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News

Carbon-capture scheme could cause toxic blooms

Findings raise more concerns over proposals to boost plankton growth in the oceans.

Brian Vastag

The controversial idea of adding iron to the oceans to help suck up atmospheric carbon dioxide faces yet another hurdle, with the finding that the extra iron may spark blooms of toxic plankton.

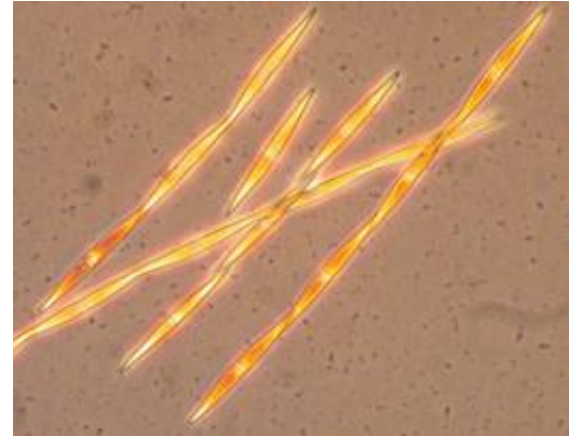
The finding, from a team led by ecologist Charles Trick of the University of Western Ontario in London, Canada, further dampens the prospects for schemes to boost the growth of CO₂-consuming organisms in surface waters.

"This is a real reminder that while we think we understand what's going on in the environment, we really don't," says Trick. "There's uncertainty with every large-scale experiment we do."

Trick and his colleagues found the neurotoxin domoic acid in samples of seawater from a site in the North Pacific, where iron-fertilization experiments have been conducted¹. Shipboard experiments by the team confirmed that adding iron increased production of the toxin by plankton of the genus *Pseudonitzschia*, they report in *Proceedings of the National Academy of Sciences USA*¹.

Domoic acid accumulates in shellfish and is a neurotoxin in birds and mammals, causing a condition called amnesic shellfish poisoning in humans. Blooms of *Pseudonitzschia* off the US west coast frequently prompt government agencies to shut down shellfish fisheries in the spring and summer. Scientists who study the blooms have blamed domoic acid for sea lion deaths, and they also speculate that the toxin may have caused an incident of frenzied bird behaviour in northern California in 1961. Local resident Alfred Hitchcock later used the event as research material for his classic 1963 film *The Birds*.

Blooming fears



Fertilizing the oceans with iron could spark the growth of toxic *Pseudonitzschia*.

B Bill / NOAA

In 2006 and 2007, Trick and his colleagues collected seawater at various depths from a research site south of Alaska. They found domoic acid in the seawater, from which they also isolated two species of *Pseudonitzschia*. The team grew the plankton in on-board incubators, spiking some of the tanks with iron. The abundance of the plankton and concentrations of domoic acid increased relative to tanks that had no iron added to them. Adding trace amounts of copper further pushed up the production of domoic acid. From these results, Trick and his team estimate that proposed large-scale ocean iron enrichment could produce domoic acid in concentrations that might be high enough to shut down coastal fisheries.

"It doesn't surprise me," says David Caron, a marine biologist at the University of Southern California, Los Angeles, who was not involved in the study. "In the majority of iron-enrichment experiments, *Pseudonitzschia* has come up in abundance. It's not unreasonable that sooner or later you're going to find domoic acid."

Two previous studies reported no domoic acid in seawater collected from open ocean iron-fertilization sites^{2,3}, but Trick says that both studies had methodological problems. "They never had much of a chance to get a positive hit because the [plankton] cells were compromised," he says.

Toxic crockpot

Oceanographer John Martin first proposed iron fertilization as a carbon sequestration strategy in the 1980s⁴. Since then, several large experiments have tested the theory that iron can induce blooms of plankton that soak up atmospheric CO₂. However, recent reports demonstrate that such schemes would sequester far less carbon than their proponents suggest⁵.

Still, several companies have sprung up to sell carbon credits in exchange for large-scale open-ocean iron dumping. One of the firms, Planktos, postponed their iron-fertilization plans indefinitely in 2008. However, Climos, another carbon-sequestration company based in San Francisco, California, is still pushing forward with the idea. Climos founder and chief executive Dan Whaley declined to discuss the company's plans, but says: "We need to study the spectrum of blooms, both natural and artificial, to see in what cases and scenarios domoic acid is produced."

Although all of the proposed iron-dumping sites are far away from active fisheries, Trick warns that "we might

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just be making this crockpot of toxic algae ready to move into new zones" — for example, by moving it in the ballast water used in cargo ships.

References

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