Chlorophyll-a fluorescence from rocky intertidal zone moorings along the Oregon and California coasts, 2007-2015 (ACIDIC project)

Website: https://www.bco-dmo.org/dataset/657733
Data Type: Other Field Results
Version:
Version Date: 2016-08-30

Project
» The role of calcifying algae as a determinant of rocky intertidal macrophyte community structure at a meta-ecosystem scale (ACIDIC)

Contributors	Affiliation	Role
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Dataset Description

Related Datasets:
Intertidal mooring PAR
Intertidal mooring temperature

Methods & Sampling

Chlorophyll-a fluorescence data were collected using a WET Labs ECO FL fluorometer (http://www.wetlabs.com/eco-fl) with the following manufacturer specifications: excitation/emission wavelengths: 470/695 nm; sensitivity: 0.02 µg/L; and range: 0-125 µg/L. Fluorometers were installed in the mid-intertidal zone (~ 0– 0.3 m above MLLW) at 11 sites along the California and Oregon coasts, USA. The instrument was encased in a custom-made, secondary PVC case and then affixed to the rock using 3 stainless steel mesh straps and stainless steel lag screws screwed into high tension plastic anchors set into pre-drilled holes. The instrument face was oriented downslope and towards the water. Observations were logged every 15 minutes. The sensor face was cleaned every 2 weeks when possible but no less than every 4 weeks (depending on sea state). Instruments were typically deployed between January and March and then retrieved between September and November of each year. They were sent back to the manufacturer for servicing and re-characterization annually.

Data Processing Description

All fluorometry data and tidal height predictions are collected and processed in Coordinated Universal Time (UTC). Out of water measurements are flagged in the dataset by interpolating between the raw fluorescence data points in order to align the fluorescence time series with tidal height predictions (downloaded from: http://tbone.biol.sc.edu/tide/) and identify observations when the tide is < 1 m above the apparent tidal height of the fluorometer. The apparent tidal height of the fluorometer is determined by visual inspection of the plotted fluorescence and tidal height data. The focal period is during extreme low tides when the fluorometer is clearly out of water, recorded measurement are close to the dark count offset value (see below) and do not change over the low tide interval. These data delineate an obvious, sharp transition as the instrument is uncovered or covered by the tide. Instrument “fouling” is also flagged in the dataset by visual inspection of the plotted fluorescence data. Fouling is defined as any period of randomly scattered data without an obvious trend in the fluorescence signal.

Table 1. WET Labs manufacturer calibration values. (PDF)

BCO-DMO Processing:
- Replaced blanks in site name with underscores
- Commented out line 2, the units
- Replaced blanks in comment column with nd
- Converted from PC to Unix formatted .csv files
- Converted to jgofs format for faster serving

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Data Files

File
chl_a.csv (Comma Separated Values (.csv), 106.18 MB) MD5:71264a63e9eb6fd6b5b1ce7faa806e31 Primary data file for dataset ID 657733

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Parameters

Parameter	Description	Units
site_name	mooring location name	unitless
site_code	mooring location code	unitless
lat	latitude; north is positive	decimal degrees
lon	longitude; east is positive	decimal degrees
year	year	year
month	month	month
day	day of month (UTC)	days
hour	hour of day (UTC)	hours
minute	minutes (UTC)	minutes
second	seconds (UTC)	seconds
ISO_DateTime_UTC	Date/Time (UTC) based on ISO 8601:2004E. Format: YYYY-mm-ddTHH:MM:SS[.xx]Z (UTC time)	unitless
yrday_utc	UTC day and decimal time: eg. 326.5 for the 326th day of the year or November 22 at 1200 hours (noon).	unitless
chl_a	factory scaled chlorophyll	micrograms/liter
tide	tidal height: feet above MLLW (predicted)	feet
out_of_water_period	flag indicating out of water: 1= out of water; 0 = submerged	unitless
fouled_period	flag indicating fouling: 1 = biofouled; 0 = clean	unitless
comment	comments	unitless

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Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Fluorometer
Dataset-specific Description	WET Labs ECO FL fluorometer (http://www.wetlabs.com/eco-fl) with the following manufacturer specifications: excitation/emission wavelengths: 470/695 nm; sensitivity: 0.02 µg/L; and range: 0-125 µg/L.
Generic Instrument Description	A fluorometer or fluorimeter is a device used to measure parameters of fluorescence: its intensity and wavelength distribution of emission spectrum after excitation by a certain spectrum of light. The instrument is designed to measure the amount of stimulated electromagnetic radiation produced by pulses of electromagnetic radiation emitted into a water sample or in situ.

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Deployments

KH_intertidal_2008-2015

Website	https://www.bco-dmo.org/deployment/656366
Platform	Kibesillah Hill Ecological Time-Series Station
Start Date	2010-01-01
End Date	2015-12-29
Description	Long-term monitoring site

BH_intertidal_2008-2015

Website	https://www.bco-dmo.org/deployment/656816
Platform	Bodega Head State Marine Reserve Intertidal Long-Term Ecological Research Site
Start Date	2008-03-13
End Date	2015-12-31
Description	Long-term monitoring site

CA_intertidal_2007-2013

Website	https://www.bco-dmo.org/deployment/657701
Platform	PISCO Cape Arago Ecological Time-Series Station
Start Date	2007-05-07
End Date	2013-10-06
Description	Long-term monitoring site

CB_intertidal_2008-2014

Website	https://www.bco-dmo.org/deployment/657705
Platform	PISCO Cape Blanco Ecological Time-Series Station
Start Date	2008-04-22
End Date	2014-09-02
Description	Long-term monitoring site

CM_intertidal_2012-2014

Website	https://www.bco-dmo.org/deployment/657717
Platform	PISCO Cape Mendocino Ecological Time-Series Station
Start Date	2012-05-09
End Date	2014-08-14
Description	Long-term monitoring site

FC_intertidal_2009-2015

Website	https://www.bco-dmo.org/deployment/657689
Platform	PISCO Fogarty Creek Intertidal Long-Term Ecological Research Site
Start Date	2009-03-06
End Date	2015-10-26
Description	Long-term monitoring site

MC_intertidal_2009-2015

Website	https://www.bco-dmo.org/deployment/656810
Platform	Moat Creek Ecological Time-Series Station
Start Date	2009-01-01
End Date	2015-12-31
Description	Long-term monitoring site

POH_intertidal_2009-2014

Website	https://www.bco-dmo.org/deployment/657709
Platform	PISCO Port Orford Head Ecological Time-Series Station
Start Date	2009-02-28
End Date	2014-10-10
Description	Long-term monitoring site

RP_intertidal_2008-2014

Website	https://www.bco-dmo.org/deployment/657713
Platform	PISCO Rocky Point Ecological Time-Series Station
Start Date	2008-05-09
End Date	2014-10-08
Description	Long-term monitoring site

SH_intertidal_2009-2015

Website	https://www.bco-dmo.org/deployment/657697
Platform	PISCO Strawberry Hill Intertidal Long-Term Ecological Research Site
Start Date	2009-03-07
End Date	2015-10-30
Description	Long-term monitoring site

YB_intertidal_2008-2015

Website	https://www.bco-dmo.org/deployment/657693
Platform	PISCO Yachats Beach Ecological Time-Series Station
Start Date	2008-05-07
End Date	2015-10-26
Description	Long-term monitoring site

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Project Information

The role of calcifying algae as a determinant of rocky intertidal macrophyte community structure at a meta-ecosystem scale (ACIDIC)

Coverage: US West Coast; North bounding latitude: 45.00N, South bounding latitude: 38.00N

Algal Communities in Distress: Impacts and Consequences (ACIDIC)

Environmental stress models have recently been modified to incorporate the influence of facilitation to join negative effects such as predation, competition, and abiotic stress as determinants of community structure. Nevertheless, our empirical understanding of the processes that regulate the expression of facilitation effects across systems and the potential for facilitation to amplify or dampen the ecological consequences of climate change remains limited. This project focuses on facilitation dynamics in the broader meta-ecosystem concept, which hypothesizes that variation among communities depends not only on locally-varying species interactions and impacts of abiotic factors such as environmental stress and physical disturbance but also on regionally- and globally-varying ecosystem processes such as dispersal and flows of materials such as nutrients and carbon. The investigators will study the influence of a potentially critical facilitative interaction between coralline algal turfs and canopy-forming macrophytes including kelps and surfgrass in a rocky intertidal meta-ecosystem. The research will be conducted in a climate change context, with a focus on how the macrophyte-coralline interaction is influenced by ocean conditions, including factors driven by variable upwelling (temperature, nutrients, phytoplankton abundance, and light) and increases in ocean acidification, which vary in a mosaic pattern along the coast of the northern California Current (NCC) in Oregon and northern California.

The goal of the project is to test the hypothesis that the coralline turf-macrophyte canopy interaction is a cardinal interaction in the determination of low rocky intertidal community structure, and that disruption of this

interaction would dramatically alter the structure and function of this kelp- and surfgrass-dominated assemblage. The project will take advantage of, and enhance, a research platform established across 17 sites spanning ~800 km in the NCC coastal meta-ecosystem with prior NSF funding that will at each site: (1) quantify ocean conditions, including temperature, nutrients, phytoplankton, light (PAR), and carbonate chemistry to document the response of community structure oceanographic variation across a meta ecosystem mosaic; (2) carry out field experiments testing the nature of the interaction between coralline algal turfs (primarily Corallina vancouveriensis) and dominant canopy species, the kelp Saccharina sessile and the surfgrass Phyllospadix scouleri; and (3) carry out laboratory experiments focusing on the mechanism of the interaction, specifically testing the effects of carbonate chemistry, light, temperature, and nutrients. Component (1) will employ both remote sensors deployed in the intertidal (fluorometers, thermal sensors, PAR sensors, and a recently developed pH sensor) and direct sampling (nutrients, phytoplankton, pCO2, and pH) to quantify the in situ exposure regime of benthic primary producers to resources, energy, and environmental stress across spatial scales. These metrics will be combined with a newly developed index for quantifying local-scale variation in upwelling intensity to characterize the linkages between climate forcing and ecosystem state. Coupling oceanography with our field and laboratory experiments will provide unique and valuable insights into how the current state of rocky intertidal ecosystems is likely to be altered in the future.

Intellectual Merit. The project will contribute one of the first studies to test the community consequences of varying upwelling and CO2 across an ecosystem scale. How these factors alter the direct and indirect interactions of key species is of fundamental importance in our efforts to learn how field ecosystems will respond to climate change. Such knowledge is crucial to our efforts to manage and conserve marine communities facing human-induced variation in climate.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1061233
NSF Division of Ocean Sciences (NSF OCE)	OCE-1061530
NSF Division of Ocean Sciences (NSF OCE)	OCE-1519401

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