

Patagonia's coast offers cool refuge for giant kelp

June 2 2022



Most kelp forests around the world's coastlines are struggling due to climate change, but a swath of kelp forest in Patagonia has been thriving. Its success is thanks to marine cold spells, according to a new study in AGU's *Journal of Geophysical Research-Oceans*. Credit: NOAA

Giant kelp forests around the world have struggled to stay healthy in recent decades, with some vanishing altogether. But along Patagonia's rugged southwestern coast, giant kelp are thriving, showing remarkable stability for almost 200 years. New research suggests frequent marine cold spells could help keep kelp happy.

The researchers found that the southwestern [giant kelp](#) forests haven't

experienced an extreme marine heat wave since 1984 and, in fact, the area has had regular marine cold spells that are growing more intense. From 2014 to 2019, the region saw more severe and extreme cold spells than over the rest of the study period. Glacial melt and increased wind activity could explain these quick, localized cooling events.

Giant [kelp forests](#) are found along a quarter of coastlines from the equator to the [high latitudes](#), and are critical species for their ecosystems, which are among the world's most productive and biodiverse. Heat waves can drive changes in what other species are around, such as [sea urchins](#) and the [sea otters](#) who snack on them in the Northern Hemisphere; if the otters disappear, urchins can overgraze the kelp forests. High sea temperatures can also stress the kelp directly, as they're best adapted for cooler waters. In central and northern Chile, unregulated direct harvesting by humans is devastating kelp forests. These threats have degraded many kelp forests over recent decades and led to losses of 2% of kelp forests every year.

Yet Patagonia's [giant kelp forests](#), on the southern tip of Chile, look just as they did the in early twentieth century, according to marine geographer Alejandra Mora-Soto, lead author of the new study, which was published today in AGU's *Journal of Geophysical Research: Oceans*. In her previous work, Mora-Soto compared nautical charts as far back as Charles Darwin's Beagle expedition to modern satellite imagery of kelp and found little had changed, despite [climate change](#) and human influence.

"It's a very persistent ecosystem, so the question was, 'Why has this particular kelp forest survived so long?'" said Mora-Soto, who is currently affiliated with the University of Victoria in British Columbia but completed this research while at the University of Oxford.

To find out, Mora-Soto and colleagues analyzed [sea surface](#)

[temperatures](#) from the southernmost 800 miles of South America's coastlines from 1981 to 2020. They were looking for marine [heat waves](#) and cold spells. While heat waves stress kelp forests, they wondered what impact cold spells have.

"Glacial melting means more cold water entering the ocean environment. This can create very short peaks in cool temperatures, from a few days to two to three weeks," said Mora-Soto. Cool waters can act like air conditioning for the kelp, regulating their environment and keeping temperatures comfortable. Wind patterns that affect ocean surface circulation and heat fluxes, or cold water traveling around Antarctica could also be factors, she added.

"The heat wave story has emerged over the last ten years, but the cold spell story hasn't been told. I think that's quite interesting to think about in terms of kelp resilience," said Kira Krumhansl, a marine ecologist at the Bedford Institute of Oceanography who was not involved in the new study. "It's neat to understand that there's a different climate signal here, where the climate is not warming as rapidly and waters are staying closer to temperatures the kelp can tolerate. It appears to be leading to their resilience and persistence."

Keeping kelp happy

The outlook for these kelp forests may stay bright, at least for the immediate future. Current climate and ocean models predict the Southern Ocean, the waters in which these thriving kelp forests live, will avoid warming dramatically. But as [glacial melt](#) increases, that freshwater can bring with it sunlight-blocking sediment, different sets of nutrients, and even too-cold temperatures.

"If there's ice in the system, that could be very stressful for kelp," Mora-Soto said. Scientists don't yet have well-defined windows for how long

different kelp species can tolerate extremely cold water.

Mora-Soto stressed the need for protecting these uniquely successful kelp forests. "In Southern Patagonia, most of the lands surrounding the kelp forests are protected, but not necessarily the waters," she said. "And in the northern regions of Chile, kelp forests are harvested for the alginate industry, creating underwater deserts in environmentally favorable conditions. I hope environmentalists, NGOs, local communities and the current government can help make the protection of kelp something real."

"I think we're at the cusp of learning more and more about what value kelp forests have for humans," said Krumhansl. "They tend to be underappreciated, but they are amazing ecosystems, just beautiful to be in. And they provide a lot of benefits with focusing on and protecting."

More information: A. Mora-Soto et al, A Song of Wind and Ice: Increased Frequency of Marine Cold-Spells in Southwestern Patagonia and Their Possible Effects on Giant Kelp Forests, *Journal of Geophysical Research: Oceans* (2022). [DOI: 10.1029/2021JC017801](https://doi.org/10.1029/2021JC017801)

Alejandra Mora-Soto et al, One of the least disturbed marine coastal ecosystems on Earth: Spatial and temporal persistence of Darwin's sub-Antarctic giant kelp forests, *Journal of Biogeography* (2021). [DOI: 10.1111/jbi.14221](https://doi.org/10.1111/jbi.14221)

Provided by American Geophysical Union

Citation: Patagonia's coast offers cool refuge for giant kelp (2022, June 2) retrieved 26 June 2024 from <https://phys.org/news/2022-06-patagonia-coast-cool-refuge-giant.html>

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