

Estimating freshwater residence time in an embayment experiencing a massive seaweed bloom – linking sources of nutrient pollution to responses for local communities.

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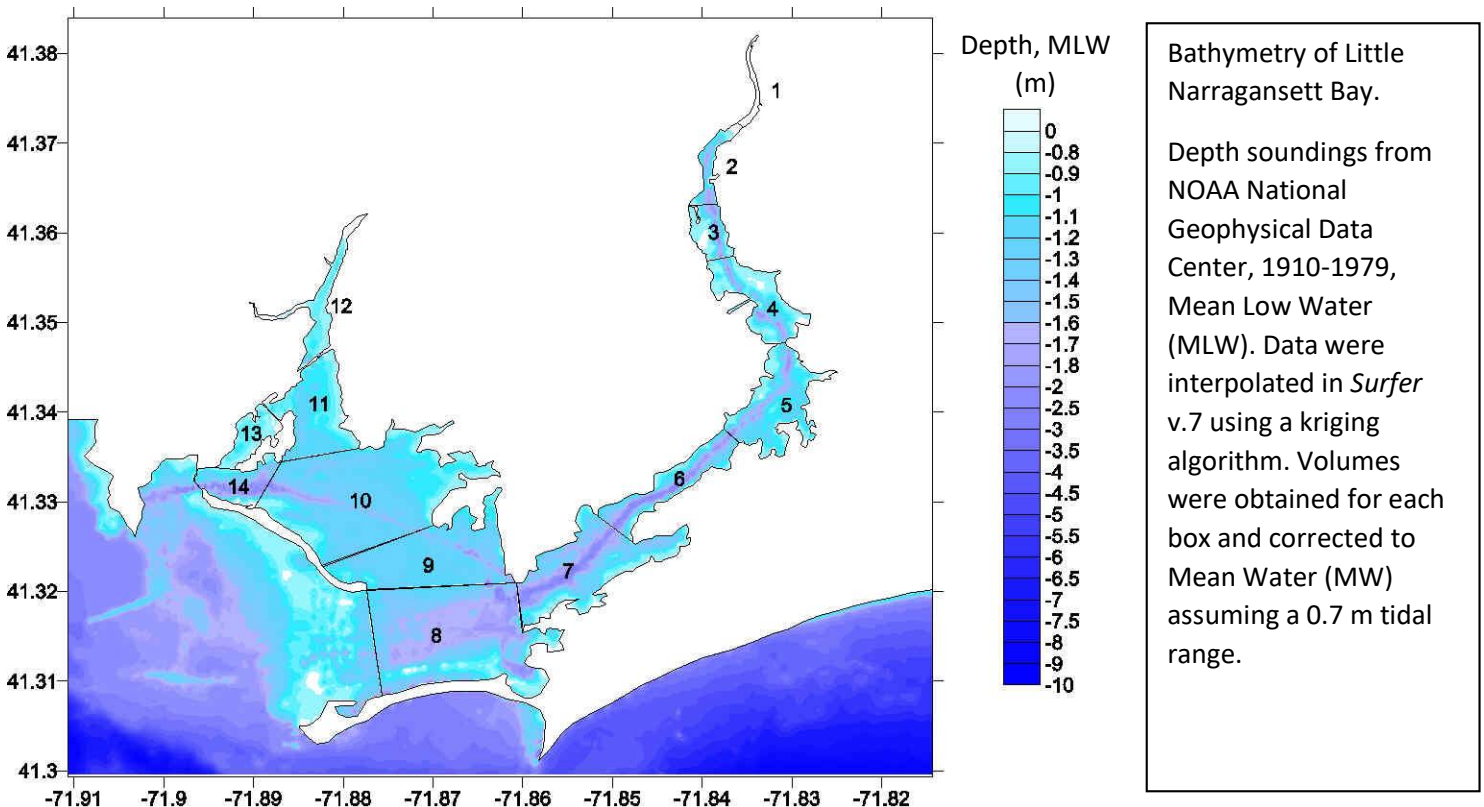
Summer 2017

Goals: (1) Estimate the amount of Pawcatuck River water entering Little Narragansett Bay (LNB) via the channel near Stonington Borough versus exiting to Long Island Sound via the channel near Napa Tree Point, (2) estimate the freshwater residence time of Pawcatuck River in Little Narragansett Bay, (3) and compare results to independent estimates of both #1 and #2.

Objective: Determine the influence of the Pawcatuck River on Little Narragansett Bay.

Methods: Flushing time was estimated using the Freshwater Replacement Time method. This method requires the volume of freshwater in each estuarine box calculated from salinity profiles, volumes of boxes in the estuary, and the volume of freshwater input. The USGS river gaging station supplied the river inflow, using data from the Westerly station for 8/4/14 and the median daily statistic (76 years) for 8/2/13, when the gage was not operational. The fraction of Pawcatuck River water flowing into LNB was estimated by comparing the cross-sectional areas of the two outlet points: Napa Tree and Stonington. Salinity profiles were provided by the Vaudrey Lab at UCONN for these two dates. Volumes of estuarine boxes were determined from a bathymetry map generated by Vaudrey.

The estimates based on physical data were compared to the biologically based estimates of Amanda Dostie in 2014. Dostie surveyed the seaweed in LNB and used the nitrogen content of the seaweed, *Cladophora*, to estimate the amount of nitrogen required to support the biomass. She estimated that 32% of the nitrogen from Pawcatuck River must enter LNB and supplies 79% of the nitrogen found in the seaweed, with the remainder coming from Wequetequock Cove and the watershed draining directly to Little Narragansett Bay. nitrogen load estimates were obtained from the Vaudrey Lab Nitrogen Loading Model for Long Island Sound.



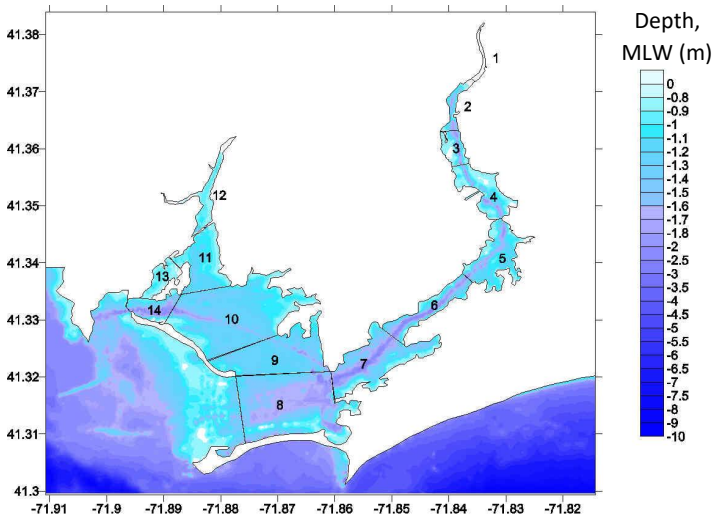
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Results:	Ahl's estimate (this study)	Other Estimate	Source of Other
Pawcatuck River Freshwater Flushing Time	1.8 to 3.9 days June to August	3.9 ± 1.6 days	Doering P H, C A Oviatt, J H McKenna, and L W Reed. (1994) Estuaries 17(3): 521-536
Little Narragansett Bay Freshwater Flushing Time	23 to 27 days August	NA	
fraction of Pawcatuck River Water Entering LNB	~30%	~32%	Dostie and Vaudrey, 2014

Suggested Future Work:

- Map bathymetry of the two channels: Stonington Borough and Napa Tree Point. This will improve the estimate of the fraction of Pawcatuck River entering LNB.
- Expand estimates to include additional salinity profiles from other seasons and years. This will better refine the freshwater flushing time. Freshwater flushing time indicates the availability of nitrogen to the seaweed.



Bathymetry of Little Narragansett Bay.

Depth soundings from NOAA National Geophysical Data Center, 1910-1979, Mean Low Water (MLW). Data were interpolated in *Surfer* v.7 using a kriging algorithm. Volumes were obtained for each box and corrected to Mean Water (MW) assuming a 0.7 m tidal range.

BELOW – Images from Dostie's 2014 seaweed (*Cladophora*) survey.

Dostie, Amanda and Jamie Vaudrey (2014) *Cladophora* sp. biomass in Little Narragansett Bay, July 8-10, 2014. Black and grey points are sample locations. Grey were sampled by snorkeler, as the *Cladophora* was too deep to sample via grab.

