Water column dissolved organic carbon (DOC) reactivity along the York River Estuary (YRE) from surface samples collected in October 2018 and February, April, and July 2019

Website: https://www.bco-dmo.org/dataset/946056
Version: 1
Version Date: 2024-12-13

Project
» Alteration of carbon fluxes by intense phytoplankton blooms in a microtidal estuary (LYRE)

Contributors	Affiliation	Role
Anderson, Iris C.	Virginia Institute of Marine Science (VIMS)	Principal Investigator
Brush, Mark J.	Virginia Institute of Marine Science (VIMS)	Co-Principal Investigator
Reece, Kimberly S.	Virginia Institute of Marine Science (VIMS)	Co-Principal Investigator
Song, Bongkeun	Virginia Institute of Marine Science (VIMS)	Co-Principal Investigator
Detweiler, Derek J.	Virginia Institute of Marine Science (VIMS)	Student
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
Data were collected to evaluate spatiotemporal variations in, and environmental controls on, water column dissolved organic carbon (DOC) reactivity along the York River Estuary (YRE), a temperate microtidal sub-estuary of the Chesapeake Bay in southeastern Virginia. Data were also collected as part of the larger, NSF-funded project (NSF BIO-OCE #1737258) entitled "Alteration of carbon fluxes by intense phytoplankton blooms in a micro tidal estuary." Surface water column samples were collected in October 2018 and February, April, and July 2019 from three locations along the YRE estuarine salinity gradient. Filtered water was inoculated and incubated in the dark at in situ York River water temperatures, and sub-sampled at the onset of the experiment (T0), one day following onset (T1), and weekly for 28 days thereafter (T7, T14, T21, T28). Samples were analyzed for DOC concentrations.

Table of Contents

Coverage

Location: York River Estuary, VA, USA
Spatial Extent: **N**:37.48011111 **E**:-76.44288889 **S**:37.25180556 **W**:-76.7595
Temporal Extent: 2018-10-10 - 2019-08-13

Methods & Sampling

These data represent concentrations of dissolved organic carbon (DOC) in units of micromoles per liter (µM) from samples collected during dark bottle incubations of estuarine surface water. These data were collected as part of a study that evaluated spatiotemporal and environmental controls on water column DOC reactivity along the York River Estuary (YRE), a temperate microtidal sub-estuary of the Chesapeake Bay in southeastern Virginia. The data were also collected as part of the larger, NSF-funded project (NSF BIO-OCE #1737258)

entitled "Alteration of carbon fluxes by intense phytoplankton blooms in a micro tidal estuary."

During October 2018 and February, April, and July 2019, triplicate surface water samples (<0.5 meters below the surface) were collected from three locations along the YRE estuarine salinity gradient, referred to as upper (37°28'48.4"N 76°45'34.2"W), middle (37°20'13.2"N 76°38'24.0"W), and lower (37°15'06.5"N 76°26'34.4"W). Samples were collected using a DataFlow pump intake system. Surface water samples were dispensed directly into 2-liter (L) polycarbonate bottles and kept in the dark on ice for transport back to the Virginia Institute of Marine Science (VIMS). Prior to sample collection, all glassware and glass-fiber filters were combusted (500 degrees Celsius (°C) for 4 hours), and polyethersulfone (PES) filters and polycarbonate collection bottles were acid-rinsed (10% HCl).

Upon return to VIMS, the 2L water samples were immediately filtered sequentially through 0.7-micrometer (µm) (Whatman GF/F) and 0.2 µm (Sterlitech PES) filters into borosilicate glass bottles. The 0.2 µm filtrate was inoculated with the 0.7 µm filtrate (1% v/v) for microbial degradation experiments. The samples were incubated in the dark at in situ York River water temperature and sub-sampled at the onset of the experiment (T0), one day following onset (T1), and weekly for 28 days thereafter (T7, T14, T21, T28). Subsamples for DOC were filtered (0.45 µm PES) and frozen (-20°C) until analyses were completed within four weeks of collection. Concentrations of DOC ([DOC]) at each time point were measured using high-temperature combustion oxidation (Shimadzu TOC-V organic carbon analyzer).

BCO-DMO Processing Description

- Imported original file "2018-2019 DOC Data (BCO DMO).csv" into the BCO-DMO system.
- Renamed fields to comply with BCO-DMO naming conventions.
- Converted Date_Collected field to YYYY-MM-DD format.
- Saved final file as "946056_v1_doc_lability.csv".

[table of contents | back to top]

Parameters

Parameter	Description	Units
Site	station where samples were collected	unitless
Lat	station latitude	decimal degrees North
Long	station longitude	decimal degrees East
Month	month of sample collection	unitless
Date_Collected	date of sample collection	unitless
Timepoint_days	time (in days) during the experiment in which the sample was collected	days
DOC_uM	dissolved organic carbon concentration	micromolar (umol/l)

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	DataFlow pump intake system
Generic Instrument Name	Pump
Generic Instrument Description	A pump is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action. Pumps can be classified into three major groups according to the method they use to move the fluid: direct lift, displacement, and gravity pumps

Dataset-specific Instrument Name	Shimadzu TOC-V organic carbon analyzer
Generic Instrument Name	Shimadzu TOC-V Analyzer
Generic Instrument Description	A Shimadzu TOC-V Analyzer measures DOC by high temperature combustion method.

[table of contents | back to top]

Project Information

Alteration of carbon fluxes by intense phytoplankton blooms in a microtidal estuary (LYRE)

Coverage: York River Estuary, Virginia

NSF Award Abstract:
Estuaries, coastal water bodies where rivers mix with ocean water, are hotspots for the processing of carbon and nutrients moving from land to the coastal ocean. Within estuaries land-based nutrient inputs can cause intense blooms of single-celled algae called phytoplankton, which can have significant impacts on the ecosystem. As blooms move down-estuary some of the phytoplankton material is buried on the bottom, and some is decomposed, resulting in low oxygen conditions (hypoxia), harmful to marine life, and production of carbon dioxide (CO2), the major greenhouse gas, which can exchange with the atmosphere. The remaining phytoplankton material can be exported to the ocean. The type and amount of carbon exported from the estuary depend both on its biological activity and physical factors such as fresh water discharge, temperature, and light availability. If phytoplankton production is greater than decomposition, the estuary will take up atmospheric CO2 and export phytoplankton carbon to the coastal ocean. On the other hand, if decomposition is greater than production the estuary will be a source of CO2 to the atmosphere and dissolved CO2 to the coastal ocean. The investigators expect that intense phytoplankton blooms will greatly amplify carbon exchanges with the atmosphere, coastal ocean, and bottom sediments. As intense phytoplankton blooms increase in the future due to increased nutrient inputs and temperature, low oxygen events may become more frequent with potential negative impacts on fisheries and increased export of carbon to the coastal ocean and atmosphere. This study will fill critical gaps identified by the Coastal Carbon Synthesis Program in knowledge of how microtidal estuaries transform and export C to the atmosphere, benthos, and coastal ocean. In addition, there will be a strong teaching and training component to this project, with support for graduate and undergraduate students. The graduate student will be partnered with secondary teachers to gain teaching experience and enrich the middle school educational programs. Summer undergraduate interns will be recruited for a summer program from Hampton University, a historically Black college. There will be public outreach through participation in existing programs at VIMS.

Estuaries serve as critical hotspots for the processing of carbon (C) as it transits from land to the coastal ocean. Recent attempts to synthesize what is known about sources and fates of C in estuaries have noted large data gaps; thus, the role of estuaries, especially those that are microtidal, as important sources of carbon dioxide (CO2) to the atmosphere and total organic carbon (TOC) and dissolved inorganic carbon (DIC) to the coastal ocean, or as a C sink in bottom sediments, remains uncertain. Intensive phytoplankton blooms

are becoming increasingly frequent in many estuaries and are likely to have important and yet unknown impacts on the C cycle. The trophic status of an estuary will determine in large part the species of C exported to the atmosphere, bottom sediments, and coastal ocean. The overarching objective of this project is to identify the impacts of intense phytoplankton blooms on C speciation, net C fluxes and exchanges in the Lower York River Estuary (LYRE), a representative mesotrophic, microtidal mid-Atlantic estuary. Metabolic processes are hypothesized to be spatially and temporally dynamic, driving the speciation, abundance, and fates of C in the LYRE. High spatiotemporal resolution sampling in the LYRE will capture rates of C cycling under both baseline conditions throughout most of the year, and during periods when the estuary is perturbed by widespread and intense, but patchy, late summer phytoplankton blooms. The short-term effects of physical drivers (wind, temperature, salinity, fresh water discharge, nutrient and organic carbon loads) and biological drivers (metabolic rates, bacterial and phytoplankton abundances and composition) on C transformations, speciation, and exchanges will be assessed. Expected longer term variations in the C cycle due to anthropogenic and natural disturbances will be predicted through use of modeling. In addition, laboratory manipulations will examine the impacts of specific organisms dominating intensive phytoplankton blooms on benthic metabolism, processing of organic C by the microbial community, and C fluxes to the water column.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1737258

[table of contents | back to top]