

# Material properties of mussel byssal threads formed under different pH - All Breaks from Carrington laboratory, Friday Harbor, WA; 2010-2013 (OA - Ecomaterials Perspective project)

Website: <https://www.bco-dmo.org/dataset/4012>

Version: 27 August 2013

Version Date: 2013-08-27

## Project

» [Effects of Ocean Acidification on Coastal Organisms: An Ecomaterials Perspective](#) (OA - Ecomaterials Perspective)

## Program

» [Science, Engineering and Education for Sustainability NSF-Wide Investment \(SEES\): Ocean Acidification \(formerly CRI-OA\)](#) (SEES-OA)

| Contributors                      | Affiliation   | Role                            |
|-----------------------------------|---|---------------------------------|
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## Dataset Description

Material properties of mussel byssal threads formed under different pH - All Breaks

See O`Donnell et al., 2013

## Methods & Sampling

For testing, an individual thread was excised from the byssus, with care taken to avoid loading the thread. The pebble to which the plaque was attached was epoxied to an aluminium bracket and the root of the thread was secured between cardboard with cyanoacrylate. The cardboard and aluminium bracket were secured in the clamps of an Instron 5565 materials testing frame. Byssal threads were tested while submerged in a 10 °C seawater bath by pulling normal to the substratum at 10 mm min<sup>-1</sup> until failure following ref. Thread strength, extensibility and failure location were recorded and unbroken thread portions were subsequently retested to measure distal yield and force to break plaque and proximal regions. Distal region failures were rare and excluded.

## Data Processing Description

These data are raw data from the measurement device.

### **BCO-DMO Processing/Edits**

- Generated from original file "Mussel Byssus final data for release 2013 07 10.xlsx", Sheet: "All" contributed by Emily Carrington
- Parameter names changed to conform to BCO-DMO parameter naming convention
- "Max Stress" column deleted
- Data values standardized to max number of decimal places reported for each parameter
- Approx Latitude, Longitude location for Friday Harbor Laboratory added to the data
- "nd" inserted into blank cells

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## **Data Files**

| <b>File</b>   |
|---|
| <b>MusselByssus_Final_All.csv</b> (Comma Separated Values (.csv), 26.07 KB)<br>MD5:f4b35a0dbb48830599d826f29a685135 |
| Primary data file for dataset ID 4012   |

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## **Related Publications**

O'Donnell, M. J., George, M. N., & Carrington, E. (2013). Mussel byssus attachment weakened by ocean acidification. *Nature Climate Change*, 3(6), 587-590. doi:[10.1038/nclimate1846](https://doi.org/10.1038/nclimate1846)  
*General*

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## **Parameters**

| Parameter             | Description   | Units                 |
|-----------------------|---|-----------------------|
| Lab_Id                | Laboratory identifier where experiments were conducted                                      | dimensionless         |
| Lat                   | Latitude of laboratory (South is negative)  | decimal degrees       |
| Lon                   | Longitude of laboratory (West is negative)  | decimal degrees       |
| Indiv                 | Individual Identifier   | dimensionless         |
| Cooler                | Cooler Identifier   | dimensionless         |
| Tank                  | Tank Identifier   | dimensionless         |
| pCO2                  | pCO2  | uatm                  |
| pCO2_SD               | pCO2 Standard of Deviation (+/-)  | uatm                  |
| pH                    | pH  | total scale           |
| pH_average_dev        | pH Average Deviation (+/-)  | total scale           |
| GI                    | The ratio of dried gonadal tissue to total tissue mass. A proxy for reproductive investment | unitless (proportion) |
| CI                    | Dried tissue mass divided by shell length cubed   | gram/cm <sup>3</sup>  |
| Order                 | Order   | integer               |
| Test_Type             | Test_Type (Which Test is This?)   | text                  |
| Thread_Break_Location | Thread_Break_Location (Where Did the Thread Break?)   | text                  |
| Thread_Break_Pattern  | Thread Break Pattern  | text                  |
| Distal_Diameter       | Distal Diameter   | mm                    |
| L0                    | L0  | mm                    |
| Lfinal                | Lfinal  | mm                    |
| Max_Strain            | Max Strain  | unitless (proportion) |
| Max_Load              | Max Load  | Newtons (N)           |
| Extension             | Extension   | mm                    |
| Yield                 | Yield   | Newtons (N)           |

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## Instruments

|   |   |
|---|---|
| <b>Dataset-specific Instrument Name</b> | Hach Sension 5 conductivity meter   |
| <b>Generic Instrument Name</b>          | Conductivity Meter  |
| <b>Dataset-specific Description</b>     | Hach Sension 5 conductivity meter sensION5 Conductivity Meter, with electrode, 1-meter cable Product #: 5180010 OBSOLETE ITEM Fast Response Quick single-point calibration All-in-one 5-pin connector Recall/download/print data via built-in RS232 serial ports (sensION5) or via optional docking station (sensION7) Also measures Salinity and TDS Specifications Conductivity resolution: 0.1 $\mu$ S, 1 $\mu$ S, 0.01 mS, 0.1 mS Measuring Range Conductivity: 0 to 199.9 $\mu$ S/cm Measuring Range Conductivity 2: 200 to 1999 $\mu$ S/cm Measuring Range Conductivity 3: 2 to 19.99 mS/cm Measuring Range Conductivity 4: 20 to 199.9 mS/cm Measuring Range Salinity: 0 to 42 g/L (ppt) Measuring Range TDS: 0 to 50000 mg/L as NaCl Measuring Range Temperature: -10 to 110 $^{\circ}$ C Salinity Resolution: 0.1 g/L (ppt) TDS Resolution: 3 significant digits Temperature Resolution: $\pm$ 0.1 $^{\circ}$ C Warranty: 2 years Weight: 5 lbs. (2.27 kg) |
| <b>Generic Instrument Description</b>   | 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.   |

|   |   |
|---|---|
| <b>Dataset-specific Instrument Name</b> | Licor LI-700 CO2 detector   |
| <b>Generic Instrument Name</b>          | Gas Analyzer  |
| <b>Dataset-specific Description</b>     | Licor LI-700 CO2 detector   |
| <b>Generic Instrument Description</b>   | Gas Analyzers - Instruments for determining the qualitative and quantitative composition of gas mixtures. |

|   |  |
|---|--|
| <b>Dataset-specific Instrument Name</b> | Instron 5565 materials testing frame   |
| <b>Generic Instrument Name</b>          | Materials Testing System   |
| <b>Dataset-specific Description</b>     | Instron 5565 materials testing frame   |
| <b>Generic Instrument Description</b>   | Testing systems that are used to test a wide range of materials in tension or compression. |

|   |  |
|---|--|
| <b>Dataset-specific Instrument Name</b> | Fluke 1523 thermometer   |
| <b>Generic Instrument Name</b>          | Water Temperature Sensor   |
| <b>Dataset-specific Description</b>     | Fluke 1523 thermometer Single channel that reads RTD's (PRTs), thermocouples, and thermistors. Featuring visual data trending and records the values and statistics associated with up to 25 measurements. Specifications Product Type Multi-Parameter Thermometers Temp range probe dependent Battery life 20 hours (minimum) Power 3 AA Batteries RTD Resistance Accuracy 0.004% + 0.002 ohm percent of reading + floor Dimensions 96x200x47 Brand Hart Scientific Manufacturer number 1523-156 Model 1523 |
| <b>Generic Instrument Description</b>   | General term for an instrument that measures the temperature of the water with which it is in contact (thermometer).   |

## Deployments

### lab\_UW\_FHL\_OAEL\_Carrington

|                    |  |
|--------------------|--|
| <b>Website</b>     | <a href="https://www.bco-dmo.org/deployment/59061">https://www.bco-dmo.org/deployment/59061</a>  |
| <b>Platform</b>    | lab UW FHL OAEL  |
| <b>Report</b>      | <a href="http://depts.washington.edu/fhl/oael.html">http://depts.washington.edu/fhl/oael.html</a>  |
| <b>Start Date</b>  | 2010-09-01   |
| <b>End Date</b>    | 2013-08-31   |
| <b>Description</b> | FHL Ocean Acidification Environmental Laboratory (OAEL) Overview FHL completed construction of a new 1500 sq. ft. experimental facility for ocean acidification research in summer 2011. The facility was funded by an award from NSF's Field Stations and Marine Laboratories (FSML) program, matching funds from the University of Washington, and private donors. The experimental facility currently includes an analytical chemistry laboratory, indoor mesocosms fed by a custom seawater-CO2 blending system and temperature control, laboratory space, as well as outdoor in-water mesocosms. Led by Dr. Emily Carrington, OAEL Director ( <a href="mailto:ecarring@uw.edu">ecarring@uw.edu</a> ), this state-of-the-art ocean acidification facility offers unique research and instructional opportunities for experimental manipulations with on-site monitoring of carbonate system parameters. FHL's location, facilities, and educational mission combine to make an ideal site for the experimental mesocosm and analytical facility. |

## Project Information

### Effects of Ocean Acidification on Coastal Organisms: An Ecomaterials Perspective (OA - Ecomaterials Perspective)

**Website:** <http://depts.washington.edu/fhl/oael.html>

**Coverage:** Friday Harbor, WA

### Effects of Ocean Acidification on Coastal Organisms: An Ecomaterials Perspective

This award will support researchers based at the University of Washington's Friday Harbor Laboratories. The overall focus of the project is to determine how ocean acidification affects the integrity of biomaterials and how these effects in turn alter interactions among members of marine communities. The research plan emphasizes an ecomaterial approach; a team of biomaterials and ecomechanics experts will apply their unique perspective to detail how different combinations of environmental conditions affect the structural integrity and ecological performance of organisms. The study targets a diversity of ecologically important taxa, including bivalves, snails, crustaceans, and seaweeds, thereby providing insight into the range of possible biological responses to future changes in climate conditions. The proposal will enhance our understanding of the ecological consequences of climate change, a significant societal problem.

Each of the study systems has broader impacts in fields beyond ecomechanics. Engineers are particularly interested in biomaterials and in each system there are materials with commercial potential. The project will integrate research and education by supporting doctoral student dissertation research, providing undergraduate research opportunities via three training programs at FHL, and summer internships for talented high school students, recruited from the FHL Science Outreach Program. The participation of underrepresented groups will be broadened by actively recruiting URM and female students. Results will be disseminated in a variety of forums, including peer-reviewed scientific publications, undergraduate and graduate course material, service learning activities in K-8 classrooms, demonstrations at FHL's annual Open House, and columns for a popular science magazine.

## Program Information

### Science, Engineering and Education for Sustainability NSF-Wide Investment (SEES): Ocean Acidification (formerly CRI-OA) (SEES-OA)

**Website:** [https://www.nsf.gov/funding/pgm\\_summ.jsp?pims\\_id=503477](https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503477)

**Coverage:** global

NSF Climate Research Investment (CRI) activities that were initiated in 2010 are now included under Science, Engineering and Education for Sustainability NSF-Wide Investment (SEES). SEES is a portfolio of activities that highlights NSF's unique role in helping society address the challenge(s) of achieving sustainability. Detailed information about the SEES program is available from NSF ([https://www.nsf.gov/funding/pgm\\_summ.jsp?pims\\_id=504707](https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504707)).

In recognition of the need for basic research concerning the nature, extent and impact of ocean acidification on oceanic environments in the past, present and future, the goal of the SEES: OA program is to understand (a) the chemistry and physical chemistry of ocean acidification; (b) how ocean acidification interacts with processes at the organismal level; and (c) how the earth system history informs our understanding of the effects of ocean acidification on the present day and future ocean.

#### Solicitations issued under this program:

[NSF 10-530](#), FY 2010-FY2011

[NSF 12-500](#), FY 2012

[NSF 12-600](#), FY 2013

[NSF 13-586](#), FY 2014

NSF 13-586 was the final solicitation that will be released for this program.

#### PI Meetings:

[1st U.S. Ocean Acidification PI Meeting](#) (March 22-24, 2011, Woods Hole, MA)

[2nd U.S. Ocean Acidification PI Meeting](#) (Sept. 18-20, 2013, Washington, DC)

3rd U.S. Ocean Acidification PI Meeting (June 9-11, 2015, Woods Hole, MA - Tentative)

#### NSF media releases for the Ocean Acidification Program:

[Press Release 10-186 NSF Awards Grants to Study Effects of Ocean Acidification](#)

[Discovery Blue Mussels "Hang On" Along Rocky Shores: For How Long?](#)

[Discovery nsf.gov - National Science Foundation \(NSF\) Discoveries - Trouble in Paradise: Ocean Acidification This Way Comes - US National Science Foundation \(NSF\)](#)

[Press Release 12-179 nsf.gov - National Science Foundation \(NSF\) News - Ocean Acidification: Finding New Answers Through National Science Foundation Research Grants - US National Science Foundation \(NSF\)](#)

[Press Release 13-102 World Oceans Month Brings Mixed News for Oysters](#)

[Press Release 13-108 nsf.gov - National Science Foundation \(NSF\) News - Natural Underwater Springs Show How Coral Reefs Respond to Ocean Acidification - US National Science Foundation \(NSF\)](#)

[Press Release 13-148 Ocean acidification: Making new discoveries through National Science Foundation research grants](#)

[Press Release 13-148 - Video nsf.gov - News - Video - NSF Ocean Sciences Division Director David Conover answers questions about ocean acidification. - US National Science Foundation \(NSF\)](#)

[Press Release 14-010 nsf.gov - National Science Foundation \(NSF\) News - Palau's coral reefs surprisingly resistant to ocean acidification - US National Science Foundation \(NSF\)](#)

[Press Release 14-116 nsf.gov - National Science Foundation \(NSF\) News - Ocean Acidification: NSF awards \\$11.4 million in new grants to study effects on marine ecosystems - US National Science Foundation \(NSF\)](#)

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## Funding

| Funding Source   | Award                       |
|--|-----------------------------|
| <a href="#">NSF Division of Ocean Sciences (NSF OCE)</a> | <a href="#">OCE-1041213</a> |

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