Dataset: Tank seawater conditions from Coral/Temperature/pCO2 Experiments at LTER site in Moorea, French Polynesia, 2011 (OA_Corals project)

Project(s): The effects of ocean acidification on the organismic biology and community ecology of corals, calcified algae, and coral reefs (OA_Corals)

Abstract: 'Tank conditions' is a summary of conditions in the eight tanks assigned randomly to create four treatments of ambient or high temperature and ambient or high CO2. These tanks were used to examine the responses of four species of calcifying coral to temperature and CO2 concentration. The experiments took place in Moorea, French Polynesia in January and April, 2011. These data were published in Brown & Edmunds (2016) Marine Biology, Table 1. For a complete list of measurements, refer to the supplemental document 'Field_names.pdf', and a full dataset description is included in the supplemental file 'Dataset_description.pdf'. The most current version of this dataset is available at: http://www.bco-dmo.org/dataset/641759

Description: Seawater conditions in 8 tanks

Summary of conditions in the eight tanks assigned randomly to create four treatments of AT-ACO2.

Related Reference:
Darren Brown, Peter J. Edmunds. Differences in the responses of three scleractinians and the hydrocoral Millepora platyphylla to ocean acidification. Marine Biology, 2016 (in press).

Related Dataset:
MarBio. 2016: calcification and biomass

Acquisition Description: **Experimental conditions and maintenance**

Treatments were created in 8 tanks (Aqua Logic, San Diego), each holding 150 L of seawater and regulated independently for temperature, light, and pCO2.

Temperatures were maintained at 28.0°C, which corresponded to the ambient seawater temperature in the back reef when the study was conducted, and 30.1°C which is close to the maximum temperature in this habitat (Putnam and Edmunds 2011). pCO2 treatments contrasted ambient conditions (~ 408 micro-atm) and 913 micro-atm pCO2, with the elevated value expected to occur within 100 y under the "stabilization without overshoot" representative concentration pathway (RCP 6.0) (van Vuuren et al. 2011). pCO2 treatments were created by bubbling ambient air or a mixture of ambient air and pure CO2 that was blended continually and monitored using an infrared gas analyzer (IRGA model S151, Qubit Systems). A solenoid-controlled, gas regulation system (Model A352, Qubit Systems, Ontario,

Canada) regulated the flow of CO2 and air, with pCO2 logged on a PC running LabPro software (Vemier Software and Technology). Ambient air and the elevated pCO2 mixture were supplied at ~ 10-15 L min-1 to treatment tanks using pumps (Gast pump DOA-P704-AA, see Edmunds 2011).

The temperatures and pCO2 levels created four treatments with two tanks treatment-1: ambient temperature-ambient pCO2 (AT-ACO2), ambient temperature-high pCO2 (AT-HCO2), high temperature-ambient pCO2 (HT-ACO2) and high temperature-high pCO2 (HT-HCO2). Treatment conditions were monitored daily, with temperature measured at 08:00, 12:00 and 18:00 hrs using a digital thermometer (Fisher Scientific model #150778, ± 0.05 °C), and light intensities at 12:00 hrs using a Li-Cor LI-193 sensor attached t 170 o a LI-1400 meter. Seawater within each tank was replaced at 200 ml/min with filtered seawater (50 micro-m) pumped from Cook's Bay.

Carbonate chemistry and pH analysis

To evaluate dissolved inorganic carbon (DIC) conditions in the 8 tanks, total alkalinity (TA) and pH of the seawater were recorded every third day of the experiment. Seawater was collected between 07:00-09:00 hrs using stoppered glass bottles, equilibrated to room temperature (25.0°C), and processed within 2-3 hrs of collection. TA was determined using an open cell potentiometric titrator (Model T50, Mettler-Toledo, Columbus, OH) fitted with a DG115-SC pH probe (Mettler-Toledo, Columbus, OH) calibrated daily using NBS buffers (pH 4.00, 7.00 and 10.00, Fisher Scientific, 15-0787-8, ± 0.05 °C), and used to perform gran titrations using standard operating procedure 3 (SOP) of Dickson et al. (2007). Seawater pH was determined spectrophotometrically using the dye m-cresol purple (SOP 6b of Dickson et al. 2007), where pH was expressed on the total scale. The results of the gran titrations together with seawater salinity (YSI 3100 conductivity meter) and seawater temperature were used to calculate TA, pCO2, HCO3-, CO3 2- and aragonite saturation state (Omega) using CO2SYS (Lewis and Wallace 1998), with the constants of Mehrbach et al. (1973) and pH on the total scale.

To evaluate the accuracy and precision of TA analyses, certified reference materials (CRM, batch 105 from A. Dickson, Scripps Institution of Oceanography) were processed before each set of seawater samples. CRMs were evaluated with a mean error of 0.37% (~ 8 micro-mol kg-1, n = 11) relative to the certified values. The precision and accuracy of pH measurements were evaluated using standardized Tris buffers (Batch 5 from A. D 193 Dickson Laboratory, Scripps Institution of Oceanography) that were processed spectrophotometrically with m-cresol as described above. Percent average error from the known pH of the Tris

buffer was 0.16% (0.01 pH units, n = 13).

Incubation schedule and dependent variables

On April 24th 2011, nubbins and cores were buoyant weighed (± 1 mg, Spencer-Davies 1989) and randomly placed in the mesocosm, with four taxa and two replicates per taxon in each tank. Over the following 24 h, seawater temperature and pCO2 were adjusted to target values. Corals remained in the treatments for 19 d, and were moved randomly within the tanks daily to eliminate position effects. Individual corals, along with the racks holding them, were cleaned every 5 d by wiping algal growth from walls of the tanks, racks, and PVC coral holders. On May 12th, the experiment ended and the corals were again buoyant weighed and the area of living tissue determined using aluminum foil (Marsh 1970).

Processing Description: **BCO-DMO Processing:**

- added conventional header with dataset name, PI name, version date, reference information
- renamed parameters to BCO-DMO standard
- added location, lat and lon columns

Deployment Information

Deployment description for Richard B Gump Research Station - Moorea LTER MCR_Edmunds

Ongoing studies on corals

Instrument Information

Instrument	
Description	4p LI-193 quantum sensor
Generic Instrument Name	LI-COR LI-193 PAR Sensor
Generic Instrument Description	The LI-193 Underwater Spherical Quantum Sensor uses a Silicon Photodiode and glass filters encased in a waterproof housing to measure PAR (in the 400 to 700 nm waveband) in aquatic environments. Typical output is in micromol s-1 m-2. The LI-193 Sensor gives an added

	dimension to underwater PAR measurements as it measures photon flux from all directions. This measurement is referred to as Photosynthetic Photon Flux Fluence Rate (PPFFR) or Quantum Scalar Irradiance. This is important, for example, when studying phytoplankton, which utilize radiation from all directions for photosynthesis. LI-COR began producing Spherical Quantum Sensors in 1979; serial numbers for the LI-193 begin with SPQA-XXXXX (licor.com).

Instrument	
Description	150 L tanks
Generic Instrument Name	In-situ incubator
Generic Instrument Description	A device on shipboard or in the laboratory that holds water samples under controlled conditions of temperature and possibly illumination.

Instrument	
Description	*local description not specified*
Generic Instrument Name	Water Temperature Sensor
Generic Instrument Description	General term for an instrument that measures the temperature of the water with which it is in contact (thermometer).

Instrument	
Description	Open cell potentiometric titrator (Model T50, Mettler-Toledo, Columbus, OH) fitted with a DG115-SC pH probe (Mettler-Toledo, Columbus, OH)
Generic Instrument Name	Automatic titrator
Generic Instrument Description	Instruments that incrementally add quantified aliquots of a reagent to a sample until the end-point of a chemical reaction is reached.

Instrument	
Description	LiCor LI-1400 meter
Generic Instrument Name	Light Meter
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)

Instrument	
Description	YSI 3100 conductivity meter
Generic Instrument Name	Conductivity Meter
Generic Instrument Description	Conductivity Meter - An electrical conductivity meter (EC meter) measures the electrical conductivity in a solution. Commonly used in hydroponics, aquaculture and freshwater systems to monitor the amount of nutrients, salts or impurities in the water.

Instrument	
Description	Ultrasonic dismembrator (Fisher model 216 15-338-550; fitted with a 3.2 mm diameter probe, Fisher 15-338-67)
Generic Instrument Name	ultrasonic cell disrupter
Generic Instrument Description	Instrument that applies sound energy to agitate particles in a sample.