Pathogen Pollution: A Deadly Global Threat to Amphibians

Ariel Elliott

Overview

I. Deadliest Threats to Amphibians
II. Define Pathogen Pollution
III. Spread of Pathogens
IV. Impact of Pathogen Pollutions

Deadliest Threats to Amphibians

Initial Threats
- Overexploitation
- Direct Killing
- Habitat Loss
- Chemical Pollution
- Competition/Predation
- Introduction of Nonnative Species

Recent Threats
- Climate Change
- PATHOGEN POLLUTION

PATHOGEN POLLUTION
A. Volcana
A. Crawford
A. A. Cunningham et al. (2003)
What is Pathogen Pollution?

- “Pathogen pollution is the introduction of a pathogenic (or potentially pathogenic) parasite to a new (or naïve) host species or population.”
  —A.A. Cunningham et al. (2003)

- “Pathogen pollution...refers to the process whereby pathogens are moved to new areas of the globe and then wreak havoc on unsuspecting hosts.”
  —V.J. McKenzie et al. (2012)

What Makes Pathogens Deadly?

Global Spread
- Unintentionally or accidentally from:
  - Food Trade
  - Pet Trade
  - Scientific Research

Other Reasons:
- Unpredictable
- Far-reaching
- Hybridization
- Stay in soil/water for years
- Many unnoticed/unrecorded

Emerging Infectious Pathogens

Ranavirus
- Affects amphibians through indirect and direct contact and ingestion
- Signs:
  - Edema
  - Hemorrhage
  - Ulcerations
- Death probably by respiratory failure
- Ranavirus epidemic within common frog populations in Britain

Chytridiomycosis
- Death by impaired function of the skin and muscle failure, leading to cardiac arrest
- Signs:
  - Thick skin
  - Lethargy
  - Abnormal posture with extension of hind legs
- Multiple die-offs in North America, Australia, Europe, Central America, South America, Asia, Africa, Caribbean, and New Zealand

A.A. Cunningham et al. (2003)
D.B. Wake et al. (2008)
Global Presence of Ranavirus

Trans-Atlantic trade has introduced ranavirus strains in various countries around the globe. Laboratory analysis have connected these strains.

Global Ranavirus Reporting System, July 2013

Importation of American bullfrogs and goldfish have led to the introduction of ranavirus in the U.K., leading to common frog die-offs.

A.A. Cunningham et al. (2003)

Global Presence of Chytridiomycosis

Chytrid fungus has spread globally due to pet trade and other means, causing massive die-offs and declines in Costa Rica, North America, and Australia, and the pathogen is still spreading.

Fisher et al. (2009)

Mass die-offs of the critically endangered yellow-legged frogs in California are due to chytrid fungus, introduced from nonnative frogs released in the area.

D.B. Wake et al. (2008)

Global Spread Through Trade

- Global trade is primary driver of emergent pathogens, especially ranavirus.
- Hong Kong Pet Trade
  - 66.8% of live amphibians are positive for ranavirus
  - 11.7% tested positive for chytrid fungus

J.E. Kolby et al. (2014)

L.M. Schloegel et al. (2009)
Impact of Pathogen Pollutions

Add pathogen pollutions into the diagram at any point.

References

- Kolby, J.E., K.M. Smith, L. Pederson, A. Preston, A.P. Pessier, and L.P. Rodrigues. 2014. First evidence of amphibian chytrid fungus (Batrachochytrium dendrobatidis) and ranavirus in Hong Kong amphibian trade. PLOS ONE.
Questions?