



Fertilizers may be linked to amphibian deaths

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CORVALLIS, Ore. - Researchers have discovered that a level of nitrogen-based compounds which the EPA says is safe for human drinking water - a level often found in agricultural areas as a result of using crop fertilizers - is enough to kill some species of amphibians.

A new study at Oregon State University, just published in the journal *Environmental Toxicology and Chemistry*, has shown that several frog, toad and other amphibian species, especially at their more vulnerable larval stages, can be highly susceptible to fairly low levels of nitrate and nitrite exposure.

When exposed to moderate amounts of nitrates and nitrites, some tadpoles and young frogs reduced their feeding activity, swam less vigorously, experienced disequilibrium, developed physical abnormalities, suffered paralysis and eventually died. In control tanks with normal water, none died.

"I think this is clearly a significant problem," said Andrew Blaustein, a professor of zoology at OSU and expert on global amphibian declines. "Right here in the Pacific Northwest we're having localized extinctions of some amphibians and widespread declines in others. We now have clear evidence that nitrate and nitrite exposure at levels considered safe for humans or fish is enough to kill amphibians."

Blaustein has done pioneering research on the potential impact of UV-B radiation in sunlight as one possible cause of amphibian problems. He now says that exposure to nitrogen fertilizers - along with habitat destruction, climate change, pollution, pathogens and introduced predators - is probably another part of the answer to an international mystery that has alarmed ecologists around the world.

But this latest part of the puzzle goes to the heart of crop agricultural practices, he said, which depend heavily on the use of artificial fertilizers rich in nitrogen to produce the world's food supply.

In their study, the OSU scientists worked with five species of amphibians, including the Oregon spotted frog, red-legged frog, western toad, Pacific treefrog and northwestern salamander. In the past 40 years, the Oregon spotted frog has largely disappeared from most of its known historical range - an area of lowlands with intensive agricultural use.

The scientists tested the sensitivity of the amphibians to environmental levels of nitrates and nitrites. The Oregon spotted frog was the most sensitive - three to four times more vulnerable to nitrates and nitrites than red-legged frogs and Pacific tree frogs. Not by coincidence, the scientists believe, the more-sensitive spotted frog is the species that has almost totally disappeared from these areas.

Levels of nitrites considered safe for human drinking water killed over half of the Oregon spotted frog tadpoles after 15 days of exposure. All five species showed a similar level of mortality at levels of nitrites that were higher, but still well below those that the EPA considers safe for warm water fishes.

Nitrates themselves are of low toxicity, the study pointed out, but they cause health problems when reduced to nitrites. Nitrite levels can become higher in specific areas such as shore sites with high contents of organic matter, and also be concentrated by ranch animal manures. And nitrate can be reduced to nitrite in the gastrointestinal tract - especially in younger animals.

The study results indicate that water quality criteria set up by the EPA does not guarantee the survival of some protected and endangered amphibians, the authors said in their report.

According to Blaustein, health effects such as those caused by nitrates and nitrites may also work in concert with other environmental insults, such as acid rain or UV-B exposure, to compound problems.

"Many people are looking for the one single thing that is causing all these amphibian declines, but in reality it's almost certainly a combination of causes," Blaustein said. "It's clear there can be a synergistic effect that causes higher mortality when you have different problems all occurring at once."

For instance, Blaustein said the furor that has arisen over frog deformities such as extra legs has been linked to a trematode parasite known as a fluke.

"But it's probably not that simple," he said. "These flukes have been around forever and we never observed the level of problem we're now seeing with deformed frogs. It's quite possible this fertilizer issue relates to that, along with killing tadpoles directly."

The flukes that can cause amphibian deformities live part of their life cycle in a snail, Blaustein said. Snails eat algae. And higher levels of nitrogen-based fertilizers can cause increased algal growth, increasing the snail populations.

"At one pond near Corvallis, we found 67 percent of the frogs had multiple legs," Blaustein said. "And this was in a wildlife management area, which was not intensively farmed but was only surrounded by agricultural lands."

Measurements of water there showed highly elevated levels of nitrate - up to 11 milligrams per liter - which is just above the EPA legal level for drinking water.

The researchers stated in their report that chemicals used for various purposes, including crop agriculture, may permeate lakes, ponds and streams, making them unsuitable for many amphibians.

One of the amphibian species that appears to be the least vulnerable to nitrates, they said, is bullfrogs - an introduced and voracious predator that in turn preys on other amphibian species and is tending to displace them in many agricultural areas.

"As we look for the cause of declining amphibians, we're going to find a lot of these types of interactions," Blaustein said. "But the fact remains that nitrogen fertilizers by themselves, used at levels considered safe in drinking water, are enough to kill some amphibians. So clearly that's part of the answer and a fairly serious concern in its own right. And it's pretty good evidence that we need to think again about the level of these nitrate compounds that we say is safe."

Note: [Electronic images](#) to illustrate this story are available.

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