Past events reveal how future warming could harm cold-water corals

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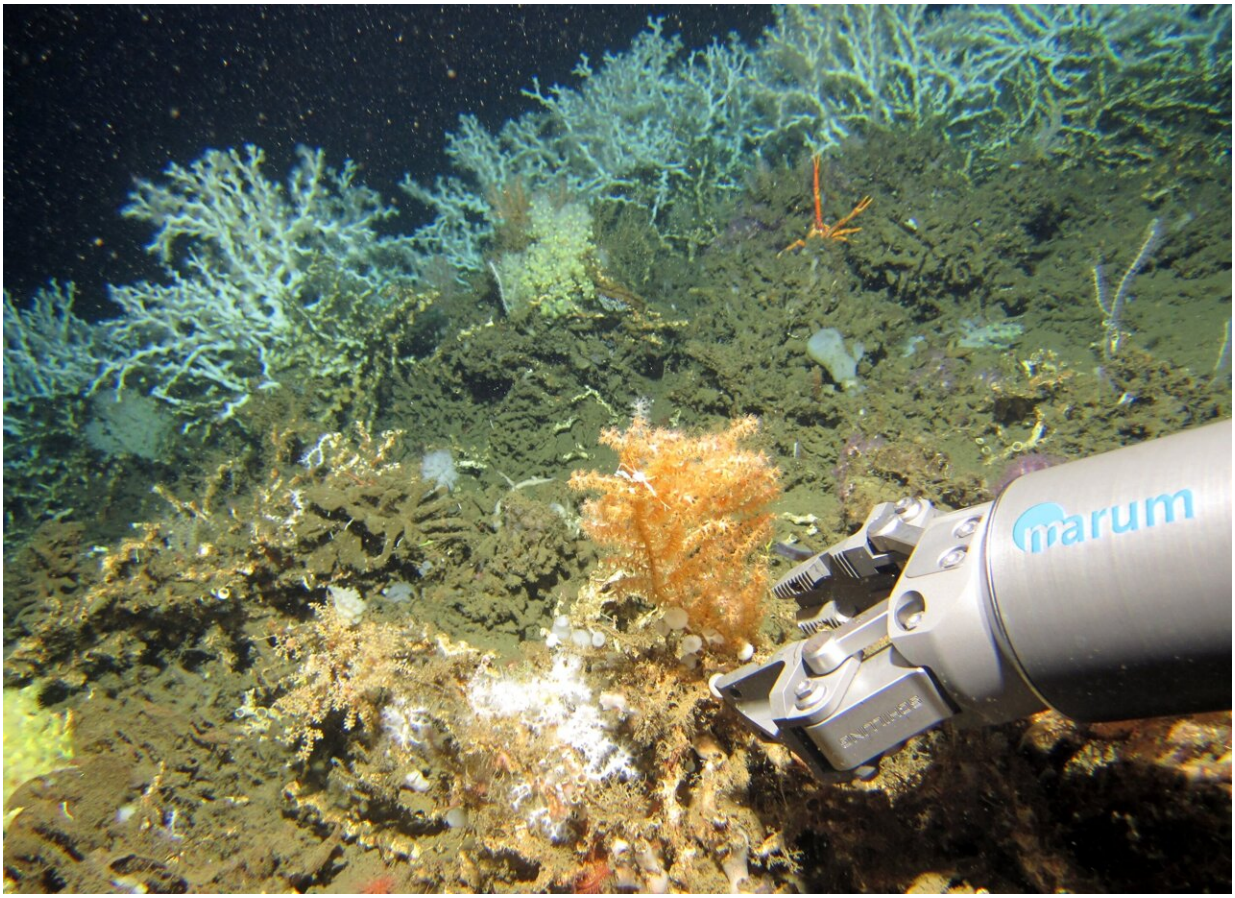

Sampling of cold-water corals in the deep Atlantic Ocean by the MARUM ROV Squid, Bremen, Germany. Credit: Dierk Hebbeln and Claudia Wienberg (CC-BY 4.0, https://creativecommons.org/licenses/by/4.0/)

How will future warming of the planet impact cold-water corals? A new analysis of ancient evidence from the last major global warming event identifies food and oxygen supply as key environmental factors that influence the vitality of cold-water corals in the North Atlantic Ocean and the Mediterranean Sea. Rodrigo da Costa Portilho-Ramos of the University of Bremen, Germany, and colleagues present these findings in the open-access journal *PLOS Biology* on May 19.

Much like tropical corals in shallower waters, cold-water corals serve as crucial "engineers" of deep-sea reefs and mounds that are home to rich, unique ecosystems. As climate change progresses, researchers predict, cold-water corals are likely to face harm from such factors as rising ocean temperatures, decreased food supply, lower oxygen levels, and ocean acidification. However, no extinctions of cold-water coral ecosystems have been documented in real-time, so the precise factors that may determine their fate have been unclear.

To shed new light, Portilho-Ramos and colleagues turned to ancient evidence of past climate change as captured in seafloor sediments. They analyzed sediments collected at or near six sites of cold-water coral ecosystems in the North Atlantic Ocean and the Mediterranean Sea, applying standard techniques to reconstruct ocean conditions and the abundance of the common coral species Lophelia pertusa over the last 20,000 years. This period encompasses Earth's last major global warming event.

The analysis revealed that ancient L. pertusa abundance was most strongly influenced by changes in food supply, delivered either vertically from shallower depths or by lateral water flow along the seafloor. Low oxygen concentration also appeared to be a key stressor for L. pertusa. Meanwhile, changes in ocean temperature and salinity did not appear to be significantly associated with proliferation or disappearance of L. pertusa over time.

These findings suggest that climate change-driven alterations to ocean processes that affect food and oxygen supplies may play key roles in the future health of cold-water coral ecosystems. In some cases, the data suggest, high abundance of food may compensate for low oxygen levels.

The authors call for future research to further explore the role of food supplies and to consider ocean acidification, which could not be captured in this study.

Portilho-Ramos adds, "Marine sediment records from the North Atlantic and the Mediterranean Sea reveal that events of growth and mortality of cold-water corals induced by climatic changes over the last 20,000 years were mainly triggered by food supply controlled by export production and turbulent hydrodynamics rather than by changes in the bottom-water temperature. Therefore, climate-driven changes in oceanic processes concerning food supply are also likely to be the determining factors of life and death of cold-water coral species in the coming decades."

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