Morphological Plasticity of a Native SAV Species in the San Francisco Estuary

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Submerged aquatic vegetation (SAV) is an important habitat-builder in estuary ecosystems. In San Francisco Estuary (SFE), the native pondweeds *Stuckenia* spp*.,* are widespread in the ecologically important low-salinity zone, but were unstudied in the region prior to 2011. We now know there are over 500 hectares of *Stuckenia* spp*.* in the SFE, spanning more than 25 kilometers from east to west, and that they appear to be expanding. We have been conducting a series of studies on these pondweeds since 2011, but some basic questions such as species identity remain unanswered. Individuals are morphologically ambiguous, and have been identified as either *S. pectinata* or *S. filiformis*. In the field, we observe patches with distinctly different plant architecture and morphological complexity, which may be due to phenotypic plasticity, or genetic differences. We hypothesized that both species and/or hybrid individuals may be present, and have investigated that question with a combination of common garden experiments and genotyping. Preliminary results show that these plants are morphologically plastic in response to flow conditions. When genetically identical plant shoots from the same rhizome were separated and grown in mesocosms with high water flow or no water flow, sister plants in the two treatments became significantly distinct in multiple morphological traits. In the field, these morphological differences may affect the food web, since different levels of habitat complexity can influence abundance and composition of epifaunal communities. The results from this experiment and from our genetic work will allow us to predict how these plants may respond to changing conditions in the SFE, including changes in flow dynamics that could result from different management scenarios. Further, conservation and restoration actions may be informed by an understanding how species identity and plasticity relate to habitat values.

Keywords: Submerged Aquatic Vegetation, Suisun Bay, Pondweeds, Low Salinity Zone, plasticity

Poster Topic: Habitat Restoration: Seagrass

San Francisco Bay Living Shorelines Project: Progress in restoring *Zostera marina* in San Rafael Bay

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Seagrasses provide valuable habitat for fish and invertebrates and ecosystem services such as sediment stabilization and carbon sequestration. These marine plants are declining worldwide, thus restoration is planned or underway in many regions, including San Francisco Bay. The San Francisco Bay Living Shorelines: Nearshore Linkages Project is working to advance understanding of how to successfully restore native eelgrass (*Zostera marina*) as well as native Olympia oysters (*Ostrea lurida*) while evaluating shoreline stabilization functions. At our project site in San Rafael, we transplanted eelgrass from two sources (Point Molate and Point San Pablo) to assess the importance of donor choice, and conducted these plantings either in an eelgrass only plot, or interspersed with reef mounds of Pacific oyster shell (to serve as a substrate for Olympia oyster settlement) to evaluate whether oyster reefs could be beneficial to eelgrass and vice versa. Project delays led to a late summer (2012) planting of eelgrass, which did not survive; however, following a replanting effort the next spring both plots are now well established, with 132% of the original planted number of shoots overall. There are fewer shoots in the plot where oyster shell bags are present, possibly due to leaf abrasion and space limitation. For the first year we were able to track success of the two donors, before the plants spread outside of the original planting configuration; the majority of the plants originated from Point Molate, perhaps due to more similar soils at this donor site and the restoration site. We conclude that donor choice may be an important consideration and that we should plant in spring to maximize success. Further, this restoration has successfully provided new habitat to many fish and invertebrate species, which is maximized by the presence of both habitat-forming species.

Keywords: Seagrass, restoration, *Zostera*, habitat, sediment,

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