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Sewage Altering Fish, Study Reports

By Marla Cone
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Male fish with female characteristics have been discovered in ocean waters off Los Angeles and Orange counties, raising concerns that treated sewage released offshore contains hormone-disrupting compounds that are deforming the sex organs of marine life.

Scientists around the world have found sexual abnormalities in frogs, fish, alligators and other wild animals exposed to sewage effluent and industrial contaminants that mimic estrogens and other hormones. But the latest research in the waters off Southern California is among the first to find such effects in ocean creatures.

Eleven male bottom-dwelling fish out of 64 caught between Santa Monica and Huntington Beach had ovary tissue in their testes. No such sexual defects were found elsewhere off Southern California, even though fish were collected from Point Conception to the U.S.-Mexico border.

Two other studies found other signs of feminized fish in the same ocean areas. Two-thirds of male turbot and sole caught near Orange County's sewage outfall had egg-producing proteins. And when males were exposed in a laboratory to ocean sediment collected off the Palos Verdes Peninsula and Huntington Beach – where huge volumes of sewage effluent are pumped out to sea – all of them developed female egg proteins.

Dan Schlenk, an aquatic ecotoxicologist at UC Riverside who co-wrote two of the three studies to be reported today at a national conference, said it is clear that the ocean floor at the sewage outfalls is contaminated with estrogenic compounds that are feminizing fish. But effects on the overall health and abundance of fish populations and the rest of the marine ecosystem are unknown.

"There's definitely estrogenic activity out there; no doubt," Schlenk said. "But whether it affects populations of the animals is the question we need to answer."

Every day, nearly 1 billion gallons of treated wastewater from an area that includes about 9 million people are discharged into deep waters off Huntington Beach, the Palos Verdes Peninsula and Playa del Rey via three long undersea pipelines, called outfalls, operated by the two counties and the city of Los Angeles.

Sewage effluent contains several dozen chemicals – both natural and man-made – that can alter animal hormones, environmental scientists say. Women excrete natural estrogen and man-

made forms from birth-control pills, and some industrial chemicals, pesticides and compounds in household items are endocrine disruptors, which mimic hormones.

The wastewater is filtered and processed, but many contaminants remain and settle into ocean sediment, where they are consumed by bottom-feeding organisms.

Excessive amounts of estrogens or estrogen mimics can create so-called intersex animals with both male and female genitals. Previously, scientists have shown that some fish with the altered organs were infertile.

The effect on humans, however, is largely unknown and unproven, though some studies have linked hormone-mimicking chemicals to reduced sperm counts, altered genitalia in baby boys and premature puberty in girls.

One study, for example, found that men exposed to agricultural pesticides were more likely to have defective sperm and low sperm counts than those with little or no exposure. Another found that phthalates, used in plastics and beauty products and widely found in people, seemed to alter the reproductive organs of baby boys.

The estrogenic substances in the effluent are not considered a threat to people swimming or surfing at Southland beaches. The outfalls discharge into waters two to seven miles offshore.

Eating fish from the area, however, has long been a health concern because the pesticide DDT and other toxic substances have contaminated the ocean floor. Turbot, sole and other bottom-dwelling fish can ingest the contaminants.

State health officials for years have advised people to limit consumption of many bottom-feeding fish caught between Malibu and Newport Beach because of the risk of cancer and neurological and reproductive effects.

No specific chemicals have been implicated in the new studies, but at the Palos Verdes Peninsula site, some experts suspect that a decades-old, 100-ton deposit of DDT, which can mimic estrogen in its effect on some animals, could be responsible. A pesticide plant near Torrance dumped waste into Los Angeles County sewers for three decades.

The mixed-sex fish were found among two common species of flatfish that feed in bottom sediments: English sole and hornyhead turbot. The study was conducted by the Southern California Coastal Water Research Project, which has researched ocean contamination for 35 years using county, state and federal funds.

Eighty-two male turbot and sole were caught at 30 sites along about 600 miles of coastline, and the 11 with both male and female organs were found at eight of 14 sites between Huntington Beach and Port Hueneme, said Doris Vidal, a researcher at the institute who led the study.

Bob Horvath, head of technical services at the Los Angeles County Sanitation Districts, said that although the numbers were small, finding ovary tissue in males near the sewage outfalls was worrisome and had spurred more research.

Next spring, the water research institute plans to collect about 50 flatfish from each of five outfalls between Ventura and San Diego and compare them to fish from a relatively uncontaminated area off Dana Point. Results will be ready about a year later.

Steve Weisberg, the institute's director, said that the results cannot be considered definitive because of the small numbers of fish, but that "certainly this is some very good information, and the first of its kind."

The most intriguing aspect, he said, is that "we did not find any intersex fish north of Santa Monica Bay or south of Newport Bay, which suggests some association with the presence of the outfalls and contaminated sediments." He added that "this is also the most highly urbanized portion of Southern California," which means contaminants from rivers and runoff might also be altering the fish.

Since the early 1990s, scientists have found altered hormones or deformed sex organs in alligators in Florida, fish in British rivers, frogs in the Midwest, polar bears in the Norwegian Arctic and a variety of other creatures, mostly aquatic ones.

But until now, nearly all the research has been conducted in freshwater environments, mostly rivers and lakes. Only a few projects have examined ocean creatures, mostly in British estuaries.

Results of the Southern California studies will be reported at the annual meeting of the Society of Environmental Toxicology and Chemistry in Baltimore.

Scientists today also will report sexually altered fish being found in San Francisco Bay, Puget Sound and New York Harbor. The Southern California studies are particularly unusual because the fish were caught in deep water.

Gary Ankley, branch chief of the U.S. Environmental Protection Agency's National Health and Environmental Effects Research Laboratory, called the feminized fish "a worldwide phenomenon."

"What's being seen in these fish is not physiologically normal," he said. "But we are still trying to sort out the significance of this to the fish. Is it just a localized phenomenon, a few individuals around the outfalls that are really impacted? Or does it impact populations as a whole? That is the 64-million-dollar question."

Scientists are concerned that the feminized fish off Southern California might be less fertile and cause some species to disappear. But so far, there have been no declines in the abundance of turbot or sole in the region, even around the outfalls, Weisberg said. "We don't see any clear evidence of ecological disruption," he noted.

At the Huntington Beach outfall, UC Riverside environmental toxicologist Mary Ann Irwin found that 47 of 72 male turbot and sole produced female egg protein, and the amounts of the protein were higher than in fish caught a few miles to the north. But she also found that the two species remain commonplace there, and males outnumber females.

In Schlenk's laboratory, halibut were exposed for one week to sediment collected at outfalls off Huntington Beach, the Palos Verdes Peninsula and San Diego, and all the males grew small amounts of female egg protein. The Palos Verdes fish developed five times more egg protein than fish exposed to the Huntington Beach sediment and 10 times more than those exposed to relatively clean sediment collected between the two outfalls.

But to Schlenk's surprise, man-made estrogens, not the more potent natural ones, were apparently responsible for feminizing the fish. There was no correlation between natural estrogens and the egg proteins in the fish.

The research team tested 62 man-made contaminants in the wastewater, but only one – oxybenzone, used in sunscreens – stood out, and it was unlikely to be the only culprit.
Even widespread chemicals in plastics and detergents called nonylphenols – found in high doses in Orange County's sediment and implicated in other studies – were not linked to the amount of egg proteins in the fish, Schlenk said.

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