



# Evaluating the Health of Our National Wildlife Refuges

## *Amphibian Abnormalities*

### Issue

National attention was focused on the issue of amphibian abnormalities in 1995, when a group of middle school students from Minnesota discovered large numbers of frogs with misshapen, extra, or missing limbs. In recent years, an increasing number of frogs and toads with severe abnormalities have been observed throughout the United States, as well as in other parts of the world. Researchers have been investigating the problem at many levels, including conducting surveys, laboratory studies, and developing the North American Reporting Center for Amphibian Malformations, a clearinghouse for the collection and dissemination of information. Although several Federal agencies and other researchers are involved in the amphibian decline and abnormality issue, the U.S. Fish and Wildlife Service (Service), with the expertise provided by its Division of Environmental Quality, is uniquely suited to determine the role of contaminants in amphibian abnormalities.

### Reason for Concern

The Service helps conserve habitat through the National Wildlife Refuge System (Refuges), the world's largest and most diverse collection of lands set aside specifically for the conservation of wildlife. To ensure the health of this habitat, Service environmental contaminant specialists monitor the effects of contamination on fish and wildlife. Many amphibian species are sensitive to a variety of environmental stresses and may be good early indicators of the health of their environment. Therefore, the Service is interested in determining whether abnormal frogs occur on Refuges, and if so, investigating potential causes.



*Refuge Wildlife Biologist, Randy Hill, Collecting Frogs at Columbia National Wildlife Refuge*

### What is the Difference Between Malformation and Deformity?

The phrases abnormality, malformation, and deformity are often used interchangeably. For our purposes, "abnormality" is defined as missing, extra, or unusual body parts based on field observations. A malformation occurs when something goes wrong during developmental stages, causing an organ or body part to form improperly. A deformity occurs when a body part that already exists becomes disfigured.

### What is Causing Amphibian Abnormalities?

Potential causes include:

- Changes in climate (increased UV-B light due to ozone depletion, acid rain, drought, etc.);
- predatory species (e.g. fish, bullfrogs, invertebrates);
- parasites, bacteria, fungus, and viruses; and,
- pollution and contaminants (pesticides, metals, fertilizer, etc.).

Scientists believe frog abnormalities have a number of different possible causes. In some areas, multiple factors may be causing the abnormalities. It is also possible that the cause(s) may differ from one site to another.

### Have Abnormalities Been Found On Any Refuges?

Due to the especially high incidences of frog abnormalities reported in Minnesota and Vermont, the Service's Northeast (Region 5) and Midwest (Region 3) Regions began assessments in 1997 to document the extent of abnormal frogs on Refuges.



*A frog with an abnormal leg*



*Frog with extra fore limb*

Abnormal frogs were found on several Refuges in both Regions. In 1999, the Northeast Region conducted a second set of assessments. Abnormal frogs were discovered in nine Refuges. In 2000, the Service expanded its efforts to Refuges nation-wide, using standard procedures developed by Region 5. The objectives of this program are to: 1) determine if Refuges have sites where frogs with abnormalities are frequently observed; 2) evaluate whether the prevalence of abnormalities at a site is consistent within a season and among years; and 3) investigate possible causes. As of December 2002, 85 Refuges in 40 states have been monitored at least once for abnormal frogs, and many Refuges have been visited more than once. Although our assessment of all Refuges is not complete, abnormal frogs occur at frequencies greater than would be expected at some sample sites. Scientific literature suggests that abnormalities in amphibians occur normally at low frequencies in wild populations (0-2%), therefore, the Service set  $\geq 3\%$  abnormalities as a level at which additional sampling would be considered for this project. The presence of abnormal frogs on Refuges varies over time and space; collections vary between and within years, between Refuges, within ponds on individual Refuges, and even within a single pond over the course of one sampling season. These differences may be due to normal fluctuations in amphibian populations, changing levels of environmental stressors, or some combination of the two. Some

abnormal frogs were sent to the U.S. Geological Survey's National Wildlife Health Center for confirmatory diagnoses (deformity vs. malformation) using radiographs, dissections, and other tools. Some frogs were sent to the University of Wisconsin-La Crosse for parasitological examinations.

### Outcomes

So far, abnormal frogs have been found on Refuges from all regions. 30 Refuges found  $\geq 3\%$  abnormal frogs in at least one pond during at least one sampling period. Several Refuges have found  $\geq 3\%$  abnormal frogs for at least two sampling seasons. These Refuges are being considered for intensive sampling. Predator surveys and toxicity tests were conducted at a Refuge in Alaska, and additional funding was secured to conduct special studies at Refuges in New Hampshire and New Jersey. Laboratory and field studies are also being conducted at other government, educational, and private institutions around the U.S. and abroad. As cause-effect linkages are made, Refuge Managers will take action to mitigate the effects of management practices on amphibians and other wildlife. If the Service determines that land use practices on private property adjacent to Refuges are the likely cause of amphibian abnormalities, the Service will work closely with the landowners to help determine whether there are other cost-effective and efficient management methods available to them.



*Green frogs*

### How do the Service's and USGS's Efforts Complement Each Other?

The U.S. Geological Survey (USGS) is coordinating a cooperative national effort to determine the scope and severity of amphibian population declines and to investigate causes. Scientists from USGS and other agencies have been studying amphibian populations and life history traits, measuring and monitoring environmental



*Frog with missing hind legs*

characteristics, and conducting research into potential causes of decline. As a result, the USGS formed the National Amphibian Research and Monitoring Initiative. By directly focusing efforts on Refuge lands, the Service can share information with the USGS and avoid duplication of effort, maximize the information generated by the available funding, and implement actions that will maintain the integrity and health of the Refuge system.

### For more information contact

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