



A Critical Connection

THE LINK BETWEEN ZOO RESEARCH AND WILDLIFE HEALTH

By Sharon L. Deem



Credit: Ray Meibaum/STL Zoo

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In the past four decades, populations of hellbender salamanders (*Cryptobranchus alleganiensis*)—North America's largest salamanders—have declined by over 70 percent in the rivers of Missouri's Ozarks region. Recently listed as federally endangered, Ozarks hellbenders (*C. alleganiensis bishopi*)—like all amphibians—are sensitive to environmental toxins, so their decline may indicate poor ecosystem health. In fact, researchers believe one problem for hellbender survival is that pesticide runoff in Missouri streams could be upsetting the salamander's reproductive system. That problem may also be occurring in humans: Men in Missouri have been shown to have lower sperm counts than other regions in the U.S. (Swan *et al.* 2003).

To study the problem, the St. Louis Zoo has been working with the U.S. Fish and Wildlife Service, the Missouri Department of Conservation, and a number of universities to identify the environmental causes of the sudden and drastic decline in hellbender populations. In addition, the zoo maintains both a climate-controlled habitat in its herpetarium and outdoor artificial streams (both off exhibit) for captive breeding of hellbenders.

This case is just one of many that illustrate how zoological institutions have become increasingly involved in studying the interconnections between animal, human, and ecosystem health—an interest that gave birth to the discipline of conservation medicine.

Conservation Medicine in Zoos

Conservation medicine is an interdisciplinary field that highlights the relationship between environmental conditions and human and animal health. The underlying concept of this emerging discipline—born in the 1990s—is that the health of all species is related. As a result, many of the global health challenges today, from disease-related species loss to public health threats associated with zoonotic pathogens, can be best tackled with a multidisciplinary conservation

medicine approach. Conservation medicine practitioners include biologists, ecologists, physicians, economists, sociologists, veterinarians, and others who work on multidisciplinary teams to better understand the causes and consequences that environmental change has on the health of humans, animals, and ecosystems.

Zoos practice conservation medicine in a number of ways, from providing health care for collection animals to identifying and monitoring diseases in both zoo animals and free-living populations. A number of zoo-led studies focus on zoonotic diseases, such as rabies and tuberculosis, that could spread between wildlife, domestic animals, and humans. In fact, zoo animals may serve as sentinels for emerging zoonotic diseases.

For example, West Nile virus appeared in the Western Hemisphere in the summer of 1999, killing thousands of wild crows in the northeastern U.S. Staff at New York City zoos were among the first to notice a high mortality of crows, followed by the death of a number of other bird species, including zoo collection birds. In response, veterinarians with the Wildlife Conservation Society—which manages the Bronx Zoo, the Queens Zoo, and a number of other zoos and an aquarium in New York City—submitted samples from one of their flamingos to the National Veterinary Services Laboratory where the virus was first isolated from these samples. That information was then used to help develop a vaccine for the virus. Today, in addition to monitoring West Nile virus, many zoos have launched surveillance programs for diseases of conservation and public health concern, including avian influenza, chronic wasting disease, tuberculosis, and rabies. Several of these surveillance programs extend to both animals in zoo collections and urban wildlife such as wild birds, raccoons, and skunks—creatures that often share zoo grounds.

Zoos also study a number of non-infectious diseases (such as lead poisoning in California condors) and infectious diseases (such as chytrid

fungus in amphibians). In 1999, for example, scientists with the National Zoo in Washington, D.C., began working with a researcher at the University of Maine to identify the cause of the rapid decline in amphibian populations across the world. Their research revealed an amphibian chytrid fungus that is responsible for the fatal amphibian skin disease chytridiomycosis. Since then, zoos have focused their efforts on protecting disappearing frog species. In 2009, the National Zoo and eight other institutions—including Zoo New England, Cheyenne Mountain Zoo, the Smithsonian Tropical Research Institute, and Defenders of Wildlife—launched the Amphibian Rescue and Conservation Project. Its goal is to protect rapidly declining populations of amphibians in eastern Panama, a region rich in amphibian diversity. So far, the project has successfully bred the critically endangered La Loma tree frog (*Hyloscirtus colymba*) and the endangered Limosa harlequin frog (*Atelopus limosus*).

Zoo animals are increasingly acknowledged for their value in the field of comparative medicine, which recognizes the similarities between diseases in humans and many species of animals. In 2009, for example, the Houston Zoo and Baylor College of Medicine launched a project to study the elephant herpes virus after a two-year-old Asian elephant at the Houston Zoo died from a herpes infection in 2008. The main objective of the project is to grow the virus in cell culture, monitor zoo elephants for active infection, and test the effectiveness of antiviral drugs as a potential treatment. The Houston Zoo hopes to find a cure that would benefit not only zoo elephants but also elephants found in the wild, while the Baylor College of Medicine focuses on research that could benefit humans.

A Global Approach

Conservation medicine programs developed in zoos often extend far beyond zoo walls, leaving a global footprint. For example, the Center for Avian Health in the Galapagos Islands—part of the St. Louis Zoo’s WildCare Institute—partners with many organizations both in the U.S. and Ecuador, including the University of Missouri-Saint Louis and the Galapagos National Park. Among its many projects, the Center is studying pathogens in the islands’ growing poultry population. Some of these pathogens have potential conservation and public-health impacts as a number of them

have the ability to transfer between poultry, wild birds, and humans. Such diseases could include *Salmonella* spp. and Newcastle disease, a contagious and fatal viral infection that affects birds.

As human-related environmental changes impact animal and human health, zoo veterinarians and other zoo workers focus their energies on safeguarding the health of animals in both captive and wild settings, and, at the same time, protecting the health of humans and other species. Because work such as this is most effective when collaborative, the American Association of Zoo Veterinarians and the American Association of Wildlife Veterinarians have partnered to create a joint committee on Wild-



Credit: Sharon L. Deem

Author Sharon L. Deem helps Bolivian veterinarian Sixto Angulo Alpire collect blood from an anesthetized maned wolf (*Chrysocyon brachyurus*) as an assistant looks on. The effort was part of a zoo-led study on diseases shared between wild and domestic canids.

life Health and Conservation. One of the main goals of this committee is to increase zoo veterinarians’ awareness of conservation issues and to encourage more cooperative efforts between zoo and non-zoo personnel in conservation efforts in the field. Given that emerging diseases have become an ever-widening concern of wildlife professionals, such collaborations will only continue to expand. ■

This article has been reviewed by a subject-matter expert.