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The Good and Bad News about Frog Abnormalities

On average, amphibian deformities at U.S. national wildlife refuges are lower than expected. But in abnormality "hotspots," rates can approach 40 percent

Nov 21, 2013 | By John R. Platt

Mari Reeves has several deformed frogs living on her dining room table in Anchorage, Alaska. One of them, named Skinny by her literally minded six-year-old son, has a leg that bends back on itself, making it hard for him to compete for food. Another, Skillson, is a skilled jumper, but one of his limbs appears slightly shrunken. The appearance of a third frog, Limpy, isn't as dramatic: he just has a leg that doesn't look quite the way it should.

USFWS/Fred Pinkey

Malformed frogs like these started turning up regularly in 1995, when children playing around a pond in Minnesota famously found deformed frog after deformed frog. Some of the frogs had missing limbs or digits. Others had an extra leg or two. More discoveries soon happened around the country. In 2000 the U.S. Congress asked the U.S. Fish and Wildlife Service (FWS) and the U.S. Geological Survey to look into the health of the country's amphibians.

This week the FWS released the results of their 10-year study, which examined the rate of amphibian abnormalities on national wildlife refuges. Their paper, published November 18 in *PLoS One*, examines more than 68,000 frogs found at 497 wetland sites on 152 refuges. It reveals that frog deformities at these locations are actually much lower than expected, averaging fewer than 2 percent across the entire country over the period of 2000 to 2009. Previous smaller-scale, regional studies had anticipated a rate closer to 5 percent. Cases of extra limbs (polymelia) were almost nonexistent, with just 22 cases over the 10 years. "Our study shows that abnormal amphibians are not the norm across the landscape," says Reeves, the study's lead author and an ecologist with the FWS field office in Anchorage.

But the study did find high percentages of abnormal frogs—those with absent or shortened limbs, missing eyes, shortened digits or other injuries—at several "hotspots" around the country, including the Mississippi Valley, California's Central Valley, and south-central and eastern Alaska. At some of these sites the abnormality rate approached 40 percent in certain years. "This phenomenon of abnormal amphibians appears to be really variable," Reeves says. Some years they might have found 10 abnormal frogs out of 100. The next year they might not have found any. "We've long suspected that abnormalities are localized to hotspots," says co-author Pieter Johnson,

associate professor of ecology and evolutionary biology at the University of Colorado at Boulder. He says this paper, by virtue of its scope and time span, is the first attempt to confirm and quantify the existence of the hotspots. (Johnson also co-authored the article "Explaining Frog Deformities" in the February 2003 issue of *Scientific American*.)

The study does not attempt to link the abnormalities to any particular cause, although many frogs—particularly those apparently afflicted by parasites—were sent off for further study and will be addressed in future papers. Potential causes mentioned in the current paper and in previous research include parasites, UVB radiation, predation (dragonflies or small fish can bite digits off developing amphibian larvae, causing partial regeneration into malformed limbs) or toxic chemicals from agricultural runoff, waste disposal or landfills.

Chemicals were probably not the primary cause for these particular abnormalities, as the study focused on environmentally protected wildlife refuges, says Brandon Ballengée, a biologist at McGill University in Montreal who was not affiliated with the study. "The authors, I think rightfully so, reinforce the idea that natural factors are playing a role in ecosystems." A more random sampling of protected and unprotected sites around the country may have shown different results.

Johnson says the paper will help to focus attention on the hotspots and the need for additional research. "This study sets the stage for people to be able to do that."

In addition to the paper itself, the complete data set of all 68,000 frog examinations has also been published online so other scientists or researchers can use it in conjunction with future studies.

This week's paper follows a nine-year study, released in May by the U.S. Geological Survey, which found all amphibian populations in the U.S. were in decline 3.7 percent per year.