UC SANTA BARBARA

THE Current

November 14, 2016
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# The Pulse of Underwater Forests

Like all marine ecosystems around the world, kelp forests are threatened by human activities. However, a new study reports that kelp ecosystems are in fact faring relatively well in the face of those dangers.

A working group from UC Santa Barbara's National Center for Ecological Analysis and Synthesis (NCEAS) collected nearly all of the existing kelp-monitoring data sets from around the world and analyzed them to identify long-term trends. The researchers, including marine ecologist Jennifer Caselle, sought to determine whether kelp forests — like corals, sea grasses and other key coastal ecosystem-forming species — are in decline. The findings appear in the Proceedings of the National Academy of Sciences.

"We were surprised to discover that while one-third of the kelp regions for which we had data are in decline, one-quarter of them are increasing in size," said Caselle, a research biologist at UCSB's Marine Science Institute and lecturer in the Department of Ecology, Evolution, and Marine Biology. "For the remainder we were unable to detect a signal. This shows that we simply cannot understand how global change will affect globally distributed taxa without understanding how global stressors interact with local human pressures and environmental conditions."

The international team of 37 scientists analyzed trends in kelp abundance from 34 regions of the globe, representing 1,138 sites that had been monitored over the past half century. Despite amassing such a comprehensive database, the scientists found little to no data for many regions of the globe, making it impossible to determine

whether kelp abundance is on an increasing or decreasing trajectory in those areas.

The investigators reported that while kelp in 38 percent of the analyzed regions showed clear declines, 27 percent of regions posted increases and 35 percent had no net change. However, the range of trajectories seen across regions far exceeded a small rate of decline — 1.8 percent per year — at the global scale.

The research team suggests that this variability reflects large regional differences in the drivers of local environmental change and that global factors associated with climate change vary by region, depending on the kelp species, the local environmental conditions and other sources of stress. This contrasts with many other species, such as corals and seagrasses, whose abundances are declining on the global scale. According to the scientists, this difference is likely in part due to the unique capacity of kelp to recover quickly from disturbances.

“Kelp is a rock star of resilience; in many places, it’s managed to hold its own against environmental change,” said co-author Jarrett Byrnes, a former postdoctoral associate at NCEAS who is now at the University of Massachusetts Boston. “Kelps may well not be the canary in the coal mine for the effects of global environmental change for our oceans. Rather, their loss may be a sign that we have finally tipped over the edge of a precipice.”

The team’s findings highlight the importance and opportunity for managing kelp forests on a local scale. Indeed, regions where declines were documented were often those experiencing multiple local and global stressors acting together to harm forests. These sometimes included the combination of fishing and climate change.

“Kelp forests support an incredible diversity of species and are of rich economic and cultural value to humans,” said lead author Kira Krumhansl of Simon Fraser University in British Columbia. “Our study highlights that maintaining the health of kelp forests relies on understanding what is happening on local scales. Each region is unique. In fact, each forest is unique. Managing stressors on local scales has a key role to play in maintaining the health of kelp ecosystems in the face of increasing global pressures.”

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