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MICROPLASTICS CAN INCREASE PATHOGEN CONTAMINATION IN SHELLFISH

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ISSUE

Microplastics can now be found in marine ecosystems around the world. Despite their global extent, much work remains to fully understand the consequences of microplastic pollution. Exposure to microplastics can reduce the growth, reproduction, and survival of aquatic organisms, including those consumed by humans. When directly exposed to microplastics, humans can also experience negative health outcomes, including inflammatory lesions.

A growing area of concern is the potential for microplastics to serve as substrates for pathogen association in aquatic environments. Sticky biofilms can readily develop on the surfaces of microplastics in aquatic environments, facilitating incorporation of terrestrial-based pathogens, such as fecal protozoan parasites. By attaching to microplastics, these pathogens can be transported through the water to the benthos or locations far from initial source of contamination. If consumed by shellfish, like oysters, microplastic-borne pathogens can enter marine food webs, with potential exposure to humans and marine animals consuming seafood.

To assess the feasibility of this exposure pathway, we tested whether microplastics enhanced the ability of pathogens to enter marine food webs. Using the Pacific oyster *Crassostrea gigas*, we compared how polyester microfibers increased the uptake and retention of three zoonotic protozoan parasites: *Cryptosporidium parvum*, *Giardia duodenalis*, and *Toxoplasma gondii*. Oysters were selected as the model system because they are commonly eaten raw and consumption of raw oysters is a known risk factor for *T. gondii* infection in humans. Microfibers were used as a substrate to reflect their abundance in natural marine systems.

KEY RESEARCH FINDINGS

Oysters exposed to microfibers with pathogens contained significantly more parasites than oysters exposed to pathogens alone. Counts of protozoan pathogens were 2.6x higher in microfiber-exposed oysters.

Microplastic fibers extended pathogen retention even after oysters were held in clean flow-through water. All parasites were detectable for two days in oysters exposed to protozoa alone but three days in oysters exposed to microfibers with protozoa. Low levels of some protozoa still persisted in the microfiber treatment after six days of depuration.

POLICY IMPLICATIONS

Incorporate microplastic-pathogen interactions into California and federal shellfish-safety assessments, especially for raw oysters.

Evaluate whether standard U.S. shellfish depuration periods remain adequate following events that simultaneously elevate pathogen and microplastic contamination, such as heavy runoff.

Expand coastal monitoring to measure pathogens and microplastics together, rather than treating them as independent pollutants.

Prioritize microfiber source reduction in wastewater, stormwater, and other land-to-sea pathways.

MORE INFORMATION

This policy brief summarizes findings from the article “Microplastics facilitate protozoan pathogen contamination in shellfish” by Minji Kim and colleagues, available at <https://doi.org/10.3390/microorganisms14020468>.

For more information, contact Karen Shapiro at kshapiro@ucdavis.edu.

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