

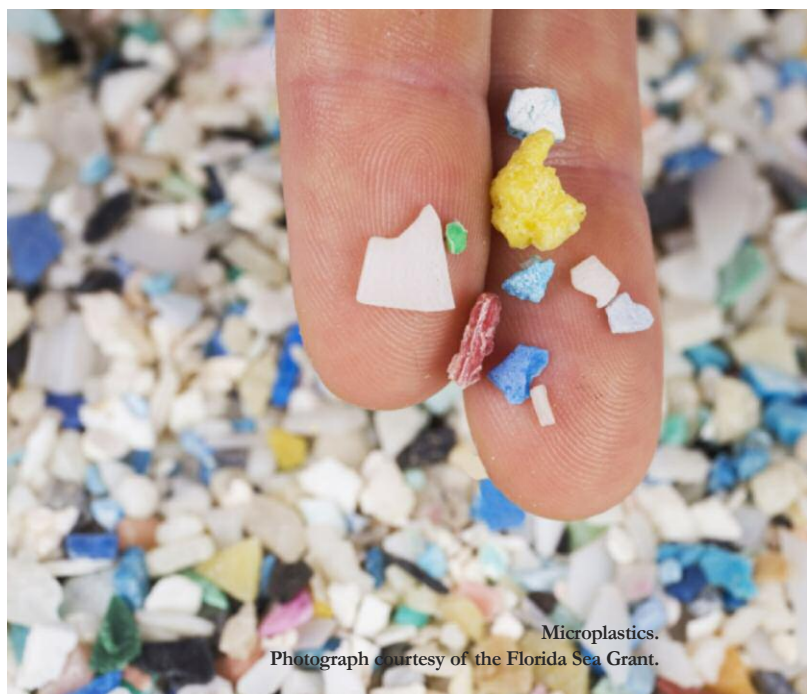
Studying Microplastics in the Gulf

Mandy Sartain, Eric Sparks, and Caitlin Wessel

Plastic has quickly stolen the show as the focal marine debris item. Marine debris is a global issue that is reducing the quality of life in coastal environments. It is defined by the National Oceanic and Atmospheric Administration as “any persistent solid material that is manufactured or processed and directly or indirectly, intentionally or unintentionally, disposed of or abandoned into the marine environment or the Great Lakes.” Common examples include trash such as food wrappers and other single-use items; derelict vessels; and abandoned fishing gear such as nets and fishing line. Marine debris typically originates on land, although some marine debris comes from recreational and cargo vessels. Dumping, littering, and flooding are all routes trash can take to the ocean. Marine debris is harmful to the marine environment because it can entangle marine animals, be mistaken for food and ingested by animals, and destroy habitats.

The magnitude of the plastic problem is escalating quickly. Companies are producing plastic much faster than consumers are conscientiously disposing of it. Scientists estimate that by 2050, there will be more plastic in the ocean than fish. Although humans value plastic because it is cheap and disposable, the situation is completely different for the environment. Nature cannot breakdown plastic. Plastic is man-made, and as it “breaks down” it is really just breaking up into smaller and smaller pieces, known as microplastics. Microplastics are plastic pieces smaller than 5 mm in size. Microplastics are a growing environmental problem, prevalent in coastal sediments of the northern Gulf of Mexico.¹ They are often mistaken as food and ingested by marine animals, affecting animals of all sizes, from tiny copepods to huge whale sharks. Plastic absorbs toxins in the water column, and once ingested, the toxins are introduced into the marine food web.

There are two categories of microplastics: primary and secondary. Within these categories, microplastics are usually

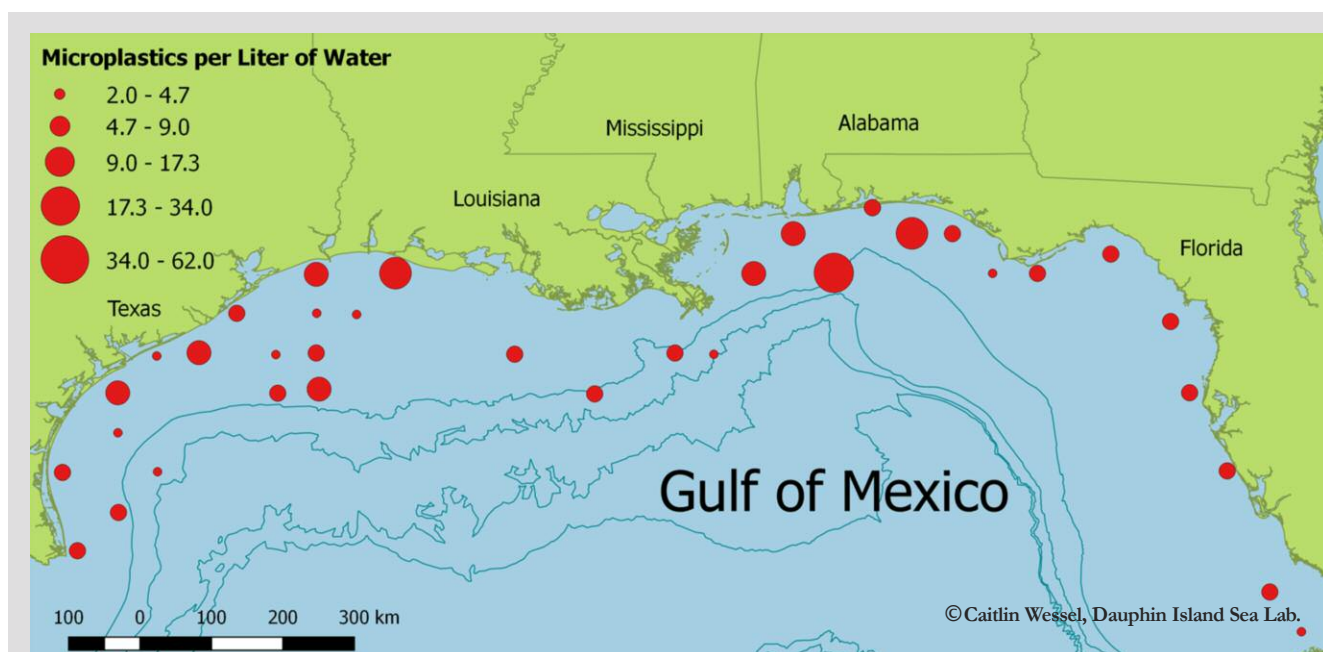


Microplastics.
Photograph courtesy of the Florida Sea Grant.

separated into four forms: microbeads, microfibers, films, and fragments. Primary microplastics include plastic particles that are purposefully made as small plastic pellets, beads, and fragments. Many everyday cosmetic products including face wash, toothpaste, exfoliates, deodorant, and make-up contain plastic microbeads. However, a U.S. law banned the manufacture of personal care products and cosmetics that contain microbeads as of July 2017,² limiting continued contamination by that plastic.

Another common form of primary microplastics is “nurdles,” small plastic pellets that serve as raw material in the creation of plastic products. Throughout the transportation and handling process, nurdles can get carelessly spilt and lost into the environment. Their size, shape, and color make them easily mistaken as food to many marine animals.

Secondary microplastics are the result of the degradation of larger plastic pieces. Chemical and physical processes



Microplastics Concentrations in the Surface Water of the Gulf of Mexico

Background: In September 2016 and 2017, Caitlin Wessel, a scientist with the Dauphin Island Sea Lab and University of South Alabama, participated in the NOAA Fisheries Southeast Monitoring and Assessment Program (SEAMAP) plankton sampling along the Gulf Coast to collect pieces of plastic smaller than 5 mm, known as microplastics. Scientists use the same methods to sample for microplastics as they do for plankton. One of these methods is collecting whole water samples from the surface, middle, and bottom of the water column using a niskin bottle (a type of bottle that has openings at both ends). The water samples are filtered onto a grid, and then, using a microscope, the scientists count the number of microplastics found in each liter of water. This map shows the average numbers of microplastics found in surface waters throughout the northern Gulf of Mexico based on that one type of sampling: an overall average of 7 bits of microplastics per liter.

like wave action, heat, UV radiation, and animal grazing cause plastics to break down into smaller and smaller pieces. For example, laundering causes synthetic clothing fibers such as nylon, polyester, and acrylic to shed microfibers in the wash that then flush to sea.

In 2016, Mississippi State University (MSU) received a Gulf Star grant from the Gulf of Mexico Alliance to study plastic pollution in the Gulf of Mexico. It has partnered with 12 coastal organizations³ to collect and analyze microplastic data in the Northern Gulf across two years. Citizen scientists – encompassing a wide range of volunteers with an interest in data collection but not necessarily any formal scientific training – will be taught by the project partners to collect and process samples. Two processes are used to count the bits of plastic, depending on whether the samples are of water or sediment. Using the water-filtration technique, water samples are vacuum-pumped through porous filter paper. The paper catches the plastic for counting. Sediment samples are processed using density separation, a method created by engineers at the Dauphin Island Sea Lab in Alabama. In density separation,

salt water is pumped through the sediment sample, and because microplastics are less dense than the salt water and sediment, they float to the top where they can be counted. This project will give a first look at microplastic abundance in the Northern Gulf of Mexico. The 12 project partners – spanning from Corpus Christi, Texas to Key Largo, Florida – will give scientists the ability to see data on microplastic abundance for the entire Gulf. Additionally, the study will narrow down what type of microplastic (bead, fiber, fragment, or film) is the most prevalent in the Gulf. Based on the data received thus far, microfibers are the most commonly found microplastic in water samples.

During the grant's two-year period, there are only two mandatory sample dates for each partner and citizen scientist: the local International Coastal Cleanup dates of 2017 and 2018. The 2017 International Coastal Cleanup was held on September 16; Mississippi's planned October date was postponed after Hurricane Nate. The two specific dates will give a Gulf-wide snapshot of microplastic abundance at a particular time, helping to eliminate any seasonal variations between samples. Sampling at other times is at

the discretion of the participants and is encouraged, and many participants sample throughout the year.

Using GIS software, MSU will use this data to create maps exhibiting the most current microplastic abundance levels in the Gulf of Mexico. The data from this study will generate strategies to prevent microplastics from entering our oceans. It is still early in the project timeline, but due to the proactive partners and dedicated citizen scientists, data is currently pouring in not just from the first round of mandatory samplings, but from all other samplings. The hope is that the more data on microplastic are gathered, the more easily they'll be eradicated in the future. 🐡

Mandy Sartain and Eric Sparks, PhD, work with the Mississippi State University Coastal Research and Extension Center and are affiliated with the Mississippi-Alabama Sea Grant Consortium.

Caitlin Wessel is the Gulf of Mexico Regional Coordinator for NOAA's Marine Debris Program and works at the Dauphin Island Sea Lab.

Endnotes

1. Pub. L. No. 114-114 (Dec. 28, 2015).
2. Caitlin Wessel, *et al.*, *Abundance and Characteristics of Microplastics in Beach Sediments: Insights into Microplastic Accumulation in Northern Gulf of Mexico Estuaries*, 109 Marine Pollution Bulletin, pp. 178-183 (2016).
3. Those partners are: University of Florida, Institute of Food and Agricultural Sciences Marine Lab; Nature's Academy; Charlotte's Harbor National Estuary Program, Key Largo Marine Lab - Marine Resources Development Foundation; Florida A&M University, Apalachicola National Estuarine Research Reserve (NERR), Turtle Island Restoration Network, Texas Parks and Wildlife Department, Barataria-Terrebonne National Estuary Program; Texas State Aquarium, Weeks Bay NERR, Grand Bay NERR.



IN SUM.

A Summation of the Facts and Figures of Interest in this Edition

★ Tons of plastic that end up in the ocean each year	8.8 million tons
★ Rank of the Gulf of Mexico for highest plastic concentrations in the world	2 nd
★ Amount of the fine paid for dumping oil and plastic bags of trash from a ship into the Gulf	\$1.9 million
★ Percentage of cities in Mississippi (pop. > 15,000) that do not offer residential curbside plastic recycling	12.5%
★ Percentage of cities in Alabama (pop. > 15,000) that do not offer residential curbside plastic recycling	32.4%
★ Of bead, fiber, fragment, or film types of microplastic found in the Gulf, the rank of microfibers	1 st
★ Number of years it takes a new energy-efficient building to overcome the climate change impacts of that new construction	10-80 years