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Amphibian Advocates

In this newsletter Truong Nguyen, from the Institute of Ecology and Biological Resources in Vietnam and Enrique La Marca from the Venezuelan Andean Reptile and Amphibian Conservation Center talk about their respective efforts with amphibian conservation programs.

The profiles of all of our Amphibian Advocates can be found on the AArk web site at www.amphibianark.org/amphibian-advocates. If you would like to nominate an Amphibian Advocate to be featured in a future edition of the AArk Newsletter, please send us an email at newsletter@amphibianark.org and we'll add your suggestion to our list!

Truong Nguyen, Researcher at the Institute of Ecology and Biological Resources, Vietnam Academy of Science and Technology, Vietnam

My name is Truong Quang Nguyen, a researcher at the Institute of Ecology and Biological Resources, Vietnam Academy of Science and Technology, in Hanoi, Vietnam. My first field work for amphibian exploration was conducted in 1997 with a research team from the American Museum of Natural History in central Vietnam. Since then I aspired to become a herpetologist. I finished my doctoral research in 2011 at the Zoological Research Museum Alexander Koenig and the University of Bonn, Germany (DAAD Fellow). From 2012 to 2014 I worked as a postdoctoral researcher in the Institute of Zoology, University of Cologne and Cologne Zoo (Alexander von Humboldt Fellow).

My research interests are systematics, ecology, phylogeny, and conservation of amphibians in Southeast Asia. I am the co-author of nine books and more than 200 papers relevant to the biodiversity research and conservation in Southeast Asia. Since 2000, together with my colleagues, I

have described twenty-three new species of amphibians from Vietnam, as well as from neighboring countries such as Cambodia, China and Laos. I also published several papers about amphibian use and trade or conservation status of specific groups of amphibians from Southeast Asia. As a member of the IUCN SSC Amphibian Specialist Group, I am an assessor and a reviewer for numerous species assessments of amphibians for the IUCN Red List and Red Data book of Vietnam. I have also been involved in some conservation projects of amphibians in Vietnam, including the establishment of new protected areas; ecological research and conservation breeding of endemic and threatened species of newts and tree frogs; and listing of endangered amphibian species in the national regulations as well as CITES appendices.



Tylostotriton vietnamensis, an endemic species of Vietnam and recently proposed to list this species in the CITES Appendix III.

Many amphibians are under the risk of decline and extinction and conservation success can only be achieved by our joint effort and collaboration.

Enrique La Marca, Venezuelan Andean Reptile and Amphibian Conservation Center

An unexpected beginning

It will be forty years next year since a trek into the high Venezuelan mountains resulted in an interesting finding. A Doberman pup was playing with something among paramo rosette plants, and it turned out to be a small frog. I took it to the University of Los Andes at Merida city, where I was pursuing an undergraduate degree in biology. There, I realized the specimen belonged to an undescribed species (that I later named *Eleutherodactylus colostichos*). About fifteen days later, I traveled to another location and found two more frogs that were also undescribed (and later described the species as *Colostethus molinarii*). The next specimens (caught seven months later) upon further study required a change from their subspecies designation to a full species designation. One year later, I had a total of twenty collected specimens, of which three were undescribed taxa; and just one more year there were five new species in a small collection of about thirty specimens! What a way to forcibly deviate from my original desire to be a student of human behavior through the understanding of animals, to become a herpetologist.

A life's passion

In 1980, just three semesters before graduation, I decided to move to the USA, where I ended up studying at the University of Colorado in Boulder under the mentorship of Dr. Hobart M. Smith. He was one of the most influential people in my herpetology career, through his teachings, friendship and professional guidance. My first two papers, as an undergraduate, are co-authored with him. He recommended that I continue studying in the States, and put me in contact with Dr. John D. Lynch, who led me to finish a Master's thesis on an amphibian group that I later named as a new genus (*Mannophryne*). Later on, Dr. Lynch mentored my doctoral studies and dissertation on the biogeography of frogs (taxonomy included) from the Venezuelan Andean Cordillera de Merida.

I became a full professor at the University of Los Andes in Venezuela, lecturing mainly on biogeography.



But my interest in herpetology never decreased. I continued participating in field trips that took me to even the most remote corners of the country (although most collections came mainly from the Andean region) and amassed a large number of specimens that were the basis to establish a herpetological collection (the Biogeografía de la Universidad de Los Andes) that currently holds about 8,000 specimens. In 2004, I founded an international journal on tropical amphibians and reptiles (Herpetotropicos). The journal ran for ten years but unfortunately closed due mainly to a huge shortage of funds that have affected the whole national science system until now. Additionally, I am thankful that this life's passion has taken me to more than twenty countries through the Americas, Caribbean, Europe and Africa, mainly participating in field trips and attending congresses and other meetings. This passion is also reflected in my writing of seven books and more than 230 scientific papers. To date, my taxonomic work has led me to describe thirty-two new species of frogs, three lizards and seven snakes.

A twist of interests

Having first-hand knowledge of frog populations of the Venezuelan Andes was crucial to detect declines. Consequently, in 1991 I wrote a pioneer paper highlighting population changes in all *Atelopus* species known from the Cordillera de Mérida and postulated possible causes of the declines. I became a member of the IUCN Amphibian Specialist Group of experts in 1995. Since then, I dedicated efforts to categorize Venezuelan frog species to include threatened taxa into the Venezuelan Red Data Book. In 2002, I

got involved with the Research and Analysis Network for Neotropical Amphibians (RANA) heading two conservation projects, mainly on *Atelopus*, but also on dendrobatid frogs. Later on, in 2004, I participated in the Global Amphibian Assessment, analyzing the distribution and conservation status of all of the Venezuelan amphibian species known to date, aiming to better understand their threats for later implementation of actions to protect them and provide appropriate conservation management.

The time was ripe to initiate a Venezuelan conservation program for endangered herp species. Under the auspice of the Venezuelan NGO Biocontacto, I recently founded the Venezuelan Andean Reptile and Amphibian Conservation Center. The financial support of Amphibian Ark has been germane to initiate some conservation actions at the Center on frog species of the genera *Mannophryne*, *Lepidodactylus* and *Aromobates*. A regional team has been developed through training personnel, and actions are now headed to organize workshops and to create public conservation awareness on endangered frogs. We have already developed husbandry and breeding protocols for one species, and have started to develop others. These *ex situ* experiences are unique in Venezuela in terms of their goals and results and are important to the conservation of threatened frog species.

Saving the Lake Titicaca Water Frog

You can help keep the largest fully aquatic frog from disappearing forever!

In conjunction with the Bolivian Amphibian Initiative, Amphibian Ark is running a crowd-funding project to help save the Lake Titicaca Water Frog.

Found only in the cold waters of this high elevation lake, the Lake Titicaca Water Frog has been identified by the International Union for the Conservation of Nature (IUCN) as Critically Endangered because of four catastrophic problems: an amphibian fungal disease, the introduction of exotic species, overharvesting and pollution. These large frogs can grow up to 145mm long and 380g in weight!

Arturo Muñoz, a Bolivian amphibian biologist, and his team are working to save the Titicaca Water Frog. They have established an assurance population in a captive breeding facility at the Museo de Historia in Cochabamba, Bolivia, where the water frogs are thriving and reproducing. But now, because of a failing cooling system this population is also at risk.

The frogs at the Museo de Historia may be the Lake Titicaca Water Frog's best hope for the future. Because the frogs are completely aquatic, an effective and secure cooling system is critical to their continued existence. A new cooling system with the addition of an ultraviolet unit to ensure consistently clean water will cost \$6,000.

Please help Arturo and his team save the Lake Titicaca Water Frog!

Your donation today will help ensure a future for the Lake Titicaca Water Frog.

Donations can be made at www.gofundme.com/WaterFrog.



Educational exhibit as a conservation tool for the Alcatraz Snouted Tree Frog

Katia Rancura and Cybele Lisboa, São Paulo Zoo, Brazil

Modern zoos are inspiring places to raise the awareness of a huge number of people and to promote reflection and action about the wildlife conservation issues of the 21st century. In this context, receiving approximately 1.5 million visitors per year, it is evident that an important role of the São Paulo Zoo in Brazil is the dissemination of knowledge and promotion of environmental education, especially regarding the conservation of endangered species.

Since 2008, this institution has managed an *ex situ* and *in situ* conservation program for the Alcatraz Snouted Tree Frog (*Scinax alcatraz*), a Critically Endangered tree frog endemic to the Ilha dos Alcatrazes, a small island off the São Paulo State coast.

Several stages of this program have been completed, including the development of breeding protocols and maintenance of a viable population of this species in captivity. However, one thing that was missing was to present the reality of this little tree frog and of its habitat to zoo visitors, showing the threats that it is facing and what is being done for its conservation. So in July 2016, the São Paulo Zoo prepared a proposal for displaying this endangered species, using different means and educational strategies.

The Alcatraz Snouted Tree Frog has a special area in the amphibian exhibit "O Pulo do Sapo" (The Leap of the Frog), located in one of the main boulevards of the Zoo. In this area, some live animals are displayed in a terrarium representing the natural habitat of the frogs. The space includes information available to the public through visual communication and through a video that explains about the species and all the steps of the conservation program developed by the Zoo. Educational presentations are often held in this space by environmental educators.



Educational presentations are often held in the "O Pulo do Sapo" (The Leap of the Frog) exhibit by environmental educators.
Photo: Cybele Lisboa.

The goal of this exhibit is to provide knowledge about the Alcatraz Snouted Tree Frog and to inspire our visitors to reflect about the importance of amphibian conservation, as well as the whole biodiversity. We hope that more people will understand the role of zoos in this process, and that wildlife conservation depends on the joint effort of different stakeholders, including researchers, governments and society.



A new exhibit has been created for the Alcatraz Snouted Tree Frog at São Paulo Zoo in Brazil, in a terrarium which represents the natural island habitat of the frogs.
Photo: Cybele Lisboa.

Amphibian species recommended for urgent captive rescue

Kevin Johnson, Taxon Officer, Amphibian Ark

Without immediate captive management as a stopgap component of an integrated conservation effort, hundreds of species could become extinct. Because the resources available to zoos and aquariums are limited, the Amphibian Ark must try to identify which species require captive rescue and management most urgently. To date the Conservation Needs Assessment process (www.ConservationNeeds.org) has been used to generate *ex situ* (captive) and *in situ* (in the wild) recommendations for conservation actions for more than 2,307 species (31% of the 7,530 currently known species) in 28 countries. Several more country-wide assessments are presently underway.



Having not been seen in the wild since 1989, *Atelopus nanay* was formally declared extinct in 2002, but two small populations were rediscovered in 2013. A captive breeding program was subsequently established for the species at the Center for Amphibian Conservation at the BioPark Amaru Zoo in Ecuador. Photo: Ernesto Arbelaez Ortiz.



A captive assurance colony and head-start program for the Houston Toad (*Anaxyrus houstonensis*) began at Houston Zoo, Texas, USA in 2006. Since then animals have been released into the wild, in conjunction with private landowners and on public lands. Photo Rachel Rommel.

One of the most urgent actions for the captive conservation community is to attempt to rescue those species that have been recommended during national workshops as being in need of urgent rescue – these are species that still exist in the wild, but the threats being faced by them cannot or will not be reversed in time to prevent likely species extinction. Threats that constitute imminent danger of extinction include threats for which we currently have no remedy (e.g. chytrid fungus (www.amphibianark.org/chytrid-fungus/), including any species known or suspected to be susceptible; climate change) or threats for which we have a remedy but not the resources or will to intervene (e.g. imminent destruction of more than 50% of habitat by dam construction, mining/pollution etc. or species being collected from the wild to the brink of extinction).

Almost 200 species have been recommended for urgent captive rescue to prevent their extinction, but only a small portion of these are currently included in captive conservation programs.

AArk strongly recommends that rescue programs are established within the range country of the species wherever possible. Zoos, aquariums and other captive breeding organizations that are considering the implementation of new amphibian rescue programs are strongly encouraged to consider the species which have been recommended for urgent rescue programs via Conservation Needs Assessments. The full list of species in need of rescue is available on the AArk's web site, www.amphibianark.org/rescue-species/.

Information regarding the likely availability of founder animals and the completion of a relevant phylogenetic study is included where known. Such additional information may indicate which species are currently appropriate for captive rescue programs, and those which may benefit from additional research in the wild prior to a captive program being established. Species expected to have wild founders available and which have undergone a phylogenetic review should perhaps be considered ahead of others where information is incomplete.

The results of all assessments are available in the online assessment program, www.ConservationNeeds.org. Additional assessments are planned for other countries and regions over the coming months. The benefits of this assessment process are clear – we assemble the leading amphibian field experts in each region, to collectively determine the best course of conservation actions to help prevent the extinctions of threatened amphibian species in nature. These actions include habitat restoration and preservation, threat mitigation, captive breeding for release and community awareness and involvement.

Improving an African Clawed Frog facility following collaboration with AArk staff

Emanuele Fasola, Sara Costa and Isabel Lopes, Department of Biology and CESAM, University of Aveiro, Portugal

Amphibians are facing a severe global crisis that requires the best and most accurate conservation policies, and a better understanding of the processes underlying this decline is mandatory. To improve our knowledge, researchers at the laboratory of Applied Ecology and Ecotoxicology from the Department of Biology and Centre for Environmental and Marine Studies of the University of Aveiro in Portugal, have been focused on understanding the effects that environmental changes (e.g. chemical contamination, climate changes, incidence of pathogens) may cause on amphibians. Within this research line, and aiming to establish cause-effect relationships, the amphibian research group uses mainly laboratory and *in situ* approaches by working with aquatic life stages of two model species: the African Clawed Frog (*Xenopus laevis*) from Sub-Saharan Africa and Perez's Frog (*Pelophylax perezi*) from the Iberian Peninsula and the south of France.

Complying with the major goal of the EU directive 63/2010 of reducing animal experimentation, most experimental work is carried out with embryos and larval stages not exhibiting independent feeding. This requires the maintenance of reproductive adults in the laboratory in order to obtain eggs in high quantity and whenever experiments are to be carried out. The maintenance of adult amphibians in the laboratory and use in reproductive procedures must conform to animal welfare laws, which is ruled by the 3R's policy (Refinement, Reduce, Replace). The compliance of these policies is a priority among the amphibian research group. Therefore, targeting the continuous improvement of well-being and welfare of the amphibians that are held in the laboratory, this research group contacted Luis Carrillo from the Amphibian Ark to obtain expert consultancy. Following that, and as already outlined in the AArk Newsletter No. 35 (www.amphibianark.org/Newsletters/AArk-newsletter-35.pdf), we took advantage of the opportunity to organize a training course on Amphibian



During an amphibian husbandry and conservation course in Portugal earlier this year, Arturo Muñoz demonstrated how to set up a recirculation system and rain chambers.
Photo: Isabel Lopes.



Husbandry and Conservation from 6-10 June 2016 at the Department of Biology, University of Aveiro (see <https://amphibian-hc.wordpress.com> for further details on the course). One of the modules of this course dealt with practical activities for building false bottoms and environmental enrichment of aquariums, as well as drilling aquariums and creating filters for water recirculation systems, checking for water quality, measuring UV index, parasitology and necropsy.

Improvement of the amphibian facilities at the Applied Ecology and Ecotoxicology laboratory

The course greatly helped the amphibian research group at the Applied Ecology and Ecotoxicology laboratory to improve the facilities where adult amphibians were kept. A permanent water recirculation system for the African Clawed Frogs was constructed following the training course, which is now continuously working; this mainly helped to improve the water

Amphibian Ark's Training Officer Luis Carrillo demonstrating how to drill an aquarium. This technique was subsequently well-used when we built a water recirculation system.
Photo: Isabel Lopes.

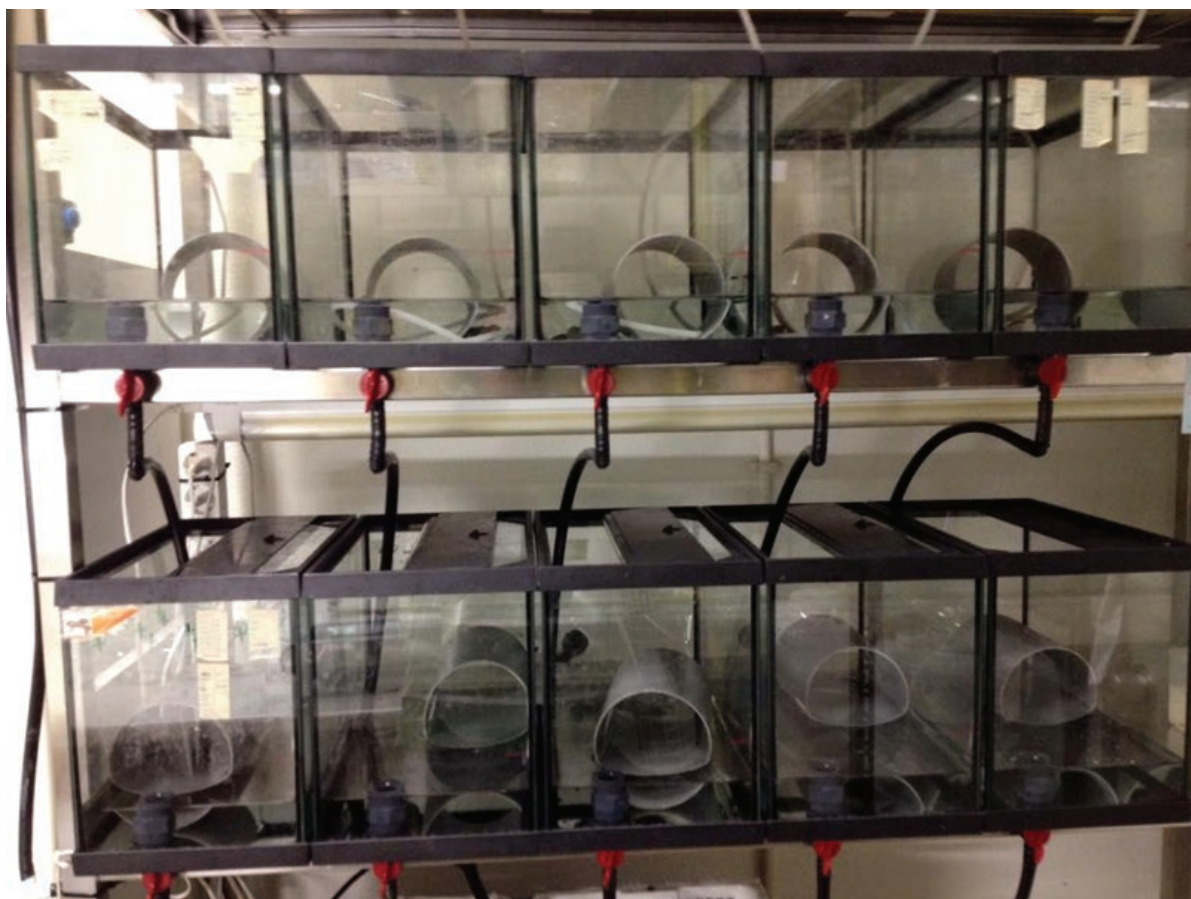


Perez's Frog (*Pelophylax perezi*) adult near an egg mass.
Photo: Emanuele Fasola.

quality of the culture aquaria. To build this system, tanks were drilled to ensure continuous water flow through PVC tubes, thereby connecting the aquaria, and finally connecting them to a water filtering system. The structure was built from a plastic tank in which two baskets were placed. When it reaches the baskets, water from the aquaria passes through a layer of fine sand, a second layer of activated carbon and a third layer of zeolyte. It then runs into the tank in which plastic balls, rich in tiny holes, provide additional space for de-nitriphying bacteria to live. At that point the water is pumped out and redistributed to the top shelf aquariums, falling down to the next level in a cascade system.



African Clawed Frog (*Xenopus laevis*) juveniles.
Photo: Emanuele Fasola.



Aquaria connected by PVC tubes in a "cascade".
Photo: Emanuele Fasola.

Recent animal husbandry documents on the AArk web site

The Husbandry Document library on the AArk web site (www.amphibianark.org/husbandry-documents/) currently has over 150 articles in it, with additional articles being added regularly. Four new documents have been added recently:

Amphibian Taxon Advisory Group Best Practice Guidelines for the Lake Oku Frog *Xenopus longipes*, Benjamin Tapley, Christopher Michaels, Luke Harding, Zoe Bryant, Iri Gill, Sebastian Grant, Nicole Chaney, Freeland Dunker, Brian Freiermuth, Jarrod Willis, David Blackburn & Thomas Doherty-Bone. The information in this Best Practice Guideline has come from a variety of sources including a literature review, the experience of the authors and others in the captive husbandry of *Xenopus longipes* as well as direct observations of the species in the field. Amphibian husbandry is a rapidly evolving field and there are many aspects that require further research. Breeding triggers for *X. longipes* are currently unknown; this area should be a focus of further research if captive populations are to be viable. The vocalization of *X. longipes* has not yet been described and further attempts to document and describe vocalization should be made as this may facilitate monitoring of the species in Lake Oku.

EAZA, 2016, English, www.amphibianark.org/?wpfb_dl=205

American Association of Zoo Veterinarians Infectious Disease Committee Manual - Chytridiomycosis, Cynthia Stadler. Fact sheet on the diagnosis, treatment, prevention and control of chytridiomycosis.

May 2013, English, www.amphibianark.org/?wpfb_dl=207

American Association of Zoo Veterinarians Infectious Disease Committee Manual - Ranavirus, Ann E. Duncan. Fact sheet on the diagnosis, prevention and control of ranavirus in amphibians.

August 2013, English, www.amphibianark.org/?wpfb_dl=206

ASG Captive Breeding Working Group Action Plan, ASG Captive Breeding Working Group.

The vision, goals and actions for captive amphibian conservation programs, generated by the ASG Captive Breeding Working Group. This document updates and replaces the Captive Breeding chapter of the 2007 Amphibian Conservation Action Plan (ACAP).

June 2016, English, www.amphibianark.org/?wpfb_dl=208

Save the axolotl!

The Takoma Voice

The axolotl is a critically endangered species. The amphibian's only natural habitat is a lake complex – what's left of it – near Mexico City. Draining and pollution have left few if any survivors in the wild. Most live in captivity.

The Amphibian Ark is trying to save the species, preferably in its habitat. Local Takoma (USA) residents Elyse MacCall and Anna Grace Uehlein helped out with a bake sale. They set up their table outside Ace Hardware store on Carroll Avenue in August last year, taking advantage of the crowds drawn to the nearby Sunday farmers market. Their goal was not only to raise funds, but to raise awareness of the axolotl. "Admiration for axolotls – and other animals," read their poster.

Elyse, a rising sixth grader at Takoma Park Middle School, learned about the Axolotl's plight from a friend. She was fascinated by the unique salamanders and sad that they were endangered. She and Anna Grace, who together had a similar bake-sale last year for the endangered Florida Panther, agreed to raise funds for the Axolotl this summer. It was an easy decision for Anna Grace, who aspires to be a marine biologist. She is a rising fifth-grader at Piney Branch Elementary School.

The pair are unaffiliated with a group. Theirs is an independent effort. "We did all the baking ourselves the day before we sold everything," said Anna Grace. Sunday morning they packed baked goods, posters, table and other gear into a car, got a lift and set up in front of Ace Hardware at the heart of Takoma Old Town.



They earned \$130 for the "walking fish" as the axolotl is called. They passed out literature about the Amphibian Ark, which is dedicated to "ensuring the survival and diversity of amphibian species, focusing on those that cannot currently be safe-guarded in their natural environments." The funds raised have gone to the program carried out by the Universidad Nacional Autónoma de México which has been working for years rescuing this species in Xochimilco Lake and in other nearby areas in Mexico City, Mexico.

"We will probably do this again next summer for a different animal," said Anna Grace.

(Reprinted, with permission from the Takoma Voice, www.takomavoice.com/2015/08/20/save-the-axolotl/).

Elyse MacCall and Anna Grace Uehlein's bake sale to help save Axolotls.
Photo: Mary Ellsworth.

2017 Biology, Management and Conservation of North American Salamanders Training Course

Amphibian Ark and Zoo Atlanta are pleased to announce the 2017 Biology, Management and Conservation of North American Salamanders training course.

The course will consist of five days of intensive training, including lectures, hands-on practical exercises, and fieldwork, with the goal of providing the students with technical skills necessary for long-term management of *ex situ* assurance populations of salamanders, from species selection to reintroductions with focus on husbandry, health, biosecurity and population management. Topics covered during the course will include: salamander biology, conservation and management; enclosure design and construction; captive breeding techniques; biosecurity and disease control; monitoring and surveys of wild and captive populations; education and scientific engagement. A field trip is arranged at Wharton Center, GA.

The course is designed to encourage the participation and sharing of knowledge and expertise among instructors and students, providing spaces to do so in a comfortable environment of camaraderie.

Target audience: Zookeepers, field biologists, grad students, and academics working in salamander conservation and research, especially in captive settings. The course is limited to 20 students.

Location: The course will be held at **Zoo Atlanta and at Wharton Center, Georgia.**

Dates: **September 18th – 22nd, 2017**

For further information please contact Luis Carrillo, AArk Training Officer - luis@amphibianark.org.



The 2016 North American salamander workshop brought together participants from seventeen institutions, representing zoos, universities and the private sector. Photo: Luis Carrillo.

Quotes from last year's students

- The instructors provided first hand, useful information regarding care of salamanders from all families, with practical tips on husbandry and diet. The veterinary discussion was extremely helpful. The field trip was fantastic. I had the opportunity to learn from everyone instructing and taking the course.

- This is a one of a kind course. I found it completely enriching in both a professional and personal context. The relationships and knowledge cultivated during the course are priceless and will be indispensable to me in regard to future salamander conservation work.

- With the amphibian decline crisis in full swing, this course serves as an opportunity to learn in depth information about salamander research and husbandry. It is imperative that researchers, aquarists, and zookeepers learn as much about this taxa as possible in order to bolster their representation in conservation efforts.

- As a graduate student, I found this course very helpful for my research. I have taken many great concepts from this course and have been able to apply them directly to my research. I was also able to network with individuals in my field which has greatly helped with professional development.

Red-legged Salamander (*Plethodon shermani*).
Photo: Luis Carrillo.



Bringing Northern Leopard Frogs back - A look at efforts to reintroduce Northern Leopard Frogs in two Canadian provinces

Lea Randall, Population Ecologist, Calgary Zoological Society, Canada

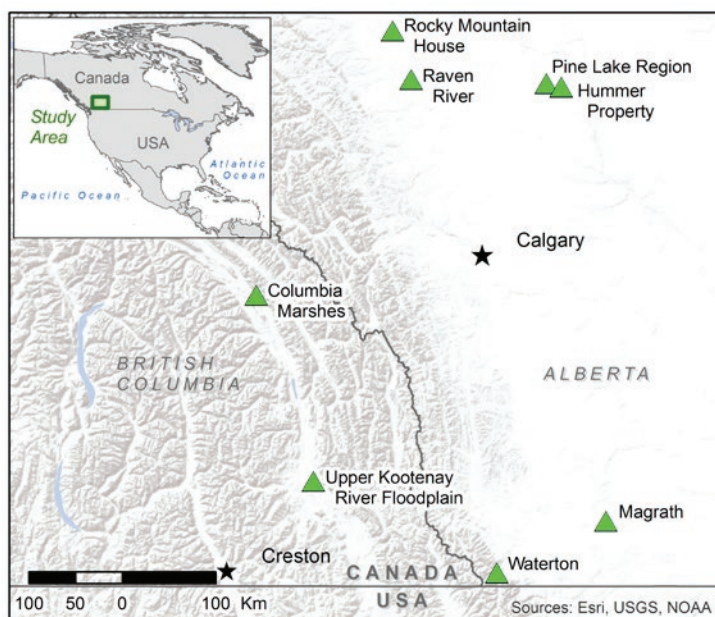
The unique sound of a Northern Leopard Frog (*Lithobates pipiens*) call—a guttural snore followed by a series of clucks—was once common in the wetlands of Western Canada, but in the 1970s and 80s a widespread decline almost silenced these spotted amphibians in British Columbia and Alberta.

Habitat loss and fragmentation, reduced water quality and quantity, introduced fish, and disease have been implicated as possible causes of declines. Although there isn't data to compare conditions before the decline in Northern Leopard Frogs, chytridiomycosis (a disease caused by the chytrid fungus) may also have been a primary cause for population declines in British Columbia, and contributed to declines in Alberta.

Shrinking range, fewer Northern Leopard Frog populations, and less frogs within those populations led to national Species at Risk Act designations for different populations—'Endangered' for British Columbia's Rocky Mountain population and 'Special Concern' for the Western Boreal/Prairie populations in the Northern Territories, Alberta, Saskatchewan, and Manitoba. In Alberta, the



The Northern Leopard Frog (*Lithobates pipiens*)
Photo: Josee-Anne Otis.



More than 40,000 tadpoles and young-of-year frogs were translocated to two British Columbia sites: Upper Kootenay River Floodplain and Columbia Marshes; and frogs have been released into more than nine different locations in central and southern Alberta. Reintroductions continue to occur in and around Waterton Lake National Park and other parts of the province.

Moving into new territory

In three separate reintroduction phases between 2003 and 2015, more than 40,000 tadpoles and young-of-year frogs were translocated to two British Columbia sites: Upper Kootenay River Floodplain and Columbia Marshes.

In Alberta, reintroductions have been happening for over thirty years. During that time, many eggs were collected from breeding sites, and eggs or head-started frogs were released into more than nine different locations in central and southern Alberta. Reintroductions continue to occur in and around Waterton Lake National Park and other parts of the province.

Listening and looking for success

In British Columbia, breeding and visual encounter surveys showed success at the Upper Kootenay River Floodplain site. While reintroduction in that site is considered successful, populations are still too small to ensure they will thrive in the future. The Columbia Marshes site is too new to expect breeding, but young-of-year frogs were detected meaning that the reintroduced eggs hatched and some tadpoles completed their metamorphosis.

species is 'Threatened' and the populations of frogs that remain are isolated, reducing genetic diversity and making it more difficult for the frogs to form new populations in nearby habitats.

Creating new populations by reintroducing frogs back into the wild was a key strategy in both provinces. In British Columbia, captive breeding—or head-starting—programs are considered essential. In Alberta, reintroduction efforts have involved moving eggs or releasing head-started individuals. Recovery efforts have been led by biologists from both British Columbia and Alberta provincial governments, Parks Canada, Creston Valley Wildlife Management Area, Alberta Conservation Association, Calgary Zoo, and other local consultants and conservation organizations. But reintroduction efforts are complex, and before a frog ever re-enters wild waters many things need to happen.

Reintroduction feasibility

The first step involves finding frogs to reintroduce and deciding where to reintroduce them. In Alberta, there are several wild populations that provide eggs that can be moved to new sites, but in British Columbia, there are only two sources of tadpoles: a single wild population in the Creston Valley Wildlife Management Area and a captive assurance population at the Vancouver Aquarium.

Northern Leopard Frogs need habitat that allows them to breed, find food and survive the winter. An ideal site should also be large enough for a sustainable population, be free of threats including disease, pollutants, parasites, invasive fish species and roads.



In Alberta, reintroductions have had varying success, the most successful being a site near Magrath where frogs have overwintered and reproduced every year since 2005.

Lessons learned

Reintroductions are challenging, and efforts in British Columbia and Alberta are no exception. Although leopard frog reintroductions in the two provinces are categorized as 'partially successful,' three decades of reintroduction efforts have resulted in many lessons that can help inform future conservation efforts.

For example, results from British Columbia show that annual reintroductions spanning five years may be necessary to ensure even modest success, and continued releases may be necessary until *in situ* reproduction can sustain populations. Monitoring those release efforts over the long term (for periods greater than five years) is needed to assess the success of reintroduction efforts.

Researcher Barb Houston checks water quality during acclimation of captive-bred Northern Leopard Frog tadpoles prior to release in the Columbia wetlands. Photo: Purnima Govindarajulu.



The unique sound of a Northern Leopard Frog (*Lithobates pipiens*) call was once common in the wetlands of Western Canada, but in the 1970s and 80s a widespread decline almost silenced these spotted amphibians in British Columbia and Alberta.

Also, although the presence of chytrid fungus has been implicated in Northern Leopard Frog declines and may influence the probability of success, its presence does not guarantee a reintroduction's failure. For example, even though chytrid fungus has been detected at the Upper Kootenay Floodplain reintroduction site, reintroduced Northern Leopard Frogs have been able to establish a small population.

Lastly, experience in both Alberta and British Columbia shows releasing eggs or tadpoles is more cost-effective than releasing young-of-year and also presents a lower risk of transmitting pathogens and parasites.

In spite of decades of work, the future for wild Northern Leopard Frogs remains tenuous. If we want to continue hearing the calls of these frogs in ponds across British Columbia and Alberta, it will take a concerted reintroduction effort—one that needs to continually adapt to be successful.

Priorities for Australia's most endangered amphibians

Michael McFadden, Supervisor, Herpetology Department, Taronga Conservation Society Australia



Though almost extinct in the wild, the Southern Corroboree Frog (*Pseudophryne corroboree*) has been secured in an insurance population, with reintroduction trials being undertaken. Photo: Michael McFadden.

species include the Southern Corroboree Frog (*Pseudophryne corroboree*), Northern Corroboree Frog (*P. pengilleyi*), Baw Baw Frog (*Philoria frosti*), Kroombit Tinker Frog (*Taudactylus pleione*), Armoured Mist Frog (*Litoria lorica*), Spotted Tree Frog (*L. spenceri*) and the Tasmanian Tree Frog (*L. burrowsae*). Each of the former six species is listed as Critically Endangered at a State or national level, and is still undergoing population declines, with extinction a likely result without intensive human intervention. The latter species is not yet listed, though it is in the earlier stages of chytrid-related decline.

Since the 1970s, amphibians on the east coast of Australia have suffered a wave of declines and disappearances due to amphibian chytrid fungus. Amongst the first casualties of the pathogen were two of the world's most unique species of amphibians, the Southern and Northern Gastric-brooding Frogs (*Rheobatrachus silus* and *R. vitellinus*). These species would swallow their eggs soon after fertilisation, with the larvae developing within the womb-like stomach of the female frogs until they emerged as metamorphs many weeks later. These two frogs disappeared in 1981 and 1985, along with at least four other species. Although no others have become extinct in the last decade, there are a number of species that have been driven to the brink of extinction due to ongoing declines as a result of the pathogen. However, a direction for the way forward in preventing the extinction of additional amphibian species has now been published.

A recent paper in *Wildlife Research* (see below) identified seven species in Australia that remain a high extinction risk due to chytridiomycosis and prioritized the actions required to ensure their survival. These



The Spotted Tree Frog (*Litoria spenceri*) is being successfully bred at two institutions, permitting reintroduction trials at a number of sites. Photo: Michael McFadden.

The actions highlighted to prevent the disappearance of these highly threatened species include necessary measures such as distributional surveys, intensive monitoring, precise risk assessments and active recovery programs. However, for each of these species, establishing insurance colonies, developing husbandry protocols and undertaking reintroduction and translocation trials were also listed as high priorities. Thus, without *ex situ* intervention, it is expected that the continual population decline will result in a number of these amphibian species becoming extinct.

Fortunately though, for most of these species, Australian zoos and wildlife parks have taken an active role in establishing insurance colonies, in partnership with various state wildlife agency and university partners. These zoological institutions include Taronga Zoo, Melbourne Zoo, the Amphibian Research Centre, Healesville Sanctuary and Tiddinbilla Nature Reserve. The Southern and Northern Corroboree Frogs have each been established in at least three institutions and captive breeding protocols have now been devised. This has permitted the trialing of a number of reintroduction strategies for both of these species. Successful breeding of the Spotted Tree Frog at two institutions over a number of years has resulted in translocation efforts to further investigate the threats to the species and trial chytrid mitigation measures. The Baw Baw Frog has also now been established at two institutions, where husbandry protocols are successfully being developed.



Currumbin Sanctuary in Queensland, Australia, is successfully breeding the Eungella Tinker Frog (*Taudactylus liemi*), which is an analog species for the Critically Endangered Kroombit Tinker Frog (*T. pleione*). Photo: Michael McFadden.

Although there are not yet any Kroombit Tinker Frogs in captivity, Currumbin Sanctuary has been closely working with the Eungella Tinker Frog (*T. liemi*). As this terrestrial frog genus had not been previously kept successfully, utilising the Near Threatened Eungella species as an analog has permitted the development of techniques to maintain and breed this species. Thus far, it has produced great results, with successful breeding being undertaken over a number of years. Furthermore, before the species suffers widespread declines, husbandry protocols are also being developed for the Tasmanian Tree Frog at Bonorong Wildlife Sanctuary.

The dedication of Australian zoos and wildlife parks has been a huge step forward in securing these highly threatened species. Each of the programs developed above have had successful results, have been tightly linked to *in situ* recovery efforts and have permitted numerous conservation research projects to be undertaken. However, as highlighted in the Wildlife Research paper, there is still more that needs to be done, with this largely

dependent on available resourcing. This includes establishing colonies of those species not already in captivity (e.g. Armoured Mist Frog and Kroombit Tinker Frog), ensuring all species are split between at least two biosecure facilities and undertaking additional translocation trials that may assist in buffering the species against the risk of extinction.

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FUNDAZOO supports the conservation of the Orange-eyed Tree Frog

Eduardo Bolaños and Yolanda Matamoros, Fundación Pro Zoológicos, Costa Rica

FUNDAZOO (Fundación Pro Zoológicos - the Pro Zoological Foundation) in San José, Costa Rica includes the Simón Bolívar Zoo and National Botanical Garden, and is a “green lung” in the middle of the city, which not only serves as an air purifier, but also represents a patch of forest for some species of amphibians, fish, reptiles, birds and mammals that use this park as a passage or as food and shelter site in downtown San José.

A natural lagoon found in the Zoo is home for the Orange-eyed Tree Frog (*Agalychnis annae*), which is endemic to Costa Rica, and has been listed as an Endangered species by the International Union for Conservation of Nature (IUCN). Many populations of this frog have disappeared or decreased from their original habitats, which were located in pristine areas of the humid and rainy premontane forest, however a naturally-occurring population exists in the lagoon within the zoo and botanical garden. Currently, the known populations of this frog are in urban areas of the Central Valley, mainly managed by humans, including vacant lots, gardens and coffee plantations sites.

Of all the natural populations that are known in the Central Valley, only the population in the lagoon at the zoo and botanical garden has been studied and therefore is well documented. The frogs found here are part of a remnant population that has survived in an urban, high pollution area, thanks to the efforts of the zoo to maintain and take care of the lagoon and vegetation surrounding it, enabling this, and other species to survive in a kind of natural shelter in the middle of the great urbanization of the Central Valley.

For these reasons the Simon Bolivar Zoo is an attraction not only for visitors who like to observe and learn about our animals, but also for scientists interested in the conservation and biology of endangered species. Therefore, any effort for the preservation and study of Orange-eyed Tree Frog are crucial to establishing conservation strategies and management plans for this species and their remaining populations.

The conservation and education project for the Orange-eyed Tree Frogs includes the preparation of a guide for the *ex situ* management of the species, with the collaboration of Federico Bolaños and Gerardo Chaves of the School of Biology at the University of Costa Rica; Tim Skelton from Bristol Zoo, England; Gerardo García, Curator of Small Vertebrates at Chester Zoo, England and president of EAZA Amphibian Taxon Advisory Group; Viviana Arguedas and David Sanchez, independent biologists; and Andrew Grey, Curator of Herpetology at the Museum of Manchester, England, in addition to the staff of the Pro Zoological Foundation. This work was done in collaboration with IUCN SSC Conservation Breeding Specialist Group (CBSG) Mesoamerica. This guide provides the basis for the *ex situ* work with the species as well as a compilation of existing information about the species.

The exhibition is open to the public from September 5, at the Simon Bolivar Zoo and the National Botanical Garden in San José.



Many populations of Orange-eyed Tree Frog have disappeared or decreased from their original habitats, which were located in pristine areas of the humid and rainy premontane forest.

Did you know?

- The population of Orange-eyed Tree Frogs located in the Simon Bolivar Zoo is the only natural population of this species which has been studied and documented.
- This breeding season for the frog is from May to November, and males usually sing in the hanging vegetation to attract females.
- Each nest (egg mass) contains from 45-126 eggs that hatch after 5-15 days after being laid.
- The process of metamorphosis—the transformation of aquatic larva (tadpoles) into adult frogs—for this species may take from 8-12 months in captivity.
- Adults feed on insects and tadpoles in organic matter present in the water bodies where they live.

ANNI

Agalychnis annae





A new education display and exhibit of Orange-eyed Tree Frog was recently opened at the Simón Bolívar Zoo and National Botanical Garden in San José, Costa Rica.



An egg mass from an Orange-eyed Tree Frog. Eggs are laid on leaves, branches or vines, up to 3m above water.

XI Latin American Congress of Herpetology

The Museo de Zoología QCAZ at Pontificia Universidad Católica del Ecuador is pleased to invite the scientific community interested in the research and conservation of amphibians and reptiles to the **XI Latin American Congress of Herpetology**. This event will take place between **July 24-28, 2017** in the city of **Quito, Ecuador**. For five days this congress will gather students, professionals, professors, researchers and enthusiasts at Pontificia Universidad Católica del Ecuador, one of the most prestigious universities of the country, located in the emblematic city of Quito, World Heritage Cultural Centre.



5 days
24 - 28
JULY . 2017
QUITO-ECUADOR

With **more than 1,000 species of amphibians and reptiles**, Ecuador will host this important meeting exclusively dedicated to herpetology. We will share the advances in the knowledge of biodiversity, evolution, ecology, conservation and general biology of Neotropical amphibians and reptiles.

The **XI CLH** will cover a broad scientific program including **plenary conferences, symposia, oral presentations, social events and field trips** to get to know the herpetofauna and natural wealth of the country before and after the congress.

The **XI CLH** will be an opportunity to share ideas and establish academic research collaborations.

We invite you to reserve time in your calendar to participate in this great event. Your presence will be a valuable contribution to the growth and strengthening of herpetology in Latin America.

To learn more about plenary speakers, activities, registration, important dates, among others, please visit the web site of the **XI Latin American Congress of Herpetology**.

We look forward to your participation!

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www.latinherps.ec



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