Retinoid data from Niskin bottle samples from B/O Sarmiento de Gamboa cruise Hotmix2014 in the Mediterranean in 2014 (Marine Retinoids project)

Website: https://www.bco-dmo.org/dataset/564968
Version: 28 Aug 2015
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Project
» Environmental regulation of retinal and bacteriochlorophyll biosynthesis (Marine Retinoids)

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Methods & Sampling

Size Fractionation of retinal, bacteriochlorophyll and chlorophyll:
Samples for quantification of light harvesting pigments in eukaryotes and prokaryotes were collected at a number of depths within the euphotic zone (see field study sites). Seawater were collected from each CTD depth using Niskin bottles and immediately filtered. Size fractionated samples were collected using a series of in-line filters using a peristaltic pump (flow rate < 50 ml per minute). Filters of different pore-size (0.2 um for picoplankton, and 3.0 um for nanoplankton) were used for the fractionation. Particulate samples were immediately stored at -80 degrees C until analysis. For analysis, samples were extracted with methanol (retinal, chla, and Bchl) and with hydroxylamine (oxime) and 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 (Seegers et al., in preparation). The mobile phase conditions for the LCMS method for chlorophyll and bacteriochlorophyll analyses were adapted from Goericke (2002). All retinoid samples were analyzed in triplicate using an external calibration curve, though not presented, precision was typically in the 5-15% range.

Data Processing Description

Energy Benefit [kJ/cell/day] = Pigment concentration [molecules/cell] × Photosynthetic unit [per cell] ×

Maximum rate [electron/RC/s] /(PAR [umol photons/m2/s] + Half saturation [umol/photons/m2/s]) / Avogadro constant [/mol] × 12 [hours] × 60 [min] × 60 [sec] × Energy per photon [kJ/mol]

BCO-DMO Processing Notes:
- Replaced blanks (missing data) with 'nd' to indicate 'no data';
- Modified parameter names to conform with BCO-DMO naming conventions;
- Added ISO_DateTime field using original date and time values provided.

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Data Files

File
hotmix2014.csv (Comma Separated Values (.csv), 36.00 KB) MD5:6dd68caae40e8bf6adb807adf874705f Primary data file for dataset ID 564968

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Parameters

Parameter	Description	Units
cruise_name	Name of the cruise.	dimensionless
sample	Sample identification number.	dimensionless
station	Station number.	dimensionless
date	Date (month, day, year).	mmddYYYY
time	Time (hours and minutes).	HHMM
lon	Longitude in decimal degrees east.	decimal degrees
lat	Latitude in decimal degrees north.	decimal degrees
depth	Sample depth.	meters
retinal_pM	Retinal.	picomoles per liter (pM)
retinal_oxime_pM	PR (Retinal Oxime).	picomoles per liter (pM)
Bchla_pM	Bacteriochlorophyll.	picomoles per liter (pM)

chla_pM	Chlorophyll-a.	picomoles per liter (pM)
tot_bacteria	Total bacteria.	cells per milliliter (cells/mL)
retinal_moleculescell	Retinal.	molecules per cell
retinal_oxime_moleculescell	PR (Retinal Oxime).	molecules per cell
Bchla_moleculescell	Bacteriochlorophyll.	molecules per cell
chla_containing_cells	Chlorophyll-a containing cells.	cells per milliliter (cells/mL)
chla_per_cell_pmolcell	Chlorophyll-a per cell.	picomolecules per cell.
chla_per_cell_moleculescell	Chlorophyll-a per cell.	molecules per cell.
EdZ305	Light intensity at wavelength of 305.	microwatts per square centimeter-nanometer (uW/(cm2nm))
EdZ313	Light intensity at wavelength of 313.	microwatts per square centimeter-nanometer (uW/(cm2nm))
EdZ320	Light intensity at wavelength of 320.	microwatts per square centimeter-nanometer (uW/(cm2nm))
EdZ340	Light intensity at wavelength of 340.	microwatts per square centimeter-nanometer (uW/(cm2nm))
EdZ380	Light intensity at wavelength of 380.	microwatts per square centimeter-nanometer (uW/(cm2nm))
EdZ395	Light intensity at wavelength of 395.	microwatts per square centimeter-nanometer (uW/(cm2nm))
EdZ412	Light intensity at wavelength of 412.	microwatts per square centimeter-nanometer (uW/(cm2nm))
EdZ443	Light intensity at wavelength of 443.	microwatts per square centimeter-nanometer (uW/(cm2nm))
EdZ465	Light intensity at wavelength of 465.	microwatts per square centimeter-nanometer (uW/(cm2nm))
EdZ490	Light intensity at wavelength of 490.	microwatts per square centimeter-nanometer (uW/(cm2nm))

EdZ510	Light intensity at wavelength of 510.	microwatts per square centimeter-nanometer (uW/(cm2nm))
EdZ555	Light intensity at wavelength of 555.	microwatts per square centimeter-nanometer (uW/(cm2nm))
EdZ670	Light intensity at wavelength of 670.	microwatts per square centimeter-nanometer (uW/(cm2nm))
EdZ694	Light intensity at wavelength of 694.	microwatts per square centimeter-nanometer (uW/(cm2nm))
EdZ710	Light intensity at wavelength of 710.	microwatts per square centimeter-nanometer (uW/(cm2nm))
EdZPAR	Light intensity at wavelengths of "photosynthetically active radiation" (PAR).	microwatts per square centimeter-nanometer (uW/(cm2nm))
bacterial_prod	Bacterial production.	micrograms Carbon per liter per day (ugC l-1 d-1)
ETS_activity	ETS activity.	?
retinal_oxime_energy_ben_Kjcellday	PR (Retinal Oxime) energy benefit.	kilojoules per cell per day (KJ cell-1 day-1)
retinal_oxime_energy_ben_KJLday	PR (Retinal Oxime) energy benefit.	kilojoules per liter per day (KJ L-1 day-1)
Bchla_energy_ben_Kjcellday	Bacteriochlorophyll energy benefit.	kilojoules per cell per day (KJ cell-1 day-1)
chla_energy_ben_Kjcellday	Chlorophyll-a energy benefit.	kilojoules per cell per day (KJ cell-1 day-1)
ISO_DateTime	Date and time formatted to ISO8601 standard.	YYYY-mm-ddTHH:MM:SS.xx

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Instruments

Dataset-specific Instrument Name	CTD
Generic Instrument Name	CTD - profiler
Dataset-specific Description	Seawater were collected from each CTD depth using Niskin bottles and immediately filtered.
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	Thermo Accela High Speed Liquid Chromatography system
Generic Instrument Name	High-Performance Liquid Chromatograph
Dataset-specific Description	For analysis, samples were extracted with methanol (retinal, chla, and Bchl) and with hydroxylamine (oxime) and 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
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	ThermoTSQ Quantum Access
Generic Instrument Name	Mass Spectrometer
Dataset-specific Description	For analysis, samples were extracted with methanol (retinal, chla, and Bchl) and with hydroxylamine (oxime) and 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.
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
Dataset-specific Description	Seawater were collected from each CTD depth using Niskin bottles and immediately filtered.
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.

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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

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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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