



# Multi-month Ranavirus outbreak leads to mass-mortality and disease in two threatened amphibian species in Florida



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## INTRODUCTION

The emerging pathogen *Ranavirus* (*Rv*) is widely associated with amphibian mass mortality events and population declines. Gopher frogs (*Lithobates capito*) and striped newts (*Notophthalmus perstriatus*) are habitat specialists with histories of decline, but disease has not yet been assessed in natural populations.

In January of 2021, we observed a two-month mass die-off of gopher frog tadpoles and morbidity in striped newts within One Shot Pond at Ordway-Swisher Biological Station (OSBS). This community hosts a diversity of amphibian species, including the southern cricket frog (*Acris gryllus*), a habitat generalist. The mass die-off was ongoing as of March 2021.

## METHODS

**Field** – We captured (Fig. 1), identified, and examined amphibians for disease signs. We collected skin swabs from each individual for pathogen detection and collected moribund gopher frog tadpoles for histopathological examination.

**Histopathology** – We sectioned, stained, and microscopically examined tadpole tissues (kidney, liver, spleen, etc.) for disease signs.  
**Lab** – We extracted DNA from swabs and confirmed infections via quantitative PCR (qPCR) assays.



Figure 1. Amphibians are captured by dipnet or by hand for data and sample collection.

## RESULTS

Gopher frogs and striped newts showed clinical signs of infection (Fig. 2), while southern cricket frogs (*Acris gryllus*) did not. qPCR confirmed high infection intensities of *Rv* at 100% prevalence (Fig. 3) in gopher frogs and striped newts. Southern cricket frogs had low to moderate *Rv* infections with 77.2% prevalence.

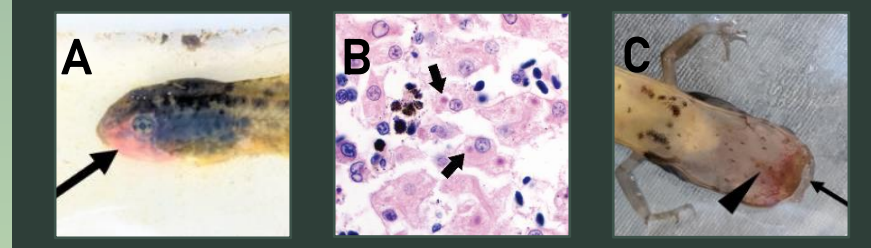


Figure 2. Clinical signs of *Rv* infection in gopher frogs and striped newts. A) Hemorrhage in gopher frog tadpole, B) Hepatocellular *Rv* inclusion bodies in gopher frog tadpole, C) Hemorrhage and erythema (triangle) of the mouth in striped newt.

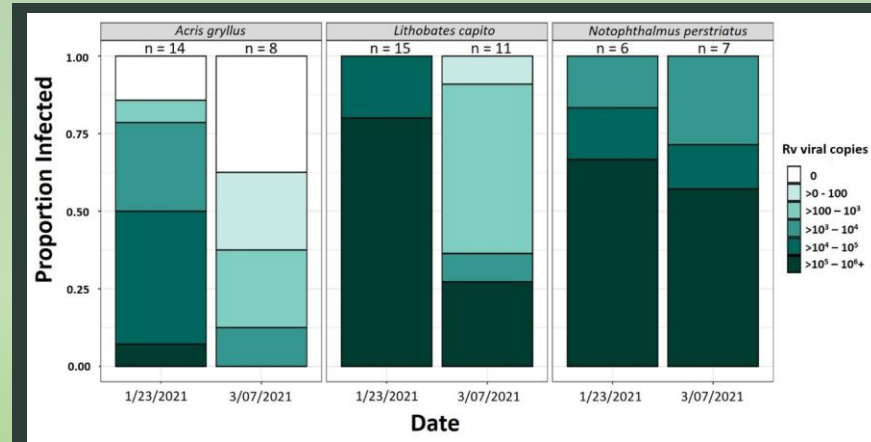


Figure 3. Prevalence and intensity of *Rv* in three amphibian species during both sampling events

## DISCUSSION

**Declines** – We provide support for disease-related decline in gopher frogs and striped newts. Both species are candidates for federal protection, and our findings could strengthen their cases.

**Transmission and Persistence** – We identify southern cricket frogs as potential *Rv* reservoirs due to their tolerance and dispersal ability. Ongoing die-offs of gopher frog tadpoles suggest that older cohorts may serve as vectors of *Rv* to younger tadpole cohorts.

**Spillover Effects** – Adult gopher frogs cohabitate with gopher tortoises (*Gopherus polyphemus*), a federally protected species which is also susceptible to *Rv*. Tortoises at OSBS have not yet been sampled for *Rv*, but pathogen spillover may occur from infected amphibians to gopher tortoises or to other susceptible ectotherms.

**Future Directions** – Pathogens can drive declines of specialist amphibian species or add pressure to existing threats. Future work should increasingly implement disease monitoring programs to detect new outbreaks and track long-term effects of pathogens on amphibian populations.

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