Scientists find microplastics in Monterey Bay water, anchovies, and seabirds

November 14 2022

Common murres in Monterey Bay. Researchers assessing the prevalence and composition of microplastics in Monterey Bay found microparticles (particles smaller than 5 millimeters) in the digestive tracts of all the common murres they examined, and in 58% of the anchovies, which make up a large part of the murres' diets. Credit: Laird Henkel

A study of microplastic pollution in Monterey Bay has found widespread occurrence of microplastics in the seawater and in the digestive tracts of anchovies and common murres, diving seabirds that feed on anchovies.

The study, accepted for publication in *Environmental Pollution*, included testing microplastic particles recovered from the murres for estrogenic activity, which indicates the potential for hormone disrupting effects. The researchers found that all the murres examined had microparticles in their digestive tracts, and almost a quarter (23%) had particles that exhibited estrogenic activity.

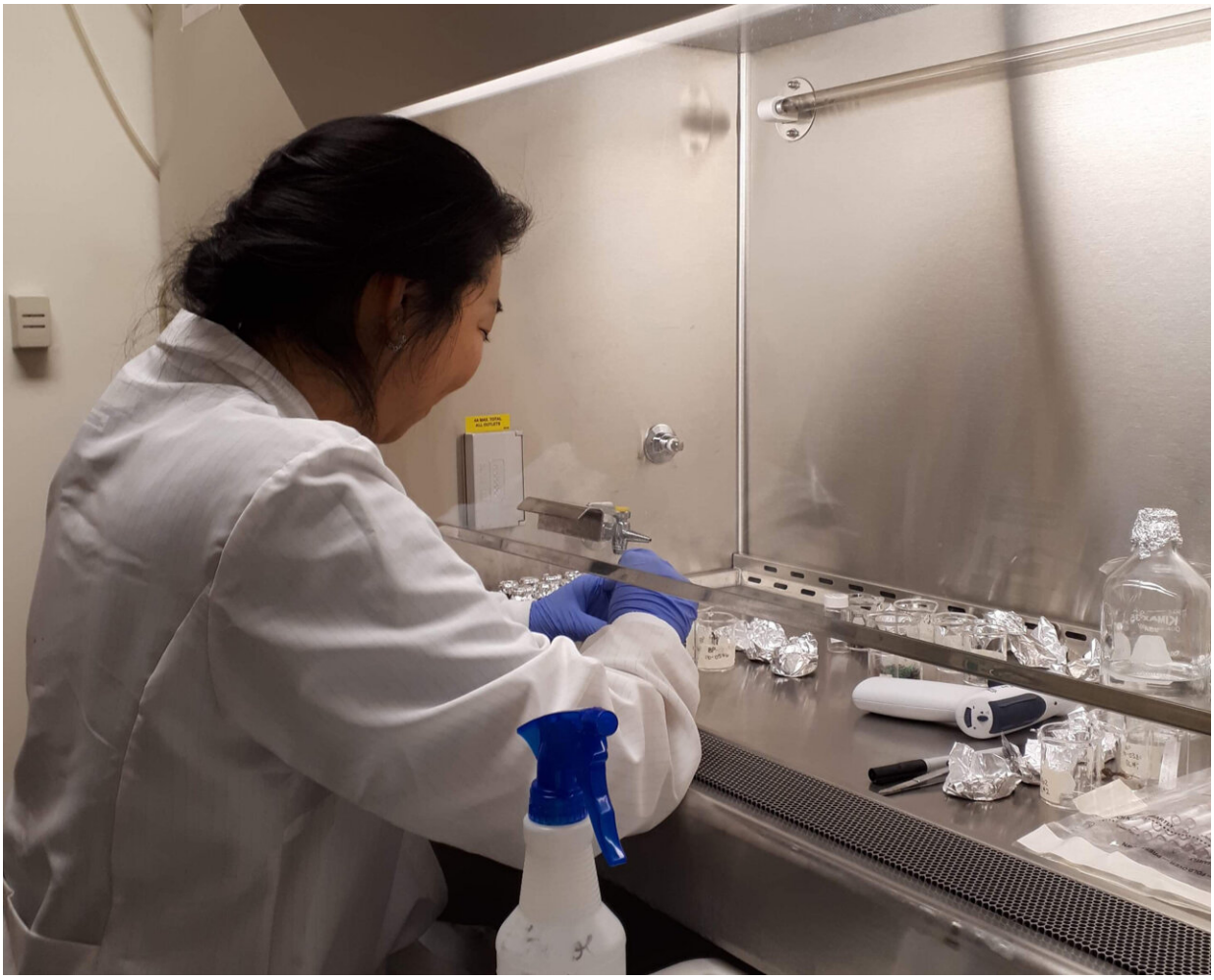
"These tiny plastic particles are leaching substances that have the potential for hormonal disruption that can have cascading effects on reproductive and immune functions," said senior author Myra Finkelstein, adjunct professor of environmental toxicology at UC Santa Cruz.

The study, led by UCSC graduate student Sami Michishita, sought to quantify the prevalence and composition of microparticles in Monterey Bay. The researchers found that 58% of anchovies and 100% of murres had microparticles (particles smaller than 5 millimeters) in their digestive tracts. Most of the particles (78%) were fibers, and more than half of the particles (57%) were identified as plastic using an optical technique called Raman spectroscopy.

The Raman spectroscopy was done in collaboration with Jenessa Gjeltema at UC Davis School of Veterinary Medicine, and testing for estrogenic activity was done in collaboration with the San Diego Zoo Wildlife Alliance.

"When you're looking at tiny fibers under the microscope, you can't always tell if it's cotton or polyester, so we took that next step to determine what it was, and then took the further step of testing them for

estrogenic activity," Finkelstein said.



Microplastics recovered from the digestive tracts of 23% of the common murres exhibited estrogenic activity in laboratory tests. Here, UCSC graduate student Sami Michishita prepares microplastics for testing. Credit: Liesbeth Van Hassel

Seawater samples obtained from two intake systems—one in Santa Cruz and one in Moss Landing—contained about 2 microparticles per 1,000 liters. Anchovies would most likely accumulate the particles in their

digestive systems because they feed by filtering tiny plankton from the seawater. As a significant component of the murres' diets, the anchovies are probably a major source of the microplastics in the murres' digestive systems.

Finkelstein has been studying the impact of plastic pollution on seabirds for years. Many seabirds consume relatively large pieces of plastic ("macroplastics"), mistaking it for food.

"One of the main problems with macroplastics is that they're taking the place of food. With microplastics, a major concern is the toxic compounds that may be leaching out of it," Finkelstein said.

Many of the chemicals associated with plastics are known as endocrine disrupting compounds because they can mimic hormones such as estrogen by binding to the hormone receptors in the body and disrupting physiological functions. In this study, the researchers did not try to determine how the murres or anchovies might be affected by the microplastics. That's a harder question to study and one that Finkelstein's lab is currently working to answer in collaboration with San Diego Zoo Wildlife Alliance.

"The next step is to see how this may be affecting the birds," she said. "With microplastics, it seems we are finding them anywhere we look. But we need to do more work to find out what the biological impact is."

Christopher Tubbs, associate director of reproductive sciences at San Diego Zoo Wildlife Alliance, said, "We know plastic debris, both large and small, in our oceans and waterways is an issue. This partnership between UCSC and San Diego Zoo Wildlife Alliance gives us the chance to dig into the reproductive consequences for seabirds when they consume microplastics. We believe this is the first time this type of estrogen-based assessment is being conducted for this type of

widespread marine pollution."

More information: Sami Michishita et al, Microplastic in northern anchovies (Engraulis mordax) and common murres (Uria aalge) from the Monterey Bay, California USA—Insights into prevalence, composition, and estrogenic activity, *Environmental Pollution* (2022). DOI: 10.1016/j.envpol.2022.120548

Provided by University of California - Santa Cruz