

Baseline Highlights from California's South Coast Kelp and Shallow Rock Ecosystems

Monitoring Life Under the Canopy



About This Snapshot Report

This report highlights some key scientific findings from the kelp and shallow rock monitoring projects, two of ten baseline projects in California's South Coast region.¹ These projects evaluated the initial conditions of kelp and shallow rock ecosystems at the time of marine protected area (MPA) implementation. Included facts and figures are derived from the projects' peer-reviewed technical reports,^{2,3} which can be found, along with the associated data, at OceanSpaces.org.

Snapshot Report Vol 2



LIFE UNDER THE CANOPY

Shallow rocky reefs in the South Coast region are **diverse and highly productive ecosystems**, hosting a variety of fish and invertebrate species as well as many marine birds and mammals. **Large, canopy-forming kelps colonize rocks in some areas**, while other areas lack a canopy and are instead dominated by understory algae or bare rock.

Rocky reefs and the kelp beds that attach to them support a range of human activities. **Important recreational and commercial fisheries**, including California spiny lobster, red sea urchins, California Sheephead, Kelp Bass, and a number of rockfish species, are dependent on healthy kelp forests. These **iconic California ecosystems are also a prime destination for recreational users**, including scuba divers and snorkelers.

Kelp forests **thrive in the cool, nutrient rich waters** brought to the surface by coastal upwelling. Upwelling occurs when winds from the north drive surface water away from shore, drawing deeper water upward to take its place. Kelp forests are **sensitive to changes in environmental conditions**, including decreased water quality and rising temperatures. Such changes are often associated with land-based pollution, climate change, and El Niño events.

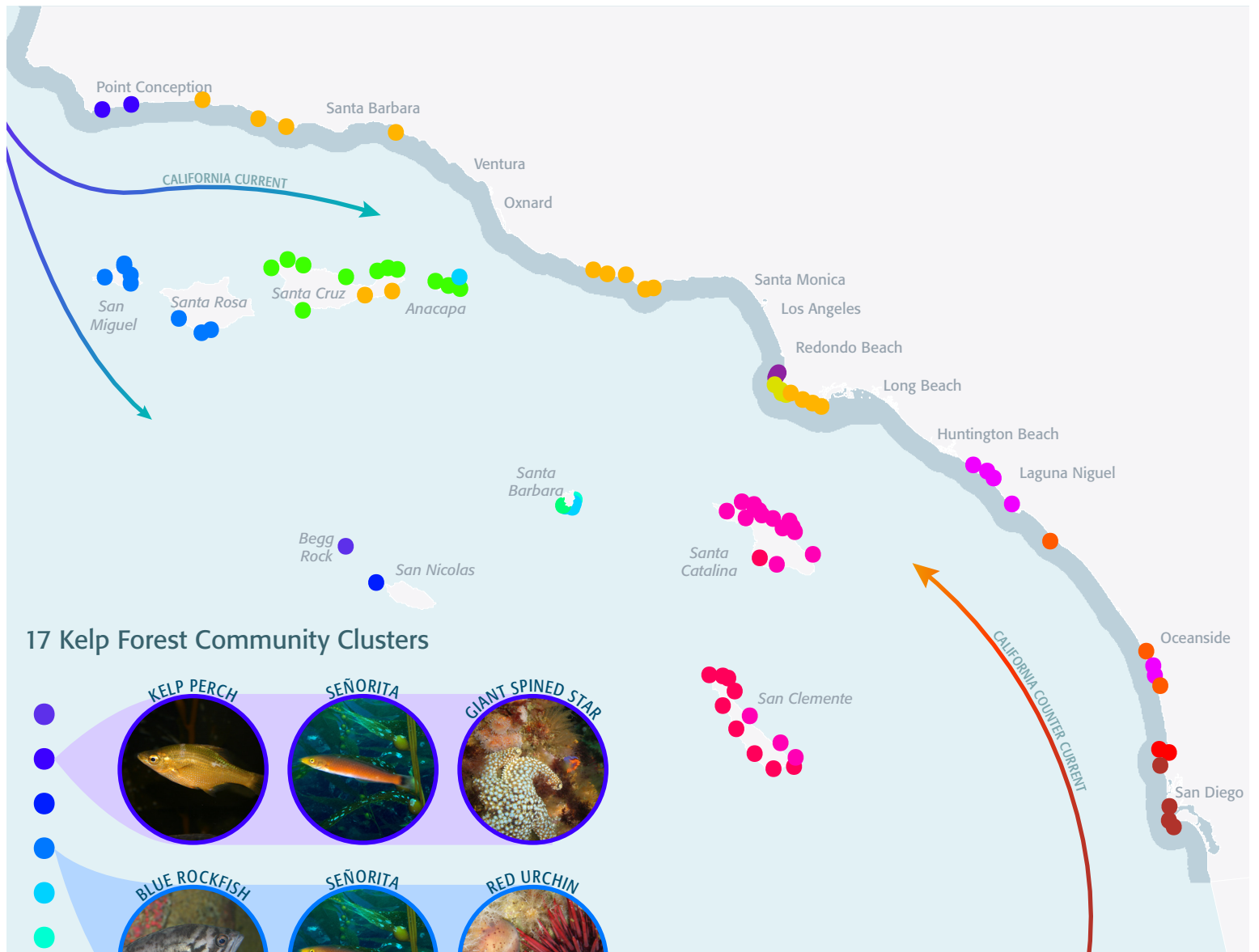
Confirming and Expanding Knowledge

The two kelp and shallow rock baseline projects **enhanced the monitoring efforts of well-established programs in the region**. One project was a collaboration between Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO)⁴ and Vantuna Research Group (VRG),⁵ and the other was led by Reef Check California (RCCA).⁶ Both projects built upon previous assessments in the region, enabling the entire South Coast to be sampled in 2011 and 2012, including each rocky reef MPA and comparable reference area. In these projects, researchers studied kelp and shallow rock ecosystems from the surface down to 30 meters. Researchers **confirmed previously identified patterns of regional fish species distributions, and substantially improved our understanding of algal and invertebrate species distributions** throughout the South Coast region.^{2,3} To learn more, see the distribution maps on the following pages.

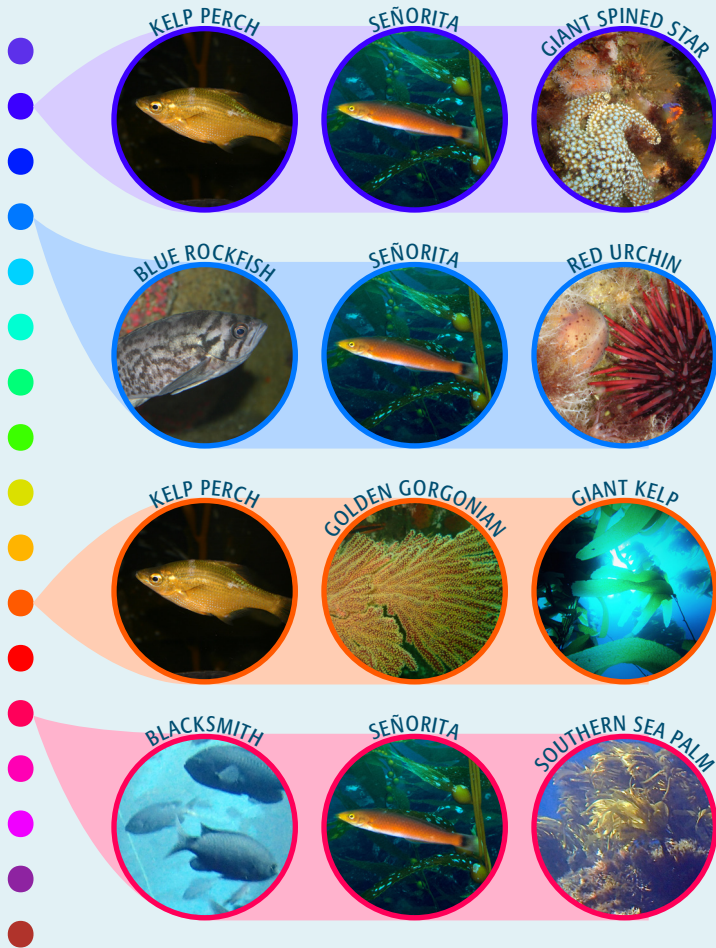
122 rocky reefs
IN THE **SOUTH COAST**

82% of south coast MPAs
contain rocky reefs

226 volunteer divers certified **254 SURVEYS**



17 Kelp Forest Community Clusters

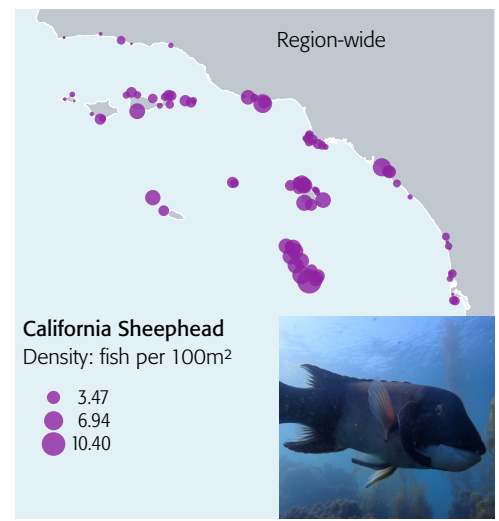
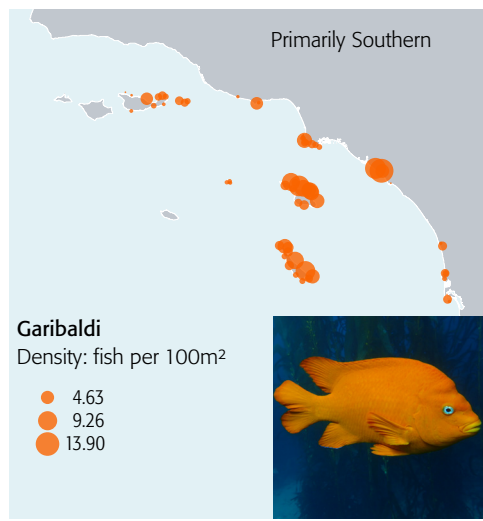
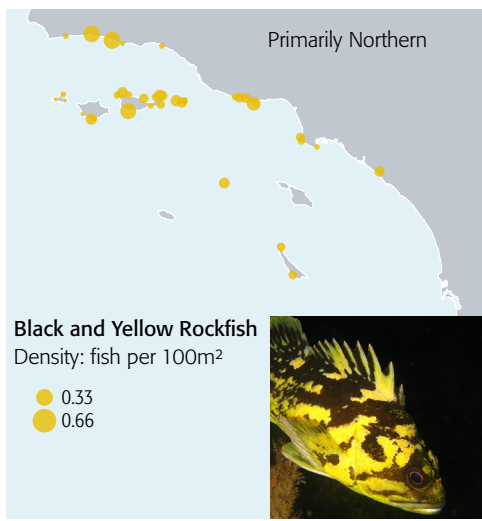


Unique Kelp Forest Community "Clusters"

The PISCO/VRG program demonstrated that reefs across the South Coast region group into 17 kelp forest community "clusters," each with its own unique combination of fish, invertebrate, and algae species.² This high degree of community structure was shaped by a variety of physical factors. The **strong water temperature gradient** in the South Coast, driven by the convergence of cool currents from the north and warm currents from the south, is a well-known driver of species distributions. Differences between **mainland and rocky island reefs** also shape community structure. Mainland reefs tend to be flatter (have less relief), are farther from shore than island reefs, and have more sediment inputs. Data collected by RCCA divers also show that, on a local scale, communities were **influenced by site depth and substrate characteristics**, including relief and proportions of sand and boulder cover.³ A detailed understanding of how kelp and shallow rock communities differ across the region can inform the selection of long-term monitoring sites, since MPAs in different parts of the region contain different kelp forest communities.

Map of the South Coast region, including major warm and cool currents (red and blue arrows, respectively) and kelp forest community "clusters" (colored dots). Each color represents a different kelp forest community cluster. Some common species are shown for a few selected clusters. This figure was adapted from the PISCO/VRG project's technical report.²

Photos: Sarah Finstad, Jim Kirklin, Steve Lonhart, Jonathan Williams

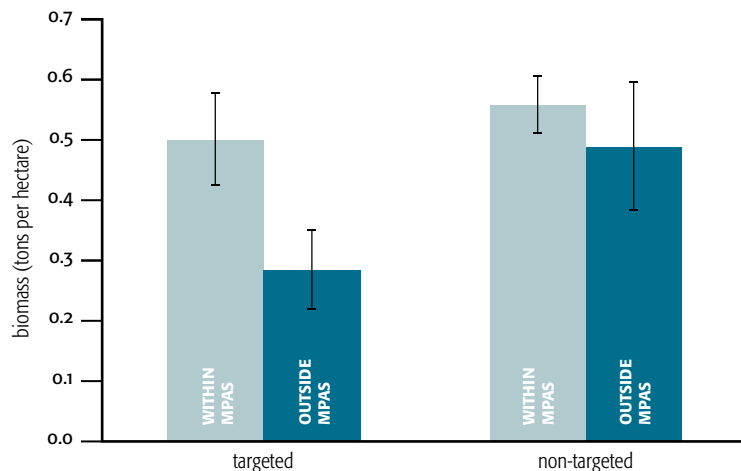


Regional Fish Distribution

Both fish and invertebrate species tended to show one of three general distributional trends: 1) primarily northern (colder waters), 2) primarily southern (warmer waters), or 3) region-wide. This information will be especially important in tracking emerging invertebrate fisheries and future shifts in species distributions due to climate change. These figures were adapted from the PISCO/VRG project's technical report.² Photos: Sarah Finstad, Colleen Wisniewski

Targeted Species Responding to Older MPAs

Twelve MPAs were implemented at the Northern Channel Islands (NCI) in 2003, prior to the establishment of other South Coast MPAs in 2012 through the Marine Life Protection Act. Ten of the twelve are State Marine Reserves, which restrict all take. **The biomass of fish species targeted by commercial and recreational fishing has increased** throughout the NCI region since 2003. Researchers detected biomass increases both inside and outside of NCI MPAs, but the **rate of change was much greater inside NCI MPAs**. The average size of individual Kelp Bass and California Sheephead was significantly larger inside NCI MPAs than outside. The abundance of targeted invertebrate species, including spiny lobster, warty sea cucumber, and red sea urchin, was higher inside NCI MPAs. Non-targeted fish species also showed increases in biomass, but at similar rates inside and outside NCI MPAs.^{2,7} While monitoring has not yet been conducted long enough to evaluate trends in the recently implemented MPAs (2012), these findings suggest that changes similar to those seen in NCI MPAs may occur over comparable timescales.



Ten-year average biomass for targeted and non-targeted fish species, inside (light blue color bars) and outside **Northern Channel Islands MPAs** (dark blue color bars) from 2003-2012. This figure was adapted from the PISCO/VRG project's technical report.² Error bars represent +/- 1 standard error.

Kelp Forests Supporting Lucrative Fisheries

Researchers analyzed South Coast fishing data from 1980-2009, which showed that the region's kelp forests and rocky reefs supported the **largest recreational fishing industry on the West Coast and 10% of the State's commercial fishing revenue**. During that time period, recreational fishermen in South Coast kelp and shallow rock habitats primarily landed finfish from the mainland, while commercial fishermen primarily landed invertebrates such as red urchin, rock crab, and spiny lobster.² Due to the concentration of the commercial sector on invertebrates, PISCO and VRG have adapted their methods to include estimates of biomass for invertebrate species, such as spiny lobster, red urchin, and Kellet's whelk.

While these fisheries sectors targeted different species groups, they extracted approximately the same amount of biomass, although fishing pressure was not uniform throughout the region. With the exception of Point Loma, which supports a highly productive lobster fishery, commercial fishermen focused their efforts at the outer Channel Islands.²

Highly Variable Ecosystems

Researchers explored baseline data, the NCI dataset, and other historical datasets for geographic patterns of species abundance over different timescales. Analyses revealed no consistent region-wide abundance trends for any species, and both studies concluded that **high variability from year to year and site to site is the norm** in these ecosystems in the South Coast.^{2,3} Researchers noted that differences across the region are expected because it is so large. A primary driver of this pattern is the effect of oceanographic conditions on recruitment (individuals successfully joining a population) in a given year. For example, years with strong spring upwelling conditions are “good” for rockfish recruitment, which prefer colder water, and “bad” for kelp bass recruitment, which prefer warmer water.



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Ample Opportunities for Citizen Science

With its warm waters and user-friendly shorelines, the South Coast is a popular destination for local and visiting scuba divers. RCCA has mobilized this volunteer base to monitor rocky reefs in the region since 2006. RCCA trained or recertified 226 volunteer divers and had over 50% volunteer retention during the baseline monitoring period—a major programmatic success. They attribute this retention to the increased volunteer engagement when contributing to baseline MPA monitoring. RCCA invests heavily in its volunteers, and increased retention from improved volunteer engagement is important to the program’s long-term viability.³ Citizen science programs that produce scientifically robust data will continue to be an important component of MPA monitoring in the future.

Connecting MPA Monitoring to Water Quality

At the time of MPA establishment, impaired water quality was considered a unique challenge for South Coast MPAs. To address this issue, PISCO and VRG partnered with the Southern California Coastal Water Research Project (SCCWRP) to begin to assess the relative effects of pollution on reefs. For the first time, **major point sources of pollution were identified and mapped**. These sources of pollution corresponded with major population centers and overlapped spatially with areas of high fishing pressure. Details of the SCCWRP effort and associated products can be found in the Bight '13 report.⁸



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About South Coast MPA Baseline Monitoring

California Ocean Science Trust, California Department of Fish and Wildlife (CDFW), California Ocean Protection Council (OPC), and California Sea Grant coordinated and collaborated in implementation of baseline monitoring, which was funded by OPC. Results from this work will inform CDFW management recommendations to the California Fish and Game Commission from the first five years of MPA implementation in the region, anticipated in 2017. MPA monitoring results can also inform the management of fisheries, water quality, coastal development, and climate change.

Footnotes

1. To learn more about the kelp and shallow rock baseline monitoring projects, visit <http://oceanspaces.org/sc-kelp-pisco-vrg> and <http://oceanspaces.org/sc-kelp-reefchecka>
2. Daniel J. Pondella, Jennifer E. Caselle, Jeremy T. Claisse, Jonathan P. Williams, Kathryn Davis, Chelsea M. Williams and Laurel A. Zahn. 2015. Baseline Characterization of the Shallow Rocky Reef and Kelp Forest Ecosystems of the South Coast Study Region. California Sea Grant. San Diego, CA 310pp. <https://goo.gl/KXRpy8>
3. Jan Freiwald, Colleen Wisniewski. 2015. Reef Check California: Citizen Scientist monitoring of rocky reefs and kelp forests: Creating a baseline for California’s South Coast. California Sea Grant. San Diego, CA 244pp. <https://goo.gl/N7aV5d>
4. Partnership for Interdisciplinary Study of Coastal Oceans <http://oceanspaces.org/pisco>
5. Vantuna Research Group <http://oceanspaces.org/vantuna>
6. Reef Check California <http://oceanspaces.org/reef-check>
7. Jennifer E. Caselle, Andrew Rassweiler, Scott L. Hamilton, and Robert R. Warner. 2015. Recovery trajectories of kelp forest animals are rapid yet spatially variable across a network of temperate marine protected areas. Scientific Reports. 5. doi:10.1038/srep14102
8. Dan Pondella, Ken Schiff, Rebecca Schaffner, Amanda Zellmer, and Julia Coates. 2016. Southern California Bight 2013 Regional Monitoring Program: Volume II, Rocky Reefs. <http://goo.gl/eFRTKK>