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## End of year message from the AArk team

As 2020 draws to a close we want to take this opportunity to wish all of you a peaceful and joyful holiday and a productive New Year. This past year has had both conservation positives – improvements in air quality, and decreases in CO<sub>2</sub> emissions in many parts of the world as countries went into various stages of “lockdown”; and conservation setbacks – as projects were put on hold because of those same lockdowns. Although it still will be a while before we are out from under the grip of this pandemic, we can look forward to the situation improving as the year progresses, to getting back into the field, and carrying on with interrupted projects.

AArk has tried very hard to adapt to this year’s challenges, moving all training courses online, and shifting Conservation Needs Assessments to online workshops. We’ve continued with our Conservation Grants program, awarding three start-up, one second year continuation, and one mentorship grant, and for the first time seeing real geographic diversity in our grant applications. We’ve launched and awarded the first George and Mary Rabb Fellowship, which you can read more about it in this issue of the



Newsletter. And we’ve continued to collaborate with colleagues in the Amphibian Specialist Group (ASG) on the next edition of the ACAP (Amphibian Conservation Action Plan) and in an advisory role with the Amphibian Survival Alliance (ASA).

We look forward to working with you in the coming year and continuing to provide information and updates in our Newsletters, on our website, and via social media. Please let us know how we can help you further our common goal of amphibian conservation.

Best regards,

Anne, Kevin Luis and Joe

## AArk Husbandry Document library

The Husbandry Document library on the AArk web site ([www.amphibianark.org/husbandry-documents](http://www.amphibianark.org/husbandry-documents)) currently has over 160 articles in it, with additional articles being added regularly. A new search engine has recently been installed on the Husbandry Documents page, which can now search for particular words or phrases within all pdf files. This results in much more accurate results when searching the document library for particular topics.

Two new documents have been added recently:

### **Spindly leg syndrome in *Atelopus varius* is linked to environmental calcium and phosphate availability** (English)

Spindly leg syndrome (SLS) is a relatively common musculoskeletal abnormality associated with captive-rearing of amphibians with aquatic larvae. We conducted an experiment to investigate the role of environmental calcium and phosphate in causing SLS in tadpoles. Our 600-tadpole experiment used a fully-factorial design, rearing *Atelopus varius* tadpoles in water with either high (80mg/l CaCO<sub>3</sub>), medium (50mg/l CaCO<sub>3</sub>), or low calcium hardness (20mg/l CaCO<sub>3</sub>), each was combined with high (1.74 mg/l PO<sub>4</sub>) or low (0.36 mg/l PO<sub>4</sub>) phosphate levels. We found that calcium supplementation significantly improved tadpole survival from 19% to 49% and that low calcium treatments had 60% SLS that was reduced to about 15% at the medium and high calcium treatments. Phosphate supplementation significantly reduced SLS prevalence in low calcium treatments. This experimental research clearly links SLS to the calcium: phosphate homeostatic system, but we were unable to completely eliminate the issue, suggesting an interactive role of other unidentified factors.

**Author:** Lassiter E, Garcés O, Higgins K, Baitchman E, Evans M, Guerrel J, et al.

**Publication:** 2020

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0235285>

### ***Platymantis insulatus* Action Plan** (English)

Project Palaka is the first *ex situ* amphibian conservation project in the Philippines. Our goal is to establish assurance colonies of at-risk populations and species of native Philippines amphibians, in partnership with the University of the Philippines, Los Baños. This action plan provides detail on establishing a captive colony of the critically endangered *Platymantis insulatus*.

**Author:** Norman Greenhawk and Dr. Leticia Espiritu-Afuang

**Publication:** 2019

[www.amphibianark.org/wp-content/uploads/2020/06/Ex-situ-Management-of-Amphibians-in-India.pdf](http://www.amphibianark.org/wp-content/uploads/2020/06/Ex-situ-Management-of-Amphibians-in-India.pdf)



## Progress with Project Palaka in the Philippines

**Norman Greenhawk, Project Palaka, the Philippines**

Project Palaka is the first *ex situ* amphibian conservation project in the Philippines and was awarded an Amphibian Ark Conservation Grant of US \$5,000 in 2019. Our goal is to establish assurance colonies of at-risk populations and species of native Philippine amphibians. The project began in 2015 as a Fulbright project of the author, in partnership with the University of the Philippines, Los Baños (UPLB). In addition to establishing these colonies, our goals include conducting *in situ* population monitoring of threatened species, releasing juvenile amphibians reared at our facilities back into the wild, conducting ecological educational outreach for elementary schools in the Philippines, and providing research opportunities for undergraduate and graduate students at the UPLB.

Since being awarded the grant from AArk in 2019, we had hoped to begin Phase II, with the main goal of establishing a captive colony of the Critically Endangered Gigante Wrinkled Ground Frog (*Platymantis insulatus*), in addition to captive colonies of six other *Platymantis* (using other funding sources). We had also planned on conducting field work to establish baseline populations of all target species. Unfortunately, the COVID-19 pandemic led to a nationwide shutdown in the Philippines, just as we were seeking the additional funds needed to bring the project to fruition. However, although we have not been able to undertake field work activities, we have made some progress in setting up the project and acquiring additional funding.

Our in-country partner is the University of the Philippines, Los Baños, Museum of Natural History. The UPLB MNH has provided a four-room building, the old hortorium, as facilities for Project Palaka. The room is a solid, secure concrete building that can withstand typhoons and other natural disasters. One room of the building will be entirely dedicated to Gigante Wrinkled Ground Frog. Since March 2020, Project Palaka has developed the following additional international partnerships:

- Asian Species Action Partnership (ASAP). ASAP is providing financial support, as well as guidance to Project Palaka as we begin to develop our long-term project plan.
- Synchronicity Earth (SE). Like ASAP, SE is providing financial support as well as advice and guidance.
- Wildlife Reserves Singapore (WRS). WRS will provide financial support, as well as the opportunity for husbandry capacity-building.
- The Center for Environment and Society at Washington College (CES). WAC is my alma mater, and I am honored to currently hold a designation as a research scholar at the CES. The Center for Environment and Society at Washington College has been promoting Project Palaka and helping us raise awareness and connect to alumni, other researchers, and potential future partners.

During the shutdown, I continued to network with other organizations (thanks to suggestions from AArk and IUCN), and secure funding from additional organizations. We have also finalized our Memorandum of Understanding with the UPLB MNH and are currently renovating the facility that will house the frogs, while we obtain the necessary collection permits from the Philippine Department of the Environment and



A new *ex situ* assurance colony for the Critically Endangered Gigante Wrinkled Ground Frog (*Platymantis insulatus*) will soon be established at the University of the Philippines, Los Baños, Museum of Natural History. Photo: Pierre Fidenci under the Creative Commons CC BY-SA 3.0 usage.

Natural Resources. While we are not as far along as we would like to have been, the project is moving forward. The COVID-19 pandemic has slowed the permitting processes, as many institutions are running on a 'skeleton crew', but, after being stalled for so many months, we are making progress. Once the necessary permit is secured, we will immediately conduct field work on the Gigantes Islands to collect the frogs.

In addition to the grant from AArk, Project Palaka has received additional funding to support field work activities and as stipend support from ASAP, Synchronicity Earth, and Wildlife Reserves Singapore. We are continuing to apply for further grants to help support this project. Shortly before publication, I learned that Pro-

Project Palaka staff (left to right): Norman Greenhawk, Dr. Leticia Espiritu-Afuang, Dr. Juan Carlos Gonzalez. Photo: Norman Greenhawk.







ject Palaka has been awarded a grant by the Stiftung Artenschutz Amphibian Conservation Fund for the 2021 field season.

Our goals for the next twelve months are:

1. Travel to Gigantes Island to collect thirty breeding pairs of Gigante Wrinkled Ground Frogs for the *ex situ* facility at UPLB.
2. Successfully breed the frogs in captivity.
3. Conduct a minimum of two, and maximum of three field work sessions to gather data pertaining to population counts, threat assessments, and habitat assessments.
4. Conduct educational outreach at elementary and high schools on Gigantes Islands during each visit (subject to COVID restrictions on schools).
5. Secure funding for 2022.
6. Finish non-profit incorporation process.
7. Begin the search for a long-term endowment.
8. Produce an official IUCN Species Strategy and Action Plan, along with husbandry guidelines for the Gigante Wrinkled Ground Frog.

The fieldwork and *ex situ* components (items 1,2, and 3) will be achieved via the methods put forth in our original grant application. Educational outreach (item 4) will be achieved via individual visits to schools on Gigantes. During each visit, Project Palaka

The old "Hortorium" at the University of the Philippines, Los Baños, Museum of Natural History, which is the location of the *ex situ* component of Project Palaka at the university.  
Photo: Norman Greenhawk.

staff will give a presentation about Philippine biodiversity. Funding for 2022 (item 5) will be achieved via grants that have already been applied for. If we are not awarded these grants, we will search for alternative funding sources. The non-profit registration process and finding endowments (items 6 and 7) will be achieved with professional help, including lawyers (for the non-profit incorporation) and contacts at my alma mater (for seeking endowments). The IUCN plan (item 8) will be achieved by collecting field data, and then using the expertise and guidance of AArk, ASAP, and Wildlife Reserves Singapore to produce the plan.

More information is available on the Project Palaka web site, [www.projectpalaka.org](http://www.projectpalaka.org).



## First annual George and Mary Rabb Research Fellowship

**Joseph R. Mendelson III, Scientific Advisor, Amphibian Ark and Director of Research, Zoo Atlanta, USA**

We are very pleased to present a summary of the first George and Mary Rabb Research Fellowship program. We were overwhelmed with both the number and quality of the proposals submitted. We received 42 proposals representing 24 countries, far more applications than are typical of other Amphibian Ark funding opportunities.

We are proud to announce that funding was provided to principal investigator (PI) Noemi Torres Sarango, representing the Ministerio de Ambiente y Agua, Cuenca, Ecuador. Noemi's project is entitled "Development of a loop-mediated isothermal amplification assay for detection of the causal agent of chytridiomycosis." The project will apply this alternative to traditional PCR-testing for chytrid fungi to Ecuador to help track chytridiomycosis in the wild and manage the disease in *ex situ* colonies in the country. This accurate, rapid, and less expensive diagnostic will expand capacity in the region. Additionally, working with colleagues at the University of Cuenca, will provide a professional development opportunity for Noemi.



Noemi Torres Sarango in the amphibian clinic at the Amphibian Conservation Center at Zoo Amaru where she works as a veterinarian. Photo: Zoo Amaru.



The winner of the inaugural George and Mary Rabb Research Fellowship, Noemi Torres Sarango, making a visual examination of *Cochranella erminea*.

Photo: Jaime Culebras, Photo Wildlife Tours.

tionneeds.org, CNA), or thematic research priorities indicated in the Amphibian Conservation Action Plan ([www.amphibians.org/resources/library/acap/](http://www.amphibians.org/resources/library/acap/), ACAP) will be given preference. Applicants must be formally associated with a mentor or lead scientist at a relevant university, NGO, zoo/aquarium, or other established institution. The fellowship carries a \$5,000 stipend and is open to applicants from all countries.

### About George and Mary Rabb

This fellowship honors Dr. George B. Rabb and his life-long partner Mary Rabb. From his boyhood days studying herps in Charleston, South Carolina through the remainder of his life, George was passionate about amphibians, conservation, and providing encouragement to developing scientists. A noted scientist, long-time Director of the Chicago Zoological Society, Chair of the Species Survival Commission of the International Union for Conservation of Nature (IUCN SSC), and recipient of numerous awards, George was a thoughtful, quiet, humble person. He never sought the limelight, and never cared about being right, only that the right thing was done. He played essential roles in stimulating, provoking and initiating new directions in amphibian conservation, ranging from the Declining Amphibian Populations Task Force (DAPTF), the Amphibian Conservation Action Plan (ACAP), the Amphibian Ark (AArk) and the Amphibian Survival Alliance (ASA). George was a steadfast supporter and advisor to the Amphibian Ark from its inception, and this fellowship recognizes that which George held dear.

We are very thankful to the Rabb Committee Review Panel which this year included: Dr. Joe Mendelson, Dr. Andrea Adams, Dr. Ruth Marcec, and Dr. Jennifer Stabile. We also extend thanks to Taylor Cooper for organizing the submitted proposals for the review team. The committee provided the highest rankings for proposals that represented direct professional development and technology transfer, especially in countries where fewer financial resources are available for conservation and research.

This fellowship supports early or mid-career scientists and conservationists in research-based professional development that furthers amphibian conservation. Proposals that address species research priorities indicated in the Amphibian Red List and/or the Amphibian Ark Conservation Needs Assessment ([www.conserva-](http://www.conserva-)





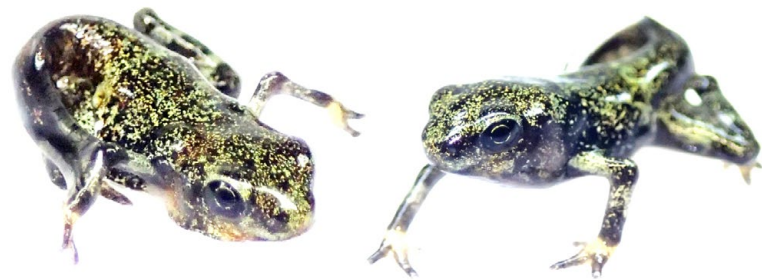
## Spindly leg syndrome is reduced by increasing calcium hardness of water used to rear tadpoles

**Elliot Lassiter and Orlando Garcés, Panama Amphibian Rescue and Conservation Project**

Rearing frogs in captivity has its own unique challenges, and one problem that has been a persistent issue in the Panama Amphibian Rescue and Conservation Project is spindly leg syndrome (SLS). This common musculoskeletal disease is mostly associated with captive amphibian breeding. SLS is a condition where legs of newly metamorphosed amphibians, with otherwise healthy and typical development, are poorly developed and cannot support the weight of the newly metamorphosed froglets. Ultimately, SLS leads to death as the animals are unable to move or feed themselves. A brief review online will reveal a host of theories and potential remedies for the condition, ranging from parental nutrition to water quality and dietary supplements, but there are very few replicated, peer-reviewed experiments identifying the cause of this disease.

As an intern with the Panama Amphibian Rescue and Conservation Project I teamed up with Orlando Garcés a graduate of the University of Panama and employee of the project to conduct an experiment primarily funded by the Morris Animal Foundation. We had observed that SLS was most prevalent in water that did not have any supplementary calcium and we knew that incoming water to our facility was very soft (lacking in calcium hardness). Inadequate bone growth is the symptom of SLS, therefore, we decided to look at the principal minerals affecting bone growth: calcium and phosphate. Tadpoles can gain calcium through their diet, but they absorb about 70% of their calcium from the water through their gills and skin. The collected calcium is then stored in endolymphatic sacs in their heads and used during metamorphosis when the tadpoles' skeletons turn from cartilage into bone and limbs begin to grow.

Elliot Lassiter and Orlando Garcés from the Panama Amphibian Rescue and Conservation Project to conduct an experiment on possible causes of spindly leg syndrome in newly metamorphosed amphibians. Photo: Brian Gratwicke.



*Atelopus varius* metamorphs, showing typical spindly leg syndrome posture (left) and normal, healthy posture (right).  
Photo: Elliot Lassiter.

We took 600 Variable Harlequin Frog (*Atelopus varius*) tadpoles and divided them into three calcium treatments (low, medium, high) and then divided those into two groups one with added phosphate and one without added phosphate. We monitored our tadpoles until they metamorphosed, at which point we looked at their legs and body posture to determine whether or not they had SLS. We found that calcium supplementation drastically increased survivorship overall and that the medium and high calcium groups had less SLS than the low calcium groups. Addition of phosphate also decreased the prevalence of SLS in low calcium treatment.

Based on the results of this study we were able to determine that SLS in harlequin frogs, is linked to an imbalance in calcium and phosphate homeostasis. Therefore, our current husbandry recommendation to reduce SLS in frogs and toads is to consider checking water hardness to determine if it is too soft. We also advise against over-feeding tadpoles which has been shown to cause an increase in SLS prevalence in another experiment. We hope that our findings can guide future SLS research and help

to lower the prevalence of SLS in captive amphibians, improving animal welfare. This research will help to improve the long-term sustainability of captive populations while we continue researching solutions for the amphibian chytrid fungus that will enable the eventual reintroduction of these frogs back into the wild.

### Reference

Lassiter, E., Garcés, O., Higgins, K., Baitchman, E., Evans, M., Guerrel, J., Klaphake, E., Snellgrove, D., Ibáñez, R. and Gratwicke, B., 2020. Spindly leg syndrome in *Atelopus varius* is linked to environmental calcium and phosphate availability. *PloS one*, 15(6), p.e0235285.



## Conservation Needs Assessments for Indian amphibians

**Kevin Johnson, Taxon Officer and Luis Carrillo, Training Officer, Amphibian Ark; and Benjamin Tapley, Curator of Reptiles and Amphibians, ZSL London Zoo, England**

For several years now, Amphibian Ark staff, and Program Officers from the IUCN Amphibian Red List Authority have co-facilitated joint Red List (RLA, [www.iucnredlist.org](http://www.iucnredlist.org)) and Conservation Needs Assessment (CNA, [www.conservationneeds.org](http://www.conservationneeds.org)) workshops for amphibians. Both types of assessments generally draw on the same groups of species experts, and holding separate workshops for each of the assessment types is not the best use of resources, such as funding to cover workshop expenses, staff time and travel costs, or use of the experts' time. The two assessment types complement each other, and when combined, give an overall picture of the history of the species, the current threat status, and priorities for various types of conservation actions which might be required to ensure each species is ultimately self-sustaining, in safe and protected habitats.

In 2018, the first joint assessment workshop was held in Penang, Malaysia, and over a five-day period, we completed CNAs for 167 species from Peninsular Malaysia and Malaysian Borneo. This joint assessment workshop was a great opportunity for both organizations to observe each other's processes, as well as the outcomes from each set of assessments. This approach to assessments was very successful, and the participants were happy to see recommendations being made for future conservation actions.

As a result of this first joint workshop, the data being collected for each of the two assessment types was compared and a single set of questions, which combine the data required for both assessments within a logical framework was prepared. In 2018 and 2019, additional joint assessment workshops were held in Honduras, Costa Rica and Papua New Guinea, with the process for each workshop being slightly tweaked to improve and streamline the joint process. The process is now working well, and we certainly plan to continue with joint workshops where the priority countries for each organization overlap.

Discussions for holding Red List and Conservation Needs Assessment workshops for Mainland South Asia had been underway for quite some time, and in late 2019, planning for holding physical assessment workshops for the region began in earnest. Unfortunately, with the arrival of the global COVID-19 pandemic, plans for a physical workshop were no longer feasible, and the focus switched to how we could hold the first joint, virtual assessment workshop. Online CNA workshops had been held in the past for a couple of quite small regions, and likewise, RLAs had previously been completed outside of physical workshops. But assessments for Mainland South Asia involved bringing together up to eighty species experts, and facilitators from four different time zones, to assess over 480 species. This would be a very large undertaking for physical workshops, but the complexity for completing these assessments was even greater since we needed to develop a new process for working in the virtual world!

Discussions between AArk staff and Amphibian Red List Authority Program Officers resulted in a plan to use the cloud-based video conferencing service Zoom, to run a series of virtual consultation sessions. Mainland South Asia was broken down into twelve different sub-regional and taxonomic groups, so that the number of species and species experts was more manageable across smaller sessions. This resulted in several smaller groups (e.g. Eastern Ghats and Central India, Islands, Caecilians), and two large groups (Western Ghats, and Eastern Himalayas and North-east). The preliminary schedule to include all of these groups was around thirty-five three-hour sessions, however the end result was more than fifty three-hour sessions!

We held an initial online Zoom meeting with all participants in August, for initial introductions, to explain the proposed virtual workshop process, and to determine a schedule that could best meet all participants' needs. This was followed by assessing two example species, so the process and questions could be explained more fully.

More than fifty three-hour online consultations sessions were required to complete Red List and Conservation Needs Assessments for over 350 amphibian species in India.





The False Malabar Gliding Frog (*Rhacophorus pseudomalabaricus*) is one of highest priority amphibian species for conservation action in India, and has been recommended for *ex situ* rescue, *in situ* conservation, further *in situ* research and for conservation education purposes. Photo: Benjamin Tapley.

Assessment consultation sessions began in late August, and ran until late October, with around fifty sessions being held. Despite a few minor teething problems with the new virtual format, the assessment sessions ran extremely well, with fantastic participation from the species experts. When possible, the sessions were scheduled to fit in with the availability of the experts, with morning, afternoon, late afternoon and evening sessions being scheduled. Over the two-month period, experts contributed to 345 Conservation Needs Assessments. Of these, fifteen still require further input from additional experts, and most of the remainder have been circulated for final review and feedback, before being approved and made available on the CNA web site, [www.Conservation-Needs.org](http://www.Conservation-Needs.org).

Although the final review is not yet complete, recommendations have been generated from most of the assessments, and they are unlikely to change a great deal after the final reviews. The preliminary results suggest:

- 75 species recommended for *ex situ* rescue
- 109 species recommended for *in situ* conservation
- 323 species recommended for *in situ* research
- 109 species recommended potential husbandry analogs
- 127 species recommended for conservation education
- 2 species recommended for supplementation

Each species can be recommended for more than one conservation action, as is shown by the figures above. Most assessments (323 or 94%) show that additional information about wild populations or their habitats is required to fully assess those species, with 75 species (22%) being recommended for *ex situ* rescue. The definitions of each of the conservation action types is available on the CNA web site, at [www.conservationneeds.org/Help/EN/ConservationActions.htm](http://www.conservationneeds.org/Help/EN/ConservationActions.htm). Some of the highest priority species for conservation action are: *Blythophryne beryet*, *Melanobatrachus indicus*, *Raorchestes jayarami* and *Rhacophorus pseudomalabaricus*.

AArk staff hope to continue working with the Indian experts to develop lists of species which potentially could be suitable for developing amphibian husbandry capacity in Indian zoos and academic institutions. Eventually the skills acquired could be used to

manage *ex situ* conservation programs for some of the species which have been recommended for *ex situ* rescue.

The most difficult aspect of the virtual workshop was probably scheduling the sessions to meet the availability of the majority of experts, but in combination with providing a format for experts to contribute to the assessments online, outside of the consultation sessions, all experts were able to contribute their knowledge. Likewise, with all assessments available for review by all experts, additional information can be contributed after the consultation sessions.

Although the virtual assessment process for Indian amphibians involved a little over two months of consultations, followed by an additional couple of months of review and finalizing, this new format of consultation via Zoom has proven to be quite successful, and will no doubt be used again over the coming year or so, until international travel is once again a safe option. There are some disadvantages of running virtual assessment workshops, which include difficulties scheduling sessions around experts' other commitments, shorter consultation times (three hours is probably the maximum that people can commit to an online call) and the lack of interactions and discussions between participants outside of the consultation sessions. However, there are definitely some advantages to virtual assessment workshops including almost no travel and accommodation costs, much lower environmental impact due to not needing to fly facilitators and experts to a central location and the ability to include a much larger group of experts during the consultations. These factors will be considered for future assessment workshops on a case-by-case basis.

### Acknowledgements

We would like to thank the following experts who participated in the Conservation Needs Assessments:

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## Developing a conservation breeding network for threatened Vietnamese Crocodile Newts

**Thomas Ziegler, Anna Rauhaus, Christian Niggemann and Joana Nicolaudius, Cologne Zoo, Germany; Marta Bernardes, Cologne University, Germany; and Truong Quang Nguyen, Institute of Ecology and Biological Resources, Vietnam Academy of Science and Technology, Vietnam**

The Vietnamese Crocodile Newt (*Tylototriton vietnamensis*) was described fifteen years ago (Böhme et al. 2005). This salamander species is endemic to northern Vietnam where it is known only from three localities (Bernardes et al. 2020). It inhabits evergreen lowland forests and was uplisted from Near Threatened to Endangered in the IUCN Red List (IUCN 2016). In the Vietnam Red Data Book (Tran et al. 2007) it is likewise listed as Endangered.

Two years ago we reported about the first successful reproduction of the Vietnamese Crocodile Newt in captivity (Rauhaus et al. 2018). Initially, a few larvae were transferred from the Me Linh Station for Biodiversity in North Vietnam to the Terrarium section of the Cologne Zoo in Germany, to share assurance colony resources and to build up an additional breeding approach abroad. Within a Vietnamese-German cooperation frame, we have jointly built indoor and outdoor amphibian and reptile facilities at the Me Linh Station in order to combine husbandry and breeding of threatened and poorly-known species with research and conservation measures, as well as housing and releasing rescued, mostly confiscated animals (Ziegler et al. 2016). The Me Linh Station belongs to the Institute of Ecology and Biological Resources in Hanoi.

Of the four larvae sent to the Cologne Zoo in 2013, only two survived the first year. Fortunately, these two remaining individuals developed well and turned out to be a male-female pair, which finally successfully reproduced (Rauhaus et al. 2018).

This report is an update about what has happened since then regarding the growth of a conservation breeding network for this and other threatened Vietnamese Crocodile Newt species at the Cologne Zoo.

The first clutch of the Vietnamese crocodile newt was laid in March 2018 and comprised about 100 eggs. From these, sixty larvae hatched, and finally fifty developed into terrestrial newts. After this first breeding success, in 2019 another reproduction event happened between the established breeding pair. However, due to an aspergilliosis (*Aspergillus niger*) infection, introduced through



Offspring of the Vietnamese Crocodile Newts (*Tylototriton vietnamensis*) at Cologne Zoo. Photo: Thomas Ziegler.

Tubifex worms, breeding success was low that year, resulting in only nineteen terrestrial newts. Most interestingly, in 2020 the first F1 offspring became mature after only one and a half years, and started to reproduce F2 clutches, resulting in a total of 160 terrestrial F2 newts. To date 229 terrestrial Vietnamese Crocodile Newts have been reared at the Cologne Zoo, and we still have around forty aquatic larvae at the Terrarium section, which will soon become terrestrial.

Of the Vietnamese Crocodile Newts reared between 2018 and 2020, twenty were transferred to other institutions and breeders throughout Europe to build up a stable conservation breeding network. Thirty others were provided to Citizen Conservation, a program initiated by "Frogs & Friends" ([www.frogs-friends.org/en/](http://www.frogs-friends.org/en/)) which enables private individuals to participate in conservation breeding networks (see [www.citizen-conservation.org/?lang=en](http://www.citizen-conservation.org/?lang=en)).



Repatriation of the Vietnamese Crocodile Newts - packing the animals at the amphibian breeding room in the Terrarium section of Cologne Zoo in Germany. Photo: Thomas Ziegler.



180° view of the new salamander breeding room in the Terrarium section of Cologne Zoo. Photo: Christian Niggemann.





Breeding pair of the Laos Warty Newt (*Laotriton laoensis*) at Cologne Zoo.  
Photo: Thomas Ziegler.

At the end of 2019 the first offspring of the Vietnamese Crocodile Newts bred in the Cologne Zoo were able to be sent back to Vietnam. They were welcomed back by the Me Linh Station and are now available for future restocking, and fortunately, both the F1 offspring sent back to Vietnam and those provided to Citizen Conservation participants have already successfully reproduced.

To avoid inbreeding processes, we have received a new genetic lineage of the Vietnamese Crocodile Newt. This was made possible with the collaboration of Prof. Dr. Frank Pasmans from Ghent University in Belgium, from whom we have also received offspring of Ziegler's Crocodile Newt (*Tylototriton ziegleri*) in the past.

However, the Covid outbreak affected our plans to fully implement the One Plan Approach, which is supported by the IUCN and aims to develop integrative strategies to combine *in situ* and *ex situ* measures with groups of experts, for the purpose of species conservation. After the very positive development of the conservation breeding network we had plans to combine that with conservation activities in Vietnam. Within the frame of a master's thesis and as a continuation of the dissertation project of one of the authors (Marta Bernardes), status and condition of known wild sites and the status of existing Vietnamese Crocodile Newt populations should be investigated. This will also act as groundwork for potential future release and restocking measures through surplus animals from the Me Linh Station and from the Cologne Zoo, respectively. However, this well-planned timeline was not able to be followed, as the pandemic did not enable field work in 2020. We hope to proceed with the conservation-based field research at the next opportunity.

Based on population and threat analyses conducted in the frame of the above mentioned dissertation, which was funded by Cologne Zoo, the German Society for Herpetology and Herpetoculture (DGHT), the European Association of Zoos and Aquaria (EAZA) and Stiftung Artenschutz, we are aware of the severe fragmentation and vulnerability to further degradation that the natural habitats of Vietnamese Crocodile Newts are experiencing in the wild (Bernardes et al. 2013; Bernardes et al. 2017a). In addition, this and other species of the *Tylototriton* genus are known to be collected for use in traditional medicine, and are sold in the national and the international pet trade, adding unsustainable harvesting as another threat factor for the species (IUCN 2016). As a consequence, the Vietnamese Crocodile Newt, all *Tylototriton* congeners, the warty newts (*Paramesotriton* species) and most of the spiny newts (*Echinotriton* species), were officially

included in 2019 in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

In a recent manuscript, *Amphibians in zoos: a global approach on distribution patterns of threatened amphibians in zoological collections* (Jacken et al. 2020) we demonstrated that amphibian holdings in zoos still consist of too many unprotected species and as a response to this alarming matter, we have adjusted amphibian keeping at the Terrarium section of the Cologne Zoo. Some years ago, we began to systematically develop holdings and conservation projects for threatened amphibian and reptile taxa at Cologne Zoo's Terrarium, Aquarium and Insectarium sections (Ziegler 2020). At that time we kept more than thirty amphibian species, with about half of them already successfully bred, along with a substantial number of threatened taxa with a focus on

Southeast Asian species, in particular salamanders. Only recently we have developed a breeding facility for threatened Indochinese salamanders, among them the endemic Laos Warty Newt (*Laotriton laoensis*), which suffered an estimated 50% population decline in the last decade and has an Endangered IUCN Red List status (IUCN 2014); the Vietnam Warty Newt (*Paramesotriton deloustali*), with natural populations and habitat quality in decline (IUCN 2017a) and which was recently included with its congeners in CITES Appendix II; and the Ziegler's Crocodile Newt (*Tylototriton ziegleri*), another species discovered in North Vietnam which is included in the IUCN Red List as Vulnerable (IUCN 2017b).



Offspring of the Vietnamese Warty Newt (*Paramesotriton deloustali*) at Cologne Zoo. Photo: Thomas Ziegler.

Currently we are rearing the first offspring from our Vietnam Warty Newts with twenty-five terrestrial juveniles from the years 2019 and 2020 produced so far. The Ziegler's Crocodile Newts laid approximately eighty-five eggs for the first time in late August 2020. This reproductive success has resulted in about forty larvae, which are starting to move onto the land, and on 17th November, the first terrestrial newt was observed after only two months of larval stage. The larval development and breeding ecology of this species was already studied by our team in





the field (Bernardes et al. 2017b) as well as the first research on longevity (Ziegler et al. 2018). Now our group is focusing on *ex situ* reproduction. We have already observed some differences related to rearing Vietnamese Crocodile Newts such as Ziegler's Crocodile Newt larvae being more territorial, and intraspecifically more aggressive. Finally, we likewise aim to build up a conservation breeding network for this species similar to the successful program for Vietnamese Crocodile Newts.

Taking into account that the network that has been developed for the Vietnamese Crocodile Newt and the large number of offspring reared and available, we consider this conservation breeding program to be a success. Being still endangered in the wild, at least a stable population in human care was built up and by doing so an assurance colony established for this species. There is still surplus Vietnamese Crocodile Newts available for other zoos or Citizen Conservation attendees who would like to participate in the conservation breeding network.

We now hope to be able to proceed without further delays, with our ecological and population status analyses in the field in northern Vietnam. This is essential research for basic conservation measures and for improved zoo keeping, as we can attest based on our experience and successful breeding results with Vietnamese Crocodile Newts at the Cologne Zoo.

Unfortunately, as in many amphibian taxa, the taxonomy of the group is still poorly resolved. However, this knowledge is crucial for proper conservation measures as well as appropriate breeding programs of pure newt stocks. In the past, the Black Knobby Newt (*Tylototriton asperrimus*) was believed to have a wide distribution range resulting in a low threat level if at all. Subsequently, a num-

Aquaria for Laos Warty Newt (*Laotriton laoensis*) (top) and *Paramesotriton deloustali* (bottom) in the new salamander breeding room in the Terrarium section of Cologne Zoo.  
Photo: Anna Rauhaus.

ber of new species have been discovered in the frame of integrative taxonomic analyses, among them the Vietnamese Crocodile Newt (Böhme et al. 2005), Ziegler's Crocodile Newt (Nishikawa et al 2013) and *Tylototriton pasmansi* and *Tylototriton sparreboomi*, which were both only described this year (Bernardes et al. 2020). Thus, the Black Knobby Newt meanwhile has become range restricted in Southeast China and is certainly more threatened than previously thought.

The One Plan Approach is successfully being implemented, both in-country in Vietnam and within the international conservation community. Application of species distribution modelling in concert with ecological *in situ* research has identified further suitable habitat for this species in northern Vietnam, although further potential habitats were very fragmented and mostly lacking protection. Continued threat assessments documented habitat loss and degradation, and also after analyses of trade, the species has received international protection status (e.g., CITES). We have continuously invested in improving the knowledge on this species' natural history, ecology and habitat requirements, and based on this information, we were finally able to successfully breed the Vietnamese Crocodile Newt. We have provided surplus captive-bred animals to other zoos, institutions and Citizen Conservation participants (mitigating the number of wild-caught animals and trade and preventing



the spread of diseases) and have provided support for the capacity building and breeding program in Vietnam. But there is still much to be done in facing the global amphibian crisis and the number of data deficient and threatened taxa, and the time to address this is now.

Cologne Zoo is partner of the World Association of Zoos and Aquariums (WAZA) with Conservation Projects 07011 (Herpetodiversity Research - To study the diversity and ecology of amphibians and reptilians in Vietnam and Laos), and 07012 (Amphibian and Reptilian Breeding and Rescue Stations - To establish and maintain breeding and rescue stations for amphibians and reptilians in Vietnam).

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Juvenile Vietnamese Crocodile Newts at the Cologne Zoo from 2018 (left) and 2019 (right). Photo: Thomas Ziegler.



## The El Rincon Stream Frog *ex situ* center during 2020: a difficult year that is ending with good news

Federico Kacolis and Melina Velasco, Wild Plateau Initiative, La Plata Museum, Argentina

2020 was a memorable year in all sorts of ways. The COVID-19 pandemic and the following quarantine, did not only affect peoples' lives but also impacted many conservation projects, including *ex situ* and reintroduction programs. This was the case for the *ex situ* program for the El Rincon Stream Frog (*Pleurodema somuncurense*) at the University of La Plata in Argentina, which maintains a survival colony of this Critically Endangered and microendemic amphibian. Started in 2015 with help from the Amphibian Ark, this *ex situ* center achieved successful breeding of this frog, and the subsequent reintroduction of several froglets into a restored habitat where a subpopulation of this species had gone extinct. These froglets thrived in their new wild habitat and are now fully established as a new and viable subpopulation.

The second step of this reintroduction program was scheduled for the beginning of 2020 when we planned to reintroduce new froglets that were born in the *ex situ* center in 2019 into another area of restored habitat. However, quarantine restrictions related to the COVID-19 pandemic upset this plan and the froglets remained within the *ex situ* facilities, as it was not possible for them to be reintroduced in the wild during that period. Due to the high number of individuals in the center, which exceeded the carrying capacity of our facilities, most of the new froglets were lost due to overcrowding. Unfortunately, this center is not able to hold all the individuals produced in captivity. Its goal is to keep a survival colony and to support the recovery program of this species in the wild by reintroducing the captive-bred individuals.

Even with the difficulties related to COVID-19 restrictions, we were able to create a lot of new aquariums and extreme biosecurity measures inside the facilities, adding new technologies such as better water filters and UV germicide filters to treat the aquarium water. Additionally, we received advice from the Amphibian Ark staff, who helped us to initiate a preventive treatment of the frogs (based on the anti-fungal drug Itraconazole and some antibiotics) to mitigate any potential disease that could arise due to the overcrowding. This management allowed us to achieve a high survival rate among the breeding colony and to keep several of the froglets that were born in 2019 safe. After several weeks



Even with the difficulties related to COVID-19 pandemic restrictions, we were able to create a lot of new aquariums inside the *ex situ* facilities. Photo: Federico Kacolis.



Second generation captive-bred El Rincon Stream Frog (*Pleurodema somuncurense*) eggs, which were laid in November this year. Photo: Federico Kacolis.

of hard work, we concluded that the frogs in our laboratory were healthy enough.

In early November we received some good news, with the frogs reproducing again in the breeding facilities. A clutch of eggs was produced by the original frogs that were collected from the wild (the founder individuals), and then we obtained a second clutch of eggs, from individuals which were born in captivity in 2018. These eggs represent the first, second-generation *ex situ* reproduction of El Rincon Stream Frogs. Our further observations concluded that this second generation of eggs was viable and resulted in healthy tadpoles. This news is important in relation to the natural history of this species and the goals of the *ex situ* program since a reproductive first generation and a viable second generation of individuals ensure that the *ex situ* population can be maintained, even when the founders are lost due to their advanced age. It also helps us increase our knowledge about the natural history and sexual maturity of this species.

The end of 2020 finds us in a good situation to continue with the conservation activities for the El Rincon Stream Frog. We have already started all the necessary measures to prepare some of the individuals which were hatched in November of 2020, with the goal of reintroducing them to the wild. This will be the third reintroduction of individuals of this species born in captivity, into a restored habitat. If successful, this reintroduction will represent the second subpopulation of this endangered frog, re-established in its wild habitat. We are very happy about the progress of our conservation program and enthusiastic about future events. Finally, we want to acknowledge the advice given by the Amphibian Ark Team, who helped us to keep going forward during these hard times.



## Kroombit Tinkerfrogs breed successfully at Currumbin Wildlife Sanctuary for the first time

**Ed Meyer, Kroombit Tinkerfrog Captive Breeding Team, Australia**

In early November 2020, staff at Currumbin Wildlife Sanctuary, Queensland, Australia, celebrated the emergence of the first Kroombit Tinkerfrog (*Taudactylus pleione*) metamorph bred in captivity. This achievement represents a significant step forward in efforts to save this Critically Endangered species from extinction.



A captive male and female Kroombit Tinkerfrog (*Taudactylus pleione*) at Currumbin Wildlife Sanctuary. Photo: Michael Vella.

Found in only a handful of rainforest patches at Kroombit Tops National Park (approximately 70 km south-west of Gladstone), the Kroombit Tinkerfrog is part of an ancient lineage of frogs in the Queensland-endemic genus *Taudactylus*. Frog species in this genus suffered catastrophic declines during the 1970s, 1980s and early 1990s due to the emergence of amphibian chytrid fungus, and three out of six *Taudactylus* species are now considered to be extinct. Ongoing declines in the number of Kroombit Tinkerfrogs since the 1990s have raised concerns about the future survival of this species, which is threatened by amphibian chytrid fungus, climate change, and habitat degradation by feral pigs and horses.

Staff working in the dedicated tinkerfrog breeding facility at Currumbin Wildlife Sanctuary. Photo: Ed Meyer.



Captive breeding of Kroombit Tinkerfrogs for release into the wild is one of a number of strategies aimed at halting and reversing the decline of this species. Successful breeding and maintenance of Kroombit Tinkerfrogs in captivity has presented a number of challenges, due to the scarcity of animals in the wild and our limited knowledge of the breeding biology of this species (with eggs and larvae of the Kroombit Tinkerfrog having never been found in the wild). For these reasons, husbandry techniques applied successfully to the Kroombit Tinkerfrog were first developed using a more common, analogue species – the closely-related Eungella Tinkerfrog (*Taudactylus liemi*).

The first successful breeding of Kroombit Tinkerfrog early in 2020 and recent emergence of the first captive-bred metamorph frog brings us one step closer to our ultimate goal of reintroducing captive-bred animals into the wild. This recent success is the culmination of many years of hard work by Currumbin Wildlife Sanctuary staff, past and present, beginning with the establishment of a dedicated frog breeding facility at the Sanctuary in 2008, largely through the efforts of former Currumbin Wildlife Sanctuary staffer Matt Hingley. Since then, Sanctuary staff have worked collaboratively with frog experts Dr Ed Meyer, Harry Hines (Queensland Parks and Wildlife Service) and Professor Jean-Marc Hero (formerly of Griffith University) to develop husbandry techniques for breeding and maintaining Kroombit Tinkerfrogs in captivity, including the safe and effective treatment of wild-caught animals for amphibian chytrid fungus. These techniques have now been applied successfully to the Kroombit Tinkerfrog resulting in the emergence of the first (and hopefully many more) captive-bred metamorphs.



Captive female Kroombit Tinkerfrog with eggs at Currumbin Wildlife Sanctuary. Photo: Michael Vella.



## Distribution patterns of threatened amphibians in the zoo and aquarium community and a call for action

Thomas Ziegler, Cologne Zoo, Germany

In a scientific paper recently published in the International Zoo Yearbook, Ariel Jacken from Leipzig Zoo in Germany, Dennis Rödder from the Zoologisches Forschungsmuseum Alexander Koenig in Bonn, Germany and Thomas Ziegler from the Cologne Zoo, Germany, investigated zoo databases for threatened amphibian holdings. A decade after the Amphibian Ark and the European Association of Zoos and Aquaria launched the 'Year of the Frog' campaign, the results of this study suggest a need for a stronger response from zoos to the global amphibian crisis to fulfill their self-imposed goal of regarding themselves as key players in both *in situ* and *ex situ* conservation.

In this recent study, the emphasis was on *ex situ* conservation and the investigation of the amphibian species selection in public zoological collections on a global scale. Anurans made up the largest taxon in collections (76%), followed by caudates (22%) and caecilians (2%). In total, only about 7% of known amphibians (540 species) were represented in zoos. The order Caudata was the best represented, with 121 of 695 (17.4%) species kept in zoological collections and with Salamandridae being the most common family found in zoos. Of the 6,758 anurans, 411 species were kept in zoos (6.1%). In contrast, caecilians appeared to be grossly under-represented, with only eight species of the 205 total (3.9%) found in zoos. Given the global species diversity of amphibians, and with more than 8,000 species currently known, this result indicates a rather poor presence. More than 10% of species kept in zoos were represented by a single specimen, and only 10.4% were kept in sufficient numbers and in several collections.

Thus, although amphibians are the most threatened vertebrate class, with 41% being threatened with extinction, globally threatened amphibians still play a subordinate role in zoos and their appearance is often restricted to a single collection (44.3%). Only 4.3% of the amphibian species which are recommended by the Amphibian Ark for *ex situ* conservation are known to be in global zoo collections. Despite the overall perception that the global zoo community, with few exceptions, has failed to establish and maintain breeding populations of threatened amphibians, it is essential to note that the underlying analysis was a broad and global approach to investigate the overall response to the amphibian crisis. Undoubtedly, some zoological institutions have gained a lot of experience in terms of research, husbandry expertise, reproduction and *in situ* and *ex situ* conservation, as well as public education. However, to date, the response to establish conservation breeding programs for threatened amphibian species by the zoo and aquarium community has been too weak and too slow.

Almost three-quarters of amphibian species in zoos and aquariums were not threatened in the wild and, thus, had no direct *ex situ* conservation impact.

To gain further understanding of focal areas of amphibian diversity in zoos, a species richness analysis was performed for all species kept in zoos, which revealed strong regional differences in terms of coverage and foci. Large numbers of zoos in North America and Europe appeared to be of great importance for a number of species, with many of them from tropical regions. This result offers a strong argument against the formulated claim that zoos in general should restrict their population planning and species selection to native species only. Partnerships established by European and North American zoos with partners in the tropics have helped to improve *in situ* research as well as developing *ex situ* measures. Phasing out exotic species in a regional collection plan and focusing exclusively on native species helps to boost native biodiversity, and might work in a region such as Australia; however, such a policy might have disastrous consequences if applied in regions such as Europe and North America. The highest number of species facing extinction occurs in the tropics where there is a comparatively low density of zoos and aquariums that are equipped to respond to the amphibian crisis. Thus the role of North American and European zoos in maintaining amphibian collections of global importance was highlighted, as they revealed to have a high capacity in terms of holding space and knowledge in husbandry and breeding amphibians from different taxa and zoogeographic realms, thus providing an important keeping and breeding network for tropical species.

However, the distribution of these institutions does not match the distribution of most amphibian species in need of *ex situ* rescue. A stronger shift of zoos towards managed conservation breeding of threatened amphibians and expansion of the cooperation with local partners in the countries of origin will help to enforce the response of zoos to the amphibian crisis. Further, a shift from keeping common species to managing threatened taxa is recommended in a coordinated framework. A better representation and higher number of threatened taxa in human care, a growing number of conservation breeding programs, and more cooperation with local partners (breeding centers and universities) should be utilized to invest in targeted threatened taxa and extend breeding groups and their offspring in zoos. A closer cooperation of zoos, research institutions and private breeders within the framework of programs such as Citizen Conservation ([www.citizen-conservation.org/?lang=en](http://www.citizen-conservation.org/?lang=en)), in conjunction with taxonomic specialist groups

was recommended and assumed to be beneficial for all contributing parties. Existing focuses in amphibian collections in zoos and cooperation with specialized breeding centers in the area of origin should be utilized.

In this study, only zoo databases were investigated, thus the focus was on amphibians in zoos. There are also a number of successful *ex situ* amphibian conservation programs in organizations other than zoos such as

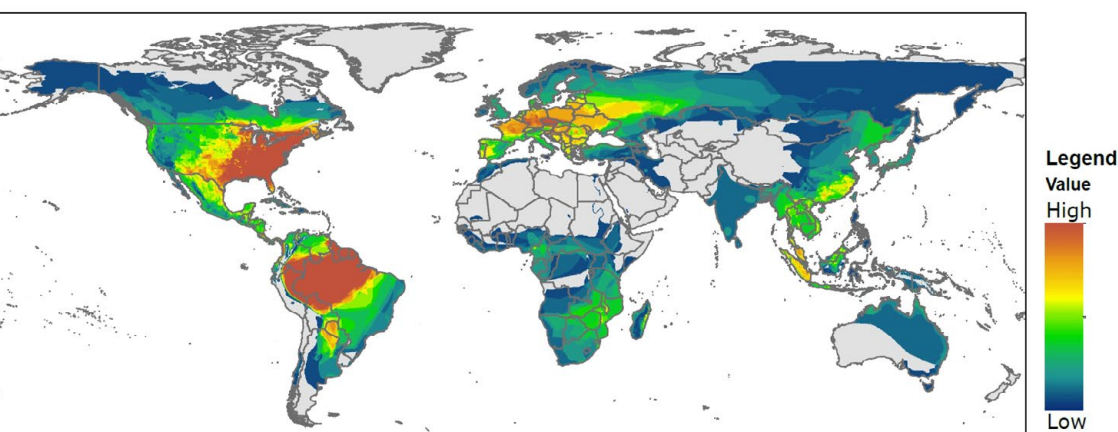


Figure 1. Distribution of amphibian species in European and North American Zoos (maximum richness: 41 species).



universities, museums, privately-managed conservation organizations etc. (e.g., <https://progress.amphibianark.org/progress-of-programs>). This is particularly true in Central and South America, where these programs partly counterbalance the low representation of amphibians in local zoos. These include many species which have been recommended for *ex situ* rescue via Conservation Needs Assessments, which are being maintained, bred, and in some cases reintroduced back to the wild.

The aim of the recently published approach was to encourage zoos to reconsider the application of their facilities, time and commitment beyond show exhibits and environmental education. Zoos can certainly play a key role in amphibian conservation by providing their expertise, capacity and specialized facilities for

research and conservation breeding of threatened amphibians in terms of the One Plan Approach supported by the IUCN, as some zoos are already doing. But this is a great chance for more zoos to join in because now is the time for action to face the global amphibian crisis.

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Jacken, A., Rödder, D. & Ziegler, T. 2020. Amphibians in zoos: a global approach on distribution patterns of threatened amphibians in zoological collections. *International Zoo Yearbook* 54: 1–19, DOI:10.1111/izy.12272.

## Editorial note:

From its beginning the Amphibian Ark has been committed to the concept that amphibian assurance colonies should be established in the country or countries in which the species is found. These ideals are also recommended in the Amphibian Conservation Action Plan (ACAP, [www.iucn-amphibians.org/wp-content/uploads/2018/12/ACAP\\_2007.pdf](http://www.iucn-amphibians.org/wp-content/uploads/2018/12/ACAP_2007.pdf)) and supported by the IUCN ASG Conservation Breeding Working Group ([www.iucn-amphibians.org/working-groups/thematic/captive-breeding/](http://www.iucn-amphibians.org/working-groups/thematic/captive-breeding/)). The Conservation Needs Assessment process identifies those species that are a high priority for assurance populations within a country or region. Zoos, aquariums, and other organizations that are outside of range countries can help in many ways, by providing expertise, training, and/or funding to assist facilities in range countries. While there may be instances in which special research efforts are needed that require the establishment of a population outside of the range country, every effort should be made to develop and support this capacity within the range country.

## Conservation Needs Assessments for Brazil

**Cybele S. Lisboa, Iberê F. Machado, Luis F.M. da Fonte and Débora L. Silvano, IUCN Amphibian Specialist Group, Brazil; Kevin Johnson and Luis Carrillo, Amphibian Ark**

During 2020, an important step was taken to advance strategic planning for the conservation of amphibians in Brazil. Despite the sad global scenario we are experiencing due to the COVID pandemic, we had an opportunity to use the AArk's Conservation Needs Assessments (CNA) process to assess all endangered Brazilian amphibian species, as well as other species which are in critical situations, but their levels of threat have not yet been evaluated. Using the CNA process, we were able to identify and prioritize conservation actions for each species, which may or may not include *ex situ* management. This process was conducted jointly by the IUCN SSC Amphibian Specialist Group (ASG Brazil) and Amphibian Ark, with support from the Brazilian government agency "Centro Nacional de Pesquisa e Conservação de Répteis e Anfíbios do Instituto Chico Mendes de Conservação da Biodiversidade" (RAN/ICMBio, National Center for Research and Conservation of Reptiles and Amphibians of the Chico Mendes Institute for Biodiversity Conservation), which provided the database with essential information about Brazilian amphibian species.

The logistics for the Brazilian assessments were conducted taking into account several aspects about our country, from the magnitude of size, to regional differences, and also the work that has already been done by RAN/ICMBio in relation to developing national action plans. Accordingly, we opted to form working sub-groups, dividing the species and participants by region, which resulted in four groups: South, Southeast, Northeast and Midwest/North. In total, sixty-seven species were evaluated and to carry out the evaluations, ASG Brazil invited more than sixty experts, from different locations and specialties, including academics, researchers, students and members of government agencies.

The assessments took place between August 17 and 21, in a



*Boana buriti* is one of the highest priority species identified during the Conservation Needs Assessments for Brazil. The main threats for this species include conversion of native areas by mechanized agriculture, reduction of the water table level by using water for agriculture, underground fire in peat soil locations in veredas areas, habitat loss due to land use, and the potential effects of climate change. Photo: Reuber Brandão.

series of online meetings using Zoom, an online video conferencing service, which were facilitated by AArk Training Officer, Luis Carrillo, and by members of ASG Brazil (Cybele S. Lisboa, Iberê Machado, Luis F. Marin



da Fonte and Débora Silvano) and by Luis F. Toledo from the University of Campinas. Additionally, some species were assessed after the workshops, when other specialists were identified and invited to complete the process. Therefore, the evaluation work ended in early November 2020.

In general terms, the process had several positive aspects. Although in-person meetings can be more productive and less tiring, virtual meetings have brought other opportunities, such as the ability to include a large number of specialists, and working according to the availability of those involved, rather than being limited to a specific timeframe. During the CNA workshops, we also noticed a great involvement of specialists in contributing to the process, who highlighted that the results of their research are being used in practice, serving as a basis to elaborate conservation strategies for threatened species. Another positive point was the way we conducted the work by region, both to facilitate discussions and to direct future actions to the national action plans of the RAN/ICMBio, which are also divided regionally and whose coordinators also participated in the workshops. Finally, an important aspect was the involvement of ASG Brazil in the CNA workshops, because, it is connected with the country's scientific and government community, and this facilitated the integration of key stakeholders into the process.

The results of the assessments are currently being reviewed by ASG Brazil and the species experts and will be shared soon on

the CNA website ([www.conservation-needs.org](http://www.conservation-needs.org)).

We would like to thank the following experts who contributed their time and knowledge to the assessments: Adrian Antonio Garda, Albertina Pimentel Lima, Ana Maria Paulino Telles de Carvalho e Silva, Ariadne Fares Sabbag, Barnagleison Lisboa, Carlos Eduardo Guidorizzi de Carvalho, Carlos Roberto Abrahão, Caroline Zank, Christine Strüssmann, Cinthia Aguirre Brasileiro, Clodoaldo Lopes de Assis, Daniel Cassiano Lima, Déborah Praciano de Castro, Délio Pontes Baêta da Costa, Diego José Santana Silva, Elaine Maria Lucas Gonsales, Eliza Maria Xavier Freire, Fabio Perin de Sá, Felipe Sá Fortes Leite, Fernanda de Pinho Werneck, Filipe Nascimento, Geraldo Jorge Barbosa de Moura, Itamar Martins, Izabela Menezes Barata, João Luiz Gasparini, Leandro João Carneiro de Lima Moraes, Leo Ramos Malagoli, Luciana Barreto Nascimento, Luís Felipe de Toledo, Luiz Fernando Ribeiro, Marcelo Duarte Freire, Marcelo Felgueiras Napoli, Marcelo Gordo, Márcio Borges Martins, Marcio Roberto Costa Martins, Michelle Abadie de Vasconcellos, Mirco Solé Kienle, Moacir Santos Tinoco, Patrick Colombo, Pedro Luiz Vieira Del Peloso, Rafael F. Jorge, Reuber Albuquerque Brandão, Robson Ávila, Rodrigo Barbosa Ferreira, Rodrigo Lingnau, Selvino Neckel de Oliveira, Sérgio Potsch de Carvalho e Silva, Thaís Barreto Guedes da Costa, Tiago Quaggio Vieira and Victor Goyannes Dill Orrico.

Participants in the online Zoom meeting for developing Conservation Needs Assessments for endangered amphibians from the Southeast region of Brazil. Photo: Cybele Lisboa.





## A vision realised

**Josh Brown, Assistant Manager Native Fauna and Domestic Animal, Orana Wildlife Park, New Zealand**

Now that the new Amphibian House has opened at Orana Wildlife Park in New Zealand, the main focus of zoo staff has been how to drum up public interest in this key new exhibit. One side of the Amphibian House is a dedicated laboratory facility specifically designed to focus on breeding endangered Maud Island Frogs (*Leiopelma hamiltoni*). The main issue is that these special native frogs are both cryptic and nocturnally active and therefore rather unlikely to be spotted by the public visiting during daylight hours. To counter this, the other side of the Amphibian House, which is maintained separately to reduce the risk of disease spread to the Maud Island Frogs, has been populated with an array of attractive exotic amphibians to draw our visitors in.

The drawback appeal of these decidedly more alluring exotic amphibians, including Chinese Fire-bellied Newts (*Cynops orientalis*), Axolotls (*Ambystoma mexicanum*), tree frogs, and Southern Bell Frogs (*Litoria raniformis*), works especially well to capture attention and allow for learning opportunities. Interpretation around the Amphibian House compares and contrasts exotic amphibians to our native frogs and teaches visitors about the ways that introduced species can wreak havoc on native ecosystems. One of the key educational aims for the facility is to encourage the public to get involved in 'Predator Free 2050', the New Zealand government's ambitious goal to eradicate introduced predators from the country so that native species like the Maud Island Frog (which currently only survives on predator-free offshore islands) can survive and thrive on the mainland once again. Traps are available for purchase in the Zoo Shop allowing visitors to get involved in conservation initiatives by trapping predators like rats and mice in their own backyards so that they can play an active role in protecting New Zealand's indigenous species from the threat of predator-induced extinction.



One side of the Amphibian House at Orana Wildlife Park in New Zealand is a dedicated laboratory facility specifically designed to focus on breeding endangered Maud Island Frogs (*Leiopelma hamiltoni*). Photo: Orana Wildlife Park.

Already in the short time it has been open, we have seen some exciting media interest in the Amphibian House. Such interest can often be hard to attract for small amphibians that aren't always considered as eye-catching as some of our more charismatic megafauna. The public reaction has similarly been excellent with visitors crowding the facility; sharing amphibian photos and tank setup pictures on social media groups; and school groups coming in to spend time in there as well. We hope to channel this increased visitation into a greater awareness and knowledge of the importance of our somewhat underappreciated amphibian species combined with a greater desire to protect them.

The other side of the Amphibian House, which is maintained separately to reduce the risk of disease spread to the Maud Island Frogs, has been populated with an array of attractive exotic amphibians including Fire-bellied Newts (*Cynops orientalis*) (left) and Southern Bell Frogs (*Litoria raniformis*) (right), to draw our visitors in. Photos: Orana Wildlife Park.





## The Mucuchíes Frog - an example of integrative conservation

Enrique La Marca, Rescue of Endangered Venezuelan Amphibians Conservation Center, Mérida, Venezuela



When one speaks of an amphibian species that is less than 25mm in total length, many might think that it is insignificant for conservation in a region. However, an example in the Venezuelan Andes can reveal to us how intricate the interactions derived from the conservation of a species can be.

The Mucuchíes Frog (*Aromobates zippeli*) was described relatively recently for science (in 2012) and its name has always been linked to Amphibian Ark, which has financially supported its research and conservation. It is through the Rescue of Endangered Venezuelan Amphibians (REVA) Conservation Center that the conservation status of this IUCN Critically Endangered species was redefined and that a captive breeding program was initiated that seeks to rescue it from extinction. In parallel to this initiative for the species, we have activated two additional programs at REVA that all together constitute the starting point of a project that we call "Integrative Conservation".

By Integrative Conservation we understand conservation directed at three levels: *ex situ* conservation, *in situ* conservation and community empowerment. *Ex situ* conservation (from the Latin "*ex situ*", outside the place, site, or location) is supported by breeding and reproduction in captivity, outside the natural habitat, to maintain a reserve of specimens and genetic diversity that guarantees the continuity of the species. Ideally it would serve for reintroduction and restocking purposes and, in worst cases, to preserve the species in captivity if it becomes extinct in the wild. Since 2018 we have maintained a captive breeding program for the Mucuchíes Frog, with successful reproduction. At the beginning of November 2020, we released the first captive-bred specimens in the field, for repopulation purposes, in a place within the Hacienda Moconoque where we discovered the species for the first time at the end of the 1980s.

*In situ* conservation (from the Latin "*in situ*", in the same place) has to do with studies to determine the ecological requirements and threats to the survival of the species, as well as with the maintenance and recovery of its populations and the ecosystems that it occupies. It involves ecological and biogeographic studies, as well as recovery and restoration of habitats, among others. After conducting the preliminary studies with the Mucuchíes Frog,

The *in situ* conservation program has made it easier to know aspects of the ecology and biogeography of the Mucuchíes Frog (*Aromobates zippeli*). Photo: Enrique La Marca.

as well as starting the preliminary restoration of the habitat prior to repopulation, we are ready to start a habitat recovery program (which would include reforestation) in the medium to long term.

The third level of Integrative Conservation is that of Community Empowerment, which supports our need to ensure that information about the conservation work we do reaches the general public, with the understanding that if our work does not engage the local communities, its impact will be much less and the benefit of protection towards the species will be diminished. On the other hand, if the communities know the species in their region, especially if those are unique there (endemic), a sense of ownership of the species and ecosystems they inhabit will begin to consolidate among the people, favoring the conservation efforts.

To complete the conservation picture, the Mucuchíes Frog lives in a geographically isolated ecosystem, the Montano dry forest, which has been destroyed throughout the Mucuchíes region to the point of only surviving in a few relicts. The destruction dates back to pre-Hispanic times, probably no less than 3,000 years old, judging by archaeological studies in the area. In the anthropological museum of the Universidad de Los Andes in Mérida, there are aboriginal frog-like ceramic figurines from the region, which also suggest some importance of these amphibians for these ancestral communities. It is well-known that in many parts of the world frogs are associated with fertility and are considered deities. In the region, frogs are still the object of respect, as they are associated with water springs and among some inhabitants there is a belief that if frogs are "sown" in some places the groundwater sprouts (pers. obs.).

The Hacienda Moconoque, where some of the populations of *Aromobates zippeli* are located, also has a historical connotation. It was there that the Liberator Simón Bolívar camped during the famous Admirable Campaign of 1813, when



he received a dog named “Nevado” as a gift, that accompanied him during that independence feat. It is tempting to imagine that the libertarian troops heard the song of the Mucuchíes Frog as they passed through the region. These are the kind of details that help create that sense of belonging and uniqueness that could be used to contribute to the conservation of the threatened amphibian.

Given the restrictions imposed by the COVID-19 coronavirus pandemic, in this initial phase, the empowerment of communities will be mainly limited to digital communications through social media on the Internet and by local radio stations. Additionally, we are forging alliances with regional conservation organizations, such as the one signed with Selva y Niebla, so that they can share the information and become local actors in conservation.

*Aromobates zippeli* is one step away from becoming a “flagship” species for conservation in the region, as well as an “umbrella species” that helps conserve other species of animals and plants in that unique ecosystem that is about to disappear: the dry montane forest of Mucuchíes. Through REVA’s Integrative Conservation project started with the Mucuchíes frog, a beautiful, practical and fruitful conservation scheme can be achieved in the region.

The community empowerment program has served to make alliances between REVA, local leaders, conservationist organizations, and social communicators in the Mucuchíes region. Photo: Enrique La Marca.



The *ex situ* conservation program has allowed the successful reproduction of the Mucuchíes Frog. Photo: Enrique La Marca.





## Diversity of amphibians in Mexico: more than half are at risk

José Antonio Ocampo Cervantes and Erika Servín Zamora, Cuemanco Biological and Aquaculture Research Center, Universidad Autónoma Metropolitana Unidad Xochimilco, Mexico

"And the toads managed to bring the great cornfield into the rain, thanks to the fact that they were pointing the way with their songs ..." This is the Mexican legend of the toads and the rain. Amphibians have always accompanied Mexicans, as well as many other cultures, in their legends and gastronomy, accompanying Tláloc, the god of rain, according to pre-Hispanic tradition.

Mexico is a megadiverse country that is home to about 10% of the world's registered species, most of them endemic. In total there are more than 108,000 species described in the country. It is the fifth highest country as far as the number of plant species is concerned, third in mammals, second in reptiles and it is in fifth place regarding diversity of amphibian species, with 376 registered species. These include 234 anurans (frogs and toads), 137 urodeles (salamanders) and 2 gymnophionas (caecilians). Mexico has a large percentage of endemic species, with almost 70% of its amphibian species found only in Mexico, due to the geographical conditions of the country, which is diverse and includes desert landscapes, mountains of temperate forests and humid forests.

Some species are unique for their characteristics, such as the caudates of the genus *Ambystoma* (mole salamanders), which can regenerate damaged tissues and some remain in neoteny (retaining their juvenile features) for their entire lives. Plethodontids are a group of salamanders which lack lungs, and this is also unique.

However in the last study, recorded in 2014, 164 species were listed in the endangered or threat-ened category (Parra-Ollea, 2014), which represents 43% of the country's amphibian diversity. An additional 42 species (11.2%) are considered to be vulnerable and approximately 14% are not known well enough to be classified.

As in many countries of the world, due to multiple social, cultural, and educational problems, there is a lack of interest and knowledge of biocultural problems and more weight is given to socio-economic problems. Therefore, amphibian conservation in the country is not a priority at this time. To some extent this is understandable, but it is important to remember that day by day we are losing an invaluable diversity, species that will not return and that play a fundamental role within each of their ecosystems. In many cases, there is incomplete information on each of the species, including population censuses, which are scarce. This could mean that the data established in the risk categories are not accurate or

An Axolotl (*Ambystoma mexicanum*) from the Center for Biological and Aquaculture Research colony of axolotls in Mexico. Photo: Madelaine Westwood, National Film and Television School.



Order	Family	Number of species	Percentage of endemic species
Anura	Bufonidae	34	38.2%
	Centrolenidae	1	0%
	Craugastoridae	39	66.6%
	Eleutherodactylidae	25	72%
	Hylidae	97	68%
	Leptodactylidae	3	0%
	Microhylidae	5	0%
	Pipidae	1	0%
	Ranidae	27	59.2%
	Rhinophrynidae	1	0%
	Scaphiopodidae	4	0%
Gymnophiona	Dermophiidae	2	50%
Caudata	Ambystomatidae	18	88.8%
	Plethodontidae	116	82.7%
	Salamandridae	1	0%
	Sirenidae	2	0%

Table 1. Diversity of species in Mexico (Taken from Parra-Ollea, 2014).

are outdated, so there may in fact be a greater number of species at risk than reported.

In the area surrounding Mexico City there are eighteen registered species. Fifteen of these are endemic, such as *Pseudoeurycea altamontana*, *P. tillicxiti*, *Ambystoma altamirani*, *Eleutherodactylus grandis* and *Litobathes tlaloci*, for which there is no recent information about their populations or threats. There are even discrepancies between what was reported by the Mexican authorities and the IUCN international classification, so many of these and other local species could be at greater risk than reported. Some examples are shown in Table 2.

These data are a reflection of the lack of permanent programs or projects that generate data on the status of amphibian populations. This means that there is still much to do in terms of conservation in Mexico, including updating censuses, reviewing and improving captive breeding programs and implementing conservation actions, mainly for species in which there are currently no reported efforts. At the Universidad Autónoma Metropolitana Xochimilco Center for Biological and Aquaculture Research (CIBAC) we are directing our efforts to implementing projects that contribute to the conservation of amphibians in the Mexico Basin, which is an area highly impacted by urban growth and which requires programs for the conservation of its fauna.

We know that Mexico is not the only country in Latin America in this situation, but the intention of this article is to remember how precarious the conditions in which amphibians are found in countries with few resources and in which conservation is not currently considered to be a priority. Support from international institutions such as Amphibian Ark represents a fundamental resource through shared experiences and knowledge, as well as the financial support offered to all those institutions and researchers dedicated



to amphibian conservation around the world.

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Species	Norma Mexicana (NOM, Official Mexican Standard -059)	IUCN Red List	Last year of IUCN review	Population trend
<i>Eleutherodactylus grandis</i>	Pr (Special protection)	CR	October 2019	Decreasing
<i>Hyla plicata</i>	A (Threatened)	LC	April 2004	Stable
<i>Lithobates montezumae</i>	Pr (Special protection)	LC	October 2019	Decreasing
<i>Ambystoma velasci</i>	Pr (Special protection)	LC	October 2019	Unknown
<i>Pseudoeurycea altamontana</i>	Pr (Special protection)	EN	June 2016	Decreasing
<i>Pseudoeurycea cephalica</i>	A (Threatened)	LC	October 2019	Decreasing

Table 2. Some examples of discrepancies between what was reported by the Mexican authorities and the IUCN international classification.

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Monitoring of water quality in the channels of the Ejidos de Xochimilco and San Gregorio Atlapulco Protected Natural Area, a remnant of the Mexican axolotl habitat. Photo: Madelaine Westwood, National Film and Television School.





## Keeping the rescue program of the southernmost marsupial frog species afloat during pandemic times

**Mauricio S. Akmentins and Martín Boullhesen, Institute of Andean Ecoregions (INECOA), UNJu – CONICET, San Salvador de Jujuy, Argentina**

As a continuation of the population supplementation program for “La Banderita Marsupial Frog” (*Gastrotheca gracilis*), which began in 2018 in north-west Argentina, we began 2020 with a successful release into the wild of a cohort of froglets which had been raised in the Reserva Experimental Horco Molle facilities in Argentina, for a second consecutive year. The collection of tadpoles and the release of the froglets was undertaken thanks to the support of the Tucumán province government’s environmental authorities, which was a considerable achievement of our project because we reached the active commitment of the provincial government in the conservation of this endangered marsupial frog species. Then, like almost all conservation programs around the world, our plans suddenly changed from March 2020 due to the COVID-19 global pandemic.

Our project “Rescuing the southernmost Marsupial Frog species (*Gastrotheca gracilis*) in Argentina” was initiated thanks to us being awarded an Amphibian Ark start-up grant in 2018, followed

by receiving a start-up extension grant in 2020. One relative advantage of our project during the present time is that it was not severely affected due to the strict nationwide lockdown coronavirus measures which were imposed by the Argentinian government and are still currently in place. Normally, the main *ex situ* activities of the population supplementation program span from December to March, when the female marsupial frogs release the tadpoles from their dorsal pouch in temporary water bodies, and for this year, we were able to “shut down” the breeding program during the intermediate months. We hope that the restrictive COVID-19 measures will be relaxed soon, and then we can resume our planned *ex situ* activities for 2021. In the next stage of the program, we hope to upgrade the existing facilities in the Reserva Experimental Horco Molle to develop an *ex situ* research program which will follow the entire cycle of captive breeding of La Banderita Marsupial Frogs. We aim to generate knowledge of the basic procedures required to maintain a viable survival assurance colony of marsupial frogs and to learn how to successfully breed this unique species in captivity.

Field search of tadpoles of La Banderita Marsupial Frog (*Gastrotheca gracilis*) in the Reserva Provincial Los Sosa for the population supplementation program in December 2019. On this occasion our team was accompanied by the environmental authorities of Tucumán province government.  
Photo: Omar Saguir.

Unfortunately, the coronavirus restrictions severely affected our *in situ* conservation activities with the rediscovered populations of *Gastrotheca gracilis*. This year we had planned to carry out an intensive search program focused on the northern geographic range, where this species has not been observed since the early







Releasing a cohort of La Banderita Marsupial Froglets into the wild. These froglets were raised in the Reserva Experimental Horco Molle facilities in February 2020. Photo: Omar Saguir.

1990s. We had also hoped to continue monitoring the population status of La Banderita Marsupial Frog in the Reserva Provincial Los Sosa in order to evaluate the success of the population supplementation actions which were previously undertaken in this protected area. Another unfortunate event during 2020 was the severe wildfires in the northern distributional range of *Gastrotheca gracilis* in Tucumán province during September and October. This event has made the planned field search for the northern populations more relevant for the future of the species and also enhances the importance of the *ex situ* breeding program.

The only *in situ* activity that continued during 2020 is the long-term passive monitoring of the rediscovered populations of La Banderita Marsupial Frog in the Aconquija National Park. This monitoring was established in 2014 when the species was re-



Training of the park ranger staff of the Aconquija National Park in the use of automated recording units for monitoring the population status of La Banderita Marsupial Frog in this protected area. Photo: Mauricio Akmentins.

corded for the first time in the protected areas and was upgraded in 2019 by incorporating passive acoustic monitoring techniques with automated recording units supported by a Rufford Foundation Small Grant. This acoustic monitoring program of the population status of these frogs has been possible due to the ongoing support of the National Park administration and the trained park ranger staff of the Aconquija National Park, and we thank them for their support. They were responsible for battery replacement and for downloading the information collected by the recorders.

The main conclusion that we can draw from the unexpected consequences of one of the world's longest lockdown measures known in Argentina, is the importance of keeping our conservation project adaptable when faced with unforeseen adverse circumstances. Also, we highlight the importance of establishing an excellent long-term relationship with the stakeholders involved in the conservation of the target species on which we focused our efforts.



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The work of AArk is possible due to the generous support of the following individuals and institutions. We know this has been a difficult year for everyone. A special thanks to these donors for continuing to support us in these challenging times. And to all of our donors, past, present, and future, wishes for brighter, prosperous New Year!

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