Researchers discover that 'red tide' species is deadlier than first thought

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A University of Connecticut researcher and his team have discovered that a species of tiny aquatic organism prominent in harmful algal blooms sometimes called "red tide" is even deadlier than first thought, with potential consequences for entire marine food chains.

Professor Hans Dam and his research group in the school's Department of Marine Sciences have discovered that the plankton species *Alexandrium tamarense* contains not one but two different types of toxins, one that's deadly to large organisms and one that's deadly to small predators.

"If it's killing multicellular animals with one toxin and small protists with another, it could be the killer of the ocean world," he says.

Dam speculates that this ability to harm both large and small oceanic predators could lead to disruptions in the marine food web during large *Alexandrium* blooms, like the red tide that occurred along the Northeast coast in 2005, severely affecting the Cape Cod area.

"These small predators that are being affected by the reactive oxygen species are the things that typically eat large amounts of the algae and keep them from growing like crazy," says Dam. "This brings up a whole new line of inquiry for us: What will actually control these algae in the future?"

In small numbers, *Alexandrium* are virtually harmless to humans, says

Dam. But when they're eaten by other clams, mussels or other microorganisms - which are then eaten by small crustaceans, which are in turn eaten by larger crustaceans or fish - the toxins can build up in large amounts. So in some parts of the world, eating contaminated shellfish, such as lobsters, clams and fish, has led to illness or death.

However, says Dam, that toxin only affects animals that have central nervous systems.

"This toxin blocks sodium channels in anything that has a well-developed nervous system," he says. "But most of the organisms in the ocean are not those kinds of organisms. They're single-celled, similar to the algae themselves, and they don't have a well-developed nervous system."

Scientists had begun to notice that even though *Alexandrium*'s toxin isn't supposed to affect single-celled animals, when the algae was in the vicinity of some of its one-celled predators, some of those predators got sick and died. Dam's post-doctoral researcher Hayley Flores showed in laboratory experiments that in fact the alga produces a different toxin, called a reactive oxygen species, that kills their predators by popping their cell membrane.

"If you only have one cell, lysing your cell membrane is all it takes to kill you," says Dam. "This new mechanism of toxicity, combined with the other, is pretty evil."

Dam notes that although harmful algal blooms have been linked to human activities, such as pollution runoff from rivers, there are many different factors that could affect the blooms, and scientists still aren't sure exactly how they begin. He speculates that the algae may have become more toxic over time, which has led to their proliferation.

His group will next try to understand how the alga produces the reactive

oxygen species and whether it also affects animals multicellular animals. He's also working with researchers at the University of Los Lagos in Chile to understand how *Alexandrium* may affect important commercial species such as salmon and king crab

"The amazing thing is, when you look at these algae under a microscope, they're so beautiful - but they're so deadly," says Dam. "We call them the beautiful assassins."

Provided by University of Connecticut

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