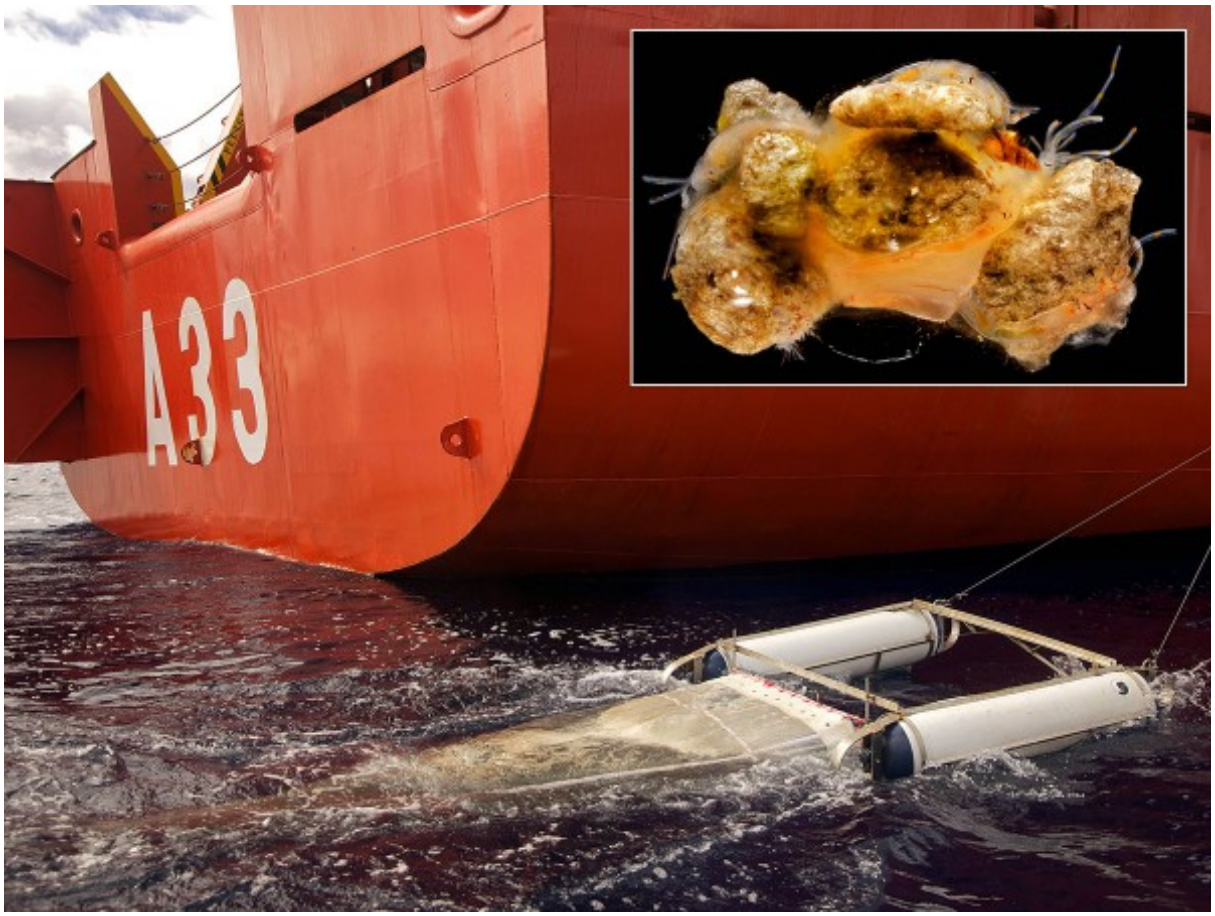

JOAN COSTA

On the hunt. The RV *Hesperides* tows along a net designed to skim the ocean surface, catching floating plastic particles (*inset*).

Ninety-nine percent of the ocean's plastic is missing

By Angus Chen (/node/111574) | 30 June 2014 3:30 pm | 51 Comments (/environment/2014/06/ninety-nine-percent-oceans-plastic-missing#disqus_thread)

Millions of tons. That's how much plastic should be floating in the world's oceans, given our ubiquitous use of the stuff. But a new study finds that 99% of this plastic is missing. One disturbing possibility: Fish are eating it.

If that's the case, "there is potential for this plastic to enter the global ocean food web," says Carlos Duarte, an oceanographer at the University of

Western Australia, Crawley. “And we are part of this food web.”

Humans produce almost 300 million tons of plastic each year. Most of this ends up in landfills or waste pits, but a 1970s National Academy of Sciences study estimated that 0.1% of all plastic washes into the oceans from land, carried by rivers, floods, or storms, or dumped by maritime vessels. Some of this material becomes trapped in Arctic ice (http://news.sciencemag.org/earth/2014/05/trillions-plastic-pieces-may-be-trapped-arctic-ice) and some, landing on beaches, can even turn into rocks made of plastic (http://news.sciencemag.org/earth/2014/06/rocks-made-plastic-found-hawaiian-beach) . But the vast majority should still be floating out there in the sea, trapped in midocean gyres—large eddies in the center of oceans, like the Great Pacific Garbage Patch (http://news.sciencemag.org/plants-animals/2012/05/ocean-trash-lifesaver-insect) .

To figure out how much refuse is floating in those garbage patches, four ships of the Malaspina expedition, a global research project studying the oceans, fished for plastic across all five major ocean gyres in 2010 and 2011. After months of trailing fine mesh nets around the world, the vessels came up light—by a lot. Instead of the millions of tons scientists had expected, the researchers calculated the global load of ocean plastic to be about only 40,000 tons at the most (http://www.pnas.org/cgi/doi/10.1073/pnas.1314705111) , the researchers report online today in the *Proceedings of the National Academy of Sciences*. “We can’t account for 99% of the plastic that we have in the ocean,” says Duarte, the team’s leader.

He suspects that a lot of the missing plastic has been eaten by marine animals. When plastic is floating out on the open ocean, waves and radiation from the sun can fragment it into smaller and smaller particles, until it gets so small it begins to look like fish food—especially to small lanternfish, a widespread small marine fish known to ingest plastic.

“Yes, animals are eating it,” says oceanographer Peter Davison of the Farallon Institute for Advanced Ecosystem Research in Petaluma, California, who was not involved in the study. “That much is indisputable.” But, he says, it’s hard to know at this time what the biological consequences are. Toxic ocean pollutants like DDT, PCBs, or mercury

cling to the surface of plastics, causing them to “suck up all the pollutants in the water and concentrate them.” When animals eat the plastic, that poison could be going into the fish and traveling up the food chain to market species like tuna or swordfish. Or, Davison says, toxins in the fish “may dissolve back into the water … or for all we know they’re puking [the plastic] or pooping it out, and there’s no long-term damage. We don’t know.”

It’s impossible to know how much the animals are eating, says Kara Law, a physical oceanographer at the Sea Education Association in Woods Hole, Massachusetts, who was not involved in the work. The estimated amount of plastic entering the ocean that the study uses is almost half a century old, and “we’re desperately in need of a better estimate of how much plastic is entering the ocean annually.”

What’s more, both Davison and Law say there are a number of other potential places the plastic could be ending up. It could be washing ashore, and a lot of it could be degrading into pieces too small to be detected. Another possibility is that organisms sticking to and growing on the plastic are dragging the junk beneath the ocean’s surface, either suspending it in the water column or sinking it all the way to the sea floor. Microbes may even be eating the stuff.

Best-case scenario for the fate of the missing plastic? It’s sinking from the weight of organisms sticking to it or in animal feces and getting buried on the ocean floor, Law says. “I don’t think we can conceive of the worst-case scenario, quite frankly. We really don’t know what this plastic is doing.”

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