Macroalgal carbon and nitrogen data collected as part of macroalgal surveys in Sitka Sound, Alaska kelp beds from 2018 to 2020

Website: https://www.bco-dmo.org/dataset/882064
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
Bell, Lauren E.	University of California-Santa Cruz (UCSC)	Student, Contact
York, Amber D.	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
Macroalgal carbon and nitrogen data collected as part of macroalgal surveys in Sitka Sound, Alaska kelp beds from 2018 to 2020.

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Coverage

Spatial Extent: **N**:57.039 **E**:-135.278 **S**:56.9875 **W**:-135.357
Temporal Extent: 2018-07-23 - 2020-07-31

Methods & Sampling

Coincident with monthly sampling of seawater for nutrient concentrations (see related dataset "Nutrient monitoring" https://www.bco-dmo.org/dataset/882057), we collected surface blades from M. pyrifera in the Breast Is. giant kelp bed from July 2018 - July 2019 to analyze for carbon (C) and nitrogen (N) content. On one frond from each plant (N = 3), we identified and removed the second intact blade closest to the frond's scimitar blade. To capture seasonal variation in C and N content in kelp species in July 2018, January 2019, and August 2019, we collected blades from M. pyrifera plants (N = 5) at ~1 m above their holdfasts and blades (N = 5) of N. fimbriatum and H. nigripes between 4 - 7 m depth (MLLW) at Samsing Pinnacle. We also opportunistically collected blades (N = 3-5) representing all kelp species present at Harris Is. in summer 2018 and 2020 and at Samsing Pinnacle in summer 2020. For all macroalgal tissue field collections, we immediately drained collected samples of excess seawater and kept them on ice in a covered cooler for transport to the lab. Within 2 hours of collection, we cleaned collected tissue of epiphytes and rinsed it briefly in fresh seawater. From all collected blades we excised 1 - 5 g of tissue immediately adjacent to the intercalary meristem where

the blade meets the stipe. We spun tissue samples 10 times in a salad spinner before drying at 60 °C for at least 24 hrs. Dried samples were analyzed for C and N content (% dry mass) by the University of California Santa Cruz Stable Isotope Laboratory using a CE Instruments NC2500 elemental analyzer coupled to a Thermo Scientific DELTAplus XP isotope ratio mass spectrometer via a Thermo-Scientific Conflo III (routine measurement error ≤ 1.0 %C and ≤ 0.2 %N).

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 "Sitkakelps_CN.csv" imported into the BCO-DMO data system.
* Date format changed to ISO format
* ISO_DateTime_UTC added from local date and time (AKT/AKST)
* Species list with codes and scientific names extracted from parameter information. Matched to known taxon ids using WoRMS taxa match (2022-09-06). The spelling of "Laminaria setchelii" changed to "Laminaria setchellii" with two Ls after confirming the change with the data submitter. Species list along with identifiers attached as a supplemental data table.
* Latitude and Longitude added to main data table from the provided site list.

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Data Files

File	
macroalgae_cn.csv	(Comma Separated Values (.csv), 15.93 KB) MD5:6837e6e7f8cbcb31c04e4ad830e654a2
Primary data file for dataset ID 882064	

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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
Sitka macroalgal survey species list filename: species_list.csv (Comma Separated Values (.csv), 490 bytes) MD5:983f490f673acb204083528f4f11e380 Species list for macroalgal surveys conducted in Sitka, Alaska between 2017 to 2020. Parameters (column name, description, units): Sp, species code used in related datasets (e.g. MPYR),unitless ScientificName,The accepted scientific name for the species (as of 2022-09),unitless AphiaID,Taxonomic identifier AphiaID for the species (see World Register of Marine Species),unitless LSID,Life Sciences Identifier (LSID) for the species,unitless

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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

References

Bell, L. E., Kroeker, K. J. (2022) **Nutrient monitoring data collected as part of macroalgal surveys in Sitka Sound, Alaska kelp beds from 2016 to 2020.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2022-10-11 doi:10.26008/1912/bco-dmo.882057.1 [view at BCO-DMO]
Relationship Description: Results from coincident monthly sampling.

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Parameters

Parameter	Description	Units
collection_date	Date of macroalgal sample collection in ISO 8601 format (YYYY-MM-DD), recorded in timezone AKT/AKST	unitless

coll_time	Time of macroalgal sample collection in ISO 8601 format (YYYY-MM-DD), recorded in timezone AKT/AKST	unitless
ISO_DateTime_UTC	Collection datetime with time zone (UTC) in ISO 8601 format (YYYY-MM-DDThh:mmZ).	unitless
depth_uncorr	Depth at time of macroalgal sample collection, uncorrected to tide level. Detection limit: 1 ft	unitless
Season	Sampling season	unitless
Site	Name of rocky reef location in Sitka Sound where sampling occurred	unitless
Latitude	Site latitude	decimal degrees
Longitude	Site longitude	decimal degrees
Sp	Species of macroalga surveyed (MPYR = Macrocystis pyrifera, NFIM = Neoagarum fimbriatum, HNIG = Hedophyllum nigripes, ACLA = Agarum clathratum, PGAR = Pleurophycus gardneri, LSET = Laminaria setchellii)	unitless
ind_ID	Alpha-numeric identifier for each macroalgal individual. Unique by site and survey date.	unitless
fronds_1m	Number of fronds at 1m above top of holdfast on sampled sporophyte (MPYR only). Also known as frond density. Detection limit: 1 frond	fronds
blade_height_m	Height above holdfast where blade collected (MPYR only). Detection limit: 0.5m	meters (m)
blade_maxlength_cm	Maximum blade length of collected individual. Detection limit: 0.1 cm	centimeters (cm)
blade_maxwidth_cm	Maximum blade width of collected individual. Detection limit: 0.1 cm	centimeters (cm)
d13C	d13C value of blade tissue. Detection limit: 0.01 ‰	per mil (0/00)
wt_prctC	percentage carbon by weight. Detection limit: 0.1%	percent (%)
mass_ugC	Carbon mass of blade tissue. Detection limit: 1 µg	micrograms of carbon (ug C)
d15N	d15N value of blade tissue. Detection limit: 0.01 ‰	per mil (0/00)

wt_prctN	percentage nitrogen by weight. Detection limit: 0.1%	percent (%)
mass_ugN	Nitrogen mass of blade tissue. Detection limit: 1 µg	micrograms of nitrogen (ug N)
C_N	Carbon to nitrogen ratio (mol:mol). Detection limit: 0.1	unitless

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Instruments

Dataset-specific Instrument Name	CE Instruments NC2500
Generic Instrument Name	Elemental Analyzer
Dataset-specific Description	CE Instruments NC2500 elemental analyzer coupled to a Thermo Scientific DELTAplus XP isotope ratio mass spectrometer via a Thermo-Scientific Conflo III (routine measurement error ≤ 1.0 %C and ≤ 0.2 %N).
Generic Instrument Description	Instruments that quantify carbon, nitrogen and sometimes other elements by combusting the sample at very high temperature and assaying the resulting gaseous oxides. Usually used for samples including organic material.

Dataset-specific Instrument Name	Thermo Scientific DELTAplus XP
Generic Instrument Name	Mass Spectrometer
Dataset-specific Description	CE Instruments NC2500 elemental analyzer coupled to a Thermo Scientific DELTAplus XP isotope ratio mass spectrometer via a Thermo-Scientific Conflo III (routine measurement error ≤ 1.0 %C and ≤ 0.2 %N).
Generic Instrument Description	General term for instruments used to measure the mass-to-charge ratio of ions; generally used to find the composition of a sample by generating a mass spectrum representing the masses of sample components.

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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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