National Park Service



The Challenge of Recovering Endangered Mountain Yellowlegged Frogs in Sequoia and Kings Canyon National Parks



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George Wright Society Oakland, CA

Mountain Yellow-legged Frog Complex (MYLF)



Rana muscosa (southern species): mountain yellow-legged frog Rana sierrae (northern species): Sierra Nevada yellow-legged frog

Photos by Isaac Chellman, 2012 and 2013

Status of MYLFs

• Both species have >90% decline

• Sierra Nevada populations listed as federally endangered in 2014

• SEKI is only mgt. unit where both species occur = key recovery site



Image courtesy of Roland Knapp, UCSB

Research on SEKI Aquatic Ecosystems since 1980s

- Shows primary causes of MYLF decline are nonnative trout and disease (Bd)
- Fish eradication is feasible & beneficial
- Improved understanding of MYLF genetics
- Developing MYLF recovery techniques





Photos by Danny Boiano, 1996; and courtesy of Roland Knapp, UCSB

Research-Park Partnership Provided Detailed Data

 Inventory of ~3250 lentic waters from 1997-2002

• 8000+ frog surveys from 1997-2013

Status and Trend of MYLFs & Bd





Photos by Isaac Chellman, 2012 and from MYLF website

Current Habitat Restoration Project (24 lakes)

- 2001 EA targeted most critical habitats for fish (trout) eradication for preliminary restoration of MYLFs project
- NPS approved trout removal by gill netting & electrofishing
- By 2014:
 - 13 lakes eradicated of
 - 11 lakes near eradication
 - MYLF expansion at 11 lakes



Photos by Danny Boiano, 2002 and 2004

Nonnative Trout Removal Results: 2001-2014



Aquatic Restoration Sites Since 2001





LeConte: 2001-2012

Fish removed and max # of *R. sierrae* / survey in 3 fish removal lakes



Average Mountain Yellow-legged Frog Density in Three Restoration Lakes in Sixty Lake Basin



Mitigate Effects of Bd on MYLFs: Fish Eradication

- Allows populations to expand:
 Higher probability to survive Bd outbreak
- Large fishless lake complexes have:
 - Habitat diversity for different life stages
 - Connectivity for metapopulation dynamics
 - Buffered from climate change
- Improved resistance and resilience



Photo by Isaac Chellman, 2012

Mitigate Effects of Bd on MYLFs: Antifungal Treatment

- Drugs (Itraconazole) clear Bd:
 - Intervention to increase survival of adult frogs during outbreak
- Beneficial bacterium (Jliv) shields frogs
 Helps frogs resist Bd
- Both may provide time for frogs to mount an adaptive immune response to Bd



Large mesh cage to hold *R*. *muscosa* during treatments. Each cage can hold up to 100 adult and/or juvenile frogs.

Photo by Roland Knapp, 2010

Mitigate Effects of Bd on MYLFs: Immunization

- Allows use of large uninfected populations for recovery actions
 - Expose frogs to Bd to induce an adpative immune response, clear with Itraconazole, then translocate or reintroduce
- Allows captive rearing of young life stages in infected populations with low survival and recruitment
- Work with zoos to grow young life stages for reintroduction to wild

Reverse Effects of Fish and Bd: Translocation/Reintroduction

- Translocate frogs from persistent populations
 - YOSE: 2 populations well established since 2006-08 and 2 populations since 2013
 - Desolation Wilderness (near Lake Tahoe): 2 populations since 2014
- Reintroduce treated frogs:
 - SEKI: 3 populations established since 2013
 - SEKI: 2 populations attempted in 2013 and 2014 may fail due to garter snake predation
 - Relocated snakes to potentially buy enough time for populations to get established





Photos by Roland Knapp, 2014

Initial MYLF Surveys in SEKI

- 1997-2002: Knapp surveys at nearly every suitable waterbody = ~3,250
- MYLFs detected in 567 waterbodies



Repeat MYLF Surveys in SEKI

- 2009-2013: Knapp surveyed 492 of the 567 previouslyoccupied sites
- 187 occupied = 38%



2013 Draft EIS: Proposed Parks-Scale Aquatic Ecosystems Restoration Plan

- Purpose: restore and conserve high elevation aquatic ecosystems over 25-35 years
- Need: urgency to recover endangered MYLFs
- Objectives: eradicate fish and conduct frog restoration techniques to develop more resilient ecosystems and conserve MYLF diversity and function
- 1 No Action and 3 Action Alternatives





Preferred Alternative B Expands the current program

- 87 lakes/ponds & 41 miles of stream proposed for physical and piscicide treatment
- Self-sustaining trout populations would remain in majority of lakes/ponds (462)
- Conduct several active restoration techniques to protect vulnerable MYLF populations and re-establish lost populations



Draft Environmental Impact Statement

- Public comment period from September - December 2013
- Received written comments from 118 individuals / organizations
- Final EIS and ROD expected in 2015 after public comment review, edits, and final decisions



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- Challenge of MYLF Recovery:
- Landscape scale effects from nonnative trout and disease (Bd)
- Preliminary restoration has good success from fish eradication
- Treating Bd and frog translocation / reintroduction are promising
- Detailed long-term proposed plan using a toolbox approach
- Recover endangered species and restore aquatic ecosystems at the park scale

