Chemical data associated with field collections from the Gulf of Maine, Nauset Marsh Estuary System, and Long Island Sound (Alexandrium isotopes project)

Website: https://www.bco-dmo.org/dataset/712027
Data Type: Other Field Results
Version: 1
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Project
» Collaborative Research: Identification of nitrogen sources for toxic Alexandrium blooms using a novel species-specific tracer, d15N-saxitoxin (Alexandrium-isotopes)

Contributors	Affiliation	Role
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Abstract
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Coverage

Spatial Extent: **N**:44.235499 **E**:-67.672347 **S**:40.816797 **W**:-73.772282
Temporal Extent: 2014-03-12 - 2015-06-18

Dataset Description

Chemical data associated with field collections.

Methods & Sampling

Stable Isotope Methods for d15N-NO3-, d18O-NO3-, d15N-POM, and d15N-NH4+: All filters, glassware, and glass vials used for isotope analysis were pre-combusted for 4 hours at 450C and plastic

bottles were acid washed in a 10% HCl bath overnight, to eliminate any crossover N. In preparation for stable isotope analysis, raw seawater was filtered onto a glass fiber filter (25-mm diameter, Whatman GF/D, Cat #: 1823010) to separate particulate organic matter (POM) and dissolved fractions (NO3- and NH4+). Filters were transferred into 20-ml glass vials (Fisher, catalog #05-719-117) and frozen at -20C until isotope analysis of POM (15NPOM). Filtrate, 200 ml, for isotope analysis of dissolved NH4+ (15NNH4+) was processed using a modified version of the NH4+ diffusion method of Holmes (1998), whereby polypropylene membrane filters (25 mm, lot #: 151579, Sterlitech) replaced Teflon filters (Hannon and Bohlke 2008). Isotope analysis of NH4+ and POM was performed on a Finnigan-MAT DeltaPlus Isotope Ratio Monitoring Mass Spectrometer coupled with a Carlo Erba NC 2500 Elemental Analyzer (Model 1108) (Organic Mass Spectrometry Facility, WHOI). Depending on the expected amount of N per sample, the instrument was configured for the typical range of detection, 0.5 to 5 moles N, or modified at the EA combustion furnace to reach a lower detection limit, 0.15 umoles N (Houghton et al. 2000, Holtvoeth et al. 2005, 2006, York et al. 2007). The precision of 15N measurements on this instrument was 0.17‰. Filtrate, 20 ml for N and O stable isotope analysis of dissolved nitrate (15NNO3-) was transferred into duplicate 30-ml HDPE bottles and analyzed by bacteria denitrification assay using ThermoFinnigan GasBench + PreCon trace gas concentration system interfaced to a ThermoScientific Delta V Plus isotope-ratio mass spectrometer (Bremen, Germany) (UC Davis Stable Isotope Facility).

Methods for nutrient quantification: Dissolved nutrient samples were filtered through a glass fiber filter (25-mm diameter, Whatman GF/F, CAT No. 1825-025). The filtrate was collected in acid-washed 20-ml scintillation vials for nutrient analysis and then frozen at -20 deg C until analysis. A SEAL AA3 four-channel segmented flow analyzer (Nutrient Chemical Facility, Woods Hole Oceanographic Institution, WHOI) was used to quantify NH4+, NO3-/NO2-, Silicate, and PO43- in the GF/F-filtered medium using standard methods.

Data Processing Description

BCO-DMO Data Processing Notes:

-Reformatted column names to comply with BCO-DMO standards.
-Removed first header line that contained descriptive metadata. This was added into the appropriate parameter descriptions.
-Dates were reformatted from mm/dd/yy to yyyy/mm/dd.

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Data Files

File
chemical_data.csv (Comma Separated Values (.csv), 4.74 KB) MD5:2ce8420590a7da60572d3dcbde241c45 Primary data file for dataset ID 712027

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Parameters

Parameter	Description	Units
Date	Date sample was taken; YYYY/MM/DD	unitless
Sample_ID	Sample ID; short name/abbreviation	unitless
Description	Full description of site and station where sample was taken	unitless
Depth	Depth that sample was taken	meters
d15N_NO3	Stable isotope value; d15N - NO3	per mil (0/00)
d18O_NO3	Stable isotope value; d18O - NO3	per mil (0/00)
d15N_NH4	Stable isotope value; d15N - NH4	per mil (0/00)
d15N_POM	Stable isotope value; d15N - POM	per mil (0/00)
NO3	Dissolved nutrient concentration; NO3-	micromoles per liter
NH4	Dissolved nutrient concentration; NH4	micromoles per liter
PO4	Dissolved nutrient concentration; PO4	micromoles per liter
Silicate	Dissolved nutrient concentration; Silicate	micromoles per liter

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Instruments

Dataset-specific Instrument Name	SEAL AA3 four-channel segmented flow analyzer
Generic Instrument Name	Continuous Flow Analyzer
Dataset-specific Description	Used to quantify NH4+, NO3-/NO2-, Silicate, and PO43-
Generic Instrument Description	A sample is injected into a flowing carrier solution passing rapidly through small-bore tubing.

Dataset-specific Instrument Name	Carlo Erba NC 2500 Elemental Analyzer (Model 1108)
Generic Instrument Name	Elemental Analyzer
Dataset-specific Description	Used to perform isotope analysis of NH4+ and POM
Generic Instrument Description	Instruments that quantify carbon, nitrogen and sometimes other elements by combusting the sample at very high temperature and assaying the resulting gaseous oxides. Usually used for samples including organic material.

Dataset-specific Instrument Name	ThermoFinnigan GasBench + PreCon trace gas concentration system
Generic Instrument Name	Gas Analyzer
Dataset-specific Description	Used to analyze N and O stable isotopes
Generic Instrument Description	Gas Analyzers - Instruments for determining the qualitative and quantitative composition of gas mixtures.

Dataset-specific Instrument Name	Finnigan-MAT DeltaPlus Isotope Ratio Monitoring Mass Spectrometer
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Dataset-specific Description	Used to perform isotope analysis of NH4+ and POM
Generic Instrument Description	The Isotope-ratio Mass Spectrometer is a particular type of mass spectrometer used to measure the relative abundance of isotopes in a given sample (e.g. VG Prism II Isotope Ratio Mass-Spectrometer).

Dataset-specific Instrument Name	ThermoScientific Delta V Plus isotope-ratio mass spectrometer
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Dataset-specific Description	Used to analyze N and O stable isotopes
Generic Instrument Description	The Isotope-ratio Mass Spectrometer is a particular type of mass spectrometer used to measure the relative abundance of isotopes in a given sample (e.g. VG Prism II Isotope Ratio Mass-Spectrometer).

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Project Information

Collaborative Research: Identification of nitrogen sources for toxic Alexandrium blooms using a novel species-specific tracer, d15N-saxitoxin (Alexandrium-isotopes)

Website:
http://www.vims.edu/research/departments/eaah/programs/aquatic_toxinology/research/isotope_project.php

Coverage: Gulf of Maine, Nauset Marsh Estuary System (Cape Cod Seashore), Northport Huntington Bay Complex (Long Island Sound)

NSF award abstract:
The US and other countries throughout the world are affected by harmful algal blooms (HABs) that negatively impact human health, marine ecosystems, fisheries resources, and local economies. Anthropogenic nutrient loadings have been linked to expanding HAB incidence, but the relationship is site- and organism-specific, and is still poorly understood. The main challenge in this regard is to determine the relative importance of natural versus anthropogenic nutrient sources in the development of an individual HAB species. Given the diverse nature of the planktonic assemblage in which HABs occur, and the lack of appropriate measurement techniques, this is exceedingly difficult to accomplish.

In this project, research teams at the Woods Hole Oceanographic Institution and University of Texas at Austin will take a novel approach to this challenge: They use use the nitrogen isotopic signature (del15N) of a species-specific HAB toxin to identify the nitrogen source and chemical form that promotes cell growth and toxin production. The bloom-forming dinoflagellate Alexandrium fundyense and its class of bioactive compounds, saxitoxins (STXs), are an ideal model system as STXs are nitrogen-rich and are typically only produced by a single species in mixed plankton assemblages. The guiding overall hypothesis is that the isotopic signature of a

HAB-specific toxin can be used to discriminate between anthropogenic and natural sources of N and provide more details than bulk material del15N on the source, chemical form, and processing of N that lead to blooms of a particular toxic species. This hypothesis is based on the principle that human and animal waste in groundwater and sewage become 15N-enriched and inorganic fertilizers 15N-depleted, relative to natural sources of N in catchment waters. While the use of the isotopic ratio del15N of bulk biomass to identify nitrogen sources to coastal waters is a widely accepted practice, this use of a toxin as a species-specific tracer or marker is new and will provide details on the explicit source, chemical form, and processing of nitrogen that results in blooms of a particular HAB species.

Broader Impacts: This project addresses fundamental issues underlying the most widespread of all HAB poisoning syndromes, paralytic shellfish poisoning (PSP), a major form of shellfish poisoning that affects countries throughout the world. Project results can also assist in policy decisions about pollution control and other bloom mitigation strategies, and can be applied to a range of HAB species - those that produce saxitoxins, as well as those that produce other toxins that are nitrogen rich. Project results will be broadly disseminated through scientific papers, presentations at workshops, domestic and international conferences, and departmental seminars, and discussions with the media.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1505604
NSF Division of Ocean Sciences (NSF OCE)	OCE-1232835

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