Dissolved Inorganic Carbon measured in situ over depth in the kelp forest (36° 37.3' N, 121° 54.1' W) recorded in July 2018.

Website: https://www.bco-dmo.org/dataset/826200
Data Type: Other Field Results
Version: 1
Version Date: 2020-10-07

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

Dissolved Inorganic Carbon measured in situ over depth in the kelp forest (36° 37.3' N, 121° 54.1' W) recorded in July 2018.

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Coverage

Spatial Extent: **Lat**:36.62167 **Lon**:-121.90167
Temporal Extent: 2018-07-11 - 2018-07-20

Dataset Description

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

Methods & Sampling

Continuous flow pumping experiments were conducted inside the kelp forest from a vessel within 15-m of the kelp mooring to obtain high temporal and vertical resolution biogeochemical data. Two experiments were conducted (July 11-13 and July 18-20, 2018) that overlapped with the kelp mooring pH timeseries data. Seawater was pumped from five depths spanning the water column using five sections of equal-length polypropylene tubing (3/8" ID, 1/2" OD) deployed over the side of a moored vessel. The depths presented here include the surface (valve #5), 6 mab (2-5 mbs, valve #3), and 1 mab (7-10 mbs, valve #1). A custom auto sampling manifold introduced water from each of the 5 tubes to a continuous flow system at 5-minute intervals, allowing the full suite of depths to be sampled every 25 minutes for the duration of each experiment (similar to Koweek et al., 2015a; Koweek et al., 2015b; Teneva et al., 2013). Seawater was drawn into the continuous flow system from each depth by a peristaltic pump operating at 2L/min.

Dissolved inorganic carbon (DIC) samples were automatically drawn every 5 minutes and analyzed using a custom-built sample acidification and delivery system coupled to a Li-COR 7000 infrared gas analyzer as described in Long et al. (2011). DIC was calibrated every hour using certified reference materials (CRM), Batch 169 (Dickson, 2010). Instrumental precision, based on 102 CRM analyses, was ± 5.7 µmol kg-1.

Data Processing Description

DIC samples were drawn from whichever depth was being actively pumped. The samples were later paired to the
appropriate depth by matching DIC sampling time to the valve control record of which depth was being pumped. Data processing was completed in Matlab.

BCO-DMO Processing notes:

- Converted Timestamp to ISO format, and timezone from Pacific Standard Time (PST) to UTC

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Data Files

File
DIC_pump.csv(Comma Separated Values (.csv), 41.08 KB) MD5:71d88423b662609ab64542ead425c21e Primary data file for dataset ID 826200

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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., 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

Koweek, D. A., Dunbar, R. B., Monismith, S. G., Mucciarone, D. A., Woodson, C. B., & Samuel, L. (2015). High-

resolution physical and biogeochemical variability from a shallow back reef on Ofu, American Samoa: an end-member perspective. Coral Reefs, 34(3), 979–991. doi:[10.1007/s00338-015-1308-9](#)
Methods

Koweek, D., Dunbar, R. B., Rogers, J. S., Williams, G. J., Price, N., Mucciarone, D., & Teneva, L. (2014). Environmental and ecological controls of coral community metabolism on Palmyra Atoll. Coral Reefs, 34(1), 339–351. doi:[10.1007/s00338-014-1217-3](#)
Methods

Long, M. C., Dunbar, R. B., Tortell, P. D., Smith, W. O., Mucciarone, D. A., & DiTullio, G. R. (2011). Vertical structure, seasonal drawdown, and net community production in the Ross Sea, Antarctica. Journal of Geophysical Research, 116(C10). doi:10.1029/2009jc005954 https://doi.org/10.1029/2009JC005954
Methods

Teneva, L., Dunbar, R. B., Mucciarone, D. A., Dunckley, J. F., & Koseff, J. R. (2013). High-resolution carbon budgets on a Palau back-reef modulated by interactions between hydrodynamics and reef metabolism. Limnology and Oceanography, 58(5), 1851–1870. doi:[10.4319/lo.2013.58.5.1851](#)
Methods

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Related Datasets

IsSupplementedBy

Hirsh, H., Nickols, K. J., Takeshita, Y., Traiger, S., Monismith, S. G., Mucciarone, D., Dunbar, R. B. (2020) **pH measured in situ over depth in the kelp forest (36° 37.3' N, 121° 54.1' W) recorded in July 2018.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2020-10-07 doi:10.26008/1912/bco-dmo.826162.1 [[view at BCO-DMO](#)]
Relationship Description: Part of the same continuous flow pumping experiments.

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Parameters

Parameter	Description	Units
Timestamp_DIC	local date and time, PST	unitless
DIC_1mab	DIC measured 1 meter above the bottom	micromoles per kilogram (umol/kg)
DIC_6mab	DIC measured 6 meters above the bottom	micromoles per kilogram (umol/kg)
DIC_surface	DIC measured at the surface	micromoles per kilogram (umol/kg)
ISO_DateTime_UTC	Sampling date and time in ISO format (yyyy-mm-ddThh:mm:ssZ) in UTC (coordinated Universal Time)	unitless

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Instruments

Dataset-specific Instrument Name	Li-COR 7000 infrared gas analyzer
Generic Instrument Name	LI-COR LI-7000 Gas Analyzer
Dataset-specific Description	Li-COR 7000 infrared gas analyzer
Generic Instrument Description	The LI-7000 gas analyzer is a differential, single source, non-dispersive, infrared gas analyzer. It has two solid state detectors, one each for CO_2 and H_2O, filters at 4.255 microns and 2.595 microns respectively. CO_2 is measured in the range 0-3000ppm, with an accuracy of 1 percent nominally. H_2O is measured in the range 0-60 mmol per mol, with an accuracy of one 1 percent.

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:

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 (CO_2) 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 CO_2. 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 CO_2 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.

Funding

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