Particulate B vitamins from Hotmix expedition, B/O Sarmiento de Gamboa Hotmix, May 2014

Website: https://www.bco-dmo.org/dataset/653431
Data Type: Cruise Results
Version:
Version Date: 2016-08-08

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

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Table of Contents

- Dataset Description
  - Methods & Sampling
  - Data Processing Description
- Parameters
- Instruments
- Deployments
- Project Information
- Funding

Dataset Description

Access to this data set is restricted until 2017-12-31. Please contact L. Cutter for further information.

Related Datasets:
vitamin B dissolved - Hotmix 2014
vitamin B particulate - Vitacopss 2015

Methods & Sampling

Samples for quantification of dissolved and particulate B vitamins were collected at a number of depths within the euphotic zone (see field study sites). Seawater was collected from each CTD depth using Niskin bottles and immediately filtered. Particulate samples were collected using 0.2µm in-line filters and a peristaltic pump (flow rate < 50 ml per minute), transferred into sterile cryovials. and were immediately stored at -80 degrees C until analysis. One liter of filtrate was collected and stored in 1-L bottles at -20 degrees C until analysis. Dissolved B-vitamin pre-concentration was performed as described in Suffridge et. al (2017) and Sañudo et al 2012.

All vitamin samples were analyzed by liquid chromatography/tandem mass spectrometry (LC/MS/MS). The LCMS system consists of a ThermoTSQ Quantum Access electro-spray ionization triple quadrupole mass spectrometer, coupled to a Thermo Accela High Speed Liquid Chromatography system.

Particulate B-vitamins were extracted in acidic methanol (pH 3.5, 5% MeOH, 95% LC/MS Grade water) using bead-beating for cell lysis and a 30C incubation for B-vitamin extraction. A liquid phase extraction using chloroform (1:1 v/v) was used to clean up the samples prior to analysis. The extraction was performed as described in Suffridge et. al (submitted to L&O Methods, June 2016).

Cited References:

Suffridge, Christopher; Cutter, Lynda; Sanudo-Wilhelmy, Sergio (2017) A New Analytical Method for Direct Measurement of Particulate and Dissolved B-vitamins and Their Congeners in Seawater. Front. Mar. Sci. vol.4 doi.org/10.3389/fmars.2017.00011

Sanudo 2012 - Proc Natl Acad Sci U S A. 2012 Aug 28;109(35):14041-5. doi: 10.1073/pnas.1208755109. Epub 2012 Jul 23

Data Processing Description

BCO-DMO Processing:

- added conventional header with dataset name, PI name, version date
- renamed parameters to BCO-DMO standard
- replaced blank cells with nd (no data)
- mean_pM and std_dev: reduced digits right of decimal from 9 to 1 to take measurement precision into consideration

[table of contents | back to top]

Parameters

Parameter	Description	Units
station	station number	unitless
lat	latitude; north is positive	decimal degrees
lon	longitude; east is positive	decimal degrees
depth	sample depth	meters
analyte	dissolved vitamin-B form: AB12: Adenosyl Cobalamin B1: Thiamine B7: Biotin CB12: Cyanocobalamin HB12: Hydroxycobalamin HMP: 4-Amino-2-methyl-5-pyrimidinyl methanol MB12: Methylcobalamin MET: Methionine TMP: Thiamine monophosphate TPP: Thiamine pyrophosphate	unitless
mean_pM	analyte concentration	picomoles per liter
std_dev	concentration standard deviation	picomoles per liter

[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	
Generic Instrument Name	High-Performance Liquid Chromatograph
Dataset-specific Description	Thermo Accela High Speed Liquid Chromatography system
Generic Instrument Description	A High-performance liquid chromatograph (HPLC) is a type of liquid chromatography used to separate compounds that are dissolved in solution. HPLC instruments consist of a reservoir of the mobile phase, a pump, an injector, a separation column, and a detector. Compounds are separated by high pressure pumping of the sample mixture onto a column packed with microspheres coated with the stationary phase. The different components in the mixture pass through the column at different rates due to differences in their partitioning behavior between the mobile liquid phase and the stationary phase.

Dataset-specific Instrument Name	
Generic Instrument Name	Mass Spectrometer
Dataset-specific Description	ThermoTSQ Quantum Access electro-spray ionization triple quadrupole mass spectrometer
Generic Instrument Description	General term for instruments used to measure the mass-to-charge ratio of ions; generally used to find the composition of a sample by generating a mass spectrum representing the masses of sample components.

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

Hotmix2014

Website	https://www.bco-dmo.org/deployment/564980
Platform	B/O Sarmiento de Gamboa
Start Date	2014-04-29
End Date	2014-05-28

[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]