Water level and seafloor temperature from Onset HOBO U20L loggers deployed on the seafloor adjacent to instrument moorings inside and outside of kelp forests near the Monterey Peninsula, California, USA from June to August 2018 and 2019

Website: https://www.bco-dmo.org/dataset/864720
Data Type: Other Field Results
Version: 1
Version Date: 2021-11-12

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
These data are from Onset HOBO U20L data loggers recording at 1-minute intervals deployed on the seafloor from June to August in 2018 and 2019. The HOBO loggers were deployed adjacent to instrument moorings inside and outside of kelp forests near the Monterey Peninsula, California, USA.

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Coverage

Spatial Extent: **N**:36.63088 **E**:-121.897 **S**:36.61795 **W**:-121.9188
Temporal Extent: 2018-06-07 - 2019-08-07

Methods & Sampling

Sampling Locations:
Sampling was conducted near the Monterey Peninsula near Pacific Grove and Monterey, California, USA. Kelp sites ranged from 8.8 to 10.3 meters deep and offshore sites ranged from 13.1 to 16.5 m deep.

Instrument moorings were deployed in 2018 in the following areas: a wave-protected kelp forest, ~100 meters offshore of the protected site, in a wave-exposed site devoid of kelp (historically has had kelp), and ~100 meters offshore of the exposed site.

Instrument moorings were deployed in 2019 in the following areas: a wave-protected kelp forest, ~175 meters offshore of the protected site, in a wave-exposed kelp site, and ~180 meters offshore of the exposed site.

Location Abbreviations:
PK = Protected kelp 2018,

PO = Protected offshore 2018,
EK = Exposed ‘kelp’ 2018,
EO = Exposed offshore 2018,
MK = Protected kelp 2019,
MO = Protected offshore 2019,
OK = exposed kelp 2019,
OO = Exposed offshore 2019.

Methodology:
HOBO U20L water level and temperature loggers were attached to the bottom of each instrument mooring ~0.45 m above the seafloor. Instruments had to be swapped out periodically during deployment due to data storage capacity. Time and depth of deployment were recorded each time a sensor was deployed.

Data Processing Description

Data Processing:
Data were processed using R software version 1.4.1717. Data from multiple instruments at each site were stitched together based on deployment times and data outside of deployment times was trimmed off.

BCO-DMO Processing:
- converted local date to ISO8601 format;
- created the ISO8601 date-time field in UTC;
- replaced "NA" with "nd" (no data).

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Data Files

File
HOBO_U20L.csv (Comma Separated Values (.csv), 77.12 MB) MD5:4e69296e6ba4e03d74eafbc8c21310f7 Primary data file for dataset ID 864720

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Parameters

Parameter	Description	Units
Site	Site code: PK = Protected kelp 2018, PO = Protected offshore 2018, EK = Exposed kelp 2018, EO = Exposed offshore 2018, MK = Protected kelp 2019, MO = Protected offshore 2019, OK = exposed kelp 2019, OO = Exposed offshore 2019.	unitless
ISO_DateTime_Local	Date and time (PST) in ISO8601 format: YYYY-MM-DDThh:mm:ss	unitless
Time_zone	Indicates the local time zone (PST)	unitless
ISO_DateTime_UTC	Date and time (UTC) in ISO8601 format: YYYY-MM-DDThh:mm:ssZ	unitless
Site_depth_0_tide	Depth of the site at at 0 tide	meters (m)
Latitude	Latitude	decimal degrees North
Longitude	Longitude	decimal degrees West
Location	Indicates if the location is Kelp or Offshore	unitless
Temperature_C	Temperature	degrees Celsius
AbsPres_kPa	Pressure	kiloPascals (kPa)
AbsPres_decibar	Pressure	decibars
AbsPres_decibar_corrected	Pressure minus atmospheric pressure	decibars

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Instruments

Dataset-specific Instrument Name	HOBO U20L water level and temperature logger
Generic Instrument Name	Onset HOBO U20L water level logger series
Generic Instrument Description	The HOBO U20L is designed for monitoring changing water levels in a variety of applications including tidal areas, streams, lakes, wetlands, and groundwater. It outputs pressure, water level, and temperature data. The instrument can record samples, sensor measurements at each logging interval, and events data, occurrences such as a bad battery or host connected. The samples are recorded as absolute pressure values, which are later converted to water level readings using software. Absolute pressure is atmospheric pressure plus water head. The deployment of an additional HOBO U20L at the surface can be used to compensate for barometric pressure changes. Each instrument is individually calibrated. They require a coupler and optic base station or HOBO waterproof shuttle to connect to a computer. The instrument is operated with a 3.6 V lithium battery. This series contains 3 models, U20L-01, U20L-02, and U20L-04, with different operation ranges, calibrated ranges, and burst pressures. The pressure sensor is temperature compensated between 0 and 40 degrees Celsius (C), and calibrated between 69 and a maximum of 400 kPa (depending on the model). Its accuracy is within 0.3 % of the full scale for absolute pressure, and 0.1 % FS for water level readings. The temperature sensor operates between -20 and 50 degrees C, with an accuracy of 0.44 deg C, and a resolution of 0.1 deg C. The drift is 0.1 deg C per year.

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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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