

Action Plan for La Banderita Marsupial Frog (*Gastrotheca gracilis*)

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BACKGROUND

Species

La Banderita Marsupial Frog. *Gastrotheca gracilis* Laurent, 1969

Photo

Adult male of *Gastrotheca gracilis*. Ph: Mauricio Akmentins



Conservation status

Endangered (EN) in IUCN Red List (IUCN, 2020) and Endangered in Argentina red List (Vaira *et al.*, 2012).

Distribution, population size and trends

To the date, this species is only confirmed three of the nine localities with historical registries (Akmentins *et al.*, 2014). Its estimated extent of occurrence (EOO) is 1,407 km² in the provinces of Catamarca and Tucumán in NW Argentina (IUCN, 2020). The rediscovered populations seem to be stable in the past five years, but declining in the entire range (IUCN, 2020). These localities are now included in the recently created Aconquija National Park. Northern populations in Tucuman Province, in the Sierra San Javier Provincial Park and Sierras de Medina/Burrucacú, need to be confirmed.

Habitat and ecology

This species inhabits in the Yungas Andean forest ecoregion, in an altitudinal range between 1200 to 2800 m asl (Akmentins *et al.*, 2014). Adult specimens have secretive life habits and occur arboreally in tree crowns, tree holes and rock crevices. Tadpoles were found in temporary water bodies. This

marsupial frog species has an indirect development, females can carry in their dorsal pouch up to 73 fertilized eggs and tadpoles are retained until Gosner's Stage 26 and later are released into temporary water bodies to continue as free-living tadpole until metamorphosis occurs (Laurent, 1976; Laurent et al., 1986). Reproductive activity is characterized by an extended calling season between from May to November, gravid females were found between September and December and tadpoles were found from November to March (Laurent et al., 1986).

Primary threats

The major threat is habitat loss caused by human activities as wildfires, deforestation, and road maintenance. Domestic animals can cause mass mortality of tadpoles and reproductive habitat alteration (IUCN, 2020).

Conservation measures required

Two subpopulations, one registered in Los Sosa Provincial Reserve and other in the type locality of "La Banderita" require effective habitat protection.

In the case of Los Sosa Provincial Reserve, the environmental agency of Tucumán province government should implement in the short term (1 to 2 years), an improvement of the protection in the identified reproductive habitats of the species in order to minimize or eradicate the negative impacts of human activities (habitat alteration by domestic animals, solid waste pollution, habitat alteration by road maintenance works, wildfires). In the medium-term (3 to 10 years), should be established a monitoring program to evaluate the effectiveness of the protection measures and to assess the population trends of the species.

In the case of the type locality in "La Banderita", most of the registered reproductive habitats of the species are outside of the recently incorporated area to Aconquija National Park. National Parks Administration and the governments of the Catamarca and Tucumán provinces should implement some degree of habitat protection to *G. gracilis* (1-5 years), tending to prevent the negative impacts of the expansion works of the trace of the national route 65, habitat alteration by domestic animals and wildfires.

Gastrotheca gracilis is still missing from the northern range of its historic geographical distribution (Akmentins et al., 2014). There is the need to confirm if this species suffered a geographic reduction range. The researchers of academic institutions (Universidad Nacional de Tucumán - CONICET) and the environmental agency of Tucumán province government should implement in the short-term (1 to 5 years) an intensive search program focused in detecting the presence of *G. gracilis* in Sierra San Javier Provincial Park and Sierra de Medina/Burrucacú.

Current protection

Most of the extent of occurrence of *G. gracilis* is now protected in the recently created Aconquija National Park, that also includes the rediscovered population in Campo de Los Alisos National Park and three localities with historic registries but still unconfirmed. This species is effectively protected and monitored inside Aconquija National Park.

The rediscovered population of *G. gracilis* in Los Sosa Provincial Park is not effectively protected but effective protection could be reached in the short term (1 to 5 years) if the identified threats for the species will be mitigated or eradicated.

Gastrotheca gracilis can also occur in Sierra San Javier Provincial Park, but the presence of the species is needed to be reconfirmed. There is a need to establish a search program in the short term (1 to 5 years).

Current and previous conservation actions

The first conservation action for *G. gracilis* was the rediscovery of the species in 2011 (Akmentins et al., 2012), and the subsequent registry of this species in Campo de Los Alisos National Park (Akmentins et al., 2014).

Currently two conservation actions are being carried out on *G. gracilis*. One is the population supplementation program in Los Sosa Provincial Reserve developed in the *ex situ* breeding facilities of Reserva Experimental Horco Molle established with a start-up grant of the Amphibian Ark and led by researchers of the Instituto de Ecorregiones Andinas (INECOA, CONICET - UNJu) and professionals and voluntaries of Reserva Experimental Horco Molle (Universidad Nacional de Tucumán). Another is the long-term monitoring of the population of the species in Aconquija National Park, as part of a project supported by the Rufford Small Grants Foundation, led by researchers of the Instituto de Ecorregiones Andinas (INECOA, CONICET - UNJu) and personnel of the National Parks Administration.

Knowledge gaps

It will desirable continue with the search in the historical localities with registries of *G. gracilis* to determine the current extent of occurrence of this species.

There is an urgent need to evaluate the response of this species to extreme climatic events as a consequence of the climatic crisis. Also, information is needed about the susceptibility to *Batrachochytrium dendrobatidis* and the prevalence of *Bd* infection in wild populations.

Future research in *ex situ* breeding of *G. gracilis* should be concentrated in reach the complete reproductive cycle of this species in captivity. There is a lack of knowledge of the procedures to maintain viable survival assurance colony and to reach a successful reproduction of this species in captivity.

Challenges and obstacles

The main obstacles are the multiplicity of stakeholders and the lack of long-term environmental policies in Argentina. Due to the federal system of organization of Argentina, the ultimately responsibility of environmental protection is the provincial government but the national parks are federal territories that depends on the National Parks Administration of the national government. The challenge is to reach common protection policies for *G. gracilis* and its habitat in Yungas Andean forests. Ideally, the protection policies should be in agreement between researchers and the national and provincial governments.

The lack of awareness among local people and visitors towards the marsupial frogs and general nature is still threatening the correct protection of their environmental habitats. This could be overcome by implementing an intensive media campaign about marsupial frogs aimed to increase the knowledge and awareness among local people and national park visitors.

Another challenge is to secure enough funds to achieve the goals of this plan.

Budget and funding sources

No data.

PRIORITY ACTIONS

In situ

Habitat management, restoration and/or protection

The southernmost population of the species in the type locality of la Banderita in the limits of the provinces of Catamarca y Tucumán need of habitat protection.

The most desirable strategy should be to incorporate this area to the recently created Aconquija National Park. This strategy should involve the joint work of provincial governments of both provinces and National Park authorities.

Although it is a logical management action, is unfeasible, for what there is not a time frame for this measure.

Threat mitigation

The main threat for *G. gracilis* in Los Sosa Provincial Reserve is the reproductive habitat alteration as a consequence of human activities and domestic animals. A simple solution is the installation of fences in the perimeter of the identified reproductive sites in order to avoid habitat alteration. This urgent action should be implemented in the short-term (1 to 2 years) by the environmental agency of the Tucumán province government and subsequently monitored.

Distribution surveys

An intensive search program to confirm the presence of *G. gracilis* in the historic localities of Javier Provincial Park and Sierra de Medina/Burruyacú should be established in the short-term (a to 2 years). This search program should be led by the researchers of the Instituto de Ecorregiones Andinas (INECOA, CONICET - UNJu) and implemented by the environmental agency of Tucumán province government and Universidad Nacional de Tucumán.

Population and conservation status monitoring

Currently there is a long-term monitoring program of the rediscovered population of *G. gracilis* in Aconquija National Park. This program is led by researchers of the Instituto de Ecorregiones Andinas (INECOA, CONICET - UNJu) and personnel of the National Parks Administration combined the active search and passive acoustic monitoring through automated recording units. The monitoring program should be expanded to the rediscovered populations of *G. gracilis* in the type locality of "La Banderita" and Los Sosa Provincial Reserve and will be implemented by the environmental agency of Tucumán province government. In case of the registry of new populations by the search program, these populations should be also monitored in the long-term.

Ex situ

Captive management

Even before the rediscovery of the species, *ex situ* actions were not recommended for *G. gracilis* (Ark/ASG, 2010). Despite this, it will be necessary the incorporation of an *ex-situ* component to the recovery plan and this component should be centred in research and education purposes. There are several knowledge gaps of the biology and the development of this species and most of the conservation problems of this species are derived by the lack of knowledge of the general public about the existence of this endangered and charismatic marsupial frogs. The *ex-situ* component should lay the groundwork of the development of husbandry guidelines to manage marsupial frogs in captivity in case of the need captive breeding for the reintroduction of this or other related species.

The *ex-situ* component should be based in the existing facilities of Reserva Experimental Horco Molle (Universidad Nacional de Tucumán) and should involve to the academic units (i.e. National Universities, CONICET) and the environmental agency of Tucumán province.

Founder animals could be obtained from metamorphic individuals of the ongoing population supplementation program in Reserva Experimental Horco Molle. It will be desirable a first small scale captive breeding program based in approximately 10 founder specimens. Because these specimens are not intended for conservation purposes, no genetic management is needed.

Capacity building for *ex situ* management

For the particular case of *G. gracilis*, there is a capable team led by Med. Vet. Elena Correa in Reserva Experimental Horco Molle (Universidad Nacional de Tucumán). But it will be necessary to expand the number of skilled people involved in *ex situ* management of amphibians in captivity in the country. A training course or workshop in *ex situ* conservation is needed in the short term (1 to 5 years) in the country. The training course or workshop should involve all institutions and researcher interested in the *ex situ* management of amphibians for research and conservation purposes and ideally supported by Amphibian Ark experts.

Develop husbandry guidelines

Currently, there is available a draft of husbandry guidelines for tadpoles' rearing for population supplementation of *G. gracilis* as result of one head-starting project supported by the Amphibian Ark, but the complete husbandry guidelines are still needed. The husbandry guidelines should be

developed by the personnel of Reserva Experimental Horco Molle (Universidad Nacional de Tucumán) and the researchers involved in the program (National Universities and CONICET).

Ex situ research

Future research in ex situ breeding of *G. gracilis* should be concentrated to reach the complete reproductive cycle of this species in captivity. There is a lack of knowledge of the procedures to maintain viable ex situ survival assurance colony and to how to successfully breed this species. The *ex situ* research should depend of Reserva Experimental Horco Molle (Universidad Nacional de Tucumán) and researchers (National Universities and CONICET).

Supplementation/translocation

There is a population supplementation program of *G. gracilis* developed in the facilities of Reserva Experimental Horco Molle (Universidad Nacional de Tucumán). This program was established in 2018 as a conservation project granted with a start-up grant of Amphibian Ark and is led by researchers of the Instituto de Ecorregiones Andinas (INECOA, CONICET - UNJu) and professionals and voluntaries of Reserva Experimental Horco Molle (Universidad Nacional de Tucumán). To the date, this program successfully released into the wild two cohorts of post-metamorphic individuals *G. gracilis* reared in captivity in Los Sosa Provincial Reserve in the years 2019 and 2020.

This program is expected to continue at least in the short term (1 to 5 years).

Reintroduction strategy

For the moment, there is no need for a reintroduction strategy for *G. gracilis*.

Education and awareness

Public education and raising awareness

Since 2013 there was a proactive educational campaign tending to raise the awareness in the key stakeholders and the general public about the importance of the conservation of the marsupial frog species of Argentina and its habitat in the Yungas Andean forests. This campaign is led by researchers of the Instituto de Ecorregiones Andinas (INECOA, CONICET - UNJu) with the initiative CANOA (Fb: @canoa_anfibios; Instagram: @canooanfibios). In recent years were incorporated to this campaign more institutions, like the National Parks Administration and Reserva Experimental Horco Molle (Universidad Nacional de Tucumán).

In the short and medium-term is expected the installation of display panels in the protected areas (national park and provincial reserves) to inform to the visitors about the La Banderita Marsupial Frog and the importance of preserving this emblematic species of the Yungas forests of NW Argentina.

A viable option for future educational programs is the establishment of a permanent exhibit with species ambassador's in the Reserva Experimental Horco Molle as part of the ongoing program "Proyecto de Conservación. Rana Marsupial de la Banderita".

Community and stakeholder engagement

This is the draft of the Action Plan for *G. gracilis*, but in a next step in the short-term is to circulate this document within the stakeholders (i.e. National Parks Administration, national and provincial environmental authorities, and researchers), to allow them to make their contributions.

Exit strategy

The search program will have finished when the species being registered in the two target areas.

The monitoring program should be extended much as possible until the threat category of this species diminished.

The education program should be extended much as possible until the threat category of this species diminished.

The population supplementation program will have finished once the species will be effectively protected in Los Sosa Provincial Reserve.

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