Pseudo-nitzschia spp. cell counts, nutrients water temperature and salinity, and concentrations of the toxin domoic acid from weekly samples and offshore cruises with the Northeast U.S. Shelf (NES) Long-Term Ecological Research (LTER)

Website: https://www.bco-dmo.org/dataset/847448
Data Type: Cruise Results
Version: 1
Version Date: 2021-04-05

Project
» RII Track-1: Rhode Island Consortium for Coastal Ecology Assessment, Innovation, and Modeling (C-AIM)

Contributors	Affiliation	Role
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Abstract
This dataset is related to approximately weekly sampling of Narragansett Bay, RI in tandem with the University of Rhode Island (URI) Graduate School of Oceanography (GSO) Long-Term Plankton Time Series (LTPTS) and Fish Trawl Survey to examine species assemblages and toxicity of the diatom genus Pseudo-nitzschia spp. This includes nutrient concentrations, cell counts, water temperature and salinity, and concentrations of the toxin domoic acid from these weekly samples and more, including offshore cruises with the Northeast U.S. Shelf (NES) Long-Term Ecological Research (LTER).

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Coverage

Spatial Extent: **N**:41.6716 **E**:-70.8626 **S**:40.206 **W**:-71.42
Temporal Extent: 2016-09-26 - 2019-11-25

Methods & Sampling

For ease of comparison to previous enumeration data in the URI GSO LTPTS dataset, Pseudo-nitzschia spp. cells were enumerated using similar methods with the same counting volume. Between 15 and 50 mL of whole seawater was preserved with 1% acidic Lugol's solution in glass or plastic containers (with a silica bead later added). Samples were stored at 4 °C for less than a year before being counted. One mL of sample was placed in a Sedgewick-Rafter counting chamber (Science First / Wildco, Yulee, FL, USA), Pseudo-nitzschia spp. cells were identified at the genus level and counted using 20x phase contrast light microscopy on a BX40 (Olympus

America Inc., Melville, NY, USA). Pseudo-nitzschia spp. cell counts from the LTPTS were conducted on live samples using the same enumeration protocol on an Eclipse E800 (Nikon Instruments Inc., Melville, NY, USA). Cell counts by same-day LTPTS on the Eclipse E800 were preferentially used over our counts performed in the BX40. Cell counts from the LTPTS are available at https://web.uri.edu/gso/research/plankton/data/.

Samples for nutrient analysis were collected from 0.2 mm polyethersulfone filter (Sterlitech, Kent, WA, USA) filtrate, and frozen at -20 °C until analysis within approximately a year.

Extracted chlorophyll a measurements were taken by vacuum filtering surface seawater in triplicate onto GF/F filters (0.6 – 0.8 µm particle retention; Whatman n.k.a. Cytiva, Marlborough, MA, USA). The filters were placed in a glass tube with 90% acetone and extracted in the dark at -20 °C. After 24 hours, samples were equilibrated at room temperature for 20 minutes, vortexed, filter removed, and extract transferred to a sample reading tube for the fluorometer. After the first reading, samples were acidified with 3 drops of 10% hydrochloric acid. Fluorometers were calibrated with commercially purchased chlorophyll a standards in 90% acetone solution (P/N: 10-850, Turner Designs, Inc., San Jose, CA, USA). Measurements from the Trilogy were taken as relative fluorescent units (RFUs) and then pigments were determined using an external calibration calculation following the manufacturer's protocol from standards previously measured. The 10AU fluorometer is maintained by URI GSO.

At each sampling station, approximately 2 L of the surface seawater collected was filtered across a 47 mm, 5.0 mm polyester membrane filter (Sterlitech, Kent, WA, USA) to collect phytoplankton biomass. These filters were flash frozen in liquid nitrogen and stored at -80 °C until extraction. Phytoplankton-containing filters were extracted in 0.1 M acetic acid for four hours, vigorously vortexing each hour. Following extraction, samples were filtered using a 0.2 µm syringe filter directly into a 1.5 mL LC-MS vial for LC-MS/MS analysis. The LC-MS/MS method utilized a Prominence UFLC system (Shimadzu, Kyoto, Japan) coupled to a SCIEX 4600 Qtrap mass spectrometer (Sciex, Framingham, MA, USA). A Kinetex C18 column (150 mm x 4.6 mm, 2.6 µm) (Phenomenex, Torrance, CA, USA) was used for chromatographic separation of samples. The flow rate was 0.4 mL min-1 and the mobile phase solvents were H2O (A) and MeOH (B) each modified with 0.05% formic acid. A gradient method was employed for analysis: Initial conditions of 95% A and 5% B were held for 5 min with the eluent sent to waste for the first 2 min. Next, the % of B was increased to 50% from 5 to 15 min, with a final change to initial conditions (95% A and 5% B) from 16 to 20 min. The peak of DA eluted at 11.00 min. LC-MS/MS with MRM was employed for sensitivity and selectivity in DA detection and quantification. Analysis was carried out in positive mode, and three transitions from the protonated DA molecule were used: m/z 312 → 266, m/z 312 → 248, and m/z 312 → 193. DA was quantified during each sample set analysis period using an external calibration curve generated using pure DA standards of increasing concentrations (Sigma-Aldrich, St. Louis, MO, USA). Phytoplankton-associated DA measurements are described as ng pDA L-1 of filtered seawater.

The software KorDSS was used to access data from the YSI ProDSS.

Problem report: In general, sites were sampled weekly or twice a week, with higher frequency in the spring, summer, and fall and less frequently in the winter. Some sites only have short-term sampling efforts like from Fort Wetherill. Some samples from this dataset were selected for sequencing of the Pseudo-nitzschia species assemblages from corresponding plankton biomass filters. However, some of the sequenced samples do not have corresponding environmental metadata including Library IDs AS 467 – 489 & AS 493 – 495.

Also see: NCBI Bioproject PRJNA690940 which contains the high throughput sequences associated with the SequenceSample_ID column of this datasheet and the resulting amplicon sequence variants (ASVs) of the *Pseudo-nitzschia* taxa recovered (NCBI Accession Numbers MW447658 - MW447770). The NCBI Bioproject and Accession Numbers will be active in January 2025 or upon publication of the associated manuscript, whichever occurs first.

Data Processing Description

BCO-DMO Processing Notes:
- data were submitted in file "DATA01_metadata_Sterling_NBay.csv"
- added conventional header with dataset name, PI name, version date
- split column Lat_Long into lat and lon converted date to ISO format (yyyy-mm-dd) and added ISO_DateTIme_Local column

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Data Files

File
pseudonitzschia_counts_nuts_etc.csv (Comma Separated Values (.csv), 70.80 KB) MD5:76dafe84c79db45c3bce6ac377404f64 Primary data file for dataset ID 847448

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Related Datasets

IsSupplementTo

NCBI Bioproject PRJNA690940

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Parameters

Parameter	Description	Units
library_ID	The identifying sample number that connects the row of environmental data to the corresponding plankton biomass filter that was sequenced for the Pseudo-nitzschia species assemblages. The Sequence Sample ID connect to the sample_title; library_ID; and file names in NCBI's Short Read Archive (SRA) under this related Bioproject #PRJNA690940. There are no units. nd = that sample was not used for corresponding DNA sequencing of the Pseudo-nitzschia species assemblages	unitless
Sample_Date	The local date associated with Rhode Island USA that the water sample was collected; all samples have a date. Samples include some from the Long Term Plankton Time Series during the precautionary shellfish harvest closure due to the neurotoxin domoic acid produced by the diatom Pseudo-nitzschia spp. in the fall of 2016 and a true closure in the winter and spring of 2017 due to domoic acid. Regular weekly sampling for this project started on 2017-09-18 at the LTPTS and goes until 2019-11-25 for the associated manuscript. Formatted as YYYY-MM-DD.	unitless
Collection_Time_EST	Local Eastern Standard Time (EST) that water sample was taken as recorded on the YSI near Rhode Island USA; formatted as hours:minutes with AM or PM; nd denotes time not recorded.	unitless
ISO_DateTime_Local	Local date and time converted to ISO format	unitless

Site	The location name that the water sample was collected from using a boat (East Passage; Long Term Plankton Time Series; NES LTER cruises; Whale Rock) or from the shore [Castle Hill Beach; Fort Wetherill; University of Rhode Island Graduate School of Oceanography dock (GSO Dock)]. The Site name for samples from the NES LTER cruises include the closest station (L#); CTD cast; Niskin bottle that the sample came from; and approximate depth in meters (m) that the sample came from according to the CTD bottle log. There were two instances the CTD cast was not used for these samples: One sample (AS399) was taken using the flowthrough (a.k.a. underway system) which takes a sample from a surface depth of 5 meter from the ship and another sample (AS421) was taken using a bucket over the side of the ship at a depth of 0 meters at the surface of the water.	unitless
Site_Abbreviation	The abbreviation commonly used for these sampling locations in sample names and the associated manuscript. nd = no abbreviation	unitless
Lat	Latitude of sampling locations. NES LTER locations used recorded latitude and longitude from corresponding CTD casts and Niskin bottles; when available. For one sample (AS399): the latitude and longitude provided are for station L1; as the exact location of the flowthrough sample was not recorded on the event log. North is positive.	decimal degrees
Lon	Longitude of sampling locations. NES LTER locations used recorded latitude and longitude from corresponding CTD casts and Niskin bottles; when available. For one sample (AS399): the latitude and longitude provided are for station L1; as the exact location of the flowthrough sample was not recorded on the event log. East is positive.	decimal degrees
Depth_m	sampling depth	meters
Pseudonitzschia_cells_L	Number of individual cells identified as belonging to the diatom genus Pseudo-nitzschia [NCBI:txid41953] calculated in one liter (L) of surface seawater	cells/liter
Pseudonitzschia_chains_L	Number of chains of the diatom genus Pseudo-nitzschia calculated in one liter (L) of surface seawater. One individual Pseudo-nitzschia cell was considered one chain; two Pseudo-nitzschia cells were considered one chain; etc.	chains/liter
YSI_Instrument	The model of the YSI multiparameter used to collect the depth/water temperature/water salinity. A YSI 6920 V2 (YSI Inc. / Xylem Inc.; Yellow Springs OH USA) was used for weekly LTPTS and Fish Trawl Survey samples from October 2018 through September 2019. Data from the LTPTS are available here: https://web.uri.edu/gso/research/plankton/data/ ; and 2017 Fish Trawl Survey data are available here: https://web.uri.edu/fishtrawl/data/ . Fish Trawl Survey data from 2018 – 2019 were acquired from the fish trawl assistant upon request. Surface seawater temperature and salinity were measured using a YSI ProDSS multiparameter meter (YSI Inc. / Xylem Inc. from Yellow Springs OH USA) starting September 2018. Prior to September 2018; a YSI EXO Sonde (YSI Inc. / Xylem Inc. from Yellow Springs OH USA) was used for samples from May 2018 through August 2018 outside of the LTPTS and Fish Trawl Survey.	unitless

YSI_depth_surface_m	The depth at which water temperature and salinity measurements were recorded for surface water samples. The depth sensor on the YSI ProDSS was calibrated each day of use using the internal calibration on the device following manufacturer's protocol and the depth was offset by the probe sensors' tip distance from bulkhead which was 0.272 m. It was unknown what the calibration for depth was for the other YSI instrument models. If not indicated (nd) and there are YSI measurements: the shallowest measurement was used as the surface value typically on the upcast	meters
Salinity_surface_psu	The surface seawater salinity as measured by the YSI instrument indicated; units are practical salinity units (psu). For the YSI ProDSS; salinity was calibrated with a purchased seawater standard from Xylem; Inc. at 50 mS/cm following manufacturer's protocols about every month that the instrument was in active use. Salinity calibration was reported to be steady and reliable for a few weeks. For the other YSI instruments: it was unknown what the calibration protocol was.	Practical Salinity Units (PSU)
Temp_surface_degC	The surface seawater temperature as measured by the YSI instrument indicated. There was no temperature calibration performed on the YSI ProDSS; and it is unknown whether the other instruments had temperature calibration; although it's unlikely. Units are degrees Celsius.	degrees Celsius
Nutrients_collected_by	Which sampling group collected the water samples used for subsequent nutrient analysis. Jenkins refers to the Dr. Bethany Jenkins (the PI of this project and team members). PhytoAsst refers to the phytoplankton assistant who collects the weekly water sample for the Long-Term Plankton Time Series (LTPTS) at the LTPTS site run by the University of Rhode Island Graduate School of Oceanography. In most instances; the nutrient samples collected by the LTPTS are also available at: https://web.uri.edu/gso/research/plankton/data/.	unitless
Nutrient_analyzer	Which nutrient autoanalyzer was used to generate the nutrient values. Nutrient analysis was conducted either on a Lachat QuickChem 8500 (Hach; Loveland; CO; USA) at the URI Marine Science Research Facility (Narragansett; RI; USA) or on AA3 (SEAL Analytical; Inc.; Mequon; WI; USA) at the University of Washington Nutrient Analysis Facility (Seattle; WA; USA). Limits of detection are reported on the websites of each of these nutrient analysis labs in regards to the different nutrient ions measured. There were no processing steps to remove data below reported limits of detection in this data set; although any reported negative value of a nutrient ion was changed to 0. The only instance of this were some negative values of ammonium measured using the Lachet.	unitless
Phosphate_uM	Concentration of dissolved inorganic phosphate in surface seawater sample. All measurements from the SEAL AA3 were single measurements; and some measurements of phosphate from the Lachat are averages of replicate measurements from the same water sample.	microMolar
Silicate_uM	concentration of dissolved inorganic silicate in surface seawater sample. All measurements from the SEAL AA3 were single measurements; and some measurements of silicate from the Lachat are averages of replicate measurements from the same water sample.	microMolar
Nitrate_and_nitrite_uM	The concentration of nitrate and nitrite in surface seawater sample. The AA3 measures nitrate directly; whereas the Lachat relies on nitrate calculated from nitrite + nitrate minus nitrite.	microMolar

Nitrite_uM	The concentration of nitrite in surface seawater sample.	microMolar
Ammonium_uM	The concentration of ammonium in surface seawater sample.	microMolar
Nitrate_uM	The concentration of nitrate in surface seawater sample. The AA3 measures nitrate directly; whereas the Lachat relies on nitrate calculated from nitrite + nitrate minus nitrite.	microMolar
DIN_uM	The concentration of the dissolved inorganic nitrogen (DIN) that is the summation of ammonium; nitrate; and nitrite in a sample.	microMolar
DIN_P_Ratio	The concentration of dissolved inorganic nitrogen (DIN) concentration divided by the dissolved inorganic phosphate concentration.	unitless
DIN_Si_Ratio	The concentration of dissolved inorganic nitrogen (DIN) concentration divided by the dissolved inorganic silicate concentration.	unitless
Fluorometer	The instrument used to obtain the extracted chlorophyll a and pheophytin values. All LTPTS samples and samples from May 2018 through July 2018 were read on a 10AU fluorometer (Turner Designs; Inc.; San Jose; CA; USA); while samples from August 2018 through October 2019 were read on a Trilogy fluorometer (Turner Designs; Inc.; San Jose; CA; USA). Fluorometers were calibrated with commercially purchased chlorophyll a standards in 90% acetone solution (P/N: 10-850; Turner Designs; Inc.; San Jose; CA; USA).	unitless
Fluorometer_used_by	Which team used the fluorometer to get the pigment measurements. Jenkins refers to this project PI Dr. Bethany Jenkins and the team members. PhytoAsst refers to the phytoplankton assistant who collects the weekly water sample for the Long-Term Plankton Time Series (LTPTS) at the LTPTS site run by the University of Rhode Island Graduate School of Oceanography. In most instances; the pigment values measured by the LTPTS are also available at: https://web.uri.edu/gso/research/plankton/data/.	unitless
Chl_a_ug_L	Concentration of extracted chlorophyll a in surface seawater samples.	micrograms/liter (ug/L)
Pheo_ug_L	Concentration of the pigment pheophytin in surface seawater samples. Measurements for pheophytin were taken the same way as the chlorophyll a samples.	micrograms/liter (ug/L)
pDA_ng_L	Particulate (cell-associated) domoic acid measured by LC-MS/MS in surface seawater samples.	nanograms/liter (ng/L)

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Instruments

Dataset-specific Instrument Name	Lachat QuickChem 8500 (Hach, Loveland, CO, USA) at the URI Marine Science Research Facility (Narragansett, RI, USA)
Generic Instrument Name	Flow Injection Analyzer
Generic Instrument Description	An instrument that performs flow injection analysis. Flow injection analysis (FIA) is an approach to chemical analysis that is accomplished by injecting a plug of sample into a flowing carrier stream. FIA is an automated method in which a sample is injected into a continuous flow of a carrier solution that mixes with other continuously flowing solutions before reaching a detector. Precision is dramatically increased when FIA is used instead of manual injections and as a result very specific FIA systems have been developed for a wide array of analytical techniques.

Dataset-specific Instrument Name	Trilogy fluorometer (Turner Designs, Inc., San Jose, CA, USA)
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	SCIEX 4600 Qtrap mass spectrometer (Sciex, Framingham, MA, USA)
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	YSI 6920 V2 (YSI Inc. / Xylem Inc., Yellow Springs, OH, USA)
Generic Instrument Name	Multi Parameter Portable Meter
Generic Instrument Description	An analytical instrument that can measure multiple parameters, such as pH, EC, TDS, DO and temperature with one device and is portable or hand-held.

Dataset-specific Instrument Name	YSI ProDSS multiparameter meter (YSI Inc. / Xylem Inc., Yellow Springs, OH, USA)
Generic Instrument Name	Multi Parameter Portable Meter
Generic Instrument Description	An analytical instrument that can measure multiple parameters, such as pH, EC, TDS, DO and temperature with one device and is portable or hand-held.

Dataset-specific Instrument Name	AA3 (SEAL Analytical, Inc., Mequon, WI, USA) at the University of Washington Nutrient Analysis Facility (Seattle, WA, USA)
Generic Instrument Name	Nutrient Autoanalyzer
Generic Instrument Description	Nutrient Autoanalyzer is a generic term used when specific type, make and model were not specified. In general, a Nutrient Autoanalyzer is an automated flow-thru system for doing nutrient analysis (nitrate, ammonium, orthophosphate, and silicate) on seawater samples.

Dataset-specific Instrument Name	10AU fluorometer (Turner Designs, Inc., San Jose, CA, USA)
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)

Dataset-specific Instrument Name	YSI EXO Sonde (YSI Inc. / Xylem Inc., Yellow Springs, OH, USA)
Generic Instrument Name	YSI EXO multiparameter water quality sondes
Generic Instrument Description	Comprehensive multi-parameter, water-quality monitoring sondes designed for long-term monitoring, profiling and spot sampling. The EXO sondes are split into several categories: EXO1 Sonde, EXO2 Sonde, EXO3 Sonde. Each category has a slightly different design purpose with the the EXO2 and EXO3 containing more sensor ports than the EXO1. Data are collected using up to four user-replaceable sensors and an integral pressure transducer. Users communicate with the sonde via a field cable to an EXO Handheld, via Bluetooth wireless connection to a PC, or a USB connection to a PC. Typical parameter specifications for relevant sensors include dissolved oxygen with ranges of 0-50 mg/l, with a resolution of +/- 0.1 mg/l, an accuracy of 1 percent of reading for values between 0-20 mg/l and an accuracy of +/- 5 percent of reading for values 20-50 mg/l. Temp ranges are from-5 to +50 degC, with an accuracy of +/- 0.001 degC. Conductivity has a range of 0-200 mS/cm, with an accuracy of +/-0.5 percent of reading + 0.001 mS/cm and a resolution of 0.0001 - 0.01 mS/cm.

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Deployments

EN608

Website	https://www.bco-dmo.org/deployment/848016
Platform	R/V Endeavor
Start Date	2018-01-31
End Date	2018-02-06
Description	C-AIM project

EN617

Website	https://www.bco-dmo.org/deployment/848018
Platform	R/V Endeavor
Start Date	2018-07-20
End Date	2018-07-25

EN644

Website	https://www.bco-dmo.org/deployment/848020
Platform	R/V Endeavor
Start Date	2019-08-20
End Date	2019-08-25

EN627

Website	https://www.bco-dmo.org/deployment/848056
Platform	R/V Endeavor
Start Date	2019-02-01
End Date	2019-02-06

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Project Information

RII Track-1: Rhode Island Consortium for Coastal Ecology Assessment, Innovation, and Modeling (C-AIM)

Coverage: Narragansett Bay, Rhode Island

NSF Award Abstract:

Non-technical Description
The University of Rhode Island (URI) will establish the Consortium for Coastal Ecology Assessment, Innovation, and Modeling (C-AIM) to coordinate research, education, and workforce development across Rhode Island (RI) in coastal marine science and ecology. C-AIM addresses fundamental research questions using observations, computational methods, and technology development applied to Narragansett Bay (NB), the largest estuary in New England and home to important ecosystem services including fisheries, recreation, and tourism. The research will improve understanding of the microorganisms in NB, develop new models to predict pollution and harmful algal bloom events in NB, build new sensors for nutrients and pollutants, and provide data and tools for stakeholders in the state. Observational capabilities will be coordinated in an open platform for researchers across RI; it will provide real-time physical, chemical, and biological observations ? including live streaming to mobile devices. C-AIM will also establish the RI STEAM (STEM + Art) Imaging Consortium to foster collaboration between artists, designers, engineers, and scientists. Research internships will be offered to undergraduate students throughout the state and seed funding for research projects will be competitively awarded to Primarily Undergraduate Institution partners.

Technical Description
C-AIM will employ observations and modeling to assess interactions between organisms and ecosystem function in NB and investigate ecological responses to environmental events, such as hypoxia and algal blooms. Observations of the circulation, biogeochemistry, and ecosystem will be made using existing and new instrument platforms. The Bay Observatory ? a network of observational platforms around NB - will be

networked to trigger enhanced water sampling and sensing during specific environmental events, such as hypoxic conditions or phytoplankton blooms. Biogeochemical, ecological, and coastal circulation models will be integrated and coupled to focus on eutrophication and pollutant loading. Data and models will be integrated on multiple scales, from individual organisms and trophic interactions to food-web responses, and from turbulence to the regional ocean circulation. New sensing technologies for nutrients and pollutants will be developed, including affordable, micro-fluidic (Lab-on-a-Chip) devices with antifouling capabilities. The results will be synthesized and communicated to stakeholders.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1655686
NSF Office of Integrative Activities (NSF OIA)	OIA-1655221
National Oceanic and Atmospheric Administration (NOAA)	NA18OAR4170094
National Oceanic and Atmospheric Administration (NOAA)	NA14OAR4170082

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