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The role of source water chemistry on microbial nitrogen processing in near-surface sediments in coastal salt marsh sediment

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Coastal salt marshes are complex biogeochemical systems that filter terrestrial-derived contaminants and nutrients, particularly nitrogen (N) species. While the general drivers of N processing in salt marshes are well studied, there is a need to understand the role of spatiotemporal variability of dominant flow path sourcing (terrestrial versus marine) and their distinct chemical compositions. To address this, we conducted wet and dry season sediment slurry experiments to measure potential denitrification (DNF) and dissimilatory nitrate reduction to ammonium (DNRA) rates along a 25 m study transect located in the Elkhorn Slough, California. We conducted two experiments in the wet season and three in the dry season of 2023, collecting and partitioning 5 - 35 cm of sediment at upper, middle, and lower marsh locations. Slurry experiments were paired with pore water chemistry samples (nitrate, ammonium, dissolved organic carbon, salinity), subsurface water level time series, and environmental variables, including rainfall, air temperature, and surface water temperature. Preliminary results suggest that DNF and DNRA rates differ significantly, decreasing with depth (DNF by 88% from 5 cm to 15 cm; DNRA by 80% from 5 cm to 15 cm). DNF and DNRA exhibit the highest potential processing rates in the winter (DNF 3 times greater than DNRA), but only DNF rates show distinct wet and dry seasonality. This suggests that as the potential rates become more similar in the dry season (June - November), environmental conditions, such as salinity and other inhibitory species, become more favorable for DNRA, shifting the N process dynamic and creating a more balanced competition for nitrate between DNF and DNRA. Additionally, there are no statistical differences in potential rates across the marsh positions despite evidence of variation in terrestrial-marine dominant sourcing over time. This is unexpected as terrestrial and marine inputs provide unique N and salinity concentrations for biogeochemical activity and processing rates. Our findings suggest that the seasonal partitioning between DNF and DNRA pathways is affected by large-scale hydrologic drivers, rather than small-scale variation associated with salt marsh elevation.