

CTD sensor and nutrient measurements from R/V Yellowfin cruises to the San Pedro Ocean Time-series (SPOT) station in 2013 and 2014

Website: <https://www.bco-dmo.org/dataset/685342>

Data Type: Other Field Results

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Project

» [Collaborative Research: Use of Triple Oxygen Isotopes and O₂/Ar to constrain Net/Gross Oxygen Production during upwelling and non-upwelling periods in a Coastal Setting](#) (UpRISEE O₂ upwelling)

Contributors	Affiliation	Role
Haskell, William	University of California-Santa Barbara (UCSB-MSI)	Principal Investigator
Hammond, Douglas E.	University of Southern California (USC)	Co-Principal Investigator
Prokopenko, Maria	Pomona College (Pomona)	Co-Principal Investigator
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

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Coverage

Spatial Extent: Lat:33.55 Lon:-118.4

Temporal Extent: 2013-02-14 - 2014-06-19

Dataset Description

CTD sensor and nutrient measurements. Measurements were made at the San Pedro Ocean Time-series (SPOT) station (33°33'N, 118°24'W). Data are also published in Table C1 in the following publication: Haskell, W. Z., et al. 2016. An organic carbon budget for coastal Southern California determined by estimates of vertical nutrient flux, net community production and export. Deep-Sea Research I, 116, 49-76. doi:[10.1016/j.dsr.2016.07.003](https://doi.org/10.1016/j.dsr.2016.07.003)

Methods & Sampling

See complete methodology in Haskell et al. (2016). In summary:

This study is part of an effort aimed at characterizing the biological response to upwelling at SPOT on 21 cruises between January 2013 and June 2014; the Upwelling Regime In-Situ Ecosystem Efficiency (Up.R.I.S.E.E.) study.

Nutrients: Samples for dissolved nutrient and pH analysis were collected via Niskin at 12 depths from the surface to 400 m and filtered through 0.8/0.2 µm Acrodisc syringe filters. One Nalgene bottle was filled

completely leaving no headspace and kept at ambient temperature for 6–8 h until return to the lab where pH was measured using a combination electrode calibrated with buffers of pH 4 and 7, referenced to NBS standards. About 20 of these samples were analyzed for alkalinity and total dissolved inorganic carbon (DIC). To make the measured pH internally consistent with the DIC and alkalinity, all pH values were increased by 0.02, the estimated uncertainty in electrode calibration. After the pH aliquot was taken, samples were refrigerated until silicic acid and phosphate analyses were done colorimetrically at USC with a Hitachi UV/vis-spectrophotometer. Nitrate samples were collected in acid-washed 60 ML HDPE Nalgene bottles and frozen at -20 degrees C until analysis. Nitrate concentrations in samples collected from January to June 2013 were determined by converting nitrate to N₂O and quantifying the amount of N₂O as integrated sample areas on an Isotope Ratio Mass Spectrometer (IRMS) in the D. Sigman lab at Princeton University. Prior to analyses, nitrite was chemically removed from samples. The remainder of the samples (October 2013 to June 2014) were analyzed for nitrate + nitrite and nitrite only by chemiluminescence. The analytical uncertainty for nitrate and silica concentrations is ~0.5 uM. Samples for DIC were collected at each depth by using a syringe to inject 5–7 mL of filtered water into evacuated vials through a needle-pierced septum. Following measurement of the mass of water, measurements of TCO₂ and δ¹³C were made on a Picarro Cavity Ring-Down Spectrometer at USC. Alkalinity was calculated from DIC and pH using Mehrbach constants. On samples titrated for alkalinity, DIC calculated from the adjusted pH was within +/- 10 umol per kg (+/- 1 ssd) of the measured values. Measurements were standardized with Dickson standards from SIO, and alkalinity precision was typically +/- 5 ueq per kg. DOC samples were syringe-filtered into acid-washed and combusted 40 ML borosilicate vials with silicone/PTFE septa caps (Thermo Fisher Scientific). After sampling, samples were acidified with distilled HCl to pH ~2 and refrigerated until analysis on a Shimadzu TOC-VCSN analyzer at Scripps Institute of Oceanography (L. Aluwihare lab). The analytical uncertainty on DOC concentrations based on replicates is ~ 5 uM. Each day's run included the analysis of a deep seawater community standard, and if the concentration of this standard was not between 41 and 42 uM C then all samples were re-analyzed.

Data Processing Description

CTD data was processed through the standard Seabird Seasave V7 data processing algorithm.

BCO-DMO Processing:

- modified parameter names to conform with BCO-DMO naming conventions;
- created separate column for date and formatted to yyyy-mm-dd;
- replaced "-" and blanks (missing data) with "nd";
- added site name, lat, and lon from information on metadata form.

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Data Files

File
CTD.csv (Comma Separated Values (.csv), 37.14 KB) MD5:97e2fd8c1b2f386ab5a98a2b8b1087e7
Primary data file for dataset ID 685342

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Parameters

Parameter	Description	Units
site	Name of the site	unitless
lat	Latitude of the site	decimal degrees

lon	Longitude of the site	decimal degrees
cruise_id	Cruise identifier	unitless
date	Date of sampling formatted as yyyy-mm-dd	unitless
year	4-digit year	unitless
month	2-digit month	unitless
day	2-digit day	unitless
yrday	Year day (sequential day of year, eg. Jan 1 = 1)	unitless
depth	Sample depth	meters (m)
temp	Temperature	degrees C
sal	Salinity	parts per thousand (ppt)
O2	Oxygen concentration calibrated by Winkler titration.	micromoles per kilogram (umol kg-1)
AOU	Apparent oxygen utilization defined as the saturation concentration of oxygen at the given temperature and salinity minus the measured oxygen concentration.	micromoles per kilogram (umol kg-1)
chl_fluor	Chlorophyll fluorescence	milligrams per cubic meter (mg m-3)
density	Density	kilograms per cubic meter (kg m-3)
pH	pH; NBS scale	unitless
DIC	Dissolved inorganic carbon (DIC)	micromoles per kilogram (umol kg-1)
alk	Alkalinity	micromoles per kilogram (umol kg-1)
DOC	Dissolved organic carbon (DOC)	micromolar (uM)

NO3	Nitrate	micromolar (uM)
PO4	Phosphate	micromolar (uM)
H4SiO4	Silicic acid	micromolar (uM)

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Instruments

Dataset-specific Instrument Name	chemiluminescence
Generic Instrument Name	Chemiluminescence NOx Analyzer
Dataset-specific Description	The remainder of the samples (October 2013 to June 2014) were analyzed for nitrate + nitrite and nitrite only by chemiluminescence.
Generic Instrument Description	The chemiluminescence method for gas analysis of oxides of nitrogen relies on the measurement of light produced by the gas-phase titration of nitric oxide and ozone. A chemiluminescence analyzer can measure the concentration of NO/NO2/NOX. One example is the Teledyne Model T200: https://www.teledyne-api.com/products/nitrogen-compound-instruments/t200

Dataset-specific Instrument Name	Seabird CTD
Generic Instrument Name	CTD Sea-Bird
Generic Instrument Description	A Conductivity, Temperature, Depth (CTD) sensor package from SeaBird Electronics. This instrument designation is used when specific make and model are not known or when a more specific term is not available in the BCO-DMO vocabulary. Refer to the dataset-specific metadata for more information about the specific CTD used. More information from: http://www.seabird.com/

Dataset-specific Instrument Name	Isotope Ratio Mass Spectrometer
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Dataset-specific Description	N2O was quantified on an Isotope Ratio Mass Spectrometer at Princeton University.
Generic Instrument Description	The Isotope-ratio Mass Spectrometer is a particular type of mass spectrometer used to measure the relative abundance of isotopes in a given sample (e.g. VG Prism II Isotope Ratio Mass-Spectrometer).

Dataset-specific Instrument Name	Seabird SBE 43
Generic Instrument Name	Sea-Bird SBE 43 Dissolved Oxygen Sensor
Dataset-specific Description	Oxygen was measured by SBE 43 on the CTD.
Generic Instrument Description	The Sea-Bird SBE 43 dissolved oxygen sensor is a redesign of the Clark polarographic membrane type of dissolved oxygen sensors. more information from Sea-Bird Electronics

Dataset-specific Instrument Name	Shimadzu TOC-VCSN analyzer
Generic Instrument Name	Shimadzu TOC-V Analyzer
Dataset-specific Description	DOC samples were acidified with distilled HCl to pH ~2 and refrigerated until analysis on a Shimadzu TOC-VCSN analyzer at Scripps Institute of Oceanography.
Generic Instrument Description	A Shimadzu TOC-V Analyzer measures DOC by high temperature combustion method.

Dataset-specific Instrument Name	
Generic Instrument Name	Spectrometer
Dataset-specific Description	Following measurement of the mass of water, measurements of TCO ₂ and δ ¹³ C were made on a Picarro Cavity Ring-Down Spectrometer at USC.
Generic Instrument Description	A spectrometer is an optical instrument used to measure properties of light over a specific portion of the electromagnetic spectrum.

Dataset-specific Instrument Name	Hitachi UV/vis-spectrophotometer
Generic Instrument Name	Spectrophotometer
Dataset-specific Description	Silicic acid and phosphate analyses were done colorimetrically at USC with a Hitachi UV/vis-spectrophotometer.
Generic Instrument Description	An instrument used to measure the relative absorption of electromagnetic radiation of different wavelengths in the near infra-red, visible and ultraviolet wavebands by samples.

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Deployments

UpRISEE_SPOT_13-14

Website	https://www.bco-dmo.org/deployment/684011
Platform	R/V Yellowfin
Start Date	2013-01-16
End Date	2014-06-19
Description	A series of cruises were conducted from January 2013 to June 2014 to the San Pedro Ocean Time-Series (SPOT) station. These cruises were part of a study aimed at characterizing the biological response to upwelling at SPOT: the Upwelling Regime In-Situ Ecosystem Efficiency (Up.R.I.S.E.E.) study.

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Project Information

Collaborative Research: Use of Triple Oxygen Isotopes and O₂/Ar to constrain Net/Gross Oxygen Production during upwelling and non-upwelling periods in a Coastal Setting (UpRISEE O₂ upwelling)

Coverage: Northeast Pacific Ocean

The marine biological pump is one of the primary pathways via which anthropogenic carbon dioxide may be sequestered from the atmosphere and exported to the deep ocean as organic carbon. While the link between nutrient supply and high primary productivity in upwelling regions is well established, factors controlling the organic carbon export efficiency of upwelling ecosystems are not well known. Scientists from the University of Southern California and Pomona College plan to determine the factors that control the rates and magnitudes of two components of biological production, Net Community Production (NCP) and Gross Primary Production (GPP), as well as particulate organic carbon export efficiency, at the San Pedro Ocean Time Series, a coastal site in the California Borderland during periods of minimal and high upwelling velocity over a 2-year span. At this site, past and ongoing observations of hydrography and carbon rain will provide an historical context for interpreting results and mechanisms at work.

Rates of NCP and GPP will be quantified at different upwelling intensity, using dissolved oxygen to argon (O₂/Ar) ratios and the oxygen triple isotope composition of dissolved oxygen (O₂). The export of organic carbon will be established using ²³⁴Th (thorium) profiles in the water column, coupled with floating sediment trap deployments, and the development of a carbon isotope balance for the water column. Upwelling will be characterized using non-steady state budgets for atmospheric ⁷Be (beryllium) input and its depth-integrated decay, as well as estimating rates based on remote measurements of wind stress curl and budgets for dissolved inorganic carbon and silicon. Application of the O₂/Ar ratio and the oxygen triple isotope approach will require depth-integrated profiles of these tracers to evaluate the impact of upwelling on mixed layer inputs and use of non-steady state models during seasonal transitions in upwelling. The comprehensive data set to be obtained should provide insights into the organic carbon export efficiency under variable upwelling regimes and help to relate the satellite-based measurements of chlorophyll to the organic carbon export of these highly productive ecosystems.

Broader Impacts: One graduate and one undergraduate student from the University of Southern California and two undergraduate students from Pomona College would be supported and trained as part of this project.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1260296
NSF Division of Ocean Sciences (NSF OCE)	OCE-1260692

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