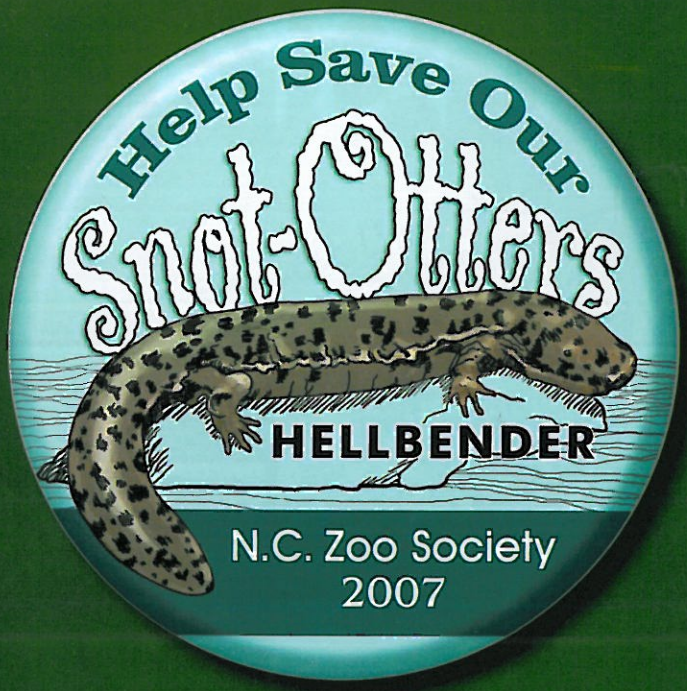
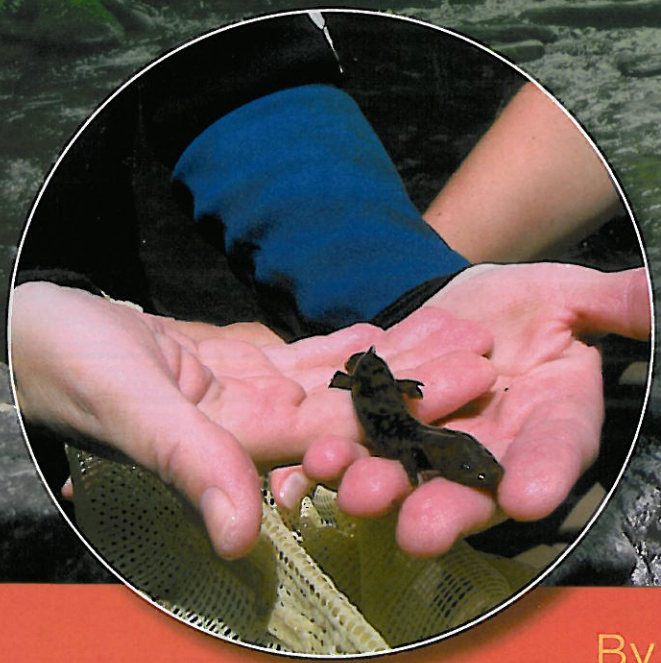


IN SEARCH OF THE HELLBENDER IN NORTH CAROLINA

For more than 20 years, biologists worldwide have sounded alarms about declining amphibian populations. Field studies from every continent and every type of habitat confirm major, often precipitous, drops in at least some amphibian groups. One-third of named amphibian species have declined sufficiently to warrant classification as threatened or endangered. While 60 percent of the remaining species appear stable, the status of the last 40 percent cannot be confirmed. They are too poorly studied for anyone to venture a guess about the health of their populations.



By John D. Groves and Lori A. Williams

Major international and national conservation agencies (e.g., AZA, IUCN, Conservation International, CBSG) have responded to these findings by elevating amphibian conservation to a top-tier priority. As part of their emphasis, these groups have asked zoos to focus on amphibian conservation, including salamander conservation efforts within the United States.

The hellbender (*Cryptobranchus alleganiensis*) is a native salamander in need of such help. One of North America's largest salamanders, the hellbender inhabits clean, fast-moving, cool mountain streams and rivers in the eastern United States. The species occurs in three metapopulations: one in the southern Ozark Mountains (*C. a. bishopi*); one further east, primarily in the Appalachian Mountains (*C. a. alleganiensis*); and a third, relict population (*C. a. alleganiensis*) in the northern Ozarks.

Fieldwork has documented steep declines – some as high as 77 percent – among a few hellbender populations, but most remaining populations have not been evaluated. The Appalachian metapopulation in particular has received little scientific scrutiny.

This neglect probably springs from the prevailing conventional wisdom that considers North Carolina's hellbender populations as stable. Unfortunately, this wisdom relies on anecdotal, not empirical, evidence. Until our study began in 2007, no one had surveyed the state's hellbender populations.

That situation changed when the Association of Zoos and Aquariums (AZA) awarded a Conservation Endowment Fund (CEF) Grant to the North Carolina Zoo. The grant funded a series of hellbender surveys in our Appalachian Mountains. These surveys helped us begin to define, on a fine scale, our native hellbender's range and allowed us to start searching for environmental factors that correlate with hellbender abundance.

Staff at the North Carolina Zoo collaborated with the North Carolina Wildlife Resources Commission to complete these surveys. We also recruited state and federal agency partners, university and environmental organization volunteers, and even a few eager citizen scientists to help us.

Our teams conducted three field surveys in August 2007, ten field surveys between May and October 2008 and four more surveys between July and August of 2009. We also undertook an additional 2008 survey that visited two study sites to look exclusively for hellbender larvae.

We selected study sites from each of the five river basins that are known to support hellbender populations inside North Carolina. We applied standard survey methods to search for and capture hellbenders living in these boulder-strewn, fast-moving waterways. We weighed and measured each captured hellbender, took skin swab samples from it to test for the Chytrid fungus and released it back into its home stream. We also recorded several water quality measures at each study site.

Findings and Outcomes

We surveyed 54 river sites, 32 of which were selected because of historical records that documented the presence of hellbenders in their waters. We found hellbender populations in 24 of these historical sites. In contrast, hellbenders occurred in only nine of the 22 new locations we selected.

Our preliminary findings suggest that hellbenders are more abundant in the state's western mountain river basins than on its eastern slopes (e.g., the New River and French Broad River drainage systems). Our early findings also pointed to a negative, but not statistically significant, correlation between hellbender densities and human development. Waterways away from human development tended to support the largest hellbender populations. None of our water quality measures correlated with the size of the hellbender populations we found.

This non-finding may result from sampling errors: our point samples may have been insufficient to represent the entire waterways. Our results may also have been confounded by a three-year drought that had reduced the water volume in many of the streams we studied. The shallower, warmer conditions could have produced spurious population densities. These factors underscore the need to return to these locations to repeat these surveys and verify our findings.

Our surveys found normal age and sex demographics in most of the survey samples, suggesting that these sample groups remain reproductively viable. We estimated the ages of 87 of our captured hellbenders. A large proportion of them were young, again suggesting the viability of their populations. Our samples were too small to predict the demographics of each study population. But our findings do suggest that most of these groups continue to recruit new individuals.

Several of our study sites did not produce any young hellbenders. Our teams found only a few, widely spaced, older hellbenders at these sites. The absence of younger age classes suggests that reproduction has been disturbed within these groups.

Because Chytrid fungus is a major factor in global amphibian declines, we took a skin swab from each hellbender in our study and used funds from the NC Zoo Society to have the samples analyzed for the fungus. The tests confirmed low levels of Chytrid in some individuals, none of whom exhibited any symptoms of illness.

Survey Educational Impacts

Findings from our survey provided supporting evidence to upgrade the water quality status of a river in the French Broad Drainage system. By boosting the system's ranking from High Quality Waters to Outstanding Resource Waters (based on the NC Division of Water Quality's rating system) the survey data afforded the river, and its resident hellbenders, increased protection from developers or municipalities who request new construction, development, or discharge permits. We continue to use our findings to provide justification for river reclassification for several NC mountain rivers.

Researchers have presented data from these surveys at two hellbender conservation meetings. One meeting held at the NC Zoo drew participating biologists from the NC Wildlife Resources Commission, the NC Division of State Parks & Recreation, the U.S. Forest Service, several universities and other interested environmental educational organizations and agencies. Attendees developed a series of action plans describing the steps conservationists need to follow in order to protect the state's hellbender populations. We also presented our survey results at the 4th Hellbender Symposium, held in Corbin, Kentucky, as part of a broader presentation of hellbender conservation and research activities in North Carolina.

The Zoo promoted our findings in several segments of its television news program, *The ZooFileZ*. The segments emphasize relevant conservation issues and explain why citizens should be concerned about protecting the state's hellbenders. Segments of these programs were reconfigured to produce a short hellbender video that plays throughout the day in the Zoo's SimEx Theater. This video explains our surveys and relevant hellbender conservation issues and has played to 370,000 Zoo visitors.

Our team also produced several articles for general audiences, publishing hellbender stories in selected newspapers, including one

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front-page piece, and in two short articles in the AZA Amphibian Conservation newsletter. The NC Zoo Society also included a featured story on hellbenders in its member magazine, *Alive*. The NC Zoo's educators are also currently developing hellbender education programs to present to Zoo audiences.

In another outreach program, the NC Zoo Society funded ten hellbender interpretive signs that have been set out along North Carolina's New River Drainage System. Developed by New River State Park personnel, the signs present some of our survey results and promote hellbender conservation to people who use the waterway for recreational purposes. The NC Zoo Society funded these signs and other hellbender conservation activities by designing and selling Hellbender ('Snot Otters") buttons and T-shirts that heighten the general public's awareness of issues affecting hellbenders.

Survey Political Impacts

This project successfully integrated a field and zoo-based conservation program and facilitated a partnership between the NC Zoo, an AZA institution, and the NC Wildlife Resources Commission. The program also supported the work of various other environmental agencies around the state. The project advanced priority actions listed in the North Carolina Wildlife Action Plan of 2005 (NC Wildlife Resources Commission) and began addressing some of the action plan items identified at the hellbender Population and Habitat Viability Assessment in St. Louis in 2006.

These Hellbender surveys improved our understanding of hellbender distribution inside North Carolina and should eventually help us identify environmental factors that influence this distribution and the hellbender's population size. Ultimately, these data will help define the management and land use policies North Carolina should implement to ensure this species' future.

For the Future

North Carolina boasts 3,000 waterways that have the potential to support hellbender populations. We must survey many more sites before we can generate an accurate description of this species' distribution within our mountain river systems. Future surveys will also help us sort out the environmental variables that are affecting hellbender population size and density.

The NC Zoo plans to undertake these surveys as part of a continued partnership with biologists working for the NC Wildlife Resources Commission. We will rely on future funding from the NC Zoo Society to help us gather the information we need to ensure that North Carolina hellbender populations are managed appropriately.

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Take the First Leap!

By Diane Barber, ATAG Chair

For the past two years, AZA-accredited institutions, such as the North Carolina Zoo, have responded to the global amphibian crisis by increasing capacity and dedicating more resources to amphibians. However, there are still many species of amphibians in need of champions and tremendous obstacles to overcome in order to halt the rapid declines that continue across the globe. It is crucial that we increase our momentum and resolve to allocate the resources needed to stop amphibian extinctions. We must continue to initiate and direct programs for threatened species, as well as monitor "common" amphibians in our own backyards.

To make it easier for AZA members to become involved in amphibian conservation, the Amphibian Taxon Advisory Group (ATAG) has identified species of conservation concern and suggested areas of focus. These recommendations can be found in the Regional Collection Plan (RCP), alongside husbandry and conservation resource manuals: *www.aza.org/amphibian-conservation-and-education-resources.* Specific examples of what other institutions are doing for amphibians are showcased in AZA's ***Amphibian Conservation 2010 Highlights and Accomplishments:*** *www.aza.org/amphibian-news* and the Conservation Education Committee has developed numerous educational activities and downloadable outreach materials about amphibians and their reasons for declines: *www.aza.org/amphibian-education-resources.*

Every institution (regardless of size and revenue), and every person (director, curator, keeper, educator, veterinarian, reproductive physiologist, geneticist, etc.) possesses the ability to make a real impact on amphibian conservation, but it won't happen until someone takes the first leap!

If further assistance or information is needed about how you or your institution can make a difference for amphibians, please contact ATAG Chair, Diane Barber *dbarber@fortworthzoo.org.*