Patterns of Inorganic Nitrogen Flux from Northern Florida Bay Sediments

Introduction

The availability of nitrogen in Florida Bay for the production of algal blooms may be dependent upon rates of denitrification of organic matter in Bay sediments and the resultant release of inorganic nitrogen from these sediments. As part of a program to understand the ecosystem-level effects of the hydrological restoration of Florida Bay and the resultant changes in sedimentary nitrogen dynamics, sediment core samples were collected from northern Bay sediments near the mangrove ecosystem. Five sites along north-south transects through Little Madeira Bay and Tampa Bay were measured seasonally using in situ chambers from May 1996 through September 1998 and measured frequently since then. Both dark chambers and open chambers were used to estimate fluxes during day and night.

Site Description

<table>
<thead>
<tr>
<th>Pond</th>
<th>East</th>
<th>West</th>
</tr>
</thead>
<tbody>
<tr>
<td>Madeira</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Little</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Benthic Chamber Characteristics and Deployment

Mean benthic fluxes (±SE) from 5/96-2/00.

Methods

Sampling

- Four replicate light and dark benthic chambers per site
- Water column controls
- Measurements from 5/96-9/98 and measured less frequently since then (to 2/00)
- Four bay sites along north bay coast (2 east, 2 west)

Measurements

- Hydrobio: continuous O₂, pH temperature, salinity
- Dissolved nutrient analyser: N<sub>N</sub>, N<sub>D</sub>, N<sub>NO</sub>, N<sub>NO</sub> single dissolved solids
- Particle analysis: chlorophyll a, suspended solids
- Sediment analysis: tax on ignition, total C, N, P
- Vegetation analysis: above ground dry weight, C, N, P

Results

Dissolved Inorganic Nitrogen Flux

<table>
<thead>
<tr>
<th>Pond</th>
<th>Madeira</th>
<th>Little Madeira</th>
<th>North Tampa</th>
<th>Crocodile Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>NH&lt;sub&gt;4&lt;/sub&gt;</td>
<td>0.62±0.25</td>
<td>0.13±0.32</td>
<td>0.36±0.05</td>
<td>0.32±0.10</td>
</tr>
</tbody>
</table>

Ammonium flux temperature relations

Time weighted mean 24 hour fluxes

Mean benthic fluxes (±SE) from 5/96-2/00.

NH<sub>4</sub> flux (μmol N m<sup>-2</sup> h<sup>-1</sup>)

Anoxia Experiment

Dissolved Oxygen Concentration (μmol L<sup>-1</sup>)

NH<sub>4</sub> Flux Measurements (October 1999)

NH<sub>4</sub>-N median [μmol L<sup>-1</sup>]

Conclusions

- The importance of coupled nitrification and denitrification is indicated by:
- direct measurement of N<sub>N</sub> fluxes on high sediment release, relative to the ammonium flux.
- the magnitude of sedimentary nitrogen release is very low relative to oxygen concentrations.
- the sensitivity of ammonium fluxes to anoxia conditions.
- high ammonium flux under anoxic conditions.

We propose that the seasonality of algal blooms may be dependent on ammonium releases from the sediments, with high release of low to very low oxygen availability and high temperature because coupled nitrification-denitrification is inhibited.