EXPLORE THE ISSUE BEING INVESTIGATED

Identifying the Environmental Culprit Harming Amphibians

What started out as a relatively standard biology field trip in Minnesota in 1995 to collect frogs turned into a bizarre experience. Approximately half of the frogs students collected were deformed, with extra legs or missing legs or no eyes. Turning to the Internet, the class soon discovered that the problem was not isolated to Minnesota. Neighboring states were reporting the same phenomenon—an alarming number of deformed frogs, all across the United States and Canada.

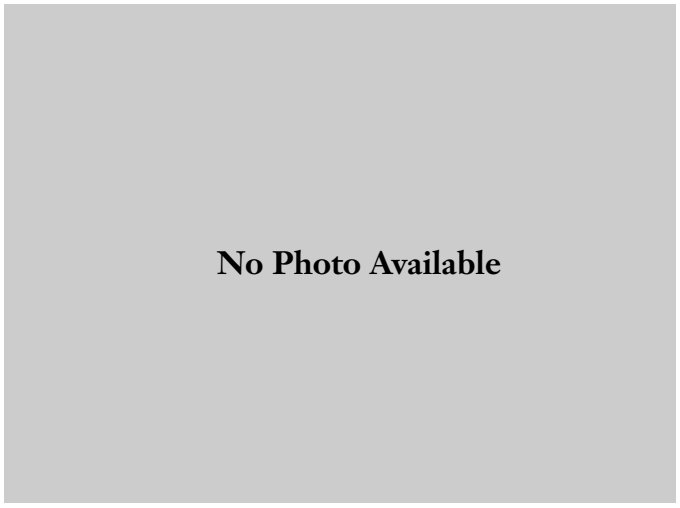
Some environmental scientists suspected that chemical pollutants in the water might be causing the deformities and that the widespread occurrence of deformed frogs might well be an early warning of potential future problems in other species, including humans.

Other scientists cautioned that a different factor might be responsible. Although chemicals such as pesticides certainly *could* produce deformities in localized situations, say near a chemical spill, so too could other environmental factors affecting local habitats, such as parasitic infections. Demonstrating this point, researchers in 1999 showed that the multilimb and missing limb phenomenon in frogs can be caused by parasites that infect the developing tadpoles, disrupting development of their limbs.

Responding to this alternative suggestion, those scientists nominating pesticides as the principal culprit have cautioned that showing parasites can have a significant effect on local populations is not the same thing as demonstrating that they have in fact done so. And, they add, it certainly doesn't rule out a major contribution to the problem by environmental pollutants.

Although deformed frogs quickly received national attention, they are but the tip of the iceberg, a global problem of declining amphibian populations. During the past 50 years, there has been a worldwide catastrophic decline in amphibian populations. In some cases we can point to specific local human activities as the cause: habitat destruction, the introduction of competitive species, and industrial pollution.

However, because the problem appears to be global in nature, we must also consider the possibility that the decline of amphibians reflects some more global environmental change. Chemical contamination of water by acid rain, increasing ionizing radiation (UV-B) resulting from ozone layer depletion, changes in weather patterns caused by the warming of the atmosphere—all have been seriously proposed as potential global causes of declining amphibian populations.



Amphibians are not the only species experiencing declining populations. Songbirds in the eastern United States, for example, have declined precipitously in the last few decades, largely due to habitat destruction. So why focus on amphibians? While amphibians play a significant role in the ecological balance of many habitats, and have proven effective in the development of new drugs, their real importance to biologists is that amphibians are particularly sensitive indicators of the environment. Their semi-aquatic mode of living, depending on a watery environment to reproduce and keep their skin moist, means that they are exposed to all types of environmental changes.

Amphibians are particularly vulnerable during early development, when their fertilized eggs lay in water, exposed to acid, chemical pollutants, and UV-B radiation. While numerous experiments performed under laboratory conditions have demonstrated the power of these factors to produce developmental deformities, and in so doing to reduce population survival rates, it is important to understand that "can" does not equal "does." To learn what is in fact going on, it is necessary to also examine the effects of these factors on amphibian development in the natural environment.

In a particularly clear example of the sort of investigation that will be needed to sort out this complex issue, Andrew Blaustein of Oregon State University headed a team of scientists that set out to examine the effects of UV-B radiation on amphibians in natural populations. In a series of experiments carried out in the field, they attempted to assess the degree to which UV-B radiation promoted amphibian developmental deformities under natural conditions.