California Ocean Science Trust
Science Briefing

Restoring and protecting California's kelp forest ecosytems

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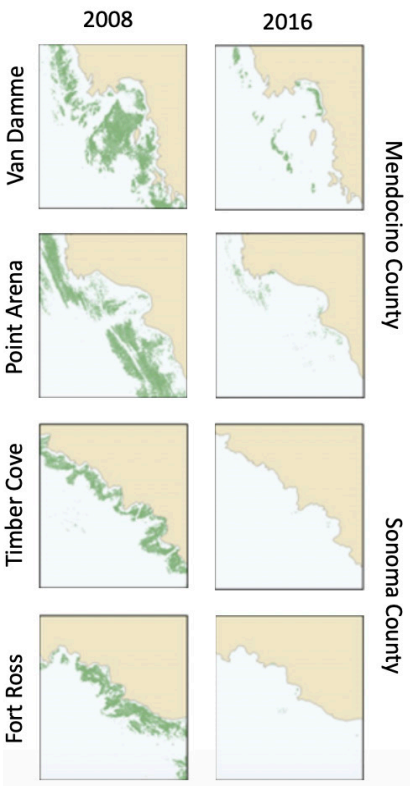

Figure 1. Kelp canopy cover pre-MHW and post-MHW (adapted from Rogers-Bennett & Catton, 2019).

BACKGROUND

Kelp forests provide habitat, food, and shelter for fish, corals, abalone, seals, sea otters, seabirds, and others. Historically, kelp forests spanned the entire California coastline. Yet, due to a "perfect storm" of warm water and uncontrolled purple sea urchin grazing, Northern California bull kelp forests declined by ~90% from 2014 to 2019. The collapse of these Northern California kelp forests was followed by the closures of the north coast's recreational abalone (~$44M/yr) and a federal fishery disaster declaration of the commercial red sea urchin (~3M/yr) fisheries.

THE PERFECT STORM:
CASCADING EVENTS

1. In 2013, sea star wasting disease began decimating sea stars, allowing unchecked purple urchins to overgraze kelp without predators (e.g. sea stars, extirpated sea otters).
2. Beginning in 2014, a marine heatwave (MHW) led to high temperatures and low nutrients, severely hindering kelp production.
3. The ecosystem shifted rapidly from abundant kelp forests to bare rock or "urchin barrens".

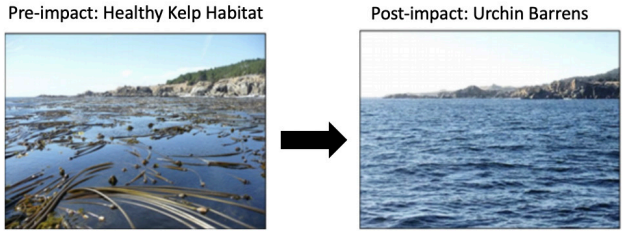

Figure 2. Kelp forest ecosystem collapse & shift from abundant kelp habitat (left) to urchin barrens (right) (adapted from Rogers-Bennett & Catton, 2019).

WHY KELP IS IMPORTANT TO PEOPLE

- Kelp forests **provide habitat that supports high biodiversity**, sustaining coastal communities and economies reliant on fisheries, diving, and ecotourism activities.
- California Native American Tribal communities also depend on kelp forests to **maintain cultural connections** to the California coast.
- Kelp farming is **a promising industry** that may alleviate wild kelp loss and associated benefits and services, and generate marketable products (e.g. food, biofuels).
- Kelp forests **protect coastal communities** by buffering waves and storm surges, and may capture carbon and reduce the impacts of ocean acidification.

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Key Knowledge Gaps & Current Activities

Restoring and protecting California's kelp forests is vital to maintaining benefits for nature and people. The following knowledge gaps/current activities will help inform restoration solutions.

**Knowledge gaps & activities from the California Ocean Protection Council and California Sea Grant's Kelp Recovery Research Program & Interim Kelp Action Plan.*

Kelp - Urchin Dynamics

A healthy density of purple urchins and the best method to manage urchin numbers along our coasts are unclear. Researchers and non-profits (e.g. Bay Foundation, Reef Check) are assessing the best tactics for urchin removal.

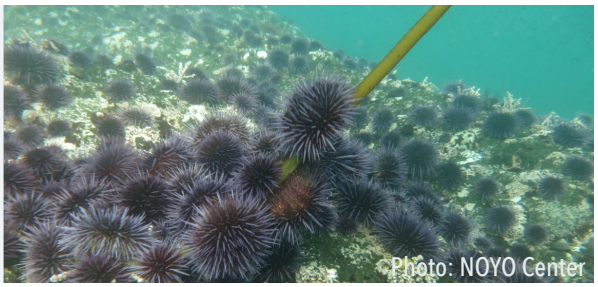

Photo: NOYO Center

Efficacy of Restoration Solutions

Other research efforts are examining kelp forest resilience and testing the efficacy of different restoration strategies. Example strategies include:

1. Creating a bull kelp seed bank to preserve genetic diversity
2. Determining successful methods to outplant young bull kelp
3. Assessing the feasibility to reintroduce sea stars

Photo: CA Dept. Fish & Wildlife

Social & Cultural Value

The value of kelp forests to coastal communities has not been thoroughly assessed. Enhanced understanding of the social, cultural, and economic values of kelp forests to the Indigenous and non-Indigenous communities in California is essential to identifying, evaluating, and implementing viable and equitable strategies for management and adaptation.

Photo: Chad King

LOOKING AHEAD

Ongoing research will help assess the efficacy and inform selection of potential restoration strategies. Understanding the natural and social drivers of successful restoration can not only bring this valuable system back, but also enable swift responses to future rapid environmental change.

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