Immunity, Genes and Chytridiomycosis in Chiricahua Leopard Frogs

By Dr. Anna E. Savage and Stuart Wells

In 2012, the support of an Association of Zoos and Aquariums (AZA) Conservation Grants Fund (CGF) award enabled us to conduct a study examining how variation in immunity genes may predispose or protect Chiricahua leopard frogs (*Lithobates chiricahuensis*) from succumbing to chytridiomycosis, a deadly infectious disease caused by the fungus *Batrachochytrium dendrobatidis* (Bd). Chiricahua leopard frogs are a Federally Threatened species that suffer die-offs and declines from chytridiomycosis, which remains an ongoing threat to their survival. In collaboration with the Arizona Game and Fish Department, we examined Chiricahua leopard frog populations throughout the state of Arizona and sequenced Major Histocompatibility Complex (MHC) genes, which activate T-cells and initiate acquired immunity. Although dozens of MHC variants are typically found within a population, we found that Chiricahua leopard frog populations each had only one to two MHC types, indicating poor ability to flight disease. We also used a molecular test for Bd infection and found that several populations were highly infected. We used this information to select an egg mass for head-starting from a population that was Bd-infected and had two MHC types, allowing us to test whether MHC type influences survival. This egg mass was reared at the Phoenix Zoo’s Conservation and Science Center where over 20,000 Chiricahua leopard frogs have been head-started and released to the wild. After head-starting, we sequenced each frog’s MHC, released them all to the region we collected them from, and monitored survival. Half of the released frogs had two MHC variants, and the other half had only one. After six months, all of the observed surviving frogs had only one MHC variant, suggesting that this variant may be a chytridiomycosis resistance gene. We plan to continue MHC sequencing and monitoring head-started frogs to track MHC impacts on survival across regions and time.

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