

Amphibians Status Overview

In recent years, scientists have reported decreases in worldwide populations of amphibians. There also appears to be an increase in the number of abnormalities among amphibians. What might be affecting amphibian populations? This information sheet is intended to be a summary of the most commonly suspected causes.

Possible factors in population decline. *A number of factors may contribute to the current decreases in amphibian populations.*

Habitat Destruction: Roads, houses, forestry, mining, industry, loss of wetlands, sprawl, and other human activities often make wild areas uninhabitable or less inhabitable. Because most amphibians require both aquatic and terrestrial habitats, human encroachment may impact populations in ecosystems that encompass either of these types of lands.

Pollution: Air pollution and water pollution such as heavy metals, pesticide residues and runoff, human and agricultural waste, carbon dioxide, chemical compounds, and other waste or by-products can rain on or leach into wetlands and other amphibian habitats. Because amphibians' permeable skin directly absorbs water, and any contaminants, these species may be at greater risk from this type of habitat degradation.

Global warming: Higher average temperatures may create a wide range of results, including climate changes. Some areas may receive less rainfall, while others may receive more. Amphibians require aquatic and terrestrial habitats at specific points during their life cycles, and a decrease in moisture may make some habitats unsuitable for some species. Likewise, increased water levels may submerge areas that are now suitable shoreline habitats.

Ozone depletion: The layer of ozone in our atmosphere protects the earth from the sun's harmful ultraviolet (UV) rays. With this layer depleted, or in some places gone, more UV light reaches the earth. Lacking the protection of shells, fur, feathers, or scales, amphibians are often exposed to direct sunlight and its potentially damaging effects.

Predators: Most amphibians are prey for many other animals. If conditions in an ecosystem cause predators' populations to increase, or if non-native predators such as game fish are introduced, amphibians may be hunted more. This could result in a sharp decrease in amphibian populations, possibly followed by a decrease in the predators' population if this food source is exhausted.

Parasites: If conditions are favorable for parasites that use amphibians as hosts, this may cause a decline in amphibian populations. Parasites may cause a range of other impacts, depending on how they take advantage of the host. Environmental changes that impact parasites and their hosts could in turn affect amphibians.

Disease: Disease may have a wide variety of effects on amphibian populations, including lower reproduction rates, lower survival rates, and shorter life spans.

Collection: Over-collection for scientific use, school dissections, and other purposes may contribute to local and large-scale population declines.

Synergistic Causes: It is possible that two or more factors, acting together, may be responsible for the decline in amphibian populations. For example, loss of habitat may reduce the biodiversity among amphibians, specifically the variety of unique characteristics that help prevent an entire population from being vulnerable to one specific threat. In turn, this loss of biodiversity may make more amphibians more susceptible to parasites. In such a case, the effects of habitat loss and parasites would act together to threaten a population.

Possible factors in increased amphibian abnormalities. *The following factors may contribute to the higher rates of deformations recently observed in amphibian species.*

Parasites: A parasitic trematode flatworm is known to cause malformations in developing amphibians. These parasites penetrate the skin of developing amphibians, forming cysts around the mouth, cloaca, and hind limbs. Their presence disturbs the normal growth of that area, causing deformities consistent with some of those reported. The natural relationship between amphibians and trematodes, which also involves other hosts such as pond snails, may involve natural cycles that cause fluctuations in amphibian populations. If changes such as global warming make conditions more favorable for parasites, amphibians could be affected adversely.

Pollution: A number of pollutants may have harmful effects on amphibians, including pesticides and their by-products. Some research has established higher rates of abnormalities in areas exposed to pesticides and runoff, though further study is needed. While some pesticides pose no direct threat to amphibians, when exposed to sunlight, water, and microorganisms they may break up into other products that do alter development. Mercury and other heavy metals, which bio-accumulate in aquatic ecosystems, may be factors, as well as acid rain and other pollution. Amphibians' permeable skin and unique life cycles may make them more susceptible to such pollutants.

Radiation: Some research has shown that increased exposure to ultraviolet (UV-A and UV-B) light can cause changes in the development of amphibians. These past studies did not focus on the types of abnormalities being found recently, and some did not use UV levels that would be normal in the environment. UV radiation may have a range of other impacts. Some amphibians may be affected more than other species because of the portion of their life cycle spent directly exposed to sunlight.

Others: It is possible that abnormal amphibians are being found more often because more people are looking for amphibians, and human population growth and sprawl are bringing humans and wildlife into closer contact. Certainly there may be causes that have not yet been identified.

Synergistic Causes: It is likely that increased rates of amphibian abnormalities are due to a combination of factors. For example, we may find that an amphibian's skin and immune system are more vulnerable to trematode cysts if the amphibian has been exposed to pesticides, UV radiation, or acid rain. We may learn that higher average temperatures provide more favorable conditions for the pond snails that serve as the crucial host in the trematode life cycle. Perhaps the problem is habitat loss, which reduces biodiversity among amphibians. Reducing the variety of unique characteristics among amphibians diminishes their overall ability to resist, fight, or recover from disease, predators, parasites, and other potential threats. Maybe we will find that the problems start in the reproductive systems of adults, with these factors or others causing damage to eggs before they are laid.

Many groups are investigating the possible causes of declines in amphibian populations and the increases in amphibian abnormalities. Listed below are some additional resources for updates and more information:

- VT Agency of Natural Resources: www.anr.state.vt.us/dec/waterq/bassfrog.htm
- VT Public Interest Research Group:
www.vpirg.org/campaigns/environmentalHealth/frog_deformities.html
- North American Amphibian Monitoring Program: www.im.nbs.gov/amphibs.html
- Amphibian Species Identification Guide: www.npwrc.usgs.gov/narcam/idguide/specieid.htm
- Toads and Frogs of Minnesota: www.dnr.state.mn.us/fish_and_wildlife/frogs/truefrog.html
- Hartwick College Biology Department, Oneonta NY: www.hartwick.edu/biology/def_frogs