

# Nutrient concentrations from R/V Pelican cruise PE21-18 in the Northern Gulf of Mexico in April and May 2021

**Website:** <https://www.bco-dmo.org/dataset/879560>

**Data Type:** Cruise Results

**Version:** 1

**Version Date:** 2022-09-06

## Project

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

Contributors	Affiliation	Role
<a href="#">Thrash, J. Cameron</a>	University of Southern California (USC)	Principal Investigator
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## Abstract

This dataset includes marine chemistry measurements (PO<sub>4</sub>, SiOH<sub>4</sub>, NO<sub>3</sub>, NO<sub>2</sub>, NH<sub>4</sub>) from the "Microbial DO respir" cruise on R/V Pelican (cruise ID PE21-18) in the Northern Gulf of Mexico during April-May 2021. Surface and bottom water samples were collected in duplicate at five stations.

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## Coverage

**Spatial Extent:** N:28.8686 E:-90.4903 S:28.6083 W:-91.6167

**Temporal Extent:** 2021-04-27 - 2021-05-02

## Methods & Sampling

Sampling was conducted on R/V Pelican cruise PE21-18 in the Northern Gulf of Mexico during April-May 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](https://www.ocean.washington.edu/story/Marine_Chemistry_Laboratory)

Details on sample processing for this dataset can be found in the attached Supplemental File "[PE21-18\\_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;
- added column for Station ID number;
- empty/blank values are filled with "nd" (no data).

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## Data Files

File
<b>pe2118_nutrients.csv</b> (Comma Separated Values (.csv), 1.87 KB) MD5:cef91cbf6c574b8ac8277234be4b9d64 Primary data file for dataset ID 879560.

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## Supplemental Files

File
<b>PE21-18_Nutrients_File_Header.pdf</b> (Portable Document Format (.pdf), 336.86 KB) MD5:812418b7df35e47e3fd66cd238de507f Sample processing information from the University of Washington Marine Chemistry Laboratory for dataset "PE21-18 Nutrients" (879560); PI: Cameron Thrash.

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## Parameters

Parameter	Description	Units
Seq	Internal ID number used by the lab	unitless
Bottle	Bottle number	unitless
Sample_ID	Sample ID number	unitless
Station_ID	Station 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 (calculated value)	micromolar (uM)
SiOH4	Concentration of SiOH4 (calculated value)	micromolar (uM)
NO3	Concentration of NO3 (calculated value)	micromolar (uM)
NO2	Concentration of NO2 (calculated value)	micromolar (uM)
NH4	Concentration of NH4 (calculated value)	micromolar (uM)

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## Instruments

<b>Dataset-specific Instrument Name</b>	Niskin bottles
<b>Generic Instrument Name</b>	Niskin bottle
<b>Generic Instrument Description</b>	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.

<b>Dataset-specific Instrument Name</b>	SEAL AA3
<b>Generic Instrument Name</b>	Nutrient Autoanalyzer
<b>Generic Instrument Description</b>	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.

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## Deployments

### PE21-18

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/859609">https://www.bco-dmo.org/deployment/859609</a>
<b>Platform</b>	R/V Pelican
<b>Report</b>	<a href="https://datadocs.bco-dmo.org/docs/305/Coastal_O2_Respir/data_docs/Cruise_Plan_Apr2021.pdf">https://datadocs.bco-dmo.org/docs/305/Coastal_O2_Respir/data_docs/Cruise_Plan_Apr2021.pdf</a>
<b>Start Date</b>	2021-04-27
<b>End Date</b>	2021-05-02
<b>Description</b>	See more cruise information at R2R: <a href="https://www.rvdata.us/search/cruise/PE21-18">https://www.rvdata.us/search/cruise/PE21-18</a>

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## 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.

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## Funding

Funding Source	Award
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-1945279</a>

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