



Life in the Rocks



The Newsletter of the Arkansas Game and Fish Commission Nongame Aquatics Program



Osage Burrowing Crayfish – Photo by B. Wagner

One Less Crayfish in Need of Conservation

By Brian Wagner, Nongame Aquatics Biologist

In 1988, Hobbs and Robison described the Lonoke crayfish, *Procambarus ferrugineus*, from two locations in Lonoke County. This primary burrowing crayfish was most similar to the Osage burrowing crayfish, *Procambarus liberorum*, described by Fitzpatrick ten years earlier from Washington County, half a state away. As the years passed, efforts by Dr. Henry Robison and others expanded the Osage burrowing crayfish's range to the south and east. Eventually I found them as far east as Conway. Yet, in all these years, there were no new collections of the Lonoke crayfish and

even Hobbs began to doubt the validity of the species.

Thus, in 2003, Arkansas Game and Fish Commission and the United States Fish and Wildlife Service used *Section 6 Endangered Species Act* funds to contract with Dr. Robison to determine the status and distribution of the Lonoke crayfish; and, with Dr. Keith Crandall, crayfish geneticist at Brigham Young University, to examine the species' distinctness from the Osage burrowing crayfish and other similar crayfishes in Arkansas.

Dr. Robison and I visited the published locations from the description of the Lonoke crayfish, and were stunned to find no burrowing crayfish, at all! Searching much of Lonoke County, the only primary burrowers we found were the common Painted devil crayfish, *Cambarus ludovicianus*, and Digger crayfish, *Fallicambarus fodiens*. At this point, depression set in. How can we look at status, distribution, and genetics of an animal that we can't even find? Did we miss the extinction of a rare Arkansas crayfish? Would we ever know?

Then, Dr. Crandall had an idea – could he isolate DNA from the preserved specimens the Lonoke crayfish was originally described from? He arranged a trip to the United States Museum of Natural History (Smithsonian Institution) in Washington, D. C., and was allowed to collect tissue samples from their preserved specimens – the same ones that Hobbs looked at in 1988 to describe the

Lonoke crayfish. These specimens had been preserved in 1985 and 1987 with no special efforts to maintain tissue for genetic analysis. After 18 years, would there be enough intact DNA to analyze? Back at the lab, at Brigham Young University, the answer was YES!

The methods of analysis and conclusions are presented in detail in a recent paper in the journal *Conservation Genetics*. For our purposes, the result is that the DNA from the Lonoke crayfish was not distinct from the Osage burrowing crayfish – they are the same species. Since the Osage burrowing crayfish was named first, the Lonoke crayfish is no more.

This results in “loss” of one of Arkansas’ species of concern, but in a good way. Instead of having the extinction we feared, we just have the loss of a fringe population of an endemic species that is more widely distributed in Arkansas.



Digger crayfish (left) and Painted devil crayfish (right) – Photos by B. Wagner



Molecular Systematics, Cladistics, and Evolutionary Histories: Cryptic Species Revealed in Species Complexes and Discerning True Species Diversity

By Kelly Irwin, Herpetologist

Thanks to popular crime drama television programs such as CSI, and all its iterations, a large percentage of the public is probably familiar with the term “DNA” and the general concept of comparing genetic material to use as evidence to put away the bad guys. Advances in genetic techniques and analyses over the past 25 years have increased the power of these tools for a variety of purposes of interest to wildlife biologists and academic researchers alike. The field of herpetology has taken advantage of these genetic research tools to help study the evolutionary relationships in groups of species – this is called “molecular systematics.” Molecular systematics takes the genetic information from various populations of organisms and looks for similarities between these populations. Genetic samples from closely related organisms have similar genetic

signatures, while more distantly related organisms have dissimilar genetic signatures. Once a researcher has obtained genetic samples, from their study population, they can use that data to perform a cladistic analysis. Cladistics (derived from the ancient Greek word *klados* or “branch”) is a method of inferring evolutionary ancestry by comparing relationships of organisms, via an objective, quantitative analysis based on genetic, morphological, or other data that characterize the species under study. Once a researcher has defined the various data sets and characters, to use in their cladistic analysis, they input these data into a computer program that generates a hierarchical cladogram or “evolutionary tree” which graphically illustrates the evolutionary histories, or lineages of the organisms, based on shared characters of genes, morphology, etc.

So, what does all this mean to a Programs biologist in the AGFC? Being charged with protection and management of Arkansas' natural resources, it is critical to understand the true species diversity of our state. This is essential for making informed management decisions as we attempt to conserve all the components of our varied ecosystems. The more species-diverse an ecosystem, the greater its stability. The greater the stability, the healthier the system, thereby increasing the likelihood of its long-term maintenance. Before the advent of today's powerful analytical and genetic tools, species were defined by the old system of "taxonomic classification" based solely on their morphological similarities. For example, there is a group of very similar looking small brown frogs in the eastern United States called chorus frogs (genus *Pseudacris*). Up until last year, there were six recognized species within this group: *P. brachyphona*, *P. brimleyi*, *P. feriarum*, *P. maculata*, *P. nigrita* and *P. triseriata*. Groups of such similar looking animals are referred to as a "species complex." This species complex has historically been problematic in terms of defining each of the species. However, a recently published study by Lemmon et al. (2008) analyzed genetic, morphological, and breeding call data in this group of frogs, which revealed a previously unrecognized and distinct evolutionary lineage within this group. New species that are

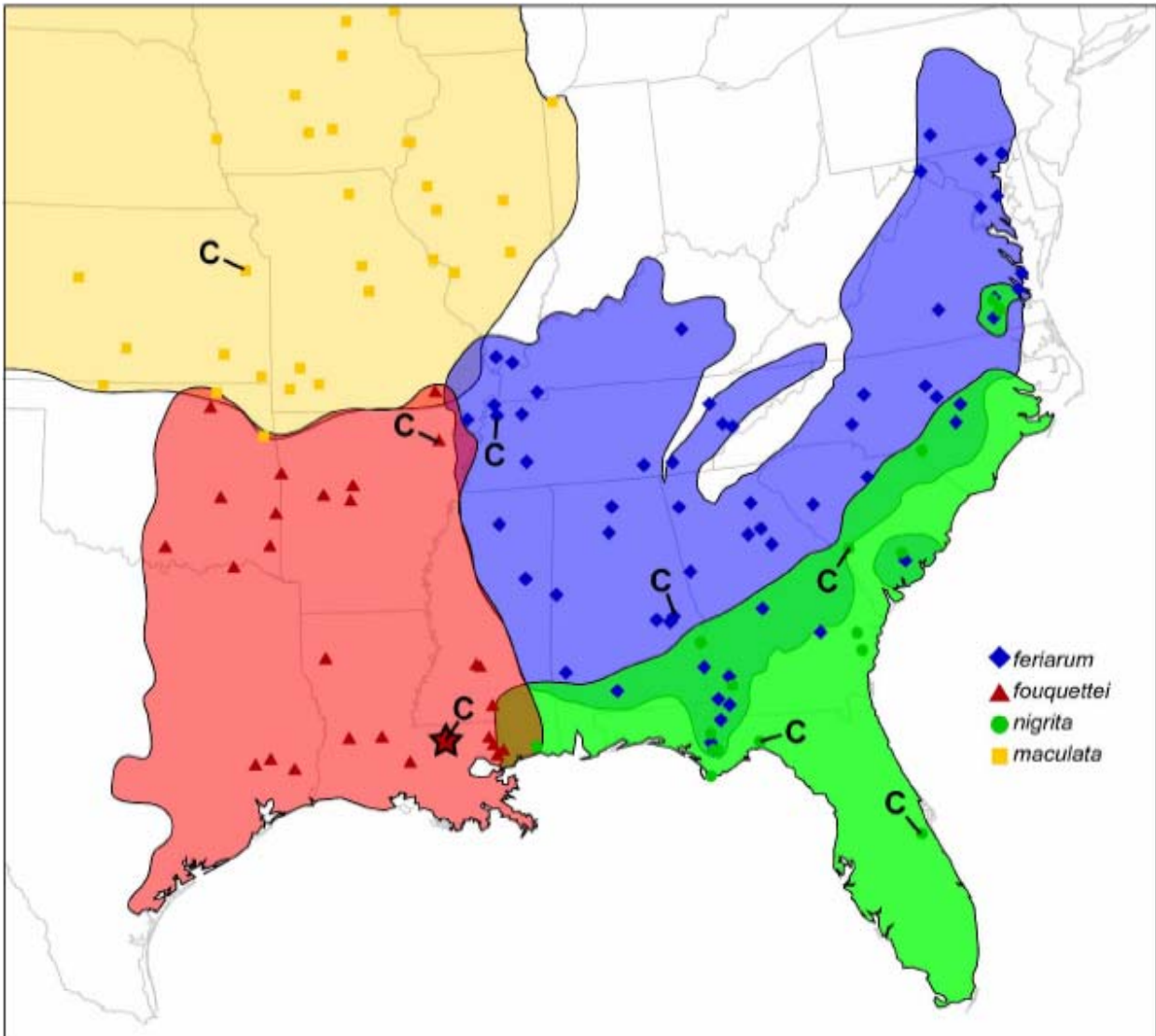
discovered within a species complex, such as this, are called "cryptic species," since they were formerly hidden in the old system of taxonomic classification. As a result of their work, Lemmon et al. (2008) described a new species of frog and named it the Cajun chorus frog, *Pseudacris fouquettei*. The Cajun chorus frog is found throughout most of Arkansas, with the possibility of two other species occurring in the state: *P. maculata* - in the northwestern corner and *P. feriarum* - in the northeastern corner.

This type of research is an excellent example of why we need to determine the true species diversity of all our wildlife resources. Without this information we would treat all chorus frogs as the same in Arkansas and might inadvertently lose the two other species that might occur in the state. It is through studies, like this, that resource managers and biologists learn about the resources they are charged with conserving, and can then make the necessary management decisions to insure their continued existence for future generations.

Acknowledgements – Special thanks to Suzanne Collins for the use of her superb photograph of the Cajun chorus frog and Joe Collins for discussions on chorus frog systematics.

Literature Cited

Lemmon, E. M., A. R. Lemmon, J. T. Collins and D. C. Cannatella. 2008. A new North American chorus frog species (*Pseudacris*: Hylidae: Amphibia) from the south-central United States. *Zootaxa*. 1675: pp. 1-30.



Geographic distribution of chorus frog lineages *Pseudacris* sp. The red shaded area is the range of the newly described Arkansas species, the Cajun chorus frog *Pseudacris fouquettei* (from Lemmon et al., 2008).

Pebbles...

(Quick notes on what we've been up to...)

- Bill Posey netted for paddlefish on the Red River.
- Brian Wagner met with staff of the Fayetteville office of The Nature Conservancy to discuss work on Aquatic GAP and to develop a proposal for conservation planning for the Arkansas darter and Least darter in Arkansas.
- Bill searched unsuccessfully for gravid female Ouachita rock pocketbook mussels to propagate juveniles for release in the Little River above Millwood Lake. Only one Ouachita rock pocketbook was located at a sight where nine had previously been found.
- Brian and Shawn Sanders set up a crayfish display at the Forrest L. Wood Crowley's Ridge Nature Center, in Jonesboro, and Brian gave a presentation on "Arkansas Crayfish." Both of these were held for public attendance and were very well attended.
- Kelly attended the Southeastern Division of the Partners in Amphibian and Reptile Conservation annual meeting in Athens, Georgia. He attended a series of presentations on herp conservation and participated in a workshop as part of the development of an amphibian and reptile inventory and monitoring techniques handbook.
- Brian represented Arkansas at a meeting of the Mississippi River Basin Panel on Aquatic Nuisance Species.
- Bill, Jeff Quinn and Lee Holt attended the Mississippi Interstate Cooperative Resource Association's (MICRA) annual Paddlefish and Sturgeon Committee meeting in Nashville, TN.
- Brian attended the joint Arkansas – Mississippi Chapter American Fisheries Society meeting, where he made a presentation on AGFC's Williams crayfish work.
- Kelly gave a presentation at the Forrest L. Wood Crowley's Ridge Nature Center on venomous snakes and the American alligator. This program was open to the public and was attended by 50+ people.
- Bill conducted an endangered mussel survey on the South Fork Spring River for an Arkansas Stream Team project.
- The Ozark Hellbender Working Group met at the Missouri Department of Conservation's "Shepherd of the Hills Hatchery and Conservation Center" in Branson, Missouri. Kelly attended the meeting where he gave a summary of ongoing work and the current status of the Ozark hellbender in Arkansas. Attendees spent most of the day working in groups to finalize sections of the Ozark Hellbender Conservation Strategy Plan. This plan can be used in the future as a recovery plan should the species become listed as threatened or endangered under the *Endangered Species Act*.

Pebbles...

...continued

- Bill attended a Fat Pocketbook Mussel Recovery Team meeting in Memphis, TN.
- Brian attended the Southern Division American Fisheries Society meeting and participated in a symposium on conservation of southeastern crayfishes. He gave a presentation on AGFC's Williams crayfish work and was a co-author of a presentation on "Genetics of Midget Crayfish and Neosho Midget Crayfish."
- Bill participated in an episode of Talkin' Outdoors with Steve "Wildman" Wilson.
- We all attended a Fisheries Division staff meeting and participated in discussion of possible new regulations.
- Bill and "bossman" Steve Filipek attended the Lower and Upper Mississippi River Conservation Councils (LMRCC/UMRCC) Annual Meeting in Collinsville, IL. While there, they also attended a special MICRA Paddlefish and Sturgeon Committee meeting.
- Brian served with the US Fish and Wildlife Service (USFWS) and The Nature Conservancy on an expert panel to develop sampling protocols for long-term monitoring of Yellowcheek darters.
- Bill participated in the *Outdoor Hotline* call-in show.



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The Cajun chorus frog is one “cryptic” species uncovered using genetic analyses.

Photograph by Suzanne Collins.

This month in *Life in the Rocks* we discuss example of how modern genetic analyses are helping us to understand and conserve Arkansas’ aquatic biodiversity!



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