Effect of temperature and nutrient manipulations on eelgrass Zostera marina L. from the Pacific Northwest, USA

Jim Kaldy

Global climate change will have a large impact on the three predominate drivers of estuarine seagrass productivity, temperature, light and nutrients. I experimentally evaluate the response of Pacific Northwest Z. marina to interactive effects of temperature and nutrient conditions. Experimental manipulations were conducted hydroponically in acrylic chambers and spanned a range of temperatures and nutrient concentrations. Preliminary single factor experiments were conducted to evaluate physiological tolerances to temperature and nitrogen concentrations. Eelgrass exhibited a linear increase in specific growth with increasing NH4 concentration (range from 10 to 1000 µM); in contrast, there was no significant relationship between specific growth rate and increasing NO3 concentration over the same concentration range. Leaf growth metrics all exhibited strong linear relationships with increasing water temperature (temperature range 4-25 ºC). In the factorial experiment, plants were exposed to 3 temperatures (10, 18 and 25 ºC) and 3 nitrate concentrations (10, 30 and 100 µM) with 3 replicate chambers per treatment combination. Most metrics (leaf elongation, growth, specific growth, wasting index) exhibited a significant temperature effect indicating the importance of temperature on metabolic rates. Tissue stable isotope ratios and C:N values exhibited a significant nutrient effect and in some cases a significant temperature effect. Whole plant non structural carbohydrate content of eelgrass exhibited no relationship to either temperature or nitrate concentration. These experiments suggest that (1) Z. marina may not experience nitrogen toxicity, (2) Z. marina stressed by warm temperatures may be more susceptible to wasting disease and (3) temperature may not exacerbate Z. marina response to nitrogen loading.