

Life in the ocean's 'twilight zone' could disappear due to the climate crisis

By [Ashley Strickland](#), CNN

Published 7:09 AM EDT, Fri April 28, 2023



Footage shows pristine coral reef discovered in ocean's 'twilight zone'

CNN —

One of Earth's largest habitats could see its rich diversity of life reduced by the end of the century due to the climate crisis.

The ocean's mesopelagic zone, also called the "twilight zone," is located between 656 feet and 3,280 feet (200 meters to 1,000 meters) below the surface.

The marine region, which accounts for approximately a quarter of the ocean's volume, is home to billions of metric tons of organic matter and some of Earth's most stunning biodiversity, despite being beyond the reach of sunlight.

The twilight zone also a crucial habitat for marine life that dives in search of prey, like sharks, or lanternfish that hide in the twilight zone during the day and swim to the surface waters to feed at night.



Small crustaceans known as *Megacalanus princeps* live in the ocean's twilight zone at a depth of 1,000 meters in the Northeast Atlantic.

Natural Visions/Alamy Stock Photo

New research warns that the climate crisis could reduce life in the twilight zone between 20% and 40% by the end of the century. And if greenhouse gas emissions continue, the researchers estimate that the ocean region's life could be severely depleted within 150 years — and recovery may not be possible for thousands of years.

Ancient warm oceans

Paleontologists and ocean scientists teamed up to study the impacts on the ocean's twilight zone during previous ancient warming events in order to predict how the habitat may respond in the future due to global warming. The research team studied cores taken from the seafloor that included evidence of preserved microscopic shells from plankton.

Over time, the calcium carbonate shells accumulate on the seafloor, preserving information about what the environment was like during their lifetime. The tiny shells effectively create a timeline of how the ocean has changed over millions of years.

A study detailing the findings was published Thursday in the journal [Nature Communications](#).

“We still know relatively little about the ocean twilight zone, but using evidence from the past we can understand what may happen in the future,” said lead study author Dr. Katherine Crichton, a postdoctoral research fellow at the University of Exeter in the United Kingdom, in a statement.

The researchers focused on two warm periods that occurred 15 million years ago and 50 million years ago, where even ocean temperatures were “markedly warmer than today,” according to the study.

“We found that the twilight zone was not always a rich habitat full of life,” said study coauthor Paul Pearson, an honorary professor at Cardiff University in the United Kingdom, in a statement. “In these warm periods, far fewer organisms lived in the twilight zone, because much less food arrived from surface waters.”

Particles of organic matter from the ocean’s surface drift down and serve as one of the main food sources for life in the twilight zone. But past warming events caused the material to be degraded more quickly by bacteria, so less of it reached the ocean region.

Warmer ocean temperatures also increase the metabolic rates of organisms, leading to increased food demand and oxygen consumption, according to the study.

“The rich variety of twilight zone life evolved in the last few million years, when ocean waters had cooled enough to act rather like a fridge, preserving the food for longer, and improving conditions allowing life to thrive,” Crichton said.



In the ocean's twilight zone, this diver is discovering vibrant new species

Luiz A. Rocha, curator and Follett Chair of Ichthyology at the California Academy of Sciences, worries that changes are underway that haven’t been detected because the twilight zone is so understudied, largely due to a disconnect between funding and the costs of exploring this region.

Rocha, who was not involved in the study, researches the twilight zone and the mesophotic zone just above it, located between 98 and 492 feet (30 and 150 meters) below the surface.

“There are no baseline data to compare what we are measuring against, so this study that looks at the composition of the fossil record over time is one of the few ways we can try to understand how we are causing the twilight zone to change,” Rocha said.

Predicting the future

Based on what they discovered from the ancient warming events, the researchers combined that data with Earth system model simulations — modeling of Earth's carbon cycle as it moves through the land, sea and atmosphere.



Ocean census aims to discover 100,000 previously unknown marine species

The team's work revealed what is currently occurring in the twilight zone and how that might change in the future across decades, centuries and even millennia as the world warms.

“Our findings suggest that significant changes may already be under way,” Crichton said. “Unless we rapidly reduce greenhouse gas emissions, this could lead to the disappearance or extinction of much twilight zone life within 150 years, with effects spanning millennia thereafter. Even a low-emissions future may have a significant impact, but that would be far less severe than medium- and high-emissions scenarios. Our study is a first step to finding out how vulnerable this ocean habitat may be to climate warming.”

The researchers used three emissions scenarios based on the total carbon dioxide emissions after 2010.

The low estimate was 625 billion metric tons, medium was 2,500 billion metric tons and high was 5,000 billion metric tons.



'What we know now is how much we don't know': Enter the strange world of the ocean twilight zone

The Global Carbon Budget estimates that the total global carbon dioxide emissions in 2022 was 40.6 billion metric tons. Yearly emissions have been close to that number each year since 2010, so the researchers noted that the low-estimate scenario they used has already been emitted.

The team thinks the medium emissions scenario will have been reached in about 50 years, and the high estimate in just over a century.

“The twilight zone plays an important role in the ocean’s carbon cycle because most of the carbon dioxide taken up by phytoplankton ends up there as their remains sink down from the surface ocean,” said study coauthor Jamie Wilson, a postdoctoral researcher at the UK’s University of Liverpool, in a statement.

INTERACTIVE: See what’s at risk of disappearing on Earth

“One of the challenges of predicting how this movement of carbon might change in the future is that there are many processes to disentangle in the modern ocean. By looking back at the twilight zone in past warm periods we can identify the most important processes and use those to predict the future. We found that this natural cycling of carbon is likely already changing and may be perturbed long into the future.”

The climate crisis has impacted Earth’s oceans in the form of pollution, warming, deoxygenation, acidification and overfishing, according to the study. These effects have caused conservationists to consider different protective efforts, such as restricting harmful activities in the oceans.

Protecting the twilight zone will be difficult since typical conservation efforts, such as preventing fishing or deep-sea mining, can’t apply there, Rocha said.

“A marine protected area for the (twilight zone) makes very little sense because the impacts that are affecting it are global in nature,” he said. “What we really need to protect the (twilight zone) is to stop, or at least slow down, the high rate of change that we are subjecting our planet’s climate to.”