Eelgrass density and reproduction at Curlew Beach in Nahant, MA and Niles Beach in Gloucester, MA from samples collected by SCUBA in 2014

Website: https://www.bco-dmo.org/dataset/851673
Data Type: Other Field Results
Version: 1
Version Date: 2021-05-10

Project
» RUI: Collaborative Research: Trait differentiation and local adaptation to depth within meadows of the foundation seagrass Zostera marina (ZosMarLA)

Contributors	Affiliation	Role
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Abstract
This dataset includes eelgrass density and reproduction at Curlew Beach in Nahant, Massachusetts and Niles Beach in Gloucester, Massachusetts from samples collected by SCUBA in 2014.

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Coverage

Spatial Extent: **N**:42.597 **E**:-70.655 **S**:42.42 **W**:-70.915
Temporal Extent: 2014-07-14 - 2014-08-03

Methods & Sampling

SCUBA was used to sample *Zostera marina* in late summer 2014 from two coastal eelgrass meadows in the Gulf of Maine, USA, separated by approximately 48 km: Curlew Beach in Nahant, MA (hereafter CB) and Niles Beach in Gloucester, MA (hereafter NI). Samples were collected from three depths at each site: the center of the meadow (mid), and approximately 5 m from the inshore and offshore edges (shallow and deep, respectively); depth of the shallow, mid and deep samples was approximately 1, 3 and 5 m MLLW, respectively. At each depth, 8-10 flowering shoots, separated by at least 2 meters, were collected. To compare shoot density and morphology between sites and among depths, all aboveground biomass was harvested from 0.0625-m² quadrats set adjacent to these focal flowering shoots, and back in the lab, the number of vegetative and flowering shoots were recorded. In both meadows, eelgrass cover was patchy along the deep transect,

and quadrats were deliberately set to capture areas where eelgrass was present; thus, deep quadrats inflate any area-based estimate of total eelgrass density but describe the local density of interacting shoots. To estimate seed production, the total number of spathes per flowering shoot was recorded along with the number of seeds per spadix on the focal shoot and up to two additional flowering shoots from the associated quadrat (n = 10-24 flowering shoots per depth).

Data Processing Description

BCO-DMO Processing:
- changed date format to YYYY-MM-DD.

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Data Files

File
field_2014.csv (Comma Separated Values (.csv), 3.01 KB) MD5:89e07d6bcae25cd127797aa4f61c0cc7 Primary data file for dataset ID 851673

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Related Publications

Hays, C. G., Hanley, T. C., Graves, R. M., Schenck, F. R., & Hughes, A. R. (2020). Linking Spatial Patterns of Adult and Seed Diversity Across the Depth Gradient in the Seagrass Zostera marina L. Estuaries and Coasts, 44(2), 383–395. doi:10.1007/s12237-020-00813-1
Results

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Parameters

Parameter	Description	Units
date	Sampling date; format: YYYY-MM-DD	unitless
lat	Latitude of sampling site	degrees North
lon	Longitude of sampling site	degrees East
site_depth	Site and depth: CB_S = Curlew Beach shallow; CB_M = Curlew Beach mid; CB_D = Curlew Beach deep; NI_S = Niles Beach shallow; NI_M = Niles Beach mid; NI_D = Niles Beach deep.	unitless
quad	Quadrat number	unitless
reproductive_shoots	Number of reproductive shoots	unitless
veg_shoots	Number of vegetative shoots	unitless
spikes_per_shoot	Number of spikes per shoot	unitless
seeds_per_spike	Number of seeds per spike	unitless

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Instruments

Dataset-specific Instrument Name	SCUBA
Generic Instrument Name	Self-Contained Underwater Breathing Apparatus
Generic Instrument Description	The self-contained underwater breathing apparatus or scuba diving system is the result of technological developments and innovations that began almost 300 years ago. Scuba diving is the most extensively used system for breathing underwater by recreational divers throughout the world and in various forms is also widely used to perform underwater work for military, scientific, and commercial purposes. Reference: http://oceanexplorer.noaa.gov/technology/diving/diving.html

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Project Information

RUI: Collaborative Research: Trait differentiation and local adaptation to depth within meadows of the foundation seagrass Zostera marina (ZosMarLA)

Coverage: Massachusetts, USA

NSF Award Abstract:
Understanding how species cope with spatial variation in their environment (e.g. gradients in light and temperature) is necessary for informed management as well as for predicting how they may respond to change. This project will examine how key traits vary with depth in common eelgrass (Zostera marina), one of the most important foundation species in temperate nearshore ecosystems worldwide. The investigators will use a combination of experiments in the field and lab, paired with fine-scale molecular analyses, to determine the genetic and environmental components of seagrass trait variation. This work will provide important information on the microevolutionary mechanisms that allow a foundation species to persist in a variable environment, and thus to drive the ecological function of whole nearshore communities. The Northeastern University graduate and Keene State College (KSC) undergraduate students supported by this project will receive training in state-of-the-art molecular techniques, as well as mentorship and experience in scientific communication and outreach. A significant portion of KSC students are from groups under-represented in science. Key findings of the research will be incorporated into undergraduate courses and outreach programs for high school students from under-represented groups, and presented at local and national meetings of scientists and stakeholders.

Local adaptation, the superior performance of "home" versus "foreign" genotypes in a local environment, is a powerful demonstration of how natural selection can overcome gene flow and drift to shape phenotypes to match their environment. The classic test for local adaptation is a reciprocal transplant. However, such experiments often fail to capture critical aspects of the immigration process that may mediate realized gene flow in natural systems. For example, reciprocal transplant experiments typically test local and non-local phenotypes at the same (often adult) life history stage, and at the same abundance or density, which does not mirror how dispersal actually occurs for most species. In real populations, migrants (non-local) often arrive at low numbers compared to residents (local), and relative frequency itself can impact fitness. In particular, rare phenotypes may experience reduced competition for resources, or relative release from specialized pathogens. Such negative frequency dependent selection can reduce fitness differences between migrants and residents due to local adaptation, and magnify effective gene flow, thus maintaining greater within-population genetic diversity. The investigators will combine spatially paired sampling and fine-scale molecular analyses to link seed/seedling trait variation across the depth gradient at six meadows to key factors that may drive these patterns: local environmental conditions, population demography, and gene flow across depths. The team will then experimentally test the outcome of cross-gradient dispersal in an ecologically relevant context, by reciprocally out-planting seeds from different depths and manipulating relative frequency in relation to both adults and other seedling lineages. The possible interaction between local adaptation and frequency-

dependence is particularly relevant for Zostera marina, which represents one of the best documented examples of the ecological effects of genetic diversity and identity. Further, a better understanding of seagrass trait differentiation is not simply a matter of academic interest, but critical to successful seagrass restoration and conservation.

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-1851432
NSF Division of Ocean Sciences (NSF OCE)	OCE-1851043

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