What happens when Nutrients are Reduced?

Candace Oviatt

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Coastal Institute Auditorium
RI Department of Environmental Management Summer Total Nitrogen Inputs

May - October Total Nitrogen at RI "11" Plants

Note that Warren WWTF is not included in the total nitrogen calculations from 2006-2010. They would have added ~150 lbs/day to the total nitrogen load.

Slide courtesy of Warren Prell and the RI DEM Office of Water Resources
Nutrients have decreased by over 50%
Decrease in Primary Production Along the North-South Axis of Narragansett Bay with Nitrogen Reduction

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<tbody>
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<td>-21</td>
<td>-31</td>
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<tr>
<td>CP</td>
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<tr>
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Average Statistical Significance: ** N.S. **

** = 0.01 level of significance
N.S. - not significant at the 0.05 level of significance
Decrease in Summer Chlorophyll

Mean Chlorophyll, µg l⁻¹

- PR
- UB
- MB
- LB

<table>
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<th>Year</th>
<th>PR</th>
<th>UB</th>
<th>MB</th>
<th>LB</th>
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<tr>
<td>1980/97</td>
<td>50</td>
<td>40</td>
<td>30</td>
<td>20</td>
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<td>2006-11</td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>7</td>
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<tr>
<td>2013-15</td>
<td>5</td>
<td>4</td>
<td>3</td>
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Decrease in Winter-Spring Bloom, JFM
Summary of the Narragansett Bay Ecosystem with and without the Winter-Spring Bloom

With the bloom during cold winters and high nutrients:
1- Prolonged bay-wide, several week diatom bloom with high chlorophyll concentrations during winter-spring period which sinks to the benthos.

2- High biomass benthic infauna, epifauna and demersal fish community.

Without the bloom during warm winters and high or low nutrients:
1- Small, non-extensive, short or no diatom bloom with low input of organic matter to the benthos but numerous zooplankton community in the water column.

2- Lower biomass benthos with pelagic fish dominating in the water column.
Increased water clarity in the Providence River and Upper Bay.

Summer Mean Extinction Coefficients
PR, UB, MB

Extinction coefficient, k(m⁻¹)

- 1997
- 2006-2009
- 2014
Summary

Nutrients in the Bay have been decreased by over 50%.

Primary Production has decreased by about 30%.

The Winter Spring Diatom Bloom has decreased due to warmer winters and reduced nutrients.

As a result we have greater water clarity in the upper Bay.
Questions?
Continued periods of low oxygen in the Bay.
What about Fish?

Narragansett Bay Five Station Transect During to After Nutrient Reduction (After Decapod Decline)

Significant decreases for all except Ohio and Hope between during and after nutrient reduction.

What about Fish?
Decrease in Crabs and Lobsters due to Predation/Temperature?

GSO Fox Island Demersal Invertebrate Mass

Mean Tow ww, kg y⁻¹

0 20 40 60 80

Figure 20

The relationship between fisheries yield (first reference) and the primary production (second reference) of a variety of marine systems (points in shaded area) compared with the regression line developed by Oglesby (1977) for similar data from large fresh water systems.

<table>
<thead>
<tr>
<th>gC m⁻² y⁻¹</th>
<th>kgww/hect/y⁻¹</th>
<th>Mean</th>
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<tr>
<td>327</td>
<td>243</td>
<td>X</td>
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<tr>
<td>276</td>
<td>214</td>
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<tr>
<td>311</td>
<td>94</td>
<td>0</td>
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| 311        | 336           | 0    | before decapod corr