Dissertation Defense

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“NITROGEN CYCLING IN THE GULF OF MEXICO ESTUARIES: HOW DO NITRATE REDUCTION PATHWAYS DIFFER BETWEEN RIVER-DOMINATED AND GROUNDWATER-DOMINATED ESTUARIES?”

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Abstract -Sediment nitrogen (N) cycling was investigated through multi-year field and laboratory experiments in river- and groundwater-dominated northern Gulf of Mexico estuaries. In order to determine the dominant N reduction pathway, assessment of how N is retained or lost from these systems was quantified at eight sites in Mobile Bay, AL, USA and its sub-estuaries through simultaneous measurements of *in situ* and potential rates of denitrification, N fixation, dissimilatory nitrate reduction to ammonium (DNRA) and anammox using intact sediment cores and sediment slurries and applying ^{15}N-isotope techniques. Denitrification rates were higher in the more saline sites in Mobile Bay and Weeks Bay (up to 47 μmol m^{-2} hr^{-1}), while rates of DNRA at these locations were higher at sites closest to the rivers, where salinity was lower (up to 210 μmol m^{-2} hr^{-1}). Maximum DNRA rates (up to 237 μmol m^{-2} hr^{-1}) were measured in the groundwater-dominated Little Lagoon and typically exceeded rates at the river-dominated estuaries. DNRA accounted for up to 40% of nitrate reduction at Little Lagoon, ~ 55% at the Delta in Mobile Bay, and as much as 66% at Weeks Bay. In Mobile Bay and Weeks Bay, water column nitrate concentrations and organic matter availability influenced DNRA rates, while in Little Lagoon, porewater sulfide concentration was an important factor. DNRA is a dominant process and by retaining bioavailable N in these systems, it potentially contributes to eutrophication. In contrast to DNRA and denitrification, anammox was a minor component of the N cycle at all of the study locations.