

Published: 12.11.2005

Effluent alters sexuality of fish

Tucson may drink treated wastewater

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ARIZONA DAILY STAR

Treated wastewater is altering the genes of native fish — making male fish more like females and females more like males.

A study is finding that an endangered fish species experiences dramatic hormonal changes after being immersed for three months in treated effluent from Pima County's Roger Road sewage plant.

For some hormones, male and female bonytail chub tested in wastewater contain up to five times more hormones of the opposite sex than of their own sex.

The University of Arizona and federal researchers worry it's not just fish that could be affected.

Sometime around 2020, Tucsonans may start drinking wastewater — in a much more highly treated form than the Roger Road plant now dumps into the Santa Cruz River.

Nobody knows if the compounds in treated wastewater can harm human reproduction because their effects on people haven't been thoroughly studied, said David Walker, a UA research scientist who is a lead investigator on the fish study, and Gail Cordy, a U.S. Geological Survey hydrologist who also works on it.

But Tucson Water will not serve treated wastewater "unless we could be assured that we were removing any elements that might be of concern," said its spokesman, Mitch Basefsky.

Researchers say the fish hormones are probably affected by what many scientists call endocrine disruptors.

These disruptors belong to a heretofore little-known class of chemicals that interferes with the body's basic endocrine system that creates male and female hormones, they said.

The chemicals are now getting scrutiny because technology has advanced far enough to detect them at very low levels that couldn't be detected 10 or 15 years ago.

Several other studies, in the United States and Europe, have found similar gene-switching among male and female fish exposed to treated wastewater.

Last year in Colorado, researchers concluded that male fish living below a sewage plant were developing female sex organs. In Boulder Creek, female white suckers outnumbered males 5 to 1, and half of males had female sex tissue.

Scientists there concluded that this stemmed at least partially from the presence of too much estrogen in the water. The estrogen, a basic female hormone, apparently came from compounds in detergents and soaps that can mimic estrogen.

In the UA-USGS study, the fish gene-switching appears to come from compounds created by the breakdown of detergents and by plasticizers — chemical additives that make plastics more flexible and durable. They go down people's drains into the sewer system, Cordy said.

Tests of the wastewater found 30 to 40 various chemical compounds, less than half endocrine disruptors, at levels of parts per billion or parts per trillion.

Assuming the compounds' effects continue or get worse if the fish live in them for a long time, "You could

have a population out there that would be unable to survive or reproduce," Walker said.

The researchers are still waiting for test results on the levels of pharmaceuticals in the water.

As far as Walker knows, this study has looked at the effects of wastewater on fish for longer than any other such study — three months. So far, fish have been kept in tanks with no more than two-thirds wastewater; he now plans to start studying them in tanks with 100 percent wastewater for three months.

The new study's findings raise concerns, Walker said, about whether people who drink treated wastewater could suffer the same genetic switching that could make breeding for the bonytails impossible.

By about 2014, Tucson Water officials expect to be asking their customers whether they wish to pay higher water bills to treat the sewage effluent to make it drinkable.

If the water department's household and business customers — now about 213,000 — approve that plan, they could be drinking this water by 2020.

"Little federal dollars have been spent on examining the effect of these compounds on wildlife, let alone humans, but I will say that all vertebrates share remarkably similar endocrine systems," said Walker, adding that he "absolutely" believes that his fish study results have human implications.

With concentrations of the compounds in wastewater as low as parts per trillion, and with people exposed to air pollution and other environmental problems daily, "My understanding is that it is too difficult to predict human health effects" on those who drink water with low levels of these compounds for long periods, Cordy said.

The U.S. Environmental Protection Agency did not return calls for comment.

As for cleaning the chemicals from wastewater, Basefsky said Tucson Water officials know of cleanup methods for some, but not all, of them. Some will be removed from water as the city artificially recharges the water into the ground before pumping it back out for future reuse.

Other compounds cannot be cleaned through recharge. The city is at the very early stages of looking at what would be needed to remove these compounds from wastewater.

Basefsky said he cannot say today if the cost will be reasonable. "The other thing to keep in mind is: What is the cost of alternatives, like additional water supplies or draconian conservation measures where you outlaw certain uses?" he said.

"You can clean anything if you have enough money, but are people willing to pay the price?" Cordy added. "You think gasoline is expensive — wait until the water gets cleaned," she said.

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