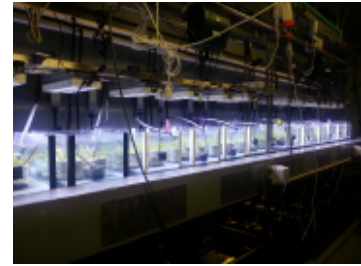


**Photosynthetic and growth responses in three tropical seagrass species to pCO<sub>2</sub> enrichment (440, 700, 890, 1204 µatm) (NERP TE 5.2, AIMS)**



[Metadata](#) | [Metadata \(XML\)](#)

Title	Photosynthetic and growth responses in three tropical seagrass species to pCO <sub>2</sub> enrichment (440, 700, 890, 1204 µatm) (NERP TE 5.2, AIMS)
Date	2015-09-23
Date type	Publication

Abstract	<p>This dataset consists of one data file (spreadsheet) from a 2 week aquarium experiment manipulating pH (pCO<sub>2</sub>) changes and measuring photosynthetic and growth responses of three tropical seagrass species (<i>Cymodocea serrulata</i>, <i>Halodule uninervis</i> and <i>Thalassia hemprichii</i>).</p> <p>The aim of this study was to test the hypothesis that increased pCO<sub>2</sub> would increase photosynthetic and growth rates to various extents between seagrass species.</p> <p>Method:</p> <p>This experiment exposed three seagrass species, <i>Cymodocea serrulata</i>, <i>Halodule uninervis</i> and <i>Thalassia hemprichii</i>, to four pCO<sub>2</sub> treatments (440, 700, 890, 1204 µatm) for two weeks to investigate the effects of acidification on their physiology. These treatments were chosen to bracket the range of atmospheric CO<sub>2</sub> levels predicted for different end-of-century emission scenarios in the near-future (2100). Each treatment was replicated across four aquaria, each with 2 duplicate pots per species.</p> <p><i>C. serrulata</i> and <i>H. uninervis</i> were collected from the intertidal meadow at Cackle Bay, Magnetic Island, Great Barrier Reef (19°10.88'S, 146°50.63'E) in late March 2013. <i>T. hemprichii</i> was collected from Green Island in the Northern Great Barrier Reef (16°45.37'S, 145°58.19'E) in early April 2013. <i>H. uninervis</i> and sediment was collected as intact plugs. <i>C. serrulata</i> and <i>T. hemprichii</i> were collected by excavating intact shoots with connected horizontal rhizomes from the sediment. The experiment started two to four weeks after the collection.</p> <p>Photosynthetic rates and respiration of the second youngest leaf of a haphazardly chosen shoot from each pot were measured using optical oxygen sensors. Photosynthetic rates were measured over a series of light steps (10, 30, 70, 110, 220, 400, 510 µmol m<sup>-2</sup> s<sup>-1</sup>), with each light step lasting 20 minutes. Rates were normalised to the dry weight of the leaf, after drying leaves at 60°C for 48 hours. To determine photosynthetic parameters (P<sub>max</sub>, alpha, E<sub>k</sub>, E<sub>c</sub>), photosynthesis versus irradiance (P-E) data plots were fitted to the adapted hyperbolic tangent model equation of Jassby and Platt (1976). Net productivity (NP) was taken to be the photosynthetic rate measured at the experimental light level (400 µmol m<sup>-2</sup> s<sup>-1</sup>). Energetic surplus (PG:R) was calculated as the ratio of gross productivity to dark respiration rate.</p> <p>To measure growth rates, all shoots were marked at the top of the sheath with a needle at the start of the experiment. After 14 days, the shoots were harvested, the length of new tissue growth were excised, dried at 60°C for 48 hours and weighed for determination of weight of new leaf growth. Leaf tissue growth was normalised to the aboveground biomass to derive relative leaf growth rates (RGR). Specific leaf area (SLA) was calculated by dividing total leaf area with the total biomass of the leaves.</p>
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Chlorophyll content was determined by acetone extraction of chlorophyll from a young mature leaf from each pot at the end of the experiment.

To determine non-structural carbohydrates (NSC) content, roots and rhizomes were dried at 60°C for 48 hours, before being homogenised. Soluble carbohydrates were extracted with 80% ethanol at 80°C. The amount of soluble carbohydrates was assayed after removal of phenolic compounds and acid hydrolysis. Starch content was analysed from the residue of the soluble carbohydrate extraction through enzyme (amylase and amyloglucosidase) digestion. The concentration of glucose is measured using a commercially available glucose oxidase/peroxidase (GOPOD) testing reagent (Megazyme). Absorbance was then measured at 510 nm. Total non-structural carbohydrates (NSC) content was the sum of the amount of soluble carbohydrates and starch content.

Format:

Comma Separated File (CSV)

Data Dictionary:

seagrass\_pCO2only.csv:

- pH: Average of the calculated pH of the aquarium over the experimental period.
- pCO2 (uatm): average pCO2 levels over two weeks.
- Temp\_real (oC): Average of measured temperatures of the aquarium over the experimental period (N=3). These were measured manually.
- N\_sampling: Number of water samples taken for pCO2 and pH determinations
- Species: "CS"= *Cymodocea serrulata*, "HU"= *Halodule uninervis*, "TH"= *Thalassia hemprichii*
- Aquaria: ID of the aquarium each pot was kept in.
- Duplicate\_pot: ID of duplicate pot of species in each aquaria
- Resp (mgO2 g-1DW h-1): dark respiration rates of leaf from haphazardly chosen shoot from pot
- Productivity (mgO2 g-1DW h-1): photosynthetic rates measured under experimental treatment light level (400  $\mu\text{mol m}^{-2} \text{s}^{-1}$ ), measured after 14 days.
- alpha: photosynthetic efficiency of shoot, calculated from the linear slope of fitted hyperbolic tangent curve (Jassby and Platt, 1976)  $P = P_{\text{max}} \times \tanh((\alpha P_{\text{max}})/E)$
- Ec ( $\mu\text{mol m}^{-2} \text{s}^{-1}$ ): Light level at which photosynthetic rate is equal to the dark respiration rate.
- Ek ( $\mu\text{mol m}^{-2} \text{s}^{-1}$ ): Light level at which photosynthetic rate reaches maximal photosynthetic rate (Pmax).
- Pmax (mgO2 g-1DW h-1): maximum photosynthetic rates, derived from fitted curve (shown above).
- Pg:R\_ratio: ratio of gross photosynthetic rate (Productivity+Resp) to dark respiration rates.
- Chl\_a (mg g-1FW): chlorophyll a content per gram fresh weight leaf tissue.
- Chl\_b (mg g-1FW): chlorophyll b content per gram fresh weight leaf tissue.
- Growth (mg sht-1 d-1): increase in leaf biomass per pot, averaged over duration of experiment (14days) and normalise to number of shoots in pot.
- RGR (g g-1 d-1): relative growth rate. Increase in leaf biomass per pot, averaged over duration of experiment (14days) and normalised to aboveground biomass in pot.
- Specific leaf area: Total leaf area extended divided by the total biomass of the leaves.
- SolCarbs (mg g-1DW): Soluble carbohydrates content per unit dry weight of rhizome tissue. Only 4 reps were analysed, i.e. 1 per aquaria.
- Starch (mg g-1DW): Starch content per unit dry weight of rhizome tissue. Only 4 reps were analysed, i.e. 1 per aquaria.
- NSC (mg g-1DW): Total non-structural carbohydrates content per unit dry weight of rhizome tissue. Only 4 reps were analysed, i.e. 1 per aquaria.

Metadata language	eng
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Character set	UTF8
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Hierarchy level	Dataset
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## OnLine resource

Linkage	<a href="https://eatlas.org.au/data/uuid/0fd70612-a07a-492a-bacf-8e0b7951da4d">https://eatlas.org.au/data/uuid/0fd70612-a07a-492a-bacf-8e0b7951da4d</a>
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Protocol	WWW:LINK-1.0-http--metadata-URL
Linkage	<a href="https://eatlas.org.au/nerp-te/gbr-aims-combined-water-quality-climate-effects-5-2">https://eatlas.org.au/nerp-te/gbr-aims-combined-water-quality-climate-effects-5-2</a>
Protocol	WWW:LINK-1.0-http--related
Linkage	<a href="http://link.springer.com/article/10.1007%2Fs00227-015-2644-6">http://link.springer.com/article/10.1007%2Fs00227-015-2644-6</a>
Protocol	WWW:LINK-1.0-http--link
Linkage	<a href="https://eatlas.org.au/pydio/data/public/nerp-te-5-2_aims-tropwater_seagrass-co2_2013-zip.php">https://eatlas.org.au/pydio/data/public/nerp-te-5-2_aims-tropwater_seagrass-co2_2013-zip.php</a>
Protocol	WWW:LINK-1.0-http--downloaddata

## Point of contact

Individual name	Ow, Yan Xiang
Organisation name	Australian Institute of Marine Science (AIMS)
Role	Point of contact
Topic category	Biota

## Keyword

Keyword	ocean acidification
Keyword	Cymodocea serrulata
Keyword	Halodule uninervis
Keyword	Thalassia hemprichii
Type	Theme
Keyword	marine
Type	Theme

## Extent

Description	Cockle Bay, Magnetic Island, Australia Collection site for <i>C. serrulata</i> and <i>H. uninervis</i>
Description	Green Island, Australia Collection site for the amples of <i>T. hemprichii</i>
Description	Australian Institute of Marine Science (AIMS)

## Geographic bounding box

West bound	146.8438
East bound	146.8438
South bound	-19.18133
North bound	-19.18133
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File identifier	0fd70612-a07a-492a-bacf-8e0b7951da4d
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	2015-12-09T16:44:29