Acartia tonsa survival data for transgenerational ocean warming and acidification data

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Data Type: experimental
Version: 1
Version Date: 2023-09-07

Project
» Collaborative Research: Response of marine copepods to warming temperature and ocean acidification (Copepod Response to Warming Temp and OA)

Contributors	Affiliation	Role
Dam, Hans G.	University of Connecticut (UConn)	Principal Investigator
Baumann, Hannes	University of Connecticut (UConn)	Co-Principal Investigator
Finiguerra, Michael	University of Connecticut (UConn)	Co-Principal Investigator
Pespeni, Melissa H.	University of Vermont (UVM)	Co-Principal Investigator
Brennan, Reid	University of Vermont (UVM)	Scientist
deMayo, James A.	University of Connecticut (UConn)	Student, Contact
Park, Gihong	University of Connecticut (UConn)	Student
Norton, Lydia	University of Connecticut (UConn)	Technician
Soenen, Karen	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
These data include survivorship measurements collected for Acartia tonsa during multigenerational exposure to ocean warming (OW), ocean acidification (OA), and combined ocean warming and acidification (OWA) including a benign ambient condition temperature and CO2 control (AM). These data were collected every third generation between F0 and F15 and at F25 for all treatments. Data was collected as the proportion of surviving individuals on any day (x) relative to the starting number of individuals for an single experiment.

Table of Contents

- Dataset Description
  - Methods & Sampling
  - Data Processing Description
- Data Files
- Related Publications
- Related Datasets
- Parameters
- Instruments
- Project Information
- Funding

Dataset Description

These data are part of at multigenerational experiment of Arcatia tonsa exposure to ocean warming (OW), ocean acidification (OA), and combined ocean warming and acidification (OWA) including a benign ambient condition temperature and CO2 control (AM). These data were collected every third generation between F0 and F15 and at F25 for all treatments.

Methods & Sampling

Survival was measured from nauplius 1 (N1) stage to copepodid 6 (adult) stage. For a given generation, all adults from the previous generation were removed from the culture and allowed to lay eggs in food-replete media for 48 h. Resulting nauplii were chosen for tracking survival. Unhatched eggs and any nauplii not chosen for survival analysis were returned to their respective replicate cultures for continued population maintenance. To measure survival for all generations where life-history traits were evaluated, three 250-mL beakers for each replicate culture were supplied with 25 randomly chosen N1 nauplii each and housed in the plexiglass enclosure described above (n = 21 per treatment). Copepods were checked every 48-72 h. The number of dead, live, and missing copepods were logged for each beaker along with general stage (i.e. nauplius, copepodite, adult female, or adult male). Nauplii were grown with media at levels of 500 µg C L-1 to prevent overgrowth of phytoplankton and allow for adequate nauplii grazing. Following the naupliar stages, copepods were grown with food-replete (800 µg C L-1) media as described earlier. Food was replaced with fresh media on monitoring days. The target (actual ± standard deviation) conditions were as follows: ambient (AM) temperature = 18 °C (18 ± 0.34, N = 330), AM pCO2= 400 µatm (379 ± 36, N = 18; pH = 8.26 ± 0.1, N = 330); high temperature = 22 °C (22 ± 0.81, N = 336); and high pCO2= 2,000 µatm (2,301 ± 215, N = 18; pH = 7.55 ± 0.08, N = 330). AM target levels represented extant conditions for this species in northeast Atlantic estuaries.

Data Processing Description

The fraction of survived individuals (lx) was calculated as nx/ni where *nx* represents the number of live individuals on day *x*, and *ni* represents initial individuals. Average survival was calculated per each replicate culture at each generation measured. Differences in day-specific survival between replicates and treatments was assessed using the 'survival' package in R.

[table of contents | back to top]

Data Files

File
906222_v1_survival.csv (Comma Separated Values (.csv), 117.58 KB) MD5:ee08914513f0ec4ffff3cf3d027bb4e1 Primary data file for dataset 906222

[table of contents | back to top]

Related Publications

Dam, H. G., deMayo, J. A., Park, G., Norton, L., He, X., Finiguerra, M. B., Baumann, H., Brennan, R. S., & Pespeni, M. H. (2021). Rapid, but limited, zooplankton adaptation to simultaneous warming and acidification. Nature Climate Change, 11(9), 780–786. https://doi.org/10.1038/s41558-021-01131-5
Results

[table of contents | back to top]

Related Datasets

IsPartOf

deMayo, J., Dam, H. G., Park, G., Norton, L., Finiguerra, M., Baumann, H., Brennan, R., Pespeni, M. (2023) **Acartia tonsa body size data for transgenerational ocean warming and acidification experiments.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2023-09-07 doi:10.26008/1912/bco-dmo.906342.1 [view at BCO-DMO]
Relationship Description: Dataset is part of same experiment.

deMayo, J., Dam, H. G., Park, G., Norton, L., Finiguerra, M., Baumann, H., Brennan, R., Pespeni, M. (2023) **Acartia tonsa development time for transgenerational experiment.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2023-09-07

doi:10.26008/1912/bco-dmo.906188.1 [view at BCO-DMO]
Relationship Description: Dataset is part of same experiment.

HasPart

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deMayo, J., Dam, H. G., Park, G., Norton, L., Finiguerra, M., Baumann, H., Brennan, R., Pespeni, M. (2023) **Acartia tonsa egg production rate and egg hatching success for transgenerational exposure to ocean warming and ocean acidification.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2023-09-07 doi:10.26008/1912/bco-dmo.906780.1 [view at BCO-DMO]
Relationship Description: Dataset is part of same experiment.

[table of contents | back to top]

Parameters

Parameter	Description	Units
Generation	The corresponding generation when survival was measured.	unitless
Treatment	The corresponding treatment evaluated.	unitless
Temp	The target temperature in Celsius for each treatment.	degrees Celsius(°C)
pH	The pH for each treatment	unitless
Rep	The biological culture replicate for each treatment.	unitless
Beak	The replicate 25mL beaker used in survival assays.	unitless
time	The number of days after the start of the experiment.	unitless
nx	The number of surviving individuals.	unitless
lx	The proportion of surviving individuals remaining.	unitless

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Olympus SZH-ILLD stereoscope
Generic Instrument Name	Microscope - Optical
Generic Instrument Description	Instruments that generate enlarged images of samples using the phenomena of reflection and absorption of visible light. Includes conventional and inverted instruments. Also called a "light microscope".

[table of contents | back to top]

Project Information

Collaborative Research: Response of marine copepods to warming temperature and ocean acidification (Copepod Response to Warming Temp and OA)

Coverage: North western Atlantic ocean; Gulf of Maine, coastal and estuarine habitats

NSF Award Abstract:
Over time, our oceans are becoming both warmer and higher dissolved carbon dioxide. The latter condition is called ocean acidification. The consequences of these simultaneous changes for populations of marine organisms are not well understood. For this project, the investigators will conduct a series of laboratory experiments to determine how two closely-related, common species of Acartia copepods will respond to the interactive effects of warming and acidification and also how well these species can adapt over multiple generations to changing ocean conditions. Since these copepods are key species in coastal food webs, results will have important implications for understanding and predicting how marine ecosystems may respond to future climate change. The investigators will share results from the research through traditional print media, case studies, and video mini lectures. The goal will be for educators of all levels to easily access material on climate change and ocean acidification to include in teaching curricula, in alignment with recommendations for universal design for learning. The project is a collaborative effort between an established professor at the University of Connecticut and an early-career female scientist at the University of Vermont. It will provide training and opportunities for collaborative, interdisciplinary research for two postdoctoral investigators, two graduate students and an undergraduate student.

The project's main goals are: 1) to test the simultaneous effects of temperature and carbon dioxide under current and future conditions on life history traits throughout the life cycle for two key copepod species, warm-adapted Acartia tonsa and cold-adapted Acartia hudsonica; 2) to test for adaptive capacity of both copepod species to a warmer and carbon-dioxide-enriched ocean; 3) to measure the genetic and maternally-induced changes across multiple generations of experimental selection in future conditions in both copepod species, and to identify the genes and pathways responding to selection. The investigators will use experiments encompassing current and projected temperature and carbon-dioxide conditions, will determine the roles of each variable and their interaction on traits that affect the fitness of both copepod species. They will also determine which life stages are most sensitive to individual or simultaneous stress conditions. Through multigenerational selection experiments, the investigators will identify and characterize the mechanisms of copepod evolutionary adaptation. Finally, they will measure genomic changes across the generations under all four experimental conditions to quantify the relative contributions of genetic and maternally-induced change in the physiological and life history traits of copepods in response to near-future climate conditions.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1559075
NSF Division of Ocean Sciences (NSF OCE)	OCE-1559180

[table of contents | back to top]