Nutrient concentrations from R/V Pelican cruise PE22-03 in the Northern Gulf of Mexico in August 2021

Website: https://www.bco-dmo.org/dataset/878848
Data Type: Cruise Results
Version: 1
Version Date: 2022-09-02

Project
» CAREER: Investigating aerobic microbial respiration dynamics in coastal hypoxia (Coastal O2 Respir)

Contributors	Affiliation	Role
Thrash, J. Cameron	University of Southern California (USC)	Principal Investigator
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
This dataset includes marine chemistry measurements (PO4, SiOH4, NO3, NO2, NH4) from the "Microbial DO respir" cruise on R/V Pelican (cruise ID PE22-03) in the Northern Gulf of Mexico in August 2021. Surface and bottom water samples were collected in duplicate at five stations.

Table of Contents

Coverage

Spatial Extent: **N**:28.8686 **E**:-90.4903 **S**:28.6083 **W**:-91.6167
Temporal Extent: 2021-08-03 - 2021-08-07

Methods & Sampling

Sampling was conducted on R/V Pelican cruise PE22-03 in the Northern Gulf of Mexico in August 2021. Surface and bottom water samples were collected in duplicate at five stations.

Duplicate water samples from surface and bottom water at each station were collected from Niskin bottles attached to the CTD rosette into polycarbonate carboys and subsequently filtered via peristaltic pumping and masterflex tubing through 2.7 µm Whatman GF/D and 0.22 µm Sterivex filters. This filtrate was collected into 50 mL Falcon tubes and immediately stored at -20 degrees Celsius. Samples were shipped frozen to the University of Washington Marine Chemistry Laboratory for analysis. Details on analysis protocols and instruments can be found at https://www.ocean.washington.edu/story/Marine_Chemistry_Laboratory

Details on sample processing for this dataset can be found in the attached Supplemental File "PE22-03_Nutrients_File_Header.pdf".

Data Processing Description

BCO-DMO Processing:
- added station latitude and longitude from the separate file of station locations for PE22-03;
- renamed fields to comply with BCO-DMO naming conventions;
- rounded numeric columns to same precision shown in the original Excel file;
- empty/blank values are filled with "nd" (no data).

[table of contents | back to top]

Data Files

File
pe2203_nutrients.csv (Comma Separated Values (.csv), 1.57 KB) MD5:1915bb9f171489281cd24141f927c7d8 Primary data file for dataset ID 878848.

[table of contents | back to top]

Supplemental Files

File
PE22-03_Nutrients_File_Header.pdf (Portable Document Format (.pdf), 339.29 KB) MD5:308545e7f3af8a59e988aab956925fa7 Sample processing information from the University of Washington Marine Chemistry Laboratory for dataset "PE22-03 Nutrients" (878848); PI: Cameron Thrash.

[table of contents | back to top]

Parameters

Parameter	Description	Units
Seq	Internal ID number used by the lab	unitless
Bottle	Bottle number	unitless
Sample_ID	Sample ID number	unitless
Latitude	Station latitude	degrees North
Longitude	Station longitude	degrees East
Depth	Sample depth	meters (m)
Dilution_Factor	Dilution factor	unitless
PO4	Concentration of PO4 (calcuated value)	micromolar (uM)
SiOH4	Concentration of SiOH4 (calcuated value)	micromolar (uM)
NO3	Concentration of NO3 (calcuated value)	micromolar (uM)
NO2	Concentration of NO2 (calcuated value)	micromolar (uM)
NH4	Concentration of NH4 (calcuated value)	micromolar (uM)

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Niskin bottles
Generic Instrument Name	Niskin bottle
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	SEAL AA3
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.

[table of contents | back to top]

Deployments

PE22-03

Website	https://www.bco-dmo.org/deployment/878845
Platform	R/V Pelican
Report	https://datadocs.bco-dmo.org/docs/305/Coastal_O2_Respir/data_docs/Cruise_Plan_Aug2021.pdf
Start Date	2021-08-03
End Date	2021-08-07

[table of contents | back to top]

Project Information

CAREER: Investigating aerobic microbial respiration dynamics in coastal hypoxia (Coastal O2 Respir)

Coverage: Northern Gulf of Mexico, Southern California Bight

NSF Award Abstract:
Decreasing marine dissolved oxygen (DO) is a widespread and growing global problem. Among the chief causes for coastal losses of DO are anthropogenic nutrient inputs that lead to seasonal hypoxia- DO concentrations below 2 mg/L. Microorganisms are the primary agents of oxygen removal, and although we have a basic mechanistic understanding of how nutrient enrichment combines with stratification to stimulate

microbial metabolism and oxygen drawdown, we still do not know which microorganisms are ultimately responsible for oxygen consumption leading to, and during, coastal hypoxia in any particular region. Nor do we know the extent to which each hypoxic system arises from universal microbial mechanisms or whether there may be unique microorganisms and metabolic pathways involved in each locale. Hypoxic regions are increasing in number and size around the globe, amplifying the need to better understand the microbial processes responsible for oxygen consumption. In response, the project pursues an integrated research and education effort to study the microbial mechanisms of oxygen respiration in two coastal zones where DO depletion occurs: the northern Gulf of Mexico ?dead zone?, and the Southern California Bight. This work identifies the microorganism actively consuming oxygen in these systems, what fuels them, and whether/how those taxa respond to environmental changes. The investigators are generating microbial DO consumption rate, genetic, and taxonomic data critical to better constraining respiration models focused on water column DO depletion. In doing so, hundreds of undergraduate and students and dozens of high school STEM teachers contribute valuable data by participating in modern marine microbiological research. The project also improves integration of authentic research experiences into college and high-school classrooms in the context of a problem of global relevance.

Regions of low DO take multiple forms, from vast open ocean oxygen minimum zones (OMZs) which hover in the upper water column, to shallower coastal zones of bottom water hypoxia fueled by close proximity to fluvial inputs of human supplied nutrients. Microbial respiration is primarily responsible for the ultimate consumption of DO, and therefore understanding the microorganisms that inhabit these systems and their metabolic capabilities is critical for improving our ability to predict the timing, extent, and severity of DO depletion, and how these factors relate to environmental change. While there has been substantial research into the microbiology of OMZs, we know comparatively little about the microbial dynamics, and in particular, the microorganisms responsible for oxygen consumption, in coastal hypoxia. This integrated research and education effort is framed by the following objectives:

1. Determine the microorganisms and metabolic processes responsible for actively respiring water column DO prior to, and during, hypoxia.
2. Quantify microbial respiration rates for communities and representative water column species in both the planktonic and particle-associated fractions.
3. Integrate authentic microbiology research on a globally relevant topic into undergraduate and high school classrooms.

The work uses a combination of advanced cultivation-independent and pure culture measurements to discriminate between oxygen consumption by planktonic and particle-associated microbial fractions, as well as by communities at the surface and those in bottom waters, in two different systems of coastal DO depletion (the northern Gulf of Mexico hypoxic zone and the Southern California coastal shelf). Direct assessment of actively respiring taxa are connected with their metabolic potential, gene expression, and respiration rates. This project is determining, for the first time, the taxa actively consuming oxygen in these systems. The results also provide size fractionated respiration rates and bacterial growth efficiency (BGE) with depth across multiple sites and seasons, and importantly, also yield cell-specific respiration rates and BGE for active taxa within these systems. This data will constrain variable respiration across differing environmental conditions. The investigators are experimentally testing how alterations in environmental variables affect these respiration rates and BGEs, leading to greater predictive insight for the range of effects climate forcing will have on DO consumption. This information also facilitates comparisons between multiple marine systems to identify whether common or distinct organisms and metabolic processes are operating to remove DO.

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.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1945279

[table of contents | back to top]