Global Amphibian Loss

Bellwether of environmental degradation

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1. Amphibians & ecosystem services
2. Declines & threat
3. Disease
4. Correlates of extinction
5. World frog trade
6. The future
Ecosystem Services

- Reduce desertification
- Maintain soils
- Crop pollination
- Seed dispersal
- Food provision
- Water purification
- Fuel provision
- Fibre provision
- Climate regulation
- Flood regulation
- Disease regulation
- Waste decomposition/detoxification
- Nutrient cycling
- Soil formation
- Primary production
- Pharmaceutical sources
- Cultural appreciation (aesthetic, spiritual, educational, recreational…)

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### Why care about amphibians?

- **ecosystem function (insect control; water quality)**
- **cultural importance**
- **skin secretions for pharmaceuticals**
- **human food**
- **diversity of life histories**
- **first land vertebrates**
What are amphibians?

- **Anura (frogs & toads)**

- **Caudata (salamanders & newts)**

- **Gymnophiona (cecaelians)**

> 6260 known species

5532 (A); 552 (C); 176 (G)

*mainly require freshwater for reproduction (no marine)*

*metamorphosis (gills $\rightarrow$ lungs; skin glands; eardrum; tail loss)*
A long-known problem

• **1970s**: effects of pollution (< 25 studies)

• **1980s**: 1st World Congress of Herpetology (> 100 studies)

• **1990s**: widespread & large declines documented (~ 700 studies)

• **2000s**: reasons
  – climate change
  – UV radiation
  – disease
  – habitat loss
  – pollution
  – invasive species
  – harvest

• **43 % spp. declining**
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Status and Trends of Amphibian Declines and Extinctions Worldwide
Simon N. Stuart,1* Janice S. Chanson,1 Neil A. Cox,1 Bruce E. Young,2 Ana S. L. Rodrigues,3 Debra L. Fischman,3 Robert W. Waller3

Complex causes of amphibian population declines
Joseph M. Kiesecker†, Andrew R. Blaustein† & Lisa K. Belden†

Widespread amphibian extinctions from epidemic disease driven by global warming
J. Alan Pounds1, Martin R. Bustamante2, Luis A. Coloma3, Jamie A. Consuegra3, Michael P. L. Fogden1, Pru N. Foster4†, Enrique La Marca5, Karen L. Masters6, Andrés Merino-Viteri2, Robert Puschendorf7, Santiago R. Ron8†, G. Arturo Sánchez-Azofeifa9, Christopher J. Still10 & Bruce E. Young1
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Pie chart showing the percentage of amphibian species threatened with extinction.

- 37% EX&EW
- 24% threatened with extinction
- 13% CR
- 11% EN
- 8% VU
- 6% NT
- 1% LC
- 1% DD

Note: Too poorly documented.
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chytridiomycosis

- *Batrachochytrium dendrobatidis*
- 1st EID in ‘pristine’ sites
- Australia, Panama, Ecuador, Venezuela, NZ, Spain
- possible African origin
chytridiomycosis

• sharp-snouted day frog *Taudactylus acutirostris*
• 1\textsuperscript{st} documented Bd extinction

The Decline of the Sharp-Snouted Day Frog (*Taudactylus acutirostris*): The First Documented Case of Extinction by Infection in a Free-Ranging Wildlife Species?

Lisa M. Schloegel,\(^1\) Jean-Marc Hero,\(^2\) Lee Berger,\(^3\) Rick Speare,\(^3\) Keith McDonald,\(^4\) and Peter Daszak\(^1\)
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Habitat Loss

- Australia: ~ 50% remaining forests (10 → 5%)
- 1983-1993: 600000 ha/yr
- Tropics: 1.2% rain forests lost/yr (Bangladesh)
- Boreal: < 30% undisturbed

![Map of Australia showing habitat loss](image)
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Bradshaw et al. (2009) *Front Ecol Environ* 7:79-87
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**extinction**

- 100 – 10 K × higher extinctions now vs background
- perhaps much higher (Melbourne & Hastings 2008 *Nature* 454:100-103)
- many cryptic & poorly documented species
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habitat loss most pervasive threat

most studies cannot quantify harvesting
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Correlates of extinction

- 3366 spp
- Life history (reproduction, fecundity, body size, habit)
- Ecological (range size)
- Environment (temperature, precipitation, human density)
- Threat ~ $X_1 + X_2 + X_3 + \ldots$ (Order/Family)
- Decline ~ …

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Harvest

- uncertainty on origin
- some farming
- wild harvest largely unquantified
- how big is the problem?
Harvest

• Europe: > 15 million kg/yr
• USA: > 3 million kg/yr
• Asia: much larger, but mainly unknown
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Harvest mitigation

- awareness of magnitude
- better/more farming
- CITES
- certification
- better monitoring

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B

MVP

small population paradigm

declining population paradigm

habitat loss
harvest
climate change
small synergy
large synergy

biodiversity loss

relationship among threatening processes
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Conclusions

- Most threatened taxon - imperative we restrict extinctions

- Ironically, least-understood

  - Cryptic species

  - Lack of harvest monitoring

- Climate change & synergies most important future stressors


Bickford, D., Ng, T. H., Lan, Q., Kudavidanage, E. P. & Bradshaw, C. J. A. 2009 Forest fragment and breeding habitat characteristics explain frog diversity and abundance in Singapore. Biotropica in press