

DATA PAPER

Large-scale, multidecade monitoring data from kelp forest ecosystems in California and Oregon (USA)

Daniel P. Malone¹  | Kathryn Davis²  | Steve I. Lonhart³  |
Avrey Parsons-Field²  | Jennifer E. Caselle²  | Mark H. Carr¹ 

¹Department of Ecology and Evolutionary Biology, University of California, Santa Cruz, Santa Cruz, California, USA

²Marine Science Institute, University of California, Santa Barbara, Santa Barbara, California, USA

³Monterey Bay National Marine Sanctuary, National Ocean Service, NOAA, Santa Cruz, California, USA

Correspondence

Daniel P. Malone
Email: dmalone@ucsc.edu

Funding information

David and Lucille Packard Foundation, Grant/Award Number: F1066C-A; National Science Foundation, Grant/Award Numbers: OCE-1260693, OCE-1538582

Handling Editor: William K. Michener

Abstract

Kelp forests are among the most productive ecosystems on Earth. In combination with their close proximity to the shore, the productivity and biodiversity of these ecosystems generate a wide range of ecosystem services including supporting (e.g., primary production, habitat), regulating (e.g., water flow, coastal erosion), provisioning (e.g., commercial and recreational fisheries), and cultural (e.g., recreational, artisanal) services. For these reasons, kelp forests have long been the target of ecological studies. However, with few exceptions, these studies have been localized and short term (<5 years). In 1999, recognizing the importance of large-scale, long-term studies for understanding the structure, functioning, and dynamics of coastal marine ecosystems, and for informing policy, the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) designed and initiated a large-scale, long-term monitoring study of kelp forest ecosystems along 1400 km of coast stretching from southern California to southern Oregon, USA. The purpose of the study has been to characterize the spatial and temporal patterns of kelp forest ecosystem structure and evaluate the relative contributions of biological and environmental variables derived from external sources (e.g., sea otter density, Chl-*a* concentration, sea surface temperature, wave energy) in explaining observed spatial and temporal patterns. For this purpose, the ecological community (i.e., density, percent cover, or biomass of conspicuous fishes, invertebrates, and macroalgae) and geomorphological attributes (bottom depth, substratum type, and vertical relief) of kelp forest ecosystems have been surveyed annually using SCUBA divers trained in both scientific diving and data collection techniques and the identification of kelp forest species. The study region spans distinct ecological and biogeographic provinces, which enables investigations of how variation in environmental drivers and distinctive species compositions influence community structure, and its response to climate-related environmental change across a portion of the California Current Large Marine Ecosystem. These data have been used to inform fisheries management, design and evaluate California's state-wide network of marine protected areas (MPAs), and assess the ecological consequences of climate change (e.g., marine heatwaves). Over time, the spatial and temporal

design of the monitoring program was adapted to fill its role in evaluating the ecological responses to the establishment of MPAs. There are no copyright restrictions; please cite this paper when data are used.

KEYWORDS

algae, community, fishes, invertebrates, kelp forest, marine protected area (MPA), Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO), population, rocky reef, SCUBA, temperate

CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

Data are also available on the Metacat Data Catalog at https://doi.org/10.6085/AA/PISCO_kelpforest.1.6.

ORCID

Daniel P. Malone  <https://orcid.org/0000-0002-1758-7026>

Kathryn Davis  <https://orcid.org/0000-0003-1025-9051>

Steve I. Lonhart  <https://orcid.org/0000-0002-5559-792X>

Avrey Parsons-Field  <https://orcid.org/0000-0002-6126-4136>

Jennifer E. Caselle  <https://orcid.org/0000-0002-1364-3123>

Mark H. Carr  <https://orcid.org/0000-0001-9644-7680>

SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

How to cite this article: Malone, Daniel P., Kathryn Davis, Steve I. Lonhart, Avrey Parsons-Field, Jennifer E. Caselle, and Mark H. Carr. 2022. "Large-Scale, Multidecade Monitoring Data from Kelp Forest Ecosystems in California and Oregon (USA)." *Ecology* 103(5): e3630. <https://doi.org/10.1002/ecy.3630>