

Our medicines are altering marine biology

Study finds chemicals from wastewater are ending up in coastal waters — and affecting hormone levels in fish.

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BOSTON — Sewage-treatment plants in Southern California are failing to remove hormones and hormone-altering chemicals from water that gets flushed into coastal ocean waters, according to the results of a study released Saturday.

The preliminary findings were part of the most ambitious study to date on the effect of emerging chemical contaminants in coastal oceans. It confirms the findings of smaller pilot studies from 2005 that discovered male fish in the ocean were developing female characteristics, and broadened the scope of the earlier studies by looking at an array of man-made contaminants in widespread tests of seawater, sea-floor sediment and hundreds of fish caught off Los Angeles, Orange and San Diego counties.

The results, outlined by a Southern California toxicologist at a conference in Boston, reveal that a veritable drugstore of pharmaceuticals and beauty products, flame retardants and plastic additives are ending up in the ocean and appear to be working their way up the marine food chain.

Flame retardants used in upholstery and plastic additives are showing up in fish tissues at levels as high or higher than lingering residue of the banned pesticide DDT and another stubborn industrial pollutant, polychlorinated biphenyls, or PCBs.

The study also showed that male flatfish contain unusually high levels of the female hormone estrogen, possibly in reaction to one or more of these hormone-altering chemicals.

As many as 90% of these male fish were found to have produced egg yolk proteins, and one had actually produced eggs, indicating that the feminizing of fish seen in freshwater streams and lakes can happen in the open ocean as well. This evidence, scientists said, suggests that diluting pollution with a vast amount of seawater may not be an effective way to dispose of these new and little-understood contaminants.

"Dilution is not the solution for some of these newer compounds," said Steven Bay, a toxicologist with the Southern California Coastal Water Research Project in Costa Mesa. He expects the study to raise policy debates over upgrading sewage-treatment plants.

Although some of these contaminants may be in urban runoff, the main source appears to be the 1 billion gallons of partially treated sewage that flows into the ocean every day from the region's four major

sewage outfalls.

Women taking birth control pills excrete estrogen in their urine, which is flushed down the toilet and ends up in the ocean. The same is true of antidepressants, tranquilizers, anti-inflammatory medicine and other drugs, as well as musk fragrances, sunscreens, soaps and additives to plastics — compounds known to mimic or disrupt hormones.

"Sewage-treatment plants only remove 50% to 70% of these chemicals," Bay said.

Bay sketched out the preliminary results in a special session at the annual meeting of the American Assn. for the Advancement of Science.

Much of Saturday's discussion focused on sex-changing chemicals in municipal wastewater. "It doesn't take much of the pill to stop fish from reproducing," said Karen Kidd, a biology professor at the University of New Brunswick in Canada.

Kidd said sewage plants could remove virtually all estrogen with more advanced forms of treatment.

Primary treatment, the type used in San Diego, doesn't take out as much estrogen as secondary treatment, used by Los Angeles' Hyperion plant in El Segundo. Those plants, if upgraded to tertiary treatment, could remove nearly all of the estrogen, Kidd said.

Another study looked at how compounds used as fabric stain repellents, nonstick pan coatings and coatings in microwave popcorn bags have accumulated in the blood and tissue of loggerhead sea turtles. They are suppressing the immune systems of these turtles, which are officially designated as threatened with extinction.

The sea turtles pick up these compounds through what they eat, said Jennifer M. Keller, a researcher with the National Institute of Standards and Technology. "They eat crabs and clams and other shellfish — a diet they share with humans."

The study in Southern California waters looked at contaminants in wastewater, surrounding ocean waters, sediments and in the flesh of 600 flatfish called hornyhead turbot.

These bottom-dwelling fish were selected because they reside near sewage outfalls.

The results showed that the chemicals and responses from the fish were widespread and not confined to areas near sewage outfalls, showing how easily the chemicals get dispersed.

Besides elevated estrogen levels in male fish, test results showed altered thyroid hormone levels in the turbot. They also had depressed cortisol levels, an indication that the fish were worn out and are vulnerable to disease.

So far, Bay said, no evidence has emerged that the chemicals are threatening their survival or ability to reproduce.

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