Kelp forest community structure studied with respect to Clathromorphum bioerosion at central and western Aleutian Islands, Alaska from visual surveys, July 2014

Website: https://www.bco-dmo.org/dataset/755265
Data Type: Cruise Results
Version: 1
Version Date: 2019-01-30

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
Steneck, Robert S.	University of Maine (U Maine DMC)	Principal Investigator
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Abstract
Kelp forest community structure studied with respect to Clathromorphum bioerosion at central and western Aleutian Islands, Alaska from visual surveys, July 2014. Estimates were derived from visual surveys, performed via SCUBA.

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Coverage

Spatial Extent: **N**:52.9306 **E**:-176.61505 **S**:51.41001 **W**:173.28
Temporal Extent: 2014-07-10 - 2014-07-21

Methods & Sampling

Prior to examining *Clathromorphum nereostratum* bioerosion at each focal study site, we characterized the ecological status of the site by quantifying the abundance of its benthic constituents (i.e., kelps, understory algae, coralline algae, etc.) using the same methods that have been employed by us and others over the past 30 years (Estes et al. 2010). We characterized two types of sites: (1) those that have long persisted as urchin barrens (“habitat.type” = “Barren”) and (2) urchin barrens that are situated immediately adjacent to shallow, remnant kelp stands, and thereby receive urchin food subsidies (“habitat.type” = “Barren + kelp subsidy”). At

these latter sites, we also surveyed the adjacent kelp stand (“habitat.type” = “Shallow kelp”).

At each site, a diver sampled twenty 0.25-m^2 quadrats at the target depth (21-37 feet) and along its contour, taking a random number of kicks between quadrats. Patches of unconsolidated substrate were rare on the rocky reef; however, if one was encountered while sampling, the diver took an additional random number of kicks and again deployed the quadrat. In each quadrat, s/he counted the stipe density of all kelps (by species) and estimated the abundance (percent cover) of fleshy red algae, sessile invertebrates, encrusting coralline algae (almost exclusively *C. nereostratum*), branching coralline algae, and other algae such as Desmarestia or Codium species. Percent cover was visually estimated on a scale of 1-6, where 1 = 0-5%, 2 = 6-25%, 3 = 26-50%, 4 = 51-75%, 5 = 76-95%, and 6 = 96-100 % cover.

Data Processing Description

BCO-DMO Processing Notes:
- added conventional header with dataset name, PI name, version date
- modified parameter names to conform with BCO-DMO naming conventions
- re-formatted date from m/d/yyyy to yyyy-mm-dd
- converted west longitudes to negative values and removed E/W designations
- changed latitude for Kirilof Point from 51.14198 to 51.41198 as req'd by PI

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Data Files

File
target_vegetation.csv (Comma Separated Values (.csv), 40.70 KB) MD5:8406cbd7521c79c8466cdd56773853f3 Primary data file for dataset ID 755265

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Related Publications

Estes, J. A., Tinker, M. T., & Bodkin, J. L. (2010). Using Ecological Function to Develop Recovery Criteria for Depleted Species: Sea Otters and Kelp Forests in the Aleutian Archipelago. Conservation Biology, 24(3), 852–860. doi:10.1111/j.1523-1739.2009.01428.x
Methods

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Parameters

Parameter	Description	Units
island	name of island	unitless
site_name	identity of site	unitless
latitude	latitude of study site	decimal degrees

longitude	longitude of study site	decimal degrees
depth_feet	depth of benthic survey	feet
habitat_type	phase state of habitat: see Description	unitless
date	calendar date of survey formatted as yyyy-mm-dd	unitless
observer	last name of observer	unitless
replicate	replicate 0.25-m^2 quadrat identifier	unitless
Eualaria_fistulosa_density	Number of Eualaria_fistulosa found in quadrat	count per 0.25 m^2
Laminaria_spp_density	Number of Laminaria_spp	count per 0.25 m^2
Laminaria_yezoensis_density	Number of Laminaria_yezoensis found in quadrat	count per 0.25 m^2
Laminaria_longipes_density	Number of Laminaria_longipes found in quadrat	count per 0.25 m^2
Agarum_clathratum_density	Number of Agarum_clathratum found in quadrat	count per 0.25 m^2
Thalassiophyllum_clathrus_density	Number of Thalassiophyllum_clathrus found in quadrat	count per 0.25 m^2
Cymathaere_triplicata_density	Number of Cymathaere_triplicata found in quadrat	count per 0.25 m^2
filamentous_red_algae_cover_score	Percent cover of filamentous red algae	percent cover per 0.25 m^2
suspension_feeder_cover_score	Percent cover of suspension feeder found in quadrat	percent cover per 0.25 m^2
Desmarestia_spp_cover_score	Percent cover of Desmarestia spp. found in quadrat	percent cover per 0.25 m^2

Codium_spp_cover_score	Percent cover of Codium spp. found in quadrat	percent cover per 0.25 m^2
crustose_coralline_algae_cover_score	Percent cover of crustose coralline algae found in quadrat	percent cover per 0.25 m^2
erect_calcified_algae_cover_score	Percent cover of erect calcified algae found in quadrat	percent cover per 0.25 m^2
shell_cover_score	Percent cover ofshell found in quadrat	percent cover per 0.25 m^2
sand_cover_score	Percent cover of sand found in quadrat	percent cover per 0.25 m^2
rock_cover_score	Percent cover of rock found in quadrat	percent cover per 0.25 m^2

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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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