Kelp (Macrocystis pyrifera) frond growth data from macroalgal surveys in Sitka Sound, Alaska kelp beds from 2017 to 2019

Website: https://www.bco-dmo.org/dataset/882050
Data Type: Other Field Results
Version: 1
Version Date: 2022-10-10

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

Contributors	Affiliation	Role
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Abstract
Kelp (Macrocystis pyrifera) frond growth data from macroalgal surveys in Sitka Sound, Alaska kelp beds from 2017 to 2019.

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Coverage

Spatial Extent: **N**:57.039 **E**:-135.278 **S**:56.9875 **W**:-135.357
Temporal Extent: 2017-01-09 - 2019-08-01

Methods & Sampling

We monitored monthly growth and loss of dominant kelp species in Sitka Sound from January 2017 - February 2018 at Breast Is. and Harris Is. (M. pyrifera only), and from July 2018 - July 2019 at Harris Is., Breast Is., and Samsing Pinnacle (M. pyrifera, N. fimbriatum, H. nigripes). At each site, we identified 12 - 15 “adult” individuals of each species (M. pyrifera: at least one frond reaching the surface; N. fimbriatum and H. nigripes: maximum blade length > 20 cm) along a 5 - 6 m depth (MLLW) contour with numbered tags. Each month, we re-surveyed tagged M. pyrifera plants for frond density, with zip ties loosely bound around new fronds exceeding 1 m in height to distinguish new growth. For tagged N. fimbriatum and H. nigripes plants, each month we punched a new hole through the thallus at 10 cm from the intercalary meristem (Parke 1948), and we measured blade morphometrics (maximum blade length and width) and distance from meristem to the previous month’s punched hole. When previously tagged individuals were not re-sighted after two consecutive months, we assumed they had been physically removed from the substrate, either through grazing or abiotic factors.

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 "MPYR_frond.growth.csv" imported into the BCO-DMO data system.
* Date format changed to ISO format
* 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
frond_growth.csv (Comma Separated Values (.csv), 31.40 KB) MD5:1e55d93d1dede2fa956f569a9d604102 Primary data file for dataset ID 882050

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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

Parke, M. (1948). Studies on British Laminariaceae. I. Growth in Laminaria Saccharina (L.) Lamour. Journal of the Marine Biological Association of the United Kingdom, 27(3), 651–709. https://doi.org/10.1017/s0025315400056071 https://doi.org/10.1017/S0025315400056071
Methods

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Parameters

Parameter	Description	Units
Site	Name of rocky reef location in Sitka Sound where survey occurred.	unitless
Latitude	Site latitude	decimal degrees
Longitude	Site longitude	decimal degrees
Transect	Identity of recurring 30 x 2 m transect in which surveyed plants were located (A-D)	unitless
plant_ID	Alpha-numeric identifier for each tagged M. pyrifera sporophyte. Unique by site.	unitless
date_T0	Date of survey period start (T0) in ISO 8601 format (YYYY-MM-DD)	unitless
date_T1	Date of survey period end (T1) in ISO 8601 format (YYYY-MM-DD)	unitless
fronds_T0	Number of fronds at 1m above top of holdfast at survey period start (T0). Also known as frond density. Detection limit: 1 frond	fronds
fronds_T1	Number of fronds at 1m above top of holdfast at survey period end (T1). Also known as frond density. Detection limit: 1 frond	fronds
fronds_count_new	Number of new fronds at survey period end (T1) that grew to surpass 1m height over survey interval. Confirmed as new when >1m in height and no prior tag. Detection limit: 1 frond.	fronds
fronds_count_lost	Number of fronds present at survey period start (T0) that were lost over survey interval. Confirmed with missing tags. Detection limit: 1 frond.	fronds
interval_days	Number of days elapsed between T0 and T1. Detection limit: 1 day	days
dataquality_flag	Data quality identifier. G = good = frond counts and new/lost counts match. P = poor = # of new and lost fronds doesn't match total change in frond count	unitless

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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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