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Ecological Consequences of Genetic Diversity in Eelgrass

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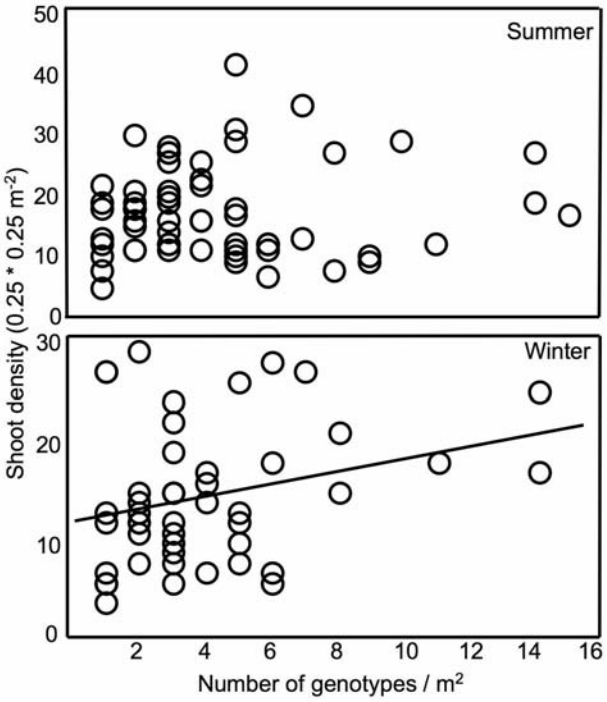
The Question: *What is the impact of genotypic (i.e., clonal) diversity in Tomales Bay eelgrass populations on ecosystem processes such as primary production?*

Studying the genetic diversity of eelgrass plots in Tomales Bay indicates (among other things) that more diverse plots are more resistant to disturbance (ex. strong storms, herbivore grazing, shipwrecks).

Species diversity can be important for ecosystem processes such as primary production; in general, as species diversity increases so does primary production. Primary production refers to the synthesis and storage of organic molecules during the life span of photosynthetic organisms and is one measure among many, of the productivity of an area. Interestingly, many marine systems are dominated by one or a few habitat-forming species (e.g., seagrasses, kelps, mussels) and these systems are still considered productive. In these systems, genetic diversity within a few species may play the same role as species diversity in other systems (as genetic diversity increases so does primary production). To assess the importance of genetic diversity within these key marine species, we need a better understanding of the distribution of genetic variation in natural populations and to understand its association with other ecosystem processes (such as population and community dynamics).



Eelgrass density increases with genetic diversity.

The Project: *Document patterns of eelgrass genotypic diversity and assess correlations with key measures of eelgrass productivity.*

Using 1-meter plots, levels of small-scale genotypic diversity were quantified in seven eelgrass (Zostera marina) populations. This sampling was done in Tomales Bay and Bodega Bay in relation to tidal height and distance from the habitat edge. In addition, shoot density, epiphytic algal biomass (weight of algae living on eelgrass), and reproductive shoot density were assessed at each site during summer (high productivity) and winter (low productivity).

Preliminary Results: *Eelgrass can exhibit high levels of genotypic diversity at small spatial scales, and this diversity is important for the productivity of the system.*

Small-scale (1-meter plots) genotypic diversity ranged from as few as one clone (genetically identical individuals grouped together) to as many as 15 clones, with an average of four clones per plot. Unlike Bodega Bay where diversity was higher

in the intertidal than the subtidal, diversity in Tomales Bay did not show a consistent pattern of variation with tidal height.

Other preliminary results include:

1. Across all sites, diversity was higher in the interior of the bed than along the edge of the bed, particularly in the intertidal.

2. Genotypic diversity was not correlated with shoot density, reproductive shoot density, or epiphyte biomass in the productive summer season. However, there was a positive relationship between genotypic diversity and eelgrass shoot density during the winter, when eelgrass experiences stress from abiotic (e.g., lower light levels) and biotic (e.g., grazing by migratory geese) factors. This natural pattern is consistent with the results of a previous manipulative experiment in which more diverse eelgrass plots were more resistant to disturbance, suggesting that conserving genotypic diversity is important to ensure the persistence of these productive marine ecosystems.