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## Ocean plants show effects of warming

Star-Bulletin staff  
[citydesk@starbulletin.com](mailto:citydesk@starbulletin.com)

University of Hawaii researchers are reporting that tiny ocean plants called phytoplankton can be affected by global warming, according to a study published recently in Nature magazine.

The increase in ocean temperature produced by global warming causes less dense warm water at the surface to rise and limits the mixing with the colder water found deeper in the ocean. The analysis suggests that reduced vertical mixing could cause the deep water layers of phytoplankton to oscillate and shift, the University of Hawaii reported in a news release.

The discovery that the layers of phytoplankton are unstable during climate shifts indicates that the plankton can inspire further warming, the news release continued. The results could come as a surprise to scientists who had generally assumed that these plankton bands were relatively stable.

The study was conducted by microbial biologist and oceanographer David Karl from the School of Ocean and Earth Science and Technology, along with colleagues from the Netherlands. They used climate models to correlate with observations at Station Aloha, a site about 62 miles north of Hawaii where physical, biological and chemical measurements of the water column have been taken for the past 20 years.

"Deep chlorophyll layers have been known to occur in the sea for nearly a century, though we are not absolutely certain why they form, what sustains them and what temporal dynamics, if any, they have," Karl said.

"The lack of vertical mixing in the ocean due to climate variability and greenhouse gas-induced warming are already upon us," Karl continued. "We are effectively in the middle of a large, global-scale experiment with only a very basic and incomplete understanding of the processes and controls of ocean plankton dynamics. What will happen when the surface ocean changes its acidity? What will happen when human activities and land use practices begin to influence the amount of fixed nitrogen entering the coastal zone or the amount of iron-rich dust in the atmosphere? These are important, unresolved questions that will need to be addressed."

**School of Ocean, Earth Science, and Technology**  
University of Hawaii at Manoa

[www.soest.hawaii.edu](http://www.soest.hawaii.edu)

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