

Hixon Center for Urban Ecology Student Research Fellows

the Impact of Urbanization and Disease on Amphibians

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Problem Investigated:

The increasing threat of emerging infectious diseases in both wildlife and humans has spurred interest in the causes of disease emergence, including landscape development. Previous research suggests that infection caused by a macroparasite, an echinostome, may be an emerging disease of green frogs (*Rana clamitans*) living in wetlands associated with urbanization and development. I performed laboratory studies to examine the impact of echinostome infection on green frog tadpole growth, development, survival and physiology.

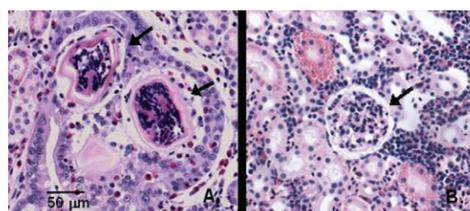
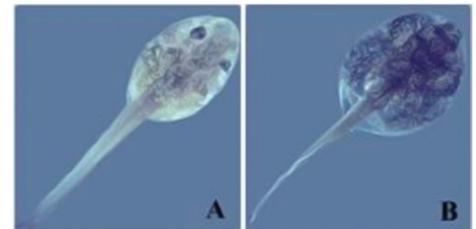
Background— Disease Emergence:

- Emerging infectious diseases are diseases that are:
- Newly recognized
- Rapidly increasing in incidence or geographic range
- New to a population
- Emerging infectious diseases of amphibians are the focus of increasing global concern as they are linked with population declines, extinctions, and developmental deformities.
- Echinostomes are widely distributed and common across North America, and they infect many amphibian species.
- Echinostomes have a complex life cycle in which they must go through three hosts: a snail, followed by a tadpole, and finally a bird or mammal. They form cysts within the kidneys of tadpoles.

Methods:

- Tadpoles were divided into two sets of three treatment groups based on whether they were exposed to parasites early v. late (13 days later) in development:
Early: 0 parasites (control), 40 parasites, 80 parasites
Late: 0 parasites (control), 80 parasites, 120 parasites
- 3 replicates (containers of 5 tadpoles) of each treatment group
- Tadpoles were infected with parasites from infected field-collected snails.

A. Uninfected tadpole
B. Tadpole 24h post-infection with 50 echinostomes. This is a generalized edema response.



Histological sections. A. Infected kidney tissue. The arrows point to echinostome parasites. B. Uninfected kidney tissue. The arrow points to a normal glomerulus, the main filtration unit of the kidney. Sections of tissue from infected kidneys had fewer glomeruli than uninfected tissue, which suggests that echinostomes disrupt glomeruli.

Conclusions:

- Echinostomes cause mortality in green frog tadpoles, having a greater affect on smaller tadpoles at earlier developmental stages.
- Echinostomes cause edema, a sign of compromised kidney function, in green frog tadpoles.
- Echinostomes cause a reduction in the number of glomeruli in tadpole kidneys, which can result in compromised kidney function.
- Kidney size and the number of glomeruli increase dramatically during tadpole development. This may explain the greater impact of echinostomes on tadpoles earlier in development.
- The presence of echinostome parasites in the field coincides with developmentally vulnerable stages of tadpoles. Echinostomes may affect tadpole survival in natural wetlands.

Note: This work is published in the Journal of Zoology (Holland et al. 2007, 271: 455-462).

