Daily intertidal temperatures (air and water) for Oregon and California PISCO sites from 1993 to 2024

Website: https://www.bco-dmo.org/dataset/990924
Data Type: Other Field Results
Version: 1
Version Date: 2026-01-30

Project
» LTREB: Testing tipping points in a model rocky intertidal meta-ecosystem – Climate-change, increasing variances, and response mechanisms (LTREB Intertidal Tipping Points)

Contributors	Affiliation	Role
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Abstract
To characterise the temperature regime at each site, we used temperature loggers deployed by the PISCO and MARINe research programmes at several sites along the Oregon and California coasts. These data are valuable for determining how organisms on shore (see associated datasets in the project) are responding to temperature changes as the climate warms. See methods for details.

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Coverage

Location: Rocky intertidal shoreline of Oregon and California
Spatial Extent: **N**:44.83863831 **E**:-119.87804 **S**:34.40692902 **W**:-124.5651
Temporal Extent: 1993-07-18 - 2024-12-08

Dataset Description

This time series is part of the LTREB project listed on this page (Award DEB-2050017) and was supported by the prior awards listed in the “Awards” section on this page.

PISCO = Partnership for Interdisciplinary Studies of Coastal Oceans
MARINe = Multi-Agency Rocky Intertidal Network

Methods & Sampling

To characterize the temperature regime at each site, we used existing temperature loggers deployed by the PISCO and MARINe research programs. Temperature loggers (HOBO TidBit v2 by Onset) were deployed at fixed locations inside steel mesh cages, set to record every 15 mins, and swapped every ~6-12 months. Once

loggers were collected, we assigned the tidal levels for each site and time stamp using Xtide software (https://flaterco.com/xtide/files.html) and the nearest harmonic tidal station. See Gravem et al. (2024, doi:10.1111/jbi.15029; Appendix S1, Table S1.2a). We graphed the temperature and the tide heights for each logger, and used this to visually estimate the shore level of the logger to the nearest 0.5 ft (air temperatures have clearly higher variance than water temperatures). We assigned any tide height higher than the logger height as "water" and any tide height lower than the logger height as "air". We calculated the daily average mean and maximum air and water temperatures at each site. We also calculated the average daily mean, minimum and maximum water temperature. On wavy days, temperatures assigned as air temperatures probably intermittently submerged. However, we are more interested in air temperature stress than average air temperature, so our focal air temperature metric was maximum daily air temperature, which likely occurred during the lowest tides when waves were not washing over the loggers.

BCO-DMO Processing Description

* Table within the submitted file "Temps_Daily.csv" was imported into the BCO-DMO data system for this dataset. Values "NA" imported as missing data values. Table will appear as Data File: 990924_v1_daily-intertidal-temps.csv (along with other download format options).

* Sheet 1 within file "TempLogger_LatLongShoreLevel_2023-11-17_SAG.xlsx" was imported and appears in this dataset as "templogger-site-metadata.csv"

* Table within BCODMO_SiteList_STARS_2023-04-11_SAG.xlsx added as supplemental file sitelist_stars.csv

Missing Data Identifiers:
* In the BCO-DMO data system missing data identifiers are displayed according to the format of data you access. For example, in csv files it will be blank (null) values. In Matlab .mat files it will be NaN values. When viewing data online at BCO-DMO, the missing value will be shown as blank (null) values.

* Column names in the supplemental table were adjusted to conform to BCO-DMO naming conventions designed to support broad re-use by a variety of research tools and scripting languages. [Only numbers, letters, and underscores. Can not start with a number]

* lat and lon values rounded to five decimal places

* daily_meantemp_c contained long decimals and was rounded to two decimal places as consistent with the precision show in the daily_mintemp_c and daily_maxtemp_c columns.

Problem Description

Several gaps in data due to loss of loggers due to wave dislodgement.

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Related Publications

Gravem, S. A., Bachhuber, S., Bignami, S., Chiachi, A. E., Field, L. C., Gaddam, R. N., Raimondi, P. T., & Menge, B. A. (2024). Biogeographic Patterns in Density, Recruitment, Body Size and Zonation of Rocky Intertidal Predators Suggest Increased Population Vulnerability Near Southern Range Limits. Journal of Biogeography, 52(2), 257–273. Portico. https://doi.org/10.1111/jbi.15029
Results

Gravem, S. A., Poirson, B. N., Robinson, J. W., & Menge, B. A. (2024). Resistance of rocky intertidal communities to oceanic climate fluctuations. PLOS ONE, 19(5), e0297697. https://doi.org/10.1371/journal.pone.0297697
Results

Menge, B. A., Robinson, J. W., Poirson, B. N., & Gravem, S. A. (2023). Quantitative biogeography: Decreasing and more variable dynamics of critical species in an iconic meta-ecosystem. Ecological Monographs, 93(1). Portico. https://doi.org/10.1002/ecm.1556
Results

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Parameters

Parameter	Description	Units
pisco_code	Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) code for site	unitless
SiteCode_OSU	Unique abbreviated code for each site	unitless
Name	Unique long form site name for each site	unitless
State	US state in which site is located	unitless
Cape	Cape assignment for site (i.e. nearest headland)	unitless
Region	Region as Oregon, NorCal (N of SF Bay), CenCal (Pt Conception to SF Bay), or So Cal (S of Pt Conception)	unitless
Latitude	Logger latitude coordinate in decimal degrees	decimal degrees
Longitude	Logger longitude coordinate in decimal degrees	decimal degrees
date	date of record	unitless
year	year of record	unitless
month	month of record	unitless
yearmonth	year and month of record	unitless
day	day of record	unitless
zonetype	High (XHS), mid (XMS) or low (XLS) zone within the intertidal. high is in barnacle zone, mid in mussel zone, and low below mussel zone.	unitless
airwater	whether most likely recorded in air or water based on the shore level of logger and tide height at time of record	unitless
n_records	number of records in air or water taken that day	count

mean_dailytemp_c	mean temperature of records in air or water taken that day	degrees Celsius
max_dailytemp_c	max temperature of records in air or water taken that day	degrees Celsius
min_dailytemp_c	minimum temperature of records in air or water taken that day	degrees Celsius

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Instruments

Dataset-specific Instrument Name	HOBO TidBit v2 by Onset
Generic Instrument Name	Onset HOBO TidbiT v2 (UTBI-001) temperature logger
Generic Instrument Description	A temperature logger that measures temperatures over a wide temperature range. It is designed for outdoor and underwater environments and is waterproof to 300 m. A solar radiation shield is required to obtain accurate air temperature measurements in sunlight (RS1 or M-RSA Solar Radiation Shield). With an operational temperature range between -20 degrees Celsius and +70 degrees Celsius, the TidbiT v2 has an accuracy of +/-0.21 and a resolution of 0.02 degrees Celsius.

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Project Information

LTREB: Testing tipping points in a model rocky intertidal meta-ecosystem – Climate-change, increasing variances, and response mechanisms (LTREB Intertidal Tipping Points)

Coverage: West coast of North America

NSF abstract:

In recent decades, ocean ecosystems, long thought to be immune to change, have undergone disruptions to their structure, diversity, and geographic range, yet the actual underlying reasons for such changes in oceanic biota are often unclear. Coastal intertidal zones (i.e., the shore between high and low tides) have long served as important ecological model systems because of advantages in accessibility and ease of observation, occupancy by easily studied and manipulated organisms of relatively short lifespans, and exposure to often severe environmental conditions. This research will address the stability of a well-known rocky shore system along the Oregon and California coasts. Prior long-term research indicates that, although casual observation suggests these systems are stable, in fact, they may be on the cusp of shifting into another state, losing iconic organisms like mussels and sea stars, and becoming dominated by seaweeds. These changes might be comparable to losing trees and large predators from terrestrial systems. This study would result in the training of undergraduates and graduate students, including individuals from under-represented groups. Additionally, this study would include outreach to the general public.

The researchers will focus particularly on impacts of increasing and more variable warming on community recovery. For example, climate oscillations (e.g., El Niño), coastal upwelling, and particularly temperature have all changed in recent decades in ways leading to increased stress on intertidal biota. In apparent response, coastal ecosystems evidently have become less productive, organismal performance (growth, reproduction)

has declined, and key dynamical processes (species interactions) have weakened. The new research will pursue these strong hints of an impending “tipping point” by (1) continuing the projects that led to the insights of increasing instability, (2) adding new projects that will pinpoint ecological changes, and (3) expanding the region of work to include locations in California. Research will assess whether or not sea stars recover from wasting disease, experimentally test if species interactions are indeed weakening, quantify the annual inputs of new prey and changes in abundance, diversity, stability, and resilience of intertidal communities, and document changes in the physical environment. Using field observations and experiments, the research will provide insight into impacts of environmental change, particularly warming, on the future of coastal ecosystems, and more generally, into possible future states of Earth’s ecosystems. Using these data, we will test the hypothesis that direct and indirect effects of climate change are driving, or may drive these systems into new, alternative states.

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-1061233
NSF Division of Ocean Sciences (NSF OCE)	OCE-0726983
NSF Division of Ocean Sciences (NSF OCE)	OCE-1448913
NSF Division of Environmental Biology (NSF DEB)	DEB-2050017
NSF Division of Environmental Biology (NSF DEB)	DEB-1554702
NSF Division of Environmental Biology (NSF DEB)	DEB-1050694

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