

# Discarded plastic forms an ecosystem at sea

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Sea Education Association's brigantine Robert C. Seamans sails 10 miles offshore from Point Loma in San Diego to conduct research into a new ecosystem known as the plastisphere, which refers to the effect discarded plastic is having on the oceans, on Sept. 14, 2013. Bob Chamberlin/Los Angeles Times/MCT

OFF THE COAST OF SAN DIEGO — Marine science graduate student Elizabeth Lopez maneuvered a huge steel claw over the side of a 134-foot sailboat. Carefully, she lowered it through swaying seaweed and schools of fish. She was hoping to catch pieces of something scientists are calling the plastisphere.

The plastisphere is a mysterious marine ecosystem scientists are only now beginning to find out about. It starts with bits of broken-down plastic no bigger than grains of salt. Bacteria grow on those tiny pieces of debris. Then single-celled animals feed on the bacteria, and larger predators feed on them.

“We’ve created a new man-made ecosystem of plastic debris,” said Lopez, who is studying at the University of San Diego.

The plastisphere was six decades in the making. It’s a product of all the thrown-out plastic that gets swept from city sewer systems and river channels into the sea. It’s made up of bits of everything from flip-flops and margarine tubs to toys and toothbrushes.

## "Garbage Patches" In The Ocean

When that debris washes into the ocean, it breaks down into bits that are then colonized by microscopic organisms. Researchers suspect that some of these tiny creatures may be pathogens – that is, disease-causing bacteria. They may be hitching long-distance rides on all the floating junk.

Scientists also fear that creatures in the plastisphere are completely breaking down chunks of polyethylene and polypropylene, allowing dangerous chemicals to seep into the environment.

"This is an issue of great concern," said marine geochemist Tracy Mincer. "Microbes may be greatly accelerating the weathering of plastic debris into finer bits. If so, we aren't sure how zooplankton and other small creatures are responding to that."

And, she said, we don't know what's happening as the plastic is being broken down. "Harmful additives, pigments, plasticizers, flame retardants and other toxic compounds" may be "leaching into the water."

About 245 million tons of plastic is produced annually around the world. That represents 70 pounds of plastic annually for each of the 7.1 billion people on the planet, scientists say.

The waste gathers in vast oval-shaped ocean "garbage patches." Once trapped, plastic particles may remain for centuries.

## Spreading Through The Food Web?

The effects of visible plastic debris are well-documented. Fish, birds, turtles and marine mammals that swallow it suffer clogged intestines and can choke or starve to death.

But the effects of the tiny pieces that make up the plastisphere are only beginning to be understood.

As far back as 1972 scientist Edward Carpenter reported that microbes could attach themselves to bits of plastic floating in the ocean. This debris enabled the growth of algae – a type of simple marine plant. And, he said, it probably also allowed bacteria to grow. Carpenter suggested that hazardous chemicals showing up in ocean animals may have come from bits of plastic.

Unfortunately, Carpenter's discovery went largely unnoticed for years. But now, more and more scientists are attempting to understand the plastisphere. They are collecting seawater and marine life to study the bits of plastic they contain. Their findings are shedding new light on the effects of our addiction to plastic.

"We're changing the basic rhythms of life in the world's oceans," said marine biologist Miriam Goldstein. "We need to understand the consequences of that."

Goldstein has studied plastic debris in the Great Pacific Garbage Patch between Hawaii and California. In October, she and oceanographer Deb Goodwin released a report on the gooseneck barnacles they had collected there: One-third had plastic particles in their guts.

Since crabs prey on barnacles, the plastic the barnacles eat may be spreading through the food web, Goldstein and Goodwin reported.

### **More Study Is Needed**

Fish that swallow plastic debris tend to build up hazardous substances in their bodies that can cause damage to their livers. And not only is the plastic itself dangerous, so too are the toxic chemicals the plastic has absorbed.

Other scientists have studied the microbes and algae that live on plastic marine debris.

So far researchers have identified more than 1,000 different types. Particularly worrying was the discovery of bacteria that cause cholera and other gastrointestinal illnesses. Such bacteria could travel long distances by attaching themselves to plastic debris.

But it doesn't end with those bacteria. Other bacteria feed on their waste products, and predators feed on all of them.

"Each one of these plastic bits is a circle of life," Mincer said. "One microbe's waste is another microbe's dinner." And some microbes may simply be "hanging out on plastic trash, just waiting to be eaten by fish" in order to travel into a whole new environment.

Marine scientist Drew Talley believes more study of these plastisphere systems is essential. "It would be a crime not to investigate the damage they might be doing to the oceans and to humans."