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Finding mercury. Researchers deploy a McLane pump during a 2013 west Pacific GEOTRACES cruise to gather small organic particles to which mercury attaches.

Mercury levels in surface ocean have tripled

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By [Jia You \(/author/jia-you\)](#) | 6 August 2014 2:45 pm | [4 Comments \(/environment/2014/08/mercury-levels-surface-ocean-have-tripled#disqus_thread\)](#)

In the 1950s, a neurological epidemic [killed thousands of villagers in the seaside town of Minamata, Japan](#) (<http://www.sciencemag.org/content/341/6153/1446.summary>), and caused mental retardation in newborns. Only later did the villagers learn that the fish they ate had been contaminated with toxic mercury dumped by a local chemical plant. Now, new research suggests human activities since the Industrial Revolution have tripled the amount of mercury in shallow parts of the ocean, posing a threat to human health worldwide.

The study presents an impressive set of empirical data collection across oceans, says David Streets, an environmental policy scientist at Argonne National Laboratory in Lemont, Illinois, who was not involved in the research. “This is the first time, to my knowledge, that a group [has] tried to give an overview of all the major ocean areas,” he says. “It’s a valuable data set.”

Industrial processes such as [small-scale gold mining](http://www.sciencemag.org/content/341/6153/1448.summary) (<http://www.sciencemag.org/content/341/6153/1448.summary>) and coal burning emit mercury into the atmosphere. In gold mining, miners use liquid mercury to soak up gold from ore, then vaporize the toxic metal while leaving the gold behind. Burning coal releases mercury naturally contained in the fuel. Once in the atmosphere, the metal can travel for months and thousands of kilometers until rain deposits it into oceans. There, bacteria help convert it to the neurotoxin methylmercury. The methylmercury then travels up the food chain, ultimately accumulating in fish.

Consuming contaminated seafood is the single leading source of mercury exposure for people, says Carl Lamborg, an oceanographer at the Woods Hole Oceanographic Institution in Massachusetts. But monitoring mercury levels in the oceans has proven a challenge for researchers because the metal is present only in tiny concentrations in seawater, and gathering samples from different oceans requires time and resources.

So an international team led by Lamborg embarked on cruises to the Atlantic, Pacific, Southern, and Arctic oceans and spent 8 years collecting water samples at various depths. The cruises were conducted under the international GEOTRACES program, which sends ships around the globe to map the distribution of key trace elements in the oceans.

Sifting through data gathered from the cruises, Lamborg and his colleagues observed that unpolluted waters, such as waters more than 1000 meters deep in the Pacific Ocean, contain a fixed ratio of mercury to phosphate, a better studied substance. The team used this ratio as a benchmark to identify and compare levels of mercury pollution caused by human activities across water samples from different oceans.

But calculating mercury that originated from human activities (as opposed to natural processes like the breakdown of rocks on land) required an additional step. To scale the calculations to ocean-wide estimates, the team crosschecked the amount of mercury they derived with the

extensively studied greenhouse gas carbon dioxide (CO₂) as a proxy. They found that across ocean basins, the ratio of human-generated mercury to human-generated CO₂ tends to stay consistent among waters in the same layer of depth, because coal burning, for example, emits both mercury and CO₂. Using existing databases of CO₂ measured in ocean waters, the team derived an index relating the two substances, and used it to estimate the amount and distribution of mercury contributed by human activities in different ocean basins.

The calculations suggest that the ocean contains about 60,000 to 80,000 tons of mercury from pollution, with almost [two-thirds residing in water shallower than a thousand meters](http://www.nature.com/nature/journal/v512/n7512/full/nature13563.html) (<http://www.nature.com/nature/journal/v512/n7512/full/nature13563.html>), the team reports online today in *Nature*. Mercury concentration in waters shallower than 100 meters has tripled compared with preindustrial times, they found, whereas mercury levels in intermediate waters have increased by 1.5 times. Higher mercury concentrations in shallower waters could increase the amount of toxin accumulating in food fish, exposing humans to greater risk of mercury poisoning, Lamborg says. Countries ringing the North Atlantic Ocean, where the mercury concentration is among the highest recorded in the study, may be particularly vulnerable.

Even with these data, researchers still can't ascertain the impact of rising levels of mercury on marine fish, and on the people who consume them, Lamborg notes. That's because scientists still don't know precisely how inorganic mercury transforms into toxic methylmercury.

The findings contradict previous thought that the Gold Rush of the 1850s was a major source of mercury to the oceans. Lamborg says his results suggest mercury from past gold mining in the United States might have been deposited in nearby soils instead of in the ocean.

Streets points out that more research is needed to paint a better picture of the mercury cycle. "There are still big gaps in our understanding of how mercury moves between air, soil, and water, and between different parts of the world," he says. "This paper is a good estimate of mercury in oceanic water, but it's only part of the bigger picture."

Now, more than a hundred nations have [signed the Minamata Convention on Mercury](http://www.sciencemag.org/content/341/6153/1443.summary) (<http://www.sciencemag.org/content/341/6153/1443.summary>), an international treaty to reduce mercury emission levels through measures

such as banning new mercury mines. "I hope that these data will help countries in terms of assessing how badly we need to regulate mercury emission," Lamborg says.

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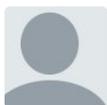
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neal dawson · 10 months ago

National groups that support recreational gold mining in the US (e.g. Gold Prospector Association of America) strongly support the notion that mercury should never be used by recreational minors. GPAA and similar organizations suggest multiple alternatives for gold recovery.

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Zafar Adeel · 10 months ago

This is sloppy and poor reporting. "Thousands" did not die in Minamata - read your reference more carefully....

^ | v · Reply · Share ›



russ george · 10 months ago

This crisis of high and rising mercury in the world's ocean is compounded as the natural mechanism to scrub the surface ocean of this deadly poison is also diminished. The solution to both issues is the same restore and revive the ocean pastures so that their natural biofiltering processes will scrub the surface ocean clean of mercury in a short time. Here's how <http://russgeorge.net/2014/...>

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Jbar → russ george · 10 months ago

If the ocean gets scrubbed of mercury and all these industrial activities releasing it didn't start in large scale more than two centuries ago, then why wasn't the baseline level close to zero? Something smells high-mercury fishy.

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downwinder — I think Uncle Al's implicit point is that he is entitled to bray like a jackass wherever it suits "him".

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Dave — Conservatives are allergic to science.

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