Thermal limits of Acartia tonsa and the effect of isopod parasitism from Critical Thermal Maxima (CTmax) experiments conducted with copepods collected from Key Largo, Florida in February 2023

Website: https://www.bco-dmo.org/dataset/955736
Data Type: experimental
Version: 1
Version Date: 2025-03-11

Project
» Linking eco-evolutionary dynamics of thermal adaptation and grazing in copepods from highly seasonal environments (evolutionary_copepods)

Contributors	Affiliation	Role
Dam, Hans G.	University of Connecticut (UConn)	Principal Investigator
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Abstract
Acartia tonsa were collected from Key Largo, Florida in February 2023. A portion of the adult female copepods in this collection were parasitized by juvenile bopyrid isopods. We measured thermal limits (as Critical Thermal Maximum) for individuals with and without these parasites. Data were collected by Dr. Matthew Sasaki.

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Coverage

Location: Copepods were collected from Key Largo, Florida in surface plankton tows in the top three meters of water.
Spatial Extent: **Lat**:25.283906 **Lon**:-80.330128
Temporal Extent: 2023-02-27 - 2023-03-01

Methods & Sampling

Mature females were sorted from the bulk plankton tow. Females bearing juvenile bopyrid isopods were held separately from the unparasitized females. Thermal limits were measured as Critical Thermal Maxima (CTmax). During these assays, individual females are moved into 50 mL flat-bottom glass vials, which are then placed in a water bath. The temperature of the water bath is gradually raised (0.1-0.3°C per minute) until the individual stops moving. The water temperature at that point is recovered from a continuous temperature record; three sensors are placed into separate vials in the water bath and record temperature every five seconds for the duration of the experiment. These CTmax experiments were repeated four times over a three day period.

Organism identifiers (Life Science Identifier (LSID))

copepod, Acartia tonsa, urn:lsid:marinespecies.org:taxname:345943
bopyrid isopod, Bopyridae, urn:lsid:marinespecies.org:taxname:1195

Data Processing Description

The raw data and code used to measure CTmax are contained in the referenced Zenodo holding (doi: 10.5281/ZENODO.14037360).

BCO-DMO Processing Description

* Data were imported from provided file "Sasaki et al 2023.csv" and will appear on this dataset as "955736_v1_a-tonsa-thermal-isopods-parasitism.csv"

* Date converted to ISO 8601 format

* Organism LSIDs added from matches at the World Register of Marine Species (WoRMS) on 2025-03-11

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Related Publications

Sasaki, M., Woods, C., & Dam, H. G. (2023). Parasitism does not reduce thermal limits in the intermediate host of a bopyrid isopod. Journal of Thermal Biology, 117, 103712. https://doi.org/10.1016/j.jtherbio.2023.103712
Results

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Related Datasets

IsRelatedTo

Matt Sasaki. (2024). ZoopEcoEvo/parasitized_tonsa_limits: Initial Release (Version v1.0.0) [Computer software]. Zenodo. https://doi.org/10.5281/ZENODO.14037360 https://doi.org/10.5281/zenodo.14037360

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Parameters

Parameter	Description	Units
experiment	The experimental replicate (1-4)	unitless
experiment_date	The date thermal limits were measured	unitless
experiment_day	The day component of the experiment date	unitless
experiment_month	The month component of the experiment date	unitless
experiment_year	The year component of the experiment date	unitless
tube	The tube position during the experiment (positions 1 through 10)	unitless
bopyrid	Was the female parasitized by a bopyrid isopod (yes or no)	unitless
ctmax	The measured critical thermal maximum for the individual, recorded in degrees C	degrees Celsius

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Project Information

Linking eco-evolutionary dynamics of thermal adaptation and grazing in copepods from highly seasonal environments (evolutionary_copepods)

Coverage: Connecticut and Florida

NSF Award Abstract:

Many parts of the ocean are warming rapidly, but it is still unknown how this warming will affect marine food webs. Copepods, small crustaceans, are the most abundant animals in the ocean; consequently, they play crucial roles in plankton marine food webs and in the transfer of energy to fishes. Many species of copepods are able to choose between prey such as microscopic plants and single-celled animals. The choice affects how energy moves through marine food webs. Past work suggests that increasing temperature should favor herbivory over carnivory. This project is investigating whether this prediction holds in the face of genetic adaptation to warming in highly seasonal systems such as coastal temperate zones. Results from this study are contributing to understanding and predicting the response of marine ecosystems to future climate conditions, as well as for planning and implementing sustainable fisheries management plans. Other broader impacts include the development of learning modules for high school and college students. Hands-on science exhibits for K-6 students and public presentations at established lecture series focus on the role of copepods in marine food webs in coastal habitats.

Predicting responses of the oceanic biota to climate change is limited not only by an incomplete understanding of how warming affects ecological interactions and evolutionary dynamics individually, but also by how these two factors interact. Copepods are both grazers of phytoplankton and predators of microzooplankton in marine systems. Increasing temperatures may drive a large-scale shift in the diet of omnivorous copepods towards stronger herbivory, with significant consequences for the structure of marine food webs and the control of primary productivity. However, thermal adaptation may moderate or even nullify these shifts. This project examines the interactive role ecological and evolutionary dynamics plays in shaping grazing and individual fitness in a warming ocean. The main goals of the project are to: 1) quantify seasonal variation in thermal performance curves in dominant coastal copepod species; 2) determine whether observed seasonal variation in thermal performance is caused by genetic differentiation or phenotypic plasticity; 3) assess how temperature affects respiration and protein synthesis rates, selective feeding, and individual fitness; and 4) determine how changes in the thermal performance curve, via both genetic differentiation and phenotypic plasticity, affect the relationship between temperature and food preference. Selective feeding experiments are being paired with measurements of egg production and hatching success across a wide range of temperatures to measure thermal effects on feeding selectivity and individual fitness. Finally, genetic differentiation and phenotypic plasticity on temperature sensitivity is being investigated across populations from environments that differ in their thermal regime. The outcomes of this project contribute to the parameterization of models that forecast fisheries dynamics in response to climate change.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1947965

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