Green Crab Density for Multiple Sites in the Gulf of Maine for 1973, 2003, 2017-2018 and 2021

Website: https://www.bco-dmo.org/dataset/990378
Data Type: Other Field Results, Synthesis
Version: 1
Version Date: 2025-12-10

Project
» Local adaptation and the evolution of plasticity under predator invasion and warming seas: consequences for individuals, populations and communities (evolution of plasticity)

Contributors	Affiliation	Role
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Abstract
This dataset contains green crab density (Carcinus maenas) data for multiple sites throughout the Gulf of Maine that were collected in 1973, 2003, 2017-2018 and 2021. All data were obtained via manual searches (1 hour) in the mid intertidal zone during low tide.

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Coverage

Location: Rocky intertidal shores in the Gulf of Maine
Temporal Extent: 1973 - 2021

Dataset Description

This dataset is part of a broader study conducted in the Gulf of Maine to investigate phenotypic plasticity of prey species in response to predator invasion and warming oceans:

1. Green crab surveys plus historical crab density data **(this dataset)**
2. Green crab density from field studies at rocky intertidal sites from April 2019 to December 2021 (dataset 911365)
3. Latitudinal (clinal) variation in *Littorina obtusata* shell thickness and tissue mass (dataset TBD xxxxxxx)
4. Reciprocal transplant experiment in the field (dataset TBD xxxxxxx)

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Related Publications

Corbett, J. J., & Trussell, G. C. (2025). Evolution in changing seas: The loss of plasticity under predator invasion and warming oceans. Science Advances, 11(6). https://doi.org/10.1126/sciadv.adr6947
Results

Edgell, T. C., & Rochette, R. (2008). DIFFERENTIAL SNAIL PREDATION BY AN EXOTIC CRAB AND THE GEOGRAPHY OF SHELL-CLAW COVARIANCE IN THE NORTHWEST ATLANTIC. Evolution, 62(5), 1216–1228. https://doi.org/10.1111/j.1558-5646.2008.00350.x

Methods

Welch, W. R., Richards, M., & Bass, B. (1973). Relative abundance of green crabs along the Maine coast. Maine Department of Marine Resources, Fisheries Research Laboratory.
Methods

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Parameters

Parameters for this dataset have not yet been identified

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Project Information

Local adaptation and the evolution of plasticity under predator invasion and warming seas: consequences for individuals, populations and communities (evolution of plasticity)

NSF Award Abstract:
Over the past two decades, the Gulf of Maine has experienced unprecedented warming that, among other things, has further enabled the invasive green crab to expand its range in rocky shore habitats. The adverse ecological impacts of this invasive predator have been documented worldwide. This study examines how geographic variation in the capacity of two common prey species to respond to the combination of this predator and warming ocean temperatures can shape prey feeding and performance and impact community structure and dynamics. Hence, this research enhances understanding of the evolution of phenotypes, their plasticity, and the nature of adaptation and its role in eco-evolutionary dynamics. More broadly, it informs understanding of how organisms and marine communities may respond to future environmental change. In addition, this project makes contributions to the STEM pipeline by providing middle and high school, undergraduate, and graduate students with cross-disciplinary training in evolutionary and community ecology. In collaboration with an institutional outreach program, the investigator is also developing web-based multimedia projects and teacher resource materials based on this research.

A central principle in ecology is that species residing in the middle of food chains must balance the benefits of eating with the risk of being eaten by their predators. Solving this foraging-predation risk trade-off often involves plasticity in prey traits with consequences for the evolution of adaptation and species interactions that drive community-level processes. Hence, the foraging-predation risk trade-off provides a powerful conceptual framework that links evolutionary and community ecology. Yet at the same time, other environmental stressors like temperature can shape this trade-off, adding complexity that makes it difficult to predict the capacity of organisms to adapt to environmental change and the consequences for communities. The investigator is conducting this study in rocky shore habitats of the Gulf of Maine (GOM) which have long been influenced by strong latitudinal temperature gradients and non-native species invasions. The overarching hypothesis is that predation risk and temperature are factors shaping geographic variation in plasticity and adaptation, with consequences for individuals, populations, and communities. First, the investigator is conducting field experiments to document geographic variation in the trait plasticity of two common prey species in the green crab's diet. Second, he is using reciprocal transplant experiments to examine trait plasticity in response to risk and water temperature, generating data to compare with similar experiments conducted in the late 90s prior to recent ocean warming and expansion in range of green crabs. Third, he is conducting a laboratory common garden experiment to evaluate the effects of risk and water temperature on trait plasticity. Finally, he is using reciprocal transplant experiments in the field to understand the interactive effects of risk and water temperature on prey foraging rates and the abundance of a species that plays an important role in intertidal community structure and dynamics.

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-2017626

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