Vegetative density data from two surveys of eelgrass flowering in shallow and deep zones at four different sites in Massachusetts, USA in 2019

Website: https://www.bco-dmo.org/dataset/847062
Data Type: Other Field Results
Version: 1
Version Date: 2021-03-30

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 vegetative densities from two surveys of eelgrass flowering in shallow and deep zones at four different sites in Massachusetts, USA in 2019. The four sites were West Beach in Beverly (N 42.55921, W 70.80578), Curlew Beach in Nahant (N 42.42009, W 70.91553), Lynch Park in Beverly (N 42.54488, W 70.85842), and Niles Beach in Gloucester (N 42.59711, W 70.65592).

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Coverage

Spatial Extent: **N**:42.59711 **E**:-70.65592 **S**:42.42009 **W**:-70.9155
Temporal Extent: 2019-06-26 - 2019-08-16

Methods & Sampling

We conducted two surveys of four different eelgrass beds in Massachusetts during the summer of 2019. The four sites were West Beach in Beverly (N 42.55921, W 70.80578), Curlew Beach in Nahant (N 42.42009, W 70.91553), Lynch Park in Beverly (N 42.54488, W 70.85842), and Niles Beach in Gloucester (N 42.59711, W 70.65592). Surveys were done in both the shallow and deep zone. These zones were defined as being along the respective edges of the eelgrass beds. The exact depths of the zones varied from bed to bed. The first survey of each site was conducted at the end of June/early July. In these surveys, we counted the number of both vegetative and flowering shoots in 5-7 0.0625 m^2 quadrats from each of three previously established permanent quadrats per depth per site. This gave us a total of 15-21 0.0625 m^2 quadrats per depth per site. The second survey of each site was conducted in mid-August. Instead of doing the surveys from within the permanent quadrats, we did so outside of them to avoid overlap. We counted the number of vegetative and flowering shoots within 0.0625 m^2 quadrats every 2 m along a 30 m transect (that would be extended for each quadrat that had no eelgrass). This led to there being 15-18 quadrats per depth per site.

Data Processing Description

Data Processing:
We analyzed the number of vegetative shoots per 0.0625 m^2 quadrat using a generalized linear model (GLM) with a negative binomial regression and site, depth, and time (week) as fixed effects and including all possible interactions. We did the same for the density of flowering shoots and the density of all shoots (total density). We analyzed the proportion of flowering shoots (% flowering by density) using a GLM with a quasi binomial distribution and logit link function with site, depth, and time (week) as our fixed effects and including all possible interactions. For all of these analyses week was treated as a categorical factor.

Statistical analyses were conducted using R Statistical Software v. 3.6.0 (R Core Team 2019). Negative binomial regressions were done using the glm.nb function in the MASS package (Venables and Ripley 2002). We used a significance level of α = 0.05 for all of our analyses.

BCO-DMO Processing:
- changed date format to YYYY-MM-DD;
- renamed fields to conform with BCO-DMO naming conventions;
- replaced "NA" with "nd" to indicate "no data".

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Data Files

File
permanent_plot_density.csv (Comma Separated Values (.csv), 10.02 KB) MD5:2060ef8d775aa7737924edd66fff5ddc Primary data file for dataset ID 847062

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Related Publications

R Core Team (2019). R: A language and environment for statistical computing. R v3.6.0. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/
Software

Venables, W. N., & Ripley, B. D. (2002). Modern applied statistics with S (4th ed., Ser. Statistics and computing). Springer. URL: http://www.stats.ox.ac.uk/pub/MASS4 https://isbnsearch.org/isbn/0-387-95457-0
Methods

Von Staats, D. A., Hanley, T. C., Hays, C. G., Madden, S. R., Sotka, E. E., & Hughes, A. R. (2020). Intra-Meadow Variation in Seagrass Flowering Phenology Across Depths. Estuaries and Coasts, 44(2), 325–338. doi:10.1007/s12237-020-00814-0
Results

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Related Datasets

IsRelatedTo

Sotka, E., Hughes, A. R., Hanley, T. C., Hays, C. (2024) **Eelgrass shoot lengths measured at two depths within each of four coastal sites in Massachusetts, USA in 2019.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2024-10-03 doi:10.26008/1912/bco-dmo.939440.1 [view at BCO-DMO]
Relationship Description: These datasets all contain results from the same sampling effort (end of June/early July of 2019). Dataset "Permanent plot vegetative density" (847062) also contains additional results from an additional sampling effort in August of 2019.

Sotka, E., Hughes, A. R., Hanley, T. C., Hays, C. (2024) **Quadrat-based measurements of eelgrass shoot density and above-ground biomass for plants growing in shallow and deep zones at four coastal sites in Massachusetts, USA in 2019.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2024-10-03 doi:10.26008/1912/bco-dmo.939467.1 [view at BCO-DMO]
Relationship Description: These datasets all contain results from the same sampling effort (end of June/early July of 2019). Dataset "Permanent plot vegetative density" (847062) also contains additional results from an additional sampling effort in August of 2019.

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Parameters

Parameter	Description	Units
Date	The date of sample collection; format: YYYY-MM-DD	unitless
Month	The month of the survey (June or August) *one of the first surveys was conducted on July 1, but is counted as June.	unitless
Site	The site of collection. WB (West Beach, Beverly, MA), DC (Curlew Beach, Nahant, MA), NB (Niles Beach, Gloucester, MA), or LP (Lynch Park, Beverly, MA)	unitless
Depth	SH (shallow zone) or DP (deep zone)	unitless
Permanent_Quadrat	For the first surveys (June/July) the permanent quadrat that data came from (there are 3 permanent quadrats per depth per site)	unitless
Transect_Meter_Mark	For the second surveys (August), the corresponding transect meter mark that samples were taken from	unitless
Cattle_Tag	For the first round of sampling, the corresponding cattle tag number for each sample	unitless
Vegetative_Density	The number of vegetative shoots in each quadrat	number of shoots per quadrat
Flowering_Density	The number of flowering shoots in each quadrat	number of shoots per quadrat
Total_Density	The number of vegetative AND flowering shoots found in each quadrat	number of shoots per quadrat

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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-1851043

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