

# Predation data of tethered *Tegula funebris* in the presence of predator *Pisaster ochraceus* within laboratory mesocosms at Bodega Marine Lab in 2018

**Website:** <https://www.bco-dmo.org/dataset/959441>

**Data Type:** experimental

**Version:** 1

**Version Date:** 2025-04-21

## Project

» [Trophic consequences of ocean acidification: Intertidal sea star predators and their grazer prey](#) (BOAR Trophic)

Contributors	Affiliation	Role
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## Abstract

To examine the impacts of fear removal on the strength of trophic cascades, we measured predation rates on tethered and untethered *Tegula funebris* in the presence of *Pisaster ochraceus* and *Cancer productus*. Data from these experiments were used to estimate predation rates on *Tegula* that did not display a behavioral fear response. Additionally, we used two predator species of differing attack rates to examine how predator identity might influence the loss of fear in a trophic cascade. The experiment was conducted within laboratory mesocosms at Bodega Marine Lab in 2018. This dataset reports the results for experiments with *Pisaster ochraceus* as the predator. See related dataset <https://www.bco-dmo.org/node/959435> for results with predator *Cancer productus*.

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## Coverage

**Location:** Collections along coastline of Sonoma County, CA; mesocosms at Bodega Marine Lab, CA

**Spatial Extent:** N:38.372172 E:-123.048703 S:38.309334 W:-123.076438

**Temporal Extent:** 2018-03-19 - 2018-04-17

## Dataset Description

See "Related Datasets" section for other datasets to be published in Ng & Gaylord (2025, in-prep). These datasets are also listed on the "Related-Resource" page for that results publication <https://www.bco->

[dmo.org/related-resource/948176](https://dmo.org/related-resource/948176)

All datasets in this project can be viewed from the "Dataset Collections" of the project page <https://www.bco-dmo.org/project/712799>

Of particular note are:

Dataset: Fear behavior with predators: tethered *Tegula funebris* in the presence of predator *Cancer productus*

<https://www.bco-dmo.org/node/959435>

(same tethered organism, different predator)

Dataset: Fear behavior with predators: tethered *Nucella lamellosa* in the presence of predator *Pisaster ochraceus*

<https://www.bco-dmo.org/dataset/948222>

(different tethered organism)

## Methods & Sampling

*Pisaster ochraceus*, *Cancer productus*, and *Tegula funebris* were collected along the coastline of Sonoma County, California in 2018. Both *Pisaster* and *Tegula* were sampled at Carmet Beach (38.372172 N, 123.076438 W), and the *Cancer* crabs were gathered subtidally from Doran Beach (38.309334 N, - 123.048703 W).

We introduced predators to snails that either displayed a fear response or did not to determine the baseline and enhanced culling rates in the fear and no-fear treatments respectively. For the enhanced culling rates where prey did not have a behavioral fear response, (i.e. did not leave the water in the presence of predators), we tethered a subset of our snails when subjecting them to predators. These latter trials provided data on predation rates when snails spent 100% of their time underwater such that they could not implement their standard fear-induced flight responses. We tethered snails using 10mm long mono-filament line attached to the shell with cyanoacrylate adhesive and to the base of the mesocosm using epoxy. Snails were distributed uniformly over the mesocosm. For *Tegula*, we used 20 mesocosms each with ten *Tegula* and an individual *Pisaster* (86.7mm +/- 14.4mm from madreporite to tip of longest arm). Ten of the mesocosms contained tethered snails and the other half had untethered snails. We used a similar approach with 20 *Cancer* crabs (136.8mm +/- 10.8mm carapace width).

We ran a linear regression on logged proportion of snails surviving with tethering, duration of the experiment, and their interactive effects as fixed factors.

Organism identifiers (taxonomic names used in dataset metadata):

Scientific Name, Life Science Identifier (LSID)

*Tegula funebris*, urn:lsid:marinespecies.org:taxname:534190

*Nucella lamellosa*, urn:lsid:marinespecies.org:taxname:404218

*Pisaster ochraceus*, urn:lsid:marinespecies.org:taxname:240755

*Cancer productus*, urn:lsid:marinespecies.org:taxname:440382

## Data Processing Description

See "Supplemental Files" for analysis package (R-language).

## BCO-DMO Processing Description

\* Raw data and analysis R-scripts for three related datasets were packaged into the supplemental file *Tegula tethering with predators analysis package.zip* (no modifications to files). The zip file was attached to two datasets (BCO-DMO datasets 959435 and 959441).

- \* Data table from submitted file "Pisaster pred data.csv" was imported into the BCO-DMO data system. Table will appear on this dataset page as Data File: 959441\_v1\_predation\_t-funebralis-pisaster.csv (with other download format options).
- \* Inconsistent date format in date column corrected to the same format by changing "19-Mar" to 3/19/18 and "20-Mar" to 3/20/18. (year provided as 2018 metadata.) 2018 is consistent with other adjacent days reported in the Date column.
- \* Date column (format was %d-%b, e.g. 25-Apr) transformed to ISO date %Y-%m-%d (e.g. 2018-04-25), year assumed to be 2018 from provided metadata. Will confirm with data submitter.
- \* Column "Date" renamed to "Date\_local", and "Time" renamed to "Time\_local". [US/Pacific local time]
- \* New column "ISO\_DateTime\_UTC" added by combining "Date\_local" and "Time\_local" with timezone conversion to UTC in ISO 8601 format.
- \* Any column names with characters other than letters, numbers and underscores were renamed to meet BCO-DMO naming conventions designed to support broad re-use by a variety of research tools and scripting languages. [Only numbers, letters, and underscores. Can not start with a number]

#### Missing Data Identifiers:

- \* In the BCO-DMO data system missing data identifiers are displayed according to the format of data you access. For example, in csv files it will be blank (null) values. In Matlab .mat files it will be NaN values. When viewing data online at BCO-DMO, the missing value will be shown as blank (null) values.
- \* Taxonomic identifiers added to the metadata (Life Science Identifiers (LSID)). Names matched using the World Register of Marine Species (WoRMS) on 2024-01-02.

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## Data Files

File
<b>959441_v1_predation_t-funebralis-pisaster.csv</b> (Comma Separated Values (.csv), 38.46 KB) MD5:2f3ea5a77404e3fa2da1af36721c397f  Primary data file for dataset ID 959441, version 1

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## Supplemental Files

File
<b>Tegula tethering with predators analysis package (R-language)</b> filename: Tegula_tethering_with_predators_analysis_package.zip  <div>(ZIP Archive (ZIP), 53.09 KB)</div> MD5:c9764a6183bcbe31276683ee3eaa176d  This analysis and plotting package contains scripts for analyzing the laboratory data. Note that the csv data tables included in this package are the exact format of the data required to import into the supplied R-scripts. They differ slightly from the data provided from the BCO-DMO data system due to column naming requirements and date formats (see "BCO-DMO Processing" section).  Zip file contents:  "Cancer tegula teth stats.csv" = Tegula tethering data with Cancer crabs. Data with the filename and column names required for the analysis R-script. This is the source file imported into the BCO-DMO data system for dataset 959435 version 1 ( <a href="https://www.bco-dmo.org/dataset/959435">https://www.bco-dmo.org/dataset/959435</a> ).  "Cancer tegula predation stats final.R" = Tegula predation analysis with Cancer productus  "Pisaster pred data.csv" = Tegula tethering data with Pisaster seastar. Data with the filename and column names required for the analysis R-script. This is the source file imported into the BCO-DMO data system for dataset 959441 version 1 ( <a href="https://www.bco-dmo.org/dataset/959441">https://www.bco-dmo.org/dataset/959441</a> ).  "Pisaster behavior stats final.R" = Tegula predation analysis with Pisaster ochraceus.

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## Related Publications

Ng, G., & Gaylord, B. (2025). Identifying the role of fear in trophic cascades. Ecosphere. Manuscript in preparation.  
*Results*

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## Related Datasets

### IsRelatedTo

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Ng, G., Gaylord, B. (2025) **Algal consumption data from Tegula in the presence of the predator Cancer productus, displaying anti-predatory responses or not within mesocosms at Bodega Marine Lab in 2018**. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2025-01-02 doi:10.26008/1912/bco-dmo.947753.1 [[view at BCO-DMO](#)]  
*Relationship Description: Data from experiments to be published in results publication Ng & Gaylord (2025, in-prep). See "Related-Resource" page for that results publication <https://www.bco-dmo.org/related-resource/948176>*

Ng, G., Gaylord, B. (2025) **Algal consumption data from Tegula in the presence of the predator Pisaster ochraceus, displaying anti-predatory responses or not within mesocosms at Bodega Marine Lab in 2018**. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2025-01-02 doi:10.26008/1912/bco-dmo.947757.1 [[view at BCO-DMO](#)]  
*Relationship Description: Data from experiments to be published in results publication Ng & Gaylord (2025, in-prep). See "Related-Resource" page for that results publication <https://www.bco-dmo.org/related-resource/948176>*

Ng, G., Gaylord, B. (2025) **Barnacle consumption of Nucella lamellosa that either displayed behavioral or morphological fear responses or not in the presence of predators within laboratory mesocosms at Bodega Marine Lab in 2019**. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2025-01-09 doi:10.26008/1912/bco-dmo.948228.1 [[view at BCO-DMO](#)]  
*Relationship Description: Data from experiments to be published in results publication Ng & Gaylord (2025, in-prep). See "Related-Resource" page for that results publication <https://www.bco-dmo.org/related-resource/948176>*

Ng, G., Gaylord, B. (2025) **Behavioral data of Nucella lamellosa in the presence of predators within laboratory mesocosms at Bodega Marine Lab in 2018**. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2025-01-09 doi:10.26008/1912/bco-dmo.948204.1 [[view at BCO-DMO](#)]  
*Relationship Description: Data from experiments to be published in results publication Ng & Gaylord (2025, in-prep). See "Related-Resource" page for that results publication <https://www.bco-dmo.org/related-resource/948176>*

Ng, G., Gaylord, B. (2025) **Behavioral data of Tegula funebris in the presence of predator Cancer productus within laboratory mesocosms at Bodega Marine Lab in 2018**. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2025-01-09 doi:10.26008/1912/bco-dmo.948210.1 [[view at BCO-DMO](#)]  
*Relationship Description: Data from experiments to be published in results publication Ng & Gaylord (2025, in-prep). See "Related-Resource" page for that results publication <https://www.bco-dmo.org/related-resource/948176>*

Ng, G., Gaylord, B. (2025) **Behavioral data of Tegula funebris in the presence of predator Pisaster ochraceus within laboratory mesocosms at Bodega Marine Lab in 2018**. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2025-01-09 doi:10.26008/1912/bco-dmo.948216.1 [[view at BCO-DMO](#)]  
*Relationship Description: Data from experiments to be published in results publication Ng & Gaylord (2025, in-prep). See "Related-Resource" page for that results publication <https://www.bco-dmo.org/related-resource/948176>*

Ng, G., Gaylord, B. (2025) **Nucella lamellosa morphometric measurements after induction in the presence of predatory Pisaster ochraceus at Bodega Marine Laboratory in 2018 and 2019**. Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2025-

04-21 doi:10.26008/1912/bco-dmo.959533.1 [[view at BCO-DMO](#)]

*Relationship Description: Data from experiments to be published in results publication Ng & Gaylord (2025, in-prep). See "Related-Resource" page for that results publication <https://www.bco-dmo.org/related-resource/948176>*

Ng, G., Gaylord, B. (2025) **Predation data of tethered *Nucella lamellosa* in the presence of predator *Pisaster ochraceus* within laboratory mesocosms at Bodega Marine Lab in 2019.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2025-01-09 doi:10.26008/1912/bco-dmo.948222.1 [[view at BCO-DMO](#)]

*Relationship Description: Data from experiments to be published in results publication Ng & Gaylord (2025, in-prep). See "Related-Resource" page for that results publication <https://www.bco-dmo.org/related-resource/948176>*

Ng, G., Gaylord, B. (2025) **Predation data of tethered *Tegula funebris* in the presence of predator *Cancer productus* within laboratory mesocosms at Bodega Marine Lab in 2018.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2025-04-21 doi:10.26008/1912/bco-dmo.959435.1 [[view at BCO-DMO](#)]

*Relationship Description: Data from experiments to be published in results publication Ng & Gaylord (2025, in-prep). See "Related-Resource" page for that results publication <https://www.bco-dmo.org/related-resource/948176>*

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## Parameters

Parameter	Description	Units
Date_local	date (local, US/Pacific time zone) of data collection.	unitless
Time_local	time (local, US/Pacific time zone) of data collection.	unitless
ISO_DateTime_UTC	datetime with timezone (UTC, in ISO 8601 format) of the data collection.	unitless
Observation	the number of observations since the start of the experiment.	unitless
Containers	mesocosm identifier. A unique identifier for individual mesocosm.	unitless
Tethered	whether the snails were tethered (T) or not (NT).	unitless
Snails_not_freed	the number of snails (out of 10) that did not escape from their tethers during the course of the experiment.	unitless
Total_number_of_snails	number of total snails used per mesocosm.	unitless
Snails_Alive	number of snails still alive.	unitless
Cumu_snails_eaten	is the cumulative sum of snails consumed since the start of the experiment.	unitless
Teth_snails_alive	number of snails still alive at that time point minus the number of snails that have escaped their tethers (potentially leading to negative numbers).	unitless
Snails_currently_being_consumed	the number of snails that were in the process of being consumed by Pisaster but not yet counted as eaten.	unitless
Snails_Eaten	the number of snails consumed since the last observation	unitless
Seatable	Seatable identifier. which of two sea tables were used in the experiment.	unitless
Pisaster	the size of the Pisaster used (length in mm from madreporite to longest arm).	millimeters (mm)

## Project Information

### Trophic consequences of ocean acidification: Intertidal sea star predators and their grazer prey (BOAR Trophic)

**Coverage:** Central California coast, USA

#### *NSF Award Abstract:*

The absorption of human-produced carbon dioxide into the world's oceans is altering the chemistry of seawater, including decreasing its pH. Such changes, collectively called "ocean acidification", are expected to influence numerous types of sea creatures. This project examines how shifts in ocean pH affect animal behavior and thus interactions among species. It uses a case study system that involves sea star predators, snail grazers that they eat, and seaweeds consumed by the latter. The rocky-shore habitats where these organisms live have a long history of attention, and new findings from this work will further extend an already-large body of marine ecological knowledge. The project provides support for graduate and undergraduate students, including underrepresented students from a nearby community college. The project underpins the development of a new educational module for local K-12 schools. Findings will moreover be communicated to the public through the use of short film documentaries, as well as through established relationships with policy, management, and industry groups, and contacts with the media.

Ocean acidification is a global-scale perturbation. Most research on the topic, however, has examined effects on single species operating in isolation, leaving interactions among species underexplored. This project confronts this knowledge gap by considering how ocean acidification may shift predator-prey relationships through altered behavior. It targets as a model system sea stars, their gastropod grazer prey, and macroalgae consumed by the latter, via four lines of inquiry. 1) The project examines the functional response of the focal taxa to altered seawater chemistry, using experiments that target up to 16 discrete levels of pH. This experimental design is essential for identifying nonlinearities and tipping points. 2) The project addresses both consumptive and non-consumptive components of direct and indirect species interactions. The capacity of ocean acidification to influence such links is poorly known, and better understanding of this issue is a recognized priority. 3) The project combines controlled laboratory experiments with field trials that exploit tide pools and their unique pH signatures as natural mesocosms. Field tests of ocean acidification effects are relatively rare and are sorely needed. 4) A final research phase expands upon the above three components to address effects of ocean acidification on multiple additional taxa that interact in rocky intertidal systems, to provide a broad database that may have utility for future experiments or modeling.

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## Funding

Funding Source	Award
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-1636191</a>

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