Particulate Carbon and Nitrogen data from CTD casts from R/V Hugh R. Sharp HRS1610 in the Mid-Atlantic coastal waters from August 2016 (CyanateInTheSea project)

Website: https://www.bco-dmo.org/dataset/920423
Data Type: experimental, Cruise Results
Version: 1
Version Date: 2024-02-19

Project
» Cyanate in the Sea: Sources, Sinks, and Quantitative Significance (CyanateInTheSea)

Contributors	Affiliation	Role
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Abstract
Particulate Carbon and Nitrogen (PNPC) data collected from CTD casts aboard the R/V Huge R. Sharp cruise to Mid-Atlantic coastal waters in August 2016. Nitrogen uptake rates were calculated from 15N-isotope labeled incubation. The parameters include PN, PC, and six N species uptake rates by whole water community at three depths: near surface, the depth above the Chl maximum (or near the bottom of the mixed layer), and the depth of the Chl maximum.

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Coverage

Location: Mid-Atlantic coastal waters, 33-38º N, 73-79º W
Spatial Extent: **N**:37.6683 **E**:-73.3708 **S**:33.3306 **W**:-78.5848
Temporal Extent: 2016-08-07 - 2016-08-17

Methods & Sampling

Particulate Carbon and Nitrogen (PNPC)

Whole water from three target depths (near surface, the depth above the Chl maximum (or near the bottom of the mixed layer), and the depth of the Chl maximum) at each station was collected from Niskin bottles into 10 L carboys and transported to the on-board laboratory where water samples were mixed and sub-samples (0.2–1.4 L) were collected onto pre-combusted GF-75 filters (Whatman®, nominal pore size 0.3 µm) in triplicate, for analysis of particulate nitrogen (PN) and carbon (PC) concentrations and the natural abundance of 15N and 13C. The filters were stored in cryovials and immediately frozen and stored in a freezer at -20 °C until analysis. Prior to their analysis, filters were dried at 40 ºC, pelletized in tin capsules, and analyzed on a Europa 20/20 isotope ratio mass spectrometer equipped with an automated N and C analyzer. The detection limit of the mass spectrometer was 0.0018 and 0.0005 atom% for 15N and 13C, respectively; these values were derived based on three times the standard deviation (3 × SD) of the atom% of 12.5 µg N and 100 µg C standards (n=40).

Nitrogen Uptake

Parallel sets of triplicate whole water (0.5−2 L) from the three target depths mentioned above (near surface, above the depth of the Chl maximum (or near the bottom of the mixed layer), and at the depth of the Chl maximum) from 27 stations were dispensed from 10 L carboys into acid-cleaned polyethylene terephthalate glycol incubation bottles (NalgeneTM).

Nitrogen uptake incubations were initiated by amending incubation bottles with highly enriched (98−99%) 15N-labeled substrates (Cambridge Isotope Laboratories, Inc., USA), including ammonium chloride (15NH4Cl), potassium nitrate (K15NO3), potassium nitrite (K15NO2), and 15N- and 13C-labeled potassium cyanate (KO13C15N), urea (13CO(15NH2)2), and algal amino acid mixture.

Data Processing Description

Nitrogen update rates were calculated via the formula included in the supplemental files section of this metadata landing page.

Within this formula, *(atom% PN)initial* and *(atom% PN)final* represent the 15N isotopic composition of the particulate pool at the initial and final time points of the incubation period; *atom% N source pool* is the 15N isotopic enrichment of the dissolved nitrogen pool after the tracer addition; [PN] represents the concentration of the particulate nitrogen pool; here, we used the average value between the initial and final PN concentrations for this calculation.

BCO-DMO Processing Description

- Converted date values from %m/%d/%Y format to %Y-%m-%d format

Problem Description

Nitrogen uptake rates should be considered as the potential rates rather than in-situ rates.

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Data Files

File
920423_v1_PNPC_and_Nitrogen_Uptake_Rates.csv (Comma Separated Values (.csv), 26.01 KB) MD5:9e973dc5c28f062e90bc12b79e068fc7 Primary data file for dataset ID 920423, version 1

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Related Publications

Zhu, Y., Mulholland, M.R., Bernhardt, P., Neeley A.R., Tapia, A.M., and Echevarría, M.A. (2024). Summertime phytoplankton composition and nitrogen uptakes across contrasted North Atlantic Ocean regimes off Cape Hatteras. Frontiers in Microbiology
Results

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Related Datasets

IsRelatedTo

Mulholland, M. (2024) **Bottle sample data from CTD casts from R/V Hugh R. Sharp HRS1610 in the Mid-Atlantic coastal waters from August 2016 (CyanateInTheSea project).** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2024-02-16 doi:10.26008/1912/bco-dmo.920383.1 [view at BCO-DMO]

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Parameters

Parameter	Description	Units
Station	Station number (1-41)	unitless
Cast	CTD cast number	unitless
ISO_DateTime_UTC	Datetime of CTD cast in UTC	unitless
Latitude	Latitude of cast location in decimal degrees; a positive value indicates a Northern coordinate	decimal degrees
Longitude	Longitude of cast location in decimal degrees; a negative value indicates a Western coordinate	decimal degrees
Depth	Depth value from CTD	meters (m)
Temp	Temperature value from CTD	Celcius (C)
Salinity	Salinity value from CTD	practical salinity unit (PSU)
Fluorescence	Fluorescence value from WET Labs ECO-AFL/FL	milligram per cubic meter (mg/m^3)
Total_Chl	Total chlorophyll (chl) value measured through high-performance liquid chromatoraphy (HPLC)	microgram per liter (µg/L^1)
Chl_SD	Standard deciation of chlorophyll	microgram per liter (µg/L^1)
Ammonium	Ambient NH4 concentration	micromole per liter (µmol/L^1)
Nitrate	Ambient NO3 concentration	micromole per liter (µmol/L^1)
Nitrite	Ambient NO2 concentration	micromole per liter (µmol/L^1)
Urea	Ambient Urea concentration	micromole N per liter (µmol N /L^1)
Phosphate	Ambient PO4 concentration	micromole per liter (µmol/L^1)

Dissolved_free_amino_acids	Ambient Dissloved free amino acids concentration	micromole N per liter (µmol N /L^1)
Cyanate	Ambient cyanate concentration	micromole per liter (µmol/L^1)
PC	Initial particulate carbon concentration	micromole per liter (µmol/L^1)
PN	Initial particulate nitrogen concentration	micromols N per liter (µmol N/L^1)
NH4_avg_uptake_rate	Ammonium average uptake rate	micromols N per liter per hour (µmol N /L^1/h^1)
SD_NH4	Standard deviation of ammonium uptake rate (triplicates)	micromols N per liter per hour (µmol N /L^1/h^1)
NO3_avg_uptake_rate	Nitrate average uptake rate	micromols N per liter per hour (µmol N /L^1/h^1)
SD_NO3	Standard deviation of nitrate uptake rate (triplicates)	micromols N per liter per hour (µmol N /L^1/h^1)
NO2_avg_uptake_rate	Nitrite average uptake rate	micromols N per liter per hour (µmol N /L^1/h^1)
SD_NO2	Standard deviation of nitrite uptake rate (triplicates)	micromols N per liter per hour (µmol N /L^1/h^1)
Urea_avg_uptake_rate	Urea average uptake rate	micromols N per liter per hour (µmol N /L^1/h^1)
SD_Urea	Standard deviation of urea uptake rate (triplicates)	micromols N per liter per hour (µmol N /L^1/h^1)
AAs_avg_uptake_rate	Amino acids average uptake rate	micromols N per liter per hour (µmol N /L^1/h^1)
SD_AAs	Standard deviation of amino acids uptake rate (triplicates)	micromols N per liter per hour (µmol N /L^1/h^1)
Cyanate_avg_uptake_rate	Cyanate average uptake rate	micromols N per liter per hour (µmol N /L^1/h^1)
SD_cyanate	Standard deviation of cyanate uptake rate (triplicates)	micromols N per liter per hour (µmol N /L^1/h^1)
Specific_NH4_uptake_rate	Specific ammonium value independent from partiulate nitrogen concentration	per hour (h^-1)
Specific_NO3_uptake_rate	Specific nitrate uptake rate value independent from particulate nitrogen concentration	per hour (h^-1)
Specific_NO2_uptake_rate	Specific nitrite value independent from particulate nitrogen concentration	per hour (h^-1)
Specific_urea_uptake_rate	Specific urea uptake rate value independent from particulate nitrogen concentration	per hour (h^-1)
Specific_AAs_uptake_rate	Specific amino acid uptake rate independent from particulate nitrogen concentration	per hour (h^-1)
Specific_cyanate_uptake_rate	Specific cyanate uptake rate independent from particulate nitrogen contentration	per hour (h^-1)

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Mass Spectrometer
Dataset-specific Description	An isotope ratio mass spectrometer was used for PNPC measurement.
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	10 L Niskin bottles
Generic Instrument Name	Niskin bottle
Dataset-specific Description	Dissolved seawater samples were collected using a sampling rosette equipped with a 12 X 10 L Niskin bottles.
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

HRS1610

Website	https://www.bco-dmo.org/deployment/715332
Platform	R/V Hugh R. Sharp
Start Date	2016-08-05
End Date	2016-08-18
Description	Additional cruise information is available from the Rolling Deck to Repository (R2R): http://www.rvdata.us/catalog/HRS1610

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Project Information

Cyanate in the Sea: Sources, Sinks, and Quantitative Significance (CyanateInTheSea)

Coverage: Western North Atlantic Coastal waters (mid- and south Atlantic Bight)

NSF Award Abstract:

Nitrogen is a critical nutrient in the world's oceans because, among other things, it is a major component of living organisms and can be a driver in primary productivity. Nitrogen is present in the ocean in a number of organic and inorganic forms, which vary in their ease in being assimilated by marine organisms. Cyanate is a simple form of organic nitrogen present in the ocean, although its abundance and importance to the ocean nitrogen cycle is poorly understood. Using newly developed and tested methods for measuring ambient cyanate concentrations and its uptake in seawater, researchers will analyze the distribution, sources, and geochemistry of cyanate in shelf waters of the Atlantic Ocean. Results from this project will elucidate the importance of cyanate in the marine nitrogen cycle and transform understanding of cyanate production and assimilation in the sea. This project will provide a unique opportunity for both graduate student research and undergraduate training, and will likely expose underrepresented groups to marine sciences.

Although physiological and genomic evidence suggest that marine microbes can utilize a broad array of inorganic and organic nitrogen compounds, cyanate's role in the marine nitrogen cycle has not yet been examined. As one of the simplest organic nitrogen compounds, cyanate has likely been present in the environment over Earth's long history. Evidence suggests that cyanate metabolism appeared early on in bacterial genomes and thus, the study of cyanate assimilation in the contemporary ocean may illuminate microbial processes with deep evolutionary roots. However, a decade since discovering the genomic capacity for cyanate utilization in marine cyanobacteria, little is still known about cyanate distributions in the environment, how it is produced, and how widespread cyanate utilization is among marine microbes. To further understanding of cyanate's role in the marine nitrogen cycle, a combination of geochemical approaches will be used to assess: 1) the distribution of cyanate in the marine environment, 2) potential sources of cyanate and the timescales at which cyanate is produced, 3) the rate of cyanate removal via microbial uptake and spontaneous decomposition, and 4) the geochemical coupling between cyanate production and consumption. Results generated from this study will be important for augmenting knowledge of the marine nitrogen cycle, refining biogeochemical models, and further understanding of the functioning of marine microbial communities.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1459698

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