Introduction

• The Comprehensive Everglades Realization Plan, which proposes to restore sheet flow throughout the Everglades, will change the amount, sources, and ratios of nutrients delivered to Florida Bay, particularly nitrogen.
• Identifying the linkages between nutrient inputs from the Everglades and biogeochemical cycling processes in Florida Bay is critical to understanding the effects of hydrological restoration and changing nutrient regimes on water quality and ecosystem function in Florida Bay.
• A stable isotopic approach provides an effective way of tracing the fate of varying nutrient sources and delineating the dominant biogeochemical processes governing nutrient cycling in the bay.

Research Objectives

• Use N and C stable isotopic analyses of dissolved nutrients and organic materials to determine spatial and seasonal relationships between Everglades nutrient sources and biological sinks in Florida Bay.
• Investigate the biogeochemical relationships among inorganic and organic components of the water column and the benthos in Florida Bay.
• Provide a predictive perspective of future ecological response to changing nutrient inputs resulting from hydrologic restoration.
• Our isotopic study is part of a larger study whose additional aims include determining the regional and temporal bioavailability of nutrients to photoautotrophic communities in Florida Bay (See Heil and Glibert presentations).

Research Approach

• Spatial and seasonal sampling:
  – East to west transect
  – Wet and dry Seasons
  – Nutrient abundances and ratios
  – Stable isotopic Analyses (DIN, DIC, HMW DOM, Particulate organic matter (POM), Seagrass (T. interruptum), and Sediment
  – Ten sites in Florida Bay and the Everglades were chosen to represent the 3 upland regions and the 3 chemically and ecologically distinct regions of the bay.
• To enhance the resolution of the isotopic values, a bimonthly survey (23 sites) of water, seagrasses and sediment was conducted.
• Ecological Response (See Heil and Glibert presentations)

Biogeochemical Relationship Between the Everglades and Florida Bay Revealed Through Spatial and Temporal Variability of Nitrogen Isotopic Composition of Dissolved Nutrients and Biologically-Derived Organic Components

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Hydrologic Flow, DIN, $\delta^{15}N$ of Seagrass

• Freshwater discharge into eastern Florida Bay is strongly correlated with rainfall (a,b). Flow from the Everglades delivers nutrients such as DIN into the bay, thereby affecting the biogeochemistry (c).
• There is a strong correlation between DIN and $\delta^{15}N$ Thalassia indicating assimilation of nutrients during periods of higher primary productivity (d).

$\delta^{15}N$ of Seagrass

• $\delta^{15}N$ Thalassia shows a progression to more enriched values (typically 2‰ heavier in Eastern Florida Bay) during the transition from the dry season to the wet season.
• This enrichment directly correlated with an increase in DIN during times of higher freshwater flow from the Everglades into the bay.

$\delta^{15}N$ of Sediment

• More enriched $\delta^{15}N$ values (4‰ heavier) were observed during the dry season, when freshwater flow from the Everglades is less and circulation is restricted in eastern Florida Bay. Long residence time of water in eastern Florida Bay, coupled with the shallowness of the system, are favorable for rapid recycling of nutrients through nitrification-denitrification processes in the sediment.
• In the wet season, when freshwater flow from the sloughs dramatically increases, allochthonous nitrogen sources, e.g. runoff from agricultural fields, may become incorporated into the isotopic signal, thereby shifting to more depleted values.
• In western Florida Bay, where circulation patterns are more open and influenced by the Gulf of Mexico and less directly hydrologically influenced by Everglades sheet flow, $\delta^{15}N$ values show less of a seasonal shift.

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