Nutrient and hydrology data from CTD bottles from 2012 to 2019 in the Gulf of Maine.

Website: https://www.bco-dmo.org/dataset/834444
Data Type: Cruise Results
Version: 1
Version Date: 2020-12-22

Project
» WHCOHH - Physiological and behavioral plasticity in harmful algal bloom dynamics: variation across different habitats (WHCOHH Algal Bloom Dynamics)

Program
» Woods Hole Center for Oceans and Human Health (WHCOHH)

Contributors	Affiliation	Role
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Abstract
Nutrient and hydrology data from CTD bottles from 2012 to 2019 in the Gulf of Maine.

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Coverage

Spatial Extent: **N**:44.599 **E**:-66.113 **S**:42.599 **W**:-70.698
Temporal Extent: 2013-04-28 - 2019-08-12

Methods & Sampling

Sea-Bird SBE 9 CTD data measurements using Sea-Bird Software SBE Seasave at standard CTD stations: profiles (down casts) with water sampling (up casts).

Data Processing Description

CTD Data processing: Sea-Bird Software SBE Data Processing;

Nutrient data processing: water filtering, samples processing and preserving, standard methods for further samples processing.

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Data Files

File
nutrient_data.csv (Comma Separated Values (.csv), 308.99 KB) MD5:ed6e83c5e6a0cd936b85512c437a160b Primary data file for dataset ID 834444

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Parameters

Parameter	Description	Units
Year	Sampling year	unitless
Ship_ID	Vessel identifier: 1 - R/V Tioga, 2 - R/V Connecticut, 3 - R/V Gulf Challenger, 4 - R/V Warren Jr., 5 - R/V Scarlett Isabella	unitless
Cruise_number	Cruise identifier	unitless
Station_number	Station number	unitless
Niskin	Niskin bottle number	unitless
Depth	Sample depth	meters (m)
Pressure	Pressure	decibels (db)
Bottom_depth	Bottom depth	meters (m)
Temperature	Temperature	degrees Celcius (°C)
Salinity	Salinity	units
Density	Sigma-theta density from primary sensor	kilograms per cibic meters (kg/m^3)
Oxygen	Oxygen	mililiters per liters (ml/l)
Fluorescence	Fluoresence	milligrams per cubic meters (mg/^m3)

Transmission	Beam Transmission Chelsea/Seatech	percentage (%)
Conductivity	conductivity	Siemens per meter (S/m)
Oxygen_Raw	Raw oxygen	volts (V)
Nitrate_and_Nitrite	NO3+NO2	micromoles (um)
Silicate	Si(OH)4	micromoles (um)
Ammonium	NH4	micromoles (um)
Phosphate	PO4	micromoles (um)
Ph	pH	unitless
Latitude	Station latitude, south is negative	decimal degrees
Longitude	Station longitude, west is negative	decimal degrees
ISO_DateTime_UTC	Date and time of start CTD cast in UTC, standard ISO format (yyyy-mm-ddThh:mmZ)	unitless

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Instruments

Dataset-specific Instrument Name	SeaBird 911
Generic Instrument Name	CTD Sea-Bird 911
Dataset-specific Description	SeaBird 911+ Rosette 24-position, 10-liter bottle Rosette with dual T/C sensors At each station, CTD casts measured temperature, salinity and PAR. Water samples collected at depths of 300, 250, 200, 150, 120, 100, 80, 60, 40, 30, 20, 10 m, and the surface were filtered and preserved for nutrient analysis.
Generic Instrument Description	The Sea-Bird SBE 911 is a type of CTD instrument package. The SBE 911 includes the SBE 9 Underwater Unit and the SBE 11 Deck Unit (for real-time readout using conductive wire) for deployment from a vessel. The combination of the SBE 9 and SBE 11 is called a SBE 911. The SBE 9 uses Sea-Bird's standard modular temperature and conductivity sensors (SBE 3 and SBE 4). The SBE 9 CTD can be configured with auxiliary sensors to measure other parameters including dissolved oxygen, pH, turbidity, fluorescence, light (PAR), light transmission, etc.). More information from Sea-Bird Electronics.

Dataset-specific Instrument Name	Rosette 24 positions
Generic Instrument Name	Niskin bottle
Dataset-specific Description	SeaBird 911+ Rosette 24-position, 10-liter bottle Rosette with dual T/C sensors At each station, CTD casts measured temperature, salinity and PAR. Water samples collected at depths of 300, 250, 200, 150, 120, 100, 80, 60, 40, 30, 20, 10 m, and the surface were filtered and preserved for nutrient analysis.
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.

Dataset-specific Instrument Name	Digiquartz
Generic Instrument Name	Pressure Sensor
Dataset-specific Description	Digiquartz
Generic Instrument Description	A pressure sensor is a device used to measure absolute, differential, or gauge pressures. It is used only when detailed instrument documentation is not available.

Dataset-specific Instrument Name	Seapoint Turbidity
Generic Instrument Name	Seapoint Turbidity Meter
Generic Instrument Description	The Seapoint Turbidity Meter detects light scattered by particles suspended in water, generating an output voltage proportional to turbidity or suspended solids.

Dataset-specific Instrument Name	WETstar
Generic Instrument Name	WET Labs (Sea-Bird WETLabs) WETStar fluorometer
Generic Instrument Description	Submersible fluorometer designed for through-flow or pumped CTD applications manufactured by WetLabs and which can be configured for various types of fluorescence. The probe has a temperature range of 0-30 degrees C and a depth rating of 600 meters.

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Deployments

CT2015-01

Website	https://www.bco-dmo.org/deployment/846019
Platform	R/V Connecticut
Start Date	2015-05-07
End Date	2015-05-07

CT2015-04

Website	https://www.bco-dmo.org/deployment/846022
Platform	R/V Connecticut
Start Date	2015-08-06
End Date	2015-08-07

CT2016-01

Website	https://www.bco-dmo.org/deployment/846024
Platform	R/V Connecticut
Start Date	2016-05-03
End Date	2016-05-05

CT2016-02

Website	https://www.bco-dmo.org/deployment/846026
Platform	R/V Connecticut
Start Date	2016-07-19
End Date	2016-07-20

CT2018-01

Website	https://www.bco-dmo.org/deployment/846028
Platform	R/V Connecticut
Start Date	2018-04-30
End Date	2018-05-02

CT2018-02

Website	https://www.bco-dmo.org/deployment/846030
Platform	R/V Connecticut
Start Date	2018-07-18
End Date	2018-07-19

CT2019-01

Website	https://www.bco-dmo.org/deployment/846032
Platform	R/V Connecticut
Start Date	2019-06-12
End Date	2019-06-17

CT2019-02

Website	https://www.bco-dmo.org/deployment/846034
Platform	R/V Connecticut
Start Date	2019-07-09
End Date	2019-07-11

CT2019-03

Website	https://www.bco-dmo.org/deployment/846035
Platform	R/V Connecticut
Start Date	2019-08-13
End Date	2019-08-13

TI661

Website	https://www.bco-dmo.org/deployment/845981
Platform	R/V Tioga
Start Date	2013-04-28
End Date	2013-04-28

TI667

Website	https://www.bco-dmo.org/deployment/845983
Platform	R/V Tioga
Start Date	2013-05-14
End Date	2013-05-16

TI670

Website	https://www.bco-dmo.org/deployment/845985
Platform	R/V Tioga
Start Date	2013-05-30
End Date	2013-05-31

TI672

Website	https://www.bco-dmo.org/deployment/845987
Platform	R/V Tioga
Start Date	2013-06-12
End Date	2013-06-13

TI677

Website	https://www.bco-dmo.org/deployment/845989
Platform	R/V Tioga
Start Date	2013-07-08
End Date	2013-07-09

TI747

Website	https://www.bco-dmo.org/deployment/845993
Platform	R/V Tioga
Start Date	2014-05-02
End Date	2014-05-03

TI751

Website	https://www.bco-dmo.org/deployment/845995
Platform	R/V Tioga
Start Date	2014-05-20
End Date	2014-05-22

TI758

Website	https://www.bco-dmo.org/deployment/845999
Platform	R/V Tioga
Start Date	2014-06-15
End Date	2014-06-17

TI762

Website	https://www.bco-dmo.org/deployment/846001
Platform	R/V Tioga
Start Date	2014-07-10
End Date	2014-07-12

TI813

Website	https://www.bco-dmo.org/deployment/846006
Platform	R/V Tioga
Start Date	2015-06-17
End Date	2015-06-18

TI817

Website	https://www.bco-dmo.org/deployment/846008
Platform	R/V Tioga
Start Date	2015-07-07
End Date	2015-07-08

TI972

Website	https://www.bco-dmo.org/deployment/846015
Platform	R/V Tioga
Start Date	2017-07-17
End Date	2017-07-22

TI978

Website	https://www.bco-dmo.org/deployment/846017
Platform	R/V Tioga
Start Date	2017-08-09
End Date	2017-08-11

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Project Information

WHCOHH - Physiological and behavioral plasticity in harmful algal bloom dynamics: variation across different habitats (WHCOHH Algal Bloom Dynamics)

The goal of this project is to identify commonalities and differences in regional bloom dynamics for two key harmful algal bloom (HAB) taxa, *Alexandrium fundyense* and *Pseudo-nitzschia* spp. *The project's* ***central hypothesis*** *is that HAB global biogeography and variable bloom and toxin dynamics are determined by a common repertoire of physiological and behavioral responses to environmental forcings and that the ability to understand, forecast, and mitigate HAB events requires a deep understanding of the plasticity of these repertoires within species and between populations.* Novel, targeted, efficient, and data-rich *in situ* sampling paradigms developed with previous WHCOHH funding have revealed numerous unforeseen aspects of *A. fundyense* dynamics in the Nauset Marsh (NM), a long-studied inshore "model" bloom habitat. It is now clear that accurate rate estimates and behavioral patterns are needed for modeling and forecasting, and that these need to be generated as much as possible through *in situ* observation, a recognized strength of the WHCOHH. In this project, the approach includes deployments of a portable, solar-powered observatory platform supporting remotely controlled instruments and profiling capabilities, the centerpiece being the IFCB, a unique autonomous underwater microscope for the *in situ* detection of rates of growth, accumulation, mortality, and life cycle stage conversions. Variability in environmental forcing across years and among habitats provides a proxy for future climate scenarios, revealing the responses of these key HAB organisms under natural conditions. These novel observational and analytical approaches will be used to characterize the

behaviors and responses of *A. fundyense* across a range of other habitats and environmental regimes. They will also be directed towards *Pseudo-nitzschia* spp., a group that presents a growing public health threat to the northeast U.S. Improved understanding of critical physiological and behavioral features of both taxa are essential for accurate predictions of their climate responses and assessment of short- and long-term human health impacts.

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Program Information

Woods Hole Center for Oceans and Human Health (WHCOHH)

Website: https://www2.whoi.edu/site/whcohh/

Coverage: Western N. Atlantic, Arctic

NSF Award Abstract

The mission of the Woods Hole Center for Oceans and Human Health is to protect the public health through enhanced understanding of how oceanic and environmental processes including climatic variation affect the population dynamics of toxin producing organisms, and the risks from exposure to their potent neurotoxins. Factors affecting the distribution, survival, proliferation, and toxicity of harmful algal bloom (HAB) species still are poorly known, despite their enormous consequences for human health. Three research projects and two cores comprise the Center. The Center structure will facilitate the integration among projects, and the integration of research with education and community engagement activities. The Center will engage stakeholders, facilitate education on HAB science at many academic levels, and strengthen public knowledge about HAB blooms and their impacts. The Center is jointly supported by NSF and by the National Institute for Environmental Health Sciences (NIEHS).

The research activities of the Center will focus on two key HAB taxa: Alexandrium fundyense that produces the saxitoxins responsible for paralytic shellfish poisoning (PSP), and Pseudo-nitzschia spp. that produce domoic acid responsible for the amnesic shellfish poisoning (ASP) syndrome. Novel, targeted, efficient, and data-rich sampling approaches developed by the applicants and applied in situ have revealed that critical aspects of A. fundyense dynamics in natural settings differ dramatically from those inferred from laboratory studies, indicating plasticity in response to climate. The research proposed will build on these new and fundamental insights into what regulates blooms, and on the Center's established strengths in ocean observation technologies and modeling, to predict how environmental variables may influence population dynamics of known and emerging HAB threats. Hindcast simulations compared with climate data records in the Gulf of Maine will assess model performance and uncertainty. Forecasts run for a range of potential climate scenarios can help quantify future public health risks. Similarly, specific cells have been identified in the developing brain that are targets of HAB toxins, findings giving insights into developmental toxicological mechanisms. These will guide studies to address the scope of toxin effect in the developing central nervous system, potentially linking developmental exposures to adult consequences. Studies of new mechanisms of toxin action will include determination of the effects of combined or repeated exposure to sub-lethal levels of saxitoxin and domoic acid, and possible silent neurotoxicity, at different life stages in the zebrafish model.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

The data management plan for the program can be found here.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1314642
NSF Division of Ocean Sciences (NSF OCE)	OCE-1840381
National Institutes of Health (NIH)	NIH-P01ES021923
National Institutes of Health (NIH)	NIH-P01ES028938

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