

# Experiment testing the temperature dependence of urchin grazing at the Galapagos Science Center on San Cristobal Island from February to March 2018

**Website:** <https://www.bco-dmo.org/dataset/775500>

**Data Type:** experimental

**Version:** 1

**Version Date:** 2019-08-20

## Project

» [The Role of Temperature in Regulating Herbivory and Algal Biomass in Upwelling Systems](#) (Temperature and Herbivory)

Contributors	Affiliation	Role
<a href="#">Bruno, John</a>	University of North Carolina at Chapel Hill (UNC-Chapel Hill)	Principal Investigator
<a href="#">Biddle, Mathew</a>	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

## Abstract

This study was conducted from February to March 2018 at the Galapagos Science Center on San Cristobal Island. The rate of *Ulva* sp. consumption by the two sea urchins, *Lytechinus semituberculatus* and *Eucidaris galapagensis* was measured at 10 temperatures: 14°, 16°, 18°, 20°, 22°, 24°, 26°, 28°, 30°, 32°C. *L. semituberculatus* (green urchin), *E. galapaguensis* (pencil urchin) and *T. depressus* (white urchin) are the three most common species in the Galapagos Islands and together make up 91% of the sea urchin biomass. *Ulva* sp. was used as the prey item because it is one of the most abundant macroalgal species, together with turf, encrusting coralline algae and *Sargassum* near the Galapagos and coast and because it is highly palatable for herbivores.

## Table of Contents

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

## Coverage

**Spatial Extent:** Lat:-0.883 Lon:-89.608

**Temporal Extent:** 2018-02 - 2018-03

## Dataset Description

This study was conducted from February to March 2018 at the Galapagos Science Center on San Cristobal Island. The rate of *Ulva* sp. consumption by the two sea urchins, *Lytechinus semituberculatus* and *Eucidaris galapagensis* was measured at 10 temperatures: 14°, 16°, 18°, 20°, 22°, 24°, 26°, 28°, 30°, 32°C. *L. semituberculatus* (green urchin), *E. galapaguensis* (pencil urchin) and *T. depressus* (white urchin) are the three most common species in the Galapagos Islands and together make up 91% of the sea urchin biomass. *Ulva* sp. was used as the prey item because it is one of the most abundant macroalgal species, together with turf, encrusting coralline algae and *Sargassum* near the Galapagos and coast and because it is highly palatable for herbivores.

## Methods & Sampling

For each temperature run (i.e., each experimental level) eight urchins of each species were collected from Cerro Tijeretas cove (0°53'16.78"S, 89°36'29.18"W) at an average depth of 4 m. Urchins were transported in plastic containers filled with sea water to the UNC/USFQ Galapagos Science Center.

Each individual, whose volume has been calculated using a beaker (ie, via water displacement), was randomly assigned to a numbered mesocosm: green and pencil urchins were placed in 21x11x9 cm and 42x9 cm (circumference x depth), respectively, with 5g (wet weight) of fresh *Ulva* sp. each taken from the Cerro Tijeretas site. *Ulva* sp. was weighed after excess water was removed using a salad spinner that was cycled twice for 20 repetitions. The 16 mesocosms were then placed randomly within a large water bath of 130x60x35 dimensions at the temperature to be tested randomly. A chiller and two heaters, paired with an Apex aquarium thermostat, were used to control the water temperature inside the water bath. Each mesocosm closed with a wire mesh top so that the water temperature inside the mesocosm was the same as that in the aquarium and water could be exchanged freely. Before the test, the individuals were left to fast for 24 hours in basins with oxygenators. The water inside the basins was changed approximately every 12 hours with new sea water at an ambient temperature of ~23°C. This procedure was repeated for every temperature tested.

## Data Processing Description

BCO-DMO Processing Notes:

- added conventional header with dataset name, PI name, version date

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

---

## Data Files

File
<b>urch_graz.csv</b> (Comma Separated Values (.csv), 2.78 KB) MD5:d8d12d5f58b701d4ba5ea9c9a095739a
Primary data file for dataset ID 775500

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

---

## Parameters

Parameter	Description	Units
Mesocosm	mesocosm identifier	unitless
Species	Species of sea urchin	unitless
Temperature	water temperature	degrees Celsius
Grazing	volume of <i>Ulva</i> app eater (g) divided by the urchin volume; I.e. size normalized grazing rate.	unitless

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

---

## Instruments

<b>Dataset-specific Instrument Name</b>	aquarium
<b>Generic Instrument Name</b>	Aquarium
<b>Dataset-specific Description</b>	Each mesocosm closed with a wire mesh top so that the water temperature inside the mesocosm was the same as that in the aquarium and water could be exchanged freely.
<b>Generic Instrument Description</b>	Aquarium - a vivarium consisting of at least one transparent side in which water-dwelling plants or animals are kept

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

---

## Project Information

### The Role of Temperature in Regulating Herbivory and Algal Biomass in Upwelling Systems (Temperature and Herbivory)

**Website:** [http://github.com/johnfbruno/Galapagos\\_NSF.git](http://github.com/johnfbruno/Galapagos_NSF.git)

#### *NSF Award Abstract:*

A well-known pattern in coastal marine systems is a positive association between the biomass of primary producers and the occurrence or intensity of upwelling. This is assumed to be caused by the increase in nutrient concentration associated with upwelling, enabling higher primary production and thus greater standing algal biomass. However, upwelling also causes large, rapid declines in water temperature. Because the metabolism of fish and invertebrate herbivores is temperature-dependent, cooler upwelled water could reduce consumer metabolism and grazing intensity. This could in turn lead to increased standing algal biomass. Thus upwelling could influence both bottom-up and top-down control of populations and communities of primary producers. The purpose of this study is to test the hypothesis that grazing intensity and algal biomass are, in part, regulated by temperature via the temperature-dependence of metabolic rates. Broader impacts include the training and retention of minority students through UNC's Course Based Undergraduate Research program, support of undergraduate research, teacher training, and various outreach activities.

The investigators will take advantage of the uniquely strong spatiotemporal variance in water temperature in the Galápagos Islands to compare grazing intensity and primary production across a natural temperature gradient. They will combine field monitoring, statistical modeling, grazing assays, populations-specific metabolic measurements, and in situ herbivore exclusion and nutrient addition to measure the effects of temperature on pattern and process in shallow subtidal communities. The researchers will also test the hypothesis that grazer populations at warmer sites and/or during warmer seasons are less thermally sensitive, potentially due to acclimatization or adaptation. Finally, the investigators will perform a series of mesocosm experiments to measure the effect of near-future temperatures on herbivores, algae, and herbivory. This work could change the way we view upwelling systems, particularly how primary production is regulated and the temperature-dependence of energy transfer across trophic levels.

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

---

## Funding

<b>Funding Source</b>	<b>Award</b>
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-1737071</a>

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