



STATE WILDLIFE GRANT PROJECT REPORT—INDIANA

Assessing Juvenile Survival in Eastern Hellbenders



Larval hellbenders are being reared in raceways that mimic more natural riverine conditions in hopes of improving their success after reintroduction to the wild. These raceways are larger than standard aquarium tanks and have a variety of rocky substrate. Three have water current that mimics natural hellbender habitat. (photo by Erin Kenison)

CURRENT STATUS

Second year of three-year project

FUNDING SOURCES AND PARTNERS

State Wildlife Grant Program (T7R15)
Purdue University

PROJECT PERSONNEL

Dr. Rod N. Williams, Principal Investigator, Purdue University
Emily McCallen, doctoral student (2013-present),
Purdue University
Erin Kenison, doctoral student (2014-present),
Purdue University

Brianna Osinski, master student (2015-present),
Purdue University

TECHNICIANS

Brian Tornabene (2015)
Nick Burgmeier (2015)
Kodiak Hengstebeck (2014)
Lucas Hoehn (2014)
Weston Schrank (2014)
Brandon Zinman (2014)
Matthew Farr (2014)

BACKGROUND AND OBJECTIVES

The Eastern hellbender (*Cryptobranchus alleganiensis alleganiensis*) is a large aquatic salamander that historically occurred throughout much of the eastern United States. These giant salamanders are important indicators of water quality and ecosystem health. Because they remain aquatic all their life and breathe through skinfolds on the sides of their bodies, they are constantly exposed to potential risks in the aquatic environment. As a result, they may alert us to contaminants or dangers that could affect humans.

During the past few decades, hellbender populations have exhibited range-wide declines. They are now listed as threatened or endangered in nearly every state in which they occur. Factors such as habitat degradation, pollution, collection for scientific investigations or the pet trade, and being killed by anglers have reduced hellbender populations; however, the ultimate cause of declines remains unknown.

In the Midwest, hellbender population declines have been particularly pronounced. Populations in Ohio and Missouri continue to be at risk. Hellbenders have been extirpated in Illinois and reduced to a 112km stretch of the Blue River in southern Indiana. Hellbender density in the Blue River is far lower than studied hellbender populations outside of Indiana. Moreover, there has been no record of larvae or juveniles for the past two decades in the Blue River despite extensive survey efforts. Indiana's Eastern hellbender population is skewed toward older adults that are likely approaching the end of their 30-year life span. With continued decline in population sizes and no indication of successful reproduction, hellbenders in southern Indiana are extremely vulnerable to extirpation.

In order to reverse the risk of local and statewide extirpation, it is crucial to concentrate efforts on improving larval survival and juvenile success in the wild. We plan to advance captive rearing methods in the laboratory to better prepare young larvae for reintroduction as sub-adults to the Blue River. We will be investigating larval responses to a variety of natural conditions in a controlled environment. It is also essential to explicitly evaluate the habitat requirements of Indiana's hellbenders and assess potential release sites to maximize the survival of reintroduced sub-adults. Habitat evaluation and assessment will be achieved through ecological niche modeling. We ultimately hope to influence rearing methods, release techniques, and management decisions to preserve future hellbender populations.

METHODS

We have an active head-starting program at Purdue University's Aquaculture Facility. We use eggs collected from the wild and plan to rear larvae for two years before reintroduction. During this time, our work will be directed at creating an artificial stream in which larvae can experience water current, monitoring larval

responses to changes in environmental conditions and predator cues, and introducing larvae to natural and artificial habitat structures so they can be conditioned to use ideal habitat when released. Before release, we will develop an ecological niche model to help determine optimal sites for young hellbenders.

Ecological niche modeling is a process that relates patterns of known species occurrence to environmental covariates and results in a predictive map of habitat suitability covering a continuous area of interest. Because hellbenders require large boulders for protection, the substrate of the Blue River will be classified using side-scan sonar. The resulting substrate map will be used to derive the primary predictor variables for the hellbender niche model.

We will also include the presence of river otters and crayfish within the model—these two species respectively represent the main predator and food resource for local hellbenders. The data collected from the Blue River watershed will be used to create an explicit map of adult Eastern hellbender habitat suitability in Indiana, and we will use data collected throughout the species' range to gain insight into habitat requirements of Eastern hellbender larvae. We will use radio telemetry to track individuals released back into the Blue River to better understand juvenile habitat use, movement and survival after laboratory conditioning.

PROGRESS TO DATE

Data for a multi-species ecological niche model was collected during 2014 with 14 sites surveyed for crayfish and Eastern hellbenders, and 35 sites surveyed multiple times for river otter latrines. During summer 2015, multi-pass sonar imagery was collected and processed for 35 river kilometers. The goal was to create a substrate map for use in ecological niche modeling. The data are currently being analyzed using semi-automated classification techniques. The rest of the Blue River will be imaged during late fall 2015 or spring 2016 high-water events. These data will be used to identify priority areas for release of captive-reared juvenile hellbenders.

We continued to enhance our captive-rearing program and conditioning of captive-reared hellbenders. We have setup six large raceway tanks at Purdue's aquaculture facility with a variety of stone substrate and rock-slab cover objects. We introduced twenty 2-year-old hellbenders to each tank in May ($n=120$) and manipulated water flow in three of the six tanks to expose larvae to water current. Water current velocities in treatment tanks mimic flow rates in riffle and run river sections where hellbenders are naturally found. This experiment is designed to introduce hellbenders to more natural conditions than standard aquarium tanks. The hope is that they will become better acclimated to and more prepared for a riverine system before release.

We are interested in comparing hellbender behavior and morphology between tanks with and without



Raceways with and without water current. Hellbenders will be housed in these raceways for a year before being reintroduced to the Blue River in southern Indiana. We are investigating how rearing environments with water current change hellbender morphology, behavior and, ultimately, success in the wild. (photo by Erin Kenison)

environmental conditioning. We are specifically interested in how the presence or absence of water current influences growth rates, size differences, and refuge use (i.e., probability of being inside or outside of cover objects). We plan to continue monthly morphological measurements and daily refuge use until the completion of the experiment in May 2016.

We continued to search for hellbender nest sites and signs of reproduction throughout the 2015 breeding season. We observed three males guarding natural nest rocks and one male guarding an artificial nest box. One fertilized nest was collected from the artificial nest box occupied with a guarding male and brought back to Purdue's aquaculture research lab for rearing. Within the fertilized nest, 156 eggs were viable and 149 larvae hatched on Nov 1.

We are preparing for the 2016 field season, in which we will conduct our largest release of juvenile hellbenders to date. During summer 2016, 80 of the 120 juveniles reared in the large raceway tanks will be surgically implanted with radio transmitters and released within the priority habitat identified by our ecological niche model. We will use the data collected from radio-tracking to estimate the survivorship of juvenile hellbenders reared within different environments, and assess their movement patterns and how they use their habitat.

We will use data obtained from this project to fulfill one master and two doctoral degree requirements for Purdue University and provide useful information for other groups, agencies and scientists working with hellbenders. This project encompasses innovative ways

to understand and protect an endangered species. It may influence future rearing and management decisions for Eastern and Ozark hellbender conservation throughout the nation.

COST: \$423,164 FOR THE COMPLETE THREE-YEAR PROJECT