Questions and Responses from J.S. Latimer Concerning
Latimer & Rego, 2010

Draft responses provided by Latimer on November 8, 2018 are provided in the boxed text below each corresponding question.

Data Requests:

- Please provide the parameter values listed in Table 1 for each site identified in the report.
  - TBD
- Please provide the data used to populate Figures 2 and 3. In particular, which systems have 80-100% loss?
  - TBD
- Please provide the estuarine volume, tidal range, and freshwater input parameters for each of the sites used in this study (identified in Table S1 of the Supplemental Information).
  - TBD
- Please identify those systems where significant TN impairment (light limitation caused by excessive epiphytes, excessive macroalgae or excessive phytoplankton growth) was documented as the reason for the change in eelgrass population).
  - Unknown

Questions:

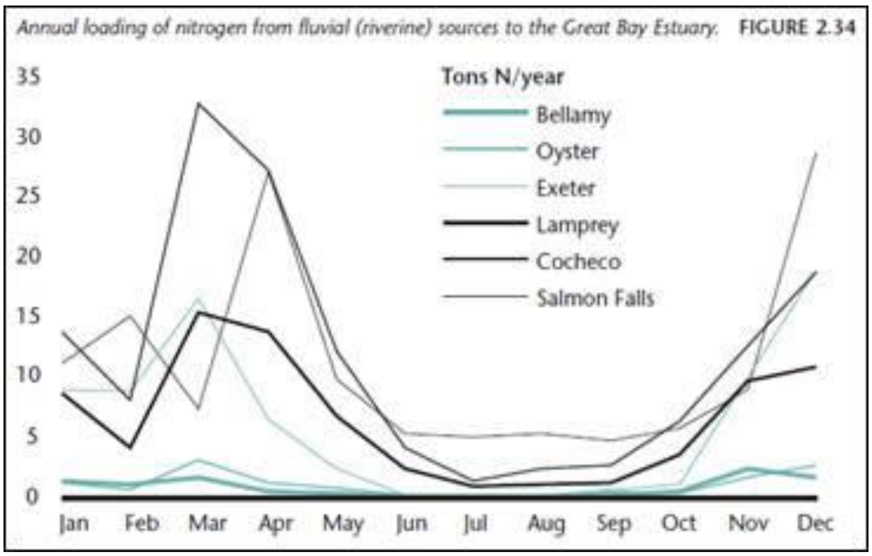
- Our understanding of your paper is that it presumed eelgrass should exist in various New England locations in bays, tidal ponds and tidal rivers (based on a chosen depth), compared that calculation to the amount of eelgrass presently there to calculate "eelgrass loss" and then plotted that value against the amount of TN loading occurring in those areas, but did not confirm that (1) eelgrass actually could thrive in the calculated areas (2) if historical beds did exist, their loss was not caused by other non-nutrient factors (e.g., wasting disease, storms, boat traffic, invasive species, etc.) or (3) TN related impairments were documented for the systems in question where major losses were calculated to have occurred. Is this an accurate understanding of information presented in the paper?
  - Yes
- How did you calculate TN loading rates used to populate the graphs – were these measured loads or estimated loads? Did you account for tidal transport within the system or only "upstream" sources?
  - TDN was calculated using the NLOAD (NLM) watershed model; see Latimer and Charpentier 2010 paper for details. Upstream (watershed) sources were considered as well as atmospheric deposition to estuarine surface.
- What were the adverse TN impacts on eelgrass in the study's references?

- We did not document TN impairments to the estuaries (except for anomalous estuaries)

- On what basis was the 99%ile used to identify the high dilution category threshold where the TN load model may yield inaccurate results?
  - Dilution values: source: Bricker SB, et al, (1999): 1/ (estuarine volume) for well mixed estuaries
  - Dilution potential: Bricker SB, et al, (1999); High dilution potential 10^-13 to 10^-12; MED dilution potential 10^-11; LOW dilution potential 10^-10 to 10^-9; but these were from very large estuaries where the estuarine volumes are huge.
  - Adjusted dilution potential: Used 33.33, 66.6 and 99.9 percentile cut-off values to separate categories - HIGH <=2.1485X10^-7; MOD >2.1485-<8.4504X10^-7; LOW >=8.4504x10^-7. We looked for a way to scale down NOAA's values to the volume ranges of our estuaries. We evaluate the statistical characteristics for break points and used best professional judgment to divide the volumes in 3 bins (33, 67, 99th percentiles).
- What averaging period was used for chlorophyll trophic status? (e.g., growing season, annual)?
  - We did not consider trophic state (chl-a) in our analysis.
- What level of phytoplankton biomass (as chlorophyll-a, µg/L – average and maximum) was present in the 2010 study sites for the year characterized in the study?
  - We did not consider phytoplankton biomass (chl-a) in our analysis.
- For the 2010 study sites, what is the characteristic water depth at low tide? How much of the eelgrass habitat for the selected sites has a low tide water depth of 1.0 meter or less? Which water bodies in the study have eelgrass which are exposed to the surface during the tidal cycle?
  - Regarding water depth. Bathymetry for each estuary was used to generate a triangular irregular network (TIN) model. A contour line for the 0.5, 2, and 3m depth was generated from the TIN model. The area between the 0.5 and 2m depth was determined along with the area between the 0.5 and 3m depth.
- Do you have information on the extent of eelgrass that was present at these sites and the timing of its loss? Which sites identified in the 2010 study historically contained eelgrass beds that persisted throughout the year?
  - We have SAV data from aerial photography – that we considered representative of the period of the last decade of the 2000s; similar to the land use data and therefore the N loading rate data (1990s).
- Did this study assume that eelgrass can grow at all areas with average depth < 3 meters? Was any confirmation undertaken to document the assumption was appropriate for the various waterbodies included in this paper – in particular waters with naturally elevated CDOM levels?
  - Yes; we used general conclusions from the Vaudrey 2008 report. We had no data on CDOM levels for the estuaries.
- Measuring the extent of eelgrass present is highly dependent on the time of year aerial photos are taken and the antecedent conditions. Maximum growth can occur anywhere from August to October. On what dates were aerial photography eelgrass surveys conducted? Were Connecticut eelgrass cover data based on springtime photos?

  - Aerial surveys were taken (decisions of when to take aerial photos considered weather, water clarity and phenology by the respective states): CT, Spring 2006; MA, Spring-Summer 2001; RI, August 2006.
- The 2010 study identifies anomalous estuaries (Category 3) and hypothesizes that uncharacterized nitrogen inputs and hydrodynamic effects, substrate characteristics, nonalgal particle water clarity effects, availability of seed stock for reproduction, predator activity, etc. can reduce the viability of eelgrass. Were any of these factors analyzed for the waters in question, if so, which waters?
  - Anomalous estuaries (n=5): the cause of the anomalies was purely based on general ecological knowledge and not specific data, except where noted in Table 3.
- For systems not classified as "anomalous" were the factors listed above evaluated as the possible cause of eelgrass decline?
- How did this study account for wasting disease? (Note: The data for Massachusetts estuaries were obtained for 2001. The Atlantic coast experienced a significant outbreak of wasting disease in 1988-1989 and in the late 1990s/early 2000s)
  - We did not account for wasting disease; although, in general, southern New England system wide losses from wasting disease has been documented to be before the imagery was collected for this study.
- Which sites identified in the 2010 study are most susceptible to adverse hydrodynamic effects on eelgrass populations? (Note: The data for Connecticut and Rhode Island estuaries were obtained in 2006. Great Bay experienced a major flooding event in 2006 that corresponded with a significant reduction in eelgrass population from the prior year.)
  - We did not characterize the hydrodynamics of the study systems except for general tidal range, volume, etc.
- Hydrodynamically, where do the Great Bay, Piscataqua River, Portsmouth Harbor and Little Bay fit within the characterization used in this study?
- Which water bodies identified in the study are most similar to Great Bay, Little Bay, Piscataqua River, and Portsmouth Harbor?
  - Portions of Great Bay likely have tidal ranges similar to the study systems. (i.e., mean tidal range for Latimer/Rego 2010 study: 0.4-2.7 m) (for comparison, the mean tidal range for portions of GBE: 1.9-2.1 m, Denney 2012)
- Did the study include any analysis that separated water bodies into tidal rivers, versus ponds and harbors due to the well-known differences in hydrodynamics and non-nutrient factors affecting light transmission, sediment quality, and the ability of eelgrass repatriation to occur?
  - Only non-river dominated systems were studied.
- Where does Great Bay and the Great Bay Estuary fall on Figure 2 and Figure 3 of the 2010 report based on loads occurring in 1992-1996 and 2003-2005 when the system was not considered impaired for eelgrass?
  - My understanding is that total nitrogen loads to entire Great Bay estuary are ~150 kg ha-1 yr-1.
- Why was annual TN loading used when nutrient loads and their impacts on eelgrass are seasonal (see below from PREP, S. Jones, 2000)?

- Annual loading rate was used because the model used to estimate loading is based on land use and thus integrates over time (average loading).



- Do you have any data showing October-April TN loads substantially affect eelgrass population growth?
- Where actual system data indicate eelgrass is not affected by TN >100 kg/ha-yr, how should this study be applied? What would be the explanation? Would this anomalous?