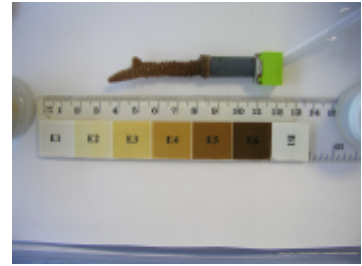


Additive effects of ocean acidification (7.8/ 8.1 pH) and reduced light availability (35/ 150 PAR) on growth, photosynthesis, calcification and pigment content of stony coral *Acropora millepora* (NERP 5.2, AIMS)



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Title	Additive effects of ocean acidification (7.8/ 8.1 pH) and reduced light availability (35/ 150 PAR) on growth, photosynthesis, calcification and pigment content of stony coral <i>Acropora millepora</i> (NERP 5.2, AIMS)
Date	2015-09-28
Date type	Publication
Abstract	<p>This dataset consists of one data file from a 16 day aquarium experiment manipulating pH and light level and measuring growth, photosynthesis, calcification and pigment content of <i>Acropora millepora</i>.</p> <p>The aim of this study was to test the hypothesis that a combined effect of decreased pH and decreased light on physiological responses of the coral is larger than that of each stressor individually.</p> <p>Method:</p> <p>Colonies of the coral <i>Acropora millepora</i> were collected from an inshore fringing reef next to Pelorus Island (central section of the Great Barrier Reef (GBR); 18° 33.001' S, 146° 29.304' E) between 2 and 4 m below lowest astronomical tide (LAT). After colonies were fragmented, individual coral nubbins were glued onto stubs and kept at the Australian Institute of Marine Science (AIMS, Townsville) in flow-through (recirculating flow ~1200 l h⁻¹) aquaria facilities under plasma light (150 μmol photons m⁻² s⁻¹) for >3 mo. Nubbins were transferred into experimental tanks 2 weeks prior to the start of experiment to acclimate to experimental control conditions. Light levels chosen as the control and low light conditions were well within average ranges found between 3 and 6 m below LAT at midshelf and inshore reefs on the GBR, respectively.</p> <p>The manipulative aquaria experiment was carried out in flow-through conditions over a period of 16 days between July and August 2012 at AIMS. After two weeks acclimation, four nubbins of <i>A. millepora</i> were allocated to each of the twelve experimental aquaria. Four treatments with three replicate tanks (working volume 17.5 L) were placed in alternating order. Treatments consisted of combinations of ambient pCO₂ (427 μatm), high pCO₂ (1073 μatm), low light (35 μmol photons m⁻² s⁻¹) and control light (150 μmol photons m⁻² s⁻¹). Light intensities were chosen from average PAR readings from an inshore and mid-shelf reef at ~ 5 m below LAT, present during the summer months. Water flow was provided with fresh filtered (0.5 μm) seawater at 25 °C, with a salinity of 34.5, at a flow-rate of 150 mL min⁻¹. Irradiance was delivered by white light LED (6000 K, Aqua Illumination), covering the full color spectrum. Light levels were set to 12 h/ 12 h light-dark cycle. Additional aquaria pumps (AquaWorld, Australia, 250 L h⁻¹) were fitted into each tank to assure water movement. Target pH levels were achieved by an automatic CO₂ injection system (Aqua Medic, Germany) controlled by potentiometric pH sensors.</p> <p>Growth of organisms was determined by the buoyant weight technique. Individual specimens were single-weighted (accuracy: 0.1 mg, Mettler Toledo, USA) in a custom build buoyant weight set-up with water jacket and seawater of constant temperature (25 °C) and salinity</p>

(34.5 ppt) at the start and at the end of the experiment. Growth of organisms was expressed as daily percentage of change.

After 16 days in experimental conditions, two individuals of each replicate tank were incubated for 1 h in the light and thereafter 1 h in the dark to determine calcification and photosynthesis. Light intensity and seawater pH of incubations corresponded to treatment condition of each organism. One experimental run consisted of 12 parallel incubations in 200 mL incubation chambers, including two blanks per treatment. To assure constant water temperature during incubation, chambers were placed into a flow-through water bath at 25 °C. Additionally, magnetic stirrer bars ensured water movement within the incubation chambers.

Calcification rates in light and dark were determined by the alkalinity anomaly technique (Chisholm & Gattuso 1991). A subsample of 50 mL was pipetted from the incubation seawater and directly titrated for total alkalinity (AT) on a Metrohm 855. A change in one mole of AT corresponds to a change of half a mole of calcium carbonate (Gao and Zheng 2010). Thus, calcification can be expressed by determining the change of carbon in calcium carbonate. Calcium carbonate precipitation or dissolution in $\mu\text{M C h}^{-1}$ was calculated following Gao and Zheng (2010) and standardized to organisms' surface area.

Net photosynthesis in the light or dark respiration were monitored consecutively during the incubations by three Firesting 4-channel oxygen meters (Pyroscience, Germany), which were connected to each chamber with fibre optic cables. Gross photosynthesis, net photosynthesis and respiration rates were expressed as $\mu\text{M O}_2 \text{ h}^{-1}$ and standardized to organism surface area.

Chlorophyll a content of coral *A. millepora* was determined after coral tissue was stripped from the skeleton with an air gun utilizing fresh, ultra-filtered (0.2 μm) seawater. Zooxanthellae were isolated from the host tissue and re-suspended in 2 mL of ethanol (EtOH 95%), heat shocked and extracted for 24h in the cold. Absorbencies were read on 750 and 664 nm and Chl a content was calculated standardized to nubbin surface area.

References:

Gao K, Zheng Y (2010) Combined effects of ocean acidification and solar UV radiation on photosynthesis, growth, pigmentation and calcification of the coralline alga *Corallina sessilis* (Rhodophyta). *Global Change Biol* 16:2388-2398

Chisholm JRM, Gattuso JP (1991) Validation of the alkalinity anomaly technique for investigating calcification and photosynthesis in coral-reef communities. *Limnol Oceanogr* 36:1232-1239

Format:

A single csv text file, `Acid_Light_Millepora_Growth.csv`

Data Dictionary:

- Tank: running number of tanks in experiment
- pH: single factor pH
- Light: single factor light
- Treatment: combined factor of pH and light
- Growth: increase in buoyant weight of coral after 16 days of experimental treatment given in % change d-1
- Light calcification: calcification in light, given in $\mu\text{M C h}^{-1} \text{ cm}^{-2}$
- Dark calcification: calcification in darkness, given in $\mu\text{M C h}^{-1} \text{ cm}^{-2}$
- Net calcification: light calcification + dark calcification
- Net photosynthesis: oxygen production during light, given in $\mu\text{M O}_2 \text{ h}^{-1} \text{ cm}^{-2}$
- Respiration: oxygen consumption during darkness, given in $\mu\text{M O}_2 \text{ h}^{-1} \text{ cm}^{-2}$
- Gross photosynthesis: net photosynthesis – respiration
- Chlorophyll: Chlorophyll a content after 16 days in experimental conditions, given in $\mu\text{g cm}^{-2}$

Metadata language	eng
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Character set	UTF8
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Hierarchy level	Dataset
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Linkage	https://eatlas.org.au/data/uuid/5a9d49e1-8a4a-4bb5-9c2d-0181a2237f34
Protocol	WWW:LINK-1.0-http--metadata-URL
Linkage	https://eatlas.org.au/nerp-te/gbr-aims-combined-water-quality-climate-effects-5-2
Protocol	WWW:LINK-1.0-http--related
Linkage	http://doi.org/10.3354/meps11088
Protocol	WWW:LINK-1.0-http--link
Linkage	https://eatlas.org.au/pydio/data/public/nerp-te_5-2_aims_acid-light-millepora_2012-zip.php
Protocol	WWW:LINK-1.0-http--downloaddata

Point of contact

Individual name	Uthicke, Sven, Dr
Organisation name	Australian Institute of Marine Science (AIMS)
Role	Point of contact
Topic category	Biota

Keyword

Keyword	ocean acidification
Keyword	Acropora millepora
Keyword	climate change
Type	

Extent

Description	Pelorus Island, Great Barrier Reef, Queensland, Australia Collection site for Acropora millepora
Description	Australian Institute of Marine Science (AIMS)

Geographic bounding box

West bound	146.4884
East bound	146.4884
South bound	-18.55002
North bound	-18.55002
West bound	147.05599
East bound	147.05599
South bound	-19.27229
North bound	-19.27229

File identifier	5a9d49e1-8a4a-4bb5-9c2d-0181a2237f34
Metadata language	eng
Character set	UTF8

Metadata author

Individual name	eAtlas Data Manager
Organisation name	Australian Institute of Marine Science (AIMS)
Role	metadataContact
Date stamp	2015-12-16T14:06:40