STATE WILDLIFE GRANT PROJECT REPORT—INDIANA

Eastern Hellbender Juvenile Habitat Restoration

Gravel substrate and large rocks have been added to enrich the environment of captive-reared hellbenders. (Photo by Rod Williams' lab)

Current Status

First 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

Dr. Steven J.A. Kimble, Purdue University, Department of Forestry and Natural Resources, postdoctoral research assistant

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

A juvenile hellbender is released into the Blue River in Indiana. (Photo by Rod Williams' lab)

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 reason is the Ohio River, which is the Blue River's only water connection to other hellbender populations, is likely unsuitable for hellbender survival 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 matings. 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 settings enriched to mimic natural settings (e.g., water currents that mimic those of a real river) may help released hellbender individuals survive in the Blue River and 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 rangewide. The raceways will be enriched with gravel, cobble and cover objects to mimic the natural substrate found throughout the river.

For wild habitat restoration, 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 are in the preliminary design phase of the project but already have more than 200 larvae growing in captivity. We will need to collaborate with engineers to design the high-flow raceway for captive rearing and to place gravel and cobble beds in the river. Habitat niche modeling is already underway in our laboratory, and we will use these data in selecting wild release sites in the Blue River.

Cost: $106,163 for the complete two-year project.