

# Kelp forest community surveys on invertebrate and algal density from nearshore in Monterey and Carmel starting in 1999 (Kelp Forest Resilience project)

**Website:** <https://www.bco-dmo.org/dataset/661081>

**Data Type:** Other Field Results

**Version:** 1

**Version Date:** 2017-11-20

## Project

» [Kelp forest community resilience in action: adaptive responses of predators to a disease-driven food web perturbation](#) (Kelp\_Forest\_Resilience)

Contributors	Affiliation	Role
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## Abstract

Kelp forest community surveys on invertebrate and algal density from nearshore in Monterey and Carmel starting in 1999 (Kelp Forest Resilience project)

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## Coverage

**Spatial Extent:** N:36.640454 E:-121.894574 S:36.397717 W:-121.982468

**Temporal Extent:** 1999-09-07 - 2016-11-02

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## Dataset Description

This metadata record documents the kelp forest community survey component of the investigators' project. Data generated by these surveys consists of the following recorded on "transects" (described in Methodology section below): (i) the number and size of individuals greater than 2.5 cm diameter of all sea star species as well as notation of evidence of disease, (ii) the number and size of individuals greater than 2.5 cm diameter of both sea urchin species (*Strongylocentrotus purpuratus* and *Mesocentrotus franciscanus*) as well as notation of evidence of disease, (iii) density (individuals per 60m<sup>2</sup>) of all conspicuous invertebrates and macroalgae.

## Acquisition Description

Sampling consists of visual surveys of the density (number per 60m<sup>2</sup>) of all non-cryptic sessile and mobile solitary invertebrates and macroalgae by SCUBA divers. In addition, sizes of select species (sea urchins, abalone, giant kelp) are recorded. Surveys are conducted at sites distributed throughout the study region (Carmel Bay and southern Monterey Bay). Each sample site is divided into three "zones" (by depth - 20m, 12.5m, 5m - or from offshore to inshore at sites with little depth variation) to assure that samples are distributed across the face of a reef from inshore to offshore. Where possible, taxa (or taxonomic categories) are enumerated on six transects stratified across the three depth strata (two per stratum) per site (typically a 100m length of coastline, extending from onshore to the 20m isobath). Each "transect" is a 2m x 30m swath haphazardly located within one of the three depth strata. Transects within a stratum are separated end-to-end by approximately 5m. Sampling of each transect is conducted by three divers simultaneously. One diver records the number of individual invertebrates and macroalgae within each of three 10m-long segments of the 60m<sup>2</sup> swath. A second diver records the organism and substratum type beneath each of 30 points uniformly distributed along the 30m length of the transect (i.e. 1.0m increments) and the vertical relief (highest to lowest height of the reef surface) within a 0.5m long by 1m wide area centered on each uniform point. A third diver records the number and size of sea urchins and abalone within each of the 10m long segments of the 60m<sup>2</sup> swath. High densities of any species are enumerated by recording the distance along the transect at which 30 individuals are recorded within each 10m segment of the 30m-long transect. Surveys are designed to measure year-to-year site-wide variability in species density or percent cover, from which community structure and interannual dynamics are derived.

## **Processing Description**

Data recorded on underwater paper by divers are entered into Excel spreadsheets by hand and double checked for accuracy. Each dataset is checked for valid entries and completeness.

### **BCO-DMO Data Processing Notes:**

- Month and day combined with year to create date column.
- All column names reformatted to comply with BCO-DMO standards
- nd was entered into all blank cells
- Commas were removed from the descriptions in notes column
- lat/lon columns created based on information found in the site keys submitted with the data

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## Parameters

Parameter	Description	Units
year	The year that the survey was done. This date is expressed in YYYY format. Dates reflect measurements taken in Local Time.	unitless
date	The date that the survey was done. This date is expressed in YYYYmmdd format. Dates reflect measurements taken in Local Time.	unitless
site	The unique site code where the survey was performed. This site code refers to a specific GPS location defined by a bounding box and is likely associated with a placename (i.e there may be multiple sitecodes at the 'Jalama Beach' placename).	unitless
lat	Latitude; north is positive.	decimal degrees
lon	Longitude; east is positive.	decimal degrees
side	A division of the site into two or three areas; referred to as sides. Sides may be East (E); West (W); South (S); North (N); CEN (central)	unitless
zone	A division of the side into 2 or 4 categories representing onshore-offshore stratification or targeted bottom depths for transects. Zones may be INNER; INMID; OUTMID; OUTER.	unitless
<b>Deployments</b>		
transect	A number representing one of the parallel transects through the sitearea along which are located the sampling segments.	unitless
classcode	The unique taxonomic or functional classification code that is being counted as defined in the PISCO classification table. This refers to a code that defines the Genus and Species. See "Species Key" dataset for definitions.	unitless
count	The count of the species or class indicated by the class code. The count is the number of points which fall on the identified classcode at 1m intervals along the transect tape.	count
size	The size of an individual or group of individuals (of the same length). When referring to giant kelp (Macrocystis) size indicates the number of stipes per plant at 1m above bottom.	centimeters (cm)
depth	Average depth of the transect estimated by the diver. Each level is measured.	meters (m)
notes	Notes and field observations.	unitless

## Carr\_1999

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/661099">https://www.bco-dmo.org/deployment/661099</a>
<b>Platform</b>	Long Marine Lab UCSC
<b>Start Date</b>	1999-09-22
<b>End Date</b>	2015-07-24
<b>Description</b>	Sites of Kelp Forest Resilience project. Nearshore waters of southern Monterey Bay and Carmel Bay, California. 36 N, 121 W.

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## Project Information

### **Kelp forest community resilience in action: adaptive responses of predators to a disease-driven food web perturbation (Kelp\_Forest\_Resilience)**

**Coverage:** Monterey Bay and Carmel Bay, California; 36 N, 121 W

A key goal of ecology is to understand how species interactions -- competition, predation, mutualism -- influence the structure (e.g., biodiversity) and functions (e.g., productivity) of ecological communities and contribute to the stability and resilience of ecosystems. Kelp forests along the West Coast of North America have been a model ecosystem in which marine ecologists have explored these questions. That work has provided evidence that predators, including sea otters, sea stars, and fishes, can be important in controlling sea urchins that otherwise overgraze forests and create alternative "barrens" states, devoid of kelp. However, other examples suggest that disease and disturbance, not predators, suppress urchin overgrazing. Here we employ experiments and surveys to determine whether and how sea otters and sea stars act separately and in combination to control the rapid growth of sea urchin

populations that is occurring in concert with a sea star "wasting" epidemic along the West Coast of North America. The results of this work will (i) advance our understanding of how multiple predators interact to influence community structure, stability and resilience, and (ii) shed light on how species interactions contribute to the stability of these forests that are the foundation of productive commercial and recreational fisheries. The project will involve citizen scientists contributing to surveys of sea otter abundance, foraging behavior and diet, and underrepresented (largely Latino) undergraduates and results will be disseminated in several public outreach facilities and K-12 educational programs. This project will advance our understanding of the combined roles of species diversity and predators in contributing to the stability and resilience of community structure. Though both predators and diversity have been the focus of numerous studies, fewer have explored how predator diversity does or does not enhance the resilience of marine ecosystems. The investigators will determine the relative contributions of southern sea otters (*Enhydra lutris lutris*) and two species of sea stars (*Pycnopodia helianthoides* and *Pisaster giganteus*) in controlling the density and size structure of two prey species, the purple sea urchin (*Strongylocentrotus purpuratus*) and a snail (*Promartynia pulligo*), and the cascading effects on survival and density of giant kelp (*Macrocystis pyrifera*). Orthogonal manipulations of predator access in large field enclosures/exclosures will be used to assess the relative roles of redundancy, complementarity and "sampling effect" (i.e. particular importance of either species) among the two predators on both direct mortality and indirect (trait-mediated) foraging behavior of their prey. The PIs will evaluate whether results from the experiments "scale up" to explain geographic variation in the relative densities of predators (otters and stars), prey (urchins) and the major primary producer (giant kelp) and the ability of sea otters to compensate for declines in sea stars to control the rapid growth in purple sea urchin populations that can otherwise cause phase shifts (forests to barrens) of these ecosystems.

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## Funding

Funding Source	Award
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-1538582</a>

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