



LOCAL AND LANDSCAPE HABITAT ASSOCIATION, POPULATION ECOLOGY AND FUTURE RECOVERY OF CRAWFISH FROGS (*RANA AREOLATA*) IN INDIANA



Crawfish frog (Lithobates areolatus), breeding male, from Hillenbrand Fish and Wildlife Area.

Current Status

First year of 3 ½-year project

Funding Sources and/or Partners

State Wildlife Grant, Indiana University

Project Personnel

Dr. Michael Lannoo,
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Dr. Daryl Karns, Hanover College
Dr. Joe Robb,
USFWS, Big Oaks National Wildlife Refuge
Dr. John Whitaker, Indiana State University
Dr. John Crawford, Lindenwood College
(on the project from Jan. 1–June 30, 2009)
Perry Williams, USFWS,
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Nate Engbrecht, graduate student,
Indiana State University
Jennifer Heemeyer, graduate student,
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Vanessa Kinney, graduate student,
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Dr. Alan Pessier, veterinarian,
San Diego Zoo (Disease)
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Dr. Stephen Richter,
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Dr. Alisa Gallant, USGS EROS Data Center (GIS)
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Shane Stephens, part-time technician
Austin McClain, part-time technician
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Background and Objectives

Crawfish frogs are large (adults are 3 inches or longer), heavy frogs that spend much of their adult life in crayfish burrows.



Hillenbrand F&W Area, west section, looking east.



Southwest corner of west section of Hillenbrand F&W Area. Willow Pond with drift fence.

In Indiana, crawfish frogs (*Lithobates [Rana] areolatus*) are considered State Endangered, and their declining status across much of their range has caused broad concern about their conservation. According to Sherman Minton, crawfish frogs were locally plentiful in southwestern Indiana until about 1970. The reasons for their recent and rapid decline are unknown.

Typically, crawfish frogs are associated with tallgrass prairies or other native grasslands; however, these habitats are increasingly being fragmented by, or converted to, row-crop agriculture. Crawfish frogs are also considered weak larval competitors, which likely results in reduced recruitment into populations. Local and regional declines may be further enhanced by interactions with exotic species and the emergence of infectious diseases. While there is some information on general habitat use and population demographics, the fossorial nature and scarcity of crawfish frogs has made detailed investigations difficult and recovery plans ineffective.

If the ultimate goal for an endangered species is the recovery of populations, then distribution, habitat use, and mechanisms of decline must be investigated. The status of the crawfish frog in Indiana presents a unique opportunity for this type of study.

Objectives

1. Determine the status of crawfish frog populations in Indiana.
2. Develop methods to monitor the status of crawfish frog populations in Indiana.
3. Determine population parameters of crawfish frogs on public lands in an effort to delimit potential life-history bottlenecks that affect in the survival of this species.
4. Define natural history features such as movement patterns (across the landscape), activity patterns (daily and seasonally), and habitat use features (burrow location) of crawfish frogs, and identify

threats to this species from current landscape attributes (roads, agricultural fields) and land-use practices (frequency of plowing, prescribed burning).

5. Determine the genetic relationships among Indiana crawfish frog populations.
6. Define the role of disease (chytrid fungus) in limiting Indiana crawfish frog populations.
7. Determine how practical captive rearing can be for augmenting populations.
8. Run parallel studies at sites in southwest Indiana (Hillenbrand Fish and Wildlife Area, Dave's Pond) and southeast Indiana (Big Oaks National Wildlife Refuge)
9. Provide management recommendations to Indiana DNR and U.S. Fish and Wildlife Service to maximize the likelihood that crawfish frog populations persist in Indiana.

Methods

We use a wide variety of methods and techniques, including drift fences/pitfall traps, call surveys, seining, minnow trapping, radio telemetry, museum and literature searches, wildlife cameras, song meters, digital videography, pit tagging, toe clipping, microsatellite arrays, histology, PCR analyses, visual surveys, disease surveys, tissue sampling for genetic analysis, and captive rearing, as follows:

- 1) Status: Literature searches, museum searches, call surveys, seining, minnow trapping, song meters;
- 2) Monitoring: Song meters, minnow trapping;
- 3) Population parameters: Drift fences/pitfall traps, radio telemetry, pit tagging, histology;
- 4) Natural history: Drift fences/pitfall traps, radio telemetry, wildlife cameras, videography;
- 5) Genetics: Toe clipping, microsatellite arrays;

- 6) Disease: Swabs for chytrid fungus, histology, PCR;
- 7) Population augmentation: Captive rearing pools, diet, timing;
- 8) Statewide comparison: Two crews, one in southwest Indiana led by Lannoo, the other at Big Oaks led by Karns and Robb

Progress

Papers accepted:

Heemeyer, J.L., V.C. Kinney, N.J. Engbrecht, and M. J. Lannoo. The biology of crawfish frogs (*Lithobates areolatus*) prevents the full use of telemetry and drift fence techniques. *Herpetological Review*. In Press.

Invited papers submitted:

Lannoo, M.J., V.C. Kinney, J.L. Heemeyer, N.J. Engbrecht, A.L. Gallant, and R.W. Klaver. Mine Spoil Prairies Expand Critical Habitat for Endangered and Threatened Amphibian and Reptile Species. *Diversity* (Submitted 21 Oct., '09)

Papers submitted:

Engbrecht, N. J. and J. L. Heemeyer. *Lithobates areolatus circulosus* (northern crawfish frog). *Heterodon platyrhinos* (eastern hog-nosed snake). Predation. *Herpetological Review* (Submitted August '09).

Kinney, V.C. and M.J. Lannoo. *Lithobates areolatus circulosus* (northern crawfish frog). Breeding. *Herpetological Review* (Submitted August '09).

Papers presented:

Engbrecht, N. J. Status and Distribution of Crawfish Frogs (*Lithobates areolatus*) in Indiana. Indiana Academy of Science, October '09.

Heemeyer, J.L. Post-breeding Migration and Habitat Selection of the Crawfish Frog (*Lithobates areolatus*). Indiana Academy of Science, October '09.

Hoffman, A.S., P.J. Williams, J.R. Robb, and Daryl R. Karns. Activity Patterns of the Crawfish Frog (*Lithobates* [*Rana*] *areolatus*) at Crayfish Burrows in Big Oaks National Wildlife Refuge, Southeastern Indiana. Indiana Academy of Science, October '09

Kinney, V.C. Breeding Biology of Crawfish Frogs (*Lithobates areolatus*) in Southwestern Indiana. Indiana Academy of Science. October '09.

Lannoo, M.J. Habitats lost and habitats found. Association of Zoos and Aquariums Workshop (Keynote). Toledo Zoo, April 2009.

Williams, P.J., A.S. Hoffman, J.R. Robb, and D.R. Karns. Burrow Selection by the Crawfish Frog (*Lithobates* [*Rana*] *areolatus*) in Southeastern Indiana. Indiana Academy of Science, October '09.

Narrative

We have made substantial progress in understanding the life history and natural history features of crawfish frogs in Indiana. We understand much of their historic distribution and their current distribution. We under-



Newly metamorphosed crawfish frog, from Hillenbrand F&W Area.



Crawfish frog in primary burrow at Hillenbrand F&W Area. Feeding platform is bare muddy area located in front of animal.



Amplexed pair of crawfish frogs at Hillenbrand F&W Area. Arrived at drift fence on May 1st, three weeks after breeding pulse.



Crawfish frog female at Hillenbrand F&W Area with a chytrid fungus infection. This frog died within 72 hours and was necropsied by Dr. Alan Pessier, San Diego Zoo.

stand when they breed, and have identified a large percentage of their known breeding sites in Indiana. We understand survivability in both egg and larval stages, and in postbreeding adults. We have successfully reared large numbers of tadpoles to metamorphosis. We understand where adult burrows are located, and have made a distinction between primary and secondary burrows. We understand activity patterns and habitat use. Despite efforts to track juveniles, we do not understand much about what juveniles do or where they go—this will be a major focus in 2010. We understand the role that management techniques such as prescribed burning, mowing, and establishing food plots have on populations. We have made arrangements to have genetic analyses done. We have also made arrangements to have different populations, and different life history stages within populations, surveyed for the presence of chytrid fungus (16 of 18 breeding crawfish frogs at Hillenbrand Fish and Wildlife Area tested positive).

Workers within the state communicate frequently. In addition we have set up a listserv (sevosa@listserve.eku.edu) to communicate with people working on this species group (three species: Crawfish Frogs, Gopher Frogs [*L. capito*], and Dusky Gopher Frogs [*L. sevosus*, which are federally endangered])

Cost: \$820,518



Juvenile crawfish frog with belt radio attached.



Nocturnal activity of crawfish frog documented by wildlife camera.



Graduate students Kinney and Heemeyer working up a breeding crawfish frog at Hillenbrand F&W Area.