Behavioral data of Nucella lamellosa in the presence of predators within laboratory mesocosms at Bodega Marine Lab in 2018

Website: https://www.bco-dmo.org/dataset/948204
Data Type: experimental
Version: 1
Version Date: 2025-01-09

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

Contributors	Affiliation	Role
Gaylord, Brian	University of California - Davis: Bodega Marine Laboratory (UC Davis-BML)	Principal Investigator
Ng, Gabriel	University of California - Davis: Bodega Marine Laboratory (UC Davis-BML)	Student
York, Amber D.	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
To examine the intensity of anti-predatory behavior of both Tegula funebralis and Nucella lamellosa, we measured the proportion of time individual snails spend above the waterline in the presence and absence of their predator species, Pisaster ochraceus and Cancer productus. Data from this experiment are used to calculate estimated predation rates for snails that do not behaviorally respond to their predators, which are used to determine the impact anti-predatory responses have on the strength of trophic cascades. The experiment was conducted within laboratory mesocosms at Bodega Marine Lab in 2018 and 2019. This dataset reports results from mesocosms in this experiment with Nucella lamellosa in the presence of predator cues. See "Related Datasets" section for results from other mesocosms and experiments to be published in Ng & Gaylord (2025, in-prep).

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Coverage

Location: Bodega Marine Laboratory, Bodega Bay, CA; Washington Park, Anacortes, WA
Spatial Extent: **N**:48.50219 **E**:-122.691865 **S**:38.309334 **W**:-123.076438
Temporal Extent: 2018-12-11 - 2018-12-25

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

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

Methods & Sampling

To examine the intensity of anti-predatory behavior of both *Tegula funebralis* and *Nucella lamellosa*, we measured the proportion of time individual snails spend above the waterline in the presence and absence of their predator species, *Pisaster ochraceus* and *Cancer productus*. Data from this experiment are used to calculate estimated predation rates for snails that do not behaviorally respond to their predators, which are used to determine the impact anti-predatory responses have on the strength of trophic cascades. The experiment was conducted within laboratory mesocosms at Bodega Marine Lab in 2018 and 2019.

Pisaster ochraceus, *Cancer productus*, and *Tegula funebralis* 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). *Nucella lamellosa* were collected at Washington Park in Anacortes, Washington (48.502190 N, -122.691865 W) in July 2019.

We measured the behavior of both *Nucella* and *Tegula* in the presence and absence of their respective predators. We established 20 mesocosms (33cm x 20cm x 11.5cm) each with 10 *Tegula* that were provided with *Ulva* sp. *ad libitum.* Half of the mesocosms were exposed to *Pisaster* cue and the other 10 to just seawater. Predator exposure was accomplished by placing an individual *Pisaster* in a separate container, and then allowing cue generated by it to flow into the appropriate mesocosms. *Pisaster* were fed an individual *Tegula* once a week. Over a period of 14 days, we measured the number of snails either above or below the water line. *Ulva* sp. was included in the experiment in case its presence affected the snails' decision to leave the water. We used the same procedure with *Cancer* to estimate *Tegula's* behavioral response to them. We also used an analogous procedure to estimate *Nucella's* behavioral response to *Pisaster*, with the exception that only five snails were used in each mesocosm due to the larger sizes of individuals of this snail species, and a small rock with *Balanus glandula* replaced *Ulva* as the basal resource*.*

Because a subset of our *Nucella* displayed morphological inducible defenses from the induction period, we also crossed the *Pisaster* cue treatment with the induced morphology treatment such that of the 10 mesocosms experiencing *Pisaster* cues, half of them contained induced *Nucella* and the other half had non-induced *Nucella*. Of the 10 mesocosms with no predator cue, half had induced *Nucella* and the other half had non-induced individuals.

To test the effect of predator cue on the snails' behavior, we conducted a logistic regression on the proportion of snails in and out of the water line with container as a random effect. For *Nucella*, we also added induced morphology as a predictor along with its interaction with *Pisaster* cue, but because both terms were non-significant, we removed them from the final model. In addition, we added the containers they were housed in during the induction period as an additional random effect.

Organism identifiers (taxonomic names used in dataset metadata):

Scientific Name, Life Science Identifier (LSID)
Tegula funebralis, 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
Ulva sp., urn:lsid:marinespecies.org:taxname:144296
Balanus glandula, urn:lsid:marinespecies.org:taxname:394848

BCO-DMO Processing Description

* Bounding box for dataset determined by sampling locations provided and location of experiment at Bodega Bay Marine Laboratory (38.3180548,-123.0743098).

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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

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 http://lod.bco-dmo.org/id/dataset/947753 [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 http://lod.bco-dmo.org/id/dataset/947757 [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/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 http://lod.bco-dmo.org/id/dataset/948228 [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 funebralis 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 http://lod.bco-dmo.org/id/dataset/948210 [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 funebralis 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 http://lod.bco-dmo.org/id/dataset/948216 [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 2019.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2025-01-09 http://lod.bco-dmo.org/id/dataset/948240 [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 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 http://lod.bco-

dmo.org/id/dataset/948222 [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 funebralis 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 http://lod.bco-dmo.org/id/dataset/948234 [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

Parameters for this dataset have not yet been identified

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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 macoalgae 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
NSF Division of Ocean Sciences (NSF OCE)	OCE-1636191