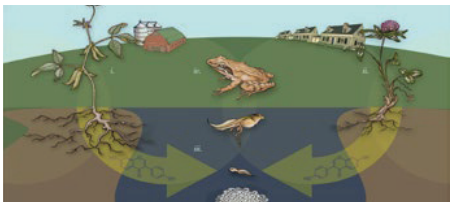
parameters varied considerably between sites, with higher turbidity, nutrients, total and dissolved organic carbon, alkalinity and arsenic (As) concentrations at CMW1, and higher conductivity, salinity, dissolved solids, hardness and sulfate levels at CMW2. There was no mortality in controls and less than 5% mortality in CMW1 treatments, whereas survival was significantly decreased in tadpoles exposed to CMW2 with 40 and 55% mortality in the 50 and 100% treatments, respectively. Development was significantly delayed in 100% CMW1 wastewater, but tadpole size (growth) was not influenced by the exposure. Hepatosomatic indices were significantly increased in tadpoles exposed to 25 and 50% CMW1 but not the 100% treatment group. Exposed tadpoles (predominantly those exposed to CMW1) exhibited increased activity after very short-term exposure (24 h), but this did not persist as animals approached metamorphic climax. At the end of the experiment, tadpoles exposed to both wastewaters had elevated levels of selenium (Se), cobalt (Co) and As in tail and liver tissue compared to controls. Manganese (Mn) levels were also elevated in livers and tails of CMW2 exposed tadpoles. Hepatic tissue accumulated 8–9 times higher concentrations of Co, Mn and Se compared to tail tissue, irrespective of treatments. Future research is warranted to explore possible relationships between metal bioaccumulation,morpho-physiological effects during development, and subsequent higher-level outcomes related to individual performance and population fitness.

C. Lanctôt, W. Bennett, S. P. Wilson, L. Fabbro, F. D. L. Leusch, S. D. Melvin, *Aquat. Toxicol.* **173**, 218–227 (2016).



Conceptual diagram illustrating parallel impacts from plants like (i) agricultural soy or (ii) clover in suburban yards on developing (iii) and adult (iv) amphibians from root exudates. These exudates are hormonally active and hypothetically transit through the soil into aquatic ecosystems, impacting amphibian development. Illustration: Monte Kawahara.

Clover root exudate produces male-biased sex ratios and accelerates male metamorphic timing in Wood Frogs

Max R. Lambert

In amphibians, abnormal metamorph sex ratios and sexual development have almost exclusively been considered in response to synthetic compounds like pesticides or pharmaceuticals. However, endocrine-active plant chemicals (*i.e.*, phytoestrogens) are commonly found in agricultural and urban waterways hosting frog populations with deviant sexual development. Yet the effects of these compounds on amphibian development remain predominantly unexplored.Legumes, like clover, are common in agricultural fields and urban yards and exude phytoestrogen mixtures from their roots. These root exudates serve important ecological functions and may also be a source of phytoestrogens in waterways. I show that clover root exudate produces male-biased sex ratios and accelerates male metamorphosis relative to females in low and intermediate doses of root exudate. My results indicate that root exudates are a potential source of contaminants impacting vertebrate development and that humans may be cultivating sexual abnormalities in wildlife by actively managing certain plant species.

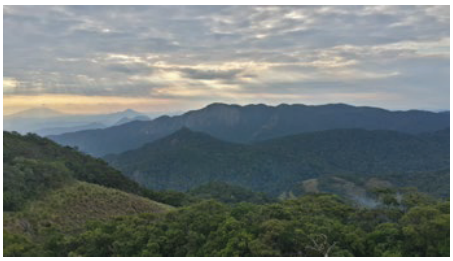
M. R. Lambert, *R. Soc. Open. Sci.* **2**, 150433 (2015).

Amphibian-killing chytrid in Brazil comprises both locally endemic and globally expanding populations

Thomas S. Jenkinson, Clarisse M. Betancourt Román, Carolina Lambertini, Anyelet Valencia-Aguilar, David Rodriguez, Carlos H. L. Nunes-de-Almeida, Joice Ruggeri, Anat M. Belasen, Domingos da Silva Leite, Kelly R. Zamudio, Joyce E. Longcore, L. Felipe Toledo & Timothy Y. James

Chytridiomycosis, caused by the fungus *Batrachochytrium dendrobatidis* (*Bd*), is the new disease responsible for recent population declines and extinctions of amphibian species worldwide. *Bd* isolates from regions of amphibian decline have all belonged to a single, hypervirulent clonal strain (*Bd*-GPL). However, prior studies in the Atlantic Forest of southeastern Brazil detected a novel, putatively endemic lineage (*Bd*-Brazil), and hybrid strains between *Bd*-GPL and *Bd*-Brazil. In this study, we describe the spatial distribution and population history of these strains in the Brazilian Atlantic Forest. To investigate the genetic structure of *Bd* in this region, we collected and sequenced DNA from *Bd* strains along a 2,400 km stretch of the Atlantic Forest. *Bd*-Brazil genotypes were confined to a narrow zone in the southern Atlantic Forest, while *Bd*-GPL strains were widespread and geographically unstructured. *Bd* population genetics in this region support the hypothesis that the recently discovered Brazilian lineage is endemic in the Atlantic Forest of Brazil, and that *Bd*-GPL is likely a more recently expanded invasive. We collected additional hybrid isolates that demonstrate the recurrence of hybridization between *Bd*-GPL and *Bd*-Brazil strains, confirming the existence of a hybrid zone in the Serra da Graciosa mountain range of Paraná State. Our observations suggest that *Bd*-GPL may be more infective toward native Brazilian amphibians, and potentially more effective at dispersing across a fragmented landscape. We also provide further evidence of pathogen translocations mediated by the Brazilian Bullfrog farming industry with implications for regulations and policies on global amphibian trade.

T. S. Jenkinson, C. M. Betancourt Román, C. Lambertini, A. Valencia-Aguilar, D. Rodriguez, *et al.*, *Mol. Ecol.* **25**, In Press (2016).



'Sky Islands' forest of Mount Mabu, northern Mozambique. Photo: Werner Conradie.

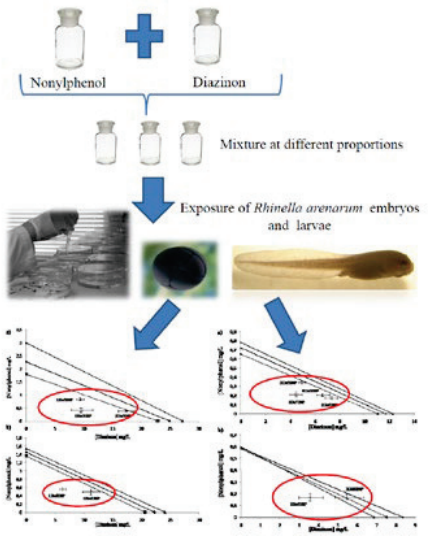
Batrachochytrium dendrobatidis survey of amphibians in the northern Mozambique "Sky Islands" and low-lying areas

Werner Conradie, Gabriela B. Bittencourt-Silva, Simon P. Loader, Michele Menegon, Cristovão Nanvonamuquitxo, Antoinette Kotzé, Desiré L. Dalton, Hanlie M. Engelbrecht & Krystal A. Tolley

Over the last few decades the amphibian chytrid fungus, *Batrachochytrium dendrobatidis* (*Bd*) has been cited as a possible cause for widespread mortalities and population declines in anuran species, however its status as a pathogen implicated in amphibian losses in Africa remains uncertain. In Africa, although most studies have mainly focused on reporting *Bd* presence, some studies have reported on the absence of *Bd* in localities. The mapping of the presence and absence of *Bd* has allowed us to determine areas of high prevalence of the pathogen and therefore potentially areas of greater conservation concern in terms of possible population declines. The high altitude inselbergs in northern Mozambique have been predicted as hotspots for *Bd*. Until now, no *Bd* surveys have been undertaken for Mozambique and we report on the first results of the presence and absence of *Bd* in the northern part of the country. Samples from Mount Mabu, Mount Namuli and Mount Ribáuè showed no infection, except for the one low-lying record. The almost complete absence of chytrid as outlined here, if correct, is surprising as areas in northern Mozambique are geographically close to areas where high prevalence has

been recorded. For now, it appears that the amphibians of northern Mozambique are not yet negatively impacted by *Bd* and prevalence is low. However, additional surveys are needed with larger sample sizes and species over a greater geographical coverage, to fully understand of the prevalence and consequence of the fungus in Mozambique.

W. Conradie *et al.*, *Herp. Review*. **47**, 42–46 (2016).



Credit: Aronzon Carolina.

Synergy between Diazinon and Nonylphenol in toxicity during the early development of the *Rhinella arenarum* toad

Carolina M. Aronzon, Gabriela V. Svartz & Cristina S. Pérez Coll

On May 2016, we published a paper in *Water, Air and Soil Pollution Journal*. The aim of the study was to assess the single and joint toxicity of the extensively applied organophosphate pesticide, diazinon and nonylphenol one of the major degradation products of nonylphenol polyethoxylates which is commonly used as surfactant in pesticide formulations. Both pollutants are widely distributed and often coexist in agroecosystems, where they might cause toxic effects to wild biota. Toxicity was assessed by means of a standardized test, AMPHITOX, on the early development of *Rhinella arenarum*. Joint toxicity of diazinon/nonylphenol mixtures were assessed in embryos and larvae exposed to three different proportions at different exposure times. Embryo and larval toxicity was time-dependent, and larvae were significantly more sensitive than embryos to both compounds with LC50s values of 0.59 mg nonylphenol/L and 8.34 mg diazinon/L at 168 h. For both embryos and larvae, nonylphenol was between 11 and 18 times more toxic than diazinon. It is noteworthy that the use of alkylphenol ethoxylates is still completely unrestricted in Latin American countries and nonylphenol is an emerging pollutant, not currently covered by water quality regulations, and it is thought to be a potential threat to ecosystems and human health. These results are particularly relevant for Argentina and other developing countries where large agricultural areas are treated with pesticides containing non-ionic surfactants. Despite that some active ingredients of pesticides are reported of low toxicity, added surfactants may be a health risk to aquatic biota as shown in this study. Joint toxicity of chemicals showed a tendency to be significantly higher than the predicted by additivity effects. These synergistic toxic effects provide evidence of the possible higher toxicity of commercial formulations. The synergistic interactions observed highlight the threat that diazinon/nonylphenol mixtures represent for *Rhinella arenarum* populations.

C. M. Aronzon, G. Svartz, C. Pérez Coll, *Water, Air and Soil Pollution Journal* **227**(5), 139 (2016).

Combined endosulfan and cypermethrin-induced toxicity to embryo–larval development of *Rhinella arenarum*

Gabriela V. Svartz, Carolina M. Aronzon & Cristina S. Pérez Coll

On February 2016, we published a paper in the *Journal of Toxicology and Environmental Health*. The combined effects of two widely used pesticides, endosulfan and cypermethrin, on survival of embryo–larval development of the South American Toad (*Rhinella arenarum*) were examined. The toxicity bioassays were performed according to the AMPHITOX test. Embryos and larvae were exposed to mixtures of these pesticides at equitoxic ratios from acute or chronic exposure to evaluate interaction effects. The results were analyzed using both Marking's additive index and combination index (CI)–isobologram methods. Acute (96-h) and intermediate (168-h) toxicity of endosulfan–cypermethrin mixtures remained almost constant for larvae and embryos, but when exposure duration was increased, there was a significant elevation in toxicity, obtaining chronic (240-h) no-observed-effect concentrations (NOEC) values of 0.045 and 0.16 mg/L for embryos and larvae, respectively. These are environmentally relevant concentrations that reflect a realistic risk of this pesticide mixture to this native amphibian species. The toxicity increment with the exposure duration was coincident with the central nervous system development on embryos reaching the larval period, the main target organ of these pesticides. The interactions of the pesticide mixtures at acute and chronic exposure were antagonistic for embryo development (CI > 1), and additive (CI = 1) for larvae, while chronic exposure interactions were synergistic (CI < 1) for both developmental periods. Data indicated that endosulfan–cypermethrin mixtures resulted in different interaction types depending on duration and developmental stage exposed. As a general pattern and considering conditions of overall developmental period and chronic exposure, this pesticide mixture usually applied in Argentine crop fields is synergistic with respect to toxicity for this native amphibian species.

G. Svartz, C. Aronzon, C. Pérez Coll, *J. Toxicol. Environ. Health A*. **79**(5), 197–209 (2016).

Japanese Tree Frogs (*Hyla japonica*) infected by chytrid fungus call more to attract mates. Photo: Jungbae Park.

Enhanced call effort in Japanese Tree Frogs infected by amphibian chytrid fungus

Deuknam An & Bruce Waldman

Some amphibians have evolved resistance to the devastating disease chytridiomycosis, associated with global population declines, but immune defenses can be costly. We recorded advertisement calls of male Japanese Tree Frogs (*Hyla japonica*) in the field. We then assessed whether individuals were infected by *Batrachochytrium dendrobatidis* (*Bd*), the causal agent of the disease. This allowed us to analyze call properties of males as a function of their infection status. Infected males called more rapidly and produced longer calls than uninfected males. This enhanced call effort may reflect pathogen manipulation of host behavior to foster disease transmission. Alternatively, increased calling may have resulted from selection on infected males to reproduce earlier because of their shortened expected lifespan. Our results raise the possibility that sublethal effects of *Bd* alter amphibian life histories, which contributes to long-term population declines.

D. An, B. Waldman, *Biol. Lett.* **12**, 2016.0018 (2016).

Sex reversal assessments reveal different vulnerability to endocrine disruption between deeply diverged anuran lineages

Stephanie Tamschick, Beata Rozenblut-Kościsty, Maria Ogielska, Andreas Lehmann, Petros Lymberakis, Frauke Hoffmann, Ilka Lutz, Werner Kloas & Matthias Stöck

Multiple anthropogenic stressors cause worldwide amphibian declines. Among several poorly investigated causes are global pollution of aquatic ecosystems with endocrine disrupting compounds (EDCs). These substances interfere with the endocrine system and can affect the sexual development of vertebrates including amphibians. We test the susceptibility to an environmentally relevant contraceptive, the artificial estrogen 17α-ethinylestradiol (EE2), simultaneously in three deeply divergent systematic anuran families, a model-species, *Xenopus laevis* (Pipidae), and two non-models, *Hyla arborea* (Hylidae) and *Bufo viridis* (Bufonidae). Our new approach combines synchronized tadpole exposure to three EE2-concentrations (50, 500, 5,000 ng/L) in a flow-through-system and pioneers genetic and histological sexing of metamorphs in non-model anurans for EDC-studies. This novel methodology reveals striking quantitative differences in genetic-male-to-phenotypic-female sex reversal in non-model vs. model species. Our findings qualify molecular sexing in EDC-analyses as requirement to identify sex reversals and state-of-the-art approaches as mandatory to detect species-specific vulnerabilities to EDCs in amphibians.

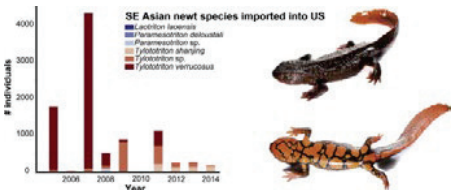
Stephanie Tamschick *et al.*, *Scientific Reports* **6**, Article number: 23825 (2016). doi:10.1038/srep23825

A model to inform management actions as a response to chytridiomycosis-associated decline

S. J. Converse, L. L. Bailey, B. A. Mosher, W. C. Funk, B. D. Gerber, & E. Muths

Decision-analytic models provide forecasts of how systems of interest will respond to management. These models can be parameterized using empirical data, but sometimes require information elicited from experts. When evaluating the effects of disease in species translocation programs, expert judgment is likely to play a role because complete empirical information will rarely be available. We illustrate development of a decision-analytic model built to inform decision-making regarding translocations and other management actions for the Boreal Toad (*Anaxyrus boreas boreas*), a species with declines linked to chytridiomycosis caused by *Batrachochytrium dendrobatidis* (*Bd*). Using the model, we explored the management implications of major uncertainties in this system, including whether there is a genetic basis for resistance to pathogenic infection by *Bd*, how translocation can best be implemented, and the effectiveness of efforts to reduce the spread of *Bd*. Our modeling exercise suggested that while selection for resistance to pathogenic infection by *Bd* could increase numbers of sites occupied by toads, and translocations could increase the rate of toad recovery, efforts to reduce the spread of *Bd* may have little effect. We emphasize the need to continue developing and parameterizing models necessary to assess management actions for combating chytridiomycosis-associated declines

S. J. Converse *et al*, *EcoHealth*, 1–12 (2016). DOI: 10.1007/s10393-016-1117-9



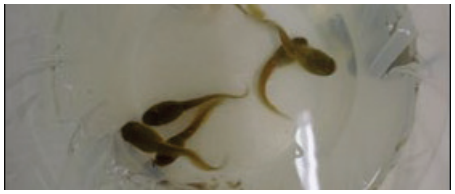
Number of individuals of Southeast Asian (Laos, Myanmar, Thailand and Vietnam) newts, (or newts potentially from Southeast Asia (*Paramesotriton* sp. and *Tylototriton* sp.), imported into the US during 2005–2014 (LEMIS) by species. Newt is *Paramesotriton deloustali*. (from paper).

Estimating the global trade in Southeast Asian newts

Jodi J. L. Rowley, Chris R. Shepherd, Bryan L. Stuart, Truong Q. Nguyen, Huy D. Hoang, Timothy P. Cutajar, Guinevere O.U. Wogan & Sompouthone Phimmachak.

The global trade in amphibians is widespread, involves hundreds of species, and has been implicated in amphibian population declines. The pet trade is the primary driver for population declines in one Southeast Asian newt species (*Laotriton laoensis*), and is a known threat to most of the 13 other known species from the region. Despite this, there has been little attempt to assess the impact of collection for the pet trade on Southeast Asian newts. We examined available import data from the US, Europe and Hong Kong, assessed current online trade and surveyed local pet traders within Southeast Asia. Large numbers of Southeast Asian newts are harvested from the wild to meet the demands of the international pet trade, with more than 7,500 individual newts imported into the US alone during 2005–2014. Internet trade surveys revealed the global extent of the trade, with Southeast Asian newts for sale as pets in 15 countries throughout Europe, Asia and North America, at between ~ USD30–260 each. The trade in newts within Southeast Asia appears negligible in comparison. Urgent measures are required in order to conserve Southeast Asian newts but the lack of data on the species and number of individuals impacted by the pet trade makes it difficult to monitor and accurately assess its threat. We strongly recommend that all Southeast Asian newts be listed on CITES. This measure should improve monitoring of trade and provides importing countries opportunity to curb trade in species that were illegally harvested, thus helping to safeguard wild populations.

J. J. L Rowley *et al.*, *Biol. Conserv.* **199**, 96–100 (2016).



Bullfrog (*Lithobates catesbeianus*) tadpoles. Photo: Ana M. Vasconcelos.

Acute and chronic sensitivity, avoidance behavior and sensitive life stages of Bullfrog tadpoles exposed to the biopesticide abamectin

Ana M. Vasconcelos, Michiel A. Daam, Liliana R. A. dos Santos, Ana L. M. Sanches, Cristiano V. M. Araújo & Evaldo L. G. Espíndola

As compared to other aquatic organism groups, relatively few studies have been conducted so far evaluating the toxicity of pesticides to amphibians. This may at least partly be due to the fact that regulations for registering pesticides usually do not require testing amphibians. The sensitivity of amphibians is generally considered to be covered by that based on toxicity tests with other aquatic organisms (*e.g.*, fish) although the impact of a pesticide on amphibians may be very different. In the present study, acute and chronic laboratory tests were conducted to evaluate the acute and chronic toxicity of abamectin (as Vertimec 18EC) to Bullfrog (*Lithobates catesbeianus*) tadpoles. Acute tests were conducted at two tadpole stages (Gosner stage 21G and 25G) and avoidance tests were also conducted with stage Gosner stage 21G tadpoles. Calculated acute toxicity values were greater than those reported for standard fish test species, hence supporting the use of fish toxicity data as surrogates for amphibians in acute risk assessments. Given the limited number and extent of available amphibian toxicity studies, however, research needs to increase our understanding of pesticide toxicity to amphibians are discussed.

A. M. Vasconcelos, M. A. Daam, L. R. A. dos Santos, A. L. M. Sanches, C. V. M. Araújo, E. L. G. Espíndola, *Ecotoxicology* **25**, 500–509 (2016).

Long term effects of carbaryl exposure on antiviral immune responses in *Xenopus laevis*

Francisco De Jesús Andino, B. Paige Lawrence & Jacques Robert

There is growing awareness that exposure to environmental contaminants is an overlooked but important contributor to the burden of infectious diseases. This is particularly significant for emerging infectious diseases implicated in the dramatic worldwide amphibian declines that are of major concern for the maintenance of biodiversity. Notably, water pollutants associated with agriculture may contribute to the increased prevalence of infectious diseases caused by ranaviruses. We have established the amphibian *Xenopus laevis* and the ranavirus Frog Virus 3 (FV3) as an important model system for evaluating the effects of common waterborne pollutants, such as the insecticide carbaryl. Exposure to for 3 weeks 10 ppb carbaryl induced marked mortality and accelerated development of *X. laevis* tadpoles. Furthermore, exposure to lower concentrations, albeit not overtly toxic of carbaryl (0.1 and 1.0 ppb), impaired tadpole innate antiviral immune responses, as indicated by significantly decreased expression of immune genes such as TNF-α, IL-1β, IFN-I, and IFN-III. Notably, the defect in IFN-I and IL-1β gene expression levels persisted after metamorphosis in froglets, whereas only IFN-I gene expression in response to FV3 was attenuated when carbaryl exposure was performed at the adult stage. These data suggest that the agriculture-associated carabaryl exposure at low but ecologically–relevant concentrations has the potential to induce long lasting alterations in host-pathogen interactions and antiviral immunity.

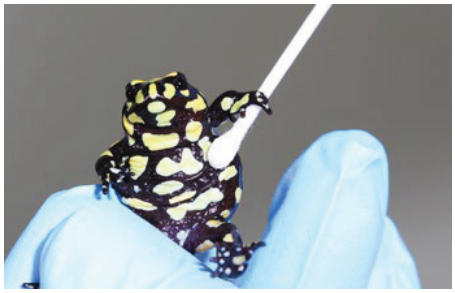
F. De Jesús-Andino, B. P. Lawrence, J. Robert, *Chemosphere* **170**,169 (2017)...

Recombinant ranaviruses for studying evolution of host–pathogen interactions in ectothermic vertebrates

Jacques Robert & James K. Jancovich

Ranaviruses of the family Iridoviridae are large double standed DNA viruses that are causing emerging infectious diseases at an alarming rate in both wild and captive cold blood vertebrate species worldwide. The general biology of these viruses that presents some similarities with poxvirus has been characterized to some extent. However, many aspects of their replication cycles, host cell interactions and evolution still remain poorly known, especially in vivo. In recent years, strategies to generate site-specific ranavirus recombinant, either expressing fluorescent reporter genes or deficient for particular viral genes, have been developed. The authors of this article review these strategies, the main ranavirus recombinants characterized and their usefulness for in vitro and in vivo studies.

J. Robert, J. K. Jancovich, *Viruses*, pii: E187. doi: 10.3390/v8070187 (2016).



A Southern Corroboree Frog (*Pseudophryne corroboree*) getting tested for infection with *Batrachochytrium dendrobatidis* (Bd). Photo: Doughty.

Characterization of MHC class IA in the endangered Southern Corroboree fFog

Tiffany A. Kosch, John A. Eimes, Chelsea Didinger, Laura A. Brannelly, Bruce Waldman, Lee Berger & Lee F. Skerratt

Southern corroboree frogs (*Pseudophryne corroboree*) have declined to near extinction in the wild after the emergence of the amphibian chytrid fungus *Batrachochytrium dendrobatidis* (*Bd*) in southeastern Australia in the 1980s. A major captive breeding and reintroduction program is underway to preserve this iconic species, but improving resistance to *Bd* would help the wild population to be self-sustaining. Using 3′ and 5′ rapid amplification of complementary DNA ends (RACE), we characterized the major histocompatibility complex (MHC) class IA locus in this species. We then used sequences generated from RACE to design primers to amplify the peptide-binding region (PBR) of this functional genetic marker. Finally, we analyzed the diversity, phylogeny, and selection patterns of PBR sequences from four *P. corroboree* populations and compared this with other amphibian species. We found moderately high MHC class IA genetic diversity in this species and evidence of strong positive and purifying selection at sites that are associated with putative PBR pockets in other species, indicating that this gene region may be under selection for resistance to *Bd*. Future studies should focus on identifying alleles associated with *Bd* resistance in *P. corroboree* by performing a *Bd* laboratory challenge study to confirm the functional importance of our genetic findings and explore their use in artificial selection or genetic engineering to increase resistance to chytridiomycosis.

T. A. Kosch, J. A. Eimes, C. Didinger, L. A. Brannelly, B. Waldman, L. Berger, L. F. Skerratt, *Immunogenetics* (2016). doi:10.1007/s00251-016-0965-3

COMMUNICATION & EDUCATION

Houston Toad, *Anaxyrus houstonensis*. Photo: Rachel E Rommel

Leaping from awareness to action: Impacts of an amphibian educator workshop

Rachel E. Rommel, Paul S. Crump & Jane M. Packard

Where endangered species occur, recommendations call for conservation education programs that engage local educators; however, few studies have measured the effectiveness of implemented programs. We conducted a multipartner educator workshop for the endangered Houston Toad, *Anaxyrus houstonensis*, as one local example illustrating the broader issue of globally declining amphibians. We measured the effect of the workshop on participants' (n = 50) awareness/knowledge, values, beliefs, emotions and intent to take action. We observed significant increases in awareness/knowledge and values regarding general amphibian declines and the focal species. The workshop significantly increased participants' belief that they had necessary resources to teach about the Houston Toad. Ninety-nine percent of participants agreed that they cared more about wild toads after meeting live ambassador toads. Postworkshop, we observed a 33% increase in use of amphibians or Houston Toads in participant learning settings. We recommend that educator workshops include biologist–educator teams, identify and address incentives and barriers to action, develop ecological knowledge and incorporate experiential programming focused on native species and habitats.

R. E. Rommel, P. S. Crump, J. M. Packard, *J. Herpetol.* **50**, 1 (2016).

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.

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

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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 Standard US English. For example, "colour" should be spelled "color."

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/

American toad (*Anaxyrus americanus*). Photo: Dave Huth.