Dr. Andrew Blaustein at a field site in the Cascade Mountains

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CORVALLIS - Zoologists at Oregon State University presented the first major field study which concludes that the levels of ultraviolet, or UV-B, radiation now found in sunlight can cause physical deformities in amphibians, a problem that has alarmed researchers around the world.

The findings were announced in the journal Proceedings of the National Academy of Sciences.

They confirm prior lab studies done on this topic, scientists say, and may serve as an ominous early warning of some of the real impacts of global climate change.

In this experiment, which was done with long-toed salamanders in lakes of the central Oregon Cascade Range, more than 90 percent of the salamander embryos that were not shielded from UV-B radiation either died or hatched with deformities.

By comparison, almost all of the embryos protected by special filters from the UV-B radiation levels that are currently present in sunlight survived and were perfectly normal.

"The findings were astounding to us," said Andrew Blaustein, an OSU professor of zoology and expert on amphibian declines around the world. "The point to remember is that these were not artificially-elevated levels of UV-B light or results from a laboratory. These salamanders were exposed to nothing more than ambient, natural levels of sunlight while living in their normal habitat.

"The salamander embryos that were not protected from natural sunlight mostly died," Blaustein added. "The few that managed to survive were almost always deformed."

Other possible causes of amphibian deformities which have been proposed, such as attacks by certain parasites or exposure to pesticides, were not present in this field experiment, Blaustein said. This suggests that UV-B exposure, by itself, is adequate to cause high levels of death or deformity in some species. But it does not preclude the possibility that other forces, including parasites or pesticides, may be relevant in other areas, or that combinations of the various causes may sometimes be at work.

The global decline in amphibian populations, and more recently the disturbing number of deformed amphibians, have caused many researchers to believe they may be an early indicator of serious environmental problems. At various locations, acid rain, habitat destruction, pollution, predation and other factors have all been implicated in amphibian declines, and disappearing species have been found from Europe to North America, Australia, Asia, Africa and elsewhere.

One of the more disturbing concerns, especially on a global scale, may be the role of rising levels of ultraviolet light which are linked to depletion of Earth's protective ozone layer. Such increases in UV-B radiation have been demonstrated both in polar and temperate regions, Blaustein said - including one Canadian study which found increased UV-B levels over a five-year period at the same latitude as the recent experiments done in Oregon.

In previous studies, Blaustein and his colleagues demonstrated that natural levels of UV-B radiation were causing high levels of embryo mortality in several species of frogs, toads and salamanders.

The latest research examined long-toed salamanders, partly because they were known to have low levels of the enzyme photolyase, which plays a key role in repairing DNA damaged by UV-B. This salamander in particular, and many other amphibians in general, are vulnerable species because they have no hair

or feather protection, lay unshelled eggs and at various stages of development may be exposed to a wide range of environmental insults.

But they also have thrived since before the age of the dinosaurs.

In the OSU study, some eggs in a Cascade Range pond were protected from UV-B radiation, while others were not. Of those not protected, 85 percent died and 92 percent of the survivors had some type of developmental deformity, affecting their bodies, heads, eyes, tail, growth rate or other area. Of those shielded from natural UV-B levels, only 5 percent died and less than 1 percent had any deformities.

Collaborating on this study were scientists from Yale University, the University of Maine, and the Oregon Cooperative Wildlife Research Unit of the U.S. Geological Survey.

It's difficult to project the findings of studies such as this to potential impacts on other plant and animal species, Blaustein said. Many plants, insects, mammals, birds and fish are sensitive to UV-B radiation. Among those known to be the most sensitive are algae, some aquatic insects and fish, coral, and ocean plankton, which forms the basis of the marine food chain.

High levels of ultraviolet light exposure in humans has been linked to cataracts, immune suppression and skin cancer.

But beyond the larger concerns for other species, Blaustein said, the declining populations and disappearance of amphibians are a serious problem in their own right. These frogs, toads, salamanders and other species have survived for hundreds of millions of years - until now - and play key roles in numerous ecosystems, often serving as both prey and predator to other species.

"What you're seeing here are profound deformities and death being caused in a wild species by nothing more than the UV-B radiation levels now being found in sunlight," he said. "In my opinion, studies such as this suggest people should be taking concerns about climate change very seriously. It's increasingly clear a lot of ecosystems are already suffering significant impacts."