

Amphibians in losing race with environmental change

Even though they had the ability to evolve and survive for hundreds of millions of years - since before the time of the dinosaurs and through many climatic regimes - the massive, worldwide decline of amphibians can best be understood by their inability to keep pace with the current rate of global change, a new study suggests.

The basic constraints of evolution and the inability of species to adapt quickly enough can explain most of the causes that are leading one species after another of amphibians into decline or outright extinction, say researchers from Oregon State University, in a study published today in the journal *BioScience*.

"We know that there are various causes for amphibian population declines, including UV-B light exposure, habitat loss, pesticide pollution, infections and other issues," said Andrew Blaustein, a professor of zoology at OSU and one of the world's leading experts on amphibian decline.

"But looked at in a different way, it's not just that there are threats and pressures amphibians have to deal with," Blaustein said. "There have always been threats, and these have been some of the most adaptive and successful vertebrate animals on Earth. They were around before the dinosaurs, have lived in periods with very different climates, and continued to thrive while many other species went extinct. But right now, they just can't keep up."

It has been estimated that the rate of plant and animal extinction is greater now than any known in the last 100,000 years, the researchers note in their report. Amphibians are of particular interest because their physiology and complex life cycle often exposes them to a wider range of environmental changes than other species must face – they have permeable skin, live on both land and water, their eggs have no shells.

In the face of these challenges, amphibians appear to be losing the battle – of 5,743 known species of amphibians on Earth, 43 percent are in decline, 32 percent are threatened and 168 species are believed extinct. The impacts of changes are far more pervasive on amphibians than many other vertebrates, such as birds or mammals.

"Historically, amphibians were adept at evolving to deal with new conditions," Blaustein said. "What they are doing is showing us just how rapid and unprecedented are the environmental changes under way. Many other species will also be unable to evolve fast enough to deal with these changes. Because of their unique characteristics, the amphibians are just the first to go."

In their analysis, the OSU scientists point out that evolution is not a precise or perfect process - it takes time, is constrained by historic changes and compromises, and does not always allow a species to adapt in a way that meets rapidly changing conditions. Through genetic variation and natural selection pressures, some species or populations will be able to adapt – while others fail and go extinct.

The systems developed over millions of years to give amphibians survival advantages have now turned against them, scientists say. Examples include:

-- Many amphibians lay their eggs in shallow, open water in direct sunlight to provide a more oxygenated environment, increase growth rate of larvae and reduce predation. But the increased levels of UV-B radiation in today's sunlight, due to erosion of the Earth's ozone layer, is causing mutations, impaired immune systems and slower growth rates. Through evolution, amphibians were able to adapt to changing UV-B levels in the past, but the current change has occurred too rapidly.

-- In the past, water was reasonably pure and clean. But increased "eutrophication" of freshwater ponds due to use of modern fertilizers and waste from grazing animals has led to higher rates of parasite infections, and chemical contamination of aquatic systems is also more common.

-- Many animal species lay their eggs communally or congregate socially, often to avoid predation or improve resource use. But global warming has caused higher levels of certain infectious diseases of some amphibians, and it spreads more easily in closely connected communities.

"Although relatively rapid evolution may occur within some amphibian populations when a novel threat arises, other threats may be too intense and too new for amphibians to cope with them," the researchers wrote in their report. "Behaviors and ecological attributes that have probably persisted, and were probably beneficial, for millions of years . . . under today's conditions may subject amphibians to a variety of damaging agents."

Natural selection and species adaptation may, in time, allow amphibians to react to and recover from the new environmental insults, Blaustein said, if they don't go extinct first.

But evolution is an erratic, often slow and imperfect system, and the complexities of amphibian life cycles makes them more immediately vulnerable than many other species, the researchers said.

Source: Oregon State University

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