Nutrient Standing Stock Dynamics With Onset of Tertiary Treatment

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1998 & 2006-2009 Stations

Oviatt 1980 Stations

Nutrient Stations

No Lower East Passage Stations
What is the Actual Load Reduction?

- 2004-2009 data based on loading data and previous mass balance (Nixon et al. 2008)
- 2011-2015 data based on loading estimates (Liberti, pers. Comm.) and monthly design flows (a conservative estimate)
- Reduction is almost entirely DIN
• DIN/DIP ratio <16:1 is traditionally viewed as a nitrogen limited system.

• On an annual average basis, Narragansett Bay remains nitrogen limited throughout, though this limitation is more severe in the mid and lower bay.

• On shorter time scales, some areas of the Upper Bay do show evidence of P limitation, which may become even more important as N inputs continue to drop.
Lining Up the Stations with Volume Boxes from GEM Box Model (Kremer et al. 2010)

• Used Average of 9, 14, 8 for Box 5
• Averaged 5 and 6 for Box 12
• Buoy data used for Greenwich Bay boxes (6 and 7)
• For 1979-80 data West passage data were used for stations 4, 5, 6. 2006-2009 data were used for Greenwich Bay and MHB

• Multiplying by volume gives us the total ‘standing stock’ in the bay...

• Future Work: Bottom data may significantly improve resolution
The Short Short Version

• We do see a reduction in DIN roughly proportional to the reduction we might expect.
• We do not see a reduction in TN. However, we may lack resolution to detect the ≈7% reduction which has occurred.
• The observed reduction does not appear to be greater in the summer.
• Phosphorus reduction appears to be much larger than would be expected from wastewater improvements alone.
Implications for Management

• Short and long term temporal variability in standing stocks relative to WWTF inputs is an important consideration.
• While there is a reduction in DIN, there is no apparent reduction in TN. DIP and TP show a similar pattern.
• Standing stocks of total nutrients are much less variable than inorganic nutrients.
• While DIN in the upper bay has not changed measurably, stocks in the lower bay have been significantly reduced, a possible indication that the lower bay is more nutrient limited.
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References


