What can zoos contribute to amphibian conservation?

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The History of Amphibians in Zoos

Conservation through Education
Primary role of zoos in amphibian conservation
Raise awareness with the visiting public about the wonders of amphibian diversity
Be an ambassador for amphibians…

This is not what I’m going to talk about.
Beyond the general zoo visitors...

- **In situ and ex situ research**
  - Distributional surveys
  - Population monitoring
  - Ecological study
  - Genetic evaluation
  - Diet/Nutrition
  - Captive reproduction
  - ...
- Head starting and supplemental releases
- Captive assurance populations
- Reintroductions
- **Capacity Building**

1980s-1990s

- **Houston Toad** *(Anaxyrus houstonensis)*
- **Wyoming Toad** *(Anaxyrus baxteri)*
- **Puerto Rican Crested Toad** *(Peltophryne lemur)*

In Europe...

- **Mallorcan Midwife Toad** *( Alytes muelleri)*

“Chytrid” Fungus

- *Batrachochytrium dendrobatidis*
- First identified in 1998
- Pathogenic fungus implicated in widespread global amphibian declines and extinctions
- Infects skin of amphibians
  - Respiration
  - Osmoregulation
  - Electrolyte balance
- Curable in captivity, but does not impart resistance
Early 2000s

“Captive assurance populations”

“For a species facing an enigmatic decline, the only conservation option currently available is captive breeding”
Stuart et al., 2004. Science 306:1783–1785

IUCN 2005 GAA

Call to action from the scientific community

Amphibian Conservation Action Plan (ACAP), 2007

1. Expand understanding of the causes of declines and extinctions
2. Document amphibian diversity, and how it is changing
3. Develop and implement long-term conservation programs
4. Provide emergency response to immediate crises

Amphibian Ark 2008 Year of the Frog

Association for the Conservation of Amphibians and Reptiles
International Union for Conservation of Nature (IUCN)
What have I done about it?
Unintended consequences of captive breeding + reintroduction

The Genus *Nectophrynoides*

- Bufonidae – “true” toads
- At least 17 (30+?) species, 5 new described in 2004, many more awaiting description.
- Entire genus listed under Appendix I of CITES.
- All endemic to the Eastern Arc mountains of Tanzania: mainly Usambara, Udzungwa, Uluguru, Rubeho, and Nguru.

IUCN biodiversity “hotspot”
Spray Wetlands

Lower Kihansi Hydropower Project (LKHP)

- $272 million USD
- 180 MW of CO2-free electricity
  - Up to 30% of Tanzania’s power during extreme drought
- Funded in part by the World Bank
- Planned since early 1980s, began construction in 1993
- Tiny ecological footprint (20 ha)
Remediation Effort

- Sprinklers and spray jets installed in areas of spray wetlands in hopes of reviving ecosystem (after 9 month delay…)
- 499 Kihansi Spray Toads sent to the Bronx Zoo in the fall of 2000, 230 of these immediately sent to the Detroit Zoo
- Ongoing studies of vegetation, insect communities, amphibians in the gorge
Problems with Sprinklers

- Gravity fed system
- Natural silt in river clogged nozzles

- Installation of settling tanks to remove silt
- Full time maintenance staff
Captive Spray Toads

• 499 Kihansi Spray Toads sent to the Bronx Zoo in the fall of 2000, 230 of these immediately sent to the Detroit Zoo
• Approximately half of toads brought in from wild died in subsequent weeks due to parasitic lungworms
• With medication and husbandry changes the parasite was controlled
• Captive animals were breeding readily and population rebounded by late 2001

Other zoos became involved

• Baltimore Zoo, MD
• Oklahoma City Zoo, OK
• Buffalo Zoo, NY
• Toledo Zoo, OH

At the Toledo Zoo

• First 24 spray toads received Feb 2002
• Initial problems with nutrition resulted in losses and subsequent husbandry changes
  – R.O. → Carbon filtered H₂O
  – Substrate changed: gravel → live moss
  – Changes in vitamin/mineral supplements
  – UV lighting: blacklight → halogen

Captive Care

• 22 hour misting cycle
• Feed on:
  – Pinhead crickets
  – Wingless fruit flies
  – Bean beetles
  – Soldier fly larvae
  – Springtails
  – Misc. inverts in tank
  – Isopods
  – Mites
Captive Insights

Ultrasonic Calling?
• Corinne Richards – University of Michigan
  – Studied male-male combat and interactions at Detroit and Toledo Zoos
  – Found ultrasonic component to calls, still uncertain if toads can hear these frequencies

Premature births
Other challenges to survival.

Capacity Building…
UDSM Facility
Long-term Goals

- Controlling captive population size...
- Return animals for captive colony in Tanzania (UDSM)
  - In situ captive animals utilizing local resources
  - Design facilities and train staff with knowledge of species gained in U.S. 2009
- Determine if Kihansi gorge is suitable habitat
- Prevent introduction of disease from captivity
  - Histopathology
  - Genetic evaluation of parasites
  - Sentinel animal trials

Panamanian Golden Frog
(Atelopus zeteki)
Guatemala?

Guatemala

- 108,890 sq km (compared to 109,220 for TN)
- 41* described caudate species in 8 genera
  - *Not shabby at all…
- All Bolitoglossine taxa (Plethodontidae)
- Likely more species awaiting description/discovery
- Most surveying/descriptions conducted by UC-Berkeley in the 1970s

Conservation Status

- Due to political situation, little work conducted in 1980s
-Surveys in the late 1990s revealed dramatic declines, extirpations, extinctions? of both salamanders and their associated predators
  - Chytridiomycosis?
  - Climate Change?

[Pie chart: IUCN Status of Guatemalan Salamanders]
Bolitoglossa

- Tropical “web-footed” salamanders
- Abysmal record in captivity
- i.e., very challenging group for captive assurance populations
- Pilot husbandry work underway with 2 species at the Toledo Zoo
  - B. rufescens (LC)
  - B. conanti (EN)
Project Goals

- Refine husbandry, captive reproduction
  - As in Panama, many taxa have barely been observed or studied
- Support *in situ* research
  - Identify cause(s) of declines
  - Survey and monitor remaining populations
- Establish *ex situ* facilities in Guatemala for captive assurance populations

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always a complicating factor.
Captive Reproduction of North American Plethodontids

Capacity building in the U.S.
Plethodon petraeus

Plethodon yonahlossee

Gyrinophilus p. duryi

Aneides aeneus

Thanks!