

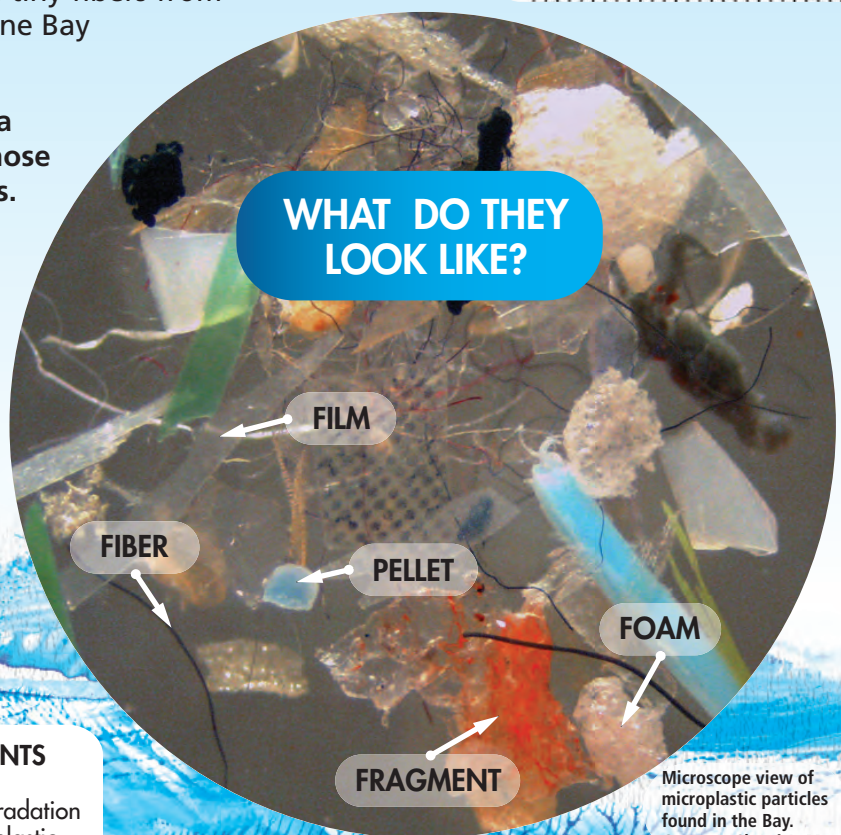
MICROPLASTIC CONTAMINATION IN SAN FRANCISCO BAY

Contribution No. 770

RMP
REGIONAL MONITORING PROGRAM FOR
WATER QUALITY IN SAN FRANCISCO BAY

www.sfei.org/rmp

- **Microplastics are tiny particles of plastic five millimeters or smaller, and they enter the environment through human use.** Beauty products with microbeads, synthetic clothing, plastic bags, polystyrene foam packaging, and disposable plastic items can all contribute to microplastic pollution.
- **Wildlife mistake microplastics for food.** When eaten, the tiny particles expose them to pollutants that plastics absorb from their surroundings. Microplastics cause physical harm, and toxic exposures move up the food chain, perhaps reaching people.
- **In a pilot study, microplastic pollution appeared to be greater in San Francisco Bay than in the Great Lakes and Chesapeake Bay.** Microbeads from beauty products and tiny fibers from synthetic clothing were found in all nine Bay water samples.
- **Microplastics passed through Bay Area wastewater treatment plants, even those using the most advanced technologies.** Bay Area wastewater typically had more of these particles than wastewater in other parts of the US, but data are extremely limited. Fibers made up most of the plastics released into the Bay via treated wastewater.



WHAT DO THEY LOOK LIKE?

MICROBEADS
pellets and fragments used in personal care products such as facial scrubs and toothpastes

FOAMED PLASTIC PARTICLES
from packaging, cigarette filters, and other items

KEY TYPES OF MICROPLASTIC POLLUTION

FRAGMENTS
from the photodegradation of larger plastic items such as plastic bottles

FIBERS
derived from clothes and fabrics made with synthetic materials (polyester, acrylic) or fishing lines

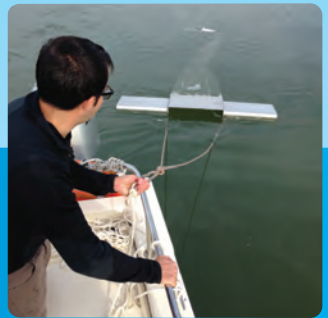
NURDLES
pre-production plastic pellets that are molded into larger plastic products

Microscope view of microplastic particles found in the Bay. Courtesy Sherri A. Mason.

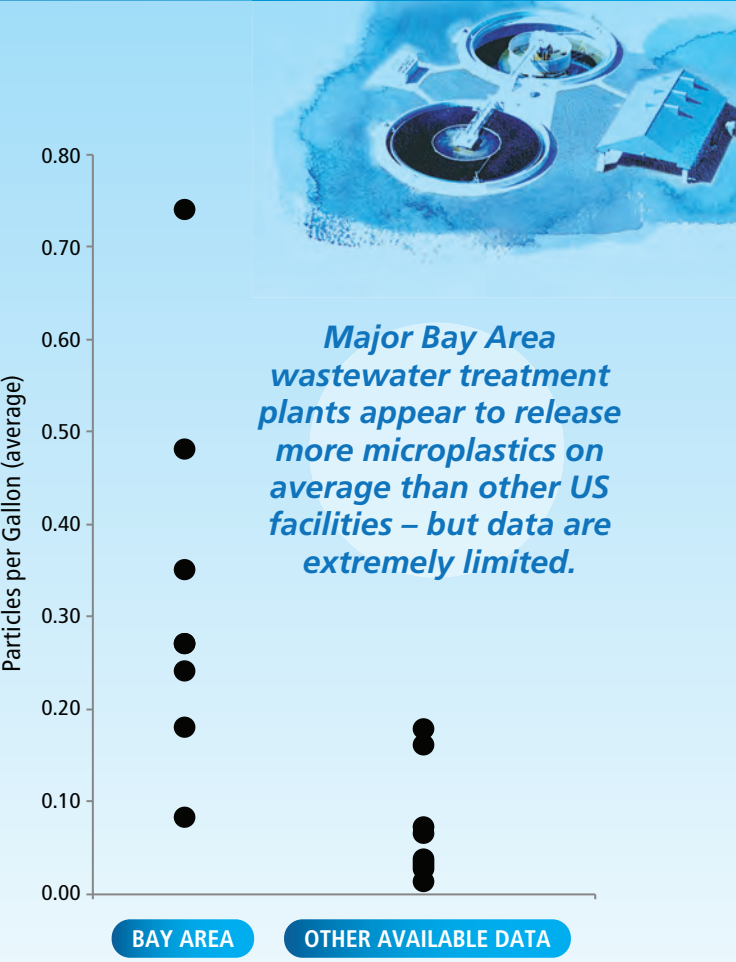
THE REGIONAL MONITORING PROGRAM FOR WATER QUALITY IN SAN FRANCISCO BAY (RMP) is an independent, long-term monitoring program providing policymakers with the information they need to protect this vital urban ecosystem. The RMP is an innovative collaboration between the San Francisco Estuary Institute, the San Francisco Bay Regional Water Quality Control Board, and regulated dischargers.

MICROPLASTIC POLLUTION IS WIDESPREAD IN BAY AREA WASTEWATER AND BAY WATER

Ian Wren of San Francisco Baykeeper deploying the Manta Trawl. Photo courtesy Meg Sedlak.



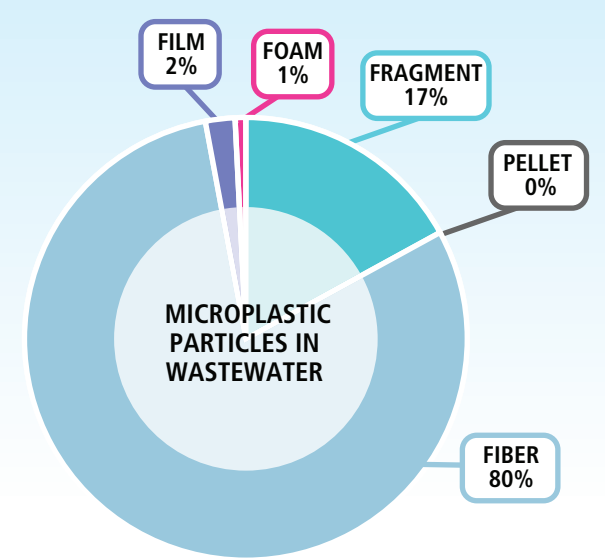
Scientists with SFEI, San Francisco Baykeeper, and the 5 Gyres Institute collected surface water samples at nine locations in the Bay by deploying a Manta Trawl – a device that skims the water surface – for 30 minutes. Additional monitoring is needed to confirm these findings and determine the full extent of Bay microplastic pollution.



Wastewater

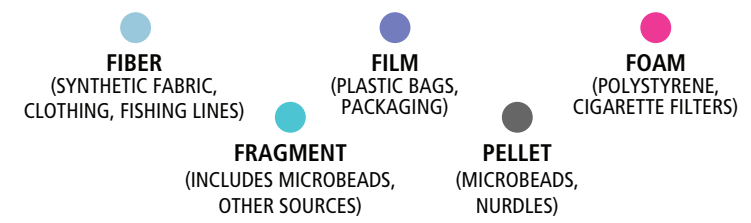
HOW DO MICROPLASTICS END UP IN WASTEWATER RELEASED TO THE BAY?

Microbeads from the beauty products we wash down the drain and synthetic fibers rinsed from clothing by our washing machines make their way to the Bay because they are too small, light-weight, and inert to be removed by treatment plants.



Fibers made up most of the microplastic particles in wastewater.

Many of the fragments in wastewater are thought to be microbeads derived from beauty products.



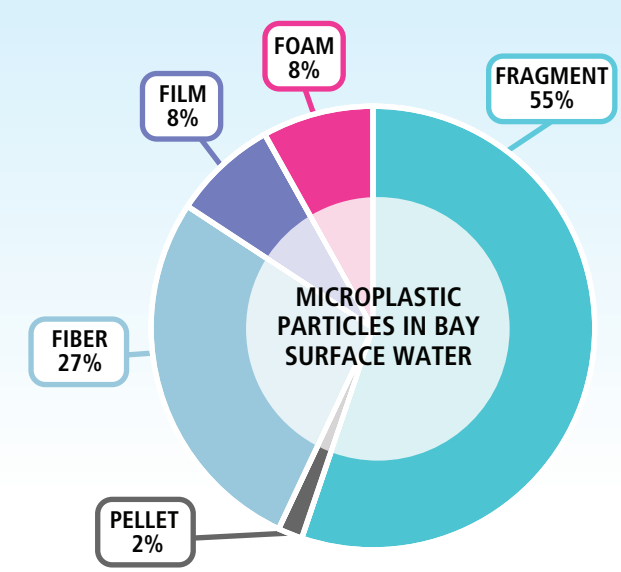
SFEI scientists collected particles from wastewater at eight Bay Area wastewater treatment plants using sieves. The eight plants discharged an average of 0.33 particles of microplastic per gallon. This was more than four times the average of 0.07 particles per gallon observed in a study of nine facilities in other parts of the US, part of a larger study of municipal wastewater treatment facilities that Dr. Sherri A. Mason is completing now.

On average, Bay Area facilities released an estimated 7,000,000 particles of microplastic per day to San Francisco Bay.

Bay Surface Water

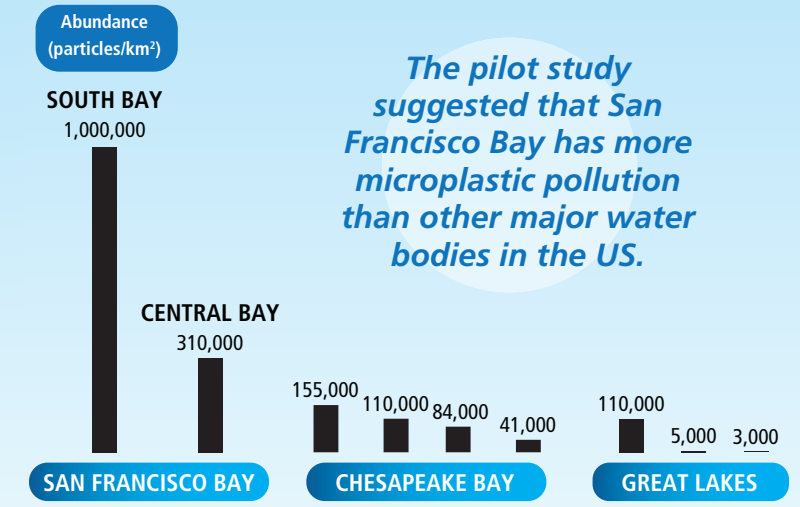
HOW ELSE DO MICROPLASTICS END UP IN THE BAY?

Wastewater is not the only pathway for microplastics to enter the Bay. Rain carries plastic litter of all sizes from land into the Bay through urban creeks and storm drains. Illegal dumping and wind-borne plastic trash also add to the plastic pollution in the Bay.

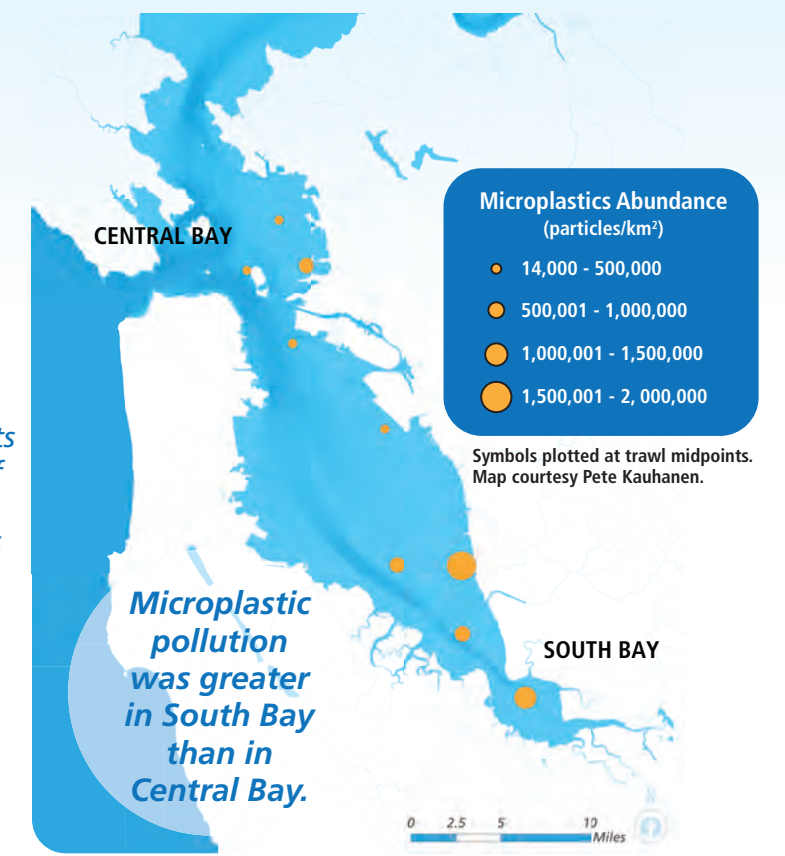


Bay surface water contained more fragments and fewer fibers than wastewater. Some of the plastic pollution in the Bay comes from stormwater, which likely has different sorts of microplastic particles than wastewater.

Processes that occur within the Bay, such as breakdown of larger plastic litter, settling of heavier particles on the Bay floor, and ingestion by wildlife can also affect the array of particles found in Bay surface water.



The pilot study suggested that San Francisco Bay has more microplastic pollution than other major water bodies in the US.



MICROPLASTICS IN FISH

We found 52 particles of plastic in nine small fish caught during Bay surface water sampling. This average of nearly six pieces of microplastic per fish is higher than the one to three pieces typically found in Great Lakes fish.

WHY ARE WE CONCERNED?

Microplastics accumulate toxic pollutants, and may be ingested by aquatic organisms that mistake them for food. These plastic particles can cause physical blockages, starvation, and increased exposure of wildlife to contaminants.

Microplastics accumulate in digestive organs, and people are most likely to be exposed to them if they consume wildlife whole. However, human exposure to the toxic pollutants transferred by microplastics could occur from eating any part of an affected fish or shellfish.

FOCUS ON MICROBEADS

Microbeads are plastic particles intentionally added to beauty products for their abrasive qualities. Beauty products with microbeads typically list “polyethylene” or “polypropylene” as an ingredient. Microbeads include both round, bead-like, brightly-colored plastic pellets, and rough, plain fragments.

In October 2015, Governor Jerry Brown signed AB 888, a bill that will ban the sale of personal care products containing microbeads in California beginning January 1, 2020. This bill is the toughest ban on microbead-containing products in the nation. Many companies have already committed to eliminating these ingredients from their products.

Until 2020, consumers can limit their personal contributions to microplastic pollution by avoiding products that contain microbeads, choosing clothing made from natural fibers, and taking care not to litter or flush plastic materials down the toilet.



Photo courtesy 5 Gyres

Optical microscope photo of microbeads extracted from off-the-shelf personal care products showing rounded, bead-like pellets along with more plentiful, rough plastic fragments. Courtesy Sherri A. Mason.

WHAT'S NEXT?

This study provides an initial baseline understanding of current conditions in the Bay as scientists, policymakers, and industry leaders work towards reducing the impact of microplastic pollution. More monitoring is needed to confirm these results and track trends in microplastic levels in response to the microbead ban and other policy changes designed to reduce plastic pollution.

Further study of microplastics in Bay fish is needed to determine whether they are more contaminated than fish in other major water bodies, and to investigate the potential for accumulation of microplastics and attached pollutants in sport fish that people eat.

ACKNOWLEDGMENTS

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FOR REFERENCES OR INFORMATION

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sfei.org/microplastics

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