Processed CTD data (binned) from 24 casts conducted on R/V Pelican cruise PE22-03 in the Northern Gulf of Mexico in August 2021

Website: https://www.bco-dmo.org/dataset/879704
Data Type: Cruise Results
Version: 1
Version Date: 2023-07-06

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

Contributors	Affiliation	Role
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Abstract
This dataset includes the processed CTD data from 24 casts conducted on R/V Pelican cruise PE22-03 in the Northern Gulf of Mexico in August 2021. Data were averaged into bins of 0.25 meters.

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Coverage

Spatial Extent: **N**:29.71696 **E**:-87.68239 **S**:27.69985 **W**:-94.58739
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. All CTD casts were conducted according to standard ship operator procedure.

The data were collected using a SeaBird 911 plus system with twelve 12-liter Niskin bottles. The instruments included in the 911 plus suite are dual Temperature (SBE 3), dual Conductivity (SBE 4), and dual Oxygen (SBE 43) sensors. Additionally, the suite included an SBE 27 pH/Oxidation, Chelsea Aquatracka 3 Chl-a, and a Wetlabs CDOM sensor. Serial numbers and calibration information is stored in the Header Information included in the .cnv files (see Supplemental Files).

Data Processing Description

Data Processing:

The data were processed using Seabird's SBEDataProccessing_Win32 software. The data were converted from hexadecimal to engineering units first. Using the software's Bin Averaging tool, it was also averaged in bins of 0.25 meters. The attached Supplemental File, "PE22-03_Seabird_CTD_File_Header.txt", contains the complete Seabird header from one cast (C6C_2).

For the unbinned data, see the related dataset https://www.bco-dmo.org/dataset/879930.

BCO-DMO Processing:
- captured starting latitude, starting longitude, and starting date/time from the Seabird headers as columns;
- replaced "-9.990e-29" with "nd" (no data);
- concatenated separate files (one per cast) into one dataset;
- converted starting latitude and longitude to decimal degrees (rounded to 5 decimal places);
- converted starting date/time to ISO8601 format;
- created Cast column based on the original file name;
- removed three rows of data where CTD recording started too early resulting in unusually low data values;
- renamed fields to comply with BCO-DMO parameter naming conventions.

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Data Files

File	
binned_ctd_all.csv	(Comma Separated Values (.csv), 524.42 KB) MD5:0766e5c365c4a1055cfc40486d5f4960
Primary data file for dataset ID 879704.	

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Supplemental Files

File	
PE22-03_Seabird_CTD_File_Header.txt	(Octet Stream, 12.21 KB) MD5:ac2079ec2a802f63b0cc18c61a5af7f1
Seabird CTD file header from a binned PE22-03 .cnv file.	

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Related Datasets

IsDerivedFrom

Thrash, J. C. (2023) **Processed CTD data from 24 casts conducted on R/V Pelican cruise PE22-03 in the Northern Gulf of Mexico in August 2021.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2022-09-08 doi:10.26008/1912/bco-dmo.879930.1 [view at BCO-DMO]

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Parameters

Parameter	Description	Units
Cast	Cast identifier	unitless
Lat_Start	Latitude at start of cast	degrees North
Lon_Start	Longitude at start of cast	degrees East
ISO_DateTime_Start_UTC	Date and time (UTC) at start of cast in ISO8601 format: YYYY-MM-DDThh:mm:ssZ	unitless
latitude	Latitude	degrees North
longitude	Longitude	degrees East
depSM	Depth	meters (m)
t090C	Temperature [ITS-90]	degrees Celsius
t190C	Temperature, 2 [ITS-90]	degrees Celsius
c0mS_cm	Conductivity	millSiemens per centimeter (mS/cm)
c1mS_cm	Conductivity, 2	millSiemens per centimeter (mS/cm)
sal00	Practical salinity	PSU
sal11	Practical salinity, 2	PSU
sbeox0Mg_L	Oxygen, SBE 43	milligrams per liter (mg/L)
sbeox1Mg_L	Oxygen, SBE 43, 2	milligrams per liter (mg/L)
flC	Fluorescence, Chelsea Aqua 3 Chl Con	micrograms per liter (ug/L)
ph	pH	unitless
orp	Oxidation Reduction Potential	millivolts (mV)
wetCDOM	Fluorescence, WET Labs CDOM	milligrams per cubic meter (mg/m^3)
flag	Flag	unitless

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Instruments

Dataset-specific Instrument Name	SeaBird 911 plus system
Generic Instrument Name	CTD Sea-Bird SBE 911plus
Dataset-specific Description	SeaBird 911 plus system with twelve 12-liter Niskin bottles
Generic Instrument Description	The Sea-Bird SBE 911 plus is a type of CTD instrument package for continuous measurement of conductivity, temperature and pressure. The SBE 911 plus includes the SBE 9plus Underwater Unit and the SBE 11plus Deck Unit (for real-time readout using conductive wire) for deployment from a vessel. The combination of the SBE 9 plus and SBE 11 plus is called a SBE 911 plus. The SBE 9 plus uses Sea-Bird's standard modular temperature and conductivity sensors (SBE 3 plus and SBE 4). The SBE 9 plus CTD can be configured with up to eight 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	Wetlabs CDOM
Generic Instrument Name	Fluorometer
Generic Instrument Description	A fluorometer or fluorimeter is a device used to measure parameters of fluorescence: its intensity and wavelength distribution of emission spectrum after excitation by a certain spectrum of light. The instrument is designed to measure the amount of stimulated electromagnetic radiation produced by pulses of electromagnetic radiation emitted into a water sample or in situ.

Dataset-specific Instrument Name	Chelsea Aquatracka 3 Chl-a
Generic Instrument Name	Fluorometer
Generic Instrument Description	A fluorometer or fluorimeter is a device used to measure parameters of fluorescence: its intensity and wavelength distribution of emission spectrum after excitation by a certain spectrum of light. The instrument is designed to measure the amount of stimulated electromagnetic radiation produced by pulses of electromagnetic radiation emitted into a water sample or in situ.

Dataset-specific Instrument Name	12-liter 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	SBE 27 pH/Oxidation
Generic Instrument Name	Sea-Bird SBE 27 pH/O.R.P. sensor
Generic Instrument Description	The SBE 27 pH and O.R.P. (Redox) sensor combines a pressure-balanced, glass-electrode, Ag/AgCl reference probe and platinum O.R.P. electrode to provide in-situ measurements at depths to 1200 m. The replaceable pH probe is permanently sealed and is supplied with a soaker bottle attachment that prevents the reference electrode from drying out during storage. The SBE 27 is intended for use as an add-on auxiliary sensor for profiling CTDs (SBE 9plus; SBE 19, 19plus, and 19plus V2 SeaCAT; and SBE 25 and 25plus Sealogger).

Dataset-specific Instrument Name	dual Oxygen (SBE 43) sensors
Generic Instrument Name	Sea-Bird SBE 43 Dissolved Oxygen Sensor
Generic Instrument Description	The Sea-Bird SBE 43 dissolved oxygen sensor is a redesign of the Clark polarographic membrane type of dissolved oxygen sensors. more information from Sea-Bird Electronics

Dataset-specific Instrument Name	dual Temperature (SBE 3) sensors
Generic Instrument Name	Sea-Bird SBE-3 Temperature Sensor
Generic Instrument Description	The SBE-3 is a slow response, frequency output temperature sensor manufactured by Sea-Bird Electronics, Inc. (Bellevue, Washington, USA). It has an initial accuracy of +/- 0.001 degrees Celsius with a stability of +/- 0.002 degrees Celsius per year and measures seawater temperature in the range of -5.0 to +35 degrees Celsius. more information from Sea-Bird Electronics

Dataset-specific Instrument Name	dual Conductivity (SBE 4) sensors
Generic Instrument Name	Sea-Bird SBE-4 Conductivity Sensor
Generic Instrument Description	The Sea-Bird SBE-4 conductivity sensor is a modular, self-contained instrument that measures conductivity from 0 to 7 Siemens/meter. The sensors (Version 2; S/N 2000 and higher) have electrically isolated power circuits and optically coupled outputs to eliminate any possibility of noise and corrosion caused by ground loops. The sensing element is a cylindrical, flow-through, borosilicate glass cell with three internal platinum electrodes. Because the outer electrodes are connected together, electric fields are confined inside the cell, making the measured resistance (and instrument calibration) independent of calibration bath size or proximity to protective cages or other objects.

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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

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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
NSF Division of Ocean Sciences (NSF OCE)	OCE-1945279

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