Nutrient monitoring data collected as part of macroalgal surveys in Sitka Sound, Alaska kelp beds from 2016 to 2020

Website: https://www.bco-dmo.org/dataset/882057
Data Type: Other Field Results
Version: 1
Version Date: 2022-10-11

Project
» CAREER: Energy fluxes and community stability in a dynamic, high-latitude kelp ecosystem (High latitude kelp dynamics)

Contributors	Affiliation	Role
Kroeker, Kristy J.	University of California-Santa Cruz (UCSC)	Principal Investigator
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Abstract
Nutrient monitoring data collected as part of macroalgal surveys in Sitka Sound, Alaska kelp beds from 2016 to 2020.

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Coverage

Spatial Extent: **N**:57.0725 **E**:-135.278 **S**:56.9875 **W**:-135.415
Temporal Extent: 2016-06-13 - 2020-08-11

Methods & Sampling

To capture the annual variation in nutrient concentrations around a high latitude giant kelp bed, we sampled seawater monthly (July 2018 - July 2019) from the water column adjacent to Breast Is. in Sitka Sound, Alaska. We collected seawater using a surface-deployed Niskin bottle at 0.5 m and 4.5 m depth at each of four locations: in the middle of the Breast Is. giant kelp bed canopy, at the canopy edge, 150 m away from canopy edge, and 600 m away from the canopy edge towards the open ocean (Gulf of Alaska). In addition, we collected benthic seawater samples monthly (June 2016 - July 2017) and opportunistically (Fall 2017 - Summer 2020) using a diver-deployed Niskin bottle at 8 - 10 m depth at Breast Is., Harris Is., Samsing Pinnacle and Talon Is. (57.073 N, 135.414 W). We brought collected water to the surface, immediately filtered each sample through a 0.2 µm filter and kept it frozen until analysis for dissolved inorganic nitrogen content as NOx (NO3 + NO2) on a Lachat QuikChem 8000 Flow Injection Analyzer at the University of California Santa Cruz Marine Analytical Laboratory (detection limit < 0.28 µM NOx, average run measurement error < 0.1 µM NOx).

Additional Funding Details:

In addition to primary funding from the NSF award OCE-1752600 additional funding was provided from The David and Lucile Packard Foundation and the North Pacific Research Board's Graduate Student Research Award (1748-01) to Lauren Bell, PhD University of California Santa Cruz, Award title: "Fish Habitat, Fishes and Invertebrates, Lower Trophic Level Productivity Effect of substrate on herring roe response to global change."

Data Processing Description

BCO-DMO Data Manager Processing Notes:
* File "Sitka.seawater_NOx.csv" imported into the BCO-DMO data system.

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Data Files

File
nutrients.csv (Comma Separated Values (.csv), 10.60 KB) MD5:d05de11c0778f7b4982ca554467eff81 Primary data file for dataset ID 882057

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Supplemental Files

File
Sitka macroalgal survey site list filename: site_list.csv (Comma Separated Values (.csv), 259 bytes) MD5:785b37ebc9f99bea71257234529ad278 Site list for macroalgal surveys conducted in Sitka, Alaska between 2017 to 2020. Parameters (column name, description, units): Site, Site name,unitless Latitude, latitude of site, decimal degrees Longitude,longitude of site, decimal degrees

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Related Publications

Bell, L. E., & Kroeker, K. J. (2022). Standing Crop, Turnover, and Production Dynamics of Macrocystis pyrifera and Understory Species Hedophyllum nigripes and Neoagarum fimbriatum in High Latitude Giant Kelp Forests. Journal of Phycology, 58(6), 773–788. Portico. https://doi.org/10.1111/jpy.13291
Results

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Related Datasets

IsReferencedBy

Bell, L. E., Kroeker, K. J. (2022) **Macroalgal carbon and nitrogen data collected as part of macroalgal surveys in Sitka Sound, Alaska kelp beds from 2018 to 2020.** Biological and Chemical Oceanography

Data Management Office (BCO-DMO). (Version 1) Version Date 2022-10-11 doi:10.26008/1912/bco-dmo.882064.1 [view at BCO-DMO]
Relationship Description: Results from coincident monthly sampling.

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Parameters

Parameter	Description	Units
Sample_type	Sample collection purpose. Monthly_timeseries = monthly collection of seawater and Macrocystis blades at Breast Is. for nutrient and CN content comparison. Benthic_seasonal = opportunistic collection of seawater samples near benthos of rocky reef sites.	unitless
Date	Date of seawater sample collection in ISO 8601 format (YYYY-MM-DD)	unitless
Site	Name of rocky reef location in Sitka Sound where sampling occurred. See methods for lat/long	unitless
Latitude	Site latitude	decimal degrees
Longitude	Site longitude	decimal degrees
Distance_from_bed_m	Approximate distance from edge of Breast Is. kelp bed (0 m mark). Negative values indicate sample site inside kelp bed. For "monthly_timeseries" samples only. Detection limit: 1m	meters (m)
Depth_category	Category of sampling depth from surface. Benthic samples ranged from 8-10m depth (Mean Lower Low Water (MLLW)).	unitless
NOx_uM	Total concentration of nitrate + nitrite in seawater. Detection limit: 0.001 uM	micromolar (uM)

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Instruments

Dataset-specific Instrument Name	Lachat QuikChem 8000
Generic Instrument Name	Flow Injection Analyzer
Dataset-specific Description	Lachat QuikChem 8000 Flow Injection Analyzer at the University of California Santa Cruz Marine Analytical Laboratory (detection limit < 0.28 µM NOx, average run measurement error < 0.1 µM NOx).
Generic Instrument Description	An instrument that performs flow injection analysis. Flow injection analysis (FIA) is an approach to chemical analysis that is accomplished by injecting a plug of sample into a flowing carrier stream. FIA is an automated method in which a sample is injected into a continuous flow of a carrier solution that mixes with other continuously flowing solutions before reaching a detector. Precision is dramatically increased when FIA is used instead of manual injections and as a result very specific FIA systems have been developed for a wide array of analytical techniques.

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Project Information

CAREER: Energy fluxes and community stability in a dynamic, high-latitude kelp ecosystem (High latitude kelp dynamics)

Coverage: SE Alaskan coastal waters

NSF Award Abstract:
High latitude kelp forests support a wealth of ecologically and economically important species, buffer coastlines from high-energy storms, and play a critical role in the marine carbon cycle by sequestering and storing large amounts of carbon. Understanding how energy fluxes and consumer-resource interactions vary in these kelp communities is critical for defining robust management strategies that help maintain these valuable ecosystem services. In this integrated research and education program, the project team will investigate how consumer populations respond to variability in temperature, carbonate chemistry and resource quality to influence the food webs and ecosystem stability of kelp forests. A comprehensive suite of studies conducted at the northern range limit for giant kelp (Macrocystis pyrifera) in SE Alaska will examine how kelp communities respond to variable environmental conditions arising from seasonal variability and changing ocean temperature and acidification conditions. As part of this project, undergraduate and high school students will receive comprehensive training through (1) an immersive field-based class in Sitka Sound, Alaska, (2) intensive, mentored research internships, and (3) experiential training in science communication and public outreach that will include a variety of opportunities to disseminate research findings through podcasts, public lectures and radio broadcasts.

Consumer-resource interactions structure food webs and govern ecosystem stability, yet our understanding of how these important interactions may change under future climatic conditions is hampered by the complexity of direct and indirect effects of multiple stressors within and between trophic levels. For example, environmentally mediated changes in nutritional quality and chemical deterrence of primary producers have the potential to alter herbivory rates and energy fluxes between primary producers and consumers, with implications for ecosystem stability. Moreover, the effects of global change on primary producers are likely to depend on other limiting resources, such as light and nutrients, which vary seasonally in dynamic, temperate and high latitude ecosystems. In marine ecosystems at high latitude, climate models predict that ocean acidification will be most pronounced during the winter months, when primary production is limited by light. This project is built around the hypothesis that there could be a mismatch in the energetic demands of primary consumers caused by warming and ocean acidification and resource availability and quality during winter months, with cascading effects on trophic structure and ecosystem stability in the future. Through complementary lab and field experiments, the project team will determine 1) how temperature and carbonate chemistry combine to affect primary consumer bioenergetics across a diversity of species and 2) the indirect effects of ocean acidification and warming on primary consumers via environmentally mediated changes in the

availability, nutritional quality and palatability of primary producers across seasons. Using the data from the laboratory and field experiments, the project team will 3) construct a model of the emergent effects of warming and ocean acidification on trophic structure and ecosystem stability in seasonally dynamic, high latitude environments.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1752600

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