Cross-shore and alongshore velocity outside the kelp forest at Hopkins Marine Station (36° 37.342' N, 121° 54.049' W) recorded between June and October, 2018.

Website: https://www.bco-dmo.org/dataset/822913
Data Type: Other Field Results
Version: 1
Version Date: 2020-09-02

Project
» Collaborative Research: RUI: Building a mechanistic understanding of water column chemistry alteration by kelp forests: emerging contributions of foundation species (Kelp forest biogeochemistry)

Contributors	Affiliation	Role
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Abstract
Cross-shore and alongshore velocity outside the kelp forest at Hopkins Marine Station (36° 37.342' N, 121° 54.049' W) recorded between June and October, 2018.

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Coverage

Spatial Extent: **Lat**:36.6224 **Lon**:-121.9008
Temporal Extent: 2018-08-08 - 2018-10-05

Dataset Description

These data are published in Hirsh *et al.*, see related publications section.

Methods & Sampling

A bottom-mounted 1200 kHz Teledyne-RDI workhorse ADCP (1 m vertical resolution) was deployed <10 m from the outside kelp mooring site (36° 37.342' N, 121° 54.049' W) from August 8 to October 5, 2018, coinciding with the second ADCP deployment inside the kelp forest.

There was only one deployment at the outside mooring. There is no current data available for the outside mooring before August 8 due to limited instrument availability.

- Deployment 1 (19 x1 meter bins):
  - Bin depths (meters above bottom):
    1.56
    2.56
    3.56
    4.56
    5.56
    6.56
    7.56
    8.56
    9.56
    10.56
    11.56
    12.56
    13.56
    14.56
    15.56
    16.56
    17.56
    18.56
    19.56

Data Processing Description

Current directions were corrected for declination: true north was 13.12° degrees from magnetic north.

Velocity measurements from the ADCP deployment was rotated into cross-shore and alongshore velocity components using the principal axes calculated (*princax* function in Matlab) for the deployment. Individual current profiles were smoothed using a cubic smoothing spline (Matlab *csaps* package; smoothing parameter = 0.8).

- Outside Kelp Forest: August 8 - October 5, 2018
  - Alongshore: Principal axis = 137°
  - Cross-shore: Principal axis = 47°

The top 10% of the water column and velocity > 0.3 m/s was replaced with NaN.

BCO-DMO Processing Notes:

- Adjusted column headers to comply with database requirements
- Converted Timestamp to ISO format
- Merged cross-shore and alongshore dataset, reformatted the datasets to convert zbins into 1 column.
- Added collumns: Mooring_ID, Deployment_ID and Velocity_Components

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Data Files

File
adcp_outside_concat.csv(Comma Separated Values (.csv), 52.38 MB) MD5:bb6e36ce246c7d452585330453500e9a Primary data file for dataset ID 822913

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Related Publications

Hirsh, H. K., Nickols, K. J., Takeshita, Y., Traiger, S. B., Mucciarone, D. A., Monismith, S., & Dunbar, R. B. (2020). Drivers of Biogeochemical Variability in a Central California Kelp Forest: Implications for Local Amelioration of Ocean Acidification. Journal of Geophysical Research: Oceans, 125(11). Portico. https://doi.org/10.1029/2020jc016320 https://doi.org/10.1029/2020JC016320
Results

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Parameters

Parameter	Description	Units
Mooring_ID	Mooring name: kelp = inside kelp forest mooring; outside = mooring outside kelp forest	unitless
ISO_DateTime_UTC	Timestap (date and time) in ISO format, UTC (yyyy-mm-ddThh:mmZ)	unitless
Zbin_Depth	Depth, meters above bottom	meters (m)
Velocity	Velocity	meters per second (m/s)
Velocity_Component	Velocity components: cross-shore and alongshore	unitless
Latitude	Latitude of mooring location, south is negative	decimal degrees
Longitude	Longitude of mooring location, west is negative	decimal degrees

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Instruments

Dataset-specific Instrument Name	Nortek Signature and RDI Teledyne-RDI workhorse ADCPs
Generic Instrument Name	Acoustic Doppler Current Profiler
Dataset-specific Description	A 1200 kHz Teledyne-RDI workhorse ADCP (1 m vertical resolution) was deployed at the outside site from August 8 to October 5, 2018, coinciding with the second ADCP deployment inside the kelp forest.
Generic Instrument Description	The ADCP measures water currents with sound, using a principle of sound waves called the Doppler effect. A sound wave has a higher frequency, or pitch, when it moves to you than when it moves away. You hear the Doppler effect in action when a car speeds past with a characteristic building of sound that fades when the car passes. The ADCP works by transmitting "pings" of sound at a constant frequency into the water. (The pings are so highly pitched that humans and even dolphins can't hear them.) As the sound waves travel, they ricochet off particles suspended in the moving water, and reflect back to the instrument. Due to the Doppler effect, sound waves bounced back from a particle moving away from the profiler have a slightly lowered frequency when they return. Particles moving toward the instrument send back higher frequency waves. The difference in frequency between the waves the profiler sends out and the waves it receives is called the Doppler shift. The instrument uses this shift to calculate how fast the particle and the water around it are moving. Sound waves that hit particles far from the profiler take longer to come back than waves that strike close by. By measuring the time it takes for the waves to bounce back and the Doppler shift, the profiler can measure current speed at many different depths with each series of pings. (More from WHOI instruments listing).

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Deployments

OUTSIDE

Website	https://www.bco-dmo.org/deployment/826371
Platform	Mooring - Hopkins Marine Station
Start Date	2018-06-07
End Date	2018-10-04
Description	This deployment represents the mooring itself and related datasets that have been taken in close proximity of it and are reviewed as samples "outside a kelp forest": ADCP data:

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Project Information

Collaborative Research: RUI: Building a mechanistic understanding of water column chemistry alteration by kelp forests: emerging contributions of foundation species (Kelp forest biogeochemistry)

Coverage: Central California 36.6 N 122 W

NSF Award Abstract:
Kelp forest ecosystems are of ecological and economic importance globally and provide habitat for a diversity of fish, invertebrates, and other algal species. In addition, they may also modify the chemistry of surrounding

waters. Uptake of carbon dioxide (CO2) by giant kelp, Macrocystis pyrifera, may play a role in ameliorating the effects of increasing ocean acidity on nearshore marine communities driven by rising atmospheric CO2. Predicting the capacity for kelp forests to alter seawater chemistry requires understanding of the oceanographic and biological mechanisms that drive variability in seawater chemistry. The project will identify specific conditions that could lead to decreases in seawater CO2 by studying 4 sites within the southern Monterey Bay in Central California. An interdisciplinary team will examine variations in ocean chemistry in the context of the oceanographic and ecological characteristics of kelp forest habitats. This project will support an early career researcher, as well as train and support a postdoctoral researcher, PhD student, thesis master's student, and up to six undergraduate students. The PIs will actively recruit students from underrepresented groups to participate in this project through Stanford University's Summer Research in Geosciences and Engineering (SURGE) program and the Society for Advancement of Hispanics/Chicanos and Native Americans in Science (SACNAS). In addition, the PIs and students will actively engage with the management community (Monterey Bay National Marine Sanctuary and California Department of Fish and Wildlife) to advance products based on project data that will assist the development of management strategies for kelp forest habitats in a changing ocean.

This project builds upon an extensive preliminary data set and will link kelp forest community attributes and hydrodynamic properties to kelp forest biogeochemistry (including the carbon system and dissolved oxygen) to understand mechanistically how giant kelp modifies surrounding waters and affects water chemistry using unique high-resolution measurement capabilities that have provided important insights in coral reef biogeochemistry. The project sites are characterized by different oceanographic settings and kelp forest characteristics that will allow examination of relationships between kelp forest inhabitants and water column chemistry. Continuous measurements of water column velocity, temperature, dissolved oxygen, pH, and photosynthetically active radiation will be augmented by twice-weekly measurements of dissolved inorganic carbon, total alkalinity, and nutrients as well as periods of high frequency sampling of all carbonate system parameters. Quantifying vertical gradients in carbonate system chemistry within kelp forests will lead to understanding of its dependence on seawater residence time and water column stratification. Additional biological sampling of kelp, benthic communities, and phytoplankton will be used to 1) determine contributions of understory algae and calcifying species to bottom water chemistry, 2) determine contributions of kelp canopy growth and phytoplankton to surface water chemistry, and 3) quantify the spatial extent of surface chemistry alteration by kelp forests. The physical, biological, and chemical data collected across multiple forests will allow development of a statistical model for predictions of kelp forest carbonate system chemistry alteration in different locations and under future climate scenarios. Threshold values of oceanographic conditions and kelp forest characteristics that lead to alteration of water column chemistry will be identified for use by managers in mitigation strategies such as targeted protection or restoration.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1737096
NSF Division of Ocean Sciences (NSF OCE)	OCE-1737176

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