amphibian ark

Keeping threatened amphibian species afloat

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CONSERVATION NEEDS ASSESSMENTS

RED LIST

Amphibian Ark
c/o Conservation Planning Specialist Group
12101 Johnny Cake Ridge Road
Apple Valley MN 55124-8151
USA

www.amphibianark.org

Phone: +1 952 997 9800
Fax: +1 952 997 9803

Using radio-telemetry to track survival and disease outcomes in the Mountain Yellow-legged Frog to inform *ex situ* management

Dr. Talisin Hammond and Dr. Debra Shier, Institute for Conservation Research, San Diego, USA

Releasing captive-bred endangered Mountain Yellow-legged Frogs (*Rana muscosa*) with radio-transmitter implants. Photo: Talisin Hammond.

In Summer 2019 we used funds from an Amphibian Ark Conservation Grant to purchase radio-transmitters from Advanced Telemetry Systems (model R1655). In August 2019, after veterinarians at San Diego Zoo Global, USA had developed a surgical protocol, radio-transmitters were successfully implanted into twenty-one captive-bred Mountain Yellow-legged Frogs (*Rana muscosa*). After approximately one week of recovery, frogs were transported to a release site in the San Jacinto Mountains and were released into the wild along with eighty-seven tadpoles. Post-release monitoring took place approximately bi-weekly for the first month after release, and then approximately weekly until late-November, when snow was on the ground and water temperatures were below 5° (at which point this species is thought to enter hibernation). At that time the access road shut down for the season, however, the site was accessed using snow-shoes and surveys took place approximately bi-monthly through mid-May 2020.

The batteries of all but two transmitters lasted to at least mid-May 2020. However, we were rarely (~9% of all individual locations) able to visually locate frogs due to their cryptic behavior (in a few cases when we visually confirmed their presence they appeared to be wedged between rocks or hiding in caves). Whenever possible we captured frogs and measured, weighed, and swabbed them for chytrid fungus. Most frogs had maintained or gained weight and their surgical incision sites appeared to be healed.

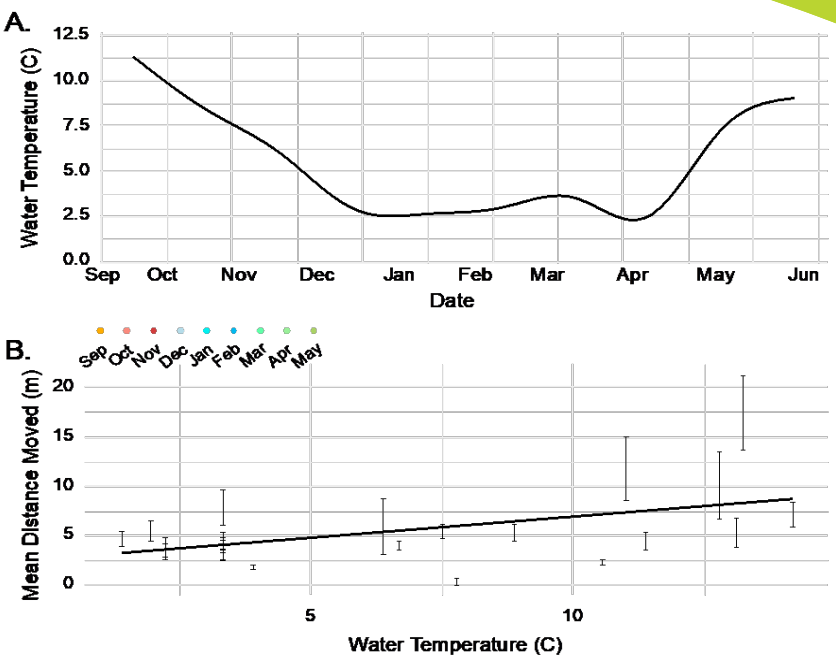
Post-release movement away from the release location was limited in comparison to other release sites (average <50 meters, in contrast to ~500 meters at another release site in 2019). Like other release sites, however, movements were almost exclusively upstream. Movements decreased as water temperatures decreased and date progressed, but there was still some movement and on a small number of occasions, frogs were visually detected moving about in pools even as water temperatures approached freezing. Frogs appeared to be hibernating/brumating in habitats that were either in the water (most common) or within ~1 meter of the water's edge. Habitat data was collected on each survey and future analyses will integrate these measures and describe overwintering locations in more detail. We are unsure why this is the case, but have three main hypotheses: (1) the water temperatures at this site were cooler; (2) (relatedly) these animals were released slightly later than what we usually do (in order to ensure the radio-transmitters would last through the spring); (3) this is the first time we've released significant numbers of three-year old animals, and possibly they behave differently than the younger animals we normally release.

Unfortunately, beginning in January 2020 we began to document mortalities of frogs in the field, and due to decomposition, it was difficult to identify a cause of death. Body condition was scored as fair to good for all recovered individuals. There were little to no indications that the transmitters were related to the mortalities. The fungal pathogen *Batrachochytrium dendrobatidis* (*Bd*) is one possible cause of death, but data is limited due to low recapture rates. Analyses are still in progress, but a number of individuals tested positive for *Bd*, particularly in the winter and spring and our findings are not inconsistent with a *Bd*-related die-off. Future work

A researcher conducting radio-telemetry work during the fall (left) and winter (right) to re-locate reintroduced Mountain Yellow-legged Frogs. Photo: Talisin Hammond.

will test hypotheses related to *Bd*, movement, and survival in more detail.

These data are extremely valuable and could not have been collected without the support of the Amphibian Ark. In addition to revealing previously unknown information about the natural history of endangered Mountain Yellow-legged Frogs in southern California, our results suggest that more work is needed to examine the seasonality of *Bd* in our focal populations. The investment from Amphibian Ark has allowed us to generate critical information for the conservation and management of this endangered species that will directly impact decision-making. We now better understand over-wintering needs in this species, which will inform future release site selection. Future work will assess *Bd* outside of standard survey windows (late spring through early fall) in order to characterize seasonal dynamics of this pathogen and how they may impact this reintroduced, endangered species.



Relationships between water temperature, date, and animal movement. A. Relationship between water temperature and date, colored by month. B. Relationship between mean (± S.E) between-survey movement distances and water temperature on each survey date, colored by month.

A Mountain Yellow-legged Frog with a radio-transmitter implant immediately before release into the wild. Photo: Talisin Hammond.

AArk Husbandry Document library

The Husbandry Document library on the AArk web site (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.

Five new documents have been added recently:

Reproductive Techniques for Ovarian Monitoring and Control in Amphibians (English)

Author: Natalie E. Calatayud, Norin Chai, Nicole R. Gardner, Michelle J. Curtis, Monica A. Stoops

Publication: *J. Vis. Exp*. (147), e58675, doi:10.3791/58675 (2019)

Ovarian control and monitoring in amphibians require a multi-faceted approach. There are several applications that can successfully induce reproductive behaviors and the acquisition of gametes and embryos for physiological or molecular research. Amphibians contribute to one quarter to one-third of vertebrate research, and of interest in this context is their contribution to the scientific community's knowledge of reproductive processes and embryological development. However, most of this knowledge is derived from a small number of species. In recent times, the decimation of amphibians across the globe has required increasing intervention by conservationists. The captive recovery and assurance colonies that continue to emerge in response to the extinction risk make existing research and clinical applications invaluable to the survival and reproduction of amphibians held under human care. The success of any captive population is founded on its health and reproduction and the ability to develop viable offspring that carry forward the most diverse genetic representation of their species. For researchers and veterinarians, the ability to monitor and control ovarian development and health is, therefore, imperative. The focus of this article is to highlight the different assisted reproductive techniques that can be used to monitor and, where appropriate or necessary, control ovarian function in amphibians. Ideally, any reproductive and health issues should be reduced through proper captive husbandry, but, as with any animal, issues of health and reproductive pathologies are inevitable. Non-invasive techniques include behavioral assessments, visual inspection and palpation and morphometric measurements for the calculation of body condition indices and ultrasound. Invasive techniques include hormonal injections, blood sampling, and surgery. Ovarian control can be exercised in a number of ways depending on the application required and species of interest.

www.amphibianark.org/wp-content/uploads/2020/08/Reproductive-techniques-for-ovarian-monitoring-control-in-Amphibians.pdf

Basic manual for the care in captivity of the Xochimilco axolotl (*Ambystoma mexicanum*) (Spanish)

Author: Horacio Mena González and Erika Servín Zamora, Universidad Nacional Autónoma de México

Publication: February 2014

This manual is addressed to all these people whose objective is to provide the necessary information for the knowledge and maintenance of the Xochimilco Axolotl (*Ambystoma mexicanum*) in captivity. It is important to point out that currently, in addition to the Xochimilco Axolotl, other species of salamanders are threatened or endangered; this situation supposes as a priority a knowledge of the current regulations in terms of possession of a specimen of this species as a pet. Likewise, in order to provide adequate treatment and provide the necessary elements for the welfare of this species in captivity, this manual presents the essential recommendations to consider, from the identification and acquisition of a specimen, through strategies for its management, to the facilities and equipment necessary to achieve adequate containment. Suggestions are also given on how to maintain the health of the organisms and finally, by way of conclusion and for a better understanding, the measures that are currently being put into practice for the conservation of this species are presented.

www.amphibianark.org/wp-content/uploads/2020/06/Manual-básico-para-el-cuidado-en-cautiverio-del-Ambystoma-mexicanum.pdf

Action Program for the Conservation of *Ambystoma* Species (Spanish)

Author: Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT), Mexico

Publication: 2018

The Action Program for the Conservation of *Ambystoma* Species (PACE: *Ambystoma*) is developed within the framework of the Conservation of Species at Risk Program (PROCER), a guiding document of the Directorate of Priority Species for Conservation (DEPC) of the National Commission for Protected Natural Areas (CONANP). The PACE *Ambystoma* is part of the axis of Conservation and Management of Biodiversity, of the Strategy of the CONANP 2040 that is expressed in the strategic line as: Develop and implement action programs for the recovery of species at risk, linked to the Programs of Management of Protected Natural Areas and other instruments, with the participation of society. The foregoing constitutes a basic tool to fulfil the strategic objectives of the National Program of Natural Protected Areas, the Sectorial Program for the Environment and the National Development Plan.

www.amphibianark.org/wp-content/uploads/2020/06/PACE-Ambystoma.pdf

***Ex situ* Management of Amphibians in India** (English)

Author: Brij Kishor Gupta, Benjamin Tapley, Karthikeyan Vasudevan and Matt Goetz

Publication: 2015

India has about 390 species and more than 70% of them are endemic to the region. Indian Zoos could play a pivotal role in the conservation management of the countries threatened amphibians. In addition, zoos are ideally placed to educate the visiting the public about amphibians and the threats that they face. Currently amphibians are underrepresented in Indian Zoos and only one species (i.e. Salamander *Tylototriton verrucosus*) maintained by one institution, Padmaja Naidu Himalayan Zoological Park in Darjeeling. The Central Zoo Authority (CZA) recognises the need to increase capacity in amphibian zoos. Over the years the CZA has paved way for prioritization of species and preparation of a plan for coordinated conservation breeding for Indian amphibians. With ecology and biology of many amphibians in India remains unknown, it is potentially difficult to keep, establish and breed Indian amphibians. We strongly urge young biologists and zoo professionals to gather information through targeted studies on species in the field before embarking on captive breed-

ing programs. The present guidelines on the *ex situ* management of amphibians are part of output of the workshop on "Building National Capacity for *ex situ* Amphibians Management and Conservation" held at the Assam State Zoo, Guwhati, Assam, India during December, 2013.

https://www.amphibianark.org/wp-content/uploads/2020/06/Ex-situ-Management-of-Amphibians-in-India.pdf

Amphibian husbandry nanotraining videos

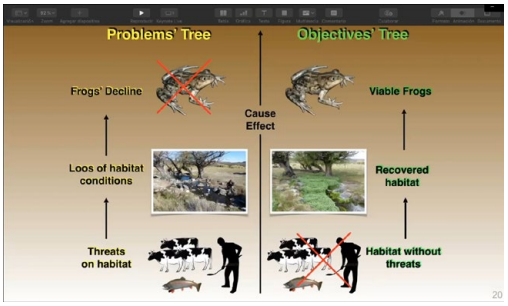
This short webinar series, developed by the Amphibian Ark, provides an interactive, online forum where managers of *ex situ* amphibian programs can discuss some of the main challenges program managers and keepers might have as they strive to reach their conservation goals. The content of the webinars follows the key steps in establishing and maintaining a successful *ex situ* amphibian conservation program. Each session runs for 60 minutes.

The first step is to be successful in obtaining founder animals and maintaining them in optimal conditions. There are different sampling techniques that help us to find founder animals, in the case where a source of captive individuals from other institutions is not available. An overview of the logistics for doing remote fieldwork where many priority species occur will be presented during one of the webinars.

Water quality, lighting and nutrition are some of the important husbandry aspects that program managers need to be very aware of if the program is to be successful. Biosecurity is also very important, especially for animals which will eventually be reintroduced into the wild. These topics will be covered during the husbandry webinars.

One of the exit strategies of any amphibian ex situ conservation program is reintroduction of the offspring to the wild. One of the post-release monitoring techniques is radio-telemetry, and a presentation during the webinar series will discuss this activity.

Recordings of the webinars are available on the AArk web site at www.amphibianark.org/husbandry-nanotraining-videos/. The complete set of videos is also available as a playlist on YouTube at www.youtube.com/playlist?list=PLVjpGsWSiXYvf_8-aXWDkty17rLu4NFFx.

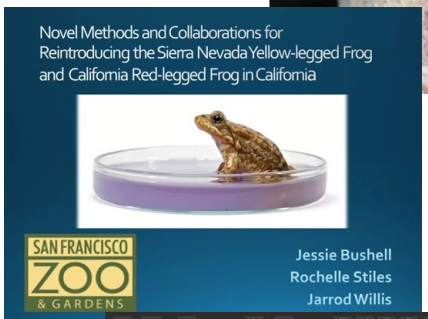


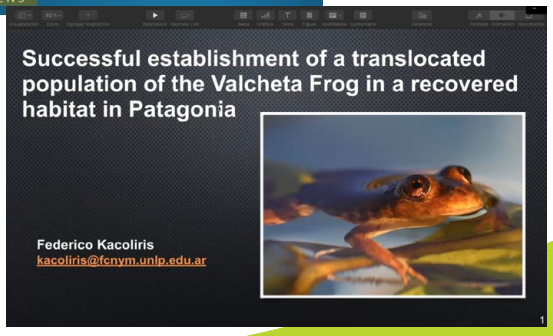
Grant writing webinars

Money, money, money… we are always struggling to find resources for our conservation programs, so many times we need to write and request grants from other institutions.

In this short webinar series, developed by the Amphibian Ark, grant managers from different organizations share advice on what a good/successful proposal is for them, regardless of the guidelines of the organization they represent. From the many applications they receive each year, they discuss which stand out over others, what is the key to success, what they are looking for as reviewers and granting bodies in a well-written proposal. This information from organizations that provide grants is a way to give our audience tools to write better proposals, not only to apply for AArk grants, but also to other organizations. Each session runs for between 30-40 minutes.

Recordings of the webinars are available on the AArk web site at www.amphibianark.org/grant-writing-webinars/. The complete set of videos is also available as a playlist on YouTube at www.youtube.com/playlist?list=PLVjpGsWSiXYvYLfYiPjDFCco2-AXZJEeF.





New Amphibian House opens at Orana Wildlife Park, New Zealand

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

In May 2020, Orana Wildlife Park in Christchurch, New Zealand, finally opened the doors of our long-awaited Amphibian House which has been many years in the making. Inspiration for the Amphibian House first started back in 2008 when Orana Wildlife Park CEO Lynn Anderson attended the Year of the Frog campaign launch and heard New Zealand native frog researcher Professor Phil Bishop present on the global amphibian extinction crisis. A plan was developed to create an indoor, climate controlled habitat to identify the required cues for breeding. Construction of the building was completed in 2011 but fit-out was put on hold by numerous unexpected events including the 2011 Christchurch earthquake and a significant gale-force storm hitting Park grounds in 2013, meaning that it wasn't until 2018 that the Amphibian House could be completed.

The laboratory facility which was created to house the native frogs is one of the most technically challenging projects ever completed at Orana, with specially designed rooms that simulate the climate of Maud Island throughout the year. Each of the two rooms is independently controlled, using data collected from weather stations on Maud Island in the Marlborough Sounds to replicate the day-length, temperature, rainfall and phases of the moon in an artificial environment.

Maud Island Frogs (*Leiopelma hamiltoni*, formerly *L.pakeka*) are one of New Zealand's three endangered native frog species. These tiny 5cm long frogs evolved in the absence of mammalian predators and were almost wiped out by the introduction of mice, rats, and stoats to New Zealand by the early settlers. Today they are relegated to just a few small predator-free islands. The three species in the *Leiopelma* genus are an ancient and primitive group which are considered evolutionarily distinct and lack the adaptive traits of frogs in other parts of the world. They live on land in shaded forest areas, have an extra presacral vertebrae (for a total of nine), lack an external eardum, do not croak due to lack of vocal sacs, do not have a tadpole stage (instead hatching as fully-formed froglets which are cared for by their father who carries them around on his back), and demonstrate 'late jump recovery', repositioning their legs for their next jump only after crash landing in a somewhat ungainly bellyflop. These stunning little nocturnal frogs can live for over forty-five years in the wild and live life at an unhurried pace, rarely travelling far from their home range of a roughly 5m radius. When threatened, *Leiopelma* frogs adopt a freeze-in-place strategy which can provide good camouflage from their native avian predators, but leaves them vulnerable to introduced mammalian predators such as rats and stoats which have completely wiped them out on the New Zealand mainland. Although the wild population of Maud Island Frogs is believed to number around 40,000, the fact that they are only found on a few predator-free offshore islands means they are extremely vulnerable to natural disasters or disease.

New Zealand's tiny Maud Island Frogs (*Leiopelma hamiltoni*) are part of an ancient and primitive group of frogs which are considered evolutionarily distinct and lack the adaptive traits of frogs in other parts of the world. Photo: Orana Wildlife Park.

As part of the Department of Conservation's Native Frog Recovery Group plans, seventeen Maud Island Frogs (seven males and ten females) were transferred to Orana Wildlife Park from Professor Phil Bishop at Otago University in May 2020 and were moved into vivarium style tanks in their new home. These frogs appear to have settled in very well at Orana so far and have been observed exhibiting social interactions at night under the glow of the laboratory's replica moon lights, and retreating to shelters during the day. Particularly exciting is that we are already seeing them occasionally choosing to spend time in male-female pairs. Our ultimate hope is that we will be able to crack the tricky task of breeding them in a captive situation, to allow us to make an important contribution to the conservation of New Zealand's native frog species.

An exhibit for the Green and Golden Bell Frog (*Litoria aurea*) within the new Amphibian House.
Photo: Orana Wildlife Park.

The new and long-awaited Amphibian House opened recently at Orana Wildlife Park in Christchurch, New Zealand, and now houses a group of seventeen endangered Maud Island Frogs. Photo: Orana Wildlife Park.

As part of the Department of Conservation's Native Frog Recovery Group plans, seventeen Maud Island Frogs were transferred to Orana Wildlife Park in May 2020. Photo: Orana Wildlife Park.

At Orana Wildlife Park, one of our aims is to provide an insurance population to help conserve and protect these frogs should anything happen to the wild population. Little is currently known about the breeding requirements of Maud Island Frogs and so the laboratory setting has been designed with multiple habitat options allowing for different variables to be trialled to see what produces the best reproductive results. Some of the vivariums allow for height in case climbing is an important aspect of breeding, while others allow for cooling of the substrate, increased rainfall, or simply different options in terms of the internal fit-out – do the frogs prefer a plant-filled, tank which replicates a forest floor, or one with rock piles and multiple crevices for hiding? The team will be trialling multiple different options to see what produces the best response during the breeding season, collating our knowledge and adapting as we go in order to try to provide the ultimate artificial habitat for these wonderful frogs.

As Maud Island Frogs are both cryptic and nocturnal they do not make for an especially attention-grabbing display species and it can be hard, if not impossible, for visitors to see them. To counter this, specialised interpretative materials have been developed to facilitate an appealing visitor experience that will also address the science of frog husbandry, whilst advocating for Predator Free 2050 – a vision in which a private charitable organisation is encouraging, supporting and connecting New Zealanders in their efforts to control and eradicate introduced predators including rats, possums, and mustelids by 2050. Members of the public visiting the zoo are able to see pictures of each individual frog and learn their names as well as where they were last spotted within their tank and which other individuals they are spending time with. In addition to this, the Amphibian House also has an attractive display of paladariums housing exotic amphibian species found in New Zealand, allowing our visitors to see bell frogs, Brown Tree Frog tadpoles (which are currently metamorphosing), axolotls, and Fire Belly Newts and learn how New Zealand's native amphibians evolved differently to amphibians overseas, as well as how introduced amphibians can threaten the survival of our own native species.

The Amphibian House is a shining example of how essential breeding programs can be achieved alongside educational displays, in order to accomplish positive outcomes for endangered species. Orana Wildlife Park would like to thank Amphibian Ark for their generous grant towards the construction of this facility which played an important part in allowing this vital conservation work to happen.

Costa Rican Amphibians Conservation Needs Assessment Workshop

Luis Carrillo, Training Officer, Amphibian Ark

With limited conservation resources and thousands of threatened species in need of help, the Conservation Needs Assessment (CNA, www.conservationneeds.org) process, managed by the AArk, seeks to objectively and consistently identify priority species and their immediate conservation needs.

Through a transparent, logical and objective method, the CNA process uses current knowledge of species in the wild to determine those with the most pressing conservation needs and provides a foundation for the development of holistic conservation action plans that combine *in situ* and *ex situ* actions, as appropriate. Conservation Needs Assessments generate national prioritized lists of species recommended for one or more conservation action, and these can subsequently be used to assist in the development of species recovery plans and national action plans, or to better inform national conservation priorities, identifying priority taxa for both *in situ* or *ex situ* conservation work. Templates for both national action plans and species recovery plans are available on the AArk website at www.amphibianark.org/husbandry-documents/.

Assessors from a wide variety of backgrounds are identified, and may include ASG members, academics, field biologists and researchers, university students, amphibian husbandry experts, and members of national, local, or regional wildlife agencies.

The assessments

The primary aim of a workshop which was held at Simón Bolívar Zoo and Botanical Garden, San José, Costa Rica, in January 2020, was to update and in some cases conduct first-time assessments for approximately 184 species which occur in Costa Rica. The joint Amphibian Red List workshop and CNA workshop included thirty experts, representing universities, NGO's, zoos and museums, both within Costa Rica and from overseas, contributed to the assessments, along with facilitators from the IUCN Amphibian Red List Authority and the Amphibian Ark.

During the workshop, a large amount of unpublished data were readily shared and recorded within the assessments, showing one of the values of the process. In addition to updating the Amphibian Red List and compiling the CNAs, bringing experts together is an excellent opportunity for networking, and furthering collaboration between those present.

Information provided by the experts resulted in conservation actions being recommended for over 180 Costa Rican species, which include:

- 54 species recommended for *in situ* conservation
- 170 for further *in situ* research
- 12 species recommended for *ex situ* rescue programs
- 4 species which can be used for *ex situ* research to develop husbandry and breeding protocols for more threatened species
- 1 species recommended mass reproduction in captivity
- 7 species which are suitable for conservation education purposes
- 12 species for which genetic material should be collected for biobanking
- 24 species for which no conservation action is needed at this time.

This was the fourth joint RLA / CNA which has been held – these joint assessment workshops not only result in the development of two different types of assessments, but offer considerable cost savings over holding two separate workshops. In addition they avoid the need for experts to spend time coming together on separate occasions for separate workshops. They are yet another example of how working collaboratively for conservation is far more efficient than working alone. Additional joint workshops are planned for the future, wherever the national priorities of the Red List Authority and the Conservation Needs Assessments overlap.

The CNAs for Costa Rica, along with the resulting recommendations for conservation action can be seen at the CNA web site at www.conservationneeds.org.

Thirty experts, representing universities, NGO's, zoos and museums, both within Costa Rica and from overseas, contributed to the Conservation Needs and Red List assessments, at Simón Bolívar Zoo and Botanical Garden, Costa Rica, in January 2020. Photo: Luis Carrillo.

Another high-Andean frog is proposed to be an endangered species

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

The "Teleférico de Mérida" is the highest and longest cable-car of its type in the world and constitutes a major tourist attraction of the Venezuelan Andes. It ascends to about 5,000m elevation, traversing several ecosystems; one of them, the paramo (high treeless plateaus in tropical South America), housing a small endangered amphibian bearing the name of this feat of engineering: *Pristimantis telefericus*. This "Merida Cable-car Frog", or "Ranita del Teleférico" as it is also known in Spanish, was described from elevations close to 3,500m asl (above sea level) in the Sierra Nevada National Park.

The species had remained elusive despite several searches during this century. Records were absent for twenty years after the species was first collected, until we rediscovered this species in recent expeditions involving staff from Rescue of Endangered Venezuelan Amphibians (REVA). Specimens seen in the course of a one-year in situ program plus those of the original description (in total, less than fifty individuals) suggest a small population.

In our field research we recorded the lowest altitude for the species, at 3,000m asl, in an ecotone shrubland between paramo and the upper location of cloud forests, indicating occupancy of warmer environments than previously known. The distribution of the Merida Cable-car Frog is then restricted to a narrow paramo and sub-paramo belt between 3,000 and 3,600m asl. The area of occupancy is approximately 30km^2 in the slopes of the Sierra Nevada facing the city of Mérida, bordered by high altitude cliffs and exposed rocky environments above 4,000m asl and by cloud forests below 3,000m. We did not find the frog beyond those limits.

The main natural habitat is dominated by shrubs, grasses and herbaceous or rosette plants (among which those of the genus *Espeletia* abound). Frogs were usually found under stones, with a sandy soil substrate with small amounts of silt and clay that probably account for humidity retention. The preferred microhabitat was under relatively flat and dark stones surrounded by low vegetation or mosses. The flat and dark-coloured stones certainly allow for a more rapid warming and transmission of heat once they are exposed to sunlight. A single specimen was seen by day standing in an open situation inside a natural ditch.

Staying below rocks is advantageous in the harsh paramo conditions where low temperatures prevail during most part of the day and freezing conditions arise by night. Most animals were seen active by day between 8:30 am and 11:00 am and probably they stay out until about 16:00 pm, when temperatures start to drop sharply. Yearly temperatures in paramo do not exhibit marked variability; daily temperatures, on the contrary, vary drastically from near freezing before sunrise to near 25-30°C by noon.

An adult female Merida Cable-car Frog (*Pristimantis telefericus*) from the Sierra Nevada mountain range, in the Venezuelan Andes. Photo: Enrique La Marca.

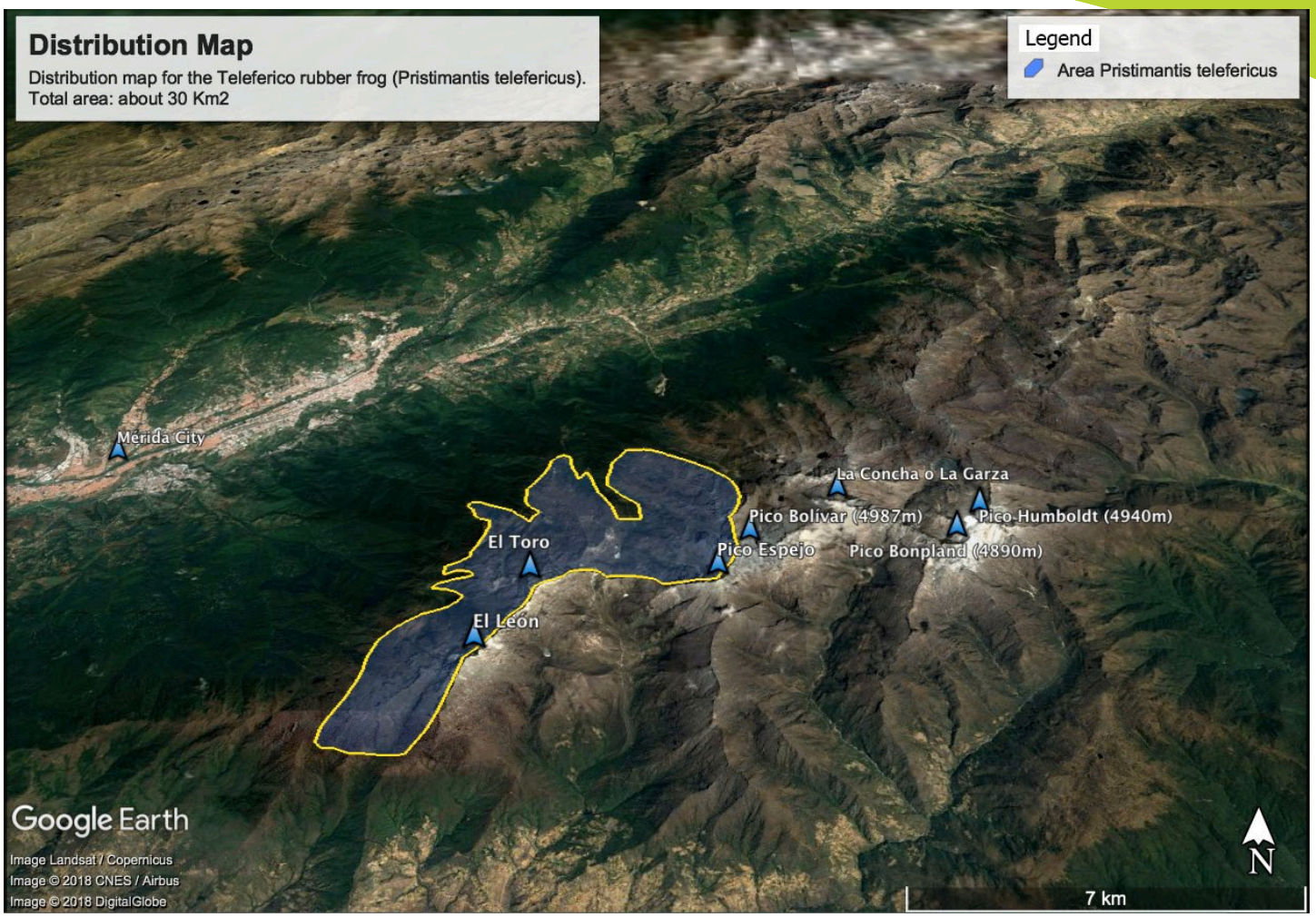
Limit between the paramo (high treeless plateau) and the sub-paramo vegetation, habitats of *Pristimantis telefericus*. Photo: Enrique La Marca.

The Merida Cable-car Frog is a small species, reaching sexual maturity at about 31mm SVL (snout-to-vent length) in females (when they develop enlarged and convoluted oviducts and have mature eggs of about 2mm) and 23mm SVL in males (when these get enlarged testes between 4-7mm). Once eggs are laid on land, the development of the embryo occurs entirely within the egg, without formation of a free-living tadpole, ending with a minute frog hatching, as occurs in all other direct-development species of the genus. Although we have not found egg masses, with the data at hand we infer that reproduction takes place mainly at the onset of the first local rainy period, in May.

Primary threats

Original paramo vegetation at the sites of Merida Cable-car Frog must have been like it is today, relatively unchanged for many centuries. The construction of the Merida's cable car system by the middle of the 20th century and its remodelling during the last decade of the current century brought severe vegetation changes near the stations. Other than that, there are few changes, especially those at trails that are used by mountaineers, tourists and local residents of places like La Aguada and Los Nevados.

Climate change, leading to warmer temperatures and more pronounced and extended dry seasons might be a threat to the



Distribution range of Pristimantis telefericus in the northern slopes of the Sierra Nevada mountain range facing the city of Merida, Venezuela. Highest peaks indicated by blue arrows.

species. We performed a climatic study to ascertain climate changes in the region. The fifty-year period analysis (1956-2006) of the city of Merida data from the airport climate station showed an increase of temperatures between 1.5-1.7°C. This may influence an altitudinal shift of vegetation from lower to higher elevations in the future, if trends persist, which could be assessed through multi-temporal studies of satellite images. The maximum and minimum mean temperatures at the Merida terrace show a greater increase from 1980-1983 and 1985-1987, coincident with the occurrence of the El Niño Southern Oscillation (ENSO) phenomenon, that could have influenced these changes.

The precipitation shows a decrease after 1988, with a slight increase in the years after 2000. The observed decrease in rainfall corresponds to severe drought periods brought about by the ENSO phenomenon in those years. There is a coincidence between the recorded droughts, chytrid fungus (*Bd*) outbreaks and Venezuelan Andean amphibian population declines, as we have published elsewhere. Likewise, the Merida Cable-car Frog may have been affected as well by the pathogen fungus *Bd* at those times and the frogs we found may be resistant survivors of this emergent disease. No diseases are known to occur in this high Andean frog (*Bd* has not been identified yet for the species). Unidentified ectoparasites and a parasite below skin have been the only ones detected in live specimens.

Conservation status

The species is currently considered as Data Deficient (IUCN 2006). Our direct observations indicate that *Pristimantis telefericus*, known to exist at no more than four locations, is facing a high risk of extinction after experiencing an estimated reduction in population size of ≥50% over the last twenty years. The reduction of its causes are suspected to be linked to climate change and/or the presence of the Bd, but with the real cause of the continued decline in the extent of occurrence (estimated to be much less than 50km2) not being well understood. According to this, we propose *Pristimantis telefericus* as an Endangered frog with the Red List Category (EN) A2a; B1a.

We currently have a single specimen in captivity at REVA, where we hope to develop captive husbandry experience, and to write husbandry protocols for the species, before collecting additional individuals, as founders for an *ex situ* conservation breeding program

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Pathogenicity of Aeromonas hydrophila to Pátzcuaro Salamander

MVZ Huitzilihuitl Barrera Manzano, Zacango Ecological Park, Mexico

Bacterial dermatosepticemia or "red leg syndrome", is a systemic, infectious bacterial disease of the Pátzcuaro Salamander (*Ambystoma dumerilii*), associated with pathology overdiagnosis, which often occurs on the underside or extremities of the animal. It occurs due to cutaneous erythema (skin rash), petechial, ulcers and edema (generalized or localized to extremities or the lymphatic sacs) (Densmore y Green, 2007). Historically this condition can be caused by several opportunistic gram-negative bacterial species including *Aeromonas hydrophila* and occasionally, *Proteus*, *Citrobacter*, *Salmonella*, *Eherichia coli* and *Chlamydia*. These bacteria associated with salamander skin (except for *Chlamydia*) can be found in the natural environment, but when the salamander is infected with chlamydiosis it is a fatal disease (Reavill, 2001; Densmore and Green, 2007; Foster, 2017).

Bacterial dermatosepticemia is associated with poor water quality, poor temperature gradients (below 55°F), poor biosecurity and other intrinsic and extrinsic factors. The clinical signs include lesions, generally result from a trauma injury in the skin, or open skin wounds (Reavill, 2001, Foster 2017).

To date, there is no report of a successful treatment regime for bacterial dermatosepticemia in amphibians, but the treatment we have applied successfully at the Zacango Ecological Park, is using therapeutic baths and topical specific antibiotics, and fluid therapy. The treatment involves supportive therapy to counter dehydration and gastrointestinal compromise with oral food assistance.

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Gill lesions with hemorrhage and skin ulcers in a Pátzcuaro Salamander (*Ambystoma dumerilii*) at Zacango Ecological Park. Photo: Huitzilihuitl Barrera.

Petechiae into the dorsal side of a Pátzcuaro Salamander at Zacango Ecological Park. Photo: Huitzilihuitl Barrera.

Severe cutaneous saprolegniasis (ulcers) on the right fore limb of a Pátzcuaro Salamander at Zacango Ecological Park. Photo: Huitzilihuitl Barrera.

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