Differential host susceptibility to *Batrachochytrium dendrobatidis*, an emerging amphibian pathogen

By Catherine L. Searle, Stephanie S. Gervasi, Jessica Hua, John I. Hammond, Rick A. Relyea, Deanna H. Olson & Andrew R. Blaustein

Global declines in amphibian populations are due to many factors, including infectious disease. In particular, the fungal pathogen, *Batrachochytrium dendrobatidis* (*Bd*), has been associated with amphibian population declines and die-offs in many locations. However, some amphibian populations appear to be persisting even in the presence of *Bd*. While environmental factors may be partly responsible for these observed differences in *Bd* susceptibility, there may also be species-specific differences in susceptibility. We experimentally tested susceptibility to *Bd* of 6 amphibian species at the post-metamorphic stage. We exposed individuals of each species to *Bd* for 30 days and monitored mortality, feeding rates and infection levels. In all species, exposure to *Bd* increased rates of mortality, but species differed in their rates of *Bd*-associated mortality. We did not detect differences in infection levels among species, but within species the relationship between body size and infection levels differed. This study demonstrates that amphibian species differ in susceptibility to *Bd* even under identical conditions. Information from this study may be used to optimize strategies for amphibian conservation.

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A dilution effect in the emerging amphibian pathogen *Batrachochytrium dendrobatidis*

By Catherine L. Searle, Lindsay M. Biga, Joseph W. Spatafora & Andrew R. Blaustein

Change in biodiversity can alter disease dynamics in complex ways. For example, the dilution effect occurs when communities high in biodiversity have lower disease risk compared to low-diversity systems. Therefore, losses in biodiversity can increase disease risk for the remaining organisms. We tested for the dilution effect in the fungal pathogen of amphibians, *Batrachochytrium dendrobatidis* (*Bd*), which is associated with amphibian population declines around the world. Little is known about how community structure and biodiversity affect *Bd* susceptibility and risk. We

Biodiversity can reduce disease risk in the western toad (*Anaxyrus boreas*). Photo by Ivan Phillipsen, Oregon State University.

experimentally tested for the effects of host diversity and density on the severity of *Bd* infection in larval amphibians. We found a dilution effect where increasing species richness decreased disease risk, even when accounting for changes in host density. This study demonstrates the importance of incorporating community biodiversity into studies of *Bd*. In regions where amphibian species are disappearing, lowered diversity may result in greater risk of infection.

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Can differences in host behavior drive patterns of disease prevalence in tadpoles?

By Matthew D. Venesky, Jacob L. Kerby, Andrew Storfer & Matthew J. Parris

Quantifying the outcomes of host-pathogen interactions is essential for understanding the ecological implications of emerging diseases. Differences in host behavior and resistance to disease can influence the outcome of these interactions, yet the degree to which they influence pathogen transmission in natural systems is not well understood. We capitalized on the variation in aggregation behavior of Fowler's toads (*Anaxyrus* [= *Bufo*] *fowleri*) and grey treefrogs (*Hyla versicolor*) tadpoles and tested for differences in transmission of *Batrachochytrium dendrobatidis* (*Bd*) and host-specific fitness consequences (i.e., life history traits that imply fitness) of infection in single-species amphibian mesocosms. Although *Bd* transmission was low in our experiment (inferred through increases in prevalence above the baseline starting prevalence), we observed higher intraspecific transmission in *A. fowleri* mesocosms relative to *H. versicolor*. On average, *A. fowleri* mesocosms supported higher *Bd* prevalences and infection intensities relative to *H. versicolor* mesocosms. Compared to disease-free conditions, we observed significantly more *A. fowleri* tadpoles aggregating when raised in the presence of *Bd* but observed the opposite effect among *H. versicolor* tadpoles. In addition, irrespective of species, mesocosms in which tadpoles aggregated significantly predicted *Bd* infection intensity, further supporting the idea that aggregations can increase transmission and disease risk. Lastly, we also found that tadpoles raised in the presence of *Bd* were smaller and less developed than tadpoles raised in disease-free conditions, suggesting that *Bd* appears to negatively impact larval growth and developmental rates of *A. fowleri* and *H. versicolor* similarly, even in the absence of high *Bd* prevalence.

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Aquatic and terrestrial stressors in amphibians: a test of the double jeopardy hypothesis using maternally and trophically derived mercury

By Brian D. Todd, Christine M. Bergeron, Mark J. Hepner, & William A. Hopkins.

Many amphibians have complex life cycles (i.e., biphasic life histories). Because such species rely on suitable habitat in both aquatic and terrestrial systems, they may face twice the risk of habitat loss or degradation compared with vertebrates that occupy only one habitat type. This increased risk has been termed

American toads (*Bufo americanus*) were collected from the riparian zone of a mercury-contaminated river in northern Virginia, USA. Photo: B. Todd.