Atlantic oyster drill (Urosalpinx cinerea) montly size (shell length) and oyster consumption rates from a reciprocal transplant experiment in western Atlantic coastal waters from 2021–2023

Website: https://www.bco-dmo.org/dataset/993965
Data Type: experimental
Version: 1
Version Date: 2026-02-10

Project
» Investigating mechanisms underlying adaptive capacity to ocean warming (URO)

Contributors	Affiliation	Role
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Abstract
This dataset includes monthly Urosalpinx cinerea size (shell length) and oyster consumption rates from a reciprocal transplant experiment of Atlantic oyster drills sourced from three populations from 2021 to 2023. See the "Related Datasets" section for other datasets from this experiment. Experiment description: Urosalpinx cinerea is a predatory gastropod that plays an important role in coastal ecosystems. In these datasets we examine how growth and other life history traits may respond to differing environments across latitude and seasonality. We compare differences between three distant populations of Urosalpinx (New Hampshire, North Carolina, and Georgia). Datasets from this experiment include size, growth rate, feeding rate, and reproductive output in F1 Urosalpinx cinerea in a reciprocal transplant experiment. The data was collected from the summer of 2021 to December 2023 in a laboratory setting at the University of Massachusetts Amherst.

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Coverage

Location: coastal waters of the western Atlantic Ocean
Spatial Extent: **N**:43.09 **E**:-70.864722 **S**:34.717222 **W**:-76.670833
Temporal Extent: 2022-04-15 - 2023-12-31

Dataset Description

See the "Related Datasets" section for other datasets at BCO-DMO from this experiment published in Dwane et al. (2025).

Methods & Sampling

Broodstock Collection: Adult *Urosalpinx* were collected from Great Bay, NH, Beaufort, NC, and Skidaway, GA. They were brought back to the lab at the University of Massachusetts Amherst in late April through early May 2022. Broodstock were then sexed, paired, and placed into separate plastic jars inside a recirculating seawater table held at 18°C.

Reciprocal Transplant Experiment: Two recirculating seawater tables were set up to represent temperature regimes from both sites where the broodstock originated (NH and NC). We primarily focused environmental conditions on NH and NC because of limited hatchling production for the GA animals. Reference temperatures were obtained from NOAA buoys located near the sample locations. Within ten days of hatching, F1 juveniles were separated into individual tea strainers and divided among the two temperature regimes. Temperatures in both systems were set at 22 degrees °C at introduction to match the previous temperature regime and slowly ramped up to the respective temperature regimes. Snails were maintained on a diet of juvenile oysters (*Crassostrea virginica*, sourced from Ward Oyster, VA, USA) and fed *ad libitum*. At around 7.5 months of age, snails were paired for reproduction. Paired snails were housed in larger enclosures with high flow. The experiment was ended at 17 months.

Size and Growth Rate Measurements: Shell length was measured using digital calipers at regular 4-6 week intervals. Tissue weight was collected by placing snails on a submerged basket attached to a weight below a hook and balance (i.e. buoyant weight measurement technique). The whole organism's wet weight was measured by blotting the snails dry using a paper towel. Then the tissue weight was calculated as the weight in air minus the buoyant weight.

Feeding Rate: Daily per-capita feeding rates were measured at 4-6 week intervals. Snail enclosures were emptied of oysters from previous *ad libitum* feedings, and fresh oysters were loaded. The week following loading (7-9 days), oyster consumption was measured by counting the number of dead oysters within each enclosure displaying drill-holes characteristic of *Urosalpinx* predation. Oyster consumption was measured over 14 days during the winter months.

Reproductive Output: Snail enclosures were checked for egg capsules every 1-3 days. The day that laying ceased was recorded, and egg capsules were removed to record both the total number of capsules laid and the number of individual embryos per capsule. Each clutch was then placed in individual tea strainers and returned to the respective temperature regimes. Following hatching, the number of successfully hatched juveniles was compared to the number of previously recorded embryos to determine hatching success.

Locations (coastal waters of the western Atlantic Ocean):

Great Bay, New Hampshire, USA - Latitude: 43.089945°, Longitude: -70.864813°
Beaufort, North Carolina, USA - Latitude: 34.717463°, Longitude: -76.670906°
Skidaway, Georgia, USA - Latitude: 31.989594°, Longitude: -81.022629°

Organism Identifier (Life Science Identifier, LSID):
Urosalpinx cinerea, urn:lsid:marinespecies.org:taxname:140429

Data Processing Description

No processing was conducted

BCO-DMO Processing Description

* Source data was loaded into the BCO-DMO data system from the submitted file "RTdata.xlsx" Sheet 1.

Problem Description

In the RawHatchingSuccess_ALR table some proportional hatching success values are reported as greater

than 1. This is not technically possible, and so is likely because of an undercount in the intial number of embryos before hatching.

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Related Publications

Dwane, C., Komoroske, L. M., Rugila, A. L., Bentley, B. P., Rawson, E., Clark, E., Nichols, G., Newbrey, M., Bucari, E., Yan, C., Barley, J., Horrigan, R., McCarthy, L., Duncan, N., Juarez Stucker, A. B., Villeneuve, A. R., & Cheng, B. S. (2025). Adaptation to warm environments with a fast pace of life in a marine predatory snail. https://doi.org/10.1101/2025.06.20.660751
Results

[ ]

Parameters

Parameters for this dataset have not yet been identified

[ ]

Instruments

Dataset-specific Instrument Name	Mitutoyo 4-Way Digital Caliper
Generic Instrument Name	calipers
Generic Instrument Description	A caliper (or "pair of calipers") is a device used to measure the distance between two opposite sides of an object. Many types of calipers permit reading out a measurement on a ruled scale, a dial, or a digital display.

Dataset-specific Instrument Name	Leica S9i, Leica Microsystems GmbH, Wetzlar, Germany
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".

Dataset-specific Instrument Name	Ohaus Compass CX Scale - 2,200 grams x 1 gram, Model number: PX224/E
Generic Instrument Name	scale or balance
Generic Instrument Description	Devices that determine the mass or weight of a sample.

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Project Information

Investigating mechanisms underlying adaptive capacity to ocean warming (URO)

Coverage: Coastal marine waters of western Atlantic ocean from 31 to 44 degrees latitude N

NSF Award Abstract:
Understanding how marine life copes with drastically different environmental conditions now and into the future is essential for the management and conservation of biodiversity in the ocean. One complicating factor is the observation that populations within a given species are often fine-tuned to the environment that they live in. Yet, it is often unclear what components of the environment create these differences across populations. This project focuses on Atlantic oyster drills, a predatory snail that consumes farmed and wild oysters on the Atlantic coast of North America, the location of one of the strongest temperature gradients in the world. The investigators combine field and laboratory studies to understand how differences in temperature affect the growth and survival of oyster drills sourced from populations throughout their range. This information is paired with molecular analyses to help determine genetic and physiological differences among populations. In addition to benefitting oyster reefs, this information broadly contributes to the understanding of how marine life will respond to rapidly changing environmental conditions. The project also supports the education and marine science training of students at the undergraduate, graduate, and postdoctoral level. In partnership with the non-profit organization Waterstrong, the investigators will provide marine science and swimming skills training to thirty girls from historically underrepresented groups.

Predicting how marine communities will respond to rapid environmental change is difficult because species responses can vary across populations and because organisms may evolve over time. Knowledge of how such evolutionary potential arises and is maintained is limited. A useful approach for examining species response to environmental change is to investigate how species have locally adapted to environmental differences across their range. This project tests competing mechanisms that can generate countergradient variation (CnGV; a widespread form of local adaptation) in an ecologically important marine species (Atlantic oyster drill, Urosalpinx cinerea). The objectives of this integrative research are to 1) quantify the strength of seasonality and mean temperature in generating CnGV and to 2) identify if these responses are correlated across biological traits using a combination of field sampling and common garden experimentation. These objectives are complemented with a molecular approach that 3) quantifies neutral genetic structure across populations and 4) identifies the roles of genetic adaptation and transcriptional plasticity in facilitating physiological adaptation to environmental change. The proposed work is significant because it provides a novel test for different environmental drivers of a commonly observed form of local adaptation. This research also reveals the genetic underpinnings of how such local adaptation arises and will give insight into the adaptive capacity of organisms to rapid 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.

Other project information:
Further information about this project and related work can be found on the UMass Amherst website "MARINE GLOBAL CHANGE ECOLOGY" (http://bscheng.com).

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2023571