Current Status
First year of 3 ½-year project

Funding Sources and/or Partners
State Wildlife Grant, Indiana University

Project Personnel
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Dr. Joe Robb,
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Dr. John Whitaker, Indiana State University
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(on the project from Jan. 1–June 30, 2009)
Perry Williams, USFWS,
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Dr. Stephen Richter,
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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.
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:

Invited papers submitted:

Papers submitted:

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

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-
Crawfish frogs 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

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.

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.