Environmental and physical data associated with ocean acidification microbe adaptation from 2012-2014

Website: https://www.bco-dmo.org/dataset/700974
Data Type: Other Field Results
Version: 1
Version Date: 2017-05-25

Project
» Pivers Island Coastal Observatory (PICO)
» Collaborative Research: Ocean Acidification: microbes as sentinels of adaptive responses to multiple stressors: contrasting estuarine and open ocean environments (OA microbe adaptation)

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
Environmental and physical data associated with ocean acidification microbe adaptation from 2012-2014

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Coverage

Spatial Extent: **Lat**:34.7181 **Lon**:-76.6707
Temporal Extent: 2012-07-03 - 2014-12-31

Dataset Description

Environmental and physical data associated with ocean acidification microbe adaptation.

For related research, go to: http://oceanography.ml.duke.edu/johnson/research/pico/

Methods & Sampling

DIC: Water was sampled using a 5 L niskin bottle centered at 1 m with a bottle length of 0.7 m. DIC was measured on mercuric chloride poisoned samples by acidification and subsequent quantification of released CO2 using a CO2 detector (Li-Cor 7000). DIC samples were collected following recommended procedures {Dickson et al., 2007} and measurements were calibrated against Certified Reference Materials provided by Dr. A. G. Dickson at Scripps Institution of Oceanography (SIO), University of California, San Diego (UCSD).

pH: Water was sampled using a 5 L niskin bottle centered at 1 m with a bottle length of 0.7 m. pH was measured spectrophotometrically {Clayton and Byrne, 1993} in triplicate at standard temperature (25°C) immediately following collection. pH samples were collected following recommended procedures {Dickson et al., 2007}.

Secchi Depth: Secchi depth was measured in duplicate using a 20 cm disk with four alternating white and black quadrants (Cole Parmer #EW-05492-00) by lowering the disk until no longer visible and recording the depth.

Salinity: Water was sampled using a 5 L niskin bottle centered at 1 m with a bottle length of 0.7 m. Salinity was measured using a calibrated handheld digital refractometer (Atago PAL-06S), using a refractometer (Vista A366ATC), or using a Guideline Portasal 8410A all according to manufacturer's instructions and calibrated against known reference materials. In situ salinity at the same depth was measured using a YSI Pro30.

Turbidity: Turbidity was measured in duplicate on discrete samples using a calibrated handheld turbidimeter (Orion AQ4500).

Dissolved Oxygen: Oxygen was measured optically in situ and atmospheric pressure measured near the sea surface using a calibrated probe (YSI ProODO) using manufactures recommendations.

Chlorophyll: Water was sampled using a 5 L niskin bottle centered at 1 m with a bottle length of 0.7 m. Methods described in Johnson et al. 2010: Chlorophyll concentrations were measured by filtering 25 mL of seawater sample onto a 0.22 µm pore size polycarbonate filter using gentle vacuum (<100 mm Hg) and extracting in 100% MeOH at -20°C in the dark for >24 h following (Holm-Hansen and Riemann, 1978). Fluorescence was measured using a Turner Designs 10-AU fluorometer following (Welschmeyer, 1994) that was calibrated against a standard chlorophyll solution (Ritchie, 2008).

Bacteria: Bacterioplankton (i.e. 'bacteria') were enumerated using a FACSCalibur flow cytometer (Becton Dickinson) and populations characterized as previously described (Johnson et al., 2010). Briefly, cells were excited with a 488 nm laser (15 mW Ar) and inelastic forward (<15°) scatter, inelastic side (90°) scatter (SSC), green (530 ± 30 nm) fluorescence, orange fluorescence (585 ± 42 nm), and red fluorescence (> 670 nm) emissions were measured. Bacterioplankton were quantified by staining the samples with the nucleic acid stain SYBR Green –I (Molecular Probes Inc.) (Marie et al., 1997).

Nutrients: Water was filtered through a 0.22 µm Sterivex cartridge filter, Millipore #SVGPL10RC using a peristaltic pump input line at 1 m for later nutrient analysis (NO3, NO2, PO4, SiOH4) and water was placed into duplicate HCl-cleaned HDPE bottles (VWR#414004-110) and stored at -80°C until later analysis using an Astoria-Pacific A2 autoanalyzer following the manufacturer's recommended protocols running each replicate sample in duplicate.

Certified reference materials were used to verify protocols (Inorganic Ventures: QCP-NT, QCP-NUT-1, CGSI1-1). The detection limit was NO2 = 0.05 µM, NO3 = 0.1 µM, PO4 = 0.05 µM, SiOH4 = 0.2 µM). Values measured below these limits are reported as zero.

Temperature: Water was sampled using a 5 L niskin bottle centered at 1 m with a bottle length of 0.7 m. Temperature was measured in duplicate using NIST traceable thermocouples (VWR#23609-232). In situ water temperature at the same depth was measured using a YSI Pro30.

Data Processing Description

Quality Scores (Q) as follows: 1=excellent (no known issues), 2=suspect, 3=poor (known reason to suspect data)

Nutrients: Samples that had a mean concentration (mean of replicated samples) below the nominal detection limit are reported as zero.

Bacteria: Cells counts were normalized to volume sampled to determined cells per mL.

Chlorophyll: >0.22 um referred to as “total” or simply “chlorophyll”

BCO-DMO Data Processing Notes:

- replaced NaN with nd
- added ISO DateTime column
- separated date and time into two columns

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Data Files

File
PICO2017.csv (Comma Separated Values (.csv), 54.17 KB) MD5:19c9b2560b506ab16b05f6dfa726c969 Primary data file for dataset ID 700974

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Related Publications

Clayton, T. D., & Byrne, R. H. (1993). Spectrophotometric seawater pH measurements: total hydrogen ion concentration scale calibration of m-cresol purple and at-sea results. Deep Sea Research Part I: Oceanographic Research Papers, 40(10), 2115–2129. doi:10.1016/0967-0637(93)90048-8
Methods

Dickson, A.G., Sabine, C.L. and Christian, J.R. (Eds.) 2007. Guide to best practices for ocean CO2 measurements. PICES Special Publication 3, 191 pp. ISBN: 1-897176-07-4. URL: https://www.nodc.noaa.gov/ocads/oceans/Handbook_2007.html https://hdl.handle.net/11329/249
Methods

Holm-Hansen, O., & Riemann, B. (1978). Chlorophyll a Determination: Improvements in Methodology. Oikos, 30(3), 438. doi:10.2307/3543338
Methods

Johnson, Z. I., Shyam, R., Ritchie, A. E., Mioni, C., Lance, V. P., Murray, J. W., & Zinser, E. R. (2010). The effect of iron- and light-limitation on phytoplankton communities of deep chlorophyll maxima of the western Pacific Ocean. Journal of Marine Research, 68(2), 283–308. doi:10.1357/002224010793721433
Methods

Marie, D., Partensky, F., Jacquet, S., and Vaulot, D. (1997) Enumeration and cell cycle analysis of natural populations of marine picoplankton by flow cytometry using the nucleic acid stain SYBR Green I. Applied and Environmental Microbiology 63: 186-193. https://aem.asm.org/content/63/1/186.short
Methods

Ritchie, R. J. (2008). Universal chlorophyll equations for estimating chlorophylls a, b, c, and d and total chlorophylls in natural assemblages of photosynthetic organisms using acetone, methanol, or ethanol solvents. Photosynthetica, 46(1), 115–126. doi:10.1007/s11099-008-0019-7
Methods

Welschmeyer, N. A. (1994). Fluorometric analysis of chlorophyll a in the presence of chlorophyll b and pheopigments. Limnology and Oceanography, 39(8), 1985–1992. doi:10.4319/lo.1994.39.8.1985
Methods

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Parameters

Parameter	Description	Units
date	Date of sampling; YYYY/MM/DD	unitless

time	Time of sampling; HH:MM	unitless
depth	Depth ID	unitless
bacteriaA	Concentration of bacteria; Sample A; Includes Archaea and Prochlorococcus	cells per milliliter
bacteriaB	Concentration of bacteria; Sample B; Includes Archaea and Prochlorococcus	cells per milliliter
BarometricPressureA	Atomospheric (barometric) pressure; Sample A	hectopascals
BarometricPressureB	Atomospheric (barometric) pressure; Sample B	hectopascals
ChlExtractA	Extracted chlorophyll concentrations (greater than 0.22 um); Sample A	milligrams of chlorophyll a per meter cubed
ChlExtractB	Extracted chlorophyll concentrations (greater than 0.22 um); Sample B	milligrams of chlorophyll a per meter cubed
DICA	Dissolved inorganic carbon; Sample A	uM
DICB	Dissolved inorganic carbon; Sample B	uM
DICC	Dissolved inorganic carbon; Sample C	uM
NH4A	Inorganic nutrient concentration; Sample A	uM
NH4B	Inorganic nutrient concentration; Sample B	uM
NH4C	Inorganic nutrient concentration; Sample C	uM
NO2A	Inorganic nutrient concentration; Sample A	uM
NO2B	Inorganic nutrient concentration; Sample B	uM
NO2C	Inorganic nutrient concentration; Sample C	uM
NO3A	Inorganic nutrient concentration; Sample A	uM
NO3B	Inorganic nutrient concentration; Sample B	uM
NO3C	Inorganic nutrient concentration; Sample C	uM
OxygenA	Oxygen concentration; Sample A	uM
OxygenB	Oxygen concentration; Sample B	uM
OxygenSaturationA	Percent of theoretical saturation value for a given temperature salinity and pressure; Sample A	milligrams of oxygen per liter
OxygenSaturationB	Percent of theoretical saturation value for a given temperature salinity and pressure; Sample B	milligrams of oxygen per liter
pHT25A	pH measurement; Sample A	pH
pHT25B	pH measurement; Sample B	pH
pHT25C	pH measurement; Sample C	pH
PICONumber	Sample number	unitless
PO4A	Inorganic nutrient concentration; Sample A	uM
PO4B	Inorganic nutrient concentration; Sample B	uM
PO4C	Inorganic nutrient concentration; Sample C	uM
QbacteriaA	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QbacteriaB	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QBarometricPressureA	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless

QBarometricPressureB	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QChlExtractA	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QChlExtractB	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QDepth	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QDICA	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QDICB	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QDICC	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QNH4A	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QNH4B	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QNH4C	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QNO2A	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QNO2B	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QNO2C	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QNO3A	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QNO3B	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QNO3C	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QOxygenA	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QOxygenB	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QOxygenSaturationA	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QOxygenSaturationB	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QpHT25A	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QpHT25B	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QpHT25C	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QPO4A	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QPO4B	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless

QPO4C	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QSalinityAtagoA	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QSalinityAtagoB	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QSalinityPortasalA	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QSalinityPortasalB	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QSalinityPro30A	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QSalinityPro30B	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QSalinitySpyGlassA	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QSalinitySpyGlassB	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QSecchiDepthA	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QSecchiDepthB	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QSiOH4A	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QSiOH4B	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QSiOH4C	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QTempBottleA	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QTempBottleB	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QTempPro30ProbeA	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QTempPro30ProbeB	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QTurbidityA	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
QTurbidityB	Quality score: 1=excellent (no known issues); 2=suspect; 3=poor (known reason to suspect data)	unitless
SalinityAtagoA	Salinity measurement by instrument; Sample A	PSU
SalinityAtagoB	Salinity measurement by instrument; Sample B	PSU
SalinityPortasalA	Salinity measurement by instrument; Sample A	PSU
SalinityPortasalB	Salinity measurement by instrument; Sample B	PSU
SalinityPro30A	Salinity measurement by instrument; Sample A	PSU
SalinityPro30B	Salinity measurement by instrument; Sample B	PSU

SalinitySpyGlassA	Salinity measurement by instrument; Sample A	PSU
SalinitySpyGlassB	Salinity measurement by instrument; Sample B	PSU
SecchiDepthA	Secchi depth; Sample A	meters
SecchiDepthB	Secchi depth; Sample B	meters
SiOH4A	Inorganic nutrient concentration; Sample A	uM
SiOH4B	Inorganic nutrient concentration; Sample B	uM
SiOH4C	Inorganic nutrient concentration; Sample C	uM
TempBottleA	Temperature; Sample A	Celsius
TempBottleB	Temperature; Sample B	Celsius
TempPro30ProbeA	Temperature from Pro 30 Probe; Sample A	Celsius
TempPro30ProbeB	Temperature from Pro 30 Probe; Sample B	Celsius
TurbidityA	Turbidity; Sample A	Nephelometric turbidity units (NTU)
TurbidityB	Turbidity; Sample B	Nephelometric turbidity units (NTU)
ISO_DateTime_UTC	ISO_Date format	unitless

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Instruments

Dataset-specific Instrument Name	HDPE bottle
Generic Instrument Name	Bottle
Dataset-specific Description	Used in nutrient analysis
Generic Instrument Description	A container, typically made of glass or plastic and with a narrow neck, used for storing drinks or other liquids.

Dataset-specific Instrument Name	Li-Cor 7000
Generic Instrument Name	CO2 Analyzer
Dataset-specific Description	Used to sample DIC
Generic Instrument Description	Measures atmospheric carbon dioxide (CO2) concentration.

Dataset-specific Instrument Name	NIST traceable thermocouples
Generic Instrument Name	digital thermometer
Dataset-specific Description	Used to measure temperature
Generic Instrument Description	An instrument that measures temperature digitally.

Dataset-specific Instrument Name	10-AU Turner Designs Fluorometer
Generic Instrument Name	Fluorometer
Dataset-specific Description	Used to measure fluorescence
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	Niskin
Generic Instrument Name	Niskin bottle
Dataset-specific Description	Used to collect water samples
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	Astoria-Pacific A2 autoanalyzer
Generic Instrument Name	Nutrient Autoanalyzer
Dataset-specific Description	Used in nutrient analysis
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.

Dataset-specific Instrument Name	YSI ProODO
Generic Instrument Name	Oxygen Sensor
Dataset-specific Description	Used to measure dissolved oxygen
Generic Instrument Description	An electronic device that measures the proportion of oxygen (O2) in the gas or liquid being analyzed

Dataset-specific Instrument Name	Peristaltic pump
Generic Instrument Name	Pump
Dataset-specific Description	Used in nutrient analysis
Generic Instrument Description	A pump is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action. Pumps can be classified into three major groups according to the method they use to move the fluid: direct lift, displacement, and gravity pumps

Dataset-specific Instrument Name	Atago PAL-06S Digital Refractometer
Generic Instrument Name	Refractometer
Dataset-specific Description	Used to sample salinity
Generic Instrument Description	A refractometer is a laboratory or field device for the measurement of an index of refraction (refractometry). The index of refraction is calculated from Snell's law and can be calculated from the composition of the material using the Gladstone-Dale relation. In optics the refractive index (or index of refraction) n of a substance (optical medium) is a dimensionless number that describes how light, or any other radiation, propagates through that medium.

Dataset-specific Instrument Name	Spectrometer
Generic Instrument Name	Spectrometer
Dataset-specific Description	Used to sample pH
Generic Instrument Description	A spectrometer is an optical instrument used to measure properties of light over a specific portion of the electromagnetic spectrum.

Dataset-specific Instrument Name	Orion AQ4500
Generic Instrument Name	Turbidity Meter
Dataset-specific Description	Used to analyze turbidity
Generic Instrument Description	A turbidity meter measures the clarity of a water sample. A beam of light is shown through a water sample. The turbidity, or its converse clarity, is read on a numerical scale. Turbidity determined by this technique is referred to as the nephelometric method from the root meaning "cloudiness". This word is used to form the name of the unit of turbidity, the NTU (Nephelometric Turbidity Unit). The meter reading cannot be used to compare the turbidity of different water samples unless the instrument is calibrated. Description from: http://www.gvsu.edu/wri/education/instructor-s-manual-turbidity-10.htm (One example is the Orion AQ4500 Turbidimeter)

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Deployments

PICO_1-301

Website	https://www.bco-dmo.org/deployment/59063
Platform	Duke University Marine Lab
Start Date	2010-06-28
End Date	2012-06-26
Description	The PICO time series is sampled weekly (or more frequently) to capture physical, chemical and biological variability in the coastal ocean. This time series enables the investigator to collaborate with a number of researchers and will serve as a long-term research focus. Project information: http://oceanography.ml.duke.edu/johnson/research/pico/

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Project Information

Pivers Island Coastal Observatory (PICO)

Website: http://oceanography.ml.duke.edu/johnson/research/pico/

Coverage: 34.7181 deg N, 76.6707 deg W

From the project website:
Carbon dioxide is rising at ~3% per year in the atmosphere and oceans leading to increases in dissolved inorganic carbon and a reduction in pH. This trend is expected to continue for the foreseeable future and ocean pH is predicted to decrease substantially making the ocean more acidic, potentially affecting the marine ecosystem. However, coastal estuaries are highly dynamic systems that often experience dramatic changes in environmental variables over short periods of times. In this study, the investigators are measuring key variables of the marine carbon system along with other potential forcing variables and characteristics of the ecosystem that may be affected by these pH changes. The goal of this project is to determine the time-scales and magnitude of natural variability that will be superimposed on any long term trends in ocean chemistry.

This project is associated with Ocean Acidification: microbes as sentinels of adaptive responses to multiple stressors: contrasting estuarine and open ocean environments.

Collaborative Research: Ocean Acidification: microbes as sentinels of adaptive responses to multiple stressors: contrasting estuarine and open ocean environments (OA microbe adaptation)

Coverage: Neuse-Pamlico Sound to the Sargasso Sea

Extracted from the NSF award abstract:

This collaborative project by Duke University and Georgia Institute of Technology researchers will combine oceanographic and advanced molecular techniques to characterize the adaptive responses of microbial communities to multiple stressors associated with OA. In particular, microbial communities from estuarine and coastal ecosystems as well as open ocean waters will be incubated under conditions of increased acidity or temperature or both, and their activities will be measured and quantified.

Preliminary data from time-series observations of a coastal temperate estuary shows that pH, temperature and other stressors vary over multiple space and time scales, and this variability is relatively higher than that observed in open ocean waters. Based on this evidence, the guiding hypothesis of this work is that microbes in coastal ecosystems are better adapted to ocean acidification as well as multiple stressors compared to similar microbes from the open ocean. To quantify the adaptive genetic, physiological and biogeochemical responses of microbes to OA, the team's specific goals are to: (1) characterize complex natural microbial community responses to multiple stressors using factorial mesocosm manipulations, (2) assemble a detailed view of genomic and physiological (including transcriptional) adaptations to OA at the single species level using cultured model marine microbes (e.g. Prochlorococcus, Synechococcus, Vibrio) identified as responsive to stressors in whole community mesocosm experiments, and (3) assess the power of model microbial strains and mesocosm experiments to predict microbial community responses to natural OA variability in a temporally dynamic, temperate estuary and along a trophic/pH gradient from the Neuse-Pamlico Sound to the Sargasso Sea. By comparing an estuarine ecosystem to its open ocean counterpart, this study will assess the sensitivity of microbial structure and function in response to ocean acidification.

This project is associated with Pivers Island Coastal Observatory.

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Program Information

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

Website: https://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 (https://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-FY2011
NSF 12-500, FY 2012
NSF 12-600, FY 2013
NSF 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-1416665

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