# STATE WILDLIFE GRANT PROJECT REPORT—INDIANA
## Eastern Hellbender Juvenile Habitat Restoration

***A male Eastern hellbender guards a natural nest rock during the fall 2015 breeding season. (photo by Brian Tornabene)***

### CURRENT STATUS

Second year of a two-year project

### FUNDING SOURCES AND PARTNERS

State Wildlife Grant Program (T7R17)
Purdue University

### PROJECT PERSONNEL

Principal Investigator, Dr. Rod N. Williams, Purdue University, Department of Forestry and Natural Resources, associate professor

Graduate Student, Erin Kenison, Purdue University, Department of Forestry and Natural Resources, doctoral degree program

### BACKGROUND AND OBJECTIVES

The Eastern hellbender *(Cryptobranchus alleganiensis alleganiensis)* is a large, fully aquatic salamander historically found in streams throughout much of the eastern United States. Typical hellbender streams have a variety of gravel and cobble substrates. Such substrates are thought to provide important food and cover for larval and juvenile life stages. The presence of these habitat types is likely important to the survival of younger hellbender age classes and, by extension, recruitment of new individuals into the population.

In the last few decades, hellbender populations have declined dramatically throughout their range. Without sufficient recruitment or immigration, existing populations will not sustain themselves. The only remaining hellbender population in Indiana is in the Blue River, which feeds directly into the Ohio River. There has been no documented recruitment into this population in the past two decades despite intense search efforts.

Immigration of hellbenders from other sources is unlikely. The only water connection from the Blue

River to other hellbender populations is through the Ohio River, which is likely unsuitable for hellbenders because of its dams. In 2013, a population viability analysis found that without increased juvenile recruitment and survival, the Indiana population will likely disappear within 25 years.

Mitigation efforts to date have included the release of 4-year-old, captive-reared juveniles from West Virginia into the Blue River and moving resident Blue River adult hellbenders closer to each other in an effort to increase mating opportunities. These strategies have increased juvenile annual survivorship up to 30% and resulted in several clutches of eggs, but long-term prospects remain unknown. These approaches are resource-intensive. The release of younger captive-reared individuals may yield equal or better outcomes if we can continue to improve rearing techniques.

Captive habitat enrichment is a conservation technique used to increase the likelihood that captive-reared amphibians will survive after being released. Captive-rearing techniques designed to mimic natural settings (e.g., water currents that mimic those of a real river) may help released hellbenders survive in the Blue River and therefore, increase the population size.

Larval and juvenile hellbenders require suitable substrate. When this is absent or in short supply, individuals may be forced to live in more marginal habitats. This may increase the chances of mortality. Habitat restoration has been used as a management tool for a variety of organisms. Other projects aimed at the habitat requirements of larval and juvenile animal stages have been successful, but most have been aimed either at pond-breeding amphibians such as frogs or fish species such as salmon.

A final challenge potentially facing hellbenders is pollutants in stream sediments. Many pollutants can accumulate in stream-bottom sediments while not being detectable in the water column. These can become dangerous to organisms such as hellbenders. Testing for a panel of 27 pesticides was previously conducted in the Blue River. While three potentially dangerous compounds were detected at low concentrations, the testing was conducted only from water column samples. It did not include other common contaminants such as heavy metals, polychlorinated biphenols (PCBs) and polycyclic aromatic hydrocarbons (PAHs).

The three chief objectives of this research are:

1. to increase juvenile survival through improved enrichment in captivity,
2. to increase juvenile survival through improved release-site gravel-bed substrate, and
3. to conduct pollution testing of water and sediment samples.

Ultimately, the results of this research will be used to inform management decisions on how to increase hellbender populations in Indiana and throughout their range.

## METHODS

To address our first objective, we will improve the current captive rearing system by replacing the standard aquarium system we use with a raceway system. This will introduce the higher flow of water that is typical of natural hellbender habitats range-wide. The raceways will be enriched with gravel, cobble and cover objects to mimic the natural substrate found throughout the river.

To restore habitat in the wild, we will select a suitable site in the Blue River for gravel enrichment based on current habitat mapping and niche modeling being done in our laboratory on a related project (Assessing Juvenile Survival in Eastern Hellbenders—T7R15). Gravel-retention mesh will be installed and anchored into bedrock or with boulders too large to be moved by seasonal flooding. Clean gravel and cobblestones will be used to build gravel beds and will be combined with larger rocks to provide hydrodynamic stability. The gravel beds will be kept in the water, without hellbenders, for one year. This will allow for colonization of these new beds by invertebrates and other potential prey.

After a year in the river, approximately 80 larval hellbenders will be released at the site. They will be released first into mesh enclosures that are anchored in the river and filled with gravel and invertebrate prey for one week. Finally, they will be released from the mesh enclosures into the surrounding gravel and monitored for survival.

Water and substrate samples will be collected and sampled for a comprehensive list of heavy metals, PCBs and the metabolites they create, PAHs and their breakdown products, and substrate- or pore water-bound pesticides. These samples will be submitted to a professional environmental testing laboratory.

## PROGRESS TO DATE

We have designed and installed six large, polyethylene raceways (55 x 22 x 24" LWH), three with water current and three without. Velocities are maintained to mimic natural riffles and runs where hellbenders are found (0.3 m/sec) or equivalent to pools in native hellbender rivers (0.05 m/sec). Raceways have a variety of gravel, pebble, and tile substrate and multiple rock-slab hides to resemble more natural conditions, as compared to standard aquarium tanks.

We introduced 20 hellbenders to each raceway in May 2015. We are currently collecting monthly morphologic measurements to quantify growth, body condition, and phenotypic plasticity in response to the presence or absence of water current. We are interested in investigating how environmental conditioning influences morphologic features such as tail shape, how these changes may alter swim performance, and how conditioning influences survival, movement, and habitat use of reintroduced individuals. Habitat niche modeling is already underway in our laboratory, and

***Members of the Williams lab do a snorkel survey for Eastern hellbender nests in the Blue River. (photo by Brian Tornabene)***

preliminary data have identified several priority areas for future release sites.

Water and substrate samples will be collected during early spring 2016 and screened for potential pollutants among proposed released sites. Habitat suitability, based on our ecological niche modeling and pollutant screening, will provide the needed information to finalize our release site location(s). We are in the process of constructing the gravel retention bed frames in preparation for river deployment during late winter or early spring 2016.

We will use data obtained from this project to fulfill degree requirements for one doctoral and one master student at Purdue University. The information gathered will be useful for other states that are relying on captive-rearing and release of juvenile hellbenders to augment declining populations.

## COST: $106,163 FOR THE COMPLETE TWO-YEAR PROJECT