Measuring Effects of Two Shellfish Cultivation Methods on Eelgrass Shoot Density: A Before-After / Control-Impact Experiment

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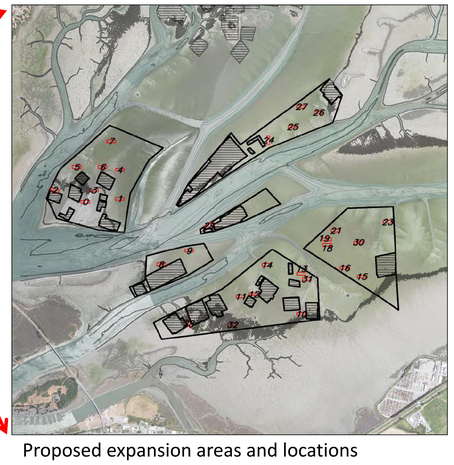
1. Introduction

Native eelgrass (*Zostera marina* L.) is a perennial monocot seagrass that grows in shallow marine embayments and estuaries throughout the northern hemisphere. It provides numerous ecological services and receives protection under no-net-loss wetland policies in addition to being designated as essential fish habitat. Humboldt Bay (located 80 miles south of the Oregon border) is home to nearly half of the eelgrass in California and also produces over half of the oysters consumed in California. Historical aquaculture production methods in Humboldt Bay have resulted in pulses of eelgrass impacts and recoveries during the 20th century. Coast Seafoods Company proposes to expand their cultivation area into areas of dense eelgrass that have not been in shellfish production for decades.

Humboldt Bay



Proposed expansion areas and locations of experimental blocks

Cultch-on-line cultivation method

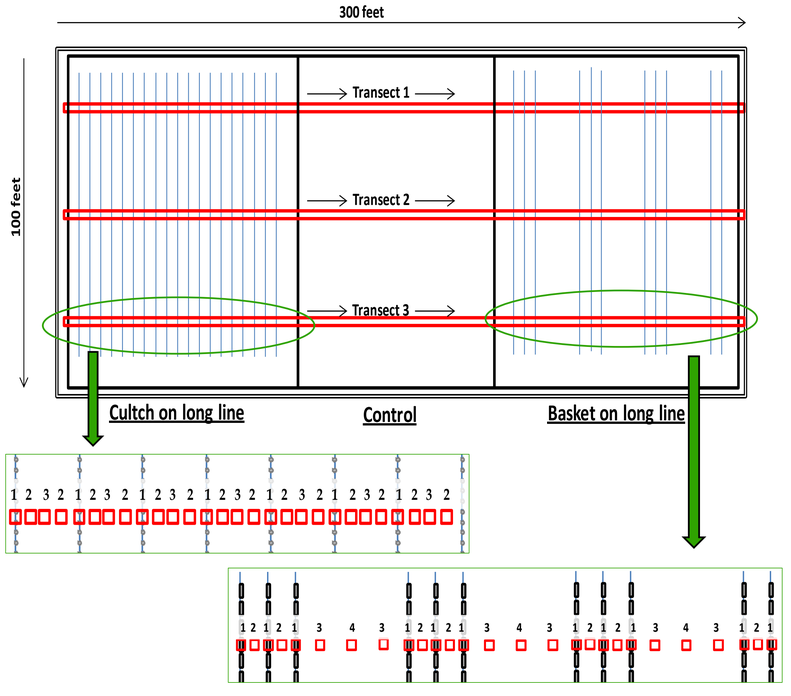
Basket-on-line cultivation method

2. The Question

What effects will Coast Seafood's expansion project have on eelgrass? NOAA guidelines recommend mitigation for projects that result in any loss of eelgrass areal extent and/or a 25% reduction in eelgrass turion (shoot) density. To assess impacts to shoot density, a stratified, blocked sampling design has been developed within the framework of a before-after / control-impact (BACI) experiment.

3. Methods

The experimental design is composed of two treatments and one control plot nested within a blocked design. Measurements of shoot density are stratified within treatment plots by "quadrat postions" under lines, next to lines, between lines, etc to capture the gradient of shading (and other effects) from distance to line. Quadrat sampling occurs along three random transects across blocks. Each quadrat position category is sampled twice per transect, resulting in 24 subsamples for the basket treatment and 18 subsamples for the cultch treatment and control plot. A statistical power analysis predicted that 30 blocks will be needed to detect a 25% reduction in shoot density, given an alpha of 0.1 and beta of 0.1. The 30 block locations were randomized after stratifying by elevation and sediment type proportional to the expansion area.

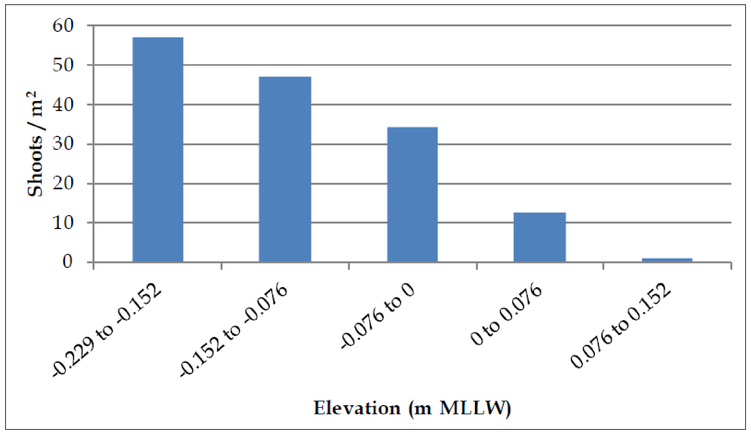


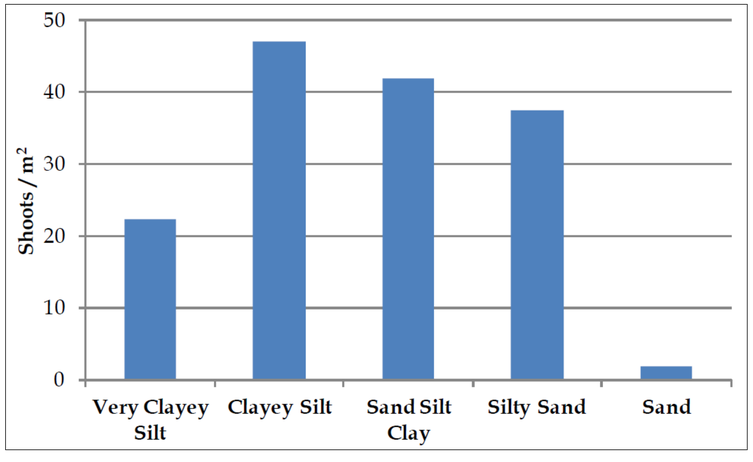
4. Timeline

Two years of pre-project (before) data and two years of post-implementation (after) data will be collected. The first year of pre-project data was collected during summer of 2015 and the final year of post-implementation data will be collected during summer of 2018.

5. Preliminary Results

Data collected during the 2015 survey documented the first year of "before" impact data and provides the largest dataset in Humboldt Bay on correlations of eelgrass shoot density with elevation and sediment type. For the elevation range of the project area, shoot density is negatively correlated with elevation. There does not appear to be a linear correlation with sediment texture but the finest and coarsest textures contained the lowest shoot density.





6. Acknowledgments

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