EELGRASS LOSS AND RECOVERY IN OREGON'S SOUTH SLOUGH ESTUARY FOLLOWING A MARINE HEATWAVE

Oregon's Coos Bay Estuary, home to the South Slough National Estuarine Research Reserve (NERR), has historically supported healthy eelgrass meadows, crucial for sediment maintenance, aquatic habitat, and as a carbon sink. However, eelgrass has increasingly struggled under the pressures of climate change.

Figure 1. Long-term intertidal eelgrass monitoring site at Valino Island in the South Slough estuary, the focus of this analysis.

Between December 2013 and August 2016, a significant northeast Pacific Ocean marine heatwave occurred, causing impacts to many organisms. Initially, intertidal eelgrass abundance increased marginally at some Coos estuary sites, but as temperatures rose, habitats became unsuitable, leading to declines. Recent years have seen variability in recovery, with some sites showing increases and others remaining declined.

To understand environmental impacts on estuary habitats, South Slough participates in the NERRS System-Wide Monitoring Program (SWMP), which gathers data to track short and long-term changes in the ecosystem. A recent study analyzed South Slough's SWMP data for trends in temperature, turbidity, and eelgrass cover. Declines in eelgrass were correlated with the marine heatwave, with increased air and water temperatures likely contributing to the losses.

The study focused on the Valino Island SWMP site, where SWMP data were collected every 15 minutes and eelgrass surveys were conducted quarterly starting in 2004 along three transects (nearshore, middle, and offshore) to capture densities at different depths. Data analysis included system identification, breakpoint analyses, and time series decomposition. The study's methods and code are available online.

The system identification analysis revealed that water temperature at Valino Island was non-linear, while turbidity was linear.

Significant breakpoints were identified for temperature, turbidity, and eelgrass density. A notable change in temperature occurred in April 2014, followed by turbidity in March 2015. Eelgrass cover showed significant changes at different times across locations, first declining at the offshore transect in October 2015, followed by the middle in April 2014, and finally at the nearshore transect in October 2016.

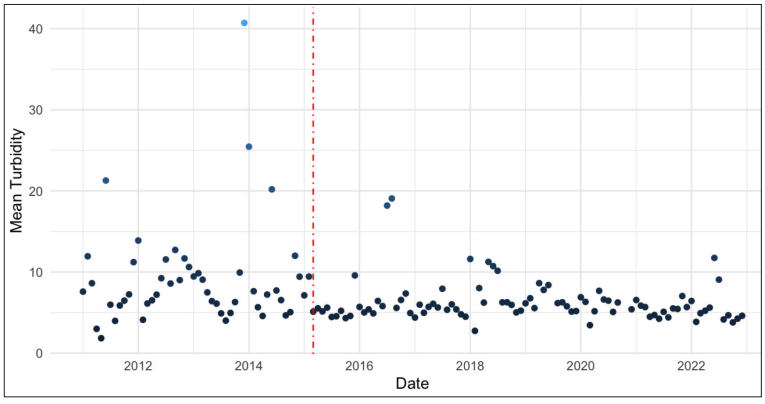

Figure 2. Mean turbidity data for Valino Island since 2011, with the red dashed line marking a significant breakpoint.

These changes coincide with the 2013-2016 marine heatwave. Eelgrass densities increased in summer 2014 after the heatwave began, likely due to warmer winter and spring temperatures, but then declined. Spikes in turbidity during the heatwave may have further contributed to these declines by limiting light availability.

The variation in the timing of eelgrass declines across locations may be attributed to the greater heat resistance of nearshore eelgrass, which is more exposed to atmospheric conditions. Despite the early declines at the offshore site, some recovery was observed, suggesting that deeper areas might offer protection from heat stress.

These findings underscore the impact of heatwaves and turbidity on eelgrass, providing valuable insights into the evolving water quality dynamics within the South Slough Estuary and laying the groundwork for future conservation and management efforts.

This study was conducted by Peter Conowall and Charlie Dougherty at the University of Wisconsin – Madison in collaboration with Alicia Helms and Adam DeMarzo at the South Slough National Estuarine Research Reserve.

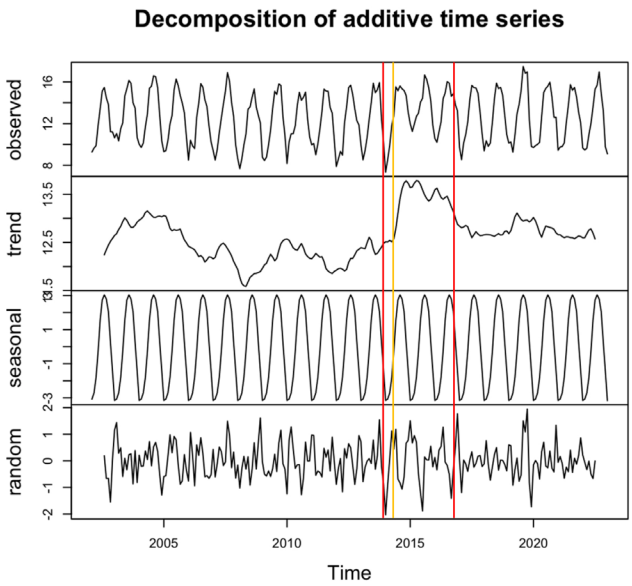

Figure 3. Decomposition analysis of mean water temperature data from all South Slough NERR sites. Red lines mark the start and end of the marine heatwave, while the orange line shows the significant temperature breakpoint.

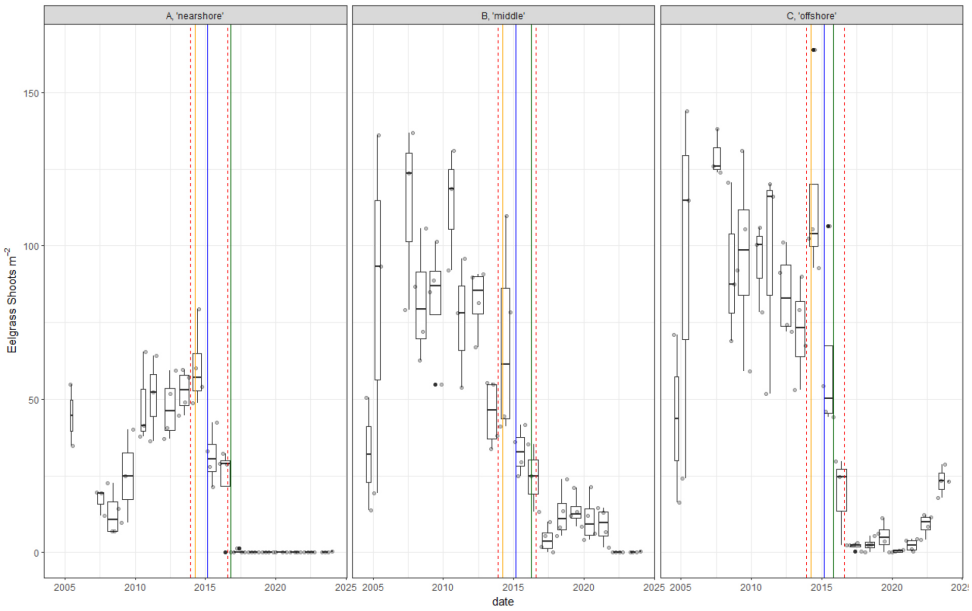

Figure 4. Eelgrass density along nearshore, middle, and offshore transects. Red dashed lines mark the start and end of the marine heatwave. Green lines show eelgrass density breakpoints at each transect, while the orange and blue lines indicate temperature and turbidity breakpoints, respectively.