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More case studies from around the globe
Edited by Pritpal S. Soorae

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Conservation and recovery of the mountain yellow-legged frog in Southern California, USA

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Introduction

The mountain yellow-legged frog (*Rana muscosa*) is endemic to California and occupies the Transverse Ranges of southern California and the southern extent of the Sierra Nevada Mountains. The mountain yellow-legged frog occurs almost entirely on protected lands yet has declined from more than 98% of its historic range (Vredenburg *et al.*, 2007). Currently in the Transverse Ranges, nine extant populations exist across three mountain ranges with less than 200 adult frogs remaining in the wild (USGS unpublished data). This species is listed as Endangered by the IUCN, Endangered by the U.S. Fish and Wildlife Service, Sensitive by the U.S. Forest Service, a Species of Special Concern by the California Department of Fish and Game and is being reviewed for listing as California State Endangered. An informal working group was assembled to address conservation activities for the mountain yellow-legged frog in 1999. This group consists of representatives from the U.S. Geological Survey, U.S. Fish and Wildlife Service, California Department of Fish and Game, U.S. Forest Service, San Diego Zoo, Los Angeles Zoo, and the Fresno Chaffee Zoo. This work involves monitoring known populations, surveying for new populations, habitat restoration, disease screening, captive breeding, and re-establishment to sites within the historic range.

Goals

- Goal 1: To establish self-sustaining populations of mountain yellow-legged frogs within the historic range of the species.
- Goal 2: Understand the genetic structure of remaining frog populations to guide captive breeding and reestablishment efforts.
- Goal 3: Understand the dynamics and challenges of restoring Bd positive wild populations.

Mountain yellow-legged frog © Adam Backlin

Success Indicators

- Indicator 1: Develop effective techniques and protocols for captive husbandry and breeding, translocation, and restoration for mountain yellow-legged frogs.
- Indicator 2: Develop successful captive breeding colonies for each of the three conservation units (mountain ranges).
- Indicator 3: Identify suitable reestablishment sites with compliance from all partners.
- Indicator 4: Increase the numbers of approved re-establishment sites.
- Indicator 5: Expand the available habitat to the mountain yellow-legged frogs at sites currently occupied through habitat restoration.

Project Summary

Feasibility: The mountain yellow-legged frog was historically abundant across the Transverse Ranges of southern California. Museum vouchers indicate a large scale decline occurred between 1968 and 1970, likely due to the amphibian chytrid fungus (*Batrachochytrium dendrobatidis* - Bd). By the mid-1990s it was apparent that this species had declined to a point that required active management in order to persist. In 2000, surveys were initiated to understand the population status and identify remaining populations. To date, nine populations have been found, occupying less than 1 km of stream habitat, with all but three populations containing less than 20 adults. Disease screening revealed all populations to be positive for Bd. Mitochondrial and microsatellite analyses show that substantial population structure is evident. This data suggests a high degree of historical isolation within and between mountain ranges and that each mountain range in southern California should be managed separately to protect unique evolutionary lineages of the mountain yellow-legged frog (Schoville *et al.*, in press). As part of an emergency salvage effort in 2006, 86 tadpoles were collected from Dark Canyon, San Jacinto Mountains, Riverside County, CA, USA, to prevent desiccation. These tadpoles were placed in a captive husbandry program at the San Diego Zoo Institute for Conservation and Research and raised to adults for captive breeding. In 2009, 106 additional tadpoles were collected from Devils Canyon, Los Angeles County, CA, USA, as an emergency salvage following a wildfire that burned the occupied watershed. These tadpoles were placed in a captive husbandry program at the Fresno

Typical habitat of the mountain yellow-legged frog © Adam Backlin

Chaffee Zoo with plans to raise these animals to adults for captive breeding. To obtain approval for a location to release mountain yellow -legged frogs, several permit and regulatory processes were required. Both federal and state permits were obtained to collect, relocate, breed, and release mountain yellow-legged frogs. A Memorandum of Agreement was developed and signed by all relevant partners to facilitate and approve releases of mountain yellow-legged frogs.

Preparing for release © Adam Backlin

Implementation: 2010 marked the first successful captive breeding of the mountain yellow-legged frog at the San Diego Zoo Institute for Conservation and Research. Two releases were conducted in April and in August 2010. The April release consisted of three egg masses (approximately 600 eggs) placed in cages in the stream. The August release consisted of 36 tadpoles head-started from the San Diego Zoo that were placed in cages in the stream. All releases were conducted in Indian Creek, Riverside County, California, USA. The breeding in 2010 produced approximately 1,200 eggs. Unfortunately, only 46 of the eggs released were fertilized and 36 tadpoles survived in the head-starting program to be released, totaling 80 released mountain yellow-legged frogs in 2010.

Post-release monitoring: Following the egg mass and tadpole releases, surveys were conducted to monitor the success of this effort. Eggs were monitored bi-weekly in their cages until they hatched. After hatching, weekly surveys were conducted. No tadpoles were detected in the creek following hatching. This is likely due to the small number and size of the newly hatched tadpoles and their cryptic coloration and behavior. All 36 head-started tadpoles were released into four cages at two locations within the stream. At each location, nine tadpoles were placed in each cage. Cages were monitored bi-weekly for the first two weeks then bi-monthly until the onset of winter. After the first week, nine tadpoles were released into the creek at each location. All 18 tadpoles appeared healthy when released. The remaining 18 tadpoles remained in the cages for monitoring until winter, approximately three months. With the first winter storm approaching in November 2010, the remaining 18 tadpoles were released. The bi-monthly monitoring also failed to detect tadpoles within the stream.

Major difficulties faced

- Problem obtaining the appropriate permits for all partners. This required approval by all partners which is challenging due to the complex logistics required for regulatory agencies and land managers to approve sites for reestablishments in southern California.
- Securing long term funding is difficult and requires actively seeking and applying for grants.
- Low fertility encountered in the first year breeding effort.

Major lessons learned

- Initiate restoration and conservation actions before species reaches critical stages.
- Develop comprehensive working group with representation from all required partners at the early stages of restoration.
- Develop long term adaptive recovery planning at early stages of project.
- Species level restoration requires long term commitments from multiple partners.

Success of project

Highly Successful	Successful	**Partially Successful**	Failure
		√	

Reason(s) for success/failure:

- The partial success of this project was the accomplishment of releasing a captively breed endangered species into the wild in southern California.
- The success of the frogs re-establishing their new site will require at least five years to evaluate.

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