TidBiT logger temperature data for intertidal ocean temperatures in Northern and Central California between Jun 2022 and Dec 2023

Website: https://www.bco-dmo.org/dataset/1000482
Data Type: Other Field Results
Version: 1
Version Date: 2026-06-09

Project
» Evolutionary and ecological dynamics of a contemporary climate-driven range expansion (LottiaRangeExp)

Contributors	Affiliation	Role
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Abstract
These data include TidBiT logger temperature readings collected in the rocky intertidal zone across five sites spanning the northern and central California coast between Summer 2022 and Fall 2023. TidBiT loggers were deployed in steel mesh enclosures bolted to the rocky substrate and programmed to sample on 30 minute cycles. To ensure we only recorded ocean temperatures, we filtered the dataset to only include readings that occurred within 1.5 hours of high tide. These data were collected in conjunction with a manipulative field experiment to assess how the strength of competition varies across the range edge and range core for Lottia gigantea.

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Coverage

Location: Northern and Central California rocky intertidal zone
Spatial Extent: **N**:38.5973 **E**:-120.6144 **S**:34.5878 **W**:-123.363
Temporal Extent: 2022-06-19 - 2023-12-13

Methods & Sampling

We recorded ocean temperature at five intertidal sites in Northern and Central California (Kruse Ranch, Bodega Marine Reserve, Hopkins Marine Station, Soberanes Point, and Vandenberg) by deploying two TidbiT dataloggers (Onset Computer Corp.) in the intertidal zone at each site in June 2022, which recorded temperature at 30 min intervals. We anchored dataloggers in small steel mesh cages bolted to the substrate.

Data Processing Description

Temperature data were filtered to only include readings recorded within 1.5 hrs of high tide. Datasets were trimmed to ensure that only water temperature readings were included and not aerial temperatures.

BCO-DMO Processing Description

- Loaded dataloggers_temp from dataloggers.temp.csv with header row 1; empty strings and "nd" treated as missing values
- Applied find_replace on Datetime.logger to replace date-only values (matching pattern ^\d+/\d+/\d+$, i.e. values with no time component) with empty string, treating them as missing
- Renamed columns: Datetime.logger to Datetime_logger, H1 to hightide_1, H2 to hightide_2
- Converted Datetime_logger from format %m/%d/%y %H:%M (Pacific Time) to ISO 8601 datetime string %Y-%m-%dT%H:%M in Pacific Time, output to new column Datetime_logger_PT, preserving metadata
- Converted Date from format %m/%d/%y to ISO 8601 date format %Y-%m-%d, overwriting the Date column in place, preserving metadata
- Converted hightide_1 from format %m/%d/%y %H:%M (Pacific Time) to ISO 8601 datetime string %Y-%m-%dT%H:%M in Pacific Time, overwriting hightide_1, preserving metadata
- Converted hightide_2 from format %m/%d/%y %H:%M (Pacific Time) to ISO 8601 datetime string %Y-%m-%dT%H:%M in Pacific Time, overwriting hightide_2, preserving metadata
- Converted Datetime_logger_PT from format %Y-%m-%dT%H:%M (Pacific Time) to UTC datetime string %Y-%m-%dT%H:%MZ, output to new column Datetime_logger_UTC, preserving metadata
- Deleted original Datetime_logger column
- Reordered columns to: Datetime_logger_PT, Datetime_logger_UTC, Temp, Date, hightide_1, hightide_2, Logger, Site, Latitude, Longitude
- Renamed hightide_1 to Datetime_hightide_1_PT and hightide_2 to Datetime_hightide_2_PT
- Renamed table from dataloggers_temp to 1000482_v1_datalogger_temp
- Output final table to 1000482_v1_datalogger_temp.csv

Problem Description

We were unable to download temperature data from a logger at Soberanes. As a result, there are only recordings from one logger at that site

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Related Datasets

IsRelatedTo

Walkes, S., Bay, R., Sanford, E. (2026) **Lottia gigantea growth data from field experiments of experimentally manipulated competitor densities on the Northern and Central California coast from Feb to Dec 2023.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2026-06-09 http://lod.bco-dmo.org/id/dataset/1000489 [view at BCO-DMO]
Relationship Description: Data were collected in conjunction with intertidal temperature data to assess how the strength of competition varies across the range edge and range core for Lottia gigantea.

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Parameters

Parameter	Description	Units
Datetime_logger_PT	Datetime at which the logger recorded temperature. Times are recorded in Pacific Time (PT)	unitless
Datetime_logger_UTC	Datetime at which the logger recorded temperature. Times are recorded in UTC	unitless
Temp	Temperature reading from logger	degrees Celsius
Date	Local date on which temperature was recorded, in Pacific Time (PT)	unitless
Datetime_hightide_1_PT	Datetime of the first high tide for the temperature readings were recorded, in Pacific Time (PT)	unitless
Datetime_hightide_2_PT	Datetime of the second high tide for the temperature readings were recorded, in Pacific Time (PT)	unitless
Logger	Logger ID	unitless
Site	The site at which the logger was deployed; KR = Kruse Ranch, BMR = Bodega Marine Reserve, HMS = Hopkins Marine Station, SBR = Soberanes Point, and VSB = Vandenberg	unitless
Latitude	Latitude of the site, positive is North	decimal degrees
Longitude	Longitude of the site, negative is West	decimal degrees

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Instruments

Dataset-specific Instrument Name	TidBiT v2
Generic Instrument Name	Onset HOBO TidbiT v2 (UTBI-001) temperature logger
Dataset-specific Description	TidBiT v2 Water Temperature Datalogger (Onset)
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

Evolutionary and ecological dynamics of a contemporary climate-driven range expansion (LottiaRangeExp)

Coverage: Coastal California intertidal

NSF abstract:
Anthropogenic climate change is shifting the distributions of species across the globe. Such contemporary shifts in species' ranges may have cascading effects on entire ecosystems. This project disentangles the mechanisms underlying climate-driven species range shifts in marine systems using the intertidal owl limpet as a case study. During the recent marine heatwaves off the Pacific coast of North America, populations at the northern range limit in northern California have expanded, with ongoing reproduction even after termination of the heatwave events. This is therefore an ideal system to explore the dynamics of natural selection that occur as species occupy new regions. Broadly, this project deepens understanding of how range shifts occur in marine systems and furthers the ability to predict future species distributions in response to climate change. The project provides research experiences for high school and undergraduate students from historically underrepresented groups by engaging with existing, demonstrably-effective programs. The investigators host leadership and skill-building workshops for senior female graduate students and engage the public in partnership with the California Academy of Sciences, Bodega Marine Lab, and San Francisco Exploratorium. Finally, the project provides training for a postdoctoral scholar and two graduate students.

Although phenomenological studies suggest that climate-associated range shifts are common in marine systems, to date, mechanistic studies of the climate-organism interactions that alter geographic distributions have largely focused on terrestrial systems. However, dispersal dynamics greatly differ in many marine systems, as currents may frequently transport planktonic larvae into new environmental regimes. This project integrates detailed demographic observations of the recent range expansion of the intertidal owl limpet, Lottia gigantea, with ecological, phenotypic, and genomic measurements of divergence across its range. Specifically, the work 1) documents phenotypic divergence in larval and juvenile traits across the zone of range expansion, 2) uses whole genome sequencing to estimate gene flow across the entire range, 3) identifies genomic patterns of selection across the zone of range expansion and through time, and 4) identifies drivers of variation in performance over latitudinal and microgeographic scales. The ability to monitor this range shift in real time, along with the suitability of this system for tracking individuals across multiple years, allows the investigators to examine the impact of selection in novel range-edge conditions at the phenotypic and genomic levels, and scale from individuals to species-level responses to ongoing environmental change.

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-2023297

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