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## The plight of the spadefoot toad in Belgium

**Loïc van Doorn, Jeroen Speybroeck, Johan Auwerx and Bruno Picavet, Research Institute for Nature and Forest, Belgium; and Lily Gora, Agency for Nature and Forest, Belgium**

The spadefoot toads of the old world belong to the family Pelobatidae, an ancient family of frogs which is widespread in western Eurasia, the Near East and the extreme northwest of Africa. The six species in the sole extant genus (*Pelobates*) share a fossorial lifestyle, tunnelling backwards into sandy substrate using their rigid metatarsal tubercles (spades) and spending most of their lives underground.

The Common Spadefoot Toad (*Pelobates fuscus*) ranges through much of continental Europe. They are nocturnal, only surfacing when weather conditions are favorable. Under the cover of darkness they feed on a wide range of invertebrates before digging back into the substrate at dawn. Breeding occurs in Spring,



Adult female Common Spadefoot Toad (*Pelobates fuscus*).  
Photo: Loïc van Doorn.

when they enter their breeding waters and call from under the surface. Eggs are deposited in strands, each containing up to several thousand eggs. Larvae may grow to large sizes (over 15cm) and require ample food to reach metamorphosis. As with many amphibian species, the timing of metamorphosis is flexible. Spadefoot toad larvae usually start the terrestrial part of their life cycle at the end of Summer, as the larvae take several months to grow sufficiently large. Historically, the species is associated with seasonally flooded wetlands along rivers and streams, where vast areas of suitable water habitats are adjacent to sandy soils. In areas where these habitats have remained functionally present, spadefoot toads can be the most common amphibian species. However, this specific combination of habitat types has become scarce in Western Europe, where streams and rivers are canalised, floodplains have been drained and structural diversity of the surrounding habitats lost. As a result, spadefoot toads have adapted towards living in agricultural areas, especially in those environments where agricultural practices are small-scale and offer a variety of crops. In these anthropogenic environments, they breed in sufficiently large and deep cattle ponds. With the agricultural intensification of the last decades, functioning metapopulations in these secondary habitats were lost however, leading to small, relictual populations.

Consequently, the Common Spadefoot Toad is declining substantially along the entire western edge of its range. The species has become locally extinct in Switzerland and Luxembourg and is deemed threatened in seven more West- and Central-European countries. In Belgium, after the extinction of several populations over the last decades, it has become restricted to two small and isolated localities. Next to loss of habitat and connectivity, further degradation, due to the introduction of invasive fish species, such as pumpkinseed, eastern mudminnow, brown bullhead and topmouth gudgeon in the breeding habitats, resulted in reduced larval survival, aggravating the population declines in Belgium.

Part of the breeding facility Research Institute for Nature and Forest in Belgium, which has a permanent flow system.  
Photo: Johan Auwerx.



Common Spadefoot Toad egg strands can contain up to several thousand eggs. Photo: Jeroen Speybroeck.





A large Common Spadefoot Toad tadpole. Photo: Loïc van Doorn.

To turn the tide, the Agency for Nature and Forest of the Flemish Region (ANB) issued a protection program for the species, including a reintroduction effort, assigned to the Research Institute for Nature and Forest (INBO). To this end, each Spring, egg strands are collected in the two populations. They are then reared into fully grown larvae and metamorphosed juveniles, that are subsequently released to restock the remaining populations and (re)introduce spadefoot toads in suitable habitats within their historical range. Prior to the reintroductions, management efforts have resolved habitat issues that led to the initial demise of the spadefoot toad populations.

Egg strands are reared *ex situ* in the specialised breeding facilities of INBO. As such, survival and growth can be maximised, while maintaining a disease-free stock. In 2020, 11,465 larvae and 190 juveniles were released into the two extant and two historical populations. In 2021, however, very few egg strands could be collected, possibly due to atypically cold and dry Spring weather, highlighting the need for additional sources to allow for a continued successful introduction effort. Two solutions are currently being worked out. A breeding stock of native animals is being built up, to allow for captive breeding of spadefoot toads. Next to captive breeding, collection of egg strands or larvae from healthy populations or breeding stocks in neighbouring countries could offer major advantages in terms of enhancing quality and quan-

tity of the available material. Both as a backup in case of failing natural and/or captive local reproduction, as well as to increase the genetic diversity.

The aim is to repopulate high-potential habitats for spadefoot toad with larvae and juveniles during at least four consecutive years, ensuring a natural population structure. Thus, depending on the available larval stock, spadefoot toads will be introduced into a subset of predetermined locations before moving on to other potential locations. This rationale has successfully been implemented in the Netherlands, where spadefoot toads are once again heard calling all over the country. Hopefully, Belgium can likewise become a safe haven for this emblematic species.



## Rescuing the southernmost marsupial frog species in Argentina

**Mauricio Sebastián Akmentins and Martín Boullhesen, INECHOA, CONICET-UNJu, Argentina; Elena Correa, Walter Javier González Raffo, Gabriel Federico Rodríguez and Juan Pablo Juliá, Reserva Experimental Horco Molle, UNT, Argentina**

Despite the success in the implementation of a population supplementation program of La Banderita Marsupial Frog (*Gastrotheca gracilis*), the conservation status of this endangered species is still a matter of concern. Therefore, we have been upgrading the existing facilities at the Reserva Experimental Horco Molle, in Tucumán, Argentina, to develop an *ex situ* research and captive breeding program for this threatened marsupial frog. We will continue the supplementation program of the La Banderita Marsupial Frog population in the Reserva Provincial Los Sosa and we will establish an intensive search program focused on detecting the presence of this endangered species on the northern distribution range where it has been missing for nearly thirty years.

The major outcomes expected from the *ex situ* component of this program are to upgrade the *ex situ* facilities of the Reserva Experimental Horco Molle; obtain founder animals for the first captive breeding attempts; and to continue the supplementation program of La Banderita Marsupial Frogs in the Reserva Provincial Los Sosa.

For the *in situ* component, we hope to search for missing populations of the frog in the northern range of the geographical distribution and to monitor the conservation status of La Banderita Marsupial Frog in the rediscovered populations.

Our main partner, the Reserva Experimental Horco Molle is fully committed to the project and through the National University of Tucumán, funding has been obtained to help with labor and materials for the improvement of the *ex situ* facilities. Government authorities continue to support to our project and have given appropriate permission for us to collect founder animals, and a second-year Start-up Extension grant from the Amphibian Ark also was an important funding source

Despite the delays and limitations in our activities due to the COVID-19 pandemic situation, we have been able to achieve some important objectives of our project during the past six months. We have nearly finished the upgrade works in the *ex situ* facilities at



A metamorph La Banderita Marsupial Frog (*Gastrotheca gracilis*) found in a new reproductive site in the Reserva Provincial Los Sosa in Tucumán province, Argentina. Photo: Martín Boullhesen.

Juvenile La Banderita Marsupial Frogs raised in the *ex situ* facilities of the Reserva Experimental Horco Molle in Tucumán province, Argentina. Photo: Elena Correa.







Upgrade works in the *ex situ* facilities of the Reserva Experimental Horco Molle (UNT), Tucumán province, Argentina.  
Photo: Elena Correa.

the Reserva Experimental Horco Molle, with many improvements, including roof repairs; air conditioner system maintenance; installation of a new window for natural illumination of the facilities; installation of a new access door to improve biosecurity; painting the facilities with waterproof paint; and development of a new room to raise live food for the frogs. Most significantly, we have now obtained the founder individuals for the first captive breeding attempts.

We were also able to undertake the first search campaign for the missing populations of *G. gracilis* in February 2021, although unfortunately, without positive results. We detected that the main threats for *G. gracilis* in the Reserva Provincial Los Sosa were still active, particularly the presence of solid waste and domestic animals (pigs) in the reproductive habitats. We registered a new reproductive site of *G. gracilis* in the Reserva Provincial Los Sosa, and thankfully, the population of La Banderita Marsupial Frog in its type locality seems to be stable.

During the next twelve months, we will continue our work, and hope to finish the upgrade of the *ex situ* facilities at the Reserva Experimental Horco Molle by September 2021. We will continue our captive breeding attempts in order to obtain the first cohort of *ex situ* raised individuals of La Banderita Marsupial Frogs, and we will begin a new round of supplementation efforts for the species in the Reserva Provincial Los Sosa during the 2021-2022 breeding season. Once field surveys have been concluded, we will gather the obtained information about the conservation status of La Banderita Marsupial Frog and we will present a technical report to the authorities at the Universidad Nacional de Tucumán and environment authorities of Tucumán province.



Active threats for La Banderita Marsupial Frogs detected during 2021 field campaigns in the reproductive sites in the Reserva Provincial Los Sosa include human waste and wild pigs.  
Photo: Mauricio Akmentins.



## Field monitoring, *ex situ* management and reintroduction of threatened urban amphibians of the city of Cuenca, Ecuador

Jackeline Arpi, Nataly Aguilar, Fausto Siavichay and Carlos Martínez, AMARU Amphibian Conservation Center, Ecuador

At present the loss of biodiversity in cities has been evident, mainly due to urban expansion and pollution. Amphibians are species which are highly susceptible to any alteration in their habitats, have been affected by these changes, and additionally, have been affected by the appearance of emerging pathogens such as chytrid fungus and ranavirus, endangering several of their populations.

According to the National Red List for Ecuadorian amphibians (Ortega-Andrade et al., 2021) more than 57% of amphibians are categorized as threatened. In the city of Cuenca in Ecuador, ten species of native anurans (frogs) belonging to four families (Hemiphractidae, Dendrobatidae, Microhylidae and Strabomantidae) can be found (Siavichay et al 2016). So far only five of these have been evaluated and two are considered extirpated from the city (Ortega-Andrade et al., 2021). Therefore, according to the current state of Cuenca's anuran populations, most are in danger. In this context, the Amphibian Conservation Center - Zoo Amaru (CCA), is dedicated to both *in situ* and *ex situ* monitoring and management where scientific research and the management of actions for the conservation of species are involved. The CCA manages four species which are considered to be urban amphibians: Boulenger's Rocket Frog (*Hyloxalus vertebralis*), Cuenca Nelson Frog (*Ctenophryne aequatorialis*), San Lucas Marsupial Frog (*Gastrotheca pseustes*) and *Gastrotheca cuencana*. The management of these species involves *in situ* monitoring to analyze the status of populations, rescue of individuals in areas that are going to be impacted by development, *ex situ* reproduction and reintroduction in suitable habitats for each species.

To maintain the food supply for the individuals in our *ex situ* program, the CCA has a specialized animal facility where a variety of arthropods that meet amphibian nutritional needs are managed. The urban amphibians base their diet on species such as springtails (*Folsomia candida*), crickets (*Acheta domesticus*), tenebrios (*Tribolium castaneum* and *Tenebrio molitor*) and moths (*Galleria mellonella*). It should be noted that when preparing the diet we feed to our amphibians, several aspects are taken into account, including age, biology, rations and their physiological state.

So far, we have reintroduced two species of marsupial frogs – the San Lucas Marsupial Frog and *Gastrotheca cuencana*, both of which are endemic to Ecuador and can be common in urban environments. Their natural distribution range varies between regions such as western montane forest, páramo (high, tropical, montane vegetation above the continuous timberline) and inter-Andean scrub. They present semi-arboreal nocturnal habits and can be found generally in grasslands and urban pastures near ditches, water reservoirs, temporary ponds or wetlands, where lentic water is available for tadpoles. Their small known areas of occurrence within the city are dispersed and their habitats are in densely populated areas that are rapidly urbanizing (Carvajal et al., 2019).

In September 2019, an *in situ* monitoring program was carried out in the town of Yanaturo-Cuenca, with a large number of tadpoles deposited in an artificial pond created by the Cuenca Municipal Cleaning Company (EMAC). However, the company had to proceed with cleaning the pool, so the tadpoles were rescued and taken to the CCA-Amaru. The rescue is part of an Urban Biodiversity conservation program managed by the Environmental Management Commission of the Municipality of Cuenca. Approximately 1,200 individuals were collected between larval development stages 22-30 according to Gosner (1960) and were housed in plastic containers for better management of water exchanges to prevent levels of ammonia from rising. The larvae diet basically



Personnel in charge of invertebrate management supply nutritional needs of the amphibian species managed in the CCA-Amaru. Photo: Fausto Siavichay.

consisted of supplementary food for herbivorous/omnivorous fish (TetraVeggie / Pleco Wafers - Protein 30.0% min; fat 6.0% min; fiber 5.0% max). During the metamorphosis process, which lasted about twelve months, several individuals died. Many did not present obvious signs to suggest why they died, and we understand that this was because they did not adapt properly to life in captivity.

Once the tadpoles completed their metamorphosis, they were transferred to plastic containers with wet paper substrates, and shelters to reduce stress. To maintain control of the amount of insects that were supplied in the diet, a monthly control was carried out, showing that live food was provided three times a week, and consisting of 2g of tenebrios and beetles, and 3g of crickets for every twenty-five individuals. The size of the prey was less than a third the total length of the individuals, that is, appropriate for the age and size of the juvenile frogs.

Individuals between 2-3g in weight and with a face-cloaca length of 25-30mm and a tibia length of 12-15mm were determined to be suitable candidates for reintroduction. We proceeded with a marking technique that consisted of amputation of the second phalanx of the right lower limb. To carry out the procedure, 2% Xylocaine and Chlorhexidine were used only in the limb in which the phalanx is to be amputated. It should be noted that this marking technique is an established practice as the most reliable and permanent for long-term monitoring and is accepted as an ethical and statistically reliable process (Perry et al 2011). It was done for future identification purposes to assist in monitoring reintroduced animals. Once the marking was done, the individuals were then observed for a five-week period, where they were checked to ensure correct healing. During this period fecal examinations were carried out, and a slight parasite load was observed with nematodes of the Strongylidae family and protozoa of the *Opalina* genus.



The reintroduction process includes transport and handling of San Lucas Marsupial Frogs (*Gastrotheca pseustes*).  
Photo: Fausto Siavichay.



Finally, in 2021, the first three reintroduction trials were carried out in the same locality where the rescue was made. Twenty-five, thirty, and thirty-one individuals respectively were reintroduced, and we hope to be able to carry out the corresponding monitoring to evaluate their adaptability in the future.

Working with urban amphibians is a very big challenge since it involves aspects of meeting the needs of both citizens and wildlife. Therefore, these conservation projects must be deeply linked to constant environmental education in order to achieve the expected results. In addition, research is needed on the state of populations, analyzing emerging diseases, malformations caused by pollution and pathogenic parasites that could affect not only amphibian species, but all elements of urban biodiversity.

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## In Memorium

Sadly, we report the passing of renowned evolutionary biologist, Dr. David Wake, the world's leading expert on salamanders and among the first to warn of a precipitous decline in frog, salamander and other amphibian populations worldwide. Dr. Wake died peacefully at his home in California on April 19.





## AArk Conservation Grant recipients

**Kevin Johnson, Amphibian Ark**

Amphibian Ark's Conservation Grants program ([www.amphibianark.org/conservation-grants/](http://www.amphibianark.org/conservation-grants/)) supports start-up 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 is 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 ([www.conservationneeds.org](http://www.conservationneeds.org)) or a similar, national assessment process. Since 2009, we have awarded forty-three grants, from twenty-two countries, totaling US\$ 203,970.

This year we awarded two grants, for new programs planned in Iran and Peru. Both programs include *ex situ* conservation breeding as their primary focus.

### Establishing an *ex situ* conservation strategy for *Paradactylodon persicus gorganensis* in Iran

**Dr. Seyyed Saeed Hosseinian Yousefkhani; Institute of Biological studies, School of Biology, Damghan University, Damghan, Iran**

The Critically Endangered Persian Mountain Salamander (*Paradactylodon persicus gorganensis*) is an endemic cave salamander in Iran which is found within the Hyrcanian forest in Golestan province, northern Iran. It has a very restricted distribution range. The subspecies was previously known as a full species, but recently based on the two taxonomic studies (Stock et al., 2019; Ahmadzadeh et al., 2020) defined as subspecies. Tourism and habitat destruction are the main threats for the species so far, but it will also be valuable to evaluate the populations of this taxon for the *Bd* pathogen. In addition to being a source of income for locals, tourism creates many environmental problems. Tourists do not observe the cleanliness of the environment and leave a lot of garbage to in the area during their visits. Tourists swimming in the pools created in the forest can also transmit various fungal agents to the area, which is dangerous for the salamanders as well as other amphibians.



Tourists swimming in the pools created in the forest can also transmit various fungal agents to the area.

Photo: Seyyed Saeed Hosseinian Yousefkhani.



The Critically Endangered Persian Mountain Salamander (*Paradactylodon persicus gorganensis*).  
Photo: Dr. Haji Gholi Kami.

This project will establish an urgent rescue program for populations of Persian Mountain Salamander in two stages: as captive husbandry at natural controlled ponds in the Hyrcanian Forest; and through captive breeding in laboratory controlled aquaria at the Institute of Biological Science at Damghan University.

Objectives for the first year are:

1. Determine suitable ponds for survival of the salamanders within the Hyrcanian territory region.
2. Translocate reproductive individuals to newly identified habitats in the Hyrcanian forest
3. Establish an *ex situ* breeding program within the natural controlled ponds.
4. Work on the *in situ* conservation program by distributing brochures and video clips to help educate local people.

The effectiveness of the project will be evaluated after one year. The IUCN Red List assessment will be updated and the map for new ponds will be provided to the agencies. Videos and printed brochures about the conservation program will be developed to increase the public awareness about this issue.

The project is planned for three years, and we will continually monitor it during this period. After completion of project all ponds and released specimens will continue to be monitored and threats around the ponds will be reviewed, to evaluate the success of the project.



## The Junín Amphibian Conservation Center

Roberto Elias, NGO Grupo RANA, Peru

The Lake Junín Frog (*Telmatobius macrostomus*) is endemic to Peru. According to the IUCN Red List and national legislation it is endangered, and in recent decades the population has reduced dramatically (by more than 95% since 1950 according to own calculations) due to the illegal trafficking of the species, the presence of the invasive Rainbow Trout (*Oncorhynchus mykiss*), the degradation of habitat and the lack of a technical center for the breeding of the species. Given these threats, *ex situ* conservation measures are necessary to reintroduce individuals to safe natural habitats and to reinforce existing populations. We propose the formation of a breeding and research center in the district of Ninacaca within the Junín National Reserve, which has an existing infrastructure (catchment channel, waste control grid, breeding ponds and space for a laboratory). We already have an agreement with Jesús Espinoza, a local resident that the space where the project will be carried out would be available.

The initial population will be twelve tadpoles and six adults collected from the natural environment, and individuals confiscated by the Peruvian Government from illegal farming and hunting operations. We will work with this relatively small number of animals initially, to learn how to raise them and see if we can get them to reproduce, without damaging the current wild population unnecessarily. Should the breeding be successful with these initial pairs, the goal is to increase the number to ensure healthy genetic viability in the Conservation Center.

All individuals will undergo a quarantine and a complete examination including treatment for chytridiomycosis. This site will additionally provide opportunities for studies of habitat quality, food availability and training resources for the local citizen science project "Guardians of the Chinchaycocha frogs" under the direction of Denver Zoo, USA and the NGO Grupo RANA. The animals will be reared in natural pools meeting the required water chemistry parameters, hoping that greater than 50% of the tadpoles



Roberto Elias, photographing Lake Junín Frogs in the field.  
Photo: Jhusely Navarro.

and confiscated individuals will develop properly. As the breeding program succeeds, half of the reared individuals will be released, when they reach stage 36 per Gosner, in the local monitoring sites, rehabbed sites devoid of threats, sites within the territory and buffer zones of national protected areas, and those that are part of the citizen monitoring program. The remaining frogs will remain in captivity to ensure the success of the project. The *ex situ* conservation facility will work with the rural communities, Denver Zoo, Junín National Reserve, the Amphibian Survival Alliance,



The Lake Junín Frog (*Telmatobius macrostomus*) is endemic to Peru. *Ex situ* conservation measures are necessary to reintroduce individuals to safe natural habitats and to reinforce existing populations. Photo: Oscar Damian.

local governments and communities, the Peruvian University Cayetano Heredia and the Municipality of Ninacaca.

We currently have a community monitoring program in partnership with the Denver Zoological Foundation called "Guardians of the Chinchaycocha frogs" which trains the local population in the monitoring and conservation of this amphibian. The objective of this project is to conserve the population of Lake Junín Frogs through *ex situ* efforts. We propose to strengthen the existing artisanal breeding center located within the geographic distribution area of the species, through the implementation of a laboratory and strengthening of the technical and conservation capacities of the local population which today manages the center and with whom we have an agreement and our community monitoring program.

The anticipated results for this project are to:

1. Implement and strengthen the necessary facilities to breed Lake Junín Frogs
2. Evaluate the ecological requirements of the species
3. Develop a captive breeding program
4. Train the local population in aspects of amphibian husbandry, live food production, biosecurity and captive breeding
5. Strengthen our community monitoring program by involving communities in creating microhabitats and enter into conservation agreements with them.



## 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 270 documents in it, with additional documents 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 provides much more accurate results when searching the document library for particular topics.

Five new documents have been added recently:

### **Gazetted Biodiversity Management Plan for Pickersgill's Reed Frog for Implementation** (English)

Pickersgill's Reed Frog, *Hyperolius pickersgilli*, is a small frog known only from limited and highly fragmented coastal wetland habitat in the KwaZulu-Natal Province of South Africa. The species has been prioritised for conservation action due to its Red List status, endemism and ongoing deterioration in and loss of habitat. Without concerted proactive conservation intervention in the near future, it is highly likely that *H. pickersgilli* will become extinct. A Biodiversity Management Plan for *H. pickersgilli* is therefore warranted to formalise urgent, targeted conservation action for the species. Given that the majority of sites occur on privately or commercially-owned land, the participation of all relevant stakeholders in the management of habitat for the long-term protection of *H. pickersgilli* is crucial. There are at least 15 different stakeholder groups that are well placed to influence the long-term future of *H. pickersgilli*. The overall aim of the Biodiversity Management Plan for *H. pickersgilli* is to improve the conservation status of *H. pickersgilli* and secure its survival in perpetuity in the wild.

**Authors:** Jeanne Tarrant and Adrian John Armstrong.

**Publication:** June 2017

[www.researchgate.net/publication/325441597\\_Gazetted\\_Biodiversity\\_Management\\_Plan\\_for\\_Pickersgill%27s\\_Reed\\_Frog\\_for\\_Implementation](http://www.researchgate.net/publication/325441597_Gazetted_Biodiversity_Management_Plan_for_Pickersgill%27s_Reed_Frog_for_Implementation)

### **A survival blueprint for the Taylor's Salamander, *Ambystoma taylori*** (English)

**Author:** José Alfredo Hernández Díaz

**Publication:** Output from an EDGE of Existence fellowship, Zoological Society of London, London, UK, 2017

[www.edgeofexistence.org/wp-content/uploads/2017/06/Survival\\_Blueprint\\_2019\\_Ambystoma\\_taylori.pdf](http://www.edgeofexistence.org/wp-content/uploads/2017/06/Survival_Blueprint_2019_Ambystoma_taylori.pdf)

### **Conservation Action Plan for the Amphibians of Argentina** (English)

The Conservation Action Plan for the Amphibians of Argentina proposes goals and actions that are considered priority to cover the existing information gaps and face the current and future threats to the conservation of amphibians in our country. It aims to provide clear guidance on issues that are considered relevant to conservation by identifying and ordering a set of measurable goals and the respective actions that respond to specific recommendations grouped in the thematic lines proposed and that can be implemented in the short, medium and long term (1, 3 and 5 years).

**Editors:** Marcos Vaira, Mauricio S. Akmentins and Esteban O. Lavilla

**Publication:** August 2018

[www.amphibianark.org/wp-content/uploads/2021/03/Amphibian-Action-Plan-Argentina.pdf](http://www.amphibianark.org/wp-content/uploads/2021/03/Amphibian-Action-Plan-Argentina.pdf)

### **Lessons from practitioners for designing and implementing effective amphibian captive breeding programmes** (English)

With 40% of global amphibian species threatened with extinction, captive breeding programmes are an increasingly important conservation tool. The highest priority species occur in tropical countries, which presents a number of challenges. We conducted semi-structured interviews with 25 practitioners in Latin America, Africa and Asia to investigate how the effectiveness of amphibian captive breeding programmes could be improved. A thematic analysis identified 94 barriers and enablers across 13 themes. We found that existing programmes commonly followed a reactive and often ineffective four-stage operational model. Subsequently, we developed a proactive operational model, using the barriers and enablers identified by this study, to support programme managers in the implementation of effective programmes. Our findings suggest human dimensions are often critical barriers or enablers across all stages of captive breeding programmes. We recommend the development of strategic partnerships between institutions, including zoos, NGOs, governments and captive breeding programmes, to help overcome these critical barriers and improve the effectiveness of global amphibian conservation. This operational model could be translated to captive breeding programmes for other taxa.

**Authors:** Karlsdóttir, B., Knight, A., Johnson, K., & Dawson, J.

**Publication:** Oryx, 1-11 (2021)

[www.doi.org/10.1017/S0030605320000332](http://www.doi.org/10.1017/S0030605320000332)

### **IUCN guidelines for amphibian reintroductions and other conservation translocations: first edition** (English)

The number of amphibian reintroductions and other conservation translocations has increased in recent decades. Amphibian reintroductions are challenging and may not always work, but amphibian reintroductions may be the best or only option for conserving some species. Clearer guidance to plan, implement, and obtain resources for amphibian reintroductions is needed to improve conservation outcomes. These Guidelines outline the most important considerations for each stage of an amphibian reintroduction. They provide guidance, best practices, case studies, and links to helpful resources that will be useful for a wide variety of practitioners involved in amphibian reintroductions.

**Editors:** Luke J. Linhoff, Pritpal Soorae, Gemma Harding, Maureen A. Donnelly, Jennifer M. Germano, David A. Hunter, Michael McFadden, Joseph R. Mendelson III, Allan P. Pessier, Michael J. Sredl and Mallory E. Eckstut

**Publication:** First edition, 2021

<https://portals.iucn.org/library/node/49485>



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Anne Baker & Robert Lacy,  
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William Aukshun  
Beastly Threads  
Buffalo Zoo  
Davis Breen  
Charles Burnette  
Rachael Creager  
Fahim Dhalla  
Jessica Finberg  
Jonathan Foise  
Ron Gagliardo  
Cassandra Giannousis  
Traci Hartsell  
Julia Hertl  
Da-Shih Hu  
Raymond Picciano  
Ella Rowan  
Andrew Smith  
Georgette Taylor  
Brendan Wenzel  
Brett Williams

### Up to \$100

Leopold Avallone  
Amiran Berman  
Roman Bodinek  
Monique Canonico  
Chris Carvalho  
Eithan Dudnik  
Marvin Goldberg  
Susan Handa  
James Hanken  
Chris Johnson  
Tomas Kraus  
Ron & Joanne Lane  
Lubomyr Luciuk  
Eamon Matthews  
Kevin Mitchell  
Poppy Ostrowski  
Claire Rosser  
George Sommer  
Kamil Sudyarov  
Madeleine Sullivan Murphy  
Margaret Trautner  
Brian Ugurlu  
Lori Van Allen  
David & Marvalee Wake  
Bruce Weber  
Stephanie Zimmerman

### Up to \$50

Jonathan Brater  
Joseph Cannizzaro  
David Corsini  
Karen Crumley  
Matthew D'Ambrosio  
In memory of Adelaide Ellis  
Leonard Epstein  
Ramona Fenner  
Valrie Fingerman  
Torey Haas  
Alyce Hopko  
Terry Keiser  
Shaun Miller  
Tracy Tallar

Henry Thomas  
Stuart Weeks  
Douglas Widener  
Georgeanne Wilcox

### Up to \$25

Anonymous B  
Tara Bowden  
McKay Caruthers  
Scott Edelen  
Steve Greco  
Mary Lew Kehm  
Danielle Levin  
Milla Louann  
Coral Miller  
Alessandro Mastrococco  
Erik Paul  
Dan Pomfret  
Emily Serven  
Stephan Schwinn  
Rebecca Walden, in memory of Ken  
Walden

### Up to \$10

Artem Alexeev  
Laura Brown  
Daniel Gribble  
Melinda Halicki  
Mikail Kane  
Noriko Logan  
Basil Parks  
Dashiell Rich  
Axl Rose  
Jesus Sanchez Olivero  
Savy Som  
James Thorne  
Jessica Thunte  
Mike Tufl  
Eleanor Whitenack