CTD

Website: https://www.bco-dmo.org/dataset/719199
Version:

Project
» Life in the Dead Zone: Microbial respiration, production, diversity and gene expression in seasonally anoxic estuarine waters (LiDZ)

Contributors	Affiliation	Role
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Dataset Description

These data have been submitted to BCO-DMO and are in the process of being served.

This dataset contains CTD profiles from the middle region of the Chesapeake Bay, in seasonally anoxic bottom waters, collected in spring and summer of 2010-2011.

CTD profiles collected during sixteen research cruises in 2010-2012: two 1-week cruises aboard the UNOLS vessel R/V Hugh R. Sharp, and fourteen 1-day cruises aboard the R/V Terrapin, which is a 25' Parker outboard motorboat with davit for deploying a CTD package.

Data Processing Description

CTD data was processed using Software Version Seasave V 7.20c

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Parameters

Parameters for this dataset have not yet been identified

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Sea-Bird SBE 25 Sealogger CTD
Generic Instrument Description	The Sea-Bird SBE 25 SEALOGGER CTD is battery powered and is typically used to record data in memory, eliminating the need for a large vessel, electrical sea cable, and on-board computer. All SBE 25s can also operate in real-time, transmitting data via an opto-isolated RS-232 serial port. Temperature and conductivity are measured by the SBE 3F Temperature sensor and SBE 4 Conductivity sensor (same as those used on the premium SBE 9plus CTD). The SBE 25 also includes the SBE 5P (plastic) or 5T (titanium) Submersible Pump and TC Duct. The pump-controlled, TC-ducted flow configuration significantly reduces salinity spiking caused by ship heave, and in calm waters allows slower descent rates for improved resolution of water column features. Pressure is measured by the modular SBE 29 Temperature Compensated Strain-Gauge Pressure sensor (available in eight depth ranges to suit the operating depth requirement). The SBE 25's modular design makes it easy to configure in the field for a wide range of auxiliary sensors, including optional dissolved oxygen (SBE 43), pH (SBE 18 or SBE 27), fluorescence, transmissivity, PAR, and optical backscatter sensors. More information from Sea-Bird Electronics: http:www.seabird.com.

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Deployments

LDZ1

Website	https://www.bco-dmo.org/deployment/515278
Platform	R/V Terrapin
Start Date	2010-05-17
End Date	2010-05-17
Description	One of 14 one-day cruises on a 25' Parker outboard motorboat with a davit for deploying a CTD package.

LDZ2

Website	https://www.bco-dmo.org/deployment/515281
Platform	R/V Terrapin
Start Date	2010-06-07
End Date	2010-06-07
Description	One of 14 one-day cruises on a 25' Parker outboard motorboat with a davit for deploying a CTD package.

LDZ3

Website	https://www.bco-dmo.org/deployment/515284
Platform	R/V Terrapin
Start Date	2010-06-16
End Date	2010-06-16
Description	One of 14 one-day cruises on a 25' Parker outboard motorboat with a davit for deploying a CTD package.

HRS100709BC

Website	https://www.bco-dmo.org/deployment/514970
Platform	R/V Hugh R. Sharp
Start Date	2010-07-09
End Date	2010-07-16

LDZ5

Website	https://www.bco-dmo.org/deployment/515323
Platform	R/V Terrapin
Start Date	2010-08-05
End Date	2010-08-05
Description	One of 14 one-day cruises on a 25' Parker outboard motorboat with a davit for deploying a CTD package. The deployment synonym (in the same place and time) called "*_filt" is labeled a deployment although it was really a different treatment of the samples -- filtered or unfiltered.

LDZ6

Website	https://www.bco-dmo.org/deployment/515326
Platform	R/V Terrapin
Start Date	2010-08-31
End Date	2010-08-31
Description	One of 14 one-day cruises on a 25' Parker outboard motorboat with a davit for deploying a CTD package. The deployment synonym (in the same place and time) called "*_filt" is labeled a deployment although it was really a different treatment of the samples -- filtered or unfiltered. [DMO- I have removed this synonym. Not necessary.]

LDZ7

Website	https://www.bco-dmo.org/deployment/515329
Platform	R/V Terrapin
Start Date	2010-10-18
End Date	2010-10-18
Description	One of 14 one-day cruises on a 25' Parker outboard motorboat with a davit for deploying a CTD package. **Methods & Sampling** http://dmoserv3.bco-dmo.org/jg/serv/BCO-DMO/LiDZ/sediment_cores.html0%7B...

LDZ8

Website	https://www.bco-dmo.org/deployment/515332
Platform	R/V Terrapin
Start Date	2011-04-18
End Date	2011-04-18
Description	One of 14 one-day cruises on a 25' Parker outboard motorboat with a davit for deploying a CTD package.

LDZ9

Website	https://www.bco-dmo.org/deployment/515334
Platform	R/V Terrapin
Start Date	2011-05-24
End Date	2011-05-24
Description	One of 14 one-day cruises on a 25' Parker outboard motorboat with a davit for deploying a CTD package.

LDZ10

Website	https://www.bco-dmo.org/deployment/515337
Platform	R/V Terrapin
Start Date	2011-06-14
End Date	2011-06-14
Description	One of 14 one-day cruises on a 25' Parker outboard motorboat with a davit for deploying a CTD package.

HRS110705BC

Website	https://www.bco-dmo.org/deployment/515146
Platform	R/V Hugh R. Sharp
Start Date	2011-07-05
End Date	2011-07-13

LDZ12

Website	https://www.bco-dmo.org/deployment/515340
Platform	R/V Terrapin
Start Date	2011-08-08
End Date	2011-08-08
Description	One of 14 one-day cruises on a 25' Parker outboard motorboat with a davit for deploying a CTD package.

LDZ13

Website	https://www.bco-dmo.org/deployment/515343
Platform	R/V Terrapin
Start Date	2011-08-30
End Date	2011-08-30
Description	One of 14 one-day cruises on a 25' Parker outboard motorboat with a davit for deploying a CTD package.

LDZ14

Website	https://www.bco-dmo.org/deployment/515346
Platform	R/V Terrapin
Start Date	2011-09-21
End Date	2011-09-21
Description	One of 14 one-day cruises on a 25' Parker outboard motorboat with a davit for deploying a CTD package.

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Project Information

Life in the Dead Zone: Microbial respiration, production, diversity and gene expression in seasonally anoxic estuarine waters (LiDZ)

Coverage: Chesapeake Bay

Every summer in many estuaries and coastal margins, eutrophication-elevated phytoplankton production drives rapid bacterial respiration creating hypoxic and anoxic bottom waters. These so-called “dead zones” exclude fish, kill benthic organisms, and eliminate habitat. Despite their popular name, anoxic/hypoxic zones are not really dead, but rather are populated with living and very active microbial communities. In fact, bacterial production in anoxic waters can exceed that in overlying oxic waters due, in part, to reduced grazing and increased cell size and abundance. Once oxygen is depleted, microbial respiration undergoes a succession of redox reactions with decreasing energy yield as terminal electron acceptors are depleted (e.g., O2, NO3-, Mn(IV), Fe(III), and SO42-). This combination of high production and reduced growth efficiency creates a condition in which respiration may be very high, making anoxic zones significant sinks for organic matter and key sites for nutrient cycling.

Previous research documented respiratory succession in Chesapeake Bay bottom waters based on redox chemistry measurements. Heterotrophic bacterial production was very high at some stages of this succession, suggesting elevated respiration. Also, the phylogenetic composition of bacterioplankton communities in anoxic waters was similar to oxic surface waters for nearly half the summer, only changing after the appearance of H2S. This suggests that typical aerobic estuarine bacteria are able to shift to anaerobic metabolisms and continue to dominate.

Most of what is known about microbial respiration and community composition in anoxic water comes from studies of permanently anoxic systems like the Black Sea and Cariaco Basin. By comparison, very little is known about what is a much more common and more dynamic marine environment – seasonally anoxic estuarine waters. This proposal describes a 3-year integrated study to advance the quantitative and mechanistic understanding of biogeochemical cycling in one of the largest seasonal estuarine anoxic zones in the USA. It hypothesize that:

• Dominant sub-pycnocline respiratory processes undergo a succession from aerobic respiration to nitrate respiration and metal reduction to sulfate reduction.
• Bacterial growth efficiency decreases with this respiratory succession, but bacterial production remains high,

resulting in very high carbon respiration rates.
• Bacterial community composition changes little during respiratory succession until sulfate respiration dominates (i.e., the sulfide threshold), but gene expression closely tracks changes in redox conditions in order to support the most energetic respiratory processes.

These hypotheses will be addressed by quantifying carbon respiration rates using several techniques including delta CO2; quantifying bacterial production, biomass and growth efficiency; and characterizing succession in the composition and respiratory gene expression patterns of microbial communities in water column and sediments during each stage of respiratory succession. This project will integrate biogeochemical, biological, and genomic data to explain how biogeochemistry influences, and is influenced by, microbial respiration, production, diversity, and gene expression.

The proposed research will provide (1) reliable measurements of production and respiration in anoxic/hypoxic waters, (2) techniques applicable to other ecosystems, and (3) ecological insight for predicting future changes with ongoing restoration efforts in anoxia-impacted estuaries. These measurements will be useful for calibrating biogeochemical models and for estimating carbon budgets. This research will train two graduate students and one postdoctoral scientist in several state-of-the-art geochemical and molecular biology techniques. Applications will be submitted to the NSF Research Experiences for Teachers program to engage two teachers to work on this project and to participate in the seven-week Environmental Science Education Partnership (ESEP) Teacher Research Fellowship Program (www.esep.umces.edu) at UMCES Horn Point Laboratory. New discoveries will be incorporated into graduate-level courses entitled Aquatic Microbial Ecology, Biological Oceanography, and Environmental Geochemistry. Nucleic acid sequences will be deposited in online repositories including GenBank.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0961920

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