A Conceptual Model of the Biological Effects of Mississippi River Nitrogen on the Northern Gulf of Mexico

M. J. Dagg and G. A. Breed
<table>
<thead>
<tr>
<th>River</th>
<th>fw discharge $10^9$ m³ yr⁻¹</th>
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</thead>
<tbody>
<tr>
<td>Amazon (Brazil)</td>
<td>6300</td>
</tr>
<tr>
<td>Zaire (Zaire)</td>
<td>1250</td>
</tr>
<tr>
<td>Orinoco (Venezuela)</td>
<td>1200</td>
</tr>
<tr>
<td>Ganges-Brahmaputra (Bangladesh)</td>
<td>970</td>
</tr>
<tr>
<td>Yangtze (China)</td>
<td>900</td>
</tr>
<tr>
<td>Yenisey (Russia)</td>
<td>630</td>
</tr>
<tr>
<td>Mississippi (USA)</td>
<td>530</td>
</tr>
</tbody>
</table>
NO$_3$ concentrations > 100 $\mu$mol
Primary Production as high as 8.2 g C m$^{-2}$ d$^{-2}$

Copepod nauplii as high as 1000 liter$^{-1}$

Fisheries Production: In US, Louisiana is second to Alaska in fisheries landings
near-field, mid-field, far-field
<table>
<thead>
<tr>
<th></th>
<th>near-field</th>
<th>mid-field</th>
<th>far-field</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspended sediments</td>
<td>high</td>
<td>low</td>
<td>v. low</td>
</tr>
<tr>
<td>Nutrient concentrations</td>
<td>high</td>
<td>medium</td>
<td>low</td>
</tr>
<tr>
<td>Phytoplankton growth</td>
<td>low</td>
<td>v. high</td>
<td>low</td>
</tr>
<tr>
<td>Microzooplankton</td>
<td>low</td>
<td>high</td>
<td>medium</td>
</tr>
<tr>
<td>Mesozooplankton</td>
<td>low</td>
<td>med</td>
<td>high</td>
</tr>
</tbody>
</table>
small phytoplankton - microzooplankton

- Relative abundance/rate
- [NO3]
- small phyto mu
- [small phyto]
- [microzoo]
- OC flux rate

1.0
0.8
0.6
0.4
0.2
0.0

near
mid
far
Time and Space scales
Small phytoplankton

Large phytoplankton

Dissolved organic matter and bacteria

Future Directions

How do optical characteristics of plume water control the timing and magnitude of the biological and photochemical responses to river inputs?

What are the relationships between mixing and community structure? How does the rate of mixing of buoyant plume water with ambient coastal water determine the structure and composition of the planktonic community?

What controls the balance between autotrophy and heterotrophy within the plume and how do these factors vary from the near-field to the far-field plume regions?

What controls the vertical flux of plume materials, especially organic production that occurs within the plume?