

# PAR from rocky intertidal zone moorings along the Oregon and California coasts, 2008-2015 (ACIDIC project)

**Website:** <https://www.bco-dmo.org/dataset/657810>

**Data Type:** Other Field Results

**Version:**

**Version Date:** 2016-09-01

## Project

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

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## Dataset Description

### Related Datasets:

[Intertidal mooring chlorophyll-a](#)

[Intertidal mooring temperature](#)

## Methods & Sampling

Photosynthetically Active Radiation (PAR; 400-700 nm) was recorded using a pair of data logging PAR sensors deployed to the shoreline at different elevations. Irradiance was measured using a LiCor 190 PAR sensor together with a universal transconductance amplifier (EME systems) to amplify the micro-amp current output of the PAR sensor and then recorded to a datalogger (Onset Hobo). The entire assembly was housed in a custom-molded waterproof case with a window of spectrally unbiased Plexiglas. The base had stainless steel mesh straps embedded in it to bolt the case to the rock, and leveling feet to level the sensor. The case was affixed to the rock by eight stainless steel lag screws and high tension plastic anchors set into pre-drilled holes. PAR data were recorded every 15 minutes. One PAR sensor (UWPAR) was located in the intertidal zone (~ 0-0.3 m above MLLW) and therefore experiences both underwater and above water periods, depending on the tidal cycle. The second PAR sensor (TPAR) was deployed well above the intertidal zone on an adjacent terrestrial rocky bench or cliff and only measures out of water irradiance.

## Data Processing Description

The voltage data were converted to photosynthetic photon flux ( $\text{mmol m}^{-2} \text{s}^{-1}$ ) using the LiCOR scale factors associated with each PAR sensor ( $\text{PAR} = (\text{voltage}/0.2) \times \text{scale factor}$ ) (Table 1). The data for each year were normalized to the maximum value on a clear day near the summer solstice at local solar noon, and then scaled to the modeled clear sky value for PPF for local solar noon using an online calculator (<http://clearskycalculator.com/quantumsensor.htm>) based on the ASCE Standardized Reference Evapotranspiration Equation, American Society of Civil Engineers.

Reston, Virginia, USA. 2005 (<http://www.kimberly.uidaho.edu/water/asceewri/index.html>).

Table 1. LiCOR manufacturer scale factors ([PDF](#))

### BCO-DMO Processing:

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

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## Data Files

File
<b>par.csv</b> (Comma Separated Values (.csv), 225.68 MB) MD5:61c45a3c12d733b92f3d586b15bf8d29
Primary data file for dataset ID 657810

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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
yday_utc	UTC day and decimal time: eg. 326.5 for the 326th day of the year or November 22 at 1200 hours (noon).	unitless
PAR	Photosynthetically Available [Active] Radiation	micromoles photons/meter <sup>2</sup> /second
serial_no	serial number of PAR sensor	unitless
location	whether mooring is on land or intertidal zone	unitless

## Instruments

<b>Dataset-specific Instrument Name</b>	
<b>Generic Instrument Name</b>	Radiometer
<b>Dataset-specific Description</b>	Irradiance was measured using a LiCor LI-190R Quantum Sensor together with a universal transconductance amplifier (EME systems) to amplify the micro-amp current output of the PAR sensor and then recorded to a datalogger (Onset Hobo).
<b>Generic Instrument Description</b>	Radiometer is a generic term for a range of instruments used to measure electromagnetic radiation (radiance and irradiance) in the atmosphere or the water column. For example, this instrument category includes free-fall spectral radiometer (SPMR/SMSR System, Satlantic, Inc), profiling or deck cosine PAR units (PUV-500 and 510, Biospherical Instruments, Inc). This is a generic term used when specific type, make and model were not specified.

## Deployments

### KH\_intertidal 2008-2015

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

### BH\_intertidal 2008-2015

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

### CA\_intertidal 2007-2013

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

**CB\_intertidal\_2008-2014**

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

**CM\_intertidal\_2012-2014**

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

**FC\_intertidal\_2009-2015**

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

**MC\_intertidal\_2009-2015**

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

**POH\_intertidal\_2009-2014**

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

**RP\_intertidal\_2008-2014**

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

#### **SH\_intertidal 2009-2015**

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

#### **YB\_intertidal 2008-2015**

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/657693">https://www.bco-dmo.org/deployment/657693</a>
<b>Platform</b>	PISCO Yachats Beach Ecological Time-Series Station
<b>Start Date</b>	2008-05-07
<b>End Date</b>	2015-10-26
<b>Description</b>	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, pCO<sub>2</sub>, 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 CO<sub>2</sub> 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
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-1061233</a>
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-1061530</a>
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-1519401</a>

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