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ENVIRONMENT

## Invasive Species Are Riding on Plastic Across the Oceans

Crustaceans and mollusks foreign to the United States have survived up to six years riding on ocean trash.



BY WHITNEY PIPKIN

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We know plastics are as plentiful in parts of the open ocean as they are in our everyday lives. But, until recently, scientists didn't consider that such debris could also be carrying a new wave of invasive species to the shores of the United States. Now they're finding that not only is that happening, but they suspect that some of the species will thrive.

Not long after the 2011 earthquake and tsunami that ravaged the east coast of Japan, a surge of floating trash—shellfish cages, portions of piers, entire fishing vessels—started washing onto the West Coast of North America and Hawaii. The tsunami had dragged Japan's plastic infrastructure out to sea, where it bobbed toward North America. (Related: Japan Tsunami: 20 Unforgettable Pictures)

Scientists largely expected the debris to land, knowing the pace and direction of ocean currents. But they didn't know that Japanese mussels, barnacles, and sea squirts could survive for six years on a trek across the Pacific Ocean and arrive not only alive, but ready to reproduce.

Marine invertebrates, such as these invasive tunicate species, are commonly found by researchers in marinas and ports far from their native habitat.

PHOTOGRAPH BY BRIANNA TRACY, SMITHSONIAN

“Until then, we didn’t really think these coastal organisms could survive at sea long enough to make the transit,” says Greg Ruiz, senior scientist at the [Smithsonian Environmental Research Center’s marine invasions lab \(SERC\)](#). “This showed us that they can and do—and that we should expect to see this more often as the amount of debris in the ocean continues to increase.”

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Researchers collected as much of the debris as they could over the six-year period during which it continued washing onto West Coast shores. One study documented the creatures that came with the trash and found 289 Japanese species had survived the ride.

Christina Simkanin, a research biologist with SERC's marine invasions lab, is now studying the fallout of that incremental invasion to see whether any species might establish new populations where they landed. Many of those species that arrived had not yet been introduced to the West Coast and, like any non-native, could cause harm in their new environments.

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A Japanese algae species, for example, that had already spread to San Francisco and San Diego landed with the debris in Oregon. A Japanese shore crab, native to several parts of Asia, also rode the tsunami of trash to the West Coast. And scientists feared a shore mussel originally from the Mediterranean Sea could have carried with it a parasite that is not yet known to the West Coast of the U.S. and Canada. (Related: Edible Conservation: Eat the Enemy)

When researchers ring the alarm bell that a new non-native species has arrived, they usually make an educated guess as to how it got there. Historically, many marine species make the trip in the ballast water a ship collects on one coast to give it stability until it reaches the next (though legislation requiring ships to drain their tanks at sea has helped reduce the number of foreign travelers reaching U.S. shores). Other unwelcome visitors have been introduced by humans looking for a new fish to catch or dumping a tropical creature from their tanks into a lake back home.

But the wave of new species that followed the Japanese tsunami got researchers thinking: How many other invaders have taken the floating-trash train to new waters?

“It’s probably been happening for a while,” says Simkanin. The debris “would have been floating in Japan, gathering this coastal community of species, and then the extreme event basically dislodged and sent them out to the sea.”

“That likely happens during any storm,” she says, “and will continue to happen.”

These mounds of coastal trash are a new frontier for the scientists who study invasive species. In the past, coastal critters have traveled on driftwood that often decomposes at sea. But the proliferation of plastics along more foreign shores makes possible longer journeys as long as the plastic exists, which can be hundreds of years.

But the abundance of ocean plastics poses new scientific questions. How do these species subsist on plastic and polystyrene? Do large pieces of debris become microcosms of their coastal ecosystems, like a floating hotel with food? What if their trash raft gets stuck at sea in gyres like the Great Pacific Garbage Patch?

The nudibranch, a soft-bodied, marine gastropod, is an organism commonly found on marine debris washed ashore.

PHOTOGRAPH BY BRIANNA TRACY, SMITHSONIAN

Linsey Haram, a postdoctoral fellow with the invasions lab, is among the scientists trying to find answers during a research tour through the open ocean this year. The work, funded by NASA, is part of an interdisciplinary study of the unique ecosystems that may be forming on floating debris.

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This fall, she'll work with The Ocean Cleanup—an audacious project to remove some of the 80,000 metric tons of trash swirling in the Pacific gyre—to study the organisms that might be living there. Researchers expect to find communities of coastal life similar to what washed up on the West Coast. But they also wonder if some have evolved to survive on a patchwork of manmade structures.

“Our hypothesis is that many of the organisms that are coastal can survive at sea, and that there is reproduction that happens at sea,” says Ruiz, who still wants to know more about what these species are eating while they float. “Up until now, we thought they required coastal areas where there are more nutrients.”

Mussels, clams, and crustaceans have long made their way to new coasts in the ballasts or on the hulls of ships, which travel from one shore to another over a few days or weeks. But the idea that those same organisms can survive after a years-long float through the Pacific is still, as Simkanin puts it, “mind blowing.” It also makes it hard to predict where they’ll wind up. 🟡

Whitney Pipkin is a journalist based in Northern Virginia covering food, agriculture, and the environment.

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