

Estimates of island-wide sea otter population density as surveyed with boats circumnavigating nine focal islands within the central and western Aleutian Islands (Alaska) from 1991-2015.

Website: <https://www.bco-dmo.org/dataset/838077>

Data Type: Cruise Results, Other Field Results

Version: 1

Version Date: 2021-01-26

Project

» [Ocean Acidification: Century Scale Impacts to Ecosystem Structure and Function of Aleutian Kelp Forests](#) (OA Kelp Forest Function)

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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Abstract

Island-wide sea otter population densities were quantified at each of six focal islands (as well as three other islands) over the last three decades (1991-2015). Surveys were conducted opportunistically as part of a long-term monitoring program coordinated and overseen by the U.S. Fish and Wildlife Service.

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Coverage

Spatial Extent: N:52.8991 E:-176.174031 S:51.518 W:172.90952

Temporal Extent: 1991 - 2015

Dataset Description

These data were published in Table S1 in Rasher et al., 2020 (see Related Publications section below).

Methods & Sampling

At each island, visual counts of sea otters were made from a 4 m open boat as it circumnavigated the island perimeter at a speed of 18 to 25 km per hour, just outside of any existing kelp canopy and/or close enough to shore (50-150 m) to be able to easily see an animal swimming or resting on the surface. The perimeter of the island was divided into sectors, and these designations were utilized every year a survey was conducted. Survey teams consisted of a primary observer, data recorder, and boat operator (who also acted as a secondary observer). As the boat moved parallel to shore and around any offshore islets, observers visually scanned for sea otters both inshore and offshore of the boat trajectory and, in the case of larger sea otter groups or difficult-to-access locations, the boat was paused and binoculars were used to scan the area and obtain accurate counts. Whenever sea otters were observed and counted, we noted their geo-location, group size, reproductive status (single animals or females with pups), whether the animals were less than or greater than 20 m from the nearest point of land or emergent substrate, and whether each animal was within or outside a surface canopy of kelp. Here, we report only island-wide abundance estimates for independent (non-pup) individuals, as dependent pup counts were variable due to annual differences in the timing of reproduction. Because surveys varied from year to year in terms of the percentage of the island's perimeter surveyed (ranging from ~50% to 100%), we standardized counts to linear density (independent sea otters per km of linear coastline surveyed).

NOTE: Surveys were conducted opportunistically, and thus intermittently, from 1991 to 2015 at each island. As such, some islands were surveyed more frequently than others.

Data Processing Description

BCO-DMO processing:

- Adjusted parameter names to comply with database requirements
- Added a conventional header with dataset name, PIs, and version date
- Converted longitude West values to degrees East

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Data Files

File
island_survey_sea_otter_density_historical.csv (Comma Separated Values (.csv), 7.42 KB) MD5:e92485e59abf23a1822fd843ac169111
Primary data file for dataset ID 838077

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Related Publications

Doroff, A. M., Estes, J. A., Tinker, M. T., Burn, D. M., & Evans, T. J. (2003). SEA OTTER POPULATION DECLINES IN THE ALEUTIAN ARCHIPELAGO. *Journal of Mammalogy*, 84(1), 55-64. doi:10.1644/1545-1542(2003)084<0055:sopdit>2.0.co;2 [https://doi.org/10.1644/1545-1542\(2003\)084<0055:SOPDIT>2.0.CO;2](https://doi.org/10.1644/1545-1542(2003)084<0055:SOPDIT>2.0.CO;2)
Results

Rasher, D. B., Steneck, R. S., Halfar, J., Kroeker, K. J., Ries, J. B., Tinker, M. T., ... Estes, J. A. (2020). Keystone predators govern the pathway and pace of climate impacts in a subarctic marine ecosystem. *Science*, 369(6509), 1351-1354. doi:[10.1126/science.aav7515](https://doi.org/10.1126/science.aav7515)
Results

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Parameters

Parameter	Description	Units
Year	Year of survey	Year
Island	Name of island surveyed	Unitless
Latitude	Latitude of island surveyed	Decimal degrees
Longitude	Longitude of island surveyed	Decimal degrees
Density	Number of individuals per linear km of coastline	Units

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Binoculars Handheld
Generic Instrument Description	Handheld binoculars, generally used for bird or mammal observations.

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Deployments

PS1409

Website	https://www.bco-dmo.org/deployment/755184
Platform	R/V Point Sur
Start Date	2014-07-05
End Date	2014-07-22
Description	Benthic community studies associated with project "Project: Ocean Acidification: Century Scale Impacts to Ecosystem Structure and Function of Aleutian Kelp Forests".

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Project Information

Ocean Acidification: Century Scale Impacts to Ecosystem Structure and Function of Aleutian Kelp Forests (OA Kelp Forest Function)

Extracted from the NSF award abstract:

Marine calcifying organisms are most at risk to rapid ocean acidification (OA) in cold-water ecosystems. The investigators propose to determine if a globally unique and widespread calcareous alga in Alaska's Aleutian archipelago, *Clathromorphum nereostratum*, is threatened with extinction due to the combined effects of OA and food web alterations. *C. nereostratum* is a slow growing coralline alga that can live to at least 2000 years. It accretes massive 'bioherms' that dominate the regions' rocky substrate both under kelp forests and deforested sea urchin barrens. It develops growth bands (similar to tree rings) in its calcareous skeleton, which effectively record its annual calcification rate over centuries. Pilot data suggest the skeletal density of *C. nereostratum* began to decline precipitously in the 1990's in some parts of the Aleutian archipelago. The investigators now propose to use high-resolution microscopy and microCT imaging to examine how the growth and skeletal density of *C. nereostratum* has changed in the past 300 years (i.e., since the industrial

revolution) across the western Aleutians. They will compare their records of algal skeletal densities and their variation through time with reconstructions of past climate to infer causes of change. In addition, the investigators will examine whether the alga's defense against grazing by sea urchins is compromised by ongoing ocean acidification. The investigators will survey the extent of *C. nereostratum* bioerosion occurring at 10 sites spanning the western Aleutians, both inside and outside of kelp forests. At each site they will compare these patterns to observed and monitored ecosystem trophic structure and recent *C. nereostratum* calcification rates. Field observations will be combined with laboratory experiments to determine if it is a decline in the alga's skeletal density (due to recent OA and warming), an increase in grazing intensity (due to recent trophic-level dysfunction), or their interactive effects that are likely responsible for bioerosion patterns inside vs. outside of forests. By sampling *C. nereostratum* inside and outside of forests, they will determine if kelp forests locally increase pH via photosynthesis, and thus buffer the effects of OA on coralline calcification. The combination of field observations with laboratory controlled experiments, manipulating CO₂ and temperature, will help elucidate drivers of calcification and project how these species interactions will likely change in the near future. The project will provide the first in situ example of how ongoing ocean acidification is affecting the physiology of long-lived, carbonate producing organisms in the subarctic North Pacific. It will also be one of the first studies to document whether OA, ocean warming, and food web changes to ecological processes are interacting in complex ways to reshape the outcome of species interactions in nature.

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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

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).

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
NSF Arctic Sciences (NSF ARC)	PLR-1316141

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