Dissolved oxygen and potential density measurements from the R/V Atlantis, R/V Ronald Brown, & E/V Nautilus in the Gulf of Mexico & Florida from 2010-2014 (Lophelia OA project)

Website: https://www.bco-dmo.org/dataset/659040

Data Type: Cruise Results

Version: 1

Version Date: 2016-09-19

Project

» Physiological and genetic responses of the deep-water coral, Lophelia pertusa, to ongoing ocean acidification in the Gulf of Mexico (Lophelia OA)

Program

» Science, Engineering and Education for Sustainability NSF-Wide Investment (SEES): Ocean Acidification (formerly CRI-OA) (SEES-OA)

Contributors	Affiliation	Role
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Abstract

Dissolved oxygen and potential density measurements from the R/V Atlantis, R/V Ronald Brown, & E/V Nautilus in the Gulf of Mexico & Florida from 2010-2014 (Lophelia OA project)

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Coverage

Spatial Extent: **N**:29.16 **E**:-88.02 **S**:27.42 **W**:-93.6

Temporal Extent: 2010 - 2014

Dataset Description

Dissolved O2 and potential density data derived from surface-deployed and vehicle-mounted CTD measurements taken on the R/V Atlantis, R/V Ronald Brown, and E/V Nautilus in the Gulf of Mexico and Florida from 2010 to 2014.

Acquisition Description

CTD data (temperature, salinity, pressure, and dissolved oxygen) were collected both as water column data from ship deployments and as bottom–water data from a vehicle–mounted CTD. In all years, a SBE 9/11+ CTD was used for water column measurements, while vehicle-mounted CTD usage varied by year: SBE 19 (2010), SBE 37-SI (2012), and SBE 49 (2013, 2014). All dissolved oxygen measurements were collected using a SBE 43 dissolved oxygen sensor.

Processing Description

CTD and dissolved oxygen measurements were vertically binned every meter in order to smooth water column profiles prior to additional analyses.

Data Management Office Notes:

-Combined several tabs from the original file into one table.
-Site, cruise, and year were separated into 3 columns. This information was initially in one column.
-Re-formatted column names to comply with BCO-DMO naming standards.

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Related Publications

Georgian, S. E., DeLeo, D., Durkin, A., Gomez, C. E., Kurman, M., Lunden, J. J., & Cordes, E. E. (2015). Oceanographic patterns and carbonate chemistry in the vicinity of cold-water coral reefs in the Gulf of Mexico: Implications for resilience in a changing ocean. Limnology and Oceanography, 61(2), 648–665. doi:10.1002/lno.10242

Lunden, J. J., Georgian, S. E., & Cordes, E. E. (2013). Aragonite saturation states at cold-water coral reefs structured byLophelia pertusain the northern Gulf of Mexico. Limnology and Oceanography, 58(1), 354–362. doi:10.4319/lo.2013.58.1.0354

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Parameters

Parameter	Description	Units
site	Site where samples were taken	unitless
cruise_name	Project investigator's cruise name	unitless
year	Year of cruise; YYYY	unitless
depth	Depth at which sample was taken	meters
temperature	Temperature at depth	celsius
salinity	Salinity of water sample	practical salinity units (PSU)
potential_density	Sigma-t density of seawater	kilogram per cubic meter (kg/m^3)
DO	Dissolved oxygen concentration	micromoles per kilogram (umol/kg)
cruise_id	Official cruise identification	unitless
lat	Latitude	decimal degrees
lon	Longitude	decimal degrees

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Instruments

Dataset-specific Instrument Name	CTD
Generic Instrument Name	CTD profiler
Dataset-specific Description	Water samples taken from CTD casts
Generic Instrument Description	The Conductivity, Temperature, Depth (CTD) unit is an integrated instrument package designed to measure the conductivity, temperature, and pressure (depth) of the water column. The instrument is lowered via cable through the water column and permits scientists observe the physical properties in real time via a conducting cable connecting the CTD to a deck unit and computer on the ship. The CTD is often configured with additional optional sensors including fluorometers, transmissometers and/or radiometers. It is often combined with a Rosette of water sampling bottles (e.g. Niskin, GO-FLO) for collecting discrete water samples during the cast. This instrument designation is used when specific make and model are not known.

Dataset-specific Instrument Name	SBE 43 dissolved oxygen sensor
Generic Instrument Name	Dissolved Oxygen Sensor
Dataset-specific Description	All dissolved oxygen measurements collected using this instrument
Generic Instrument Description	An electronic device that measures the proportion of oxygen (O2) in the gas or liquid being analyzed

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Deployments

AT26-14

Website	https://www.bco-dmo.org/deployment/658949
Platform	R/V Atlantis
Start Date	2014-04-27
End Date	2014-05-16

RB1007

Website	https://www.bco-dmo.org/deployment/659009
Platform	NOAA Ship Ronald H. Brown
Start Date	2010-10-14
End Date	2010-11-04

NA028

Website	https://www.bco-dmo.org/deployment/659016
Platform	E/V Nautilus
Report	https://scholarsphere.psu.edu/downloads/x346dx36d
Start Date	2013-06-21
End Date	2013-07-05

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Project Information

Physiological and genetic responses of the deep-water coral, Lophelia pertusa, to ongoing ocean acidification in the Gulf of Mexico (Lophelia OA)

Coverage: Northern Gulf of Mexico

The Gulf of Mexico deep water ecosystems are threatened by the persistent threat of ocean acidification. Deep-water corals will be among the first to feel the effects of this process, in particular the deep-water scleractinians that form their skeleton from aragonite. The continued shoaling of the aragonite saturation horizon (the depth below which aragonite is undersaturated) will place many of the known, and as yet undiscovered, deep-water corals at risk in the very near future. The most common deep-water framework-forming scleractinian in the world's oceans is Lophelia pertusa. This coral is most abundant in the North Atlantic, where aragonite saturation states are relatively high, but it also creates extensive reef structures between 300 and 600 m depth in the Gulf of Mexico where aragonite saturation states were previously unknown. Preliminary data indicate that pH at this depth range is between 7.85 and 8.03, and the aragonite saturation state is typically between 1.28 and 1.69. These are the first measurements of aragonite saturation state for the deep Gulf of Mexico, and are among the lowest Aragonite saturation state yet recorded for framework-forming corals in any body of water, at any depth. This project will examine the effects of ocean acidification on L. pertusa, combining laboratory experiments, rigorous oceanographic measurements, the latest genome and transcriptome sequencing platforms, and quantitative PCR and enzyme assays to examine changes in coral gene expression and enzyme activity related to differences in carbonate chemistry. Short-term and long-term laboratory experiments will be performed at Aragonite saturation state of 1.45 and 0.75 and the organismal (e.g., survivorship and calcification rate) and genetic (e.g., transcript abundance) responses of the coral will be monitored. Genomic DNA and RNA will be extracted, total mRNA purified, and comprehensive and quantitative profiles of the transcriptome generated using a combination of 454 and Illumina sequencing technologies. Key genes in the calcification pathways as well as other differentially expressed genes will be targeted for specific qPCR assays to verify the Illumina sequencing results. On a research cruise, L. pertusa will be sampled (preserved at depth) along a natural gradient in carbonate chemistry, and included in the Illumina sequencing and qPCR assays. Water samples will be obtained by submersible-deployed niskin bottles adjacent to the coral collections as well as CTD casts of the water column overlying the sites. Water samples will be analyzed for pH, alkalinity, nitrates and soluble reactive phosphorus. These will be used in combination with historical data in a model to hindcast Aragonite saturation state. This project will provide new physiological and genetic data on an ecologically-significant and anthropogenically-threatened deepwater coral in the Gulf of Mexico. An experimental system, already developed by the PIs, offers controlled conditions to test the effect of Aragonite saturation state on calcification rates in scleractinians and, subsequently, to identify candidate genes and pathways involved in the response to reduced pH and Aragonite saturation state. Both long-term and population sampling experiments will provide additional transcriptomic data and specifically investigate the expression of the candidate genes. These results will contribute to our understanding of the means by which scleractinians may acclimate and acclimatize to low pH, alkalinity, and Aragonite saturation state. Furthermore, the investigators will continue a time series of

oceanographic measurements of the carbonate system in the Gulf of Mexico, which will allow the inclusion of this significant body of water in models of past and future ocean acidification scenarios.

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Program Information

Science, Engineering and Education for Sustainability NSF-Wide Investment (SEES): Ocean Acidification (formerly CRI-OA) (SEES-OA)

Website: http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503477

Coverage: global

NSF Climate Research Investment (CRI) activities that were initiated in 2010 are now included under Science, Engineering and Education for Sustainability NSF-Wide Investment (SEES). SEES is a portfolio of activities that highlights NSF's unique role in helping society address the challenge(s) of achieving sustainability. Detailed information about the SEES program is available from NSF (http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504707). In recognition of the need for basic research concerning the nature, extent and impact of ocean acidification on oceanic environments in the past, present and future, the goal of the SEES: OA program is to understand (a) the chemistry and physical chemistry of ocean acidification; (b) how ocean acidification interacts with processes at the organismal level; and (c) how the earth system history informs our understanding of the effects of ocean acidification on the present day and future ocean. Solicitations issued under this program:NSF 10-530, FY 2010-FY2011NSF 12-500, FY 2012NSF 12-600, FY 2013NSF 13-586, FY 2014 NSF 13-586 was the final solicitation that will be released for this program. PI Meetings:1st U.S. Ocean Acidification PI Meeting(March 22-24, 2011, Woods Hole, MA)2nd U.S. Ocean Acidification PI Meeting(Sept. 18-20, 2013, Washington, DC) 3rd U.S. Ocean Acidification PI Meeting (June 9-11, 2015, Woods Hole, MA – Tentative) NSF media releases for the Ocean Acidification Program: Press Release 10-186 NSF Awards Grants to Study Effects of Ocean Acidification Discovery Blue Mussels "Hang On" Along Rocky Shores: For How Long? Discovery nsf.gov - National Science Foundation (NSF) Discoveries - Trouble in Paradise: Ocean Acidification This Way Comes - US National Science Foundation (NSF) Press Release 12-179 nsf.gov - National Science Foundation (NSF) News - Ocean Acidification: Finding New Answers Through National Science Foundation Research Grants - US National Science Foundation (NSF) Press Release 13-102 World Oceans Month Brings Mixed News for Oysters Press Release 13-108 nsf.gov - National Science Foundation (NSF) News - Natural Underwater

Springs Show How Coral Reefs Respond to Ocean Acidification - US National Science Foundation (NSF) Press Release 13-148 Ocean acidification: Making new discoveries through National Science Foundation research grants Press Release 13-148 - Video nsf.gov - News - Video - NSF Ocean Sciences Division Director David Conover answers questions about ocean acidification. - US National Science Foundation (NSF) Press Release 14-010 nsf.gov - National Science Foundation (NSF) News - Palau's coral reefs surprisingly resistant to ocean acidification - US National Science Foundation (NSF) Press Release 14-116 nsf.gov - National Science Foundation (NSF) News - Ocean Acidification: NSF awards $11.4 million in new grants to study effects on marine ecosystems - US National Science Foundation (NSF)

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1220478

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