Discrete seawater samples collected at the surface, 1 m below the surface, and 1 m above the bottom two times a week at each mooring (Kelp and Outside) from June 12, 2018 to August 3, 2018.

Website: https://www.bco-dmo.org/dataset/826410
Data Type: Other Field Results
Version: 1
Version Date: 2020-10-12

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
Discrete seawater samples collected at the surface, 1 m below the surface, and 1 m above the bottom two times a week at each mooring (Kelp and Outside) from June 12, 2018 to August 3, 2018.

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Coverage

Spatial Extent: **N**:36.6222 **E**:-121.9007333 **S**:36.62161667 **W**:-121.9017
Temporal Extent: 2018-06-12 - 2018-08-03

Dataset Description

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

Methods & Sampling

Discrete seawater samples were collected at the surface, 1 m below the surface, and 1 m above the bottom two times a week at each mooring (Kelp and Outside) from June 12, 2018 to August 3, 2018 between 10:30 and 14:00 local time. Water was collected using a 1.7 L Niskin bottle and subsampled into a 30 mL glass serum bottle (with rubber stopper and crimp cap) for DIC and a 120 mL glass bottle for TA. All samples were immediately preserved with 1 µL of saturated mercuric chloride solution for every 1 mL of sample (Dickson et al., 2007)

Data Processing Description

DIC and TA samples were analyzed within four months of sample collection. TA was analyzed with a Metrohm 855 Robotic Titrosampler using a standardized 0.1 M HCl (Acros, 124200010) in a 0.6 M NaCl background. TA was calculated using a modified gran method in an open cell (Dickson et al., 2003). The acid concentration was calibrated by measuring certified reference materials (Dickson, 2010) every 10 samples (36 CRM runs; batch numbers 169, 172, 175, and 176). Precision and accuracy were estimated as 3.4 mol kg-1, based on the measured CRM values. DIC samples were analyzed using a custom-built instrument loosely based on the design of O'Sullivan and Millero (1998). The DIC instrument was calibrated using CRMs approximately every hour. Instrumental precision was estimated as 0.8 mol kg-1, based on 60 measured CRM values (batch numbers 169, 172, and 175). DIC accuracy was estimated at 2 mol kg-1. Discrete DIC and TA samples were used to calculate in situ pH using CO2SYS (van Heuven et al., 2011) for comparison with moored pH logger data.

Sometimes the depth was too shallow for the CTD to measure an accurate surface salinity. Salinity measurements lower than 33.4 were flagged and replaced by the mean near surface salinity measured at the kelp mooring site = 33.6.

Salinity was flagged (and replaced with the mean salinity, 33.6) for 4 samples reported here:

- Outside Surface July 6, 2017 11:08
- Kelp Surface July 24, 2017 13:02
- Outside Surface July 31, 2017 11:30
- Kelp Surface July 31, 2017 12:04

BCO-DMO Processing notes:

- Adjusted column headers to comply with database requirements
- Added ISO_DateTime_UTC column, converting Date and Time to ISO format, and timezone from Pacific Standard Time (PST) to UTC

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Data Files

File
discrete_samples.csv (Comma Separated Values (.csv), 10.67 KB) MD5:09774a0312cdb3cfc22984e787d87ac8 Primary data file for dataset ID 826410

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Related Publications

Dickson, A. (2010). Standards for Ocean Measurements. Oceanography, 23(3), 34–47.

doi:10.5670/oceanog.2010.22 https://doi.org/https://doi.org/10.5670/oceanog.2010.22
Methods

Dickson, A. G., Afghan, J. D., & Anderson, G. C. (2003). Reference materials for oceanic CO2 analysis: a method for the certification of total alkalinity. Marine Chemistry, 80(2), 185–197. https://doi.org/10.1016/S0304-4203(02)00133-0
Methods

Dickson, A.G., Sabine, C.L. and Christian, J.R. (Eds.) 2007. Guide to Best Practices for Ocean CO2 Measurements. PICES Special Publication 3, 191 pp https://isbnsearch.org/isbn/1-897176-07-4
Methods

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

Van Heuven, S., Pierrot, D., Rae, J. W. B., Lewis, E., & Wallace, D. W. R. (2011). MATLAB Program Developed for CO2 System Calculations. ORNL/CDIAC-105b. Carbon Dioxide Information Analysis Center (CDIAC). https://doi.org/10.3334/CDIAC/OTG.CO2SYS_MATLAB_V1.1
https://doi.org/10.3334/CDIAC/otg.CO2SYS_MATLAB_v1.1
Software

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Parameters

Parameter	Description	Units
Site	Mooring (Kelp or Outside)	unitless
Sample_ID	Sample identifier	unitless
Longitude	Longitude of mooring location, west is negative	decimal degrees
Latitude	Latitude of mooring location, south is negative	decimal degrees
Depth_ID	Identifier for the depth of the sample (1B = 1 m above bottom, 1T = 1 m below surface, S=surface)	unitless
Depth_m	Actual depth (from CTD)	meters (m)
Date	Local Date (PST)	unitless
Time	Local Time (PST)	unitless
DIC	Dissolved inorganic carbon	micromoles per kilogram (umol/kg)
TA	Total alkalinity	micromoles per kilogram (umol/kg)
Salinity	Salinity	unitless
Temperature	Water temperature	degrees Celsius (°C)
pH	pH	unitless
ISO_DateTime_UTC	Timestap (date and time) in ISO format, UTC (yyyy-mm-ddThh:mmZ)	unitless

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Instruments

Dataset-specific Instrument Name	SBE 19plus V2 SeaCAT Profiler CTD
Generic Instrument Name	CTD Sea-Bird SEACAT
Generic Instrument Description	The CTD SEACAT recorder is an instrument package manufactured by Sea-Bird Electronics. The first Sea-Bird SEACAT Recorder was the original SBE 16 SEACAT developed in 1987. There are several model numbers including the SBE 16plus (SEACAT C-T Recorder (P optional))and the SBE 19 (SBE 19plus SEACAT Profiler measures conductivity, temperature, and pressure (depth)). More information from Sea-Bird Electronics.

Dataset-specific Instrument Name	1.7 Niskin bottle
Generic Instrument Name	Niskin bottle
Generic Instrument Description	A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24, or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc.

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Deployments

KELP

Website	https://www.bco-dmo.org/deployment/826373
Platform	Mooring - Hopkins Marine Station
Start Date	2018-06-08
End Date	2018-10-04
Description	This deployment represents the mooring itself and data that has been acquired at this site or in close proximity of it, and are considered samples "inside a kelp forest": ADCP data:

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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