Attributes of 36 tide pools measured in the light and dark at John Brown's Beach, Sitka, Alaska, USA during 2018-2020

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Data Type: Other Field Results
Version: 1
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Project
» Collaborative Research: Effects of multiple aspects of climate change on marine biodiversity and ecosystem functioning (Sitka CO2 and Temp Expt)

Contributors	Affiliation	Role
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Abstract
This dataset includes attributes of tide pools measured in the light and dark at John Brown's Beach, Sitka, Alaska, USA. 36 tide pools were selected for the light/dark incubation experiments during the first year of the experiment (2018) and sets of those pools were sampled in the following two years.

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Coverage

Spatial Extent: **N**:57.05632 **E**:-135.37253 **S**:57.05492 **W**:-135.37306
Temporal Extent: 2018-07-01 - 2020-09-19

Acquisition Description

Sampling and Analytical Procedures:
This study was conducted on a set of tide pools on a rocky shoreline at John Brown's Beach (57.05 N, 135.37 W), near Sitka, Alaska, USA. We selected 36 tide pools for the light/dark incubation experiments during the first year of the experiment (2018), and sampled sets of those 36 pools in the following two years. The light/dark incubation trial method is separated into three phases: initial, dark, and recovery.

We recorded the time that each measurement was taken throughout the experiment. Dates and times are recorded in local Alaska Standard / Alaska Daylight Time. Refer to the attached Supplemental File "Tide_Pool_Characteristics.csv" for additional data characterizing each tide pool (e.g maximum depth, perimeter, volume, etc.)

We began each phase with a set of "ocean" measurements, which were collected from shallow (<0.5m) water adjacent to the shoreline. We measured salinity, dissolved oxygen, temperature, pH, and light (just below the water's surface). During the remainder of the initial phase, we visited each tide pool and measured salinity, dissolved oxygen, temperature, pH, and light (just below the water's surface in the center of the pool). We then secured an opaque black plastic tarp over the tide pool for a duration of 30-45 minutes.

We revisited each pool after this dark incubation period and repeated the salinity, dissolved oxygen, temperature, and pH measurements prior to removing the tarp. We then removed the tarp to measure light. We allowed each pool to recover, un-covered, for another 30-45 minute period before collecting a third round of measurements of salinity, dissolved oxygen, temperature, pH, and light.

Known Problems/Issues:
There are small gaps in the data, primarily from light measurements which were not collected in the field during some sampling periods. These gaps in the data include the absence of light measurements for the ocean in the initial and dark phases on 7/1/18, the absence of light measurements from the dark phase on 1/18/19, the absence of any ocean measurements for the initial and dark phases on 8/5/19, and the absence of a recovery phase light measurement in pools 29-32 and the ocean on 6/27/20.

There were also a pair of tide pools (22 and 23) in the original 36 which were connected, preventing accurate volume measurements from being taken.

Related References:
The light/dark incubation method is also outlined in the methods of *Warming and Elevated CO2 Interact to Drive Rapid Shifts in Marine Community Production* (Sorte and Bracken, 2015) and *Assessment of a field incubation method estimating primary productivity in rockpool communities* (Noel et al., 2010). The multipoint calibration protocol used with the Hanna Instruments 9829 Multiparameter Meter is thoroughly described in SOP 6a in the *Guide to Best Practices for Ocean CO2 Measurements* (Dickson, Sabine & Christian, 2007).

Processing Description

Data Processing:
Data were collected on data sheets in the field and entered into an Excel spreadsheet, where the data were later double-checked against the original data sheets to ensure transfer accuracy.

BCO-DMO Processing:
- joined the Latitude and Longitude columns to the Productivity data from the "Pool_Characteristics" sheet in the original Exel file, matching on Pool_ID field;
- converted date to YYYY-MM-DD format;
- exported the "Pool_Characteristics" sheet as a .csv file.

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Related Publications

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 https://isbnsearch.org/isbn/1-897176-07-4
Methods

Noël, L. M.-L. J., Griffin, J. N., Thompson, R. C., Hawkins, S. J., Burrows, M. T., Crowe, T. P., & Jenkins, S.

R. (2010). Assessment of a field incubation method estimating primary productivity in rockpool communities. Estuarine, Coastal and Shelf Science, 88(1), 153–159. doi:10.1016/j.ecss.2010.03.005
Methods

Sorte, C. J. B., & Bracken, M. E. S. (2015). Warming and Elevated CO2 Interact to Drive Rapid Shifts in Marine Community Production. PLOS ONE, 10(12), e0145191. doi:10.1371/journal.pone.0145191
Methods

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Parameters

Parameter	Description	Units
Pool_ID	The number assigned to each tide pool.	unitless
Latitude	The latitude of each tide pool.	degrees North
Longitude	The longitude of each tide pool.	degrees East
Date	The date when the data were collected (local Alaska Standard / Alaska Daylight Time). Format: YYYY-MM-DD	unitless
Initial_Light	Light measured with a MQ-210 Underwater Quantum Meter (Apogee, Logan, Utah, USA), measured in the center of the tide pool ~1cm below water surface.	micromoles per square meter per hour (umol/m2*hr)
Initial_Salinity	Salinity (in Practical Salinity Units) measured with a ProDSS Multiparameter Water Quality Meter (YSI, Yellow Springs, Ohio, USA).	PSU
Initial_Dissolved_Oxygen	Dissolved oxygen measured with a ProDSS Multiparameter Water Quality Meter (YSI, Yellow Springs, Ohio, USA).	milligrams per liter (mg/L)
Initial_Temperature	Temperature measured with a ProDSS Multiparameter Water Quality Meter (YSI, Yellow Springs, Ohio, USA).	degrees Celsius
Initial_pH	pH measured with a Hanna Instruments 9829 Multiparameter Meter (Hanna Instruments, Smithfield, Rhode Island, USA).	millivolts (mV)
Initial_Time	The time when the data were collected (local Alaska Standard / Alaska Daylight Time). Format: hh:mm	unitless
Dark_Light	Light measured with a MQ-210 Underwater Quantum Meter (Apogee, Logan, Utah, USA), measured in the center of the tide pool ~1cm below water surface.	micromoles per square meter per hour (umol/m2*hr)
Dark_Salinity	Salinity (in Practical Salinity Units) measured with a ProDSS Multiparameter Water Quality Meter (YSI, Yellow Springs, Ohio, USA).	PSU
Dark_Dissolved_Oxygen	Dissolved oxygen measured with a ProDSS Multiparameter Water Quality Meter (YSI, Yellow Springs, Ohio, USA).	milligrams per liter (mg/L)
Dark_Temperature	Temperature measured with a ProDSS Multiparameter Water Quality Meter (YSI, Yellow Springs, Ohio, USA).	degrees Celsius

Dark_pH	pH measured with a Hanna Instruments 9829 Multiparameter Meter (Hanna Instruments, Smithfield, Rhode Island, USA).	millivolts (mV)
Dark_Time	The time when the data were collected (local Alaska Standard / Alaska Daylight Time). Format: hh:mm	unitless
Recovery_Light	Light measured with a MQ-210 Underwater Quantum Meter (Apogee, Logan, Utah, USA), measured in the center of the tide pool ~1cm below water surface.	micromoles per square meter per hour (umol/m2*hr)
Recovery_Salinity	Salinity (in Practical Salinity Units) measured with a ProDSS Multiparameter Water Quality Meter (YSI, Yellow Springs, Ohio, USA).	PSU
Recovery_Dissolved_Oxygen	Dissolved oxygen measured with a ProDSS Multiparameter Water Quality Meter (YSI, Yellow Springs, Ohio, USA).	milligrams per liter (mg/L)
Recovery_Temperature	Temperature measured with a ProDSS Multiparameter Water Quality Meter (YSI, Yellow Springs, Ohio, USA).	degrees Celsius
Recovery_pH	pH measured with a Hanna Instruments 9829 Multiparameter Meter (Hanna Instruments, Smithfield, Rhode Island, USA).	millivolts (mV)
Recovery_Time	The time when the data were collected (local Alaska Standard / Alaska Daylight Time). Format: hh:mm	unitless

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Instruments

Dataset-specific Instrument Name	ProDSS Multiparameter Water Quality Meter
Generic Instrument Name	Water Quality Multiprobe
Dataset-specific Description	Salinity, dissolved Oxygen, and temperature were measured with a ProDSS Multiparameter Water Quality Meter (YSI, Yellow Springs, Ohio, USA).
Generic Instrument Description	An instrument which measures multiple water quality parameters based on the sensor configuration.

Dataset-specific Instrument Name	Hanna Instruments 9829 Multiparameter Meter
Generic Instrument Name	Water Quality Multiprobe
Dataset-specific Description	pH was measured with a Hanna Instruments 9829 Multiparameter Meter (Hanna Instruments, Smithfield, Rhode Island, USA), which was calibrated with a multipoint calibration to a Tris standard (Marine Physical Laboratory, Scripps Institution of Oceanography, La Jolla, California, USA).
Generic Instrument Description	An instrument which measures multiple water quality parameters based on the sensor configuration.

Dataset-specific Instrument Name	MQ-210 Underwater Quantum Meter
Generic Instrument Name	Light Meter
Dataset-specific Description	Light measurements were taken with a MQ-210 Underwater Quantum Meter (Apogee, Logan, Utah, USA).
Generic Instrument Description	Light meters are instruments that measure light intensity. Common units of measure for light intensity are umol/m2/s or uE/m2/s (micromoles per meter squared per second or microEinsteins per meter squared per second). (example: LI-COR 250A)

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Project Information

Collaborative Research: Effects of multiple aspects of climate change on marine biodiversity and ecosystem functioning (Sitka CO2 and Temp Expt)

Coverage: Sitka Sound, Alaska, USA (57.1N 135.4 W)

NSF Award Abstract:
This project addresses fundamental gaps in our knowledge of how changing environmental conditions will impact the earth's species and ecosystems. One of the main challenges is predicting impacts of multiple environmental stressors changing at the same time within highly dynamic ecosystems. Climate simulations in coastal marine habitats will, therefore, yield critical information about likely future changes in biodiversity and ecosystem health. This project is a partnership between institutions with a strong focus on serving underrepresented communities of students, and the investigators are committed to participating in K-12 and undergraduate mentorship programs through their respective institutions. Furthermore, the research will be based in Sitka, Alaska, where investigators will collaborate with the Sitka Sound Science Center to incorporate research into the Scientist in the Schools program and a summer day camp for elementary age children.

This work aims to uncover the trajectory of climate change impacts and interactive responses to multiple

climatic stressors on coastal marine species, communities, and ecosystem functioning. To uncover these links, the investigators will (1) quantify seasonal and diel dynamics under ambient conditions in a benthic marine community, (2) conduct factorial manipulations of two climatic stressors - increased carbon dioxide concentrations and temperatures - and measure impacts on physiology, diversity, and productivity, and (3) conduct a second field experiment to evaluate whether productivity responses are due to changes in physiology or biodiversity. Climatic changes have the potential to influence ecosystem functioning by altering physiology, abundance, and community structure (i.e., biodiversity), and this research specifically aims to partition these different pathways, leading to more effective predictions of impacts on benthic marine ecosystems.

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-1756173
NSF Division of Ocean Sciences (NSF OCE)	OCE-1756208
NSF Division of Ocean Sciences (NSF OCE)	OCE-1756216
NSF Division of Ocean Sciences (NSF OCE)	OCE-1904185

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