

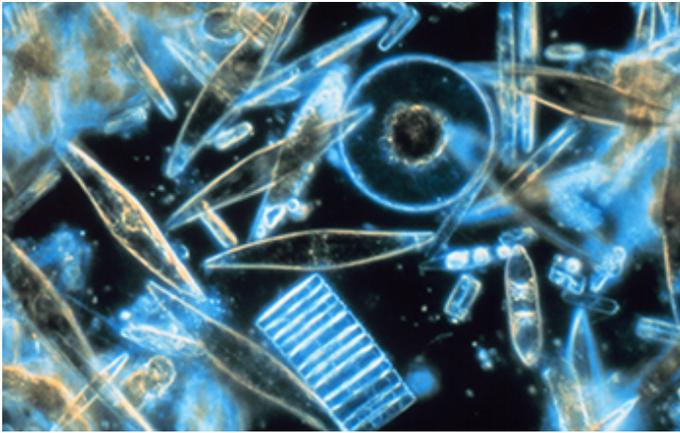


National Science Foundation
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SMALL MARINE ORGANISMS' BIG CHANGES COULD AFFECT WORLD CLIMATE

Warmer future oceans could cause phytoplankton to thrive near poles, shrink in tropics



Plankton (diatoms) among crystals of annual sea ice in McMurdo Sound, Antarctica.

Credit and Larger Version

October 25, 2012

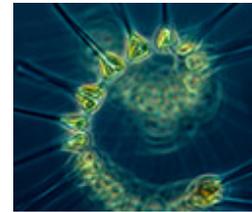
In the future, warmer waters could significantly change ocean distribution of populations of phytoplankton, tiny organisms that could have a major effect on climate change.

Reporting in this week's online journal *Science Express*, researchers show that by the end of the 21st century, warmer oceans will cause populations of these marine microorganisms to thrive near the poles and shrink in equatorial waters.



Blooms of phytoplankton off the coast of New Zealand in October, 2009, form sea-swirls.

Credit and Larger Version



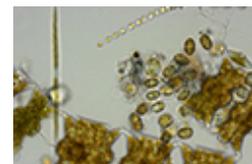
Phytoplankton in a dark sea; countless numbers drift through the world's oceans.

Credit and Larger Version



Two *Odontella aurita* diatoms floating in the wide, wide sea.

Credit and Larger Version



"In the tropical oceans, we are predicting a 40 percent drop in potential diversity, the number of strains of phytoplankton," says Mridul Thomas, a biologist at Michigan State University (MSU) and co-author of the journal paper.

"If the oceans continue to warm as predicted," says Thomas, "there will be a sharp decline in the diversity of phytoplankton in tropical waters and a poleward shift in species' thermal niches--if they don't adapt."

Thomas co-authored the paper with scientists Colin Kremer, Elena Litchman and Christopher Klausmeier, all of MSU.

"The research is an important contribution to predicting plankton productivity and community structure in the oceans of the future," says David Garrison, program director in the National Science Foundation's (NSF) Division of Ocean Sciences, which funded the research along with NSF's Division of Environmental Biology.

"The work addresses how phytoplankton species are affected by a changing environment," says Garrison, "and the really difficult question of whether adaptation to these changes is possible."

The MSU scientists say that since phytoplankton play a key role in regulating atmospheric carbon dioxide levels, and therefore global climate, the shift could in turn cause further climate change.

Phytoplankton and Earth's climate are inextricably intertwined.

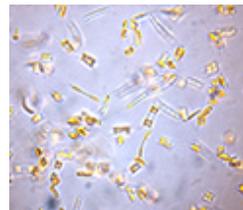
"These results will allow scientists to make predictions

about how global warming will shift phytoplankton species distribution and diversity in the oceans," says Alan Tessier, program director in NSF's Division of Environmental Biology.

"They illustrate the value of combining ecology and evolution in predicting species' responses."



A mix of plankton in a water sample taken in winter-spring from Long Island Sound. **Credit and Larger Version**



The diatom, *Attheya longicornis*, in water from the Barents Sea. **Credit and Larger Version**



The research results are described in the Oct. 26, 2012, issue of the journal *Science*. **Credit and Larger Version**

The microorganisms use light, carbon dioxide and nutrients to grow. Although phytoplankton are small, they flourish in every ocean, consuming about half of the carbon dioxide emitted into the atmosphere.

When they die, some sink to the ocean bottom, depositing their carbon in the sediment, where it can be trapped for long periods of time.

Water temperatures strongly influence their growth rates.

Phytoplankton in warmer equatorial waters grow much faster than their cold-water cousins.

With worldwide temperatures predicted to increase over the next century, it's important to gauge the reactions of phytoplankton species, say the scientists.

They were able to show that phytoplankton have adapted to local temperatures.

Based on projections of ocean temperatures in the future, however, many phytoplankton may not adapt quickly enough.

Since they can't regulate their temperatures or migrate, if they don't adapt, they could be hard hit, Kremer says.

"We've shown that a critical group of the world's organisms has evolved to do well under the temperatures to which they're accustomed," he says.

But warming oceans may significantly limit their growth and diversity, with far-reaching implications for the global carbon cycle.

"Future models that incorporate genetic variability within species will allow us to determine whether particular species can adapt," says Klausmeier, "or whether they will face extinction."

-NSF-

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