Temperature, salinity, and chlorophyll data used for analysis of urchin gut microbiota, Echinometra sp. EZ (Temporal Data Series)

Website: https://www.bco-dmo.org/dataset/858366
Data Type: Other Field Results
Version: 1
Version Date: 2021-08-12

Project
» Dispersal, connectivity and local adaptation along an extreme environmental gradient (Env Gradient Adaptation)

Contributors	Affiliation	Role
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Abstract
Temperature, chlorophyll, and salinity data used for the analysis of urchin gut microbiota, Echinometra sp. EZ. Sea surface temperature data were obtained from NOAA. In addition, a temperature logger (Onset Hobo Tidbit V2) was deployed on the reef substrate at Saadiyat reef which recorded at 60-minute intervals for the temporal series. Chlorophyll concentrations were obtained from NASA MODIS AQUA. Salinity data were obtained from a numeric ocean model: the 1/12 Global Hybrid Coordinate Ocean Model.

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Coverage

Spatial Extent: **Lat**:24.599 **Lon**:54.4215
Temporal Extent: 2017-03-12 - 2018-02-11

Methods & Sampling

The temporal series involved sampling from one site in the Arabian Peninsula, Saadiyat. We used NOAA's

Environmental Research Division Data Access Program (ERDDAP) website to collect sea surface temperature data. The temperature data was downloaded using a bounding box that covered the study area on the day of collection at 12:00:00 UTC (temperature was averaged over one day).

In addition, a temperature logger (Onset Hobo Tidbit V2) was deployed on the reef substrate at Saadiyat reef which recorded at 60-minute intervals for the temporal series (Figure S1 of Ketchum et al., 2021). Chlorophyll concentrations were obtained from MODIS AQUA (https://oceancolor.gsfc.nasa.gov) level 3 monthly averaged data, and salinity data were obtained from a numeric ocean model: the 1/12 Global Hybrid Coordinate Ocean Model (HYCOM; https://www.hycom.org/data/glbu0pt08/expt-91pt2) at 12:00:00 UTC on the day of collections.

Data Processing Description

BCO-DMO Processing:
- changed date format to YYYY-MM-DD;
- replaced 'NA' with 'nd' (no data).

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Data Files

File
temporal_series.csv (Comma Separated Values (.csv), 12.53 KB) MD5:0582b620be57e0fca4e95fa74c1ba962 Primary data file for dataset ID 858366

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Related Publications

Ketchum, R. N., Smith, E. G., Vaughan, G. O., McParland, D., Al-Mansoori, N., Burt, J. A., & Reitzel, A. M. (2021). Unraveling the predictive role of temperature in the gut microbiota of the sea urchin Echinometra sp. EZ across spatial and temporal gradients. Molecular Ecology, 30(15), 3869–3881. doi:10.1111/mec.15990
Results

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Related Datasets

IsRelatedTo

Ketchum, R., Smith, E. G., Vaughan, G. O., McParland, D., Al-Mansoori, N., Burt, J. A., Reitzel, A. (2021) **Temperature, salinity, and chlorophyll data used for analysis of urchin gut microbiota, Echinometra sp. EZ (Spatial Data Series).** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2021-08-12 doi:10.26008/1912/bco-dmo.858398.1 [view at BCO-DMO]

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Parameters

Parameter	Description	Units
Sample	Sample ID. Format is either "month.sample#" or "month.sa.sample#."	unitless
season	Season is determined by temperature at time of collection and subsequently split into three groups: summer, winter, or overlap.	unitless
site	Collection site ID. SA represents Saadiyat Reef.	unitless
gulf	The Gulf that samples were collected from. PAG is Persian/Arabian Gulf.	unitless
dataset	This study generated two datasets; the temporal series and the summer-winter spatial series.	unitless
month	Month of collection	unitless
year	Year of collection	unitless
Hycom_Salinity	Salinity data was obtained from a numeric ocean model: the 1/12 Global Hybrid Coordinate Ocean Model (HYCOM; https://www.hycom.org/data/glbu0pt08/expt-91pt2) at 12:00:00 UTC on the day of collections.	PPT
Temp_CRW	NOAA's Environmental Research Division Data Access Program (ERDDAP) website was used to collect sea surface temperature data. The temperature data was downloaded using a bounding box that covered the study area on the day of collection at 12:00:00 UTC (temperature was averaged over one day).	Degrees Celsius
Temp_Logger	Temperature logger (Onset Hobo Tidbit V2) was deployed on the reef substrate at Saadiyat reef which recorded at 60-minute intervals	Degrees Celsius
Mon_Ocean_Color_NASA_Chl	Chlorophyll concentrations were obtained from MODIS AQUA (https://oceancolor.gsfc.nasa.gov) level 3 monthly averaged data.	milligrams per cubic meter (mg m-3)
Date_Collected	Day of collection in YYYY-MM-DD format (UTC)	unitless
Latitude	Latitude of collection site	decimal degrees
Longitude	Longitude of collection site	decimal degrees

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Instruments

Dataset-specific Instrument Name	Onset Hobo Tidbit V2
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

Dispersal, connectivity and local adaptation along an extreme environmental gradient (Env Gradient Adaptation)

Coverage: Persian/Arabian Gulf and the Gulf of Oman

NSF Award Abstract:
Future increases in sea temperatures are expected to have far-reaching and detrimental consequences for marine organisms. Organisms must either move to more favorable environments, acclimate to maintain homeostasis, or adapt through genomic changes to the new thermal regime, otherwise local extinction will occur. For marine benthic organisms that are largely and completely sedentary, their capacity to migrate is dependent on larval dispersal, which is hypothesized to be limited under warming conditions. In this project, the research team studies populations of four marine invertebrate species (coral, sea urchin, oyster, ascidian) across the substantial thermal gradient along the northeastern Arabian Peninsula as a natural system to quantify the effects of elevated temperatures on dispersal, genetic connectivity and adaptation. The team will use an integrative approach that consists of experimental larval assays, biophysical modeling and high throughput sequencing technologies. This study provides a comprehensive assessment of the potential impacts of climate change on economically and ecologically important organisms, while enriching the understanding of core ecological and evolutionary concepts. The success of this project results from a synergistic international collaboration with New York University at Abu Dhabi, United Arab Emirates. This research project provides mentoring and training for a postdoctoral scholar, a graduate student, and four undergraduate students from underrepresented minority groups who are interested in pursuing graduate education. Each of these scholars is provided access to cutting-edge science, international and collaborative research opportunities, and experience disseminating their science to different audiences. Furthermore, the broader impacts extend to the Charlotte community and wider public in this region of North Carolina through the implementation of two outreach exhibits at a local science museum.

Understanding the interplay between dispersal, genetic connectivity and adaptation will be key to forecasting the impacts on future sea temperature increases on marine benthic invertebrates. This project uses the world's warmest reefs in the Persian/Arabian Gulf, that currently experience temperatures not anticipated on reefs elsewhere within the next century, as a model system to study the effects of elevated temperatures on these ecologically and evolutionary important processes. Populations of four invertebrate species from the Persian/Arabian Gulf are compared to populations in the neighboring Gulf of Oman that experiences a more benign thermal environment. The first aim characterizes the impact of elevated temperatures on the survival, pelagic duration, and settlement responses of larvae from different populations of the four focal species along the thermal gradient. These results are additionally compared with potential shifts in egg investment strategies by females from each location. The second aim uses these population-specific responses gleaned from the larval experiments to parameterize models of present day and future dispersal and compares them against existing patterns of genetic connectivity. The final aim analyzes the genomic basis for thermal adaptation in these populations through a combination of whole genome comparisons and single-generation selection experiments, with the goal to ascertain whether there is evidence for convergent/parallel evolution in the taxonomically distinct invertebrate species. This project is expected to advance our knowledge of adaptation to climate change by providing new insights into the impacts of temperature on a key life cycle stage and elucidate the genomic processes governing thermal adaptation in marine invertebrates.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1924498

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