Variable primary producer responses to nutrient and temperature manipulations in mesocosms: temperature usually trumps nutrient effects.

James Kaldy[1], Melanie Frazier[2], Keri Caudle[3] Cheryl Brown[1] and Walt Nelson[1]

[1] Western Ecology Division, US-EPA, 2111 SE Marine Science Dr., Newport, OR USA

[2] National Center for Ecological Analysis and Synthesis, 735 State St., Santa Barbara, CA, USA

[3] Fort Hays State University, Dept. of Biol. Sciences, Hays, KS, USA

Mesocosm experiments have been used to evaluate the impacts of nutrient loading on estuarine plant communities in order to develop nutrient response relationships. Mesocosm eutrophication studies tend to focus on long residence time systems. In the Pacific Northwest, many estuaries have high nutrient loads, short water residence times, seasonal macroalgal blooms, while intertidal seagrass meadows persist under what appear to be largely naturally-derived eutrophic conditions. Using experimental mesocosms, we examined how primary producer communities in rapidly flushed systems respond to a range of temperature (10 and 20 °C) and nutrient loads (ambient, 1.5, 3 and 6 x ambient). Thermal and nutrient loading regimes were maintained for three sets of 3 week-duration experiments during the summer of 2013. Statistical analysis was performed using an information criterion approach to evaluate the best fit model. Green macroalgal (GMA) growth and tissue N increased in response to nutrient loading. Irrespective of nutrient load, GMA at 10 °C remained intercalated among seagrass shoots, but at 20 °C formed floating mats that overtopped seagrass. Outgassing of O_2 in combination with photosynthetic O_2 production likely induced floating mat formation. No phytoplankton blooms were observed. *Zostera japonica* leaf biomass and C:N responded to temperature while other metrics exhibited no statistically significant difference. *Z. marina* growth, wasting disease, and morphological metrics including the nutrient pollution index exhibited significant responses to experimental treatments. Differences in ecosystem metabolism were primarily related to temperature. Primary producer responses to temperature and nutrients were species specific, and under conditions of rapid flushing and cool temperatures, generally appear to be resilient to simulated eutrophication. Seagrass communities may become more susceptible to degradation from nutrients with continued warming of estuarine waters.