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Climate 'fix' could poison sea life

By Richard Black
Environment correspondent, BBC News

The scientific team deployed their instruments in open water

Fertilising the oceans with iron to absorb carbon dioxide could increase concentrations of a chemical that can kill marine mammals, a study has found.

Iron stimulates growth of marine algae that absorb CO2 from the air, and has been touted as a "climate fix".

Now researchers have shown that the algae increase production of a nerve poison that can kill mammals and birds.

Writing in Proceedings of the National Academy of Sciences, they say this raises "serious concern" over the idea.

The toxin - domoic acid - first came to notice in the late 1980s as the cause of amnesiac shellfish poisoning.

It is produced by algae of the genus *Pseudonitzschia*, with concentrations rising rapidly when the algae "bloom".

> **"If the end goal is to use it to fight climate warming, then we have to understand the consequences for marine life"**
>
> Dr William Cochlan
> San Francisco State University

Now, its presence in seawater often requires the suspension of shellfishing operations, and is regularly implicated in deaths of animals such as sealions.

Domoic acid poisoning may also lie behind a 1961 incident in which flocks of seabirds appeared to attack the Californian town of Capitola - an event believed to have shaped Alfred Hitchcock's interpretation of Daphne du Maurier's The Birds in his 1963 thriller.

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Over the last decade, about 10 research projects have investigated iron fertilisation, with mixed results.

But only two of them measured domoic acid production, and only then as an afterthought, explained William Cochlan from San Francisco State University, a scientist on the new project.

"We had a number of major aims in this work; but one of them was to ask 'do you normally find the species of algae that produce domoic acid, are they producing domoic acid, and will production be enhanced by iron?'," he said.

In studies conducted around Ocean Station Papa, a research platform moored in the north-eastern Pacific Ocean, the answers to all three questions turned out to be "yes".

Satellites can spot phytoplankton blooms in the process of formation

Pseudonitzschia algae were present naturally; they were producing domoic acid, and experiments showed that production increased during fertilisation with iron and copper.

Also, under iron-rich conditions, the *Pseudonitzschia* algae bloomed at a rate faster than other types.

The levels of domoic acid in iron-enriched water samples were of the same order as those known to cause poisoning in mammals in coastal waters.

Ailsa Hall, deputy director of the Sea Mammal Research Institute at St Andrews University in Scotland, said that domoic acid poisoning was already becoming a regular occurrence in some parts of the world.

"Ever since 1998 we've seen regular episodes of mass mortality and seizures in sea lions on the US west coast," she said.

The toxin accumulates in animals such as fish that are themselves immune.

"We've seen it in seals, pelicans and harbour porpoises; it does depend on how much they eat, but if a sea lion or a pelican eats its way through a school of contaminated anchovies, then that would be enough," Dr Hall told BBC News.

Domoic acid's effect on other species was unknown, she said, but it would be reasonable to think it would also affect marine mammals such as whales.

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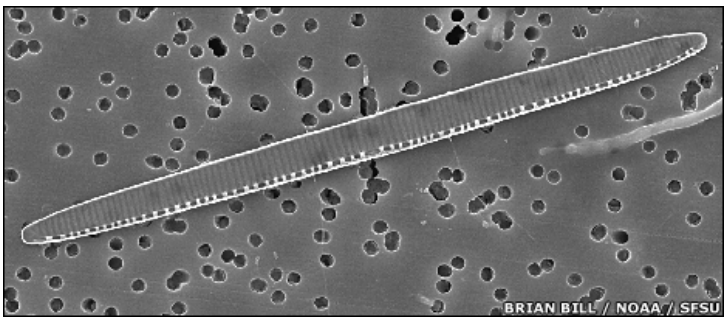

The poison producer - *Pseudonitzschia turgidula*

Whether iron fertilisation ever will be deployed as a "climate fix" is unclear.

The last major investigation - last year's Lohafex expedition - found that despite depositing six tonnes of iron in the Southern Ocean, little extra CO2 was drawn from the atmosphere.

Nevertheless, one company - Climos - aims eventually to deploy the technique on a commercial basis.

A Climos spokesman agreed that further research on domoic acid production was needed.

"Moving forward, we need to understand exactly how deep-ocean phytoplankton respond to iron, be it naturally or artificially supplied; whether and in what situations domoic acid is produced, and how the ecosystem is or is not already adapted to this," he said.

For William Cochlan's team, the potential impact on sea life is something that regulators and scientists must take into account when deciding whether to allow further studies or deployment.

"We saw some literature going around with claims like 'there is no indication of toxicity to sea life' - well, if you don't measure it, of course there's no indication, and we have to keep that kind of legalese out of science," he said.

"If the end goal is to use it to fight climate warming, then we have to understand the consequences for marine life."

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