Retinoid data from SPOT cruises during different months (2016-2017)

Website: https://www.bco-dmo.org/dataset/718580
Data Type: Cruise Results
Version: 1
Version Date: 2017-11-03

Project
» Environmental regulation of retinal and bacteriochlorophyll biosynthesis (Marine Retinoids)

Contributors	Affiliation	Role
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Coverage

Spatial Extent: **Lat**:33.55 **Lon**:-118.4
Temporal Extent: 2016-09-14 - 2017-07-11

Dataset Description

Location: San Pedro Ocean Time Series (SPOT) station (33°33′N, 118°24′W)

Samples for quantification of retinal oxime 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 were collected using in-line 0.2µm, 3µm and 10µm 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. The retinal oxime was formed by the addition of hydroxylamine hydrochloride and irradiated under yellow light for 2 hours before analysis. Retinal oxime samples were 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.

For chlorophyll-a measurements, 100 microliters of the pigment extraction were diluted in acetone (50x dilution) and analyzed using a Turner 10AU fluorometer.

Bacterial production was estimated by incorporation of [3H] thymidine and [3H] leucine into DNA and protein, respectively, as earlier described (Simon & Azam, 1989, Fuhrman and Azam 1982).

Methods & Sampling

Deployment: SPOT
Platform: RV Yellowfin and RV Nerissa
Platform Type: vessel
Start Date: 09/14/2016
End Date: 07/11/2017

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.

Data Processing Description

The LC-MS data was processed using LCQUAN quantitative software from Thermo Scientific.

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Data Files

File
SPOT_cruise.csv (Comma Separated Values (.csv), 12.20 KB) MD5:80a25260f1c2f7014e5c6506ab05ac06 Primary data file for dataset ID 718580

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Related Publications

Fuhrman, J. A., & Azam, F. (1982). Thymidine incorporation as a measure of heterotrophic bacterioplankton production in marine surface waters: Evaluation and field results. Marine Biology, 66(2), 109–120. doi:10.1007/bf00397184 https://doi.org/10.1007/BF00397184
Methods

Simon, M., & Azam, F. (1989). Protein content and protein synthesis rates of planktonic marine bacteria . Marine Ecology Progress Series, 51, 201–213. doi:10.3354/meps051201
Methods

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Parameters

Parameter	Description	Units
Cruise	Cruise ID	SPOT month and year
Date	Sampling date	mm/dd/yy
Time	Start and end times of sampling	hh:mm-hh:mm
Longitude	SPOT longitude	decimal degrees
Latitude	SPOT latitude	decimal degrees
Depth	Sampling depth	meters
Microbial_Size_fraction	Size range of particles collected	micrometers(µm)
PR_retinal_Oxime_sw	Average Proteorhodopsin concentrations of triplicate analytical replicates of retinal oxime using HPLC-MS	picomolar (pico mol L-1)
STDEV_retinal_oxime_sw	Standard deviation of Proteorhodopsin concentrations of triplicate analytical replicates of retinal oxime using HPLC-MS	picomolar (pico mol L-1)
Chl_a_sw_avg	Average Chlorophyll-a concentrations of triplicate analytical replicates using a 10-AU fluorometer	picomolar (pico mol L-1)
STDEV_Chl_a_sw	Standard deviation of Chlorophyll-a concentrations of triplicate analytical replicates using a 10-AU fluorometer	picomolar (pico mol - L)
Leucine_BP	Bacterial production calculated from Leucine uptake	lls ml-1 day-1
Thymidine_BP	Bacterial production calculated from Thymidine uptake	cells ml-1 day-1
PAR	Photosynthetically active radiation (400-700nm)	micro Einsteins per square meter per second
ISO_DateTime_start	Time at sampling start	yyyy-mm-ddThh:mm:ss

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Instruments

Dataset-specific Instrument Name	Turner 10AU fluorometer
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	ThermoTSQ Quantum Access electro-spray ionization triple quadupole mass spectrometer
Generic Instrument Name	Mass Spectrometer
Dataset-specific Description	The LC-MS system used for the pigment quantification consists of a Thermo TSQ Quantum Access electro-spray ionization triple quadruple mass spectrometer, coupled to a Thermo Accela High Speed Liquid Chromatography pump and auto-sampler.
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.

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Deployments

SPOT_20160914

Website	https://www.bco-dmo.org/deployment/723491
Platform	R/V Yellowfin
Start Date	2016-09-14
End Date	2016-09-14
Description	San Pedro Ocean Time-series

SPOT_20161130

Website	https://www.bco-dmo.org/deployment/723494
Platform	R/V Yellowfin
Start Date	2016-11-30
End Date	2016-11-30
Description	San Pedro Ocean Time-series

SPOT_20170131

Website	https://www.bco-dmo.org/deployment/723511
Platform	R/V Yellowfin
Start Date	2017-01-31
End Date	2017-01-31
Description	San Pedro Ocean Time-series

SPOT_20170315

Website	https://www.bco-dmo.org/deployment/723516
Platform	R/V Yellowfin
Start Date	2017-03-15
End Date	2017-03-15
Description	San Pedro Ocean Time-series

SPOT_20170524

Website	https://www.bco-dmo.org/deployment/723521
Platform	R/V Nerissa
Start Date	2017-05-24
End Date	2017-05-24
Description	San Pedro Ocean Time-series

SPOT_20170711

Website	https://www.bco-dmo.org/deployment/723526
Platform	R/V Nerissa
Start Date	2017-07-11
End Date	2017-07-11
Description	San Pedro Ocean Time-series

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Project Information

Environmental regulation of retinal and bacteriochlorophyll biosynthesis (Marine Retinoids)

Coverage: Mediterrean Sea and the North Pacific Ocean

Description from NSF award abstract:
Rhodopsins are the simplest energy-harvesting photoproteins and community metagenomics have revealed that their synthesis genes are ubiquitous throughout the world oceans. These include microbial rhodopsin (proteorhodopsin (PR)), which occur in an estimated 75% of marine bacteria and archaea in oceanic surface waters. The discovery of this abundant and widespread photoprotein in the surface ocean has challenged the notion that solar energy can only be converted into chemical energy for growth in marine ecosystems through chlorophyll-based photosynthesis. Although the potential of light-driven energy flux in ocean ecosystems through PR could be significant, the physiological and ecological functions of this type of rhodopsin remains undetermined, mainly due to the lack of a technique for a direct measurement of this photoprotein. To evaluate the ecological relevance of PR in the marine environment, the investigators have developed a new analytical technique to measure the concentrations of the light-sensitive pigment in the PR, the chromophore retinal. Because rhodopsins have a single retinal chromophore associated with the polypeptide opsin, the total number of retinal molecules is equivalent to the total number of PR.

This project will employ the PI's newly developed protocol to examine the effects of light, organic carbon and trace metals availability on PR and bacteriochlorophyll synthesis using field and laboratory manipulations. Such experiments will establish the impact of abiotic factors on the two known bacterial photoheterotrophic metabolisms. The laboratory studies will be complemented with the analyses of those pigments in field samples collected along spatial and temporal gradients in light intensity, organic carbon and trace metals in different

oceanographic regimes. Gene expression patterns will be determined in concert with changes in retinal and bacteriochlorophyll concentrations and microbial growth responses in the field and in the laboratory. Therefore, the combination of observational and manipulative approaches, will address fundamental questions in regard to the impact of retinal-based photochemical energy transformation in the ocean, a process that still is not well understood.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1335269

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