Bacteria, picoeukaryote, and Synecoccus cell counts and chlorophyll-a from nitrate and vitamin-B treatments, from upwelled coastal waters off Southern California, March 2015 (B-vitamin plankton succession project)

Website: https://www.bco-dmo.org/dataset/725929
Data Type: experimental
Version: 1
Version Date: 2018-01-26

Project
» Can the availability of B-vitamins control phyto-and-bacterioplankton successions in a coastal upwelling region? (B-vitamin plankton succession)

Contributors	Affiliation	Role
Sanudo-Wilhelmy, Sergio A.	University of Southern California (USC-WIES)	Principal Investigator
Fu, Feixue	University of Southern California (USC-WIES)	Co-Principal Investigator
Hutchins, David A.	University of Southern California (USC-HIMS)	Co-Principal Investigator
Cutter, Lynda	University of Southern California (USC)	Contact
Copley, Nancy	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
This dataset includes chlorophyll-a concentrations and cell counts for picoplankton collected in water samples from the San Pedro Ocean Time-series (SPOT), 2015. They were incubated with six treatments of nitrate and vitamin B.

Table of Contents

Coverage

Spatial Extent: **Lat**:33.5478 **Lon**:-118.3983
Temporal Extent: 2015-03-12 - 2015-03-24

Dataset Description

This dataset includes chlorophyll-a concentrations and cell counts for picoplankton collected in water samples from the San Pedro Ocean Time-series (SPOT), 2015. They were incubated with six treatments of nitrate and vitamin B.

Methods & Sampling

Water samples were collected from 3 meters depth at the San Pedro Ocean Time-series (SPOT) station (33°33'N, 118°24'W) off the coast of Southern California in March 2015. Six treatments were used: control, nitrate, nitrate+B1, nitrate+B7, nitrate+B12, and nitrate+B1+B7+B12 with triplicate 10L incubations. Growth was tracked daily. Samples were collected initially, and at two points during the experiment: exponential growth and stationary phase. Exponential growth occurred at day 7 and stationary growth varied between treatment ranging from 10-12 days. The incubations were co-limited by nitrate and B12. Samples were flash frozen and stored at -80C until analysis. For further details on the methodology, see Suffridge et al (2017).

Samples for flow cytometry were collected, fixed with 2% formalin, and frozen at -80C. Analysis for the cellular abundance of heterotrophic bacteria, Synechococcus, and pircoeukaryotes was conducted using a BD Accuri C6 flow cytometer (Becton Dickerson and Company).

Chl-a concentrations were measured using the protocol described by Welschmeyer (1994). 40 ml of water samples from each replicate were filtered through GF/F glass fiber filters, 3.0-µm and 8.0-µm polycarbonate membrane for size fractionated Chl-a analyses. After adding 6 ml of 90% acetone, Chl-a was extracted in the freezer at -20°C and measured using the non-acidification method with a Turner Designs 10-AUTM fluorometer after 24 hours.

Data Processing Description

BCO-DMO Processing:

- added conventional header with dataset name, PI name, version date
- renamed parameters to BCO-DMO standard
- reformatted columns by adding chla, organism, and cell_count -replacing type, units, and value in order to keep one type of data in each column
- changed 'syn' to 'Synechococcus', 'picoeuk' to 'picoeukaryotes'
- changed B1, B7, B12 to N+B1, N+B7, N+B12

[table of contents | back to top]

Data Files

File
Vitacopss_cell_chla_conc.csv (Comma Separated Values (.csv), 20.37 KB) MD5:b2eca13025a751ff88d1b751fafaa022 Primary data file for dataset ID 725929

[table of contents | back to top]

Related Publications

Sanudo-Wilhelmy, S. A., Cutter, L. S., Durazo, R., Smail, E. A., Gomez-Consarnau, L., Webb, E. A., … Karl, D. M. (2012). Multiple B-vitamin depletion in large areas of the coastal ocean. Proceedings of the National Academy of Sciences, 109(35), 14041–14045. doi:10.1073/pnas.1208755109
General

Suffridge, C., Cutter, L., & Sañudo-Wilhelmy, S. A. (2017). A New Analytical Method for Direct Measurement of Particulate and Dissolved B-vitamins and Their Congeners in Seawater. Frontiers in Marine Science, 4. doi:10.3389/fmars.2017.00011
Methods

Welschmeyer, N. A. (1994). Fluorometric analysis of chlorophyll a in the presence of chlorophyll b and pheopigments. Limnology and Oceanography, 39(8), 1985–1992. doi:10.4319/lo.1994.39.8.1985

Parameters

Parameter	Description	Units
treatment	treatments: control; nitrate (N); nitrate+B1 (N+B1); nitrate+B7 (N+B7); nitrate+B12 (N+B12); and nitrate+B1+B7+B12 (All)	unitless
date	date of experiment formatted as yyyy-mm-dd	unitless
time_point_code	code for sampling period during one of three growth phases of the population: 0=initial sampling; 1=exponential phase; 2=stationary phase. Dates: 2015-03-12 (time 0); 2015-03-20 (time 1); 2015-03-25 (time 2)	unitless
organism	type of microorganism counted	unitless
chla	chl-a Rf value	unitless
cell_count	cell count of microorganism	cells/milliliter

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	CTD - profiler
Generic Instrument Description	The Conductivity, Temperature, Depth (CTD) unit is an integrated instrument package designed to measure the conductivity, temperature, and pressure (depth) of the water column. The instrument is lowered via cable through the water column. It permits scientists to observe the physical properties in real-time via a conducting cable, which is typically connected to a CTD to a deck unit and computer on a ship. The CTD is often configured with additional optional sensors including fluorometers, transmissometers and/or radiometers. It is often combined with a Rosette of water sampling bottles (e.g. Niskin, GO-FLO) for collecting discrete water samples during the cast. This term applies to profiling CTDs. For fixed CTDs, see https://www.bco-dmo.org/instrument/869934.

Dataset-specific Instrument Name	BD Accuri C6 flow cytometer (Becton Dickerson and Company)
Generic Instrument Name	Flow Cytometer
Dataset-specific Description	Samples for flow cytometry were collected, fixed with 2% formalin, and frozen at -80C. Analysis for the cellular abundance of heterotrophic bacteria, Synechococcus, and pircoeukaryotes was conducted using a BD Accuri C6 flow cytometer (Becton Dickerson and Company).
Generic Instrument Description	Flow cytometers (FC or FCM) are automated instruments that quantitate properties of single cells, one cell at a time. They can measure cell size, cell granularity, the amounts of cell components such as total DNA, newly synthesized DNA, gene expression as the amount messenger RNA for a particular gene, amounts of specific surface receptors, amounts of intracellular proteins, or transient signalling events in living cells. (from: http://www.bio.umass.edu/micro/immunology/facs542/facswhat.htm)

Dataset-specific Instrument Name	
Generic Instrument Name	Fluorometer
Generic Instrument Description	A fluorometer or fluorimeter is a device used to measure parameters of fluorescence: its intensity and wavelength distribution of emission spectrum after excitation by a certain spectrum of light. The instrument is designed to measure the amount of stimulated electromagnetic radiation produced by pulses of electromagnetic radiation emitted into a water sample or in situ.

Dataset-specific Instrument Name	
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.

[table of contents | back to top]

Deployments

lab_Sanudo_2015

Website	https://www.bco-dmo.org/deployment/653467
Platform	R/V Yellowfin
Start Date	2015-03-01
End Date	2016-06-01

[table of contents | back to top]

Project Information

Can the availability of B-vitamins control phyto-and-bacterioplankton successions in a coastal upwelling region? (B-vitamin plankton succession)

Coverage: Southern California Bight

Description from NSF award abstract:
B-vitamins (thiamin (B1), biotin (B7), and cobalamin (B12)) are organic molecules used by all organisms for many biochemical reactions ranging from DNA and amino acid synthesis to carbon dioxide assimilation. Despite their metabolic importance, many marine organisms cannot make them and need to obtain them from the environment. Because the requirement for a specific vitamin is different for different organisms, changes in the species composition of algae could be explained by their different B-vitamin requirements. For example, changes in the biological properties of waters during an algal bloom (removal of needed vitamins and release of other vitamins) may favor algae that require the vitamin released by the previous bloom (setting up a floral succession). This selective preconditioning of the waters may be one factor in the seasonal succession of algal species. However, evaluating the role of vitamins in marine ecology has been difficult. No study to date has been comprehensive enough to estimate the importance of vitamins in primary productivity and species succession. This is especially true in coastal upwelling regions that although relatively small in area, are orders of magnitude more productive than their open-ocean counterparts. In fact, those regions contribute a significant portion of the world fisheries. Therefore, in order to try to predict future changes in the world ocean due to human activity, the variables that influence or control the algal communities that dominate the very productive food chains of upwelling regions need to be identified.

This study will investigate how the availability of B-vitamins affects the dynamics of algal- and bacterioplankton population growth in coastal waters of an upwelling region off Southern California. This comprehensive field investigation will determine in situ temporal concentrations of several dissolved and particulate B-vitamins, inorganic micro- and macronutrients, concurrently with seasonal changes in phytoplankton and bacterial abundances and species composition at a long-term time series station within the San Pedro Basin near Los Angeles. Those measurements will be complemented with field incubation experiments with natural plankton assemblages to study the effect of organic and inorganic nutrient amendments on phytoplankton and bacterial community structure. This study will establish for the first time that the availability of ambient B-vitamins influence algal and bacterial species succession in a highly productive coastal upwelling region and that multiple and differing B-vitamin requirements limit growth of some phytoplankton species in those areas. Furthermore, this study will try to show that coastal upwelling transports some B-vitamins to the phytoplankton community in the photic zone from bacterially-influenced source waters within the upper mesopelagic zone.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1435666

[table of contents | back to top]