Characteristics of tidepools from seasonal surveys conducted at tidepools along the California coast from 2017 to 2018

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Project
» Collaborative Research: Context-dependency of top-down vs. bottom-up effects of herbivores on marine primary producers (CalCoast Grazer TDBU)

Contributors	Affiliation	Role
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Abstract
This dataset includes overall attributes of the tide pools in each of three study regions. Data include tide height, depth, perimeter, and surface area of the pools. Sampling took place in 2017 and 2018 at tide pools located in three regions along the California (USA) coast: (1) Bodega Head, Sonoma County (38.31°N, 123.07°W); (2) Kenneth Norris Rancho Marino Reserve and Hazards Canyon Reef, San Luis Obispo County (35.54°N, 121.09°W and 35.29°N, 128.88°W, respectively); and (3) Corona del Mar State Beach, Orange County (33.59°N, 117.87°W). In the fall of 2017, initial surveys and measurements were conducted quantifying physical attributes, including surface area, volume, and height on the shore. Surveys were repeated every three months until immediately prior to the establishment of grazing experiments at each site in the summer of 2018. During the quarterly surveys, consumer abundances, nutrient fluxes, oxygen fluxes, and photosynthetic biomass in each tide pool were quantified.

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Coverage

Spatial Extent: **N**:38.3195 **E**:-117.866 **S**:33.5867 **W**:-123.075
Temporal Extent: 2017-10 - 2018-04

Dataset Description

Users of these data are requested to contact Matthew Bracken (m.bracken@uci.edu) prior to use.

Acquisition Description

Methodology:
High-intertidal pools are common in all three regions, allowing us to work at two spatially separated sites in each region. At each site, we identified 18 tide pools, marking each pool and quantifying physical attributes, including surface area, volume, and height on the shore. We also anchored TidbiT temperature datalogger (Onset; Bourne, Massachusetts, USA) in most pools. In the fall of 2017, we identified tide pools and conducted initial surveys and measurements. We repeated surveys every three months until immediately prior to the establishment of grazing experiments at each site in the summer of 2018. These surveys provided insights into the natural temporal variability in community and ecosystem metrics and provided baseline information on relationships between grazer abundances and producer biomass.

Sampling and analytical procedures:
During the quarterly surveys, we quantified consumer abundances, nutrient fluxes, oxygen fluxes, and photosynthetic biomass in each tide pool. Organism abundances were measured by pumping the water from each pool into a bucket, spreading a flexible mesh quadrat over the bottom of the pool, and censusing the algae and invertebrates present in each pool. Nutrient and oxygen fluxes were measured during whole-pool incubations in the dark and in the light.

Pool Characteristics:
Pool characteristics include overall attributes of the tide pools in each of our three study regions. Values were measured at the beginning of our surveys (in October 2017) and refined and remeasured throughout the year (see related dataset "Seasonal Surveys"). Latitude (decimal degrees; values are positive indicating degrees north) and longitude (decimal degrees; values are negative indicating degrees west) were determined for each pool using a Garmin eTrex handheld GPS unit set to WGS84. Tidal elevation (meters above mean lower-low water) was measured using a CST/berger self-leveling rotary laser system. Maximum tidepool depth (cm) was measured using a probe and ruler. Perimeter (m) was measured using a transect tape. Surface area (square count, m2) was measured using a flexible mesh quadrat (Bracken and Nielsen 2004), with 10cm x 10cm squares. Dye volume was determined by adding a known quantity of blue dye to the pool mixing it, measuring it on a spectrophotometer at 640 nm, and relating it to a standard curve relating absorbance to volume (Bracken et al. 2018). Pump volume was determined by pumping the water from each tidepool into a graduated 20L bucket using a hand bilge pump.

This work was conducted at sites located in three regions along the California (USA) coast: (1) Bodega Head, Sonoma County (38.31°N, 123.07°W); (2) Kenneth Norris Rancho Marino Reserve and Hazards Canyon Reef, San Luis Obispo County (35.54°N, 121.09°W and 35.29°N, 128.88°W, respectively); and (3) Corona del Mar State Beach, Orange County (33.59°N, 117.87°W).

Known Problems/Issues:
Some environmentally-related (e.g., tides, darkness) issues caused gaps in the data. These are indicated by "nd".

Processing Description

Data Processing:
Data reported here were recorded in the field, transcribed into a database, then collated using R.

BCO-DMO Processing:
- Added a conventional header with dataset name, PI names, version date
- Rounded Latitude and Longitude columns to 6 decimal places; rounded Dye_Volume column to 3 decimal

places

Related Publications

Bracken, M. E. S., & Nielsen, K. J. (2004). DIVERSITY OF INTERTIDAL MACROALGAE INCREASES WITH NITROGEN LOADING BY INVERTEBRATES. Ecology, 85(10), 2828–2836. doi:10.1890/03-0651
Methods

Bracken, M. E. S., Silbiger, N. J., Bernatchez, G., & Sorte, C. J. B. (2018). Primary producers may ameliorate impacts of daytime CO2 addition in a coastal marine ecosystem. PeerJ, 6, e4739. doi:10.7717/peerj.4739
Methods

Related Datasets

IsRelatedTo

Bracken, M., Martiny, A., Miller, L. P. (2021) **Seasonal data on productivity, characteristics, and community composition of tidepools on the California coast from 2017 to 2018.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2021-12-16 http://lod.bco-dmo.org/id/dataset/860440 [view at BCO-DMO]

Bracken, M., Martiny, A., Miller, L. P. (2021) **Tidepool attributes by date and ecological survey data from seasonal surveys conducted at tidepools along the California coast from 2017 to 2018.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2021-12-16 http://lod.bco-dmo.org/id/dataset/861571 [view at BCO-DMO]

Parameters

Parameter	Description	Units
Site	Site of measurements (BMR = Bodega Marine Reserve; RMR = Rancho Marino Reserve / Hazards Canyon Reef; CDM = Corona del Mar)	unitless
Pool	Pool number and station (A or B), including adjacent Ocean	unitless
Latitude	Latitude in decimal degrees North	Decimal Degrees
Longitude	Longitude in decimal degrees East (west is negative)	Decimal Degrees
Tide_Height	Height of pool in m above MLLW meaured on 10/11/2017	meters above MLLW
Tide_Height2	Height of pool	meters above MLLW
Max_Depth	Maximum depth of pool	centimeters
Perimeter	Perimeter of pool	meters
Surface_Area_Squares	Surface area of pool	Number of squares (0.1 square meters)
Surface_Area_m2	Surface area of pool	meters squared
Dye_Volume	Volume of pool in liters estimated using dye method	Liters
Pump_Volume	Volume of pool in liters estimated using pump method	Liters

Instruments

Dataset-specific Instrument Name	Garmin eTrex handheld GPS
Generic Instrument Name	Global Positioning System Receiver
Generic Instrument Description	The Global Positioning System (GPS) is a U.S. space-based radionavigation system that provides reliable positioning, navigation, and timing services to civilian users on a continuous worldwide basis. The U.S. Air Force develops, maintains, and operates the space and control segments of the NAVSTAR GPS transmitter system. Ships use a variety of receivers (e.g. Trimble and Ashtech) to interpret the GPS signal and determine accurate latitude and longitude.

Dataset-specific Instrument Name	
Generic Instrument Name	Spectrophotometer
Generic Instrument Description	An instrument used to measure the relative absorption of electromagnetic radiation of different wavelengths in the near infra-red, visible and ultraviolet wavebands by samples.

Dataset-specific Instrument Name	Hand bilge pump
Generic Instrument Name	Pump
Generic Instrument Description	A pump is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action. Pumps can be classified into three major groups according to the method they use to move the fluid: direct lift, displacement, and gravity pumps

Dataset-specific Instrument Name	Self-leveling rotary laser kit, CST/berger
Generic Instrument Name	Laser
Generic Instrument Description	A device that generates an intense beam of coherent monochromatic light (or other electromagnetic radiation) by stimulated emission of photons from excited atoms or molecules.

Dataset-specific Instrument Name	TidbiT temperature datalogger (Onset; Bourne, Massachusetts, USA)
Generic Instrument Name	Temperature Logger
Generic Instrument Description	Records temperature data over a period of time.

Project Information

Collaborative Research: Context-dependency of top-down vs. bottom-up effects of herbivores on marine primary producers (CalCoast Grazer TDBU)

Coverage: Coast of California, USA

Humans are modifying marine food webs both from the top-down, by reducing consumer abundances, and from the bottom-up, by adding nutrients to coastal habitats. Predicting these impacts is complicated because herbivores affect primary producers both from the top-down, by eating them, and from the bottom-up, by recycling nutrients and facilitating the recruitment of algae into local marine ecosystems. This project uses experimental manipulations along a natural gradient in nutrient availability on the California coast to evaluate the complex interactions between top-down and bottom-up processes in marine communities. This project includes experiments and outreach in a location with substantial exposure to the public, and the investigators will work with community and university outreach personnel to communicate this research to broader audiences. Specifically, the project includes mechanisms for curriculum development and outreach and will train undergraduate and graduate students in marine science.

The investigators are implementing a suite of innovative approaches to understand the multiple roles that herbivores play in marine systems. Traditional experimental methods for herbivore removal result in the

loss of both the consumptive and facilitative effects of herbivores. In contrast, the investigators' experimental design allows them to partition the different effects of herbivores on marine primary producers. These methods, including observations, experiments, and modeling approaches, allow researchers to (i) calculate the relative importance of herbivores' consumptive and facilitative effects on algal diversity and abundance; (ii) determine the effects of temperature, nutrients, and herbivores on the microbial community; and (iii) evaluate the relative importance of internal processes and spatial subsidies.

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Funding

Funding Source	Award
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NSF Division of Ocean Sciences (NSF OCE)	OCE-1737065
NSF Division of Ocean Sciences (NSF OCE)	OCE-1904184

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