amphibian ark

keeping threatened amphibian species afloat

Newsletter
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In this issue...

***Ex situ* conservation success stories.** Above: Froglet of the casque-headed frog at CECFAU in Brazil. (Cauê Monticelli) Below: Rancho Grande harlequin toad (eggs and tadpoles) at CRIA in Venezuela (Margarita Lampo)

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SSC Species Survival Commission

World Association of Zoos and Aquariums | WAZA United for Conservation

Tribute to Kevin Johnson

Kevin Johnson with another Australian native.
Photo: Luis Carrillo

After more than a decade and a half, Kevin Johnson will be leaving the Amphibian Ark to travel and explore new horizons. Kevin joined AArk when it was still in its early stages with an impressive background in zoos, zoo and aquarium associations, and zoo software. Since then, he has been a crucial part of the team. Beyond managing the AArk newsletter, grants process, and the amphibian *ex situ* program database, Kevin spearheaded the Conservation Needs Assessment (CNA) process. In 2007, a working group drafted a decision tree to determine whether *ex situ* conservation action was appropriate for specific taxa, as well as a process for prioritizing species for *ex situ* action. Kevin subsequently expanded and developed these processes into a sophisticated online methodology and database—one of the most rewarding projects of his career.

This is truly a bittersweet parting. In Kevin's words: "I am extremely grateful to many people who have generously shared their knowledge and expertise with me over the past 16 years. When I first started, I learned so much from dedicated herpetologists and mentors like Kevin Zippel, Ron Gagliardo, Richard Gibson, and Joe Mendelson. One of the most enjoyable aspects of this job is that I have continued to learn. It is an honor to have been able to work with so many experts who have dedicated their lives to amphibian conservation, both in the field and through *ex situ* conservation programs."

<u>As tribute to this amazing friend, colleague, and champion for conservation, we have collected quotes from people who have worked closely with Kevin over the years</u>:

"It's hard to bid farewell to a longtime and much-valued member of the Amphibian Ark team. It's a team that's always been small in numbers, but large in commitment to the task of conserving the world's most threatened amphibians. Since he joined the team at the beginning of AArk's journey, Kevin Johnson has been an integral and critical part of this effort. In 2007 when he first came aboard AArk, Kevin was half-time, also working half-time for the Australasian Regional Association of Zoos and Aquariums (ARAZPA, now ZAA—Zoo and Aquarium Association) in a variety of roles including a nine-month period as Executive Director. Kevin's long history of working with zoos made him an ideal member of the AArk team and by 2009 all of Kevin's energies were devoted to AArk. As the work of the Amphibian Ark evolved, so did Kevin's role. Although his original job title was Taxon Program Officer, his role expanded to include leading the development of the Conservation Needs Assessment and facilitating workshops utilizing this process, managing the captive programs database, overseeing the Conservation Grants program, publishing AArk's quarterly newsletter, and interfacing with dozens of amphibian specialists around the globe. At this point Kevin's official job title is Taxon, Communications and Development Officer, though it really should be Program Officer for Just About Everything!

Sadly, we've come to the time when we must say a fond good-bye to Kevin, knowing that, although he is officially stepping down as a member of AArk's team, he will always be there when we need him to answer a question, or offer his perspective. Working with Kevin for the past nine years has been a wonderful experience. His thoughtful approach to problems, attention to detail, ability to disagree without being disagreeable, his ability to be tactful while still being straightforward, his willingness to tackle any task, and his ever-present humility and sense of humor have made him as close to perfect a team member as one could ask for. We will miss him and wish him all the best wherever the road ahead takes him."

-**Anne Baker,** AArk Executive Director

"It has been so great working with Kevin for so many years. Not only is he talented, but he thinks ahead to provide answers and develop tools for issues we would face in the future… His charisma and charm precede him, and his help and friendship has been invaluable to me."

-**Luis Carrillo,** AArk Training Officer

"Kevin, it has been a wonderful experience working with you, your good humour, positive attitude and commitment to amphibian conservation has been truly inspiring!"

-**Ben Tapley,** Curator of Reptiles and Amphibians, Zoological Society of London; Co-chair, IUCN ASG Captive Breeding Working Group

"Kevin is a wonderful friend and ambassador for amphibian conservation. It was Kevin's patience and determination that often got us through some of the more stressful moments of our joint amphibian Red List-CNA workshops. Whether in Honduras or Papua New Guinea, Kevin's witty and fun sense of humor would boost morale and energize the room. Kevin, thanks for all you've done for amphibians. I am confident that you will enjoy your well-deserved retirement!"

-**Kelsey Neam,** Species Priorities and Metrics Coordinator, Re:wild

"Kevin has been an incredible champion for Amphibian Ark and amphibian conservation."

-**Ariadne Angulo,** Chair, IUCN SSC Amphibian Specialist Group (ASG)

"I have not worked with a more kind, capable, understanding and fun person than Kevin since I departed the AArk."

-**Ron Gagliardo,** former AArk Program Officer for Training

"I had the immense pleasure of working side-by-side with Kevin for many years, beginning soon after we launched the organization. Kevin's commitment, credibility, energy, and solidly grounded ethics were inspirational to me and helped get me through some of the tougher issues we faced in terms of amphibian conservation. I learned so much from Kevin and was regularly amazed at his steady, calm, and patient demeanor and, of course, his legendary organizational skills. Kevin, and especially the Conservation Needs Assessment tool that he spearheaded, was absolutely vital to the ongoing success and progressive agenda of AArk. I am so proud that I was able to be his close colleague for so many years."

-**Joe Mendelson,** Director of Research, Zoo Atlanta

"There is no AArk without the remarkable, dedicated, charming and extremely clever Kevin Johnson!! It's just that simple. It has been a joy to work with you, KJ, and I wish you nothing but the very best of all there is."

-**Onnie Byers,** Chair, Conservation Planning Specialist Group

"Even though I've only known Kevin for a short while, it's clear that Kevin is a remarkable person. His legacy at AArk is inspiring, and he has been a wonderful conservation mentor."

-**Becca Brunner,** AArk Program Officer

Kevin Johnson, Anne Baker, and Luis Carrillo: the core Amphibian Ark team for many years.
Photo: Anne Baker

Kevin Johnson, leading an AArk CNA workshop.
Photo: Luis Carrillo

Thank you so much, Kevin!

Kevin Johnson among the participants of an IUCN Red List/AArk CNA Workshop in Papua New Guinea.

The Rancho Grande harlequin toad breeds for the first time at CRIA in Venezuela

Margarita Lampo & Onil Ballestas | Foundation for the Development of Physical, Mathematical, and Natural Sciences (FUDECI) & Venezuelan Institute of Scientific Research (IVIC)
Ingrid Márquez | Central University of Venezuela
Federico Pantin | Leslie Pantin Zoo, Venezuela

On February 1st, 2023, we found a string of Rancho Grande harlequin toad (*Atelopus cruciger*) eggs in one of our breeding tanks at the Reproduction and Research Center for Harlequins (Centro de Reproducción e Investigación para Arlequines (CRIA)). After we found one of our males in amplexus with a stage five gravid female, the pair went underwater searching for a suitable spawning spot for more than twelve hours. The female eventually laid hundreds of eggs in a dark cavity under a rock. About seventy-two hours later, we observed evidence of cleavage in many eggs; hatching started five days later. Most of the eggs were fertilized and tadpoles are now swimming freely in our tanks.

With a start-up grant provided by Amphibian Ark, CRIA initiated operations in October 2022 to secure back-up populations and produce captive-bred individuals of the Critically Endangered Rancho Grande harlequin toad. This clutch of fertilized eggs marks the first successful breeding of this species in captivity. One of the major upcoming challenges is maximizing tadpole survival to metamorphosis and obtaining juveniles that can develop into the first F1 adults of Rancho Grande harlequin toads.

The first egg clutch of the Rancho Grande harlequin toad laid at the Reproduction and Research Center for Harlequins (CRIA) in Venezuela. Photo: Margarita Lampo

One-day-old Rancho Grande harlequin toad tadpoles.
Photo: Margarita Lampo

Rancho Grande harlequin toad tadpoles (more developed).
Photo: Margarita Lampo

To improve our breeding system at CRIA, we recently began the implementation of hormonal stimulation trials for sperm characterization. After attending a training course on assisted reproduction in December 2022 at Centro Jambatu in Quito, Ecuador, we attempted our first hormonal stimulation in a male. Motile sperm was recovered after injection with hCG (Human Chorionic Gonadotropin). In collaboration with other members of the Atelopus Survival Initiative (ASI) from Panama, Ecuador and Colombia, we are currently working on developing standardized protocols for assisted reproduction for harlequin toads, one of the most threatened amphibian genera.

The Rancho Grande harlequin toad has disappeared from most of its historical distribution—only two populations are currently known to still exist. Visual counts of post-metamorphic individuals during visits to both populations in January and February 2023 suggest that abundances have not changed significantly since our last estimates using mark-recapture techniques in 2014. No new populations have been detected elsewhere. Therefore, this species continues to be threatened by a combination of its small geographic distribution and the presence of the pathogenic fungus *Batrachochytrium dendrobatidis* (Bd) in its habitat. Our goal is to restore self-sustaining populations that will thrive naturally without the need for intensive management by introducing captive-bred toads in lowland habitats within their former range.

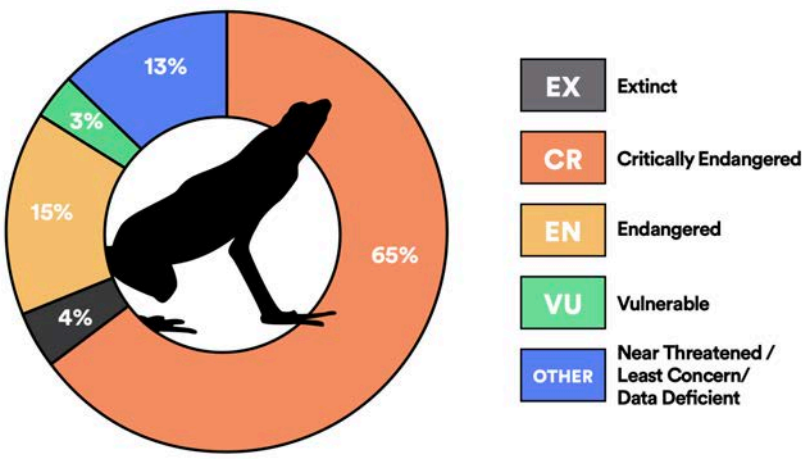
2023 Conservation Needs Assessments: A focus on harlequin toads

Becca Brunner | Amphibian Ark

For more than a decade, Amphibian Ark has been facilitating the Conservation Needs Assessment (CNA) process, with the help of experts from around the world. This process results in recommendations for immediate *in situ* (in the wild) and/or *ex situ* (in captivity) conservation actions for individual species within a country or region.

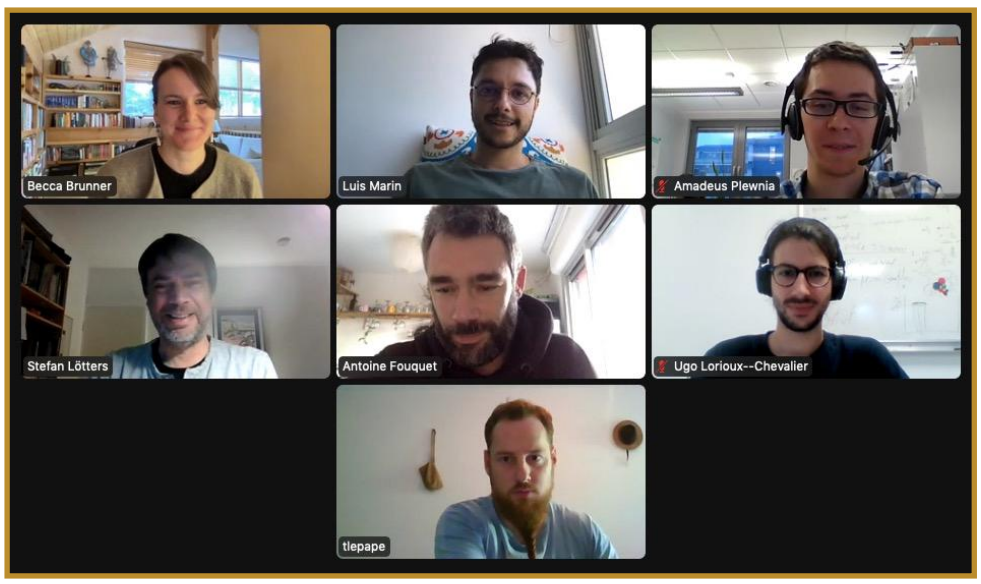
This year, Amphibian Ark will focus on evaluating harlequin toads (species in the genus *Atelopus*) in our CNA process, in collaboration with the Atelopus Survival Initiative (ASI; www.atelopus.org). Harlequin toads—'the jewels of the Neotropics'—are among the most beautiful and threatened amphibians in the world. Of the 99 described species, nearly 83% are at risk of extinction due to infectious disease, habitat loss, invasive species, and environmental change (Valencia & Fonte 2021). In response to this crisis, ASI was established at the end of 2019. ASI represents a collaborative network of conservation NGOs (including Amphibian Ark), governments, academic institutions, zoos, Indigenous communities, and other entities, all with the same goal: to prevent the extinction of harlequin toads.

Range map of harlequin toad species, with approximate number of species per country. Image courtesy of ASI/Atelopus Action Plan.



Top: Breakdown of IUCN Red List categories for harlequin toad species. Image courtesy of ASI/Atelopus Action Plan.

Bottom: Screenshot of French Guiana Atelopus CNA workshop participants. Photo: Luis Carrillo



Although every effort will be made to protect harlequin toads in their natural habitats, the establishment of temporary captive populations may be the only way to conserve certain species—especially when populations are small—until suitable numbers are established and/or conditions for their reintroduction are identified. AArk's CNA process will help determine which species are candidates for *in situ* versus *ex situ* conservation actions.

This important work is underway. AArk and ASI have already facilitated CNAs for Atelopus species in French Guiana (links here and here) and Bolivia (link here); CNAs for Peru, Suriname, and Guyana will continue this April.

If you are planning or are currently conducting *ex situ* work with a harlequin toad species, consider applying for one of AArk's conservation grants this cycle! See page 8 and/or https://www.amphibianark.org/conservation-grants/ for more information. Start-up and mentorship grant program outlines are due April 1st and full applications are due May 6th!

The Harlequin Toad (*Atelopus*) Conservation Action Plan (HarleCAP): Valencia, L.M. and Fonte, L.F.M. 2021. Harlequin Toad (Atelopus) Conservation Action Plan (2021-2041). Atelopus Survival Initiative, 52 pp. https://www.atelopus.org/_files/ugd/9db650_60f3e6095cbf4b1dabb7376a4fb88366.pdf

News from the captive breeding program of the Critically Endangered tree frog *Nyctimantis pomba*

Cybele Sabino Lisboa | Reserva Paulista—Zoológico de São Paulo, Brazil
Cauê Monticelli | Coordinator of Wild Fauna—Secretary of Environment, Infrastructure & Logistics, São Paulo, Brazil
Clodoaldo Lopes Assis | Federal University of Viçosa, Brazil

Background

The casque-headed frog, *Nyctimantis pomba*, is a Critically Endangered tree frog from southeastern Brazil. It is endemic to a small and unprotected fragment of Atlantic Forest (1.36km²) in the municipality of Cataguases (Minas Gerais State), which has legal problems and is highly impacted by farming activities. Its future is uncertain and *ex situ* rescue was a recommended conservation action (www.conservationneeds.org/summaryreport/6780) from the Conservation Needs Assessment process. Thus, in 2019, we started a conservation program to develop a captive protocol for maintenance and reproduction of *N. pomba*. Our objective is to establish an *ex situ* insurance population in case there is a need to supplement the wild population.

Casque-headed frog (*Nyctimantis pomba*) froglet. Photo: Cauê Monticelli

To start the program, we were provided with US $3,000 from a private donor (through Amphibian Ark), which allowed us to undertake three field trips to search for founder animals and to buy basic lab equipment for maintaining them. We collected four males and two juveniles, but we didn't find any females, which are essential to start an *ex situ* population. As this species is very rare, seasonal, and likely has a small population, it is not easy to find individuals. It was therefore necessary to increase our efforts and to change our strategies. To solve various challenges and continue the search for females, in 2021 we were awarded a second grant of US $3,000 by Amphibian Ark. We now present our actions and current results.

Fieldwork

As a first step, we decided to increase search efforts during the period of greatest activity of *N. pomba*. We hired three interns for daily sampling in the occurrence area, from November 16th to December 10th 2021. This search increase was fundamental for our objectives, because for the first time, we found females and recorded a large chorus of more than twenty males calling together. This event only took place on one night and we would have missed it if the interns had not been in the field daily. In the days that followed this event, we found some individuals, but not with the same calling activity or density. In previous years, we would only find a few individuals or none at all.

We measured and photographed all captured individuals. We also swabbed their skin to test for the presence of *Bathrachochytrium dendrobatidis* in the wild population; all swabbed individuals were negative. We also collected females, which we needed to start developing the captive breeding program at the Wildlife Conservation Center of the State of São Paulo (CECFAU), in Araçoiaba da Serra, Brazil.

Ex situ management

After the field campaign, the founding captive population consisted of twelve individuals (five males, four females, and three juveniles of undetermined sex). All individuals were in the managing laboratory, which had been established at CECFAU.

We have continued with the same husbandry practices since 2019, which were reported in AArk Newsletter Number 49 (March 2020, www.amphibianark.org/Newsletters/AArk-newsletter-49.pdf). Individuals were maintained in terrariums according to size and sex and monitored in relation to food intake and body score. We also started to collect nocturnal images using an infrared camera, which will be used to obtain data about the behavior of the species.

Our first breeding attempt occurred December 2021, as one of the newly collected females had oocytes in her abdominal cavity. We immediately placed her in a terrarium with two males; the next day, she laid eggs in the water. Unfortunately, the eggs did not develop. We are not sure if the eggs simply weren't fertilized or if the water conditions were not suitable

***Nyctimantis pomba* froglet.**
Photo: Cauê Monticelli

for their development. During the following breeding season, in November 2022, we put male-female pairs together rather than keeping them separate until oocyte development.

When the breeding season came, two females laid fertilized eggs. At the moment, several tadpoles are still developing; many already finished metamorphosis. This marks the first time that *N.pomba* has reproduced in captivity.

Final Considerations

The funding provided by Amphibian Ark allowed us to find founder animals and establish the captive population of *N. pomba*. This support also made it possible for us to record previously undocumented information about their reproduction in the wild, as well as to collect important population data—both of which are essential for conservation of the species in the wild.

Finally, the successful breeding of *N. pomba* in captivity was a major step towards our goal of creating an *ex situ* insurance population for the species. At the end of 2022, the regional Amphibian Specialist Group of Brazil (ASG-Brazil) organized a workshop to develop a specific action plan for *N. pomba*. This workshop involved relevant stakeholders and utilized all of the data obtained in our study. This plan will be published soon. We hope these actions will contribute to the conservation of *N. pomba*.

Acknowledgements

We would like to thank the donors and AArk for the grants, and Kevin Johnson for always believing in and supporting our program. We also thank Kaíque Macedo, Eduarda Melo, Heithor Simão and Cesar Alexandre for their great help in the field; Felipe Toledo and the Amphibians Natural History Lab (LaHNAB) for providing the *Bathrachochytrium dendrobatidis* results; and Fundação Parque Zoológico de São Paulo for supporting the program.

Field team that collected *Nyctimantis pomba* founders.
Photo: Cybele Lisboa

Call for Amphibian Ark Grant Applications

Project Outlines due: April 1st, 2023
Full Applications due: May 6th, 2023

Amphibian Ark is pleased to announce the 15th annual call for proposals for our grants program. Some new guidelines and requirements for grant recipients have been included, so please be sure to read these guidelines carefully. Download the complete guidelines from: https://www.amphibianark.org/grants/AArk-Conservation-Grants.pdf

While applications are welcomed from programs in all countries, this year we are especially keen to see applications to work with *Atelopus* species (see page 5), which support the goals of the Atelopus Survival Initiative (www.atelopus.org). We are also keen to see applications for extension grants from any existing *ex situ* amphibian conservation program.

We will be accepting applications for the following types of grants:

Start-up grants** – initial funding to help newly-launched projects get started at the very beginning of their life, to help them attract larger and/or long-term funding for the duration of the program. One-time grants of up to US$5,000 are available. Recipients can apply for second and third year extension grants.

Start-up grant extensions – additional funds are available to provide continued support for existing *ex situ* amphibian conservation programs that a) have met their stated objectives for previous years, and b) can demonstrate that additional supplemental funds have been secured since the original grant was provided. All existing programs are eligible to apply for these extensions however it is expected that husbandry guidelines and a species action plan have been completed. Second-year grants of up to US$4,000 and third-year grants of up to US$3,000 are available.

Workshop attendance – partial funding to assist attendance at *ex situ* amphibian conservation-related workshops, especially those which focus on amphibian husbandry, planning and reintroduction. Applicants must have already secured partial funding to attend the workshop. You must already be actively involved in an amphibian conservation project or have well-developed plans and funding in place to implement a new program. Grants of up to US$750 are available.

Mentorship grants** – support for organizations which have previously received an AArk seed or start-up grant, to bring in a designated outside expert to assist with an aspect of their amphibian conservation efforts (e.g. veterinary training, enclosure design for optimal microhabitat conditions, etc.). Grants up to US$1,500 are available.

Workshop support grants - support for organizations which are planning an in-person amphibian conservation-related workshop or symposium, especially those which focus on amphibian husbandry, planning and reintroduction. Applicants must have already secured partial funding for the workshop, and the dates and location for the workshop should have been publicly announced. Grants up to US$2,500 are available.

****Start-up and Mentorship grants require submission of a brief Project Outline, prior to submitting a full application.** Ideally, your Project Outline should be in English or Spanish, but it can be submitted in any language. Your Project Outline should be less than 300 words in length and should contain information under the following headings: Species, Organization, Project Manager, Previous amphibian experience, Goals, Proposed Outcomes. Other funding Sources (both requested and received) and the status of a Species Action or Recovery Plan for the species (including authors of the plan). Project Outlines for start-up grants from institutions with limited amphibian expertise must include a copy of the report from the Institutional Program Implementation Tool (https://www.amphibianark.org/program-implementation-tool/) for the species at your institution. Your final application should address any shortfalls highlighted within the tool.

Project Outlines will be reviewed, and successful applicants will then be invited to submit a full application. Full applications will not be accepted without a Project Outline having been approved by the review committee.

Our grants are intended to support conservation projects for amphibian species that cannot currently be saved in the wild, with a focus on *ex situ* actions, and in partnership with appropriate field activities. Preference will be given to projects for species which have been assessed as in need of *ex situ* rescue or research work, either as a recommendation from a Conservation Needs Assessment or a similar, national assessment process.

Start-up grants and start-up extension grants are **NOT** intended to fund:

- Educational exhibits
- Project overheard or indirect costs
- Field projects without a strong *ex situ* component

Need some help?

AArk staff are available if you need assistance in formulating your proposal. Please do not hesitate to contact us with any questions. Each year several proposals have been rejected due to issues that could have been prevented with a little extra guidance! Email us at grants@amphibianark.org.

Important dates

April 1st, 2023: Project Outline deadline

April 15th, 2023: Project Outline applicants notified of review decision

May 6th, 2023: All Full Applications due

May 20th, 2023: Grant decision/notification date

June 3rd, 2023: Successful applicants must provide bank account details, signed MOU and 3-4 photos of species and/or facilities

June 16th, 2023: Grant payment

January 1st, 2024: Initial progress report and species action plan due

June 30th, 2024: Final progress report, species action plan, and husbandry guidelines due

We would like to acknowledge the generous support of AArk funders (www.amphibianark.org/our-funders/) and donors (www.amphibianark.org/our-donors/) who have helped to establish and support these grants.

Captive collaboration: conservation research

Andrew Gray | University of Manchester, England

One area which is often overlooked when evaluating the benefit of keeping and breeding amphibians in captivity is the great potential for the development of scientific knowledge and particularly the huge benefit of being able to conduct related conservation research.

In 1999, I first visited Ecuador and met Dr. Luis Coloma, who I consider a legendary herpetologist. At the time he was just developing his captive collection specifically to support conservation research on Ecuadorian amphibians and training a PhD student on the subject. He had already initiated the development of a wonderful online resource that would eventually catalogue all the amphibian species of Ecuador. Meeting him and seeing for myself how he integrated field research with data collection from the captive collection, whilst supporting student learning and the public understanding of amphibians, had a huge impact on me. On that trip I also got to witness some species I had only dreamed of, including the true splendid leaf frog (*Cruziohyla calcarifer*), and the Amazonian leaf frog (*Agalychnis hulli*).

Years later, I am pleased to say that at the University of Manchester, where I am based, we have also been able to develop the skills that have allowed us to reproduce every single species we have maintained in our Vivarium collection over the years—successfully caring for them by continually striving to provide optimum conditions. This has been achieved through a combination of factors, including making behavioral observations, utilizing micro-habitat data from the wild and gaining experience with different species in captivity over time.

Our non-invasive behavioral studies have directly facilitated many new captive observations, which would otherwise have been impossible to witness or follow in the wild. Such observations with rare tree frogs at Manchester have included male-male combat in the crowned tree frog (*Triprion spinosus*) and the phenomenon of leg-waving in Sylvia's tree frog (*Cruziohyla sylviae*). These observations have allowed us to study territoriality in these frogs, and help us better maintain them. Apart from tree frogs, we've also been successfully working with rare high-altitude toads, including the variable harlequin toad (*Atelopus varius*) and the Chompipe toad (*Incillius chompipe*). The latter had never been maintained or reproduced in captivity and thus facilitated the first report of direct development in any Central American toad.

More recently, my research has focused on learning more about the species I first saw in my early career, such as those wonderful frogs from Ecuador. I have stayed in contact with Dr. Coloma over the years and only through him kindly providing specimens has it been possible to do this new research. I am a big believer in collaboration, and also in supporting and involving private herpetologists. As such, and through committed captive breeding efforts in both Ecuador and Europe, the tadpoles of both the true splendid leaf frog and the Amazonian leaf frog have now recently been described.

The direct developing Chompipe toad, *Incillius chompipe*
© Andrew Gray/University of Manchester

The value of combining field observations and environmental data when maintaining specific amphibians in captivity, including considering native flora associations, microhabitat preferences and intra-specific interactions, should not be underestimated; combined, they provide the best conditions to allow captive amphibians to thrive. Likewise, captive amphibian research that aims to improve our understanding of specific species allows us to potentially recognize any fundamental changes in the natural requirements of wild amphibians and how these changes may adversely affect populations.

In our most recent publication, Dr. Coloma and I describe the tadpole of the Amazonian leaf frog from captive-bred specimens (https://doi.org/10.11606/issn.2316-9079.v21i2p141-149), which has indicated the tadpoles in question appear to have evolved specifically for surviving in small, temporary, forest pools. With recent climatic changes, the environmental conditions in its native Amazon have become so extreme that the areas are either flooding or completely dry for much longer periods, directly impacting this rare species and its survival for the future. In a previous paper, I detailed a tadpole that has remained undescribed for over one hundred years after the species was first found, the original splendid leaf frog (https://doi.org/10.33256/31.3.170176). Again, this is a species which has a specific and fragile reproductive strategy, and which now only occurs in very few places throughout Ecuador and Colombia. It has not been found in Panama for twenty years now, and likewise has been missing from Costa Rica for thirty-nine years. This is still news to many who thought they knew the species well.

In the world of frogs, it seems there are always new things to learn. I found this out first-hand after researching a particular species' biology, reproduction, and behavior for over twenty years, only to discover later that it was actually a new species that had been hiding in plain sight.

When I first started at Manchester, we had no computers, no email, and no internet access—a lot has developed and changed in such a short amount of time. We now communicate globally, instantly. At the press of a button, we can access so much information. As such it seems we are often consumed–in fact, the sheer volume of information can sometimes interrupt the important, traditional methods. But to sit, undisturbed and motionless, quietly watching a frog or tadpole that feels safe enough to behave naturally, to me is one of the most wonderful things to do in life. I know I am not alone in this. Maybe the deep fascination for amphibians is ancestral—after all, they were the first vertebrates to ever walk on land.

Developing the skills to be able to reproduce all the species maintained in the collection at Manchester and, perhaps more importantly, improving animal health and thus extending longevity, is something I am very proud of achieving. However, it certainly hasn't been something I achieved alone; it has been a full team effort, and not just the Museum team, but friends and colleagues from many other collections as well as passionate private keepers. In many cases, amateur herpetologists, hobbyists, and the more serious private keepers of frogs have been fully instrumental in helping me develop my experience and in fueling and supporting my passion for these amazing animals. This also includes friends who have helped in the design and production of specific enclosures, supporters of my personal frogblog, local people who helped me in the field, and fellow 'frog nuts' who have always been there for me, day and night, to simply 'talk frogs'.

Without these people on my wavelength, the journey I now look back on would have not meant very much at all. In my experience, it is true to say that there are many private individuals who have developed better herpetological keeping and breeding skills with specific species than most academics I know. Focusing down on a subject, genus or species in particular is how we develop expertise, and thankfully the valuable species knowledge private individuals are able to bring to the table is finally being recognized. Irrespective of how those making some money from the animals resonates, I believe at heart true herpetologists care passionately about the animals they work with. Where this deep interest is harnessed, where husbandry and wider research is encouraged and caringly integrated into proper scientifically focused projects, it's clear that great things can be achieved. In doing so, we can all share the same goal of passing on our passion and collaboratively-gained knowledge to support the best future animal care.

I would like to take this opportunity to thank Dr. Luis Coloma, my curatorial assistants and herpetological colleagues over the years, and the valued private herpetologists who are so passionate about keeping amphibians and whose skills, great effort and dedication often go unrecognized. I hope that the new wave of budding herpetologists will fully recognize the unique opportunities often facilitated through the maintenance of species in captivity. No live specimen should be kept in captivity lightly, so if we truly care for them, we owe it to them to ensure that they are contributing to the species' conservation in the wild in as many ways as possible.

Links:

He spent his career studying a frog. Then he discovered its true identity (National Geographic, Link & Garrett, 2019): https://www.nationalgeographic.com/animals/article/scientist-discovered-new-frog-species-sylvias-leaf-frog

Review of the genus Cruziohyla, with the description of a new species (Gray, 2018): https://frogblogmanchester.files.wordpress.com/2018/07/cruziohyla.pdf

Notes on the reproduction of the endemic Costa Rican toad, *Incilius chompipe* (Gray & Bland, 2016): http://mesoamericanherpetology.com/uploads/3/4/7/9/34798824/mh_3-2_other_contributions.pdf

Combat behaviour in captive male coronated treefrogs, *Anotheca spinosa* (Bland & O'Donnell, 2016): http://mesoamericanherpetology.com/uploads/3/4/7/9/34798824/mh_3-3_other_contributions.pdf

We recently described the tadpole of the splendid leaf frog, *Cruziohyla calcarifer*
© Andrew Gray/University of Manchester

Is establishing a conservation breeding program for a particular species at your institution appropriate?

Kevin Johnson & Luis Carrillo | Amphibian Ark
Kay Bradfield | Perth Zoo, Australia
Benjamin Tapley | Zoological Society of London, UK

Once it has been determined through a Conservation Needs Assessment (CNA, www.amphibianark.org/planning-workshops/) or another credible assessment process (e.g. state or national wildlife agency) that a species requires *ex situ* conservation action as part of its recovery, it is essential to then determine two additional factors: 1) Is the species a suitable candidate to be managed under captive conditions? 2) If so, does the institution interested in establishing an *ex situ* program for the species have all the required resources in place to ensure the most successful outcomes are achieved?

A significant challenge for *ex situ* programs relates to ensuring that all programs are adequately supported for their duration. Establishing facilities and collecting rescue populations is only the initial, albeit usually the greatest, expense. However, it is insufficient to support only those first-year expenses without operational support for the long term, which may amount to years or even decades. In addition to financial planning, *ex situ* programs should establish at the onset a plan for working with partners to mitigate threats in the wild—and, when possible, getting animals back into the wild—as well as how to distribute the progeny of captive animals in the interim.

Amphibian Ark's program implementation tool is a useful resource for checking how prepared your institution is to manage a conservation program for a particular species. It has recently been updated and expanded and can be accessed from the AArk web site at: www.amphibianark.org/program-implementation-tool/. This implementation tool consists of a series of questions that are designed to help institutions identify components of *ex situ* conservation program set-up that may not have been considered, or that may be somewhat lacking. Thirty-nine questions are grouped in eleven sections, although not all questions need to be answered–depending on responses to previous questions, subsequent questions may not be appropriate and are hidden. Some issues covered by the tool include:

- **Species range** – can the program be established within the range country, or will it need to be established elsewhere?
- **Biosecurity** – has an appropriate disease risk assessment been done, and can dedicated facilities and equipment be provided for the species? Can appropriate quarantine facilities be provided?
- **Husbandry expertise** – has the target species, or a suitable husbandry analog species, been maintained at the institution before? Or are husbandry protocols available for the species based on experiences at another institution? Are there any specific husbandry requirements such as diet, enclosure design, environmental conditions, etc.?
- **Resources** – are sufficient financial and staffing resources currently available to develop the necessary facilities and to manage the program into the future?
- **Conservation planning** – has a species management team or a recovery group been established, and has a comprehensive action plan been developed? Have the threats facing the species in the wild been identified, and how will they be mitigated?
- **Reintroduction** – has reintroduction of captive-bred animals been considered?

If an institution provides an answer that might indicate additional preparation or resources are required, responses are generated with suggestions on how to better prepare the institution to manage the captive program. The responses follow a 'traffic-light' color-coding system, with green responses indicating a positive result, yellow responses indicating a lack of information, orange responses indicating some form of low-level risk, and red responses indicating that additional preparation or resources are definitely required before proceeding.

Green responses - the species or proposed host satisfies this criterion.

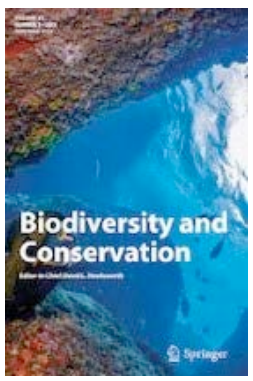
Yellow responses - unable to assess due to limited data, in which case relevant data should be collected (if that does not occur for any reason, this criterion should be kept in mind as something that could be adversely impacting a conservation breeding program or post-release survival and reproduction). If this lack of information is considered ok by the assessor, the conservation breeding program should proceed carefully and be reviewed and assessed on a regular basis.

Orange responses - the associated risk means that you should only establish a conservation breeding program for the species if it is a very high priority for conservation efforts, if your institution has sufficient resources available, there are no other more suitable native species that your institution could focus on instead, and the risk to other amphibian species both on site and at the release site(s) is low.

Red responses - the species or proposed host does not currently satisfy this criterion; the high level of risk associated with establishing a conservation breeding program means that it should not proceed at this time. Either address the issue(s) to reduce the risk or investigate alternative options such as cryobanking.

Each question includes a note field where you can add comments, which are then included in a report that is compiled when the results are submitted. The report clearly identifies any areas of potential concern that should be addressed prior to implementation of the proposed program. The report is emailed to the person completing the program assessment.

It is recommended that anyone who is considering a new *ex situ* amphibian conservation program use Amphibian Ark's program implementation tool to help identify aspects of the program that might require further consideration. While the tool has been designed to be of most benefit to institutions that have not yet implemented a new program, it can also be a useful tool to help identify any potential issues with existing programs. Although some host institutions will not be able to meet all of the criteria included in the tool, identifying any potential risks involved with establishing and managing a new program (and the ability to resolve those risks) will help determine how appropriate it is to establish a captive program for a certain species at your institution. After any potential risks have been resolved, the captive program can proceed with a higher chance of successful outcomes.



This article has been compiled from a manuscript that was published in Biodiversity and Conservation in late 2022. The full article is available at https://rdcu.be/c17Sr. The assessment of the suitability of a species to be managed in an *ex situ* conservation program will be discussed in a subsequent article in this Newsletter.

Amphibian Ark welcomes Becca Brunner to the team

Anne Baker | Executive Director, Amphibian Ark

Needless to say, after 16 years at AArk, Kevin Johnson leaves big shoes to fill (see pages 2-3). We're fortunate to have found Dr. Becca Brunner as our new Program Officer at AArk. For the past 3 months, Kevin has been training Becca in all aspects of this multi-faceted job.

Becca joins us with over a decade of amphibian-related field and research experience—she has conducted conservation fieldwork on every continent that has frogs. She holds a PhD in Conservation Biology from the University of California, Berkeley and an MSc in Behavioral Ecology from Cornell University. For her dissertation research, Becca conducted biodiversity surveys, monitored populations for the fungal pathogen *Batrachochytrium dendrobatidis*, and analyzed bioacoustics data for Ecuadorian amphibian communities across gradients of human disturbance. In the process, she helped discover a new glassfrog species (Mashpi glassfrog, *Hyalinobatrachium mashpi*). Before her scientific endeavors, Becca worked as an environmental policy analyst, leading workshops on biodiversity safeguards within international policies and presenting at venues like the United Nations Framework Convention on Climate Change (UNFCCC). She also has experience as professional scientific editor. Becca is excited to continue contributing to amphibian conservation with Amphibian Ark!

Becca lives in the forest outside Santa Fe, New Mexico (USA) with her husband Colin and her cat Sabu. In her free time, she enjoys hiking, writing, and volunteering with local conservation and STEM education groups, as well as with Third Millennium Alliance, an NGO that works to protect the last remnants of the Pacific Forest of Ecuador through conservation and community-led regenerative agroforestry.

Becca Brunner conducting fieldwork in Ecuador.
Photo: Juan Manuel Guayasamín

Becca's website: www.beccabrunner.com

Selected publications:

Two new glassfrogs (Centrolenidae: *Hyalinobatrachium*) from Ecuador, with comments on the endangered biodiversity of the Andes. PDF link

Nocturnal visual displays and call description of the cascade specialist glass frog *Sachatamia orejuela*. PDF link

Thermal buffering of microhabitats is a critical factor mediating warming vulnerability of frogs in the Philippine Biodiversity Hotspot. PDF link

Conservation brought to the public via rocket frogs from the Venezuelan Andes

Enrique La Marca | Rescue of Venezuelan Amphibian Species Center (REVA), Venezuela

Mural of the Mucuchíes frog on Andrés Bello Avenue in Mérida, Venezuela. Photo: Veronica Marcó

At the Rescue of Venezuelan Amphibian Species Center (REVA) we have worked with both *ex situ* and *in situ* conservation (that is, 'outside' and 'inside' a species' habitat) of various species in the genus *Aromobates*—commonly known as 'rocket frogs' because of the speed with which they escape when detected. We have shared our experience thus far mainly with the scientific community and enthusiasts who breed frogs in captivity. However, much of this information remains in specialized magazines and media that does not reach the public.

At REVA, we are aware that the conservation of a species must start from the knowledge of it, but also from the need that the general public know how to identify it, love it, and finally protect it as part of the biological and cultural heritage of their region. Consequently, we recommend that every conservation project has a component in which scientific knowledge and the results of captive breeding efforts are shared with the wider population, especially in the places where the species comes from. Mindful of this challenge, we have implemented several strategies to reach the public.

The first strategy is the one you are likely most familiar with: the use of social networks. Social media allows us to reach a broad spectrum of the population, all around the world. REVA has accounts on Instagram and Facebook (@revafrog), YouTube (@revafrog7092), and Twitter (@RevaFrog); we also have a website (www.revafrog.home.blog).

Our second strategy is the dissemination of our work by experts. Some journalists, especially those with an environmental specialty, have sought us out to cover REVA news. The results are disclosed in their respective communication channels, and the conservation organizations themselves can share it to their own networks. In our case, we have been favored by the production of several opinion articles (for example, Mongabay, http://bit.ly/3IEV273 and bit.ly/3Zs4BNx). We have recently been collaborating with young social communicators in the production of podcasts about threatened amphibians that will be broadcast on the radio and uploaded to social networks in 2023. Another recent case of international dissemination came from the interest of the French Associated Press to cover our activities with the Mucuchíes frog (*Aromobates zippeli*), which was also published by various news agencies, particularly in Europe (bit.ly/3EJQafQ).

A different way of facilitating conservation is the use of murals to raise awareness about threatened species. We have been fortunate that some official entities in Mérida, where REVA operates, have supported our conservation activities through the creation of two separate murals in avenues of the city: the cable-car frog (*Pristimantis telefericus*) and the Mucuchíes frog are featured among other threatened species of the Andes. It is the first time in Venezuela that frogs have appeared in street murals as part of a public conservation campaign. A few years ago, we were involved in the installation of a giant poster of the Mucubají skunk frog (*Aromobates leopardalis*) for the Caracas subway. Similar information campaigns are needed to raise awareness about the amphibian extinction crisis, especially since they are not currently as emblematic as birds and mammals.

It is also necessary to share our knowledge and achievements with rural communities, where many of the threatened amphibian populations are located. When we speak with local people, we start by explaining the importance of conservation—not only for frogs, but also for the local community. In the case of the Critically Endangered La Culata frog (*Aromobates duranti*), we began by cleaning several springs in an area that has a large influx of tourists. This place (which supports the type locality of the species) was being used as a dump for solid and liquid contaminants. We finally succeeded in protecting the perimeter of the area where the endangered frog population is located. In a similar case, we worked with a local community to protect a spring and associated small watercourse where one of the few remaining populations of the Critically Endangered Mucuchíes frog occurs. We fenced off the perimeter of the spring to prevent the passage of cattle and stop the dumping of garbage. With the support of the Chessington Conservation Fund in the United Kingdom, we also began a reforestation program there to recover the spring, as well as an ecological restoration plan for the hill where the aquifers are located to guarantee continuity of environments and greater biological diversity. We are now trying to protect springs on the city outskirts of Mucuchíes, where another population of Mucuchíes frog is located. We aim to establish a community-owned forest there that will protect water quality for human consumption, which in turn would benefit the frogs.

Mural on Los Próceres Avenue in Mérida, Venezuela. Photo: Yocelin Contreras

Student group with REVA facilitators after an environmental education activity in Moconoque, Venezuela. Photo: Erik La Marca

Another priority for REVA is environmental education for children in elementary schools. Children share what they learn with their family and friends, and in the future, they may be the guardians of endangered species in their communities. We have spoken about conservation to a hundred children in three rural towns in the state of Mérida, where populations of many endangered species occur, particularly frogs in the genera *Aromobates*, *Atelopus*, and *Mannophryne*. We were encouraged when a teacher in the town of Mucurubá, which we had not yet visited with our environmental program, contacted us. One of her students had participated in one of the workshops we gave in the Moconoque community. Upon returning to her school, the girl asked the teacher, "Do you know the Mucuchíes frog?". Her teacher contacted us to find out more about this species and later organized a frog conservation activity at her school. Occurrences like this give us hope that education can make a difference in conservation.

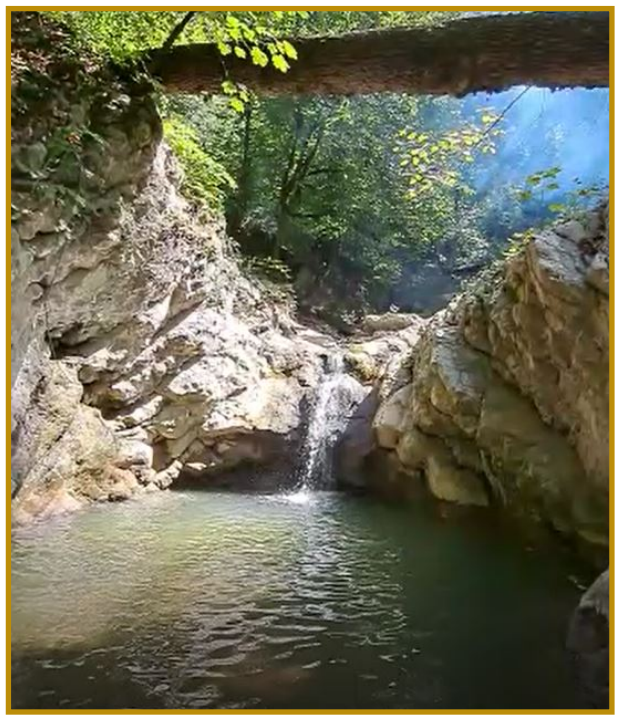
A more recent objective of REVA is to bring scientific and conservation information to a greater number of people. With the support of a small grant from Dendrobatidae Netherland, we have started a citizen science program for the Mérida collared frog (*Mannophryne collaris*). We aim to increase local people's interest in the species while simultaneously learning more about its distribution. Eventually, we plan to propose that the species be recognized as the emblematic frog of Mérida city. Who knows, maybe we will soon see the collared frog adorning an avenue of our city!

It is worth noting that all the species mentioned here have benefited from funding provided by Amphibian Ark—mainly through *ex situ* conservation projects, but also through additional activities related to those initiatives. Through this type of support, it is possible to counteract the negative effects that have led to a marked decline in amphibians throughout the world.

Protective fencing at the type locality of the La Culata frog (*Aromobates duranti*). Photo: Enrique La Marca

Progress with the captive breeding program for Gorgan mountain salamanders in Iran

Seyyed Saeed Hosseinian Yousefkhani | Institute of Biological Science, Damghan University, Iran



The water pool at the Pashmeki Spring where twelve Gorgan mountain salamander larvae were observed. Photo: Saeed Hosseinian

The captive breeding project for the Gorgan mountain salamander (*Paradactylodon persicus gorganensis*) was established in Iran one year ago. The first step was to locate individuals in the wild for transport. Among the thirteen localities where this species was previously observed (Pa Qala, Cheshme Pashmeki and Ramyan city), only one locality contained Gorgan mountain salamander larvae. We found twelve two-year-old salamander larvae in just one water pool in Pashmaki Spring. Because we only observed larvae in one place and there were not enough individuals, we did not transfer them to the laboratory. The population decline of this species is clear from our field studies.

Fortunately, the larvae we observed in Peshmeki Spring were far from human activity and very little damage had been done to that area. This valuable habitat is not easily accessible to tourists, which at least partially explains its healthy condition.

All of the necessary preparations have been made for the initiation of a breeding center for the Gorgan mountain salamander: laboratory equipment has been prepared and an aquarium has been set up with a suitable environment for reproduction. We hope that in the second year of the project, we will find at least two more populations and an appropriate number of salamanders needed to be transferred to the breeding facility. It is essential that we begin the breeding program with at least ten pairs from each locality to maintain genetic diversity.

Our breeding laboratory has many facilities in which the salamanders can be managed and continuous monitoring can take place. In this laboratory, there is an air transfer device as well as aquarium water purification. The aquariums are covered with plants matching the salamanders' habitat, and pieces of rock and pebbles are placed for them to move and hide as well as spawn. The assessment of different habitats of this species will continue in the second year of the project, and we will try to find enough individuals to transfer to the breeding site.

Larvae (with external gills) observed inside water pool. Photo: Saeed Hosseinian

Testing water quality (pH, salinity, oxygen, total dissolved solids [TDS], temperature, and conductivity) inside water pool. Photo: Haji Gholi Kami

Aquarium prepared for salamanders. Photo: Haji Gholi Kami

Amphibian Ark Donors, January-March 2023

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Up to $50,000

Bernard & Nancy Karwick
The George & Mary Rabb Fund for Conservation
Synchronicity Earth
Brevard Zoo

Up to $10,000

Anne Baker & Robert Lacy
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