KELP

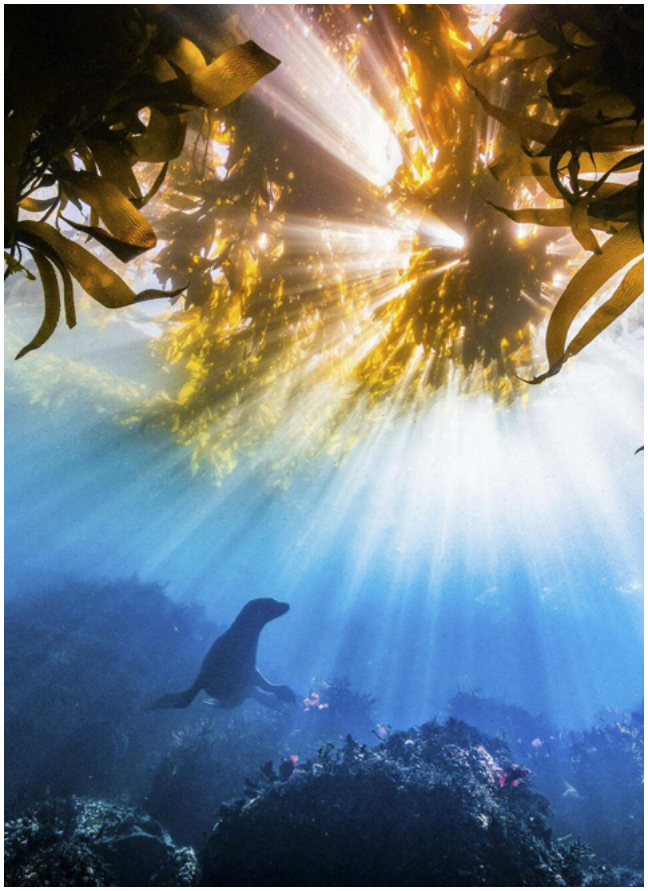
REPORT CARD 2024

Assessing the abundance of canopy-forming kelps in the Northeast Pacific

The Nature Conservancy

WOODS HOLE OCEANOGRAPHIC INSTITUTION

kelpwatch.org



INTRODUCTION

About this document

The Kelp Report Card is an annual, data-driven evaluation of kelp canopy dynamics in the Northeast Pacific relative to historical trends. This analysis spans the West Coast of the United States through Baja California, Mexico and mobilizes 40 years of Landsat satellite-derived kelp canopy data (Bell et al. 2025) to provide a summary of 2024 trends in kelp canopy to inform strategic conservation, restoration, management, and research of this important natural resource and ecosystem. The data underlying this report card are publicly available in interactive format on Kelpwatch.org.

Background

The Kelp Report Card summarizes the annual status of the floating canopies of the two dominant canopy forming kelp species in the Northeastern Pacific (bull kelp and giant kelp, *Nereocystis luetkeana* and *Macrocystis pyrifera* respectively) in 2024 relative to historical trends. Both species in the Northeastern Pacific were impacted by multiple stressors during the 2014–2016 marine heatwave and El Niño events, a time frame defined by several prolonged high seawater temperature periods, reduced upwelling of ocean nutrients, an increase in herbivorous native purple sea urchins (*Strongylocentrotis purpuratus*), and the near-complete loss of an important sea urchin predator, the sunflower sea star (*Pycnopodia helianthoides*). Since 2014, many regions experienced large losses of kelp forests and recovery has been variable by region. Additionally, interannual variability in oceanographic conditions and changes in purple sea urchin abundance and grazing behavior have contributed to varied regional kelp canopy dynamics. The Kelp Report Card shows the kelp canopy status for 2024 by mapping the annual maximum kelp canopy area and displaying these as a percentage of the historical mean of annual maximum kelp canopy area from 1984 to 2013 (the period before the multiple stressor events that began in 2014).

Methods

The methods used to calculate the annual maximum bull kelp and giant kelp canopy area are built on Bell et al., 2023, a peer-reviewed paper that described regional kelp loss and recovery using Kelpwatch.org. The kelp canopy detections are not distinguishable at the species level from the Landsat imagery. In this analysis, kelp canopy data for each year was included if at least 50% of the historical kelp habitat within each region contained a valid (e.g., cloud-free) observation in at least three seasons of a given year. In addition to replicating published methods, the Kelp Report Card analysis required that one of these valid seasonal observations occurred during summer. The inset maps of the featured reefs on the regional pages of the report card use the same methodology to show maximum annual kelp canopy area for 2024 across selected areas within each region at 30 meter spatial resolution. We also include figures showing the historical dynamics of kelp canopy area within each region and sea surface temperature compared to the mean and standard deviation from all previous years starting in 1985 from the NOAA Coral Reef Watch 5 km sea surface temperature (SST) product. Landsat data are not available for some years, which appears as gaps on the graph.

Photo on cover: © Ralph Pace; Photos on this page, from top: © Tyler Schiffman/TNC Photo Contest 2019; © Ralph Pace

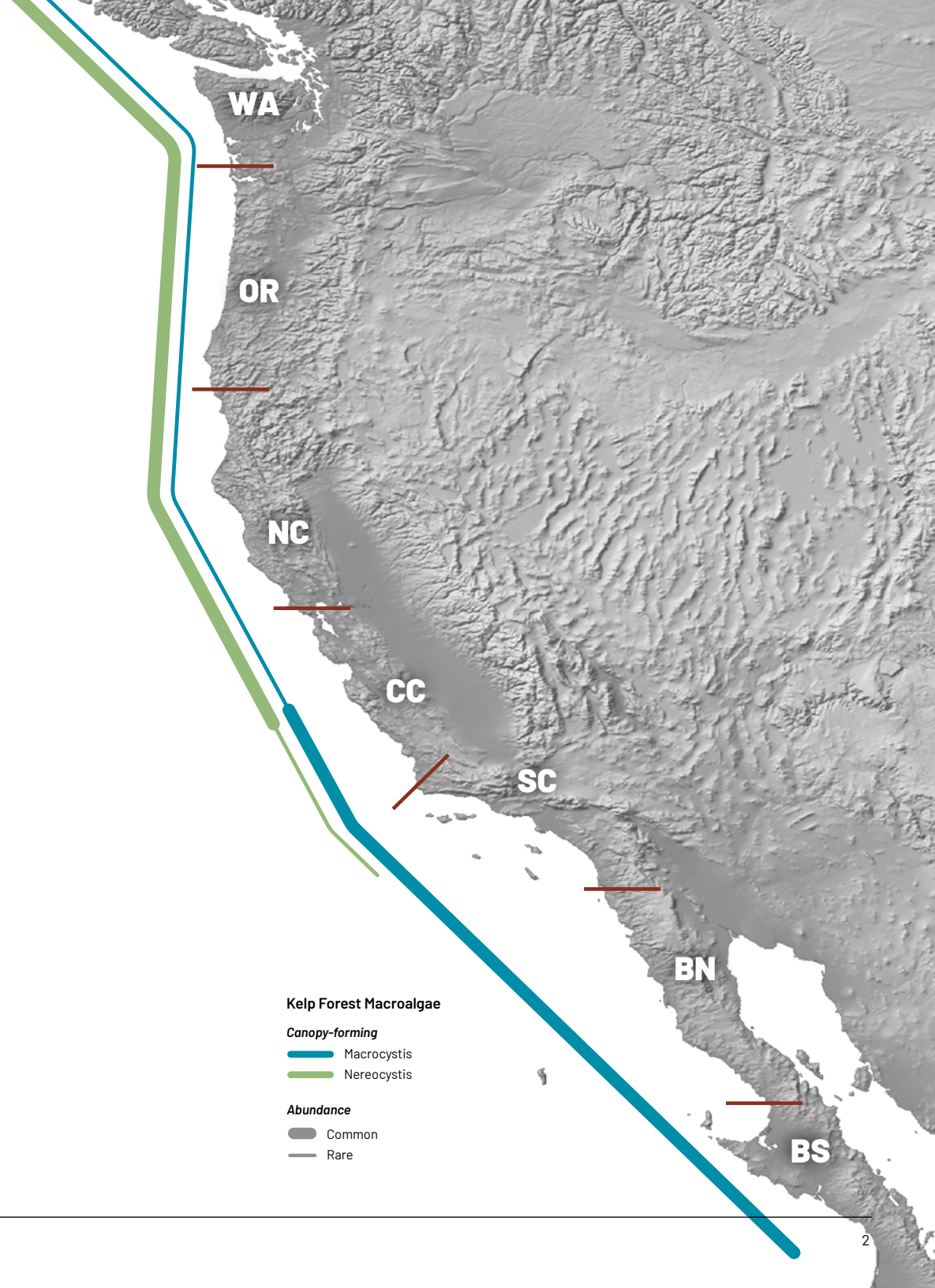
REGIONS

How the regions are established

The Kelp Report Card summarizes kelp canopy area trends in the Northeast Pacific in 2024 at a regional and sub-regional level. Regions follow state and national boundaries across the west coast of the United States and Mexico: Washington (WA), Oregon (OR), California, Baja California Norte (BN), and Baja California Sur (BS). The state of California is categorized into three sub-regions: Northern (NC), Central (CC), and Southern California (SC) that represent areas defined by the dominant canopy-forming kelp species and physical ocean conditions: the Northern California region includes kelp canopy north of San Francisco to the Oregon border; Central California includes kelp canopy south of San Francisco to Point Conception; and the Southern California region includes kelp south of Point Conception to the Mexico border including the offshore Channel Islands (Carr and Reed, 2016).

Sea surface temperature

Ocean temperatures are one of the strongest correlates to both seasonal and interannual kelp dynamics. Cool, nutrient-rich seawater is typically associated with strong kelp recruitment and rapid growth, leading to high kelp canopy area. Warm seawater is typically associated with poor kelp recruitment and growth. The Kelp Report Card summarizes the mean daily sea surface temperature for the current year in each region and shows seawater temperature compared to previous years. Warm and cool water periods are identified as events that extend well beyond the standard deviation of historical temperature. Sea surface temperature data are acquired from areas that currently or have historically contained kelp canopy.



Suggested citation: The Kelp Report Card 2024 is a collaboration between The Nature Conservancy and Woods Hole Oceanographic Institution. Please use the following citation: Woods Hole Oceanographic Institution and The Nature Conservancy. (2025). Kelp Report Card 2024. https://kelpwatch.org/tnc_kelp_report_card_2024.pdf.

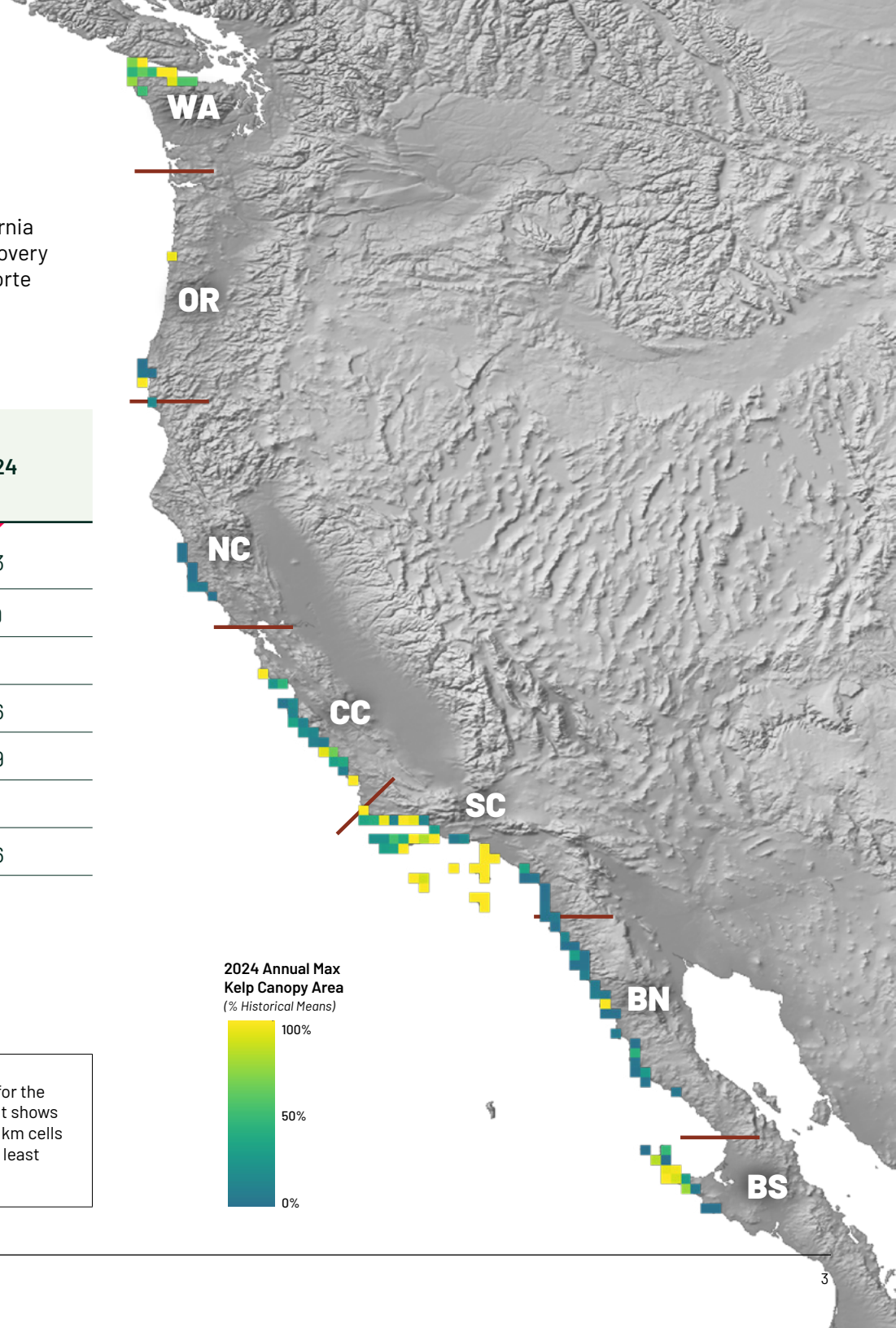
2024 AT A GLANCE

In 2024, kelp canopy coverage across the northeast Pacific remained variable. Some regions, including Washington, parts of Southern California, and Baja California Sur, were near historical averages. However, Northern California showed little recovery from the heat wave period, while Oregon, Central California, and Baja California Norte remained well below historical averages.

LATEST TRENDS *(kelp canopy area as a % of historical mean*)*

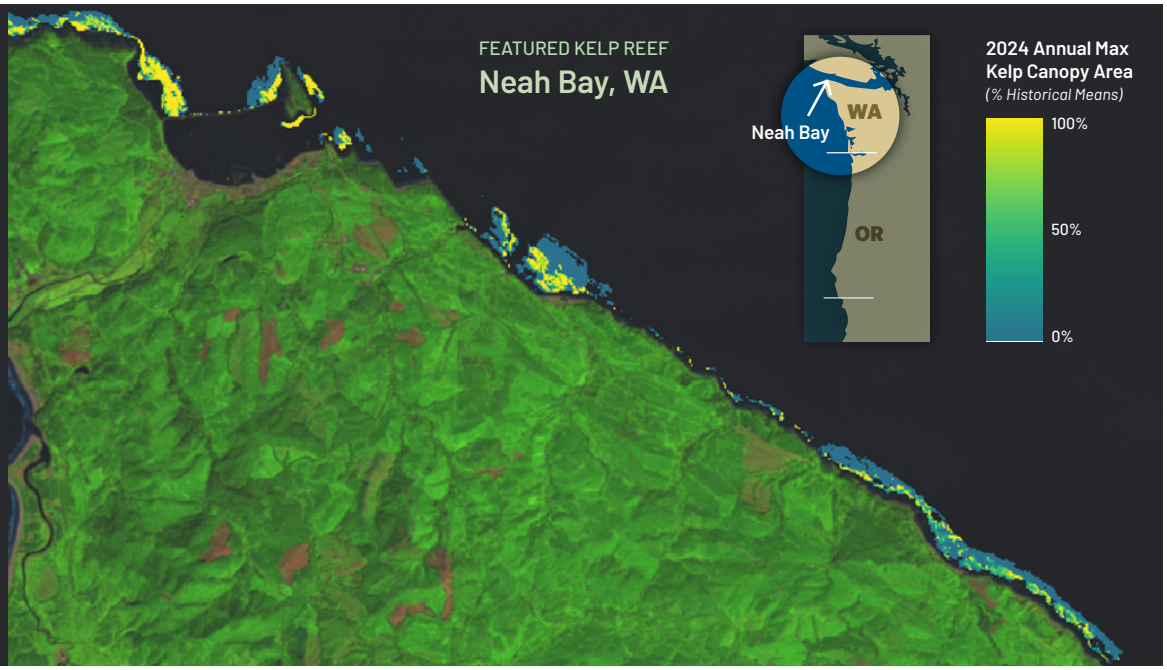
Region	Average Marine Heatwave (2014–16)	Average Last 5 Years (2020–24)	2024
Washington (WA)	98	84	83
Oregon (OR)	54	39	19
Northern California (NC)	12	9	3
Central California (CC)	88	59	36
Southern California (SC)	53	63	69
Baja Norte (BN)	81	23	6
Baja Sur (BS)	105	86	66

*Kelp canopy area was measured against the historical mean of the annual maximum canopy area for the period before the multiple disturbance events that began in 2014 (1984–2013). The map on the right shows the maximum annual kelp canopy area for 2024 as a percentage of the historical mean for 20 x 20 km cells across the range included in this report card. A 20 x 20 km cell was only included if it contained at least 0.45 km^2 of kelp habitat (Bell et al. 2024).



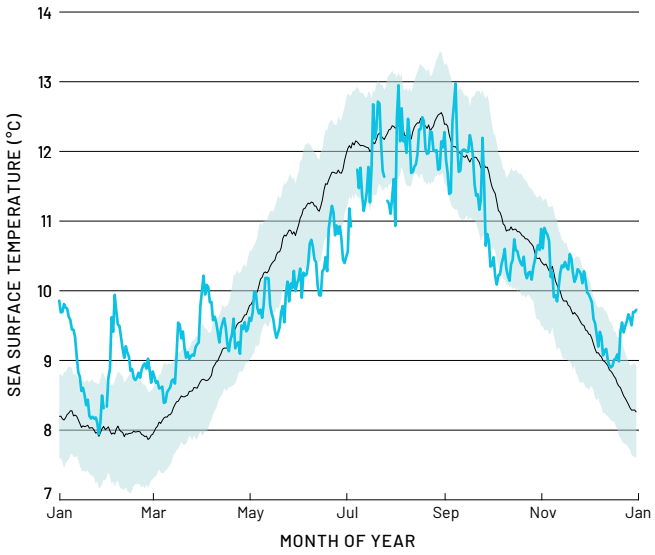
WASHINGTON, USA

In 2024, the giant and bull kelp canopies along the open coast and the Strait of Juan de Fuca in Washington (WA) remained at similar levels to 2023, staying close to the historical average. This region continues to be one of the most stable in the Northeast Pacific, including areas around Neah Bay and the northwest coastline of the Olympic Peninsula (as shown on the right).



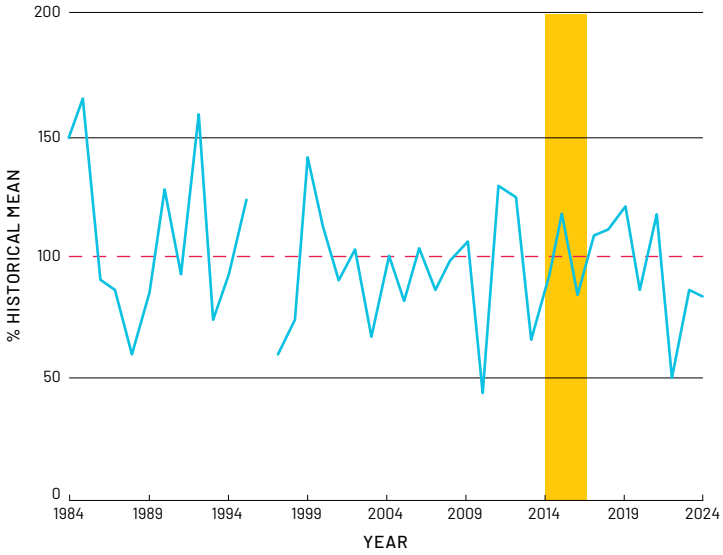
Washington sea surface temperature for 2024

- Sea surface temperatures in 2024 (blue line) were elevated early in the year but then generally followed the historical pattern. Historical mean is the black line and blue shaded area is the standard deviation.



Washington annual maximum kelp canopy area for 2024

- The blue line shows the annual maximum kelp canopy area as a percentage of the historical mean. Yellow shaded area shows the multiple disturbance events that began in 2014. Landsat data are not available for some years, which appear as gaps on the graph.

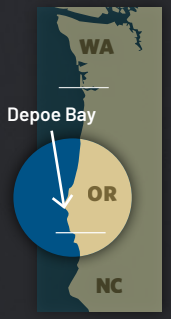


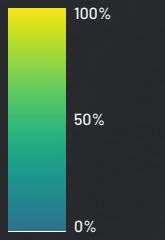
OREGON, USA

Oregon (OR) bull kelp canopy area remained low in 2024 and well below the historical mean. This continues to be the case for Orford Reef, one of the largest reef systems in the region. Kelp canopies near Depoe Bay continued to exceed historical means (shown on the right).

FEATURED KELP REEF

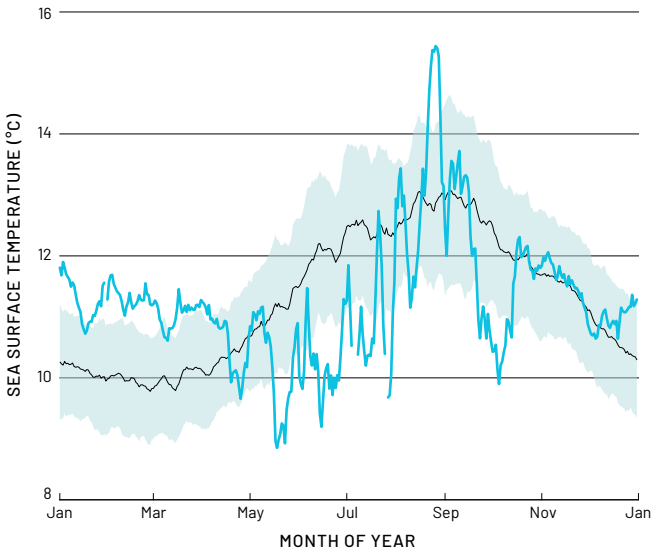
Depoe Bay, OR





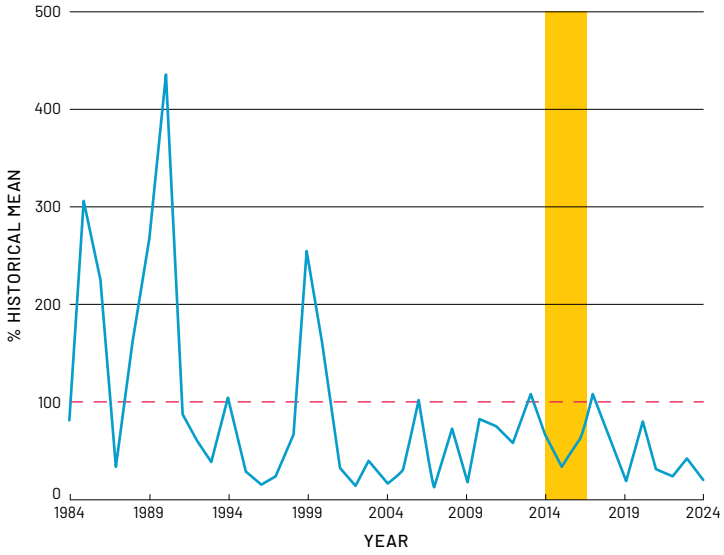
Oregon sea surface temperature for 2024

- Sea surface temperatures in 2024 (blue line) were elevated early in the year and transitioned to periodic cool water events from the late spring to early autumn. Historical mean is the black line and blue shaded area is the standard deviation.



Oregon annual maximum kelp canopy area for 2024

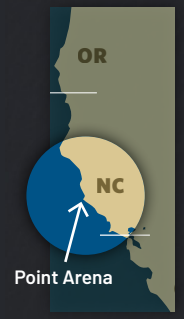
- The blue line shows the annual maximum kelp canopy area as a percentage of the historical mean. Yellow shaded area shows the multiple disturbance events that began in 2014.

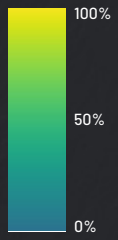


NORTHERN CALIFORNIA, USA

In 2024, bull kelp canopies in Northern California (NC) remained sparse compared to the historical average, showing minimal signs of recovery from the multiple stressor events that began in 2014. Small kelp canopies were observed throughout the region, and south of point arena as shown to the right, but they represented only a small portion of the historical kelp canopy extent.

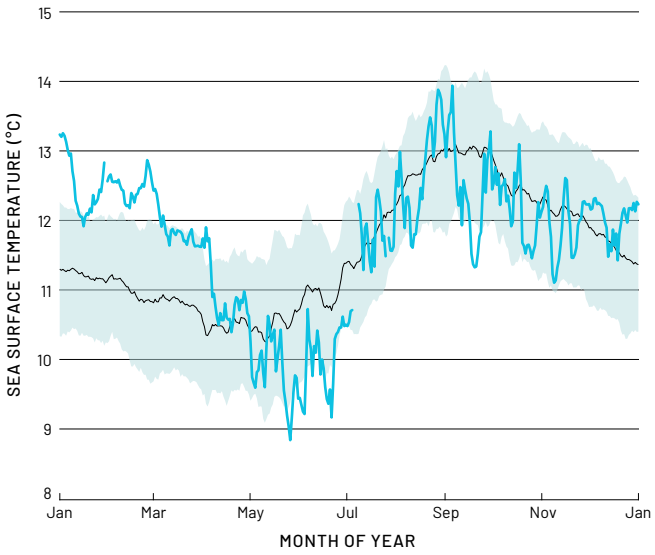
FEATURED KELP REEF
Point Arena, NC





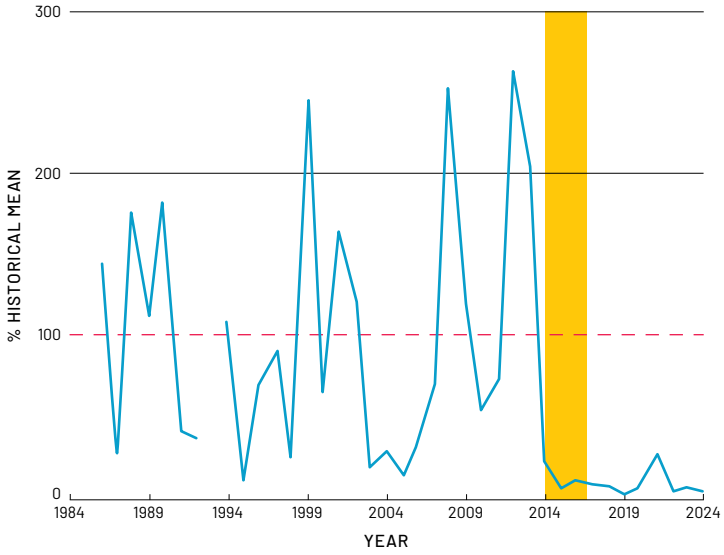
Northern California sea surface temperature for 2024

- Sea surface temperatures in 2024 (blue line) were elevated early in the year but then generally followed the historical pattern. Historical mean is the black line and blue shaded area is the standard deviation.



Northern California annual maximum kelp canopy area for 2024

- The blue line shows the annual maximum kelp canopy area as a percentage of the historical mean. Yellow shaded area shows the multiple disturbance events that began in 2014. Landsat data are not available for some years, which appear as gaps on the graph.



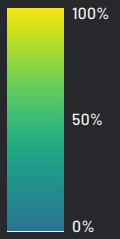
CENTRAL CALIFORNIA, USA

The California Central Coast (CC), home to both giant and bull kelp canopies, rebounded slightly from the historic lows in 2023, but remained below historical means. Kelp canopies around the Monterey Peninsula (as shown on the right) remained low with persistent canopies in Carmel Bay and near the city of Monterey.

FEATURED KELP REEF

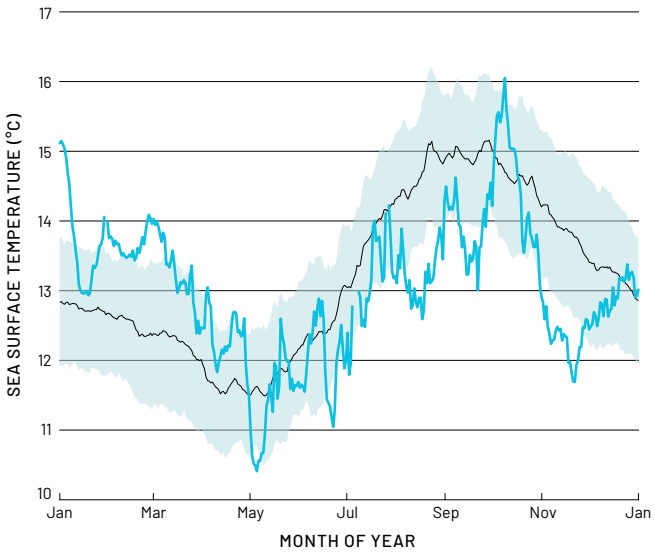
Monterey Peninsula, CC

2024 Annual Max Kelp Canopy Area
(% Historical Means)



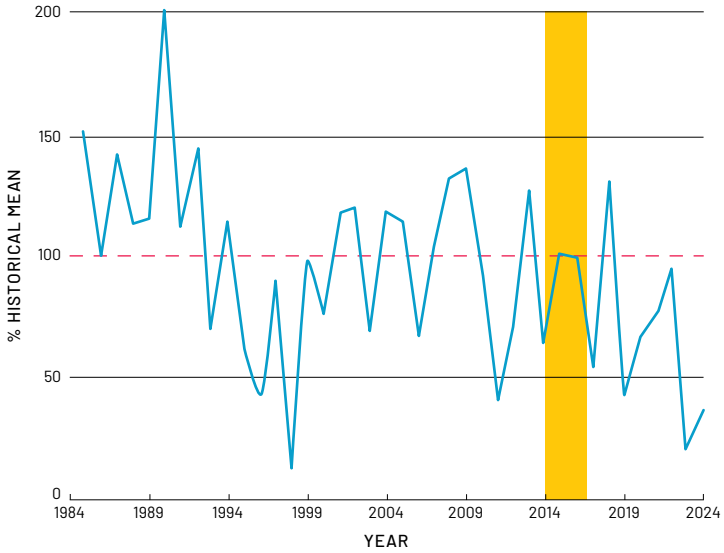
Central California sea surface temperature for 2024

- Sea surface temperatures in 2024 (blue line) generally followed the historical pattern with periodic cool water events during the summer and autumn. Historical mean is the black line and blue shaded area is the standard deviation.



Central California annual maximum kelp canopy area for 2024

- The blue line shows the annual maximum kelp canopy area as a percentage of the historical mean. Yellow shaded area shows the multiple disturbance events that began in 2014.

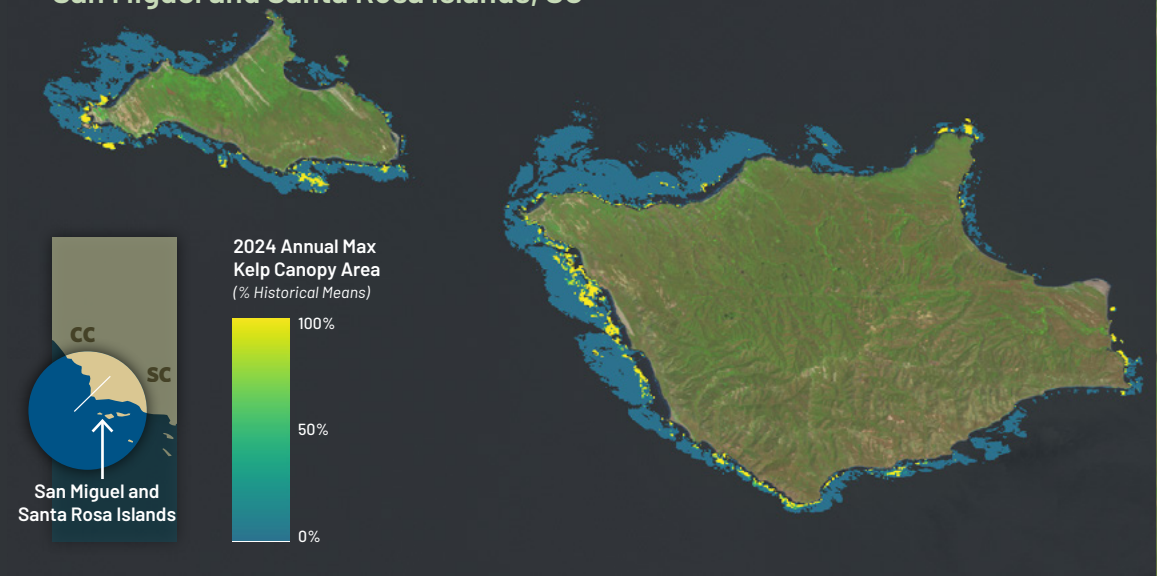


SOUTHERN CALIFORNIA, USA

In 2024, giant kelp canopy area in the Southern California (SC) Bight varied across the region. Areas such as the Southern Channel Islands and mainland Santa Barbara coast remained at or above historical averages. However, kelp canopy area near the western Channel Islands (as shown on the right) and San Diego remained low.

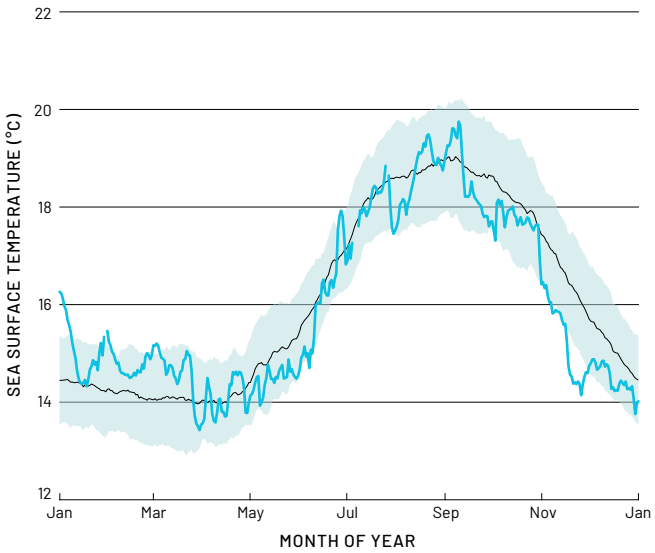
FEATURED KELP REEF

San Miguel and Santa Rosa Islands, SC



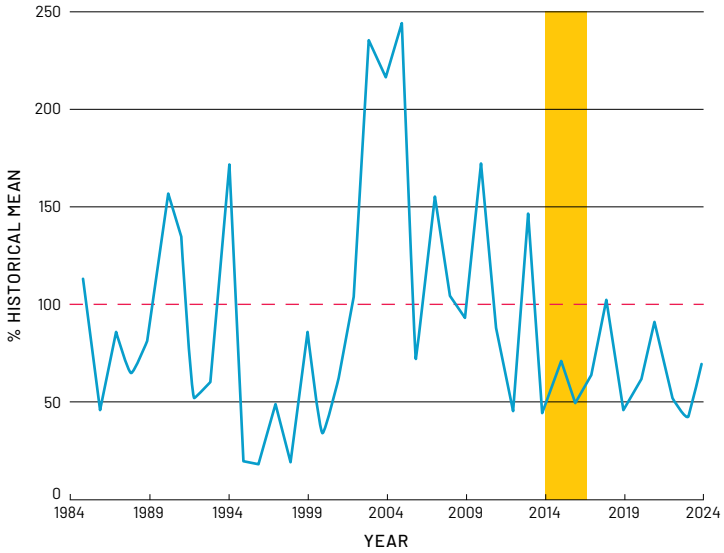
Southern California sea surface temperature for 2024

- Sea surface temperatures in 2024 (blue line) generally followed the historical pattern. Historical mean is the black line and blue shaded area is the standard deviation.



Southern California annual maximum kelp canopy area for 2024

- The blue line shows the annual maximum kelp canopy area as a percentage of the historical mean. Yellow shaded area shows the multiple disturbance events that began in 2014.

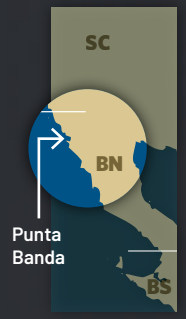


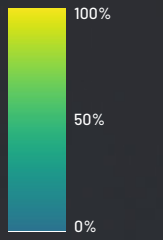
BAJA CALIFORNIA NORTE, MEXICO

In 2024, kelp canopy area in Baja California Norte (BN) continued to decline, remaining very low compared to the historical average. Several large giant kelp forests south of Punta Banda (as shown on the right), continued to decrease in size in 2024, while some forests remained near La Bocana.

FEATURED KELP REEF

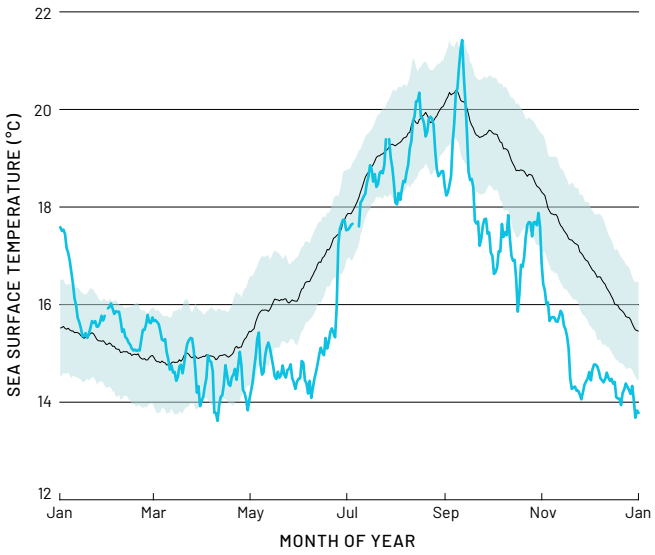
Punta Banda, BN





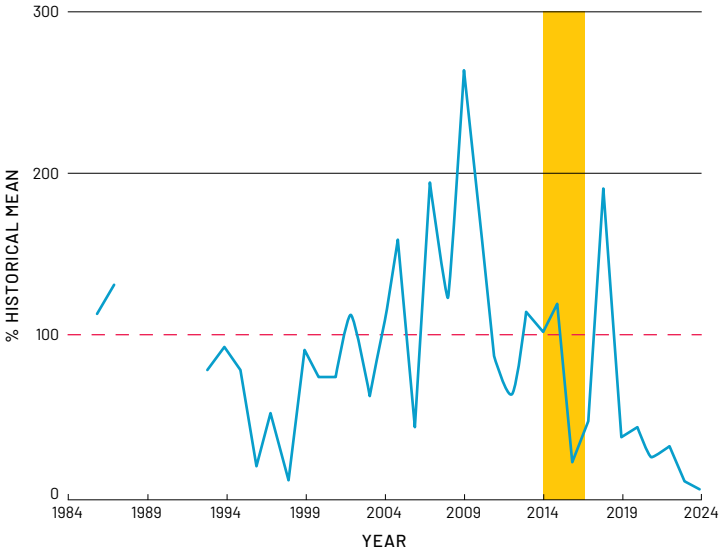
Baja California Norte sea surface temperature for 2024

- Sea surface temperatures in 2024 (blue line) were cooler than average during the early summer and fall. Historical mean is the black line and blue shaded area is the standard deviation.



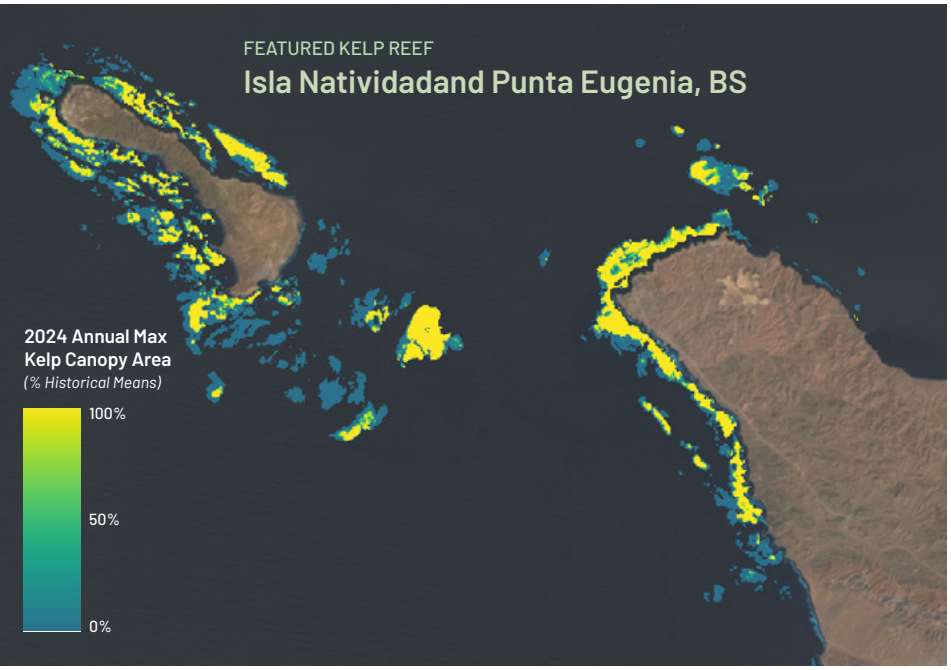
Baja California Norte annual maximum kelp canopy area for 2024

- The blue line shows the annual maximum kelp canopy area as a percentage of the historical mean. Yellow shaded area shows the multiple disturbance events that began in 2014. Landsat data are not available for some years, which appear as gaps on the graph.



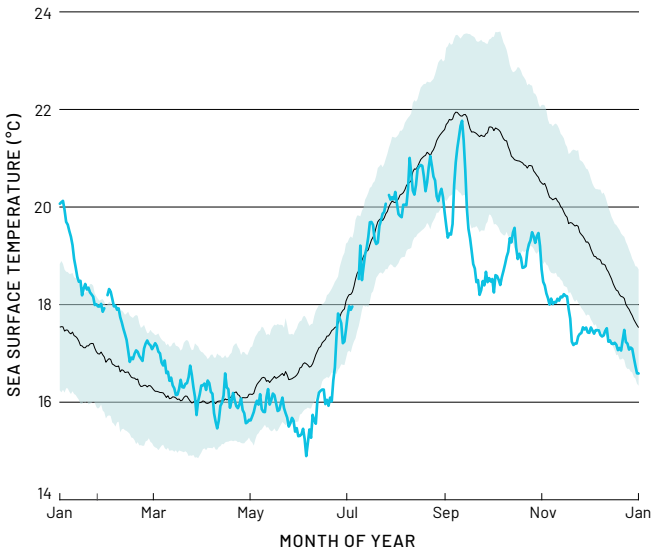
BAJA CALIFORNIA SUR, MEXICO

In 2024, Baja California Sur (BS) kelp canopy area was similar to 2023, with large forests present around Isla Natividad and Punta Eugenia (shown on the right). These forests, combined with other extensive canopies around around Bahia Tortugas, represent the most resilient large giant kelp canopies in this region.



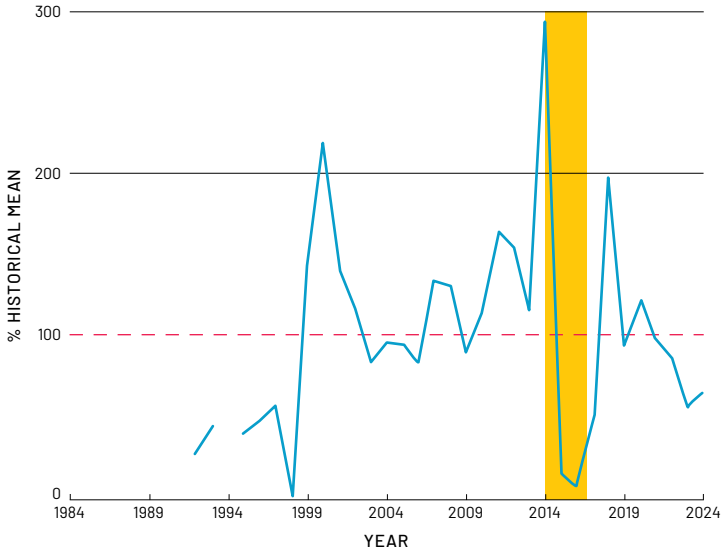
Baja California Sur sea surface temperature for 2024

- Sea surface temperatures in 2024 (blue line) were cooler than average during the fall. Historical mean is the black line and blue shaded area is the standard deviation.



Baja California Sur annual maximum kelp canopy area for 2024

- The blue line shows the annual maximum kelp canopy area as a percentage of the historical mean. Yellow shaded area shows the multiple disturbance events that began in 2014. Landsat data are not available for some years, which appear as gaps on the graph.



CONCLUSION

Kelp canopy exhibited significant variability across and within regions in 2024, with some areas showing increases compared to 2023. At the regional scale, only Washington remained near historical averages, while Oregon, Northern California, and Baja California Norte continued to be well below historical means. In contrast, kelp canopies in Central and Southern California increased relative to the low levels observed in 2023. In Southern California, kelp canopies across all Southern Channel Islands, as well as around Anacapa and Santa Cruz Islands, were at or above historical means in 2024. However, canopy coverage remained low around San Diego, Malibu, and San Miguel and Santa Rosa Islands. Large kelp forests around Punta Eugenia and Isla Natividad in Baja California Sur continued to persist through the summer and fall of 2024. Although sea surface temperatures were relatively warm during the winter (January–March, 2024), most regions experienced normal or cooler temperatures throughout the spring, summer, and fall. The weak El Niño conditions present at the end of 2023 did not persist into 2024. However, warmer temperatures earlier in the year have been linked to decreased bull kelp abundance later in the growing season.

Suggested citation

The Kelp Report Card 2024 is a collaboration between The Nature Conservancy and Woods Hole Oceanographic Institution. Please use the following citation: Woods Hole Oceanographic Institution and The Nature Conservancy. (2025). Kelp Report Card 2024. https://kelpwatch.org/tnc_kelp_report_card_2024.pdf

References

Bell, T.W., Cavanaugh, Ky.C., Saccomanno, V.R., Cavanaugh, Ka.C., Houskeeper, H.F., Eddy, N., Schuetzenmeister, F., Rindlaub, N., Gleason, M. (2023), Kelpwatch: A new visualization and analysis tool to explore kelp canopy dynamics reveals variable response to and recovery from marine heatwaves, PLOS ONE, 18, e0271477.

Bell, T, K. Cavanaugh, D. Siegel. (2025). SBC LTER: Time series of quarterly NetCDF files of kelp biomass in the canopy from Landsat 5, 7 and 8, since 1984 (ongoing) ver 27. Environmental Data Initiative https://doi.org/10.6073/pasta/5b441f39c0876ef901068709df8f3e50.

SST Data: https://coralreefwatch.noaa.gov/product/5km/index.php

Carr, M. H., and Reed, D. C. (2016). "Shallow Rocky Reefs and Kelp Forests," in Ecosystems of California, eds H. Mooney and E. Zavaleta (Berkeley, CA:University of California Press), 311–336.

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The Nature Conservancy

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