

Intertidal temperatures measured via data loggers deployed at 19 rocky intertidal sites in California, USA and Baja California, Mexico from spring 2022 to fall 2023

Website: <https://www.bco-dmo.org/dataset/926813>

Data Type: Other Field Results

Version: 1

Version Date: 2024-06-19

Project

» [Predicting impacts of coastal species redistribution in a changing climate](#) (CoastalRedistImpacts)

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Abstract

Coastal zones are some of the most productive and most threatened ecosystems on Earth, yet our ability to predict their vulnerability or resilience is limited due to the highly dynamic nature of these habitats. Importantly, surface temperatures measured at broad scales (e.g., by satellites) cannot capture onshore temperatures which vary at meso- and micro-scales due to, e.g., aspect, solar radiation, waves, etc. We monitored intertidal temperatures via data loggers deployed at 19 rocky intertidal sites in California, USA and Baja California, Mexico. Loggers were deployed at 1.0 meter (m) above MLLW (mean lower-low water) at all sites and at 0.5 and 1.5 m at a subset of sites. At each site and tide height (for sites with multiple loggers), completeness of the temperature record varies but most provide continuous records for up to ~18 months from spring 2022 to fall 2023.

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Coverage

Location: Rocky intertidal zone of California, USA and Baja California, Mexico

Spatial Extent: N:40.396 E:-116.037 S:30.459 W:-124.378

Temporal Extent: 2022-04-12 - 2023-10-31

Methods & Sampling

Temperature loggers were attached to the inside of a white PVC cap with cable ties, and the cap was bolted flush with the rock in the intertidal zone. Loggers were deployed at 1.0 meter (m) elevation (and, at some sites, 0.5 and 1.5 m) above MLLW (mean lower-low water) as determined using a laser level and tide predictions (<https://tide.arthroinfo.org/>). The loggers recorded temperatures continuously at 30-minute intervals.

Data Processing Description

Temperature data were cleaned "by hand" at the start and end of deployments to ensure that all records are from the time that the loggers were deployed in the intertidal zone.

BCO-DMO Processing Description

- Imported original file "Logger Data (Range Shift NSF) - FINAL.xlsx" into the BCO-DMO system.
- Replaced years of "0202" with "2022".
- Renamed fields to comply with BCO-DMO naming conventions.
- Converted date and time columns to ISO 8601 format in PDT (UTC-7:00); removed the original, separate Date and Time columns.
- Created an ISO 8601 date-time column in UTC.
- Removed duplicate rows as discussed with PI.
- Removed original rows numbered 7761 and 7762 as discussed with PI due to missing temperature values.
- Removed original rows numbered 182217 and 160838 as requested by PI because the logger had not equilibrated to field temperature.
- Saved the final file as "926813_v1_coastal_intertidal_temperatures.csv"

Problem Description

There are some gaps in data due to loss of loggers and malfunctions, particularly at Little Corona 1.0 m, Heisler Park 0.5 m, and Cardiff State Beach 0.5 m. Since loggers were deployed at 1.0 m at all sites, there is the best data availability at this elevation, with the exception of Little Corona.

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Data Files

File
926813_v1_coastal_intertidal_temperatures.csv (Comma Separated Values (.csv), 51.66 MB) MD5:5f33fc92cba947543cae8d2980b26968
Primary data file for dataset ID 926813, version 1

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Parameters

Parameter	Description	Units
Site_Name	Name of the location at which temperature was measured	unitless
Latitude	Latitude of sampling location (positive values = North)	decimal degrees
Longitude	Longitude of sampling location (negative values = West)	decimal degrees
Elevation	Tide height at which temperature was measured	meters above mean lower-low water
ISO_DateTime_PDT	Date and time of temperature measurement in ISO 8601 format; time zone = PDT (UTC-7:00)	unitless
ISO_DateTime_UTC	Date and time of temperature measurement in ISO 8601 format; time zone = UTC	unitless
Temperature	Temperature measurement	degrees Celsius

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Instruments

Dataset-specific Instrument Name	Pendant MX (part ID: MX2201)
Generic Instrument Name	Onset HOBO Pendant MX2201 temperature logger
Dataset-specific Description	Pendant MX (part ID: MX2201; $\pm 0.5^{\circ}\text{C}$ Accuracy) temperature loggers from Onset Corp. (Bourne, MA, USA)
Generic Instrument Description	The Onset HOBO MX2201 is an in-situ instrument for wet or underwater applications. It supports soil temperature, temperature, and water temperature. A one-channel logger that records up to approximately 96,000 measurements or internal logger events with 8K bytes memory. It has a polypropylene housing case. Uses Bluetooth to transmit data. Can be used with a solar radiation shield. Measurement range: -20 deg C to 70 deg C. Accuracy: +/- 0.50 deg C from 0 deg C to 50 deg C. Water depth rating: 30.5 m

Dataset-specific Instrument Name	HOBO TidbiT v. 2 (part ID: UTBI-001)
Generic Instrument Name	Onset HOBO TidbiT v2 (UTBI-001) temperature logger
Dataset-specific Description	HOBO TidbiT v. 2 (part ID: UTBI-001; -20°C to 70°C Temperature Measurement Range with $\pm 0.2^{\circ}\text{C}$ Accuracy) temperature loggers from Onset Corp. (Bourne, MA, USA)
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

Predicting impacts of coastal species redistribution in a changing climate (CoastalRedistImpacts)

NSF Award Abstract:

This project will improve our ability to anticipate the impacts of shifts in the geographic range of coastal species in a changing climate. Although range shifts may be necessary for some species to avoid extinction as the climate warms, the arrival of new ones to an ecosystem can also lead to population declines and loss of biodiversity. The investigator is developing approaches to predict the impacts of range shifts along Pacific shorelines using techniques that have been previously validated for risk assessments for invasive species. The research objectives of this study are integrated with educational activities: engagement of undergraduate and graduate students in data collection and analysis and implementation of a hierarchical mentoring program to serve English Language Learners within the investigator's Minority Serving Institution. The investigator is also partnering with outreach organizations in the U.S. and Mexico to educate K-12 students and multiple stakeholder groups about climate-driven range shifts and tools for predicting outcomes of redistribution, which can assist practitioners in creating management plans and policies.

This study is developing a framework for understanding the impacts of marine species redistribution with a focus on poleward-moving carnivorous whelk species in rocky shorelines from Northern California to Baja, Mexico. Project goals are to 1) quantify the impacts of shifting species on populations and communities in the expanded range; 2) assess whether impacts of shifting species differ between their native and expanded ranges; and 3) predict future impacts under climate warming. The investigator is addressing fundamental questions in community ecology about the degree to which species interactions are density- and context-dependent. She is combining observational and experimental approaches with a broader data synthesis effort to test whether the impacts of species redistribution can be predicted by key indicators of invasion impacts: abundance, trophic level, and impacts in the native range. Empirical data combined with paired demographic and distribution modeling will be used to project future impacts across the expanded ranges of these coastal marine species.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2124438

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