

Estrogen threatens minnow manhood

Released into an Ontario lake as an experiment, tiny amounts of the hormone wreak havoc on male fish

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Back in the summer of 2001, a team of Canadian and U.S. researchers spiked a lake in Northwestern Ontario with traces of synthetic estrogen used in human birth control pills. They then repeated the unusual treatment for the next two years and sat back and watched what happened to minnows living in the lake.

The results were nothing short of frightening. Exposing fish to tiny doses of the active ingredient in the pill, amounts little more than a whiff of estrogen, started turning male fish into females. Instead of sperm, they started developing eggs. Instead of looking like males, they became indistinguishable from females. Within a year of exposure, the minnow population began to crash. Within a few years, the fish, which at one time teemed in the lake, had practically vanished.

Details of the unusual experiment, conducted by a team of Canadian and U.S. government scientists, are being published online this week in the Proceedings of the National Academy of Sciences. The dramatic results are likely to raise further concerns about the possible impact on wildlife and humans of drug residues in waterways.

In the experiment, the scientists added just enough estrogen to give the lake water the same level of the sex hormone found in water discharged from sewage treatment plants in Canada and in other countries where the birth control pill is widely used.

More than a million women in Canada and more than 100 million worldwide are on the pill, making it one of the most commonly prescribed drugs. Women on the pill pass on some of the estrogen in their urine, from which it gets into surface waters.

Although the doses in the lake's water were thousands of times lower than the amounts women on the pill receive, even this slight exposure was enough to skew development in both male and female fish, with males far more affected.

After treatment, the lake water had estrogen concentrations of about 5 parts per trillion, the scientific equivalent of almost nothing. A part per trillion is the equivalent of a few grains of salt in an Olympic-size swimming pool. The amount of estrogen added was about a fifth of a gram a day, or about one-tenth the weight of a penny.

The lead researcher, Karen Kidd, who conducted the project while with the Department of Fisheries and Oceans and is now a biologist at the University of New Brunswick, was astonished that so little of a hormone used by people could harm fish.

"What's sobering for me is that we've shown such a dramatic response in fish population at these low concentrations," Dr. Kidd said in an interview.

It's not known what effect, if any, human exposure to estrogen in drinking water might have, although Dr. Kidd said it is an area that should be a research priority. Reproductive problems in human males, such as declining sperm counts and testicular cancer, have been rising in recent decades, and the causes are not known.

"When we see these kinds of responses in fish, it raises a red flag for what these compounds are doing to humans," she said.

There are currently no regulations in Canada covering estrogen or other drug residues in waterways. Municipalities typically don't check for them and it is not known if there are human health effects for people who draw drinking water from sources receiving sewage, a common practice in Canada.

Researchers with the U.S. Environmental Protection Agency also worked on the experiment, which was funded primarily by the federal government and the American Chemistry Council. One of the companies that manufactures birth control pills, Schering AG, donated the estrogen.

The researchers monitored fathead minnows, a species that breeds after about two years of life, making its population vulnerable to the reproductive effects of the drug sooner than longer-living fish.

After dosing the lake for three years, researchers monitored populations for the next two. It is expected that with time, estrogen levels in the lake, which was about 35 hectares, or about the size of a large farm field or a medium-sized cottage-country lake, will decline, allowing fish populations to recover.

To ensure that the population decline they were observing wasn't a natural phenomenon, the researchers tracked several other water bodies similar to the lake under investigation. There were no large population fluctuations elsewhere. The lake was located near Kenora.

Over the past decade, there have been a number of studies in North America and Europe showing skewed sexual development in aquatic life

living near outfalls from sewage plants. This study is the first to show that exposure to drugs not only changes sexual characteristics, but can also destroy fish populations.

Dr. Kidd doesn't think women should stop taking the pill out of worry for wildlife. She said municipalities need to build more advanced sewage treatment plants, which are able to degrade more of the estrogen into harmless chemicals.

Because of the high expense of the project, estimated at \$250,000 a year, the researchers didn't test the effects of lower estrogen levels on fish to determine if there is a safe exposure amount.

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