

Senior Thesis Proposal

A Comprehensive Guide to Captive Rearing Gopher Frogs in Georgia

Morgan Kaplan

Warnell School of Forestry & Natural Resources

University of Georgia

Athens, GA 30602

Dr. John Maerz

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General Background

Amphibians are the most threatened vertebrate class, with over 40% of species at risk of extinction (IUCN, 2024). One of the major threats facing amphibians is habitat degradation. In the southeast, Gopher frogs (*Rana* [Lithobates] capito) are suffering from population declines due to the loss of Longleaf pine ecosystem (Cork, 2019) and wetland degradation (Enge et al., 2014). As habitats become more fragmented, population isolation occurs, which leads to limited resource availability and eventually loss of genetic diversity (Hunt, 2019). These issues can lead to local extinction and poor persistence of species in fragmented landscapes. With other imperiled species, tools that have been used to mitigate these issues include captive-rearing and release, and translocations. In 2021, a study involving captive-rearing, releasing, and radio-tracking Dusky gopher frogs (*Rana sevosus*) found that frogs had a high survival rate of 76% after release, and were able to travel long distances and find suitable shelter (Roznik et. al, 2021). This research emphasized the utility of captive-rearing programs to foster Gopher frog population success.

The University of Georgia has hosted a captive-rearing and translocation project of Gopher frogs (*Rana capito*) since 2009. The ongoing captive-rearing project aims to translocate captive-reared metamorphs to repatriate restored historic sites, establish populations at new sites, and supplement small relic populations and the few donor populations on managed properties. The project has expanded to include collaborators rearing Gopher frogs at three additional facilities, all coordinated through UGA on behalf of the state. The UGA program and its protocols have also been used as a model for similar programs in other states. Throughout the fifteen-year program, researchers have tried various methods of captive rearing including differing stocking densities, type of feed, vegetation and aquaculture tank setups. There has been

variable tadpole survival, size and timing to metamorphosis, occurrence of disease outbreaks, abnormalities, and a novel abnormality (McFall, 2023). As more programs for captive rearing of Gopher frogs and related species come online and organizations integrate captive rearing into management plans, information is needed on the potential variation in captive-rearing success to guide decision models and planning.

Objectives

The objectives of this thesis are to summarize the fifteen years of Gopher frog captive rearing data from the UGA program and to analyze how stocking densities and weather patterns affect interannual rearing success and the potential for outbreaks of disease or abnormalities. I will estimate random variation in rearing success related to clutch identity. This thesis will also formalize the existing rearing protocol for dissemination and use by other amphibian captive-rearing programs.

Methodology

I will combine the captive rearing data from the University of Georgia from 2009-2024 into a master data file that includes information about clutch identity, date of hatching, stocking date, stocking density, date of metamorphosis, mass at metamorphosis, year, and fate comments or other additional morphological notes. After I compile this dataset, I will look for patterns associated with how long it took for metamorphosis to occur versus the fate of each frog, along with the fate associated with different clutches. I will then gather data on humidity and rainfall to see if there are any patterns between these variables and time to metamorphosis and mass at metamorphosis, along with any fate associations. I will use this information to edit the current Maerz Lab standard operating protocol on captive-rearing amphibians to be a comprehensive

guide to captive-rearing Gopher frogs in Georgia. This protocol will be available to collaborators and other entities that are working with Gopher frogs throughout their range. I will include my analysis of different variables in the guide to promote the highest success rates of other captive-rearing projects as well as our own.

Anticipated Results and Significance of Research

I expect to demonstrate that there is a high variation in captive-rearing success (survival and size at metamorphosis) that is related to random variation among clutches. This might reflect inherent genetic differences among individuals or maternal effects that can occur in female provisioning of resources to their eggs, which might vary among females and from year to year. I also expect development to be slower in cooler, rainier years because of the effects of temperature and light on algal production in aquaculture tanks; though I also expect higher mortality in very hot years associated with reduced dissolved oxygen and stress-related outbreaks of disease or abnormalities. This research will be important for forecasting the capacity of captive-rearing programs to provide predictable numbers of viable juvenile Gopher frogs for release and in estimating the rates at which programs can expect random poor performance in captive-rearing outcomes.

Prior Research Experience

I conducted undergraduate research through the Maerz Lab in Spring 2023 that included assisting with the Gopher frog captive-rearing project. Because I helped raise frogs from an egg to metamorph firsthand, I have a strong grasp on how the process works and the importance of each step I will analyze. I was also responsible for caring for adult frogs that lived in the field lab prior to translocation, so I am familiar with their needs and regular behaviors and morphology. I

have additionally helped with research projects on salamanders and terrapins, so my general herpetological knowledge may also assist me with my thesis.

Literature Cited

- Cork, E. (2019). *Modeling occupancy and habitat suitability to guide management for the gopher frog (Rana capito) in South Georgia* (Master's thesis). University of Georgia. Athens, GA.
- Graham, K. M. (2015). *Conserving the Mississippi gopher frog (Lithobates sevosa) through the use of assisted reproductive technologies* (Master's thesis). Mississippi State University. Mississippi State, MS.
- IUCN SSC Amphibian Specialist Group (2024). Amphibian conservation action plan: A status review and roadmap for global amphibian conservation. Wren, S., Borzée, A., Marcec-Greaves, R. & Angulo, A. (Eds.). IUCN SSC Occasional Paper, No 57. Gland, Switzerland: IUCN.
- McFall, A. J., Nelson, K. N., Stonecypher, E. T., Swartzbaugh, C. S., Allender, M. C., Burrell, C. E., Yabsley, M. J., & Lance, S. L. (2023). Morphological abnormalities in the gopher frog (*Lithobates capito*) during a headstarting event. *Herpetological Conservation and Biology* 18(3), 436-449.
- Roznik, E. A., & Reichling, S. B. (2021). Survival, movements and habitat use of captive-bred and reintroduced dusky gopher frogs. *Animal Conservation*, 24(1), 51-63.
<https://doi.org/10.1111/acv.12599>

Traci D. Castellón, Anna C. Deyle, Anna L. Farmer, Javan M. Bauder, Elizabeth A.

Roznik, Steve A. Johnson; Effects of Translocation on Gopher Frog Survival and Movement. *Herpetologica* 1 September 2022; 78 (3): 161–168.

doi: <https://doi.org/10.1655/Herpetologica-D-20-00061>