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Methane fluxes along a salinity gradient on a restored salt marsh, Harpswell, ME

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This study functions as a pilot project to understand the relationship between salinity and methane emissions on a recently restored salt marsh in Casco Bay, Maine. Salt marshes are dynamic and highly productive ecosystems that provide a multitude of ecosystem services including nutrient filtration, storm-water buffering and carbon sequestration. These ecosystems are highly susceptible to anthropogenic alteration. The emplacement of causeways and narrow culverts, restricts tidal flow and leads to loss of healthy salinity gradients. Consequently, numerous salt marshes have experienced increases in freshwater vegetation growth as a result of coastal population expansion. Recent restoration efforts on Long Marsh, Harpswell, ME replaced a severely undersized culvert with a larger one in February, 2014. The salinity gradient has since been restored along much of the marsh, and freshwater vegetation that encroached on the marsh platform has died back. Vegetation and salinity are key indicators and drivers of CH4 emissions on salt marshes. Using static gas chambers, we quantified CH4 fluxes along two transects at five diverse sites ranging from healthy marsh (salinity of 27 to 31 psu) with Spartina vegetation, to regions invaded by Typha and other freshwater vegetation (salinity of 0 to 4 psu). Sampling was executed in the months of July, August and October. CH4 concentrations were determined using a gas chromatograph with a flame-ionization detector. Preliminary findings suggest reintroduction of healthy tidal flows into the marsh inhibits CH4 production, where the lowest fluxes with least variability were observed at the most saline sites with Spartina vegetation. The largest range of CH4 fluxes exhibited emissions from 0.75 μmol CH4/m2/hr to 518.4 μmol CH4/m2/hr at the Typha dominated sites from July to October. Fluxes at the saltwater and brackish regions were far less variable with ranges from 0.94 μmol CH4/m2/hr to 8.2 μmol CH4/m2/hr and 2.6 to 9.5 μmol CH4/m2/hr, respectively. The transitional sites exhibited ranges from 1.2 μmol CH4/m2/hr to 16.8 μmol CH4/m2/hr. For all sites, lowest fluxes were observed during the month of October, suggesting seasonal influence on CH4 emissions. These data will be complimented by sediment analyses at each site providing δC and % organic carbon using isotope-ratio mass spectrometry, as well as bulk density and rates of decomposition using a tea bag index.