Acartia tonsa egg production rate and egg hatching success for transgenerational exposure to ocean warming and ocean acidification

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Data Type: experimental
Version: 1
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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
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Abstract
These data include egg production rate (EPR) and egg hatching success (HS) data 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 number of eggs produced and hatched offspring per female per treatment at each generation.

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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

For each replicate culture within a treatment, 10 pairs of newly developed males and females were placed into 20 mL petri dishes for 48 h (n = 280 per treatment). The dishes were housed in custom-made, airtight, plexiglass enclosures whose atmosphere was controlled to the appropriate CO2 concentration. There was one enclosure per temperature-controlled incubator. After the 48-h egg laying period, adults were checked for survival and removed from the petri dishes. Eggs were left in the dishes for an additional 72 h to allow for egg hatching and their contents preserved with non-acid Lugol's solution. Dishes with dead males were used for EPR, but not HS, since fertilization could not be assumed.

Data Processing Description

Dishes with dead females were discarded. EPR was calculated as (Eu + Eh)/t where *Eu* represents unhatched eggs, *Eh* represents hatched eggs (nauplii), and *t* represents egg laying time. Hatching success was calculated as Eh. All data was processed in R v4.0.2

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Data Files

File	
906780_v1_dam_eggprod.csv	(Comma Separated Values (.csv), 31.51 KB) MD5:73865cfe814b672dd302b59968c573bc
Primary datafile for datase 906780	

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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

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: Dateset 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 corresponding generation when survival was measured	unitless
Rep	The corresponding treatment evaluated	unitless
Treatment	Target temperature for each treatment	unitless
Temp	Target pH for each treatment	degrees Celsius (°C)
pH	Biological culture replicate for each treatment	unitless
Hatched	Number of hatched eggs observed	unitless
Unhatched	Number of unhatched eggs observed	unitless
Total	Sum of "Hatched" and "Unhatched" columns	unitless
EPRtot	Rate of eggs produced per female per day	unitless
HFtot	Frequency of hatching success	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
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