Vitamin and methionine quantifications from SPOT cruises during different months from from March to December 2017

Website: https://www.bco-dmo.org/dataset/753883
Data Type: Cruise Results
Version: 0
Version Date: 2019-02-06

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

Contributors	Affiliation	Role
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Coverage

Spatial Extent: **Lat**:33.55 **Lon**:-118.4
Temporal Extent: 2017-03-15 - 2017-12-15

Methods & Sampling

Samples for quantification of B-vitamins B1, B7, CB12 and Methionine were collected at a six of depths within the euphotic zone (5-250m). Seawater was collected from each CTD depth using Niskin bottles and immediately filtered. Particulate samples for chlorophyll quantifications were collected using in-line 0.2um, 3µm and 10um pore-size 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. Pigments were extracted from the filters in 3 mL of methanol, BHT(butylated hydroxytoluene) was added and placed in a -20 degrees C freezer overnight. For chlorophyll-a measurements, 100 microliters of the pigment extraction were diluted in acetone (50x dilution) and analyzed using a Turner 10AU fluorometer.

B-vitamins and Methionine samples were analyzed as in Suffridge et al. 2017. Two liters of seawater were filtered through um pore-size filters and then preconcentrated using a C18 resin (HF Bondesil (Agilent Technologies) and analyzed by liquid chromatography/triple mass spectrometry (LC/MS/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. The LC system used a stable- bond C18 reversed-phase column (DiscoveryHSC18 10cm × 2.1mm,5 µm column, Supelco Analytical)

with a100 uL sample loop. In order to increase the sensitivity and precision, theLC/MS was run in full-loop mode (100 ul/injection).

Bacterial cell counts were heterotrophic prokaryotes were enumerated by flow-cytometry (Becton–Dickinson FACScalibur) (Gasol & del Giorgio, 2000).

Data Processing Description

Data Processing: The LC-MS data was processed using Xcalibur and LCQUAN quantitative softwares from Thermo Scientific.

Problem report: The SPOT sampling for the months of May and July were carried out on the research vessel Nerissa of the Orange County Sanitation District. This was because the RV Yellowfin was in the dry dock for maintenance and repairs. Unfortunately, the light intensity for those two months is missing due to problems with the sensor.

BCO-DMO Processing:
- replaced spaces with underscores in cruise names;
- changed date format from m/d/yyyy to yyyy-mm-dd;
- separated time column into Time_start and Time_end
- converted Latitude and Longitude from degrees and minutes to decimal degrees, added new columns and removed original;
- modified parameter names (replaced spaces and decimals with underscores, removed units)
- filled in empty cells with "nd"; replaced NaN with "nd" ("no data").

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Related Publications

Gasol, J. M., & Del Giorgio, P. A. (2000). Using flow cytometry for counting natural planktonic bacteria and understanding the structure of planktonic bacterial communities. Scientia Marina, 64(2), 197–224. doi:10.3989/scimar.2000.64n2197
Methods

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

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Parameters

Parameter	Description	Units
Cruise	Cruise name	unitless
Date	Date; format: yyyy-mm-dd	unitless
Time_range	Time range	unitless
Time_start	Start time; format: HH:MM	unitless
Time_end	End time; format: HH:MM	unitless
Longitude	Longitude of sampling site; postivie values = East	decimal degrees
Latitude	Latitude of sampling site; positive values = North	decimal degrees
Depth	Sample depth	meters (m)
B1	Average Vitamin B1 (Thiamin) concentrations of triplicate analytical replicates using HPLC-MS	picomolar (pM)
B7	Average Vitamin B7 (Biotin) concentrations of triplicate analytical replicates using HPLC-MS.	picomolar (pM)
CB12	Average Vitamin B12 (as Cyanocobalamin) concentrations of triplicate analytical replicates using HPLC-MS.	picomolar (pM)
MET	Average Methionine concentrations of triplicate analytical replicates using HPLC-MS.	picomolar (pM)
Chla_0_2	Chlorophyll-a concentrations of triplicate analytical replicates using a 10-AU fluorometer. This fraction contains chlorophyll from organisms of 0.2-3 um and was collected onto 0.2 um pore-size filters.	picomolar (pM)
Chla_total	Chlorophyll-a concentrations of triplicate analytical replicates using a 10-AU fluorometer. This fraction contains chlorophyll from all microorganisms larger than 0.2 um.	picomolar (pM)
Bacterial_cell_counts	Bacterial cell concentration per milliliter of seawater.	cells per milliliter (cells ml-1)

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Instruments

Dataset-specific Instrument Name	ThermoTSQ Quantum Access electro-spray ionization triple quadrupole mass spectrometer
Generic Instrument Name	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	Niskin bottles
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.

Dataset-specific Instrument Name	Peristaltic pump
Generic Instrument Name	Pump
Generic Instrument Description	A pump is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action. Pumps can be classified into three major groups according to the method they use to move the fluid: direct lift, displacement, and gravity pumps

Dataset-specific Instrument Name	Turner 10AU fluorometer
Generic Instrument Name	Turner Designs Fluorometer 10-AU
Generic Instrument Description	The Turner Designs 10-AU Field Fluorometer is used to measure Chlorophyll fluorescence. The 10AU Fluorometer can be set up for continuous-flow monitoring or discrete sample analyses. A variety of compounds can be measured using application-specific optical filters available from the manufacturer. (read more from Turner Designs, turnerdesigns.com, Sunnyvale, CA, USA)

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Deployments

SPOT_Yellowfin_Cruises

Website	https://www.bco-dmo.org/deployment/754348
Platform	R/V Yellowfin
Start Date	2005-01-19
End Date	2018-07-18
Description	San Pedro Ocean Time Series (SPOT) station (33°33′N, 118°24′W) R/V Yellowfin, monthly SPOT cruises in the San Pedro Channel Deployment: SPOT Platform: RV Yellowfin Platform Type: vessel

SPOT_Nerissa_Cruises_2017

Website	https://www.bco-dmo.org/deployment/754351
Platform	R/V Nerissa
Start Date	2017-03-15
End Date	2017-12-15
Description	San Pedro Ocean Time Series (SPOT) station (33°33′N, 118°24′W) Deployment: SPOT Platform: RV Yellowfin and RV Nerissa Platform Type: vessel Start Date: 03/15/2017 End Date: 12/15/2017

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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.

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Funding

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

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