Phallusia nigra larval settlement data from experiments with varying temperature conducted in May of 2022

Website: https://www.bco-dmo.org/dataset/938160
Data Type: experimental
Version: 1
Version Date: 2024-09-23

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

Contributors	Affiliation	Role
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Abstract
We conducted a preliminary study of the larval settlement success for the ascidian Phallusia nigra in response to temperature. Adult ascidians were collected from two locations and transported to the campus of NYU-Abu Dhabi. Gametes were collected from adults and embryos were fertilized in the laboratory. We quantified the number that metamorphosed and settled over a 92 hours.

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Coverage

Location: New York University - Abu Dhabi
Temporal Extent: 2022-05-11 - 2022-05-15

Methods & Sampling

Adult Phallusia nigra (LSID=urn:lsid:marinespecies.org:taxname:103725) were collected from two reef locations: Abu Dhabi and Fujairah. The adults were transferred to NYU-Abu Dhabi. Gametes were collected from adults by pipette and combined to produce embryos. Embryos (n=30) were then aliquoted into 6-well plates and cultured at three temperatures (27, 33 and 36 degree Celsius). Number of larvae that successfully metamorphosed and settled as juveniles were quantified at four time points (0, 8, 20, 44, and 92 hours).

BCO-DMO Processing Description

* Data table from "Phallusia larval settlement.csv" was imported into the BCO-DMO data system for this dataset.

* Column names 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]

* Date converted to ISO 8601 format

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Data Files

File
938160_v1_p-nigra-larval-settlement.csv (Comma Separated Values (.csv), 5.48 KB) MD5:b65786b84115e53f5ee734f0459e57ad Primary data file for dataset ID 938160, version 1

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Parameters

Parameter	Description	Units
DATE	date of the observation	unitless
SITE	original site of collection for the adult ascidians	unitless
TEMP	temperature for the condition	degrees Celsius
REP	replicate	unitless
ID	individual identifier	unitless
TIMEPOINT_HRS	hours in the experimental time period	hours
LARVAE	number of larval P. nigra	unitless
METAMORPHOSIS	number of metamorphosed P. nigra	unitless
JUVENILE	number of juvenile P. nigra	unitless
SURVIVAL_out_of_30	number of surviving P. nigra	unitless

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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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