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Vital Marine Plant Life at Risk

By GAUTAM NAIK

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Virgin Islands National Park in the U.S. Virgin Islands. Researchers have found that rising sea temperatures pose

Rising sea temperatures can harm the tiny plant life that forms the base of the oceans' food chain as well as affect the diversity of marine life, two new studies have found.

Over the years, humans have affected the oceans by pollution and over-fishing and through habitat alteration caused by dredging and other activities. Less understood is the role of higher sea temperatures, which many scientists believe is linked to global climate change. Scientists estimate that the oceans have warmed a total of roughly half a degree Celsius on average over the past 100 years.

Researchers have long debated whether phytoplankton concentrations have increased or declined. The algae have flourished in many coastal areas because increased runoff from rivers brings nutrients that the algae gorge on. However, no one has properly assessed whether

a threat to essential algae.

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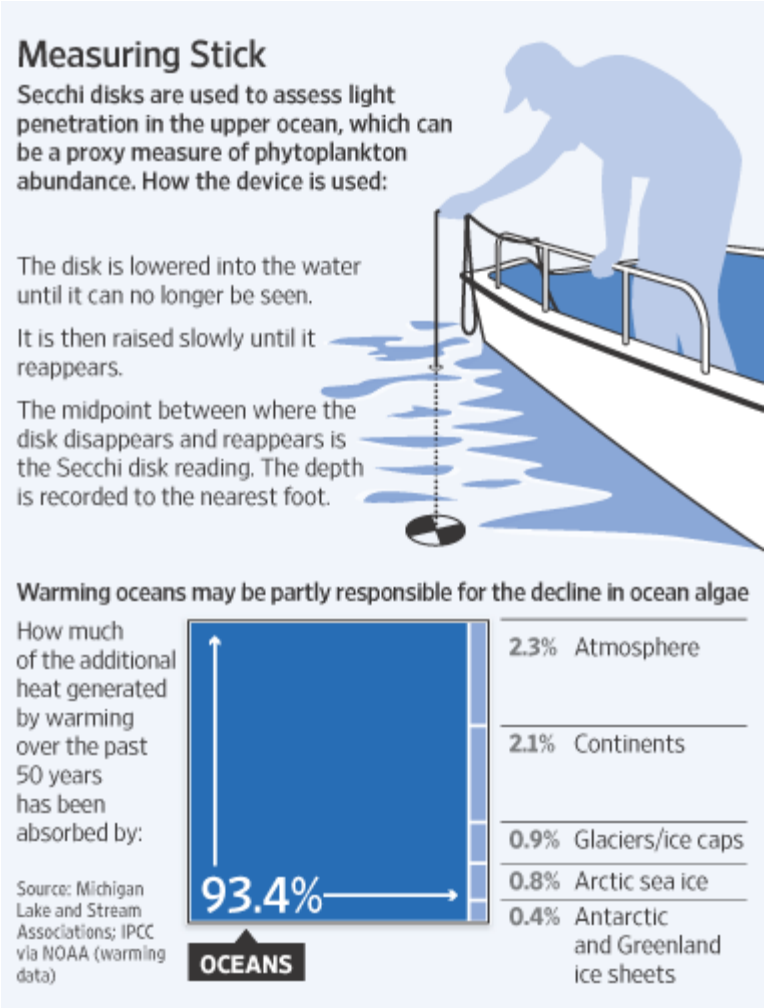
Marine diatom cells (Pleurosigma), a group of phytoplankton

the global oceans are losing or gaining phytoplankton, which forms the base of the marine food chain, from crustaceans to fish and ultimately to humans.

Consistent satellite-based measurements exist only from 1997, so scientists at Dalhousie University in Nova Scotia, Canada instead used data obtained with a simple oceanography device known as a Secchi. Used by scientists since the late 1800s, a Secchi is a disk lowered into the water to provide an estimate of water clarity and thus serves as a proxy measure of phytoplankton abundance.

By collating and analyzing about half a million Secchi observations, plus other direct measurements of algae, the Dalhousie team estimated that phytoplankton levels declined by about 1% of the global average each year from 1899 onward. The data are more reliable for recent decades, translating into a 40% decline in algae since 1950.



The team investigated several factors that could have caused the decline, including wind intensity, cyclical climate changes and sea-surface temperature. "We found that temperature had the best power to explain the changes," said Boris Worm, a marine biologist at Dalhousie and co-author of the study.

Marine algae live in the upper layers of the ocean but rely on nutrients that circulate up from lower layers. Rising temperatures mean the different water layers mix less with each other, so fewer nutrients reach the algae. However, Dr. Worm notes that algal abundance can be affected by other factors, such as shifts in predator-prey populations.

Mike Behrenfeld, an expert on phytoplankton who has read the Nature paper, said it was similar to a 1992 study which also used Secchi data to show a long-term decline in marine algae in the north Pacific. "But this paper covers the globe," said Dr. Behrenfeld of Oregon State University. "And the scientists also took the next step of relating the [algal decline] to sea temperatures."

Another team of scientists, including Dr. Worm, mapped the diversity of marine life on a broad scale. One surprise finding was that while coastal marine species showed greater diversity at the equator, the diversity of oceanic species peaked in the mid-latitudes. That's unlike terrestrial diversity, which largely peaks at the tropics.

The researchers also analyzed possible links between the global distribution of 11,000 marine species—big and small—to such environmental factors as temperature, oxygen levels and habitat availability. For all species types, only one factor showed a consistent correlation to diversity: sea temperature.

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It's not clear what this means globally, however. When the water warms, some species may move elsewhere, reducing the diversity of their original habitat. Creatures that can't move may come under environmental stress or die off, also altering the ecosystem.

"While a changing climate is likely to lead to a change in patterns of diversity, we don't have the data yet to know what this response might look like," said Derek P. Tittensor, marine ecologist at Dalhousie and co-author of the second Nature paper, which analyzed marine diversity.

Meanwhile, other scientists are trying to assess how sea creatures respond to declining oxygen levels, caused by pollution or natural factors. Most of the 400 oxygen-depleted "dead zones" identified by scientists so far are near areas of human impact. Together, they cover an area of 96,500 square miles.

When oxygen levels drop, animals in the area fight for what's left, and many don't survive. A team of scientists from the University of Vienna lowered a plexiglass box to the Adriatic sea floor and used a time-lapse camera to document how various creatures inside responded as oxygen levels dropped.

A future catalog of such behaviors could help scientists identify areas in the ocean where oxygen depletion is under way. Some of the results will be published in Marine Ecology Progress Series, a scientific journal.

Write to Gautam Naik at gautam.naik@wsj.com