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Deformed Minnesota frogs still largely a mystery 17 years later

Stephanie Hemphill · Henderson, Minn. · Jul 17, 2012

Environment

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A deformed frog *MPR Photo/Jennifer Simonson*

Minnesota made headlines around the world in 1995 when schoolchildren discovered dozens of grossly deformed frogs in a pond in south central Minnesota.

Soon there were more reports of deformed frogs from around Minnesota and other places — gruesome photographs of frogs with extra legs, or missing legs, or eyes in the wrong place. People wondered if the frogs were a sign that something in the environment was wrong, which could also spell trouble for humans.

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Seventeen years later, scientists still have not completely solved the mystery of what caused frogs to develop those deformities.

But more is known about how the investigation unfolded, and how the case spawned a fight within the Minnesota Pollution Control Agency over whether the agency should even look into the matter.

Judy Helgen, the MPCA biologist who pushed for investigation, is telling her story in a new book, "Peril in the Ponds — Deformed Frogs, Politics, and a Biologist's Quest." Helgen has not told her story before now.

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On a recent day, Helgen revisited the pond where the deformed frogs were first found. It's called Ney Pond, and is part of a nature center near the town of Henderson.

The pond rests in a sloping bowl with cornfields on one side and scrubby woods on the other. A breeze ripples the surface. Red-winged blackbirds stake out their territory, and the sweet scent of milkweed fills the air.

It doesn't look like a place that would spark worldwide scientific inquiry.

Helgen still shakes her head at the memories this place evokes for her.

"There's a lot of history at this pond," she said.

Helgen, a trim woman in her early 70s, is now retired. But back in August 1995, Helgen was working at the Minnesota Pollution Control Agency in St. Paul when she received an urgent call for help. Students on a nature hike had seen numerous deformed frogs jumping out of a pond. Helgen and an assistant came to check it out.



Ney Pond *MPR Photo/Jennifer Simonson*

"It was terrible. The kids and the parents, everybody looked really worried," Helgen said. "The kids had already collected some frogs, and then we went around and did some surveying, and it was horrible."

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More than half of the frogs they collected from Ney Pond were grotesquely deformed -- with missing legs, or extra legs, or legs that branched unnaturally into multiple sections. Helgen had never seen anything like it.

She examined the frogs, taking careful notes, and brought some of them back to her office for further study.

Helgen's mind swirled with possible explanations. The pond was manmade: had the digging exposed some toxin in the soil? Were pesticides running off from the farm fields above? Was it damage from the sun? Parasites?

Helgen's normal work at the MPCA was to develop bio-indicators for wetland health. Essentially, she was studying which wetland dwellers — such as mayflies, beetles, crayfish — can tolerate pollution and which cannot. Colleagues were doing similar work on fish and plants. They created a citizens monitoring project, and trained volunteers to use the information to assess the health of wetlands. These methods are in common use today.

THE 'SENTINEL SPECIES'



Judy Helgen *MPR Photo/Jennifer Simonson*

That hot, sticky August afternoon turned out to be a turning point in Helgen's work and her life. The frogs came to represent far more than an abstract scientific question.

The media jumped on the story and Helgen began getting calls from people who had found their own deformed frogs.

"We had a call from this teacher in Litchfield. she had a kid bring in a bucket of deformed frogs to school, and it became sort of chilling because we started getting phone calls, and not just from Minnesota, but from people in other states," Helgen said.

Helgen and other scientists regard frogs as a "sentinel species" — they are the proverbial canary in the coal mine. Their skin absorbs what surrounds them, and they move from pond to grass and woods to deeper water and back. When they have problems, it can be a signal that other animals, including humans, may face the same problems eventually.

Looking for an explanation, Helgen approached outside experts. One of them was Bob McKinnell, a professor who spent most of his career studying frogs and cancer at the University of Minnesota. McKinnell, now retired, visited Ney Pond.

"I had collected extensively in South Dakota, North Dakota, Minnesota, and in years previous to that in Vermont. And I simply had never, never, never seen the abundance of abnormalities such as Judy and those students were seeing in Henderson and subsequently throughout Minnesota and even throughout the world," McKinnell said.

The phone calls Helgen received led her to "hot spots" where numerous deformed frogs were found. She made it her mission to collect samples of frogs, water, and sediment, and to record conditions with as much detail as possible at each of these locations.

She coordinated the research of an informal group of biologists, toxicologists, hydrologists, chemists, experts in endocrines and parasites and animal development. They worked in labs and in the field, around the U.S. and in Canada.

They catalogued frogs with missing legs, fingers and toes, extra legs, partial legs, skin webbing that prevented legs from stretching, and missing or extra eyes.



Deformed frog *Photo courtesy of Pieter Johnson*

Over the next few years, workers in Minnesota collected more than 13,000 northern leopard frogs, the most common frog in the state. Six-and-a-half-percent of them had deformities. The usual rate of deformities in frog populations is between zero and 2 percent.

LOOKING FOR A CAUSE

As she dug deeper into the mystery of the frogs, Helgen began to feel a closer connection to them than she ever had before. There was a moment when she realized they had become deeply important to her. It happened one moonlit night when she approached a pond to record the frogs.

"The chorus of frogs started with the spring peepers, and the tree frogs, and the leopard frogs were growling — they're hard to hear; they kind of grumble. It was like they were calling me back to a very ancient time," Helgen said. "Realizing that they had evolved 300 million years ago, I just had a much more spiritual connection with them. Hearing the calls did it; it sends shivers up your spine to hear the frogs chorusing at night."

Helgen wasn't the only one who cared about the frogs. Ordinary people were curious and concerned from the beginning. But two years after the initial discovery, concern turned to fear when the issue moved from nature into people's homes.

A federal agency had found that deformed frog embryos would grow in tap water from the homes of three families who lived near hot-spot ponds. The MPCA delivered bottled water to the families, and researchers redoubled their efforts. Soon they discovered that cleaning the well water with a charcoal filter eliminated whatever was causing the deformities. Later interpretation of the original embryo-in-tap-water study determined the results were actually inconclusive.

The picture was getting more and more confusing. Nature was proving too complex to offer easy answers.

Chemicals in the environment behave in complex ways, breaking down into new compounds and interacting with each other unpredictably. Standard research methods rely on testing one chemical at a time, but that doesn't reflect the realities of nature.

A parasite (*Ribeiroia ondatrae*) is known to cause malformations, but only when it attacks tadpoles at a certain point in their development. Predators can cause missing or shortened limbs, as partially eaten tadpoles regenerate lost tissue. But this mechanism is unlikely to produce extra limbs.

The thinning ozone layer normally filters ultraviolet light, which is now thought to be increasing and can affect eggs that develop in shallow water to produce frogs with fewer legs. But those deformities are usually symmetrical, unlike most of the deformities found in nature.



Deformed frog *Photo courtesy of the MPCA*

Chemical contaminants may reduce frogs' immune systems, making them more susceptible to parasites. Lakes in farm country, loaded with extra nutrients from runoff, may produce more snails, the parasites' alternate hosts. UV radiation can turn normally benign chemicals into poisons. These are just a few of the complexities that confront researchers.

Helgen and her fellow researchers grappled with all sorts of theories. At Ney Pond, even radioactive material from some unknown source, possibly nuclear testing, was suspected.

"We're still here with a mystery," Helgen said. "Really, it's unsolved."

HELP FROM A FOLKSY POLITICIAN

In her book, Helgen describes fighting a war on two fronts: On one front, she worked overtime to find out what was wrong with the frogs. On the other, she confronted what felt to her like bitter resistance from her bosses at the Minnesota Pollution Control Agency.

Helgen said at first her bosses refused to ask the Legislature to fund and expand the frog research, fearing they would lose money for other priority projects. Then, when the Legislature allocated money anyway, Helgen said the MPCA raided the frog money to use for other purposes.

Helgen admits she did not have much patience with the bureaucracy, and she sometimes bent the rules.

"If you didn't push, you wouldn't be able to do what you thought was important to do," Helgen said. "And I think that's probably true for everybody — if you don't take a stand and really try hard to get what you think is important, even at personal risk. There were many times when I thought I'd be fired."

Helgen is not the only researcher who's run into problems at the MPCA. In 2006, Fardin Oliaei dropped her whistleblower lawsuit

(http://news.minnesota.publicradio.org/features/2006/02/03_edgerlym_fardinleaves/) and left the agency in a negotiated settlement after calling attention to pollution in fish in the Mississippi River from 3M company chemicals. And in 2007 the MPCA fired hydrologist Paul Wotzka, (<http://minnesota.publicradio.org/display/web/2007/10/10/whistleblower/>) a long-time critic of the pesticide atrazine. The agency said he had inappropriately taken files from his previous job in the state Agriculture Department.

At the MPCA, Mike Sandusky is head of the division that took over Helgen's work in an agency reorganization in 1998. He said he doesn't know about or remember many of the specific events Helgen chronicles in her book. But he says many of the agency's scientists are fierce fighters for the issues they work on, and the agency values such commitment.



Wildflowers at Ney Pond Wednesday, June 20, 2012 near Henderson, Minn. *MPR Photo/Jennifer Simonson*

Sandusky warns against looking for ulterior motives in government decisions; he says usually the simplest explanation is the right one.

"It's a lack of funding, or it's priorities, or we're running into things that are not part of our mandate and our mission," Sandusky said. "This is a fairly routine thing that happens here, but people always are looking for reasons that, by and large, do not exist."

MPCA officials told Helgen that the agency was not a research organization — that it was set up to enforce laws and not to investigate scientific problems.

Helgen said she felt threatened for most of the time she worked on the frog research, even after she found a champion in the Legislature.

"Rep. Munger is one of my heroes," she said.

Within six months of the initial discovery, state Rep. Willard Munger, DFL-Duluth, a folksy politician people called Mr. Environment, held two hearings at the state Capitol.

Some of the students who had found the deformed frogs at Ney Pond spoke to legislators. Afterward, student Ryan Fisher told MPR it would take a while to find the answer because no one knew whether the deformities would continue.

"We've only found first-year frogs, which means either this is the first year it's happened, or they're all dying, which is possible," Fisher said. "When you look at the deformities, it's very possible that they're not living through the year."

That hearing was a pivotal moment for Judy Helgen.

"Boy, you could have heard a pin drop in that hearing room, those kids were so passionate. And that was the hearing where I was told before I went over there that if [MPCA] is offered money, that I will have to say 'we can't take it from the Legislature.' "

It was Munger who persuaded fellow legislators to fund the frog research at the MPCA. But a few years later, after Munger's death, the funding stopped and the MPCA dropped its research into frogs.

"And so the deformed frog problem hadn't gone away, but our agency did. It just made me very sad," said Helgen.

STILL A MYSTERY

The deformities emerged after a period of sudden and dramatic decline in populations of amphibians all over the world. Estimates differ, but some scientists say as many as 120 species of amphibians may have become extinct in the 1980s, and perhaps one-third of amphibians are at risk of extinction today.

But it's not even clear whether there is a connection between the deformities and the population decline. Many experts believe habitat loss is the biggest cause of declining frog populations.

At the Ney Nature Center, some of the young people who first discovered the deformed frogs are still around after 17 years.

Becky Pollack was a middle school student back then. Helgen became a role model for Pollack, and today she directs the nature center where she first met Helgen. Pollack loves taking young kids to the pond to collect mayfly and damselfly nymphs and other tiny creatures. They don't find many deformed frogs here anymore, she said.

"I'm hoping that means the environment is cleaning itself up, going through a natural filtering system, and whatever was there is hopefully no longer," said Pollack.

The damselfly nymphs are a sign of a healthy ecosystem.

Helgen dedicated herself to finding ways to keep our natural world healthy. She spearheaded research on deformed frogs, but she also leaves a broader legacy. She helped create a new way of evaluating the health of wetlands by observing which plants and animals live only in healthy wetlands, and which can survive in degraded environments. That biomonitoring system is widely used today.

Her book, "Peril in the Ponds," has just been published by University of Massachusetts Press.

 **GALLERY**



Biologist Judy Helgen talks about her research on deformed frogs Wednesday, June 20, 2012 at Ney Pond near Henderson, Minn., where many frogs were found in the mid-1990s. *MPR Photo/Jennifer Simonson*

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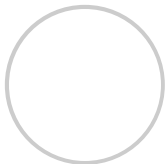
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