Issue number 109 (January 2014)
ISSN: 1026-0269
eISSN: 1817-3934

FrogLog

Volume 22, number 1

www.amphibians.org

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

SPECIAL EDITION

Collaborating for Conservation Success

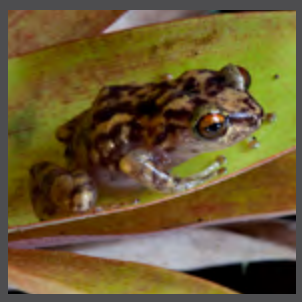
Million Dollar Fund for Frogs

2014 Year of the Salamander

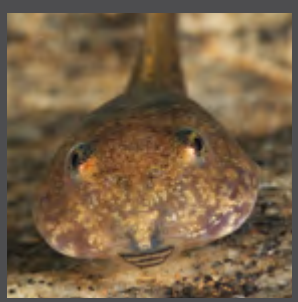
Recent Publications

And Much More!

Fire Salamander (*Salamandra salamandra*)
Photo: Jelger Herder.



Leaping to the Rescue



Ecological Service of Frogs

FrogLog

CONTENTS

Editorial

The IUCN SSC Amphibian Specialist Group and Amphibian Survival Alliance would like to thank everyone for pushing forward on amphibian conservation in 2013. With your continued support and dedication, 2014 is set to become a banner year for amphibian conservation around the world!

At the end of last year, the Amphibian Survival Alliance—the world's largest partnership for amphibian conservation—announced the creation of the first major land conservation fund to help stem global amphibian declines. The Leapfrog Conservation Fund, pulled together from support of Alliance partners, has an initial investment of USD $1,000,000 and will be dispersed over the course of the upcoming year.

Partners in Amphibian and Reptile Conservation (PARC) along with conservation groups from around the world have also designated 2014 as the *Year of the Salamander*. Through this unprecedented partnership, organizations and individuals such as you will work together to not just raise awareness of salamanders but also really scale up global salamander conservation, education and research efforts.

And now with this special edition of *FrogLog*, we showcase some more examples of collaborative amphibian conservation efforts from around the world—from Mexico to The Netherlands, from Honduras to South Africa, from Poland to Jamaica, Ireland and beyond.

These projects are successful because collaborative partnerships can often achieve far more by working together than on their own. Each brings to the table a unique set of approaches and perspectives, which can take ideas and actions farther, faster.

But, they also succeed because of the strong sense of purpose and passion of the individual people involved. Like you, they care deeply about amphibians and the threats they face.

And like us, they also realize that we all have a vested interest in protecting amphibians and their habitats.

Candace M Hansen
Editor-in-chief

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

FrogLog

ASG Secretariat

Claude Gascon
ASG Co-Chair

Phillip J. Bishop
ASG Co-Chair

Sally Wren
ASG Program Officer

Jos Kielgast
ASG Program Officer

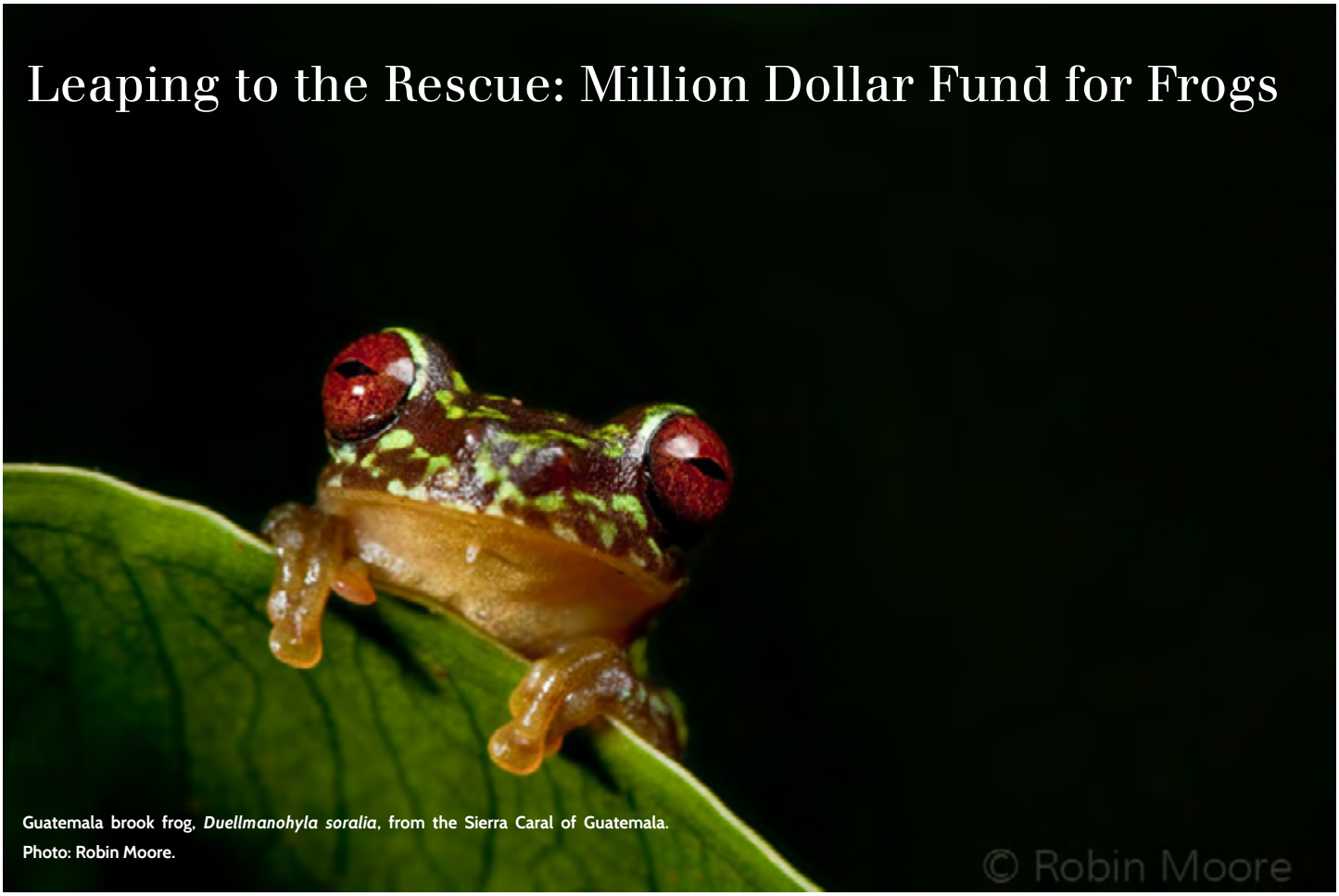
Helen Meredith
ASG Program Officer

Ariadne Angulo
Amphibian RLA Coordinator

Jennifer Luedtke
Amphibian RLA Deputy Coordinator

Editorial Office
Global Wildlife Conservation
PO Box 129, Austin, TX 78767, USA
froglog@amphibians.org

Leaping to the Rescue: Million Dollar Fund for Frogs



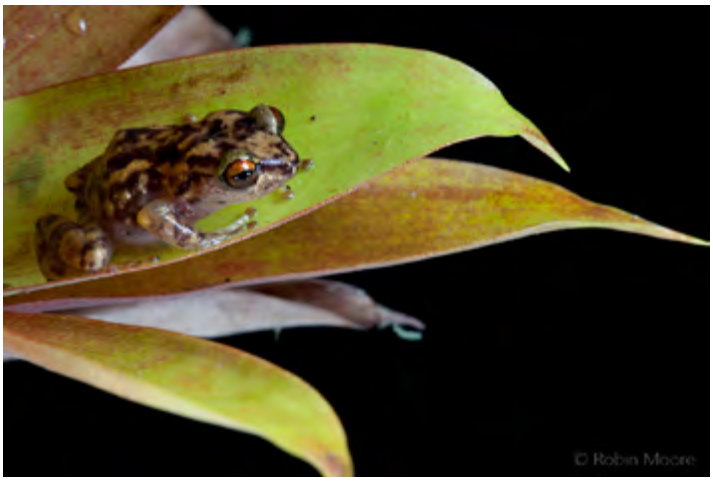
Guatemala brook frog, *Duellmanohyla soralia*, from the Sierra Caral of Guatemala. Photo: Robin Moore.

The Amphibian Survival Alliance, Rainforest Trust, Global Wildlife Conservation and Andrew Sabin Family Foundation are taking a bold step in the fight to save amphibians by committing one million dollars to protect key habitats worldwide over the coming year. The fund, which has been named the Leapfrog Conservation Fund, will be dispersed through the ASA – the world's largest partnership for amphibian conservation – to strategically protect and manage key habitats for frogs, salamanders, caecilians and other species for the benefit of current and future generations.

"Habitat loss is the single biggest threat to the survival of amphibians worldwide" said Don Church, Executive Director of the ASA, adding "this million dollar commitment represents a landmark in the battle to stem the alarming loss of frogs, salamanders and caecilians. We hope that it will encourage others to step forward and make a commitment to protecting amphibians and habitats." Dr Paul Salaman, CEO of Rainforest Trust, said "amphibians represent an opportunity to stem biodiversity loss through relatively modest investments. We can literally save entire species through strategic habitat protection. We are thrilled to be able to make this commitment to protecting the most threatened vertebrate group in priority sites worldwide."

Amphibians are at the forefront of what is being widely referred to as the sixth mass extinction event on earth. Around a half of over 7,000 amphibian species are in decline, a third are on the International Union for the Conservation of Nature (IUCN) Red List of Threatened species, and more than 120 species are thought to have been lost in recent years. Disease and climate change have been implicated in the sudden and rapid disappearance of species from South, Central and North America, Europe and Australia – but the primary threat to the survival of many amphibian species is the rampant loss and degradation of habitats, such as rainforests. In the tropics, where the entire range of a species may be as small as a single stream, amphibians often fall through the cracks in protected area coverage and a recent study revealed that 940 amphibian species worldwide occur in unprotected habitat.

A Giant palm salamander, *Bolitoglossa dofleini*, in the Sierra Caral of Guatemala - an area recently protected. Photo: Robin Moore.



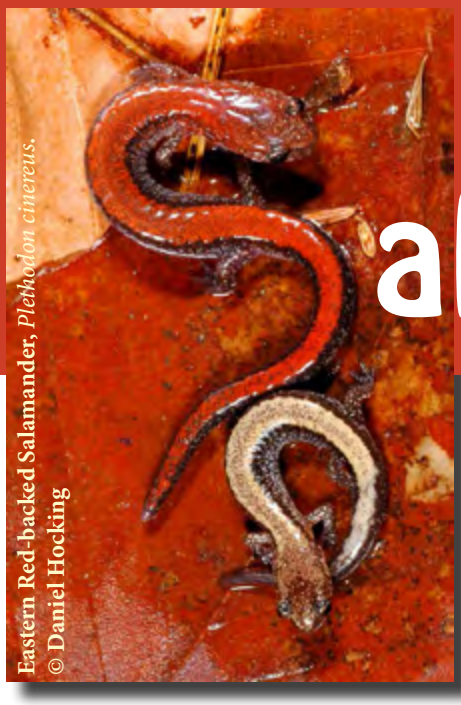
A new species of rain frog from the Massif de la Hotte in Haiti, one of the highest priorities for species conservation in the world. Photo: Robin Moore.

The Leapfrog Conservation Fund will strategically and collaboratively target the most threatened habitats for protection. "Partnerships are the key to success" said Robin Moore, Conservation Officer with the ASA, Rainforest Trust and Global Wildlife Conservation, "we all have a stake in the future of our environment, and what is truly exciting about the Leapfrog Conservation Fund is that it represents an opportunity for unique collaborations to achieve a common goal – saving amphibians and the habitats upon which we all depend."

To support amphibian conservation through the Leapfrog Conservation Fund, or apply for funding for a project, please visit our webpage or contact Robin Moore at rdmoore@amphibians.org

A new species of ruby-eyed toad in the Choco rainforests, Colombia. Photo: Robin Moore.

State of the salamander



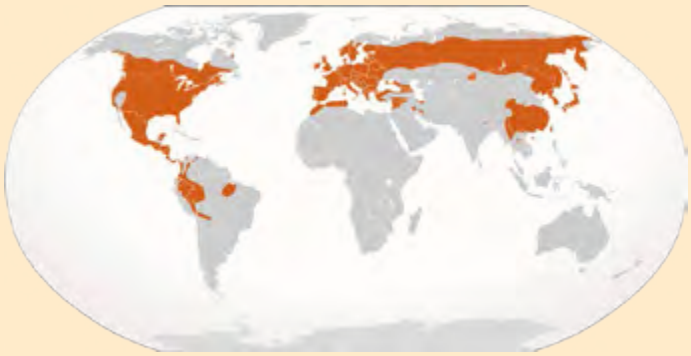
Eastern Red-backed Salamander, *Plethodon cinereus*.
© Daniel Hocking

Partners in Amphibian and Reptile Conservation (PARC) is celebrating 2014 as the **Year of the Salamander** to energize salamander education, research, and conservation. This is a worldwide effort, leveraged through the actions of numerous partner organizations and individuals from all walks of life – public to professional. Over the coming year, PARC and its collaborators will be working to raise awareness about:

- the importance of salamanders in natural systems and to humankind;
- diverse ongoing research pathways aimed at better understanding salamanders, their role in ecosystems, and threats to their existence;
- actions being implemented around the world to conserve salamander populations and their habitats;
- education and outreach efforts through a kaleidoscope of individual and group involvement.

Did You Know?

- There are more than 600 species of salamanders worldwide.
- Most salamander species occur in temperate areas of the northern hemisphere.
- USA is a salamander hotspot, with more species than any other country.
- Worldwide, nearly half of salamander species are threatened with extinction.
- Salamanders are central to food webs, connected to many other animal groups.
- Loss of salamanders may indicate poor environmental health.



Map © by TheEmirr/ Maplab/Cypron Map Series, from Wikipedia

Partners in Amphibian and Reptile Conservation Mission:

"To conserve amphibians, reptiles and their habitats as integral parts of our ecosystem and culture through proactive and coordinated public-private partnerships." **www.parcplace.org**

For more details on **Year of the Salamander**, visit our website: **www.yearofthesalamander.org**

Join us as a partner, and get involved in celebrating our salamander natural heritage. For information on becoming a partner, please contact us at: **yearofthesalamander@gmail.com**.

The Elusive Salamander

Have these incredible creatures been living under the radar or simply under a rock?

Salamanders are poorly understood and undervalued amphibians. Due to their secretive nature, often hidden from human view, it may come as a surprise that salamanders are one of the most abundant vertebrates found in forest, grassland, and riparian environments. Consequently, salamanders serve as vital components of food webs and are integral to ecosystem stability. While many species can be found on land, others are strictly aquatic, and most serve as a functional link between land and water. Intrigued? Read on!

Long-tailed Salamander, *Eurycea longicauda*

Did You Know?

The Appalachian Mountains are the area of highest salamander diversity anywhere on earth!

Over 50 species of salamanders are found in the southern Appalachians alone, almost 10% of the global diversity of salamanders. Many of these species are endemic—found nowhere else on the planet. The humid, forested conditions of the Appalachians provide a perfect climate for salamanders to thrive. The great age of this landscape helps explain why so many different species of salamanders may be found here: the mountains and ravines of the Appalachians may have helped protect ancient plethodontid salamanders from the effects of the Yucatan meteor proposed as a cause of the K-T extinctions.

Yonahlossee Salamander, Plethodon yonahlossee, *native to the Blue Ridge Mountains, part of the Appalachians.*

Salamanders 101

Most salamanders have moist skin and feel slimy to the touch, as opposed to the dry, scaly skin of lizards (lizards are reptiles, not amphibians). Water is critically important to salamanders, even those species living on land their entire lives, which require moist and shaded habitats so they do not become dehydrated. They are generally most active on cloudy and rainy days or evenings and can be found hiding under rocks or logs on hot, sunny days. Maintaining proper hydration is critical to terrestrial salamanders, which helps explain their generally small home ranges. Aquatic species, although not so concerned with hydration, can be extremely sensitive to temperature and chemical contaminants. They may be elusive like their terrestrial counterparts because they tend to leave the safe areas provided by stones, cobbles, and other debris only at night. All salamanders are carnivores. Terrestrial species eat a wide variety of invertebrates such as insects, slugs, snails, and earthworms. Aquatic species eat leeches, mollusks, crustaceans, and eggs of other amphibians. Larger species of salamander may eat small mammals, frogs, and even other salamanders.

The Northern Dusky Salamander, Desmognathus fuscus, *requires moist microhabitats like forest duff to live and lay its eggs on land.*

Diversity at its Finest

Salamanders can be difficult to identify because they come in a variety of shapes, sizes, and color patterns, and they are an extremely diverse group (Order: Caudata/Urodela) of amphibians. Over 600 different species are assorted into 10 family groups. Some families, like the Proteidae, Sirenidae, and Cryptobranchidae, are fully aquatic and retain larval characteristics as adults (neoteny); some are fully terrestrial and lungless (Plethodontidae), and have no larval form; others may lay eggs in water but usually develop a terrestrial form as adults (Ambystomatidae and Salamandridae). Most salamanders have four short limbs and a long tail, but species differ in form and proportions.

Southern Two-lined Salamander (*Eurycea cirrigera*)

Associated with brooks, springs, seeps, river swamps, and forest floodplains, the Southern Two-lined Salamander ranges from Illinois to northern Florida. Unlike many plethodontids, it lays its eggs in the water, on plants, rocks, or logs.

Mexican Axolotl (*Ambystoma mexicanum*)

Axolotls, unlike the rest of the family Ambystomatidae, are fully aquatic life-long, retaining the gills of the larval stage. Endemic to the lakes near Mexico City, they are critically endangered due to habitat loss. This individual is an albino.

Two-toed Amphiuma (*Amphiuma means*)

Amphiumas (family Amphiumidae) take "short limbs" to an extreme—their legs are so tiny they are practically vestigial. These eel-like aquatic salamanders actually have a rather short tail relative to body length.

Salamanders sending out an SOS!

An alarming 49.8% of salamander species worldwide are listed in Threatened categories or extinct, according to the Red List of Threatened Species™ of the International Union for Conservation of Nature (IUCN). This is a larger proportion than for frogs (31.6%) and other taxonomic groups that often are cited as symbols of the ongoing biodiversity crisis. Why are salamanders so vulnerable?

Common but decreasing in Panama, according to the IUCN, Bolitoglossa schizodactyla *lives only in undegraded lowland and montane forests, which are falling to agriculture, livestock, expanding human settlements, and industry.*

Common Threats to Salamanders

Habitat Loss/Degradation: The biggest issue affecting salamander species today is loss of their natural habitat. Land cleared for agriculture and development has greatly altered areas that were once suitable for salamanders. Deforestation can have a huge effect on salamanders due to both the physical disturbances of harvest and the changes to forest-floor habitats that remain, with reduced shade and cover, and increased sunlight exposure and overall temperatures. Fragmentation of habitats is a secondary effect of our land use, resulting in disruption of population connectivity due to dispersal barriers.

Water Modification: Our activities affect natural water bodies upon which many salamanders rely. The drying of vernal pools and wetlands, changes in water temperature, pH, salinity, and the alteration of water flow can negatively affect salamanders.

This culvert, part of a study on salamander movement, would be impassable in an upstream direction.

*Why did this Spotted Salamander (*Ambystoma maculatum*) cross the road? To get to its breeding pond. But every time it makes the attempt, it's dicing with death.*

Road Mortality: Roads can cause direct mortality, and may bisect stream or pond habitats, and disrupt connectivity among salamander populations.

Chemical Contaminants: Without proper control and care, industrial contaminants, sewage runoff, pesticides, and other oils and chemicals from residential, commercial, and agricultural sites can make their way in surface runoff or through the water table and into salamander habitats. As for all amphibians, salamanders' skin can rapidly absorb these foreign toxic chemicals, which can result in death.

Climate Change: The changes in temperature, humidity levels, desertification, and drought resulting from changing climate can negatively affect salamanders' health and life cycles. Harsher winters and drier summers cause problems during important migration and breeding periods if critical habitats such as vernal pools do not form or dry up too soon, before larvae can metamorphose (change into their adult form).

Chuxiong (Blue-tailed) Fire-bellied Newt, Cynops cyanurus*, native to the Yungui highlands of Yunnan Province.*

Human Exploitation: In certain areas throughout the world, salamanders are captured and sold in the exotic pet trade. While the idea of a pet salamander may seem strange to some, over 20 million amphibians are sold every year in the United States alone. Throughout Asia, species like fire-bellied newts (*Cynops* spp.) are captured, sealed up in small containers, and sold as keychain pets and souvenirs. These salamanders survive a few weeks before they slowly die for lack of food and water. Some salamanders are caught for food, and the Chinese Giant Salamander (*Andrias davidianus*), a delicacy in China, is threatened from over-harvesting. Salamanders are routinely used as bait, which can lead to over-collecting from natural populations, and transfer of diseases into new areas.

Invasive/Introduced Species: Introduced fish populations in ponds and wetlands prey on salamander eggs, larvae, and adults. Local populations of species accustomed to living without these predators may be decimated.

Diseases: Two emerging infectious diseases, the amphibian chytrid fungus and ranavirus, are well-documented in salamanders and may lead to mass mortalities. In 2013, an alarming report from Europe established that a new species of chytrid fungus was having a deadly effect on Fire Salamanders (*Salamandra salamandra*).

Small Animal, Big Value

Why should we care about salamander species?

Aesthetic Value: Although some salamanders are cryptic and rarely seen, many have striking coloration and patterns that make them quite beautiful. Some cave-dwelling species that live in darkness lack pigmentation and appear translucent, whereas other species possess bright oranges, fiery reds, stripes, and spots.

*Red Salamanders (*Pseudotriton ruber*) are anything but inconspicuous! But you may never see a Georgia Blind Salamander (*Eurycea wallacei*), as its cave habitat is very deilicate and sensitive.*

Ecological Value: Salamanders have an incredibly important role in natural ecosystems. They are centrally nested in food webs, supplying an abundant source of energy and nutrients for both terrestrial and aquatic consumers, such as birds, fish, reptiles, and mammals. Salamanders serve as connecting pathways for energy and matter between aquatic and terrestrial ecosystems. Salamanders that burrow underground facilitate soil dynamics. Salamanders also serve as indicator species of the overall health and functioning of an ecosystem.

Educational/Research Value: Salamanders are charismatic and provide an excellent teaching tool for engaging and educating people about the importance of protecting the natural areas on which many associated species rely. So little is known about many salamanders that researchers are still identifying new species. In addition, salamanders serve as model organisms for how a simpler vertebrate body works, and are highly valuable in research on human physiology.

Cultural Value: Over the centuries, countless legends and myths have developed around salamanders. Some legends tie salamanders to the element of fire. These tales may have originated when old logs were thrown on the fire, and salamanders that lived under the bark fled from the heat, giving rise to the idea that salamanders were born from flames. Cultural images of salamanders remain in many societies across the globe.

Medical value: Tiger Salamanders, Ambystoma tigrinum*, eat disease-carrying pests like small rodents and insects.*

Medical Value: Many salamanders consume insects such as mosquitoes and ticks that spread diseases including West Nile virus, yellow fever, Lyme disease, and malaria. Salamanders help keep population levels of these disease carriers in check. In biomedical research, salamander limb regeneration is being studied to understand the mechanisms involved in tissue reformation. Their hormone systems are models for humans. Their toxins and skin microbiota are being explored for pharmaceutical uses.

Intrinsic Value: It is important not to overlook the fact that salamanders matter by just simply existing. They have intrinsic value as an inhabitant of our planet.

Background image: Red-spotted (Eastern) Newt eft, Notophthalmus viridescens*, by Mark Tegges.*

Did You Say a FIVE-FOOT Salamander?!

If you happen to be in China and find a monster crawling out of the water, it may be *Andrias davidianus*, the Chinese Giant Salamander (family Cryptobranchidae). The largest amphibians in the world, averaging over 3 feet long (100 cm), they are capable of living up to 75 years in captivity!

Conservation Efforts and Supporting Organizations

Many groups are working hard to protect salamanders. You can help by participating in and supporting their efforts.

Habitat Protection: Initiatives to manage critical areas of habitat are being undertaken at a variety of scales, from local and regional land trusts, to national governments and international organizations. These efforts include development of conservation easements (or agreements) that protect key habitats for conservation purposes.

Habitat Restoration: Many community-based programs are working to restore damaged habitat. Restoration of streams and protection of watershed areas help provide quality habitat for a variety of salamanders. See the Stanford Habitat Conservation Plan (***http://hcp.stanford.edu***), which includes the California Tiger Salamander as a target species.

Restored Culverts: Improved culvert designs that allow passage of aquatic organisms are now being installed. These benefit salamanders and a host of other organisms.

Salamander Tunnels and Road Crossing Signs: The creation of salamander tunnels under roads and highways that separate habitat areas allows safe passage for salamanders during their breeding migration.

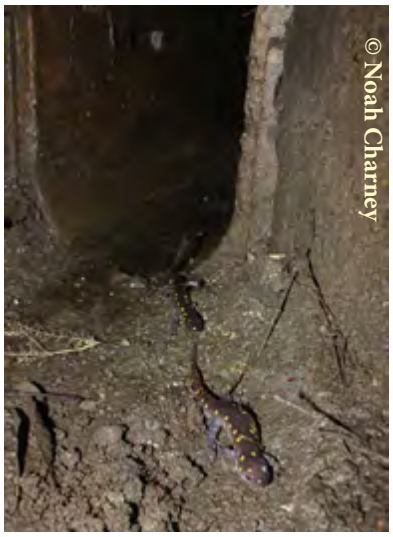
Diseases: Conservation efforts are increasing research worldwide on a variety of salamander diseases. New diseases are being described, such as the fungus *Batrachochytrium salamandrovirans* that is threatening Fire Salamanders in the Netherlands. We can reduce human-mediated transmission of diseases by being more careful as we move animals or water in trade and during fire fighting. Disinfection procedures can be used to decontaminate water or field gear.

Habitat restoration: a breeding pond for the Eastern Tiger Salamander, Ambystoma tigrinum*, in New Jersey.*

Salamander tunnels provide safe passage across busy roads.

This salamander is being swabbed for amphibian chytrid fungus testing.

"RRTH" Relocation, Repatriation, Translocation, and Headstarting: RRTH activities are the last-gasp approach to rare species conservation due to their high economic cost and often low success. Nevertheless, some captive breeding programs have been successful in reintroducing threatened or endangered species back into their natural habitat. A list of RRTH efforts at the PARC website can provide useful lessons learned to facilitate success with new endeavors. Organizations and research



Do salamanders actually use the tunnels? Yes! This tunnel in North Amherst, MA, allows Spotted Salamanders access to and from their vernal pool breeding habitat.

*This rare and striking Luristan Newt (*Neurergus kaiseri*), endemic to the southern Zagros Mountains of Iran, is part of a captive breeding effort.*

teams such as the Reptile, Amphibian, and Fish Conservation Netherlands (RAVON) have set up breeding and captive facilities to help save the rapidly declining Fire Salamander from extinction.

CITES: The Convention on International Trade in Endangered Species of Wild Fauna and Flora is an international agreement that aims to ensure that international trade in specimens of wild animals and plants does not threaten their survival. This is especially important as thousands of salamanders are marketed annually.

Chopsticks for Salamanders: This organization works to raise awareness about deforestation for the production of disposable chopsticks. They raise money to support salamander conservation, education, and research. (***www.chopsticksforsalamanders.org***)

Right: Rod Williams and Herbie the Hellbender visit a teacher education workshop to spread the word about Hellbender conservation.

Education and Interpretive Programs: The more the general public knows and cares about salamanders and the important role they play in our ecosystems, the easier it will be to conserve them. Education can happen in many ways: at ecological centers, natural history museums, and even this State of the Salamander document. Websites such as Save the Salamander, created by Matt Ellerbeck, provide information for those interested in salamander conservation and advocacy.

Phillip deMaynadier, Molly Docherty, and a Spotted Salamander teach students about amphibians.

It's Up to Us to Make a Difference

What can YOU do to help in the conservation of salamanders?

- Do not use salamanders as fishing bait.
- Never catch and attempt to keep a wild salamander as a pet.
- If you come across a salamander in the wild, appreciate it by observation only; don't disturb it or the habitat around it. Salamanders have extremely sensitive skin that can be damaged by the oils and chemicals on our hands, and therefore should not be picked up.
- The only time you should ever pick up a salamander is to help it cross a road or high-traffic path. The proper way to do this is by first wetting your hands and then moving it across in the direction that it is headed. However, safety first! Watch for oncoming vehicles.

- Do not use (and urge others not to use) poisons, non-organic pesticides, fungicides, herbicides, harsh insect repellents, and other harmful chemicals during your outings in natural areas, or around your home or business. These chemicals wash away and eventually make their way into nearby habitats where salamanders may dwell.
- In winter, consider using sand on roads and footpaths instead of salt – salamander skin absorbs salt.
- Keep others informed about the risks to and conservation efforts being made for salamanders.
- When camping, be careful when choosing fallen branches, logs, or stumps for fires, as salamanders can often be found hiding in them. A better alternative is to use locally available firewood bundles, or organic compressed paper bricks made of recycled materials.
- Join a herpetological or nature society or club!


© Heidi Bock

Community members learn to use a field guide to identify salamanders.

For More Information on Salamanders:

Visit the United States Fish & Wildlife Service to learn more about endangered salamander species in the U.S. ***www.fws.gov/endangered/***

Log on to the International Union for Conservation of Nature (IUCN) Red List to learn even more about endangered and threatened salamanders: ***www.iucnredlist.org***

Explore AmphibaWeb (***amphibiaweb.org***) for detailed information on salamander species from around the world.

For additional information on the Year of the Salamander campaign, go to ***www.yearofthesalamander.org*** or contact ***yearofthesalamander@gmail.com***

Authors: Kristen Glass, Devin Rigolino, and Mary Beth Kolozsvary, *Siena College; mkolozsvary@siena.edu;* **Editing, design, and layout:** Kathryn Ronnenberg, *U.S. Forest Service, Pacific Northwest Research Station*

Acknowledgements: *This document was improved by comments from D. Olson, K. Greenwald, T. Gorman, J. Kubel, J. Lewis, P. Conrad, and C. Hansen. Many others helped secure or contributed images for this publication.*

Year of the Salamander Planning Team: Mary Beth Kolozsvary *(Siena College);* Dede Olson *(U.S. Forest Service);* JJ Apodaca *(Warren-Wilson College);* Michelle Christman *(USFWS);* Rod Williams *(Purdue University);* Thomas Gorman *(Virginia Tech);* Katherine Greenwald *(Eastern Michigan University);* Karena DiLeo *(Conserve Wildlife Foundation of New Jersey);* Brandon Ruhe *(Mid-Atlantic Center for Herpetology and Conservation);* Ruth Marcec *(The Association of Reptilian and Amphibian Veterinarians);* Jacob Kubel *(Massachusetts Natural Heritage and Endangered Species Program);* Kathryn Ronnenberg *(U.S. Forest Service);* Valorie Titus *(Wildlife Conservation Society);* Carrie Elvey *(The Wilderness Center);* Matthew Evans *(Smithsonian Conservation and Biology Institute);* Lynn Bogan *(NYS OPRHP);* Kirsten Hecht *(University of Florida)*

Do Not Disturb!

Moist, dark microhabitats like cracks in the rocks are great places for salamanders to hide, but these conditions can take many years to create and only seconds to destroy. If you spot a hidden salamander, please don't pry up the rocks to get at it. Leave it in peace.


Green Salamander, *Aneides aeneas*. © Jonathan Mays

Now Available: Synopsis of Evidence on Global Amphibian Conservation

Are you involved in amphibian conservation? Do you have to make decisions about how to manage the habitat or animals you are trying to conserve? Have you seen the Amphibian Synopsis of conservation evidence? The recently completed synopsis brings together and summarises scientific knowledge about what works and what doesn't work in amphibian conservation. It is freely available as a searchable database, or as a pdf to download or as a book that can be purchased, all on our website: **www.conservationevidence.com**

Ideally conservationists would share experience and information with others all over the world, to help others make decisions about conservation management. Unfortunately, this is not always done and that is where the Conservation Evidence project at the University of Cambridge has stepped in. We summarise evidence about the effects of conservation management for both habitats and species in an easily accessible format. Our website is a reliable information resource designed to support decisions about how to maintain and restore global biodiversity. We tell you what evidence there is (or isn't) about the effects that your planned conservation management could have, we do not make decisions for you. Our aim is to encourage evidence-based conservation worldwide. So far we have completed synopses of evidence for the conservation of amphibians, bees, birds, bats and European farmland. Evidence for carnivores, reptiles, plants, forests and wetlands and management of invasive species is now being summarised.

The Amphibian synopsis summarises over 400 studies testing 129 possible conservation interventions for amphibians, anywhere in the world. Each study is summarised in one short paragraph. All of the results for one conservation intervention are summarised in key messages. Here are examples of just eleven of the interventions covered:

INSTALL CULVERTS OR TUNNELS AS ROAD CROSSINGS

Thirty-two studies investigated the effectiveness of installing culverts or tunnels as road crossings for amphibians. Six of seven studies, including three replicated studies, in Canada, Europe and the USA found that installing culverts or tunnels decreased amphibian road deaths. One found no effect on road deaths. Fifteen of 24 studies, including one review, in Australia, Canada, Europe and the USA found that tunnels were used by amphibians. Four found mixed effects depending on species, site or culvert type. Five found that culverts were not used or were used by less than 10% of amphibians. Six studies, including one replicated, controlled study, in Canada, Europe and the USA investigated the use of culverts with flowing water. Two found that they were used by amphibians. Three found that they were rarely or not used. Certain culvert designs were found not to be suitable for amphibians.

CREATE WETLANDS (EVIDENCE FOR INDIVIDUAL PONDS SUMMARISED SEPARATELY)

Fifteen studies, including one review and seven replicated studies, in Australia, Kenya and the USA, investigated the effectiveness of creating wetlands for amphibians. Six studies found that created wetlands had similar amphibian abundance, numbers of species or communities as natural wetlands or in one case adjacent forest. Two of those studies found that created wetlands had fewer amphibians, amphibian species and different communities compared to natural wetlands. One global review and two other studies combined created and restored wetlands and found that amphibian abundance and numbers of species were similar or higher compared to natural wetlands. Five of the studies found that up to 15 amphibian species used created wetlands.

PAY FARMERS TO COVER THE COSTS OF CONSERVATION MEASURES

Four of five studies, including two replicated studies, in Denmark, Sweden and Taiwan found that payments to farmers increased amphibian populations, numbers of species or breeding habitat. One found that amphibian habitat was not maintained.

PROVIDE EDUCATION PROGRAMS ABOUT AMPHIBIANS

One study in Taiwan found that education programmes about wetlands and amphibians, along with other interventions, doubled a population of Taipei frogs. Four studies, including one replicated study, in Germany, Mexico, Slovenia, Zimbabwe and the USA found that education programmes increased the amphibian knowledge of students.

RETAIN RIPARIAN BUFFER STRIPS DURING TIMBER HARVEST

Six replicated and/or controlled studies in Canada and the USA compared amphibian numbers following clearcutting with or without riparian buffer strips. Five found mixed effects and one found that abundance was higher with riparian buffers. Two of four replicated studies, including one randomized, controlled, before-and-after study, in Canada and the USA found that numbers of species and abundance were greater in wider buffer strips. Two found no effect of buffer width.

REMOVE OR CONTROL FISH POPULATION BY CATCHING

Four of six studies, including two replicated, controlled studies, in Sweden, the USA and UK found that removing fish by catching them increased amphibian abundance, survival and recruitment. Two found no significant effect on newt populations or toad breeding success.

REMOVE THE CHYTRID FUNGUS FROM PONDS

One before-and-after study in Mallorca found that drying out a pond and treating resident midwife toads with fungicide reduced levels of infection but did not eradicate chytridiomycosis.

RELEASE CAPTIVE-BRED INDIVIDUALS

Twenty-six studies investigated the success of releasing captive-bred amphibians. Ten of 15 studies, including three reviews, in Australia, Europe, Hong Kong and the USA found that captive-bred amphibians released as larvae, juveniles, metamorphs or adults established populations at 38–100% of sites. Five found that amphibians did not establish breeding populations, or only established following one of four release programmes. One review and one before-and-after study in Spain found that 41–79% of release programmes of captive-bred, captive-reared and translocated frogs combined established breeding populations. An additional 10 studies, including one review, in Australia, Italy, Puerto Rico, the UK and USA measured aspects of survival or breeding success of released captive-bred amphibians and found mixed results.

USE ANTIFUNGAL SKIN BACTERIA OR PEPTIDES TO REDUCE CHYTRID INFECTION

Three of four randomized, replicated, controlled studies in the USA found that introducing antifungal bacteria to the skin of chytrid infected amphibians did not reduce infection rate or deaths. One found that it prevented infection and death. One randomized, replicated, controlled study in the USA found that adding antifungal skin bacteria to soil significantly reduced chytridiomycosis infection rate in salamanders. One randomized, replicated, controlled study in Switzerland found that treatment with antimicrobial skin peptides before or after infection with chytridiomycosis did not increase toad survival.

EXCLUDE DOMESTIC ANIMALS OR WILD HOGS FROM PONDS BY FENCING

Four replicated studies, including one randomized, controlled, before-and-after study, in the USA found that excluding livestock from streams or ponds did not increase overall numbers of amphibians, species, eggs or larval survival, but did increase larval and metamorph abundance. One before-and-after study in the UK found that pond restoration that included livestock exclusion increased pond use by breeding toads.

ENGAGE LANDOWNERS AND OTHER VOLUNTEERS TO MANAGE LAND FOR AMPHIBIANS

Three studies, including one replicated and one controlled study, in Estonia, Mexico and Taiwan found that engaging landowners and other volunteers in habitat management increased amphibian populations and axolotl weight. Six studies in Estonia, the USA and UK found that up to 41,000 volunteers were engaged in habitat restoration programmes for amphibians and restored up to 1,023 ponds or 11,500 km^2 of habitat.

REMOVE OR CONTROL INVASIVE BULLFROGS

Two studies, including one replicated, before-and-after study, in the USA and Mexico found that removing American bullfrogs increased the size and range of frog populations. One replicated, before-and-after study in the USA found that following bullfrog removal, native frogs were found out in the open more.

To read more see www.conservationevidence.com.

There are some conservation interventions for which we found no published evidence on their effectiveness. Despite our search effort it is possible that some evidence was missed, but it is also likely that the effects of many conservation projects have not been monitored, or results have not been made widely available. We want this to change for the better!

Do you have evidence of the effectiveness of conservation interventions for amphibians, or other species groups or habitats? The practitioner focussed Conservation Evidence Journal aims to make publishing your results easy. It is an open access journal that publishes research, monitoring results and case studies on the effects of conservation interventions. There are no publication fees. A paper needs to have a detailed description of the intervention and a clear quantification of the consequences, but simple, concise papers are welcomed. So far only five of the 258 papers published in our journal have been about the management of amphibians – can you help improve this?

Details for submitting a case study to the Conservation Evidence Journal can be found on our website: **http://conservationevidence.com/collection/view.**

1% for the Planet: Hop to It!

Giant palm salamander, *Bolitoglossa dofleini*, in the Sierra Caral of Guatemala. Photo: Robin Moore.

1% for the Planet (1% FTP) is all about coming together to help make the world a better place. There's no better example than WorthWild and Quantum Rush, 1% FTP member businesses that are partnering with Amphibian Survival Alliance to protect amphibian habitat around the world.

Last week 1% member WorthWild went live with their crowd-sourcing website—a resource designed to help individuals and organizations get funds or feedback for environmental initiatives—and they launched with collaboration as a priority. One of the first organizations to WorthWild aligned with was the Amphibian Survival Alliance, the world's largest partnership for amphibian conservation. Don Church, Executive Director of the Alliance said "When we joined the 1% for the Planet network we were looking for a truly mutually beneficial partnership. As an Alliance we believe that if a partnership is equally beneficial both parties will get a lot more out of the experience and the outcomes will be much greater, hence when we saw that both WorthWild and Quantum Rush had joined 1% FTP we jumped on the opportunity to work with them".

"Our brand, our operation, our mission..." says Evan Grinde, Founder of Quantum Rush, "...it all hinges entirely on partnerships. We know we can't do everything on our own, and we don't try to. So, naturally, when the Alliance reached out to us and proposed that we work together to raise funds for worldwide amphibian conservation, we agreed wholeheartedly. Their mission really resonated with us, aligning perfectly with the exact kind of differences that we wanted to be making. So before long, we got to work on not only a campaign to be launched through our own website, but also a t-shirt to be given out as a reward for supporters donating at the $250-level through another campaign-driven, 1% for the Planet company: WorthWild. And that all right there is the beauty of 1% for the Planet: it creates collisions. It's a magnet for like-minded forces and it creates dynamic relationships that might never have otherwise been established... and truly great things can come about because of it."

"It's a trifecta." says WorthWild cofounder Kyle Pribish. "By partnering with 1% for the Planet, Amphibian Survival Alliance and Quantum Rush, we hope to 'Give Back to Blue' in a way that stretches beyond ourselves and inspires change the world over. I love that we all found each other through the 1% network. We're in the business of inspiration, influence and change and the organizations we work with are aligned with these goals as well. We really hope to see some generous traffic to our platform so that all 1% causes and parties may benefit. We're just starting out and we want to send a loud message about coming together to accomplish great things."

In order to maximize impact, efforts in conservation should be concentrated. Participation in these efforts, however, should not be. There truly is strength in numbers, and getting as many individual members of society as possible involved in the collaborative efforts of the Amphibian Survival Alliance, Quantum Rush, and WorthWild is the key to success for our conservation campaign. You, as a passionate and concerned individual, are presented today with

greater, more transparent opportunities than ever before to contribute to real causes. The struggles we face in amphibian conservation are representative of the struggles we face on a wider ecological basis. The loss of amphibian biodiversity sets out of balance the ecologies that these sensitive creatures belong to, and these ecologies are not systems in which humans have no place. Any harm we inflict against these animals is harm we inflict against ourselves and our children. Any measure of action we take to protect these animals are measures of action we take to secure a happier, simpler, more natural future for ourselves and our loved ones.

Interested in collaborating? Each new organization brings value to the table in a cooperative partnership through their mission, audience, perspectives, and ideas. We can achieve far more together than any of us could alone. The Amphibian Survival Alliance, Quantum Rush, and WorthWild would like to extend an invitation for collaboration to any fellow 1% for the Planet companies or NGOs who feel that their missions align on any level with our own. Don't hesitate to reach out if you feel that there exists some potential synergy between your organization and any of our own individually or all of ours collectively.

Ready to leap to the rescue? Here's how you can make an impact right away:

Until January 29th 2014, the Amphibian Survival Alliance will triple every dollar raised through the "Leaping to the Rescue! Hop to it!" campaign on WorthWild. To support amphibian conservation through WorthWild please visit their website.

Indefinitely, you can also support by purchasing an eco-friendly, USA-made Amphibian Conservation artisan t-shirt from Quantum Rush at quantumrush.com/amphibians.

Together we can save amphibians and the habitats upon which they - and we - depend.

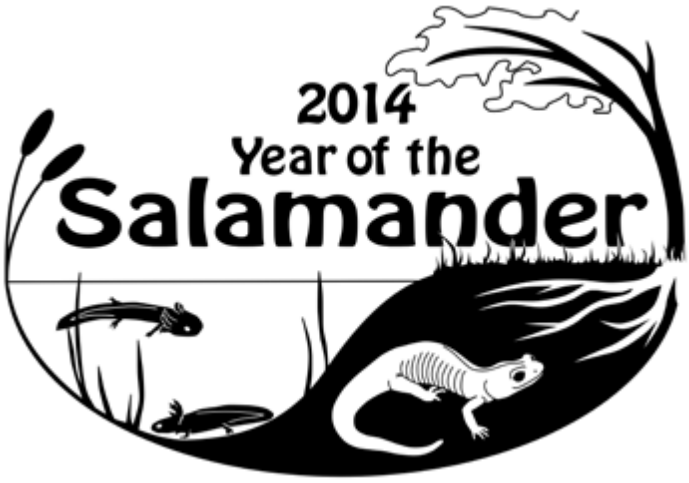
Quantum Rush Amphibian Conservation artisan tee front (top) and back (bottom).

Announcing the 2014 Year of the Salamander logo!

The Year of the Salamander planning team is pleased to announce the winning logo, designed by Sheri Sanders, which will be used for PARC's Year of the Salamander campaign. Sheri's logo was selected out of a pool of 14 logo entries that were submitted by very talented artists. Congratulations to Sheri and thanks to all the artists that competed in this contest!

Please be sure to check out the 2014 Year of the Salamander page: www.yearofthesalamander.org. There will be more information posted at the beginning of 2014, including our ongoing photo contest (already underway), partners page, monthly newsletter, and outreach and education resources.

To learn more about becoming a partner or to sign up to receive our monthly newsletter by email, contact: yearofthesalamander@gmail.com.



Pre-Eminent Authority on Amphibians and Reptiles Publishes the Frog Reference Work of the Decade

With many frog populations declining or disappearing and developmental malformations and disease afflicting others, scientists, conservationists, and concerned citizens need up-to-date, accurate information. *Frogs of the United States and Canada* is a comprehensive resource for those trying to protect amphibians as well as for researchers and wildlife managers who study biodiversity. From acrobatic tree frogs to terrestrial toads, C. Kenneth Dodd Jr. offers an unparalleled synthesis of the biology, behavior, and conservation of frogs in North America.

This two-volume, fully referenced resource provides color photographs and range maps for 106 native and nonindigenous species and includes detailed information on

- past and present distribution
- life history and demography
- reproduction and diet
- landscape ecology and evolution
- diseases, parasites and threats from toxic substances
- conservation and management

From tree frogs to terrestrial toads, this comprehensive resource offers an unparalleled synthesis of the biology, behavior, and conservation of frogs in North America. Full species accounts for all frogs north of Mexico make this the amphibian book of the decade.

C. Kenneth Dodd Jr. is an associate professor (courtesy) in the Department of Wildlife Ecology and Conservation, University of Florida, and is a former president of the Herpetologists' League. He is the author of *The Amphibians of Great Smoky Mountains National Park.*

All orders placed through Johns Hopkins University Press (either online or by calling the Hopkins Fulfillment Services at 800-537-5487) receive a 30% discount with code NAF.

Foundation of a National Amphibian Genome Bank and Oversight Group Creation

By Craig Hassapakis

The need to defend against the Earth's dwindling number of species has placed a heavy burden on the conservation community. This need is not new, but how to best save, secure, and rescue what is quickly and assuredly being lost forever (i.e. our unique genetic heritage of life on earth which is not replaceable) is still being debated. Well-thought out and enticing steps to take in the future have been identified in the scientific literature (*1*).

Most certainly habitat protection is heralded among scientists as being the most critical activity to safeguard species; but, even this single activity is often not enough given the threats to species worldwide (in particular, amphibians are most at risk with 41% of all known species experiencing population declines and one-third threatened with extinction). Moreover, the amphibian disease *Batrachochytrium dendrobatidis* (*Bd*; commonly referred to as chytrid fungus) is devastating amphibians species the world over and is something that habitat protection cannot protect against. What needs to happen is a concerted effort among stake holders for a multi-pronged approach that takes the salient points from various determined conservation approaches (e.g., see ACAP below) for protection from further global loss of animal species, and particularly amphibians.

Photo: Andrew Kouba.

The 2007 *Amphibian Conservation Action Plan* (ACAP) (*2*) discusses eleven categories of actions to be taken in an integrated approach to conservation responses within the group Amphibia, and Genome Resource Banks (GRBs) being one of them. Though GRBs are one major category within the ACAP, sufficient collaborative and functional resources for GRBs have yet to be established. In 2008, a meeting on cryobanking for endangered species was held at Trier University, Germany, out of which a task force known as the *Amphibian Ark Biobanking Advisory Group* (http://aark.portal.isis.org/Biobanking) was formed (*3*). Following this seminal meeting, several other subsequent symposiums have followed including: (a) *Towards a Biobanking Strategy for Amphibian Conservation* (*4*); (b) in July 2011 at the joint meeting of Ichthyologists and Herpetologists in Minneapolis, USA; and (c) at the *7th World Congress of Herpetology* in Vancouver, Canada. A synopsis of these international workshops and, in particular, the hopes, realities, and current challenges inherent to this field of applied research (Bioresource Banking) are detailed in Kouba et al. 2013 (*1*).

Due to very little worldwide coordination of activities within this important discipline, it is more evident than ever an organization, group, or committee (i.e., an Amphibian Biobanking Working Group) is needed to help facilitate continued progress. This group would help coordinate worldwide activities, establish achievable goals, and be accountable for management and protocol development in this important field of conservation. The Memphis Zoo has created the first National Amphibian Genome Bank (NSGB) (*5*) and could act as a focal point for coordinated world efforts and lend expertise in research and policy—for more details on the advantages of maintaining a NAGB reference (*6,7*). A diversified amphibian biobank (i.e., the NAGB at the Memphis Zoo), and the creation of an accountable oversight group, will further establish benefits to conservation programs (present and future) and stave further loss of amphibian species in a last desperate effort to protect our amphibian natural heritage, which would otherwise be lost.

Three important goals of a worldwide strategy for GRBs are: 1) gene banking as much male sperm as possible from all threatened amphibian species; 2) increasing genetic exchange between wild and captive populations using frozen-thawed sperm held in gene banks; and 3) further collaboration between field ecologists, zoo researchers, and private collectors—who have the best access to specimens for potential cryopreservation. These three goals should be integrated into research proposals. Furthermore, it should become a normal activity for those working in the field to collect biological materials and contribute to GRBs. This important conservation action could be further facilitated by writing a manual on standard operating protocols (SOP) about how to contribute to world cyropreservation efforts for amphibian conservation.

It is hoped that this short introduction to genetic resource banking efforts and directions for future progress evokes an essential national and global discussion on how best to secure biological materials from all representative amphibian species worldwide.

Acknowledgements

I would like to kindly thank Andrew Kouba (Memphis Zoo) and Michael Hutchins for their help in editing and contributing ideas to this paper.

References

1. A. J. Kouba *et al. Biol. Conserv.*, **164**, 10 (2013).
2. C. Gascon, J. P. Collins, R. D. Moore, D. R. Church, J. E. McKay, J. R. Mendelson, III (Eds). Amphibian Conservation Action Plan. IUCN/SSC Amphibian Specialist Group, Gland, Switzerland and Cambridge, UK. (2007).
3. D. Lermen *et al. Mol. Ecol.*, **18**, 1030 (2009).
4. R. Lloyd *et al. Biobank*, **10**, 62 (2012).
5. Amphibian Genome Bank, available at: http://memphiszoo.org/amphibiangenomebank [accessed: 21 December 2013].
6. A. J. Kouba and C. K. Vance. *Reprod. Fertil. Dev.*, 21, 719 (2009).
7. Genome Resource Banking for Global Conservation, available at: http://nationalzoo.si.edu/SCBI/ReproductiveScience/GenomeResTech/ [accessed: 21 December 2013].

Editor and Publisher, *Amphibian & Reptile Conservation* (journal):
amphibian-reptile-conservation.org; arc.publisher@gmail.com

Amazing Amphibian: The Gorgan Mountain Salamander

The amazing thing about the Gorgan Mountain Salamander, *Paradactylodon gorganensis* is also a major threat to this species—the adults of this salamander are only known to reside in a single pool in a cave that measures 100 m by 10 m at most. It is estimated that only about 100 breeding adults remain in this extremely confined range. However, larvae of this species can be found outside the cave in the stream flowing from it.

The Gorgan Mountain Salamander is listed as 'Critically Endangered' on the IUCN Red List of Threatened Species™ because of its narrow range and increasing decline in its specialized habitat in the Shir-Abad Cave of northern Iran. The cave is often disturbed by visitors. The Gorgan Mountain Salamander is an almost fully aquatic salamander, which can be identified by its rounded snout, large head, and long tail.

Threats to Gorgan Mountain Salamanders include human encroachment on its highly specialized range and possible collection for the pet trade.

Since the Shir-Abad Cave and the surrounding area were designated a Natural National Monument by the Department of Environment of Gorgan and Gonbad-e-Kavous in 1998, the range of this species are within protected areas.

Donate $50 to

RECEIVE A FREE

2014 METAMORPHOSIS CALENDAR!

100% of all donations go back to ASA

asa
amphibian survival alliance

Go here to donate:
http://gabbywild.com/donate.php

Conservation Actions for Amphibians in Chiapas State, Mexico

[1, 4]Roberto Luna-Reyes & [2, 3]Patricia Elizabeth Pérez López

As a result of a preliminary survey, 108 amphibian species have been registered in Chiapas State, Mexico (Luna-Reyes, 2010). Almost 50% of these species have been evaluated as Threatened according to IUCN's Red List of Threatened Species, and also according to the Mexican Official Norm (Norma Oficial Mexicana NOM-059-SEMARNAT-2010). It is in this context that in 2008-2009, personnel from the Research Department of the then Institute for Natural History of Chiapas (IHN) implemented the project "Development of a Strategy to Conserve Critically Endangered Amphibians in Chiapas, Mexico", supported by the Critical Ecosystem Partnership Fund (CEPF). The project had among its goals the drafting of the document of the "Conservation Strategy for the Critically Endangered Amphibians in Chiapas, Mexico" (Fig. 1) and the creation of the network "RED para la Conservación de Anfibios en Chiapas".

Fig. 1. Front cover of the document and working session for the drafting of a Conservation Strategy for Critically Endangered Amphibians in Chiapas. Photo: Roberto Luna-Reyes.

The "Conservation Strategy for the Critically Endangered Amphibians in Chiapas, Mexico" is the first one of its kind in Mexico, and is the result of one of the key goals stated in the Amphibian Conservation Action Plan (2005), namely the drafting of concrete regional and local conservation plans and strategies. Such strategic document is key because, on top of establishing the strategic directions for the conservation of frogs, toads and salamanders in Chiapas, it attempts to be a role model for the generation and implementation of conservation strategies in other States in Southern Mexico and the Yucatan peninsula, and also to be complementary to a broader regional conservation strategy for Mesoamerican amphibians (García-Moreno *et al*. 2008) and thus achieve integration between Mexico and Central America with regard to amphibian conservation. The strategy aims to facilitate the identification of relevant stakeholders, the delegation of institutional tasks to the relevant parties, and the fundraising activities and management of funds necessary to implement the tasks. Thus, the document considers four key elements: 1) determine the priority species to conserve in Chiapas State; 2) determine the species amenable for captive breeding actions; 3) determine the strategic directions, goals, deliverables, potential stakeholders, activities and timelines; and 4) the constitution of a formal network, the "Red para la Conservación de Anfibios en Chiapas" (RED).

The network was built parallel to the crafting of the strategy, as it was considered to be a key mechanism for communication and feedback (Fig. 2). The RED is made up by expert researchers, students, managers, and Protected Area managers and technical staff, which in turn bring in additional stakeholders from different sectors, including the government, for profits, and the local people, many of whom live within the boundaries of protected areas and are therefore an important group that participates directly and indirectly in the conservation and management of natural resources in general, and of amphibian species and their habitats in particular.

To implement the amphibian conservation strategy, the "RED para la Conservación de Anfibios en Chiapas" together with other State, national and international institutions, has been coordinating an "International Week for Amphibians" for three years in a row already, in April of 2011, 2012 and 2013. This "International Week for Amphibians" has two main objectives: 1) to communicate to the general public about the importance of amphibians and their perilous situation in Chiapas, in Mexico, and around the world; and 2) to present advances in the implementation of actions and fundraising by the "RED para la Conservación de

RED
para la Conservación
de Anfibios en Chiapas

Fig. 2. Logo for the "Red para la conservación de anfibios en Chiapas" (Alliance for Amphibian Conservation in Chiapas).

[1]Coordinación Técnica de Investigación, Secretaría de Medio Ambiente e Historia Natural. Calzada de los Hombres Ilustres s/n. Fracc., Francisco I. Madero. C. P. 29000, Tuxtla Gutiérrez, Chiapas, México. Email: rlr07@hotmail.com [2]Dirección de Medio Ambiente, H. Ayuntamiento Constitucional de Berriozábal, Chiapas, 1ª. Norte y 1ª. Poniente s/n, Palacio Municipal, C. P. 29130, Berriozábal, Chiapas. [3]RED para la Conservación de Anfibios en Chiapas, Calzada de los Hombres Ilustres s/n, Centro C.P. 29000 Tuxtla Gutiérrez, Chiapas, México.

Fig. 3: Different activities during the "International Week for Amphibians." Photo: Roberto Luna-Reyes.

Anfibios en Chiapas." In order to achieve the goals, every one of the "International Amphibian Week" has been aided by the organization of a National Amphibian Congress, and a National Symposium/Workshop on Amphibian Monitoring. These events are then complemented with different activities (Fig. 3) like a) Plenary conferences, b) Oral and poster presentations, c) Capacity building workshops, d) Field trips to see amphibians, e) Photographic exhibitions, f) Drawing, sculpture, photography and robotic amphibian contests, g) Raffles, h) Exhibition and sales of amphibian-related publications, and i) Cycling tours. These events have been widely covered by the media locally, state-wide, and even nationally, in all different formats: fliers, triptychs, posters, banners, email, social networks, newspapers, radio and television.

In order to support the strategic line that refers to "Education and Communication," the RED has organised environmental education workshops aimed at primary school children in some of the primary schools of the municipality of Berriozabal, home to several Critically Endangered amphibian species. A first workshop for the knowledge, appreciation and conservation of amphibians and reptiles took place on 2012 in the Rural Primary School "Tierra y Libertad," located in the municipality with the same name, and was followed by a second one in March 2013 that took place in the Centro Educativo "Miguel Alvarez del Toro" (Fig. 4). The talks were enriched with other activities like the photo exhibit "Mexican Amphibians," arts and crafts, games, songs, and the showing of a video produced for that purpose. Also, two drawing contests —"I take care of the amphibians" and "Let´s take care of Amphibians"—were organised in order to promote amphibians, teach appreciation for these creatures, and ultimately sensitize the children to the need to conserve them.

The implementation of the project "Educate with environmental responsibility to achieve the conservation of biodiversity in the municipality of Berriozábal, Chiapas" will be starting soon. This project will teach a set of workshops for biodiversity conservation

Fig. 4: Participants in the 2nd workshop on the knowledge, appreciation and conservation of amphibians. Photo: Roberto Luna-Reyes.

in the primary schools—first at the head of the municipality, and in a second phase throughout its territory—and is set in the framework of the program "Education with Environmental Responsibility" set forth by Chiapas State Government in order to promote an environmental culture among the children and youth from the State. The project also follows from agreements between the Amphibian Survival Alliance, the municipality of Berriozábal, the Chiapas State Ministry of the Environment and Natural History (SEMAHN) and the Chiapas University for the Sciences and Arts (UNICACH), always with participation of the RED.

Last, and as a consequence of the support and engagement of the Amphibian Survival Alliance, researchers from different institutions and members of the RED have submitted the proposal "Conservation and monitoring of amphibians at risk of extinction in Chiapas" to the national environmental authority (CONABIO). The project is intended to set the foundation for conservation and monitoring of amphibians throughout the state. It will be implemented in three stages: i) first the setting of a knowledge base line of all amphibians known to occur in Chiapas, including a species list with precise information about localities of occurrence based on field-data from 1980 onwards; ii) a couple of workshops with participation of national and international experts to develop, validate, and share a normalised protocol for amphibian monitoring; and iii) the implementation of monitoring activities for those species and populations highlighted in the previous stage. We expect to develop a data base with all known amphibian records in the State derived from the field, literature, and museum specimens; an image data base, with emphasis on those species selected for monitoring and the general characteristics of the sites being monitored; and an up to date list of the species still occurring in Chiapas. Based on the threats detected through the entire project, we will be able to include recommendations for the conservation, and the management of species and habitats in the different regions of Chiapas.

References:

1. J. García-Moreno et al., *Mesoamericana,* **12** (1): 37 (2008).
2. R. Luna-Reyes, Diagnóstico general sobre la situación de los anfibios del Estado de Chiapas: riqueza, categoría de riesgo, distribución y endemicidad (Secretaría de Medio Ambiente Vivienda e Historia Natural-Conservación Internacional-Fondo de Alianzas para los Ecosistemas Críticos, Tuxtla Gutiérrez, Chiapas, México. 2010).

Two species at risk of extinction in Chiapas: a) *Agalychnis moreletii* and b) *Pseudoeurycea nigra.* Photos: Roberto Luna-Reyes.

Collaboration for Conservation Success in the Netherlands

Photo: Jelger Herder.

By Annemarieke Spitzen–van der Sluijs, Jeroen van Delft, Wilbert Bosman & Jelger Herder

RAVON, Reptile, Amphibian and Fish Conservation the Netherlands, is an active organization founded in 1988. Currently, we have 30 employees, and over 1,000 volunteers that collect data and restore habitats. We are situated in the Netherlands, and have two offices. Our main office is in Nijmegen, and the second is in Amsterdam. The main aim of RAVON is to increase the number of sustainable populations of amphibians, reptiles and fish in the Netherlands.

In order to achieve this goal, we cooperate with various partners to improve amphibian conservation. We work with scientists to strengthen the theoretical background on the ecology of species and on conservation issues. We also closely collaborate on the practical side of amphibian conservation in that we organize excursions, workshops on habitat restoration, and we facilitate digital data entry of sightings. Also, we design brochures on various topics, such as habitat management for amphibians and on the eradication of the invasive Pumpkinseed sunfish. When requested upon by land owners and land managers, we provide them with advice on sustainable amphibian conservation.

The full-day workshops, providing both a theoretical and practical part, have been very successful in providing information on not only the theoretical background of habitat improvement, but also on the practical implementation of the suggested measures in the field. Similarly, we have constructed an "Early Warning System" for sightings of the invasive American bullfrog (*Lithobates catesbeianus*). Volunteers and professional nature conservationists, but also governmental muskrat eliminators, monitor the Dutch-Belgium border for invading bullfrogs from Belgium. This enables us to react at an early stage of invasion of this species and so prevent the build-up of a sustainable population.

Three brochures on various habitat management issues; the first one focuses specifically on habitat improvement in favour of the slow worm (*Anguis fragilis*), the second one focuses on improving aquatic and terrestrial habitat for amphibians in general in the province Noord-Brabant; and the latter discusses the ecology of the invasive pumpkinseed fish, the main conservation issues and suggests several management options. All can be downloaded from www.ravon.nl (in Dutch only).

We can provide many of these examples in which we have set up a collaboration between volunteers, practical conservationists and scientists to work on amphibian conservation, but we would like to

Reptile, Amphibian and Fish Conservation the Netherlands, PO Box 1413, 6501 BK The Netherlands. Corresponding author: a.spitzen@ravon.nl. www.ravon.nl

restrict ourselves and exemplify our road to success for amphibian conservation through collaboration by illustrating three projects: a) environmental DNA, b) the Common spadefoot and c) the Fire salamander.

ENVIRONMENTAL DNA

Environmental DNA (eDNA) enables us to determine the presence of one or multiple aquatic freshwater species by collecting a water sample. The method is based on the fact that all species that live in the water release DNA via faeces, urine and skin cells. This DNA can then be collected and analyzed in the lab. Focussing on secretive species (e.g., *Pelobates fuscus* and *Triturus cristatus*) the advantage of using this technique is that it is very cost-effective, since the chance of detecting a species is much higher with eDNA and can be done in a shorter time frame than by using the traditional survey techniques (using a dip net for example). More on the theoretical and practical background can be read on our website which is also available in English: http://www.environmental-dna.nl/

RAVON forms a partnership with SPYGEN (http://www.spygen.fr/en/), one of the globally leading laboratories in the field of eDNA. The Dutch Mammal Society and Dutch Butterfly Conservation joined the consortium in 2012, FLORON (Floristic Research Netherlands) joined in 2013. Together we carry out research into novel applications of the method to other species such as the Green hawker dragonfly (*Aeshna viridis*), Root vole (*Microtus oeconomus*) and Floating water-plantain (*Luronium natans*). We additionally work on the optimization of the sampling method, as well as on the development of tools to estimate species densities using eDNA and the development of the technique to generate entire species lists from single eDNA samples using next generation sequencing. Within a few months a thorough review on eDNA and its application will be published by RAVON, SPYGEN, LECA and the Centre for GeoGenetics (Natural History Museum of Denmark, Copenhagen University).

Photo: Jelger Herder.

Photo: Jelger Herder.

In a National Park in the Netherlands Italian crested newts (*Triturus carnifex*) have been released some 40 years ago. This species is not native to our country and we have started to study the amount of hybridization with the Great crested newt (*T. cristatus)* in order to be able to frame the scale of the problem. For this purpose we have recently collected tail tips from suspected mixed *T. cristatus* and *T. carnifex* populations, as well as from 100% pure *T. cristatus* and *T. carnifex* populations. The laboratory of Naturalis Biodiversity Centre, highly specialised in genetics concerning the crested newts, studied the amount of inbreeding using DNA analysis. The results were astonishing in that the populations were far more mixed than we originally thought they would be.

Photo: Jelger Herder.

Besides the study on hybridization we also conducted a pilot study in collaboration with SPYGEN to see if we could develop eDNA primers to monitor the distribution of *T. carnifex*. This pilot study was very successful. Using eDNA we found *T. carnifex* in eight out of eight locations from which we knew the species was present. As a control we also tested four sites where *T. carnifex* was surely absent and only *T. cristatus* occurred. The eDNA samples from those locations tested negative for *T. carnifex*, confirming that the primers work properly. We then collected 56 water samples around the edges of the *T. carnifex* distribution, to be able to more precisely define the geographic size of the problem. With these data we can advise the Dutch government on the need and possibilities of conservation actions.

COMMON SPADEFOOT

The Common spadefoot (*Pelobates fuscus*) is a secretive species and is hard to detect using the traditional monitoring techniques (acoustic monitoring using underwater microphones and dipnets, fykes and nocturnal terrestrial searches using a torch). Moreover, this species is very rare (< 40 populations in the Netherlands) and

Photo: Jelger Herder.

Critically Endangered in our country. To improve the spadefoot's fate, a breeding programme has been started. For this project we collect egg strings, raise them to nearly metamorphosing toadlets and then release them in suitable ponds. This work is conducted in close collaboration with Staatsbosbeheer (State Forestry) and the Province of Noord-Brabant. Secondly, because the species is so easily missed using the regular methodology, we collected aquatic samples on 33 locations for eDNA analysis and herewith we could determine its current range was 17% larger than we thought! The species even appeared to be present at sites where over more than 20 years no individual had been sighted.

https://www.facebook.com/RavonKnoflookpad

SOSVUURSALAMANDER

The Fire salamander (*Salamandra salamandra terrestris*) has declined significantly due to the novel pathogen *Batrachochytrium salamandrivorans* (*Bs*). This "chytrid 2.0" has caused the population to decline 96%. We are working to safeguard this species, and we simultaneously study the devastating effects of *Bs* on amphibian populations.

The Fire salamander lives in the Netherlands at the very edge of its distribution range and it is confined to old deciduous forests with brooklets in the most hilly part of our country. For a long time, we considered the species to be stable, but from 2008 onwards dead fire salamanders were found. From 2010 onwards an extremely sharp decline in the number of sightings of living salamanders was noticed. Thanks to dedicated volunteers this decline was noticed and recorded. Considering the period 1997-2012 the species shows a very strong and significant decrease in all populations.

Photo: Jelger Herder.

Together with several scientific institutions we studied the possible causes for the decline, ranging from habitat deterioration (B-Ware, NL) to genetic composition (Bielefeld University, D). A great team of scientists under leadership of Ghent University (B) eventually found the cause, being the novel pathogen *Batrachochytrium salamandrivorans* (*Bs*). This was subsequently published in PNAS (*1*).

This case clearly illustrates the great and essential collaboration between volunteers, scientists and nature conservationists. The volunteers, who have been intensively monitoring the fire salamander populations, sighted the dead fire salamanders and noticed the strong decrease in alive sightings. They notified RAVON and we increased monitoring efforts, started SOSvuursalamander and got other scientists involved. www.SOSvuursalamander.nl, https://www.facebook.com/SoSvuursalamander

CONCLUSION

At various topics we seek collaboration with volunteers, scientists and other professional partners. Hereof, volunteers are an essential chain. Not only are they our eyes and ears in the field, they also have a great local network enabling us to work at the micro level. Simultaneously, we seek partnerships in nature conservation agencies and scientific institutions, but again, the data collected by volunteers is extraordinarily valuable and thoroughly focussed on amphibians, reptiles and fish.

References

1. A. Martel et al. PNAS 110, 15325-15329 (2013).

Photo: Jelger Herder.

Strengthening Partnerships and Preparations for the Honduras Amphibian Rescue and Conservation Center

By [1*,2]Jonathan E. Kolby & [3]Brandon L. Greaves

In October 2013, Jonathan Kolby and Brandon Greaves spent two weeks at Jardín Botánico y Centro de Investigación Lancetilla (JBL), located in Tela, Honduras. The purpose of this visit was to further strengthen the foundation for the new Honduras Amphibian Rescue and Conservation Center (HARCC) and initiate facility construction. JBL serves as the headquarters for HARCC and provides the physical location where all *ex situ* head-start and captive assurance activities will take place.

Meetings were held with Ciro Navarro Cruz, Director of JBL, to further solidify HARCC's long-term presence in Honduras and conservation vision. To strengthen HARCC's infrastructure, Cruz extended project partnership to an additional Honduran governmental entity, the Escuela Nacional de Ciencias Forestales (ESNACIFOR). At present, HARCC now represents an international collaboration sealed by a Memorandum of Agreement between Jonathan Kolby (USA), JBL (Honduras), Omaha's Henry Doorly Zoo & Aquarium (USA), Departamento de Vida Silvestre del Instituto Nacional de Conservacion y Desarollo Forestal Areas protegidas y Vida Silvestre (ICF) (Honduras), Operation Wallacea (UK), Expediciones y Servicios Ambientales de Cusuco (ESAC) (Honduras) and ESNACIFOR (Honduras). In addition, HARCC recently became an Associate Partner of the Amphibian Survival Alliance (http://www.amphibians.org/portfolio/harcc).

Main on-site activities in October included preparations of the building provided by JBL where two isolated amphibian rooms and a feeder insect rearing facility will be stationed. Inside this building, walls were sealed and coated with mold and fungal resistant paint and through a series of scouting trips, most of the necessary construction supplies were located, purchased and prepared for the next visit to install the amphibian isolation units. HARCC is now expected to be ready for the first arrival of wild-collected amphibians from Cusuco National Park in 2014-2015.

Now that the facility has officially entered the construction phase, we are now seeking the additional funds necessary to begin employing HARCC staff in the near future, to avoid any potential delays in amphibian acquisition. We are also currently seeking prospective local staff interested in working on this project, whom will first receive extensive training and experience at Omaha's Henry Doorly Zoo & Aquarium in the Amphibian Conservation Area. Onsite housing at JBL will be provided for all project staff, located just minutes from the amphibian rescue facility. Funding already received to make construction of HARCC facilities possible was provided by an Amphibian Ark Seed Grant, the Chicago Zoological Society-Chicago Board of Trade Endangered Species Fund and Rufford Small Grants for Nature Conservation.

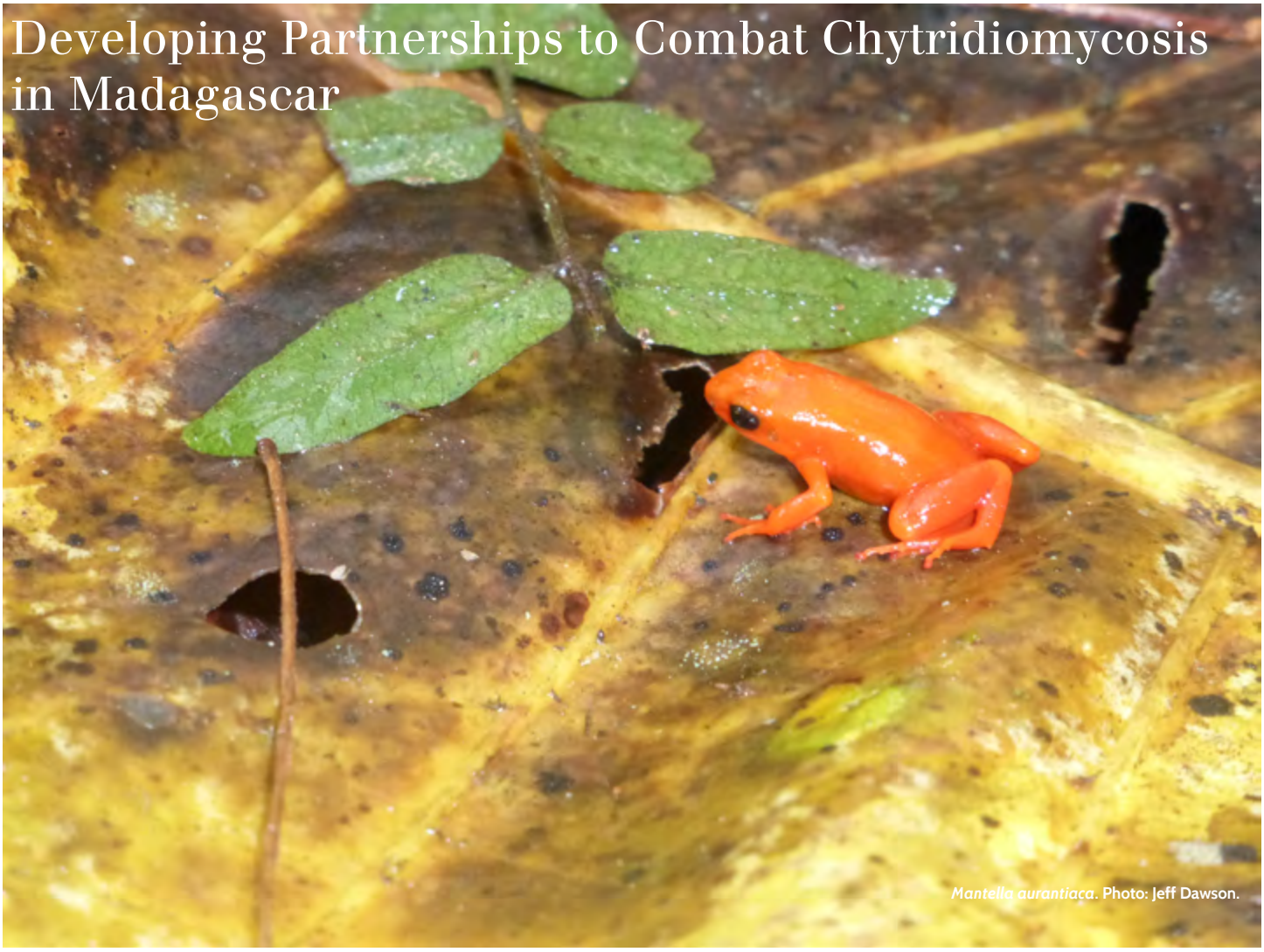
For more information about HARCC or to inquire about opportunities for involvement, please contact us at: Hondurasarcc@gmail.com

No time to waste! Jonathan Kolby and Brandon Greaves paint away into the night preparing HARCC headquarters. Photo: Jonathan Kolby.

Brandon Greaves provides information and background to the Director of Jardín Botánico y Centro de Investigación Lancetilla about the Henry Doorly Zoo & Aquarium's efforts to prevent amphibian extinction. Photo: Jonathan Kolby.

[1]IUCN SSC Amphibian Specialist Group, Regional Co-Chair (Honduras) [2]Operation Wallacea, Wallacea House, Lincolnshire, UK [3]Omaha's Henry Doorly Zoo & Aquarium, Omaha, NE, USA *Corresponding author.

Developing Partnerships to Combat Chytridiomycosis in Madagascar



Mantella aurantiaca. Photo: Jeff Dawson.

By Jeff Dawson

I was delighted and fortunate enough to begin work with Durrell Wildlife Conservation Trust in July this year in their newly created post of Amphibian Program Officer. My role is to develop Durrell's global amphibian program which will work to save some of the most threatened amphibian species in some the highest extinction risk areas of the world. Challenging certainly but extremely important with amphibians being the most threatened vertebrate group in the world and overlooked by many global conservation organizations. Having always had a leaning towards the underdog I'm really excited about being able to make a significant contribution for these fascinating species with Durrell and through our global program.

Boophis williamsi. Photo: Jeff Dawson.

A program strategy is currently being finalized that will guide the global program's interventions and activities over the coming years. Partnerships and collaborations are crucial in enabling effective conservation to be done as it is not possible or wise to attempt to do everything yourself. This is certainly true for our amphibian program where work and activities will focus on multiple species and areas.

The first location we are developing our amphibian work in is a country where Durrell has been working for over 25 years with many successes: Madagascar. This biologically rich island nation has over 300 amphibian species of which all but two are endemic. This combined with the large number of threats facing the countries amphibians' highlighted Madagascar as one of the priority areas for conservation action by the Global Amphibian Assessment in 2004. A subsequent Sahonagasy Action Plan (SAP) developed in 2008 outlined a number of key actions for the conservation of Malagasy amphibians; one of which is "Managing emerging amphibian diseases." Amazingly this is one country where the virulent strain of the deadly fungal disease *Batrochochytrium dendrobatidis* or *Bd* is

Frog habitat in Betampona. Photo: Jeff Dawson.

not yet confirmed (*1*), though experts believe that it is a matter of when and not if. Given Madagascar's unique and endemic frog fauna it is feared that when *Bd* arrives it could have catastrophic consequences as seen in the Americas and Australia.

Durrell of course, has already been engaged with amphibian conservation efforts in Madagascar and in the last few years has run workshops in November 2010 and April 2012 on amphibian health screening and captive breeding respectively. One fortuitous outcome from these was the decision to form a Government approved national chytrid response unit, the Cellule d'Urgence (CdU), to coordinate activities related to *Bd* in Madagascar. This includes the National Monitoring Plan for chytrid which Durrell has been contributing to through our sites in Menabe and Ankarafantsika alongside a number of other organizations at other sites.

Faly in Ankaratra. Photo: Jeff Dawson.

Durrell's future amphibian conservation work in Madagascar will aim primarily to support the CdU and the SAP through the delivery of this and other key actions in relation to *Bd*. It will look to develop the in country capacity necessary to enable an effective response to this deadly disease threat, focussing on three principle areas: prevention, detection and action. This is no small task and makes the need for effective partnerships even more important if this aim is going to be successfully achieved.

***Mantidactylus melanopleura*. Photo: Jeff Dawson.**

For five weeks during November and December 2013 I visited Madagascar as part of the project development phase. The main aim of this was to get first-hand experience and knowledge of some of the work currently being done in Madagascar, meeting various key people and organisations to help determine where Durrell can most effectively contribute.

One area highlighted as being a key action in the response to *Bd*, as well as being its own action in the SAP, is developing the captive breeding capacity for amphibians in Madagascar and is an activity Durrell is well placed to assist with. Though this capacity is currently in its infancy in Madagascar, an exemplary setup is to be found at Andasibe operated by local NGO Association Mitsinjo. Established initially for the purpose of breeding *Mantella aurantiaca* from areas lost to the Ambatovy nickel mine, they are now beginning to breed other species to develop husbandry guidelines for

Mantidactylus pauliani. Photo: Jeff Dawson.

Mitsinjo breeding centre. Photo: Jeff Dawson.

those species with different life histories. This is especially important for those species believed to be highly susceptible to *Bd* with Andasibe one of the most likely areas for the disease to become established due to the optimal environmental conditions present and high numbers of visiting tourists and researchers. Collaboration with Mitsinjo to provide additional expert training for staff through Durrell's Wildlife Park in Jersey as well as assisting with field surveys to collect the necessary ecological and life history information for captive breeding is an area we are exploring further.

Me, Franco and technicians at Mitsinjo. Photo: Jeff Dawson.

Providing training to staff at Mitsinjo will not only benefit the breeding center at Andasibe but others as they develop. One such centre recently set up is at Parc Ivoloina just outside Tamatave operated by Madagascar Fauna and Flora Group (MFG). Establishing a new captive breeding center is not simple with many challenges to overcome but Ivoloina can benefit greatly from the experience and knowledge of the team at Andasibe, especially in those crucial initial stages. Facilitating exchanges between Mitsinjo and Ivoloina to do just this and ensure knowledge and training is disseminated as widely as possible is an area we are keen to help with. Ultimately by assisting to develop capacity at these two centers initially a Malagasy expert base in captive breeding will be grown which can aid the establishment of potential future centers in other areas.

As with all captive breeding programs knowledge of a species life history and ecological needs are crucial. Getting this information requires dedicated field work and this is another area that we are investigating ways to collaborate on both with Mitsinjo at Andasibe and MFG through their main field site at Betampona for Ivoloina. It is also anticipated that our program will do similar work in other key areas and species including Durrell's field site at Manombo. This site in the southeast of the country links into an area rich in amphibian fauna that is also highlighted as being at high risk from chytrid, Ranomafana. Fortunately Ranomafana has a strong research presence through Centre ValBio, providing an ideal partner to discuss potential future collaborations.

Of course being primarily focused on the chytrid issue the key group to work with and through is the CdU as they are the body designated with coordinating all activity related to chytrid in

Madagascar. Faly Rabemananjara coordinates this group and I was delighted to have been able to spend time accompanying him to the Ankaratra massif in central Madagascar where he has been working over the last few years along with local NGO Vondrona Ivon'ny Fampandrosoana (VIF). This high elevation site is home to two Critically Endangered frog species, *Boophis williamsi* and *Mantidactylus pauliani* (as reported in previous editions of *FrogLog*) and has also been identified as an area potentially at high risk from *Bd*, making it a very important site for amphibian conservation.

***Boophis quasiboehmei*. Photo: Jeff Dawson.**

Given the size of Madagascar and scope of the potential *Bd* issue in Madagascar any successful intervention is going to require the collaboration and input of multiple organisations and people working throughout the country. Ensuring engagement with those groups already involved, while also exploring and developing new partnerships with other appropriate organizations will be key as from my perspective we all have the same goal. That is to ensure the continued survival of Malagasy amphibians in the wild. The timely planned revision of the SAP next year will be very useful in helping achieve this, particularly if it should identify groups to take the lead on implementing key actions.

During my visit to Madagascar it was encouraging to meet a number of committed and enthusiastic people who are already involved in amphibian conservation as well as other organizations who are keen to expand their amphibian related activities and engage with such a program. I am excited about the development of Durrell's amphibian program in Madagascar and am keen that we work collaboratively with the CdU and others to achieve the objectives of the SAP.

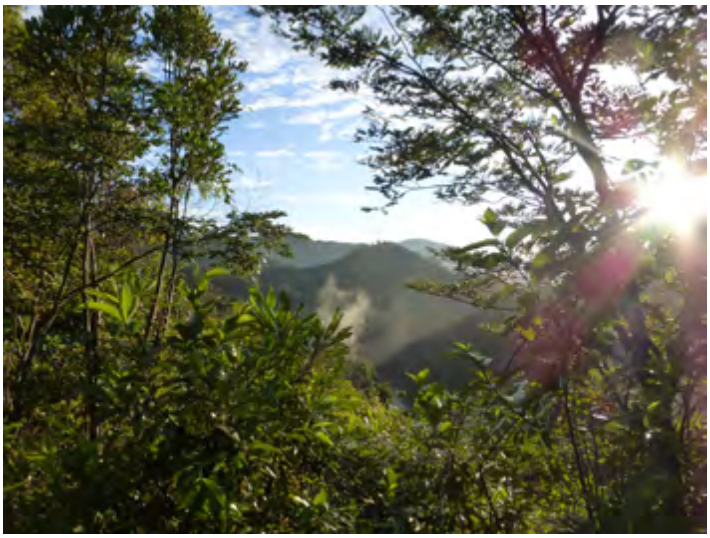
It was a pleasure to meet a number of people during my visit with particular thanks (though in no special order) to Faly Rabemananjara, Franco Andreone, Angelica Crottini, Karen Freeman, Devin Edmonds, John Cadle and the Durrell Madagascar team.

References:

1. Weldon, C., Crottini, A., Bollen, A., Rabemananjara, F. C. E., Copsey, J., Garcia, G. and Andreone, F. Pre-emptive National Monitoring Plan for Detecting the Amphibian Chytrid Fungus in Madagascar. *Ecohealth* DOI: 10.1007/s10393-013-0869-8. Published online 21 September 2013.

Searching for frogs. Photo: Jeff Dawson.

***Boophis microtympanum*. Photo: Jeff Dawson.**



Sunrise at Ranomafana. Photo: Jeff Dawson.

ENDANGERED WILDLIFE TRUST
THREATENED AMPHIBIAN PROGRAMME
conservation in action

NEWS

Western Leopard Toad Roadkill Mitigation Project

The project, implemented by the Noordhoek ToadNUTS (Noordhoek Unpaid Toad Savers) volunteer group and supported by the EWT Threatened Amphibian Programme and Wildlife and Transport Programme, has been a huge success. Barrier fencing consisting of pit-fall traps and drift-fencing was erected along both sides of a busy stretch of Noordhoek Road between 4 August and 2 October. The system was patrolled by 24 patrollers over 59 nights and any toads found were moved to safety. **A 100% survival rate of toads along the stretch of road with the barrier was achieved during the period in which the barrier was in effect.** This is a fantastic example of passionate citizens acting to save a local threatened species. The project has lent itself not only to trailing an effective mitigation option, which will provide much-needed emphasis for the construction of more permanent solutions in future, but also provided an opportunity for data-collection and analysis on a subject that until now has gained little attention in the South African context.

Photo: Alison Faraday.

TAP PROJECT UPDATES

1) The Pickersgill's Reed Frog Recovery Project

On 5 & 6 September 40 delegates representing over 15 organisations involved in one way or another with Pickersgill's Reed Frog, put their heads together at a BMP development workshop at Simbithi Country Club. The workshop was aimed at putting together actions to mitigate the known threats to this species. These efforts will culminate in the production of what's known as a Biodiversity Management Plan for Species, which will be published in the government gazette. Developing management plans in this way ensures that relevant role players are aware of, and supported in, their responsibilities to meet the conservation objectives deemed relevant for the species. The first draft of the plan has now been sent to all relevant stakeholders for comment.

Field work for the season started with an excursion to the Simbithi site on the first evening of the workshop, but unfortunately no Pickersgill's were heard calling at this time due to little rain at that stage. Since then our rains have arrived with vigour and we have now confirmed activity at Mount Moreland, Prospecton, Mtunzini and Simbithi.

NEW LOCALITIES FOUND FOR PICKERSGILL'S REED FROG

During baseline surveys in the Mtunzini area on 20-12 October two new localities for Pickersgill's were discovered. One site is just

Photo: Jeanne Tarrant.

One of the two male Amathole toads found on Amathole Forestry land adjacent to the Cathcart Road during the September 2013 survey. Photo: Jeanne Tarrant.

south of Mtunzini near Twinstreams, possibly close to the historical site frequented by WITS in the 1990s. The second site is north of Mtunzini at Kraal Hill in an area heavily impacted by subsistence agriculture.

Then just this week, Mike and Dudley from Simbithi visited neighbouring Simbali Golf Estate and confirmed the presence of Pickersgill's Reed Frog there, so within 3 weeks our total count for localities for the species is now up to 22!

BREEDING SUCCESS AT USHAKA SEAWORLD, DURBAN

An amplecting pair of Pickersgill's Reed Frog was collected from Mount Moreland in September. A clutch of around 150 viable eggs was laid about a week after collection and the Dangerous Creatures team at uShaka are carefully nurturing the tadpoles and getting to grips with the husbandry of the species. The adults are now on display at Dangerous Creatures. We are watching this space carefully!

2) The Amathole Toad Conservation Project

The 23rd to 26th September saw our first Amathole toad surveys for the season. Together with the new Source-to-Sea Field Officer, Christine Coppinger and fellow amphibian researcher, Dr. John Measey from Nelson Mandela Metropolitan University, we set off in very dry conditions to search for our elusive subject species, which has only been seen a handful of times in the past 25 years, at one point even thought to be possibly extinct. To add to the pressure of finding the toads, we had a 50/50 crew accompanying us. Two days of searching both the 2011 and 2012 sites proved unsuc-

Interview with 50/50 on top of the beautiful Elandsberg Mountain, one of the few known sites of the Amathole Toad. Catch the story on SABC 2 on 18 November at 7:30 pm. Photo: Christine Coppinger.

cessful, leaving the search team dry, dusty and disheartened. Local land-owner and businessman, Mark Andersen lead us up the Elandsberg Mountain, where the toad was discovered for the first time last year. He is very willing to help in the conservation of the species and its habitat and we started discussion on possible habitat protection options, including stewardship.

Without much hope, we revisited the 2011 site on the third day of the search and – much to the team's amazement and delight – discovered not one, but two male toads hiding out under their own separate logs! Against all expectations, the 2013 search proved a huge success and it seems that there is hope for the Amathole toad yet. Despite this, the species is still dangerously rare, especially considering their previous abundance. More intensive searching and conservation action is urgently needed if we are to save the Amathole toad. Furthermore, it was noticed that new pine saplings have been actively planted in the immediate vicinity of the toad population. The toad does not occur in the wetland areas directly, but rather moist seepage areas above the wetlands, and as such this habitat may have been overlooked in terms of planting.

PUBLIC AWARENESS

Conservation -minded Southbroom

I've been down to Southbroom on the KZN South Coast twice in the past few months, initially to give a general talk on frogs to about 70 residents, which resulted in sparking the interest of a few keen amateurs, resulting in a second trip with a more practical focus where we looked at frog species likely to be encountered in the area followed by a short walk to identify the species present on the golf-course.

Amping Up for Save Our Frogs Day 2014

Save the date for Save Our Frogs Day: 28 February 2014, where we'll be leaping into action across the country with events, activities, outings, competition etc. to highlight the importance and plight of frogs in South Africa.

also signed on as a Red List Authority for the southern African region to assist with red list assessment updates.

Warm regards,

Jeanne

To get involved or find out more, please contact:

Dr. Jeanne Tarrant

Manager: Threatened Amphibian Programme Manager

Endangered Wildlife Trust

Hillcrest, KwaZulu-Natal

Email: jeannet@ewt.org.za

W + 27 31 7655471 | C + 27 83 254 9563

http://www.ewt.org.za/programmes/ACP/acp.html

PARTNERSHIPS

The Threatened Amphibian Programme is excited to announce its recent partnership with the Amphibian Survival Alliance through which we pledge to implement actions toward achieving the objectives of the Amphibian Conservation Action Plan. We have now also signed on as a Red List Authority for the southern African region to assist with red list assessment updates.

Lissotriton vulgaris. Photo: Teresa Dunbar.

Collaborating for Irish Amphibians

By Robert Gandola and Catriona Hendry

With three native species of amphibians, the island of Ireland is not a hotspot of amphibian diversity in terms of species numbers. That being said, total species numbers need not be the only consideration in evaluating the importance of the amphibian communities found here. For example, despite all species of Irish herpetofauna being shared with the UK, populations of the Common frog (*Rana temporaria*) and the Natterjack toad (*Epidalea calamita*) have been shown to contain genetic lineages found nowhere else in Europe (*1*,*2*). Ireland also represents the most westerly distribution of these species, increasing their scientific and conservation value as they may provide key insights into evolutionary processes at species distribution limits.

Collaboration between universities, zoos, conservation agencies, government bodies and volunteer organizations has long been the mainstay of biological studies and conservation efforts. While one might typically think of projects in far flung and exotic corners of the world, the principles and strengths of a collaborative approach to research are just as applicable closer to home. The Herpetological Society of Ireland (HSI) is a volunteer-operated organization which has utilized successful collaborations to study Irish native herpetofauna.

Robert Gandola is the Senior Scientist for the Herpetological Society of Ireland and a Ph.D. student at the University of Southampton. Catriona Hendry is a Science Officer for the Herpetological Society of Ireland and a Ph.D. student at the George Washington University, Washington, D.C. (Corresponding author email: rgandola@thehsi.org).

Since establishment in 2009, the HSI has prided itself on the good relationships and standing in which it is held by both governmental and non-governmental organisations in the Republic and Northern Ireland. As with many other small voluntary organizations worldwide the HSI is dependent on assistance from its member base and other organizations when undertaking any kind of initiative.

The Irish Amphibian Chytrid Survey (IACS) 2012 was the first major project undertaken by the HSI. It began as an idea back in 2009 and in April 2012 the Society secured a generous grant from the Heritage Council of Ireland through their grant scheme which supports projects dedicated to conserving Ireland's heritage. The IACS was designed to create baseline data regarding the status of the chytrid fungus (*Batrachochytrium dendrobatidis*) throughout the island of Ireland. This fungus is having devastating effects on amphibian populations worldwide, and the IACS could be seen as a crucial step in developing management options to help safeguard Irish amphibians. This project would not have been possible without the input and endorsement from various organizations at every stage of the project. Before getting out into the field, crucial advice and letters of support were provided by Invasive Species Ireland, Amphibian and Reptile Conservation (United Kingdom; http://www.arc-trust.org/) and the Zoological Society of London/Institute of Zoology (ZSL/IoZ). As all Irish amphibians are protected by law in both the North and the South, collaboration with the National Parks and Wildlife Service of Ireland (NPWS) and the Northern Ireland Environment Agency was sought to license fieldworkers

***Epidalea calamita* being swabbed. Photo: Lisa Fay-Davin.**

to take skin swab samples from the specific species under study. In the field volunteer assistance was invaluable, with the majority of sampling being undertaken by trained volunteers, along with the HSI committee and rangers from NPWS. To complete the final analysis stage of the project, assistance was provided by ZSL/IoZ, who analyzed the samples in order to evaluate presence/absence of the fungus. All in all, the IACS was a very successful project, the first collaborative effort of its kind but certainly not the last!

In a separate project, Dr. Caitriona Carlin and student Kevin French at NUI Galway conducted an investigation into amphibian distribution in a number of water bodies in the west of Ireland, one of which was the site of discovery of a number of non-native Alpine newts (*Icthyosaura alpestris*). Again ZSL/IoZ was able to accommodate the HSI and facilitated the screening of samples for the presence of chytrid fungus, filling in important gaps left over from the IACS.

In February 2013 a concerned member of the public reported a major frog die off at a local pond in Co. Waterford. Given the description of the event and the photographs sent to the HSI, we suspected an outbreak of *Ranavirus* might be responsible. Another major cause of population decline in amphibians, the presence of *Ranavirus* in Ireland would have serious ramifications and so with the permission of NPWS we collected samples in order to investigate. Once again we called upon our collaborators at ZSL/IoZ, this time with Dr. Stephen Price at the helm, and had the specimens examined by necropsy and analyzed using q-PCR technology. Fortunately we are glad to be able to report that *Ranavirus* was not detected in any of the deceased frogs. While this is great news on the one hand, it means that an as-yet undetermined factor caused the die-off. This is an area that the HSI hopes to pursue in the near future.

***Rana temporaria*. Photo: Rob Gandola.**

Our work at the HSI is not restricted to amphibians however, with plans for the immediate future involving a collaboration with Dublin City Council to undertake a multi-species survey of North Bull Island. North Bull Island is an internationally renowned area of conservation importance, designated as both a Ramsar Site and a UNESCO Biosphere Reserve. We also plan to continue collecting data on amphibians throughout Ireland via involvement of members of the public and promotion of our "Log a Frog/Report a Reptile" initiative. A longer term aim is the creation of an Irish Amphibian Disease Monitoring Unit, an island wide monitoring initiative that aims to encourage reporting and the investigation of any large scale amphibian die-off or noticeable decline of amphibian populations at either a local or national level.

Ireland's amphibian fauna may not be the most diverse when compared with the tropics; however the species that do occur here still have great scientific and conservation value. The HSI has so far made great strides in what will become a long term and multi-faceted study of Ireland's native herpetofauna. None of this progress would have been possible without our collaborators, and we look forward to many more successful projects.

For more information see www.thehsi.org

***Rana temporaria*. Photo: Rob Gandola.**

Acknowledgements

We would like to thank all HSI members and the volunteers who have helped to make the initiatives to date so successful. The IACS was supported by a Heritage Council of Ireland Grant (Ref. No. R02371). Thanks go to Dr. Ferdia Marnell (NPWS) and Declan Looney for permissions and licensing. Special thanks go to the Wildlife Epidemiology group (ZSL/IoZ) particularly Dr. Trent Garner, Felicity Wynne, and Dr. Stephen Price for lab support, advice and assistance.

References

1. Teacher, A. G. F., Garner, T. W. J., & Nichols, R. A. European phylogeography of the common frog (Rana temporaria): routes of postglacial colonization into the British Isles, and evidence for an Irish glacial refugium.Heredity, 102(5), 490-496 (2009).
2. May, S., & Beebee, T. J. Recent introduction or ancient ancestry? Use of genetic evidence to investigate the origins of range edge populations in natterjack toads (*Bufo calamita*). *Conservation Genetics*, 11(1), 293-300 (2010).

Photo: Krzysztof Kolenda.

Active Amphibian Habitat Protection in the South Wielkopolska Region (Poland)

By Krzysztof Kolenda

Shrinking and destruction of habitats are one of main reasons for the decrease in amphibian populations around the world, including in Poland. In the Wielkoposka province of Poland over 100 small lakes have disappeared over the last century with an even greater loss of midfield ponds; a very important amphibian breeding habitat. In 1894 11,061 ponds were recorded compared to only 2,490 in 1961. Urban water reservoirs also play a very important role however, as these sites are often unprotected, they become degraded and of less value to amphibians. Great examples of this situation are ponds in Ostrów Wielkopolski (51°39'N 17°49'E, South Wielkopolska region).

In 2009, during an inventory of one of these ponds, I noticed an accumulation of litter both in the pond and the surrounding area. In September 2009 when amphibians had left the pond I arranged a pond cleaning. With the helping hands of Ostrów Wielkopolski's high school students and South Wielkopolska Group of the Polish Society for the Protection of Birds (OTOP), in only two hours the group of 30 collected 110 waste bags of litter including items such as: tires, furniture, clothes, broken monitors and more. In 2010 I conducted observations of other ponds around the city area and identified three which were most exposed to degradation, yet rich in amphibians. Fire-bellied toad (*Bombina bombina*), Great crested newt (*Triturus cristatus*), Smooth newt (*Lissotriton vulgaris*), Common toad (*Bufo bufo*), Green toad (*Bufotes viridis*), Moor frog (*Rana arvalis*), Common frog (*R. temporaria*), Edible frog (*Pelophylax esculentus*) and Marsh frog (*P. ridibundus*) where all present. Every year since 2011 I have arranged an event named "Save The Local Wildlife," with the idea of cleaning up amphibian habitats in Ostrow Wielkopolski and surrounding areas. Every year students, teachers and volunteers form the OTOP and Newt Group (www.traszka.com.pl) take part in the event. During the last four events, more than 500 people have participated. We collected almost 900 bags of litter including items such as old TV's, monitors, furniture, tires, fertilizers and pesticides packaging, glass and more. Following the event all participants are invited to take part in a meeting where they can share the results of the event—what kind of litter they collected and which amphibian species they observed. For students

Department of Evolutionary Biology and Conservation of Vertebrates, University of Wrocław, ul. Sienkiewicza 21, 50-335 Wroclaw, Poland

who are part of the "Save The Local Wildlife" events I arrange biology and conservation of amphibians classes. In 2009 the special guest was herpetologist Prof. Leszek Berger. In 2011 I tested water quality in ponds which had been cleaned every year. The results of tests confirm that ponds are very polluted. In every pond we ascertain, among other things, high level of cadmium and lead was present, and are especially dangerous to amphibians. All efforts to help protect amphibian habitat are shared with the local media in order to help demonstrate the richness of amphibians in the area and and highlight local environmental pollution issues.

In Poland amphibian protection is still a low priority. In addition general understanding of amphibian population in the region are limited. As a result we should be using every opportunity to protect habitats and support education initiatives. In the immediate future I would like to work with the local government to restore original important amphibian areas. I also plan to create an "education path" for Ostrów Wielkopolski's students to learn about biology and environmental protection directly from nature-rich locations instead of the school bench.

Photo: Janina Bartuzi.

Photo: Krzysztof Kolenda.

Six Years of Active Conservation of Amphibians in the City of Poznan, Poland

Adult male of *Triturus cristatus* one of the less common species in Poznan (Poland). Photo: Jan Kaczmarek.

By [1]Kaczmarski Mikołaj & [2]Kaczmarek Jan

Poznan is a city of 500,000 in western Poland. Located on plains by the river Warta, urban areas host most of the amphibian species present in the region: *Bombina bombina, Bufo bufo, Bufotes viridis, Epidalea calamita, Hyla arborea, Pelobates fuscus, Rana temporaria, Rana arvalis, Pelophylax lessonae, Pelophylax* kl. *esculentus, Pelophylax ridibundus, Lissotriton vulgaris* and *Triturus cristatus.*

All the amphibian species in Poland are under the protection of law. However, lack of long-term research on population trends lead the administration and the public to the delusive conviction of abundance of most of the lowland species. As a consequence, we are dealing with widespread habitat destruction. Research on amphibian communities in Poznan took place between 1991-1994 and in 2009-2013. Comparison of data from early 90's with present data clearly shows that many of the breeding locations were destroyed, and in most places we are dealing with decline both in numbers and species diversity.

The first conservation attempts in 2008 were very basic: a local

Fieldwork with students from junior high school. Photo: Mikolaj Kaczmarski.

[1]Poznan University Of Life Sciences, Faculty Of Animal Breeding And Biology, Institute Of Zoology, Wojska Polskiego 71 C, 60-625 Poznań, Poland [2]Adam Mickiewicz University In Poznan, Faculty Of Biology, Students' Naturalist Association, Ul. Umultowska 89, 61-614 Poznań, Poland.

activist was hand-capturing amphibians crossing one of the busiest streets in the city during the spring migration. In 2009, drift fences were built along the 50 m transect. In the following years, the fence and pitfall trap construction was founded by the NGO, Klub Przyrodnikow (*Naturalists' Club*), and all activities were performed by a growing number of volunteers. In 2012, for the first time conservation activities were founded by the local administration. Since 2008, more than 5,000 individuals from seven species were safely transported across the road. The plan for the future is to build a permanent amphibian crossing.

In 2010, in a different part of the city, a group of students ran a project concerning urban amphibians in a junior high school. Apart from purely educational activities, volunteers also performed field activities aiming at improving habitat quality for one of the biggest Smooth newt populations in the city, located in a park just by the school building. With support from the local council and NGO's, the locality was officially recognized by the city authorities as a protected area in 2011. One of the consequences of the project was the creation of a dynamic team working with amphibians.

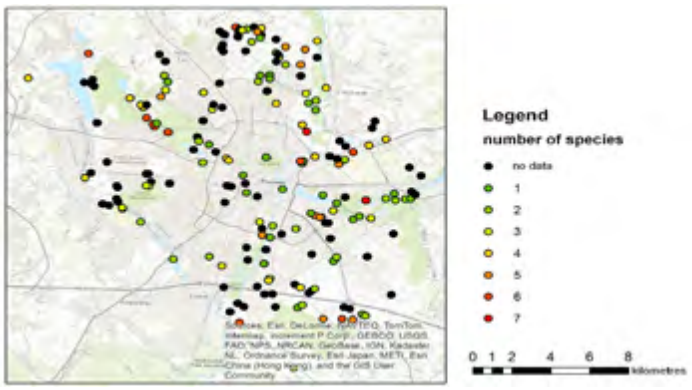
Since 2010, all the activities concerning amphibian conservation in Poznan have been announced with our website, http://www.traszka.com.pl/, in close cooperation with the local branch of Klub Przyrodnikow. After a few years of work, the group of trained volunteers has become large enough that in 2013 for the first time we were able to mitigate amphibian road mortality in three localities within city limits. What turned out to be the biggest limitation in our previous activities was the lack of knowledge where exactly amphibians needed to be protected. In 2013, we began developing a database of amphibian breeding localities in the city. The project was run in close cooperation with the municipal authorities; all the collected data were delivered to the local environmental administration. We hope this is the first step to create a monitoring system for the urban populations, and to implement an effective management program.

Acknowledgments

We thank volunteers for their help with fieldwork and Klub Przyrodnikow (Naturalists' Club) for their help in the implementation of projects.

Rana temporaria **during the releasing on the opposite side of the road. Photo: Jan Kaczmarek.**

Installing the fencing along Lutycka Street in Poznan (Poland). Photo: Jan Kaczmarek.



Amphibians species distribution in Poznan.

We Get By With A Little Help From Our Friends…

By Jeff Holmes, Photographs by Alleyn Unversaw

By always spending within our means while simultaneously expanding our capacity one cautious step at a time, The Amphibian and Reptile Conservancy (ARC) plans to be around a long time, steadily tackling more and larger projects as we grow. The formula for success and staying-power in the non-profit conservation world, especially for start-ups, is no great mystery:

- Pick an affordable, attainable goal that gives you maximum conservation value for every dollar spent,
- Demonstrate success,
- Leverage success to build capacity,
- Use your enhanced capacity to pick more ambitious goals, and
- Lather, rinse, repeat.

We are midway through Step four but we would still be stuck looking for Step one, an attainable goal, if it weren't for the help of our partners.

AN ATTAINABLE GOAL

On paper, ARC is a large non-profit because we administer funds for other organizations. In reality, our own discretionary funds for conservation programs are limited (like everyone else who works in the under-appreciated, under-funded field of herpetofauna conservation). So finding on-the-ground projects that are both consistent with our mission and within our means is difficult.

We began broadly soliciting proposals for wetlands restoration projects over a year ago. We received numerous strong submissions with both high quality direct benefits to herpetofauna and potentially exponential impacts such as professional training or student educational components. Unfortunately, every one of these proposals came with a steep price tag, including many in the six-figure range, that we simply couldn't afford.

Clearly, casting a wide net wasn't working so we quietly began approaching our closest partners for high-leverage, low-cost projects. Tom Biebighauser of the Center for Wetland and Stream Restoration (CWSR), our go-to expert on wetland design and training, immediately responded with a great idea. He suggested one of his tentative projects that was only partially funded by US Fish and Wildlife Service and needed several thousand dollars in matching funds.

Local partners, including CWSR, Unversaw and Cracchiolo Farm, Association of State Wetland Managers, and the Sheltowee Environmental Education Coalition, were willing to step up and provide logistical support and other resources. The restoration sites were identified, designs were drafted, and invitations to the training component were ready to go. Everything was in place and all they needed was matching funds from ARC. It was the perfect

project for us… almost.

Although we had the funds in hand, it would drain our reserves down to literally a few dollars. We were on the verge of having to decline when, out of the blue, yet another partner emerged with the last missing piece of the puzzle. The Wild4Ever Foundation from Cleveland, Ohio heard about the project and offered a grant to ARC. The grant would offset most of our expenditures, help us retain most of our reserve funds and allow the project to go forward.

DEMONSTRATE SUCCESS

In October 2013, ARC and partners restored five ephemeral wetlands on a privately-owned wildlife preserve in Brown County, OH. This project provided immediate, direct benefits to numerous amphibian and reptile species including at least four amphibian species considered rare by the state of Ohio. In the process, we also trained nearly four dozen landowners and habitat managers to restore their own wetlands for similar suites of species, exponentially multiplying our long-term indirect benefits.

Without CWSR, Unversaw and Cracchiolo Farm, Association of State Wetland Managers, Sheltowee Environmental Education Coalition, US Fish and Wildlife Service and, ultimately, the Wild4Ever Foundation, this incredibly successful, high-impact and high-leverage project may have never happened.

LEVERAGE SUCCESS, BUILD CAPACITY

No single partner was dispensable and the combined efforts of all involved helped the project exceed even our loftiest expectations. The project beat our original goal of four wetlands and three dozen trainees, generating widespread praise from the conservation community and attention from conservation donors, not just for ARC but for all of the partners involved. Donations, mailing list subscriptions, and social media followings are all up across the board in the wake of this successful collaboration.

MORE AMBITIOUS GOALS

ARC is considering new projects of all shapes and sizes to follow-up to our successful collaboration in Ohio. Whether we end up selecting a few big projects or a lot of smaller projects, you can bet we won't be able to succeed without partnerships. Stay tuned to see what Step four has in store.

Cape Collaborations For Amphibian Solutions

By [1]John Measey, [2]Wendy Annecke, [3]Sarah Davies, [4]Cliff Dorse, [5]Louise Stafford, [6]Krystal Tolley & [7]Andrew Turner

South Africa's Cape region is renowned for its high floral biodiversity with over 9,000 species of vascular plants, it comprises an entire floral kingdom in a very small area (*1*). The same region has also long been recognised as being special for amphibians (*2,3*). Although only comprising Anura, three genera are endemic, and a recent review of global vertebrate turnovers highlighted this area as distinct from most of continental Africa (*4*). At the extreme south-western corner of the Cape lies Cape Town, situated at the north end of the Cape peninsula (Fig. 1), a chain of mountains that runs around 60 km from Cape Point to the city bowl. The Cape peninsula today is a virtual island, surrounded by a sea of human habitation (estimated as 3.8 Million humans in 2008) in the larger City of Cape Town area (*5*). This significant urbanization in a biodiversity hotspot has resulted in a large number of threatened species, including frogs. A diverse range of stakeholders need to work together to ensure that threat levels for these species and their habitat do not escalate (*5*).

Here we highlight some examples of collaborative efforts that focus on the conservation of threatened amphibians in the City of Cape Town. While none of these has yet achieved a reduction in threat status, this is seen as the goal for each project. Our exemplars show that different collaborative approaches are appropriate for different species, mostly based on the stakeholders involved as well as the threats that act upon the species.

THE WESTERN LEOPARD TOAD

Half of the distribution and most of the genetic diversity of the Western leopard toad (*Amietophrynus pantherinus*; IUCN Endangered) is found in the "southern suburbs" of the City of Cape Town, coinciding with acid soils of the Sand Fynbos (*7,8*; Fig. 1). Like many large bufonids, it undergoes annual migrations to and from large open water-bodies, in which a number of adults congregate during the austral winter (typically August). Most of the breeding sites are managed by the City of Cape Town municipality, but after breeding has concluded the toads move to a variety of areas, many of which are private gardens. The conservation of this species relies on a good understanding by members of the public of the accommodation of toads in their gardens, as well as help across hazardous roads during migration events.

The Western Leopard Toad Conservation Committee (WLT-CC) arose as a result of a stakeholders meeting held in 2009. It includes members from each of the extant volunteer groups as well as representatives from the official conservation bodies: South African National Biodiversity Institute, CapeNature, South African National Parks and the City of Cape Town. Regular meetings are held at strategic times throughout the annual cycle of the toad. The WLT-CC is able to coordinate the conservation effort and has made significant advances to the City of Cape Town planning guidelines, habitat restoration, education as well as migration awareness. These areas are each fully discussed in a *FrogLog* article published in 2012: Conservation of the Western Leopard Toad by a dedicated multi-stakeholder group in the City of Cape Town (*7*).

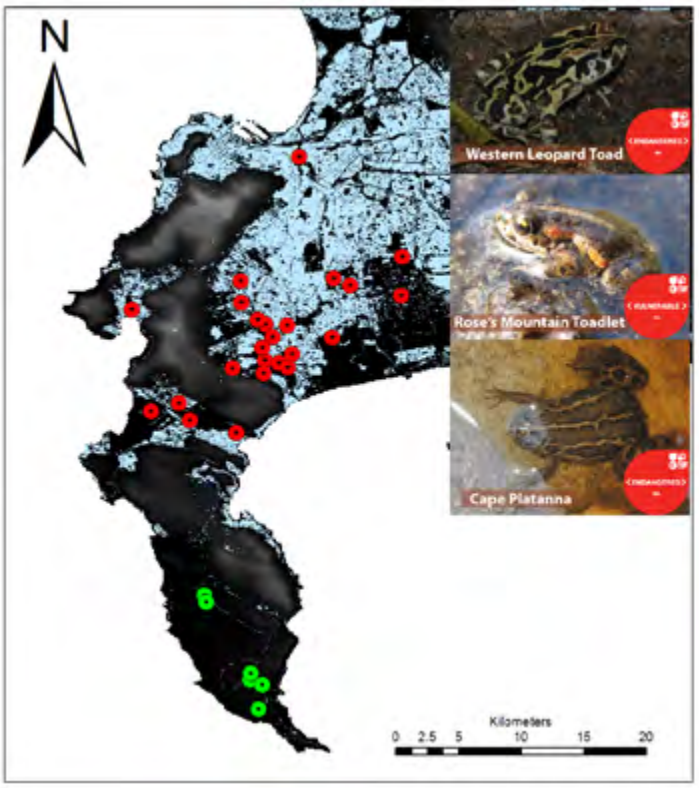


Fig. 1: Urbanization of the City of Cape Town (blue shading) impacts much of the region's biodiversity, including the frogs. Differing threats and stakeholders require different approaches to conservation actions that involve various collaborative efforts. Inset (from top to bottom): the Western leopard toad (*Amietophrynus pantherinus*) breeds in urban areas (red circles) and requires buy-in from a large number of stakeholders to ensure its protection, especially during migration. Rose's mountain toadlet (*Capensibufo rosei*) is reduced to only two known breeding sites whose locations are undisclosed. The western distribution of the Cape platanna (*Xenopus gilli*; green circles) is restricted to the Cape of Good Hope Section of Table Mountain National Park.

Invasive species are known to threaten the Cape's amphibian species (*9*). A newly emerging threat comes from Guttural toads (*Amietophrynus gutturalis*) which are expanding into the Western leopard toad's breeding habitat after being introduced from elsewhere in South Africa. This situation is being tackled by another collaborative effort (*10*): The CAPE Invasive Alien Animal Working Group (CAPE-IAA) is made up of representatives from University of Cape Town, University of the Western Cape and Centre for Invasion Biology (Stellenbosch University), Cape of Good Hope SPCA, Natural Resource Management Programmes, South African National Bio-

[1]DST-NRF Centre of Excellence for Invasion Biology, Department of Zoology, Nelson Mandela Metropolitan University, Port Elizabeth, South Africa: john@measey.com [2]Cape Research Centre, South African National Parks, Tokai, Cape Town, South Africa: wendy.annecke@sanparks.org [3]DST-NRF Centre of Excellence for Invasion Biology, Department of Botany & Zoology, University of Stellenbosch, Stellenbosch, South Africa: sdavies@sun.ac.za [4]Environmental Resource Management Department, City of Cape Town, Maitland, Cape Town, South Africa: Clifford.Dorse@capetown.gov.za [5]Environmental Resource Management Department, City of Cape Town, Westlake, Cape Town, South Africa: Louise.Stafford@capetown.gov.za [6]Applied Biodiversity Research Division, South African National Biodiversity Institute, Newlands, Cape Town, South Africa: k.tolley@sanbi.org.za [7]Scientific Services, CapeNature, Jonkershoek, Stellenbosch, South Africa: aaturner@capenature.co.za

diversity Institute, CapeNature, South African National Parks and the City of Cape Town. This initiative plays a crucial role in providing a forum to reach consensus on issues relating to invasive animals in the Cape region. The committee's remit covers all invasive animals, and the Guttural Toad Working Group is overseeing work on eliminating threats from invasive Guttural toads.

ROSE'S MOUNTAIN TOADLET

Rose's mountain toadlet (*Capensibufo rosei*; IUCN Vulnerable) is now recognised to occur solely on the Cape peninsula with only two known breeding populations, which necessitates a review of the IUCN Re List status (*15*). Collaboration between researchers, South African National Parks and the South African National Biodiversity Institute led to a long-term monitoring programme that is now in its fourth year and has been written into the 5 year conservation plan for the Table Mountain National Park. Breeding site localities are not disclosed, and sensitive areas are closed to the public to prevent potential impact from park visitors. Past threats to this species include habitat change from urbanization as well as alien invasive plants (*15*). Current conservation efforts concentrate on ensuring reproductive success at the known breeding sites and a coordinated continued effort to relocate historic breeding areas with help from the extended community of amphibian workers. The importance of the collaboration lies in coordinating search efforts, sharing monitoring data and exploring active management of breeding sites, with minimum impact on the fragile breeding environments.

THE CAPE PLATANNA

The Cape platanna (*Xenopus gilli*; IUCN Endangered) also has half of its distribution on the Cape peninsula, although most of this is now restricted to the Cape of Good Hope section of Table Mountain National Park (*11*; Fig. 1). The Cape platanna is found at acid black-water sites, many of which have been in-filled for housing and development. Disturbed sites are also vulnerable to invasion by the Common platanna (*Xenopus laevis*), with concomitant threats of predation, competition and hybridization between the two congeners, with the eventual displacement of the smaller Cape platanna (*12-14*).

Threats to this species have long since been recognised and conservation efforts have been ongoing since at least the 1970s (*12-14*). However, because the threats associated with this species are not influenced by the general public, but by land owners and managers, solutions are sought through collaborations that involve a much smaller group of stakeholders, most of them conservationists. Collaborations between researchers and South African National Parks have resulted in the removal of thousands of Common platannas from the Cape of Good Hope section (*10*). Management of Common platanna numbers has been written into the five year conservation plan for Table Mountain National Park, and the ongoing work has been very successful. Work has just started on a collaboration with CapeNature to manage the invasive threat from the Common platanna at sites around Kleinmond (around 60 km East of Cape Point).

PERSPECTIVE

Our examples show the strength of different collaborative efforts in conserving amphibian fauna in the richly biodiverse South African Cape. Each of these initiatives was made possible through the dedication of a number of champions for amphibian conservation who hold key positions in local and national institutions. The existence of these champions has made active conservation collaborations a reality in an area where so many other economic needs are pressing and where personnel and financial resources are limited (*16*). However, the momentum built up by champions is not sufficient to provide a sustained conservation effort which requires written policy to be entrenched within and between institutions. Without this, the effect of champions is transient, lasting as long as their own careers or the short funding cycles which maintain their involvement. South Africa has a legislative tool to formalize agreements between stakeholders in order to maintain biodiversity: Biodiversity Management Plan – Species (BMP-S) which is provided for by National Environmental Management: Biodiversity Act (2004).

A BMP-S has already been submitted for conservation of the Western leopard toad, and is being considered for species such as the Cape platanna, where multiple stakeholders are implicated in holistic conservation. Although the formalization of agreements is bureaucratic and time consuming for the relatively few conservationists involved, it has the advantage of solidifying agreements and enabling them to survive beyond the champions that spearhead them. Conservation of the unique Cape amphibian fauna will continue to be a collaborative effort into the future, and we will continue to face more and varied challenges. But together we will have increased chances of fulfilling our ambitions and responsibilities through combining the resources of multiple institutions and the complimentary ingenuities of those who work for them.

Acknowledgements

The collaborations mentioned in this article represent a great number of individuals from the highest levels of our organizations who support and facilitate our work to the legions of helpers and volunteers who aid with hands on frog work. We would like to take this opportunity to thank you all and trust that you are enriched by your experience of conservation of Cape amphibians.

References

1. M. Rouget, D. M. Richardson, R. M. Cowling, J. W. Lloyd, A. T. Lombard, *Biol. Cons.* 112, 63 (2003).
2. G. Alexander, J. A. Harrison, D. H. Fairbanks, R. A. Navarro, *In* Atlas and red data book of the frogs of South Africa, Lesotho and Swaziland, edited by L. R. Minter, M. Burger, J. A. Harrison, H. Braack, P. J. Bishop and D. Kloepfer (Smithsonian Institution, Washington, DC, 2004), p. 31.
3. J. C. Poynton, *Ann. Natal Mus.* 17, 1 (1964).
4. B. Holt, et al., *Science* 339, 74 (2013).
5. A. G. Rebelo, P. M. Holmes, C. Dorse, J. Wood, *S.A. J. Bot.* 77, 20 (2011).
6. J. S. Compton, *Quaternary Science Rev.* 30, 506 (2011).
7. G. J. Measey, S. Dorse, A. Faraday, *FrogLog* 20, 14 (2012).
8. G. J. Measey, K. A. Tolley, *Conserv. Genet*. 12, 61 (2011).
9. A. Angulo, M. Hoffmann, G. J. Measey, *In* Ensuring a future for South Africa's frogs: a strategy for conservation research, edited by G. J. Measey (South African National Biodiversity Institute, Pretoria, 2011), p. 1.
10. G. J. Measey, S. J. Davies, *Froglog* 97, 28 (2011).
11. D. J. Fogell, K. A. Tolley, G. J. Measey, *PeerJ* 1, e166 (2013).
12. M. D. Picker, *Copeia* 1985, 574 (1985).
13. M. D. Picker, A. L. de Villiers, *Biol. Cons.* 49, 169 (1989).
14. A. de Villiers, *In* Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland, edited by L. R. Minter, M. Burger, J. A. Harrison, P. J. Bishop and H. Braack (Smithsonian Institution Press, Washington DC, 2004), p. 260.
15. E. R. Cressey, G. J. Measey, K. A. Tolley, Oryx (in press).
16. K. A. Tolley, L. R. Minter, J. Harvey, J. Tarrant, G. J. Measey, *In* Ensuring a future for South Africa's frogs: a strategy for conservation research., edited by G. J. Measey (South African National Biodiversity Institute, Pretoria, 2011), p. 37.

Industry Threatening to Eliminate Endemic Jamaican Frogs

By Christopher Ward

Fig. 1: Three endemic Jamaican frogs. Clockwise from top left: *Eleutherodactylus pantoni* (Jamaican yellow-bellied frog), *Eleutherodactylus luteolus* (Jamaican masked frog), *Osteopilus brunneus* (Jamaican laughing frog). Photos: Christopher Ward, Herlitz Davis.

The name "Jamaica" is believed to have been derived from the Taino word, Xaymaca, which means "land of wood and water." But since the arrival of Christopher Columbus in 1494, it has faced a serious decline in forest cover of over 60%, and is now better known for its beaches and Bob Marley (*1*). In what remains of the forest that once covered the island, there are still minimally-disturbed areas and the island is home to 505 endemic species of snail, 28 endemic species of bird and 25 frog species, of which 21 are endemic (*2-4*).

The conservation status of Jamaican reptiles and amphibians is a major concern however. Of the endemic frog species, 15 are labelled Endangered or Critically Endangered by the IUCN (*5*). Very little is known about the ecology of these frogs, and indeed there are potentially undiscovered species in Jamaica—a new species was found so recently that it has yet to be published (*6,7*). Furthermore the expansion of agriculture and mining are threatening to severely disrupt the already fragile habitat of these frogs, some of which have a range of only 10 km^2 (*8,9*).

University of Manchester, Windsor Research Centre.

The Blue and John Crow Mountains in the East of the island, and the Cockpit Country area in the centre-west are the last remaining large areas of undisturbed forest. The Cockpit Country area is geographically distinct being a karst limestone plateau with many sink holes that drain the area, leaving little standing water (*10*). While this pattern of limestone appears in several of the Greater Antilles, the Cockpit Country area is the most extensive.



Fig. 2: One of the hazards of working in the jungle, the Golden orb weaver spider, a *Nephila* spp. (left). Engaged students during a presentation (center) Out in the field (right). Photo: Christopher Ward.

The current project is developed by Windsor Research Centre based in the heart of Cockpit Country, in the parish of Trelawny and just down the road from the house where Usain Bolt grew up. Pending approval of permits by the National Environment and Planning Agency, the project will aim to determine the spread and impact of the chytrid fungus in Jamaican frogs in the Catadupa Key Biodiversity Area (KBA), within the greater Cockpit Country Area, building on a previous but inconclusive study (*11*). The information we will gather during this study is part of the development of a Catadupa Conservation Action Plan (*12*), which will be implemented to help ensure the conservation and protection of this area and the 12 endemic species of frog found there.

Pilot reconnaissance of the area involves long days and late nights out in the tropical thunderstorms listening for frogs (and stumbling across the occasional snake in the process) in the forest while trying not to slip onto the razor-sharp limestone rocks or down a car-sized sinkhole. More than once I have been caught out by the sudden afternoon rains, and left scrambling up and down a slippery gully hoping that my foothold is not about to snap off.

After tramping through the forest until long after nightfall, carrying passive acoustic dataloggers which seem to weigh less going out than coming in, avoiding bird eating spiders and being eat alive by mosquitoes, settling down to camp to the sound of the frogs would be perfect were it not for inevitable rock or twig that you missed when choosing your campsite.

In general, Jamaicans regard frogs as cold and slimy. People are afraid that they will spit poison on them and are therefore something to be killed, more often than not by pouring salt on them. This attitude is largely due to misinformation. This may be exacerbated by local naming conventions, as invariably the people I have spoken to in my time here know the infamous introduced Rhinella marina, or Canetoad as the frog, and all the Eleutherodactylus and Osteopilus species are referred to as toads.

As an essential part of any conservation program, community outreach is therefore an important focus for Windsor Research Centre, and we regularly go to schools and community meetings to give presentations about the importance of frogs, wildlife and the environment in general.

The calls of the Jamaican Laughing and Snoring frogs, *Osteopilus brunneus* and *Osteopilus crucialis*, are attractive teaching tools as being able to anthropomorphise the frogs really seems to help people connect with their native fauna.

It is particularly rewarding to see how perceptions of frogs can be changed, and how engaged the children are when they hear the recordings of the frogs calls. Many of the adults are shocked to find out that these sounds are not produced by insects!

In order to protect this area and these species, Windsor Research Centre brings science-based data together with local stakeholder experience and knowledge so that government organizations such as the National Environment and Planning Agency, the Forestry Department, the Mines and Geology Division and the Jamaica Bauxite Institute can make the best planning decisions. This project aims to build on conservation in Jamaica that has been fairly successful in some areas such as the Blue and John Crow Mountains, and also in the Cockpit Country KBA following the implementation of the Cockpit Country Conservation Action Plan from 2006. It is hoped that the eventual outcome of this project will result in effective legislation and management to ensure the protection of this area and the many endemic species of various taxa.

Acknowledgements

This effort would not be possible without the funding provided by both the Critical Ecosytem Partnership Fund (CEPF) and the International Association of Butterfly Exhibitors and Suppliers. It is possible to learn more about the Windsor Research Centre and its work by visiting the website: http://www.cockpitcountry.com/

References:

1. O. B. Evelyn, R. Camirand, Forest cover and deforestation in Jamaica: an analysis of forest cover estimates over time. *Int. For. Rev.* **5**, 354–363 (2003).
2. H. A. Raffaele, T. Pedersen, K. Williams, "*A guide to the birds of the West Indies*." (Princeton University Press, Princeton, New Jersey, USA, 1998).
3. G. Rosenberg, I. V. Muratov, Status report on the terrestrial Mollusca of Jamaica. *Proc. Acad. Nat. Sci. Phila.* **155**, 117–161 (2006).
4. B. Hedges, Jamaican Herpetofauna. http://www.caribherp.org/index.php?il=Jamaica&vw=y&dd=n&so=class,%20ord,%20subord,%20family,%20species&mob=y. [Accessed: 29-Sep-2013].
5. IUCN Red List of Threatened Species. Version 2013.2 (IUCN, 2013; www.iucnredlist.org)
6. D. S. Moen, J. J. Wiens, Phylogenetic evidence for competitively driven divergence: body-size evolution in Caribbean treefrogs (Hylidae: Osteopilus). *Evolution*, **63**, 195–214 (2009).
7. I. Holmes, B. H. Wilson, K. Mclaren, Surveys for Frog Diversity and Batrachochytrium dendrobatidis in Jamaica. *Herpetol. Rev.* **43**, 278 (2012).
8. Government of Jamaica, Active Special Exclusive Prospecting Licence. (Mines & Geology Division Ministry of Science, Technology, Energy & Mining, 2012).
9. B. Hedges, *Eleutherodactylus griphus* In: IUCN 2013. (IUCN Red List of Threatened Species. Version 2013.2, 2013)
10. W. B. White, *Geomorphology and Hydrology of Karst Terrains* (Oxford University Press New York, 1988). vol. 464.
11. I. Holmes, Checking in with Jamaica's endangered frogs, *FrogLog*, 38, (2011)
12. CEPF, Caribbean Islands Biodiversity Hotspot Contracted Grants Status as of June 30th, 2013. (Critical Ecosystem Partnership Fund, 2013).

Dead Wood for Frogs! Extensive Storm Damage to a Forest Brings New Opportunities for Amphibians

An amplectant pair of *Rana temporaria*. Photo: Tariq Stark.

By Tariq Stark

A big storm called "Christiaan" hit the Netherlands the 28th of October 2013 causing a lot of damage to both manmade objects and natural structures like forests. Our hometown Leeuwarden was not spared. Lots of trees were felled by the strong winds. In a forested area called "Leeuwarder forest" (hereafter referred to as "forest") lots of trees were hit hard. Lots of trees were felled, broken or severely mangled. How can such destruction bring wonderful opportunities for local amphibians and be positive for an increase of biodiversity as a whole in this area?

LEEUWARDER FOREST

The forest, previously an agricultural area, was designated to be a forest in the early 1990's. The western part forest (seven hectares) is intended for recreation and is more "natural" with trees like Oak (*Quercus*), Beech (*Fagus*), Willow (*Salex*), Alder (*Alnus*), Birch (*Betula*) and Poplar (*Populus*). Lots of shrubs, grasses and herbs can be found in this part of the forest. The central part of the forest (60 hectares) is less divers and is mainly populated by willows and poplars and a large grassy area where cattle is allowed to range free. The eastern part of the forest (61 hectares) is meant to be solely for production of wood. Mono-cultures of different races of poplar make up this part of the forest in straight and very unnatural lines. The entire forest is very wet and contains a lot of water bodies; from large ponds to small canals. The western and central part of the forest harbors five species of amphibians: *Lissotriton vulgaris, Bufo bufo, Pelophylax ridibundus, Pelophylax klepton esculentus* and *Rana temporaria*. The eastern part of the forest is not very (bio-) divers and only very rarely amphibians are encountered there. But… the storm may change all that!

A typical sight in the eastern part of the forest. Rows and rows of Poplars. Photo: Merel Zweemer.

An arial view of the damage in the eastern part of the forest. Photo: Binne-Lou Katsma.

A beautiful male *Lissotriton vulgaris*. Photo: Tariq Stark.

THE AFTERMATH

The storm brought a lot of damage to the forest. Fallen and broken trees, branches and lots of debris littered the area. The tendency in the Netherlands is to keep forests very "clean." Fallen trees and braches are removed and only very seldom are they allowed to remain in a forested area. Dead wood is known to increase biodiversity and creates lots of microhabitats for a myriad of species. The felling of trees by a storm gives saplings the chance to sprout and grow. This creates a more natural structured, dynamic forest. Here is where we came in! After the storm we scrambled to write a report to plea to leave all the dead and dying trees, branches and debris as it is. We had to convince the municipality, which want to clean it all up, to leave it all there. We advocated for biodiversity as a whole but the opportunities for the local amphibians were a key factor. We had a real challenge on our hands and haste was of the essence!

Jeroen Breidenbach assessing the damage in the eastern part of the forest. Photo: Pystje Sol.

WHAT OPPORTUNITIES?

There are a lot of opportunities for the local populations of amphibians made possible by the storm damage. The importance of terrestrial habitat for amphibians is often overlooked. The terrestrial habitat is just as important as the aquatic breeding sites. The fallen trees and debris create a more suitable terrestrial habitat for *Bufo bufo, Rana temporaria* and *Lissotriton vulgaris* throughout the forest. These three species leave the water after breeding to forage in the woodland, forest edges and grasslands. The juveniles also adopt a terrestrial life style after metamorphosis. Debris creates damp hiding places, which are of extra importance during dry periods for all terrestrial life stages of these three species. All this extra debris also creates more places for various invertebrate species to live and reproduce. These small creatures may make up some the diet of these three species of amphibians. Dead wood and uprooted trees also created hibernation sites for these species. Uprooted trees leave a small pond behind which are utilized by various species. These ponds are used by *Lissotriton vulgaris* in the forest for reproduction if the pond contains water for an extended period of time (personal observation). Fallen trees alongside the small canals that are found throughout the forest create more suitable microhabitats for both *Pelophylax* species. These frogs are true sun lovers and canals that were not suitable for these species because they were too shaded now have become suitable in terms of sun exposure. This gives these species a chance to expand their range within the forest.

The western and central part of the forest (where the bulk of amphibians occur) could benefit greatly by all this dead wood. The

An amplectant pair of common toads (*Bufo bufo*) in the Leeuwarder Forest. Photo: Tariq Stark.

A *Pelophylax ridibundus* in the Leeuwarder forest. Photo: Tariq Stark.

mono typical eastern part of forest could also reap the benefits of the fallen poplars'. The fallen trees left large gaps where other tree species, mainly oaks' and a few species of shrub, can grow and create a more suitable terrestrial habitat for these three species of amphibians. These gaps give shrubs and herbs a place to grow creating a more natural forest composition. Hopefully all five species of amphibians can begin colonizing the eastern part of the forest and gain an extra 61 hectares of habitat. This is what we are set out to accomplish!

Some of the damage done in the Leeuwarder Forest. Photo: Jeroen Breidenbach.

A typical dutch scenario. A dutch cyclist trying to pass a fallen tree. Photo: Jeroen Breidenbach.

COMBINING FORCES!

Just a day after the storm four befriended ecologists (Jeroen Breidenbach, Erik van Hoffen, Merel Zweemer and Tariq Stark) saw the destruction and immediately recognized the vast potential. After a quick meeting between the four of us we made a visit to the forest to assess the potential and make a quick scan of the damage done. After this field visit we decided that this was too good an opportunity to pass up. That same week we wrote a report in which we described the advantages of leaving the dead wood in the forest for various groups of organisms (plants, fungi, invertebrates, amphibians, mammals and birds). We also calculated the expected benefits and costs of harvesting all the poplars from the eastern side of the forest. Remember, this was all meant to be harvested. Our calculations showed that the costs out weighted the profit. More than 1,500 Poplars had fallen and it would be a great victory for biodiversity for that part of the forest to leave them be. On November the 12th we handed our report to Municipal executive councilor Isabelle Diks. We hope some of our recommendations' will end up in the management plans of the city.

LOCAL SUPPORT

Many local people reacted very emotional to the fallen and often beloved trees. On the Facebook page that is dedicated to the forest, lots of people mourned the fallen trees and were dismayed by the destruction. This attitude quickly changed after we made clear what the ecological advantages were and that the forest will rejuvenate in a more natural way. Soon people celebrated the damage and continue to do so. Attitude and recreational opportunities after the storm made up an important part of our report (community based conservation). For us it was important to implement the support of local people. After all, the forest is also for the people of Leeuwarden! After this initial damage the forest has an opportunity to become more divers and more beautiful in various aspects. For local people who already enjoy the forest because of its natural values this enjoyment will only heighten.

NOW WHAT?

So we have written a report and presented it to the city. Now what? Will our ideas really be executed? This is something we still do not know. We can only hope that our ideas are "planted" in the minds and hearts of the people that manage the forest. Even if just 1/3 of all the dead wood is left in the forest this would be a victory. The message we would like to send through *FrogLog* is that you can do the same in your country or area. Sometimes opportunities arise quite suddenly and you have to react quickly. Taking action,

combining forces and implementing the support of local people is essential. In our case we already had a team of friends, all with their own network, ready to rise to the opportunity. The first step has been made. Now we have to continue to work together with the city, legislators and other stakeholders.

We will continue to monitor the biodiversity in the forest, especially in the eastern part. Will the species react to the new opportunities and how long will it take? It is a long-term project that is driven by passionate people from all kinds of disciplines, from fungi experts to birders and legislators to civilians. Like an ecosystem one cannot exist without the other! Hopefully: to be continued!

Acknowledgements

A project like this is not done alone: it's a group effort! We would like to thank the following people for their contribution: Dick van Hoffen, Peter Koomen, Rein Leguijt, Gilberto Squizatto, 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.

Merel Zweemer of Eco Consultancy Merula handing over the dead wood for biodiversity report to Isabelle Diks (Council woman). Photo: Jeroen Breidenbach.

Summer impression of the western side of the forest with flowering fields, oak, alder, birch and beech. Photo: Tariq Stark.

The central part of the forest with grass lands and willows. Photo: Merel Zweemer.

Mission *Mantella*—A Story About the First Wild Encounter with One's Favorite Animal

A dream come true! A wild *Mantella*! Photo: Jonno Stelder.

By Jonno Stelder

We all have that one special animal for which we would travel around the globe, just for a mere glimpse of it in the wild. This first sentence will probably put some of you back into that first unforgettable moment where you found this particular animal and stood in awe with your mouth wide open, or perhaps you couldn't help yourself but to ecstatically jump around screaming with a giant grin on your face.

For me this special kind of animal has always been poisonous frogs (Dendrobatidae & Mantellidae).

As a child growing up in the Amsterdam region, my family and I always went to Artis (Amsterdam Royal Zoo) on Sundays where my brother and sister would take art class while my parents and I strolled through the zoo. However, from the point where I did not need a buggy anymore, this easy strolling quickly changed into a high-speed chase as soon as they let go of my hand, as I sprinted towards the aquarium, where they housed the amphibians. I always refused to leave here before I was absolutely sure I counted each and every brightly colored poisonous frog they had.

This fascination stayed with me ever since and resulted into studying Wildlife-Management at the University of Applied Sciences Van Hall Larenstein in Leeuwarden, The Netherlands.

This year, I've spent five months in the jungle of Ranomafana National Park, Madagascar working on a biodiversity project, as part of my major-internship, where I took charge of the herpetological part of the project focusing on amphibians and chameleons. While flying the 9,000 kilometers to Madagascar my girlfriend, Tara Schelling, kept talking about all the amazing animals we were going to see on this epic journey. Although totally agreeing with her, some little voice in the back of my head kept saying "*Mantella*!" over and over again. Just like back in the days in the aquarium of Artis, I had my eyes on the prize and I would refuse to leave before I found my frog. This time: A wild *Mantella*.

Unfortunately our internships started at the end of the rainy season which meant the days were getting colder and amphibian activity started to decline. In the beginning of our stay, it was nearly impossible to hear the immense gushing river nearby at night due to the intense choruses of frogs coming from all directions. Sadly, as weeks progressed, it became harder and harder to hear frogs at night due to this very same river that was drowned out by these very same frogs just a few weeks ago.

After around six weeks of work I still had not found my first *Mantella* and hopes began to slim even though I found many other stunning frogs like *Guibemantis pulcher*, *Boophis luteus*, *Spinomantis fimbriatus* and gorgeous chameleons like *Calumma oshaugnessyi* and *Brookesia supercilliaris*. It just felt bad realizing there was a chance that I would not find any *Mantella* before my scheduled return flight.

This all changed when my project leader, James Herrera, announced an expedition to Miaranony—a very remote region of Ranomafana National Park where only few foreigners have ever

***Boophis madagascariencis*. Photo: Jonno Stelder.**

been. This is confirmed by the fact that the local Malagasy people even call a certain area here "Tsy tonga fazaha," which quite literally means "Where the white people don't come" of which I can now say, with certainty that I am the first European that ever walked here (the first "Fazaha" here was James, an American, a few years earlier).

This 17-day long expedition took us 28 kilometers from the nearest road, which was a good 10 hour hike through swamps and rice fields and over giant, steep mountains and valleys. But James told me that the last time he went there, he literally had to watch out where he put his feet on one of the transects in order not to step on the *Mantella baroni*'s, and even though it wasn't the right season we would have a great chance of finding *Mantella*'s, if only just one…

Our camp here was situated near the top of a huge, steep, 650 meters high mountain (for a Dutchmen, everything above 30 meters is considered as a huge mountain) with transects laid out along the mountain at various heights in order to measure what influence elevation has on biodiversity.

After a few exhausting days of running down the mountain to a transect so we could later crawl back up to camp again, that one notorious transect of which James claimed was crawling with *Mantella*'s on his last visit was pulled out of the hat (random selection can be a pain sometimes). There was a river called "Saka Be" (meaning "Big Cat," probably referring to the infamous Fossa) flowing down the mountain through all of our transects. This way we could also measure how species composition changes as you move closer or further away from a water body at several elevations. This river was also the place on this particular transect where the said *Mantella's* lived according to James.

When we arrived at the start of the transect, I already felt the adrenaline flowing. The river was situated some 800 meters away from the starting point of the transect. We still had to slowly cover some painstaking meters looking for other frogs and chameleons before I would hopefully find my first wild poisonous frog. My assistant had to pull me back a few times as I was going too fast, just like when I was a child where my parents had to hold my hand so I would not run off to the aquarium.

Finally arriving at the river, I could almost not contain myself. Especially when my assistant said he thought he heard a clicking/beeping sound, just like *Mantella baroni* makes. The banks of the river were covered with rocks and boulders. I told my assistant to look at one side of the river while I looked at the other. After around 15 minutes of rock flipping (which felt like hours) there was still no sign of any *Mantella*. Excitement was taken over by frustration. If there was one moment on this entire journey to find one, it was now. Still there was no sign of any of them. But then, all of a sudden my assistant shouted: "Jonno! Look!" I looked up from in between the boulders, and there he stood with his hand held

up high in the air with some small brightly orange/green colored thing in between his fingers. I jumped up screaming so loud they could've probably heard it back at the camp some 500 meters higher up. I ran up to him, suddenly gazing at this spectacular *Mantella baroni* in all its blazing orange and bright green glory. It felt like I had won the lottery and expressed this by running around in circles with my hands held up high in the air screaming like I was fifteen years younger.

As soon as I had control over myself again, my assistant gave me the *Mantella* and there I stood in awe with quite possibly the widest grin known the mankind, looking at this beauty of nature. Without thinking I gave the frog a kiss. Looking back I was lucky my first wild poisonous frog wasn't *Phyllobates terribilis*. After an hour or so of taking pictures of this magnificent animal it was time to finish up the last part of the transect and to head back to camp. I was still so excited I pretty much ran back up, faster than ever before. Rice and beans never tasted so good before, and sleeping on a flat sleeping mat with tree roots poking in your back never felt so comfortable. After travelling more than 9,500 kilometers, I finally found it. My first wild poisonous frog, a dream come true. Mission accomplished.

***Guibemantis pulcher*. Photo: Jonno Stelder.**

***Calumma parsonii* held by Jonno Stelder. Photo: Philip Schelling.**

An Ecological Service of Frogs: Tadpoles Feeding on Dengue Mosquito Eggs

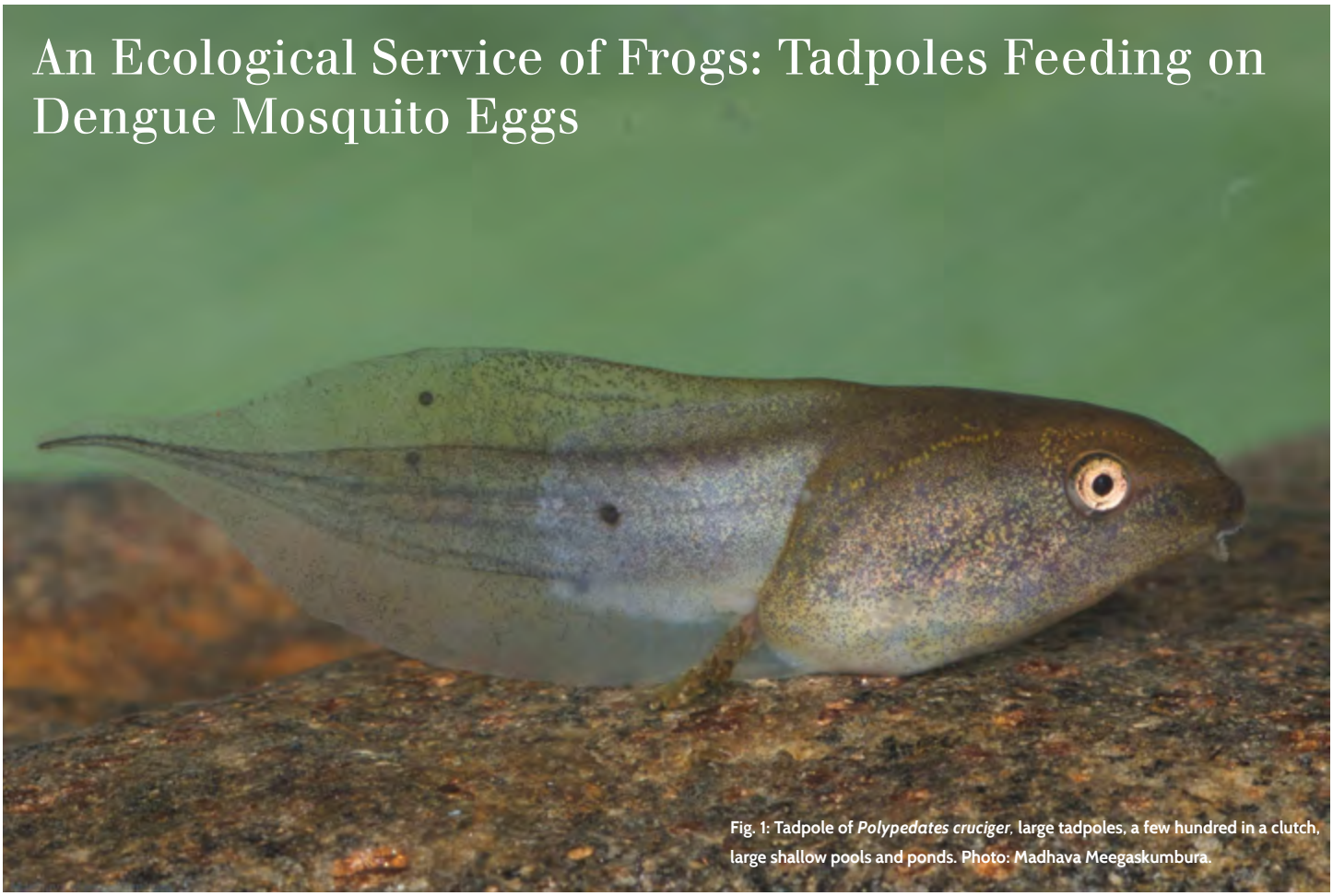


Fig. 1: Tadpole of *Polypedates cruciger*, large tadpoles, a few hundred in a clutch, large shallow pools and ponds. Photo: Madhava Meegaskumbura.

By Gayani Senevirathne, Gayan Bowatte & Madhava Meegaskumbura

Our recently published study (*1*) suggests that declining amphibian populations could lead to increase in mosquito borne diseases in the world. Specifically, we show that Dengue mosquito eggs, which act as vehicles to transmit Dengue through seasons, are predated upon by the five species of tadpoles that we tested. We also show that female mosquitoes are attracted to lay eggs in water that contain tadpoles, fulfilling the dual tasks of attracting mosquitoes to lay eggs and predating on those eggs.

Dengue fever, in which the virus is borne and spread by the mosquitoes of the genus *Aedes* affects nearly 200,000 people, causing about 30,000 deaths worldwide. Among mosquito control methods, biological control is valued for its low ecological impact and reduced side effects on humans. However, amongst vertebrates mostly fish have been highlighted in biological control of mosquito larvae. But fish, especially when introduced, could cause ecological damage by becoming a threat to native organisms including amphibians whose populations are often in decline. Furthermore, fish need interconnected waterways to spread and are often not found in isolated pools, tree holes, rock pools, ponds and most ephemeral water bodies, ideal breeding grounds for mosquitoes.

The transmission of dengue virus from tainted female mosquito to their eggs (termed transovarian transmission) and the resistance of the eggs to drought conditions make them excellent vehicles of disease propagation through seasons. Furthermore, the number of dengue virus laden eggs surviving unfavorable seasons determines the initial population size and incidence of the disease during the subsequent rainy season, suggesting that effectively dealing with mosquito eggs is an integral part in both controlling the propagation of the disease through seasons, and controlling the initial infected mosquito population size. *Aedes aegypti* tend to lay eggs in anthropogenic refuse like water filled discarded plastic containers, tires, etc. which however can be controlled by removing them from the environment (*2*), which many anti-dengue campaigns usually aim

Fig. 2: Tadpole of *Bufo melanostictus*, small in size, sometimes up to thousands swarm, in open pools and ponds. Photo: Madhava Meegaskumbura.

.

Evolutionary Ecology and Systematics Lab, Department of Zoology, Faculty of Science, University of Peradeniya, Sri Lanka www.frogsl.org
Gayani Seneviratne – gayani88s@gmail.com Gayan Bowatte – gbowatte@gmail.com Madhava Meegaskumbura – madhava88m@gmail.com

Fig. 3: Tadpole of *Ramanella obscura*, filter feeding habit, lives in tree holes and small puddles on ground. Photo: Madhava Meegaskumbura.

to do across the world. Frogs often do not lay eggs in such habitats. However, mosquitoes also lay eggs in ecologically sensitive natural sites, which are also used by frogs for breeding like tree holes, marshy areas, ponds, temporary pools, which cannot be removed from the environment.In this study, we raised *Aedes aegypti* mosquitoes in the lab.

Mosquito larvae collected from the wild were raised in water through pupation till adults emerged, which were kept in a fine mesh cage, feeding initially with a sugar and vitamin solution for 2-3 days, switching to a blood meal for the females after that. We collected tadpoles of *Polypedates cruciger* (Fig. 1), *Bufo melanostictus* (Fig. 2), *Ramanella obscura* (Fig. 3), *Euphlyctis cyanophlyctis* and *Hoplobatrachus crassus* (Fig. 4) from several man made ponds, tree holes and ephemeral pools from near human habitations. They were fed with fish food, egg yolk or boiled lettuce depending on the food source they prefer.

We did four experiments and the first three involving only the tadpoles of *Polypedates cruciger*. First, the female egg laying preference was examined. Four containers contained only aged normal tap water, another four consisted of water that previously had tadpoles (but none at the time of experiments) and the last four had water with two tadpoles in each container. This experiment was repeated four times, with different sets of tadpoles. We saw that most eggs were laid in tadpole water (TW) instead of normal water (NW), and the least number of eggs were observed in water that had tadpoles (TP) during the experiment (Fig. 5). We also observed that tadpoles do lay eggs in containers that had tadpoles during the experiment, and also that the tadpoles fed on eggs such laid. Hence, from these results we interpret that mosquitoes are significantly attracted to tadpole water, and if tadpoles were present, they fed on those eggs.

Fig. 4: Tadpole of *Hoplobatrachus crassus*, a large predatory tadpole, predates actively even on mosquito larvae, large ephemeral and permanent ponds and pools. Photo: Madhava Meegaskumbura.

We did a second experiment to observe survivability and hatching patterns of mosquito eggs. We used 64 eggs from 25 female mosquitoes, which were placed in eight glass aquaria of which four contained four tadpoles each. We provided an alternative food source (boiled lettuce) to ensure and not force feed mosquito eggs to tadpoles, if they were feeding on them. We saw that despite the presence of an equal number of eggs in each tank the number of larvae

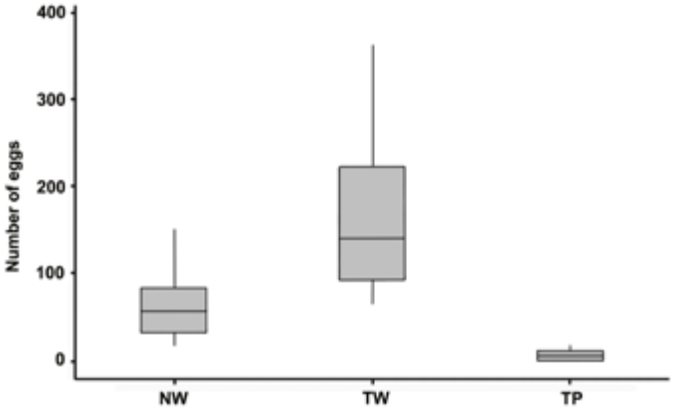


Fig. 5: Box and whisker plots depicting the median and spread of the number of eggs laid in Normal Water, Tadpole Water (no tadpoles at times of experiment) and Tadpole Present Water (tadpole present at time of experiment).

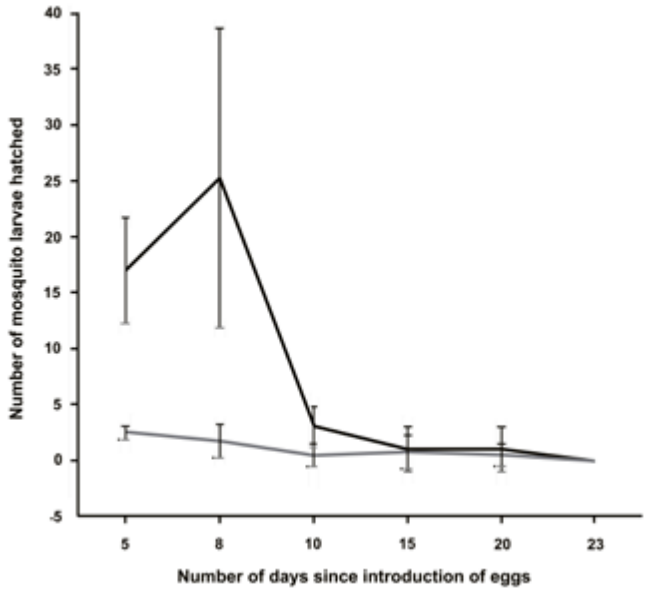


Fig. 6: Out of the 64 eggs initially introduced, the mean (n = 4) number of eggs hatched in tanks with tadpoles (light line) and tanks without (dark line) against the number of days since the introduction of eggs, error bars represent standard deviations.

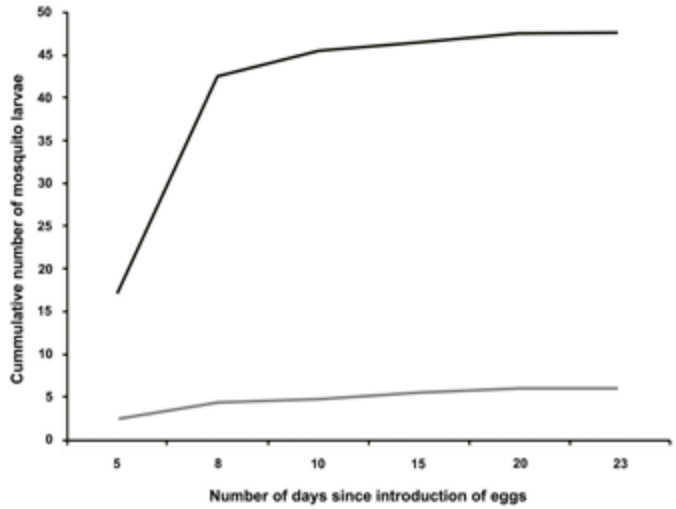


Fig. 7: Cumulative mean number of mosquito larvae that hatched, in tanks with tadpoles (light line; n = 4) and in tanks without tadpoles (dark line; n = 4).

hatching in tadpole containing tanks were significantly less than in tanks that did not contain tadpoles, which suggested that tadpoles actively destroyed the eggs (Fig. 6 & Fig. 7).

The third and fourth experiments were conducted to ensure that tadpoles actually fed on mosquito eggs (i.e., to find the mode of destruction of eggs). We made video recordings (*P. cruciger* tadpoles only) and dissected tadpoles (*P. cruciger, B. melanostictus, R. obscura, E. cyanophlyctis* and *H. crassus*) to analyze their gut contents after leaving them in a container with mosquito eggs for three h (Fig. 8).

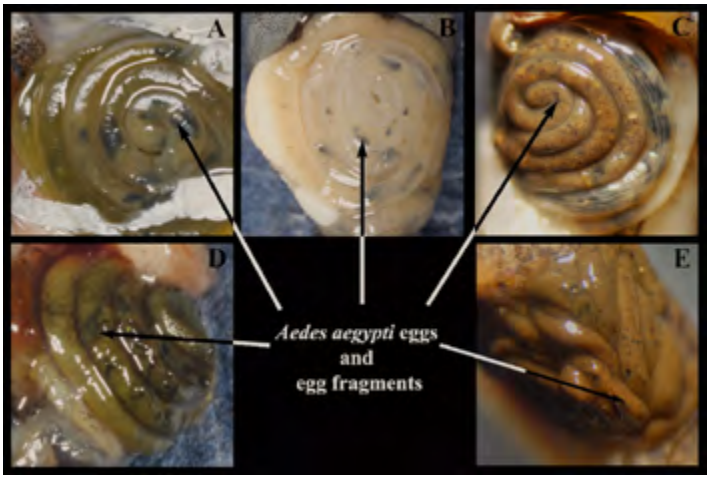


Fig. 8: Mosquito egg case fragments found within the five species of Tadpoles: A – *P. cruciger*, B – *B. melanostictus*, C – *H. crassus*, D – *R. obscura*, E – *E. cyanoplyctis*. Egg cases remain intact in *R. obscura*, but not others. Photo: Madhava Meegaskumbura.

The video, where the *Polypedates cruciger* tadpoles fed on the eggs and the dissections of tadpoles' guts, indicates the active egg predation by tadpoles is the cause of egg destruction. Physical structure of mosquito eggs within gut contents seem to depend on the mouth structure and feeding habits. Species that had keratinized mouth parts such as *Polypedates cruciger*, *Bufo melanostiscus*, *Euphlyctis cyanophlyctis* and *Hoplobatrachus crassus* crush mosquito eggs (in *H. crassus* finely crushed compared to others) prior to swallowing. Whereas complete egg casses are found in *R. obscura* who do not crush their food due to their filter feeding habit; they only have a horny ridge on their upper lip.

The tadpole species used in this study were also representative of several aquatic habitats: *Polypedates cruciger* tadpoles are typically found in open or closed, shallow pools and ponds; *Bufo melanostictus* tadpoles, in an array of small and large pools and ponds, even in the presence of fish; *Euphlyctis cyanophlictis*, in many types of shallow ephemeral pools and small streams; *Hoplobatruchus crassus* tadpoles, in large pools including ephemeral pools; *Ramanella obscura* tadpoles, in tree holes and small pools, well isolated from streams. The presence of tadpoles in all these types of aquatic habitats, as mentioned, not available for fish to exploit, makes tadpoles far versatile in dealing with dengue mosquito eggs, which are laid in a diversity of aquatic habitats.

All five frog species that we studied are commonly found among human habitations and many of them lay a large number of eggs. For instance, species like *Bufo melanostictus* that lay about a thousands eggs are in fact rare in primary forests and *Polypedates cruciger* lay hundreds of eggs in foamy masses above water tanks from which tadpoles fall into water undergoing further development. Therefore, these frogs could be extremely important in reducing the populations of *A. aegypti*. Furthermore, the breeding seasons

Fig. 9: Gayan Bowatte, monitoring water quality. Photo: Madhava Meegaskumbura.

Fig. 10: Gayani Senevirathne, sorting and counting mosquito eggs. Photo: Madhava Meegaskumbura.

of all frogs studied and the dengue seasons coincide, leading to maximum interaction.

The control of mosquitoes by tadpoles probably extends beyond egg predation (competition for food and other resources) (*3,4*). Hence, it cannot be conclusively stated that egg predation is totally responsible for the reduced number of mosquito larvae in pools with tadpoles. However, our study suggests that mosquito egg predation could be a major contributor of reduction of the density of mosquitoes.

With more than 7,000 species of frogs in the worldthe role of mosquito egg destruction by tadpoles could be significant. The ecological services tadpoles provide should be evaluated when management of water bodies for mosquito borne disease prevention is assessed. If this is done effectively both dengue prevention and conserving declining amphibian populations can be done effectively. This will require the networking of disease managers, epidemiologists, conservation biologists and herpetologists.

Acknowledgements

We acknowledge the Department of Wildlife Conservation of Sri Lanka for research permits to study tadpoles, and the Department of Zoology, Faculty of Science, University of Peradeniya, for resources. We are grateful to the Amphibian Specialist Group (IUCN SSC ASG), Rohan Pethiyagoda, Kelum Manamendra-Arachchi, Global Wildlife Conservation (GWC), Don Church, James Lewis and Robin Moore for supporting this work.

References

1. G. Bowatte, P. Perera, G. Senevirathne, S. Meegaskumbura, M. Meegaskumbura, *Biol. Cont.* **67**(3), 469 (2013).
2. T. C. Weeraratne, M. D. B. Perera, M. Mansoor, S. H. P. P. Karunaratne, *Int. J. Trop. Insect Sci.* **9**, 1 (2013).
3. A. Mokany, R. Shine, *Austral Ecol.* **28**, 33 (2003).
4. A. Mokany, R. Shine, *Oecologia*, **135**, 615 (2003).

Fig. 11: Madhava Meegaskumbura, examining a rare frog. Photo: Sudath Nanayakkara.

Stimulating an Interest in Salamander Conservation and an Ambition to Help These Amphibians

By Matt Ellerbeck

There is an old adage, out of sight... out of mind. This certainly rings true in the case of salamanders. These cryptic and secretive amphibians are rarely encountered by the lay community. In fact, salamanders are so infrequently observed that when talking to locals about these amphibians, I often hear that prior to discussion many individuals didn't even know that any salamander species existed within their regions. This means that not only are salamanders largely unseen, but the decline in these animals also goes unnoticed—even as species dwindle and become extirpated.

To help raise awareness for salamanders, and the need for their conservation I have been utilizing several platforms. These include media appearances, awareness campaigns, social networking, the distribution of informative fact sheets and giving educational presentations/lectures. With this awareness and education, people develop a sense of empathy and concern for salamanders, and this in turn fuels their desire to become active in salamander preservation and advancement. With a passion to get involved, individuals are taught that through behavioral changes, informed decision making, stewardship actions, and habitat management efforts they can make a positive impact for salamanders and other amphibians. Such outreach education endeavors have taken me all over Ontario, and I have brought the message to a wide array of audiences. This includes varying ages, walks of life and both rural and urban residents. A special focus has been paid to both rural landowners (who are often in a great position to help through habitat management activities) and youth. Engaging youth helps foster positive attitudes about wildlife, conservation and helps create the excitement in young people that drive them to get involved!I am grateful to have received some promising feedback from those who have attended some of my salamander conservation presentations. Such feedback confirms that this approach is working and making a difference. For instance, earlier in the year I was presenting a display on salamanders at a Humane Society fundraiser. During the event a father and son approached me to let me know that they had seen one of my previous presentations too. At the time that they had gone to the presentation, the son had been contemplating wild salamanders as potential pets. The father informed me that after the presentation his son understood that salamanders belong in the wild, so they can mate and contribute to their population. I was elated to hear such news.

More recently I was told of another positive impact that was made. Earlier in the year, I dropped off a stack of educational fact sheets on salamander conservation at the Mazinaw lakeside Resort Eatery. The mail-lady in the area, who admittedly was never a fan of reptiles/amphibians, happened to come across one of the salamander sheets. Shortly thereafter she encountered a salamander on the road, and made sure to stop and move it across. Salamanders for the most part are small and slow and many of the salamanders that venture over roads unfortunately get killed. This individual certainly helped by moving it off of the busy road! After this action, she even made a point of coming back to the Eatery to let people know about her good deed, and credited the salamander sheets for the motivation to do so. This goes to show that even people who never thought of helping these animals, or even liked them, can and do help out when awareness is raised—not just of the issues they face but on how to help combat them!

Stories like these only reinforce my ambition to educate and promote the conservation of salamanders.

Photo by: Clinton Alexander.

Photo by: Clinton Alexander.

The Amphibians of Guyana: A Photographic Journey

Hyalinobatrachium sp.

Phyllomedusa bicolor.

By Andrew Snyder

Guyana is called the "Land of Many Waters." Located north of the Amazon river and east of the Orinoco, with a network of rivers throughout, it isn't hard to see why. Its boundaries are set upon the ancient 1.7 billion year old Guiana Shield, which stands as the northernmost edge of the Amazon biome and also happens to be the largest tract of pristine tropical rainforest found anywhere in the world.

Osteocephalus leprieurii.

Guyana's amphibian diversity may not nearly reach the numbers like those of Ecuador or a handful of other South American countries, but it still boasts representatives from every unique habitat including rainforest, savannah, swamps and mountains. Currently, official records report 148 species of amphibians, including 137 species of frogs and toads and 11 species of caecilians. These numbers are only going to continue to rise as more areas are surveyed. The table-top tepuis harbor the majority of the country's endemic species, most of which are amphibians, while the surrounding lowland rainforests and savannahs display many of characteristic widespread species of the Guianan region and Amazonia. Owed in large part to the intactness of this area, much of Guyana is hard to access and as such, limited scientific surveys have been conducted.

As someone who studies reptiles and amphibians, there are naturally many very attractive reasons to target Guyana. Generally speaking, where there is water, there are amphibians, and to be the first to document the species in a particular regions is always exciting. I am a PhD student at the University of Mississippi where I study patterns of evolution of reptiles and amphibians across the Guiana Shield, with most of my sampling occurring in Guyana. My research broadly focuses on the effect of isolation on evolution of reptiles and amphibians. Essentially, I am taking the principles of island biogeography and applying them to a terrestrial system where instead of looking at islands surrounded by water, I am focusing on a rainforest-covered mountain "islands" surrounded by vast lowland savannahs.

Hypsiboas boans.

I have had the good fortunate to make four separate trips to Guyana over the past three years to explore a few different regions throughout the country, with more to come. Each summer since 2011, I have spent time in the rainforests of Iwokrama and Surama on the edge of the Pakaraima Mountains, working with Operation Wallacea. I have also spent time in the Kanuku Mountains, with a long return trip planned for this upcoming summer, and most recently I joined the World Wildlife Fund and Global Wildlife Conservation's Biodiversity Assessment Team to survey the reptiles and amphibians of the southern Rupununi of Guyana.

My research in these areas is two-fold. While my dissertation focuses on reading the story hidden in the DNA of these reptiles and amphibians, I am also providing important baseline surveys.

While most of Guyana is intact rainforest, there are increasingly looming threats from mining and logging companies. Having a better understanding of the species that occur in a given area is vital to making informed conservation decisions. While my main priority in the field is science, my camera comes everywhere. Pictures can be very powerful for connecting people to an area, and I have made it my mission to expose locals and foreigners alike to the cold-blooded denizens of Guyana. Over the next few pages are just a few examples of many of the stunning amphibians that have been found during these surveys.

Rhaebo guttatus.

Hypsiboas geographicus.

Dendrobates leucomelas.

Rhinella martyi.

Physalaemus cuvieri.

Hypsiboas crepitans.

Ceratophrys cornuta.

Osteocephalus taurinus.

Rhinella marina.

Hamptophryne boliviana.

Pipa pipa.

Hypsiboas cinerascens.

Phyllomedusa bicolor.

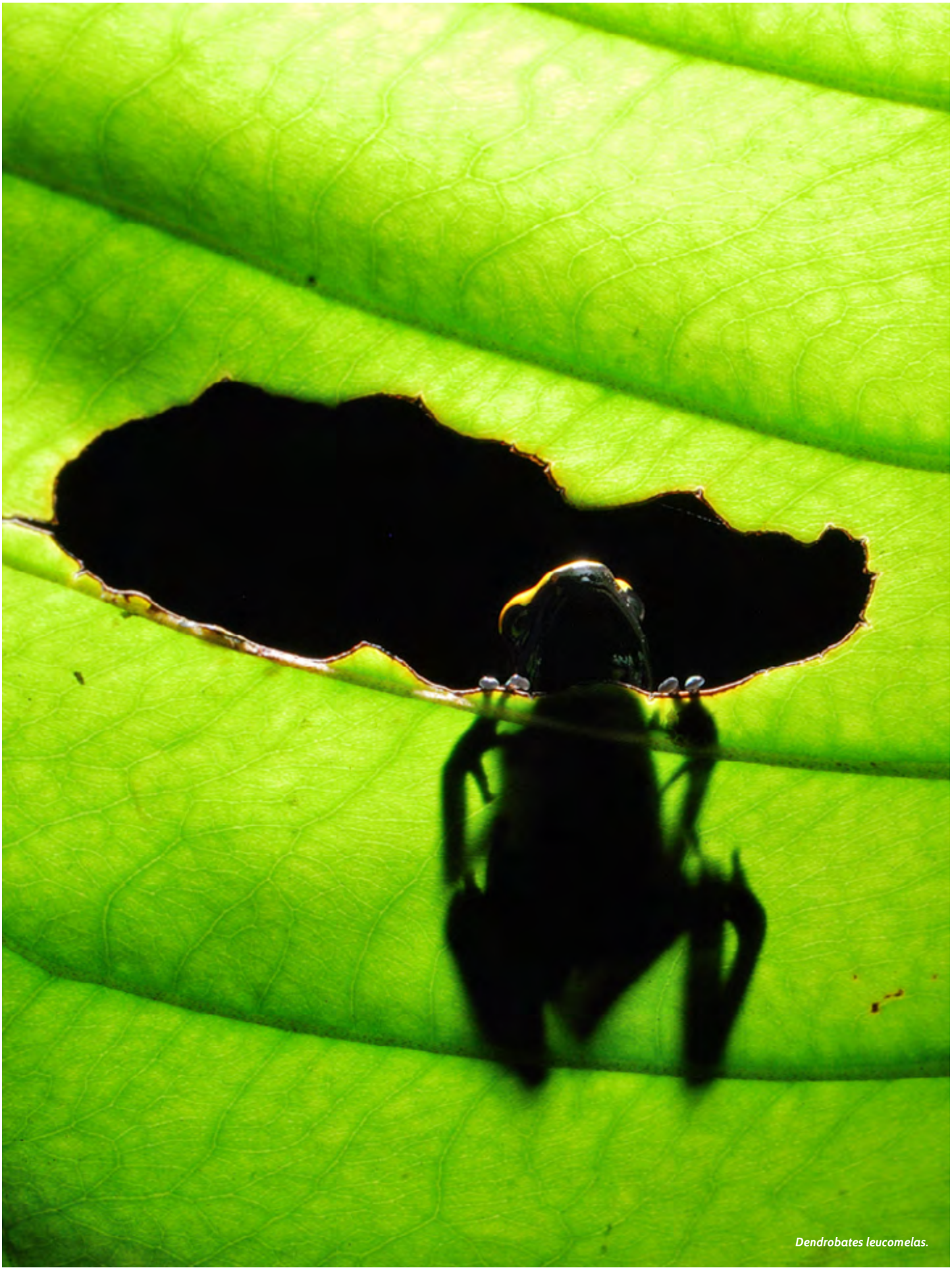
Leptodactylus knudseni.

Hysiboas crepitans.

Rhinella martyi.

Dendropsophus minutus.

Rhinella marina.



Dendrobates leucomelas.

Conservation and Ecology

***R. draytonii* at an abandoned Butte County mill pond, 19 July 1997. Photograph by Sean J. Barry.**

History and status of the California Red-legged Frog (*Rana draytonii*) in the Sierra Nevada, California, USA

Sean J. Barry, Gary M. Fellers

The status of the California Red-legged Frog (*Rana draytonii*), a Federally listed Threatened species, has long been uncertain in the Sierra Nevada range in eastern California. We examined museum collections and historical records, and conducted 213 field surveys at 151 sites over 21 years to evaluate the status of this frog in the Sierra Nevada. We found no records of Sierra Nevada or Cascade Mountain *R. draytonii* from before 1916, and we documented only 20 Sierra Nevada localities and one Cascades Mountains locality where *R. draytonii* was found between 1916 and 1975. These historical records extended from Tehama County southeast about 405 km to Madera County. The elevation range of most of the historical localities was 200–900 m (about 40 km from lower to upper elevation), but three apparently extirpated populations that may have originated from deliberate translocations occurred at 1,500–1,536 m elevation in Yosemite National Park. We surveyed directly or within 5 km of 20 of the 21 historical Sierra Nevada/Cascades *R. draytonii* localities and found that at least one of these historical populations persists today, in large numbers. We also discovered or confirmed six new Sierra Nevada *R. draytonii* populations and we documented individual frogs at three additional new sites, for a total of seven recent populations and three recent single-specimen occurrences extending from Butte County southeast about 275 km to Mariposa County. The elevations of these recent Sierra Nevada *R. draytonii* occurrences ranged from 300 to 1100 meters. Historically, *R. draytonii* in the Sierra Nevada probably bred in stream pools. These pools tend to be small with limited forage, a likely constraint on the historical size and number of Sierra Nevada *R. draytonii* populations. Since the 1850's, manmade tailings and mill ponds sometimes capable of supporting large *R. draytonii* populations have supplemented stream pool breeding habitat. Excluding the southernmost and Yosemite historical localities, the current range of Sierra Nevada *R. draytonii* differs little from the historical range, and further surveys may reveal additional surviving Sierra Nevada *R. draytonii* populations. Sierra Nevada *R. draytonii* are threatened primarily by habitat modification and loss related to human population increase in the Sierra Nevada foothills.

S. J. Barry, G. M. Fellers, *Herpetol. Conserv. Biol.* **8**, 456 (2013).

Matrix and habitat quality in a montane cloud-forest landscape: amphibians in coffee plantations in central Veracruz, Mexico.

Rene Murrieta-Galindo, Fabiola López-Barrera, Alberto González-Romero, Gabriela Parra-Olea

The processes of fragmentation, habitat loss, degradation and their combined effects are formidable threats to amphibian populations. We evaluate the effect of three land use-type variables and nine landscape matrix quality factors on amphibian presence in four coffee agro-ecosystems and two cloud-forest fragments in central Veracruz, Mexico. Each site was thoroughly searched using the visual-encounter survey technique along different trails in the most feasible microhabitats for detecting amphibians during four rainy seasons (2005, 2006, 2008 and 2009). Centred on the location where each amphibian species was first recorded, we established what we refer to as a buffer area within a radius of 1.5 km. A Co-Inertia mathematical model was used to determine which of the explanatory variables contributed to maintaining amphibian diversity. The landscape variables were landscape-quality index, open areas, canopy cover (low, intermediate, dense) at the matrix level, river, road and human population density and site size. Local variables were elevation, plant-structure and biological-impact indices. During the study we recorded 1078 amphibians belonging to 26 species, 17 genera and 10 families. The variables explaining the composition of amphibian diversity were river and human population density, low canopy cover at the matrix level, elevation, site size and plant-structure index. Amphibian diversity increased as the structural complexity of the habitat increased, and the former was positively correlated with fragment size. The present study indicated that coffee agro-ecosystems and the cloud-forest fragments in the region form a gradient in habitat quality and landscape variables that exert a differential influence on amphibian assemblages, and that each species responds uniquely to different variables.

Coffee agro-ecosystems and forest fragments cannot be seen as homogenous patches with a certain habitat quality, separate from the landscape matrix in which they are immersed. Stakeholders are not advised to rely on a single strategy to conserve the amphibian community, but rather should aim to maintain a heterogeneous landscape with forest fragments and coffee agro-ecosystems that have a complex vertical plant structure at the habitat level, especially in highly river-dense landscapes.

R. Murrieta-Galindo, F. López-Barrera, A. González-Romero, G. Parra-Olea, *Wildlife Res* **40**, 25–35(2013). http://dx.doi.org/10.1071/WR12076

As beauty as cryptic leaf frog *Craugastor loki* from the central mountain cloud forests of Veracruz, Mexico (Photo: Rene Murrieta-Galindo)

Uncertainty in distribution forecasts caused by taxonomic ambiguity under climate change scenarios: a case study with two newt species in mainland Spain

David Romero, Jesús Olivero, Ana L. Márquez, Jose C. Báez, and Raimundo Real

Distribution models are increasingly used to study the effects of climate change on biodiversity. Studies on the impact of climate change on species distributions are affected by several sources of uncertainty. For example, uncertainty associated with using different atmosphere-ocean general circulation models and emission scenarios, with using

***Triturus pygmaeus* in a natural habitat of Cadiz (South of Spain). This species is catalogued as Vulnerable to extinction according to the International Union for the Conservation Nature (UICN). Photo: David Romero.**

different methodological approaches to combine models and with the taxonomic ambiguity. The pygmy newt *Triturus pygmaeus* and the marbled newt *Triturus marmoratus* are taxa now treated as species, but were formerly treated as subspecies, *T. marmoratus pygmaeus* and *T. m. marmoratus*. We analyse the effects of using different taxonomic criteria on distribution forecast. We compare alternative distribution forecasts derived from modelling according to two taxonomic options: considering the two newts as different parapatric species, and considering them as the former single species. We modelled according to both taxonomic options using variables related to four explanatory factors: climate — using two IPCC emission scenarios and two atmosphere-ocean general circulation models regionalized to mainland Spain by the Spanish Meteorological Agency—, spatial constraints, topography and human activity, and the presence/absence dataset of each taxon was represented on a 10km x 10km UTM grid in mainland Spain. The models were projected to three time periods between 2011 and 2100 within the context of climate change. Five criteria were used to assess the fit of the models: sensitivity, specificity, and Correct Classification Rate, based on the 0.5-favourability threshold; the Area Under the Curve of the receiver operating characteristic, and the parsimony based on the Akaike information criterion. To evaluate the taxonomic ambiguity we calculated the discrepancy between forecasts produced with the different taxonomic options and their consistency under the same climate change scenario. Models based on the two species together did not distinguish between particular environmental requirements of either of the two species. Different distribution forecasts for the two newt species were obtained depending on the taxonomic option considered. A reduction in areas favourable to *T. pygmaeus* and its north-eastward displacement was only predicted when this species was analysed separately. Results show that consequences of choosing one taxonomic option over the other are important for conservation. Taxonomic uncertainty also affected other sources of uncertainty. A reasonable way to proceed could be to construct a set of models taking into consideration all possible taxonomic options and to analyse the differences that may appear between forecasts. Finally, we propose guidelines to deal with this kind of uncertainty.

D. Romero, J. Olivero, A.L. Márquez, J.C. Báez, and R. Real, *J. Biogeogr.* (2013) DOI: http://wileyonlinelibrary.com/journal/jbi.doi:10.1111/jbi.12189.

Southern Corroboree Frog (*Pseudophryne corroboree*). Photo: Michael McFadden.

Captive management and breeding of the Critically Endangered Southern Corroboree Frog (*Pseudophryne corroboree*) (Moore 1953) at Taronga and Melbourne Zoos

Michael McFadden, Raelene Hobbs, Gerry Marantelli, Peter Harlow, Chris Banks and David Hunter

The Southern Corroboree Frog *Pseudophryne corroboree* is a small myobatrachid frog from south-eastern Australia that has rapidly declined in recent decades largely due to disease, caused by infection with the amphibian chytrid fungus *Batrachochytrium dendrobatidis*. It is now one of Australia's most threatened vertebrate species, with potentially fewer than 50 individuals remaining in the wild, and no reproduction occurring in remnant wild populations in 2013.

To prevent the imminent extinction of this species, an *ex situ* captive breeding program has been established in a collaborative partnership between the New South Wales state wildlife department and four Australian zoological institutions: Taronga Zoo, Melbourne Zoo, Healesville Sanctuary and the Amphibian Research Centre.

Despite initial difficulties, successful captive breeding protocols have been established with most females at Taronga and Melbourne Zoos producing eggs in recent years. Key factors in achieving breeding in this species include providing an adequate pre-breeding cooling period for adult frogs, separation of sexes during the non-breeding period, allowing female mate-choice via the provision of numerous males per enclosure and permitting the females to attain significant mass prior to breeding. Difficulties were experienced with egg and larval mortality in early years, though these issues have since been largely resolved.

In view of its continued decline toward extinction, the survival of *P. corroboree* depends on the success of *ex situ* conservation measures. The success of captive breeding from 2010–2012 has permitted the reintroduction of 1,060 captive-produced eggs to the wild in experimental trials and an increasing captive population size that will support conservation research and provide insurance against further declines.

M. McFadden, R. Hobbs, G. Marantelli, P. Harlow, C. Banks, D. Hunter. 2013. *Amphibian & Reptile Conservation* 5(3): 70–87 (e72). http://amphibian-reptile-conservation.org/documents/ARC_5_3_70-87_e72_high_res.pdf

Fire salamander, *Salamandra infraimmaculata*. Photo: Dr. Shay Levy

Genetic population structure of the endangered fire salamander (*Salamandra infraimmaculata*) at the southernmost extreme of its distribution

Lior Blank, Iftah Sinai, Shirli Bar-David, Nir Peleg, Ori Segev, Asaf Sadeh, Naama M. Kopelman, Alan R. Templeton, Juha Merilä and Leon Blaustein

The negative effects of habitat fragmentation and population isolation on population viability, genetic variability and structuring are well documented, and conservation plans failing to take into account spatial population structure and connectivity can be ineffectual. Of special concern are populations at the periphery of the species range that might show reduced genetic diversity, thus affecting their adaptive potential at environmental margins. We investigated genetic variability and differentiation of the globally near threatened and locally endangered fire salamander (*Salamandra infraimmaculata*) in northern Israel, an area that represents the periphery of this species' distribution range. Analyses of variability in 15 microsatellite loci from 20 sites revealed substantial population structuring, most of which was due to a strong

subdivision between two regions separated by a heavily urbanized valley. In addition, levels of genetic variability within populations were lowest in the peripheral, southern-most populations. These results suggest that the conservation plans for this species should recognize the lower diversity and increased divergence in the peripheral regions, and take into account the observed spatial population structure when devising strategies and measures to increase the likelihood of species persistence.

L. Blank et al., *Anim. Conserv.* 16, 412-421 (2013). http://onlinelibrary.wiley.com/doi/10.1111/acv.12009/abstract

The native Alpine newt (*Ichthyosaura alpestris*) and the introduced goldfish (*Carassius auratus*). Photo: M. Denoël

Introduced goldfish affect amphibians through inhibition of sexual behaviour in risky habitats: an experimental approach

Laurane Winandy, Mathieu Denoël

The introduction of alien species is one of the major causes of current and global biodiversity loss. The introduction of fish can be a particular threat to native amphibian populations, which are declining worldwide. One way for amphibians to persist in such altered environments is to adopt anti-predator strategies especially at the behavioral level. However, although it has been shown that avoidance behavior may decrease the probability of being detected by a potential predator, little is known of the consequences on sexual behavior. In this study, we tested the hypothesis that adult Alpine newts (*Ichthyosaura alpestris*) use shelters more often and exhibit less sexual activity in the presence of goldfish (*Carassius auratus)* and that they reduce sexual activity more in risky micro-habitats than in safe environments. To this end, we assessed behavioural patterns of adult newts in a replicated laboratory design. Goldfish were present in direct contact with newts in half of the tanks. Consistently throughout the study period, significantly more newts used shelter in the presence of fish than in their absence. Newts also significantly decreased their sexual activity level overall, but especially outside the shelter when they were in direct contact with fish. These results show that fish presence can affect newts in complex ways, such as through inhibition of their reproduction. Our work highlights that integrating behavior in conservation studies is essential to understanding the patterns of coexistence and exclusion between introduced fish and amphibians.

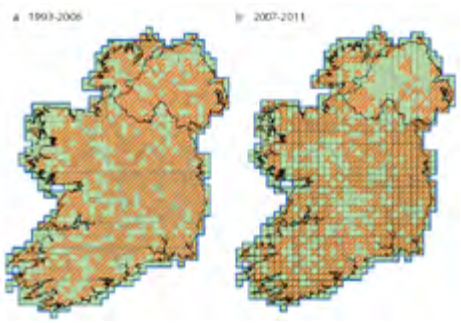
L. Winandy, M. Denoël, *PLoS ONE* 8 (2013): e82736.

http://dx.doi.org/10.1371/journal.pone.0082736

Population enumeration and assessing conservation status in a widespread amphibian: a case study of Rana temporaria in Ireland

Neil Reid, S. Karina Dingerkus, Richard E. Stone, Stéphane Pietravalle, Ruth Kelly, John Buckley, Trevor J.C. Beebee, Ferdia Marnell & John W. Wilkinson

Global amphibian declines are a major element of the current biodiversity crisis. Monitoring changes in the distribution and abundance of target species is a basic component in conservation decision making and requires robust and repeatable sampling. For EU member states, surveillance of designated species, including the common frog *Rana temporaria,* is a formal requirement of the 'EC Habitats & Species Directive'. We deployed established methods for estimating frog population density at local water bodies and extrapolated these to the national and ecoregion scale. Spawn occurred at 49.4% of water bodies and 70.1% of independent 500-m survey squares. Using spawn mat area, we estimated the number of adult breeding females and subsequently the total population assuming a sex ratio of 1:1. A negative binomial model suggested that mean frog density was 23.5 frogs ha−1 [95% confidence interval (CI) 14.9–44.0] equating to 196 M frogs (95%CI 124 M–367 M) throughout Ireland. A total of 86% of frogs bred in drainage ditches, which were a notably common feature of the landscape. The recorded distribution of the species did not change significantly between the last Article 17 reporting period (1993–2006) and the current period (2007–2011) throughout the Republic of Ireland. Recording effort was markedly lower in Northern Ireland, which led to an apparent decline in the recorded distribution. We highlight the need to coordinate biological surveys between adjacent political jurisdictions that share a common ecoregion to avoid apparent disparities in the quality of distributional information. Power analysis suggested that a reduced sample of 40–50 survey squares is sufficient to detect a 30% decline (consistent with the International Union for Conservation of Nature Category of 'Vulnerable') at 80% power providing guidance for minimizing future survey effort. Our results provide a test case for other EU member states to follow when conducting future conservation assessments for *R. temporaria* and other clump-spawning amphibians.



N. Reid, et al. *Anim. Conserv.* DOI: 10.1111/acv.12022 (2013).

A shub frog (*Pseudophilautus poppiae*) from Sri Lanka (photo by Alex Pyron), one of many tropical species from diverse radiations that are currently under pressure worldwide.

Large-scale phylogenetic analyses reveal the causes of high tropical amphibian diversity

R. Alexander Pyron, John J. Wiens

Most groups of plants and animals have more species in tropical regions, a pattern noticed for hundreds of years that still remains unexplained. Despite many competing hypotheses to explain latitudinal diversity gradients, only three processes can directly change species richness across regions: speciation, extinction, and dispersal (colonization, range expansion). These processes can be addressed most powerfully using large-scale phylogenetic approaches, but most previous studies have focused on small groups, recent time scales, or did not separate speciation and extinction rates. To resolve this question, we analyzed an evolutionary tree for amphibians (frogs, salamanders, caecilians) containing 2,871 species. Our results show for the first time that high tropical biodiversity is caused by higher rates of species origins in tropical regions and more species extinctions in cooler, temperate regions. These patterns are strongly associated with climate-related

variables such as temperature, precipitation, and ecosystem energy. Results from models of diversity dependence in speciation rate suggest that temperate clades may have lower carrying capacities and may be more saturated (closer to carrying capacity) than tropical clades. Most surprisingly, we find that extinction rates were close to zero in tropical regions in the past, in contrast to the high rates of human-related extinctions in tropical amphibians today.

Pyron, R. A. and J. J. Wiens. 2013. Large-scale phylogenetic analyses reveal the causes of high tropical amphibian diversity. *Proceedings of the Royal Society B, Biological Sciences* 280 (1770): 1622.

Rocky Mountain Tailed Frog (*Ascaphus montanus*) tadpole in Glacier National Park, Montana, USA. Photo: J. Joseph Giersch, US Geological Survey.

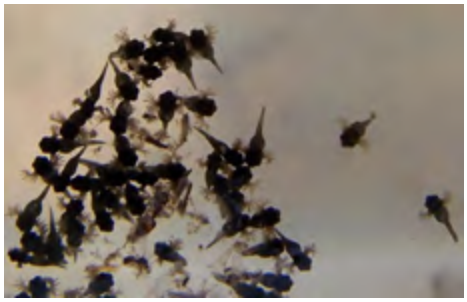
Population-level thermal performance of a cold-water ectotherm is linked to ontogeny and local environmental heterogeneity

Blake R. Hossack, Winsor H. Lowe, Molly A. H. Webb, Mariah J. Talbott, Kevin M. Kappenman and Paul Stephen Corn

Negative effects of global warming are predicted to be most severe for species that occupy a narrow range of temperatures, have limited dispersal abilities or have long generation times. These are characteristics typical of many species that occupy small, cold streams. Habitat use, vulnerabilities and mechanisms for coping with local conditions can differ among populations and ontogenetically within populations, which could modify species-level responses to climate change. However, we still have little knowledge of mean thermal performance for many vertebrates, let alone variation in performance among populations. Assessment of these sources of variation in thermal performance is critical for projecting the effects of climate change on species and for identifying management strategies to ameliorate its effects. To gauge how populations of the Rocky Mountain Tailed Frog (*Ascaphus montanus*) might respond to long-term effects of climate change, we measured the ability of tadpoles from six populations in Glacier National Park (Montana, U.S.A.) to acclimatize to a range of temperatures. We compared survival among populations according to tadpole age (1 or 2 years) and according to the mean and variance of late-summer temperatures in natal streams. The ability of tadpoles to acclimatize to warm temperatures increased with age and with variance in late-summer natal streams. Moreover, performance differed among populations from the same catchment. Our experiments with a cold-water species show population-level performance varies across small geographic scales and is linked to local environmental heterogeneity. This variation could influence the rate and mode of species-level responses to climate change, both by facilitating local persistence in the face of changes in thermal conditions and by providing thermally tolerant colonists to neighboring populations.

B. R. Hossack *et al., Freshwater Biology* 58: 2215-2225.

Diseases and Toxicology



Hatching of *Trachycephalus thyponius.* Photo: Paola Peltzer.

Effect of exposure to contaminated pond sediments on survival, development, and enzyme and blood biomarkers in veined treefrog (*Trachycephalus typhonius)* tadpoles

Paola M. Peltzer , Rafael C. Lajmanovich, Andrés M. Attademo, Celina M. Junges, Mariana C. Cabagna-Zenklusen

Amphibian species living in human-dominated landscapes face numerous threats, mainly due to their life cycles that alternate between aquatic and terrestrial habitats, exposing them to direct (e.g. aerial application) and diffuse (e.g. industrial sewage) pollution during egg and larval development. Direct and diffuse pollution have long degraded aquatic systems and constitute a great threat of global change. Sediments play a role in aquatic ecosystem processes and store various contaminants. Anurans potentially have a greater risk of exposure to contaminants in sediments, especially in their larval stages. Due to the extent of contaminants in different ecosystems of Argentina, mainly in the mid-eastern region and little known effects of those contaminants, the test of sediments provides first lines of evidences of the effect of different sediments to determine the ecological risk on anuran larvae. Sediment test in outdoor microcosms were conducted to study biological endpoints (survival, development, growth, and morphological and organ malformation), enzyme activity (butyrylcholinesterase, BChE; glutathione-S-transferase, GST; and catalase, CAT) and blood biomarkers in veined treefrog Trachycephalus typhonius tadpoles, a widespread Neotropical species. The experiments were located in the Biochemistry and Biological Sciences Faculty of the National Littoral University, Santa Fe Province. Hatching (stage 23) of T. thyphonius was exposed until they reached metamorphosis (stage 46). Sediment toxicity tests were performed and four different treatments were used (three ponds influenced by industrial and agricultural activities and a reference treatment from a forest), all collected from the mid-western Entre Ríos Province (Argentina). Physical-chemical variables and concentration of nutrients, pesticide residues, and metals were determined in each one before start test and during the experiment. One treatment was metal-rich and two were nutrient-rich. Sediment treatments had no significant effect on survival; however metal and nutrient-rich sediments had significant sublethal effects on *T. typhonius* larval development and growth rates, and affected overall size and shape at stage 38. Principally, animals in metal-rich treatment were significantly larger respect to the control, exhibiting swollen bodies (looked like edema), tail muscles and tail fin. In addition, metamorphs from contaminated sediment were smaller and showed signs of emaciation (which is typical of precocious individuals that present a very narrow body silhouette along the abdomen and flank) by the end of the experiment. The proportions of each type of morphological abnormalities (swollen bodies and diamond shape, diverted gut, gut uncoiling, polydactyly, stiff tails, and visceral and hindlimb hemorrhaging) were significantly greater in metal- and nutrient-rich sediment treatments. Additionally, activities of BChE, GST and CAT, as well as presence of micronuclei, immature, mitotic, anucleated erythrocytes varied significantly among treatments, being more evident in contaminated treatments. The biological effects of sediments in this study

highlights the use of different biological endpoints and biomarkers on anuran larvae at sites where pond sediment is unknown, and provide important lines of evidence in the first steps (TIER I, Amphibian ERA protocols) of ecological risk assessments. Finally, it is imperative that the discharge of effluent containing metal contaminants and agricultural runoff should be monitored and controlled during the breeding seasons of anuran amphibians to avoid deleterious effects on their populations and potential decline.

Peltzer *et al*., (2013). *Ecotox. Env. Saf.* 98: 142 - 151

Genetic evidence for a high diversity and wide distribution of endemic strains of the pathogenic chytrid fungus *Batrachochytrium dendrobatidis* in wild Asian amphibians

Arnaud Bataille, Jonathan J. Fong, Moonsuk Cha, Guinevere O. U. Wogan, Hae Jun Baek, Hang Lee, Mi-Sook Min and Bruce Waldman

Population declines and extinctions of amphibians have been attributed to the chytrid fungus *Batrachochytrium dendrobatidis* (Bd), especially one globally emerging recombinant lineage ('Bd-GPL'). We used PCR assays that target the ribosomal internal transcribed spacer region (ITS) of Bd to determine the prevalence and genetic diversity of Bd in South Korea, where Bd is widely distributed but is not known to cause morbidity or mortality in wild populations. We isolated Korean Bd strains from native amphibians with low infection loads and compared them to known worldwide Bd strains using 19 polymorphic SNP and microsatellite loci. Bd prevalence ranged between 12.5 and 48.0%, in 11 of 17 native Korean species, and 24.7% in the introduced bullfrog *Lithobates catesbeianus*. Based on ITS sequence variation, 47 of the 50 identified Korean haplotypes formed a group closely associated with a native Brazilian Bd lineage, separated from the Bd-GPL lineage. However, multilocus genotyping of three Korean Bd isolates revealed strong divergence from both Bd-GPL and the native Brazilian Bd lineages. Thus, the ITS region resolves genotypes that diverge from Bd-GPL but otherwise generates ambiguous phylogenies. Our results point to the presence of highly diversified endemic strains of Bd across Asian amphibian species. The rarity of Bd-GPL-associated haplotypes suggests that either this lineage was introduced into Korea only recently or Bd-GPL has been outcompeted by native Bd strains. Our results highlight the need to consider possible complex interactions among native Bd lineages, Bd-GPL and their associated amphibian hosts when assessing the spread and impact of Bd-GPL on worldwide amphibian populations.

Bataille *et al*, (2013). *Mol Ecol*. (16):4196-209. DOI: 10.1111/mec.12385.

Smooth newt, Lissotriton vulgaris Photo: Teresa Dunbar.

No detection of the chytrid fungus (*Batrachochytrium dendrobatidis*) in a multi-species survey of Ireland's native amphibians

Robert Gandola & Catriona Hendry

We present the results of the first survey undertaken to determine the status of *Batrachochytrium dendrobatidis* (Bd) on the island of Ireland. All three species of Ireland's native amphibian fauna were sampled, resulting in 195 skin swabs obtained from 22 locations in eight counties across the island. Using Bd-specific DNA primers in quantitative real-time PCR (qPCR) analysis, all samples tested negative for the presence of chytrid. These results may be considered good news for Ireland's amphibians, however we advise that the establishment of a long-term monitoring system will be essential for future management.

R. Gandola, C. Hendry, Herpetol. J. 23, 233 (2013). http://www.ingentaconnect.com/content/bhs/thj

Mouthparts of Southern Leopard Frog, *Lithobates sphenocephalus*, Tadpoles Not Affected by Exposure to a Formulation of Glyphosate

Shane M. Hanlon, Kyle J. Lynch, Matthew J. Parris

Contaminants enter aquatic systems through a variety of pathways and negatively impact aquatic organisms such as amphibians. While aquatic contaminants can be lethal to non-target organisms, sublethal effects such as reduction in growth and developmental rates may also occur; however, the mechanism(s) for such reductions is largely unknown. Previous studies have shown that damage to larval amphibian mouthparts correlates with reductions in growth and development. Specifically, one study showed that exposure coal-ash caused significant mouthpart damage and corresponding reductions in growth rates compared to unexposed subjects. Accordingly, we tested the hypothesis that Roundup®, a popular herbicide known to negatively effect tadpole life history traits, would damage tadpole mouthparts and subsequently reduce body condition (=mass/length). We measured the impacts of Roundup (0.023, 0.23, 2.3 mg/L) on larval mouthpart damage in *Lithobates sphenocephalus* (Southern Leopard Frog) as measured by an oral deformity index. We also tested for the subsequent effects of Roundup exposure on life history measures of body condition and developmental rates. We did not find evidence that Roundup damages larval mouthparts, nor was there a significant relationship between mouthpart damage and either body condition or developmental rate. However, the highest concentration of Roundup significantly stunted development compared to all other treatments. Although we observed a significant effect of Roundup on developmental rate, we conclude that mouthpart damage is not likely to be a mechanism for this life history response.

S. M. Hanlon, K. J. Lynch, M. J. Parris. *Bull. Environ. Contam. Toxicol.* 91:611-615

Why does amphibian chytrid (*Batrachochytrium dendrobatidis*) not occur everywhere? An exploratory study in Missouri ponds.

Alex Strauss and Kevin G. Smith

The amphibian chytrid fungus, *Batrachochytrium dendrobatidis* (Bd), is a globally emerging pathogen that has caused widespread amphibian population declines, extirpations, and extinctions. However, Bd does not occur in all apparently suitable amphibian populations, even within regions where it is widespread, and it is often unclear why Bd occurs in some habitats but not others. In this study, we rigorously surveyed the amphibian and invertebrate biodiversity of 29 ponds in Missouri, screened resident amphibian larvae (*Rana* (*Lithobates*) sp.) for Bd infection, and characterized the aquatic physiochemical environment of each pond (temperature pH, conductivity, nitrogen, phosphorus, and chlorophyll-a). Our goal was to generate hypotheses toward answering the question, "Why does Bd not occur in all apparently suitable habitats?" Bd occurred in assayed amphibians in 11

of the 29 ponds in our study area (38% of ponds). We found no significant relationship between any single biotic or abiotic variable and presence of Bd. However, multivariate analyses (non-metric multi-dimensional scaling and permutational tests of dispersion) revealed that ponds in which Bd occurred were a restricted subset of all ponds in terms of amphibian community structure, macro-invertebrate community structure, and pond physiochemistry. In other words, Bd ponds were more similar to each other than would be expected based on chance. The results of a structural equation model suggest that patterns in the occurrence of Bd among ponds are primarily attributable to variation in macro-invertebrate community structure. When combined with recent results showing that Bd can infect invertebrates as well as amphibians, we suggest that additional research should focus on the role played by non-amphibian biota in determining the presence, prevalence, and pathogenicity of Bd in amphibian populations.

A. Strauss, K. G. Smith, *PLOS ONE*, 8(9): e76035 (2013). DOI:10.1371/journal.pone.0076035

Underestimated ranges and overlooked refuges from amphibian chytridiomycosis

Robert Puschendorf, Lauren Hodgson, Ross A. Alford, Lee F. Skerratt and Jeremy VanDerWal

Accurately documenting and predicting declines and shifts in species' distributions is fundamental for implementing effective conservation strategies and directing future research; species distribution models (SDM) have become a powerful tool for such work. Nevertheless, much of the data used to create these models is opportunistic and often violates some of their basic assumptions. We use amphibian declines and extinctions linked to the fungus *Batrachochytrium dendrobatidis* (Bd) to examine how sampling biases in data collection can affect what we know of this disease and its effect on amphibians in the wild. We developed a distribution model for Bd in the Australian Wet Tropics incorporating known locality records for Bd and a subset of climatic variables that should correctly characterize its distribution. We tested this (original) model with additional surveys, recorded new Bd observations in novel environments and re-ran the distribution model. We then investigated the difference between the original and new models, and used frog abundance and infection status data from two of these new localities to look at the susceptibility of the torrent frog *Litoria nannotis* to chytridiomycosis. While largely correct, the original SDM underestimated the distribution of Bd; sampling in 'unsuitable' drier environments discovered abundant populations of susceptible frogs with pathogen prevalence of up to 100%. The validation surveys further uncovered a new population of the frog *Litoria lorica* coexisting with the pathogen; this species was previously believed to be an extinct rainforest endemic. Our results indicate that SDMs constructed using opportunistically-collected data can be biased if species are not at equilibrium with their environment or because environmental gradients have not been adequately sampled. For disease ecology, better estimation of pathogen distributions may lead to the discovery of new populations persisting at the edge of their range, which has important implications for the conservation of species threatened by chytridiomycosis.

R. Puschendorf, L. Hodgson, R. A. Alford, L. Skerratt, J. VanDerWal, *Diversity & Distributions*. **19**, 1313-1321.

Previous exposure of predatory fish to a pesticide alters palatability of larval amphibian prey

Shane M. Hanlon, Matthew J. Parris

Habitat preferences of organisms are reliant upon a variety of factors. Within amphibians, preferences can depend on factors such as food availability, water quality, or the presence of potential predators. Because some amphibians breed in permanent bodies of water (e.g. ponds), the threat of predation (e.g. from fish) is constant. Thus, some amphibians are unpalatable to predators, allowing them to coexist in the same habitats. However, the addition of anthropogenic stressors such as pesticides may alter the perceived palatability of prey to predators. We tested the hypothesis that bluegill fish (*Lepomis macrochirus*), previously exposed to the pesticide carbaryl, would consume more unpalatable prey (Fowler's Toad (*Anaxyrus fowleri)* tadpoles) than unexposed predators. Carbaryl is a pesticide that attacks the nervous system and can alter the taste sense in organisms. Moreover, we conducted an identical test using palatable prey (Gray Treefrog (*Hyla versicolor*) tadpoles) and predicted that no change in preference would be observed. In support of our primary hypothesis, bluegill exposed to the highest concentration of carbaryl consumed more *A. folweri* tadpoles compared to carbaryl-exposed bluegills at the lowest concentration or water control. Moreover, an effect of carbaryl on predation success on *H. versicolor* tadpoles was not observed. Our study shows that an anthropogenic stressor (carbaryl) can alter the perceived palatability of noxious prey to fish predators, potentially altering predator-prey relationships in natural settings.

S. M. Hanlon, M. J. Parris. *Environ. Toxicol. Chem.* doi:10.1002/etc.2380 (2013).

Impact of a natural pyrethrin biocide on two amphibians, Common toad *Bufo bufo* and Palmate newt *Lissotriton helveticus*, in Highland, UK

C. David O'Brien, Jeanette E. Hall, Catherine T. O'Brien, Diane Baum & Lucy Ballantyne

Signal crayfish, *Pacifasticus leniusculus*, is an invasive non-native species, which has become established across many European and Asian countries. It is an omnivorous species, and has been shown to prey on amphibian eggs and larvae. It was first confirmed in Scotland in 1995 and is now established there in at least 8 localities. It has been targeted for special action to halt its spread. A quarry pond in Highland, UK, was treated with PyBlast (a biocide derived from natural pyrethrin) to eradicate a population of crayfish. Although it was anticipated that pyrethrin application would lead to the death of all poikilothermic animals present in the quarry pond, its use was sanctioned as surveys did not reveal the presence of any protected or other scarce species. It was assumed that native fauna, including amphibians, would re-colonize from an adjacent pond which was not treated. PyBlast (0.4 mg/L) was applied from 12 to 13 June 2012. Follow-up surveys later in June, and in August and September, found no live crayfish, but established the presence of common toad, *Bufo bufo*, tadpoles, and both larval and adult palmate newt, *Lissotriton helveticus*. All appeared developmentally and behaviorally normal. These observations suggest that common toad and palmate newt larvae are able to survive levels of PyBlast generally lethal to crustaceans, indicating that amphibian presence at a site should not necessarily halt crayfish eradication programs.

C. D. O'Brien, J. E. Hall, C. T. O'Brien, D. Baum, L. Ballantyne, *Conservation Evidence* 10, 70-72 (2013)

http://www.conservationevidence.com/individual-study/5357#internal-article

A fungal pathogen of amphibians, *Batrachochytrium dendrobatidis*, attenuates in pathogenicity with in-vitro passages

Penny F. Langhammer, Karen R. Lips, Patricia A. Burrowes, Tate Tunstall, Crystal M. Palmer, James P. Collins

Laboratory investigations into the amphibian chytrid fungus, *Batrachochytrium dendrobatidis* (Bd), have accelerated recently, given the pathogen's role in causing the global decline and extinction of amphibians. Studies in which host animals were exposed to Bd have largely assumed that lab-maintained pathogen cultures retained the infective and pathogenic properties of wild isolates. Attenuated pathogenicity is common in artificially maintained cultures of other pathogenic fungi, but to date, it is unknown whether, and to what degree, Bd might change in culture. We compared zoospore production over time in two samples of a single Bd isolate having different passage histories: one maintained in artificial media for more than six years (JEL427-P39), and one recently thawed from cryopreserved stock (JEL427-P9). In a common garden experiment, we then exposed two different amphibian species, *Eleutherodactylus coqui* and *Atelopus zeteki*, to both cultures to test whether Bd attenuates in pathogenicity with in-vitro passages. The culture with the shorter passage history, JEL427-P9, had significantly greater zoospore densities over time compared to JEL427-P39. This difference in zoospore production was associated with a difference in pathogenicity for a susceptible amphibian species, indicating that fecundity may be an important virulence factor for Bd. In the 130-day experiment, *Atelopus zeteki* frogs exposed to the JEL427-P9 culture experienced higher average infection intensity and 100% mortality, compared with 60% mortality for frogs exposed to JEL427-P39. This effect was not observed with *Eleutherodactylus coqui*, which was able to clear infection. We hypothesize that the differences in phenotypic performance observed with *Atelopus zeteki* are rooted in changes of the Bd genome. Future investigations enabled by this study will focus on the underlying mechanisms of Bd pathogenicity.

P. F. Langhammer, K. R. Lips, P. A. Burrowes, T. Tunstall, C. M. Palmer, *et al.* *PLoS One* 8, e77630 (2013).

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 AmpibiaWeb latest papers page. The full list of latest papers from AmphibiaWeb is also included in every edition of *FrogLog* following the recent publications abstract section.

General Announcements

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

Biological Field Technician I

Camp Shelby, MS(Posted to PARC 11/27/13; Closing December 22, 2013)

Herpetology Research Intern—Archbold Biological Station

Lake Placid, FL (Posted to PARC 11/15/13; Open Until Filled)

Assistant Professor—Evolutionary Biology, Austin Peay State University

Clarksville, TN (Posted to PARC 11/08/13; Open Until Filled)

Guam Brown Tree Snake Biologist I Position Announcement

Guam, Pacific Islands USA (Posted to PARC 11/07/13; Closing 11/24/13)

Assistant Professor of Biology Position—Radford University

Radford, VA (Posted to PARC 09/24/13)

Post-doctoral Researcher, Lizard Physiology

University of São Paulo (USP), Brazil (Posted to PARC 09/23/13, closes 10/20/13)

Invasive Reptile Biologist

Everglades National Park, FL (Posted to PARC 08/29/13, closes 9/12/13)

Postdoctoral Research Associate (Gopher Tortoise Conservation), Georgia Cooperative Fish and Wildlife Research Unit

Athens, GA (Posted to PARC 08/14/13; Closing October 31, 2013)

Fish & Wildlife Biological Scientist II, Florida Fish and Wildlife Conservation Commission

Gainesville, FL (Posted to PARC 08/09/13; Closing August 16, 2013)

Ph.D. studentships in Reptile Ecology

James Cook University, Australia (Posted to PARC 08/09/13; Closing August 31 (International Applicants) / October 31 (Australian Applicants), 2013)

Sales Director Positions (2)—ZooMed Labs

(Posted 03/17/2013; open till filled)

MS Assistantship—Wildlife Biodiversity in NC Christmas Tree Farms—NC State University

Raleigh, NC (Posted 03/17/2013; open till filled)

Funding Opportunities

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

January 2014

Blue Earth Alliance -- Photography Projects. Blue Earth sponsors photography projects that educate the public about threatened cultures, endangered environments, and other social concerns. Blue Earth provides assistance with fund raising, publishing, and publicity. However, it does not make direct grants to sponsored projects. The deadlines for proposals are 20 January and 20 July each year. **Link**

Critical Ecosystem Partnership Fund -- Ecosystem Profile of South America's Cerrado. The CEPF seeks organizations or consortia to lead a process that develops an ecosystem profile of the Cerrado Biodiversity Hotspot (Brazil, Bolivia, and Paraguay). The available funding is US$300 thousand for one year. The deadline for applications (English) is 15 January 2014. **Link**

Global Knowledge Initiative -- Research on Agriculture, Climate, and Water in Africa. The Global Knowledge Initiative promotes collaboration to solve development challenges through its program LINK ("Learning and Innovation Network for Knowledge and Solutions"). LINK Round IV targets researchers from East and Southern Africa working on challenges in agriculture, food security, water and land management, and/or climate change. LINK provides training in collaboration, communication, and networking; analysis of the participant's challenge context; seed funding to initiate partnership formation; assistance in developing a working network; and a design process that helps define specific challenges and the best ways to tackle them. Applicants need to submit a request for engagement by 17 January 2014. **Link**

Israeli Agency for International Development Cooperation (MASHAV) -- Training Courses in Israel 2014. MASHAV funds professional courses organized and hosted by Israeli institutions in subject areas that include agriculture, energy, health, education, and social development. The 2014 calendar features courses in clean technology (English); post-harvest handling of fresh produce (English); intensive horticulture (Spanish, Russian); and others. For most courses, MASHAV covers course fees, accommodation, medical insurance, and other expenses in Israel (but not international airfare). Applications are submitted through Israel's diplomatic missions at country level, with several course application deadlines in December 2013 and January 2014. **Link**

Kinship Foundation -- Conservation Fellows 2014. Kinship supports fellows worldwide to participate in its month-long conservation leadership program in the USA, supported with stipends and lodging. Kinship focuses on market-based mechanisms for conservation by strengthening the participants' skills in leadership, communication, economics, and business and finance. Applicants should be mid-career conservation practitioners with at least five years of field experience, a bachelor's degree, and a demonstrated desire to innovate. The application deadline is 27 January 2014. **Link**

University of California at Berkeley -- Beahrs Environmental Leadership Program 2014. The Beahrs ELP sponsors an annual three-week certificate course in environmental science, policy, management, and leadership at UC Berkeley. The ELP invites applications from mid-career professionals around the world. Workshops and field trips draw on the strengths of UC Berkeley and the greater San Francisco Bay Area of California. Course participants continue their learning and networking through the Berkeley ELP Alumni Network. The application deadline is 17 January 2014. **Link**

U.S. Fish and Wildlife Service -- Africa Program 2014. The USFWS program "Wildlife Without Borders" includes a regional component for Africa. Grants in fiscal 2014 will support several conservation priorities in countries of the Congo Basin. The announcement provides

specific details about each funding priority. Eligibility for grants is unrestricted. The application deadline is 15 January 2014. **Link**

Volvo Environment Prize -- Nominations 2014. The Volvo Environment Prize is for innovations which in broad terms fall within the environmental field. The Volvo Environment Prize Foundation invites universities, research institutes, scientists, engineers, as well as other individuals and organizations to submit nominations. Priority is given to an individual or to a group of named individuals. Past laureates have included leaders in fields such as global change, biodiversity, energy efficiency, and others. The Prize consists of a diploma, sculpture, and cash award for SEK 1.5 million. The next deadline for nominations is 10 January 2014. **Link**

February 2014

Disney Worldwide Conservation Fund -- Annual Conservation Grants 2014. The Disney Worldwide Conservation Fund (DWCF) makes grants for wildlife studies, habitat protection, and community conservation and education in critical ecosystems around the world. DWCF supports projects that build on previous work, and that have the potential to contribute to long-term conservation. Eligibility extends to U.S. nonprofit organizations. Applicants from other countries need to apply through U.S. nonprofit partners. Priority is for requests of US$25 thousand or less. The deadline for letters of inquiry is 03 February 2014. **Link**

Royal Bank of Canada -- Blue Water Project 2014. The RBC's Blue Water Project makes grants for watershed protection and safe drinking water in two programs. (i) The Community Action Grants are up to $10 thousand for local and community organizations in Canada, USA, and the Caribbean. (ii) Leadership Grants ranging from $10 thousand to $100 thousand are available in North America and other countries where RBC does business. The application periods are 18 November 2013 through 20 December 2013 for Leadership Grants; and 18 November 2013 through 03 February 2014 for Community Action Grants. **Link**

March 2014

Prince Bernhard Nature Fund -- Projects to Conserve Flora and Fauna. The Prince Bernhard Nature Fund (Netherlands) aims to help save critically endangered flora and fauna in tropical and subtropical regions of Africa, Asia, and Latin America. It gives funding preference to organizations in these regions, sometimes in partnership with parties in Europe or North America. Grants are up to €25 thousand. The application deadlines are 01 March and 01 September each year. Link

United Nations Convention to Combat Desertification -- "Land for Life" Award 2014. The UNCCD presents the "Land for Life" Award for inspiring efforts in land conservation and management. Eligibility is open to individuals and institutions worldwide that are making a significant and innovative contribution to reduce land degradation through land management, political leadership, policy, business, advocacy campaigns, or scientific research. Three awards will be presented from a total prize fund of US$100 thousand. The deadline for applications is 15 March 2014. **Link**

April 2014

CRDF Global -- Travel Grants for Research Collaboration, USA-Russia 2013-2014. CRDF will support previous grantees of its USA-Russia program with grants up to US$10 thousand to complement their original projects. All research areas are eligible. Applications are reviewed on a quarterly basis through 30 April 2014. **Link**

International Development Research Center -- Doctoral Field Research in Developing Countries 2014. Canada's IDRC offers doctoral research awards twice a year (April and October) in priority themes that include agriculture and environment -- among others. The program is open to Canadians, permanent residents of Canada, and nationals of developing countries who are pursuing doctoral studies at Canadian universities. IDRC funds research in all developing countries, with a few exceptions. The award covers expenses for field research up to CA$20 thousand a year. The next application deadline is 02 April 2014. **Link**

Irwin Andrew Porter Foundation -- International Grants. The Foundation's international grant making includes projects for agriculture, natural resources, and grassroots conservation. Grants range from US$500 to US$30 thousand per year for projects of 1-2 years. Applicants must have tax-exempt status or a tax-exempt fiscal agent in the USA. The deadline for applications is 30 April. **Link**

Patagonia -- Grants for Environmental Protection. Patagonia makes grants to support nonprofit organizations for campaigns to preserve and protect the environment. Thematic areas are alternative energy, biodiversity, forests, sustainable agriculture, water/marine issues, and others. Eligible countries include Argentina and Chile. Grants are a maximum of US$12 thousand. Proposals are submitted through Patagonia's retail stores at any time of the year, or online before 30 April and 31 August of each year. **Link**

FrogLog Schedule

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

Instructions to Authors

Background

FrogLog has been one of the leading amphibian conservation community newsletters since the early 1990's. Over the years it has been affiliated with different groups but has always strived to help inform the community. In 2005 *FrogLog* became the official newsletter of the IUCN SSC Amphibian Specialist Group and is produced on a quarterly basis.

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

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

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

Publication

FrogLog is published online at: www.amphibians.org and is Open Access.

Review

All contributions should ideally be channeled through Regional ASG Chairs, the details for which can be found at http://www.amphibians.org/asg-members/. If for some reason this cannot be done, contributions will be reviewed by at least one individual within the ASG. *FrogLog* is not a peer-reviewed publication and the onus for submitting accurate information remains with the authors.

Production Editor

Candace M Hansen: cmhansen@amphibians.org

Editorial Committee

Candace M. Hansen
Craig Hassapakis
Laurence Jarvis
James P. Lewis

Additional reviewers will be requested as required.

Submission of Manuscripts

Manuscripts can only be received as electronic files. Text should be submitted in MS Word format and may contain tables, but figures should be sent as a separate attachment where possible. All documents should be sent to froglog@amphibians.org. Each file should be labeled in a style that illustrates clear association, i.e., authors_name_ms and authors_name _figure1.

Guidelines for Authors

All manuscripts must be written in English.

Title

Titles should ideally be no more than 15 words.

Authors

Authors names should be written in full as follows: By James P. Lewis & Robin D. Moore

Main body of text

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

Author details

Author details may be provided, including affiliations and contact details.

Figures

Figures should be numbered and include brief, concise legends. Where photographs or illustrations are used please state whom the image should be credited to, e.g., Photo: James P. Lewis. Graphics should preferably be submitted in tiff or jpeg format in the highest possible quality. Resolution should be at least 300 dpi at the final size.

Tables

Tables may be included within the text file and should be numbered and include brief, precise legends.

Citation of literature

FrogLog uses a numbering system for references and notes. This allows explanatory or more detailed notes to be included with the references. Journal names are abbreviated using common abbreviations to save space.

Journals/Periodicals

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

Books

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

Technical reports

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

Paper presented at a meeting

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

Published Online Only

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

Web site

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

SPECIAL NOTE: Use only one space after all punctuation marks (this includes only one space after "periods" at the end of sentences).

Further examples and details can be found on our web site at: www.amphibians.org/froglog/guidelines/

Coming up in *FrogLog* 110

Tell Us Your Story!

Regional Updates from The Americas
Recent Publications
Grants
and Much More...

April 2014

A Giant palm salamander, *Bolitoglossa dofleini*. Photo: Robin Moore.