Since 1993, scientists worldwide have been trying to understand why frog populations are reported to be steeply declining in relatively unspoiled environments on several continents. And since 1995 scientists have been struggling to explain why deformed frogs are being observed in large numbers in a broad swath across the mid-northern region of the U.S.

In both cases, the first problem has been to determine whether the observed changes represent natural fluctuations, or whether they represent unusual events that might signal something important about declining environmental quality. A consensus now seems to be emerging:

** worldwide, many frog populations ARE declining to unusually low levels (including, in some instances, extinction); and

** frog deformities are definitely occurring in unusually high numbers in some locales.

Many factors have been identified as contributing to declines in frog populations. They include:

** introduction of exotic predatory fish; stocked populations of bass, for example, can clear a stream of all frog eggs and tadpoles in short order.

** habitat destruction (draining wetlands, for example);

** landscape changes (clearing woods, building roads, etc.) that isolate particular frog populations;

** increased ultraviolet radiation, caused by industrial chemicals that have thinned the stratospheric ozone layer;

** clearing wild lands for agriculture;

** acid rain;

** humans eating frogs' legs;

** global warming, causing elevated temperatures and drought;

** pesticides;

The identified causes of deformed frogs include these:

** increased numbers of amphibian surveys, thus more and better reporting;

** parasite infestations; a parasite called a trematode may be involved in some frog deformities. Trematodes burrow into the limb buds of tadpoles and can, in fact, cause at least one of the deformities seen in Minnesota frogs.[1]

** toxic contamination (pesticides, heavy metals, acidification);

** predation (partially-successful predators may remove parts of frogs, which may then grow back incorrectly);

** ultraviolet radiation;

** pesticides.

As we review recent scientific literature and press reports of scientific studies and meetings, what seems to stand out is a growing awareness that industrial toxins --especially agricultural biocides -- are implicated in frog population declines and in frog deformities.

FROGLOG is a publication of the Declining Amphibian Populations Task Force of the World Conservation Union’s Species Survival Commission. In recent issues, FROGLOG has reported the following:

** The 1996 RED LIST OF THREATENED ANIMALS, published by the International Union for Conservation of Nature (IUCN) lists 156 amphibian species as extinct, critical, endangered, or vulnerable to extinction. This represents 25% of all the amphibians on Earth.[2]

The Nature Conservancy, a U.S. organization, in 1996 surveyed the status of 20,481 species of plants and animals in the U.S. and reported that 37.9% of amphibians are in danger of becoming extinct.[3]

** Researchers at Widener University in Chester, Pennsylvania, and at Benedictine College in Atchison, Kansas, have shown that acid rain can stress frog populations by harming their immune systems.[4] Frogs raised in water with a pH of 5.5 had significantly more bacteria in their spleens, and a significantly higher death rate, than frogs raised in waters with a pH of 7.0. The researchers attribute the increased numbers of bacteria to reduced efficiency of bacteria removal by white blood cells --part of the frogs’ immune defenses.

** Researchers at the University of Windsor in Ontario, Canada, have correlated high levels of organochlorine pesticides with reduced frog populations in several parks and wildlife reserves along the northern edge of Lake Erie.[5] At Point Pelee National Park in Canada, only 5 frog species remain, and DDT residues in these frogs average 5000 to 47,000 micrograms of DDT per kilogram of body weight. At the Holiday Beach Conservation Area 40 kilometers [24 miles] east of Point Pelee, a dozen species of frogs thrive and the DDT in their flesh averages only 6 micrograms per kilogram. This study doesn't prove that DDT has killed off the frogs in Point Pelee, but it certainly points in that direction.

** Researchers discovered numerous frogs and toads with missing back legs in ponds and ditches exposed to pesticide runoff in the St. Lawrence River valley in Quebec, Canada in 1992 and 1993.[6] Of 854 individual amphibians (among 3 species of frogs and one species of toad examined in 14 agricultural habitats), 106 (12%) had hind limb malformations. The authors hypothesize that the main cause of the deformities was exposure to pesticides. They say that such leg deformities are "virtually unknown" among frogs and toads in the wild.

** A population of leopard frogs (RANA PIPENS) exploded on a western Michigan farm after the farm converted to organic (pesticide-free) growing techniques. In 1988, a survey of the farm had revealed that leopard frogs were nearly absent, but the population rebounded quickly as soon as pesticide use ceased.[7] Researchers reported that the number of different frog species on the farm also increased after 1988.

** The Australian government in 1997 took an unprecedented action, banning 84 herbicide products for use near water because of their harmful effects on tadpoles and frogs.[8]

All of the 84 banned products contain Monsanto's glyphosate as the active ingredient. However, the harmful component appears to be not the glyphosate itself but an "inert" ingredient--a detergent or wetting agent added to the herbicides so that droplets of liquid spread out and cover the target leaves.

Detergents interfere with the ability of frogs to breathe through their skin, and tadpoles to breathe through their gills. Michael J. Tyler of the Department of Zoology at the University of Adelaide, Australia, says, "Although the herbicide [glyphosate] is claimed to be 'environmentally friendly,' it is clear that users have been lulled into a false sense of security."

** Researchers in Sri Lanka report that frogs are nearly absent from tea plantations where herbicides are heavily sprayed, but their populations rebound shortly after spraying stops.[9]
"Conversion to organic [pesticide-free] tea production in this region has contributed greatly to the re-establishment of populations of local frogs," they say.

** According to the MINNEAPOLIS STAR TRIBUNE, Swiss researchers reported earlier this year that a fungicide used heavily in Minnesota can stunt the growth of tadpoles and retard the sexual development of frogs.[10] The Swiss researchers have not produced the kinds of deformities seen in Minnesota frogs, but they say the fungicide triphenyltin could harm frog populations by delaying their growth, which would allow more time for predators to eat them.

** Another class of industrial compounds called retinoids has been implicated in frog deformities.[11] Retinoids are a class of molecules including vitamin A and similar compounds, including retinoic acid, which is a potent hormone. Exposure to excessive amounts of retinoids can cause birth defects in all vertebrates, from fish to humans. (The retinoid-based acne treatment Accutane has caused birth defects in humans.) At least one pesticide, methoprene, acts like a retinoid.[1] Methoprene is an insect growth regulator that prevents young insects from maturing.

** Researchers some years ago identified a pesticide spill into Lake Apopka as the cause of mature alligators with penises so small that they could not reproduce. (See REHW #372, #377.) Scientists assumed the trouble was confined to that one lake. But recently alligator problems have come to light all across southern Florida.[12] In the Everglades, which are contaminated with numerous pesticides, full-grown alligators weigh hundreds of pounds less than alligators elsewhere in Florida. And in Lake Okeechobee, Florida's largest lake, juvenile alligators have levels of reproductive hormones in their blood that are far below normal --another possible sign of disruption by pesticides.

The case is not airtight. There is still much to be learned. Nevertheless, evidence continues to accumulate indicating that amphibians and reptiles are being harmed by industrial chemicals released into the environment. Are humans exempt from similar harm? It seems very unlikely.

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[9] Ranil Senanayake and others, "Frog Tea?" FROGLOG No. 23 (August 1997), pg. 2.


Descriptor terms: pesticides; frogs; alligators; mn; wi; fl; species loss; wildlife; endocrine disruptors; wetlands; ozone depletion; ultraviolet radiation; agriculture; global warming; parasites; trematodes; heavy metals; mercury; lead; cadmium; nature conservancy; red list of endangered animals; acid rain; ddt; glyphosate; australia; herbicides; fungicides; inert ingredients; triphenyltin; retinoids; retinoic acid; vitamin a; accutane; methoprene; lake apopka;