

# Energy reserve and stable isotope data from 3 species of Australian coral exposed to increased temperature and nutrients treatment in 2008

**Website:** <https://www.bco-dmo.org/dataset/959971>

**Data Type:** experimental

**Version:** 1

**Version Date:** 2025-09-22

## Project

» [EAPSI: How Do Coastal Eutrophication and Elevated Ocean Temperature Impact On Reef Corals](#) (EAPSI Eutrophication Temperature)

Contributors	Affiliation	Role
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## Abstract

In this project, we tested the effects of elevated temperature and moderate nutrients for 21 days during the winter on *Montipora monasteriata*, *Acropora muricata*, and *Pocillopora damicornis* in a fully factorial experiment with two seawater temperatures (average winter temperature of 20°C and projected winter temperature later this century of 24°C) and two nutrient levels (ambient nutrients at 1.28 µmol L<sup>-1</sup> NO<sub>3</sub><sup>-</sup> and 0.14 µmol L<sup>-1</sup> PO<sub>4</sub><sup>-3</sup>, and moderate nutrients at 5.44 µmol L<sup>-1</sup> NO<sub>3</sub><sup>-</sup> and 0.36 µmol L<sup>-1</sup> PO<sub>4</sub><sup>-3</sup>). This dataset includes coral and endosymbiont tissue δ<sup>15</sup>N, δ<sup>13</sup>C, coral energy reserves (protein, lipid, carbohydrates), and temperature data. The experiment was conducted in collaboration with Dr. Kenneth Anthony at the University of Queensland at Heron Island, Australia. These data were collected by Dr. Stephen Levas at The Ohio State University and The University of Wisconsin - Whitewater.

## Table of Contents

- [Coverage](#)
- [Dataset Description](#)
  - [Methods & Sampling](#)
  - [Data Processing Description](#)
  - [BCO-DMO Processing Description](#)
- [Data Files](#)
- [Related Publications](#)
- [Parameters](#)
- [Instruments](#)
- [Project Information](#)
- [Funding](#)

## Coverage

**Location:** Coral were collected off of Heron Island, Australia reefs at 4-5 meters.

**Spatial Extent:** **Lat:**-23.4423 **Lon:**151.9148

**Temporal Extent:** 2008-07-20 - 2008-08-31

## Methods & Sampling

Twelve small colonies each of *Montipora monasteriata*, *Acropora muricata*, and *Pocillopora damicornis* were collected at 4-5m depth from the reefs at Heron Island, Queensland, Australia (23.4423°S, 151.9148°E) and placed in treatment tanks.

Daily temperature was recorded using Hobo temperature loggers every minute within the treatment tank. Chl

a, total soluble lipid, soluble animal protein, and soluble animal carbohydrate concentrations, were each measured on a 1cm<sup>2</sup> cored plugs of *M. monasteriata* and from 1cm long branch tips of *A. muricata* and *P. damicornis* from each ramet. Each measurement was made on whole coral samples (skeleton, animal tissue, and endosymbiotic algae) that were ground with a mortar and pestle and normalized to total ash-free dry tissue biomass of the organic fraction (animal tissue and endosymbiotic algae). Chl a was extracted using methods modified from Jeffrey and Humphrey (1975). Total soluble lipids were extracted using methods described in Rodrigues and Grottoli (2007), while soluble animal carbohydrate and protein concentrations were measured using the methods modified from Dubois et al. (1956) and Smith et al. (1985), respectively, as described in Levas et al. (2018). Biomass was measured according to methods outlined in McLachlan et al. (2020).

Coral fragments were airbrushed to remove all tissue from the skeleton. The host tissue and endosymbionts were separated by centrifugation and filtered onto prebaked GF/F filters. Animal host tissue and endosymbiotic algal fraction  $\delta^{15}\text{N}$  values ( $\delta^{15}\text{N}_h$  and  $\delta^{15}\text{N}_e$ , respectively) were reported relative to air ( $\delta^{15}\text{N}$  = per mil deviation of the ratio of stable nitrogen isotopes  $^{15}\text{N}:^{14}\text{N}$  relative to air). Animal host tissue and endosymbiotic algal fraction  $\delta^{13}\text{C}$  values ( $\delta^{13}\text{C}_h$  and  $\delta^{13}\text{C}_e$ , respectively) were reported relative to Vienna Pee Dee Belemnite Limestone standard ( $\delta^{13}\text{C}$  = per mil deviation of the ratio of stable carbon isotopes  $^{13}\text{C}:^{12}\text{C}$  relative to V-PDB). Repeated measurements of internal standards (n = 20) had a standard deviation of  $\pm 0.14\%$  for organic  $\delta^{15}\text{N}$  and  $\pm 0.07\%$  for organic  $\delta^{13}\text{C}$ .  $\delta^{15}\text{N}$  and  $\delta^{13}\text{C}$  values were determined using a Costech Elemental Analyzer where the resulting  $\text{N}_2$  and  $\text{CO}_2$  gases were analyzed for  $\delta^{15}\text{N}$  and  $\delta^{13}\text{C}$  with a ThermoFisher Delta IV stable isotope ratio mass spectrometer (IRMS) via a Conflo II interface in the Grottoli lab at the Ohio State University.

## Data Processing Description

The 1 minute temperature data was averaged over the 24hr period to get a daily temperature.

## BCO-DMO Processing Description

- Imported "physiological\_parameters\_heron\_island\_coral\_2008.xlsx" into BCO-DMO system
- Rounded parameters 'Protein (J mg afdw)', 'Carbs (J mg/afdw)', and 'Lipid (J mg afdw)' to 6 digits (as indicated in Excel formatting)
- Rounded 'Total EnRes (J mg afdw)' to 5 digits (as indicated in Excel formatting)
- Rounded 'Total Biomass (mg/cm2)' to 1 digit (as indicated in Excel formatting)
- Renamed fields to comply with BCO-DMO naming conventions, removing units, special characters, and spaces
- Added accepted AphiaID and LSID for host species in "AphiaID\_accepted" and "LSID"
- Exported file as "959971\_v1\_winter\_temp\_nutrient\_coral.csv"

Scientific names in the data were checked using World Register of Marine Species (WoRMS) Taxon Match. All scientific names in the data are valid and accepted names as of 2025-08-07.

[ [table of contents](#) | [back to top](#) ]

## Data Files

File
<b>959971_v1_winter_temp_nutrient_coral.csv</b> (Comma Separated Values (.csv), 16.51 KB) MD5:57f8fee520cbce40043ae027116b8282
Primary data file for dataset ID 959971, version 1

[ [table of contents](#) | [back to top](#) ]

## Related Publications

DUBOIS, M., GILLES, K., HAMILTON, J. K., REBERS, P. A., & SMITH, F. (1951). A Colorimetric Method for the Determination of Sugars. *Nature*, 168(4265), 167–167. <https://doi.org/10.1038/168167a0>  
*Methods*

Jeffrey, S. W., & Humphrey, G. F. (1975). New spectrophotometric equations for determining chlorophylls a, b, c1 and c2 in higher plants, algae and natural phytoplankton. *Biochemie Und Physiologie Der Pflanzen*, 167(2), 191–194. doi:10.1016/s0015-3796(17)30778-3 [https://doi.org/10.1016/S0015-3796\(17\)30778-3](https://doi.org/10.1016/S0015-3796(17)30778-3)  
*Methods*

Levas, S., Schoepf, V., Warner, M. E., Aschaffenburg, M., Baumann, J., & Grottoli, A. G. (2018). Long-term recovery of Caribbean corals from bleaching. *Journal of Experimental Marine Biology and Ecology*, 506, 124–134. <https://doi.org/10.1016/j.jembe.2018.06.003>  
*Methods*

McLachlan, R., Dobson, K., & Grottoli, A. (2020). Quantification of Total Biomass in Ground Coral Samples v1 (protocols.io.bdyai7se). *Protocols.io*. doi:[10.17504/protocols.io.bdyai7se](https://doi.org/10.17504/protocols.io.bdyai7se)  
*Methods*

Rodrigues, L. J., & Grottoli, A. G. (2007). Energy reserves and metabolism as indicators of coral recovery from bleaching. *Limnology and Oceanography*, 52(5), 1874–1882. doi:[10.4319/lo.2007.52.5.1874](https://doi.org/10.4319/lo.2007.52.5.1874)  
*Methods*

Smith, P. K., Krohn, R. I., Hermanson, G. T., Mallia, A. K., Gartner, F. H., Provenzano, M. D., ... Klenk, D. C. (1985). Measurement of protein using bicinchoninic acid. *Analytical Biochemistry*, 150(1), 76–85. doi:[10.1016/0003-2697\(85\)90442-7](https://doi.org/10.1016/0003-2697(85)90442-7)  
*Methods*

[ [table of contents](#) | [back to top](#) ]

## Parameters

Parameter	Description	Units
ID	ID used to identify coral based on species (first two letters), temperature treatment (second pair of letters), nutrient regime (third pair of letters) and then colony ID (four numbers)	unitless
Species	Species ID (1= <i>Montipora monasteriata</i> , 2= <i>Acropora muricata</i> , 3= <i>Pocillopora damicornis</i> )	unitless
Temp	Temperature Treatment (1= control/NB, 2 = increased temperature/BL); NB refers to Non-bleached coral and BL refers to Bleached coral	unitless
Nutrient	Nutrient Regime (1=Low nutrients, 2= high nutrients)	unitless
T_Chla	Total Chlorophyll per Area	ug/cm <sup>2</sup>
d13C_Animal	d13C for the Animal tissue	per mil
d13C_Zoox	d13C for the Endosymbiont	per mil
d13C_Animal_d13C_Zoox	d13C for the animal tissue subtracted by the d13C of the endosymbiont tissue	per mil

d15N_Animal	d15N fo the Animal tissue	per mil
d15N_Zoox	d15N for the Endosymbiont tissue	per mil
d15N_Animal_d15N_Zoox	d15N for the animal tissue subtracted by the d15N of the endosymbiont tissue	per mil
Protein	Total protein concentration	Joules per mg ash free dry weight
Carbs	Total carbohydrate concentration	Joules per mg ash free dry weight
Lipid	Total Lipid concentration	Joules per mg ash free dry weight
Total_EnRes	Total energy reserves (protein+lipid+carbs)	Joules per mg ash free dry weight
Total_Biomass	Total biomas	mg/cm2
AphialD	AphialD of sample	unitless
LSID	LSID of sample	unitless

[ [table of contents](#) | [back to top](#) ]

## Instruments

<b>Dataset-specific Instrument Name</b>	Costech Elemental Analyzer
<b>Generic Instrument Name</b>	Elemental Analyzer
<b>Dataset-specific Description</b>	$\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ values were determined using a Costech Elemental Analyzer where the resulting $\text{N}_2$ and $\text{CO}_2$ gases were analyzed for $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ with a ThermoFisher Delta IV stable isotope ratio mass spectrometer (IRMS) via a ConFlo II interface in the Grottoli lab at the Ohio State University.
<b>Generic Instrument Description</b>	Instruments that quantify carbon, nitrogen and sometimes other elements by combusting the sample at very high temperature and assaying the resulting gaseous oxides. Usually used for samples including organic material.

<b>Dataset-specific Instrument Name</b>	ThermoFisher Delta IV stable isotope ratio mass spectrometer (IRMS)
<b>Generic Instrument Name</b>	Isotope-ratio Mass Spectrometer
<b>Dataset-specific Description</b>	$\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ values were determined using a Costech Elemental Analyzer where the resulting $\text{N}_2$ and $\text{CO}_2$ gases were analyzed for $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ with a ThermoFisher Delta IV stable isotope ratio mass spectrometer (IRMS) via a ConFlo II interface in the Grottoli lab at the Ohio State University.
<b>Generic Instrument Description</b>	The Isotope-ratio Mass Spectrometer is a particular type of mass spectrometer used to measure the relative abundance of isotopes in a given sample (e.g. VG Prism II Isotope Ratio Mass-Spectrometer).

<b>Dataset-specific Instrument Name</b>	
<b>Generic Instrument Name</b>	scale or balance
<b>Dataset-specific Description</b>	Each measurement was made on whole coral samples (skeleton, animal tissue, and endosymbiotic algae) that were ground with a mortar and pestle and normalized to total ash-free dry tissue biomass of the organic fraction (animal tissue and endosymbiotic algae).
<b>Generic Instrument Description</b>	Devices that determine the mass or weight of a sample.

<b>Dataset-specific Instrument Name</b>	Hobo temperature loggers
<b>Generic Instrument Name</b>	Temperature Logger
<b>Dataset-specific Description</b>	Daily temperature was recorded using Hobo temperature loggers every minute within the treatment tank.
<b>Generic Instrument Description</b>	Records temperature data over a period of time.

[ [table of contents](#) | [back to top](#) ]

## Project Information

### EAPSI: How Do Coastal Eutrophication and Elevated Ocean Temperature Impact On Reef Corals (EAPSI Eutrophication Temperature)

**Coverage:** East Asia and the Pacific region (Australia, China, Japan, Korea, New Zealand, Singapore, Taiwan)

#### 2008 EAPSI Fellowship

This award supports a U.S. graduate student to conduct an individual research project at one of seven locations in East Asia and the Pacific region (Australia, China, Japan, Korea, New Zealand, Singapore, Taiwan). The research project will provide the student with a first-hand mentored research experience, an introduction to science and science policy infrastructure, and an orientation to the culture and language of the location. The primary goals of the East Asia Summer Institute program are to expose students to science and engineering in

the context of a research laboratory, and to initiate early-career professional relationships that will foster research collaborations with foreign counterparts in the future.

[ [table of contents](#) | [back to top](#) ]

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## Funding

Funding Source	Award
<a href="#">NSF Office of International Science and Engineering (NSF OISE)</a>	<a href="#">OISE-0813231</a>

[ [table of contents](#) | [back to top](#) ]