Acartia tonsa development time for transgenerational experiment

Website: https://www.bco-dmo.org/dataset/906188
Data Type: experimental
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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 Connecticut (UConn)	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 development (i.e. maturation) time measurements for A. 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 were calculated for naupliar development time (i.e. naupliar stage 1 to naupliar stage 6) and copepodite development time (i.e. copepodite stage 1 to adulthood).

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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

Development time was measured on 75 individuals from each replicate culture per treatment (n=4 per treatment). The 75 individuals were split among three 25-mL beakers. Life stage was measured every 2-3 days and recorded as either naupliar or copepodite. Average time through naupliar and copepodite development was calculated based on the proportion of individuals occupying each life stage over time. 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

Data was processed with R v4.0. by calculating a weighted average of the time it took to mature from nauplii to copepodite or from copepodite to adult.

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Data Files

File
906188_v1_devtime.csv (Comma Separated Values (.csv), 126.30 KB) MD5:f56845bc3c537b897e24a43d96a27f01 Primary data file for dataset 906188.

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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

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Related Datasets

HasPart

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 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.

deMayo, J., Dam, H. G., Park, G., Norton, L., Finiguerra, M., Baumann, H., Brennan, R., Pespeni, M. (2023) **Acartia tonsa survival data for transgenerational ocean warming and acidification data.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2023-09-07 doi:10.26008/1912/bco-dmo.906222.1 [view at BCO-DMO]
Relationship Description: Dataset is part of same experiment.

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Parameters

Parameter	Description	Units
Generation	the generation where the development time was measured.	unitless
Treatment	the treatment (1=AM, 2=OA, 3=OW, 4=OWA).	unitless
Temp	the temperature condition of the relevant treatment	degrees Celsius (°C)
pH	The pH condition of the relevant treatment	unitless
Rep	The biological culture replicate	unitless
Beak	The 25-mL beaker within a culture replicate	unitless
time	The day at which the beaker was measured	unitless
nx	The number of individuals at a particular time	unitless
Ndev	The number of individuals that matured from nauplii to copepodites on any given day.	unitless
Cdev	The number of individuals that matured from copepodites to adulthood on any given day.	unitless

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Instruments

Dataset-specific Instrument Name	Olympus SZH-ILLD stereo microscope
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".

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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.

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Funding

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

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