Green crab (Carcinus maenas) density at rocky intertidal sites determined at 8 sites in the Gulf of Maine from April 2019 to December 2021

Website: https://www.bco-dmo.org/dataset/911365
Data Type: Other Field Results
Version: 1
Version Date: 2023-10-12

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
Trussell, Geoffrey C.	Northeastern University	Principal Investigator
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Abstract
This dataset describes green crab (Carcinus maenas) density at rocky intertidal sites in the northern (4 sites) and southern (4 sites) Gulf of Maine.

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Coverage

Spatial Extent: **N**:44.8192 **E**:-66.9661 **S**:42.4215 **W**:-70.9076
Temporal Extent: 2019-04 - 2021-12

Methods & Sampling

We conducted crab surveys in 2019, 2020, and 2021 at eight sites in the Gulf of Maine (GOM) that are sheltered from direct wave action to characterize local and regional variation in green crab (*Carcinus maenas*) abundance. Four sites were located in the northern Gulf (Quoddy Region) and the other four were located in the southern Gulf (Nahant, MA to Cape Ann, MA). Surveys involved walking through the site and searching through the algal canopy, underneath boulders, and within cracks and crevices in the substratum. Each survey was conducted by 1 person and lasted 1 hour each. Surveys began and concluded within 2 hours of low tide, and were conducted approximately every two months at all 8 sites from April through November/early December in 2019, 2020, and 2021. The total number of crabs captured by hand in one hour of searching was recorded.

Data Processing Description

Data were first recorded manually on paper and then transferred to digital spreadsheets. Fidelity between paper and digital versions of the data were proofed by both Corbett and Trussell.

BCO-DMO Processing Description

- Imported original file named "Data from Local and Regional Geographic Variation in Inducible Defenses.GreenCrabDensity.2019.2020.2021.xlsx" into the BCO-DMO system.
- Renamed fields/columns to comply with BCO-DMO naming conventions.
- Removed degrees symbols from LATITUDE and LONGITUDE columns.
- Made LONGITUDE values negative because they're in the Western hemisphere.
- Saved the final file as "911365_v1_green_crab_density.csv".

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Data Files

File	
911365_v1_green_crab_density.csv	(Comma Separated Values (.csv), 4.79 KB) MD5:f72a5c989958007aaf4750a433020b8b
Primary data file for dataset ID 911365, version 1.	

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Related Publications

Corbett, J.J., Trussell, G.C. (In press). Local and regional geographic variation in inducible defenses. Ecology. *Results*

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Related Datasets

IsRelatedTo

Trussell, G. C., Corbett, J. J. (2023) **Littorina obtusata shell length, shell thickness, and tissue mass measured during a field experiment conducted at 12 sites in the Gulf of Maine from April to August 2021.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2023-10-11 doi:10.26008/1912/bco-dmo.911221.1 [view at BCO-DMO]

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Parameters

Parameter	Description	Units
YEAR	Year when survey was conducted.	unitless
MONTH	Month when survey was conducted.	unitless
REGION	Region where the site is located (either 'NORTH' or 'SOUTH'). NORTH = Northern Gulf of Maine. SOUTH = Southern Gulf of Maine.	unitless
SITE_NAME	Name of the site.	unitless
LATITUDE	Latitude of the site. Positive values indicate North direction.	decimal degrees
LONGITUDE	Longitude of the site. Negative values indicate West direction.	decimal degrees
Green_Crab_Density	Number of crabs found per person per hour	number of crabs

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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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