Dissolved oxygen and temperature from PME miniDOT sensors recording at 1-minute intervals at various depths on 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/864402
Data Type: Other Field Results
Version: 1
Version Date: 2021-11-04

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 PME miniDOT sensors recording dissolved oxygen and temperature at 1-minute intervals at various depths on instrument moorings from June to August in 2018 and 2019. Data were collected at mooring sites 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 - 2019-10-08

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:
In 2018, instruments were deployed at PK at 1, 3, and 5 meters above the bottom; at PO at 1, 7, and 14 meters above the bottom; at EK at 1, 5, 7 meters above the bottom; and at EO at 1, 7, and 12 meters above the bottom. In 2019, instruments were deployed at MK at 1, 4, and 7.5 meters above the bottom; at MO at 1, 7, and 14.5 meters above the bottom; at OK at 1, 4, and 9 meters above the bottom; and at OO at 1, 9, and 13.4 meters above the bottom. In 2019 instruments were also deployed at the surface at all sites.

Anti-fouling plates were installed on all instruments near the sensor. Any time diving occurred near the instrument moorings, any air bubbles that collected on the sensor were brushed away.

PME MiniDOT instruments were calibrated before and after deployment to determine and correct for any drift in instruments readings. This was done by placing all instruments in a black bucket with a lid and an air stone and left to measure dissolved oxygen for 12 to 24 hours.

Data Processing Description

Data Processing:
Data were first processed using MATLAB version 9.5.0.944444 to exclude data outside of instrument deployment and correct dissolved oxygen values. This was done using a drift coefficient derived from pre- and post-calibration and a function (calc02sat) to correctly calculate dissolved oxygen concentration using temperature recorded by the instrument and salinity recorded by CTD casts at mooring sites. Data were also removed during times of diving operations on the mooring where scuba diver bubbles disrupted data quality. Data were further processed using R software version 1.4.1717 and MATLAB to combine data from all sites and years combined into one file.

BCO-DMO Processing:
- converted local date to ISO8601 format;
- created the ISO8601 date-time field in UTC.

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Data Files

File
miniDOT.csv (Comma Separated Values (.csv), 314.55 MB) MD5:914c62901f2b5d4d070591a06c69476a Primary data file for dataset ID 864402

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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
ISO_DateTime_UTC	Date and time (UTC) in ISO8601 format: YYYY-MM-DDThh:mm:ssZ	unitless
Time_zone	Indicates the local time zone (PST)	unitless
Meters_above_bottom	Instrument height above the seafloor	meters (m)
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
Dissolved_oxygen_umol_kg	Dissolved oxygen	micromoles per kilogram (umol/kg)
Dissolved_oxygen_mg_kg	Dissolved oxygen	milligrams per kilogram (mg/kg)

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Instruments

Dataset-specific Instrument Name	PME MiniDOT
Generic Instrument Name	PME MiniDOT Logger
Generic Instrument Description	The PME miniDOT logger is a submersible sensor designed to measure water temperature and dissolved oxygen concentration. Dissolved oxygen is measured by an optode that measures lifetime-based luminescence quenching of a thin membrane. The sensing foil contains a coating with a variable fluorescence depending on the oxygen concentration of the surrounding water. The miniDOT reports in milligrams per liter (mg/L) and logs all measurements to an internal SD card. Also featured is a temperature sensor and batteries. Data can be offloaded to a computer via USB cable. The logger has an accuracy of +/- 5 percent (+/- 0.3 mg/L) for oxygen, and +/- 0.1 degrees Celsius for temperature. Temperature range is 0 to 35 degrees Celsius, oxygen range is 0 to 150 percent saturation. Depth-rated to 300 meters. Instrument description from the manufacturer: https://www.pme.com/products/minidot

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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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