

# Whelk sizes measured from 4 sites relative to tidal elevation from coastal Oregon, 2014-2015

**Website:** <https://www.bco-dmo.org/dataset/653924>

**Data Type:** Other Field Results

**Version:**

**Version Date:** 2016-08-12

## Project

» [Testing the rocky intertidal community consequences of the decimation of purple sea star populations along the Oregon coast by sea star wasting disease](#) (Sea star wasting)

## Program

» [Partnership for Interdisciplinary Studies of Coastal Oceans](#) (PISCO)

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## Dataset Description

Data are from surveys in July 2014 and 2015 of whelk size distributions. Whelks were measured from apex to bottom of siphonal canal at 4 sites in haphazard quadrats until ~200 individuals of each species were measured. This sheet is the lengths of each individual whelk measured (i.e., each row is one whelk).

### Related Reference:

Elizabeth B. Cerny-Chipman, Jenna M. Sullivan, and Bruce A. Menge. Whelk predators exhibit limited population responses and community effects following disease-driven declines of the keystone sea star *Pisaster ochraceus*. In Revision: MEPS.

### Related Datasets:

[Predator removals](#)

[Prey percent covers](#)

[Whelk size distributions: counts](#)

[Whelk surveys](#)

## Methods & Sampling

## Study system:

Our study included 4 sites along the Oregon coast: Strawberry Hill (44.250°N-124.115°W) and Yachats Beach (44.319°N-124.109°W), located on Cape Perpetua, and Fogarty Creek (44.837°N-124.0587°W) and Boiler Bay (44.832°N-124.061°W) located on Cape Foulweather (Fig.1). Cape Perpetua is a rocky headland adjacent to a wide continental shelf offshore that promotes retention of propagules such as larvae and phytoplankton (Menge et al. 2015). As a result, Cape Perpetua intertidal sites are characterized by high phytoplankton productivity and high recruitment of invertebrates (Menge et al. 1997, 2004, 2015). Cape Foulweather, in contrast, is characterized by a narrower offshore continental shelf, which leads to reduced retentiveness, lower invertebrate abundance, and high macrophyte abundance. Prior to the onset of SSWD, densities of *P. ochraceus* could be as high as 8 individuals m<sup>-2</sup> at Cape Perpetua and 4 individuals m<sup>-2</sup> at Cape Foulweather sites (Menge et al. 2016).

## Whelk size distributions

With *P. ochraceus* at low densities, whelks presumably were relieved from both competitive and consumptive pressure. Thus, we predicted that whelks would become both more abundant and larger in size as a result of greater food resources and less predation. We measured whelk size distributions at the same four sites used in our vertical abundance surveys. We haphazardly placed 0.0625 m<sup>2</sup> quadrats in the intertidal and extracted all whelks in the quadrat taking care to include small individuals. Whelks were sorted by species and measured with calipers to the nearest millimeter. This sampling was done in a semi-stratified pattern vertically along the shore within areas of intermediate wave exposure until we had at least 200 individuals of each species at each site. Size distribution surveys were conducted in July in 2014 and 2015. When possible, all counts were conducted in a single day at each site in order to minimize the chance of repeatedly counting the same individuals.

## Data Processing Description

### Statistical Analyses

Whelk size distributions were normal and were analyzed using ANOVAs, which included terms for site, year and site x year. For *N. ostrina*, the site x year interaction was not significant, so we used a Type II Sums of Squares ANOVA as data were unbalanced. Pairwise contrasts of interest were examined using the 'phia' package. Analysis was performed using R version 3.3.1 (R Core Team 2014) and RStudio version 0.98.1085 (RStudio Team 2014). We also used the 'reshape2' (Wickham 2007), 'ggplot2' (Wickham 2009), 'lattice' (Sarkar 2008), 'plyr' (Wickham 2011), and 'scale' (Wickham 2016) packages for data manipulation, analysis, and visualization.

### BCO-DMO Processing:

- added conventional header with dataset name, PI name, version date
- renamed parameters to BCO-DMO standard
- reformatted date from m/d/yyyy to yyymmdd
- replaced . in specific\_cover\_type column with nd (no data)

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## Data Files

File
<b>whelk_sizedist_ind.csv</b> (Comma Separated Values (.csv), 68.66 KB) MD5:b960bb47ad661c2d65427048a421ba03
Primary data file for dataset ID 653924

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## Parameters

Parameter	Description	Units
date	Date of monitoring in format YYYYMMDD	year-month-day
site	One of four sites: BB=Boiler Bay; FC=Fogarty Creek; SH=Strawberry Hill; YB=Yachats Beach	unitless
zone	Ecological zone: ua=upper algal zone; lm=lower edge of mussel bed; mm=middle of mussel bed; um=upper edge of mussel bed; hi=high zone; mt=bed of <i>M. trossulus</i> in low zone	unitless
exposure	Wave exposure. e=exposed; me=mid-exposed	unitless
quadrat	Quadrat number per site per survey day	unitless
species	Whelk species: can= <i>Nucella canaliculata</i> ; ost= <i>N. ostrina</i>	unitless
size	Value is from top of apex to bottom of siphonal canal	mm
specific_cover_type	Note if cover was different than that which typified the zone: mt= <i>Mytilus trossulus</i> bed; scar= <i>Semibalanus cariosus</i>	unitless

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## Deployments

### Menge\_2014

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/653801">https://www.bco-dmo.org/deployment/653801</a>
<b>Platform</b>	OSU
<b>Start Date</b>	2014-04-16
<b>End Date</b>	2015-07-17
<b>Description</b>	Benthic ecology before and after Seastar Wasting Disease infection.

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## Project Information

### Testing the rocky intertidal community consequences of the decimation of purple sea star populations along the Oregon coast by sea star wasting disease (Sea star wasting)

**Website:** <http://www.eeb.ucsc.edu/pacificrockyintertidal/data-products/sea-star-wasting/>

**Coverage:** Oregon coast

This study will investigate the ecological consequences of the decimation of sea star populations by wasting disease along the Oregon coast. Hallmarks of wasting disease are the formation of sores on the sea star that progress to cause loss of arms, and ultimately death of the animal. Wasting disease was reported in sea star populations including those of the purple sea star, *Pisaster ochraceus*, in British Columbia, Washington, and California as early as April 2013. In Oregon, wasting was first observed in April 2014, and by June 2014 rates of infection ranged up to 80%, and sea star abundance had declined. At that rate, many populations may disappear by the end of summer 2014. Prior research has shown that in the absence of the purple sea star, mid-shore mussel populations increase, and ultimately overgrow the sea weeds and invertebrates that occur low on the shore, reducing biodiversity. However, because disease events of this magnitude have never occurred along the entire coastline, it is unclear if the small-scale expansion of mussels observed previously will be a general result of this event. One possibility is that predators unaffected by wasting, such as whelks and crabs, will increase their predation effects and blunt the expected invasion of mussels to the low shore. The

research in this project will evaluate this possibility by testing the role of these alternative predators. Broader Impacts include the training of undergraduate and graduate students, the involvement of coastal residents and the production of microdocumentaries and video to document the changing context of this ecosystem.

The research project is designed to test three hypotheses. First, that in the absence of *Pisaster ochraceus*, predation by whelks will increase in strength through increases in whelk abundance and in whelk size, and at least partially compensate for the absence of *Pisaster*. Second, the small sea star *Leptasterias* spp. will also expand its role as a predator through increased size and abundance, and expansion of its habitat beyond mussel beds. Although individuals of this sea star have been observed to suffer from wasting as well, the frequency so far appears low, and it seems likely this species may persist. Third, the crab *Cancer productus*, normally mostly a subtidal species, will expand its range into the intertidal and help to compensate for the loss of *Pisaster*. Tests of these hypotheses will include manual removal experiments (whelk removal, *Leptasterias* removal, removal of both and of neither), cage exclusion experiments (whelk exclusions), cage inclusion-exclusion experiments (*Leptasterias* inclusion, *Leptasterias* exclusion). Experiments will be replicated with appropriate controls, and done at multiple sites on the central Oregon coast that vary naturally in population abundances, rates of prey and predator recruitment, and oceanographic conditions. Results obtained under this unprecedented set of circumstances will deepen and expand our empirical understanding of the dynamics of an iconic ecosystem, and will help parameterize community models.

**Additional Project Information:** [Sea Star Wasting Map](#)

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## Program Information

### Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO)

**Website:** <http://www.piscoweb.org/>

**Coverage:** West coast of North America from Mexico to Alaska

The Partnership for Interdisciplinary Studies of Coastal Oceans is a long-term ecosystem research and monitoring program established with the goals of:

- understanding dynamics of the coastal ocean ecosystem along the U.S. west coast
- sharing that knowledge so ocean managers and policy makers can make science based decisions regarding coastal and marine stewardship
- producing a new generation of scientists trained in interdisciplinary collaborative approaches

Over the last 10 years, PISCO has successfully built a unique research program that combines complementary disciplines to answer critical environmental questions and inform management and policy. Activities are conducted at the latitudinal scale of the California Current Large Marine Ecosystem along the west coast of North America, but anchored around the dynamics of coastal, hardbottom habitats and the oceanography of the nearshore ocean – among the most productive and diverse components of this ecosystem. The program integrates studies of changes in the ocean environment through ecological monitoring and experiments. Scientists examine the causes and consequences of ecosystem changes over spatial scales that are the most relevant to marine species and management, but largely unstudied elsewhere.

Findings are linked to solutions through a growing portfolio of tools for policy and management decisions. The time from scientific discovery to policy change is greatly reduced by coordinated, efficient links between scientists and key decision makers.

Core elements of PISCO are:

- Interdisciplinary ecosystem science
- Data archiving and sharing
- Outreach to public and decision-making user groups
- Interdisciplinary training
- Coordination of distributed research team

Established in 1999 with funding from The David and Lucile Packard Foundation, PISCO is led by scientists from core campuses Oregon State University (OSU); Stanford University's Hopkins Marine Station; University of California, Santa Cruz (UCSC); and University of California, Santa Barbara (UCSB). Collaborators from other institutions also contribute to leadership and development of PISCO programs. As of 2005, core PISCO activities are funded by collaborative grants from The David and Lucile Packard Foundation and the Gordon and Betty Moore Foundation. Core support, along with additional funding from diverse public and private sources, make this unique partnership possible.

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## Funding

Funding Source	Award
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-1448913</a>

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