Alexandrium cell counts from CTD bottle sampling from 2012 to 2019 in the Gulf of Maine

Website: https://www.bco-dmo.org/dataset/834443
Data Type: Cruise Results
Version: 1
Version Date: 2021-05-04

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
Alexandrium cell counts from CTD bottle sampling from 2012 to 2019 in the Gulf of Maine

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Coverage

Spatial Extent: **N**:44.983 **E**:-66.113 **S**:41.5283 **W**:-70.7927
Temporal Extent: 2012-05-04 - 2019-08-12

Methods & Sampling

Standard station CTD profiles measurements (down casts) with water sampling (up casts);

Calculations of the concentration (cells/Liter) of Alexandrium catenella, formerly A. fundyense, were completed using MS Excel. The spreadsheet used inputs of the original volume sieved at sea (usually 2 Liters), the volume re-suspended into formalin and then methanol (usually 14ml), and the volume of the plankton concentrate filtered for the molecular probe assay (usually 7ml, or less volume if during a significant bloom), and the number of labeled cells observed on that filter.

Data Processing Description

"Whole Cell" preserved samples. For the “Whole Cell” A. catenella water samples collected during the surveys, 2 Liters of seawater were drained from Niskin bottles into pre-rinsed bottles and sieved thru 20µm Nitex. The concentrated particulate material retained on the sieve was backwashed with filtered seawater (<15µm) into 15ml centrifuge tubes to a final volume of 14ml and preserved with formalin to a final concentration of 5%. After storage at 4oC for no longer than 36 hours, the tubes were centrifuged for 5 min (5000 x g), formalin was removed by aspiration leaving the pellet, replaced with 100% cold methanol, and stored at -20C for later analysis.

Enumeratio"n of the WC samples followed the methods developed by Anderson et al (2005a) using a species-specific oligonucleotide probe (NA-1) conjugated to a Cy3 fluorochrome and visualized with epi-fluorescence microscopy.

“Live" Count samples. To obtain quick estimates of Alexandrium sp. concentrations while at sea, 10 L of seawater from a surface 10L Niskin bottle was sieved and concentrated to 14ml. A 1ml aliquot of the concentrate was loaded into a Sedgewick- Rafter counting chamber and enumerated using standard light microscopy.

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Data Files

File
alexandrium_counts.csv (Comma Separated Values (.csv), 65.54 KB) MD5:a6ac080af2d879866ad1733086601973 Primary data file for dataset ID 834443

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Related Publications

Anderson, D. M., Kulis, D. M., Keafer, B. A., Gribble, K. E., Marin, R., & Scholin, C. A. (2005). Identification and enumeration of Alexandrium spp. from the Gulf of Maine using molecular probes. Deep Sea Research Part II: Topical Studies in Oceanography, 52(19-21), 2467–2490. doi:10.1016/j.dsr2.2005.06.015
Methods

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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	Station number	unitless
Depth	Nominal depth	meters (m)
Live_cell_counts	live counts of cells concentration (live)	cells per liter
Whole_cell_counts	Alexandrium catenella cells concentration (WC)	cells per liter
Date_UTC	Date of data collection in UTC, standard ISO format (yyyy-mm-dd)	unitless
Time_UTC	Time of sample and data collection in UTC, standard ISO format (yyyy-mm-ddThh:mmZ)	unitless
Latitude	latitude, south is negative	decimal degrees
Longitude	longitude, west is negative	decimal degrees
ISO_DateTime_UTC	Date and time of sample and data collection in UTC, standard ISO format (yyyy-mm-ddThh:mmZ)	unitless
Sample_type	Samples taken at ESP Stations, CTD stations or Underway	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-position
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	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.
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.

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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

GC2016-01

Website	https://www.bco-dmo.org/deployment/846037
Platform	R/V Gulf Challenger
Start Date	2016-10-05
End Date	2016-10-07

SI2017-01

Website	https://www.bco-dmo.org/deployment/846040
Platform	M/V Scarlett Isabella
Start Date	2018-08-25
End Date	2017-08-26

WJ2017-01

Website	https://www.bco-dmo.org/deployment/846043
Platform	R/V Warren Jr.
Start Date	2017-06-29
End Date	2017-07-01

TI603

Website	https://www.bco-dmo.org/deployment/845975
Platform	R/V Tioga
Start Date	2012-05-23
End Date	2012-05-25

TI606

Website	https://www.bco-dmo.org/deployment/845977
Platform	R/V Tioga
Start Date	2012-06-11
End Date	2012-06-11

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

TI691

Website	https://www.bco-dmo.org/deployment/845991
Platform	R/V Tioga
Start Date	2013-08-03
End Date	2013-08-07

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

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

TI831

Website	https://www.bco-dmo.org/deployment/846011
Platform	R/V Tioga
Start Date	2015-08-02
End Date	2015-08-05

TI906

Website	https://www.bco-dmo.org/deployment/846013
Platform	R/V Tioga
Start Date	2016-10-20
End Date	2016-10-20

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-1131038
NSF Division of Ocean Sciences (NSF OCE)	OCE-1314642
National Institutes of Health (NIH)	NIH-P01ES021923
National Institutes of Health (NIH)	NIH-P01ES028938

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