Behavior Metrics - Crab-Oyster behavior - from UNC Reis laboratory starting 2010 (OA - Ocean Acidification and Warming Impact on Calcification project)

Website: https://www.bco-dmo.org/dataset/563158
Version: 28 July 2015
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Project
» Investigation of the Effects of CaCO3 Saturation State and Temperature on the Calcification Rate and Skeletal Properties of Benthic Marine Calcifiers (OA - Ocean Acidification and Warming Impact on Calcification)

Program
» Ocean Carbon and Biogeochemistry (OCB)

Contributors	Affiliation	Role
Ries, Justin B.	University of North Carolina at Chapel Hill (UNC-Chapel Hill)	Principal Investigator
Dodd, Luke F	University of North Carolina at Chapel Hill (UNC-Chapel Hill-IMS)	Contact
Gegg, Stephen R.	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

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Dataset Description

Impacts of OA on Crab-Oyster Behavior - Behavior Metrics

Seawater chemistry and predatory behavior observations

Methods & Sampling

Experiments were conducted at University of North Carolina at Chapel Hill. Organisms studied are present across much of the US Atlantic and Gulf coasts.

See manuscript: Ocean acidification impairs crab foraging behaviour

Data Processing Description

See manuscript: Ocean acidification impairs crab foraging behaviour

BCO-DMO Processing Notes
- Generated from original files "Behavioral data for archive.xlsx, Sheet: Behavior Metrics" contributed by Luke Dodd

- Parameter names edited to conform to BCO-DMO naming convention found at Choosing Parameter Name
- "nd" (no data) inserted into blank cells

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Data Files

File
OC_Behavior_Behavior_Metrics.csv (Comma Separated Values (.csv), 16.33 KB) MD5:873b68e671bcc4ea8b78ad8c1785a9c0 Primary data file for dataset ID 563158

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Parameters

Parameter	Description	Units
Tank	Experimental tank ID	text
PCO2	Acidification treatment level: control; moderate; high	text
Crab_Treatment	Crab treatment level during growth period: crab; no crab	text
Start_trial_time	Start time of video segment in experimental time (time since T0; hh:mm)	H:MM
End_trial_time	End time of video segment in experimental time (time since T0; hh:mm)	H:MM
Crab_ID	Crab ID: A; B	text
Individual_General_Activity	General Activity for a specific crab during one 30 minute video segment; measured in seconds	seconds
Action	Action type: prey handling; eating; crab-crab interaction; na	text
Success	Event outcome: yes (crab ate oyster); no (crab failed to open a living oyster); shell (crab handled previously opened oyster); aggressor (crab instigated crab-crab interaction); defender (crab was the object of aggressors attack); mixed dominance (aggressor and defender difficult to distinguish; outcome varied and uncertain)	text
Action_start	Start time of Action in real time (24h; hh:mm:ss)	HH:MM:SS
Action_end	End time of Action in real time (24h; hh:mm:ss)	HH:MM:SS
Action_time	Difference between Action start and Action end	HH:MM:SS

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Instruments

Dataset-specific Instrument Name	Isolated 34 l tanks
Generic Instrument Name	Aquarium
Dataset-specific Description	Crabs and oysters were raised in isolated 34 l tanks for 71 days in seawater
Generic Instrument Description	Aquarium - a vivarium consisting of at least one transparent side in which water-dwelling plants or animals are kept

Dataset-specific Instrument Name	UIC 5400
Generic Instrument Name	CO2 Coulometer
Dataset-specific Description	The temperature within experimental tanks was measured every other day with a NIST-calibrated partial-immersion organic- filled glass thermometer (precision + 0.3%, accuracy + 0.4%). Salinity was measured every other day with a YSI 3200 conduc- tivity meter with a YSI 3440 cell (K 1⁄4 10) that was calibrated with seawater standards of known salinity provided by the labora- tory of Prof. A. Dickson of Scripps Institute of Oceanography. Seawater pH was measured every other day with a Thermo Scien- tific Orion 2 Star benchtop pH meter with an Orion 9156BNWP pH probe, calibrated with 7.00 and 10.01 Orion NBS buffers traceable to NIST standard reference material (for slope of the calibration curve) and with seawater standards of known pH also provided by Prof. Dickson's laboratory (for y-intercept of the calibration curve). Seawater DIC was measured via coulometry (UIC 5400) and TA was measured via closed-cell potentiometric Gran titration calibrated with certified Dickson TA/DIC standards. Measure- ment of DIC and TA of the certified reference materials (CRMs) were consistently within 0.3% of certified values. Differences between the measured and certified TA and DIC values of the CRMs were used to correct measurements of experimental seawater solutions.
Generic Instrument Description	A CO2 coulometer semi-automatically controls the sample handling and extraction of CO2 from seawater samples. Samples are acidified and the CO2 gas is bubbled into a titration cell where CO2 is converted to hydroxyethylcarbonic acid which is then automatically titrated with a coulometrically-generated base to a colorimetric endpoint.

Dataset-specific Instrument Name	Thermo Scientific Orion 2 Star benchtop pH meter with an Orion 9156BNWP pH probe
Generic Instrument Name	pH Sensor
Dataset-specific Description	The temperature within experimental tanks was measured every other day with a NIST-calibrated partial-immersion organic- filled glass thermometer (precision + 0.3%, accuracy + 0.4%). Salinity was measured every other day with a YSI 3200 conduc- tivity meter with a YSI 3440 cell (K 1⁄4 10) that was calibrated with seawater standards of known salinity provided by the labora- tory of Prof. A. Dickson of Scripps Institute of Oceanography. Seawater pH was measured every other day with a Thermo Scien- tific Orion 2 Star benchtop pH meter with an Orion 9156BNWP pH probe, calibrated with 7.00 and 10.01 Orion NBS buffers traceable to NIST standard reference material (for slope of the calibration curve) and with seawater standards of known pH also provided by Prof. Dickson's laboratory (for y-intercept of the calibration curve). Seawater DIC was measured via coulometry (UIC 5400) and TA was measured via closed-cell potentiometric Gran titration calibrated with certified Dickson TA/DIC standards. Measure- ment of DIC and TA of the certified reference materials (CRMs) were consistently within 0.3% of certified values. Differences between the measured and certified TA and DIC values of the CRMs were used to correct measurements of experimental seawater solutions.
Generic Instrument Description	An instrument that measures the hydrogen ion activity in solutions. The overall concentration of hydrogen ions is inversely related to its pH. The pH scale ranges from 0 to 14 and indicates whether acidic (more H+) or basic (less H+).

Dataset-specific Instrument Name	YSI 3200 conductivity meter with a YSI 3440 cell
Generic Instrument Name	Salinity Sensor
Dataset-specific Description	The temperature within experimental tanks was measured every other day with a NIST-calibrated partial-immersion organic- filled glass thermometer (precision + 0.3%, accuracy + 0.4%). Salinity was measured every other day with a YSI 3200 conduc- tivity meter with a YSI 3440 cell (K 1⁄4 10) that was calibrated with seawater standards of known salinity provided by the labora- tory of Prof. A. Dickson of Scripps Institute of Oceanography. Seawater pH was measured every other day with a Thermo Scien- tific Orion 2 Star benchtop pH meter with an Orion 9156BNWP pH probe, calibrated with 7.00 and 10.01 Orion NBS buffers traceable to NIST standard reference material (for slope of the calibration curve) and with seawater standards of known pH also provided by Prof. Dickson's laboratory (for y-intercept of the calibration curve). Seawater DIC was measured via coulometry (UIC 5400) and TA was measured via closed-cell potentiometric Gran titration calibrated with certified Dickson TA/DIC standards. Measure- ment of DIC and TA of the certified reference materials (CRMs) were consistently within 0.3% of certified values. Differences between the measured and certified TA and DIC values of the CRMs were used to correct measurements of experimental seawater solutions.
Generic Instrument Description	Category of instrument that simultaneously measures electrical conductivity and temperature in the water column to provide temperature and salinity data.

Dataset-specific Instrument Name	Closed-cell potentiometric Gran titration
Generic Instrument Name	Titrator
Dataset-specific Description	The temperature within experimental tanks was measured every other day with a NIST-calibrated partial-immersion organic- filled glass thermometer (precision + 0.3%, accuracy + 0.4%). Salinity was measured every other day with a YSI 3200 conduc- tivity meter with a YSI 3440 cell (K 1⁄4 10) that was calibrated with seawater standards of known salinity provided by the labora- tory of Prof. A. Dickson of Scripps Institute of Oceanography. Seawater pH was measured every other day with a Thermo Scien- tific Orion 2 Star benchtop pH meter with an Orion 9156BNWP pH probe, calibrated with 7.00 and 10.01 Orion NBS buffers traceable to NIST standard reference material (for slope of the calibration curve) and with seawater standards of known pH also provided by Prof. Dickson's laboratory (for y-intercept of the calibration curve). Seawater DIC was measured via coulometry (UIC 5400) and TA was measured via closed-cell potentiometric Gran titration calibrated with certified Dickson TA/DIC standards. Measure- ment of DIC and TA of the certified reference materials (CRMs) were consistently within 0.3% of certified values. Differences between the measured and certified TA and DIC values of the CRMs were used to correct measurements of experimental seawater solutions.
Generic Instrument Description	Titrators are instruments that incrementally add quantified aliquots of a reagent to a sample until the end-point of a chemical reaction is reached.

Dataset-specific Instrument Name	NIST-calibrated partial immersion organic-filled glass thermometer
Generic Instrument Name	Water Temperature Sensor
Dataset-specific Description	The temperature within experimental tanks was measured every other day with a NIST-calibrated partial-immersion organic- filled glass thermometer (precision + 0.3%, accuracy + 0.4%). Salinity was measured every other day with a YSI 3200 conduc- tivity meter with a YSI 3440 cell (K 1⁄4 10) that was calibrated with seawater standards of known salinity provided by the labora- tory of Prof. A. Dickson of Scripps Institute of Oceanography. Seawater pH was measured every other day with a Thermo Scien- tific Orion 2 Star benchtop pH meter with an Orion 9156BNWP pH probe, calibrated with 7.00 and 10.01 Orion NBS buffers traceable to NIST standard reference material (for slope of the calibration curve) and with seawater standards of known pH also provided by Prof. Dickson's laboratory (for y-intercept of the calibration curve). Seawater DIC was measured via coulometry (UIC 5400) and TA was measured via closed-cell potentiometric Gran titration calibrated with certified Dickson TA/DIC standards. Measure- ment of DIC and TA of the certified reference materials (CRMs) were consistently within 0.3% of certified values. Differences between the measured and certified TA and DIC values of the CRMs were used to correct measurements of experimental seawater solutions.
Generic Instrument Description	General term for an instrument that measures the temperature of the water with which it is in contact (thermometer).

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Deployments

lab_Ries_UNC_Chapel_Hill

Website	https://www.bco-dmo.org/deployment/58723
Platform	Ries
Report	http://www.unc.edu/~jries/index.html
Start Date	2010-09-01
End Date	2099-01-01
Description	The Ries Lab

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Project Information

Investigation of the Effects of CaCO3 Saturation State and Temperature on the Calcification Rate and Skeletal Properties of Benthic Marine Calcifiers (OA - Ocean Acidification and Warming Impact on Calcification)

Website: http://www.unc.edu/~jries/index.html

Coverage: Chapel Hill, North Carolina (lab) and Mesoamerican Barrier Reef System - Sapodilla Caye, Belize (16.2 N 88.5 W)

Description from NSF award abstract:
Anthropogenic elevation of atmospheric pCO2 is increasing the acidity of the oceans, thereby reducing the saturation state of seawater with respect to calcium carbonate (CaCO3). Of mounting concern is the potential impact of these changes on the ability of calcifying organisms to form their shells and skeletons. Recent studies, including pilot work conducted by investigator Ries and his colleagues on a suite of benthic marine calcifiers spanning broad taxonomic, mineralogical, and ecological ranges, have revealed that marine organisms exhibit a wide range of calcification responses to CO2-induced ocean acidification, including positive, negative, parabolic, threshold, and neutral responses. Marine calcifiers build their shells and skeletons from various forms (polymorphs) of CaCO3, most commonly aragonite, high-Mg calcite, and low-Mg calcite. These polymorphs differ greatly in their solubility in seawater and, therefore, in their potential response to CO2-induced ocean acidification. X-ray diffraction analysis of shells secreted by the organisms investigated in the pilot study reveals that the proportion of calcite (the less soluble form of CaCO3) to aragonite (the more soluble form) within their shells increases under elevated pCO2, while the Mg:Ca ratio of their calcite declines. These observations suggested that some marine calcifiers may partially adapt to a declining CaCO3 saturation state by accreting a greater proportion of the less-soluble form of CaCO3 (low-Mg calcite) at the expense of the more soluble forms (aragonite, high-Mg calcite). However, it is likely that such mineralogical and compositional changes in the shells and skeletons of marine organisms would alter their structural and biomechanical properties.

The project seeks to build upon the results of a pilot study by rearing a suite of benthic marine calcifiers under past (280 ppm), present (385 ppm), and predicted future (540, 840 ppm) pCO2 and under three distinct temperatures to investigate changes in: (1) their rates of calcification and linear extension; (2) the relative abundance and micron-scale distribution of the various CaCO3 polymorphs within their shells/skeletons; (3) the ultrastructure and crystal morphology of their shells/skeletons; and (4) their biomechanical properties. The research also builds upon the pilot experiments by utilizing a more thoroughly replicated study design, by more precisely constraining the chemical parameters of the experimental seawater treatments, by investigating calcification responses under 3 different temperature regimes, and by employing a "pre-industrial" pCO2 level (280 ppm). The results of the proposed research should advance our understanding of how benthic marine calcifiers shall respond to future CO2-induced changes in seawater temperature and CaCO3 saturation state. By investigating the response of organisms over the range of atmospheric pCO2 that has occurred since late Paleozoic time, this research should inform our understanding of the putative links between atmospheric pCO2, mass extinction events, and secular variation in the polymorph mineralogy of marine calcifiers throughout geologic time. Finally, comparison of the observed biological responses to variable pCO2-T scenarios with that already established for abiogenic carbonates will advance our understanding of the very mechanisms by which marine calcifiers build their shells and skeletons.

Results of this research project will inform the decisions of policy makers and legislators working to mitigate the impacts of CO2-induced warming and ocean acidification by establishing pCO2-T tolerances for a range of marine calcifiers.

Note (02 Oct 2014): Funding for this project has transferred from award OCE-1031995 to OCE-1357665, coincident with Principal Investigator's affiliation change from University of North Carolina at Chapel Hill to Northeastern University.

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Program Information

Ocean Carbon and Biogeochemistry (OCB)

Website: http://us-ocb.org/

Coverage: Global

The Ocean Carbon and Biogeochemistry (OCB) program focuses on the ocean's role as a component of the global Earth system, bringing together research in geochemistry, ocean physics, and ecology that inform on and advance our understanding of ocean biogeochemistry. The overall program goals are to promote, plan, and coordinate collaborative, multidisciplinary research opportunities within the U.S. research community and with international partners. Important OCB-related activities currently include: the Ocean Carbon and Climate Change (OCCC) and the North American Carbon Program (NACP); U.S. contributions to IMBER, SOLAS, CARBOOCEAN; and numerous U.S. single-investigator and medium-size research projects funded by U.S. federal agencies including NASA, NOAA, and NSF.

The scientific mission of OCB is to study the evolving role of the ocean in the global carbon cycle, in the face of environmental variability and change through studies of marine biogeochemical cycles and associated ecosystems.

The overarching OCB science themes include improved understanding and prediction of: 1) oceanic uptake and release of atmospheric CO2 and other greenhouse gases and 2) environmental sensitivities of biogeochemical cycles, marine ecosystems, and interactions between the two.

The OCB Research Priorities (updated January 2012) include: ocean acidification; terrestrial/coastal carbon fluxes and exchanges; climate sensitivities of and change in ecosystem structure and associated impacts on biogeochemical cycles; mesopelagic ecological and biogeochemical interactions; benthic-pelagic feedbacks on biogeochemical cycles; ocean carbon uptake and storage; and expanding low-oxygen conditions in the coastal and open oceans.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1031995
NSF Division of Ocean Sciences (NSF OCE)	OCE-1357665

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