Hellbender salamander study seeks answers for global amphibian decline

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A new study co-authored by University of Florida researchers on the endangered Ozark Hellbender giant salamander is the first to detail its skin microbes, the bacteria and fungi that defend against pathogens.

Published today in the online journal PLoS One, the study details changes in the salamander's declining health and habitat, and could provide a baseline for how changing ecosystems are affecting the rapid decline of amphibians worldwide.

"Scientists and biologists view amphibians as kind of a 'canary in the coal mine' and their health is often used as a barometer for overall ecosystem health, including potential problems that may affect humans," said study co-author Max Nickerson, herpetology curator at the Florida Museum of Natural History on the UF campus.

More than 2 feet long, the Ozark Hellbender is the one of largest salamander species in the United States. Its unusual biological characteristics include the ability to regenerate injured or missing body parts.

In the new study, lead author Cheryl Nickerson, a professor at Arizona State University, along with NASA and UF scientists, cultured and identified microorganisms from abnormal and injured tissue on the salamanders searching for pathogens that may be causing the lack of regeneration and population decline.

The researchers found several potentially dangerous pathogens, including Aeromonas hydrophila, a bacterium scientists believe is associated with disease and death in both amphibians and fish.

While many different pathogens were found in the injured tissue, no single organism was found to be responsible for the lack of regeneration. Researchers believe the occurrence of abnormalities and injury in the Ozark Hellbender may have many contributing factors, including disease and habitat degradation, and say further study is needed

"If you don't understand an amphibian's skin you don't understand the amphibians," Nickerson said.

Scientists have known about the remarkable powers of salamander regeneration for more than 200 years, but beginning in the 1980s, researchers noticed a sharp decline in the Ozark Hellbender population. They also found a specific population from the North Fork of Missouri's White River was declining dramatically and losing the ability to regenerate.

"We were finding animals with no legs that were still alive with flesh wounds or bones sticking out of limbs," Nickerson said.

"Looking at the microorganisms on their skin can help us understand why these animals aren't regenerating at the rate we're used to seeing, and may lead to conclusions about population declines," he said.

In November, the U.S. Fish and Wildlife Service added the Ozark Hellbender to the federal endangered species list. Its species name is Cryptobranchus alleganiensis bishopi.

Stanley Trauth, curator of amphibians and reptiles in the department of biological sciences at Arkansas State University, said public awareness

of the species is increasing, and Hellbenders have recently been successfully bred for the first time in captivity at the St. Louis Zoo.

"There has been a dramatic decrease in the population and there are a number of factors that contribute to that," Trauth said. "But these types of studies will help provide more consistent results on the impact of microorganisms and animal health."

"In the last 20 years we have been finding a tremendous number of injuries on these animals and those injuries are not healing," Nickerson said. "Now the population is down to almost nothing and we are very worried about the species and the environmental changes around them."

The Ozark Hellbender's fossil record goes back 161 million years and it represents one of the most ancient lines of amphibian life.

"This is about as far, in phylogeny, as that type of regeneration goes, this is the most ancient group of salamanders that we know of," Nickerson said. "They have been through a lot and we want to find out what these changes mean."

"The animals in the river systems in that area, just like in Florida, where we have these huge amounts of spring water you have to worry about it," Nickerson said. "That's a big dome of fresh water and it has implications on human health as well."

Provided by University of Florida