaller geographic ranges, and consequently, greater threats of extinction. First, we need a systematic conservation plan to quantify population sizes, phylogenetic patterns, geographical distributions and population structure of endemics, and then to evaluate whether current protected areas include those vulnerable and endemic species. This information should be complemented with those who promote and understand socioeconomic, bioethical, and politic issues. In this way, a number of emergent opportunities to enhance conservation of amphibians of the Valdivian Coastal range can be identified. The most obvious of these involve some form of long-term protection (either by province, or communally managed), initiatives for private protected areas, or the possibility to develop non-damaging or low-impact tourism initiatives. Also, public engagement activities are successfully being carried out in other parts of the Coastal range. This information and the work in the Valdivian Coastal range could give us real possibilities to develop better strategies tending towards the mitigation of the increasing loss of biodiversity in the temperate rainforests of Southern South America.

Figure 4. Activities of the Herps team leaded by Dr. José J. Nuñez from Universidad Austral de Chile. Top left: recognizing different frog species from Valdivian Coastal Range. Top right: Taking pictures and measuring microhabitat parameters in the field. Bottom left: Field work with students of secondary schools. Bottom right: Amphibian interactive talks with children in Valdivia City.

Acknowledgments

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Darwin's frogs in Chile

By Johara Bourke

Chilean amphibians are characterized by their uniqueness. Compared with other countries, Chile is ranked eleventh for its number of endemic species and thirteenth in percentage of endangered or extinct amphibian species (Stuart et al. 2008). Within Chilean fauna, amphibians have the highest level of endemism (69%) and the highest rate of threatened species (36.2%) (Stuart et al. 2008). Furthermore, almost one-third of Chilean amphibian species are included as evolutionarily distinct and globally endangered (EDGE 2011).

Rhinoderma darwinii. Photo: Johara Bourke.

Darwin's frogs (*Rhinoderma* spp.) are an example of a unique and endangered Chilean amphibian. They are characterized by a nasal prolongation, dorsal leaf-like colors and patterns, and most of all a unique brood system, in which males brood their offspring after hatching in their vocal pouch. Such a sophisticated brood system is only comparable with the Australian gastric brooding frogs (*Rheobatrachus* spp.), which brood their offspring in their stomachs. Unfortunately *Rheobatrachus* spp. are already extinct (Hero et al. 2004). Darwin's frogs probably will experience the same tragic end, because currently *Rhinoderma* spp. are endangered and declining (Young et al. 2001), while *R. darwinii* is classified by IUCN as Vulnerable, its only sister species *R. rufum* is considered by IUCN as Critically Endangered (IUCN 2011), but it has not been seen since 1980 by Penna and Veloso (1990).

Some likely causes to explain the decline of *Rhinoderma* spp. are habitat destruction and diseases such as chytridiomycosis, which is caused by a chytrid fungus named *Batrachochtrium dendrobatidis*. (Úbeda et al. 2010, Veloso et al. 2010). Chytrids were only discovered recently in Chile in a known chytrid vector: *Xenopus leavis* (Solis et al. 2010) and in native species (Bourke et al. 2011a), including *R. darwinii* (Bourke et al. 2010a). In the contrary, up to now, no *R. rufum* has been found infected with chytrids at collection material (Bourke et al. 2010a). Habitat destruction on the other hand, is a frequent cause of amphibian population declines worldwide (Alford and Richards 1999). In the case of Darwin's frogs, they inhabit a cool temperate rainforest named "Valdivian forest". This forest is one of the five biodiversity hotspots of South America, which is being rapidly destroyed and is threatened with the conversion to other land uses, particularly plantations of introduced species (Neira et al. 2002). Recent studies have found that *Rhinoderma* spp. most plausible cause of decline is habitat destruction. Results showed that *R. rufum* distribution match the areas where the larger cities are conglomerated, as well as most of the Chilean cultivation land and a high degree of anthropogenic disturbance, which is well mirrored in high human footprint score (Bourke et al. in press). In addition, *R. darwinii* occurrence records are limited to non-anthropogenically modified areas (Bourke et al. *in review*).

Due to Darwin's frogs serious situation, the *Rhinoderma* Project started surveying for *Rhinoderma* spp. in 2001. Unfortunately no *R. rufum* were found and just a few populations of *R. darwinii*. Later on, between 2006 and 2011, *R. darwinii* populations were

Rhinoderma darwinii matching microhabitat. Photo: Johara Bourke.

Field work at Huilo-huilo. Photo: Johara Bourke.

monitored, discovering that population size is related to environmental conditions (Bourke et al. in *review*.). At individual level, an age estimation study revealed that *R. darwinii* can live at least up to seven years and their first reproduction is around three years old (Bourke et al. *in review*). The polymorphism of *R. darwinii* was also analyzed, finding three body colors (green, brown, green and brown) and five dorsal patterns ("double V", "bamboo leaf", "complete green", "white forelimbs", "stained") resembling leaves. Interestingly, differences between sexes and populations were detected in body color and dorsal patterns frequency. Also it was exposed that *R. darwinii* showed sexual dimorphisms, where males were smaller, greener and more variable in dorsal patterns and body coloration than females (Bourke et al. 2011b) as well as younger and have a shorter life expectancy than females (Bourke et al. *in review*). Besides, body color was related with substrate color, and body color and dorsal patterns were related to habitat (Bourke et al. 2011b). Regarding microhabitat, individuals exhibited differences within populations, as well as within males, where brooding males were more often present in warmer and more exposed areas than calling males (Bourke et al. *in review*).

Additionally, a conservation program started in 2008, which included an *ex-situ* breeding/research facility at Concepción University and an *in-situ* breeding/protection area at Huilo-huilo foundation (more details in Bourke 2010b). Individuals at the *ex-situ* breeding facility are chytrid-free and breeding continuously. At the moment more than 100 individuals have been born at the Concepción breeding facility. New findings documented for the first time, such as color change, have been observed in the *ex-situ* breeding facility. Body colors could change from brown to green, being more developed in males (Bourke et al. 2011c).

We consider this project to be successful not only due to the numerous *ex-situ* breeding of *R. darwinii* individuals, although because currently many scientists and projects have started searching, studying, and breeding *Rhinoderma* in Chile (i.e. EDGE, Atlanta zoo, etc). This has helped to generate, through media, a general awareness of the importance of amphibians and related conservation issues. Finally, the work of scientists and the media have increased the chances of protecting the unique Chilean biodiversity.

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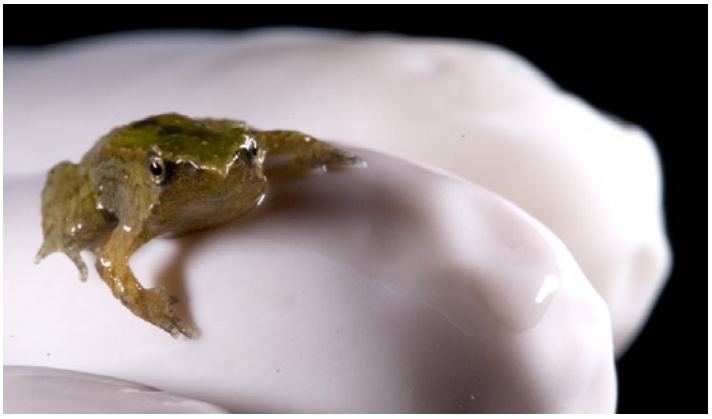
Conserving South Chile's Imperiled Amphibian Fauna

By Danté Fenolio

Darwin's Frogs, *Rhinoderma darwinii,* are declining across their range. The Chile Darwin's Frog, *Rhinoderma rufum,* has not been seen since the late 1970s. Two independent conservation efforts currently exist for *R. darwinii* that entail captive breeding of the frogs, one in Concepción and one in Santiago. Photo: Danté Fenolio.

Discussions began in 2007 that led to the establishment of the Darwin's Frog Conservation Initiative (DFCI), a joint effort of the Atlanta Botanical Garden, the National Zoo of Chile, personnel from the Center for Advanced Studies of Ecology and Biodiversity at the Catholic University of Chile, Northern Arizona University at Flagstaff, The University of Texas at Tyler, and Greentracks, Inc. The DFCI seeks, among other things, to elucidate the reasons behind declines of Darwin's Frogs (*Rhinoderma* spp) and other amphibians endemic to Chile's temperate humid forests. Goals include attempts to curb the declines using techniques such as: (1) development of captive assurance colonies with *ex-situ* breeding of endangered amphibians in Chile, (2) monitoring of diseases in wild populations to better inform policymakers and conservation authorities in Chile, and (3) education of the public regarding problems confronting Chilean amphibians. Ultimately, we aim to furnish information about declining amphibians (including the spread of emergent infectious amphibian disease) and to provide conservation options. Another goal is to establish the Darwin's Frog as a flagship species, bringing attention to the plight of all of South Chile's endangered amphibians.

We have developed a captive breeding facility in Chile. Many conservation projects have removed amphibians from the range country for captive reproduction elsewhere. Our approach involves empowering local conservation efforts, complete with trained personnel and a modern captive reproduction facility, with the hope that the chances of long-term conservation success will be enhanced. We hope to produce a program that functions in perpetuity as long as Darwin's Frogs and other endemic amphibians of Chile require conservation assistance. A grassroots effort harnessing local enthusiasm and pride is an important part of the equation. Removing individuals of an endangered species from the range country might involve exposure to new pathogens in the host country. This complicates the prospects of returning captive bred individuals to the range country for reintroduction should that become an option. This is not a condemnation of past captive reproduction efforts in host countries. Rather, we feel that as the collective amphibian conservation community has learned through its experiences, range-country breeding facilities, when possible, should be a priority. Projects with which the Atlanta Botanical Garden has participated have led us to this conclusion.



Darwin's Frogs, *Rhinoderma darwinii*, are currently being produced in the facility at the National Zoo of Chile in Santiago (Parque Metropolitano de Santiago). This two week old frog sits on the gloved fingers of one of the amphibian keepers. Captive breeding and assurance colonies for some of Chile's most imperiled frogs may buy valuable time until a solution for amphibian chytrid fungus and other environmental problems might be found. Photo: Danté Fenolio.

Our captive breeding facility is located on the grounds of the National Zoo of Chile in Santiago (Parque Metropolitano de Santiago, Chile). The facility is modeled after amphibian breeding facilities at the Atlanta Botanical Garden with one exception; we designed the building with one of its walls made of glass so that the visiting public could see into the laboratory; the glass wall makes the lab a feature attraction at the zoo. Key features include filtered water with a spare water storage tank on the hillside above the facility; if the power goes out water will still gravity feed to the lab. The lab has its own backup generator that activates as soon as the power grid goes down. Automated misting, light, and temperature systems maintain appropriate environmental conditions. All of these features worked perfectly after the 2010 earthquake, proving the safeguarding to have been a worthwhile effort. An insect culture facility exists on the first floor, providing live food for the colony. Intending to use the facility for education and public outreach, we commissioned a large sculpture of a Darwin's Frog made by a Chilean artist and placed it to the side of the lab. Once in the area of the lab, signage with information about Darwin's Frogs and other threatened Chilean amphibians educates visitors. A bilingual website featuring our project: www.savedarwinsfrogs.org provides another public interface. We have also emphasized education for the

personnel running the facility. The lead veterinarian for the zoo, Dr. Marcela Tirado, visited the Atlanta Botanical Garden for captive amphibian husbandry training. She also attended the Association of Zoos and Aquarium's captive amphibian management program.

The Darwin's Frog breeding facility at the National Zoo of Chile has one of its walls made of glass. This modification allows the zoo to use the lab as an educational exhibit. Signage hangs in front of the lab explaining the conservation breeding and assurance colony approach. Photo: Danté Fenolio.

Our first live frogs were added in 2010. We are pleased to report that they bred that year and have started again in 2011. The goal is to maintain wild-collected frogs by locality and to have as many localities represented in our facility as space permits. Breeding groups consist of three to five frogs. Captive offspring are accommodated individually in deli cups when very young, and later in plastic tubs. The website's blog has images of the facility as it was being constructed and depicts the captive breeding efforts.

Fieldwork has involved visiting historic localities where Darwin's Frogs have been reported as well as checking forests and appropriate habitat lacking reports of *Rhinoderma*. Since 2008, we have visited dozens of localities looking for the frogs. When we find populations, skin swabs are collected. The swabs are tested for the presence of amphibian chytrid fungus (*Bd*) in the laboratory of Dr. Michael Levy at North Carolina State University School of Veterinary Medicine. At the end of our study, we will publish a report documenting where we observed frogs and where we have detected amphibian diseases.

We are now working toward the conservation of additional species of southwestern Chile's most endangered amphibians. The DFCI is expanding their amphibian conservation program within Chile to include four new goals: (1) to implement a new and cost-effective amphibian conservation breeding laboratory made from two repurposed cargo shipping containers; (2) to increase the capacity of the existing in-country project such that assurance colonies of six more imperiled Chilean amphibian species can be accommodated; (3) to work toward assurance colonies ranging from 50 to 65 individuals of each species so that the number of species and genetic diversity are maximized according to resources and space available; and (4) to train two additional Chilean zoo staff members in captive amphibian management at the Atlanta Botanical Garden.

The assurance colonies that we are proposing to establish will enable Chileans to safeguard populations of six critically imperiled species. It is not unrealistic that future re-introduction programs might be developed with offspring from these colonies. For example, one of the key threats to the endangered *Telmatobufo* species (please see Table 1) are introduced salmonid fishes in the streams of their limited ranges. We suspect that the fish eat their tadpoles. If exotic fishes were removed from the streams in the range of the frogs, reintroduction would be feasible. There are a couple of other species on our priority list that may come into contact with amphibian chytrid fungus based on our monitoring of the disease in Chile. As with all assurance colonies of amphibians where amphibian chytrid fungus is an issue, we will wait and see if a new approach is developed for managing the disease in wild populations. The key factor is that without the establishment of assurance colonies, reintroductions will not be an option later.

Chile faces daunting conservation challenges. Unsustainable land management practices, introduced and invasive species, as well as a series of proposed hydroelectric dam projects threaten what remains of the native humid forests in southern Chile. Conservation of endemic species will take corporation between all stakeholders and a greater pool of funds than exists now for conservation efforts; never the less, we hope to impact the conservation of Chile's amazing amphibian fauna through both *in situ* and *ex situ* efforts.

Common Name	Species	IUCN Status
Chile Mountains False Toad	*Telmatobufo venustus*	Endangered
Bullock's Mountains False Toad	*Telmatobufo bullocki*	Critically Endangered
Pelado Mountains False Toad	*Telmatobufo australis*	Vulnerable
Barrio's Frog	*Insuetophrynus acarpicus*	Critically Endangered
Mountain Spiny-chest Frog	*Alsodes montanus*	Critically Endangered
Contulmo Ground Frog	*Eupsophus contulmoensis*	Endangered

Table 1: The six species below represent the endangered and endemic Chilean amphibian species for which the DFCI would like to develop assurance colonies. The new amphibian conservation breeding lab is to be established on the grounds of the National Zoo of Chile in Santiago. Of note is that *Telmatobufo australis* is listed by the IUCN as "vulnerable." Our fieldwork suggests that this species is at no less risk of predation by introduced salmonid fish than the other two *Telmatobufo* species. By the time this information is published and the IUCN can update the status of this species, it may well be too late to enact a conservation action; therefore, we have included *Telmatobufo australis*.

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Colombian Amphibians: Cryptic diversity and cryptic taxonomy

By Mauricio Rivera-Correa

Colombia, the northernmost country in South America, is well known as one of most biodiverse regions in the world. It is unique due to its equatorial location, its vast expanses of coast, its complex Andean orogeny, its interconnected river network, and its position connecting Central and South America. These and others factors have favored processes of diversification and specialization of its fauna and flora, which have resulted in its exceptional biodiversity. Thus it has historically been an ideal setting for research in the field of taxonomy, the discipline that discovers, defines, describes and names species.

It is thanks to the work of taxonomists that Colombia currently has 749 formally recognized amphibian species, and considered second only to Brazil in amphibian species richness, with just 140 less species (see Amphibiaweb, 2011). Historically these figures have been the result of efforts by a relatively small number of taxonomists, and in more recent decades, of the impressive work of J. D. Lynch, who has described over 200 species for Colombia.

Despite such great individual efforts, in recent years there has been a gradual decreasing trend in the number of new amphibian species described for Colombia. The numbers are not encouraging, less so when compared to new discoveries and formal descriptions in other Neotropical countries. For example, since 2005 approximately 140 and 115 new species have been described for Brazil and Peru respectively, while only 27 species were described for Colombia in the same period (Amphibiaweb, 2011; Frost, 2011; Fig.1) and only two of them described in the current decade. This small figure for Colombia is the direct result of the recent death of some prominent taxonomists or of a shift of interests to other taxonomic groups. This indicates that currently, Colombia does not have a consolidated community of amphibian taxonomists undertaking the task of describing many of these new species, as required.

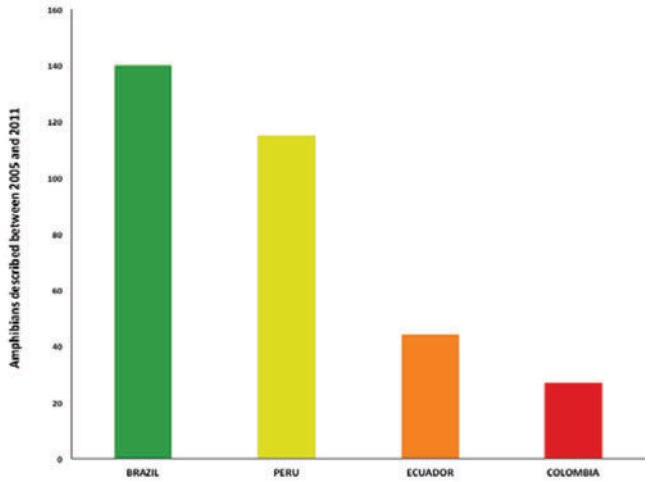

Fig 1. Amphibian species described in the last six years in the four countries with the greatest richness of amphibians in the neotropics.

Several factors might be discouraging the advance of amphibian taxonomy in Colombia. They are not exclusive, nor do they necessarily operate together, but they are latent in the national academic and scientific arenas: 1) a shortage of faculty trained in amphibian taxonomy to guide and encourage an acquaintance with this trade; 2) a biased perception of taxonomy as an ancient discipline involving hundreds of specimens stored in dusty dark spaces; 3) a depiction of taxonomy a classic, tedious and painstaking task; 4) an increasingly limited availability of funding from academic institutions to support expeditions; 5) a lack of support for the consolidation of biological reference collections; 6) an ongoing illegal armed conflict that has worsened over the last two decades, restricting access to explored and unexplored areas, and preventing the enrichment of collections and the collection of potential new species; and 7) the regulation of biological research (i.e. biological inventories, mobilization and exchange of specimens with international institutions, and access to genetic resources) governed by legislation which is often restrictive, bureaucratic, costly and exhausting to deal with.

Despite limitations in the Colombian context, in other countries taxonomy has emerged as a solid scientific discipline of unforeseen advances, particularly in addressing complex problems of species with cryptic morphology. Today we have easy access to tools that traditional taxonomists could only have dreamed of. For example, online databases with information about the species, their taxonomic history, their distributions and some systematic reviews (e.g. amphibian species of the world, AMNH), networks of natural history museums where most type specimens have been deposited (i.e. HerpNET), available gene sequence and gene bank collections (i.e. NCBI, popularly known as GenBank), a constant stream of amphibian photographs by professional and amateur contributors, even scans of the type specimens (e.g. Calphotos to University of California Berkeley, or Encyclopedia of Life - EOL), and the wide distribution of taxonomic literature through colleagues or journal databases (e.g. BioOne, JSTOR, SciELO), among others.

On the other hand, taxonomists in general and amphibian taxonomists in particular, are more than ever facing the challenge of defining and describing cryptic diversity in the context of incalculable species extinction. Thus, address taxonomic problems, especially those with cryptic morphology from different but complementary disciplines makes the taxonomy even more fascinating and attractive. It is increasingly common to find amphibian descriptions that combine information from different lines of evidence, integrating qualitative and quantitative analyses of the morphology (ie stand out diagnostic characters and multivariate analysis of morphometric distances) bioacoustic analysis (from digital recordings, which are more economical and efficient in the field), molecular analyses that help infer phylogenetic relationships and the degree of molecular divergence between candidate species, CT scans that analyze skeletal system without altering of specimens, and geographic information systems and ecological niche requirements indicating spatial and resource use segregation. The combination of all this information is evidence that, in many cases, could not be unveiled using the traditional morphological.

For this reason, descriptions of new amphibian species from highly biodiverse countries continue to accrue, especially in the last decade, with the joint efforts of different partners, while single-author contributions steadily decline (Joppa et al. 2011). It is signal that taxonomy is nourished by the collaboration between different multiple domains and colleagues from several institutions. For example, *Atelopus patazensis* and *A. eusebiodiazi* were described by four Peruvian researchers working for three different NGOs and universities in Peru and the U.S., or the description of *Hypsiboas gladiator* involved researchers from four different countries. This collaboration contributes to more effective, efficient, and rigorous descriptions, backed up by different lines of scientific evidence.

In recent years, a small group of colleagues who share a common interest in Colombian herpetofauna, have ventured both into little-explored localities and in the shelves of biological collections. With the help of researchers from different institutions and organizations for financial support, and by integrating multiple lines of evidence, we are finding many species with potential to be described, formerly overlooked due to either misidentification or cryptic morphology (examples of species currently being described, Fig 2.). Should other colleagues join us in this task, cryptic diversity will probably emerge from anonymity, and we will be leading a transformation from individual to collective work, with all its synergies. As is true for other taxa, amphibian description is a dedicated task, and one that seldom has the support of other sectors of society. However, as more scientific contributions are brought to spotlight of public knowledge, the more likely such sectors, especially the government, will be to change their vision. Perhaps then they will understand that a better knowledge of our own diversity provides the tools to make state policies that adequately address the conservation of our species.

In Colombia, where progress hinges on the use of biodiversity as the greatest resource, the moment seems appropriate for the emergence of new generations that continue to illustrate and be witness to this biological diversity. Efforts to make sampling more efficient and increase the rate at which new taxa are described, are needed today more than ever. Failing to do so, is risking that extinction will precede knowledge. Thus, I make an urgent call a new generation that will contribute establish and consolidate a strong community of taxonomists in Colombia. In their habitats and in the biological collections, new candidate species remain to be described by the scientific community and presented to society. That, indeed, would be a great legacy and long-lasting.

Acknowledgements

I am grateful to all colleagues and teachers who helped me in discussions on the taxonomy and systematics, particularly to R. Callejas, T. Grant, J. Faivovich, J. Lynch, J. Daza, M. Rada, V. Dill, J. Padial, S. Castroviejo, J. Guayasamin, R. Reis, P. Passos, S. Ron, O. Torres, A. Crawford, and V. Rueda. To all the friends who helped me in the field, thank you very much. For financial support, thanks to Conservation International, Lost Amphibians Campaigns of Amphibian Specialist Group, and Iniciativa de Especies Amenazadas, Fundación Omacha. Scholarship grant support was provided by Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq). For comments to the manuscript, I thank to A. Calle and P. Gutiérrez who provides some unpublished data.

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Fig 2. Undescribed species endemic to the Andes Mountains of Colombia being described with the participation of several colleagues and with different lines of evidence. *Hyloscirtus* sp (aff. *piceigularis*, top left); *Rulyrana* sp (aff. *orejuela,* top right); *Pristimantis* sp (aff. *acutirostris*, bottom left); *Atelopus* sp (aff. *sonsonensis* bottom right). Photos Marco Rada and MRC.

First Adult Rediscovery, First Recording of Call, and Ecological Notes for *Melanophryniscus macrogranulosus* (Braun, 1973), Brazil

By Fernando Poli, Samuel Renner, Hamilton Zanardi Grillo, & Ted R. Kahn

Fig. 1 *Melanophryniscus macrogranulosus* dorsal view showing large tubercle on snout. Photo: S. Renner.

The following article is general information on *Melanophryniscus macrogranulosus* and the 2010 adult congress rediscovery of this Nationally Critically Endangered toad. Actively calling males and amplicant pairs (males and females clasping) producing eggs were discovered. The authors further summarize climate conditions at the time of discovery and shortly afterwards, and note the ecosystem at the field site and propose designing and implementing a Species Survival Plan (SSP) in 2012 in order to prevent the loss of this species to extinction likely due to habitat loss. The authors recorded the call of *Melanophryniscus macroganulosus* for the first time and report that here, double click icon to hear call .

Melanophryniscus macroganulosus has generally been considered to be on the brink of extinction since discovery in 1960 due to its deleterious declines throughout it restricted range and habitat loss within its preferred microhabitat. This rediscovery brings to total eleven individuals (one juvenile 2004), ten (adults and eggs this paper), that have been seen alive and *in situ* and reported since the 1960´s.

In the year, 1960, Thales de Lema, a Brazilian Herpetologist recorded the first specimens for this species, from the type locality for what would later become known as *Melanophryniscus macroganulosus*. The type locality is near the Municipality of Dom Pedro de Alcântara, otherwise known as "Morro da Gruta". This species remained unknown to science until its formal description in 1973 by Pedro Canisio Braun, another Brazilian Herpetologist. Braun used Thales de Lema´s original collections to describe it.

This species of *Melanophryniscus* toad is found in the Atlantic Forest of Brazil, one of the World's most critically endangered ecosystems (Fontana et al. 2003 in Escobar et al. 2004), and is only found within the Rio Grande do Sul County. This species may possibly be found regionally extant elsewhere in Brazil, (Fontana et al. 2003), but had not been recorded from the ecologically degraded type locality since 1960. One juvenile was found during search efforts in 2004 by Rafael Becker and Gabriela Paise (Escobar et al. 2004) in the district of Barra do Ouro, Municipality of Maquiné, Rio Grande do Sul, Brazil. The specimen collected in 2004 was donated to the Museum of Science and Technology of The Pontific Catholic University of Rio Grande do Sul.

Methods

Using Visual Encounter Survey (VES) methodology Fernando Poli and Samuel Renner conducted a walking survey in a likely area of occurrence for this species where this species, *M. macroganulosus* (Fig. 1) has been historically documented in the District of Barra do Ouro, Maquiné, Rio Grande do Sul, Brazil. They searched by looking for suitable microhabitat and looking and listening for specimens and their calls (unknown at the time). Observations of

Ecological notes: *Melanophryniscus macroganulosus*
Observers: Fernando Poli and Samuel Renner (UNIVATES)
Date: 3rd September 2010 (Total search days 3rd September through 7th September).
Time: 2130h (First encounter).
Weather: Intermittent rains occurred from time to time ca. every 15 minutes the first night.
Humidity: 99% with dense fog constant the first night.
Temperature: 24.0° Celsius at time of first noted observations and recorded vocalizations.
Elevation: 370 meters.
GPS Coordinates: Available upon request for consideration to authorized researchers at author's discretion upon written request, see contacts.

this species were made only with camera, taking still photos and recording videos (with audio capabilities) showing these amphibians within suitable breeding sites, and in amplexus with apparently viable egg strings being produced. In total only ten adult specimens were found. No specimens were collected. During the first nights incursion into the habitat the climatic conditions were apparently favorable for these amphibians to reproduce. Details can be seen in the Ecological Notes.

Natural History

The aforementioned ten specimens were found amongst a small rocky stream rill (Fig. 2) with little flowing water down steep hillsides, as well in shallow pools of water within the stream rills where rain improved water volume. During the last three days of fieldwork the climate conditions quickly changed from wet to dryer and cooler. Consequently toad activities had greatly reduced. The authors concur that this species may be classed as an explosive breeder based upon almost immediate reproductive activity stopping, coinciding with lack of rain and subsequent low humidity. Suitable habitat is rare within the area of occurrence for this species within the area searched.

Conservation Summary

According to the National Brazilian List of Endangered Species (The Red Book, MMA 2003) this species is listed as Critically Endangered (CR), and considered as possibly extinct by Garcia and Vinciprova (2003). Internationally it is listed as Vulnerable (V) by the IUCN Red List of Threatened Species (2011.2), which the authors believe requires revision. *Melanophryniscus macroganulosus* is endemic to a very small range in the Atlantic Coastal Forest. The authors concur that so very little limited and suitable habitat and reproductive resources remain to facilitate its historic population numbers that this species should maintain it's Critically Endangered (CR) status and nationally it should be elevated from E to CR status. Furthermore, that without prompt and effective habitat management this species may very well become extinct in the near future and further extirpation is certain to continue. A recover plan should be designed, prioritized, fully funded and begun as soon as possible if this species is to survive. This should involve international and local community engagement and collaboration with local landowners and local universities. Long-term measuring and monitoring should be undertaken immediately until such a time in the future when this species can be down listed from the international status of Critically Endangered. Neotropical Conservation Foundation and partners, *e.g.* the authors, are working on a detailed Species Survival Plan (SSP) and budget proposal for *M. macroganulosus* as well as actively seeking funding resources to continue this critical amphibian conservation work in Brazil's Atlantic Forest.

Fig. 2 Stream rill where *Melanophryniscus macrogranulosus* reproduces. Photo: S. Renner.

Note: This work was developed and implemented independently by the authors with no initial or supporting funding. The first three authors attend UNIVATES, Centro Universitário, Lajeado, Rio Grande do Sul, Brazil. Scientific consultation and conservation partnerships have been developed between Neotropical Conservation Foundation (*NCF*) and the additional authors on their initiative to further study and assist this species long-term survival by developing, seeking funding for, and initiating a Species Survival Plan for *Melanophryniscus macroganulosus* beginning in 2012. If you are interested in supporting this work contact the authors.

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Ecological Notes, Natural History and Conservation Summary of *Melanophryniscus admirabilis* (Di Bernardo et al. 2006), Brazil

By Diego Anderson Dalmolin, Samuel Renner, Hamilton Zanardi Grillo & Ted R. Kahn

Described from specimens collected from the Municipality of Arvorezinha, near Perau de Janeiro, located within Rio Grande do Sul, Brazil (Di Bernardo, et al. 2006), *Melanophryniscus admirabilis* is a stunningly colored terrestrial bright-green toad. The dorsal coloration is vivid green with large lighter greenish-yellow tubercles, giving it a rugous warty-bumpy appearance (Fig. 1). The yellow and black venter is equally tubercle laden. The tips of the fingers and toes, palms of its hands and soles of its feet, as well as it's seat-patch, or rump, are all colored bright strawberry red (Fig. 2). This red coloration serves as flash markings that are displayed under threat to warn of the noxious, possibly toxic skin secretions this species possesses. This display is known as the unken reflex. This species is endemic to Estado Rio Grande do Sul, Brazil (Di Bernardo et al. 2006). Kwet et al. (2005) considered Estado Rio Grande do Sul (Brazil) and the neighboring country of Uruguay to be the epicenter of distribution for the diverse genus *Melanophryniscus*. It is now known that this region of Brazil may in fact have the highest species diversity for the genus.

Basic field observations are mentioned below, as well as the current looming threat to build a hydroelectric dam near the type locality.

Methods

Field observations were made in the District of Perau de Janeiro, Arvorezinha, Rio Grande do Sul, Brazil between 1–3 October 2011. Only *in situ* photographs were taken to record and document this species, none were collected. They were found using Visual Encounter Survey techniques (VES) within suitable habitat. Many pairs were found in amplexus, and producing apparently fertile eggs within shallow water-filled depressions of basalt that form the base along the margins of the Forqueta River. A total of fifteen individuals were observed.

Ecological Notes: *Melanophryniscus admirabilis*
Observers: Diego Dalmolin, Hamilton Grillo and Samuel Renner (UNIVATES).
Date: 1st October 2011 (primary activity).
Time: 1730h (first observation).
Weather: Rain showers on and off every ca. 10 minutes the first night.
Humidity: 90%
Temperature: 20.0 Celsius.
Elevation: 527 meters.
GPS Coordinates: Available upon request for consideration to authorized researchers at author's discretion upon written request, see contacts.

Natural History

Melanophryniscus admirabilis is terrestrial and diurnal. They may be considered explosive breeders, congregating during the first seasonal heavy spring rains within their small range in Brazil. Apparently optimal conditions for reproduction, as predicted by Di Bernardo et al. (2006) facilitated amplicant behavior during the first observations, and subsequent observations between 1–3 October 2012. Di Bernardo's et al. (2006) prediction that this species would likely reproduce in October was validated; precipitation in late September may also cause these toads to congress for reproduction at that time too.

This species is endemic to the southern slopes of the Brazilian Southern Plateau (Di Bernardo's et al. 2006) and dependant upon the immediate vicinity of the Forqueta River where it is an inhabitant of the rocky riparian zone located *ca*. 500 meters and has not been found anywhere else. *Melanophryniscus admirabilis* depends

Fig. 1 (left) Dorsolateral view of *Melanophryniscus admirabilis* in situ. Fig. 2 (right) Ventral surface of *Melanophryniscus admirabilis*. Photo: S. Renner.

Fig. 3 Habitat of *Melanophryniscus admirabilis* along the Forqueta River. Photo: S. Renner.

on seasonal shallow marginal pools that form in depressions of the basalt bedrock along the edges of the Forqueta River and close by additional seasonally rain-filled depressions for reproduction and larval growth.

Conservation Summary

The National Brazilian List of Endangered Species (The Red Book, MMA ,2003) does not list this species. The IUCN Red List of Threatened Species™ version 2011.2 lists this species as Near Threatened (NT). Considering populations that have been monitored recently, and typically sightings number <*ca*. 20 adults, and no information is yet available on fecundity and recruitment or total population numbers is known, a IUCN reassessment is warranted. Furthermore, the habitat is central to a proposed new dam (PCH Perau de Janeiro). In light of this threat, this species may be considered Critically Endangered (CR), as the entire area of occupancy would be altered should the PCH Perau de Janeiro dam be built and put into operation. The dam would either flood their terrestrial habitat and/or render dry their sole reproductive water resource; the Forqueta River (Fig. 3).

While observations indicate small populations of several dozen individuals are established, congressing, and reproducing, the threat to the long-term survival and their habitat is very real and immediate. If this proposed dam is built, this admirable toad is doomed to extinction in the wild.

Students from two universities (UNIVATES and UFRGS) are investigating the ecology, population dynamics, and toxic secretions expelled by the species skin glands.

Note: This work was developed and implemented independently by the authors with no initial or supporting funding. The first three authors attend UNIVATES, Centro Universitário, Lajeado, Rio Grande do Sul, Brazil. Scientific consultation and conservation partnerships have been developed between Neotropical Conservation Foundation (*NCF*) and the additional authors on their initiative to further study and assist this species. If you are interested in supporting this work contact the authors.

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Field Guide to Aposematic Poison Frogs (Dendrobatidae) of the Andean Countries: Colombia, Bolivia, Ecuador, Peru and Venezuela.

Editors: Ted R. Kahn, Enrique La Marca, Stefan Lötters, Jason Lee Brown, Evan Twomey and Adolfo Amézqueta

By Ted R. Kahn

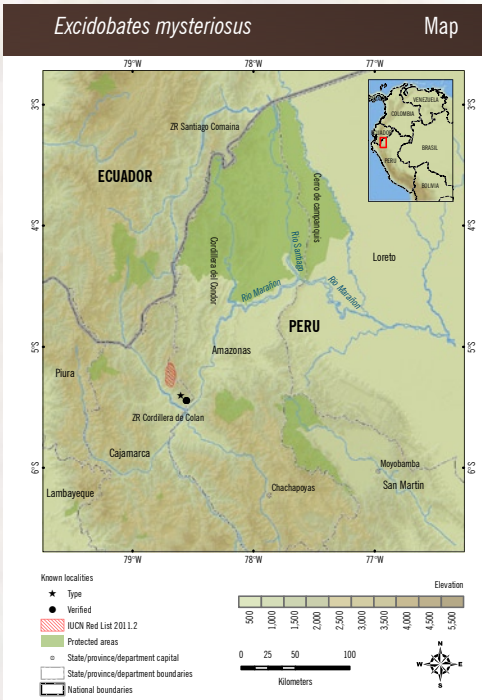
Figure 1. Chapters begin with the basic information that separates genera.

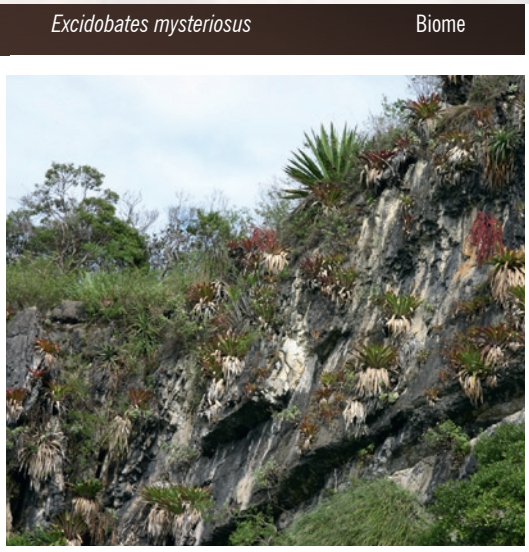
Eight years in the making, a **Field Guide to Aposematic Poison Frogs (Dendrobatidae) of the Andean Countries: Colombia, Bolivia, Ecuador, Peru and Venezuela** covers all currently described species occurring in Andean countries in full color. Students and professionals collaborated from over eight countries and dozens of institutions and universities to detail the life history of each Andean countries poison frogs from high elevation cloud forests, down into the tropical rain forested lowlands.

Each species account begins with a **Genus** page (figure 1). Then the authors and their affiliations top each account page that includes: **Name** or **Names**. These cover commonly used names, scientific names, the specific epithets and the vernacular names meanings that are explained for each poison frog species. **Taxonomic Comments** begins with the description or discovery of the species and discusses taxonomic placement and arrangement over time to the present understanding of this species relationships, and sister species are noted when known. **Identification and Description** discusses adult sizes; appearance, and notes the color and pattern of the many varied morphs. **Identification and Description of Larvae and Froglet** describes the tadpoles in detail when known, and the appearance of the froglet when known. **Similar Species** helps discriminate between similar or confusing-in appearance-species. The **Alkaloid Profile** summarizes the alkaloids known from that species, and a lengthy **Appendix II** lists all known alkaloids found in

Ranitomeya reticulata (striped morph)

Figure 2. (near right) In many cases habitat photographs are included in each account. Figure 3. (far right) Maps are included for each species based upon GPS point data.





Cliff face habitat of *Excidobates mysteriosus* showing ample bromeliads used for egg laying and tadpole deposition. Only marginal bromeliads are used for reproduction and foraging. Santa Rosa, Departamento de Cajamarca, Cordillera del Condor.

all evaluated Andean poison frog species (many unpublished). **Natural History and Ecology** covers behaviors, and activities that will assist the guidebook user in locating and observing the species *in situ*. **Calls and Vocalizations** include detailed call information and if other vocalizations are used, they are mentioned *i.e.* release *versus* advertisement calls (several published for the first time). A section on **Reproduction** covers the mode used, how many eggs are laid, parental care, and larval deposition sites and diet when known. **Distribution** covers the species range, indicating if the species is endemic. **Threats** address pressures the species faces on a case-by-case basis. **Conservation Status** indicates the current IUCN Red List status and when deemed appropriate the authors suggest reassessment and present the justifications. Protected areas where species are known to occur is noted in many cases/ Laws and CITES listings are also noted.

Additional content includes chapters on **Amphibian Conservation in the Tropical Andes and Amazon Basin** (Adolfo Amézqueta, Ted R. Kahn, Kristopher Kraus, Enrique La Marca, Ricardo A. Medina-Rengifo, Giovanni Chaves Portilla). **Discovery of Bioactive Alkaloids in Dendrobatid Frogs: Traditional and Medicinal Uses** (John W. Daly). **Recent Progress in the Systematics of Poison Frogs and their Relatives (Dendrobatoidea)** (Taran Grant and Darrel R. Frost). **Reproduction and Larvae of Aposematic Andean Poison Frogs** (Ted R. Kahn).

Over fifty authors collaborated to write some nearly eighty species accounts and were encouraged to include their often-unpublished data and results presented here for the first time. Each account and chapter is cited, and there is a complete **bibliography**, resulting in an unprecedented and extremely informative volume that will serve as a field guide, and will be useful as a resource volume for researchers.

Figure 4. Virtually every morph of each species is illustrated with full color paintings created from photographs from dozens of researchers.

Maps (figure 2) were created using 19,000+ GPS data points. Each species map depicts the type locality (star), verified (dot), and unverified (triangle) based on selections from the database of GPS points. IUCN Red List polygons are used for reference (red cross-hatch). Protected areas are also demarcated (in green).

Excellent photographs are used throughout, depicting several species and illustrating chapter content by well-known researchers in the field of herpetology (figure 3). Ted R. Kahn, herpetologist and scientific illustrator has illustrated virtually every morph in full color (figure 4).

In final proof now, the editors expect to make this volume available in very early 2012.

Nine New Species of Frogs and Toads Discovered at Reserva Natural Mesenia-Paramillo in the Northwestern Andes of Colombia

By Ted R. Kahn & Luis A. Mazariegos

Reserva Natural Mesenia-Paramillo (RNMP) is a 2,000 ha. reserve in northwestern Colombia, and is situated between *circa* 1,700 and 2,800 meters and contains the headwaters for the San Juan Antioquia, and San Juan Bravo Choco rivers. RNMP trains and employs community members from La Mesenia in biology, conservation, and to act as *guardabosques* who monitor the reserve daily preventing hunting, poaching, illegal logging and gold mining. The IUCN has accepted RNMP's application for protected area recognition submitted in 2011, and in 2012 the reserve is projected to attain official IUCN protected area status.

Working with the Nicholas School of the Environment, Duke University, The Hummingbird Conservancy, Saving Species, and Neotropical Conservation Foundation survey work in 2011 has revealed many previously unknown species of amphibians.

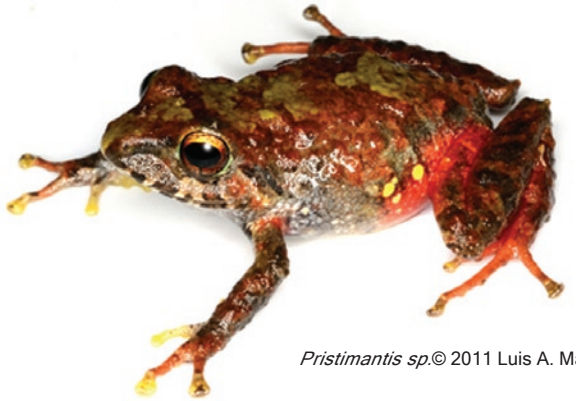
Most remarkable is a new *Atelopus* species (not pictured). Verified as new by several in country and international peers, further work to define it's range and establish protocols for venturing into its' habitat are being done prior to releasing photographs of this species and the type description.

Another notable find is an *Andinobates sp. aff. opisthomelas*. Molecular work is being conducted in early 2012 to determine the status of this species in collaboration with researchers from Duke University, Neotropical Conservation Foundation, and Universidad de Los Andes, Bogotá.

Several *Pristimantis* have been found; many with highly restricted ranges that are currently being evaluated as to specific status. Confirmed as new, researchers from Duke University, Neotropical Conservation Foundation, and Instituto de Ciencias Naturales, Bogotá, as well as others are slated to describe and publish type descriptions in middle 2012.

Two toads in the *Rhinella* clade have been looked at by peers and based on initial observations are being investigated as new by researchers at Neotropical Conservation Foundation, Universidad de Los Andes and Instituto de Ciencias Naturales, Bogotá.

Andinibates sp. aff. opisthomelas © 2011 Luis A. Mazariegos.



Pristimantis sp.© 2011 Luis A. Mazariegos.

Pristimantis sp. © 2011 Luis A. Mazariegos.

Rhinella sp. © 2011 Luis A. Mazariegos.

Batrachochytrium dendrobatidis in Venezuela: Current Research and Perspectives

By Margarita Lampo

Venezuela is among the ten top amphibian biodiversity spots in the world. Eighteen amphibian species endemic to this country, however, are Critically Endangered (IUCN et al. 2008); nine of them have not been sighted in the last 20 years, despite intensive sampling in their former habitats (Rodríguez-Contreras et al. 2008). *Batrachochytrium dendrobatidis* (*Bd*) has been linked to the disappearance of, at least, four Venezuelan frog species (Bonaccorso et al. 2003; Lampo et al. 2006). Studies on *Bd* in Venezuela initiated with the discovery of *Bd* in one of the last specimens of the harlequin frog (*Atelopus cruciger*) collected from cordillera de La Costa during the late 80's, shortly before they disappeared for nearly two decades (Bonaccorso et al. 2003). Most studies on *Bd* that followed have been conducted by a team of researchers and students at the Center for Ecology at Instituto Venezolano de Investigaciones Científicas in Caracas. These aimed to assess the risk of chytridiomycosis in highland frog communities of Venezuela, particularly those at cordillera de la Costa and cordillera de Mérida.

Dendropsophus meridensis at La Carbonera, cordillera de Mérida, Venezuela. Photo: Francisco Nava-González.

Cordillera de la Costa

After nearly two decades since its disappearance from cordillera de la Costa, *A. cruciger* was re-sighted in 2004. This species is the only one of ten species of harlequin frogs from Venezuela that can be located at present. Despite historical records indicating that this species had a wide altitudinal distribution (0-2400 m), only lowland populations (<320 m) have been detected, possibly as the result of *Bd* sensitivity to high temperatures (Rodríguez-Contreras et al. 2008). One long-term goal of the research program conducted by this team is to model *Atelopus*-*Bd* dynamics in various climatic scenarios. Mark-recapture studies of one of these populations initiated in 2005. Demographic and epidemiological parameters estimated between 2005-2007 suggest that *Bd* persists endemically at low prevalence in this population, thanks to this population's current high turnover rate (Lampo et al. 2011b). Monitoring has continued to detect climate related changes in these parameters. Also, capture histories and infection status are being combined to estimate pathogen transmission and pathogen-induced mortality rates. Nonetheless, further research should consider experimental infections of *A. cruciger* to elucidate how transmission and pathogen-induced mortality change under different temperature regimes.

Cordillera de Mérida

The detection of *Bd* from the museum specimen of *A. cruciger* prompted the search for this pathogen in other species of harlequin frogs from cordillera de Mérida. The pathogen was detected in specimens of three other species, *A. carbonerensis*, *A. mucubajiensis* and *A. sorianoi* (Lampo et al. 2006). A high prevalence of infection prior to their disappearance suggested epidemic outbreaks in the past that lead to population crashes of these species during the late 80´s (Lampo et al. 2006). DNA-tests of *Bd* in various wild populations at this cordillera revealed that the pathogen is currently widespread among anuran species (Lampo et al., 2008; Sánchez et al. 2008). The prevalence of infection in this region varies significantly among species; *Bd* is very prevalent in some species but rare in others (Sánchez et al. 2008). Experimental infections showed that the observed low prevalence of infection in some frogs (i.e. *Hypsiboas crepitans*) can be attributed to their capacity of clearing infection shortly after exposure (Márquez et al. 2010). Therefore, *Bd* appears to pose little threat to species such as *H. crepitans*. Moreover, the latter may act as a "sink species" from which pathogen transmission is less efficient. On the contrary, the high prevalence of *Bd* in the introduced America bullfrog (*Lithobates catesbeianus*) indicates that this species represents a "reservoir species" from which transmission to other species must be high. Adult bullfrogs carry high infection loads but no clinical signs of the disease (Hanselmann et al. 2004; Sánchez et al. 2008). Recent work at the cordillera de Mérida has aimed to assess the risk that this *Bd*-reservoir represents to endangered endemic frogs. *Dendropsophus meridensis* was identified as potentially at risk, as it shares habitats with bullfrogs (Sánchez et al. 2008). Despite 30% of their adults showing evidence of infection, *Bd* appears to have little effect on populations of *D. meridensis*. However, significant *Bd*-induced mortalities have been observed in experimentally infected adults of *D. meridensis* (L. Villarroel and M. Lampo, unpublished). We are currently modeling the epidemiology of *Bd* in a two-host (reservoir-susceptible) community in order to understand the possible outcomes of the spread of bullfrogs in *D. meridensis* populations at cordillera de Mérida.

Underexplored mountainous regions

Two other highland regions ideal for *Bd* growth and dispersion in Venezuela are the Sierra de Perijá and the remote highlands of the Guianan tepuis. Sierra de Perijá, west to the cordillera the Merida, is an underexplored region. Its precarious road system and high incidence of social conflicts have hindered field explorations there, although the few incursions to this area revealed several new species for science (Barrio-Amorós et al. 2011; Rojas-Runjaic et al. 2011). No samples have been screened for *Bd* from Sierra de Perijá, but its proximity to cordillera de Mérida suggests that *Bd* may oc-

Atelopus cruciger at río Cata, cordillera de La Costa, Venezuela. Photo: Celsa Señaris.

cur there. The Guianan tepuis, on the other hand, are a series of secluded table mountains located in southern Venezuela. Amphibian mortalities were observed in *Tepuhyla edelcae* from the Chimantá Massif and the Auyán-tepui between 1983 and 1986 (Ayarzagüena et al. 1992). However, histological sections from museum specimens collected on these tepuis during those years showed no evidence of the pathogen (Lampo and Señaris, 2006). It is probable that *Bd* is absent from the Guianan tepuis; their distance to other highlands where *Bd* is present, and the restricted human access to most of these tepuis have prevented the accidental introduction of *Bd* to these tepuis.

Perspectives

Investigating mechanisms to mitigate the effect of chytridiomycosis in vulnerable frog populations and identifying *Bd*-free areas to prevent further expansion of the pathogen should be among the country's research priorities to reduce the impact of this emerging disease. *Bd* impact on wild populations may be minimized by reducing transmission rates, although it is not clear yet how to achieve this reduction *in situ*. On the other hand, restricting human activities potentially contributing to *Bd* pollution is fundamental, even though we still do not know how was *Bd* introduced into cordillera de la Costa and cordillera de Mérida (Lampo et al. 2011a). To achieve these goals, however, it is necessary that government and the academic-research institutions line-up in their visions. In the last decade, almost no funds have been allocated to amphibian conservation. Moreover, permits for specimen or sample collection, and for accessing genetic resources have become increasingly difficult. In conclusion, Venezuelan amphibians still wait for their happy-hour.

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Atelopus Cruciger: Past, Present and Future in Venezuela

By César Molina

Venezuela, with more than 333 reported amphibian species (Molina et al. 2009), stands out as one of the countries with the greatest frog species richness in the world. About half of these species are endemic to the country, and 24 of them are assessed as Threatened, with one reported extinct species (Rojas-Suarez et al. 2009). The sudden disappearance of some of the world's amphibian populations has been documented since the 1980s, a problem which does not escape Venezuela (La Marca 1995).

The genus *Atelopus*, in particular, has suffered the most population declines and range reductions in Venezuela (La Marca and Reinthaler 1991, García-Pérez 1997, Barrio-Amóros 2001, Rodríguez 2004, La Marca and Lötters 1997, La Marca et al. 2005, Lampo et al. 2006). There are currently 9 known species, one of which is considered extinct (*A. vogli*), as it has not been recorded since the date of its discovery, in 1933 (Müller 1934, 1935; Lötters 1996, Lötters et al. 2004), and the remaining nine species are considered to be "Critically Endangered" following the IUCN Red List Categories and Criteria (Rojas-Suarez et al 2009, Rodriguez and Rojas-Suárez 2008) (Table 1).

Species	Last year of sighting	Author	IUCN Category
A. carbonerensis	1998	Torres & Barrio 2001, IUCN et al. 2004	CR
A. chrysocorallus	1987	La Marca 1994	CR
A. cruciger	2011	2011	CR
A. mucubajiensis	2004	Barrio-Amoros 2004	CR
A. oxyrhynchus	1994	La Marca & Lötters 1997	CR
A. pinangoi	1988	La Marca 1992, Lötters 1996, La Marca & Lötters 1997	CR
A. sorianoi	1990	La Marca & Lötters 1997	CR
A. tamaense	1987	La Marca & Lötters 1997	CR
A. vogli	1933	Müller 1934	EX

Table 1. *Atelopus* species present in Venezuela, the last year on record and IUCN category.

Targeted searches were undertaken once it became clear that some populations were disappearing from their natural habitats; these searches focused on the Venezuelan Andes, with some expeditions to the Cordillera de la Costa, all with negative results (La Marca and Reinthaler 1991, García-Pérez 1997, La Marca and Lötters 1997).

However, August 1998 brought new hopes when researchers found an individual of *A. carbonerensis* (Torres and Barrio 2001). Later, a member of the same group captured a female of *A. mucubajiensis* in September 2004 (Barrio-Amoros 2004); this specimen died quickly and further analysis showed that it was infected with the chytrid fungus *Batrachochytrium dendrobatidis* (Lampo et al. 2006). Before these findings there had been no further records of

Atelopus cruciger in amplexus, Cuyagua river. Photo: César Molina.

any of these species in the Andes, despite a series of expeditions to locations within their former historical ranges (García-Pérez 1997, Torres and Barrio 2001, Barrio 2009), as was in the case for *A. cruciger* in the Cordillera de la Costa, with negative results (Manzanilla and La Marca 2004). It is only in 2003 when a group accidentally recorded individuals of *Atelopus cruciger*, at a site on the northern slope of the Cordillera de la Costa (Eliot, 2003). This species was one of the most abundant and conspicuous amphibians in the mountain forests and streams of the region (Müller 1934, Rivero 1961), and had disappeared at least 20 years ago.

This finding gave us the opportunity to work with two relict populations viable in terms of survival and reproduction, and a group of researchers from various academic and research institutions began to conduct studies on various aspects of these frogs' biology, ecology and the presence and prevalence of the epizootic fungus *Batrachochytrium dendrobatidis* (*Bd*), an aspect which we will delve into later.

Previously, detailed investigations were available for only one of the eight Andean species, *A. oxyrhynchus*, particularly the study of its diet (Dole and Durant 1974), movement patterns and seasonal activity (Dole and Durant 1974), and longevity (La Marca 1984). In the case of *A. cruciger*, previous studies had addressed only very general aspects of natural history (Sexton 1958), larval development (Mebs 1980), the description of its vocalization (Cocroft et al. 1990) and serological characterization (Durant 1976).

Habitat of *Atelopus cruciger,* Cata river. Photo: César Molina.

However, the recent rediscovery of the latter species allows us to detail both the studies done to date and work currently in progress. To begin with, the presence of chytrid fungus (*B. dendrobatidis*) was confirmed in a specimen collected in May 1986, making this the first record of this pathogen in the genus *Atelopus* in Venezuela (Bonaccorso et al. 2003). Subsequent work has determined that the prevalence of the fungus in the river Cata, a relict locality, is low, i.e. 16,67% (n = 24 individuals) for 2006 (Lampo et al. 2008) and 9.60% (N = 73) for the period 2005 - 2007 (Lampo 2011). Today, Dr. Margarita Lampo and her team at the Venezuelan Institute for Scientific Research (IVIC) continue to assess *Bd* prevalence at the River Cata site.

Moreover, this working group studied the species' population dynamics for 17 months with mark- recapture methods over a 250 m stretch of the Cata river. The estimated population size is between 69 and 117 individuals taking seasonal variability into account, with the largest abundances reported in the dry months (Lampo et al. 2011). Parallel to this, Dr. Cesar Molina of the Faculty of Sciences of the Universidad Central de Venezuela (UCV) has conducted a population study at the two known relictual populations (Cata and Cuyagua rivers) in two 1 km-long transects. Preliminary results, together with those published by Lampo et al (2011), show a high seasonal variability for the adult population and all size and sex categories, with females being less abundant than males and usually present at higher densities in the dry season, when the breeding season begins; while the recruitment of juveniles occurs at the beginning of the rainy season (César Molina, unpublished data).

There have been continued explorations of historical sites and a set of new localities that could potentially harbor populations of *A. cruciger*; the results have been unsuccessful to date, and only two sites of the 50 explored locations, are currently home to this species (Rodriguez-Contreras et al 2008; Señaris and Rodriguez 2009, Cesar Molina unpublished data), although about 80% of these sites show null or low levels of disturbance (Manzanilla and La Marca 2004).

On the other hand, there have been studies addressing the use and selection of microhabitats at both sites and preliminary results indicate that most of the individuals were located outside the water current (> 85%), on a stretch of five (5) meters adjacent to the banks of water bodies, a pattern observed in both rivers. With regards to microhabitat use, over 40% of individuals of *A. cruciger* were located outside the stream on rocks, followed in smaller proportions by those who used the litter, sand and vegetation. All individuals that were located within the stream used rocky substrates. This pattern is similar in both rivers with some minor differences, suggesting that microhabitat use seems to be very conservative in this species, at least in the two studied sites, which have similar structural characteristics (Molina 2011, unpublished data).

Atelopus cruciger's diet was studied using stomach contents from museum specimens (44 females and 47 males). The results show that ants were the most important item, followed by beetles and mites. There were differences in diet between sexes in terms of taxonomic composition, diversity and evenness, while seasonal differences were marked by changes in prey composition (Gonzalez et al. in press). Helminthological studies were also based on herpetological collections (53 males and 43 females), and the results show that 80.41% of the specimens were parasitized, with a higher prevalence for males (43.30%) than females (37.11%). Of the total number of recorded helminths (402 individuals), 75.24% were nematodes, while 24.76% were cestodes (Cañizales 2009 and 2011, unpublished data).

Atelopus cruciger on rock, Cata river. Photo: César Molina.

In order to investigate certain aspects of this species' natural history, an ethogram was developed from 36 hours of observation based on 63 individuals, with resting being the most common behavior, followed by stalking, with movements that led to capture of prey. Prey capture efficiency varied between 50 and 75% and capture rates varied between 0.04 to 0.52 prey/min. The daily home range area varied between 0.10 and 1, 67 m2, with adults using larger areas than juveniles (Molina 2009).

Successful DNA extraction from museum specimen has recently been made possible, opening the possibility for studies on the genetic structure of populations of this species within its range and its phylogenetic relationships with other group members (Margarita Lampo, personal communication).

We envision to continue work on the population dynamics and prevalence of chytrid fungus, and to begin a study on this frog's reproductive ecology, which would bring in some of the technical elements needed to explore the possibility of reintroductions at historical sites. The reintroduction stock may come from the following two sources: a) the breeding site, following a protocol for maintenance and breeding that may allow to obtain healthy individuals; this strategy has been considered viable for some threatened

amphibian species (Molina et al. 2009, Molina 2010a), and b) extracting a set of individuals to form one or two reintroduction demes Molina 2010b). Both situations require an assessment of habitat quality and its potential to host populations of this species. However, at present, the environmental authority is reluctant to such initiatives.

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Habitat of *Atelopus cruciger*, Cuyagua river. Photo: César Molina.

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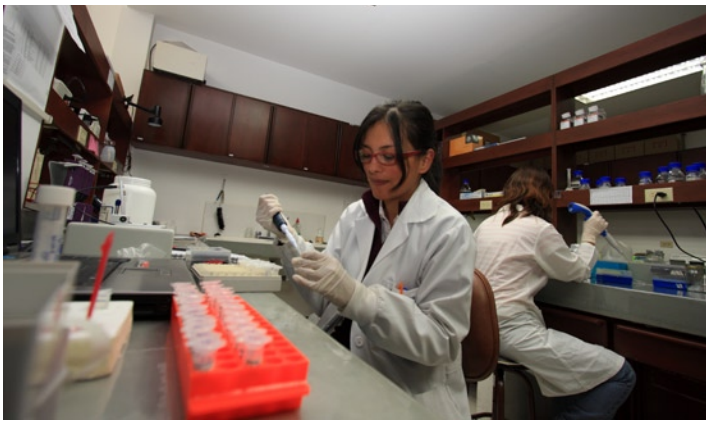
Museo de Zoología of Pontificia Universidad Católica del Ecuador (QCAZ)

By Santiago R. Ron

With 511 described species, Ecuador is ranked third in amphibian diversity worldwide (Ron, et al. 2011). This large richness is matched by a diverse set of institutions currently working in initiatives that directly or indirectly promote amphibian conservation. Among the most active Ecuadorian research centers in amphibian diversity and conservation are the following: Centro de Conservación de anfibios del Parque Nacional El Cajas (Amaru Zoo), Centro de Investigación de la Biodiversidad y Cambio Climático of Universidad Indoamérica, Centro Jambatu (Fundación Otonga), Colegio de Ciencias Biológicas y Ambientales of Universidad San Francisco de Quito, Museo de Historia Natural Gustavo Orcés of Escuela Politécnia Nacional, Museo Ecuatoriano de Ciencias Naturales, Vivarium de Quito, and Museo de Zoología of Pontificia Universidad Católica del Ecuador (QCAZ). This article presents an overview of the activities that QCAZ is carrying out to promote amphibian conservation in Ecuador.



Molecular laboratory at QCAZ. Genetic data generated at QCAZ laboratories have resulted in the discovery of dozens of new species from the Andes and the Amazon Basin. Photo: Santiago R. Ron.

The Division of Amphibians of Museo de Zoología of Pontificia Universidad Católica del Ecuador (QCAZ) is a major center for research and conservation of Neotropical amphibians. The QCAZ museum houses the largest collection of Ecuadorian amphibians in the world with a total of over 60,000 catalogued specimens. The collection includes a tissue bank with 20,000 tissue samples stored in –80 C ultra-freezers. Ecuadorian and foreign researchers actively use the specimen and tissue collections as demonstrated by the 20 scientific publications that have been derived from QCAZ amphibian material between 2010 and 2011.

The QCAZ museum has an active research program that involves a large group of professional herpetologists, graduate and undergraduate students. At present, QCAZ is carrying out a large-scale project to study the genetic and morphological diversity of Ecuadorian amphibians, especially in the Andean region. The project, funded by SENESCYT-Ecuador, is generating large amounts of DNA sequence data that have resulted in the discovery of dozens of new species of amphibians (see for example pp. 73 in this issue). The QCAZ museum has an active molecular laboratory for DNA extraction and amplification. DNA sequencing is outsourced to the company Macrogen in Korea.

With 20,000 samples, the QCAZ museum has one of the largest amphibian tissue collections in Latin America. Photo: Santiago R. Ron.

Since the late 1990s, QCAZ has been involved in large-scale initiatives to investigate amphibian population declines and to protect Ecuadorian Amphibians. The research carried out at QCAZ has resulted in several scientific landmark publications that highlight the dire scale of amphibian population declines in Ecuador (e.g., Bustamante, et al. 2005; Coloma, et al. 2010; Merino-Viteri, et al. 2005; Ron, et al. 2011; Ron, et al. 2003). In addition to research, QCAZ hosts one of the largest *ex situ* conservation centers for amphibians in Latin America, Balsa de los Sapos, which Andrés Merino describes in detail in the following section.

The QCAZ museum is actively working in outreach activities to publish general information about the biology and conservation status of Ecuadorian amphibians. The most important component of this effort is the web portal AmphibiaWebEcuador that provides access to photographs, advertisement calls, videos and species accounts of Ecuadorian amphibians. The website is still under development but a significant amount of information, including thousands of photographs, is already available at: http://zoologia.puce.edu.ec/Vertebrados/anfibios/AnfibiosEcuador/

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Caring now for the future of the Ecuadorian frogs: The "Balsa de los Sapos" Initiative

By Andrés Merino-Viteri

Ecuador is recognized among the megadiverse countries of the planet because of its high amphibian diversity and endemism (Ron et al. 2011). However, Ecuador is also recognized by being the third country in the world with the largest number of threatened amphibian species (Chanson et al. 2008). According to the latest accounts, around 150 species are threatened by extinction (Ron et al. 2011).

Since 2005, the Museum of Zoology (QCAZ) at Pontificia Universidad Católica del Ecuador (PUCE) has run and supported a long-term conservation program for Ecuadorian amphibians, named "Balsa de los Sapos" (Life Raft for Frogs). "Balsa de los Sapos" is a successful conservation program due to its achievements in its six components: (a) research and monitoring of Ecuadorian threatened amphibians, (b) strengthening of local capacities, (c) *ex situ* conservation programs for endangered species, (d) environmental education and public awareness, (e) bioinformatics and diffusion of information, and (f) *in situ* protection of specific threatened species by purchasing land. The program goals are based on the recommendations given by the IUCN Amphibian Conservation Action Plan (Gascon et al. 2007).

"Balsa de los Sapos" *ex situ* conservation facilities, at PUCE campus in Quito, keep around 40 species of Ecuadorian amphibians and take care of over 2000 individuals in different life stages from diverse anuran families, including: Bufonidae, Centrolenidae, Ceratophryidae, Dendrobatidae, Hemiphractidae, Hylidae, Microhylidae, Pipidae, Ranidae, and Telmatobiidae.

Among the most relevant contributions of QCAZ and this initiative to the conservation of amphibians are: (1) 11 publications on conservation status and risk factors affecting Ecuadorian amphibians, (2) the successful *ex situ* breeding of 12 species of amphibians including two species of critically endangered *Atelopus* and, (3) the recent declaration by a local government of an amphibian as natural symbol of the county, promoting the conservation of the species and its habitat.

Two Critically Endangered species of *Atelopus*, *A. elegans* from the Pacific lowlands of Ecuador and *Atelopus* sp. (*spumarius-pulcher* complex) from southeast Ecuador, have been successfully kept and bred in our facilities. At the moment, we are carrying out field research and developing protocols for the assessment of potential future reintroductions.

During 2010, "Balsa de los Sapos" personnel met with authorities from the local council of Leonidas Plaza Gutierrez County, Morona Santiago Province in the southeast of Ecuador urging them to protect *Atelopus* sp. (*spumarius-pulcher* complex) and its habitat. Finally, a Council Resolution on September 21st, 2010, declared this species as natural symbol of the county and protected its habitat. This is the first time that an amphibian receives special governmental protection in Ecuador.

Atelopus elegans is a Critically Endangered species of harlequin frog that has been successfully bred at Balsa de los Sapos in Quito. Photo: Santiago R. Ron.

The scientific work carried out by the "Balsa de los Sapos" Initiative has had a big impact on the amphibian conservation in the region. This project is a model of how *in situ* and *ex situ* conservation efforts can work in concert giving to very threatened amphibian species a much greater chance of survival in the future.

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The Cutting Edge of Sustainability: Cold Blooded Research in an Overlooked Hotspot

By Raffael Ernst, Monique Hölting, Raquel Thomas-Caesar & C. Isabella Bovolo

Turtle Mountain, Iwokrama Forest. Photo: Raffael Ernst.

The amphibian fauna of the Guiana Shield (GS) region of northern South America has been the subject of several general treatments and more recent studies have considerably contributed to a better understanding of the taxonomy and biogeography of selected taxa occurring in what can be considered one of the world's most interesting biogeographic areas. Despite these recent advances our knowledge of the amphibian diversity in the GS is far from being conclusive. The picture remains patchy and studies investigating the dynamics of entire amphibian communities are scarce. How these dynamics change under ever increasing natural and human induced environmental change profoundly altering the unique ecosystems that this diverse group of vertebrates inhabits, is still an open question.

Since 2003, we have been studying the impacts of anthropogenic disturbances, mainly commercial (reduced impact selective) logging, on amphibian communities in low land rainforest sites of Guyana and more recently Suriname. In our research we address the question of whether and how anthropogenic habitat alteration, such as logging and its synergistic interactions with climate change, affects diversity patterns in complex tropical amphibian communities. We particularly focus on functional aspects of diversity and interactions between different diversity levels (species, functional, trophic diversity). Our general goal is to understand the interactions between biodiversity and ecosystem functioning in complex tropical systems under the influence of human induced changes. In particular, our aim is to establish models of ecosystem change and decay that incorporate empirical patterns of diversity change and potential ecological cascading using tropical amphibians as a sensitive and suitable model system. On the more applied side, we seek to evaluate so called reduced impact or sustainable logging schemes and look at their effectiveness in conserving amphibian diversity. Through standardized monitoring and assessments, we can generate the crucial data that will ultimately help to improve the effectiveness of current harvesting and forest management strategies. This in-depth analysis and the identification of anthropogenic drivers of amphibian diversity loss in the tropics may hopefully contribute to bringing the global amphibian crisis to a halt.

Phyllomedusa tomopterna. Photo: Raffael Ernst

According to the Millennium Ecosystem Assessment, habitat change has a major and increasing impact on tropical forest ecosystems and the GS is no exception. Unsustainable wood extraction ranks among the number one direct causes of deforestation and forest degradation (Millennium Ecosystem Assessment 2005) although in the GS, clear felling for open cast mining is also a growing issue. Amphibians are particularly susceptible to environmental degradation because, especially in the tropics, their habitat requirements are very diverse and complex. As a result of its paramount role in altering tropical forest ecosystems, timber harvesting has recently been brought to the centre stage in discussions on biodiversity mainstreaming and the development of new concepts aimed at bringing increasing deforestation to a halt (Stern 2006). The past year has seen numerous activities that drew attention to these issues, particularly because the United Nations General Assembly declared 2011 as the International Year of Forests to raise awareness on sustainable management, conservation and sustainable development of all types of forests (UN 2011).

The GS accounts for more than 25 percent of the world's remaining tropical rain forests, and it is an important area of diversity and endemism within the Neotropics. Even though the forests of the GS have had among the lowest deforestation rates of the world, with very little change over the past decades, rapid economic and social changes are posing increasing pressures on these relatively well-conserved forest ecosystems (Bryant et al. 1997; Romero 2010). The Guianas are at a crossroads concerning decisions and trade-offs among utilisation, conservation and preservation of their forests and thus substantial parts of the region's biodiversity.

In Guyana, which harbours the anchor site of our studies, 13.5 of its approximately 15 million ha of rainforest is classified as state forest and is thus potentially open to logging or mining activities. We are therefore carrying out some of our core research in Guyana within a controlled polycyclic reduced impact timber harvesting scheme implemented by our project partner, the Iwokrama International Centre for Rainforest Conservation and Development (http://www.iwokrama.org/), an international not-for-profit organisation established by the Government of Guyana and the Commonwealth Secretariat to manage nearly one million acres (371,000 ha) of pristine GS rainforest with the aims of testing the concept of a truly sustainable forest, where conservation, environmental balance and economic use can be mutually reinforcing. The scheme puts us into the exceptionally rare position of being able to conduct true pre-and post timber harvest impact studies that allow us to link the impacts, effects and underlying processes at the ecosystem functioning level in a direct manner.

It is known that in general, the effects of timber harvesting are highly eclectic, altering species richness and abundance, community composition and dynamics, the trophic structure of communities, and a variety of associated ecosystem processes. Moreover, large-scale timber harvesting promotes further ecological change affecting nutrient cycling and soil erosion and influencing global climate change through losses in evapotranspiration and carbon storage for example, and hence has the potential to promote ecological cascading effects and ultimately ecosystem decay.

Purpleheart tree stump, forestry concession, Iwokrama Forest.
Photo: Monique Hölting

Our research on amphibian communities suggests that human activities, such as reduced impact logging, not only alter the composition of organisms that form a particular assemblage (through trait-dependent extinctions and invasions) but indeed alter the dynamics of the entire eco-system (Ernst et al. 2007). Functional differences between species, rather than number of species per se appear to be the decisive factor in sustaining desirable ecosystem states and thus in maintaining important ecosystem services. Commonly used simple diversity measures, such as species richness or species diversity may therefore not adequately reflect actual losses of diversity following human disturbances (Ernst et al. 2006). Because biological diversity appears to play a substantial role in ecosystem resilience, required to safeguard essential ecosystem functions in the face of environmental change, we call for a critical revision of common diversity assessment approaches.

In spite of the alarming effects of even low impact harvesting methods on amphibian diversity, amphibian communities may have the potential of recovery, if 1: original logging was conducted in a sustainable manner, 2: remaining forest stands maintain sufficient connectivity among each other to allow recolonization of true forest species, and 3: adequate recovery periods are provided. However, systematic long-term studies are needed in order to specify recommendations with regard to timber harvesting cycles and recovery potential of the forest communities. Amphibians are also important components of tropical trophic networks particularly because they link aquatic with terrestrial systems. So far we do not know how changes in species and functional diversity induced by anthropogenic disturbance will affect the trophic networks in our study sites and how this in turn will impact ecosystem processes. One step towards filling this data gap is the recently implemented "*Biodiversity Dynamics and Ecological Cascading in Logged Tropical Forests of the Guiana Shield Project (BioDEC Guiana)*" which receives funding from the German Research Foundation DFG and particularly tries to tackle these open questions (for more information see http://www.senckenberg.de/dresden/herpetology).

Our first results covering data for two consecutive years of investigation in the Iwokrama forest, illustrate that actual changes in amphibian diversity between 'pristine' and reduced impact logging areas are quite complex. Both extreme climatic events and logging activities seem to affect amphibian diversity, but not in a straight forward manner. There are "winners" and "losers" and as some species are lost, new species recolonize, altering both functional and trophic diversity in impacted sites. The challenge will be to disentangle the various components leading to these changes and resolving the underlying mechanisms. This will not only be important to guarantee the long-term viability of particular species or populations at risk, but also to maintain one of the Guiana region's most precious resources as a whole, its biodiversity. Fortunately, we can make use of data from both Iwokrama's new hydro-climate monitoring scheme and data from the reduced impact logging operations to help unravel the processes involved. Furthermore, understanding these complex interactions will help to improve reduced impact timber harvesting schemes worldwide and therefore help preserve biodiversity in these forested areas.

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Famous *Atelopus* frogs from Amazonia

By Stefan Lötters

Harlequin frogs, genus *Atelopus,* are famous for several reasons. One is that many species are conspicuously colored; they apparently are aposematic as many of them possess skin toxins, too. Another reason is that these amphibians are conspicuous for their clown-like movements and mass aggregation along stream habitats, which are utilized for reproduction (Lötters 1996). More sadly, harlequin frogs are 'famous' for their dramatic population declines and extinctions they have faced within the last two to three decades only. All of the more than 100 species are threatened and only a hand full of them is not critically endangered (La Marca et al. 2005; Rueda et al. 2005). I suggest *Atelopus* are also famous because studying them provides an interesting insight into the evolution of Neotropical biota.

Among the harlequin frogs with apparently 'stable' populations are those from the Amazon basin and adjacent areas. In recent years, along with many colleagues, among them Luis Coloma, Enrique La Marca, Pablo Venegas (to mention just those who have been keen on *Atelopus* research for many years), I have started studying their speciation and biogeography. In the following, I give a brief overview of major findings and problems of this ongoing project.

There is evidence from several mtDNA markers that Harlequin frogs comprise a monophyletic group within the Bufonidae, divided into two clades. One of them is purely Amazonian and comprises all lineages from the eastern Andean versant, the basin itself and the eastern Guiana Shield (Lötters et al. 2011). This group falls into two subclades, showing geographic signal. One is found along the southern Central Andean versant and its foothills (southern Peru, Bolivia). The other occurs in the upper Amazon basin (Ecuador, northern Peru) and again in eastern central Amazonia plus the Guianas (S. Lötters and colleagues, unpubl.), with a distribution gap in-between. According to Lötters et al. (2010), this biogeographic pattern is well in accordance with the predictions of the Disturbance Vicariance hypothesis, first proposed to *Atelopus* by Noonan and Gaucher (2005). In brief, cold-adapted Andean ancestors had

Fig. 2. A putative undescribed harlequin frog species from the eastern Andean versant of Ecuador. Photo J. Kielgast.

Fig. 1. An unidentified species of *Atelopus* from a the upper Amazon basin in Peru; it might be referable to the name *A. spumarius* sensu stricto. Photo K.-H. Jungfer.

spread over the entire Amazon basin in Late Miocene when it was colder. Subsequent warming had forced populations to higher elevations, present in western and northeastern Amazonia and the Guianas but absent in westernmost central Amazonia. Recolonization during cooler climatic phases has since been hampered as these periods were too short. Interestingly, the existence of such cool phases (i.e. Pleistocene glacials) has also hampered speciation so that today, in the East merely one or two species can be taken as tentatively 'real'. These display limited inter-populational molecular diversity, and introgression has been suggested. This is perhaps in conflict with the remarkable color variation of Guianan harlequin frogs (Noonan and Gaucher 2005; Lötters et al. 2010). In western Amazonian populations of both major subclades, the same patterns of inter-populational molecular diversity can be observed. Also, populations are mostly found on or adjacent to elevated areas, and a molecular clock is in concert with the concept of recent speciation processes (S. Lötters and colleagues, unpubl.). However, different to Guianan *Atelopus* is that color polymorphism does almost not occur and even well supported species from different subclades are indistinguishable by such traits (Lötters et al. 2010; De la Riva et al. 2011).

The presence versus absence of conservation coloration remains unexplained. In the past it has led to confusing taxonomic conclusions. While in total, five names have been proposed for the one or two Guianan species, several species do occur in the upper Amazon basin for some of which no names are available, demanding for a comprehensive taxonomic revision (Lötters et al. 2010; S. Lötters and colleagues, unpubl.). Data still should be considered as preliminary, as more integrative studies are needed involving information from other sources than mtDNA and colors, e.g. calls, tadpole characters etc. (Lötters et al. 2002). This is particularly important due to the hypothetical existence of paraphyletic species in mtDNA gene tress (Funk and Omland 2003) and the high possibility of hybridization, leaving species undetected (Noonan and Gaucher 2005). This is supported by the observation that genetically indistinguishable populations do differ by the presence versus absence of a middle ear. Interestingly, some of the cryptic taxa preliminarily

Fig. 3. It is yet unclear if *A. tricolor* actually represents a complex of cryptic species. Photo J. Köhler.

identified are not associated with higher elevations at all but occur in large lowland areas so that we are tempted to believe that rafting may have played a role in *Atelopus* distribution.

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FrogLog Schedule

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

Robin Moore / iLCP

Merging community ecology and phylogenetic biology in amphibian research: How habitats shape anuran trait communities and species' life-history traits

By Raffael Ernst

Amphibians are not only known to be one of the most diverse tetrapod vertebrate groups, they also exhibit an outstandingly high diversity in terms of life history traits that have evolved in particular lineages. Amphibian habitat requirements, especially in the tropics, are very diverse and complex. Here, as in other parts of the world, they exhibit distinct assemblage patterns over a range of spatial, temporal, and functional scales and community composition is largely influenced by the effects of environmental variables and spatial or biotic processes. Despite this alleged evolutionary success story, many amphibian species throughout the world are facing severe population declines or even extinction. Due to their physiology, mostly short generation times, and predominantly biphasic life-cycle, amphibians are particularly sensitive with respect to habitat changes and altered microclimatic conditions that accompany these changes. In the long run human activities and global change processes may therefore not only alter species ranges but also the trait composition and therefore the response variability and thus flexibility of entire ecosystems.

To those who have worked on amphibian communities in different tropical regions across the world, it always seems striking that despite the fact that we are dealing with phylogenetically only distantly related lineages, many species seem to resemble each other ecologically and appear to fill similar niches within respective ecosystems (i.e. show ecological or niche convergence) up to the point that mating calls and /or morphology resemble each other under similar environmental conditions. When observing this superficial resemblance it may stand to reason that similar environmental templets may also lead to similar adaptations. Observed trait distribution patterns, therefore would reflect how evolution has shaped species to cope with the temporal and spatial variability of their present environment and this is commonly referred to as the habitat-templet theory, formally laid out by Southwood in his seminal (1977) paper.

Fig. 1 Suriname horned frog (*Ceratophrys cornuta*) in its leaf litter habitat. Iwokrama Forest, Central Guyana. © Raffael Ernst.

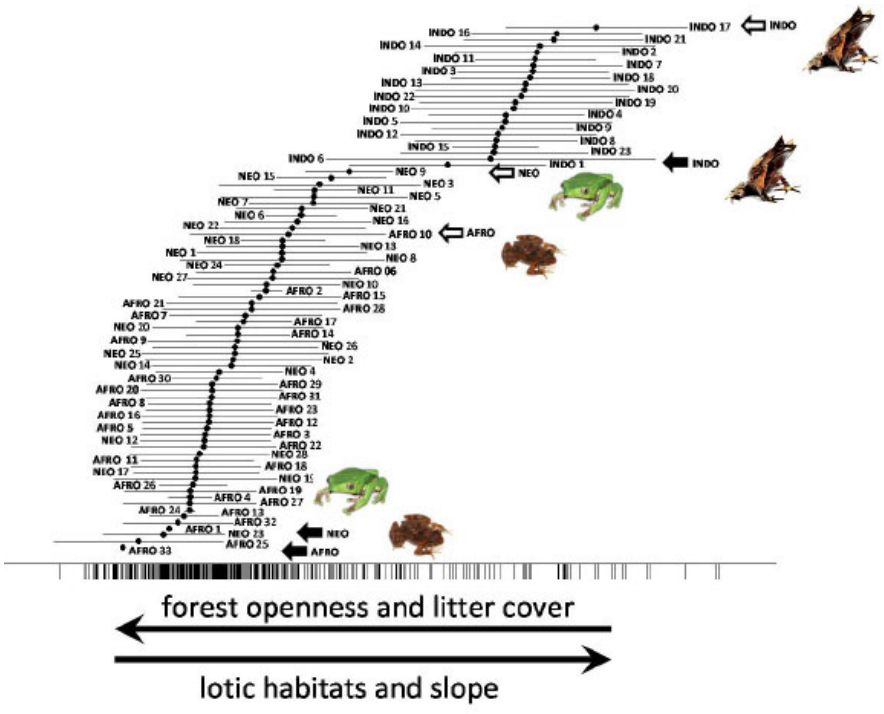

Fig. 2 Habitat niche breadths of anuran species represented as weighted average (circles) of their occurrence at sites based on the ordination along RLQ axis 1. The whisker represents the distribution amplitude of the species (standard deviation). Vertical lines represent the scores of the study sites along the respective RLQ axis. Acronyms with numbers refer to individual species of particular geographic regions: AFRO = Afrotropics, NEO = Neotropics, INDO = Indomalayan. Closed arrow = first species of particular region occurring along niche-space gradient, Open arrow = last species of particular region occurring along niche-space gradient.

Even though amphibians should be an ideal model group to test these assumptions, this has previously not been investigated systematically. This prompted us to engage in a large scale cross-regional meta-analysis that searched for multiple trait-habitat relationships in tropical anuran amphibian assemblages (Ernst et al. in press). Our aim was to investigate whether trait-habitat relations in anuran communities really converge across global regions. The specific goal was to assess the role of habitat templets in shaping trait assemblages when different assembly mechanisms are operating and to test whether trait-habitat relations reflect common evolutionary history or environmental trait filters.

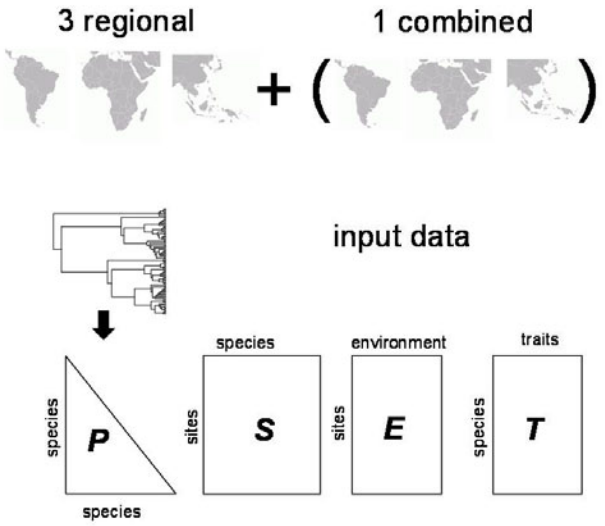

Fig. 3 Input data of for analyses. Input data consist of four types of matrices for each of four data sets (three regional, one combined = global). These are 1. Phylogenetic Distance Matrix (P), 2. Species Abundance Matrix (S), 3. Environmental Matrix (E), and 4. Trait Matrix (T).

We compared large (> 25.000 individuals of 84 different species, recorded on 549 independent sampling units, during > 850 hours of standardized acoustic and visual sampling) anuran amphibian data sets consisting of species abundance and environmental variable data tables derived from intensive investigations of amphibian assemblages in three biogeographic regions (Guiana Shield, South America; Upper Guinea Forest Block, West Africa; Borneo Rain Forests, South-East Asia). These were complemented by newly established molecular community phylogenies in order to be able to test for phylogenetic structure in communities and phylogenetic signal in traits.

In contrast to the common notion and despite the existence of significant trait-habitat links and congruent trait patterns, we did not find evidence for the existence of a universal trait-habitat relationship at the assemblage level and no clear sign for cross-continental convergence of trait-habitat relations. Patterns rather varied between continents. Despite the fact that a number of traits were conserved across phylogenies, the phylogenetic signal varied between regions. Trait-habitat relations therefore do not only reflect common evolutionary history, but also more recently operating environmental trait filters that ultimately determine the anuran trait composition in regional assemblages.

These results make it absolutely clear that integrating trait-habitat links into analyses of biological assemblages can enhance the predictive power and general application of species assembly rules in community and macroecology, particularly when phylogenetic comparative methods are simultaneously applied. However, in order to predict anuran trait composition based on habitat templets, trait-habitat links cannot be assumed to be universal but rather have to be individually established in different regions prior to model building. Only then can direct trait-based approaches be useful tools in predicting fundamental anuran community patterns.

But how can these findings contribute to the conservation of amphibian diversity at large and what does this mean in the context of designing and planning amphibian conservation measures for the future? Considering traits and life histories is not only essential for elucidating community assembly mechanisms but also for understanding species ranges. However, these ranges are not static and due to human alterations of the biosphere leading to rapid environmental changes we will likely observe future range shifts in many taxa. In the light of these developments it appears indispensable to integrate trait-environment relationships in predictive species distribution models in order to better understand the dynamics that drive species distributions in rapidly changing environments and to come up with more effective and foresighted protection strategies. Integrating trait-habitat links in these kinds of models would therefore be the next logical step. Such extended models will become increasingly important as the effects of both local and global human activities become more profound.

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Fig. 4 Amphibian community data sets used in the analyses were established during intensive investigations of amphibian assemblages in three biogeographic regions (from West to East: Guiana Shield, South America; Upper Guinea Forest Block, West Africa; Borneo Rain Forests, South-East Asia).

Biology of Hibernation in *Duttaphrynus melanostictus* (Schneider, 1799)

Suman Pratihar & Jayanta Kumar Kundu

The amphibian symbolizes one of the most diverse vertebrate groups. They have effectively adapted to almost every habitat available on planet earth. As a group they generally have a limited tolerance to temperature variation. They have very high cutaneous evaporation of water loss compared to other vertebrates. They produce dilute urine. Amphibians present unique evolutionary models for our understanding of the rigors and solutions to the aquatic - terrestrial transition for all terrestrial vertebrates and insights into how the amniota have been more successful in exploiting the land. For many ectothermic vertebrates (fishes, amphibians, and reptiles) the ability to stay away from seasonal and periodic environmental rigors by entering a state of metabolic inactivity is a crucial element in their survival. Hibernation occurs with exposure to low temperatures, as well as, under normal conditions, occurs principally during winter seasons when there are lengthy periods of low environmental temperatures. For all practical purposes, hibernation and aestivation in animals are indistinguishable, except for the nature of the stimulus, which is either cold or an arid environment. Hibernation may last several days or weeks depending on species, ambient temperature, and time of year. The typical winter season for a hibernator is characterized by periods of hibernation interrupted by sporadic euthermic arousals wherein body temperature is restored to the typical levels. There is no complete list of animals that hibernate; however, many examples can be cited among the poikilotherms, that include both vertebrates and invertebrates. Anurans are example of excellent hibernators.

However, very few studies have been performed to focus on the biology of hibernation in anurans. *Duttaphrynus melanostictus* (Schneider, 1799) is a species of toad that is common in South Asia. It is endemic to southwestern and southern China (including Taiwan and Hainan) and throughout southern Asia from northern Pakistan and Nepal through India to Sri Lanka, Andaman Island, Sumatra, Java, Borneo, and Bali. The species grows to almost 20 cm long. Commonly disturbed in open areas, villages, towns and only seen occasionally in primary forest. Nocturnal regularly found in drainage, ditches and under street lamps. The species breeds during the monsoons and the tadpoles are black. Young toads may be seen in large numbers after the monsoons. These toads are often seen at night under street lamps especially during times when winged termites swarm. They have been noted to feed on a wide range of invertebrates including scorpions. In the present study I have preferred the species *Duttaphrynus melanostictus* to study the biology of hibernation.

Heart rate, metabolic rate and body weight of the hibernating toads, decrease significantly during this period. It was observed that haemoglobin concentration was significantly reduced and this is probably because of its reduced metabolic rate and oxygen consumption. The purpose of metabolic depression is to maximize the survival time of an individual's when environment condition is unfavorable for normal life (Pratihar & Kundu, 2010a). Serum lipid concentration was recorded to be low immediately after arousal from hibernation but increased when feeding commenced (Pratihar & Kundu, 2010b). The decline in thyroid hormone concentration during the hibernating phase had its behavioral and physiological response that leads to increase and sustain cholesterol level in serum, which seems to be the most important metabolite (Pratihar & Kundu, 2009a). Significant changes have been found during hibernation in plasma protein and sugar concentration. Elevated urea level in blood was recorded to resist environmental cold stress during hibernation as elevated urea level is known to be an effective cryoprotective (Pratihar & Kundu, 2007). From the total and differential blood cell count and IgM analysis, it was clear that during hibernation their immunity was specifically antibody dependent. Significant increase in lymphocyte count indicates that the increased level of gamma-globulin which induces immune mechanism during hibernation. Increased number of eosinophil enables an increased engulfment of antigen and antibody complexes. Neutrophil on the other hand acts as a first line of defense against bacterial attack by secreting specific enzymes; on the contrary no significant change in the number of monocytes could be observed in the hibernating individuals. Humoral immunity appeared to play a central role during the hibernating period and cell mediated immunity on the contrary played rather a little role during this period (Pratihar & Kundu,

Duttaphrynus melanostictus (Schneider, 1799). Photograph taken in District Midnapore (22015/ N 87039/ E), West Bengal, India.

2010c). Absence of protein expressions corresponding to the molecular weight ranging between 80-85 kDa and 24-26 kDa in the hibernating phase could be recorded. These proteins might be playing an important modulatory function during hibernation. In the present study, significant decrease in the ratio of albumin and globulin during hibernation might be an important indicator of poikilothermic hibernation (Pratihar & Kundu, 2011). In these animals serum magnesium and calcium levels were significantly low during entry phase as well as awakening phase of hibernation compared to the deepest phase of hibernation implicating a role of these ions during different phases of hibernation. Magnesium ion concentration change should first consider a passive alteration in water balance. In other words this change may due to excess water being removed by renal tubules. The metabolic change associate with hibernation is lowered respiratory quotient which is indicative of burning of fat. The utilization of fat is a common occurrence .Thus it is doubtful that fat metabolism is responsible for elevated magnesium associate with hibernation. The lower serum calcium levels indicate that during entrance into hibernation and during arousal from hibernation the utilization or excretion of calcium exceed the mobilization of calcium. It appears that during hibernation the circulation and the kidney function is not consistently adequate to meet the tissue demands for calcium and at the same time maintain the constant serum level of calcium (Pratihar & Kundu, 2009b)

Glycolytic enzymes, during hibernation may serve two functions: depression of glycolytic activity as part of the general metabolic depression or reorganization of the fuel use in the hibernation state to limit carbohydrate catabolism and promote gluconeogenesis (Pratihar & Kundu, 2011). Isolation and characterization of different proteins expressed during hibernation in *Duttaphrynus melanostictus* however, remains to be identified. Expressions of the metabolic genes are needed to be identified and screened. This could be an important part of the future research work in hibernating biology.

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Multiple emergences of genetically diverse amphibian infecting chytrids include a globalized hypervirulent recombinant lineage

By Rhys Farrer & Matthew Fisher

Since the discovery of the amphibian-infecting pathogenic fungus *Batrachochytrium dendrobatidis* (*Bd*) during the 1990s, it has been found on every continent on Earth (except Antarctica!) and responsible for dozens of Amphibian extinctions and local extinctions (extirpations). The current global distribution of *Bd* and results of surveillance can be found at the *Bd* Global Mapping project www.bd-maps.net. One of the puzzling aspects of the disease is the extremely high genetic similarity between isolates found from diverse habitats worldwide. This finding supported a hypothesis whereby the fungus has been recently spread 'far and wide' by anthropogenic means such as the pet trade, human consumption, zoos and for medical purposes.

Because genetic variation between isolates can provide clues regarding the origin, evolution and spread of diseases, we examined the entire genomes from a global panel of *Bd* isolates that had been isolated from amphibian habitats experiencing die-offs (such as the recent mountain chicken *Leptodactylus fallax* epizootic on Montserrat), and others that appeared to be only harboring the disease. In particular, we fo-

Figure 1. Midwife mass mortalities (*Alytes obstetricans*) in the French Pyrenees, 2010. Photo: Matt Fisher.

cused on Europe, and took samples spanning Iberia, the mountains of the French Pyrenees, northern Mallorca, Switzerland and the UK, and by doing so recovered isolates of *Bd* that appeared to be markedly different from one another in their microscopic characteristics.

By examining how the *Bd* genomes differed from one and other, we identified three separate and divergent lineages that we have named *Bd*GPL, *Bd*CAPE and *Bd*CH. The first two are found in more than one continent, and the third only in Switzerland. Of these lineages, *Bd*GPL also has features within the genome that may have resulted from hybridization between two parental strains of the disease. Our data shows that this is the most common type of *Bd* (found on all 5 continents we tested), and also the type associated with mass-mortalities and extinction, by invading regions such as the US Sierra Nevadas, Central America, Australia and Montserrat. We therefore called this lineage the Global Panzootic Lineage (*Bd*GPL). The divergence between our *Bd*GPL isolates pointed to an emergence during the 20th Century, which is within the realm of time for the widespread trade of amphibians. *Bd*GPL diverged from the other two lineages at least 1000 years ago.

Figure 2. Moribund and dead Midwive metamorphs suffering from terminal chytridiomycosis. Pyrenees 2010. Photo: Matt Fisher.

Isolates belonging to *Bd*CAPE were found on both the island of Mallorca and in the Western Cape of South Africa. This finding supported a hypothesis by Dr. Susan Walker that the island of Mallorca was accidently infected by the release of infected mallorcan midwive toads *Alytes muletensis* that had aquired their infection from a South African *Xenopus gilli* at a Mallorcan breeding facility in 1991. We called this lineage *Bd*CAPE after its likely origin in Cape province, South Africa.

We also performed assessment of host response of the common toad (*Bufo bufo*) to 9 *Bd* isolates (three *Bd*CAPE and six *Bd*GPL) and 1 negative control. We found that post-metamorphic survival of animals exposed to *Bd*GPL isolates was significantly reduced when compared to isolates of *Bd*CAPE and the negative controls. The discovery of the third lineage, which we identified only in Switzerland, came too late to include in the host response experiments.

Morphological variation between the two lineages was also compared as previous studies of morphological variation among *Bd* isolates have shown that phenotypic profiles are linked to the virulence of isolates. We found that *Bd*CAPE exhibits significantly smaller sporangial sizes and increased hyphal length compared with isolates belonging to *Bd*GPL. Together, these findings show that genetic differentiation between lineages of *Bd* has resulted in significant morphological variation. However, we did not detect differences in sensitivity to the fungicide itraconazole among lineages.

The discovery of multiple emergences of Bd sheds light on a number of extant questions. Firstly, *Bd* is not a single clone as was previously thought, and different lineages exhibit different morphology, genome structure and virulence. Secondly, that the infection comprises at least two Novel Pathogens, which have both been moved via the trade in amphibians: Once by accidental cohousing in a zoo (*Bd*CAPE), and *Bd*GPL, which has been transported many times by international trade in, principally, north American bullfrogs.

If hybridization occurred between two parental strains to generate *Bd*GPL, it is likely that they arose from separate geographical regions that were brought together by some form of trade. If this hypothesis is true, extinctions from *Bd* are not solely caused by introduction of the pathogen into naive populations, but that the largely unregulated trade in amphibians may have inadvertently created this fungal superbug. However, until further sampling has been done to verify either parental strains, or lab-based experiments have identified a sexual phase of *Bd*, questions regarding the origin and life cycle of this disease remain to be found.

Our study highlights the urgent action required to prevent future panzootics, which may rest in readdressing the measures used to prevent transmission of infectious diseases (biosecurity). Like many other threatened species (little brown bats in North America, European crayfish, Zambezi Tilapia), tightening the biosecurity associated with trade is key to preventing accelerated evolution and spread of hyper-virulent diseases in the future.

An Overview of ASG Regional Activities in Mainland China

By Pipeng Li (Co-Chair) Amphibian Specialist Group-China Region

The exploration and discovery of amphibians is still active in the mainland region of China. Among more than 420 species recorded, 60 new species of anura and 15 of caudala have been found and described since 2000 and some are yet to be described.

Much of the feildwork has been in south China, e.g. Hengduan Mts, Wuling Mt, Lingnan Mt, Hainan Island and the southeast of Tibet (Xizang). From 2004, several surveys funded by Shenyang Normal University, WWF and Kunming Institute of Zoology of Chinese Academy of Sciences, were conducted by the members of former China Reptile and Amphibian Specialist Group and Amphibian Specialist Group-China Region in the southeast of Tibet, and several interesting frogs were discovered. Emerging patterns of frogs in North Medog of Tibet reveal much high incidence of extreme local endemism in East Himalaya. These findings emphasize the conservation and monitoring importance of the southeast of Tibet, especially in light of economic and tourism developments in the area.

The largest recorded Scutiger was also collected from Medog this summer and after careful examination, it is expected to be classified as a new species with tadpole of nearly 10 cm length.

In 2010 the Chinese language guide to the "Amphibians and Reptiles of Tibet" and "Tadpoles of Liaoning" were published. The guide was funded by Shenyang Normal University and introduces the research and discovery of amphibians and reptiles in Tibet and tadpoles in Liaoning province, Northeast China.

Local scientist have been involved in the creation and monitoring of a special conservation area for *Echinotriton chinhaiensis* and local natural reserve for *Ranodon sibiricus* and *Hynobius amjiensis*, all Critically Endangered species on the Red List for Chinha. Ex situ breeding initiatives are also involved in reintroducing salamanders to their natural habitat with the hope of restoringnative populations. Beside the support from China government, WWF and Ocean Park Conservation Foundation of Hong Kong funded the conservation and ex situ breeding and rearing of tadpoles from 2008.

Surveys for the Chytrid fungus, *Batrachochytrium dendrobatidis* began around 2000 and in 2010, it was reported in four species of frogs, including one invasive from Yunnan province, South China. However the impact of Chytrid on amphibian populations in mainland China has not yet been determined. The distribution of the Chytrid fungus in the mainland China still requires further investigation.

Since 2008 WWF has provided small grants to more than 20 projects where young Chinese herpetologists and conservationists undertake amphibian surveys, monitoring and conservation.

In 2008, Conservation International supported the seminar for the China National Amphibian Conservation Action Plan in Beijing and Haikou, and with WWF's further support, the action plan was finished in 2010. A national amphibian population monitoring program was established in 2010 situated in more than 10 provinces with an expected duration of 5 years.

Although much works have been focused on amphibian research and conservation. Some factors, such as over-harvesting and human population pressure, habitat destruction and chemical pollution, also threaten amphibians and require further research.

Conservation and reintroducing of baby Hynobius amjiensis in Longwang Mt funded by Ocean Park Conservation Foundation of Hong Kong.

Habitat of *Hynobius amjiensis*.

Checking pH of the breeding site.

Reintroducing the young *Hynobius amjiensis* by local conservationists, experts from Institute of Herpetology and students from The Chinese University of Hong Kong.

Protecting the stream-dwelling frog *Feirana taihangnicus* in Central China

By Xizohong Chen (Henan Normal University)

Fig. 1 *Feirana taihangnicus* in life.

Feirana taihangnicus is a stream-dwelling frog endemic to central China. It has a small range of 30,000 km^2, living in forest-covered mountainous streams at elevations from 400 to 1600 m in Central China including northern Henan and southern Shanxi provinces (35–36°N, 112–113°E; Chen et al., 2002, 2004).

The natural history of *F. taihangnicus* was poorly known before 2000. We have been studying this species over the last 10 years in Heilonggou in the Taihangshan National Nature Reserve (35°16′N, 112°04′E), north Henan province. Our study plot was a 5.5 km long stream (762–948 m elevation) located in a valley covered by temperate coniferous and broad-leaved mixed forests. Annual average air temperature at an elevation of 760 m was 11.1 °C with a total annual precipitation of 684 mm.

The research we undertook involved studying breeding biology, habitat requirements, tadpole growth and population size. The results showed that the oviposition of *F. taihangnicus* takes place between late April and early May, lasting about one week. The observed annual variation in breeding time may be linked with local climatic conditions. Unlike most anurans, male *F. taihangnicus* have no nuptial pads or other structures used to maintain amplexus. In species for which such traits are lacking, oviposition occurs without amplexus (Kunte, 2004). Oviposition sites were located in sun-exposed stream sections (2.6–6.2 m in length, 2.5–3.0 m in width), where water flowed slowly and was relatively shallow (maximum depth 22–72 cm). The frogs were highly selective with respect to oviposition habitats. Female *F. taihangnicus* of an average SVL of 75 mm produced around 450 eggs with diameters averaging 3.6 mm. According to Duellman & Trueb's (1986) list of clutch size and egg size of 41 anuran species with aquatic eggs and larvae, *F. taihangnicus* trade offspring size against offspring number. Eggs were found beneath rocks in the stream and arranged in a single layer. Larvae spend 27 months and experience two winters in streams before metamorphosing into juveniles. We expect that low temperatures in winter will delay larval development. Larvae entering winter in their first or second year (at about stages 26 or 39) will be forced to develop over an extended period in very low water temperatures. The mark–recapture data during 23 April to 10 May 2006 showed that there were 306–513 frogs living in the 5.5 km long stream. On 2 May 2010, the breeding population was estimated to have only 131 individuals.

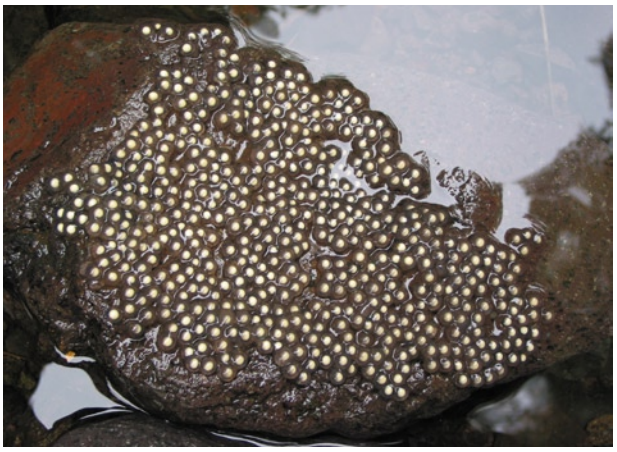

Fig. 2 Egg arrays found beneath another rock.

Its occurrence at high elevations and relatively small range raise conservation concerns for *F. taihangnicus*, as both attributes are linked to elevated extinction risk (Beebee & Griffiths, 2005; Stuart et al., 2008; Sodhi et al., 2008). *F. taihangnicus* is specialized for life in mountainous streams. Their communal breeding behavior, strong fidelity to oviposition site and prolonged larval period render the frogs very vulnerable to habitat alteration. Our field surveys showed that *F. taihangnicus* were rare outside the nature reserve, most likely as a result of illegal fish-catch using chemicals and extensive fluctuations in water level due to establishment of dams. The current data show some evidence of local, short-term declines in breeding population size, although we do not know whether missing frogs died or have simply missed breeding due to lack of appropriate egg deposition sites in 2010 or some other climate or environmental perturbation. Monitoring of streams across the range of this species is needed to understand long-term threats to its persistence. In light of these results we know conservation needs for this species, which has a restricted distribution, specialized habitat and extended larval period.

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A public education program for amphibian conservation from Shenyang Normal University Wildlife Conservation Society in China

By Yuyan Lu, Pipeng Li, Bingjun Dong, Baotian Yang, Lei Zhang & Zhengyan Zhou (Institute of Herpetology, Shenyang Normal University)

The Wildlife Conservation Society of Shenyang Normal University was setup by students to conservation amphibians and reptiles with the support and supervision of Dr. Pipeng Li, Co-Chair of Amphibian Specialist Group-China Region. The society works both independently and with the Institute of Herpetology and Liaoning Key Lab of Evolution and Biodiversity in Shenyang Normal University.

Activities of conservation education in Liaoning and Zhejiang provinces, China.

In 2010, funded by WWF, Ocean Park Conservation Foundation of Hong Kang and Prof. Yuyan Lu and Dr. Pipeng Li a select group of members from the society were involved in local amphibian conservation education programs working with local conservationists from Longwang Mt of Zhejiang Province and Yatung (Yadong county) of Xizang (Tibet) Autonomous Region.

The society conducted education programs in University Campus, Parks in Shenyang city and Xiuyan county, the area surrounding the habitat of *Onychodactylus fischeri*. The program involved distributing conservation booklets and papers highlighting the importance of amphibian conservation and performed a scientific play.

Monitoring and habitat restoration of a newly discovered population of *Onychodactylus fischeri* in China

By Pipeng Li, Yuyan Lu, Bingjun Dong & Zhengyan Zhou

The Chinese Clawed Salamander or Long-tailed Clawed Salamander, *Onychodactylus fischeri*, is considered Endangered on the China Red List as result of a severe population decline in China. Its historical distribution ranged from Changbai Mts in Heilongjiang across Jilin to Liaoning in the eastern region of northeast China. However there are now only four known remaining populations, including a population discovered in 2002 in eastern Liaoning.

Sympatric *Hynobius leechii* and its egg sacs.

Onychodactylus fischeri

A famous Chinese Herpetologist, (left) Prof. Guangfu Wu investigated *Onychodactylus fischeri* with Dr. Pipeng Li in 2004. (right) Dr. Pipeng Li investigated *Onychodactylus fischeri* in a new discovered stream in 2010.

The destructed habitat of *Onychodactylus fischeri* in 2007

Experts from Institute of Herpetology of Shenyang Normal University, students from The Chinese University of Hong Kong investigated *Onychodactylus fischeri* with the local conservation officers.

Education program with local school.

Experts from Institute of Herpetology and students from Wildlife Conservation Society of Shenyang Normal University in the habitat of *Onychodactylus fischeri* in 2010.

After the discovery of the new population, the collection of this salamander for pets, for research material and for illegal trade resulted in a huge population decline and habitat destruction.

Funded by the State Forestry Administration and Experimental Center of Shenyang Normal University, this project aimed to restore habitat, establish a indigenous community-based conservation imitative and monitor the population development of *Onychodactylus* and three other species of amphibians (*Hynobius leechii, Rana dybowskii,* and *Bombina orientalis*). In addition, we also added an environmental education program to the school and worked with the local wildlife conservation officers and the community surrounding the population to develop site conservation strategies. Furthermore, surveys in neighboring streams were conducted to determine the distribution of this population to better understand the biogeography and relationship of this population to others in Changbai MT.

From these recent activities we hope to establish a special conservation and monitoring site for *Onychodactylus fischeri*.

Survey and monitoring of amphibians in Yatung of Tibet

By Pipeng Li, Bingjun Dong, Zhengyan Zhou & Ang Li

Funded by WWF and Experimental Center of Shenyang Normal University in 2010, the second survey of amphibians in Yatung of Tibet was conducted. In addition, a long term monitoring program was put in place at two selected site and a public education program was initiated in local communities. Five species of amphibians were found in Yatung, including *Nanorana parkeri*, *Scutiger boulengeri*, *S. sikimensis*, *Paa blanfordii*, and *P. liebigii*.

Yatong is one of the five richest biodiversity hotspots in Xizang (Tibet) Autonomous Region. Compared with the first survey in 1970s, the occupied areas of *S. sikimensis*, *P. blanfordii*, and *P. liebigii* have decreased due to habitat modification through the development a town and agricultural activities resulting in population declines. In addition to habitat modification frog species in the area are threatened by overharvesting from local youths who collect the frogs for consumption.

The monitoring project will be funded by the Institute of Herpetology of Shenyang Normal University and aims to establish an amphibian population baseline dataset in Yatung and monitor its changes to indentify contributing factors including the impact of climate change.

Nanorana parkeri (left) and tadpole of *Nanorana parkeri* (right).

Paa blanfordii.

P. liebigii.

Scutiger sikimensis.

Habitat of *Nanorana parkeri* and *Scutiger boulengeri*.

Habitat of *Scutiger sikimensis*, *Paa blanfordii*, and *P. liebigii*.

Talking with local youths.

Decline and Conservation of Amphibians: an Update

By Harold Heatwole & John W. Wilkinson

The Series "Amphibian Biology" is bringing out four volumes (Vols. 9-11) that deal with the decline and conservation of amphibians and which should be of interest to readers of Froglog. Two volumes treat topical matters and review the status of decline and conservation around the world on a country-by-country basis. Volume 8 in the series is the first topical one and it deals with diseases and pollution and their role in declines, the second volume on a topical basis is volume 10.

The regional treatments are covered in volumes 9 (Western Hemisphere) and 11 (Eastern Hemisphere). These are produced, not as single volumes, but in separate parts, much like the issues or numbers making up the volume of a scientific journal. Chapters for all countries in the Western Hemisphere have been written and edited and some have been published; others are in press. Several parts of volume 11 are in press and a number of others are either written and ready for press, or are in progress.

Volume 8: Amphibian Decline: Diseases, Parasites, Maladies and Pollution. Edited by H. Heatwole and J. W. Wilkinson (2009)

Chapter 1. Viral and Bacterial Diseases of Amphibians - Valentine Hemingway, Jesse Brunner, Rick Speare, and Lee Berger

Chapter 2. Fungal Diseases of Amphibians - Lee Berger, Joyce E. Longcore, Rick Speare, Alex Hyatt and Lee F. Skerratt

Chapter 3. Factors Affecting Interspecific Variation in Susceptibility to Disease in Amphibians - Jodi J. L. Rowley and Ross A. Alford

Chapter 4. Digenetic Trematodes and their Relationship to Amphibian Decline and Deformities - Jason Rohr, Thomas Raffel, and Stanley K. Sessions

Chapter 5. Amphibian Malformations - Michael J. Lannoo

Chapter 6. Ultraviolet-B Radiation and Amphibians - Adolfo Marco, Betsy A. Bancroft, Miguel Lizana and Andrew R. Blaustein

Chapter 7. Pollution: Impact of Reactive Nitrogen on Amphibians (Nitrogen Pollution) - Adolfo Marco and Manuel Ortiz-Santaliestra

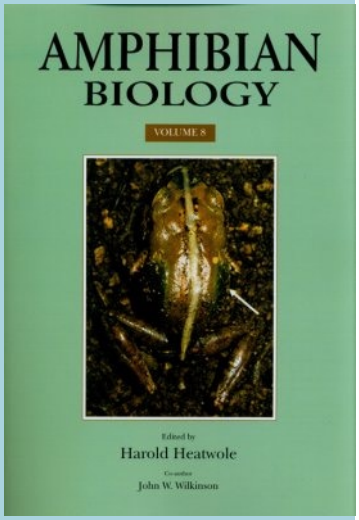
Chapter 8. Evaluating the Impact of Pesticides in Amphibian Declines - Michelle D. Boone, Carlos Davidson and Christine Bridges-Britton

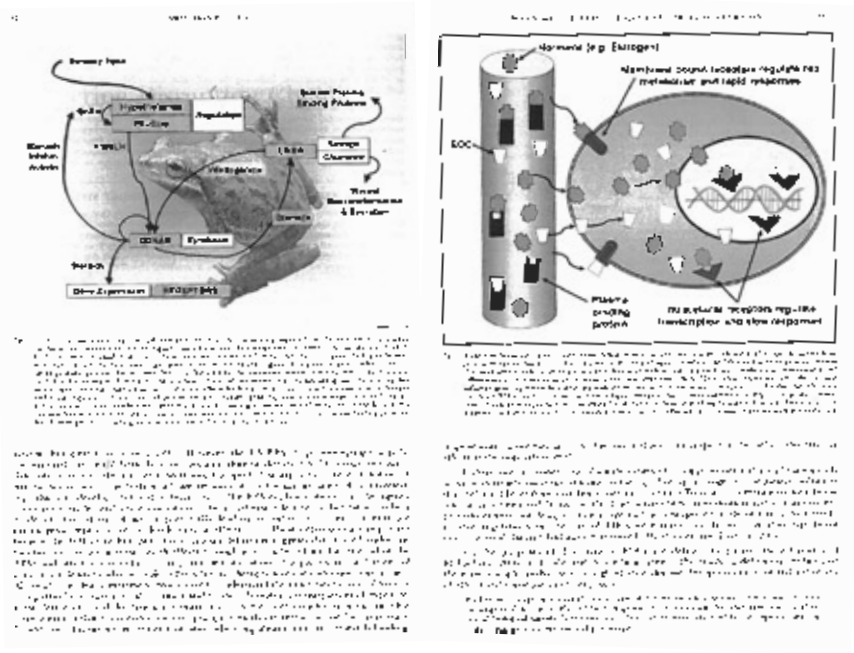
Chapter 9. Endocrine Disrupting Chemicals - Krista A. McCoy and Louis J. Guillette Jr.

Chapter 10. Role of Petrochemicals and Heavy Metals in Amphibian Declines - Luca Luiselli and Jerry Lea

Chapter 11. Acidification and its Effects on Amphibian Populations - Katja Räsänen and David M. Green

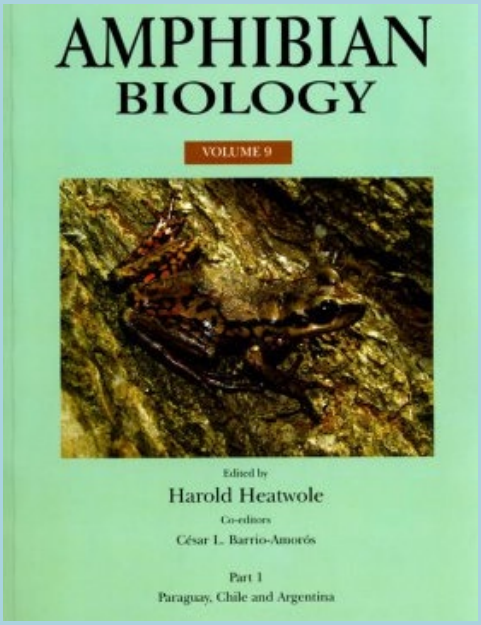
Chapter 12. Climatic Change and Amphibian Declines - Patricia A. Burrowes





Page examples from the Series "Amphibian Biology". An ongoing series, currently consisting of 11 volumes, providing a comprehensive and detailed account of the biology of frogs, toads, salamanders and caecilians.

Volume 9. Status of Decline of Amphibians: Western Hemisphere. Edited by H. Heatwole, C. L. Barrio-Amorós and J. W. Wilkinson



Part 1. Paraguay, Chile and Argentina (2010)

Chapter 1. Status of Amphibian Conservation and Decline in Paraguay - E. O. Lavilla and F. A. Brusquetti

Chapter 2. Status of Conservation and Decline of the Amphibians of Chile - Juan Carlos Ortiz and Harold Heatwole

Chapter 3. Status of Amphibian Conservation and Decline in Argentina - E. O. Lavilla and Harold Heatwole

Part 2. Uruguay, Brazil, Ecuador and Colombia (2011)

Chapter 4. Threats to Uruguayan Amphibians - José A. Langone

Chapter 5. Decline of Amphibians in Brazil - Vanessa K. Verdade, Ana Carolina Carnaval, Miguel T. Rodrigues, Luis Schiesari, Dante Pavan and Jaime Bertoluci

Chapter 6. Biodiversity and Conservation Status of Amphibians of Ecuador - Santiago R. Ron, Juan M. Guayasamin, and Pablo A. Menéndez-Guerrero

Chapter 7. Biodiversity and Conservation of Amphibians in Colombia - Ángela M. Suárez-Mayorga

Part 3. Venezuela, Guyana, Suriname, French Guiana (in press)

Chapter 8. Status of Amphibian Conservation and Deline in Venezuela - César L. Barrio-Amorós

Chapter 9. Amphibian Conservation: Guyana - Ross D. MacCulloch

Chapter 10. Status and Conservation of Amphibians in Suriname - Marinus S. Hoogmoed

Chapter 11. Status and Decline of the Amphibians of French Guiana - Christian Marty and Jean-Pierre Vacher

Part 4. Central America, the Caribbean, and North America (in press)

Chapter 12. Conservation Status of North American Amphibians - Michael J. Lannoo, Alisa L. Gallant and Robert W. Klaver

Chapter 13. Decline and Conservation of Amphibians in Central America - Steven M. Whitfield, Karen R. Lips and Maureen A. Donnelly

Chapter 14. Amphibian Conservation in the West Indies - S. Blair Hedges

Part 5. Bolivia and Peru (in press)

Chapter 15. Diversity and Conservation of the Amphibians of Bolivia - Ignacio De La Riva and Stephan Reichle

Chapter 16. Conservation Status of Amphibians in Peru - Alessandro Catenazzi and Rudolf von May

Volume 10: Conservation and Decline of Amphibians: Ecological Aspects, Effects of Humans, and Management. Edited by H. Heatwole and J. W. Wilkinson (2011)

Chapter 1. Destruction, Loss and Modification of Habitat - Francis Lemckert, Stephen J. Hecnar and David S. Pilliod

Chapter 2. Ecological Impacts of Non-Native Species - David S. Pilliod, Richard A. Griffiths, and Sergius L. Kuzmin

Chapter 3. Man Meets Frog: Perceptions, Use and Conservation of Amphibians by Indigenous People - Indraneil Das

Chapter 4. Harvesting of Amphibians for Food - Mirza D. Kusrini, Harold Heatwole, and David Davenport

Chapter 5. International Trade in Amphibians - Mizra D. Kusrini

Chapter 6. Road Kills - Miklós Puky

Chapter 7. Declines and Extinctions in Amphibian: An Evolutionary and Ecological Perspective - Sergius L. Kuzmin

Chapter 8. Phylogenetic Correlates of Population Decline and Extinction Risk in Amphibians - Jean-Marc Hero, Clare Morrison, Janice Chanson, Simon Stuart and Neil A. Cox

Chapter 9. Geographic Correlates of Extinction Risk in Amphibians - Clare Morrison and Jean-Marc Hero

Chapter 10. Life History Correlates of Extinction Risk in Amphibians - Jean-Marc Hero and Clare Morrison

Chapter 11. Monitoring Amphibian Populations - C. Kenneth Dodd Jr., Jon Loman, Dan Cogălniceanu and Miklos Puky

Chapter 12. Habitat Protection: Refuges and Reserves - Stephen J. Hecnar and Francis Lemckert

Chapter 13. Guidelines of the International Union for the Conservation of Nature (IUCN) for Re-introductions and their Application to Amphibians - Pritpal S. Soorae and Fréderic J. Launay

Chapter 14. Captive Breeding of Amphibians for Conservation - Richard A. Griffiths and Sergius L. Kuzmin

Chapter 15. Integrated Procedures; Where Do We Go From Here? - Clare Morrison, Jean-Marc Hero and Monique Van Sluys

Volume 11. Status of Conservation and Decline of Amphibians: Eastern Hemisphere. Edited by H. Heatwole, I. Das, S. Busack, and J. W. Wilkinson

Part 1. Commonwealth of Independent States, Mongolia, China, Korea, Japan (in press).

Chapter 1. Changes in Amphibian Populations in the Commonwealth of Independent States (Former Soviet Union) - Sergius L. Kuzmin and C. Kenneth Dodd Jr.

Chapter 2. Status of Conservation and Decline of Amphibians of Mongolia - Sergius L. Kuzmin

Chapter 3. Diversity and Conservation Status of Chinese Amphibians - Jianping Jiang, Feng Xie and Cheng Li

Chapter 4. The Conservation of Amphibians in Korea - Daesik Park, Mi-Sook Min, Kelly C. Lasater, Jae-Young Song, Jae-Hwa Suh, Sang-Ho Son, and Robert H. Kaplan

Chapter 5. Conservation Status of Japanese Amphibians - Masafumi Matsui

Part 2. Israel, Egypt, Libya, Tunisia, Algeria, Morocco and Mauritania (in press)

Chapter 6. Status of Conservation and Decline of Amphibians in Israel and Environs - Joy Hoffman, Michael R. Warburg and Gad Degani

Chapter 7. Amphibians of Egypt: A Troubled Resource - Adel A. Ibrahim

Chapter 8. Amphibians in Libya: A Status Report - Adel A. Ibrahim

Chapter 9. Conservation Status of Amphibians in Tunisia - Nabil Amor, Mohsen Kalboussi and Khaled Said

Chapter 10. Diversity and Conservation of Algerian Amphibian Assemblages - José A. Mateo, Philippe Geniez and Jim Pether

Chapter 11. Amphibians of Morocco, including Western Sahara: A Status Report - Ricardo Reques, Juan Manuel Pleguezuelos and Stephen D. Busack

Chapter 12. Amphibian Conservation in Mauritania - José Manuel Padial, Pierre André Crochet, Philippe Geniez, and José Carlos Brito

Part 3. Afghanistan, Pakistan, India and Sri Lanka (in press)

Chapter 13. Status and Decline of Amphibians of Afghanistan - Indraneil Das

Chapter 14. Amphibians of Pakistan and their Conservation Status - Muhammad Sharif Khan

Chapter 15. Status and Decline of Amphibians of India - Indraneil Das and Sushil K. Dutta

Chapter 16. Sri Lankan Amphibians: Extinctions and Endangerment - Rohan Pethiyagoda, Kelum Manamendra-Arachchi, and Madhava Meergaskumbura

Part 4. Thailand, Laos, Cambodia, Vietnam

Part 5. Malaysia, Singapore, Brunei, Indonesia, East Timor, Philippine Islands, New Guinea

Part 6. Nepal, Bhutan, Bangladesh, Myanmar

Part 7. Diseases and Status of Conservation and Decline of Amphibians in Western Europe

Part 8. Status of Conservation and Decline of Amphibians in Southeastern Europe and Turkey

Part 9. Status of Conservation and Decline of Amphibians in Central Europe

Part 10. Status of Conservation and Decline of Amphibians in Northern Europe

Part 11. Madagascar and Islands of the Indian Ocean

Part 12. Middle East

Part 13. Subsaharan Africa and Islands of the Atlantic Ocean (Togo has been assigned)

Part 14. Australia, New Zealand and Islands of the Pacific Ocean

Other Parts have some chapters finished but are incomplete and the order of publication may vary depending on when all chapters have been received. In some cases individual chapters have not been assigned yet. Above, countries, or Parts that have not been assigned are underlined.

Qualified persons interested in contributing manuscripts for underlined countries or Parts, should contact Harold Heatwole, Dept. Biology, NC State University, Raleigh, NC 27695-7617, USA or email: harold_heatwole@ncsu.edu

Volumes of the series on "Amphibian Biology" that deal with topics other than decline and conservation are:

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Volume 5. Osteology (2003)
Volume 6. Endocrinology (2005)
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Report on *Lithobates vibicarius* (Cope, 1894) (Anura: Ranidae) in Parque Nacional del Agua Juan Castro Blanco, Alajuela, Costa Rica

By Andrea Castro-Cruz & Francisco García-Fernández

Lithobates vibicarius (Green-eyed Frog) is an endemic species from Costa Rica and Western of Panama. Once common in Costa Rica, *L. vibicarius* could be found in Tilarán, Central and Talamancan mountain range, between 1500 to 2700 msl (Savage 2002). However, since the 1980s many amphibian species, including *L. vibicarius*, have been suddenly disappearing (Bolaños 2003). These local extinctions were attributed to three main factors: presence of the fungus *Batrachochytrium dendrobatidis*, climate change or synergistic effects between both of them (Pounds et al. 2006).

Figure 1: Differences in adults coloration of *Lithobates vibicarius*. Photos: (up) Fabio Arias and (down) Andrea Castro-Cruz.

Lithobates vibicarius is considered Critically Endangered by the IUCN Red List and is afforded protection and regulation by Conservation of Wildlife law No. 7317, Environment Organic Law No.7554 and the decree No. 26435-MINAE (UICN, 2011). Some populations of *L. vibicaria* are known in Monteverde and now also in many sectors in Parque Nacional del Agua Juan Castro Blanco (PNAJCB) in Costa Rica. For that reason there is an important urge to conserve the habitat remaining in the two localities in Costa Rica. In addition any sightings of this species are extremely important to both the science community and for the PNAJCB conservation management plans.

PNAJCB is located in Alajuela province, far northwest of the Central Valley, in the Central Range foothills, coordinates: 10°12´01´´N, 10°21´01´´W and 84°15´32´´N, 84°23´06´´W; administrated by Ministry of Environment, Energy and Telecommunications of Costa Rica (MINAET), National System of Protected Areas (SINAC), and Arenal Huetar Norte Conservation Area (ACAHN).

Figure 2: Lagoons and some ponds found in the different sectors. Photos: Andrea Castro-Cruz.

This study aimed to locate *Lithobates vibicarius* populations following the methods of visual encounter survey and inspections for larvae and eggs in water bodies (Lips *et al.* 2001), in two sectors of PNAJCB: Quetzal Station y Pozo Verde (1800 to 2050 msl respectively) and two more sectors near their borders: Volcán Viejo Station and Laguna Congo (1370 to 1820 msl respectively). Once populations or individuals were found, site coordinates were taken using a Garmin GPS, model GPSmap 60CSx.

Populations in the PNAJCB were identified highlight the importance of the park. However populations were also indentified on private land being used for cattle ranching which is likely a major threat to the survival of these populations. In total six ponds and two lagoons with *Lithobates vibicarius* populations were discovered.

Quetzal Sector: One low current pond with a large number of tadpoles of *Lithobates vibicarius* and two adults nearby (1832 msl).

Pozo Verde Sector: In this sector there is a lagoon created through volcanic activity were precipitation accumulates and takes on a greenish coloration. Temporary or seasonal ponds are formed due to the effect of rains and springs in this sector. On this site it was possible to hear the calls of large numbers of adults in the lagoon, and three ponds nearby were found with large number of tadpoles. It is also important to highlight

that in this site there are other smaller water bodies that show evidences of *L. vibicarius*. In this sector in total one metamorph, two juveniles and twelve adults were found (1946-2050 msl).

Volcán Viejo Sector: one low current pond that crosses a pasture located at 1378 msl which is below their documented altitudinal range. The pond contained at least 40 tadpoles and two individuals in their metamorphosis stage.

Congo Lagoon: (1823 msl) located in the middle of a pasture, this lagoon was drained by the owner and is currently recovering. In this sector *Lithobates vibicarius* globular egg masses were found above the emergent vegetation in the water margins, also a juvenile was found and a total of 46 individuals were counted. This sector is under severe threat by human activities.

Finally, in order to precisely gauge the impact to *Lithobates vibicarius* populations in the PNAJCB further studies must be undertaken to ascertain this species population status and to determine the presence and/or effect of the chytrid fungus on this population. The presence of this species demonstrates the importance of maintaining current conservation efforts in the area and highlights the need to identify new sectors with *Lithobates vibicarius* populations inside and outside the PNAJCB that should be contemplated for future management.

Acknowledgments
Fabio Arias Núñez (MINAET), Jimena Golcher and Juan Abarca

Figure 3: *Lithobates vibicarius* juvenile. Photo: Fabio Arias.

Figure 4: *Lithobates vibicarius* juveniles in one of the ponds. Photo: Fabio Arias.

Figure 5: *Lithobates vibicarius* metamorph. Photo: Andrea Castro-Cruz.

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Recent Publications

Conservation and Ecology

Deep intra-island divergence of a montane forest endemic: phylogeography of the Puerto Rican frog *Eleutherodactylus portoricensis* (Anura: Eleutherodactylidae)

By Brittany S. Barker, Robert B. Waide & Joseph A. Cook

Aim Hypotheses proposed for lineage diversification of tropical montane species have rarely been tested within oceanic islands. Our goal was to understand how basin barriers and Pleistocene climatic fluctuations shaped the distribution of diversity in *Eleutherodactylus portoricensis* (Eleutherodactylidae), a frog endemic to montane rain forests of Puerto Rico.

A Mountain Coquí, *Eleutherodactylus portoricensis*, at "La Roca" de El Yunque, El Yunque National Forest. Photo: Alejandro Rios Franceschi.

Location The north-eastern (Luquillo) and south-eastern (Cayey) mountains of Puerto Rico.

Methods We generated mitochondrial DNA (mtDNA) control region sequences (*c.* 565 bp) from 144 individual *E. portoricensis* representing 16 localities, and sequenced 646 bp cytochrome *b* and 596 bp nuclear DNA (nDNA) rhodopsin exon and intron 1 from a subset of individuals. We conducted a phylogenetic analysis on the mtDNA sequence data and explored population substructure with maximum parsimony networks, a spatial analysis of molecular variance, and pairwise F_{ST} analysis. Coalescent simulations were performed to test alternative models of population divergence in response to late Pleistocene interglacial periods. Historical demography was assessed through coalescent analyses and Bayesian skyline plots.

Results We found: (1) two highly divergent groups associated with the disjunct Luquillo and Cayey Mountains, respectively; (2) a shallow mtDNA genetic discontinuity across the La Plata Basin within the Cayey Mountains; (3) phylogeographic congruence between nDNA and mtDNA markers; (4) divergence dates for both mtDNA and nDNA pre-dating the Greenland Interstadial (*c.* 75 ka), and nDNA suggesting divergence prior to the penultimate interglacial (*c.* 245 ka); and (5) historical demographic stability in both lineages.

Main conclusions The low-elevation Caguas Basin is a long-term barrier to gene flow between the two montane frog populations. Measures of genetic diversity for mtDNA were similar in both lineages, but lower nDNA diversity in the Luquillo Mountains lineage suggests infrequent dispersal between the two mountain ranges and colonization by a low-diversity founder population. Population divergence began prior to the Greenland Interstadial. Stable population sizes over time indicate a lack of demonstrable demographic response to climatic changes during the last glacial period. This study highlights the importance of topographic complexity in promoting within-island vicariant speciation in the Greater Antilles, and indicates long-term persistence and lineage diversification despite late Pleistocene climatic oscillations.

Full article: Barker, B.S., Waide, R.B. & Cook, J.A. 2011. Deep intra-island divergence of a montane forest endemic: phylogeography of the Puerto Rican frog *Eleutherodactylus portoricensis* **(Anura:Eleutherodactylidae).** *Journal of Biogeography*. **38(12):2311-2325.**

Additive threats from pathogens, climate and land-use change for global amphibian diversity.

By Christian Hof, Miguel B. Araújo, Walter Jetz & Carsten Rahbek

Amphibian population declines far exceed those of other vertebrate groups, with 30% of all species listed as threatened by IUCN. The causes of these declines are a matter of continued research, but most likely include climate change, land-use change and spread of chytridiomycosis. Many studies have assessed how these threats may affect amphibian populations and how they may interact at local and regional scales, and large-scale modeling studies of the impact of climate change or chytridiomycosis have been conducted. However, an integrative, analytical, spatially explicit assessment at a global scale of the most severe threats is still lacking. Here we assess the spatial distribution and interactions of primary threats in relation to the global distribution of amphibian diversity. We show that the greatest proportions of species negatively affected by climate change are projected to be found in Africa, parts of northern South America, and the Andes. The regions with the highest projected probability of occurrence of chytridiomycosis are located in mostly temperate climates as well as mountainous and coastal regions. Areas with high projected land-use change are mainly found in tropical Central and South America, tropical Africa and montane parts

Oophaga granulifera, listed as vulnerable on the IUCN Red List of Threatened Species. The major threat is habitat loss due to agriculture, selective logging, and human settlement. According to the analyses by Hof et al., the intensity of threats across its distribution area is likely to increase during the next decades. Photo: Matthias Dehling

of central and southern Asia. Regions with the highest projected impact of land-use and climate change tend to coincide, but there is little spatial overlap with regions highly threatened by the fungal disease. Overall, the areas harboring the richest amphibian faunas are disproportionately more impacted by one or multiple threat factors than areas with low richness. Our results imply that risk assessments focusing on a single threat are most likely picturing an optimistic view. As such, they fail to identify the key actions required to curb the ongoing global decline in amphibian diversity. The substantial overlap of threats with many of the world's centers of amphibian richness underlines the pessimistic long-term perspective for global amphibian diversity. It reinforces the realization that prioritization of conservation efforts needs to be based on knowledge of the spatial distribution both of the different key threats and of biodiversity.

Full article: Hof C, Araújo MB, Jetz W, Rahbek C (2011) Additive threats from pathogens, climate and land-use change for global amphibian diversity. Nature 480, 516-519.

Geographic Variation in Northern Green Frog Larvae, *Lithobates Clamitans Melanotus*, in Northwestern New Jersey

By John K. Korky & John A. Smallwood

A total of 124 larvae of the northern green frog, *Lithobates clamitans melanotus* (Rafinesque 1820), were collected at five localities in three adjacent counties of northwestern New Jersey from 2001 to 2007. Data were recorded for 19 varying character states that included 18 morphometric features (body dimensions and characteristics of the oral disc) and developmental stage. Developmental stage differed significantly among the localities. Tables of univariate descriptive statistics are provided for the 18 morphological features from all sites. Regression analyses of body length over developmental stage and tail length over developmental stage determined that larvae from one locality (Allamuchy State Park) differed markedly from the larvae from the other four localities. Four localities expressed the larval tooth row formula (LTRF) 2(2)/ 3, while Chubb Park was 2(2)/3(1). Phenotypic plasticity likely accounts for some of the variation of all characters.

Full article: Korky, J.K. & Smallwood, J.A. (2011) Geographic Variation in Northern Green Frog Larvae, *Lithobates Clamitans Melanotus*, in Northwestern New Jersey. Bulletin of the Maryland Herpetological Society: 47: 1-4.

Estimating survival of a streamside salamander: Importance of temporary emigration, capture response and location

By Steven J. Price, Evan A. Eskew, Kristen K. Cecala, Robert A. Browne & Michael E. Dorcas.

Estimating survival for highly secretive aquatic animals, such as stream salamanders, presents numerous challenges. Salamanders often spend a considerable time in refugia where they are difficult to capture. Few studies have calculated vital rates for stream salamanders, yet the need is substantial as they are threatened by a wide range of land-use stressors, especially urban development. In this study, we used 34 months of continuous field samples collected at an urban and undisturbed stream and robust design, mark recapture analysis to evaluate the importance of temporary emigration, capture response, and location on survival estimates of the salamander *Desmognathus fuscus*. We constructed a set of candidate models incorporating combinations of time- and location varying capture and recapture probabilities, capture responses, temporary emigration, and survival estimates and ranked models using Akaike's Information Criterion. We found strong support for month-specific capture probabilities, recapture probabilities, temporary emigration and a negative behavioral response to capture in the majority of months. We found no support for variation in capture probabilities, recapture probabilities, and temporary emigration between locations. However, we found that location strongly influenced survival estimates. Specifically, survival estimates were significantly higher at the undisturbed site than at the urban site. Our results emphasize the importance of estimating capture probabilities, recapture probabilities, capture response, and temporary emigration when evaluating survival in highly secretive aquatic animals. Failure to account for these population parameters will likely yield biased estimates of survival in freshwater animal populations.

Full article: Price, S.J., E.A. Eskew, K.K. Cecala, R.A. Browne and M.E. Dorcas. 2012. Estimating survival of a streamside salamander: Importance of temporary emigration, capture response and location. Hydrobiologia 679:205-215.

Climate change is linked to long-term decline in a stream salamander

By Winsor H. Lowe

Amphibian declines have been documented worldwide and several have been linked to climate change, but the long-term data needed to detect declines are largely restricted to pond-breeding species. This limits our knowledge of population trends in other major groups of amphibians, including stream salamanders, which have their greatest diversity in North America. I hypothesized that increasing air temperature and precipitation in northeastern North America caused abundance of the stream salamander *Gyrinophilus porphyriticus* in a New Hampshire population to decline between 1999 and 2010. I found a significant decline in abundance of *G. porphyriticus* adults over this 12-year period, and no trend in larval abundance. Adult abundance was negatively related to annual precipitation, which is predicted to increase further in the Northeast due to climate change. A 6-year capture-mark-recapture data set for the same population showed no variation over time in larval and adult detectability, validating the abundance data, and no variation in larval and adult survival. However, survival during metamorphosis from the larval to adult stage declined dramatically. These results suggest that increasing precipitation is causing a decline in adult recruitment, which, if it persists, will lead to local extinction. A likely mechanism for the decline in adult recruitment is mortality of metamorphosing individuals during spring and fall floods, which have increased in volume and frequency with the increase in precipitation. More broadly, this study presents strong evidence that the amphibian decline crisis extends to North America's stream salamanders, and shows the critical need to collect population data on these species. It is sobering to think that North America's stream salamanders may be experiencing gradual declines that, ultimately, will be just as significant as other high-profile cases, but are obscured by a lack of data and the secretive habits of these species.

Full article: Lowe, W.H. In press. Climate change is linked to long-term decline in a stream salamander. Biol. Conserv. (2011), doi:10.1016/j.biocon.2011.10.004 *This article is published online at http://www.sciencedirect.com/science/article/pii/S0006320711003739

An adult *Gyrinophilus porphyriticus* in Merrill Brook, the long-term study site in northern New Hampshire. Photo: Matt Ayres.

In Amazonian frogs there is much more diversity than meets the eye

By W. Chris Funk, Marcel Caminer & Santiago R. Ron

Biodiversity conservation and its utilization for human welfare require adequate species inventories. Although the Amazon Basin is already recognized as a global center of biodiversity of amphibians, we provide new evidence that its diversity is still vastly underestimated. In particular, we discovered a 150-350% increase in Amazonian frog species diversity by combining DNA, morphological, and call data to uncover cryptic species. Our study focused on two clades: frogs of the *Hypsiboas calcaratus-fasciatus* species complex and Amazonian *Engystomops*. We sampled intensively in six countries with a focus in Ecuador (*Engystomops*: 252 individuals from 36 localities; *Hypsiboas*: 208 individuals from 65 localities). We

New species of *Hypsiboas* aff. *fasciatus* discovered in the Amazon region of eastern Ecuador by Funk et al." Photo: Santiago R. Ron.

found that in both clades, species richness was severely underestimated, with more undescribed species than described species. In *Engystomops*, the two currently recognized species are actually five to seven species (a 150– 250% increase in species richness); in *Hypsiboas*, two recognized species represent six to nine species (a 200–350% increase). Our results suggest that estimates of Amazonian frog species richness based exclusively on morphological characters could significantly underestimate true species richness. We recommend that future efforts to inventory Amazonian amphibians should be based on diverse sets of characters especially genetic markers (mitochondrial and nuclear), advertisement calls and morphology.

Full article: Funk, W.C., Caminer, M. & Ron, S.R. (2011) High levels of cryptic species diversiy uncovered in Amazonian frogs. *Proceedings of the Royal Society B-Biological Sciences*. **doi:10.1098/rspb.2011.1653**

Predator-recognition training: a conservation strategy to increase post-release survival of hellbenders in head-starting programs

By Adam L. Crane & Alicia Mathis

For species with declining populations, captive-rearing with subsequent release into natural habitats ("head-starting") is often used as part of a conservation strategy. One challenge to head-starting programs is that head-started individuals can suffer high rates of post-release predation. Head-starting programs are currently being established for hellbenders (*Cryptobranchus alleganiensis*), large aquatic salamanders that are experiencing population declines throughout much of the species' range. Although hellbenders have innate recognition of many predators, inexperienced juveniles show only weak recognition of introduced trout. We used a classical conditioning protocol to train captive-reared hellbender larvae to show fright responses to the scent of trout. We exposed hellbender larvae to trout-scented water plus a hellbender distress secretion during training trials. In a subsequent test, these larvae responded to trout cues alone with a fright response; control larvae that were trained with the trout scent plus a blank control did not show a fright response to the trout cues. Learning was specific to trout because trained larvae did not respond to water that had been scented by a suckermouth catfish. Although a number of details remain to be addressed concerning standardized procedures, we recommend that head-starting programs for hellbenders include trout-recognition training.

Full article: Crane AL, Mathis A (2011) Predator-recognition training: a conservation strategy to increase post-release survival of hellbenders in head-starting programs. *Zoo Biology* **30:611-622.**

2011 Natterjack Toad (*Epidalea calamita Laurenti*, 1768) Breeding Habitat Survey, North Dingle Peninsula, Co. Kerry, Ireland

By John Kelly Korky

Historic, natural natterjack toad (*Epidalea calamita* Laurenti) breeding sites on the north Dingle Peninsula, Co. Kerry, were surveyed in June 2011. Current habitat conditions and possible presence of toads were noted, and compared with the initial survey in 1997 by this author and others thereafter. The recent creation of new breeding ponds by the National Parks and Wildlife Service and their benefits are reviewed. Genetic data suggesting that the north Dingle toads share a common distant ancestor with those of southern Castlemaine Harbour are included. Comments on present taxonomic and systematic nomenclatural alternatives to designating the natterjack are offered.

Achomaireacht

Imí an Mheithimh 2011 scrúdaíodh láithreáin síolraithe nádúrtha an chnádáin i dtuaisceart leithinis Chorca Dhuibhne, Contae Chiarraí. Tugadh faoi deara staid reatha na gnáthóige agus láithreacht fhéideartha na gcnádán agus cuireadh i gcomparáid iad leis an suirbhé tosaigh leis an údar seo agus le daoine eile ina dhiaidh sin. Déantar athbhreithniú ar chruthú deireanach na lochán nua, agus ar a mbuntáistí, ag an tSeirbhís Páirceanna Náisiúnta agus Fiadhúlra. Cuirtear ar fáil sonraí géiniteacha a thugann le fios go roinneann cnádáin tuaisceart Chorca Dhuibhne sinsearach coiteann le cnádáin Loch na dTrí gCaol deisceartach. Déantar trácht ar mhalairtí ainmníochta tacsanomaíthí agus sistéamaí faoi láthair ar ainmniú an chnádáin.

Full article: Korky, J.K. (2011) 2011 natterjack toad (*Epidalea calamita* Laurenti, **1768) breeding habitat survey, north Dingle Peninsula, Co. Kerry, Ireland. Bulletin of the Irish Biogeographical Society: 35; 10-20.**

South African frogs show range contractions: An analysis using the South African Frog Atlas Project.

By Emily A. Botts, Barend F.N. Erasmus & Graham J. Alexander

Recent biological surveys can be compared to historical species distributions to identify species with contracting ranges that may also be declining. The *South African Frog Atlas Project* (*SAFAP*) is the first survey of amphibians in South Africa that allows for such a comparison. This survey provided a unique opportunity to investigate range size change over time by combining comprehensive recent species presence records with collated museum records of past occurrence. The primary concern in making species range size comparisons between dissimilar datasets is the problem of incomparable sampling intensities. For the South African amphibian data, an increase in sampling intensity over time was associated with the move from ad hoc museum records to the more coordinated sampling of the *SAFAP*. The consequent increased geographic coverage and higher detection probabilities resulted in a false impression of range expansion for several

species. We used a 'virtual ecologist' approach to assess several methods for managing the increased sampling intensity. We generated hypothetical ranges with known change to which we applied simulated sampling that replicated the sampling of the *SAFAP*. Methods that were based on categorical comparisons oversimplified the quantitative data and correctly measured the sign of change (contracting/expanding) for fewer than 56% of the hypothetical ranges. Sub-sampling methods correctly estimated the sign of change for up to 78% of the hypothetical ranges, but our results show that it is essential to balance data removal with a reduction of false range expansions. We found that the best measure of range change for the virtual data was a mathematical correction factor, which achieved 83% accuracy in detecting the correct sign of change and 50% for the magnitude of change. Using this method, we found that 68 (60.2%) South African frog species have undergone range contractions. South African species have previously been thought to have escaped the catastrophic declines seen in the neotropics and Australia. However, our analysis suggests that substantial numbers of species may be experiencing range contractions.

Full article: Botts, E.A., Erasmus, B.F.N. & Alexander, G.J. Methods to detect species range size change from biological atlas data: A comparison using the *South African Frog Atlas Project*. Biological Conservation (2011) doi:10.1016/j.biocon.2011.10.035

Testing climate-based species distribution models with recent field surveys of pond-breeding amphibians in eastern Missouri

By Daryl R. Trumbo, Amber A. Burgett & Jason H. Knouft

Species distribution models (SDMs) have become an important tool for ecologists by providing the ability to predict the distributions of organisms based on species niche parameters and available habitat across broad geographic areas. However, investigation of the appropriate extent of environmental data needed to make accurate predictions has received limited attention. We investigate whether SDMs developed with regional climate and species locality data (i.e., within Missouri, USA) produce more accurate predictions of species occurrences than models developed with data from across an entire species range. To test the accuracy of the model predictions, field surveys were performed in 2007 and 2008 at 103 study ponds for eight amphibian study species. Models developed using data from across the entire species range did not accurately predict the occurrences of any study species. However, models developed using data only from Missouri produced accurate predictions for four study species, all of which are near the edge of their geographic ranges within the study area. These results suggest that species distribution modeling with regionally focused data may be preferable for local ecological and conservation purposes, and that climate factors may be more important for determining species distributions at the edge of their geographic ranges.

Full article: Trumbo, D.R., Burgett, A.A., Knouft, J.H. (2011) Testing climate-based species distribution models with recent field surveys of pond-breeding amphibians in eastern Missouri. Can. J. Zool. 89: 1074-1083.

Assessing the potential impact of an invasive species on a Mediterranean amphibian assemblage: a morphological and ecological approach

By Daniel Escoriza & Dani Boix

Over the last century the range of *Discoglossus pictus*, a native species of the eastern Maghreb, has expanded across Catalonia (north-eastern Spain) where the climatic conditions have proven favorable for colonization. The region is inhabited by eight frog species that have diversified to fill the different aquatic environments although *D. pictus* has established itself with notable success. The potential impact of *D. pictus* on these species is unknown, for this reason we have studied the degree of ecological overlap among different species of frogs in the region. First we have defined the tadpole morphospace occupied by native species and the position of *D. pictus* within it, our results indicating that *D. pictus* clusters with the benthic guild. We have also analyzed the degree of niche overlap at the local scale, by studying breeding habitat selection, and overlap at the regional scale, based on presence localities and GIS-supported data, indicating that *D. pictus* selected small ponds to spawn and is as a thermophilic species. All these results suggested that a greater degree of niche overlap is expected with native *Bufo calamita* and *Pelodytes punctatus*. The definition of morphological groups can be useful to understand the invaded assemblage structure and the potential effect of an alien frog species on native communities.

Full article: Escoriza, D. & D. Boix. (2012) Assessing the potential impact of an invasive species on a Mediterranean amphibian assemblage: a morphological and ecological approach. Hydrobiologia 680:233-245 DOI 10.1007/s10750-011-0936-5

Evaluating the effects of urbanization on salamander abundances using a before-after control-impact design

By Steven J. Price, Robert A. Browne & Michael E. Dorcas

Urbanisation represents a significant threat to semi-aquatic amphibian populations, especially stream-dwelling salamanders. Although studies of urbanisation effects on amphibians have been conducted, there is an urgent need to follow populations over longer time periods, account for imperfect detection and determine the response time to urbanisation. Consequently, we used a before-after control-impact (BACI) study design to estimate changes in abundances

Discoglossus pictus. Photo: Daniel Escoriza.

of larval and adult salamanders in streams affected by urbanisation. From 2005 to 2009, we used standard sampling techniques to obtain a count of salamanders in 13 first-order streams that underwent urbanisation of their catchments after the first year of sampling. Simultaneously, we counted salamanders in 17 streams that experienced no disturbance within stream catchments. Additionally, we measured environmental variables at each stream. We used Royle's binomial mixture model to estimate annual mean abundances and individual detection probabilities, and Bayesian inference was used to estimate population parameters for each stage and species. Although mean abundance estimates varied among years in control and urbanised streams, we found that urbanisation had a negative effect on larval and adult salamander abundances. Larval salamander abundances at sites 1 year after urbanisation were significantly lower than abundances from control sites. Abundances of adult two-lined salamanders (*Eurycea cirrigera*) at urbanised sites were lower than abundances at control sites 2 years post-urbanisation, and adult dusky salamander (*Desmognathus fuscus*) abundances at urbanised sites were lower than abundances at control sites 3 years post-urbanisation. Maximum conductivity, sedimentation level and maximum stream channel width differed between urban and non-urban streams. Our results suggest that stream-dwelling salamanders exhibit little resistance to urbanisation. Our study also highlights the use of the BACI design to study how urbanisation affects populations in semi-aquatic habitats. We emphasise that inferences regarding urbanisation effects on population response may be compromised unless urban populations are compared to populations in control sites, especially for species in which populations fluctuate.

Full article: Price, S.J., R.A. Browne and M.E. Dorcas. 2012. Evaluating the effects of urbanization on salamander abundances using a before-after control-impact design. Freshwater Biology 57:193-203.

Effects of the landscape on boreal toad gene flow: does the pattern-process relationship hold true across distinct landscapes at the northern range margin?

By Jennifer A. Moore, David A. Tallmon, Julie Nielsen & Sanjay Pyare

Understanding the impact of natural and anthropogenic landscape features on population connectivity is a major goal in evolutionary ecology and conservation. Discovery of dispersal barriers is important for predicting population responses to landscape and environmental changes, particularly for populations at geographic range margins. We used a landscape genetics approach to quantify the effects of landscape features on gene flow and connectivity of boreal toad (*Bufo boreas*) populations from two distinct landscapes in Southeast Alaska (Admiralty Island, ANM, and the Chilkat River Valley, CRV). We used two common methodologies for calculating resistance distances in landscape genetics studies (resistance based on least-cost paths and circuit theory). We found a strong effect of saltwater on genetic distance of CRV populations, but no landscape effects were found for the ANM populations. Our discordant results show the importance of examining multiple landscapes that differ in the variability of their features, in order to maximize detectability of underlying processes and allow results to be broadly applicable across regions. Saltwater serves as a physiological barrier to boreal toad gene flow and affects populations on a small geographic scale, yet there appear to be few other barriers to toad dispersal in this intact northern region.

Full article: Moore, J.A., D.A. Tallmon, J. Nielsen and S. Pyare (2011) Effects of the landscape on boreal toad gene flow: does the pattern-process relationship hold true across distinct landscapes at the northern range margin? Molecular Ecology 20: 4858-4869.

Boreal toad breeding site along the Lynn Canal in Southeast Alaska. Photo: J. Moore

Anuran Larval Habitat Quality When Reed Canary Grass Is Present in Wetlands

By Tracy A.G. Rittenhouse

Ephemeral, fishless wetlands with open canopies are known to be quality breeding habitats for pond-breeding amphibians. Yet many wetlands including these are commonly invaded by exotic plants, resulting in vegetation shifts from diverse native vegetation to monotypic stands of novel material. I tested the hypothesis that an invasive grass, reed canary grass (*Phalaris arundinacea*), would reduce survival, growth, and development rates of four tadpole species relative to a mixture of native grasses. I manipulated grass type and amount in fully replicated mesocosm experiments that contained American Toads (*Anaxyrus americanus*), Cope's Gray Treefrogs (*Hyla chrysoscelis*), Pickerel Frogs (*Lithobates palustris*), or Wood Frogs (*Lithobates sylvatica*). Counter to expectations, I found little evidence that diverse vegetation enhanced wetland quality for amphibians. Rather, quantity of decomposing plant matter influenced tadpole performance more than type of plant matter. The presence of reed canary grass produced minimal direct (e.g., toxic alkaloids) or indirect (i.e., through the food web) effects on tadpoles, but differences in survival were detected. I suggest that large amounts of grass supplied excess organic matter that decomposed rapidly underwater, potentially causing a pulse of nutrients early

in the larval period and anoxia. Wetlands invaded by reed canary grass often have drastically altered hydroperiods that prevent tadpoles from reaching metamorphosis, but these wetlands may successfully produce metamorphs given that hydroperiods are adequate and eutrophic conditions do not occur in the wetland.

Full article: Rittenhouse, T.A.G. 2011. Anuran larval habitat quality when reed canary grass is present in wetlands. Journal of Herpetology 45:491-496.

Short-Term Response of *Dicamptodon tenebrosus* Larvae to Timber Management in Southwestern Oregon

By Niels Leuthold, Michael J. Adams & John P. Hayes

In the Pacific Northwest, previous studies have found a negative effect of timber management on the abundance of stream amphibians, but results have been variable and region specific. These studies have generally used survey methods that did not account for differences in capture probability and focused on stands that were harvested under older management practices. We examined the influences of contemporary forest practices on larval *Dicamptodon tenebrosus* as part of the Hinkle Creek paired watershed study. We used a mark–recapture analysis to estimate *D. tenebrosus* density at 100 1-m sites spread throughout the basin and used extended linear models that accounted for correlation resulting from the repeated surveys at sites across years. Density was associated with substrate, but we found no evidence of an effect of harvest. While holding other factors constant, the model-averaged estimates indicated; 1) each 10% increase in small cobble or larger substrate increased median density of *D. tenebrosus* 1.05 times, 2) each 100-ha increase in the upstream area drained decreased median density of *D. tenebrosus* 0.96 times, and 3) increasing the fish density in the 40 m around a site by 0.01 increased median salamander density 1.01 times. Although this study took place in a single basin, it suggests that timber management in similar third-order basins of the southwestern Oregon Cascade foothills is unlikely to have short-term effects of *D. tenebrosus* larvae.

Full article: Leuthold, N., Adams, M. J. and Hayes, J. P. (2012), Short-term response of *Dicamptodon tenebrosus* larvae to timber management in southwestern Oregon. The Journal of Wildlife Management, 76: 28–37.

Population Size Influences Amphibian Detection Probability: Implications for Biodiversity Monitoring Programs

By Lorenzo G. Tanadini & Benedikt R. Schmidt

Monitoring is important to assess the status of amphibian populations. Monitoring programs must account for imperfect detection because some individuals, populations or species will not be encountered during surveys. The paper shows that amphibian detection probability largely depends on population size. Large populations are easier to detect than small populations. This relationship holds for both newts (which have to be searched activley by a surveyor) and calling anurans. A common statistical tool to analyse presence/absence monitoring data are site occupancy models. The effect of population size on detection probabilities causes heterogeneity. This heterogeneity can lead to negative bias in site occupancy estimates. We show how the problem can be solved and we suggest that presence/absence monitoring programs should quantify population size because this can improve inference. The result also implies that standardization of field methods does not always lead to constant detection probabilities.

Full article: Lorenzo G. Tanadini, Benedikt R. Schmidt. 2011. Population Size Influences Amphibian Detection Probability: Implications for Biodiversity Monitoring Programs. PLoS ONE 6(12): e28244. doi:10.1371/journal.pone.0028244 (http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0028244)

Multiple stressors and complex life cycles: Insights from a population-level assessment of breeding site contamination and terrestrial habitat loss in an amphibian.

By Christopher J. Salice, Christopher L. Rowe, Joseph H.K. Pechmann & William A. Hopkins

Understanding how environmental stressors impact amphibians is challenging because multiple factors may individually and interactively affect life history traits important for population-level processes. Moreover, because many amphibians possess complex life cycles in which they depend on suitable aquatic and terrestrial habitats, different stressors may act on different components of the life cycle. Our understanding of how amphibians respond to stress can benefit from the use of mathematical population models as a means of integrating effects of multiple stressors operating on different components of the life cycle. We investigated the population level effects of aquatic contaminants (coal combustion residues, CCR) and terrestrial habitat loss on the Eastern narrowmouth toad, *Gastrophryne carolinensis*. The model was parameterized with existing data that demonstrated negative reproductive and developmental effects of CCR and larval and terrestrial density dependence. The empirically derived estimate of density dependent terrestrial survival, where survival of toads in the terrestrial habitat decreased when more toads were present, was used to model effects of terrestrial habitat loss. Also, a growing body of research shows that catastrophic reproductive failure can have a strong impact on population dynamics of amphibians with complex life cycles. Catastrophic reproductive failure can result from droughts or flooding that impact breeding habitats reducing reproductive success. We considered catastrophic reproductive failure as representing a form of environmental stochasticity and explored how this altered population-level responses to CCR and terrestrial habitat loss.

Results of the simplest models in which there was no catastrophic reproductive failure indicated that when terrestrial habitat was abundance, CCR-exposed toads had a larger population size compared to toads not exposed by CCR. These somewhat counterintuitive results were due to a release from density dependent effects in the aquatic phase because there were fewer initial larvae from CCR-exposed toads. However, when we included realistic probabilities of catastrophic reproductive failure, CCR-exposed toads were more susceptible to decline and extinction compared to non-exposed toads. This was especially true as terrestrial habitat declined. It may be that environmental stochasticity renders amphibian populations more susceptible to the adverse effects of other stressors (or visa versa). Although there can be significant uncertainties in modeling studies, our results yield interesting insights and point to the complexities involved in understanding and assessing the effects of anthropogenic factors on amphibian populations.

Full article: Salice, C.J., Rowe, C.L., Pechmann, H.J.K. and Hopkins, W.A. 2011. Multiple stressors and complex life cycles: Insights from a population-level assessment of breeding site contamination and terrestrial habitat loss in an amphibian. Environmental Toxicology and Chemistry 30(12):2874-2882.

Effect of search method and age on mark-recapture abundance estimation in salamanders

By Frances E. Buderman & Eric B. Liebgold

Salamanders are widely used as indicators of forest health, making it important to accurately estimate population size. The red-backed salamander, *Plethodon cinereus*, is a fully terrestrial salamander that has no larval stage, but hatches into a miniature adult. Researchers typically survey for red-backed salamanders by searching under moist rocks and logs during the day, but some researchers estimate population size by studying salamanders foraging on the ground surface on wet nights. Our goal was to determine whether there were differences in the likelihood of capturing or recapturing salamanders during day or night searches and whether incorporating data on search method or age of salamanders affected estimates of abundance. Our research took place in the southern Appalachian Mountains, which have the greatest species diversity and some of the highest densities of salamanders in the world. From 2005 to 2009, we surveyed red-backed salamanders during day and night searches and individually marked almost 700 salamanders by injecting colored elastomers under the translucent skin of their bellies. We were 40-67% more likely to capture unmarked salamanders during night searches, but we were more than twice as likely to recapture marked salamanders during day searches. As a result, mark-recapture models gave better estimates of abundance when they included information on how we searched for salamanders. There were no differences between the likelihood of capturing or recapturing adults versus juvenile salamanders, nor were abundance estimates affected by inclusion of age in our mark-recapture models. However, there was huge yearly variation in salamander abundance estimates, from less than 1 per square meter to over 6 per square meter, mostly due to yearly differences in the number of juveniles. For these reasons, we recommend that protocols for surveying terrestrial salamanders include night searches and be conducted over multiple years.

Female red-backed salamander (*Plethodon cinereus*) guarding eggs found during a day search under a log. Photo: Eric B. Liebgold.

Full article: Buderman F.E. & E.B. Liebgold (2012) Effect of search method and age class on mark-recapture parameter estimation in salamanders. Population Ecology 54; 157-167. DOI: 10.1007/s10144-011-0294-1

Toe Clipping of Amphibians and Reptiles: Science, Ethics, and the Law

By Gad Perry, Mark C. Wallace, Dan Perry, Howard Curzer, and Peter Muhlberger

Public concern for the humane treatment of animals in research has led to specific guidelines for appropriate treatment of study organisms. Field research poses special challenges that Institutional Animal Care and Use Committees find difficult to address based on existing guidelines. Toe clipping is a common but contentious example whose use has been called barbaric and whose efficacy has been questioned. We provide a brief review of the ethical bases for such positions, the legal framework they have engendered, and the scientific evidence regarding the impacts of the practice. Leading philosophical views vary but tend to focus on the suffering or distress of individual animals, primarily vertebrates. The law has adopted this individual-centered view. Biologists, in contrast, tend to more wholistic views that focus on populations and ecosystems. Scientific studies of the impacts of toe clipping, most of them relatively recent, have become increasingly sophisticated statistically. Most show little impact of toe clipping on study animals, the exception being the likelihood of recapture of toe-clipped individuals in some frogs. If unaccounted for, effects of methodology can bias scientific findings. The few studies focusing on physiological indicators of distress show no increase resulting from toe-clipping. Thus, toe clipping of reptiles and amphibians meets legal and ethical expectations and should remain acceptable where it meets study needs. Biologists have long been concerned about the possible ethical implications of their methods. Philosophical inquiry has been beneficial in improving our understanding of these methods, but the need of biologists for better philosophical elaboration of ecological ethics has only partially been addressed.

Full article: Perry, G.,et al. (2011) Toe Clipping of Amphibians and Reptiles: Science, Ethics, and the Law. Journal of Herpetology 45(4):547-555. 2011 doi: http://dx.doi.org/10.1670/11-037.1

Diseases and Toxicology

Ranavirus: past, present and future.

By David Lesbarrères

There is increasing awareness from the scientific community that emerging infectious diseases pose a significant threat to global biodiversity. Emerging diseases have been documented in various organisms including fish and herpetofauna. While historically overlooked, a group of iridoviruses in the genus Ranavirus has been responsible for die-offs in captive and wild amphibian, reptile and fish populations around the globe over the past two decades. In order to share contemporary information on ranaviruses and identify critical research directions, the First International Symposium on Ranaviruses was held in July 2011 in Minneapolis, MN, USA. Twenty-three scientists and veterinarians from nine countries examined the ecology and evolution of ranavirus – host interactions, potential reservoirs, transmission dynamics, as well as immunological and histopathological responses to infection. In addition, speakers discussed possible mechanisms for die-offs, and conservation strategies to control outbreaks.

Full paper: Lesbarrères, D. et al. (in press) Ranavirus: past, present and future. Biol. Lett. [Epub ahead of print] doi: 10.1098/rsbl.2011.0951 (dlesbarreres@laurentian.ca)

Multiple emergences of genetically diverse amphibian-infecting chytrids include a globalised hypervirulent recombinant lineage

By Rhys A. Farrer, Lucy A. Weinert, Jon Bielby, Trenton W. J. Garner, Francois Balloux, Frances Clare, Jaime Bosch, Andrew A. Cunningham, Che Weldon, Louis H. du Preez, Lucy Anderson, Sergei L. Kosakovsky Pond, Revital Shahar-Golan, Daniel A. Henk & Matthew C. Fisher

Batrachochytrium dendrobatidis (*Bd*) is a globally ubiquitous fungal infection that has emerged to become a primary driver of amphibian biodiversity loss. Despite widespread effort to understand the emergence of this panzootic, the origins of the infection, its patterns of global spread, and principle mode of evolution remain largely unknown. Using comparative population genomics, we discovered three deeply diverged lineages of *Bd* associated with amphibians. Two of these lineages were found in multiple continents and are associated with known introductions by the amphibian trade. We found that isolates belonging to one clade, the global panzootic

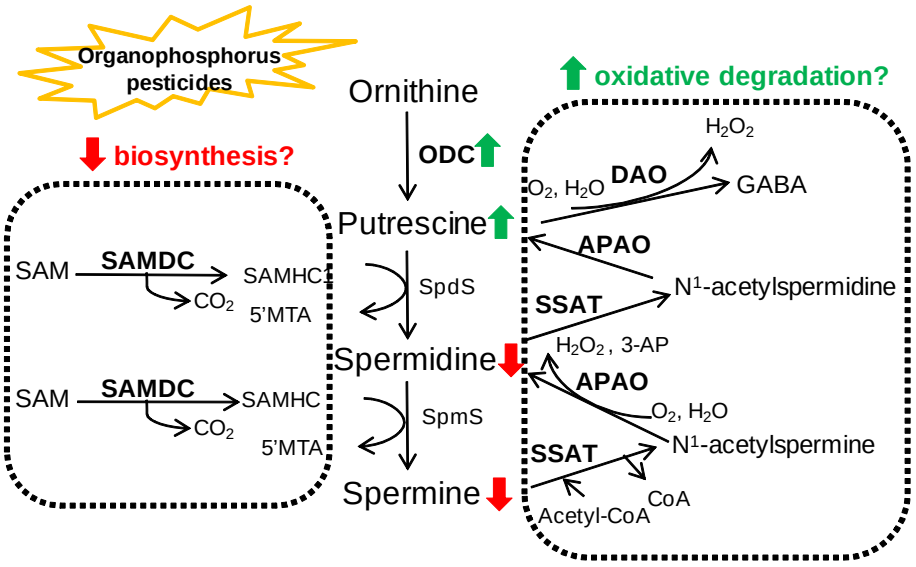
lineage (*Bd*GPL) have emerged across at least five continents during the 20th century and are associated with the onset of epizootics in North America, Central America, the Caribbean, Australia, and Europe. The two newly identified divergent lineages, Cape lineage (*Bd*CAPE) and Swiss lineage (*Bd*CH), were found to differ in morphological traits when compared against one another and *Bd*GPL, and we show that *Bd*GPL is hypervirulent. *Bd*GPL uniquely bears the hallmarks of genomic recombination, manifested as extensive intergenomic phylogenetic conflict and patchily distributed heterozygosity. We postulate that contact between previously genetically isolated allopatric populations of *Bd* may have allowed recombination to occur, resulting in the generation, spread, and invasion of the hypervirulent *Bd*GPL leading to contemporary disease-driven losses in amphibian biodiversity.

Full article: R. A. Farrer *et al.* Multiple emergences of genetically diverse amphibian-infecting chytrids include a globalized hypervirulent recombinant lineage. *PNAS* **108,** *18732-6 (2011).*

Organophosphorus insecticides affect normal polyamine metabolism in amphibian embryogenesis

By Cecilia I.Lascano, Ana Ferrari, Lidia E. Gauna, Claudia Cocca, Adriana C. Cochón, Noemí Verrengia & Andrés Venturino

Rhinella arenarum is a native toad of Argentina that inhabits the productive area of the Valley of Río Negro and Neuquén. It spends its embryonic and larval stages in water bodies of the region, so water quality greatly influences growth and development of this species. Organisms have developed a complex regulatory machinery to control intracellular levels of polyamines, which are aliphatic polycations essential for correct embryonic development. Organophosphorus pesticides are applied in the northern patagonic region to control the codling moth, among other pests. Consequently, we evaluated the concentration- and time-dependent effects of the organophosphorus insecticides malathion and azinphos-methyl on polyamine metabolism and related them to normal and altered embryonic development of the common toad *R. arenarum*. As the embryonic development progressed, polyamine metabolism shifted to higher polyamine levels with a more preponderant contribution of spermidine and spermine with respect to putrescine, and involved a dramatic change in ornithine decarboxylase activity, one of the key regulatory enzymes



Effects of organophosphorus pesticides on polyamine metabolism in *Rhinella arenarum* embryos.

of the pathway. Organophosphorus insecticides were capable of altering polyamine metabolism, slowing embryo development in parallel with a reduction in spermidine and spermine levels. An increase in the oxidative degradation of polyamines might be involved in the toxic action of organophosphorus insecticides and might also be related to other effects such as teratogenesis.

Full article: Lascano, C. et al. (2011). Organophosphorus insecticides affect normal polyamine metabolism in amphibian embryogenesis. Pest. Biochem. Physiol: 101(3); 240-247.

Ecopathology of Ranaviruses Infecting Amphibians

By Debra L. Miller, Matthew J. Gray & Andrew Storfer

Ranaviruses are capable of infecting amphibians from at least 14 families and over 70 individual species.

Ranavirus die-off in the Great Smoky Mountains National Park, USA, May 2009. Species included *Ambystoma opacum* (photo), *A. maculatum, Notophthalmus viridescens, Lithobates sylvaticus* and *Pseudacris feriarum.* Photo by Dr. Matthew Niemiller.

Ranaviruses infect multiple cell types, often culminating in organ necrosis and massive hemorrhaging. Subclinical infections have been documented, although their role in ranavirus persistence and emergence remains unclear. Water is an effective transmission medium for ranaviruses, and survival outside the host may be for significantduration.Inaquaticcommunities, amphibians, reptiles and fish may serve as reservoirs. Controlled studies have shown that susceptibility to ranavirus infection and disease varies among amphibian species and developmental stages, and likely is impacted by host-pathogen coevolution, as well as, exogenous environmental factors. Field studies have demonstrated that the likelihood of epizootics is increased in areas of cattle grazing, where aquatic vegetation is sparse and water quality is poor. Translocation of infected amphibians through commercial trade (e.g., food, fish bait, pet industry) contributes to the spread of ranaviruses. Such introductions may be of particular concern, as several studies report that ranaviruses isolated from ranaculture, aquaculture, and bait facilities have greater virulence (i.e., ability to cause disease) than wild-type isolates. Future investigations should focus on the genetic basis for pathogen virulence and host susceptibility, ecological and anthropogenic mechanisms contributing to emergence, and vaccine development for use in captive populations and species reintroduction programs.

Full article: Miller, D.L., Gray, M.J. & Storfer, A. (2011) Ecopathology of ranaviruses infecting amphibians. *Viruses,* **special issue 3:2351-2373. Open access at: doi: 10.3390/v3112351**

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

First Record of Morphological Abnormalities in Natural Populations of Two Amphibian Species in Tunisia

By Jihène Ben Hassine, Vivian de Buffrénil & Saïd Nouira.

The high frequency of various kinds of phenotypic abnormalities in some local amphibian populations has long been a puzzle. In this paper, we report malformations in the populations of two species of frogs, *Pelophylax saharicus* and *Discoglossus pictus*, inhabiting water bodies created by an artificial dam in an area devoted to intensive agriculture in the northeastern part of Tunisia. More than 35% of recently metamorphosed and young froglets in *P. saharicus*, and 25% in *D. pictus*, display morphological abnormalities that can be distributed in 18 types involving limbs, spine, eyes, or skin. Although we did not investigate the cause of these malformations, the unusually high malformation rate (33.3%) in these populations, as compared to conspecific individuals from other, noncultivated areas, points to an environmental disturbance.

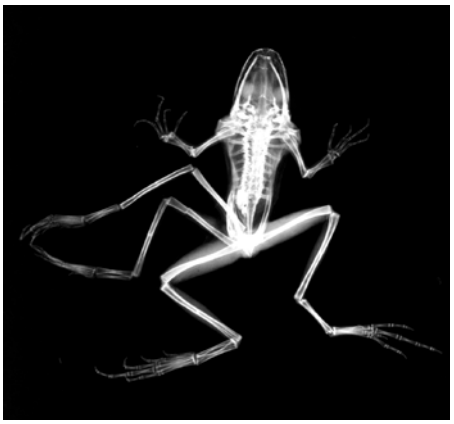
Full article: Ben Hassine, J. et al. (2011). First Record of Morphological Abnormalities in Natural Populations of Two Amphibian Species in Tunisia. Journal of Herpetology 45(4): 465-471.

Morphological and Behavioral Changes of Salamanders Infected with Amphibian Chytrid Fungus (*Batrachochytrium dendrobatidis*)

By Adam L. Crane & Alicia Mathis

For unrelated studies of salamander behavior, we collected Ozark zigzag salamanders (*Plethodon angusticlavius*) from sites in both southwestern Missouri and northern Arkansas, and eggs of spotted salamanders (*Ambystoma maculum*) from a site in southwestern Missouri. In April 2009 there was an outbreak of disease among these laboratory animals, and over 50 *Plethodon* died. Symptoms of disease included morphological (skin sloughing and loss of digits) and behavioral (raising the trunk legs or tail and apparently disoriented walking; video posted at: http://www.facebook.com/video/video.php?v=706655963964) effects. Six preserved specimens of *Plethodon* that had died following presentation of symptoms were sent to a genetic laboratory for testing for the presence of *Bd* (*Batrachochytrium dendrobatidis*) or 'chytrid,' and 100% tested positive. Post-metamorphic spotted salamanders were housed in the same environmental chamber as the Ozark zigzag salamanders, and also started to show symptoms of disease. We began treating the salamanders in our laboratory with an anti-fungal drug (intraconazole) in July 2009. These chemical treatments were generally successful in stopping the *Bd* mortalities in *P. angusticlavius*, but only about 25% of the spotted salamanders recovered. In contrast to the Ozark zigzag salamanders, the only obvious behavioral symptom among infected spotted salamanders was that the speed of their righting responses appeared to be greatly reduced. We are uncertain as to how *Bd* became introduced to the animals in our laboratory. Collection of swabs from field sites could reveal important information about the distribution of *Bd* in the Ozarks.

Full article: Crane AL, Mathis A (2011) Morphological and behavioral changes of salamanders following infection with the Chytrid fungus (*Batrachochytrium dendrobatidis*). *IRCF Reptiles and Amphibians* 18:138-143.



Left - *Pelophylax saharicus* showing an unilateral polymelia. Right - Radiography showing skeletal abnormalities in *Pelophylax saharicus* (Bilateral polymelia). Photo: Jihène Ben Hassine.

Amphibian-killing fungus losing genetic diversity as it spreads across the New World

By Guillermo Velo-Antón, David Rodriguez, Anna E. Savage, Gabriela Parra-Olea, Karen R. Lips & Kelly R. Zamudio.

The spreading pathogen hypothesis (SPH) predicts that as *Bd* spreads out from its source of origin, it should show a decrease in genetic diversity and increase in allele fixation owing to genetic bottlenecks and/or from rapid asexual reproduction as populations expand along invading epidemic waves. We used nine nuclear loci to infer phylogenetic relationships and analyze population genetic diversity of *Bd* across California, Arizona, Mexico and Panama using 125 samples collected from wild amphibian populations. We found a reduction in heterozygosity, and increased allele fixation with increasing distance from northern populations. These genetic signatures are consistent with demographic bottlenecks and rapid asexual reproduction due to rapid step-wise colonization events (Clegg et al. 2002), and supports the spread of *Bd* from North to Central America. This pattern of spread has been corroborated with evidence of amphibian population declines and species extinctions along this path (Lips et al. 2008; Cheng et al. 2011). Our finding confirms that *Bd* is a novel and spreading pathogen in the New World, and is changing genetically along the invasion path, with direct implications for amphibian conservation. Future research should prevent introductions to uninfected areas, and investigate how changes in genetic diversity affect the evolutionary potential of the pathogen in terms of the evolution of strains with different virulence and/or transmission rates. As conservation biologists, we need to understand the emergence, spread, and

evolution of pathogens to identify drivers of disease epidemics, and guide our research to prevent the loss of biodiversity.

Full article: Velo-Antón, G. et al. (in press) Amphibian-killing fungus losing genetic diversity as it spreads across the New World. Biol. Conservation:

Reptiles as potential vectors and hosts of the amphibian pathogen *Batrachochytrium dendrobatidis* in Panama

By Vanessa L. Kilburn, Roberto Ibáñez & David M. Green

Chytridiomycosis, the disease caused by *Batrachochytrium dendrobatidis*, is considered to be a disease exclusively of amphibians. However, *B. dendrobatidis* may also be capable of persisting in the environment, and non-amphibian vectors or hosts may contribute to disease transmission. Reptiles living in close proximity to amphibians and sharing similar ecological traits could serve as vectors or reservoir hosts for *B. dendrobatidis*, harbouring the organism on their skin without succumbing to disease. We surveyed for the presence of *B. dendrobatidis* DNA among 211 lizards and 8 snakes at 8 sites at varying elevations in Panama where the syntopic amphibians were at pre-epizootic, epizootic or post-epizootic stages of chytridiomycosis. Detection of *B. dendrobatidis* DNA was done using qPCR analysis. Evidence of the amphibian pathogen was present at varying intensities in 29 of 79 examined *Anolis humilis* lizards (32%) and 9 of 101 *A. lionotus* lizards (9%), and in one individual each of the snakes *Pliocercus euryzonus, Imantodes cenchoa*, and *Nothopsis rugosus*. In general, *B. dendrobatidis* DNA prevalence among reptiles was positively correlated with the infection prevalence among co-occurring anuran amphibians at any particular site ($r = 0.88$, $p = 0.004$). These reptiles, therefore, may likely be vectors or reservoir hosts for *B. dendrobatidis* and could serve as disease transmission agents. Although there is no evidence of *B. dendrobatidis* disease-induced declines in reptiles, cases of coincidence of reptile and amphibian declines suggest this potentiality. Our study is the first to provide evidence of nonamphibian carriers for *B. dendrobatidis* in a natural Neotropical environment.

Full article: Diseases of Aquatic Organisms 97: 127–134 (2011)

First report of dermal fungal infection in a frog from the Western Ghats, India.

By Kotambylu V. Gururaja, G. Preeti, Rajashekhar K. Patil & Andrew A. Cunningham

Western Ghats of India is one of world's biodiversity hotspots. In last decade, over 70 new species have been described from the region and many more await scientific description. Interestingly, there is no report on fungal infection in amphibians from the Indian sub-continent, though the Chytridiomycosis is considered an emerging infectious disease in Asia (Swei et al, 2011). For the first time, we reported a fungal infection in an Indian frog *Fejervarya caperata*, commonly called cricket frog, a widely distributed frog species in south India. One of us (KVG), caught an individual of *Fejervarya caperata* during a regular sampling of amphibians in the Western Ghats in Kali River basin near Dandeli, Uttara Kannada District, Karnataka (15.18438°N, 74.64832°E, 488 m asl) in the month of August 2009. It was a male individual with SVL = 27.24mm and weight = 1.95g found amidst grass patch in a teak (*Tectona grandis*) dominated dry deciduous forest. This individual had lesions on the body (Figure 1) and it was preserved in 70% alcohol. The skin with lesions from the abdomen was processed for hematoxylin and eosin sectioning. Based on the sectioning, fungal infection was confirmed and diagnosed as 'ulcerated subdermal mycotic granulomata' (Figure 2). Molecular work was carried out to identify the fungus, but the DNA was contaminated and therefore the taxonomic identity of fungus remains unknown. Presence of fungal infection in a frog from the Western Ghats, a region with 181 amphibians and 88% of them being endemics, calls the attention of researchers and forest manager alike to take necessary steps to study and prevent the spread of the disease.

Figure 1. a, Dorso lateral view of skin lesions in *Fejervarya caperata*. b, Skin lesions on the abdomen. (Photo: KV Gururaja)

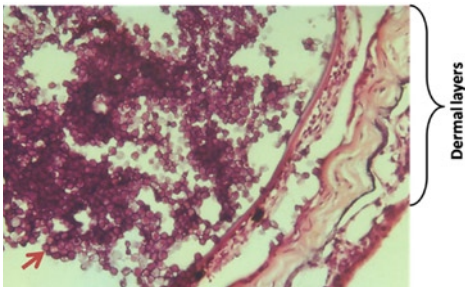


Figure 2. Hematoxylin and eosin-stained section of skin showing fungal spores (indicated by arrow). (Photo: RK Patil)

Literature cited: Swei A., Rowley J.J.L., Rodder D., Diesmos M.L.L., Diesmos A.C., et al. 2011. Is Chytridiomycosis an Emerging Infectious Disease in Asia? PLoS ONE 6(8): e23179. doi:10.1371/journal.pone.0023179

Full article: Gururaja K.V., Preeti G., Patil R.K. and Cunningham A.A. 2011. First Report of Dermal Fungal Infection in a Frog from the Western Ghats, India. CURRENT SCIENCE, 101(5):622-623. Available online at http://www.ias.ac.in/currsci/10sep2011/622.pdf (gururaj@cistup.iisc.ernet.in)

amphibian ark

Bell frog

Red-eyed tree-frog

Brown and green tree-frog

Strawberry poison dart frog

Frog paintings by Frank Beifus

Florida-based wildlife artist, Frank Beifus has very generously made ten of his beautiful frog paintings available for Amphibian Ark supporters, and the exclusive price of US$150 each, which includes packaging and shipping. *100% of the profits from the sale of these paintings will be provided for Amphibian Ark conservation projects.*

Each of these spectacular paintings measures 24″ x 24″ (except for the Brown and green tree-frog, which is 24” x 18”) and are acrylic on canvas.

Frank spent seven years working as an artist at Walt Disney World in Orlando, with the last three years spent at Disney's Wild Animal Kingdom.

If you would like to order one of these wonderful paintings, please email webmaster@amphibianark.org and let us know which painting(s) you would like. We'll provide you with payment details, and your painting will then be shipped to you.

Not only will you have a wonderful piece of artwork for your home or to give as a gift, but you'll be supporting amphibian conservation projects with your purchase.

Larger versions of these images can be seen on our web site www.amphibianark.org/frog-paintings/

Panamanian golden frog

Blue poison dart frog

Mimic poison dart frog

Gulfaducian poison dart frog

Spotted-thighed tree-frog

Golden poison dart frog

AmphibiaWeb Recent Publication List

This reference list is compiled by Professor Tim Halliday (formerly DAPTF International Director) (tim.r.halliday@gmail.com). 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: September 11, 2011).

November 2011

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Austin, J. D. *et al.* (2011) Genetic evidence of contemporary hybridization in one of North America's rarest anurans, the Florida bog frog. *Animal Conservation:* **14;** 553-561. (austinj@ufl.edu)

Bernabò, I. *et al.* (2011) Toxicity of chlorpyrifos to larval *Rana dalmatina*: acute and chronic effects on survival, development, growth and gill apparatus. *Arch. Environ. Contam. Toxicol:* **61;** 704-718. (brunelli@unical.it)

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Burgmeier, N. G. *et al.* (2011) Health and habitat quality assessment for the eastern hellbender (*Cryptobranchus alleganiensis alleganiensis*) in Indiana, USA. *J. Wildlife Diseases:* **47;** 836-848. (rodw@purdue.edu)

Channing, A. & Wahlberg, K. (2011) Distribution and conservation status of the desert rain frog *Breviceps macrops*. *African J. Herpetol:* **60;** 101-112.

Farrer, R. A. *et al.* (2011) Multiple emergences of genetically diverse amphibian-infecting chytrids include a globalized hypervirulent recombinant lineage. *PNAS:* **108;** 18732-18736. (r.farrer09@imperial.ac.uk)

Fuentes, L. *et al.* (2011) Comparative toxicity of two glyphosate formulations (original formulation of Roundup® and Roundup WeatherMAX®) to six North American larval anurans. *Envtl. Toxicology & Chemistry:* **30;** 2756-2761. (laticef@gmail.com)

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Hayes, T. B. *et al.* (2011) Demasculinization and feminization of male gonads by atrazine: consistent effects across vertebrate classes. *J. Steroid Biochemistry & Molecular Biology:* **127;** 64-73. (tyrone@berkeley.edu)

Hof, C. *et al.* (in press) Additive threats from pathogens, climate and land-use change for global amphibian diversity. *Nature:* (christian.hof@senckenberg.de)

Hoverman, J. T. *et al.* (in press) Phylogeny, life history, and ecology contribute to differences in amphibian susceptibility to ranaviruses. *EcoHealth:* (jason.hoverman@colorado.edu)

Jehle, R., Thiesmeier, B. & Foster, J. (2011) *The Crested Newt. A dwindling pond-dweller.* Laurenti-Verlag, Bielefeld, Germany.

Joneson, S. *et al.* (2011) Genomic transition to pathogenicity in chytrid fungi. *PLoS Pathogens:* **7;** e1002338. (rosenblum@uidaho.edu)

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Venesky, M. D. *et al.* (in press) Dietary protein restriction impairs growth, immunity, and disease resistance in southern leopard frog tadpoles. *Oecologia:* (mvenesky@usf.edu)

December 2011

Aisien, M. S. O. *et al.* (2011) Parasitic infections of amphibians in the Pendjari Biosphere Reserve, Benin. *African Zoology:* **46;** 340-349.

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Bell, R. C. *et al.* (2011) High prevalence of the amphibian chytrid pathogen in Gabon. *EcoHealth:* **8;** 116-120. (rcb269@cornell.edu)

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Botts, E. A. *et al.* (in press) Methods to detect species range size change from biological atlas data: a comparison using the *South African Frog Atlas Project*. *Biol. Conservation:* (emily.rsa@gmail.com)

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Campbell, C. R. *et al.* (in press) Frog skin epithelium: electrolyte transport and chytridiomycosis. *Intl. J. Biochem. Cell Biol:* (anurat@physiol.usyd.edu.au)

Chen, G. & Robert, J. (2011) Antiviral immunity in amphibians. *Viruses:* **3;** 2065-2086. (guangchun_chen@urmc.rochester.edu)

Crane, A. L. & Mathis, A. (2011) Predator-recognition training: a conservation strategy to increase postrelease survival of hellbenders in head-starting programs. *Zoo Biology:* **30;** 611-622. (aliciamathis@missouristate.edu)

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Gahl, M. K. *et al.* (in press) Varying responses of northeastern North American amphibians to the chytrid pathogen *Batrachochytrium dendrobatidis*. *Conservation Biology:* (mgahl@bates.edu)

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Gerlach, J. (2011) The potential effects of climate change on the status of Seychelles frogs (Anura: Sooglossidae). *J. Threatened Taxa:* **3;** 2153-2166.

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Hilje, B. & Aide, T. M. (in press) Recovery of amphibian species richness and composition in a chronosequence of secondary forests, northeastern Costa Rica. *Biol. Conservation:* (bhilje@gmail.com)

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Zhang, J. *et al.* (2012) Effects of titanium dioxide nanomaterials and ultraviolet light coexposure on African clawed frogs (*Xenopus laevis*). *Envtl. Toxicol. & Chem:* **31;** 176-183. (george_cobb@baylor.edu)

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

General Announcements

Upcoming Meetings & Workshops

February

Amphibian Husbandry and Conservation Training Workshop. Feb 5 – 10, 2012 Dominican Republic, Parque Zoológico Nacional (ZOODOM) Details at http://www.amphibianark.org/

Southeast PARC Annual Meeting. Feb 12 – 19, 2012. Fall Creek Falls State Park, TN. Details at http://www.separc.org/

Leap Day 2012. Feb 29, 2012. Worldwide. Details at: http://www.amphibianark.org/leap-day-2012/

March

North Carolina PARC Annual Meeting. Mar 20, 2012. Weymouth Woods Sandhills Nature Preserve, Southern Pines, NC.

AZA Mid-Year Meeting. Mar 24 – 30, 2012. Palm Springs, CA. Detials: http://www.aza.org/midyearmeeting/

Smithsonian Amphibian Monitoring and Conservation Workshop. Mar 26 – Apr 6, 2012. Front Royal, VA. Visit link for more information - http://nationalzoo.si.edu/SCBI/MAB/GMU/

April

Amphibian Taxon Advisory Group's Annual Meeting. Apr 13, 2012. Miami, Florida.

Southwestern Association of Naturalists Annual Meeting. Apr 19 – 22, 2012. Valle de Bravo, Mexico. See link for more details: http://www.biosurvey.ou.edu/swan/

4th annual Save The Frogs Day, 2012. Apr 28, 2012. Worldwide. Please visit http://www.savethefrogs.com/day

Internships & Employment

The following information can be found at http://www.parcplace.org/resources/job-listings.html. Herp jobs are posted as a service to the herpetological community. If you would like to list a job opening for your organization, please send the announcement to herpjob@parcplace.org

Herpetofaunal and Small Mammal Internship Grundy County TN (work), Huntsville, AL (housing) (1/10/12)

Reptile Keeper - Ellen Trout Zoo Lufkin, TX (1/8/12)

Assistant Collections Manager - Reptiles - Ellen Trout Zoo Lufkin, TX (1/8/12)

Research Assistants - Reptile and Amphibian Research in Mexico Mexico (1/7/12)

Volunteer Assistant - Iguana Research Dominican Republic (1/6/12)

Michigan Hereptological Intern Lower Michigan (12/21/11)

Herpetological Research Interns - Texas A&M University Maljamar, NM (12/21/11)

Ornate Box Turtle Summer Internship Program - Colorado Humane Society Longmont, CO (12/21/11)

Biological Technician - Brown Treesnake Research Guam (12/20/11)

Fish and Wildlife Biologist - Amphibian Research - Florida Fish and Wildlife Conservation Commission Gainesville, FL (12/20/11)

Curatorial Assistant - Cheadle Center for Biodiversity and Ecological Restoration at University of California, Santa Barbara Santa Barbara, CA (12/20/11)

Postdoctoral Research Associate - University of Maine Orono, ME (12/19/11)

Amphibian Research Technicians - USGS Patuxent Wildlife Research Center Laurel, MD (12/19/11)

Field Technicians - Aquatic Turtle Research - Virginia Tech Kingston, TN (12/15/11)

Field Technicians - Amphibian Surveys Yosemite National Park, CA (12/15/11)

Field Herpetology Interns - Archbold Biological Station Lake Placid, FL (12/14/11)

Biological Technician (Crew Members) - Bureau of Land Management Corvallis, OR (12/13/11)

Postdoctoral Position - Snake Systematics - Universiry of Sao Paulo Sao Paulo, Brazil (12/5/11)

Postdoctoral Position - Lizard Systematics - Universiry of Sao Paulo Sao Paulo, Brazil (12/5/11)

Institute for Applied Systems Analysis Summer Program Vienna, Austria (12/2/11)

Herpetological Researcher/Educator Intern Midewin Prairie, Wilmington, IL (12/1/11)

Assistant Professor - University of Wisconsin, Stevens Point Stevens Point, WI (11/26/11)

Volunteer Research Assistant to Conduct Conservation Ecology and Tropical Herpetology Research in Mexico - Reptile and Amphibian Ecology International Mexico (11/17/11)

Volunteer Research Assistant to Conduct Conservation Ecology and Tropical Herpetology Research in Ecuador - Reptile and Amphibian Ecology International Ecuador (11/17/11)

Amphibian and Reptile Monitoring Technicians - Cape Cod National Seashore Welfleet, MA (11/16/11)

MS Assistantship - Salamander Ecology - Murray State University Murray, KY (11/10/11)

Herpetologist - North Carolina Aquarium Pine Knoll Shores, NC (11/10/11)

Coastal Biologist - North Carolina Natural Resourse Program Raliegh, NC (11/10/11)

Genetic Resources Collection Technician – North Carolina Museum of Natural Sciences Raleigh, NC (11/4/11)

Postdoctoral Fellowship in Salamander Conservation and Reproductive Physiology - Memphis Zoo Memphis, TN (11/4/11)

Amphibian Conservation Assistant Madagascar (11/2/11)

Seasonal Herpetological Research Intern - Alabama A&M University Bankhead National Forest, Northern Alabama (10/31/11)

Director of Conservation - The Nature Conservancy in Kansas Central Kansas (10/25/11)

Seasonal Herpetology Research Intern - Alabama A&M University Bankhead National Forest, northern Alabama (10/25/11)

Threatened & Endangered Species Field Biologist - Florida Fish and Wildlife Commission Holt, Florida (10/25/11)

Lead Desert Tortoise Monitor - Natural Resources Group, LLC Southern Nevada (10/17/11)

MS Assistantship - Desert Tortoise Research - University of California, Davis Davis, CA (10/13/11)

Postdoctoral Scientist – Landscape Ecology and Amphibian Malformations - University of Colorado Denver, CO (10/6/11)

PhD Assistantship - Population Dynamics of Amphibians and Reptiles - Montana state University Bozeman, MT (9/25/11)

M.S. Assistantship - Wetland Amphibian Conservation Ames, IA (9/23/11)

Gopher Tortoise Biologist - the Nature Conservancy Camp Shelby, MS (9/19/11)

Assistant Professor - Vertebrate Ecology - Purdue University West Lafayette, IN (9/16/11)

Postdoctoral Fellowship - Turtle Research - Department of Fish and Wildlife Conservation, Virginia Tech Blacksburg, VA (9/14/11)

Postdoctoral Consultant - Amphibian Conservation/Reintroduction Tanzania (9/13/11)

Biological Aid - Bog Turtle and Bat Research - Delaware Natural Heritage and Endangered Species Program Smyrna, DE (9/9/11)

Threatened and Endangered Species Habitat Specialist - National Park Service Fort Collins, CO (9/1/11)

Funding Opportunities

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

British Ecological Society – Grants for Young Ecologists. The BES provides support of up to £20 thousand to help early-career ecologists launch research projects. The BES will look favorably on applications from individuals based outside of the UK who do not have a rich resource base in their own scientific communities. Applicants must be members of BES. Applications (first round) are due 31 January. **Link**

Commonwealth Foundation -- Civil Society Responsive Grants, Extended Deadline. The Civil Society Responsive Grants include a theme for Natural Environment. Eligibility is open to registered nonprofit organizations representing civil society, cultural and human rights organizations, trade unions, and social enterprises in the 47 countries which are members of the Commonwealth Foundation. Grants of up to £12,500 are intended to promote cross-country sharing of knowledge and skills within the Commonwealth. The Foundation will not offer grants during a review period in the first half of 2012, explaining why it has extended its previous December deadline to 31 January 2012. **Link**

Critical Ecosystem Partnership Fund -- Conservation in the Mediterranean Basin and Southern Africa. The CEPF announces two calls for proposals to enhance environmental conservation in the world's biodiversity "hot spots." The calls are open to NGOs, community groups, private enterprises, and other non-governmental organizations. (i) *Mediterranean Basin*: Large grants of up to US$1 million are available for single and multiple-country projects in Bosnia and Herzegovina, Jordan, Macedonia, Montenegro, and Tunisia. Letters of inquiry are due 31 January 2012. (ii) *Southern Africa*: Small and large grants support the conservation strategies of the Maputaland-Pondoland-Albany hotspot. Applicants submit letters of inquiry before 15 February 2012. *TVG Note: CEPF will request applications for small grants in support of the Mediterranean Basin during the first quarter of 2012.* **Link**

Critical Ecosystem Partnership Fund -- Implementation Team for Biodiversity Conservation in the Eastern Afromontane Region. The CEPF invites applications to lead the implementation of its conservation program for the Eastern Afromontane Biodiversity "hot spot." CEPF will make one grant for administration (RIT-Administration), and another for operations (RIT-Programs), possibly to the same organization. Eligibility extends to civil society organizations (NGOs as well as private and for-profit firms), and to government institutions if they satisfy certain criteria. Expressions of interest should be submitted by 31 January 2012. **Link**

Earthwatch -- Request for Proposals in Field Research 2012-2013. Earthwatch (U.S. and International) invites applications for scientific field projects in topics of ecosystems and biodiversity in several world regions. Applicants to lead these field projects can be of any nationality. Earthwatch will consider projects that have a strong rationale for requiring non-specialists (volunteers) to aid with data collection, scientific observation, or other research tasks. The deadline for concept notes is 27 January 2012. **Link**

European Commission (EC) -- EU-China Environmental Governance. The EU-China Environmental Governance Program (EGP) promotes public access and participation, and corporate environmental responsibility, for environmental governance in China. The ECP will support Partnership Projects that work for these objectives at the local level. Grants range from €300 thousand to €1 million, up to 75% of eligible costs, for projects of 1-2 years. The program is open to nonprofit organizations in China and the EU that include NGOs, universities, central and local research organizations, local independent centers that work with local authorities, etc. -- and to international (inter-governmental) organizations. Reference EuropeAid/132005/L/ACT/CN. Concept notes are due 03 January 2012 and 14 May 2012. **Link**

German Government -- International Climate Initiative 2012. Germany's BMU *(Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety)* funds the International Climate Initiative (ICI) to support projects on climate change mitigation, adaptation, and biodiversity projects with climate relevance. Most projects are led by German and international organizations with partners in developing and emerging countries. Grants are generally over €200 thousand, and sometimes much larger, for projects that are usually of two to four years. The closing date for project outlines is 09 January 2012. **Link**

Global Development Network -- 2011 Global Development Awards and Medals Competition. The annual Global Development Awards and Medals Competition is administered by the Global Development Network (GDN), with financial support from Japan and other donors. (i) The Japanese Award for Most Innovative Development Project offers US$30 thousand (first prize) and US$5 thousand (second prize) to help NGOs in the developing world scale up their innovative projects. (ii) The Japanese Award for Outstanding Research on Development offers US$30 thousand (first prize) and US$5 thousand (second prize) for research proposals in any of three themes on urban development. (iii) The Medals for Research on Development offer US$10 thousand and US$5 thousand for completed research in the same urban themes. Applicants for the research awards must be citizens and permanent residents of developing and transition countries, and under 45 years old. Applications close 31 January 2012. **Link**

Grantham Prize for Excellence in Reporting on the Environment -- Inviting Nominations for 2012. The annual Grantham Prize for Excellence in Reporting on the Environment recognizes outstanding non-fiction journalism on subjects related to environment and natural resources. Entries must have been aired or published within the U.S. or Canada during year 2011. However, there are no nationality requirements, and previous prizes have included several of international scope. The winning entry receives US$75 thousand; up to three additional entries each receive US$5 thousand. Application deadlines are 09 January 2012 for books, and 30 January 2012 for other types of entries. **Link**

International Foundation for Science -- Re-Opens for Applications. The IFS has re-opened for applications, following a period of programmatic review. IFS makes grants of up to US$12 thousand for research projects of 1-3 years in the sustainable management of biological resources (e.g., agriculture, soil science, forestry, biodiversity, environmental chemistry, natural products, food science, animal husbandry, veterinary medicine, aquaculture, and marine resources). Applications are invited from citizens of developing countries who are less than age 40 (with some exceptions, by world regions); at the beginning of their research careers; and who have at least a university master's degree. The next deadlines are 09 October 2011 and 29 January 2012. **Link**

Japan Fund for Global Environment -- Conservation Grants. The Fund makes grants for projects in environmental conservation conducted by NGOs in Japan and developing countries. In 2011, the application period was 04 through 24 January *(monitor for changes 2012). TVG Note: If required, grant seekers should use internet language translation to obtain the information from the Japanese version of the website.* **Link**

Royal Geographical Society with the Institute of British Geographers -- Awards with Deadlines in January-February 2012. The RGS-IBG offers a number of grants for graduate and post-graduate geography research in an international context. Grants range from £500 to £15,000. Many

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

awards are restricted to nationals of the UK and EU, and/or students at UK universities. The next deadline for the Geographical Fieldwork Grants, Small Research Grants, Henrietta Hutton Research Grants, and Monica Cole Research Grants is 20 January 2012. The Gilchrist Fieldwork Award, Dudley Stamp Memorial Award, Slawson Awards, Frederick Soddy Postgraduate Award, and International Congress Award have a deadline on 24 February 2011. **Link**

Smithsonian Tropical Research Institute -- Research Grants 2012. The STRI offers grant support for university and postdoctoral research at its facilities in Panama in several disciplines of biology, ecology, soils sciences, anthropology, and others. Fellowships and internships are awarded to researchers from the USA and Latin America in several program areas. Deadline for the Earl S. Tupper post-doctoral grant is 15 January of every year. Other programs have deadlines in March, May, August, and November. **Link**

Synergos Institute -- Arab World Social Innovators. The AWSI helps social innovators in selected Arab countries to transform successful models into larger-scale enterprises or non-governmental organizations. The selected individuals are offered training, networking opportunities, and funding over two years. Past participants in AWSI include innovators in waste recycling, agricultural technology, agricultural cooperatives, cultivation of medicinal plants, and youth-oriented environmental conservation. In 2011, applications were due 15 January *(monitor for changes 2012)*. **Link**

UK Department for Environment, Food, and Rural Affairs (Defra) -- Darwin Initiative 2012. Administered by UK's Defra in collaboration with the Department for International Development (DFID), the Darwin Initiative invites applications for scoping awards, fellowships, and the UK Overseas Territories Challenge Fund. Projects engage UK organizations with partners in the developing world for capacity building, research, and environmental education in support of biodiversity conservation. Scoping awards of up to £3 thousand are open to UK and non-UK applicants *(note the change from previous years)*. Funding from the Overseas Territories Challenge Fund is up to £25 thousand for individuals in the UK and its overseas territories. Fellowships are available to individuals in the developing world and in the UK's overseas territories who have links with current and recent Darwin projects, and whose current work is biodiversity conservation. The Fellows are hosted at UK organizations. The closing date for applications is 30 January 2012. **Link**

UK Field Studies Council -- 2012 Darwin Scholarship Program. The UK's Field Studies Council (FSC) annually sponsors intensive training in the UK to make "better naturalists" in honor of the work of Charles Darwin. The next course will convene 25 young scientists (under age 35) from around the world in August 2012. The FSC offers partial direct funding support, as well as assistance to successful applicants to find additional financial aid. The closing date for applications is 06 January 2012. **Link**

UNESCO - Keizo Obuchi Fellowships 2012. This program offers 20 research awards valued between US$6 thousand to US$10 thousand each. The awards are to post-graduate university researchers in four fields, one of which is environment (with emphasis on water sciences). Young researchers (under age 40) are invited to submit their applications through UNESCO's National Commissions, which will nominate a maximum of two candidates per country. Priority is for women candidates, candidates from least-developed countries, and from Palestinian researchers. Applications need to reach UNESCO Headquarters in Paris before 13 January 2012. **Link**

UNESCO -- Michael Batisse Award for Biosphere Reserve Management 2011. The United Nations Educational, Scientific and Cultural Organization (UNESCO) sponsors this award for outstanding achievements in biosphere reserve management. The winner receives US$6 thousand and travel to Paris to present the case study. Applications are due 15 January 2012. **Link**

Volvo Adventure Competition -- Youth Projects in Environment 2012. Volvo Adventure is an educational program that makes grants for community environmental projects by youth worldwide, aged 13 to 16. Applications are submitted by teams of two to five members. Volvo will invite the finalists to Sweden to compete for cash prizes of US$10 thousand, US$6 thousand, and US$4 thousand. Guidelines for the competition are available in ten languages. Closing date is 31 January 2012. **Link**

Weeden Foundation -- Biodiversity Conservation. The Weeden Foundation makes grants for biodiversity conservation in forest ecosystems, riparian corridors, and riverine and aquatic environments of ecological importance. Weeden's international geographical priorities are the Patagonia region of Chile, and the Altai Republic of Russia. The Foundation requests letters of inquiry (LOI) at least one month before proposal deadlines. The next deadline is 27 January 2012. **Link**

Wildlife Conservation Network -- Partnership Applications 2012. The WCN supports wildlife projects worldwide, with emphasis on Latin America, Africa, and Asia. WCN invites letters of inquiry from registered nonprofit organizations engaged in wildlife conservation or animal welfare to apply for partnerships. Letters of inquiry are accepted through 15 January 2012. **Link**

Wildlife Conservation Society -- Research Fellowship Program. The WCS invites applications under its Research Fellowship Program for one-year grants of up to US$20 thousand. Grant recipients support WCS to implement its priorities for wildlife conservation in developing countries. In 2011, the application deadline was 05 January *(monitor for changes 2012)*. **Link**

World Wide Fund For Nature (WWF) -- Prince Bernhard Scholarships for Nature Conservation 2012. WWF announces the 2012 Prince Bernhard Scholarships to support professional training or formal studies of individuals working in disciplines directly relevant to nature conservation. Eligibility extends to mid-career nationals from Africa (including Madagascar); Asia and Pacific; Latin America and Caribbean; Eastern Europe; and the Middle East. WWF gives priority to applicants seeking support for studies or training in their own countries or regions. The maximum grant is CH10 thousand. Applications (in English, French, or Spanish) are due before 11 January 2012. **Link**

Zoological Society of London -- Erasmus Darwin Barlow Expedition Grant 2012. The Erasmus Darwin Barlow Expedition Grant Fund offers up to £2 thousand for short field expeditions (maximum 3 months) to address a field conservation question outside of Western Europe and North America. The conservation question should focus on threatened or potentially threatened poorly-known species or habitats that currently receive little or no conservation attention. The grants are for teams of three or more persons led by a UK resident, or by an individual registered at a UK university or college. Priority is for collaboration with individuals at institutions in the destination country of the expedition. The application deadline is 31 January 2012. **Link**

American Philosophical Society -- Lewis and Clark Fund for Exploration and Field Research 2012. The Fund supports doctoral students to collect specimens and data in disciplines relying heavily on field studies, e.g., including biology, ecology, geography, and others. Applicants from the USA may use the grants for research anywhere in the world. Other applicants must be based at an institution in the USA, or carry out their work in the USA. The grants are up to US$5 thousand. The closing date for applications is 01 February. **Link**

British Ecological Society -- Travel Grants to UK. Travel grants for ecologists from developing countries to attend the Society's meeting and conduct other professional activity in the UK. Grants of up to £2 thousand are available to fund a visit normally expected to last around 14 days. The application deadline is 01 February. **Link**

Chicago Zoological Society -- CBOT Conservation Grants. The Chicago Zoological Society administers conservation grants funded by the Chicago Board of Trade (CBOT). The priority is for projects that directly assist in the protection of populations of threatened and endangered species -- or that help protect a specific habitat that is of high biological value, or that is substantially threatened. The Fund supports small projects, usually up to US$5 thousand. Grants are open to chairs and officers in IUCN's SSC Specialist Group; chairs and officers in AZA/WAZA; and all interested researchers. The next application deadline is 10 February 2012. **Link**

CRDF Global -- Research in the Russian Far East, USA and Russia 2012. CRDF

Global and the Russian Academy of Sciences support partnerships of U.S. and Russian scientists to address issues in the Russian Far East related to biodiversity, the Arctic seas, and climate change (among other topics). Grants are up to US$41 thousand for two years. The deadline for proposals is 17 February 2012. **Link**

Critical Ecosystem Partnership Fund -- Conservation in the Mediterranean Basin and Southern Africa. The CEPF announces two calls for proposals to enhance environmental conservation in the world's biodiversity "hot spots." The calls are open to NGOs, community groups, private enterprises, and other non-governmental organizations. (i) *Mediterranean Basin*: Large grants of up to US$1 million are available for single and multiple-country projects in Bosnia and Herzegovina, Jordan, Macedonia, Montenegro, and Tunisia. Letters of inquiry are due 31 January 2012. (ii) *Southern Africa*: Small and large grants support the conservation strategies of the Maputaland-Pondoland-Albany hotspot. Applicants submit letters of inquiry before 15 February 2012. *TVG Note: CEPF will request applications for small grants in support of the Mediterranean Basin during the first quarter of 2012.* **Link**

Danida -- Pilot Research Cooperation with Ghana and Vietnam 2012. The Danish International Development Agency (Danida) calls for research concept notes from Ghana and Vietnam. Project leaders in those countries choose research partners in Denmark. For Ghana, the research themes include climate variability and natural resources management *(among others)*. For Vietnam, the theme is climate change. In both countries, projects of up to three years will be funded with grants of up to DKK 5 million, including the costs of the Danish participation. Concept notes are due 03 February 2012 for Ghana, and 17 February 2012 for Vietnam. **Link**

European Commission (EC) -- Conservation in the Northern Congo Basin. The EC and the Economic Community of the Central African States (CEEAC) invite proposals for wildlife conservation in the savannah region of the northern Congo Basin (i.e., Cameroon, Chad, and Central African Republic). Main objectives include direct actions for wildlife protection; interventions to reduce human-wildlife conflicts; cross-border collaboration (e.g., legal and policy harmonization); and environmental lobbying and awareness raising. Grants are in the range of €3 million to €4 million, subject to criteria on cost-sharing. The program is open to NGOs, public agencies, and territorial collectives in the EU and ACP countries -- and to international (inter-governmental) organizations. Reference EuropeAid/131971/M/ACT/Multi. The application deadline is 06 February 2012. **Link**

Field Museum -- Graduate Fellowships and Visiting Scientists 2012. The Field Museum (Chicago, USA) offers grants and fellowships to visiting scientists and students for research and training on its scientific collections in anthropology, botany, geology, and zoology. The application deadline for graduate fellowships is 01 February 2012; the deadline for visiting scientists is 01 November 2012. **Link**

Fondation Nature & Decouvertes -- Grants for Nature Protection. The foundation supports projects for nature protection in France and Francophone Africa. Applications for small grants ('coup de main") can be submitted throughout the year. Application deadlines for major projects (from €3 thousand to €30 thousand) are 15 February and 14 August. **Link**

Higher Education for Development (U.S.) -- Caribbean Climate Adaptation. HED and the U.S. Agency for International Development will make a grant to one or more U.S.-based institutions of higher education in partnership with the University of the West Indies (UWI) to strengthen Caribbean capacity in the area of climate adaptation. The partnership will focus on research and policy through the UWI's Center for Resource Management and Environmental Studies. The available funding is US$770 thousand for three years. The closing date for applications is 22 February 2012. **Link**

Institute of Current World Affairs -- Fellows 2012. ICWA's fellowship program supports individuals for two years of self-defined studies in countries other than their own, mainly in the developing world. Geographical areas of particular interest are the Middle East and Southeast Asia (especially Indonesia), but candidates may seek support for work in any country. Several past fellows have pursued topics in natural resources (e.g., forests, fisheries, national parks, environmental protection) and agriculture. Applicants do not have to be U.S. citizens, but they must show strong and credible ties to U.S. society. Applicants must be under 36 years of age. Expressions of interest are due 01 February 2011. **Link**

King Baudouin Foundation -- King Baudouin African Development Prize 2012. The King Baudouin African Development Prize rewards innovative initiatives to improve the quality of life of local communities in Africa. Candidates for the Prize can be individuals or organizations, working in any field of endeavor. Past winners include champions of fair trade, environmental conservation, and land reform *(among a wide field of other issues)*. The Prize is worth €150 thousand, awarded every other year. The current deadline for nominations is 15 February 2012. **Link**

LAC-Brazil Agricultural Innovation Marketplace -- Call for Pre-Proposals. The LAC-Brazil Agricultural Innovation Marketplace aims to foster partnerships between Embrapa (Brazil) and other agricultural research organizations in Latin American and Caribbean for the benefit of smallholder agriculture in the region. Themes include productivity enhancement; natural resources management; advances in policies, institutions, and markets; and approaches targeted for poverty alleviation. Applications are invited from public and private R&D organizations in Latin America and the Caribbean in collaboration with one or more of Embrapa's centers in Brazil. Projects should be based outside of Brazil, and proposals should be prepared in English. Grants are up to US$80 thousand for projects of up to two years. The closing date for pre-proposals is 29 February 2012. **Link**

Leverhulme - Royal Society Africa Awards 2012. The Leverhulme Trust and the UK's Royal Society collaborate to make grants for research in agriculture, water and sanitation, biodiversity, energy, and basic human health in Tanzania and Ghana. Applicants from these countries partner with institutions in the U.K. Project leaders must have at least post-doctoral status or equivalent. Awards offer a maximum of £60 thousand per year for three years. The closing date for applications is 08 February 2012. **Link**

MacArthur Foundation -- Application Deadlines for New Strategy of Conservation and Development 2012. The John D. and Catherine T. MacArthur Foundation has published the application dates for its revised grant-making program in conservation and development. For year 2012; the deadlines for letters of inquiry are: (i) 10 February for the Lower Mekong Basin; (ii) 15 April for the Great Lakes Region (Africa); and (iii) 15 June for the Southern Andes. An additional deadline will be determined later for Marine Conservation in the Caribbean, Madagascar, and Melanesia. **Link**

MedPAN -- Small Projects for Mediterranean Protected Areas, 2nd Call. The Network of Mediterranean Marine Protected Areas (MedPAN) announces its second call for small projects. Grants can support management/planning; fund raising; communications; environmental education; monitoring; and most other responsibilities of protected areas managers. About five to ten projects will be funded, each up to €20 thousand for one year. Most grants will be made to non-European Mediterranean countries. Applications (French or English) are due by 06 February 2012. **Link**

Mohamed bin Zayed Species Conservation Fund -- First Round of Applications 2012. The Mohamed bin Zayed Species Conservation Fund makes grants to individuals, communities, and organizations for the conservation of animal, bird, plant, and fungi species worldwide. Since its inception in 2009, the Fund has made grants for more than 500 conservation projects, mainly in the developing countries. Small grants are up to US$5 thousand; larger grants of up to US$25 thousand require approval by the Fund's board. Applications (in English) received before 29 February 2012 will be reviewed before the end of April. **Link**

New England Biolabs Foundation -- Grassroots Conservation. The Foundation makes grants to grassroots and charitable organizations to support conservation of biological diversity; ecosystem services; community food security; and marine environment. The geographical scope focuses on selected countries of the Gulf of Honduras; the Andean region; and West Africa (in addition to Papua New Guinea, Tanzania, Nicaragua, and El Salvador). Maximum grant size is US$10 thousand, but most grants are smaller.The next

deadline for letters of inquiry is 15 February 2012. **Link**

Peoples Trust for Endangered Species -- Worldwide Grants. The PTES makes grants to scientific researchers and conservationists for work that helps preserve endangered species, either through research or applied field work. The program offers small grants between £2 thousand and £8 thousand for projects of up to two years. It also offers continuation grants of £10 thousand to £25 thousand for follow-up projects of two to five years. PTES invites grant requests from applicants in the UK and its overseas territories, and from countries that the World Bank does not classify as high-income. The next deadline for small grants is 10 February 2012; the next deadline for continuation grants is 11 May 2012. **Link**

UNESCO's Man and the Biosphere Program – Young Scientist Awards 2012. UNESCO's Man and the Biosphere (MAB) program makes grants for conservation research through its Young Scientists Awards. Priority is for projects carried out in the world's biosphere reserves. Awards are up to US$5 thousand in support of research on ecosystems, natural resources, and biodiversity. The application deadline is 15 February 2012. **Link**

United Nations University -- Research Fellowships 2012. UNU's Institute of Advanced Studies supports research programs for PhD and postdoctoral researchers in themes related to climate change, biodiversity conservation, bio-diplomacy, environmental policy, governance of natural resources, traditional knowledge, marine and coastal management, and others. Fellows are resident for one year at UNU-IAS in Yokohama or UNU-IAS OUIK in Kanazawa, Japan. There are no nationality requirements, but applicants should be fluent in English. Applications are especially encouraged from women and developing countries. The closing date is 29 February 2012. **Link**

University of California, Davis -- Borlaug Leadership Enhancement in Agriculture for Sub-Saharan Africa. The Norman E. Borlaug Leadership Enhancement in Agriculture Program (Borlaug LEAP) offers fellowships for graduate students from developing countries who are engaged in agricultural research at universities in the USA. Proposals are coordinated by a university in the student's home country, a university in the USA, and a mentor in the Consultative Group for International Agricultural Research (CGIAR). The current call for applications is directed to graduate students from Sub-Saharan Africa whose research is related to topics in USAID's program, "Feed the Future." Applications are due before 03 February 2012. **Link1** **Link2**

U.S. Agency for International Development -- Energy and Forests in Mexico. USAID-Mexico has extended a previous call for proposals in themes of private sector competitiveness, education, and environment. The component on environment seeks to promote climate change mitigation, with a focus on Mexico's energy and forestry sectors. USAID invites applications from Mexican and multinational corporations, foundations, NGOs, and academia. Grants are up to US$500 thousand. Funding Opportunity APS-523-12-001. The closing date for applications is 29 February 2012. **Link**

World Wildlife Fund (U.S.) -- 2012 Grants for Post-Graduate Education in Conservation. WWF-US supports the Russell E. Train Education for Nature Program for academic study at masters and doctoral levels anywhere in the world. Applications are invited from conservationists in selected developing countries. For applications in 2012, the eligible countries are Malawi, Mozambique, Nepal, and countries of the eastern Pacific Ocean (fisheries management in Mexico, Guatemala, El Salvador, Nicaragua, Costa Rica, Panama, Colombia, Ecuador, Peru, and Chile). The closing date for applications is 28 February 2012. **Link**

Association of Zoos and Aquariums -- Conservation Endowment Fund 2012. AZA's Conservation Endowment Fund makes grants for Animal Health; Animal Welfare; Conservation Education; Field Conservation and/or Reintroduction; Management and/or Breeding; and Research. The principal investigator in a grants application must be an AZA member. Many grants are awarded to collaborations among AZA-accredited institutions; government wildlife agencies; academia; and major conservation NGOs. The average project award is about US$17 thousand. The application deadline is 15 March 2012. **Link**

Australia and Pacific Science Foundation -- Grants 2012. APSF makes research grants in ecology, biodiversity, and life sciences in Australia and the Southwest Pacific region. Most grants are up to A$15 thousand per year for up to three years. Applications are due 09 March 2012. **Link**

BBVA Foundation -- Awards in Biodiversity Conservation. The BBVA Foundation will make awards for biodiversity conservation in Spain and Latin America for achievements in year 2011. For Spain, there is one award of €250 thousand for actions in biodiversity conservation, and another award of €80 thousand for environmental communications. For Latin America, there is one award of €250 thousand for actions in biodiversity conservation. The submission deadline (all awards) is 30 March 2012. **Link**

Cleveland Metroparks Zoo -- Scott Neotropical Fund. The Scott Neotropical Fund makes grants for conservation of wildlife in the neotropics (Mexico, Caribbean, Central America, and South America). Grants support research, training, and technical assistance with the aim of benefiting local communities along with providing wildlife protection. The primary investigator must be resident in the neotropical region. Grants are US$3 thousand to US$5 thousand. In 2011, the application deadline was 25 March *(monitor for changes 2012)*. **Link**

Congo Basin Forest Partnership -- Grants for Protected Areas in Central Africa. With funding through the European Commission, the Congo Basin Forest Partnership announces a call for proposals to strengthen 16 protected areas and their peripheries in Central Africa. The program works through the Central Africa Protected Areas Network (RAPAC) to make grants for conservation in high-priority protected areas in Cameroon, Central African Republic, Chad, Congo, DRC, Gabon, and Sao Tome & Principe. Applications are invited from national and international NGOs, as well as from private actors for nonprofit activities, in countries of the EU and ACP (i.e., all countries in RAPAC). The maximum grant is €200 thousand. The closing date for applications is 01 March 2012. **Link**

European Commission (EC) -- Local Natural Resources Management in Chad. The EC calls for proposals to expand and improve the productivity of agro-sylvo-pastoral systems at a decentralized level in Chad. The program is open to local organizations, producers associations, NGOs, and public research and support organizations in countries of the EU and ACP (e.g., Chad). International inter-governmental organizations are also eligible. Reference EuropeAid/132171/M/ACT/TD. The application deadline is 08 March 2012. **Link**

Firedoll Foundation – Grants 2012. Among other themes, the Foundation makes grants for environmental conservation that sometimes include activities in developing countries. Most grants range from US$5 thousand to US$25 thousand. Organizations which are applying to the Foundation for the first time send a letter of inquiry between 01 January and 31 March 2012. **Link**

Fondation de France and Comité français pour la solidarité internationale (CFSI) -- Agriculture in West Africa. The CFSI supports projects that promote family farming in West Africa by improving and diversifying production, managing natural resources, and strengthening farmers' organizations. Proposals are submitted by partnerships of African and European organizations such as farming organizations in West Africa; NGOs; research and education institutions; and networks focusing on agriculture in West Africa. In 2011, the deadline for proposals was 31 March *(monitor for changes 2012)*. **Link**

Fondation Ensemble -- Small Grants Fund 2012. The Small Grants Fund makes grants up to €30 thousand for projects in renewable energy, sustainable agriculture, waste management, biodiversity conservation, water and sanitation, and animal biodiversity in France and developing countries. Most grants are to civil society organizations. The largest share of funding is for animal biodiversity (i.e., protection of threatened wildlife species). The deadline for applications (French or English) is 11 March 2012. **Link**

Global Biodiversity Information Facility -- Ebbe Nielsen Prize 2012. The GBIF supports research and discovery in biodiversity informatics. The Ebbe Nielsen Prize of €30 thousand is awarded annually to a person or team that demonstrates excellence in combining biodiversity informatics and biosystematics research. Nominations are submitted through GBIF's representatives in its voting

and associate countries. The deadline for nominations is 15 March 2012. **Link**

Irwin Andrew Porter Foundation -- International Grant Awards. The Foundation's international grant making includes projects for agriculture, natural resources, and conservation at the grass roots. Grants range from US$500 to US$30 thousand per year. Applicants must have tax-exempt status or a tax-exempt fiscal agent in the USA. Phase I applications are due 31 March. **Link**

John Ball Zoological Society (USA)-- Wildlife Conservation Grants 2012. The JBZS makes grants to conserve wild animals and their habitats; to improve the management of captive animals; and to develop education programs related to these objectives. Most funded projects are in developing countries. Applicants can be of any nationality, and should be associated with a recognized institution (e.g., zoo, educational institution, conservation organization, etc.). Grants range from US$500 to US$2,500. The deadline for applications is 05 March 2012. **Link**

Mitsubishi Corporation Foundation for the Americas (MCFA) -- Conservation and Environment. The MCFA makes grants for biodiversity conservation, sustainable development, environmental justice, and environmental education in the Americas. Eligibility is to tax-exempt 501(c)3 organizations in the USA and their equivalents in other countries. MCFA states that the ideal timing for submitting proposals is during the first quarter of the calendar year. **Link**

Riverbanks Zoo and Garden -- International Wildlife Conservation 2012. The Riverbanks Zoo and Garden (USA) makes grants for field conservation; habitat management; conservation education; ex situ captive breeding; animal health and welfare; and other themes in wildlife research and conservation. Grants generally range from US$1 thousand to US$5 thousand. Application deadlines are 31 March and 30 September. **Link**

Tibet Fund -- Masters Studies in USA for Tibetan Refugees. The Tibet Fund announces the Tibetan Scholarship Program 2013 for masters studies in the USA, with funding provided through the U.S. Department of State. Applications are accepted from eligible Tibetan refugees in Bhutan, India, and Nepal who are age 35 or younger. Fields of study for the masters degree include agriculture, environmental studies, renewable energy, natural resources management, waste management and recycling, and several others. The application deadline is 31 March 2012. **Link**

Tourism Cares -- Worldwide Grants 2012. Tourism Cares makes grants to nonprofit charitable organizations in the USA and internationally to benefit tourism-related sites of exceptional cultural, historic, or natural significance around the world. Past grants include several for national parks, wetlands, trails, environmental education centers, etc., of importance for tourism. Applicants from (and working with) organizations in developing countries are welcome. Deadlines for letters of inquiry are 01 March 2012 and 02 July 2012. **Link**

U.S. Fish and Wildlife Service -- Conservation in Latin America and Caribbean 2012. The USFWS "Wildlife Without Borders" includes a regional program for Latin America and the Caribbean to implement the Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere. Projects should take place in the region to protect sites of high conservation value associated with flagship, migratory, or endangered species of regional concern *(except that projects in Mexico need to be submitted to the Mexico program, which is separate)*. Priority is for projects that request less than US$50 thousand, and that are able to provide matching support. Applications can be submitted in Spanish or English before 15 March 2012. **Link1 Link2**

U.S. Fish and Wildlife Service -- Critically Endangered Animals 2012. The Critically Endangered Animals Conservation Fund makes grants to conserve the world's most endangered species. The focus is on "critically endangered" and "endangered" species on IUCN's Red List, and which are not eligible for funding through other USFWS programs. Eligibility for grants extends to individuals, multi-national secretariats, government units (all levels), nonprofit NGOs, and institutions of higher education. Preference is for proposals that request less than US$25 thousand, although larger proposals will be considered. Proposals should demonstrate in-kind or financial matching. The deadline for applications is 01 March 2012. **Link**

Fondation d'entreprise Hermès -- Local Skills and Biodiversity. The Foundation makes grants for research projects and field initiatives that promote sustainable management of biodiversity at the interface of producers and consumers. In 2011, the closing date for applications was 15 April *(monitor for changes 2012)*. **Link**

MacArthur Foundation -- Application Deadlines for New Strategy of Conservation and Development 2012. The John D. and Catherine T. MacArthur Foundation has published the application dates for its revised grant-making program in conservation and development. For year 2012; the deadlines for letters of inquiry are: (i) 10 February for the Lower Mekong Basin; (ii) 15 April for the Great Lakes Region (Africa); and (iii) 15 June for the Southern Andes. An additional deadline will be determined later for Marine Conservation in the Caribbean, Madagascar, and Melanesia. **Link**

Nando Peretti Foundation. Among a broad range of interests, the Nando Peretti Foundation makes grants to nonprofit organizations in the area of environmental protection and nature conservation. Most past grants have funded projects in the developing countries and Italy. In 2011, the deadline for proposals was 08 April *(monitor for changes 2012)*. **Link**

Patagonia Environmental Grants Program. Patagonia makes grants to support grassroots organizations for campaigns to preserve and protect the environment. Thematic areas are alternative energy, biodiversity, forests, sustainable agriculture, water/marine issues, and others. Eligible countries include Argentina and Chile. Most grants are in the range of US$3 thousand to US$8 thousand. Proposals are submitted through Patagonia's retail stores at any time of the year, or by postal mail to the Environmental Grants Manager before 30 April and 31 August of each year. **Link**

Tropical Biology Association -- Small Grants for African Conservation. The TBA offers annual small grants for conservation projects and research in Sub-Saharan Africa. The call is restricted to TBA alumni groups. Grants are for a maximum of £1,500. The application deadline is 30 April of each year. **Link**

U.S. Fish and Wildlife Service -- Conservation of Amphibians in Decline 2012. *Amphibians in Decline* supports activities that address threats to frogs, toads, salamanders, newts, and caecilians that face an unprecedented threat of extinction. Eligibility for grants extends to individuals, multi-national secretariats, government units (all levels), nonprofit NGOs, and institutions of higher education. Preference is for proposals that request less than US$25 thousand, although larger proposals will be considered. Proposals should demonstrate in-kind or financial matching. The closing date is 01 April 2012. **Link**

U.S. Fish and Wildlife Service -- Grants for Species Conservation 2012. As part of its program "Wildlife Without Borders," the USFWS makes grants for the conservation of selected wildlife species. These include African elephants, Asian elephants, great apes, rhinos, tigers, and marine turtles. Grants are for applied research, training, conservation management, community outreach, law enforcement, decreased human-wildlife conflicts, and other activities in conservation. Preference is for proposals that request less than US$50 thousand. Eligibility extends worldwide to qualified and relevant government agencies, other organizations, multi-national secretariats, and individuals. Proposal deadlines are 01 April and 01 November of each year *(except marine turtles, 01 April and 01 October)*. **Link**

U.S. National Science Foundation -- World Biodiversity 2012. The Office of International Science and Engineering supports the initiative "Dimensions of Biodiversity" to focus on the integration of genetic, taxonomic, and functional dimensions of biodiversity on Earth. Most grants are to U.S. universities and research institutes, often with partners in other countries. The closing date for full proposals is 10 April 2012. **Link**

Amphibian Ark -- Seed Grants 2012. Amphibian Ark offers the AArk Seed Grant of US$5 thousand in support of ex situ conservation of globally endangered amphibian species. The grant is intended for start-up rescue projects that need seed money in order to attract larger funding. Projects should work with species in their range countries, involve range-country biologists, conform to biosecurity

standards, and observe other guidelines explained on the website. Applications are due 01 May 2012. **Link**

Lawrence Foundation -- Grants for Environment 2012. The Lawrence Foundation makes grants to nonprofit organizations based in the USA for projects in environment, education, and other themes. There is no restriction on the geographical area where grant activities can be implemented. The average grant size is about US$10 thousand. Application deadlines are 31 May and 01 November. **Link**

McKnight Foundation -- Southeast Asia 2012. McKnight's grant program for Southeast Asia (Vietnam, Laos, Cambodia) includes themes on communities in relation to natural resources and conservation. Grants are made to local and international NGOs working in the countries of interest. Average grant size is US$45 thousand per year for up to two years. The deadlines for letters of inquiry is 01 May 2012. **Link**

Northeastern Wisconsin Zoo -- Conservation Grant Fund 2012. The Fund accepts proposals from individuals and organizations for one-year conservation grants. Many past grants have supported field projects in Latin America and Sub-Saharan Africa. There is no minimum or maximum grant amount. However, most past grants have ranged from US$250 to US$1,000. Applications are accepted all year, but must be received by 01 May to be considered by the Board. **Link**

Otto Kinne Foundation -- Awards in Ecology. Each year, the Otto Kinne Foundation invites nominations from research ecologists worldwide for the Ecology Institute Prize and the IRPE Prize. In 2011, the deadline for nominations for the Ecology Institute Prize was 30 May *(monitor for changes 2012)*. **Link**

Peoples Trust for Endangered Species -- Worldwide Grants. The PTES makes grants to scientific researchers and conservationists for work that helps preserve endangered species, either through research or applied field work. The program offers small grants between £2 thousand and £8 thousand for projects of up to two years. It also offers continuation grants of £10 thousand to £25 thousand for follow-up projects of two to five years. PTES invites grant requests from applicants in the UK and its overseas territories, and from countries that the World Bank does not classify as high-income. The next deadline for small grants is 10 February 2012; the next deadline for continuation grants is 11 May 2012. **Link**

World Conservation Union, IUCN-Netherlands -- Purchase of Nature. IUCN-Netherlands makes small grants for the Purchase of Nature program, funded by the Dutch Postal Code Lottery. The program provides grants for the purchase and protection of threatened wildlife habitats and vulnerable ecosystems, mainly in tropical developing countries. The grants are made to conservation organizations in those countries. In 2011, the application deadline was 01 May *(monitor for changes 2012)*. **Link**

Zoological Society of London – Call for EDGE Fellows 2012. ZSL's EDGE of Existence Program provides fellowships for two-year projects in research and conservation of EDGE (Evolutionarily Distinct and Globally Endangered) mammals and amphibians. Applicants must be early-career conservation biologists (less than 5 years experience) who are nationals or residents of the country in which the EDGE species occur. The Fellowship includes a grant of up to £5 thousand per year, plus training and technical support. Applicants are strongly advised to discuss their projects with the EDGE team before applying. The application deadline is 31 May 2012. **Link**

MacArthur Foundation -- Application Deadlines for New Strategy of Conservation and Development 2012. The John D. and Catherine T. MacArthur Foundation has published the application dates for its revised grant-making program in conservation and development. For year 2012; the deadlines for letters of inquiry are: (i) 10 February for the Lower Mekong Basin; (ii) 15 April for the Great Lakes Region (Africa); and (iii) 15 June for the Southern Andes. An additional deadline will be determined later for Marine Conservation in the Caribbean, Madagascar, and Melanesia. **Link**

Ramsar Small Grants Fund. The Ramsar Small Grants support projects in wetlands conservation and wise use in developing countries. Projects can be proposed by individuals, government agencies, and NGOs. In 2011, the deadline for applications was 30 June *(monitor for changes 2012)*. **Link**

Roger Williams Park Zoo -- Sophie Danforth Conservation Biology Fund 2012. 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. The application deadline is 01 June. **Link**

Royal Geographical Society -- Field Projects 2012. The RGS makes fieldwork grants for 40-50 teams of researchers and students. Most projects are in developing countries. RGS encourages UK organizations to collaborate with local partners. Grants are up to £3 thousand. The application deadlines are 20 January 2012 and 14 June 2012. **Link**

Toyota Motor Corporation -- Toyota Environmental Activities Grants Program. Toyota makes grants to support environmental activities implemented by nonprofit organizations on environmental themes that vary from year to year. The grants program is open to applicants in Japan, and international partners in collaboration with Japanese groups. In 2011, applications were due 15 June*(monitor for changes 2012)*. **Link**

Zoo Boise Conservation Fund -- Wildlife Grants. Zoo Boise makes grants up to US$30 thousand for wildlife conservation in Idaho USA and internationally. Grants support habitat restoration, wildlife conservation and management, community-based conservation, and other goals consistent with Zoo Boise's master plan. Project proposals are accepted from conservation organizations around the world. In 2011, the application period was 01 April through 30 June *(monitor for changes 2012)*. **Link**

Instructions to Authors

Background

FrogLog has been one of the leading amphibian conservation community newsletters since the early 1990's. Over the years it has been affiliated with different groups but has always strived to help inform the community. In 2005 FrogLog became the official newsletter of the IUCN SSC Amphibian Specialist Group and is produced on a bimonthly basis.

As the ASG's newsletter members are encouraged to contribute to FrogLog's content and direction. To aid in this process each edition of FrogLog focuses on one of the six broad geographical zones identified by the ASG. The publication schedule is as follows:

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

FrogLog invites contributions of research, reviews on current management and conservation issues, methods or techniques papers and, editorials. We also actively encourage submissions describing the current activities relating to projects and academic institutions in order to help inform the community as to the general state of current research and conservation activities.

Publication

FrogLog is published online at www.amphibians.org and is open access.

Review

All contributions should ideally be channeled through Regional ASG Chairs, the details for which can be found at http://www.amphibians.org/asg/regional-asgs/. If for some reason this cannot be done, contributions will be reviewed by at least one individual within the ASG. FrogLog is not a peer reviewed publication and the onus for submitting accurate information remains with the authors.

Production Editor

James P. Lewis (jplewis@amphibians.org)

Editorial Committee

- James P. Collins (ASG Co-Chair)
- Claude Gascon (ASG Co-Chair)
- Phillip J. Bishop (ASG Deputy Chair)
- Robin D. Moore (ASG Program Officer)
- (Note: Additional reviewers will be requested as required)

Submission of Manuscripts

Manuscripts can only be received as electronic files. Text should be submitted in MS Word format and may contain tables, but figures should be sent as a separate attachment where possible. All documents should be sent to James Lewis at jplewis@amphibians.org. Each file should be labeled in a style that illustrates clear association, i.e., authors_name_text and authors_name_figure1.

Guidelines for Authors

All manuscripts must be written in English.

Title

Titles should ideally be no more than 15 words.

Authors

Authors names should be written in full as follows: By James P. Lewis & Robin D. Moore

Main body of text

Use Georgia 11-point font. Genus and species names should be in italics as should the abbreviation for *Batrachochytrium dendrobatidis*, *Bd*. Suggested headings include Acknowledgements, Author Details, and Literature Cited.

Author details

Author details should be provided at the end of the article after any acknowledgements. They can include as much or little information as the authors wish to provide.

Figures

Figures should be numbered and include brief, concise legends. Where photographs or illustrations are used please state whom the image should be credited to, e.g. Photo: James P. Lewis. Graphics should preferably be submitted in tiff or jpeg format in the highest possible quality. Resolution should be at least 300 dpi at the final size.

Tables

Tables may be included within the text file and should be numbered and include brief, precise legends.

Citation of literature

List all literature cited in text in alphabetical (author names) and chronological (year) order. Please adhere closely to suggested format. Names of journals may be abbreviated.

Journals/Periodicals

Hamer AJ, Mahony MJ (2007) Life-history of an endangered amphibian challenges the declining species paradigm. Australian Journal of Zoology 55(2), 79-88.

Books

Mallari, N. A. D., B. R. Tabaranza, Jr., and M. J. Crosby. 2001. Key conservation sites in the Philippines: a Haribon Foundation and BirdLife International directory of Important Bird Areas. Bookmark, Inc., Makati City. 485 pp.

Papers from books

Alford, R. A. 2010. Declines and the global status of amphibians. Pp. 13-46 In Sparling, D.W., Lindner, G., Bishop, C.A., and S. K. Krest, eds. Ecotoxicology of Amphibians and Reptiles, 2nd edition. SETAC press, USA, 916 pages.

Papers in Conference Proceedings

Berger, L., Speare, R., Daszak, P., Green, D. E., Cunningham, A. A., Goggin, C. L., Slocombe, R., Ragan, M. A., Hyatt, A. D., McDonald, K. R., Hines, H. B., Lips, K. R., Marantelli, G. and H. Parkes. 1998 Chytridiomycosis causes amphibian mortality associated with population declines in the rainforests of Australia and Central America. Proceedings of the National Academy of Science USA 95, 9031-9036.

Websites/Electronic Resources

EDGE. (2009). "The Zoological Society of London 2008: Top 100 Evolutionarily Distinct and Globally Endangered amphibians." Retrieved April, 2009, from http://www.edgeofexistence.org/amphibians.

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Coming up in FrogLog Vol. 101

Europe, North Africa and West Asia

Europe, North Africa and West Asia
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March 2012

Robin Moore / iLCP