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# Study: Denser kelp forests are better suited to survive ocean warming

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By Responsible Seafood Advocate

## Study provides first assessment of overall impact of kelp loss in Monterey Bay and offers insights into global kelp conservation

New research led by Monterey Bay Aquarium and the University of California, Santa Cruz, reveals that denser and more sheltered kelp forests can withstand serious stressors when faced with marine heatwaves caused by ocean warming.

The study, published in *Proceedings of the Royal Society B* (<https://royalsocietypublishing.org/doi/10.1098/rspb.2023.2749>), also offers a comprehensive assessment of how declines in kelp abundance affect marine algae, invertebrates and fish living in California's Monterey Bay. The study comes after a multi-year marine heatwave – the product of a 2014 “blob” of warm water prolonged by a 2015-2016 El Niño event – bathed the North American Pacific coast with sweltering sea temperatures.

A decade ago, three major challenges – a massive marine heatwave, a sea star die-off and a sea urchin outbreak – caused a sharp drop in kelp levels along California's central coast. Analyzing data spanning 14 years, researchers found that these events led to a 51 percent decline in kelp forest density on average in the years following the marine heatwave (2017–2020 compared to 2007–2013). By 2020,



New research reveals that denser and more sheltered kelp forests can withstand serious stressors amid ocean warming.

this decline had worsened to 72 percent. Despite this, some kelp forests managed to survive these extreme conditions.

“We found that larger stands of giant kelp prevented shifts in sea urchin foraging behavior, and these persistent forests were better at withstanding multiple stressors,” said Dr. Joshua Smith, the study’s lead author and Ocean Conservation Research Scientist at Monterey Bay Aquarium. “Something that surprised us was that persistent kelp forests were located in areas that are typically less productive. These persistent forests had a gradual reef slope and protection from wave exposure, which enabled them to become densely packed with kelp prior to the marine heatwave.”



(<https://globalseafood.typeform.com/podcastq124>).

Kelp has been declining worldwide for fifty years, dropping by about 1.8 percent annually. Since 2014, more than half of the ocean surface has faced extreme heat each year, putting cold-water species like kelp at risk due to ocean warming. As kelp forests and other marine ecosystems face growing threats from climate change, preserving these ecosystems and their predators, like sea otters, can help lessen the impacts of extreme events.

The study sought to understand the effects and resulting consequences of the marine heatwave and is part of Monterey Bay Aquarium's larger effort to understand kelp recovery and restoration mechanisms. Findings indicate that certain habitat features are crucial for keeping kelp alive. For instance, **[another study from Monterey Bay Aquarium \(https://www.montereybayaquarium.org/newsroom/press-releases/study-shows-sea-otters-helped-prevent-widespread-California-kelp-forest-declines-over-the-past-century\)](https://www.montereybayaquarium.org/newsroom/press-releases/study-shows-sea-otters-helped-prevent-widespread-California-kelp-forest-declines-over-the-past-century)** confirms that sea otters help by eating sea urchins, which can destroy kelp.

In places where kelp patches were less dense and more exposed, the sudden rise of sea urchins in 2014 led to many kelp forests becoming "barrens" – areas where sea urchins have eaten everything. The team looked at changes in species composition across the mosaic of barrens and persistent forests to untangle how kelp loss impacts the broader ecosystem.



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"While some kelp forests have endured, the structure of the ecological communities in the barren areas have yet to return to their pre-2013 state," Smith added. "Across the region, the number of species did not decline, but changes in their relative abundances led to an overall decline in species diversity, most notably for marine algae and kelp-associated invertebrates."

With less kelp and other macroalgae around, the study noted a disproportionate increase in animals that eat plankton, such as barnacles, scallops, tube snails and planktivorous fishes.

“This study offers important insights to help inform strategies for protecting areas where kelp can persist on its own, and siting for kelp restoration efforts, here in California and around the world,” said Dr. Pete Raimondi, a marine ecologist at UC Santa Cruz who was not a co-author on the study.

**[Read the full study here \(https://royalsocietypublishing.org/doi/10.1098/rspb.2023.2749\)](https://royalsocietypublishing.org/doi/10.1098/rspb.2023.2749)**.

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