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Fish Ecology in the News  
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## Scientists explore connection between pollution, intersex fish

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By **Nancy Hernandez**  
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FREDERICK -- A biological role reversal of fish in the Monocacy River and other local waterways has scientists wondering what problems might lie ahead for aquatic life -- and humans.

Immature eggs have been found in male smallmouth bass while female fish of the same species were lacking an egg yolk precursor, according to Vicki Blazer of the U.S. Geological Survey.

She spoke at Hood College this week about the findings of a recent fish study she led involving about 15 governmental agencies and universities across several states.

Beginning in 2005, fish were collected at sites downstream and upstream of several treatment plants on the Monocacy River and Conococheague Creek in Pennsylvania. Scientists wanted to see what, if any, role wastewater treatment plants have played in the problem, Blazer said.

The gonads of male fish were not as well developed downstream of wastewater treatment plants, with the biggest discrepancies found along Conococheague Creek, she said.

As much as 100 percent of the male smallmouth bass in some locations exhibited male and female characteristics, she said. The male fish had sperm and immature eggs. Some also had produced vitellogenin, while their female counterparts had not. Vitellogenin is an egg yolk producer typically found only in female fish.

Male largemouth bass also possessed intersex characteristics, but not as frequently, she said.

The sex abnormalities are not limited to the local region, she said. In the south branch of the Potomac River, about 58 percent of roughly 230 male fish exhibited intersex characteristics.

Intersex fish have been discovered in recent years around the world, Blazer said. The severity of the problem ranges from location to location, even within watersheds, and from season to season, she said.

What causes the sex abnormalities has not been determined, but chemical pollution is a suspect.

Roughly 15 chemicals have been identified in the Monocacy River and scientists estimate many more are present.

Under current regulations, water quality limits are set for individual chemicals and not for the myriad of



Photo by Skip Lawrence

Beginning in 2005, a team of researchers studied fish from the Monocacy River near Walkersville. They captured live smallmouth bass in an effort to determine if intersex characteristics in the fish were linked to pollution from wastewater treatment plants. Here, a scientist takes a sample from one fish while another fish waits to make its contribution to the study.

compound possibilities, said Robert Ballinger, a spokesman for the Maryland Department of the Environment.

The Monocacy River meets water quality standards for the individual chemicals, he said.

But chemicals do not necessarily pose health hazards individually, rather creating toxic compounds when combined, Blazer said.

In local fish, compounds commonly called endocrine disrupters appear to be the problem behind the gender confusion, Blazer said.

Endocrine disrupters that mimic estrogen are intercepting and distorting the normal hormonal signals of the smallmouth and largemouth bass. Both wild fish and those exposed to chemical compounds in the laboratory developed the sex abnormalities, Blazer said.

She hopes to collect more fish this spring, before and after spawning season, to study what influence the sex abnormalities might have on reproduction and future fish populations.

Further south, researchers in Virginia are trying to determine if the sex abnormalities played a role in the deaths of thousands of smallmouth bass since 2000. One 2005 episode in the south fork of the Shenandoah River wiped out about 80 percent of the smallmouth bass and redbreast sunfish population, Blazer said.

While no data has definitely linked sex abnormalities with large numbers of fish being killed, the two problems are likely related, said Drew Ferrier, a biology professor at Hood College.

Endocrine disrupters also can intercept and distort other body functions, such as the thyroid and immune system, he said. Humans are susceptible to endocrine disrupters as well.

More study is needed to determine what chemical compounds lead to intersex fish and to pinpoint where the chemicals are entering the waterways, he said.

"There are many more questions on this topic than answers," he said.

Contamination is likely coming from multiple sources, such as human wastewater, runoff from farms and industrial sites and atmospheric pollution, Blazer said.

"Many times, we want to blame agriculture and industry but when we use fertilizer to kill dandelions, use antibacterial soap, flush our prescriptions down the toilet, we need to think about that," she said.

Blazer's team will continue to analyze the collected data and hope to perform additional studies, such as chemical analysis of the soil where smallmouth bass lay their eggs.

Figuring out what is harming the fish will benefit people as well, Blazer said. Humans breathe the same air, drink the same water and eat food grown in the same ground that animals do. Aquatic species that are battling health problems offer clues that something is amiss in the environment.

"Fish are an indicator of our ecosystem's health," she said.

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1. The focus of this news story is the possible causes of sex-role reversal in smallmouth and largemouth bass in the Potomac River Basin. The phenomenon was discovered in 2005 and this article is an update on scientists' experiments and findings since then.
2. This story is related to fish ecology because it is dealing with what are most likely human-caused, unnatural mutations amongst individuals that are strongly affecting entire small and largemouth bass populations in this river basin.
3. The players in this story are the small and largemouth bass populations of this watershed, the wastewater treatment plants that are discharging chemicals into streams, the scientists researching the problem, possibly other fish species and other non-fish species that are also affected by the same chemical compounds, and communities within this watershed, which may also be suffering from this polluted system.
4. Small and largemouth bass are important game fish in this region, therefore because this issue involves inhibited reproduction and possible large numbers of fish deaths, sport fishing is directly affected. Also, as the article points out, if fish populations are unhealthy, this is an indication of imbalances in the natural environment that will likely affect humans in some way.
5. The reporting of this story appears to be accurate and unbiased because it is a follow-up article on the findings of the scientists and focus groups that have been studying this problem. This is obviously a very serious issue that needs to be studied and addressed or its consequences will continue to damage this and other ecosystems.
6. Fish ecology knowledge that would help in this situation would be understanding how chemical compounds alter fish hormones and reproductive organs, the effective concentrations of such compounds, what these species feed on and how chemicals may be concentrated in this food source, the ecological/water quality aspects of the streams/rivers that seem to be most severely affected, and how/when/where these fish populations reproduce, because eggs may be disturbed and altered by the chemicals.
7. A fish ecologist should perform experiments that test these species' health and anatomy when exposed to various concentrations of the most probable chemicals and chemical compounds that are causing these reproductive problems. He/she should make local communities and officials aware of the issue so that steps can be made toward alleviating the potential sources of pollution.