

FrogLog

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Volume 22, number 3

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

A New Meeting for
Amphibian Conservation in
Madagascar: ACSAM₂

New ASA Seed Grants

Citizen Science in the City

Amphibian Conservation
Efforts in Ghana

Recent Publications

And Much More!

*A cryptic mossy treefrog (*Spinomantis aglavei*) is encountered in Andasibe during a survey for amphibian chytrid fungus and ranavirus in Madagascar. Photo by J. Jacobs.*



The Challenges
of Amphibian
Conservation in
Tanzania



Saving the Montseny
Brook Newt

FrogLog

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Editorial

Dear Frogloggers,

This edition of *FrogLog* is more than a regional edition—it's about highlighting progress and successes being made every day within the scope of amphibian conservation efforts in these focus regions and beyond.

The Amphibian Survival Alliance (ASA) has spent the last 12 months building support and funding for research, conservation and education efforts and is now actively support conservation actions on the ground. To date the ASA has protected 5,860 hectares, awarded 8 grants with a USD value of \$315,000 and supported 11 priority species. In another exciting development, to help support our growing community in trying new and innovative approaches to the myriad threats facing amphibians today, the ASA is also pleased to announce the first round of ASA Seed Grants. Further details and information on how to apply for these grants can be found on page 9.

The Amphibian Specialist Group (ASG) is continuing to evolve with a new Secretariat taking the lead. Ariadne Angulo is now the new Co-Chair of the ASG together with Phil Bishop. In addition to Ariadne's appointment, three new Program Officers are also in place: Sally Wren Helen Meredith and Jos Kielgast.

The ASG Working Groups are continuing to identify priority actions we need to act on as a community to address global amphibian conservation challenges. The ASA is already working to implement some the actions previous identified by Working Groups. At the end of last year the Alliance launched the Leapfrog Conservation Fun, which is now a multimillion dollar annual fund for habitat conservation as well as working with Partners to develop a system of Important Amphibian Areas to help better define those critical habitats.

The Amphibian Red List Authority is also making significant progress. Last year witnessed the launch of a new and improved Amphibian Assessment Forum online platform. A total of 412 amphibian extinction risk assessments and reassessments were published on the IUCN Red List of Threatened Species, along with a total of 205 amphibian assessments and reassessments having already been submitted for Red List version 2014.

This edition of *FrogLog* is also focusing on the successes and progress being made by members of our community across Europe, West Asia and Africa. You'll find out how "A Conservation Strategy for the Amphibians of Madagascar" (ACSAM) in 2006 in Antananarivo, Madagascar led to significant conservation progress on the ground and how ACSAM2 later this year will build on this. You'll learn more about the plight of the Giant West African squeaker frog and how local perceptions about amphibian conservation in Cameroon are changing for the better. Things are happening on the ground in Europe as well. See the amazing progress that has been made three years three years after the implementation of a road mitigation project in The Netherlands and discover how eight years of research and conservation efforts are helping to save the Montseny Brook newt.

We're all working together to make a difference for amphibians around the world and this edition proves that there is phenomenal strength in numbers!

Candace M Hansen *Editor-in-chief*

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FrogLog

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A New Meeting for Amphibian Conservation in Madagascar: ACSAM₂



By ^{1,2}Franco Andreone, ³John E. Cadle, ^{2,4}Angelica Crottini², ⁵Jeff Dawson, ⁵Eileen Larney, ²Falitiana C.E. Rabemananjara, ⁶Sahondra Rabesihanaka, ²Nirhy Rabibisoa, ⁶Eric Rabsomanitrdrasana, ⁷Tsanta F. Rakotonanahary, ^{2,8}Gonçalo M. Rosa

The frogs of Madagascar constitute one of the richest groups of amphibians in the World with more than 290 described species (1), though some estimate there may be more than 400, with several new species being described annually. Of these around 99% of species and 88% of genera are endemic to Madagascar and its inshore islands ranking the country third in the world for number of endemic amphibian fauna. Most of these species belong to two highly successful radiations of astonishing eco-morphological and reproductive diversity.

However, like amphibians around the world Madagascar's amphibian fauna is under threat with around 25% of all described species listed as Globally Threatened on the IUCN Red List, though no recent extinctions have been recorded yet. Habitat loss and degradation is the main threat facing these species, with collecting for the international pet trade also likely, though not yet documented,

to impact heavily on certain species. Recently the discovery of the deadly fungal disease chytridiomycosis was reported in some exported Malagasy frogs and highlights a new, potentially devastating threat to the country's amphibian fauna. Together with the recent discovery of an invasive alien toad spreading in the north-east of Madagascar these are posing new challenges to amphibian conservation in Madagascar.



ACSAM workshop 2006. Photo: Franco Andreone.

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The conservation of Malagasy amphibians has long been an important issue, with the need for coordination and collaboration between researchers and stakeholders repeatedly stressed. This need and desire led to the holding of the workshop 'A Conservation Strategy for the Amphibians of Madagascar' (ACSAM) in 2006 in Antananarivo, Madagascar (2). Attended by over 100 biologists and key people from major conservation organizations and Government this workshop was an important step in the national implementation of the international Amphibian Conservation Action Plan (ACAP).

One crucial output from the 2006 ACSAM was the production of the Sahonagasy Action Plan (SAP) in 2008, the first national action plan for amphibians in Madagascar (2). Synthesising the discussions, opinions and outcomes of the meeting the SAP outlined the recommendations and activities required to secure the survival of Madagascar's amphibian fauna over a five year period.

Since the SAP was published there has been some significant progress made. Among these are:

- the implementation of a web platform enabling information management and citizen-science;
- the publication of a comprehensive field guide of the amphibians and reptiles of Madagascar in the local Malagasy language;
- the inclusion of amphibians as a target group in scientific proposals for reserve planning in Madagascar;
- securing most of the Critically Endangered species within the Malagasy Protected Areas Network called SAPM (Système des Aires Protégées de Madagascar);
- undertaking regular monitoring at some very important high altitude sites (e.g., Ankaratra), where data on species distribution and abundance has been collected over several years;
- the creation of breeding ponds for the Critically Endangered *Mantella aurantiaca*;
- the first in-country captive breeding facilities have been established at Andasibe by Association Mitsinjo and Parc Ivoloïna by Madagascar Fauna and Flora Group;
- the implementation of a proactive national chytrid monitoring program across eight sites in the country (3);
- the implementation of a probiotic program to combat the effects of chytrid.

Despite these successes not all targeted actions have been implemented, with around a third of the targeted actions listed being fully implemented and another third only partially implemented (4). The difficulties encountered by the SAP during this period included (but are not limited to) the political instability of Madagascar and by the need of aligning research actions with conservation priorities, which is not always feasible to pursue. It is hoped however that with the first elections taking place since then at the start of 2014 there will be an alleviation of some of the difficulties faced during the previous five years.

Even so Madagascar's amphibian fauna is still as threatened as ever, perhaps even more so. Therefore we feel that eight years on from the first ACSAM there is an urgent need to review and update the SAP.

To this end the Ministère de l'Environnement, de l'Ecologie et des Forêts de Madagascar, Amphibian Specialist Group–Madagascar, Durrell Wildlife Conservation Trust (Durrell) and Centre ValBio are organizing ACSAM2 (www.amphibians.org/acsam2). This will be held at Centre ValBio in Ranomafana from 19-22 November

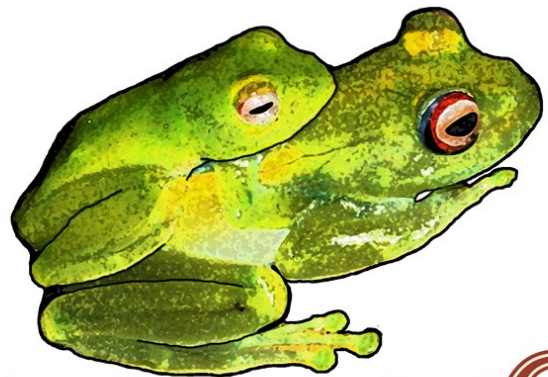
2014. Easily reachable by car from Antananarivo, Centre ValBio is a state of the art research station has excellent workshop and conference facilities and successfully hosted the 2013 International Prosimian Congress.

Around 70 national and international participants will be attending which will allow the consolidation and presentation of the results obtained in the intervening years, review progress, gather new ideas and identify targets for the forthcoming years to conserve the amphibian megadiversity of Madagascar (5).

So far a significant proportion of the funds for ACSAM2 have been raised through Durrell, the Societas Herpetologica Italica and other stakeholders gathered with the support of the Amphibian Survival Alliance.



Mantella aurantiaca. Photo: Franco Andreone.



ACSAM2

A Conservation Strategy for the Amphibians of Madagascar

We plan to publish the papers/contributions presented at the workshop mainly as extended summaries on the Web (e.g., as a supplement of *FrogLog*). Outputs following the workshop will include an updated ACSAM and *Sahonagasy Action Plan* along with news articles in appropriate publications. Ultimately we hope that that ACSAM2 will galvanise collaborative and coordinated action for the conservation of Malagasy amphibians.

References

1. AmphibiaWeb, www.amphibiaweb.org (2014).
2. Andreone F., Randriamahazo H., Eds. *Sahonagasy Action Plan. Conservation Strategies for the Amphibians of Madagascar / Programmes de conservation pour les amphibiens de Madagascar*. (Museo Regionale di Scienze Naturali, Conservation International, IUCN/SSC Amphibian Specialist Group. Turin, Italy, 2008)
3. Weldon C. *et al.* Pre-emptive national monitoring plan for detecting the amphibian chytrid fungus in Madagascar. *EcoHealth* DOI: 10.1007/s10393-013-0869-8 (2013).
4. Andreone F. *et al.* Saving the diverse Malagasy amphibian fauna: where are we four years after the implementation of the Sahonagasy Action Plan. *Alytes* 29(1-4): 44-58 (2012).
5. Andreone F. *et al.* The challenge of conserving amphibian megadiversity in Madagascar. *PLoS Biol* 6: e118 (2008).

Aichi Biodiversity Target 12: A Progress Report from the Amphibian Survival Alliance

By Amphibian Survival Alliance



Philippine Flat-headed frog, *Barbourula busuangensis*, a threatened species from Palawan. Photo: Robin Moore.

In 2010 nearly 200 countries that support the Convention on Biological Diversity (CBD) agreed on [20 Targets](#) to save biodiversity and enhance its benefits for people, and committed to meet them by 2020.

Aichi Biodiversity Target 12 in particular reads: “By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.”

In June the IUCN has prepared [an information \(INF\) paper](#) on Target 12 for the [CBD WGR15](#) and [SBSTTA18](#) meetings in Montreal. The aim of this paper is to provide information that would assist the Parties in working towards the achievement of Target 12. It focuses on the IUCN Red List of Threatened Species, other National Red Lists; Species Action Plans; and Action on the Ground.

This paper features updated information on the progress made by [Friends of Target 12](#) towards the achievement of Target 12, including a progress report from the [Amphibian Survival Alliance](#).

In 2013 the Amphibian Survival Alliance made a bold move to align our vision with that of Target 12—We envision a world in which the extinction of known threatened species of amphibians has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained. Target 12 now underpins our every action as an Alliance.

Over the course of the next two years we will be investing in the conservation of a range of species at priority sites around the world. With the launch of the [Leapfrog Habitat Conservation Fund](#) a multimillion-dollar annual habitat conservation fund, we are now well positioned to help our partners drive forward vital conservation efforts.

In addition to habitat protection the Alliance has been actively fund work to reduce the negative impact of diseases and exotoxins to amphibians and with this being the 50th year of the Red List we are actively fundraising for the upkeep of the amphibians on the Red List while directly supporting the reassessment of species effected by our projects.

Some of our recent achievements towards achieving Target 12 include:

- Remote training on the Red List methodology and associated tools was completed by 23 Amphibian RLA members, 10 interns and two Amphibian RLA institutional partners from 2013 to date.
- To facilitate collaboration between RLA members and the wider herpetological community on the assessment or reassessment of amphibian species, the Amphibian RLA launched a new and improved Amphibian Assessment Forum [online platform](#).
- Last year saw a total of 412 amphibian extinction risk assessments and reassessments submitted and published on the IUCN Red List of Threatened Species. A total of 205 amphibian assessments and reassessments have already been submitted for Red List version 2014
- In May of this year, Guatemala’s National Congress created the Sierra Caral National Protected Area, making it the nation’s first federally protected area to be established in seven years. The core of the new 47,000-acre protected area is the Sierra Caral Amphibian Conservation Reserve. A consortium of more than twenty international conservation organizations raised the funds needed to purchase the original amphibian reserve. Critical support also came from the Amphibian Survival Alliance
- A consortium of partners including the Amphibian Survival Alliance, Rainforest Trust (RT), Global Wildlife Conservation (GWC) and the American Bird Conservancy (ABC) came together to enable local partner Fundación Jocotoco to purchase 6,100 acres of critical wildlife habitat in Antisana, Ecuador. The mammoth property acquisition will create a permanent refuge for three threatened species of frogs from the genus *Pristimantis* found nowhere else and the largest population of Andean Condors in the Northern Andes. The total protected area by this group amounts to approximately 270,000 acres.

You can download the full paper with all updates [HERE](#).

Friends of Target 12 is a partnership of [organizations and institutions](#) which bring their forces together to support countries to achieve Aichi Biodiversity Target 12 by providing practical guidance and raising awareness of initiatives and programs that contribute to the implementation of the activities needed to stem the tide of species’ extinctions.

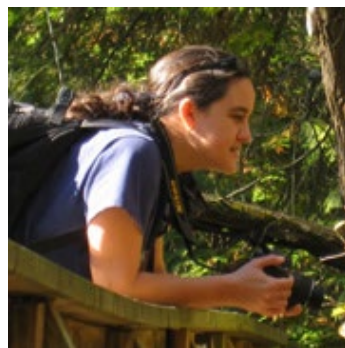
The Amphibian Survival Alliance’s vision is fully aligned with Target 12, and the Alliance is therefore well positioned to help the CBD Parties meet their commitment to saving biodiversity.

By focusing on amphibians, and the sites and habitats upon which they depend, the ASA is working to improve the quality of life for amphibians, for other wildlife (biodiversity) and for people around the world.

ASG Updates: New ASG Secretariat!

By Ariadne Angulo and Phil Bishop

There are some recent and noteworthy news on changes in the Amphibian Specialist Group (ASG) Secretariat. Since mid-June 2014 Ariadne Angulo is now the new Co-Chair of the ASG together with Phil Bishop. Ariadne has been involved with the ASG since its beginning, first as a regular member and then as the Amphibian Red List Authority (RLA) Coordinator (the Amphibian RLA is part of the ASG). Last year Ariadne was elected, together with Co-chair Giuseppe Gagliardi, as regional Co-Chair for Peru. Together, Ariadne and Giuseppe have strived to mobilize the ASG Peru membership and its activities, providing opportunities for capacity building in Red Listing, establishing new partnerships with key Peruvian collaborators, and promoting greater communication among members and more participation in national and international processes in amphibian conservation. Ariadne and Giuseppe have even more plans for ASG Peru, and Ariadne hopes that it may be possible to adapt the model used in ASG Peru in other regions, in addition to creating new models that may be better suited to other realities. Together with Phil Bishop and the ASG team, Ariadne has some major plans for ASG, so please stay tuned for news over the coming months.



ASG Co-Chairs Phil Bishop and Ariadne Angulo.

In addition to Ariadne's appointment, we now have a fantastic team of dynamic and driven ASG Program Officers: Sally Wren, Helen Meredith, and Jos Kielgast.

Sally spent several years working at the Zoological Society of London where she carried out IUCN Red List assessments for the Sampled Red List Index (SRLI), helped develop the EDGE Amphibians project, and spent time managing both the EDGE Fellows Programme and ZSL's Mongolia Programme. Sally has a BSc in Zoology from Imperial College London, an MSc in Conservation from University College London, and is currently working on a PhD at the University of Otago, which focuses on improving conservation methods for the native New Zealand frogs (*Leiopelma* spp.).

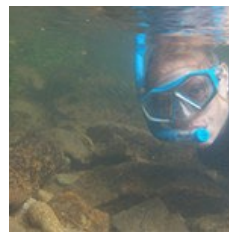
Helen Meredith is currently working towards her PhD, which investigates ways of improving the impact of amphibian conservation, and is currently based at ZSL's Institute of Zoology, UCL and the Durrell Institute of Conservation and Ecology. She spent five years developing and coordinating the EDGE Amphibians Programme at ZSL, and continues to play an active role in conservation programs globally and awareness-raising activities that promote understanding of amphibians and their plight.

Jos Kielgast is a PhD student at the University of Copenhagen at Section for Freshwater Biology and Centre for Macroecology, Evolution and Climate. His research has focused on the epidemiology

of amphibian chytridiomycosis in Africa and Europe, biodiversity and systematics of amphibians in Central Africa and more recently developing new approaches for studying aquatic biodiversity based on environmental DNA analysis on water samples.

ASG, however, would not be here today had it not been for the key people who made it possible in the first place. Claude Gascon's leadership as Co-Chair since the ASG's inception has led to landmark contributions to international amphibian conservation, such as the significant fundraising efforts for the Global Amphibian Assessment (GAA), the merger between the Global Amphibian Specialist Group (GASG) with the Declining Amphibian Population Task Force (DAPTF), which led to the current ASG, the realization of the Global Amphibian Conservation Summit, the publication of the resulting Amphibian Conservation Action Plan, and the implementation of important field projects. Robin Moore and James Lewis, previous ASG Program Officers, were also key in developing ASG. Robin has been instrumental in the former ASG habitat protection program (now under the Amphibian Survival Alliance, ASA), as well as in the initial development of *FrogLog*, and the concept was later scaled up and amplified significantly by James Lewis. As many of you know, James has galvanized ASG over the last couple of years, and has brought much dynamism to the group with his many achievements. Fortunately for us Claude, James and Robin will all remain involved with amphibian conservation in their new roles within the ASA.

The ASG Secretariat has some big shoes to fill. However, it stands on the shoulders of giants, and it is confident that together, as a group, ASG will continue to develop as the go-to network for science for amphibian conservation. We hope that you, amphibian conservation biologists, can join ASG in this exciting journey!



ASG Program Officers: Helen Meredith, Jos Kielgast and Sally Wren.

WHAT IS THE LINK BETWEEN ASG AND ASA?

The IUCN SSC Amphibian Specialist Group (ASG) is the world's largest global network of the leading amphibian experts focused on amphibian conservation and providing scientific guidance to the Amphibian Survival Alliance (ASA), the world's largest partnership dedicated to amphibian conservation worldwide and whose focus is to implement global conservation action.

ASG Working Groups Update

By Sally Wren

In mid-2013 the Amphibian Specialist Group, in partnership with the Amphibian Survival Alliance, initiated a number of thematic Working Groups to review efforts and research since the publication of the Amphibian Conservation Action Plan (ACAP), and to identify priority actions in each discipline, with the broader aim of moving forward as a community in addressing global amphibian conservation challenges.

Each Working Group has been asked to develop a vision for the future, to discuss what obstacles stand in the way of achieving that vision, and then to develop a series of priority actions necessary to overcoming those obstacles. These priority actions will provide a framework for the Amphibian Survival Alliance (ASA), as well as guidance to conservation practitioners and researchers worldwide as to where the highest priorities currently lie.

As we receive results back from the Working Group discussions it is clear that some challenges are common across disciplines, with it necessary to address capacity building, specific research gaps, and lack of funding in many areas. However, each group also has unique problems to tackle, for example the Reintroductions group discussed how to solve the lack of appropriate release sites for threatened species which may already occupy all of the available favourable habitat, and the Habitat Protection group identified the need to develop a clear definition of a 'critical habitat' for amphib-

ians and establish a fund for habitat conservation. However, once these issues are addressed there will no doubt be knock-on effects that will help improve amphibian conservation across all themes.

The ASA is already working to implement some of the priority actions identified by the working groups. At the end of last year the Alliance launched the Leapfrog Conservation Fund which is now a multimillion dollar annual fund for habitat conservation and are working with partners to develop a system of Important Amphibian Areas to help better define those critical habitats. Two of the priority actions to come out of the Communication & Education group discussions were the need to provide more engaging and positive stories about amphibians, and the need to increase efforts to engage youth and citizen scientists. The ASA have already brought on board several partners to focus on this area, have increased positive stories on the blog, and we recently saw the launch of FrogLog Jr, all of which will help with addressing these issues.

The outputs from each Working Group are being presented on the [ASG website](#) as a 'living document'. This will make it easier to incorporate regular updates with advances in research and ongoing conservation activities, and to keep up momentum with implementing these actions, which are critical for amphibian conservation worldwide.



New ASA Seed Grants—APPLY NOW!

It is with great pleasure and excitement that we announce the first round of ASA Seed Grants. Seed Grants for amphibian conservation, research and education go back a long way through the history of the IUCN SSC Amphibian Specialist Group (ASG) and the Declining Amphibian Populations Task Force (DAPTF) so we are pleased to be able to continue this tradition of providing small grants for start up projects. Seed Grants are designed to enable our growing community to try new and innovative approaches to the myriad threats facing amphibians today. Grants will be awarded in the region of USD\$500-\$1,000 and we are hoping to have four calls for applications each year.

For this round of Seed Grants we are looking for projects aiming to address threats to habitat degradation. Applications should be sent to grants@amphibians.org outlining the following:

- Title
- Project lead and team
- Partner organizations (Please indicate if any organizations are registered partners of the ASA)
- Target species
- Brief project description indicating how you think this project might positively benefit amphibians (500 words)
- Budget

Initial funding for this program has been sourced from a number of individual donors and we are hoping to be able to increase the support for this program with your help. If you are interested in supporting the Seed Grant program please visit our [support page](#) or contact us directly.

For anyone interested in establishing a Seed Grant in their name, an organization's name or on behalf of someone else please contact James Lewis at jplewis@amphibians.org.



Report on Amphibian Red List Authority Activities April-July 2014

By Ariadne Angulo and Jennifer Luedtke

The IUCN SSC Amphibian Red List Authority (Amphibian RLA) has been rather busy over the last three months. We are happy to report that a total of 204 amphibian assessments and reassessments were published in IUCN Red List version 2014.1! While this is good news as compared to previous years, the number of assessments that need to be reassessed by the end of 2014 is well over 3800, in addition to the over 800 newly described species that need to be assessed for the first time. Given the need for increased resources, the Amphibian RLA has been exploring online crowd-funding options and has recently launched its first public online crowd-funding campaign, *Keep Madagascar Hopping!* This campaign was designed to support the first-time assessment of newly described Malagasy amphibian species since 2007, in the hopes of getting these species assessed in the context of the second meeting of A Conservation Strategy for the Amphibians of Madagascar (ACSAM 2), to be held in Centre Valbio, Parc National de Ranomafana, Madagascar in November this year. The campaign closed on July 22, 2014.

In partnership with Detroit Zoological Society (DZS), the Amphibian RLA has initiated the reassessment process of Amazonian amphibians, which comprise a substantial proportion of amphibian species richness in South America. The Amazon's amphibian species richness is increasing as cryptic species are identified and described. These newly described species also need to be assessed making the Amazon a region that requires additional attention. DZS has kindly agreed to spearhead this process and has started with Least Concern (LC) species, with the goal of addressing species sequentially by extinction risk category. A call was sent out to

Amazonian amphibian experts specifically for contributions for LC species, with a closing date of July 18, 2014.

The Colombian Amphibian RLA has recently launched its online forum to reassess the [extinction risk of Colombian amphibians](#). In addition, the Amphibian RLA hopes to roll out other forums in the coming weeks/months. Announcements relating to these other forums will be made in due course.

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

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Amphibian RLA Central Coordination Team



Working Together to Make a Difference: ASA and Liquid Spark Partner to Protect Wildlife Habitat and Watersheds

Liquid Spark, Inc. and the Amphibian Survival Alliance (ASA) have teamed up under 1% for the Planet to increase frontline support for amphibians and their habitats worldwide. The driving force behind ASA's newest partnership with 1% for the Planet business member Liquid Spark is the connection between amphibian conservation and watershed and water resource protection. The ASA's approach to amphibian conservation not only has a direct link to conserving some of the most **biologically diverse and critical areas in the world**, but also has additional benefits for safeguarding an array of ecosystem services for people.

It's these benefits that make ASA a natural partner for Liquid Spark. Liquid Spark is a strategic marketing agency for the outdoor adventure industry based in Bryson City, North Carolina. Their mission is to create practical marketing that inspires adventure, action, and stewardship of people, place, and planet. They are avid outdoor enthusiasts and advocates for adventure-based recreation that supports and protects sustainable communities, wilderness areas and watersheds for current and future generations. Liquid Spark's President & Founder is also an AdventureEDU Educator for the Adventure Travel & Trade Association, helping to train adventure operators, tourism agencies, and government organizations in emerging destinations in effective adventure marketing.

"Apart from their ecological importance, amphibian species such as frogs and salamanders are woven through our cultural fabric the world over. They represent the diverse natural world of beauty and wonder we enjoy," says James Lewis, Director of Operations for the Amphibian Survival Alliance.

Despite the importance of amphibians and the places they are found, almost half of the world's 7,000 amphibian species are in decline, and this is set to rise as the destruction of their habitats continue. The ASA is the largest partnership in the world working to save amphibian species in the wild. Success to date has been dependent on the partners that make up the ASA.

By joining the ASA as a Strategic Partner, Liquid Spark's 1% donation will support international amphibian conservation efforts as well as create seed grants for amphibian and habitat conservation work near Liquid Spark's home in the Great Smoky Mountains. This region is a **hot spot for salamanders** where almost half of the salamander species in North America are found. **ASA seed grants** are a powerful mechanism for kick-starting research and conservation programs that often develop into larger or longer-term projects.

"It is really important to us to be part of the solution for protecting the environment and educating people about the critical dependencies between ecosystem health and humans' health. ASA is a proven leader in protecting

amphibian habitat and watersheds that can double the impact of our 1% for the Planet donation all while enabling us to target local environmental projects to protect rare salamander species in our own backyard of the Great Smoky Mountains," says Julie Thorner, President and Founder of Liquid Spark.

Liquid Spark serves for profit adventure companies and offers discounted agency services to a select group of non-profit organizations that align with the Liquid Spark mission. Liquid Spark's marketing and media services include Strategic Marketing, Search Marketing, Email Marketing, Print & Graphic Design, Social PR, and Education & Training.

Internationally, ASA also administers a million dollar fund for habitat protection called the **Leapfrog Conservation Fund**. Over 800 threatened amphibian species are afforded no protection at all since they are found solely outside protected areas. The fund harnesses a rare opportunity for conservation. Many of these species live within very restricted geographic ranges or even within a single locality. Entire species can be safeguarded through the strategic protection of core habitat.

By protecting key habitats and empowering local communities, entire species can be saved from impending extinction with relatively modest and focused investments. Through this fund, the ASA provides the financial support necessary to allow local organizations to purchase and manage these critical lands.

The new partnership between Liquid Spark and the Amphibian Survival Alliance will have a meaningful impact on amphibian conservation in the U.S. and abroad.



© Robin Moore

A man farms seaweed near Port Salud on the Tiburon peninsula, Haiti. Photo: Robin Moore.

Threatened Frogs Protected Alongside Andean Condors by Vast New Protected Area Around Antisana Volcano, Ecuador

By Joe Lowe

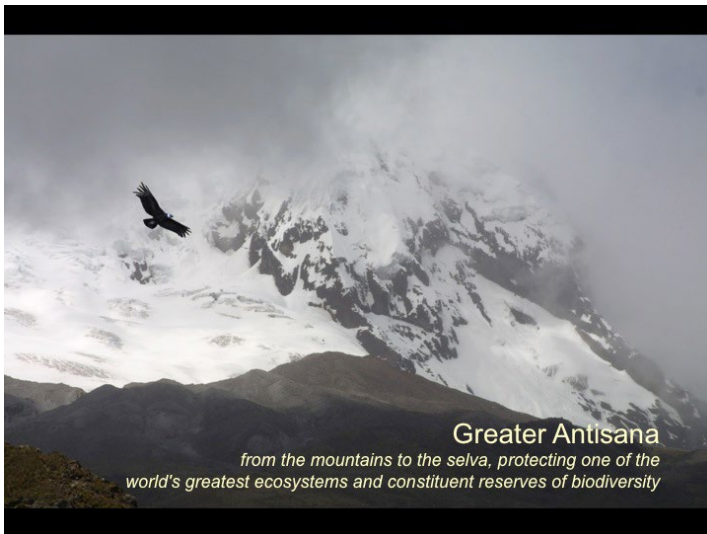


Photo: Larry Wan.

A consortium of partners including the Amphibian Survival Alliance, Rainforest Trust (RT), Global Wildlife Conservation (GWC) and Ecuadorian environmental authorities have come together to purchase more than 270,000 acres of critical wildlife habitat in Ecuador. The mammoth property acquisition, which includes the 18,714-foot Antisana Volcano, will create a permanent refuge for three threatened species of frogs from the genus *Pristimantis* found nowhere else and the largest population of Andean Condor in the Northern Andes.

The final 6,100 acre property, called Hacienda Antisanilla, was acquired to complete a project by international partners, Fundación Jocotoco, the Municipality of Quito and the Quito Water Authority in a coordinated effort that will both protect endangered species and secure an important source of drinking water for Ecuador's capital city.

"The purchase of multiple properties around Volcan Antisana



San Lucas Marsupial frog (*Gastrotheca pseustes*). Photo: Jocotoco.

represents one of the greatest conservation victories ever in the Andes of South America," said Dr. Robert Ridgely, President of Rainforest Trust and a driving force behind this conservation success. "The final acquisition of Hacienda Antisanilla caps a decade-long effort by Rainforest Trust and our Ecuadorian partner Fundación Jocotoco to protect this fragile and biodiverse ecosystem. We are grateful to all of the partners, organizations and donors who made this possible, including The Paul G. Allen Family Foundation, who provided critical support to acquire the Hacienda Antisanilla property."

"The purchase of Hacienda Antisanilla was critical, as this property held the most important site for roosting and nesting Andean Condors – Ecuador's National bird and emblazoned on our national flag," noted Fundación Jocotoco Executive Director Rocío Merino. "So after years of struggling, we were able to purchase and protect the area thanks to the constant support of Rainforest Trust and Quito authorities."

"The Paul G. Allen Family Foundation supports the important work of conservation to preserve the rich biodiversity of the Northern Andes," said Susan M. Coliton, vice president of The Paul G. Allen Family Foundation. "We saw that the Hacienda Antisanilla property was critical to protecting this population of Andean Condors and were encouraged by the effective cooperation between the conservation effort and the local authorities. We are pleased to have been a part of this successful and important initiative."

The glaciers of the 3.5 mile high Antisana Volcano give way to unique highland steppe and descend into lush subtropical forests on the Andean slopes and into Amazonian rainforest. Located just 20 miles from Quito, this enormous but undeveloped area first attracted the attention of conservationists in the 1980s. The Ecuadorian government declared it an ecological reserve in 1993, but the area remained in private hands. Much of the land continued to be farmed, and wildlife was increasingly threatened by over-grazing, fires and poaching.

Now the mosaic of alpine grasslands, rugged canyons and tropical forests has been purchased and will enjoy strict protection within the Antisana Ecological Reserve, forming one of the greatest protected areas in the Tropical Andes.

Home to the largest single population of condors in the Northern Andes, Antisana is also frequented by Cougars, Spectacled bears and the endangered Woolly tapir. Antisana is of critical global importance for biodiversity and highlighted as an Alliance for Zero Extinction site due to the presence of no less than three species of threatened frogs—*Pristimantis acerus*, *Pristimantis ignicolor*, and *Pristimantis lividus*—which are found nowhere else. Sadly the Jambato toad (*Atelopus ignescens*), once common in Antisana, has already gone extinct. In June of this year, the endangered San Lucas Marsupial frog *Gastrotheca pseustes* was discovered within the Antisanilla property.

All the properties purchased will be improved by the removal of cattle from the fragile native grassland called "Páramo," while park guards will patrol the area to curtail poaching.

"This enormous land protection project is even more significant

as not only does it help to protect the most critical source of water for the ever-expanding city of Quito but it also connects to two adjacent protected areas, Cayambe-Coca Ecological Reserve and Gran Sumaco National Park,” said Dr. Paul Salaman, CEO of Rainforest Trust, “Combined, these protected areas safeguard 1.8 million acres of biologically diverse Andean and Amazonian ecosystems.”

“The Andes are a global biodiversity hotspot, and the new reserve will help conserve a key ecosystem with species found nowhere else in the world. The project highlights the importance of collaboration among local organizations, government agencies, and international NGOs,” said Dr. Don Church, President of GWC.

This land purchase project was made possible by the efforts of the Paul G. Allen Family Foundation, Fundación Jocotoco, Rainforest Trust, Ministry of Environment, the Quito Municipality, the Quito Water Authority (EMAAP), the Quito Water Fund (FONAG), EcoFondo, American Bird Conservancy, Blue Moon Foundation, Global Wildlife Conservation, Andrew Sabin Family Foundation, March Foundation, and private donors.

Ridgely one of Jocotoco’s founders, adds. “I am grateful to one and all. This surely is the most exciting moment in my conservation career.”

We are very grateful for the support of many Ecuadorian and in-



Photo: Jocotoco.

ternational organizations and donors to make this dream a reality, including the Anadel Law; Andrew Farnsworth; Amphibian Survival Alliance; American Bird Conservancy; Andrew Sabin Family Foundation; BirdLife International; Blue Moon Fund; Butler Foundation; Cabañas San Isidro; Centro de Rescate Ilitio; Conservation International; EcoFondo; Empresa Municipal de Alcantarillado Agua Potable; Estación Científica Yanayacu; Estudio Jurídico Gallegos y Asociados; Familia Vallejo, Hacienda Guáybara; Fundación Jocotoco; James & Ellen Strauss; Juan Kohn; Global Wildlife Conservation; Grupo Nacional de Trabajo del Condor Andino; Larry Thompson; Leapfrog Conservation Initiative; Marybeth Sollins; March Foundation; Ministerio del Ambiente, Government of Ecuador; Ministerio del Turismo, Government of Ecuador; Municipio de Quito; Museo Ecuatoriano de Ciencias Naturales; Nature and Culture International; Parque Zoológico de Guayllabamba; Paul G. Allen Foundation; Rainforest Trust; Robert & Peg Ridgely; Sally Davidson; Sangreal Foundation; The Butler Foundation; The Bobolink Foundation; The March Foundation; The Nature Conservancy; The Peregrine Fund; The Robert W. Wilson Charitable Trust, and many more supporters.

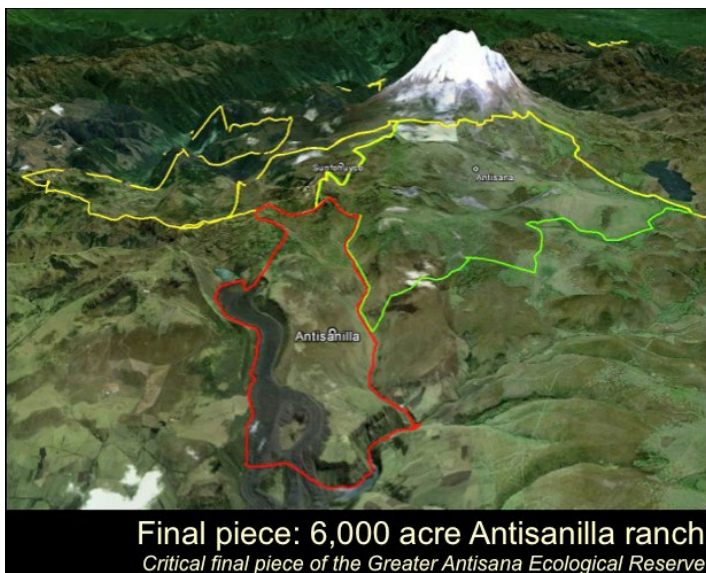


Photo: Jocotoco.

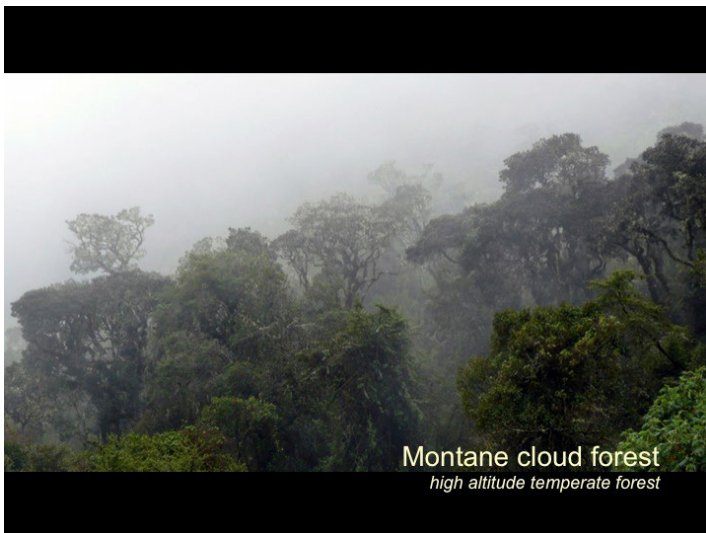


Photo: Jocotoco.

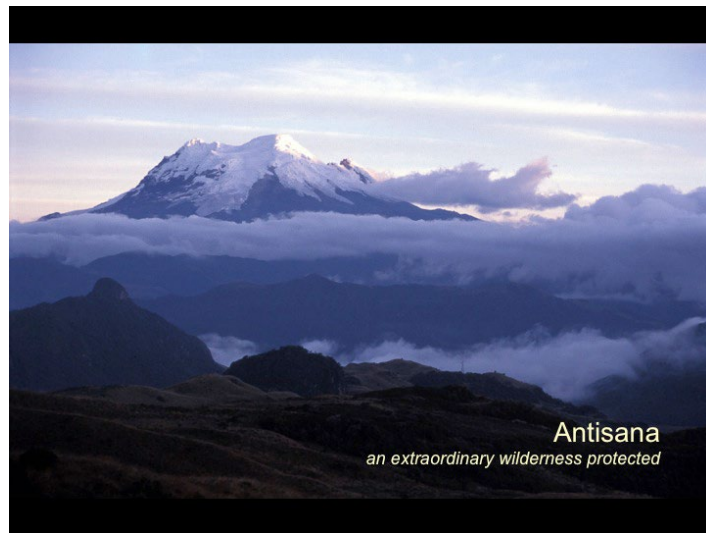


Photo: Jocotoco.

Guatemalan Government Creates 47,000-acre Sierra Caral Protected Area

By Joe Lowe



Robin Moore

Waterfall at Las Escobas, Cerro San Gil, Guatemala. Photo: Robin Moore.



Robin Moore

Guatemala. Photo: Robin Moore.

Guatemala's National Congress created the Sierra Caral National Protected Area on May 13, making it the nation's first federally protected area to be established in seven years. The core of the new 47,000-acre protected area is the Sierra Caral Amphibian Conservation Reserve which local conservation partner FUNDAECO created in 2012 with the support of more than twenty international conservation groups including Global Wildlife Conservation, Rainforest Trust, the Amphibian Survival Alliance, Neotropical Migratory Bird Conservation Act, International Conservation Fund of Canada, American Bird Conservancy and Conservation International.

"This area will fill an important conservation gap in the Guatemalan system of protected areas, and will ensure the conservation of many endemic and endangered amphibians in this globally recognized Alliance for Zero Extinction site," said Marco Cerezo, Director General of FUNDAECO.

"The Sierra Caral National Protected Area was created with the overwhelming support of Guatemala's National Congress, with eighty-four percent of Congress voting in favor. The new protected area, which is nearly eight times the size of the original reserve, will provide additional legal protection and long-term sustainability for the reserve," commented Dr. Don Church, Global Wildlife Conservation's President and Director of Conservation.

The Sierra Caral is home to unique and threatened plants and animals found nowhere else on the planet, and its forests are an important part of the Mesoamerican corridor that allows jaguars and other animals to migrate between the American continents. Furthermore, these mountains hold the headwaters to rivers that local communities depend on and the forests offer protection against landslides that pose a great risk to people in the region. The protection of the Sierra Caral by the Government of Guatemala heralds a bright future for the people and wildlife of this region.

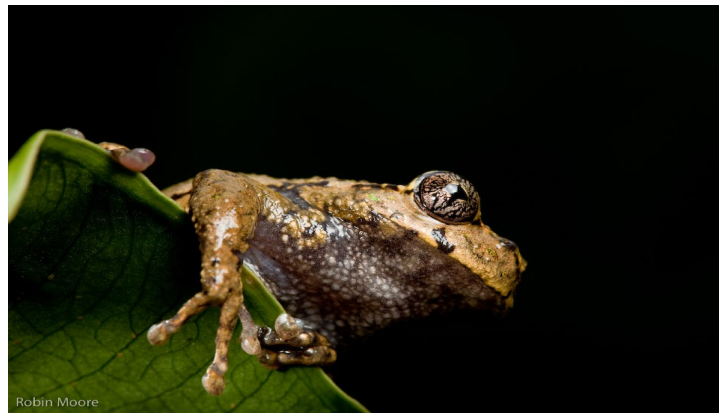
"This accomplishment highlights the fact that our work doesn't end with land purchase, rather it is the beginning of a process to ensure the land is permanently protected" noted Dr. Paul Salaman, CEO of Rainforest Trust. "Our Guatemalan partner FUNDAECO has achieved an outstanding success that will securely protect one of our planet's most biodiverse areas."

The Sierra Caral, an isolated mountain range near Guatemala's Caribbean coast, is not only home to many endemic species, but is also a natural corridor and meeting place for many North and South American species.

The protected area provides habitat for a dozen globally threatened amphibians – five found nowhere else in the world – and three species of threatened birds. Scientific explorations in the Sierra Caral have resulted in discoveries of new beetle, salamander, frog and snake species.

Over the last 20 years, however, rampant clear-cutting has led to the loss of critical wildlife habitat in the Sierra Caral and reduced populations of local species. The protected area, which contains the last stands of primary forest found in the Sierra Caral, will protect some of the best remaining habitat in eastern Guatemala for jaguars, pumas and threatened species.

In a letter to FUNDAECO's partners Cerezo wrote, "I sincerely thank you for all the support that you have given us over the past few years, in order to achieve this exciting conservation outcome for Guatemala, Central America, and the whole planet!"



Robin Moore

Plectrohyla sp., Guatemala. Photo: Robin Moore.

Calling all young frog fanatics!



summer 2014

FROGLOG^{JR}

www.amphibians.org



Click here to download your FREE copy of FrogLog Jr today!

It's filled with fun facts, action-based activities & inspiring stories from young leaping leaders who support amphibian conservation!

The Planet Needs More Superheroes!

By Avalon Theisen and Kerryon Vaughan

Do we really need more superheroes? Yes we do, according to author Kerryon Vaughan. "This planet really needs people who will stand up and do their best to make the world a better place, and it seems young people are definitely up for the challenge."

Kerryon has just released her new book "Magnificent Kids!"—23 Superheroes who are changing the world, now it's your turn." The book showcases young people who have founded projects that really are making a difference for humanity, animals or the planet. Incredibly, all of the kids started their projects at very young ages. Featured in "Magnificent Kids!" is one local hero, Avalon Theisen who explains how her project is contributing to a kinder world.

"When I was 8, I started taking herpetology classes with Mr. George L. Heinrich of Heinrich Ecological Services. I am home-schooled, so that means my education is based out of my home, but my classes are everywhere on Earth. If I could, I would take a class on a different planet, too! I also started going to frog listening workshops and learning to be a citizen scientist who identifies frogs by their sounds and reports on them. I have learned that some frogs are an important indicator species. If an area has lots of native frogs, then it is probably healthy. But if the native frogs are disappearing or dying out, then there is a problem. Unfortunately, frogs are disappearing world-wide.

I already had a connection with the natural world, but this information inspired me with an idea of how I could help people connect more effectively with the environment. After taking citizen science classes at Camp Bayou Outdoor Learning Center when I was 9 years old, I was given the chance to pick my favorite topic to share with people at an event. Of course, I chose frogs. Frogs are everywhere in the world, except for Antarctica, and even when you cannot see them, you can hear them. There are lots of small ways for people to help frogs and when we help frogs, we are helping the environment.

I kept going to frog listening workshops, and taking herpetology, conservation and nature classes. I still do all of these things and continue to learn skills which help me to share information with others. After I had my first frog booth, I was invited to a school to give my first PowerPoint presentations. Since then, I have shared information and ideas to help thousands of people, through my interactive booths, presentations, listening hikes and events. With the help of many volunteers, I planned and ran Save the Frogs Day events in 2011, 2012 and 2013 in the Tampa, Florida area. Save the Frogs Day is an international day of amphibian conservation and awareness and was started by the organization SAVE THE FROGS! It is held on the last Friday of every April. Events are independently planned worldwide. In 2010, I wrote a speech about Save the Frogs Day to share with my nature class.

Recently, Conserve It Forward joined the world's largest partnership for amphibian conservation, the [Amphibian Survival Alliance](#). I am currently working with the editors of *FrogLog*, an amphibian conservation publication, to create *FrogLog Jr*, which will be aimed at school-aged children. *FrogLog Jr* will include positive amphibian conservation stories, fun amphibian facts, activities for kids and students, conservationist profiles, ways you can take action and so much more! More information can be found at <http://www.amphibians.org/froglogjr/fljr001>.

I think all living things are connected from the start, and I think it is very unfair and sad that humans seem to lose their connection with nature, something other species do not seem to do. When people do not believe they are part of the environment, and when they do not think what happens in the natural world affects them, injustice occurs for all living things. The natural world deteriorates and so do people. I help reconnect people and the environment, usually through frogs.

I think of frogs and other non-humans as people, too. I feel sad that their homes are destroyed by someone of my species. The human nature disconnection is the cause of many species disappearing and being imperiled. Because of this, I promised I would do something to help.

I think everyone should feel they are truly interconnected with other living things and the environment. When people feel that connection, they want to help the world and the life in it, not destroy it. A stronger connection means a better life for all living things on Earth.

My project connects people and the environment, a lot of times through frogs. I share information almost daily on social media and the Internet and many times, that information is educational and about a variety of environmental subjects.

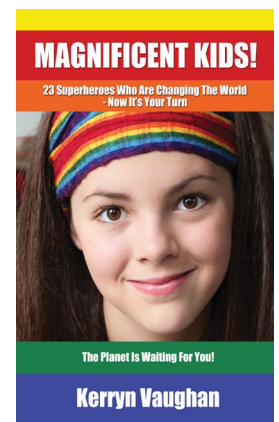
When I do a booth or presentation, it may be at a classroom, church, all adult professional conference, nature preserve or community event. My goal is for people to leave feeling empowered and inspired to act and also to feel more connected to all living things on Earth.

"Care Cans" is a Conserve It Forward project I started in 2013. Each Care Can is filled with messages about nature and artwork from people around the world. The Care Cans go to people who are not able to get outside in nature for a long period of time for some reason. Anyone may recommend somebody to receive a Care Can and they go to individuals who are in and out of hospitals, nursing homes and care centers.

My global vision is for all living things to live sustainably and at one with the Earth. We were born with a connection with nature, not a separation from nature. My dream is for everyone to respect each other and their different beliefs and uniqueness. We are all individuals that are part of one Earth.

The most important thing is to find something you love, and then act on it. Do something to make a positive difference in that area. Make sure to share your project with others and encourage them to help or to make their own positive difference. Doing good and being kind is healthy for everyone."

So it seems Kerryon just might be right, and more superheroes is exactly what we need. You can find out more about Avalon at www.conserveitforward.org, and if you're ready for an amazing journey filled with inspiration, 'Magnificent Kids!' the book is now available through [Amazon](#), or put on your cape and mask and head over to www.magnificentkids.com.au and perhaps you too can save the planet!



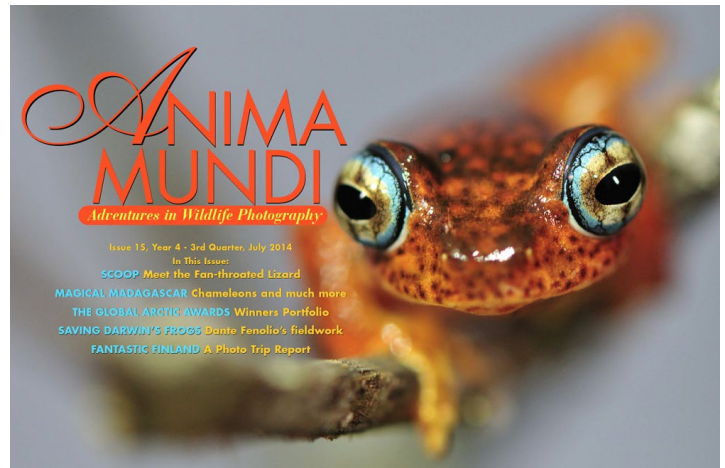
Anima Mundi—Adventures in Wildlife Photography Issue 15, July 2014 is now Out!

By Andrea Ferrari

We are chiming in to let you know that Issue 15, July 2014, of our free online magazine ANIMA MUNDI—Adventures in Wildlife Photography is now out and ready for downloading or [simple online browsing](#), if you prefer.

Contents of our latest issue include a wonderful photo-report from India on the tiny and often overlooked—but really beautiful—Flap-necked lizard *Sitana ponticeriana*, the first part of our extensive and richly illustrated trip report on our herpetological (and not only!) expedition to the fabled island of Madagascar, a truly dazzling photo gallery of the winning images from the Global Arctic Awards international competition, the first of our new Fieldwork essays with a detailed report on the amazing work done by researcher and conservationist Dante Fenolio to save the endangered amphibians of Chile and—finally—a beautiful Trip Report from the forests of Finland by Italian photographer Guido Muratore.

Also, don't miss our NEW feature—all ANIMA MUNDI published articles are now available in hi-res pdf format as single posts on our [website](#) for easier downloading and browsing!



Recent Record of an Uncommon Endemic Frog *Nanorana vicina* (Stolickza, 1872) from Murree, Pakistan

By 'Muhammad Rais

Murre hill's frog (*Nanorana vicina*) is one of the least studied anurans of South-east Asia. The species is also under-represented in the global amphibian literature. Since its first report and description in 1872, it has never been collected and described from its type locality viz. Murree, Punjab, Pakistan. In an attempt to document anuran fauna of North Punjab, a group of post-graduate students and herpetologists from Wildlife Management department, PMAS-Arid Agriculture University Rawalpindi, Pakistan, recorded two specimens of *Nanorana vicina* from a spring pool in Aliot village (N 33°, 56.154'; E 73° 27.001). Rais *et al.* (1) have presented data on morphometric measurements, habits, ecology and conservation status of the species.

References:

1. Rais M. *et al.* 2014. Rediscovery of an uncommon endemic frog *Nanorana vicina*. J. Anim. Pla. Lahore 24(2): 455.



Murre hill's frog (*Nanorana vicina*). Photo: Muhammad Rais.

¹Lecturer, Wildlife Management, PMAS Arid Agriculture University Rawalpindi, Pakistan.

Global *Bd* Mapping Project: 2014 Update

By Deanna H. Olson and Kathryn L. Ronnenberg

World scientists continue to advance knowledge of the ecology and impact of *Batrachochytrium dendrobatidis* (*Bd*) infection of amphibians. In 2007, we began mapping *Bd*'s global occurrence to aid the science and management of this infectious disease. We continue to compile global occurrence data, and we are pleased to continue working with our partners Dr. David Aanensen and Mat Fisher at Imperial College, London, UK, who lead management of the interactive website *Bd*-maps.net (Olson et al. 2013). Herein, we provide a brief update of the taxonomic and geographic patterns of our global dataset as of June 2014.

Taxonomy in this summary follows Amphibian Species of the World 6.0 (Frost 2014). Species and country counts as of June 2014 include species from published locations that may not yet be shown on the maps. Maps presented here may be downloaded for your use at: <http://www.fs.fed.us/pnw/lwm/aem/people/olson.html>. Our newly compiled data are not yet available at *Bd*-maps.net, and are intended to be uploaded there later this year as part of a larger website upgrade.

Taxonomic Patterns: To date, *Bd* has been detected in 695 of 1,377 (50%) amphibian species sampled (Table 1). In February 2011, our data compilation showed that *Bd* was detected in 508 of 1,055 (48%) species sampled (Table 2), hence over the last three years we have accrued knowledge of *Bd* detections in 187 of 322 (58%) additional species. Patterns of both sampling and infection are apparent by amphibian family (Table 3). More extensive sampling among the Gymnophiona has occurred since 2011, and caecilians have been observed with active, fatal chytridiomycosis (Gower et al. 2013).

Among salamanders, 96 plethodontids have been sampled, with *Bd* occurrence in 48% of species. Of anuran families with over 100 species sampled, *Bd* occurrence is highest in hylids (60% of 188 species), ranids (59% of 114 species) and craugastorids (57% of 102 species), and is lower in bufonids (44% of 135 species).

We are tracking changes in amphibian taxonomy. The total numbers of species and families have changed since 2011, and consequently direct comparisons with some of our previously reported family patterns (Olson et al. 2013) may be difficult. Family taxonomy has changed not only in number but in combination—the Strabomantidae have been merged back into the Craugastoridae, the Leiuperidae back into the Leptodactylidae; the Telmatobiidae have been split off from the Ceratophryidae, the Odontophrynidae from the Cycloramphidae and the Ascaphidae from the Leiopelmatidae. In addition, several very small families have been established; many of the as-yet-unsampled families are among these, and no major taxon of Anura remains unsampled for *Bd* (Table 3). Some larger families have limited sampling. Among anurans, there is relatively limited sampling in the Microhylidae (42 of 554 species, 7.6%) and Rhacophoridae (35 of 370 species, 9.5%). Among salamanders, we are not aware of *Bd* testing in Rhyacotritonidae, and only a few Hynobiidae have been sampled; one family of caecilians remains entirely unsampled, and only a few species have been sampled in other caecilian families, such as the Ichthyophiidae, the largest family, in which 3 of 55 species have been tested for *Bd*.

Table 1. Global compilation of *Batrachochytrium dendrobatidis* (*Bd*) detections in amphibians as of 10 June 2014.

Order	No. Species with <i>Bd</i> Detected	No. Species Tested	Species Prevalence (%)	Total Species	No. Families with <i>Bd</i> Detected	No. Families Tested	Family Prevalence (%)	Total families
Anura	600	1194	50.2	6,386	41	49	83.7	55
Caudata	88	159	54.8	674	7	8	87.5	9
Gymnophiona	7	24	29.2	200	4	9	44.4	10
Total	695	1,377	50.4	7,260	52	66	78	74

Table 2. Global compilation of *Batrachochytrium dendrobatidis* (*Bd*) detections in amphibians as of 4 February 2011.

Order	No. Species with <i>Bd</i> Detected	No. Species Tested	Species Prevalence (%)	No. Families with <i>Bd</i> Detected	No. Families Tested	Family Prevalence (%)
Anura	449	935	48.0	35	40	87.5
Caudata	59	114	51.7	6	8	75
Gymnophiona	0	6	0	0	2	0
Total	508	1,055	48.2	41	50	82

Table 3. *Batrachochytrium dendrobatidis* (Bd) occurrence patterns by amphibian family.

Anura	No. Species with <i>Bd</i> Detected	No. Species Tested	Species Prevalence (%)	Total No. Species in Family
Allophrynidae				3
Alsodidae	0	6	0.00	29
Alytidae	6	9	0.67	12
Aromobatidae	7	9	0.78	117
Arthroleptidae	7	37	0.19	145
Ascaphidae	1	2	0.50	2
Batrachylidae	2	4	0.50	14
Bombinatoridae	4	5	0.80	7
Brachycephalidae	1	1	1.00	54
Brevicipitidae	0	6	0	33
Bufonidae	60	135	0.44	577
Calyptocephalellidae	1	1	1.00	5
Centrolenidae	11	17	0.65	148
Ceratobatrachidae	0	3	0	86
Ceratophryidae	6	6	1.00	12
Ceuthomantidae				4
Conrauidae	0	2	0	6
Craugastoridae	58	102	0.57	728
Cycloramphidae	3	4	0.75	36
Dendrobatidae	16	23	0.70	183
Dicroglossidae	13	27	0.48	182
Eleutherodactylidae	26	41	0.63	206
Heleophrynidae	5	5	1.00	7
Hemiphractidae	8	10	0.80	104
Hemisotidae	0	2	0	9
Hylidae	113	188	0.60	941
Hylodidae	10	11	0.91	42
Hyperoliidae	32	72	0.44	218
Leiopelmatidae	1	3	0.33	4
Leptodactylidae	20	31	0.64	201
Limnodynastidae	14	21	0.67	43
Mantellidae	0	60	0	206
Megophryidae	4	13	0.31	183
Micrixalidae	0	1	0	26
Microhylidae	10	42	0.24	554
Myobatrachidae	21	37	0.57	89
Nasikabatrachidae				1
Nyctibatrachidae	1	1	1.00	29
Odontobatrachidae				1
Odontophrynidae	3	4	0.75	52
Pelobatidae	3	3	1.00	4
Pelodytidae	0	1	0	3
Petroedetidae	2	5	0.40	12
Phrynobatrachidae	5	19	0.26	87
Pipidae	10	16	0.62	33
Ptychadenidae	6	16	0.38	55
Pyxicephalidae	16	24	0.67	78
Ranidae	67	114	0.59	359
Ranixalidae	1	5	0.20	10

Anura	No. Species with <i>Bd</i> Detected	No. Species Tested	Species Prevalence (%)	Total No. Species in Family
Rhacophoridae	18	35	0.51	370
Rhinodermatidae				3
Rhinophrynidae	0	1	0	1
Scaphiopodidae	1	6	0.17	7
Sooglossidae				4
Telmatobiidae	6	7	0.86	61
Total Anurans	600	1194	0.502	6,386

Caudata	No. Species with <i>Bd</i> Detected	No. Species Tested	Species Prevalence (%)	Total No. Species in Family
Ambystomatidae	14	19	0.74	37
Amphiumidae	2	3	0.67	3
Cryptobranchidae	3	3	1.00	4
Hynobiidae	0	9	0	61
Plethodontidae	46	96	0.48	444
Proteidae	3	3	1.00	7
Rhyacotritonidae				4
Salamandridae	17	22	0.77	110
Sirenidae	3	4	0.75	4
Total Caudata	88	159	0.553	674

Gymnophiona	No. Species with <i>Bd</i> Detected	No. Species Tested	Species Prevalence (%)	Total No. Species in Family
Caeciliidae	0	4	0	42
Chikilidae				4
Dermophiidae	2	3	0.67	14
Herpeliidae	2	3	0.67	9
Ichthyophiidae	0	3	0	55
Indotyphlidae	1	1	1.00	21
Rhinatremaidae	0	2	0	11
Scolecomorphidae	2	3	0.67	6
Siphonopidae	0	4	0	25
Typhlonectidae	0	1	0	13
Total Gymnophiona	7	24	0.29	200

Of the 1,377 tested species, 322 (23.4%) are considered Threatened by the IUCN Red List of Threatened Species (falling in the Vulnerable, Endangered or Critically Endangered categories), while an additional 104 are classed as Near Threatened, and 49 as Data Deficient. *Bd* was detected in 159 of the Threatened species (49.4%), 59 of the Near Threatened species (56.7%) and 23 of the Data Deficient species (46.9%).

Geographic Patterns: *Bd* has been detected in 71 of 105 (68%) sampled countries (Figures 1, 2, and 3). In comparison to maps in Olson et al. (2013), our 2014 data set shows more comprehensive coverage of *Bd* sampling in south Asia (India, Sri Lanka, Cambodia, Laos, Vietnam, Singapore and Thailand), along with many more samples in West Africa (Côte d'Ivoire, Ghana, Cameroon, São Tomé and Príncipe, Sierra Leone and Benin). The most obvious gaps in coverage are most of Russia and central Asia, and the Amazon Basin of South America. In the U.S.A., the Great Plains are still mostly unexplored, although recent data for South Dakota have not yet been mapped (Brown and Kerby 2013). We are aware that Andrew

a great deal of additional data for the UK, France and Corsica, but these have not yet been published and so cannot be shown here.

We have provided watershed-scale maps of *Bd* occurrences for the U.S.A. at two spatial resolutions: 5th and 6th hydrologic unit code (HUC; 5th- and 6th-field watersheds) (Figures 4 and 5). These maps may be useful for a variety of management or scientific purposes due to the heightened interest in *Bd* as an emerging infectious disease and aquatic invasive species. When prioritization is needed for allocation of scarce resources, *Bd* management or research might be guided by knowledge of its known occurrence at watershed scales. For example, selecting locations for water draws for fighting wild-fires might take into consideration *Bd*-infected watersheds, since this aquatic fungus may be present in surface waters independent from amphibians and could be inadvertently transported in water drops. To mitigate this possibility, water draws might be taken from other watersheds, or disinfection might be a priority within known-infected areas. Similarly, field gear disinfection procedures,

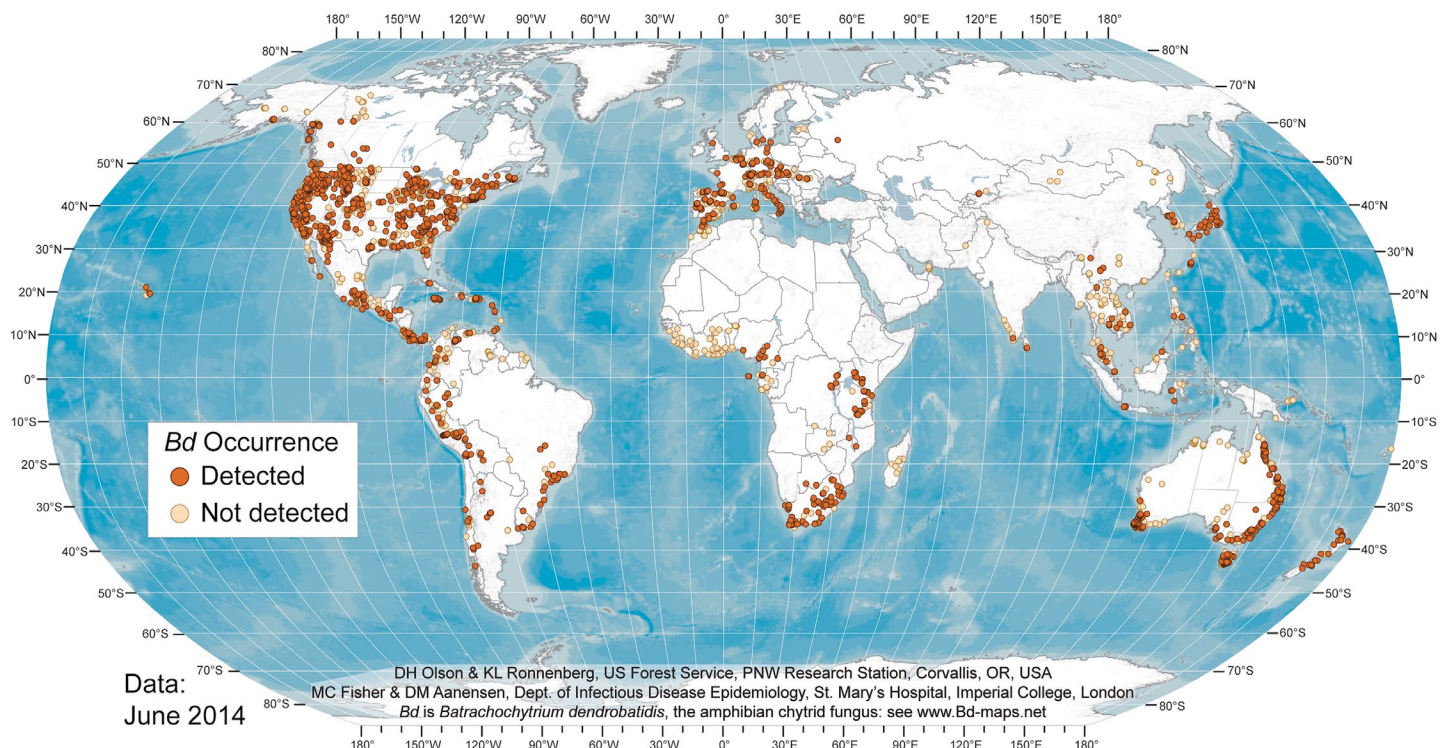


Fig. 1: Global distribution of *Batrachochytrium dendrobatidis* in June 2014. Map may be downloaded at: <http://www.fs.fed.us/pnw/lwm/aem/people/olson.html>.

reduced water or animal translocation and conservation education might be priority concerns within infected areas. This information could also be used to encourage sport fishers and recreational boaters in these areas to clean boats and gear, as is already done to prevent the spread of other aquatic invasive species such as New Zealand mudsnails (*Potamopyrgus antipodarum*) and Zebra mussels (*Dreissena polymorpha*).

In summary, we are grateful to the world community for their active partnership in this work. *Bd* mapping has been a tool that has aided communication and networking among researchers and natural resource managers. Rapid dissemination of wildlife disease research results has increased the pace of both science and conservation, with an acceleration of knowledge discovery, synthesis and application. We provide the current brief update in this spirit, without further analysis or attribution. In that light, if your data do not seem to be represented in our summary, we invite you to contact us.

References

1. Brown J., Kerby J. 2013. *Batrachochytrium dendrobatidis* in South Dakota, USA amphibians. *Herpetological Review* 44: 457-458.
2. Frost D.R. 2014. Amphibian Species of the World: an Online Reference. Version 6.0 (Date of access). Electronic Database accessible at <http://research.amnh.org/herpetology/amphibia/index.html>. American Museum of Natural History, New York, USA.
3. Gower D.J., T. Doherty-Bone, S.P. Loader, M. Wilkinson, M.T. Kouete, B. Tapley, F. Orton, O.Z. Daniel, F. Wynne, E. Flach, H. Müller, M. Menegon, I. Stephen, R.K. Browne, M.C. Fisher, A.A. Cunningham, T.W.J. Garner. 2013. *Batrachochytrium dendrobatidis* infection and lethal chytridiomycosis in caecilian amphibians (Gymnophiona). *EcoHealth* 10: 173-183.
4. Olson, D.H., D.M. Aanensen, K.L. Ronnenberg, C.I. Powell, S.F. Walker, J. Bielby, T.W.J. Garner, G. Weaver, the Bd Mapping Group and M.C. Fisher. 2013. Mapping the global emergence of *Batrachochytrium dendrobatidis*, the amphibian chytrid fungus. *PLOS ONE* 8(2): e56802. doi:10.1371/journal.pone.0056802

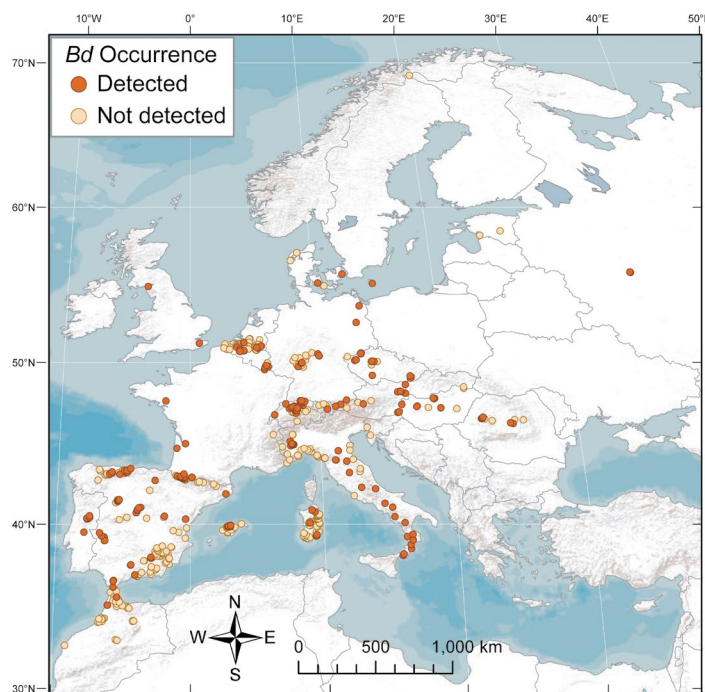


Figure 2. European distribution of *Batrachochytrium dendrobatidis* in June 2014.

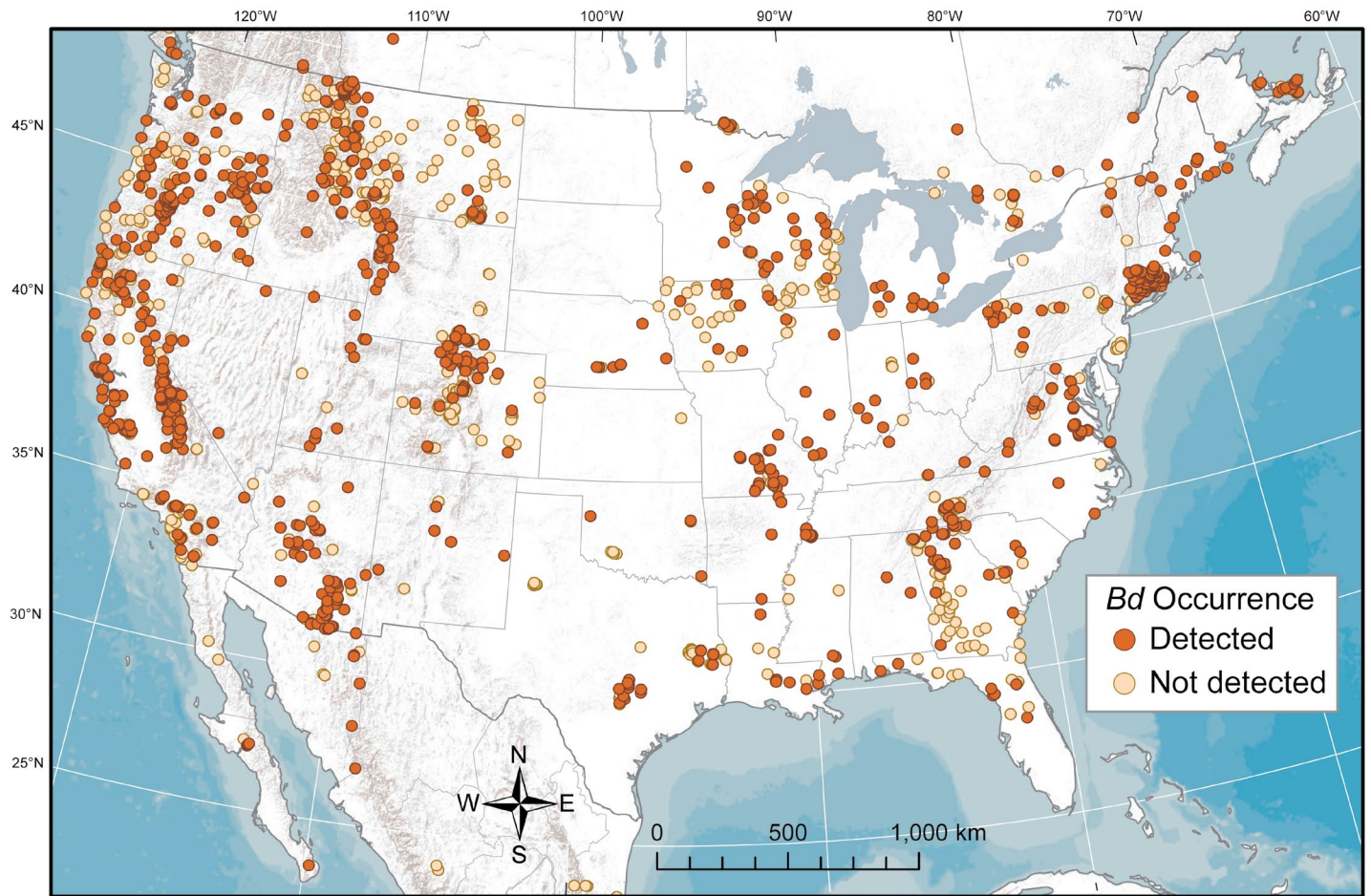


Fig. 3: United States distribution of *Batrachochytrium dendrobatidis* in June 2014.

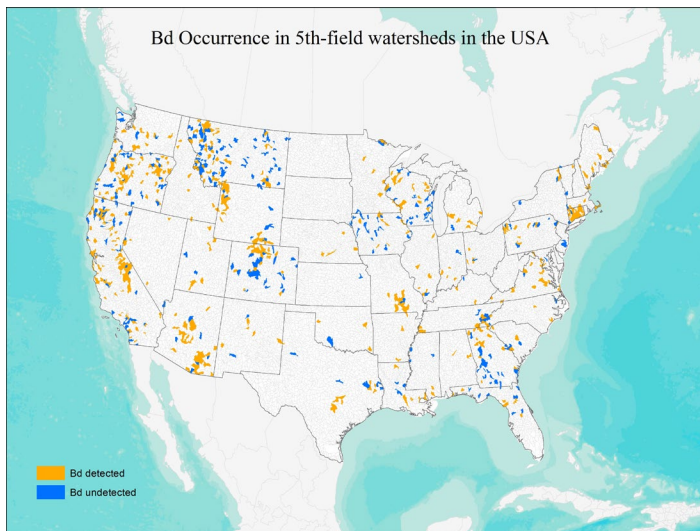


Fig. 4: Occurrence of *Batrachochytrium dendrobatidis* in the U.S.A. by 5th field watershed in June 2014.

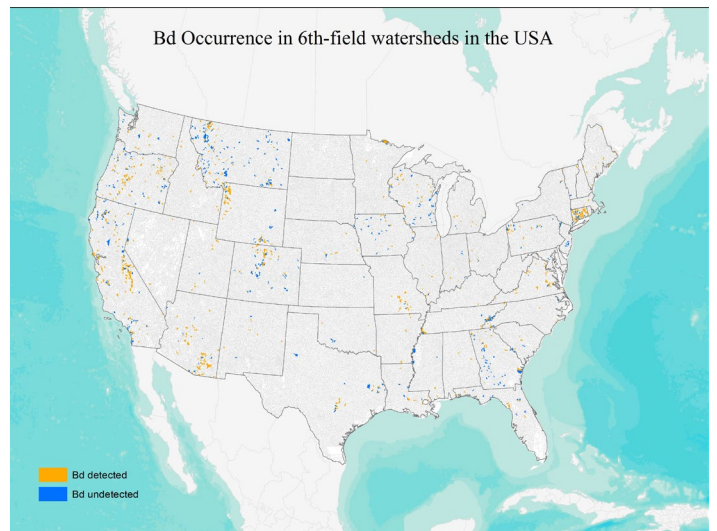


Fig. 5: Occurrence of *Batrachochytrium dendrobatidis* in the U.S.A. by 6th field watershed in June 2014.

Constructing an Amphibian Paradise in your Garden



Northern two-lined salamander in New York. Photo: Dave Huth.

By Mackenzie Kupfer

If you have a happy toad couple living in your garden, consider yourself one lucky gardener. Just after a warm summer rain you may be able to spot the amphibians out and about in my garden, and I cherish every minute of it. A few years back I found myself researching ways to see more of these amazing animals by bringing their natural habitats a bit closer to home. With the number of [Endangered amphibians](#) out there looking for a home, why not do what we can to help them?

HELPING MR. AND MRS. AMPHIBIAN FIND THE TYPE OF HOME WHERE THEY CAN RAISE A FAMILY

In order to help amphibians flourish in your garden, you need to recreate their choice settling grounds. To create a happy home that they naturally choose in the wilderness, you need facilities for shelter, hibernation and breeding.

Rocks and logs will provide shelter to all sorts of scary predators out looking for a snack. Toads will hide under your garden path rocks, so line the borders of your garden paths with them and stack a few piles up near the sides. This added comfort for the toad can also mean added design opportunities for your garden—whether it's vegetables, flowers, or both.

These rock/log features can also help with the need for hibernation structures. Toads can hibernate underground by digging beneath the freezing line, but those who do not dig so well crawl into cracks in rocks or logs.

Wood frogs make their hibernation spots their own by hiding under leaves and other organic material. What happens next is quite remarkable—most of their body functions stop entirely! The wood frog doesn't even breathe and around 40 percent of their body freez-



Common European toad. Photo: Erik Paterson.

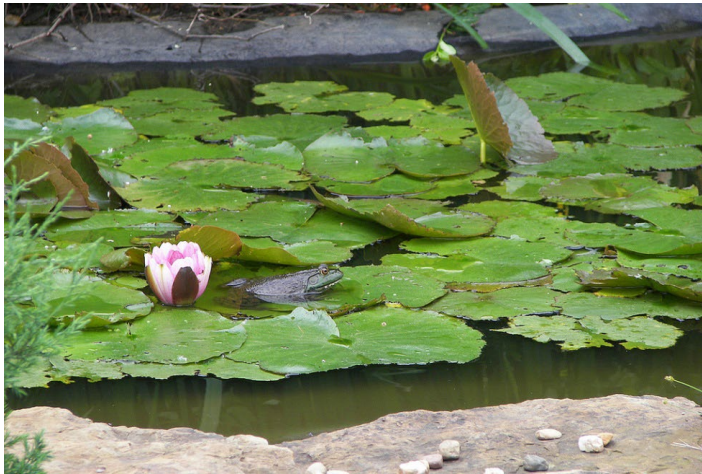


A wood frog in Southern Quebec via [Creative Commons](#).

es up! The wood frog stores glucose in its body, (which acts like antifreeze) allowing this freezing frog to come back to life when the weather warms up.

ADDING A POND THAT IS AS CLOSE TO A NATIVE WETLAND AS POSSIBLE

Without a pond you may be lucky enough to see a few toads, but even they have to find a water source to reproduce. Adding a pond to your yard will welcome in a higher variety of amphibians such as a variety of frogs, salamanders and even newts! These wonderful creatures need more hydration and a pond is the perfect ecosystem for water lovers.



An American bullfrog in Oklahoma. Photo: Tinkers Moon.

It's not really all that hard to put in a small pond. Pick a spot that has a slightly lower elevation than the rest of your yard and dig a wide hole in the ground. Cover it in some hefty plastic, and wait for the rain to fill it up little by little. This new pond will not be a perfect home for amphibians, like an established wetland environment would be—the wetlands have had many, many years to develop. They have the perfect plants for shelter, a natural filtration system, and plant and animal remains settled at the bottom which makes them so important to preserve.

In order to make your pond as close to their natural habitat as possible, plant one water lily for every three pond plants in gatherings. To avoid killing the plants, you can either stack some bricks in the water and set your plants on them in pots, or raise the water levels at a very slow rate as to match the growth rate of your pond plants.

Place native plants around the circumference to provide more shelter for froglets and toadlets. Your aim should be to match the local hydrology systems of the wetlands, by placing individual plants.

Your new pond will provide a hibernation spot for aquatic frogs.

They will use oxygen from the water as they partly conceal themselves in the mud underneath the water surface.

ALWAYS REMEMBER—NO PESTICIDES OR OTHER POISONS!

If your pond is near a chemically treated lawn, poisonous trees or other plants that can harm amphibians, your eco-system is drastically flawed. Stop using pesticides, synthetic fertilizers and weed eaters in your garden and lawn. There are a lot of ways you can accommodate the purist needs of your new yard mates. [Using compost](#), for example, will eliminate the need to use chemical fertilizers and prevents solids, oils and heavy metals from getting in storm water runoff.

The following plants are just a few that should be avoided (see the full list [here](#)):

- Avocado and Eggplant
- Rhubarb
- Bulb flowers
- Honeysuckle and Sweet pea
- Mushrooms

Amphibians are amazing animals in their own right, and they add so much diversity and natural beauty to a garden. We should consider it an environmental wakeup call when their numbers are dwindling at their current rate. So many are on the endangered species list, which means we are exploiting their natural environments way beyond any sort of “healthy” amount. With their delicate ecosystems under attack, you can do your part by creating a safe haven in your backyard.



A leopard frog enjoying a swim. Photo: Nile_Z.



The Hyatt Hidden Lakes Reserve is a 44-acre wetland preservation park near my home in Boise, ID. Photo: Mackenzie Kupfer.

Giants in the Anthropocene Part One of Two: Godzilla vs. the Human Condition

By Matthew Charnock

The abiotic factors of our innovation have become the unsightly, malignant moles on the other wise blemish-free face of Mother Nature. Oceans crest and trough with the ingestible plastics of our day-to-day lives. Trees fall in the wake of man's bipedal race for suitable infrastructure—not in silence, mind you. And the heavens now cry with an acetic lachrymal fluid, scaring the semi-permeable flesh of the creatures we keep so near-and-dear. One day—should society not experience a cardinal-shift in its moral compass—a trash-laden celestial body will find itself glaring down on the Yucatan, augmenting with each misplaced coffee cup. Ladies and gentlemen, welcome to the Anthropocene.

"In the wake of man, giants will fall." And that they will—at extinction's kneecaps."

The Chinese giant salamander (*Andrias davidianus*) is the world's largest amphibian, tipping the metric scales at nearly forty kilograms and two meters—the paedomorphic Godzilla of its aquatic realm, really. These giants rest in the rocky crevices of fast-moving streams by day and feed via asymmetrical buccal suction by night. And with their Dyson-like gape, they've ingested a fair share of sustainability issues, as well (1).

In the last issue of *FrogLog*, authors touched on the conservation status of this giant. Coupling their EDGE status with China's insatiable appetite for what I call "social-standing sustenance," it's difficult to conjure up any single amphibian facing such a hodgepodge of conservation hurdles (2). This tangled relationship is best reflected in the amount of giant salamander flesh harvested for the commercial trade between the 1960's and 1970's. In that decade alone, the kilograms of meat collected—under no government sanctioned cap—plummeted by a worrisome eighty-percent. And that was over forty years ago, mind you. While the Chinese giant salamander is protected under its CITES Appendix I status, this safety net only dictates international commerce—majority of giant salamander trafficking occurs internally within China's state borders. But fret not, fellow conservationists. The Chinese giant salamander is also classified as a Class II State Major Protected Wildlife Species in its endemic country. Great. But I—and quite possibly a few of

you as well—found myself asking a rather blissfully obvious question: "what does that actually mean?" It turned out to be a loaded, well-cloaked answer.



Essentially blind to its hydrophilic world, giant salamanders utilize what biologist call a lateral line system. These compact hair-like sensory cells line the animal's entire epidermis from head-to-toe. Much like the stereocilia of the inner ear, they are able to interpret their surroundings via vibrational stimuli. Photo: Brian Gratwike.

Law of the People's Republic of China on the Protection of Wildlife was initially adopted on March 1st, 1989 and since then has only had two proposed drafts—2004's draft was catalyzed by the overwhelming push from the western world (8). The doctrine makes the clear notion in Article 9 that species recognized by the People's Republic of China (PRC) as either "rare" or "near extinction" will receive protection under an umbrella of administrative bodies. These include local, province, and centralized powers, all of which act under the unifying body of the PRC's State Council guided department of wildlife administration (4). Yes, it's quite a mouthful of legal jargon. Just bear with me—it's imperative.

And as I began to further dissect this piece of legislation with my conservation-honed scalpel, the darker side of legal loopholes began rearing their malicious heads. Article 16 and Article 22 are just such appendages. In its contextual maze of semi-colons and run-ons, the articles segregate China's "rare" fauna into two classes. At first read, there's little distinction between them. While both articles mandate the laws and appropriate legal means for collecting, harvesting, and/or participating in any activity involving state protected species, the presence of one word creates a literary rift between the two—"scientific." Article 22 states that fauna given a Class I designation may only be purchased, harvested, domesticated, bred and utilized for scientific research only—nothing more. Class II animals aren't provided with that academic precursor. The same article expresses—therefore implying by the negation of the word scientific—that Class II designated fauna can be sold, utilized and purchased without scientific reasoning. So what does this nonchalantly imply—disaster. This in turn allows the Chinese giant salamander, given the appropriate local and/or province permits are held, to be consumed as a legal culinary delicacy in China. And to add insult-to-injury, there's still no legally capping quota for



Attaining lengths of nearly two meter and weighing over thirty-five kilograms, the Chinese giant salamander is the largest living amphibian on our planet today. Photo: J. Patrick Fischer.

the amount of giant salamander meat that can be harvested annually. Given China's indulgent, ecologically crippling Traditional Chinese Medicine (TCM) market, a salamander foot could, under the same legal circumstances as before, be sold to aid someone's futile yearning to mitigate a symptomatic illness. The survival for these enigmatic giants then begins to mirror their eyesight—bleak.



Once the female has laid her five-hundred or more eggs, the male will fertilize them externally. And at that point, the amphibious male Godzilla will viciously guard his brood till they hatch sixty days later. Photo: Teal Waterstrat (USFW).

But on the flip-side of the ocular scale, its extant sister species, the Japanese giant salamander (*Andrias japonicus*), sees its aquatic realm from less visually impaired lens. Currently classified as a Near Threatened species by the IUCN 3.1 Red List, its main threat isn't cuisine—it's concrete (1). Dam construction and other waterway alterations have devastated the salamander's migratory pathways. But never doubt the impact of ingenuity. Japanese conservationists have cleverly constructed what are now called "salamander ladders." These man-made, vertical stepping stones allow the giants to bypass Japan's ever-growing infrastructure without any deformation to its structural integrity—a win-win situation (9).

But another threat to the Japanese salamander's existence is less obvious to the naked eye. These giants may lurk in-and-around oxygen laden streams, but their gene pool remains quite stagnant. Combine this factoid with the now introduced, hybridizing threat of the Chinese giant salamander, and the Japanese giant salamander's IUCN "Near Threatened" rating begins to blush a redder complexion (3, 5, 6).

As conservationists, what can we do? Educate, first and foremost. There needs to be a conscious shift regarding the consumption and harvest of such endangered animals in China. And by educating China's masses about the importance of faunal sustainability – by no means pointing fingers toward any one person or group—we can effectively plant that 'thought seed.' No good ever results from the "blame game." But how do we assure it'll germi-



Mesocosms- housing units that allow natural environmental conditions to remain under controlled observation - have become essential in both Japanese and Chinese giant salamander conservation work. Photo: Yakashi Yamaoku.

nate? It's simple: fundamental fertilizer. When the afflicting party consciously understands how their foot print has so negatively affected the existence of another living being—and that mutualism is possible through simple every day changes—it's astonishing how much lighter they'll tread. Secondly, Chinese giant salamanders have every right to elevated to a Class I protected species by the PRC. We can catalyze that change, no doubt. But yes, this may not be a tasteful move—in both the literal and metaphorical sense—for Asiatic aristocrats. And at nearly one-hundred USD per kilogram, that's about the only socio-demographic that's able to afford the delicacy.

The Japanese giant salamander quintessentially shows how in the absence of human interference these giants can bounce-back. Once sharing the same porous life raft with the Chinese giant salamander, the Japanese giant has since found more solid ground. In 1952, Japan recognized its knife-edged conservation status. At that time, not only was the animal deemed illegal for harvest, but was nationally recognized as a natural monument in Japan—the latter is just as important. By stamping the giant salamander as a symbol of national pride, Japan's now created an umbrella of patriotism around the amphibian. And so a positive moral shift in how its population perceives the animal. Gone are the days of up-scale dining, instead replaced by parade floats celebrating these culturally-charismatic "pepper fish" (7).

As I look out from my Starbucks perch, I see no less than three clear plastic cups splayed sloppily in the trajectory of an emaciated trash can—a visual metaphor for the common man's ethos on environmental issues. But just as I'm about to leave my now dreary, heavily-caffeinated dwellings, a middle-aged mother of two—who of which had no doing in the placement of those plastics—alleviated the wrongdoer's carbon footprint. "Even if it's not your trash boys, do everyone a favor and pick it up." she preached to her toddler aged sons. And in that moment, the astrological mass I earlier described became that much more diminutive—hope lives on.

References

1. Gang L., Baorong G., Ermi Z. 2004. *Andrias davidianus*. In: IUCN 2014. (IUCN Red List of Threatened Species. Version 2014.1.)
2. EDGE: Evolutionary Distinct and Globally Endangered, Chinese Giant Salamander (*Andrias davidianus*), http://www.edgeofexistence.org/amphibians/species_info.php?id=547&search=focal (2014).
3. EDGE: Evolutionary Distinct and Globally Endangered, Japanese Giant Salamander (*Andrias japonicus*), http://www.edgeofexistence.org/amphibians/species_info.php?id=1372 (2014).
4. Law of the People's Republic of China on the Protection of Wildlife (2004 Revision), pub. l. chap. 2, 3, 9, 16, 22. (1988). Print.
5. Smithsonian National Zoological Park, Super Salamanders, <http://nationalzoo.si.edu/Publications/Zoogoer/2010/3/Salamanders.cfm> (2010).
6. Tominaga A. et al., *Molecular Phylogenetics and Evolution* vol. 49. 317, 318, 319 (2008).
7. National Geographic. (2009, Decemeber 30th). Animal News: Giant Salamanders Helped to Spawn. <http://matrix.static.nationalgeographic.com/video/news/animals-news/giant-salamander-wcvin/>
8. Sharma C. Animal Law; *Chinese Endangered Species at the Brink of Extinction: A Critical Look at the Current Law and Policy in China*. vol. 11:215. 226, 227, 228. (2005).
9. Brazil M. (2011).The Japanese Giant Salamander: Gross Grails and Salamander Tales. <http://www.japanvisitor.com/japan-nature/giant-salamander>

The Threatened, Exploding Frogs of the Paraguayan Dry Chaco



Fig. 1. The aposematic colouration of the Chaco endemic Coralline frog *Leptodactylus laticeps* (Leptodactylidae) warns of the toxic skin secretions it produces. Photo: Paul Smith.

By P. Smith¹

"We were compelled to dig again and again, until we had dug thirteen wells before we found potable water... Everybody wants to leave, for we're all dying here. The heat is unbearable...; if you still have enough potatoes for a meal, thank God for it, . . . here there aren't any"

Anonymous Mennonite settler in the Paraguayan Chaco (quoted in 1)

Paraguay, situated at the heart of the megadiverse continent of South America, is divided into two geologically distinct regions by the great Paraguay river; to the east the densely-populated Orient, and to the west the remote, desolate Chaco. The Chaco is as diverse as it is vast and can be separated broadly into three sections, the marshy palm savannas of the Humid Chaco of Presidente Hayes department, the lush Pantanal and Cerrados of Alto Paraguay department and the arid, thorny, scrub forests of the Dry Chaco of Boquerón department.

Conditions are most extreme in the Dry Chaco where daytime temperatures exceed 40°C in summer, occasionally dip below freezing in winter and annual rainfall may be as low as 35cm per year (2). Despite this a total of 36 amphibian species call this inhospitable wilderness home (3), a remarkable number of water-dependent am-

phibians for one of the driest regions on earth.

Such extreme conditions breed extreme life strategies, and the frog fauna of the Dry Chaco is one of the most unique and highly-adapted in the world. Many species spend much of the year underground in cool, moist burrows to protect themselves from desiccation, whilst others can persist only because of the presence of artificial but permanent water sources in the form of *tajamares* (cattle ponds). Most species however, depend exclusively on the short, but torrential rainy season (October to November), when an explosion of anuran activity occurs, as myriad species clamor to feed and breed in the brief window when temporary pools of precious water gather on the compacted clay soil surface. On wet nights a cacophony of frog song fills the air, and the ground writhes with a million hopping shadows as individuals of multiple species hurriedly take advantage of that rare commodity – fresh water.

With time of the essence and the breed or feed dilemma high on the agenda, several large frogs have evolved into specialist frog predators, maximizing their foraging efficiency by feeding on their smaller neighbors, victims that are hopelessly constrained by their need to frequent the same water holes as their hunters (4). But there are many ways to catch a frog. The Coralline frog *Leptodactylus laticeps* (Fig. 1), a huge and wonderfully-colored endemic has been hypothesized to imitate the call of its main prey, the abundant Oven frog *L. bufonius* in order to attract it close enough for the kill (5). Five species of Ceratophryidae have massive heads and a wide gape

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Fig. 2. Budgett's frog *Lepidobatrachus laevis* (Ceratophryidae) is a grotesque, subaquatic predator. Photo: Paul Smith.



Fig. 3. Colloquially known as the Pacman frog because of its huge gape, Cranwell's horned frog *Ceratophrys cranwelli* (Ceratophryidae) here performs its stiff-legged defensive display, a prelude to bites and hisses. Photo: Paul Smith.



Fig. 4. Mueller's narrow-mouthed frog *Dermatonotus muelleri* is the largest and most distinctive of the Paraguayan Microhylidae. Photo: Paul Smith.

lined with maxillary teeth, ideal for catching and holding on to slippery, anuran prey. The Jabba-the-Hut like aquatic genus *Lepidobatrachus* (Fig. 2) with their beady, dorsally-located eyes and large, webbed hind feet are submarine hunters striking at unsuspecting

victims from below the water surface (4); and the grotesquely-beautiful Cranwell's horned frog *Ceratophrys cranwelli* (Fig. 3) has such a huge head compared to the body that it has earned itself the nickname the Pacman frog.

With such diverse and ingenious threats lurking behind every



Fig. 5. A mating pair of Earless leaf frogs *Phyllomedusa azurea* (Hylidae). Photo: Paul Smith.

clod of mud, equally diverse and ingenious defenses have also evolved to combat them. Aposematic coloration, warning of toxic skin secretions has created some extraordinarily handsome creatures such as Mueller's narrow-mouthed frog *Dermatonotus muelleri* (Fig. 4) and the Earless leaf frog *Phyllomedusa azurea* (Fig. 5) (4), whilst the abundant, small and otherwise virtually defenceless Four-eyed weeping frog *Physalaemus biligonijerus* may rear up its hind legs, elevating its rump where it hopes that large black blotches on the inguinal glands resemble the eyes of a larger animal rather than the backside of a small one. Even the Ceratophryids, top of the amphibian food chain, possess their own intimidating defense displays, standing tall on rigid legs and jumping, biting and hissing at the threat (regardless of size). Less physically imposing, the smallest member of the family, the Lesser Chini frog *Chacophrys pierotti* (Fig. 6), blows itself up like a ping-pong ball to make it harder to swallow, but throws in a few bites for good measure.

Breeding strategies are equally varied as feeding and defense strategies. Frogs of the families Leptodactylidae and Leuiperidae, construct floating foam nests by rubbing their hind legs together, utilizing even roadside puddles for the purpose, and burying the eggs a short stay of execution before the next rains should their pond rapidly dry out (6). The highly aquatic, oar-footed, La Plata paradox frog *Pseudis platensis* (Fig. 8) has a tadpole twice the length of the adult that shows hardly any growth following metamorphosis (7), and Sauvage's leaf frog *Phyllomedusa sauvagii* constructs a nest of leaves overhanging water in which to deposit its eggs, coating them in a strange jelly-like substance which can modify its structure according to degree of hydration (8).

The remoteness and inaccessibility of the Dry Chaco meant that this marvelous ensemble of charismatic amphibians was virtually unknown until the turn of the 20th Century (9) and until very recently the opportunity to experience it first hand was a luxury of an adventurous and occasionally foolhardy few. The completion of the Trans Chaco Road in the 1960s made the region accessible

for the first time, opening up the area up to herpetologists who leapt at the chance to begin to document the complex ecologies of these mysterious animals. However, improved access also brought with it accelerating development and habitat destruction, a process which has now reached crisis proportions in the Paraguayan Chaco. Land conversion rates in the Paraguayan Chaco continue to be amongst the highest in South America (10) and it has been estimated that at the current rate of deforestation all suitable land not currently in the protected areas system will have been converted into ranchland by 2025 (11).

This is seriously bad news for the nine Chaco amphibian endemics that occur in Paraguay, all of which will now have to deal with rapid changes to an environment which they have spent millennia adapting to. Deforestation, over-grazing, desertification, salinification of soils and collection of ground water for irrigation are all hallmarks of an increasing human presence in this delicate environment (12, 13), while the use of agrochemicals and the newly legalized collection of live animals for the pet trade (14) will all present new challenges that this extraordinary frog fauna must rapidly learn to navigate.

The future may be uncertain for the Chaco, but with a frog fauna adapted to triumphing in the face of adversity, we can only hope that this is just another obstacle to be overcome in their eternal battle for survival.

Acknowledgements

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References

1. P. P. Klassen, *Die Mennoniten in Paraguay: Reich Gottes und reich dieser welt*, (Mennonitischer Geschichtsvereine, Bolanden-Weierhof, Germany, 2001), vol. 1, 2nd ed.
2. F. Hayes, *Am. Bird. Assoc. Mon.* **1**, 1 (1995).
3. F. Brusquetti, E. O. Lavilla, *Cuad. Herp.* **20**, 3 (2006).
4. N. J. Scott, L. A. Aquino, in: *Ecology and Evolution in the Tropics: A Herpetological Perspective*, Donnelly *et al.*, Eds. (University of Chicago Press, Chicago & London, 2005) pp. 243-259.
5. R. Heyer, N. J. Scott, *Herp. Nat. Hist.* **9**, 189 (2006).
6. R. Heyer, *Evol.* **23**, 421 (1969).
7. M. Fabrezi, S. I. Quinzio, J. Goldberg, *J. Herp.* **43**, 228 (2009).
8. A. P. Alcaide, M. F. Alcaide, F. J. P. Alcaide, E. O. Lavilla, *South Am. J. Herp.* **6**, 20 (2011).
9. J. S. Budgett, *Quart. J. Microscop. Sci.* **42**, 305 (1899).
10. R. Cardozo, F. Palacios, O. Rodas, A. Yanosky, *Paraquaria Nat.* **1** (2), 43 (2013).
11. A. Yanosky, *Paraquaria Nat.* **1** (1): 32 (2013).
12. J. Schofield, E. H. Bucher, *Trends Ecol. Evol.* **1**: 78 (1986).
13. E. H. Bucher, P. C. Huszar, *J. Env. Man.* **57**, 99 (1999).
14. T. Vinke, S. Vinke, *Schildkröten im Focus* **2**: 1 (2012).



Fig. 6. A Lesser Chini frog *Chacophrys pierotii* (Ceratophryidae) begins to inflate itself, to protect against predation. Photo: Paul Smith.



Fig. 7. The gigantic Rococo toad *Rhinella schneideri* (Bufonidae), which can reach 30cm in length, cools off in a muddy puddle. Photo: Paul Smith.



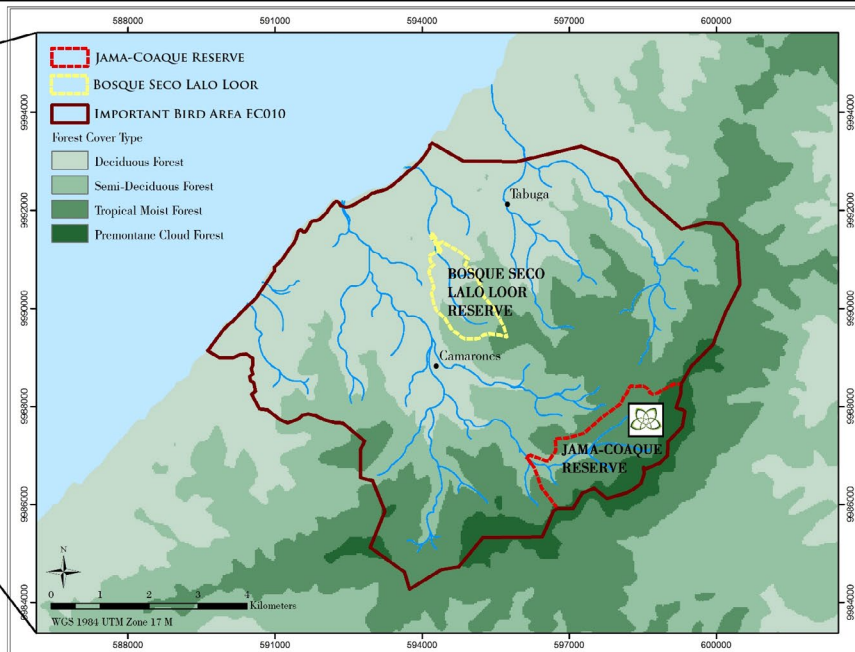
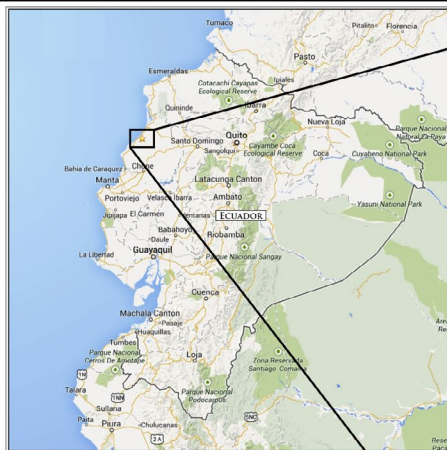
Fig. 8. The oversized, oar-like hindfeet of the La Plata paradox frog *Pseudis platensis* (Hylidae) are an adaptation for a largely aquatic existence. Photo: Paul Smith.



AMPHIBIANS OF THE JAMA-COAQUE RESERVE, ECUADOR

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CRAUGASTORIDAE

Barycholos pulcher
Pristimantis achatinus
Pristimantis latidiscus
Pristimantis subsigillatus
Pristimantis walkeri
Pristimantis cf. muricatus
Pristimantis sp. 1
Pristimantis sp. 2

DENDROBATIDAE

Epipedobates machalilla
Hyloxalus awa

HYLIDAE

Agalychnis psilopygion
Hypsiboas rosenbergi
Scinax quinquefasciatus
Smilisca phaeota
Trachycephalus jordani
Trachycephalus typhontus

BUFONIDAE

Rhinella marina

PLETHODONTIDAE

Bolitoglossa chica
Bolitoglossa sp. 1

CENTROLENIDAE

Cochranella mache
Espadarana prosoblepon
Hyalinobatrachium fleischmanni

LEPTODACTYLIDAE

Engystomops montubio
Engystomops pustulosus
Leptodactylus labrosus
Leptodactylus ventrimaculatus
Leptodactylus peritoaktites

CAECILIIDAE

Caecilia nigricans

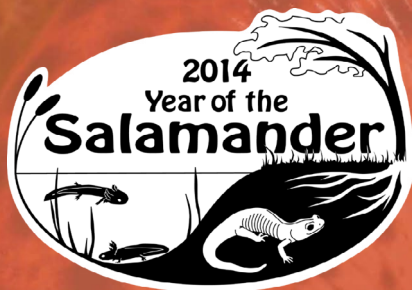


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Salamander News

No. 7

July 2014

www.yearofthesalamander.org

If You Build It, Salamanders Will Come

by John G. Palis, Palis Environmental Consulting



Eastern Tiger Salamander, Union County, Illinois (JG Palis).

Like the bluebells in H.M. Tomlinson's *A Lost Wood*, the Eastern Tiger Salamanders (*Ambystoma tigrinum*) migrating to a breeding pond on a cold, rainy night in March "expected no evil." This was their natal pond, after all, one that has been in use by generations of tiger salamanders before them. But this year was different, this year there was no pond. The farmer, in his quest to increase acreage for commodity crop production, had drained and filled the pond after these salamanders emigrated away as metamorphs in previous summers.

This scenario, no doubt, plays out in similar fashion every spring across the agricultural regions of the

northern hemisphere. Amphibian breeding sites are degraded or destroyed for various reasons, not just to increase agricultural acreage. They are also drained for mosquito control, filled to facilitate housing or business developments, or are used as convenient dumping grounds for logging slash and other organic or inorganic wastes. The end result is the same, another amphibian breeding site lost.

Salamander terrestrial habitat is, of course, also modified for human use. Most North American forests and prairies have been cleared and are now vegetated with "amber waves of grain" or lawn grass, or have been replaced with concrete and asphalt. Some forests have regenerated one or more times since the European colonists first cut them down, but many have been repurposed as tree farms. With all this habitat degradation and loss, one wonders how North American pond-breeding salamanders continue to persist.

The tenacity of the pond-breeding, terrestrial salamanders, here defined as ambystomatids, Eastern Newts (*Notophthalmus viridescens*), and Four-toed Salamanders (*Hemidactylium scutatum*) is, I believe,

continued on p. 5

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Tiger Salamander farm pond, Iltis-Fletcher Farm, Union County, Illinois (JG Palis).



sponsored by PARC - Partners in Amphibian and Reptile Conservation



Get Your July Photo Contest Calendar - Free!

Predators take warning: I taste bad! That's the message conveyed by the bright orange coloration of the eft stage of the **Eastern (aka Red-spotted) Newt**, *Notophthalmus viridescens*. **Marty Silver** snapped this winning photo in Tennessee. To get the big picture and see our runner-up, the iconic salamander of vernal pool conservation in North American forests, go to <http://www.parcplace.org/images/stories/YOSal/YoSalCalendarJuly.pdf>.

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

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

Are Sirens calling you?

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

Get your Year of the Salamander 2014 Gear!

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

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

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



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

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

July Newsletter Content Coordinator: Tom Gorman, Virginia Tech

Design and layout: Kathryn Ronnenberg, U.S. Forest Service, Pacific Northwest Research Station

Salamander News Facilitator: Tom Gorman, Virginia Tech

Year of the Salamander Committee Chair: Mary Beth Kolozsvary, Siena College

Announcing a Year of the Salamander video contest!

Here's how you can participate!

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

Here's your chance to get involved with the Year of the Salamander **by entering our video contest:**

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

You may want to make a video on:

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

But you are not limited to just these ideas!

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

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

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

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



Salamanders Matter

...to aquatic, riparian, and terrestrial ecosystems, and the interconnections among them. A pond-breeding Four-toed Salamander, *Hemidactylium scutatum*, by Noah Charney, Year of the Salamander Photo Contest.



Salamanders are...everywhere!

It may appear that the big emphasis for vernal pool conservation is on the pond-breeding salamanders of northeastern North America, but pond-breeders exist everywhere that there are salamanders. In the Pacific Northwest of the U.S.A. and Canada, pond-breeding species include the Long-toed Salamander (*Ambystoma macrodactylum*, pictured at left), the Northwestern Salamander (*Ambystoma gracile*), and the Rough-skinned Newt (*Taricha granulosa*). In California, you can find the increasingly imperiled California Tiger Salamander (*Ambystoma californiense*) plus the California, Sierra, and Red-bellied Newts (*Taricha torosa*, *T. sierrae* and *T. rivularis*), and in many other parts of the western U.S., the Barred Tiger Salamander (*Ambystoma mavortium*). Photo © Elke Wind.

Year of the Salamander Collaborating Partners

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

Opacum Land Trust

www.opacumlt.org

Opacum Land Trust is a volunteer-run land conservation organization and works within 13 south-central Massachusetts towns. The land trust is named after the Marbled Salamander (*Ambystoma opacum*), as this threatened species spurred the creation of the land trust in the year 2000. Currently Opacum has permanently protected over 1,000 acres of land. Our flagship property, Opacum Woods in Sturbridge, MA, was acquired to protect habitat for our namesake.



**VERNAL POOL
ASSOCIATION**
www.vernalpool.org

Vernal Pool Association

www.vernalpool.org

The Vernal Pool Association's goal is to encourage the appreciation, protection, and interdisciplinary study of vernal pools, particularly by students. To meet this objective, we produce educational materials, present workshops and talks, and interact with educators and students both in person and through the internet. We are actively involved with state, federal and private environmental protection and education agencies and organizations. Our website, "The Vernal Pool," is our on-line effort at education and outreach.

Heritage Conservancy

www.HeritageConservancy.org

Based in Doylestown, PA, Heritage Conservancy is a nationally accredited conservator and community-based organization committed to the preservation and protection of significant open spaces, natural resources and historic structures. A champion of conservation best practices, Heritage Conservancy is dedicated to the idea that everyone is responsible for stewardship and seeks to enlighten, engage, and empower others to help achieve this mutual vision. Recognizing the importance of protecting our salamanders, Heritage Conservancy started the Quakertown Swamp Amphibian Rescue Partnership. At the end of every winter, this partnership helps to provide safe passage for salamanders and other amphibians across a busy road in order to get to vernal pools on the other side to breed.



Harris Center for Conservation Education

www.harriscenter.org

The Harris Center for Conservation Education is a non-profit land trust and environmental education organization located in southwestern New Hampshire. We are dedicated to promoting understanding and respect for our natural environment through education of all ages, direct protection and exemplary stewardship of the region's natural resources, and programs that encourage active participation in the great outdoors. Our teacher-naturalists work with 2,500 students in nearly 30 schools each year, integrating place-based nature education (on topics including, but not limited to, salamanders and vernal pools) into K-12 curricula. We also provide over 100 lectures, film showings, and guided outings for the general public each year, including a suite of amphibian-focused programs in the spring. Lastly, our citizen science arm (www.aveo.org) coordinates the locally-celebrated Salamander Crossing Brigades and volunteer vernal pool inventories. Since 2007, our citizen scientists have documented 130 vernal pools, and saved over 15,000 migratory amphibians from the crush of the tire!

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

If You Build It, Salamanders Will Come, cont. from p. 1



Drained farm pond being filled, Union County, Illinois (JG Palis).

genetically inherent. There has been a long history of salamander habitat coming and going, predating human alterations to the landscape. Extensive portions of northern regions of North America, for example, have been covered with sheets of ice a mile or more thick for thousands of years. During these glaciation events, salamanders were forced southward, only to recolonize the glaciated areas after the ice retreated. Recolonization was likely facilitated by the creation of numerous wetlands as glaciers retreated, providing a vast network of breeding sites via which salamander populations expanded northward.

With the colonization of North America by humans came a novel and relatively rapid landscape-altering force. Humans are adept at altering both terrestrial and aquatic natural habitats to suit their own needs. These changes occur, as Rachel Carson wrote, at the “heedless pace of man rather than the deliberate pace of nature.” Oftentimes, as described above, this results in a loss of salamander habitat. But other times, salamanders benefit from the hand of man, employing their ancient habit of recolonizing formerly inhospitable space.

Here in Illinois, where I live, one is hard-pressed to find ground unaltered by the hand of man, and finding a natural, untouched wetland is nigh impossible. And yet, we have an impressive list of terrestrial, pond-breeding salamanders inhabiting the state including Jefferson’s Salamander (*Ambystoma jeffersonianum*), Blue-spotted Salamander (*Ambystoma laterale*), Spotted Salamander (*Ambystoma maculatum*), Marbled Salamander (*Ambystoma opacum*), Smallmouth Salamander (*Ambystoma texanum*), tiger salamander, Mole Salamander (*Ambystoma talpoideum*), Eastern Newt, and

Four-toed Salamander. Remarkable, I think, for a state dominated by agriculture (77.5% of the state).

Humans often inadvertently create salamander breeding habitat while engineering the landscape. Roadside ditches, irrigation ponds, borrow pits, and even idle sewage lagoons can provide suitable breeding habitat. Ponds, created for livestock or wildlife, are also colonized by salamanders (provided predatory fishes are not introduced), as are road-ruts, created when vehicles are driven on muddy dirt roads.

Biologists are beginning to critically examine whether or not these various forms of human-made water bodies—created wetlands in particular—provide suitable salamander breeding habitat; oftentimes they do. For example, in a recent review of 37 such studies (Brown et al. 2012. *International Journal of Ecology*. doi: 10.1155/2012/989872), the authors concluded that created and restored wetlands “can be valuable tools for amphibian conservation.” Amphibian colonization and successful use of created wetlands for reproduction



Created wetland, Horseshoe Lake Fish & Wildlife Area, Alexander County, Illinois (JG Palis).



Marbled Salamander & Mole Salamander wildlife pond, Cypress Pond State Natural Area, Johnson County, Illinois (JG Palis).

was influenced positively by proximity to amphibian source-populations, intermediate hydroperiod, presence of aquatic vegetation, and gently sloping banks which provide nearshore shallows. Presence of predatory fishes negatively affected amphibian species richness. Fortunately, as studies have shown, salamanders will recolonize following the removal of fishes.

Wetland creation appears to be becoming popular in some parts of the USA, especially with the advent of the Natural Resource Conservation Service's Wetland Reserve Program (WRP). Under particular conditions, a landowner can enroll his or her property into the program and, with financial and expert assistance of the NRCS, can create one or more shallow-water wetlands on the property. Often these wetlands are created with flood control or waterfowl population-enhancement in mind. It matters not to the salamanders (or those of us who enjoy interacting with salamanders) why the wetland was created, it just matters that a wetland now exists where one did not exist before.

With the advent of the WRP and similar pond/wetland creation programs (e.g., www.wetlandsandstreamrestoration.org), we can reimagine the opening scenario. The tiger salamanders, on their way to their non-existent natal pond, encounter a newly created wetland; a wetland having the aforementioned ideal traits. They now have a new place to establish themselves, to pioneer generations of salamanders to come.



Frozen-over wildlife pond, Shawnee National Forest, Union County, Illinois (JG Palis).

facebook

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



Upcoming Meetings & Events

Conservation Genetics of Salamanders course, July 7-19, Highlands Biological Station, Highlands, NC. More info at www.highlandsbiological.org

Sabino Canyon Lizard Walk, July 12, 8 am, Sabino Canyon Recreation Area, Tucson, AZ. Meet at the visitors' center.

Salamanders and Frogs!, July 19, 10 am, presentation by Dr. Mary Beth Kolozy, Thacher Park and Nature Center, Voorheesville, NY. Search for live amphibians in woodland pools and streams! Limit 15 people, call 518-872-0800 to register.

Salamander Day, July 20, 1-4 pm, Sessions Woods Conservation Education Center, Burlington, CT. Family-friendly activities, talks, and live salamanders. Optional preregistration, call 860-675-8130. See [link](#) for more info.

2014 Joint Meeting of Ichthyologists and Herpetologists (SSAR/ASIH), July 30 – August 3, Chattanooga, TN. More info at www.dce.k-state.edu/conf/jointmeeting/

NEPARC annual meeting, August 13 - 15, 2014, Allegany State Park, Salamanca, NY

Stream & Marsh Exploration, September 13, 10 am, Sessions Woods Conservation Education Center, Burlington, CT. Hillary Clifton will introduce you to the creatures of the Sessions Woods streams and beaver marsh, including salamanders. Pre-register at 860-675-8130. See [link](#) for more info.

Great Smoky Mountains Salamander Ball, September 13, Knoxville Zoo, Knoxville, TN. More info at www.dlia.org/newsdlia-events

Seduced by Salamanders

by Susan Walls, U.S. Geological Survey, Amphibian Research and Monitoring Initiative

As I struggle to lift the cumbersome dipnet from the water, the pungent smell of rotten eggs makes me grimace. Yuck—who would have thought that a bunch of leaves and mud could smell so bad! I quickly forget about the smell, however, as I spot an alien creature writhing amidst the leaves, twigs, and crayfish in the bottom of the net. By the process of elimination I assume it is a fish. But its tiny little legs and the long, fleshy, feather-type structures that extend from the sides of its head stymie me. The sides of its body are flecked with gold. A dark stripe extends through each eye. I gently roll it over in my hands and reveal the contrasting pattern of dark bands on its glistening surface. Am I sure this isn't a fish? If it is, why doesn't it have scales? And fish don't have legs! I am completely stumped by this first of many encounters with a larval Mole Salamander, *Ambystoma talpoideum*, which happens to belong to a family of the same name (mole salamanders or Ambystomatidae).



Paedomorphic Mole Salamander (*Ambystoma talpoideum*). Paedomorphosis, the phenomenon of an individual reaching sexual maturity in the aquatic habitat while retaining morphological features characteristic of a larva (e.g., external gills), occurs facultatively in this species. Photo: Dirk Stevenson.

Ten years earlier, salamanders were the farthest thing from my mind as my 5th-grade science teacher, Mrs. Saunders, waltzed into the classroom of rowdy 10-year-olds and announced that we were going to do something different that day. She approached the lab bench at the front of the room, lit a Bunsen burner, stuffed a test tube full of dirt, leaves and twigs, held the test tube over the open flame and, in story book fashion, explained how the heat and pressure of the earth—given sufficient geological time—gradually transform these ingredients into coal. After allowing the test tube to cool, she tapped it on the side of the lab bench and, as she finished her



A shallow, ephemeral woodland pond in which three species of ambystomatid salamanders are known to breed. Such ponds are favorable breeding sites because they are highly productive and their temporary hydrology eliminates predatory fishes. Photo: Susan Walls.

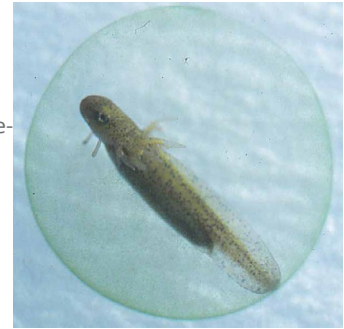
elaborate story, out popped a lump of “coal”. At that very instant, my spark for science was ignited; I was awakened to the thrill of scientific discovery. Many years later I would discover that larval salamanders are ideal for studying how natural systems work. If Mrs. Saunders could only know the impact she had that day.

I am standing in this shallow pond with a dipnet in my hands as part of the requirements of my college Field Ecology class. I am studying the reproductive ecology of amphipods—a group of freshwater crustaceans that resemble miniature shrimp—as my part of the class field project. I am scooping through the mud and leaves on the bottom of our study pond in search of these crustaceans when I excitedly exclaim that I’ve discovered a new type of “fish”. Once my professor recovers from his amusement, he explains the mystery of the dual life cycle that most amphibious creatures experience. I learn two very important facts that day—first, that amphibians do more exciting things than just sit on lily pads and eat flies and, second—that one should never publicly announce the discovery of a new creature unless they know with certainty what the heck they’re talking about.

Amphipods and other small invertebrates flourish in these small, temporary woodland ponds that don’t hold water long enough to support populations of predatory fish. The aquatic larvae of all salamanders in the mole salamander family eat tiny crustaceans, thus capitalizing on the high biological productivity—the profusion of



Left: Developing larval Marbled Salamanders (*Ambystoma opacum*), still encased in their common egg capsule. “Twinning”, as shown here, has been reported in the Eastern Tiger Salamander (*Ambystoma tigrinum*) and in captive-bred Axolotls (Mexican Salamander, *Ambystoma mexicanum*). However, as far as we know, this phenomenon has not been reported in a natural population of the Marbled Salamander. Photo: Susan Walls.



Right: Developing embryo of the Spotted Salamander, *Ambystoma maculatum*. The light greenish hue evident throughout the inner egg membrane is cast by the symbiotic green alga, *Oophila amblystomatis*. This alga is often found in developing embryos of other aquatic-breeding amphibians as well, but it is especially prevalent in embryos of Spotted Salamanders. Photo: Susan Walls.

small invertebrates that live in these ephemeral bodies of water. Adults of most ambystomatids march down to the breeding pond en masse from their underground terrestrial refugia after seasonal rains in the middle of winter or early spring, depending on the location and the species. A frenzy of males vies for the attention of individual females, attempting to seduce them with their elaborate dance (aptly described as a “waltz”) on the bottom of the pond.

The December following my first encounter with a larval salamander, I revisited the same pond on a very cold, rainy night. The light of my headlamp revealed that the small, shallow pond was literally bubbling with activity. I excitedly raced back to the car, grabbed a dipnet, and dragged it across the bottom of the pond. As I lifted the net out of the water, dozens of adult Spotted Salamanders (*Ambystoma maculatum*), another species belonging to the Ambystomatidae, poured over its sides. For the first—and, thusfar, only—time in my life, I was fortunate to be at the pond right at the peak of breeding activity of these explosive breeders. As I scooped up handfuls of purplish brown creatures with vivid yellow and orange spots and large, black eyes, I knew that I was smitten for life.

The aftermath of the intense salamander orgy is apparent at dawn when the shallow regions of the pond bottom are littered with white, cottony phallic-shaped structures known as spermatophores. Unsurprisingly, these structures are the product of evolution, nature’s way of ensuring internal fertilization in a primitive vertebrate that lacks copulatory structures. After plucking off the cap of a suitor’s spermatophore with her cloacal lips, the female salamander deposits her fertilized eggs in either a gelatinous mass or singly (depending on the species) on submergent vegetation, woody debris,

pine needles, and other suitable oviposition sites. Within hours, a miracle of nature unfolds: each fertilized ovum begins to cleave, quickly advances to a blastula, then elongates to resemble a larval salamander. Once external gills develop, examination of a living embryo with a dissecting microscope reveals red blood cells—vital transporters of dissolved oxygen—circulating through the gills like tiny bumper cars.

The embryos of at least one species, the Spotted Salamander, have maximized their oxygen uptake (and, thus, their growth) by partnering with another organism—a unique green alga, *Oophila amblystomatis* (aptly named after its salamander symbiont). Yet another fascinating product of evolution, the alga garners safe refuge within the innermost egg membrane of the developing larva, as well as the nitrogenous waste needed for sustenance. In return for its hospitality, the larval salamander gains its own oxygen factory: the algal cells are fruitful and multiply, casting a greenish hue throughout the interior of the egg membrane. Amazingly, the intricacies of this symbiotic relationship remain an unresolved mystery.



Terrestrial adult stage of the Mole Salamander. At metamorphosis, aquatic larvae undergo morphological and physiological changes and migrate from their natal pond into the surrounding terrestrial habitat, where they mature into adults like this one. Photo: Dan Holland.



The Marbled Salamander (*Ambystoma opacum*), one of only three ambystomatid salamanders known to lay their eggs on land instead of in a water-filled pond. In autumn, females of this species deposit their eggs in the dry basin of temporary ponds, then sit on or near the eggs until winter rains fill the ponds, causing the well-developed larvae to hatch. Photo: Dan Holland.

The strange and seductive ritual of salamander breeding that awakened my interest in this unique group of amphibians only exists in a remote, ephemeral environment of forested wetlands, which has been shrinking for years due to urban and agricultural development. As these types of land use continue to cannibalize more and more of the woodland habitat that is home for these animals, some members of the mole salamander family are potentially in trouble. Several species—including unisexual forms that have arisen through hybridization of species—have restricted ranges, are relatively rare, and are considered to be vulnerable to extinction. Like other animals, populations of several species of mole salamanders have been extirpated or drastically reduced in size, primarily because of loss of habitat. Four species, along with three “distinct population segments” (DPS) of a fifth (the Frosted and Reticulated Flatwoods Salamanders [*Ambystoma cingulatum* and *A. bishopi*], the Santa Cruz Long-toed Salamander, the Sonora Tiger Salamander [*A. macrodactylum croceum*], and the Central California, Santa Barbara County and Sonoma County DPS of the California Tiger Salamander, *A. californiense*) are already listed as federally threatened or endangered. Buffer zones of at least 500 meters around wetlands provide protection of breeding ponds and terrestrial habitats occupied by adults and metamorphosed juveniles and are needed to help conserve these species.

The imminent demise of my favorite group of amphibians led me to take a more proactive role in their conservation by working to establish the status of amphibian populations and attempting to gain an understanding of the factors influencing population change. More than thirty years after Mrs. Saunders lit my Bunsen burner, I traded in my career as an academic amphibian ecologist to join the ranks of the Department of Interior’s Amphibian Research and Monitoring Initiative (ARMI). As a research wildlife biologist with the U.S. Geological Survey, I now conduct a long-term monitoring program for amphibians in Alabama, Florida, Georgia, North and South Carolina, and Tennessee. Additionally, I seek answers to the vital question of what elements of an amphibian’s environment influence change in populations. I am no longer at the front of the classroom as a teacher, educating others about the diversity of our natural world, its importance to our daily lives and our inseparable connectedness to it. However, I remain an ardent student in nature’s classroom, where every encounter with a salamander—especially a mole salamander—excites me as much as it did in my undergraduate days many years ago.



The author dipnetting for larval amphibians during one of her studies. Photographer unknown.

Outreach and Education Materials – NOW AVAILABLE!

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

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

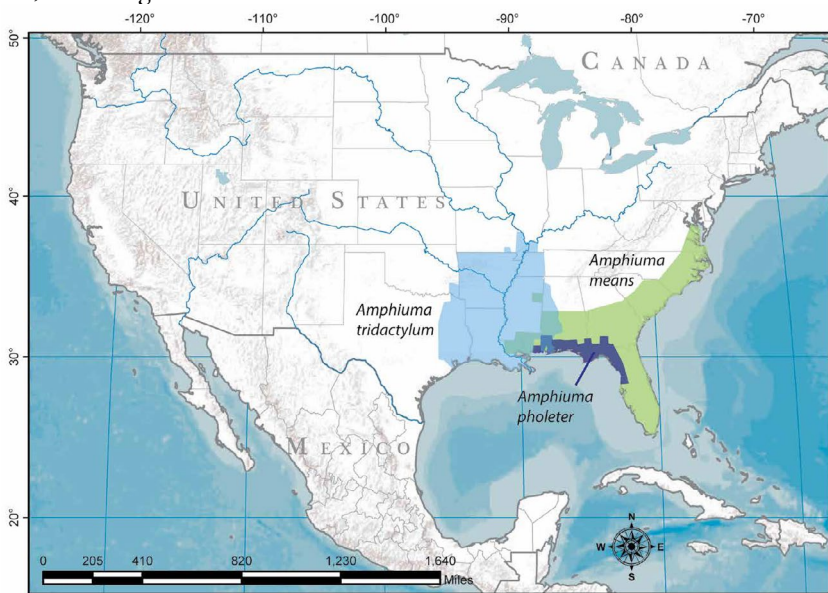
Family of the Month: Amphiumidae

The Two-toed Amphiuma (*Amphiuma means*) is a member of the family Amphiumidae, and occurs in or near wetland habitats of the southeastern United States. Reaching up to 1 m (3.3 feet) long, Amphiumas have elongated, slender bodies with reduced limbs, and are often mistaken for eels or snakes—deceptive common names include conger eel, congo eel, congo snake, lamprey eel, and ditch eel, although they are in fact salamanders. The Two-toed Amphiuma is the largest and most widespread of the three species of *Amphiuma*. Larvae have external gills at hatching, but these are soon resorbed and develop into gill slits. Adults also have lungs, and although predominantly aquatic, they will venture onto land for purposes of dispersal. A variety of invertebrate and vertebrate prey is eaten, including earthworms, insects, crayfish, fish, frogs, and other salamanders. When their aquatic habitat dries, Amphiumas can burrow into mud and form a cocoon of mucus as protection from the dry conditions and emerge when water returns.

Ranges of all three species of amphiumas. The range of *Amphiuma pholeter* (the One-toed Amphiuma) overlaps that of *A. means*; in a small area of Alabama, all three species overlap. Map by Kathryn Ronnenberg, USDA Forest Service, PNW Research Station.



Amphiuma means, the Two-toed Amphiuma - you can see why they could be mistaken for eels. Photo © KM Stohlgren.



Family: Amphiumidae

Also known as:	Amphiumas
Number of Species:	3 extant species, all in the genus <i>Amphiuma</i>
Region / Habitat:	- found in the southeastern United States - live in swamps, marshes, sloughs, slow-flowing streams, and other aquatic habitats
Physical Characteristics:	- elongated, eel-like bodies with tiny limbs - species can be differentiated by the number of toes (one, two, or three)
Behavior / Development	- nocturnal and predominantly aquatic - females lay their eggs in strings and guard their eggs - larvae have external gills and adults lack external gills, but have gill slits and lungs - defend themselves against predators and people with a powerful bite - have been reported to live up to 27 years
Fun Fact:	Amphiumas have 25% more DNA than humans

Life in the Logs—the Oregon Slender Salamander

by A.J. Kroll, Weyerhaeuser NR, Federal Way, WA



Figure 1: A pair of Oregon Slender Salamanders found in a log in the Oregon Cascades, USA.

Under the lofty forest canopies of the Pacific Northwest, the Oregon Slender Salamander (*Batrachoseps wrighti*) leads a reclusive life within the decomposing heartwood of downed logs. Searching for this retiring species (Figure 1) is a challenge, given its preference for inhabiting narrow galleries inside Douglas-fir (*Pseudotsuga menziesii*) logs, many of which exceed three feet in diameter. When log interiors are exposed, Slender Salamanders tend to freeze, relying upon their dorsal camouflage, which closely matches decomposing Douglas-fir bark and heartwood, to avoid detection (Figure 2).

The distribution of the Oregon Slender Salamander is generally restricted to forested environments on the west slope of the Oregon Cascades, USA (although a population was recently located in the eastern suburbs of



Figure 2: The dorsal patterns of Oregon Slender Salamanders are an ideal match against a background of decomposing Douglas-fir bark and heartwood, Oregon Cascades, USA.

Portland, OR, and a small portion of its range extends over the Cascade Crest). The species was petitioned for federal listing under the Endangered Species Act in 2012 because its conservation status is considered “sensitive” throughout its range and its current NatureServe status is G2/G3 (Imperiled/Vulnerable). Global demand for forest products is booming, and the majority of the Oregon Slender Salamander’s distribution lies within biologically productive coniferous forests that are managed for commodity production. As a result, managers need information about specific practices that can be employed to mitigate negative effects when they occur. As with many Pacific Northwest salamanders, the Oregon Slender Salamander was long thought to be associated strongly with late-successional forests containing substantial amounts of coarse woody debris (CWD). However, extensive sampling for this species has not occurred on intensively-managed landscapes.



Figure 3: Coarse woody debris (CWD) is a critical component of forest ecosystems, Oregon Cascades, USA.

Coarse woody debris, including snags, downed logs, and stumps, is an important component of ecological processes in forest ecosystems (Figure 3). Although many studies have examined wildlife associations with CWD, relatively few studies quantified relationships between density, distribution, and CWD characteristics (e.g., piece size and decay stage) and maintenance of viable populations of organisms that use these structures. Together with Oregon State University and Port Blakely Tree Farms LP, Weyerhaeuser NR is conducting a long-term experimental study to determine how Oregon Slender Salamanders respond to forest harvesting and to

retention of CWD. In order to gather this information, sampling for Oregon Slender Salamanders occurs at two spatial scales: larger forest stands (~40 acres in size) and plots (~80 m²) within stands. In each plot, biologists search for salamanders beneath cover objects such as moss mats and in the outer portions of downed logs (Figure 4). This design allows researchers to make inferences about where salamanders occur and what habitat structures (logs of different sizes, species, and decay class) they prefer to inhabit. Initial information suggests that Oregon Slender Salamanders are common in stands ~50-70 years of age. For example, the project has found Oregon Slender Salamanders in more than 70 stands, all of which were harvested previously. Additionally, salamanders are more abundant when downed logs are common in a stand. The latter result is not surprising, given the species' apparent reliance on downed logs to provide necessary micro-environments as well as foraging substrates.

Year of the Salamander Podcasts Coming Soon!

Podcasts will soon be posted on the Year of the Salamander webpage (www.yearofthesalamander.org). Check the site for details in July.



Figure 4: Watching the antics of Oregon Slender Salamanders is an entertaining diversion on a fine summer day, Oregon Cascades, USA.

An Interview with Cathryn (Katie) Greenberg

by Jessica A. Homyak, Weyerhaeuser Company



Katie Greenberg studies the response of wildlife communities, including salamanders, to forest management.

Cathryn (Katie) Greenberg is a Project Leader and Research Ecologist for the USDA Forest Service, Southern Research Station, Upland Hardwood Ecology and Management research work unit at the Bent Creek Experimental Forest in Asheville, North Carolina. She received a PhD from the University of Florida in 1993, a MS in Wildlife Ecology from the University of Tennessee in 1987, and a BA in Philosophy from George Washington University in 1981. Katie has worked for the U.S. Forest Service since 1993 and much of her work there examines the effects of forest management

practices and natural disturbances on plant and animal communities, including salamanders.

What lessons have you learned from working with salamanders that have affected your research on other organisms?

In working with reptiles and amphibians (including salamanders) I have learned that there is no such thing as “wildlife,” generically speaking. Each species has its own set of requirements for habitat, microhabitat, breeding, feeding, and other aspects of their lives, and each responds differently to forest disturbances. So, what might not be so great for some salamander species might create optimal conditions for another species, such as a fence lizard or an Indigo Bunting.

Based on your research, how can land managers ensure their activities are compatible with salamanders, and how resilient are salamanders to forest management or natural disturbances?

My research so far has focused on how herpetofaunal communities—including salamanders—respond to disturbances in upland forests. So, I can't really speak to effects of forest management activities on stream salamanders; however, if BMPs are followed and riparian buffers are retained, then effects of

sedimentation and water temperature should be greatly reduced. In upland forests, it's been my experience that terrestrial salamanders are relatively resilient to natural disturbances such as large areas of windthrow, and anthropogenic disturbances such as shelterwood regeneration harvests or prescribed burning. Some other studies show decreases in salamanders after harvesting—which you might expect given their sensitivity to moisture and microclimate—but so far, ours have not. It may be that site quality affects how salamanders respond to large disturbances; in moist sites where stump sprouts and other vegetation rebound quickly, dropping leaves to create new leaf litter and creating a shaded microenvironment, perhaps salamanders aren't as affected as they might be on dry sites. In my opinion, as long as management activities, such as timber harvests, occur in relatively small areas and there aren't endangered species onsite, then it's a tradeoff—some species such as (perhaps) salamanders may decrease, but they will recover...and other species, such as disturbance-adapted neomigratory birds, may benefit. I think that keeping a landscape-level perspective is important; it's not possible to manage for all species in the same exact location.

Effects of fire on herpetofauna and other ecological features have been dominant themes in your research program. What are the biggest challenges to keeping prescribed fire as a management tool in a rapidly changing landscape?

My colleagues in fire management would say public opinion, land ownership patterns (houses in forested landscapes), and smoke management are some of the biggest obstacles to prescribed burning. Strict prescription parameters or “windows” limit the usefulness of prescribed burning as a precise tool; the burns may or may not get done when, where, or at the intensity prescribed by a land manager; also, some burns are patchy and incomplete, making them a sometimes-crude management tool. In my research with collaborators, we have found that in upland hardwood forests, low-intensity, winter prescribed fire doesn't have a big effect on salamanders or other wildlife. High-severity burns that kill a lot of trees have a measurable effect on birds, but even then only a marginal effect on terrestrial salamanders in hardwood forests... and that might not be compatible with timber objectives. I'm currently collaborating to continue a study of fire effects on herpetofauna after repeated burning and different burn severities, so soon we'll hopefully know more about

that. Of course, not all ecosystems are the same. Fire suppression in most of the Coastal Plain ecosystems would adversely affect many wildlife species where fire maintains “healthy” upland ecosystems. When it comes to prescribed fire as a management tool, having specific objectives is important.

What role does your employer, the U.S. Forest Service, play in salamander conservation worldwide?

Some other scientists in the Research branch of the US Forest Service study salamanders, and contribute to their conservation through knowledge development. And, of course, the US Forest Service manages national forests nationwide, providing a land base for salamanders and lots of other plant and animal species that may not fare so well otherwise, given the current rate and sprawl of urban development.

Do you have a favorite salamander experience?

I've had a lot of what I (cornily) call “adventures with nature.” Like, catching Marbled Salamanders (*Ambystoma opacum*) far from any known water source, watching a mama bear and 3 cubs that weren't aware of my presence, or saving a rattlesnake from certain death-by-vehicle. It's wonderful being out in the woods, watching the miracle of nature, from salamanders to trilliums to Star-nosed Moles.

Many of the “giants” of salamander ecology are men. What has it been like to be a female wildlife ecologist?

I am often one of only a few females in the room when I'm working with land managers, or sometimes even with other wildlife ecologists, especially in the past. A lot of women have entered the field of wildlife in the past



Sampling salamander communities in managed forests often uses drift fence arrays as a passive trapping method. Photo by Aimee Tomcho.

few decades as the definition of “wildlife” has broadened from strictly a game focus to a diversity focus which tends to draw the interest of more women. I don’t really think about male versus female very much. I think that if you do work that’s of interest to others, and you are confident in yourself, then it’s easy to focus on common interests with others rather than differences.

What advice do you have to budding or seasoned scientists?

My advice would be to stay broad in your interests, even if you become an expert in a more narrow aspect of ecology. And, hone your naturalist skills as much as you can. Ecologists who study and model ecosystems without a “dirt” understanding of them can get off track and never know it. I don’t think anyone can really understand an organism—like a salamander—without also understanding their context—the forests and other animals.

How does one make a career out of working with salamanders?

I’m an ecologist who studies salamanders as one way to gauge effects of forest management on forests and wildlife. For me, just studying salamanders would provide an incomplete picture of how wildlife responds to disturbances. In my career, I have focused on wildlife communities, rather than single species or a single group of species. For others wishing to make a career in wildlife ecology, I’d suggest volunteering on a lot of different studies and projects to make sure you like it, and then to narrow down your interests. Conducting a field study in graduate school would be a good way to start a career, and from there hopefully get hired as a biologist or



Northern Red Salamanders (*Pseudotriton ruber*) are a stunning find for any salamander researcher. Photo by Charlotte Matthews Snoberger.

research ecologist.

What role have participating in professional societies played in your success as a scientist?

Professional societies are a wonderful way to meet other scientists who are interested in the same topics; this can lead to new ideas, and productive partnerships and collaborations. They are also a good way for students to meet and talk with other students and professionals. Finally, it’s rejuvenating to be around others in your small “club” of people who think your work is interesting and who also do interesting studies.

**The views and opinions of interviewees are not necessarily shared by all members of PARC or other Year of the Salamander Partners*

Salamanders as Environmental Sentinels

by Joseph M. Lewandowski, Maryland Herpetological Society, Baltimore, MD, USA

Throughout time, environmental signals have been identified to gauge the health and soundness of our natural world. Such predictors have relied on species trends, water and air conditions, or patterns of myriad other environmental parameters. For species indicators, if an individual organism or larger population persists, it suggests that the micro-ecosystem components vital for survival are being maintained and are in a sense “healthy.” Today, there is renewed focus on the value of species indicators, especially where umbrella, flagship, or keystone species may indicate the status of larger more complex ecosystems.

Salamanders are ideal organisms to act as our keystone to determine ecosystem health. First, their fossorial nature and often complex life history places them in extremely close association with numerous microhabitats, including water, air, and soil conditions. In particular, many species have narrow microclimate tolerances, and hence they can be bioindicators of microclimate patterns—a growing concern with climate change predictions. If all microhabitats are optimal, salamanders may thrive. Unlike other organisms that can travel extensive distances should a specific

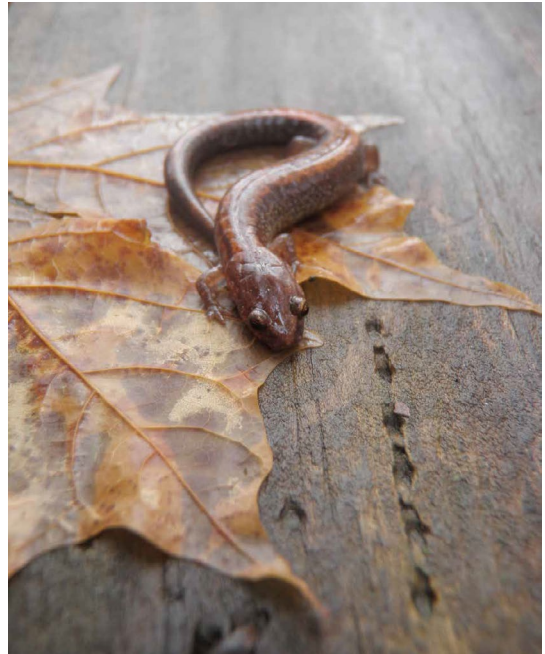
habitat decline, salamanders don't have that luxury. They are much more prone to suffer the effects of habitat fragmentation, as evidenced by the plethora of species with restricted ranges that are being identified as our molecular genetic techniques have developed in recent decades. As past populations have become isolated due to habitat changes, they have diverged sufficiently to be considered different species today.

Second, salamanders are nested in food webs, being key prey for a range of invertebrate to vertebrate predators, and in turn rely on their own faunal prey base. Changes in salamander numbers may indicate alterations in other food web components. However, the importance of salamanders as central food-web components hints at their functional role in both sequestering nutrients from the environment, and bridging aquatic and terrestrial ecosystems. As young aquatic salamanders grow, they sequester nutrients from aquatic habitats, transforming aquatic flora and fauna to vertebrate biomass. Upon metamorphosis and transition to terrestrial lifestyles, they bring those aquatic organic subsidies to terrestrial systems and enrich dry-land fauna. They are nature's transit system, bringing essential nutrients from water to land.

Recent research examines the functional role of salamanders in the cycling of finer-scale elements from their environment due to their role in the center of the food web, with an eye on the increasingly important element carbon, in particular. Atmospheric carbon is intricately tied to greenhouse gases and climate change. Simply put, more carbon in the air is tied to rising surface temperatures. Research on carbon cycling between the Earth-bound ecosystems and the atmosphere is a hot topic! Salamander habitats are among the most important carbon sequestration systems across all the continents of the world.

Carbon is trapped by standing forests and woodlands, the wood and detrital matter on the ground, the waters of those habitats, and their biota. Salamanders may have a significant role in the carbon cycle of these systems, enabling it to be trapped in detritus and soils by eating the bugs that eat leaf litter, transforming it from tiny prey to their salamander bodies—where it is then available for all land life-forms, in addition to moving it from water to land and back again as their own life cycle fluxes between land and water. The suggestion that salamanders have a role in moderating climate change may seem outlandish, but it is yet another example of how salamanders are intricately woven into the web of life on Earth, and the balance of conditions allowing environmental stability.

It becomes obvious as we proclaim the Year of the Salamander that we strive to understand that as a salamander searches for food, shelter, breeding sites, and optimum habitat, they are analyzing the environmental parameters that lead to a sustainable life. Isn't that what an environmental sentinel is? —A monitor of our environment that warns of imbalance. In more ways than previously recognized, our salamanders are excellent predictors of environmental health. They are a true watchdog of our planet, our life. We only need to pay heed that an alarm is being raised.



Terrestrial salamanders like the Eastern Red-backed Salamander (*Plethodon cinereus*) and its western North American counterpart (*P. vehiculum*) can comprise a large proportion of the vertebrate biomass of the forest floor. The predatory salamanders have a significant impact on the numbers of insects that shred and ingest leaf litter as part of the process of decomposition. Recent research suggests that their voracious appetites may actually slow the release of carbon to the atmosphere. Photo by Jenna Quinn, Year of the Salamander Photo Contest.

A New Challenge for Amphibian Conservation in Madagascar: The Invasion of *Duttaphrynus melanostictus* in Toamasina Province

By ^{1,2}Angelica Crottini, ^{2,3}Franco Andreone, ⁴Devin Edmonds, ⁵Candace M. Hansen, ⁵James P. Lewis, ⁶Jean Claude Rabemanantsoa, ⁷Maya Moore, ⁸Fred Kraus, ^{2,9}Miguel Vences, ^{2,10}Falitiana Rabemananjara, ^{2,11}Christian Randrianantoandro

Madagascar, one of the world's biodiversity hotspots (2), is known worldwide for its rich communities of unique and diverse plant and animal species. Currently, 290 amphibian species are documented, with probably over 200 more waiting to be described, classifying the country as the 12th highest in terms of amphibian species richness (3; see also <http://www.globalamphibians.org>).

There are many threats to Malagasy amphibians, including habitat loss, infectious disease and human exploitation for consumption and the pet trade. A national monitoring plan for the early detection of chytrid fungus, *Batrachochytrium dendrobatidis* (Bd), has recently been implemented by the Chytrid Emergency Cell (CEC) with the support of the Chytrid Working Group (CWG; 5). However a new danger is now threatening the amphibian communities of Madagascar—the introduction of the Asian toad *Duttaphrynus melanostictus* (1).

The Asian or Black-spined toad (Fig. 1) is a distant relative of the Cane toad (*Rhinella marina*), one of the most successful invasive amphibian species worldwide, best known for causing severe ecological problems in Australia via poisoning of predators, competition with burrow-nesting birds and disruption of nutrient pools and parasite dynamics. There is now a concern that the Asian toad may wreak similar havoc in Madagascar, where native species may be threatened by predation, competition for resources, or suffer from effects of the toad's natural defensive toxins.

Much like the Cane toad, *Duttaphrynus melanostictus* is highly fecund. It has been reported to lay around 40,000 eggs per clutch, although precise data for the Madagascar populations are lacking. It is poisonous, has a generalist diet and is well adapted for life in agricultural and urban areas. Recent surveys highlight that the first records of *D. melanostictus* in Madagascar may date back to 2010, although the first identification was available to the scientific community in late March 2014 (1). Since then, toads have been observed around Toamasina in easter Madagascar. Toamasina is a major seaport in Madagascar where many shipping containers, goods and vehicles arrive from abroad, although it is uncertain by what means the toad introduction actually took place.

Considering the high fecundity of the toad and high suitability of Madagascar's habitat and climate there is a real concern that



Fig. 1: A picture of *Duttaphrynus melanostictus* from Toamasina surroundings, Madagascar. Photo: Bernard Lambana Richardson.



Fig. 2: Jean Francois from the Madagascar Fauna and Flora Group (MFG) maps area for social surveys. Photo: Maya Moore.

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the species could rapidly spread throughout the island. Especially problematic is the likelihood of native predators feeding on the toad and being poisoned, having evolved in the absence of related taxa and their toxicity. Moreover, there is a concern that the species could enter the residual rainforests of Madagascar, areas of unique biodiversity and endemism. Not far from Toamasina is Betampona Nature Reserve, the last remaining fragment of low altitude rainforest in the area, which harbors an exceptionally high number of endemic amphibians, many of which have yet to be described (about one third of the species of amphibians found there appear to be novel and in need of description) (4).

Malagasy authorities have identified Christian Randrianantoandro (from the Amphibian Specialist Group) as the national coordinator to address this new threat. A group of national and international experts on amphibians and invasive species is currently working together with the national coordinator in order to assess the chances of the toad eradication. As a first step to coordinating the effort, the team has been divided into small Working Groups (WG) to deal with different aspects of the project. The *Survey, Education & Prevention* WG is currently conducting delimitation surveys in order to identify the extent of occurrence of this toad. The same WG is also preparing educational materials to inform local people of the threats posed by this toad to both humans and animals. An invasive-species expert who has identified professionals that can draft a feasibility study for *D. melanostictus* eradication coordinates the *Feasibility Study* WG. The *Chytrid & Sample Analysis* WG carries out phylogeographical analyses to identify the source of introduction, and to screen the collected material for the presence of various

infectious diseases (e.g. *Bd*, Chlamydiales, Amphibiocystidiosis, *Ranavirus*). The *Fundraising* WG is working to raise funds to meet these goals. Last but not least, the *Communication* WG is responsible for maintaining active communications between the different WGs and the Malagasy authorities.

In order to be successful, the actual eradication measures, based on a thorough feasibility study, must start very soon. Hence, time is short, and we here issue an urgent call to the conservation community to boost the fundraising effort.

All [online donations](#) received in support of this project through the ASA will be directed towards better delimiting the distribution of *Duttaphrynus melanostictus* within Madagascar, production and dissemination of education materials, and development and execution of a feasibility plan for eradication, while the more academic research activities are being self-funded by the researchers involved.

References

1. J.E. Kolby (2014.) Stop Madagascar's toad invasion now. *Nature* 509: 563.
2. N. Myers, R.A. Mittermeier, C.G. Mittermeier, G.A.B. da Fonseca, J. Kent 2000. Biodiversity hotspots for conservation priorities. *Nature* 403: 853-858.
3. R.G.B. Perl, Z.T. Nagy, G. Sonet, F. Glaw, K.C. Wollenberg, 2014. DNA barcoding Madagascar's amphibian fauna. *Amphibia-Reptilia* 35: 197-206.
4. G.M. Rosa, F. Andreone, A. Crottini, J.S. Hauswaldt, J. Noë, N.H. Rabibisoa, M.O. Randriambahinirime, R. Rebelo & C.J. Raxworthy 2012. The amphibians of the relict Betampona low-elevation rainforest, eastern Madagascar: An application of the integrative taxonomy approach to biodiversity assessments. *Biodiversity and Conservation* 21 (6): 1531-1559.
5. C. Weldon, A. Crottini, A. Bollen, F.C.E. Rabemananjara, J. Copsey, G. Garcia, F. Andreone 2013. Pre-emptive National Monitoring Plan for detecting the amphibian chytrid fungus in Madagascar. *EcoHealth*. 10(3): 234-240.



Fig. 3: Partner's meeting held in Toamasina to plan initial toad distribution surveys. Photo: Maya Moore.

Citizen Science in the City: Amphibian and Reptile Surveying in an Irish Biosphere Reserve

By Robert O' Sullivan



Searching nets. Photo: Meg Doyle.



Searching refugia for amphibians. Photo: Meg Doyle.

In November 2013, The Herpetological Society of Ireland (HSI) was invited by Dublin City Council (DCC) to conduct a herpetological survey of North Bull Island. The results of this survey will directly contribute to the new Biodiversity Action Plan for the island. North Bull Island is an area of international importance as a UNESCO Biosphere Reserve and a Ramsar Site among other European and national designations. The island potentially provides suitable habitat for three species of native herpetofauna; the Common frog (*Rana temporaria*), the Smooth newt (*Lissotriton vulgaris*) and the Common lizard (*Zootoca vivipara*).

North Bull Island is a 5 km long, 800 metre wide island located in Dublin Bay. The island, a relatively recent addition to the bay, formed as silt from the River Liffey was deposited following construction of the North Bull Wall in the 1820's. The island was declared a National Nature Reserve in 1988 and is home to several species of waterfowl as well as some terrestrial mammals. It is in

both public (1,318 ha) and private ownership (118 ha), and the majority of the site is a public park managed by DCC. Two of the three species this survey focused on were known to occur on the island from anecdotal reports. As all three of these species are protected by law under the Wildlife (and Amendments) Acts 1976-2000, a thorough evaluation of the distribution and status of these insular populations was deemed imperative by DCC in its Management Plan of 2009.

The Herpetological Society of Ireland began the survey in early February 2014, to coincide with the onset of the breeding season of the Common frog (*Rana temporaria*). Nocturnal and diurnal surveys of water bodies were conducted and any individuals encountered were recorded, as were spawn clumps and tadpoles. Similarly, the search for Smooth newts was conducted using a combination of visual inspections of water bodies as well as submersible net traps placed in potential breeding pools.

The focus shifted towards the Common lizard (*Zootoca vivipara*) from late March as the warmer weather should mark an increase in activity, making visual detection of the reptile more likely. Searches

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Data collection. Photo: Meg Doyle.

were conducted along existing pathways, and both natural and artificial refugia were searched. In addition to searching resident refugia, artificial cover objects (ACOs) were introduced to the sampling sites prior to commencement of the survey. These ACOs provide excellent cover for lizards, and provide surveyors with a selection of easily identifiable and replicable survey sites.

While the survey is on-going, provisional results have confirmed the presence of the common frog and the common lizard on the island. DCC has taken these findings under consideration and will aim to protect these populations by limiting further changes to the habitats around the golf courses. The results will inform land management and interpretation of the Island.

As with previous studies, citizen science continues to play a vital role in the success of the HSI's scientific undertakings. The HSI's resident science officers oversee the participation of volunteers, without whom a survey of this size could not be undertaken. Citizen science has proven invaluable in many fields, particularly in light of the global economic downturn. Many studies that cannot acquire funding for research-



HSI education event at North Bull Island Interpretative Centre. Photo: Collie Ennis.

ers from traditional avenues are turning to volunteers to ensure that vital scientific research can be continued. With this in mind, The Society would like to encourage readers to contact us if they wish to participate in this or any future studies.

Science communication is another important goal for the Society and as part of DCC's "Biodiversity in Dublin City Parks" Summer program, our Science Officers delivered a lecture on Ireland's Native Herpetofauna, at the North Bull Island Interpretative Centre. In addition to the lecture, an interactive display allowed visitors to get up close and personal with some of these species.

The HSI would like to thank Dublin City Council, National Parks and Wildlife Services, and above all, our volunteers for bringing this survey to fruition. To follow the progress of this survey, check in with us at www.thehsi.org or find us on Facebook.

A Newt Crossed the Road: Three Years of a Road Mitigation Project in Leeuwarden, the Netherlands

By Tariq Stark, Carlijn Laurijssens and Jeff Peereboom



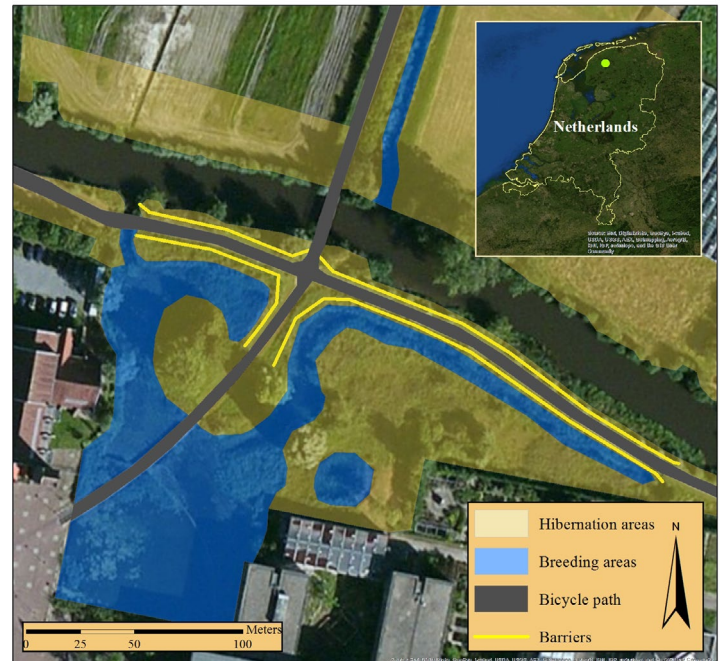
A Common newt (*Lissotriton vulgaris*) crossing the bicycle path! Photo: Tariq Stark.

Since 2012 a small but dedicated group of conservationists are helping five species of amphibians to cross the bicycle path during their spring migration in an urban environment in the North of the Netherlands (Leeuwarden). Last year in *Froglog* 107 (page 30-34) we reported the results and actions of 2012 and 2013. This year we are back and the results have never been better! A short review of the project follows.

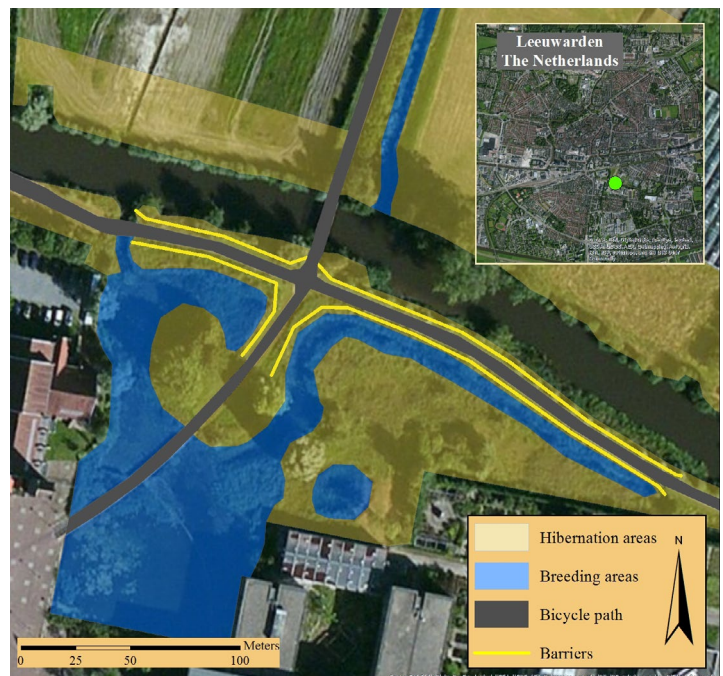
In Leeuwarden, a small river (the Potmarge) flows from downtown to the edge of the city (see figure 1). Alongside this river a narrow strip of vegetation, canals and ponds exist but are completely surrounded by buildings. This narrow and relatively small area is home to an assemblage of five species of amphibians; Common newts (*Lissotriton vulgaris*), Common toads (*Bufo bufo*), Common frogs (*Rana temporaria*), Edible frogs (*Pelophylax klepton esculentus*) and Marsh frogs (*Pelophylax ridibundus*). Alongside the river a bicycle path connects the city centre to several neighbourhoods making it a very busy road throughout the year. Outside the period in early spring when the amphibians are migrating to their breeding waters this poses little threat to the animals. However, during spring migration lots of animals (mostly Common newts and Common

toads) get run over by cyclist. To help the animals cross the road drift fences and pitfalls are placed on both sides of the road. The drift fences function as an obstacle for the animals and guides them to and in the pitfalls. These are emptied twice a day (in the morning and evening). In the first year no less than 539 animals were transferred and in the second 540. This year will shatter those records!

This third season a new management team was ready to carry out the task of helping the amphibians out. The new team consisted



The location of the project area in the Netherlands. Map: Koen van Lieshout.



The location of the project area in the city of Leeuwarden. This map clearly depicts how surrounded the area is by houses, buildings and infrastructure. Map: Koen van Lieshout.



Working on the transect. The inner city is really close to the project area! Photo: Tariq Stark.



Putting in the drift fence and pitfall traps is hard work! Photo: Tariq Stark.

of Jeff Peereboom (Project Manager) and Xandra Sleuwenhoek (Communication). Project founders Carlijn Laurijssens and Tariq Stark advised and helped out wherever they could. The season started at the end of February when temperatures became favorable and humidity and rainfall increased. This kick started the annual spring migration and marked the start for the project to set up and to help them cross the road! This year no less than sixteen volunteers, the municipality of Leeuwarden, supported the project and the Van Hall Larenstein University of applied Sciences. Without the support and help of these three groups this project would not have been possible.

RESULTS OF THE THIRD SEASON

In northern countries, like the Netherlands, conditions during winter become too harsh for populations of ectotherms: the temperature drops too low and prey availability is at its lowest (1). Amphibians in the Netherlands avoid these conditions by burrowing themselves into the ground or at the bottom of a water body (submersed), depending on the species and go into a state of hibernation. Amphibians then wait until the conditions improve sufficiently, in a combination of increasing temperatures, rainfall and humidity and a daylight time of at least nine hours (2,3). In our project area, the common newts are the first to start migrating around mid- end of February and are closely followed by the Common toads and Common frogs. Later in the season the Edible- and Marsh frogs begin their migration, which is a more vertical migration from the bottom of the pond, where they hibernate, to the waters' surface (4). Thus, very few water frogs (*Pelophylax* sp.) species are encountered in our pitfalls.

This season held some amazing nights, with counts up to 80 amphibians and also yielded the highest total number of amphibians with almost 1,000 animals—almost as much animals as the previous two seasons combined. The project started recording the number of animals that migrated throughout the annual migration from the beginning to gain some insight of the population



A male and female Common newt (*Lissotriton vulgaris*) during migration. Photo: Tariq Stark.

numbers and development of the populations over the course of several years.

Figure 1 depicts the counts of season one (2012), two (2013) and three (2014) of the five species. The increase of Common newts is notable, from a 285 individuals in 2012 to 528 in 2014. The Common toads also increased steadily from 217 individuals in 2012, 297 individuals in 2013 to 320 individuals in 2014. Only few Common frogs are caught in the pitfalls but an increase is shown from 18 individuals in 2012, 33 individuals in 2013 to 46 individuals in 2014. As mentioned Marsh frogs and Edible frogs only rarely are found in the pitfall traps. In 2012 15 individuals of Marsh frogs were found, in 2013 only seven individuals and in 2014 no less than 58 individuals were found. Edible frogs are found very infrequently; four animals in 2012, only one animal in 2013 and 14 animals in 2014. Noteworthy is that it is very difficult to distinguish the differences between Marsh frogs and Edible frogs for most of our volunteers. However, a key is available for use in the field but is mostly useful for adult animals and not for the sub adults. It is possible that due to misidentification there are some deviations in numbers. However, animals from both categories are *Pelophylax* sp. Combined the numbers are 19 individuals in 2012, eight individuals in 2013 and 76 individuals in 2014. Overall water frog populations seem to be

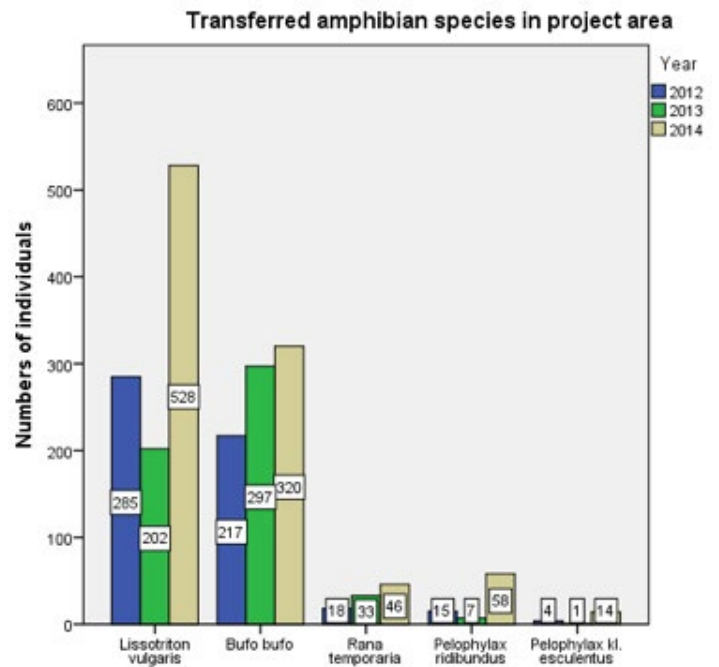


Fig. 1: The results per species of all three seasons thus far. Tariq Stark.

rising in the project area.

NOTES ON SEASON TWO AND THREE

Season two (2013) had an usual migration start near the end of February until it was interrupted in March by a period of harsh, cold weather. It is possible that because these conditions began during the migration a lot of amphibians, notably common newts, succumbed and therefore led to lower (adult) population counts than the previous year. These cold spells can be responsible for increased mortality in migrating Common newts (5).

After the migration season 2013 turned out to be having a warm and quite dry summer followed by very mild autumn and winter temperatures. Even though October/November is the time for amphibians to go into hibernation individuals were being spotted throughout the country and in the project area out and about. In



Jeff Peereboom and Xandra Sleeuwenhoek checking a pitfall trap. Photo: Tariq Stark.

December and January, having unusual high temperatures, amphibians were also seen outside of their hibernation sites. Activity during warm winter intervals is a known phenomena and for several species including *Rana temporaria* and *Lissotriton vulgaris* (5,6,7). How relatively warm winters and warm winter intervals influence body condition and fecundity remains largely unknown. In an area just outside Leeuwarden male and female Common newts were found in the water in November and December 2013 (8). Common newts that stay in the water during winter after breeding do occur occasionally (9).

Because of 2014 's very mild winter it was no surprise that last season's migration, mainly Common newts, began about a week earlier than usual. It is known that median common newt arrival times at the breeding waters are becoming earlier in the season in Southern England, maybe due to climate change (10,11).

Curiously, despite the seemingly unpleasant conditions of the spring of 2013 most populations seem to have thrived during this year resulting in quite high numbers during the spring migration of 2014 (966 amphibians counted).

Hot and dry summers have a negative effect on the condition of Common toads, just as mild winters have (12). Our group didn't measure body condition of the animals but Tariq Stark made the notion about smaller body sizes in comparison with other more southern parts of the country and in comparison of populations on soils comprised out of sand and loam. Some of the individuals in the project area also seemed to be slimmer than usual in the spring of 2014.

EDUCATION

Incorporating education in this project has been an important topic for us since the beginning. Unfortunately we didn't have the resources and manpower to make this happen. We did however have the so-called "Tag-along" shifts in season one and two where people that were interested (from the neighbourhood or otherwise) tagged along with the morning or evening shift. We continued to offer these tag-along shifts into the third season. In the last season we did however had the means to extend our educational projects. Below a short summary of the educational activities we offered this season:

Tag-along shifts: these were especially reserved nightshifts where locals could join in and help the volunteers with their shift. This would give people an insight in the work that is being performed during a nightshift and gave them an excellent moment to gain a close-encounter experience with the amphibians. These days were selected on weather forecast, to give people as much opportunity to see amphibians as possible, and on the volunteers performing the shift.



Carlijn Laurijssens checking a pitfall trap for amphibians. Photo: Tariq Stark.

Education days: The Education days were two arranged Saturdays where adults could sign up their children (ages 6-11 years old). Both days were arranged and led by Carlijn Laurijssens and aided by several members of the project. Before the children arrived the morning shift brought the amphibians caught in the pitfalls to the children so that they can have a hands-on experience with toads, frogs and newts. Even the most apprehensive children dared to hold an amphibian. After the handling session participants were allowed to release “their” toad, frog or newt. After the release session each participant was given a landing net to catch amphibians and their larvae and all other sorts of aquatic critters. Afterwards the participants tried to identify their catches and determine the position of these organisms in the food chain. Many of the children urged their parents to buy landing nets for themselves... future conservationists?

Biology classes: These were specially arranged extensions of Biology classes for a nearby high school (C.S.G. Comenius) organized and led by high school docents Eelco Dekker, Anita Boersma and Carlijn Laurijssens (founder). As a sort of expanded Education day, the students (age 12-15 years old) went netting in the Potmarge, identified their catches and placed the position of these organisms in the food chain.

Website: The project was in need of a website of its own. Volunteer René Broek created an bilingual website (under construction) of the project: <http://www.potmargepadden.com>.

FUTURE

The future of this project is entirely in the hands of ambitious, enthusiastic (future) students, the municipality of Leeuwarden and the Van Hall Larenstein University of applied Sciences. Already the current team and founders are looking for future project managers for the season of 2015. To ensure success for future year a manual is created in 2012 and is updated each year. Also we are looking at possibilities to integrate the project in Wildlife Management modules and classes. After all, the students are the future of this project and we hope that this project will exist for many years to come! The IUCN Amphibian Specialist Group did us the honour of making us partners of the Amphibian Survival Alliance (<http://www.amphibians.org/portfolio-pad>).

References

1. Ultsch G.R. *Biol Rev.* 64, 435-516 (1989).
2. Gregory P.T. *Biology of the Reptilian*, volume 13. (Academic Press, London. pp. 153-154.1982)
3. Vitt L.J., Caldwell J.P. *Herpetology: An Introductory Biology of Amphibians and Reptiles*; (3rd Edition. Academic Press, San Diego. 697 pp. 2009).
4. Kovar R., Brabec M., Vita R., Bocek R. *Amphibia Reptilia* 30, 367-378. (2009).
5. Jablonski D., FFS 18(3), 301-302. (2013).
6. Rugiero L., *Russ J.* 2: 148-152. (1995).
7. Vongrej V., Smolinský R., Bulánková E., Jandžík D. *Herpetozoa*, 20: 173 (2008).
8. Breidenbach J. Personal communication. (2014)
9. Simm C. Thesis Imperial College London (2011).
10. Beebe T.J.C. *Nature* 374: 219-220 (1995).
11. Chadwick E.A., Ormerod S.J., Slater F.M. *Glob Change Biol.* 12: 1069-1078 (2006).
12. Reading C.J. *Oecologia*. 151, 125-131 (2007).



Educational stand of the project during the open days of the Van Hall Larenstein University of Applied Sciences. Photo: Tariq Stark.



Carlijn Laurijssens explaining the differences between toads and frogs! Photo: Tariq Stark.



Carlijn explaining the role of amphibians in ecosystems. Photo: Tariq Stark.



A Common frog (*Rana temporaria*) being held during an educational presentation. Photo: Tariq Stark.



Carlijn Laurijssens educating a group of high school students about the wonders of amphibians in their own backyard! Photo: Tariq Stark.



Children releasing amphibians from the pitfall traps in the breeding water. Photo: Tariq Stark.

Saving the Montseny Brook Newt (*Calotriton arnoldi*) From Extinction: An Assessment of Eight Years of Research and Conservation



Typical morphology of newts from the eastern subpopulation: presence of yellowish spots in many individuals and lack of a whitish spot on the tip of the snout. Photo by ???

By ¹Fèlix Amat, ²Salvador Carranza, ^{3,4}Emilio Valbuena-Ureña, ⁵Francesc Carbonell

The Montseny is a mountain massif situated only 60 km from Barcelona, one of the most populated cities in Spain. As a result of its high biodiversity and rich natural patrimony, the Montseny massif received in 1978 the recognition of Biosphere's Reserve and, in 1987, of Natural Park. During all that time, the Montseny has been the subject of many scientific studies and, at the same time, it is one of the most visited places around Barcelona for mountaineering and other leisure activities. Therefore, it is hard to imagine that this highly visited and transited place is home to the most imperiled amphibian species of Western Europe, the Montseny brook newt (*Calotriton arnoldi*) (1). Populations of stream-dwelling newts were found first in 1980 and considered an isolated population of the Pyrenean brook newt (*Calotriton asper*). After several years of ecological, morphological and genetic studies, in 2005 the populations from the Montseny massif were described as a new species (2). At that time, the very few localities and the scarcity of specimens found in each locality worryingly suggested that *C.*

arnoldi could be a severely endangered species. So, from 2007 we decided to launch an integrative program to evaluate the conservation status of the species, investigating its biology and implementing management strategies.

CONSERVATION ASSESSMENT

After intensive surveys in the Montseny massif including more than 100 mountain streams, our previous fears have been confirmed and we can conclude now that the species is restricted to an extremely small area of less of 8 km². The species is structured into



Habitat of *Calotriton arnoldi* in the Montseny massif. Photo by???

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Male newt from the western subpopulation, showing the typical white spot on the tip of the snout and the absence of yellowish spots on the body and tail. Photo by ???

two subpopulations, constituted by four and three streams each divided by the Tordera river valley. The Montseny brook newt is highly selective in terms of habitat, only being found higher than 600 m above sea level in clean, cold and well-oxygenated fast-flowing streams with numerous cascades and pools, surrounded by well-structured beech and oak forests. One of the reasons for their small range is the complete avoidance of granitic rock substrates, which are otherwise very common in the Montseny massif. In one subpopulation, although the three streams are part of the same hydrographic network, the habitat at the level of the contact zone between the three streams is so degraded and unsuitable for the species that, at present, they can be considered isolated populations. Our field surveys allowed us to estimate the total linear extent of the species' range (as calculated along the different streams) at less than 5.8 km in 2008.

The main threats to the species' persistence include the hydropower period stability and the quality of the forests along the streams. Commercial and private water exploitation has increased dramatically in the last three decades, producing the complete desiccation of the upper basins and even the partial extinction of one population in the 80's. Some streams suffer from severe droughts in the summer, when most of the water flow is subterranean and only a few isolated pools remain on the surface. In one subpopulation, the natural forest has been partially replaced by alloctonous and fast-growing tree species, increasing the deposition of sediments in the streams as a result of increased erosion. These thin sediments fill the rocky crevices, reducing the availability of refuges. Moreover, climatic change has been producing an altitudinal replacement of the beech by oak forest during the last 50 years (3). Oak forests are less favorable for the maintenance of the South facing populations of the Montseny brook newt, as they do not block the sun as effectively as beeches and therefore fail to maintain the optimal conditions of temperature and humidity for the species survival. The other consequence of climate warming is the increase of overall temperatures and plant evapotranspiration, resulting in global aridification.

Most of these problems are more intensive in one subpopulation, in which we found newts affected by melanocytosis (4). Although long-term chytrid surveys have been negative for all the populations (5), in some of them there is a high prevalence of newts with limb abnormalities, especially in toes (6).

SPECIES BIOLOGY AND POPULATION GENETICS

Most aspects of the life-history of *C. arnoldi* are roughly similar to its sister species, the Pyrenean brook newt (*C. asper*), but there is a crucial difference. Contrary to the Pyrenean brook newt, in which immature specimens go through a terrestrial phase that can last up to two years, Montseny brook newts never leave the streams and are therefore aquatic during their entire life. Monitoring activities carried out in two populations during three consecutive years using capture-recapture technique have revealed some of the most relevant life-history characteristics of the Montseny brook newt. They are nocturnal and most of the newts are hidden into the rock crevices or under rocks in the streambed. Only a part of the population develops its activity on the surface and is therefore observable. Despite our intensive monitoring, we were unable to find eggs or young larvae, and observations of developed larvae or immatures were very scarce. Newts of both sexes mature at 3 years and can live up to 9 years. Demographic modeling indicates a lack of emigration and immigration in adults, and population densities vary between 1.1 and 0.2 adults / m of stream.

Taking into account the small range of this species and the results of analyses based on mitochondrial and nuclear genes (7), *C. arnoldi* exhibits a high level of population structuring that coincides with the split of the species' range into two geographically isolated subpopulations. Each subpopulation also presents some degree of structure and different levels of genetic variability according to mitochondrial DNA and, at a lesser extent, nuclear DNA. In addition, these results support that *C. arnoldi* exhibits strong phylopatry. Interestingly, this high genetic and geographic structure is paralleled by morphological differences in body proportions and coloration pattern (7).

CAPTIVE MANAGEMENT AND EXPERIMENTAL INTRODUCTION

In 2007 we launched a captive program based on 5 and 6 pairs from each subpopulation in the Center of Fauna Conservation of Torreferrusa, 30 km from the Montseny massif. The main objectives of this program were the foundation of a genetic reservoir based on the species subdivision and to evaluate the success of captive reproduction as a conservation strategy. Installations for breeding as well for the rearing of larvae and immatures have been developed independently for each subpopulation. The reproduction was very successful from the first year but fecundity of pairs has been very unequal, until a recent exchange between the captive members has improved the productivity.

In total we were able to raise 1,205 larvae until 2013 from the original founders and the first generation born in captivity. Actually, two independent breeding centers are underway, one of them in the Barcelona Zoo.

As a result of the success of the captive breeding program, in 2010 we started an experimental program to establish new populations by introducing developed larvae and immatures resulting from the captive reproduc-



Developed eggs and young larvae hatched in the captive breeding center of Torreferrusa. Photo by ???



Installations of the captive breeding center of the Montseny brook newt in Torreferrusa. Photo by ???

tion program. We selected two streams within the potential species range, each one close to a given subpopulation, to release 390 and 142 newts during the period 2010–2014. Field surveys have achieved a low number of recaptures suggesting low survivorship of the introduced newts, although the cryptic behavior of larvae and immatures complicates the assessment of the success of the introduction program. Moreover, attempts of reproduction were observed in one of the reintroduced populations.



Reintroduction of captive developed larvae in a new habitat in the Montseny massif in April 2014. Photo by ???

Acknowledgements

We want give thanks to the Mohamed bin Zayed Species Conservation Fund and the Department of Natural Areas of the Diputació de Barcelona, Miloca foundation and the Generalitat de Catalonia for financial support for the conservation of *Calotriton arnoldi*. We also thanks Yago Alonso, Albert Martínez-Silvestre (CRAC-COMAM), Monica Alonso, Raquel Larios, Elena Obon (CRF-Torreferrusa), Manel Aresté (Barcelona Zoo) and Jaime Bosch (MNCN-Madrid) for their help in the captive breeding program, Daniel Guinart and the rangers from the Montseny Natural Park for their invaluable help in the surveys of *C. arnoldi*, and Delfí Sanuy and Neus Oromí (Department of Animal Production-ETSEA Lleida) for their help and financial support of patologic, genetic, morphologic, demographic and ecologic studies of *C. arnoldi*.

References

1. S. Carranza, I. Martínez-Solano 2009. *Calotriton arnoldi*. IUCN Red List of Threatened Species. Version 2013.2.t.
2. S. Carranza, F. Amat, *Zool. J. Linn. Soc.* **145** (2005).
3. J. Peñuelas, M. Boada, *Global Change Biology* **9** (2003).
4. A. Martínez-Silvestre, F. Amat, F. Bargalló, S. Carranza, *J. Wild. Dis.* **47** (2011).
5. E. Obon, F. Carbonell, E. Valbuena-Ureña, M. Alonso, R. Larios, S. Fernández-Beaskoetxea, M.C. Fisher, J. Bosch. *Herp. J.* **23** (2013).
6. A. Martínez-Silvestre, F. Amat, S. Carranza, *Herp. Notes* **7** (2014).
7. E. Valbuena-Ureña, F. Amat, S. Carranza, *PLoS ONE* **8** (2013)

Dead Wood for Frogs in Leeuwarden, The Netherlands—Update!

By Tariq Stark

In *FrogLog* 109 (page 50-53) we reported on the extensive storm damage in the Leeuwarden Forest by storm “Christiaan” in the fall of 2013. The Leeuwarden Forest (128 hectares in size and planted in 1990’s) located in the northeast of the Netherlands was hit hard. Both sections that were designated for recreation (67 hectares) and production (61 hectares) were severely affected by the storm. Lots of trees were felled, partly felled or denuded from branches. This created a lot of dead- and dying wood on the forest floor, which are great for terrestrial hiding places and hibernation places for the local amphibian community. Dead wood also attracts a myriad of invertebrates on which the amphibians forage. Partly felled trees that were still alive created small ponds and cavities contributing to breeding areas for Common newts (*Lissotriton vulgaris*) and hibernation places. Fallen or partly fallen trees also left gaps that in turn leaves room for more natural vegetation- and forest structure. Trees that have fallen alongside water bodies created additional basking places for Water frogs (*Pelophylax* species). All in all, the storm was a blessing in disguise for amphibians and biodiversity as a whole for the forest.

Shortly after the storm Merel Zweemer, Jeroen Breidenbach, Erik Hoffen and myself (Tariq Stark) created a report of the benefits that leaving the dead wood in the forest would create for biodiversity—amphibians included. This report was offered to councilwoman Isabella Diks of the Leeuwarden municipality in the fall of 2013. We could only hope that ecological benefits would outweigh the economic benefits because the production part of the forest could generate ample money. The costs to harvest the wood would be greater than the benefits. But still, will the wood remain? Especially the large production part of the forest is interesting because the improvement of that area could mean a lot of more suitable habitat for the five amphibian species in the area.

CURRENT SITUATION

Our colleagues Jeroen Breidenbach and Merel Zweemer had a meeting with the officials of the city 13th of June. At this meeting it was revealed that some of the trees would indeed be harvested. In the forest these trees have been marked red and yellow will be cut down and harvested. Other trees have been “ringed.” Ringing a tree means that the bark is stripped away all around the trunk so that the tree will die. It is expected that these trees will also be harvested. Some trees have been marked blue, which means that these trees will not be harvested. A blue mark can indicate that the tree has a value to its surroundings, for example through woodpecker holes. Luckily in some other storm damaged plots no trees have been marked or ringed. We hope and strive to have those dead and dying trees to remain in the forest. To achieve our goals we are monitoring the plots for a second report and hope to influence the decision making process.

The effects of the cleared spaces by fallen trees and dead wood can already be seen especially in part of the forest that is set aside for production. In this part only Poplars grew and the very shaded understory was completely made up by Stinging nettles (*Urtica dioica*) and Cleavers (*Galium aparine*). Now with a more open and patchy forest type, plants like grasses, Buttercups (*Ranunculus* sp.)



A Common newt (*Lissotriton vulgaris*) peeking out of a hibernation place. Photo: Tariq Stark.

and even Redampions (*Silene dioica*) grow and flourish. An increase in invertebrates is also noticeable with lots of dragonflies, damselflies, butterflies and other invertebrates. These factors in combination with the dead wood make the terrestrial habitat for Common toads (*Bufo bufo*), Common frogs (*Rana temporaria*) and Common newts (*Lissotriton vulgaris*) more inviting, than it was before. We hope that amphibians from the other parts of the forest will occupy this part of the forest. To keep track of amphibian presence in these areas we will monitor the area several times in the summer and fall. Monitoring of plants, fungi, birds and mammals are also being planned for these periods in order to get an idea how the area has changed in terms of biodiversity.

FUTURE

To keep as much dead wood in the forest remains a challenge but all parties want the best for this forest. We will keep working together with all stakeholders in the area including citizens, the municipality and other advisors and experts. We strive to make regular updates in *FrogLog* or via blogs on the website of the IUCN ASG.

Many thanks go to the municipality of Leeuwarden, Gilberto Squizzato, Dick van Hoffen, Peter Koomen, Rein Leguijt, Jeroen Nagtegaal, Willem Bosma, Marcel Rekers, Martijn van der Ende, Tjalling Huisman, Marcel van Kammen, Stef Altena, Pieter Douma, Gjalt Faber, Michel Tilma, Pytsje Sol and Binne-Louw Katsma.



Photo: SAVE THE FROGS! Ghana.

Holding on by a Thread: The Plight of the Giant West African Squeaker Frog, *Arthroleptis krokosua*

By 'Sandra Owusu-Gyamfi and 'Gilbert B. Adum

The Giant West African squeaker frog (*Arthroleptis krokosua* Ernst, Agyei & Rödel, 2008; hereafter Giant squeaker frog), is evolutionarily distinct from any West African amphibian (3). It differs from all known members of its genus *Arthroleptis* by its large size (> 40 mm snout-vent-length), coloration and other morphological characters, such as a very broad head (2). This unusual frog, though currently listed as Endangered by the IUCN, no doubt may be one of West Africa's rarest and most endangered amphibians. For four successive years since 2009, despite investing thousands of dollars and countless man-hours in finding it, all efforts proved futile up until October 2013 when just a single adult frog was found at Western Ghana's Sui River Forest Reserve (SRFR). Unfortunately, SRFR is constantly under threat from logging, farming, illegal mineral mining and invasion of the alien weed *Chromolaena odorata* popularly called Devil Weed or Acheampong weed (1,2).

To date the Giant squeaker frog has only been recorded a few times. It was first identified in 2002 from a single specimen recorded at the Krokosua Hills Forest Reserve (3), about 30 km to the SRFR.

SAVE THE FROGS! Ghana, ghana@savethefrogs.com, www.savethefrogs.com/ghana. SAVE THE FROGS! Ghana, KS 15924 Adum Kumasi, GHANA

Despite subsequent active searching to find more frogs it was not until 2009 that 14 individuals, its highest abundance ever, were recorded at SRFR (1, 2). Thus, only 16 individuals of the Giant squeaker frog have been observed to date, three of which have been kept as museum specimens. The fate of these surviving 13 individuals hangs in the balance due to the prevailing threats at their only remaining home on earth, SRFR. In the light of the persistent threats, which we have highlighted below, to save the Giant squeaker frog from imminent extinction we have proposed herein drastic and focused measures including the upgrading of its conservation status from Endangered to Critically Endangered.

INVASION OF NON-NATIVE WEED *CHROMOLAENA ODORATA*

There are already large fragments within SRFR and the Krokosua Hills Forest Reserve that are characterized by highly compacted soil and secondary growth, clogged with the invasive weed *Chromolaena odorata* (2, 3). *C. odorata* is a non-native plant species that is a major threat to biodiversity throughout the tropics (4). *C. odorata* has formed dense thickets that impede the frogs' movement; it may

also be releasing chemicals into the soil that prevent the growth of native plants. In addition, *C. odorata* also depletes the density of leaf-litter that the Giant squeaker frog utilizes for predator escape, protection from desiccation and breeding activities. We suspect the weed's invasion to be one of the proximate causes of the frog's endangerment.

LOGGING

One-third of SRFR representing 105 km² is under logging, and unfortunately the Giant squeaker frog is restricted to these areas (1, 2). Trees here are taller (50-60 m) than those of most other Ghanaian forests and in particular the large occurrence of economic trees such as mahogany (*Khaya* spp) makes SRFR a target by both logging companies and illegal loggers. Currently, two timber companies Logs and Lumber Ltd (LLL) and John Bitar & Co. Ltd. (JCM) own and exploit timber from concessions within which the Giant Squeaker frog occurs. In addition to the legal removal of trees (supposedly 3 trees/ha), there are widespread illegal logging activities by both timber companies and local people. This extensive logging has led to severe habitat fragmentation, and loss of the species' critical habitats (1, 2, 3). There have also been records of species' variability among its small and isolated populations (2), and it may be that the species is already experiencing an inbreeding depression. Unfortunately, to date, there are still no bylaws in place to minimize the impact of logging activities on its survival.

AGRICULTURE

SRFR is a forest of paradox. It is rich in amphibian fauna (2), and at the same time characterized by rich soils essential for the cultivation of cash crops including cocoa (*Theobroma cacao*), cocoyam (*Colocasia esculenta*) and cashew (*Anacardium occidentale*). As such, local farmers have increasingly encroached the reserve, whenever their farms elsewhere become unproductive due to over-cultivation. This has created pockets of farms in and around the reserve, degrading and fragmenting the Giant squeaker frog's habitats and possibly preventing its recovery from the brink of extinction.

MINING

The only remaining home of the Giant squeaker frog has been the major focus of mining companies due to large mineral deposits here including gold. Such companies and even individuals are constantly prospecting the area illegally leaving behind trails of un-

covered mine pits. Following a series of mass evacuations of illegal miners by government recently (www.ghanamps.gov.gh/news-events/details.php?id=1524), abandoned mines have become even more prevalent, serving the more as ecological traps to the Giant Squeaker frog.

SAVE THE GIANT SQUEAKER FROG!

SAVE THE FROGS! Ghana in collaboration with SAVE THE FROGS! USA and the Amphibian Survival Alliance has established a long term-monitoring program to realise more focused conservation actions. We are currently seeking more funding to sustain this program, which also allows local people and university students to build their capacities while helping to monitor the frog's population status and progress.

We have also embarked on a restoration project to improve the species' habitat conditions (<http://www.savethefrogs.com/frog-blog/save-the-frogs-news/call-for-volunteers-to-restore-habitat-of-the-giant-squeaker-frog/>). But with the available funds we are able to remove the invasive weed *C. odorata* and replant native trees in just 4 ha. With the success of future funding, we plan to establish community tree nurseries to raise more native seedlings. With these seedlings, we will replant in the Giant squeaker frog's remaining habitat ranges to quicken the process of its recovery from the brink of extinction. Please read more about our future habitat restoration plans for the Giant squeaker frog at (<http://savethefrogs.com/amphibians/arthroleptis-krokusua.html>) and also [donate](#) here.

Given the plight of the Giant squeaker frog, we also highly recommend the upgrading of its current status of "Endangered" to "Critically Endangered." This reassessment would offer a stronger political platform for more pragmatic and successful conservation programs, which are crucial to ensure its recovery and long-term protection.

Acknowledgements

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References

1. G.B. Adum, M.P. Eichhorn, W. Oduro, C. Ofori-Boateng M.-O Rödel, *Cons. Biol.* 27, 2 (2013).
2. G.B. Adum, C. Ofori-Boateng, W. Oduro, M.-O Rödel, *Zootaxa* 2744 (2011).
3. R. Ernst, A.C. Agyei, M.-O Rödel, *Zootaxa* 1697 (2008).
4. L.G. Holm, D.L. Plucknett, J.V. Pancho, *The World's Worst Weeds: Distribution and Biology* (University Press of Hawaii, Honolulu, USA, 1977)



Photo: SAVE THE FROGS! Ghana.

Working Together to Develop Madagascar's Amphibian Captive Breeding Capacity

By ¹Jeff Dawson, ²Devin Edmonds, ³Karen Freeman, ³Bernard Iambana, ³Maya Moore, ²Justin Claude Rakotoarisoa

The Amphibian Conservation Action Plan (ACAP) 2005 highlighted captive programs as being an essential component of integrated amphibian conservation plans and central to this long-term success was the establishment of captive operations in range countries (1). Doing this however is easier said than done, especially in countries lacking infrastructure, resources and capacity to easily implement them. One such country is Madagascar.

A mega-diverse island nation, Madagascar has a tremendously rich diversity of amphibian species, with four families, 25 genera and potentially upwards of 400 species, of which over 99% are endemic and many are yet to be described. Along with much of Madagascar's other unique fauna its amphibians face a number of threats, most notably habitat loss but also the ongoing effects of climate change, overharvesting for the international pet trade and the recent discovery of chytridiomycosis in exported frogs is a new potentially devastating threat.

It was threat of chytridiomycosis and its potentially catastrophic consequences that the 2008 Sahonagasy Action Plan used to urge the need for investment in *ex situ* breeding programs (2). Now that it has been discovered in exported Malagasy frogs immediate attention is therefore warranted to develop the infrastructure and personnel in Madagascar needed to enact *ex situ* conservation programs as an important component in safeguarding Madagascar's threatened amphibian species.

BUILDING ON SOLID FOUNDATIONS

Fortunately this process is not starting from the complete beginning. In early 2011, through a collaborative effort between Association Mitsinjo, the Amphibian Specialist Group of Madagascar, and the Direction Générale des Forêts a breeding facility was developed in Andasibe, east-central Madagascar. Currently operating a breeding program for the Critically Endangered Golden mantella (*Mantella aurantiaca*), the biosecure facility now manages nine species, all of which are native to the local area, in addition to sustaining populations of a range of live food cultures. These species comprise a variety of breeding and life history types which provide information and guidelines for future threatened species.

The breeding facility is operated by the locally-run conservation organization Association Mitsinjo and is staffed by a team of eight residents from the Andasibe area. This impressive operation is testament to what can be achieved in Madagascar and is an exemplary model for other breeding facilities to follow.

To help this initiative and expand on the existing knowledge developed in Andasibe, Durrell Wildlife Conservation Trust (Durrell) jointly ran an EAZA funded Amphibian Conservation Husbandry training course in 2012. This included Malagasy participants from eight institutions, including Madagascar Flora and Fauna Group's (MFG) Parc Ivoloïna, a zoo and forestry station located near the eastern coastal city of Toamasina.

Parc Ivoloïna is now the site of a second small amphibian captive



Guibemantis pulcher at Mitsinjo's captive facility Photo: Devin Edmonds.

breeding facility. Completed in October 2013, staff have since been culturing fruit flies, developing biosecurity protocols, and finally maintaining a captive group of the Common reed frog *Heterixalus madagascariensis* as a practice species. It is imperative that any new captive breeding facility or initiative begins on the correct foundation on which to build and develop. Parc Ivoloïna is in the fortunate position of having the technical expertise and a successful model in country with Mitsinjo.

COLLABORATIVE ACTIONS

As a key component of Durrell's Madagascar amphibian pro-



A technician caring for frogs at Mitsinjo's captive facility. Photo: Devin Edmonds.

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gram Durrell are facilitating a series of training exchanges between Association Mitsinjo and MFG Parc Ivoloïna. These exchanges will enable the specialized amphibian technicians at Mitsinjo to share their expertise with the MFG team, working together to trade ideas and to improve the park's newly developed facilities.

Mitsinjo made an initial visit to Ivoloïna at the beginning of May 2014. Following this trip a plan for the coming months was drafted which includes minor infrastructure improvements—for example the installation of an isolated quarantine room—and then training exchanges whereby staff from Parc Ivoloïna work alongside Mitsinjo in Andasibe and vice versa. An improved version of the curriculum used to train Mitsinjo technicians during the first six month period in 2010-2011 when the facility in Andasibe was being constructed will be used with Ivoloïna staff. Not only will this be useful for keepers at Ivoloïna, but it will also provide an opportunity for Mitsinjo's technicians to become teachers of captive amphibian husbandry themselves, building upon their more than three years existing experience working with captive frog populations in Andasibe.

These training exchanges are being supported by additional activities to guide future captive breeding initiatives. Mitsinjo and MFG with assistance from Durrell and Amphibian Ark are applying the AArk Amphibian Conservation Needs Assessment Tool (3) to the species in the Andasibe and Betampona areas respectively. Doing so will provide information on which species to prioritize for future captive breeding and allow the necessary preparations to be made. This could involve taking in a common analogue species so as to develop husbandry guidelines and protocols prior to bringing in threatened species when needed.

Following on from this assessment, collecting crucial life history and ecological information on priority species is critical for their future captive breeding. Durrell will be working with Mitsinjo to do just this for five Data Deficient species that have been identified as being at high risk from chytridiomycosis in the Andasibe area (4). Through this Mitsinjo staff and local community members will be trained in amphibian survey and monitoring techniques again improving the local capacity for amphibian conservation.

We are hopeful that through these training exchanges, further capacity will be built in Madagascar to allow rapid *ex situ* action to take place for the unique and highly endemic amphibian fauna of the island. Importantly we also hope this will be the beginning of a broader goal to build a national captive breeding network for Madagascar. This will enable the sharing of ideas, techniques and skills amongst the centres and develop an integrated collaborative ethos within the amphibian captive breeding community which will ultimately benefit the threatened amphibian fauna of Madagascar.



Mitsinjo and MFG staff working together at Parc Ivoloïna in May 2014. Photo: Devin Edmonds.



Feeding *Boophis* tadpoles at Mitsinjo. Photo: Devin Edmonds.

References

1. Gascon C. et al., Eds. *Amphibian Conservation Action Plan*. (IUCN/SSC Amphibian Specialist Group. Gland, Switzerland and Cambridge, UK. 64pp, 2007)
2. Andreone F, Randriamahazo H., Eds. *Sahonagasy Action Plan. Conservation Programs for the Amphibians of Madagascar / Programmes de conservation pour les amphibiens de Madagascar*. (Museo Regionale di Scienze Naturali. Conservation International, IUCN/SSC Amphibian Specialist Group, Turin, Italy, 2008)
3. AArk Amphibian Conservation Needs Assessment process, http://www.amphibianark.org/pdf/AArk_Conservation_Needs_Assessment_tool.pdf (2012)
4. Lötters S., Rödder D., Kielgast J., Glaw F., Hotspots, conservation and diseases: Madagascar's megadiverse amphibians and the potential impact of chytridiomycosis. In Biodiversity Hotspots: Distribution and Protection of Conservation Priority Areas, F. E. Zachos, J. C. Habel, Eds. (Springer-Verlag, Berlin, Heidelberg, 2011)

Fragmented Habitats and Species: The Challenges of Amphibian Conservation in Tanzania Today



Afrixalus stuhlmanni, a common species in Tanzanian coastal forests. Photo: Michele Menegon.

By ¹Chris Barratt, ²Elena Tonelli, ³Michele Menegon, ⁴Nike Doggart, ⁵Andrew Bowkett, ⁶W. Edwin Harris, ⁶Kim Howell, ⁶Wilirk Ngalason and ⁷Simon Loader

Efforts to document and conserve the Tanzanian amphibian fauna have been ongoing for many years. Although no specific measures to protect amphibians were made early on, the protection of forest habitats in coastal and montane parts of Tanzania has contributed to their survival. For example, during the early days of the German occupation of Tanzania the selective protection of forests provided amphibians with a degree of protection on both small and large scales. At the same time the expansion of agricultural areas during the colonial period, such as tea and coffee plantations in the mountains, and a range of crops in the lowlands, has resulted in a highly detrimental impact. Not until relatively recently have there been conservation projects specifically aiming to monitor and preserve amphibian species, with the realization that certain species or habitats are facing serious threats. In this article we briefly outline different approaches to amphibian conservation research currently being conducted in Tanzania today, focussed either on habitats (with amphibians used as indicators) or on species of critical conservation concern.

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Current conservation challenges facing Tanzania are numerous, although they are certainly not insurmountable with appropriate management and assistance. As within many other countries around the world, particularly those in Africa, the rapid expansion of the human population has intensified pressure on natural resources and many landscapes have been heavily modified as a result. Deforestation has completely removed certain habitat types at the local scale and is causing widespread habitat fragmentation across the landscape, compromising the viability of ecosystems in these areas. Given that well over 70% of the population lives in rural areas (1), a huge proportion of the population is reliant on local woodlands and forests for non-timber forest products such as traditional medicines and food. Unsustainable logging, charcoal production, fuel wood collection, destructive mining practices and the expansion of agriculture are the major drivers which are removing natural forest cover and threatening biodiversity (including amphibians) across the region (2). The impact of increased pressure on forests is compounded by chronic under-investment in reserve management; inadequate human resources; and a weak commitment to law enforcement on the part of the Tanzania Forest Service.

Threats to amphibians are particularly evident in the coastal region of Tanzania, where forests continue to decline as a consequence of expanding populations and proximity to urban areas. Given that only a small proportion of coastal region forests are currently formally protected (3), great efforts need to be made to conserve what little of the natural forest remains. A current project led by colleagues in Tanzania, Switzerland and Italy is investigat-

ing the amphibians of the lowlands of Tanzania and the effects of habitat fragmentation on their biodiversity. The approach is more focussed on habitats than particular species. The project is examining the phylogenetic structure of amphibian communities across the entire range of the coastal lowlands, within Ruvuma, Mtwara, Lindi, Pwani, Morogoro and Tanga regions. We are cataloguing biodiversity across this region and using molecular evidence to pinpoint areas that are rich in genetic diversity. By using a range of approaches (species distribution modelling, population genetics and geostatistics) we seek to understand the distribution of biodiversity for future conservation management of the region.

In contrast to the broader habitat conservation approach, there is also concern for the many diverse and unique species restricted to montane areas in Tanzania. In particular, the Eastern Arc Mountains are home to many rare species with extremely narrow distributions whereby the loss of even small forest patches could cause extinction. Recent monitoring efforts in relatively well-protected forest areas have documented significant species declines, perhaps due to climate change or other anthropogenic ecological change. Clearly, habitat loss and degradation is especially dangerous for amphibian species with extraordinarily narrow distributions, and so documenting their presence is a priority.

Many species with narrow distribution patterns can be found in the Uzungwa Scarp Forest Reserve (USFR; 200 km²), a large block of mainly closed-canopy forest at the South-Western end of the Eastern Arc Mountains in Tanzania. The large elevation range of this forest (300 m - 2,068 m a.s.l.) results in a remarkable variety of vegetation types and possibly accounts for the presence of a number of strictly endemic species. Preliminary assessments have shown a unique herpetofauna in the USFR (4), with four amphibian species regarded as hyper-endemic (*Nectophrynoides asperginis*, *N. poyntoni*, *N. wendyae* and *Hyperolius kihangensis*) since they have only been recorded from very restricted areas within this forest. If the currently known distribution is correct (a few hundred square metres), these are amongst Africa's rarest and most threatened frogs (5). The story of *N. asperginis*, previously documented here in FrogLog (6), is a case in point. However for these hyper-endemic species it is possible that some species are more widespread within this forest than presently known as large portions of the USFR have not been adequately surveyed yet. An international collaboration, led by colleagues in Tanzania, UK, Italy and Switzerland aims to produce an exhaustive inventory of the amphibian species in USFR including an assessment of their distribution and ecology. The project will also characterize the population genetic history of these species in order to determine their conservation status.

Molecular approaches can be used to prioritize conservation management for both species and the habitats in which they are found. Even in 2014, surprisingly little is known of the Tanzanian amphibian fauna and the inter-relationships between taxa. Despite years of interest and scientific research since the start

of the twentieth century, even basic ecological data on most species is still required. In terms of systematics, many of the species which are currently known to science form complexes of morphologically similar species groups which are poorly understood, and with more molecular data in the future it is almost certain that we will uncover new species as we unravel the complexities of these groups and help towards their conservation. Overall these projects aim to highlight the importance of the amphibians of Tanzania and inform future conservation management by conducting basic scientific research. Partnerships between Tanzanian and international institutions are fundamental towards the success of these projects, and by including conservationists based in Tanzania, our aim is to understand and conserve one of the most diverse amphibian faunas on the continent of Africa.

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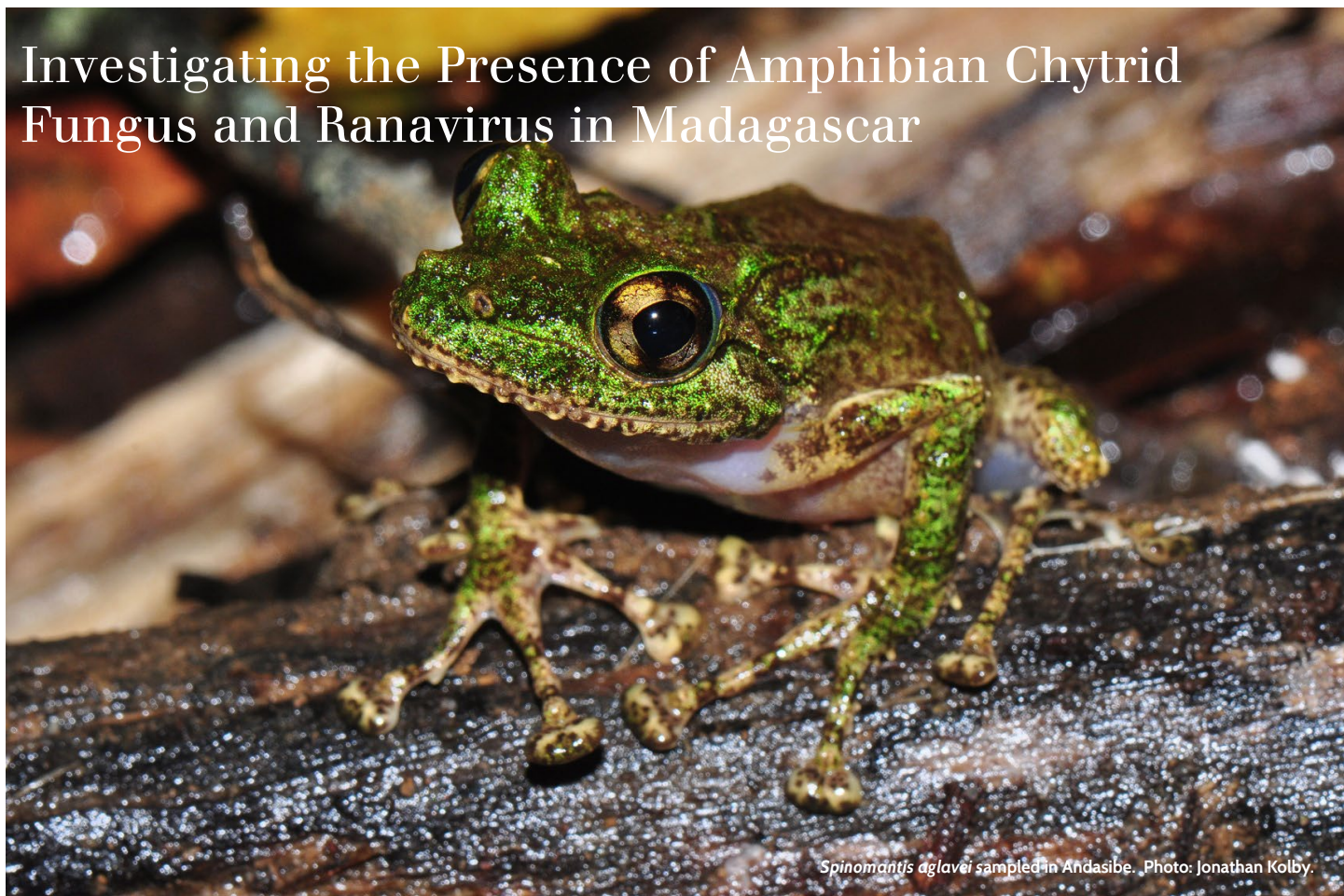
References

1. World Bank World Development Indicators, <http://data.worldbank.org/country/tanzania> (2012).
2. N. Burgess, L. B. Mwasumbi, W. J. Hawthorne, A. Dickinson & R. A. Doggett. *Biol. Conserv.* 62, 205 (1992).
3. Tanzania Forest Conservation Group, Coastal forests under threat, <http://coastalforests.tfcg.org/threats.html> (2012).
4. M. Menegon, S. Salvidio, in: *African biodiversity: molecules, organisms, ecosystems*, B. A. Huber, B. J. Sinclair, K.-H. Lampe, Eds. (Springer, New York, 2005), pp. 205–212.
5. H. A. Seki, A. E. Bowkett, M. J. Bungard, N. Doggart, M. Menegon. Current status of three endangered hyper-endemic amphibian species in the Uzungwa Scarp Forest Reserve, Tanzania (Tanzania Forest Conservation Group and Whitley Wildlife Conservation Trust, Dar es Salaam, Tanzania, 2011), pp. 1–12. <http://www.tfcg.org/pdf/Uzungwa%20Scarp%20Amphibian%20Report%202011.pdf>



Nectophrynoides poyntoni, a hyper endemic from the Udzungwa Scarp Forest reserve. Photo: Michele Menegon.

Investigating the Presence of Amphibian Chytrid Fungus and Ranavirus in Madagascar



Spinomantis aglavei sampled in Andasibe. Photo: Jonathan Kolby.

By ^{1,2}Jonathan E. Kolby

Early detection of amphibian chytrid fungus (*Batrachochytrium dendrobatidis*, *Bd*) in Madagascar is a global conservation priority, and a preemptive national monitoring plan was established to facilitate this goal (4). In addition to these coordinated field efforts, proactive *Bd* surveillance was also performed in the USA, within the international amphibian trade exported from Madagascar (3). Trade surveillance offers the unique opportunity to sample a high volume and diversity of amphibians in a short period of time at a centralized location. This approach allows expansive surveys to be performed with less human and financial resources than would be required to amass comparable samples through conventional field surveys, which is important for potentially long-term proactive surveillance aimed to detect early pathogen arrival. To investigate this concept and its relevance to Madagascar, I sampled 565 amphibians in a shipment of native wild-collected amphibians exported from Madagascar to the USA. Skin swabs were collected directly upon importation, and processed by quantitative PCR for the detection of *Bd*.

Bd was detected in three of 565 amphibians exported from Madagascar, confirming its presence in the country (1). Nine amphibian species were sampled, and *Bd* was detected in three, one individual each of the following species: *Heterixalus alboguttatus*, *Heterixalus betsileo* and *Scaphiophryne spinosa*. Although these data do confirm the presence of *Bd* in Madagascar, the inherent nature of trade sur-

veillance makes it difficult to surmise the distribution of *Bd* in the country. This is due in part to the unknown collection localities of these frogs together with the potential for cross contamination (both domestic and international) when animals are temporarily held inside a commercial export facility. Regardless, the project served its purpose and was able to help demonstrate that *Bd* is indeed present somewhere in Madagascar, raising concern for the welfare of the nation's amazing amphibian biodiversity.

In February 2014, I traveled to Madagascar to respond to this concern with a rapid response project to produce a national snapshot of amphibian pathogen distribution, specifically for *Bd*, and also ranavirus, another pathogen of considerable potential impact. This national surveillance effort targeted areas expected to be favorable for *Bd* and ranavirus, spanning 12 locations including both urban and wilderness habitats, national parks and world heritage-listed rainforests, and commercial amphibian export facilities. Hundreds of amphibians were sampled, with a particular focus on tadpoles when possible, since younger animals often demonstrate a higher prevalence of *Bd* and ranavirus infection than do adult frogs. In addition to conventional amphibian swabbing methods for disease detection, environmental sampling was simultaneously performed to enhance the sensitivity of survey results. These environmental surveys entailed water filtration techniques aimed to capture disease particles released into the habitat by infected amphibians, if present.

Activities to promote local capacity building and education were also performed. Malagasy survey participants were trained in techniques to sample amphibian larvae for *Bd* and ranavirus, as well as

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Amphibian habitat in Ankaratra sampled for the presence of *Bd* and ranavirus. Photo: Jonathan Kolby.

the methods to perform environmental pathogen detection. Outreach was also provided at a secondary school near Ankarafantsika National Park, in the form of a presentation about the importance of amphibians to a classroom of 40 highly inquisitive students.

All samples collected are now being analyzed and results will soon be announced, providing an indication of the extent of current pathogen distribution and establishing a baseline for future disease dispersal studies. The origin of *Bd* in Madagascar also remains in question due to the absence of significant amphibian importation, which is believed to be a considerable source of *Bd* introduction elsewhere. Alarming, an incursion of Asian common toads (*Duttaphrynus melanostictus*) has recently been identified in Madagascar, and these invading amphibians could possibly be involved in the introduction of disease and a variety of other ecological disturbances (2).

This rapid response effort was performed in collaboration with Madagascar's Chytrid Emergency Cell and made possible with field assistance provided by Sara Ramirez, IUCN SSC Amphibian Specialist Group-Madagascar, Association Mitsinjo, Durrell Wildlife Conservation Trust Madagascar and graduate students from the University of Antananarivo. This project was funded by the Columbus Zoo and Aquarium and the National Geographic Society.

References:

1. Kolby, J.E. 2014a. Presence of the Amphibian Chytrid Fungus *Batrachochytrium dendrobatidis* in Native Amphibians Exported from Madagascar. *PLoS ONE* 9(3): e89660.
2. Kolby, J.E. 2014b. Ecology: Stop Madagascar's toad invasion now. *Nature* 509: 563.
3. Kolby, J. E. and K. L. Richards-Hrdlicka. 2013. Early Detection of Amphibian Chytrid Fungus in Madagascar Possible Through International Wildlife Trade Surveillance. *Amphibian Specialist Group, FrogLog* 107: 49.
4. Weldon, C., Crottini, A., Bollen, A., Rabemananjara, F. C. E., Copsey, J., Garcia, G. and Andreone, F. 2013. Pre-emptive National Monitoring Plan for Detecting the Amphibian Chytrid Fungus in Madagascar. *Ecohealth* 10: 234–240.



Boophis picturatus sampled in Zahamena National Park. Photo: Jonathan Kolby.



Jonathan Kolby teaching Serge Ndriantsoa, Sylviane Rakotozafy, and Devin Edmonds (Association Mitsinjo) how to detect the presence of amphibian chytrid fungus and ranavirus in water samples. Photo: Sara Ramirez.

Bouncing Along: An Update from the Endangered Wildlife Trust's Threatened Amphibian Program

By Jeanne Tarrant

The Endangered Wildlife Trust's Threatened Amphibian Program has been running since September 2012, and has made some marked progress since receiving initial funding from the Critical Ecosystem Partnership Fund for work in the Amathole montane region of the Eastern Cape Province, South Africa. The program has since grown to include additional projects focused on threatened South African frogs and there are some exciting new prospects in the pipeline. We also launched a national awareness day for frogs in South Africa—Leap Day for Frogs on 28 February 2014.

AMATHOLE TOAD CONSERVATION PROJECT

After being rediscovered in 2011, the Critically Endangered Amathole toad, *Amietophrynus amatolicus*, has become a flagship species for ecosystem restoration work in an important catchment area in the Eastern Cape. The project has resulted in key partnerships for work in the Hogsback area and now forms part of a catchment-wide, multi-partner project to improve ecosystem services, water provision and growing the green economy. Surveys for the Amathole toad based on a predictive model generated in 2013 have so far not revealed any new toad sightings, but we have had a report of the species from a previously unknown site on a private farm. We are in the process of compiling an overall management plan for

the species and its habitat, which will be rolled out to the various relevant land-owners. The local forestry company is very willing to cooperate with management recommendations, and recently removed a large section of pine saplings from a known site.

PICKERSGILL'S REED FROG RECOVERY PROJECT

As part of an assessment for a proposed industrial development, we undertook a population estimate based on call surveys for Pickersgill's reed frog, *Hyperolius pickersgilli*. The study also forms part of a student project jointly with North-West University. Using audio-strip transects and density estimates of calling males, over the course of the breeding season (October 2013–February 2014), we spent many a rainy evening listening out for the quite chirp of this elusive species. The results indicate that approximately 2,800 adult frogs occur at the proposed development site. This information will be critical in moving forward with possible translocation and captive breeding plans for the species that may be necessitated by the development. This will be a first for such a species in South Africa.

The project has now also attracted funding to implement natural resource management and rehabilitation work at selected wetland sites in the Durban area. This work will go a long way toward achieving objectives set out in the Biodiversity Management Plan for Pickersgill's reed frog, which is currently being finalized for



The Hogsback Mountains, Eastern Cape Province, home to the elusive Amathole toad. Photo: Christine Coppinger.



A Kloof frog, *Natalobatrachus bonebergi* egg-clump. Photo by Jeanne Tarrant.

being gazetted by the South African government.

Take a look at this clip for a snap-shot of the project and its captive breeding component: <http://www.youtube.com/watch?v=JvV9KMGGipg>

MONITORING PLANS

In partnership with Ezemvelo KZN Wildlife (the Province's conservation authority), we are in the process of developing long-term monitoring and surveillance plans for KwaZulu-Natal's threatened frogs, and have tested the methods for two (of four) Threatened species during the 2013–2014 breeding season (also see above). The Endangered Kloof frog, *Natalobatrachus bonebergi*, is restricted to forested ravines inland from the KwaZulu-Natal coast. Most populations occur within protected areas as much of this habitat has disappeared outside of these areas. The female lays very distinguishable egg-clumps attached to vegetation or rocks above slow-flowing sections of stream. Counts of these



Honourary Officers monitoring at Vernon Crookes Nature Reserve. Photo supplied by: Lesley Bentley.

egg-clumps provide a potential method of assessing breeding success and indication of abundance. Vernon Crookes Nature Reserve on the KwaZulu-Natal south coast hosts an apparently abundant population of Kloof frogs. Lesley and Mike Bentley, and Brenda Angus are KZN Wildlife Honourary Officers who volunteer their time at the reserve and they readily took on board the chance to help roll out the monitoring plan using egg-clump counts. Between November 2013 and June 2014, they have surveyed a section of stream and recorded all egg-clumps along that section, taking account of details such as height-above-water, exposure to light, the presence of adult frogs and attachment surface. This data will be used to start understanding abundance and can be compared to other sites at which the species occurs.

Recovery of Aquatic Habitats for Amphibians in Natura 2000 Areas of Eastern Spain

By 'Enrique Ayllon, 'Pedro Luis Hernandez-Sastre, 'Cesar Ayres & 'Enrique Montero-Verde

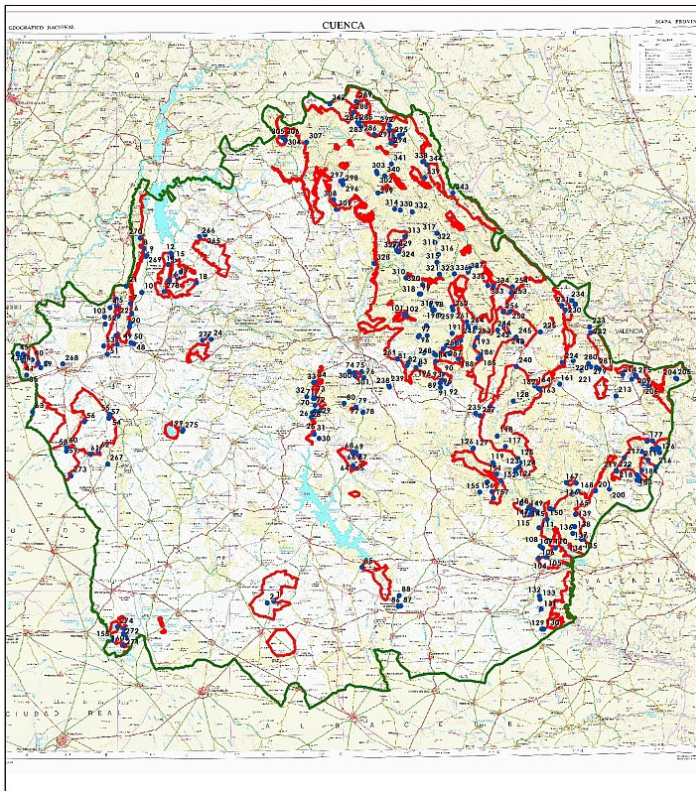


Fig 1: Map of the study area: red lines delimit Natura 2000 areas; blue dots delimit aquatic habitats.

Eastern and Central Spain are arid regions, with few available aquatic habitats for amphibians, with the exception of big rivers and man-made water points like fountains and drinking troughs for livestock (usually for sheep or goats). Cuenca province shows a similar pattern of dry areas with the exception of the mountainous areas of the Serranía. Distribution of amphibians has not been updated since the 1990's (1), even though there are reports of herpetofauna (2). Thus, one of the aims of this study was to provide updated information about the current status of amphibians, specially for species identified as being endangered.

During 2012-2014 a project financed by the regional government (JCCM), with a budget of more than €150,000, was developed by the Spanish Herpetological Society (AHE) in Natura 2000 areas of Cuenca province. Natura 2000 is a network of protected areas across Europe, promoted by the European Union, created to protect priority habitats and species.

- The aims of the project was to:
1. Create a catalogue of the reproductive habitats for amphibians.
 2. Create a database with historical and present records of species breeding in each aquatic habitat, especially for those included in regional and national Red Lists.
 3. Propose rehabilitation activities, adequacy of water points, in

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order to retrieve existing habitats and also create new points that allow connectivity between different populations amphibians, with emphasis on those listed as Endangered or those with limited distribution in the area.

To achieve these aims we undertook the following objectives:

Objective 1: We visited all water points known by technicians and rangers in addition to sites identified in the fountains catalogue released by the Provincial Government including the mapping and inventory work in the Atlas of the province of Cuenca (developed 15 years ago by the same authors of this work) that were within or in the vicinity of the Natura 2000 network. Each aquatic habitat considered suitable for the survival and or reproduction of amphibians was characterized with the number of species detected and possible actions to be taken. We collected information about 344 water points across Natura 2000 areas (Fig.1).

Objective 2: We compiled a database with the amphibian records in the Natura 2000 areas. With this database, we have developed distribution maps in order to provide all information about amphibians distribution in the study area. Nine species of amphibians were detected, eight anurans and one newt. Presence of the different species in each aquatic habitat is reported in Table 1.

Table 1: Species detected in Natura 2000 areas.

Red Natura 2000	Pw	Ao	Dj	Pp	Pc	Ha	Bb	Bc	Pp
1. ZEPA Área Esteparia Mancha Norte	O	-	X	O	X	-	X	X	X
2. LIC y ZEPA Humedales de La Mancha	X	-	X	-	-	-	X	X	X
3. ZEPA Sierra de Altomira	-	X	X	X	X	-	X	X	X
4. LIC y ZEPA Laguna del Hito	O	-	-	O	-	-	-	X	X
5. ZEPA San Clemente	-	-	-	-	-	-	X	X	X
6. ZEPA Hoz del río Gritos y Páramos de las Valeras	-	O	-	X	-	-	X	-	X
7. ZEPA Serranía de Cuenca	X	X	X	X	X	X	X	X	X
8. ZEPA y LIC Alto Tajo	X	X	-	O	-	O	X	-	X
9. ZEPA Hoces del Cabriel	O	X	O	X	X	-	X	X	X
10. ZEPA Rentos de Orchova y Páramos de Moya	-	X	O	-	X	-	X	X	X
11. LIC Yesares del Valle del Tajo	-	O	X	O	-	-	X	X	X
12. LIC Estepas Yesosas de la Alcarria Conquense	O	X	-	X	-	-	X	X	X
13. LIC Río Júcar sobre Alarcón	-	O	-	X	-	-	X	X	X
14. LIC Complejo lagunar de Arcas	-	-	-	-	-	-	X	X	X
15. LIC Cueva de los Morciguillos	-	-	-	X	-	-	X	X	X
16. LIC Cueva de la Judía	-	-	-	-	-	-	-	-	-
17. LIC Hoces de Alarcón	X	-	O	-	X	-	X	X	X
18. LIC Sabinas de Campillos-Sierra	-	X	X	X	X	X	X	X	X
19. LIC Sierra del Santerón	-	X	-	-	-	-	X	-	X
20. LIC Sierra de Talayueles y Aliaguilla	X	X	X	X	X	O	X	X	X

(Pw = *Pleurodeles waltli*, Ao = *Alytes obstetricans*, Dj = *Discoglossus jeanneae*, Pp = *Pelodytes punctatus*, Pc = *Pelobates cultripes*, Ha = *Hyla arborea*, Bb = *Bufo bufo*, Bc = *Bufo calamita*, Pp = *Pelophylax perezi*).

X Presence confirmed
O Presence not confirmed
- Not detected

Objective 3: Propose actions to avoid or correct the typical problems of these aquatic environments:

- Livestock pressure.
- Loss of water inflows.
- Erosion and sedimentation processes.
- Agricultural transformations.
- Occupation by infrastructures.
- Inadequate maintenance practices.
- Loss of traditional uses of water points.
- Indiscriminate access.

- Uncontrolled recreational use.
- Water pollution.
- Introduction of invasive alien species.
- Isolation of populations.
- Trap Effect.



Fig. 2: Traditional water trough made of wood. Photo: AHE.

In the last decade most of the traditional watering troughs made of pine wood (Fig. 2) were replaced by new troughs made of concrete or pvc (Fig. 3). Usually these artificial troughs are elevated from the surface. Thus, the water point remains unavailable for amphibian reproduction. Also, many times the water is channelled using a hose into the water trough, so there is no pond associated with the water overflowing from the trough.



Fig. 3: New water trough made of concrete. Photo: AHE.



Fig. 4: Water trough before restoration. Photo: AHE.

These proposals are mainly focused on:

1. Adequacy of access and escape measures (installation of ramps) to artificial reproductive habitats as pylons, watering troughs, irrigation pools.
2. Rehabilitation of traditional structures that have been damaged or abandoned and may harbor populations of amphibians. (Fig. 4 and 5).
3. Adequacy of water bodies that suffer eutrophication, pollution and/or trampling by livestock, trying to allow amphibians survival and also their use by livestock. (Fig. 6) After the inventory



Fig. 5: Water trough after restoration. Photo by ???



Fig. 6: Creation of a fenced pond for amphibians adjacent to a water trough. Photo: AHE.



Fig. 7: Iberian ribbed newt (*Pleurodeles waltl*) Photo: AHE.

process, the JCCM government began the program to rehabilitate traditional structures and creation of new aquatic habitats. One hundred and six aquatic habitats were created or rehabilitated. The project is still running, and there is a possibility to have an increased budget to rehabilitate more traditional structures. A monitoring scheme should be implemented in order to confirm successful colonization and reproduction of Endangered species, as the Iberian ribbed newt (*Pleurodeles waltl*) (Fig.7).

Acknowledgements

We especially appreciate the assistance from the Provincial Government of Cuenca and Esparvel Group for sharing their work on the fountains in the study area that has served to guide us in the search for breeding sites for amphibians.

We would also like to thank the technicians of the Provincial Delegation of Cuenca and environmental agents that have provided us with helpful information on the location of water points and records of amphibians.

References

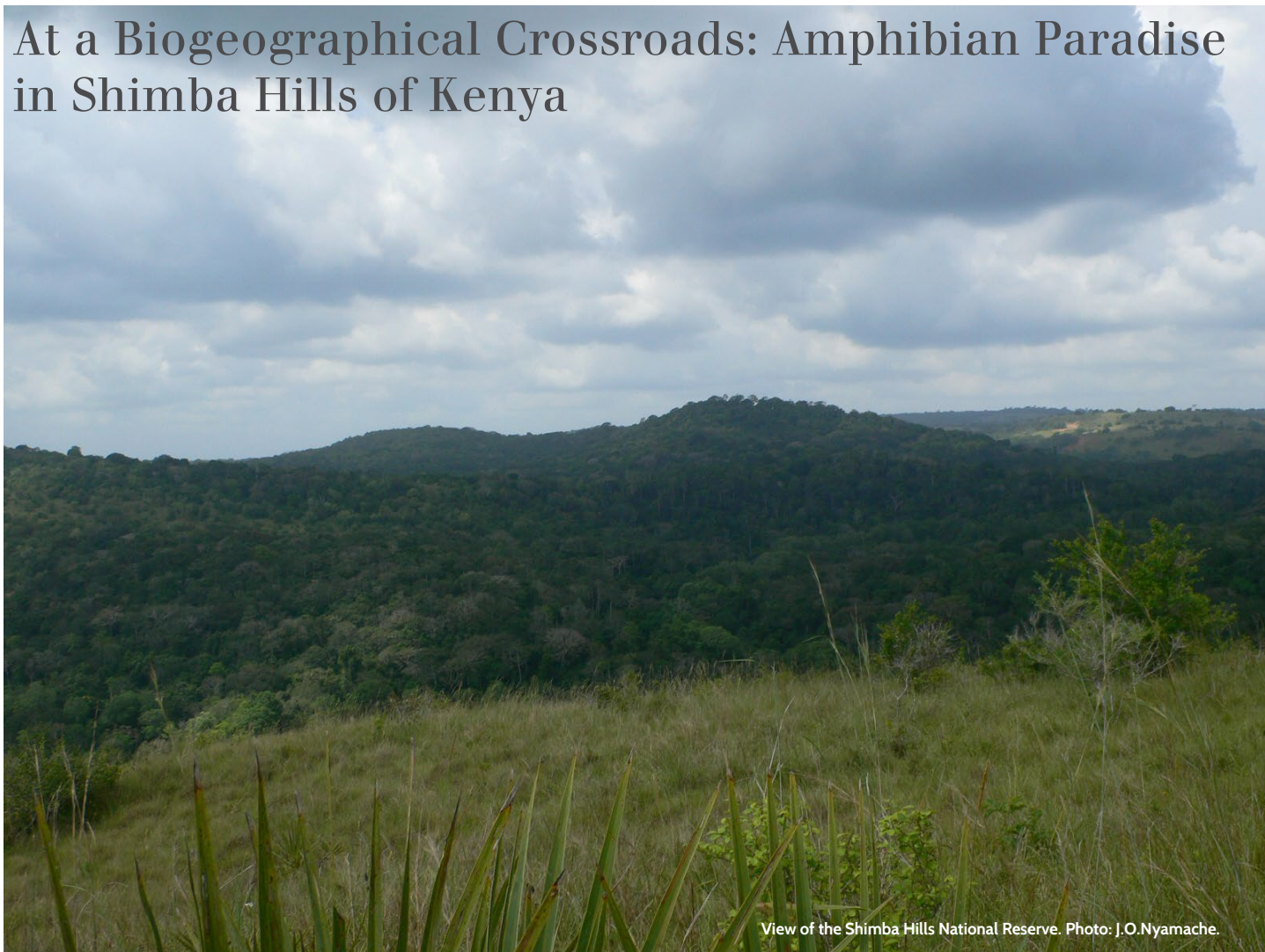
1. Barbera J.C. *et al.*, *Zool. baetica*, 10, 123-148 (1999).
2. Barbera-Luna, J.C., A.J. Galindo, E. Ayllón-López, *Boletín de la Asociación Herpetológica Española*, 17, 10-18 (2006)

FrogLog Schedule

- January – Special Topical Edition
- April – The Americas
- July – Africa, West Asia, Madagascar, Mediterranean and Europe
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At a Biogeographical Crossroads: Amphibian Paradise in Shimba Hills of Kenya



View of the Shimba Hills National Reserve. Photo: J.O.Nyamache.

By ^{1,2}Beryl A. Bwong, ¹Patrick K. Malonza, ¹Dominick V. Wasonga, ¹Joash O. Nyamache, ²Peter Nagel & ²Simon P. Loader

Located just forty minutes by car from Mombasa lie some gentle undulating hills of high biological significance – positioned at the crossroads of coastal and Eastern Afromontane biodiversity hotspots. The Shimba Hills National Reserve (SHNR), although more popularly regarded as an important tourist attraction—home to Kenya’s elephants with its highest breeding elephant population, and the only place where one can see Kenya’s breeding population of the Sable antelope (*Hippotragus niger*)—contains some special species. These species, and the geographical position of the SHNR, point to an interesting biogeographical history. In this article we point out its rich diversity and a project that aims to understand its biogeographical significance.

The Shimba Hills National Reserve (SHNR) ranging in elevation from 300-450m above sea level is one of the largest patches of remaining coastal positioned forests in East Africa. It is important as a tourist attraction site along the coastal tourist circuit in Kenya – and given its National Reserve status has served to protect it. The SHNR area is floristically known to support about 280 endemic plants (1) relatively high compared to other areas of similar size. Currently the SHNR are categorized as part of the coastal forest, however, biogeographically there are suggestions of a more complex history.

From old and recent collections of its herpetofauna it harbors species associated to both the Eastern Afromontane Region and coastal lowland forests of Eastern Africa both forming one of the global biodiversity hotspots. Despite this crossroad position and the unique species it has, no study has ever been conducted to verify its actual biogeographical affiliation and what the historical patterns of species that occupy these regions are.

Piecemeal sampling of SHNR herpetofauna started with the colonial era herpetologists, but none of these studies has ever been comprehensive in geographic or taxonomic sampling to give an impression of the total diversity of the SHNR. National Museums of Kenya Herpetology collection indicates that collecting in SHNR began in the 1960’s by Alex Duff-Mackay, Ronald Keith and Arne Schiotz who were mainly interested in “Tree Frogs” – Hyperoliids and Leptopelid frogs. A period of thirty years elapsed with little to no sampling in the SHNR.

Active collection resumed in 2005 when John Measey and Patrick Malonza made col-



Endemic and Endangered Shimba Hills reed frog (*Hyperolius rubrovermiculatus*). Photo: P.K. Malonza.

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lections, including the highlight find of the Changamwe caecilian (*Boulengerula changamwensis*), Usambara garter snake (*Elapsoidea nigra*) and Pygmy limbless skink (*Melanoseps pygmaes*) which were recorded for the first time inside SHNR (2). Both sampling time and geographical coverage was however very limited. Simon Loader and colleagues (3) detailed the presence of a potentially undescribed brevipitid from SHNR collected by Ronald Keith, which remains to this date the only available specimen. In 2006 a study focusing on the prevalence of Chytrid fungus in Kenya also included the SHNR amphibians in the analysis. As in the rest of the country where collection was done, the fungus was found to be present among the SHNR amphibians (4) outlining the rapid need to assess the biodiversity of this area.

Between 2006 and 2014 several visits lasting up to 10 days have been conducted in the SHNR with the aim to comprehensively survey the area. To date about 34 amphibian species (16 genera and 12 families) are known to exist in SHNR and its environs. This far exceeds the numbers in Kakamega forest 23, the Taita Hills 26 and even Arabuko-Sokoke 24; forests once thought to be more species rich forests in Kenya (5-7). The species so far recorded are mainly lowland coastal forest species and one Eastern Arc endemic species. Only one endemic frog *Hyperolius rubrovermiculatus* has been recorded – though its species status has been questioned (8). Two tree frogs *Arixalus sylvaticus*, *H. rubrovermiculatus*, and one caecilian *Boulengerula changamwensis* are categorised as Endangered in the IUCN Red List of threatened species.

The high diversity of amphibians in SHNR and its unique location at the crossroads of two important biodiversity areas makes it a good candidate for biogeographical studies. A Ph.D. study by the first author based at the University of Basel, Switzerland and Na-

tional Museums of Kenya is ongoing to address this precise question. The project aims to understand the biogeographical history of the SHNR using amphibians as indicator species. This will be achieved employing species distribution models (SDM) and molecular analysis to determine historical and distribution patterns of the SHNR species. The results from this particular study will be of wider significance to biogeographers in the region but we also anticipate towards underlining its conservation importance as an area of outstanding biodiversity in Kenya and threatened herpetofauna.

References

1. Luke, Q., Annotated checklist of the plants of the Shimba Hills, Kwale District, Kenya, *Journal of East African Natural History* 94, 1, 5-120 (2005).
2. Malonza, P.K. and G.J. Measey, Preliminary survey results on the status of amphibians and reptiles of Shimba Hills National Reserve, Kenya. (Tech. Rep. submitted to Kenya Wildlife Service and National Museums of Kenya, Nairobi (2005).
3. Loader, S.P., D.J., Gower, W. Ngalason, and M. Menegon. Three new species of *Callulina* (Amphibia: Anura: Brevicipitidae) highlight local endemism and conservation plight of Africa's Eastern Arc forests. *Zoological Journal of the Linnean Society*, 160, 496-514 (2010).
4. Kielgast et al, Widespread occurrence of the amphibian chytrid fungus in Kenya. *Animal Conservation* 13, 36-43, (2010).
5. Lötters, S. P. Wagner, B.A. Bwong, S.Schick, P.K. Malonza, V. Muchai, D.V. Wasonga, M. Veith A Fieldguide to the Amphibians and Reptiles of the Kakamega Forest. *Kielezo cha amfibia na reptilia wanaopatikana msitu wa Kakamega* – Nairobi and Mainz (National Museums of Kenya, University of Mainz, 2007), pp. 12-39.
6. Malonza, P.K., S. Lötters & G.J. Measey. The montane forest associated amphibian species of the Taita Hills, Kenya. *Journal of East Africa Natural History* 99, 1 (2010).
7. Drewes, R.C. *Amphibian Species of the Gedi and Arabuko-Sokoke Forests, Kenya*. California Academy of Sciences, California, USA 32 (1992).
8. Channing, A. and K.M. Howell *Amphibians of East Africa* (Ithaca and Frankfurt: Cornell University Press and Chimaira, 2006).



Endangered Changamwe caecilian (*Boulengerula changamwensis*). Photo: D.V. Wasonga.

Amphibian Conservation Efforts in Ghana



Togo slippery frog, Volta region, Ghana. Photo: Caleb Ofori.

By Caleb Ofori-Boateng & David Kwarteng Amaning

Like many of their siblings around the world, Ghana's amphibians face threats from the reduction of both the extent and quality of their forest habitat. Vast hectares of forestlands have been destroyed or degraded by the activities of small scale miners. Watersheds that serves as important habitats to critical amphibian populations are continuously threatened. In addition to these drastic reductions in amphibian habitats, commercial exploitation of amphibians as "bushmeat" is in recent times heading towards devastating proportions. It is feared that many large-bodied amphibian species will soon be extirpated due to the unregulated harvesting of amphibians in West Africa.

It is to combat and possibly reverse amphibian declines in Ghana that *Herp conservation, Ghana* (HerpGhana) was founded in 2006 (registered as a not-for-profit organization in 2011). HerpGhana aims at producing a society that is committed to the conservation of amphibians and reptiles and the preservation of the habitats on which they depend. We focus our efforts mainly on the implementation of on-the ground conservation actions such as awareness raising and behavior change education, habitat restoration and capacity building programs. In the past three years we have successfully executed a number of programs that have significantly benefited endangered amphibians in Ghana

One of our successful programs has been the Togo slippery frog

(*Conraua derooi*) conservation project. The Togo slippery frog is unique in many respects. It is Critically Endangered and ranked among some of the top 30 most genetically distinct and globally endangered amphibians of the world. It occurs in only pristine habitats such as primary forest streams in mountainous areas. Also, it has a characteristic endearing whistling call that could only be akin



HerpGhana's 2014 Amphibian Field School graduates. Photo: Isaac Amissah.

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Conservation evangelism at the Kibi Mosque, Eastern Ghana. Photo: Isaac Amissah.

to what you will rather hear on the Brazilian football pitches this June. Recently rediscovered after years of believed extinction it still faces imminent extinction threats due to human consumption and habitat destruction and occurs in only two isolated sites in Ghana (The Atewa Hills and the Togo-Volta region).

In some of the sites where the frog occurs, its habitat is already surrounded by human settlements. In these communities poverty levels are high and, therefore, the standard of living is not very conducive for species conservation in general (*i.e.*, no one cares to conserve species if they are hungry). Moreover, the rural communities are highly religious and often skeptical of ideas that are outside of their religious context. Thus, it is very difficult place to conduct amphibian conservation. To overcome the challenge of amphibian conservation in these rural Ghanaian communities, HerpGhana developed a unique conservation outreach program, dubbed "Conservation Evangelism." Conservation Evangelism uses scientific evidence presented on religious platforms to educate and inspire change that is beneficial to amphibian conservation. Conservation Evangelism, grants us access to churches and mosques to conduct conservation education and to further train religious leaders to incorporate conservation in their work. Through Conservation Evangelism, HerpGhana has successfully engaged the public in amphibian conservation and we are convinced that this is a successful strategy in rural Africa for species conservation. Our volunteers and staff have work hard to significantly reduce the consumption of native frog species, initiated habitat restoration programs with local communities in degraded frog habitats and witness a stable population of the critically endangered Togo slippery frog in some of its known localities.

HerpGhana began its first habitat restoration program in the Central Region of Ghana, by planting native trees on ~5 ha of degraded land "sacred grove." This sacred site was the only known locality for a new undescribed species of Leaf litter frog (*Phrynobatrachus* sp.). Following the success of this habitat restoration pro-



Team of volunteers monitoring the Togo slippery frog population in the Atewa Hills. Photo: Isaac Amissah.

gram, we begun an ambitious project aimed at restoring 40 ha of critical frog habitat of the Togo slippery frog in the Togo-Volta region. The planting site is part of a proposed amphibian sanctuary that will now be protected from disturbance. However, previous farming and logging have altered the watershed, and restoration of tree cover is expected to improve water quality and frog habitat. HerpGhana is working with local communities and a number of stakeholders including the Rufford Small Grants Foundation, the US Fish and Wildlife Service, the Conservation Leadership Program and the Van Tienhoven Foundation to restore native tree cover to these degraded lands.

Until recently, Ghana had only one formally trained herpetologist. Accordingly, training and equipping a generation of herpetologist in West Africa is an essential part of HerpGhana's conservation agenda. Since 2008, we have striven to provide practical training and field experiences for graduate and undergraduate students in amphibian ecology and conservation through our field school program. Our field school targets early career scientist and conservation practitioners from universities and non-governmental organizations in West Africa. Through an intensive one-week practical course in the middle of a rainforest every year in June, participants acquire various skills in species identification, designing and executing research and conservation projects. Through our field school program, we have significantly increased the number of amphibian biologist in Ghana and in the future we hope to replicate our successes all through Africa.

Herp-Ghana truly believes that every species is important and deserves a fighting chance to survival. Amphibians have a right to survival on this planet which ought to be respect by all.

Acknowledgement

We are grateful to our funders: US Fish and Wildlife Amphibians in Decline Program, the Future for Nature Foundation, the Conservation Leadership Program, the Rufford Small Grants Foundation, The EDGE fellowship Program and the Van Tienhoven Foundation, for their generous financial support all these years.



Conservation outreach in Eastern Ghana. Photo: Isaac Amissah.

Towards Enhancing Local Perceptions of Amphibian Conservation Around Mount Manengouba, Cameroon



Fig. 1: Adult *Ptychadena* cf. *mascareniensis* from Mt Manengouba. Photo: L.N. Gonwouo.

By Gonwouo Nono LeGrand, Matthew LeBreton, Difo Joseph Le Doux, Martin N. Etone and Mark-Oliver Rödel

The presence of amphibians around Mount (Mt) Manengouba, as well as their use is not news to the Bakossi tribe. Since ancient times, locals from this tribe have been collecting and using amphibians for various purposes. About 100 species of amphibians (Gonwouo et al. unpublished data) are known from the region among which several are used for various purposes, ranging from food, traditional medicine and mystical powers in various rituals. Beside the frogs being used as food, locals from this tribe seem to have developed good knowledge of the seasonality and ecological behaviors of amphibians to which they attribute cultural relationships. This traditional knowledge has persisted up to date, passed over from generation to generation and seems to constitute an important component of the daily life of the Bakossi tribe around Mt Manengouba.

Despite the high number of amphibians inhabiting the Mt Manengouba area, and the importance several species play to the livelihood of local communities, many human activities have threatened and continue to alter the mountain forest and its associated biological diversity. This mountain harbours an exceptionally rich endemic amphibian fauna most of which are connected to higher altitudes associated with special terrestrial and aquatic habitats. Over the past years environmental degradation has been on an increase in the area. This included increasing agricultural development, forest clearance for human settlement, commercial exploitation of *Prunus africanus* by pharmaceutical companies and

grazing by livestock resulting in reduced forest cover, all in important habitats for many endemic species. Increasing agricultural development has brought along widespread and prolonged use of agro-chemicals (e.g., pesticides, herbicides) leading to water pollution. It has been documented that the use of pesticides, herbicides and fertilizers in agricultural fields could have detrimental effects on the survival of many amphibian species and tadpoles (Stuart et al, 2008; Channing & Van Dijk 1995).

It was with this background that the Cameroon Herpetology-Conservation Biology Foundation (CAMHERP-CBF) developed a project to raise awareness and sensitize the general public around Mt Manengouba on the sustainable exploitation of the mountain forest and the amphibian communities. Of particular relevance to this mountain forest is the presence of at least three endemic amphibians (*Cardioglossa trifasciata*, *C. manengouba* and *Leptodactylodon erythrogaster*; further taxa await description) only known from a few sites around the summit of the mountain. These species have become seriously threatened in recent years due to the degradation of their habitats (see above). Through participatory workshops we intend to examine the importance that local communities around Mt Manengouba attach to the use and conservation of amphibians and their relevance as indicators of environmental quality. Based on the findings, we aim to develop conservation measures, taking into consideration the needs of local communities.

In May 2014 two participatory workshops were held in Nkack

(the first with the villages of Muebah, Epenebel, Ebonemin and Muabi, the second with Poala, Muasum, Muelong, Ekangte, Mbat) to develop strategies to reduce habitat alteration around streams on mountain tops where endemic amphibians are known to occur. The villages were selected on the basis of their position on the mountain flank and their proximity to mountain forest habitats where endemic amphibians are known to occur. These workshops brought together more than 130 people. Discussions were held as to collect information on the value of amphibians to local people, and the importance they attached to amphibian conservation. Discussions involved all age groups with a good representation of older people above age 50 including men and women.

LOCAL PEOPLES' PERCEPTIONS OF AMPHIBIANS CONSERVATION

Local people around Mt Manengouba proved to have a detailed knowledge of the seasonality, ecological relationships, cultural attributes and uses of various frog species found in this region. Some amphibians are considered a veritable delicacy (*Conraua crassipes*, *C. goliath*, *C. robusta*, *Trichobatrachus robustus*, *Astylosternus* spp., *Xenopus amieti*) while these or others have important cultural attributes to the livelihood of the local people (*Trichobatrachus robustus*, *Ptychadena* spp., *Kassina decorata*). Huge aggregations of amphibians around water ponds particularly (*Ptychadena* spp.), seen between March and April, indicates the start of the rainy season and as such the beginning of the planting season. Frogs of the species *Trichobatrachus robustus* (Hairy frog) indicates good luck and are believed to turn infertile couple fertile after eating the male of this species (Gonwouo & Rödel 2008). Additionally, locals revealed that frogs such as *Ptychadena* spp. possess some mystical power. It is believed that an intelligent and smart child will be born if the mother regularly eats them (Fig. 1) during pregnancy. A prediction likely derived from the fact that frog species from this genus are swift and fast jumping. Previous studies (Lawson 1993) documented that locals from the village of Oroko in south-west Cameroon called *Ptychadena mascareniensis*, "mokabe," a name referring to fast and continuous jumping. The later species has also been documented as a frog used by some local tribes in Gabon for the vaccination of balafon players to enhance strength (Pauwels *et al.* 2003).

The collection of frogs for local consumption takes place all year

round but generally, harvest peaks are in the dry season when the levels of the streams and ponds are low and frogs easy to find when rocks are turned over. Collected frogs are consumed at various stages ranging from adult to tadpoles. As far as tadpoles are concerned, they are not collected species specific and sometimes the harvest even includes invertebrates such as crabs (Fig. 2). After collection, the animals are dried and used to cook various dishes during various special cultural ceremonies in the villages. Around the caldera of Mt Manengouba adults and tadpoles of the clawed frogs, *Xenopus amieti* (Fig. 3) are netted in huge numbers by young women, the frogs then dried and used to prepare special dishes to their future husbands. This represents a sign of love and engagement to the future couple in the region. This phenomenon was witnessed and practiced by most people who took part at the workshop (Fig. 4). The various attributes to amphibians placed by locals constitute a strong, additional argument which should be considered when developing biodiversity conservation majors in the region.

ATTITUDES TOWARDS AMPHIBIAN CONSERVATION

Given the various services amphibians provide to the local community in the Bakossi region, their perceptions of the importance of conserving amphibians did not vary much among the local communities from different villages. All locals irrespective of sex and age seemed to see amphibians as important, with more emphases on the species used for food and traditional rituals. The Bakossi tribe thus views amphibians as a very common faunal group providing various services to their community and as such pay particular attention to them. This perception is reflected in reasons given to the answers on why amphibians should be conserved. Amphibians have been (until recently, M. Hirschfeld *et al.* in prep.) very common and could be found everywhere around Mt Manengouba habitats, ranging from forest along fast moving stream in different altitudes, to temporal and permanent water bodies in savanna areas. Local people recognize the importance of amphibian conservation, an idea backed by the various services played by these animals to the community. As reported from another African area where amphibians seem to be harvested in unsustainable numbers (Mohnke *et al.* 2010), the hunting of frogs for food on Mt Manengouba seems to impact the populations of some large species such



Fig. 2: Tadpoles and crabs collected for consumption in the village of Ebonemin, western flank, Mt Manengouba. Photo: L.N. Gonwouo.



Fig. 3: Adult *Xenopus amieti* from water ponds around the Caldera, Mt Manengouba. Photo: L.N. Gonwouo.

as *Conraua robusta* (Fig. 5). An indicator for that assumption is that locals report that they have to move much further from villages to find larger frogs, than previously.

IMPLICATIONS FOR CONSERVATION OF MT MANENGOUBA

The keen interest shown by local people in the amphibians of Mt Manengouba offers a very good opportunity and a potential role of impacting positively on conservation activities at the site, including other biological diversity. Traditional support for amphibian conservation in the area was remarkably strong, with the turnout of eight chiefs from the ten villages that attended the awareness workshop. This came with high community support of conserving the mountain forest with its biological richness with attention to the amphibian species used in various traditional rituals. Together, we discussed strategies to maintain viable populations of used frogs as well as endemic amphibians around mountain forest and streams. One of the major activities agreed on is to maintain forest along streams while reforesting disturbed areas with *Prunus africanus* by planting around farms and forest boundaries. The reforestation activity currently on process in the area is meant to maintain the forest cover with the biological and cultural richness of the site at its present level while also supporting the livelihoods of people who currently depend on the forest. Mt Manengouba has been recommended to the Ministry of Forestry and Wildlife and the Ministry of Culture as: "Mount Manengouba Integral Ecological Reserve" and "World Heritage Sites" on the basis of the outstanding biological richness found in this region and the cultural value played by this site to the people living at its vicinity. Its Gazetement is presently in process and as such conservation of the site should not conflict with local priorities, which is one of the major requirements for local support for conservation. The guaranteed support of local people will depend on how the international community and the Cameroonian government place importance on the biological diversity found there. Interest in the area already is high among scientist because of the continuing research carried out in the region on various taxa. This interest will grow considerably with protected status of the area with further development of a research station. Because the site is so easily accessible from the small town of Bangem, it offers tremendous potentials for both re-

search and tourist visits and as such should be carefully evaluated by the appropriate government agencies and parties interested in the area.

Acknowledgements

Thanks are given to the Government of Cameroon through the Ministry of Forestry and Wildlife (Divisional delegate of MINFOP Bangem). We thank the British Ecological Society (BES) for financial support of current activities on Mt Manengouba. Thanks are also due to IDEA WILD for providing equipment during site visits. We thank the chiefs and local community members of the later villages who participated at the workshops. We also thanks Community Acton for Development (CAD), Amphibian Survival Alliance (ASA) for collaborating in this project.

References

1. Channing A. & Van Dijk D. E. 1995. Amphibia. In: Cowan G.I. (ed.) Wetlands of South Africa. Department of Environmental Affairs and Tourism, Pretoria.
2. Gonwouo L. N. & Rödel M.-O. 2008. The importance of frogs to the livelihood of the Bakossi people around Mount Manengouba, Cameroon, with special consideration of the Hairy frog, *Trichobatrachus robustus*. *Salamandra*, 44: 23-34.
3. Lawson D.P. 1993. The reptiles and amphibians of the Korup National Park Project, Cameroon. *Herpetol. Nat. Hist.* 1(2): 27-90.
4. Mohnke M., Onadeko A. B., Hirschfeld M., and Rödel M.-O. 2010. Dried or fried: Amphibians in local and regional food markets in West Africa. *TRAF-FIC Bulletin*, 22: 11-128
5. Pauwels, O. S. G., Rödel M.-O. and Toham A. K. 2003. *Leptopelis notatus* (Anura: Hyperoliidae) in the Massif du Chaillu, Gabon: from ethnic wars to soccer. *Hamadryad*, 27: 271-273.
6. Stuart S.N., M. Hoffmann, J. S. Chanson, N.A. Cox, R.J. Berridge, P. Ramani, and B.E. Yong (eds). 2008. *Threatened Amphibians of the World*. Lynx Edicions, Barcelona, Spain; IUCN, Gland, Switzerland, and Conservation International, Arlington, Virginia, USA.



Fig. 5: Adult *Conraua robusta* from around Ebonemin, western flank of Mt Manengouba. Photo: L.N. Gonwouo.



Fig. 4: A woman expresses her view on the importance and use of some frogs during the workshop in Muabi, Mt Manengouba. Photo: L.N. Gonwouo.

Poseidon's Offspring

By Paul Johnson

Students of the Gaia Hypothesis are well acquainted with the theory of homeostasis, the idea that we inhabit a self-regulating system in which the pendulum does not take too long to start swinging in the opposite direction. This sudden penchant for all things philosophical has come about from the fact that following last month's ramblings on the effects of drought on our local flora, there have been very few days recently in which I have not walked outside and been soaked to the skin! A stroll through our little reserve will show just how resilient Ma Nature is to the foibles of our good old British weather. Those plants that did not undergo actual desiccation in the dry spell are now looking decidedly chipper!

The undergrowth is green and luxuriant and the canopy is full of large healthy leaves alive with the sighing of our seemingly perpetual breeze. The cracks in the earth have disappeared and our pond is now looking less like a large glutinous puddle and more like a decent habitat for any self-respecting aquatic fauna.

This leads us seamlessly to our 'show of hands' moment! What connects the Greek Water God, the seventh largest moon in our solar system, a cannibalised cafe-racer motor bike of the 1960s and '70s and three of our native amphibians? The answer is all in the name, *Triton*, son of *Poseidon* and father of the *Tritons* or mer-people. The aquatic theme is continued in the nomenclature of the largest moon orbiting the planet Neptune (*Triton*) and the three amphibians in question, the Smooth newt (*Lissotriton vulgaris*), the Palmate newt (*Lissotriton helveticus*) and of course the larger and rarer Great crested newt (*Triturus cristatus*).

The Smooth newt, our most common species, is similar to its Palmate relative and can grow up to 10 centimetres in length. Identification between the two can be problematic especially between the females who don't transform themselves for the purpose of wooing in the Spring. Great crested newts pose no such difficulties being bigger, very dark in colour, and have bright yellow or orange bellies with black markings. The males, as the name suggests, grow magnificent toothy crests in the breeding season. The best time for newt watching is Spring and early Summer as they perform their elaborate courtship ritual. The male, gaudily attired in brightly-coloured nuptial dress, chases after a female at break-neck speed through the water. Once he has manoeuvred himself in front of her and has her full attention he fans his tail towards her and prances around in a manner common to every love-struck male of any species! The end result is that the female lays a few hundred eggs; every one individually wrapped in a tiny leaf parcel. Newt tadpoles, known as *Efts*, differ from frog 'poles' in that their forelegs develop first. A week or so of life is sufficient for them to hone their hunting skills and their tiny teeth make short work of the small aquatic organisms, especially *Daphnia* (Water Fleas), that make up their diet. As adults their carnivorous tastes lead them to become increasingly ambitious and it is common to see newts wrestling with earthworms twice their size before finally admitting defeat. Adult newts spend surpris-



Great crested newt. Photo: Jason Steel.

ingly little time in water, often only returning to breed. Given the temporary nature of many woodland ponds (Quarry Wood being the perfect example!) this is an admirable evolutionary trait. Most newts will return to land after breeding and will overwinter underground or in any damp place where they lie, in a torpid state, curled up like little jellied shrimps. On land they fall prey to just about anything that spots them, especially the beady-eyed Heron and snuffling Hedgehogs. Grass snakes too will take their toll on newt populations, both in and out of the water. Clearly the lives of these fabulous little beasts are fraught with danger from egg to adult. In an effort to prevent *Homo sapiens sp.* from adding to their problems they are given the legislative protection afforded to all amphibians in this country. As such it is illegal for anyone to sell, barter or hire any specimens without a licence.

The Great crested newt has been given special protection which covers both the animal itself and its habitat. This is all well and good I hear you cry, but what about the cafe-racer of yesteryear? Well, bikers of a certain age will no doubt remember the *Triton*; a cunning combination of a Triumph engine and Norton frame. This does not have even the slightest connection to amphibians; although, on reflection, given our present Summer weather...! So there we have it, a very brief summary of the life of a very under-stated aquatic national treasure. These days the UK abounds with amphibian interest groups and societies, all of which do sterling work. However, I leave it to one Bertram Wilberforce Wooster to describe, in his own words, one of the founding fathers of the movement.

"Though never for an instant faltering in my opinion that Augustus Fink-Nottle was Nature's final word in cloth-headed guffins, I liked the man, wished him well."

"Tuppy, old man, the Bassett's going to marry Gussie Fink-Nottle."

"Tough luck on both of them, what?"

"She loves this newt-nuzzling blither."

Right Ho Jeeves, (P. G. Wodehouse 1934)

Aliens that Laugh in the Night

By Paul Johnson

Whilst strolling through Quarry Wood the other day I suddenly had a vivid flashback to my school days; in particular a little school on Cooden Drive, Bexhill (now St Michaels Care Home!), ran by two elderly sisters from Belgium. What had me cogitating on the Halcyon days of four decades ago? I shall keep you in suspense at least until we have had our customary show of hands. This month's ramblings involve a case of mistaken identity, an intrepid journey and yet more of my jingoistic bellowing on the benefits of protecting our native species! So can you lovers of a good mystery connect the 1943 elected Conservative MP for Ashford, a French delicacy and the invasion of our countryside? No, not 1066 and all that, but some rather jovial amphibians.

In 1932 the wife of Edward Percy Smith, Tory candidate, playwright and all round good egg, decided to surprise him with a gift of twelve edible French frogs (*Pelophylax esculentus* formerly *Rana esculenta*) for his garden in Stone in Oxney on the edge of the Romney Marshes. Not intended as a side dish on Gallic theme nights, the frogs were meant to provide aesthetic wonderment with their bright colours and keep unwanted insects at bay. Unfortunately for some reason the good lady ended up with twelve specimens of the Large Hungarian Marsh frog (*Pelophylax ridibundus* formerly *Rana ridibunda*). The Latin scholars amongst you will have already translated their name and may now see where all this is heading. The twelve Laughing Frogs (as they are also known) very soon decided that Mr. Smith's little pond was nothing compared to the vast marshlands over the garden wall. In his wonderful *Kine Saga*, A. R. Lloyd describes in fictional terms how the Founding Twelve spawned and travelled via the maze of dykes and channels pursued by another introduced species, the deadly Mink. As both species never venture far from water this part of the story certainly rings true. What cannot be disputed is that by the 1960s Laughing Frogs had colonised the whole of Romney Marsh. Today we can hear their calls a few hundred yards beyond the Crowhurst Recreation Ground and very eerie it sounds too! Their sound is produced from two large vocal sacs at the side of the mouth and as you walk along wondering from which direction the raucous laughter is coming you will suddenly hear the plop as the large frog jumps into the water. There have been mixed reviews on the deleterious effect of the invasion of these Happy Hungarians as they prefer to breed in dykes and ditches not normally chosen by our native amphibians. However, they are voracious predators and the *Herpetofauna* societies strongly advise against further spread throughout the UK. Where does this leave our little reserve in the fight for the conservation of our native species with all these foreigners knocking on the door ready to eat their younglings? Back to my school days when my venerable teachers used to produce large bowls of Tapioca pudding at lunch time; known (behind their backs) as frog spawn to those of us not reared on a post war diet! It was the sight of large clumps of spawn in our pleasingly full pond that had me reminiscing as well as reassuring me that it is *Rana temporaria*, our Common frog, that rules in Quarry Wood. The Reserve is stunning at the moment. Tadpoles are wriggling within the jelly-like masses of spawn, and newts can be seen hanging motionless just below the surface of the water as if they have been suspended in obsidian. I had the pleasure of watching a Grass snake swimming through the Duck seed leaving a trail I would have sworn was made by a small

water bird if I hadn't seen it for myself. The Bluebells, Spotted Orchids and Wild Garlic are all appearing together this year and our Ladies of the Wood, the Silver Birch, are resplendent in their fresh green leaves atop gleaming trunks. The birds are busy feeding, nest building and singing for all the world to hear. So, plenty to smile about, but no raucous laughter please!

"...Bunda recounted the legend of the great frog migration and the deadly raiders who preyed on it. It was a bleak epic, misty with images of meres, windswept willows, swampy hollows, spires of distant parishes beckoning."

Marshworld, A. R. Lloyd

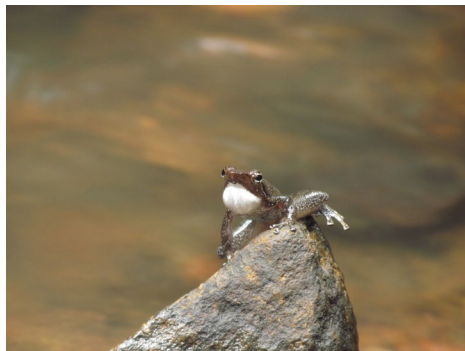


Common frog. Photo: Jason Steel.



Marsh frog. Photo: Jason Steel.

Conservation and Ecology



Micrixalus kottigeharensis, Kottigehar dancing frog. Photo: Gururaja KV.

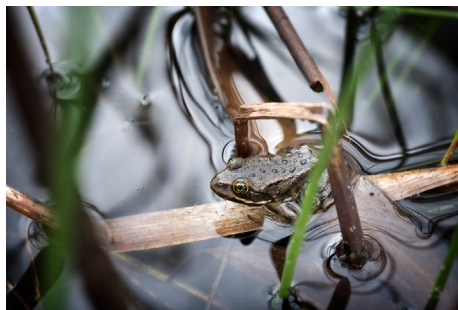
DNA barcoding reveals unprecedented diversity in Dancing frogs of India (Micrixalidae, *Micrixalus*): a taxonomic revision with description of 14 new species

S.D. Biju, Sonali Garg, K.V. Gururaja, Yogesh Shouche, Sandeep A. Walujkar

In this study, we investigate species level diversity in the monotypic frog family Micrixalidae, which is endemic to the Western Ghats of Peninsular India. Attempting the first nearcomplete taxon sampling of Indian dancing frogs from the entire Western Ghats, we use 138 tissue samples collected from 70 localities over the last 12 years for DNA barcoding. Our results of multiple mitochondrial gene (16S and COI) barcoding reveal unexpectedly high species level diversity in the genus *Micrixalus*. Based on molecular and morphological evidence, we herein describe 14 new species, leading to a more than two-fold increase in the number of known species in this ancient lineage. Additionally, certain taxonomic uncertainties about the status of previously known taxa in this genus are resolved. *Micrixalus narainensis* and *M. swamianus* are considered as junior subjective synonyms of *M. kottigeharensis*, whereas *M. herrei* is resurrected from synonymy of *M. fuscus* and confirmed as a valid species. Taxonomic accounts of three species—*M. elegans*, *M. silvaticus* and *M. thampi*—are provided for the first time after their original descriptions. For nomenclatural stability, *M. fuscus*, *M. saxicola* and *M. silvaticus* are lectotypified, and *M. elegans* and *M. kottigeharensis* are neotypified. Detailed descriptions, morphological and genetic comparisons, illustrations, data on distribution, and natural history are provided for all species. We also provide the first osteological description of *M. fuscus*, the type species of the genus *Micrixalus*, and we report foot-flagging behavior in a total eight species,

including two for which it has been studied previously. Overall, our results highlight the underestimation of true diversity in several amphibian groups of the Western Ghats, suggesting that spatial patterns of amphibian richness and endemism in this region need to be further re-examined.

S. D. Biju, Sonali Garg, K.V. Gururaja, Yogesh Shouche, Sandeep A. Walujkar, *Ceylon Journal of Science* 43, 1-87 (2014).



Rana pretiosa female. Photo: Andrew Wright.

Defining conservation-relevant habitat selection by the highly imperiled Oregon Spotted Frog, *Rana pretiosa*

Viorel D. Popescu, Amanda M. Kissel, Monica Pearson, Wendy J. Palen, Purnima Govindarajulu, Christine A. Bishop

We tested the degree of habitat selection at two spatial scales by captive-raised Oregon Spotted Frog (*Rana pretiosa*) individuals released at two sites in British Columbia to inform translocation and habitat-based recovery actions for this highly imperiled species. Telemetry of captive-raised adults during the post-breeding season (2009 and 2010) suggests that Oregon Spotted Frogs selected for herbaceous and shrub macrohabitats (delineated from high-resolution aerial imagery) that form continuous floating mats or mats interspersed with water. At the microhabitat level, frogs consistently selected for taller vegetation (122.9 ± 8.0 cm) and thicker submerged vegetation (23.5 ± 2.4 cm), based on comparisons with paired random locations (99.2 ± 9.4 cm, and 13.8 ± 1.9 cm, respectively). Within two study wetlands, microhabitats with <50% cover of semi-open herbaceous or shrub vegetation were also associated with higher frog presence. These results provide support for the hypothesis that Oregon Spotted Frogs at these sites select for taller, less dense vegetation, irrespective of the floristic composition at the microhabitat, but not macrohabitat scale. These results corroborate findings from habitat-selection studies that used wild-type animals. Differences in selection at the macrohabitat scale between years suggest that a wide

range of wetland types could be considered as candidates for translocation efforts. Our results emphasize the need for methods that transcend site-specific floristic differences among wetlands to inform potential relocation sites and guide habitat restoration activities.

V.D. Popescu, A.M. Kissel, M. Pearson, W.J. Palen, P. Govindarajulu, C.A. Bishop, *Herp. Con. Bio.* 8, 688 (2013).

Morphological and life-history responses of anurans to predation by an invasive crayfish: an integrative approach

Ana L. Nunes, Germán Orizaola, Anssi Laurila & Rui Rebelo

Invasive species are currently one of the most serious threats to biodiversity. Predator-induced phenotypic plasticity has been widely documented in response to native predators, but studies examining the extent to which prey can respond to exotic predators are scarce. As native prey do not share a long evolutionary history with exotic predators, they often lack defences against them. Many amphibians are negatively impacted by the expansion of invasive species, and their larval stages provide an excellent system for examining inducible defences in the presence of invasive predators. We examined, in a laboratory experiment, the morphological and life-history responses of nine anuran species to the presence of the exotic red swamp crayfish, *Procambarus clarkii*, a predator recently introduced in the study area (southwest of the Iberian Peninsula). These species represent the entire anuran community present in the area. Three of these species are Iberian endemics (*Alytes cisternasii*, *Discoglossus galganoi* and *Pelodytes ibericus*) and three others (*Pelobates cultripes*, *Hyla meridionalis* and *Pelophylax perezi*) have a restricted distribution outside Iberia. Larvae of each species were reared until metamorphosis in groups of ten in the presence of a caged crayfish feeding on conspecific larvae. In parallel, we examined the responses of the nine species when exposed to a native dragonfly larva. Eight of the nine species altered their morphology or life-history in response to the native dragonfly (all but *Bufo calamita*), but only four showed plastic responses to the exotic crayfish (*Alytes cisternasii*, *Bufo bufo*, *Hyla arborea* and *Pelobates cultripes*), mostly species inhabiting permanent water bodies. Morphological responses (mainly deeper headbodies and tails) were elicited in eight species when reared with the native dragonfly, but only in one (*Bufo bufo*) when reared with the invasive crayfish. Life-

history alterations were extremely variable among the nine anuran species and the two predator treatments, supporting the view that these changes can either be a direct response to predation risk or a consequence of the development of behavioural and/or morphological inducible defences. When combined with a previous behavioural study (Nunes et al. 2013 *Oecologia* 171, 115–127) the results show that two species, the Iberian parsley frog (*Pelodites ibericus*) and the Iberian water frog (*Pelophylax perezi*), do not respond to the invasive crayfish while responding to the native dragonfly. As such, these species seem to be undefended against the exotic predator, which may lead to population declines. This acquires special relevance in the case of Iberian parsley frog (*Pelodites ibericus*), a species endemic to the Iberian Peninsula. Since most inland aquatic habitats in the Iberian Peninsula are already invaded by red swamp crayfish, and most of the areas not invaded seem to be suitable for its establishment, special efforts are needed to determine precisely the level of threat that this invasive crayfish poses to native anurans.

A.L. Nunes, G. Orizaola, A. Laurila and R. Rebelo, *Ecol. & Evol.* 4, 1491–1503 (2014). <http://onlinelibrary.wiley.com/doi/10.1002/ece3.979/abstract>



Photo: Ángel Ruiz Elizalde.

Strengthening Population Inference in Herpetofaunal Studies by Addressing Detection Probability

Murilo Guimarães, Paul F. Doherty Jr. & Roberto Munguía-Steier

In conservation biology and population dynamic studies, accounting for the effect of imperfect detection of animals in the wild is crucial for correct inference of demographic parameters. However, articles published in South American herpetological journals still report estimates without considering how detection can influence estimates of vital rates, assuming that detection probability is perfect (*i.e.*, 100%) and constant. Using data from a population of the torrent frog, *Hylodes asper*, we calculate return rates and compare them with survival probability estimates adjusted

for detection probability to highlight the discrepancies between the two metrics. Then, using power analysis, we also explore how survival is underestimated, considering different scenarios and sampling efforts, given low detectability. Finally, we provide information on the optimal number of surveys to achieve a reasonable precision, assuming a fixed number of individuals initially captured for a series of parameter values. Ignoring potential bias of uncorrected estimates may lead to weak inference and erroneous decisions for management and conservation. We recommend that researchers consider detection probability in their studies to improve the accuracy of population estimates.

M. Guimarães, P. F. Doherty Jr., R. Munguía-Steier, *South Am. J. Herpetol.* 9, 1–8 (2014).

Matching species traits to projected threats and opportunities from climate change

Raquel A. Garcia, Miguel B. Araújo, Neil D. Burgess, Wendy B. Foden, Alexander Gutsche, Carsten Rahbek, and Mar Cabeza

Aim: Climate change can lead to decreased climatic suitability within species' distributions, increased fragmentation of climatically suitable space, and/or emergence of newly suitable areas outside present distributions. Each of these extrinsic threats and opportunities potentially interacts with specific intrinsic traits of species, yet this specificity is seldom considered in risk assessments. We present an analytical framework for examining projections of climate change-induced threats and opportunities with reference to traits that are likely to mediate species' responses, and illustrate the applicability of the framework.

Location: Sub-Saharan Africa.

Methods: We applied the framework to 195 sub-Saharan African amphibians with both available bioclimatic envelope model projections for the mid-21st century and trait data. Excluded were 500 narrow-ranging species mainly from montane areas. For each of projected losses, increased fragmentation and gains of climate space, we selected potential response-mediating traits and examined the spatial overlap with vulnerability due to these traits. We examined the overlap for all species, and individually for groups of species with different combinations of threats and opportunities.

Results: In the Congo Basin and arid Southern Africa, projected losses for wide-ranging amphibians were compounded by sensitivity to climatic variation, and expected gains were precluded by poor

dispersal ability. The spatial overlap between exposure and vulnerability was more pronounced for species projected to have their climate space contracting in situ or shifting to distant geographical areas. Our results exclude the potential exposure of narrow-ranging species to shrinking climates in the African tropical mountains.

Main conclusions: We illustrate the application of a framework combining spatial projections of climate change exposure with traits that are likely to mediate species' responses. Although the proposed framework carries several assumptions that require further scrutiny, its application adds a degree of realism to familiar assessments that consider all species to be equally affected by climate change-induced threats and opportunities.

R. A. Garcia, et al., *Journal of Biogeography* 41, 724–735 (2014). Published by John Wiley & Sons Ltd.



Photo by ???

Factors regulating the invasive success of an alien frog: a comparison of the ecology of the native and alien populations

Daniel Escoriza, Jihène Ben Hassine, and Dani Boix

Discoglossus pictus is an anuran recently established in Western Europe, being native from northern Africa. We examined niche occupancy of *Discoglossus pictus*, comparing the niches of native and alien populations at two spatial scales to determine whether adaptive divergence had occurred between these two populations. Additionally, we determine whether the alien species showed a wider larvae niche and higher phenotypic variability compared with co-occurring anurans. For this purpose we characterized the breeding habitats and the climatic space occupied by native and alien groups of populations of *D. pictus* and we examined morphological traits of *D. pictus* and sympatric anuran larvae. Our results revealed no divergence in breeding habitat use between native and alien populations. A shift was observed

between the realized niches occupied by the native and alien populations, but their tolerance ranges were similar, and this shift might only reflect cryptic niche conservatism. The range of reproductive habitats selected by *D. pictus* was not wider than those of most native species. In the invaded range, *D. pictus* showed broader phenotypic variability than also did some native species, but the adaptive advantages of this attribute were uncertain. The generalist character of this species has favored its establishment in Europe, possibly more than the competitive advantage over native species.

D. Escoriza, J. B. Hassine, D. Boix. Factors regulating the invasive success of an alien frog: a comparison of the ecology of the native and alien populations. *Hydrobiologia* 730, 127-138 (2014). DOI:10.1007/s10750-014-1827-3.

Intraspecific genetic variation in the common midwife toad (*Alytes obstetricans*): subspecies assignment using mitochondrial and microsatellite markers.

Bruno Maia-Carvalho, Helena Gonçalves, Iñigo Martínez-Solano, Jorge Gutiérrez-Rodríguez, Susana Lopes, Nuno Ferrand, Fernando Sequeira

The common midwife toad (*Alytes obstetricans*), widely distributed in the northern half of the Iberian Peninsula and part of Western Europe, is currently subdivided into four subspecies: *A. o. obstetricans*, *A. o. boscai*, *A. o. pertinax* and *A. o. almogavarii*. However, the delimitation of these subspecies and their ranges are still under discussion because strong discordances have been found between morphological and molecular data, and especially among different genetic markers. Here, we screen a set of novel microsatellite loci and mtDNA sequences of *A. obstetricans* populations representative of all currently recognized subspecies to investigate the correspondence between genetic groupings inferred from clustering analysis of microsatellite genotypes and the described subspecies and test whether patterns of mtDNA variation are concordant with those genetic clusters. Our results confirm previous expectations of extremely high intraspecific diversity in *A. obstetricans* in Iberia. Analyses of microsatellite and mtDNA data were concordant in recovering five well-defined groups, of which three correspond to previously defined subspecies, while the two additional clusters correspond to populations of subspecies *A. o. boscai* separated by the Douro River. Our results suggest the occurrence of two distinct genetic units within *A. o. boscai* that

are likely to result from a long independent evolutionary history, thus deserving special attention from a conservation point of view.

B. Maia-Carvalho *et al.*, *J. Zool. Syst. Evol. Res.* 52(2), 170-175 (2014).

Impact of Plant Cover on Fitness and Behavioural Traits of Captive Red-Eyed Tree Frogs (*Agalychnis callidryas*)

Christopher J. Michaels*, Rachael E. Antwis* and Richard F. Preziosi

Despite the importance of *ex situ* conservation programs as highlighted in the Amphibian Conservation Action Plan, there are few empirical studies that examine the influence of captive conditions on the fitness of amphibians, even for basic components of enclosure design such as cover provision. Maintaining the fitness of captive amphibian populations is essential to the success of *ex situ* conservation projects. Here we examined the impact of plant cover on measures of fitness and behaviour in captive red-eyed tree frogs (*Agalychnis callidryas*). We found significant effects of plant provision on body size, growth rates and cutaneous bacterial communities that together demonstrate a compelling fitness benefit from cover provision. We also demonstrate a strong behavioural preference for planted rather than non-planted areas. We also assessed the impact of plant provision on the abiotic environment in the enclosure as a potential driver of these behavioural and fitness effects. Together this data provides valuable information regarding enclosure design for a non-model amphibian species and has implications for amphibian populations maintained in captivity for conservation breeding programs and research.

C. J. Michaels*, R. E. Antwis* & R. F. Preziosi. Impact of Plant Cover on Fitness and Behavioural Traits of Captive Red-Eyed Tree Frogs (*Agalychnis callidryas*). *PloS one* 9, (2014).

The delayed effects of meteorological changes on the water frogs in Central Italy

Alessandro Ludovisi, Roberta Rossi, Romina Paracucchi, Roberta Selvaggi, Anna Fagotti, Francesca Simoncelli, Rita Pascolini, Ines Di Rosa

Changes of environmental conditions may affect organisms having long life-span after time, possibly involving future generations. In a study on the water frogs of peninsular Italy (the hybridogenetic B-H system, consisting of the parental species *Pelophylax bergeri* and the hybrid *Pelophylax kl. hispanicus*), time-delayed effects of meteorological changes on population

dynamics have been highlighted in populations breeding in shallow water bodies sited in the Tiber River basin. A Time Lagged Correlation (TLC) analysis revealed that the availability of water affects the water frog dynamics with definite time delays, corresponding to specific life-history phases. On the basis of TLC analysis, it can be hypothesized that the availability of water in late summer-early autumn affects both the parental species *P. bergeri* and the hybrid *P. kl. hispanicus*, possibly acting on the survival of tadpoles and individuals migrating from the breeding site. On the other hand, the water availability during autumn seems to mostly affect the parental species, possibly influencing its fecundity and/or reproductive success. The best linear regressions between population data and the annual de Martonne aridity index (I_{DMA}) have been used as predictive tools. Based on the equations, $I_{DMA} < 20 \text{ mm } ^\circ\text{C}^{-1}$ has been estimated as critical for the survival of the water frogs. Long-term projections, generated by applying the time-lagged equations to IPCC's scenarios, predict a significant decline (~50%) of the investigated populations during the current century.

Ludovisi *et al.*, *Hydrobiologia* 730, 139 (2014).



Metamorphic Oregon spotted. Photo: Andrew S. Wright.

Quantifying ecological life-support: the biological efficacy of alternative supplementation strategies for imperiled amphibian populations

Amanda M. Kissel, Wendy J. Palen, Purnima Govindarajulu, Christine A. Bishop

Global biodiversity loss has prompted diverse efforts to stem or reverse declines for many species. Such efforts are often implemented before mechanisms of decline are fully understood, and without a means to compare the likelihood of success of alternative management actions. Here, we develop a novel modeling framework for comparing the effectiveness of alternative management strategies aimed at reducing the extinction risk of declining amphibian populations. We used demographic data collected for the highly imperiled Oregon spotted frog (*Rana pretiosa*) as a case study,

and examined the tradeoffs between two population supplementation strategies, head-starting of early life stages and captive breeding with subsequent release. We find that when supplementation occurs after metamorphosis, captive breeding is more effective at reducing extinction risk than head-starting, but the difference declines with increasing supplementation effort. We also find that captive breeding with release as larvae yields similar reductions in extinction risk, and is two orders of magnitude more effective at reducing extinction probabilities than head-starting the same stage. Our conclusions highlight the value of quantitatively assessing the biological tradeoffs of alternative management strategies and highlight that that even basic demographic data can be leveraged to assess tradeoffs among alternative supplementation strategies.

A.M. Kissel, W.J. Palen, P. Govindarajulu, C.A. Bishop. *Cons. Letters*. (2013) doi: 10.1111/cons.12093

Diseases and Toxicology



Whistling tree frog (*Litoria verreauxii*). Photo: D. Hunter.

Decline and re-expansion of an amphibian with high prevalence of chytrid fungus

Ben C. Scheele, Fiorenzo Guarino, William Osborne, David A. Hunter, Lee F. Skerratt, Don A. Driscoll

The disease chytridiomycosis, caused by the fungal pathogen *Batrachochytrium dendrobatidis* (Bd), is a key driver of global amphibian declines. While chytridiomycosis can cause extinction, many susceptible species persist after an initial period of decline, albeit with reduced abundance and distribution. Emerging evidence indicates that amphibian abundance can recover within remnant populations, but to date, the capacity of amphibian populations to re-expand into historically occupied habitat has received limited research attention. We surveyed 145 sites in 2011 and 2012 to determine if populations of the whistling tree frog (*Litoria verreauxii verreauxii*) have re-expanded compared with historical data from 1975–1976, 1990 and 1996. *L. v. verreauxii* underwent a

major range contraction likely caused by chytridiomycosis between the first two time periods. Populations have recently re-expanded, with 39 new sites colonised despite high prevalence of Bd. We suspect that changes in disease dynamics have resulted in the increased coexistence of *L. v. verreauxii* and Bd. Habitat attributes at sites that retained frogs for the duration of the study indicate that high quality habitat may contribute to buffering against population level effects of Bd. Colonised sites had more coarse woody debris, suggesting a possible habitat management strategy to encourage range expansion for this species. Given sufficient time and adequate source populations in high quality habitat, it is possible that other amphibian species may re-expand from chytridiomycosis-induced declines. This provides an impetus for the protection of historical, but currently unoccupied amphibian habitats and highlights the importance of maintaining high quality habitat to help species survive novel shocks such as pandemic diseases.

B. Scheele *et al.* *Biol. Conserv.* **170**, 86 (2014).

Proportion of hosts carrying *Batrachochytrium dendrobatidis*, causal agent of amphibian chytridiomycosis, in Oswego County, NY in 2012

Sofia T. Windstam and Jennifer C. Olori

Although the fungus *Batrachochytrium dendrobatidis* is a causal agent behind precipitous amphibian declines globally, little is known about its regional distribution in New York State (NYS). With an aim towards an increased understanding of *B. dendrobatidis* prevalence locally, we collected amphibians between April through November 2012 at the Rice Creek Field Station in Oswego County, NY, and took swabs of the ventral surfaces of all individuals caught. Polymerase chain reaction on DNA extracted from swabs and comparison with *B. dendrobatidis* control DNA showed that 30% of amphibians sampled carried the fungus, with prevalence ranging between 20–50% for *Lithobates catesbeianus* (Bull Frogs), *Lithobates clamitans* (Green Frogs), *Pseudacris crucifer* (Spring Peepers), and *Eurycea bislineata* (Two-lined Salamanders). We detected *Batrachochytrium dendrobatidis* only during the months of April, May, June, August, and September of the sampling period. June and September had the highest percentage of amphibians infected with *B. dendrobatidis* at 32 and 48%, respectively. This study represents the first time that *B. dendrobatidis* has been documented in Oswego County and only the second time that the fungus has been documented in NYS. The documented prevalence levels

in combination with lack of observed mass amphibian declines suggest that the fungus may be endemic in local amphibian populations, but additional research is needed to establish the relative importance of these data for the health of amphibian populations in Oswego County and NYS.

S.T. Windstam, J.C. Olori, *Northeastern Naturalist* **21**, 1 (2014): NENHC-25—NENHC-34.

<http://www.eaglehill.us/NENOnline/articles/NENA-21-1/83-Olori.shtml>

Correlates and consequences of injury in a large, predatory stream salamander (*Dicamptodon tenebrosus*). Amphibia-Reptilia

Munshaw, Robin G., W. I. Atlas, W. J. Palen, Danielle M. Courcelles and Zachary L. Monteith

Aggressive interactions in the wild play an important role in structuring populations, but the process is difficult to study in cryptic species without manipulating populations. We examined injury rates as a proxy for conspecific aggression using depletion surveys of predatory Coastal Giant Salamanders (*Dicamptodon tenebrosus*) in a tributary stream of the South Fork Eel River, California. We used AIC model-selection techniques to test a range of competing hypotheses including a suite of environmental and biotic factors that may influence conspecific aggression. We examined both the probability of a given individual being injured, and the proportion of individuals within a given study pool being injured. We found strong support for models including salamander size, density of young-of-the-year steelhead, and density of the largest size-class of salamander as factors positively influencing the rate of injury at both the individual and habitat levels. We also found that density of older steelhead (1+ steelhead) had a strong, but highly variable positive impact on frequency of injury. This study shows that a range of conspecific and heterospecific factors influence intraspecific aggression for the dominant salamander throughout coastal Pacific Northwest streams. Our methodology demonstrates a non-manipulative approach to identifying correlates of natural injury in a cryptic species of amphibian. More work is needed to determine how these factors directly and indirectly influence the spatial distribution, individual fitness, and dynamics of salamander populations within streams.

R.G. Munshaw, W.I. Atlas, W.J. Palen, D.M. Courcelles, Z.L. Monteith, *Amphibia-Reptilia* **35**, 1 (2014).



Agalychnis callidryas in situ on Maderas, Ometepe Island, Nicaragua. Photo: Tariq Stark.

Death in the clouds: ranavirus associated mortality in assemblage of cloud forest amphibians in Nicaragua.

Tariq Stark, Carlijn Laurijssens, Martijn Weterings, Annemarieke Spitzen-van der Sluijs, An Martel, Frank Pasmans.

Amphibian diseases are acknowledged as significant contributors to the decline and extinction of amphibian species. The main culprits currently considered are chytridiomycosis and Ranavirus. In Central America, highly endemic and geographical restricted terrestrial species may be at risk from these diseases. We collected 49 *Agalychnis callidryas* larvae, one *Lithobates forrei* and five unidentified larvae on the Nicaraguan Island Ometepe, all deceased, and skin samples were taken. The presence of Ranavirus was determined using PCR. Ranavirus was found involved in 41 of 55 tadpoles. Forty-one *Agalychnis callidryas*, one *Lithobates forrei* and another five unidentified anuran tadpoles

T. Stark *et al.*, *Acta. Herp.* 9 (1), 125-127 (2014).

Evaluating the risk of pesticide exposure for amphibian species listed in Annex II of the European Union Habitats Directive

Norman Wagner, Dennis Rödder, Carsten A. Brühl, Michael Veith, Patrick P. Lenhardt, Stefan Lötters

Pesticide use is supposed to play a role in the worldwide amphibian decline. We tested the different exposure risks for European amphibian species – which are listed in Annex II of the EU Habitats Directive – within their special areas of conservation by calculating proportions of land use with regular pesticide applications and creating a species-specific habitat exposure index. This index was based on the occurrence probability of a species within cultivated landscapes and the migration and breeding behavior. The results of this risk evaluation suggest that most species with high exposure risk are not threatened within their entire territories and Europe and most globally threatened and European

priority species are at a lower exposure risk in their habitats. Exceptions are the Italian agile frog (*Rana latastei*), a subspecies of the Common spadefoot (*Pelobates fuscus insubricus*), the Danube crested newt (*Triturus dobrogicus*) and the Spanish painted frog (*Discoglossus jeanneae*). Management plans need to consider monitoring of habitat contamination with pesticides, at least for the special areas of conservation that were created for the aforementioned species. However, such monitoring actions would be also meaningful with regard to amphibians that do not seem to be threatened yet but reveal a higher exposure risk, e.g. the Fire-bellied toad (*Bombina bombina*). Because the results indicate also higher exposure risks in certain member states, conservation action should also take place site-specifically to avoid regional loss of amphibian biodiversity.

N. Wagner, D. Rödder, C.A. Brühl, M. Veith, P.P. Lenhardt, S. Lötters, *Biol. Conserv.* 176, 64 (2014).

<http://www.sciencedirect.com/science/article/pii/S000632071400202X>



An adult Cascades frog (*Rana cascadae*). Exposure to a stress hormone (corticosterone) did not alter fungal infection in this species or others. Photo: Trang Nguyen.

Stress and chytridiomycosis: exogenous exposure to corticosterone does not alter amphibian susceptibility to a fungal pathogen.

Catherine L. Searle, Lisa K. Belden, Pang Du, Andrew R. Blaustein

Recent emergence and spread of the amphibian fungal pathogen, *Batrachochytrium dendrobatidis* (Bd) has been attributed to a number of factors, including environmental stressors that increase host susceptibility to Bd. Physiological stress can increase circulating levels of the hormone, corticosterone, which can alter a host's physiology and affect its susceptibility to pathogens. We experimentally elevated whole-body levels of corticosterone in both larval and post-metamorphic amphibians, then tested their susceptibility to Bd. Larvae of three species were tested (*Anaxyrus boreas*, *Rana cascadae*, and

Lithobates catesbeianus) and one species was tested after metamorphosis (*R. cascadae*). After exposure to Bd, we measured whole-body corticosterone, infection, mortality, growth, and development. We found that exposure to exogenous corticosterone had no effect on Bd infection in any species or at either life stage. Species varied in whole-body corticosterone levels and exposure to corticosterone reduced mass in *A. boreas* and *R. cascadae* larvae. Exposure to Bd did not affect mortality, but had a number of sublethal effects. Across species, larvae exposed to Bd had higher corticosterone levels than unexposed larvae, but the opposite pattern was found in post-metamorphic *R. cascadae*. Bd exposure also increased larval length in all species and increased mass in *R. cascadae* larvae. Our results indicate that caution is warranted in assuming a strong link between elevated levels of corticosterone and disease susceptibility in amphibians. The role of physiological stress in altering Bd prevalence in amphibian populations is likely much more complicated than can be explained by examining a single "stress" endpoint.

C.L. Searle, L.K. Belden, P. Du, A.R. Blaustein, *J. Exp. Zool.* 321, 243 (2014).

The amphibian (*Xenopus laevis*) type I interferon response to Frog Virus 3: new insight into ranavirus pathogenicity

Leon Grayfer, Francisco DJ Andino and Jacques Robert

Ranavirus infections are increasingly threatening wild and commercially maintained amphibians worldwide. These large double-stranded DNA viruses cause systemic diseases and mortalities resulting from hemorrhaging and necrotic death of multiple afflicted organs. We have established the amphibian *Xenopus laevis* and the RV Frog Virus 3 (FV3) as a reliable infection model for studying ranavirus-host immune interactions. Adult frogs develop rapid innate immune responses followed by potent T cell and antibody responses resulting in virus clearance within a few weeks. Conversely, tadpoles mount poor and delayed anti-FV3 innate and adaptive immune responses resulting in increased susceptibility to FV3 and death within a month of infection. To delineate the role of type I interferon antiviral defences in tadpoles and adult frogs, we identified and characterized a type I interferon gene homolog in *X. laevis*. Gene expression analysis revealed that tadpoles mount relatively delayed and meager FV3-elicited IFN responses as compared to those virally induced in adult frogs. Notably, we produced a bioactive *X. laevis*

recombinant (rXI) IFN, which substantially reduced FV3 replication and infectious viral loads in a frog kidney cell line and in tadpoles. However, despite reducing FV3 loads and extending mean survival, rXIIFN treatments failed to prevent extensive tadpole tissue damage and mortality. These data underline the critical role for the amphibian type I IFN response during ranaviral infections but also suggests that FV3 is more pathogenic to tadpoles than previously thought, even at very low titers.

L. Grayfer, F. De Jesús Andino, J. Robert. *J. Virol.* **88**, 5766 (2013).



Mixophyes fasciolatus metamorph Gosner stages 43–45, sampled as emerging from water. Photo: Clara Graham.

Over-Wintering Tadpoles of *Mixophyes fasciolatus* Act as Reservoir Host for *Batrachochytrium dendrobatidis*

Edward J. Narayan, Clara Graham, Hamish McCallum, Jean-Marc Hero

B*atrachochytrium dendrobatidis* (Bd), a cutaneous amphibian fungus that causes the lethal disease chytridiomycosis, has been implicated as a cause of many amphibian declines. Bd can tolerate low temperatures with an optimum thermal range from 17–24°C. It has been shown that Bd infection may result in species extinction, avoiding the transmission threshold presented by density dependent transmission theory. Prevalence of Bd during autumn and winter has been shown to be as low as 0% in some species. It is currently unclear how Bd persists in field conditions and what processes result in carry-over between seasons. It has been hypothesised that overwintering tadpoles may host Bd between breeding seasons. The Great Barred Frog (*Mixophyes fasciolatus*) is a common, stable and widespread species in Queensland, Australia, and is known to carry Bd. Investigation into Bd infection of different life stages of *M. fasciolatus* during seasonally low prevalence may potentially reveal persistence and carry-over methods between seasons. Metamorphs, juveniles, and adults were swabbed for Bd infection over three months (between March and May, 2011) at 5 sites of varying altitude (66 m–790 m). A total of 93 swabs were analysed using Polymerase Chain Reaction (PCR) real-time analysis. PCR analysis showed 6 positive

(1 excluded), 4 equivocal and 83 negative results for infection with Bd. Equivocal results were assumed to be negative using the precautionary principle. The 5 positive results consisted of 4 emerging (Gosner stage 43–45) metamorphs and 1 adult *M. fasciolatus*. Fisher's exact test on prevalence showed that the prevalence was significantly different between life stages. All positive results were sampled at high altitudes (790 m); however prevalence was not significantly different between altitudes. Infection of emerging metamorphs suggests that individuals were infected as tadpoles. We hypothesise that *M. fasciolatus* tadpoles carry Bd through seasons. Thus, *Mixophyes fasciolatus* may act as disease reservoirs at multiple life stages.

E. J. Narayan, C. Graham, H. McCallum, J-M. Hero. *PLoS One* **9**, e92499. doi:10.1371/journal.pone.0092499 (2014).

calling all
bloggers!

want to write for
amphibians.org?



Call for recent publication abstracts

If you would like to include an abstract from a recent publication in this section of *FrogLog* please email: froglog@amphibians.org. 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 AmphibiaWeb latest papers page. The full list of latest papers from AmphibiaWeb is also included in every edition of *FrogLog* following the recent publications abstract section.

General Announcements

Events

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

July 2013

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

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

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

16 - World Snake Day!

August 2013

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

October 2013

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

Internships & Employment

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

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

Interdisciplinary, Archaeologist/Historian/Biologist/Ecologist (CESU Research Coordinator)

Panama City, FL (Posted to PARC 06/27/14, Closing July 3, 2014)

Fisheries & Wildlife Technician, Florida Fish & Wildlife Conservation Commission (FWC)

Panama City, FL (Posted to PARC 06/25/14, Closing July 7, 2014)

Wildlife Biologist (Flatwoods Salamander Conservation), U.S. Geological Survey

Gainesville, FL (Posted to PARC 06/25/14, Closing July 9, 2014)

Fish and Wildlife Science Coordinator, Association of Fish and Wildlife Agencies

Washington, D.C. (Posted to PARC 06/18/14, Closing July 3, 2014)

Reptile and Amphibian Conservation Coordinator, Florida Wildlife Commission

Tallahassee, Florida (Posted to PARC 06/13/14, Closing June 23, 2014)

Research Manager, Brown Treesnake Research Project

Guam, Mariana Islands (Posted to PARC 06/05/14, Open Until Filled)

Center Director - USGS Patuxent Wildlife Research Center

Laurel, MD (Posted to PARC 06/05/14; Closing July 11, 2014)

Research Administrator II, Florida Fish and Wildlife Commission, Gainesville Wildlife Research Laboratory

Gainesville, FL (Posted to PARC 06/03/14; Closing June 23, 2014)

Communications Internship (Unpaid), Partners in Amphibian and Reptile Conservation, Joint National Steering Committee

Remote / Telecommute (Posted to PARC 06/03/14; Closing June 30, 2014)

Park Manager (Superintendent), U.S. National Park Service

Fort Smith, MT / Lovell, WY (Posted to PARC 05/21/2014; Closing May 23, 2014)

Ecologist

Fredericksburg, VA (Posted to PARC 05/07/2014; Closing May 16, 2014)

Ecologist

Fredericksburg, VA (Posted to PARC 05/07/2014; Closing May 16, 2014)

Deputy Superintendent, Santa Monica Mountains National Recreation Area

Thousand Oaks, CA (Posted to PARC 05/05/2014; Closing May 16, 2014)

Deputy Superintendent, Santa Monica Mountains National Recreation Area

Thousand Oaks, CA (Posted to PARC 05/05/2014; Closing May 16, 2014)

Nongame Supervisor

Cheyenne, WY (Posted to PARC 05/05/2014; Closing May 23, 2014)

GS14 NPS CESU Research Coordinator position (2)

Missoula, MT (Posted to PARC 05/05/2014; Closing May 12, 2014)

GS14 NPS CESU Research Coordinator position (2)

Flagstaff, AZ (Posted to PARC 05/05/2014; Closing May 12, 2014)

Graduate Research Assistantship in Wildlife Ecology (M.S.), School of Forestry and Wildlife Sciences and Alabama Cooperative Fish and Wildlife Research Unit at Auburn University

Auburn, Alabama (Posted to PARC 04/29/2014; Apply until May 30, 2014)

FISHERIES & WILDLIFE BIO SCIENTIST IV (Position 1 of 2), Florida Fish and Wildlife Commission

Tallahassee, Florida (Posted to PARC 04/19/2014; Closing April 30, 2014)

FISHERIES & WILDLIFE BIO SCIENTIST IV (Position 2 of 2), Florida Fish and Wildlife Commission

Tallahassee, Florida (Posted to PARC 04/19/2014; Closing April 30, 2014)

Herpetological Field Assistant (unpaid)

Los Amigos Biological Station, Madre de Dios, Peru (Closing April 25, 2014)

Reptilian Biodiversity Volunteer Field Assistants

Maricopa, Arizona (Posted to PARC 04/10/14, Open Until Filled)

Herpetological Research Subsection Leader

Gainesville, Florida (Posted to PARC 04/10/14, Closing April 18, 2014)

Wyoming Toad Field Technician Positions

Laramie, Wyoming (Posted to PARC 04/07/14, Priority Applications Closing April 13, 2014)

Paid Wood Turtle Ecology Internship

George Washington National Forest, Virginia (Posted to PARC 04/03/14, Closing April 11, 2014)

Herpetologist, Maine Department of Inland Fisheries and Wildlife

York and Cumberland Counties, Maine
(Posted to PARC 04/03/14, Closing April 23, 2014 or until filled)

Biologist I Position Announcement

Guam, Mariana Islands (Posted to PARC 04/03/14, Closing April 24, 2014)

Wildlife Ecologist, Assistant Professor (Tenure track)

Athens, GA (Posted to PARC 03/25/14, Closing April 15, 2014)

Stream Ecologist, Assistant Professor (Tenure track)

Corvallis, OR (Posted to PARC 03/19/14, Closing April 14, 2014)

Environmental Intern (Wildlife biologist)

Burlington, CT (Posted to PARC 03/19/14, Closing March 31, 2014)

Spotted Turtle Field Assistant (unpaid)

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

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

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

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

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

Unpaid Tropical Salamander Research

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

Temporary field technicians - hellbenders

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

Herpetological field assistant (unpaid)

Los Amigos Biological Station, Madre de Dios, Peru (Posted to PARC 02/11/14, Closing 04/15/14)

Field Biologist - The Biological Monitoring Program Riverside,

California (Posted to PARC 01/23/2014, open till filled)

Unpaid Herpetological Researcher/Educator Internship Opportunities (2) Midewin National Tallgrass Prairie,

Wilmington, IL (Posted to PARC

01/8/2014, Closing 4/1/2014)

Unpaid Volunteer Ornate Box Turtle Telemetry Technician Nachusa Grasslands

Franklin Grove, IL (Posted to PARC 01/8/2014, Closing 4/30/2014)

Funding Opportunities

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

July 2014

Belmont Forum -- International Networking of Biodiversity Scenario.

The Belmont Forum has announced a call ("Biodiversity2014") to stimulate the formation of international networks of scientists to enhance the usefulness of biodiversity scenarios in decision-making. Participation includes Australia, Brazil, China, France, Germany, India, Japan, Norway, and South Africa. Proposals can be submitted from 09 June 2014 to 02 July 2014. [Link](#)

African Union -- Kwame Nkrumah Regional Award for Scientific Women 2014.

The African Union (AU) honors outstanding African scientists through the Kwame Nkrumah Scientific Awards for fields that include agricultural sciences, environmental sciences, and energy innovation (among others). The 2014 edition of the African Union Kwame Nkrumah Regional Award for Scientific Women is announced jointly by AU and the ECOWAS Commission. The award is for female scientists in ECOWAS member countries. Eligibility criteria and an application form are included with the announcement. The prize has a value of US\$20 thousand. The deadline for applications is 04 July 2014. [Link](#)

UK Department for Environment, Food, and Rural Affairs (Defra) -- Darwin Initiative for Biodiversity Conservation and Poverty Reduction, Round 21.

Co-administered by Defra and the UK's Department for International Development (DFID), the Darwin Initiative contributes knowledge that links biodiversity conservation and poverty reduction in low and middle-income countries. There are no restrictions on the nationality or location of applicants. Closing dates are 03 July 2014 for Main Projects (Stage 1); 08 July 2014 for Post Projects; 04 August 2014 for Darwin Plus (i.e., British Overseas Territories); 27 October 2014 for Scoping Awards; and 27

October 2014 for Darwin Fellowships. [Link](#)

U.S. Department of State -- Deterring Wildlife Trafficking in South Africa.

The U.S. Department of State, Bureau of International Narcotics and Law Enforcement, seeks to work with South Africa in matters of deterring wildlife trafficking. Funding will be provided to improve communications between wildlife-related and criminal justice stakeholders in South Africa, and to assist the government of South Africa strengthen partnerships with neighboring African countries and/or consumer countries in Asia to improve coordination and information sharing related to wildlife trafficking. Eligibility for grants extends to U.S. and non-U.S. non-profit organizations; national and provincial park boards and other parastatal entities; and for-profit companies willing to forgo profit. Funding Opportunity INL-14-CA-0020-INLAME-060214. The application deadline is 04 July 2014. [Link](#)

Pro Natura Foundation -- Applications 2014-2015.

The Pro Natura Foundation makes grants to individuals and organizations for nature conservation in Japan and developing countries (i.e., countries not included in the OECD). This program is focused on scientific research concerning the conservation of biodiversity and the relationship between humans and the environment. Grants are for one year. Applications from countries outside Japan require the support of a nominator in Japanese language. The deadline for applications is 18 July 2014. [Link](#)

Weeden Foundation -- Conservation in Russia and Chile.

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 25 July 2014. [Link](#)

CRDF Global -- Research Collaboration, USA with the Ural Branch of the Russian Academy of Sciences.

CRDF Global and the Ural Branch of the Russian Academy of Sciences invite proposals from joint U.S. and Russian teams for basic research in support of sustainable natural resource management, biodiversity, energy saving and efficiency, and other themes. Grants are a maximum of US\$80,300 for joint research teams. The application deadline is 28 July 2014. [Link](#)

UK Department for International Development (DFID) -- Building Resilience and Adaptation to Climate Change. DFID funds BRACED (“Building Resilience and Adaptation to Climate Extremes and Disasters”) to build the resilience of people to extreme climate events in selected countries of the Sahel, Sub-Saharan Africa, and South Asia. Grants are to nonprofit NGOs that lead consortia with project partners (e.g., other NGOs, local governments, research organizations, UN agencies, and the private sector). The current call is for full proposals from projects that were awarded Project Development Grants. The deadline for full proposals is 31 July 2014. [Link](#)

August 2014

International Water Center -- International Masters Scholarships 2015. In collaboration with the Global Water Partnership, Australia’s International Water Center announces funding for four international candidates accepted into the Master of Integrated Water Management. Two scholarships are for female candidates who are nationals in the 85 countries of the Global Water Partnership. Two other scholarships are open to international students, men and women, anywhere in the world who meet the eligibility requirements. The application deadline is 01 August 2014. [Link](#)

ASEAN Social Forestry Network -- Strategic Response Fund. The ASEAN Social Forestry Network is funded by the Swiss Agency for Development and Cooperation (SDC) to integrate social forestry into the climate change adaptation and mitigation strategies of ASEAN and its member states. The network’s Strategic Response Fund provides seed funds to help network leaders and focal points respond to immediate needs or catalyze strategic actions on social forestry as it relates to climate change, food security, and poverty alleviation. The announcement lists the types of actions that can be funded. The deadline for proposals is 15 August 2014. [Link](#)

Ford Motor Company in China -- Conservation and Environmental Grants 2014. Ford Motor Company China presents annual environmental awards to community groups, environmental NGOs, and individuals in mainland China for projects and communications in environmental protection. In 2014, the total prize money is RMB 200 million yuan to be awarded to 29 environmental organizations and individuals. The deadline for nominations is 15 August 2014. [Link](#)

Organization for Women in Science for the Developing World (OWSD) -- Postgraduate Fellowships in Natural Sciences. OWSD supports female scientists in Sub-Saharan Africa and Least Developed Countries (LDCs) with doctoral fellowships in the natural sciences. The fellowships are for the pursuit of a doctoral degree at a host institution in a developing country, but not in the applicant’s home country. Applicants should be qualified young women science graduates (generally below 40 years of age), who have an M.Sc. degree or outstanding B.Sc. in the natural sciences. The application deadline is 15 August 2014. [Link](#)

L’Oréal and UNESCO -- Fellowships for Women Scientists in Sub-Saharan Africa 2014. Women scientists who are nationals or permanent residents of any country in Sub-Saharan Africa can apply for the 2014 L’Oréal-UNESCO regional fellowships. The program offers five fellowships of €5 thousand each to African Ph.D. students, and another five fellowships of €10 thousand each to African postdoctoral researchers. The age limit for applicants is 40 years for Ph.D students, and 45 years for post-doc researchers. The application deadline is 21 August 2014. [Link](#)

International Tropical Timber Organization (ITTO) -- Freezailah Fellowships, Second Cycle 2014. ITTO makes grants through the Freezailah Fellowship Fund for training opportunities, demonstration tours, participation in conferences and workshops, preparation of technical papers, and post-graduate degrees. Grants up to US\$10 thousand are in support of sustainable tropical forest management. Applicants are young and mid-career professionals in ITTO’s member countries; most grants are to individuals in the developing countries. The deadline for the second application cycle in 2014 is 22 August 2014. [Link](#)

September 2014

European Commission (EC) -- Climate, Watersheds, and Coastal Areas in Latin America and the Caribbean. The EC supports WATERCLIMA as a program of international cooperation for managing watersheds and coastal areas in Latin America and the Caribbean (LAC), subject to the influence of climate change. The program will focus on interventions related to river and watershed governance, protection of water reservoirs, management of water supply in coastal-marine zones, etc. Eligibility for funding extends to nonprofit organizations in the EU and 33 countries of LAC, together

with qualified international organizations, in international consortia. Reference EuropeAid/135857/DH/ACT/Multi. The closing date is 09 September 2014. [Link](#)

French Ministry of Foreign and European Affairs -- ENVI-Med Research on Mediterranean Ecosystems, 3rd Call for Proposals. The program MISTRALS (Mediterranean Integrated Studies at Regional And Local Scales) supports research on Mediterranean ecosystems in the face of climate change and other natural and human pressures. The ENVI-Med Regional Program -- funded by the French government -- calls for proposals from French researchers in collaboration with international partners, including partners in southern and eastern Mediterranean countries. Thematic priorities include the Mediterranean climate and hydrological cycle; environment and sustainable development; water and sanitation; sustainable governance of Mediterranean development; and protection of landscapes and cultural heritage. Funding is a maximum of €20 thousand per project. The deadline for applications (French, English) is 15 September 2014. [Link](#)

Future for Nature Foundation -- Future for Nature Award 2015. The Future for Nature Award recognizes internationally outstanding efforts to conserve wild animals and plants. Work related to endangered species (IUCN’s Red List) is a priority. Candidates for the award should be no older than age 35. The Award offers international recognition, financial support, and reinforced linkages to an international conservation network. The application deadline is 15 September 2014. [Link](#)

Captain Planet Foundation -- Grants for Children’s Environmental Education. The Captain Planet Foundation makes grants to inspire and empower children worldwide to create environmental solutions in their homes, schools, and communities. Grants are primarily to schools and other nonprofit organizations in the USA. The Foundation also accepts international requests, favoring projects that have U.S.-based partners. Grants range from US\$500 to US\$2,500, with preference for projects that supply matching contributions of at least 50%. The application deadlines are 31 January and 30 September of each year. [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 quarterly basis.

As the ASG's newsletter members are encouraged to contribute to *FrogLog*'s content and direction. To aid in this process each edition of *FrogLog* focuses on one of the six broad geographical zones identified by the ASG. The publication schedule is as follows:

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

FrogLog invites contributions of research, reviews on current management and conservation issues, methods or techniques papers and, editorials. We also actively encourage submissions describing the current activities relating to projects and academic institutions in order to help inform the community as to the general state of current research and conservation activities.

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Titles should ideally be no more than 15 words.

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MAIN BODY OF TEXT

Use Georgia 11-point font. Genus and species names should be in italics as should the abbreviation for *Batrachochytrium dendrobatidis*, Bd. Suggested headings include Acknowledgements, Author Details, and References and Notes.

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Journals/Periodicals

1. E. Recuero, J. Cruzado-Cortés, G. Parra-Olea, K. R. Zamundio, *Ann. Zool. Fenn.* 47, 223 (2010).

Books

2. J. Gupta, N. van der Grijp, Eds., *Mainstreaming Climate Change in Development Cooperation* (Cambridge Univ. Press, Cambridge, UK, 2010).

Technical reports

3. G.B. Shaw, *Practical uses of litmus paper in Möbius strips* (Tech. Rep. CUCS-29-82, Columbia Univ., New York, 1982).

Paper presented at a meeting

4. M. Konishi, paper presented at the 14th Annual Meeting of the Society for Neuroscience, Anaheim, CA, 10 October 1984.

Published Online Only

5. N.H. Sleep, *Geochim. Geophys. Geosyst.*, 10, Q11010 (2009); DOI:10.1029/2009GC002702.

Web site

6. National Oceanic and Atmospheric Administration, Beaufort Wind Scale, <http://www.spc.noaa.gov/faq/tornado/beaufort.html> (2012).

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