New Hampshire Department of Environmental Services

RESPONSE TO PUBLIC COMMENT ON THE DRAFT 2012 CONSOLIDATED ASSESSMENT AND LISTING METHODOLOGY (CALM)

4/20/2012

On July 21, 2011, the New Hampshire Department of Environmental Services (DES) requested comments on the 2010 Consolidated Assessment and Listing Methodology (CALM) which served as a Draft CALM for the 2012 Section 305(b) and 303(d) Surface Water Quality Report (i.e., the 2012 CALM). Downloadable copies of the 2010 CALM and a list of possible revisions were made available on the DES website for review (http://des.nh.gov/organization/divisions/water/wmb/swqa/index.htm). In addition, the following organizations/agencies were notified by email:

Appalachian Mountain Club
Audubon Society
Connecticut River Joint Commissions
Conservation Law Foundation
County Conservation Districts
Lake and River Local Management Advisory Committees
Maine Department of Environmental Protection
Manchester Conservation Commission
Massachusetts Department of Environmental Protection
Merrimack River Watershed Council
National Park Service
New England Interstate Water Pollution Control Commission
NH Department of Health and Human Services
NH Coastal Program
NH Rivers Council
North Country Council
Regional Planning Commissions
Society for the Protection of National Forests
Natural Resources Conservation Service
The Nature Conservancy
Upper Merrimack River Local Advisory Committee
US Environmental Protection Agency
US Geological Survey
US Fish and Wildlife Service
US Forest Service
University of New Hampshire
Vermont Department of Environmental Conservation
Volunteer Lakes Assessment Program
Volunteer Rivers Assessment Program
Water Quality Standards Advisory Committee

The public comment period ended on August 22, 2011. The following represents the Department's response to public comments received during this period and to letters from the Great Bay Municipal Coalition on September 12, 2011 and November 14, 2011. Each comment is numbered and preceded by a general description of the subject matter. The Department's response immediately follows each comment (in bold font).

A. RESPONSE TO PUBLIC COMMENTS

Response to Comments Received from Mark Hemmerlein, Water Quality Program Manager, Bureau of the Environment, NH Department of Transportation

COMMENT (1):

The New Hampshire Department of Transportation (NHDOT) requests that section c. on page 67 of the 2010 CALM be revised to require some ambient chloride sampling before a waterbody is declared impaired for chloride because there can be many other ions which can affect specific conductivity.

> The Department is requesting that the language be strengthened to require some actual chloride specific ion testing be conducted before a waterbody is declared impaired for chloride. The implications and resulting restrictions that can be placed on development within impaired watersheds are so great, that a relatively inexpensive ($30) test should be required to confirm the diagnosis.

DES RESPONSE:

As stated in the Consolidated Assessment and Listing Methodology (CALM), DES *prefers*, but does *not require*, collection of chloride samples each time the chloride/specific conductance relationship is used to confirm a site fits the statewide specific conductance chloride relationship. DES does *not require* collection of chloride samples each time specific conductance is used to predict chloride.

In recognition of subtle differences in the chloride conductivity relationships DES applies one of three equations depending upon the location of the waterbody in the state (Figure 1).

1. Hodgson Brook Watershed: Chloride (mg/L) = 0.272 * Specific Conductance (uS/cm) – 24.66
2. I-93 TMDL Region: Chloride (mg/L) = 0.307 * Specific Conductance (uS/cm) – 22.00
3. Statewide: Chloride (mg/L) = 0.289 * Specific Conductance (uS/cm) – 11.7

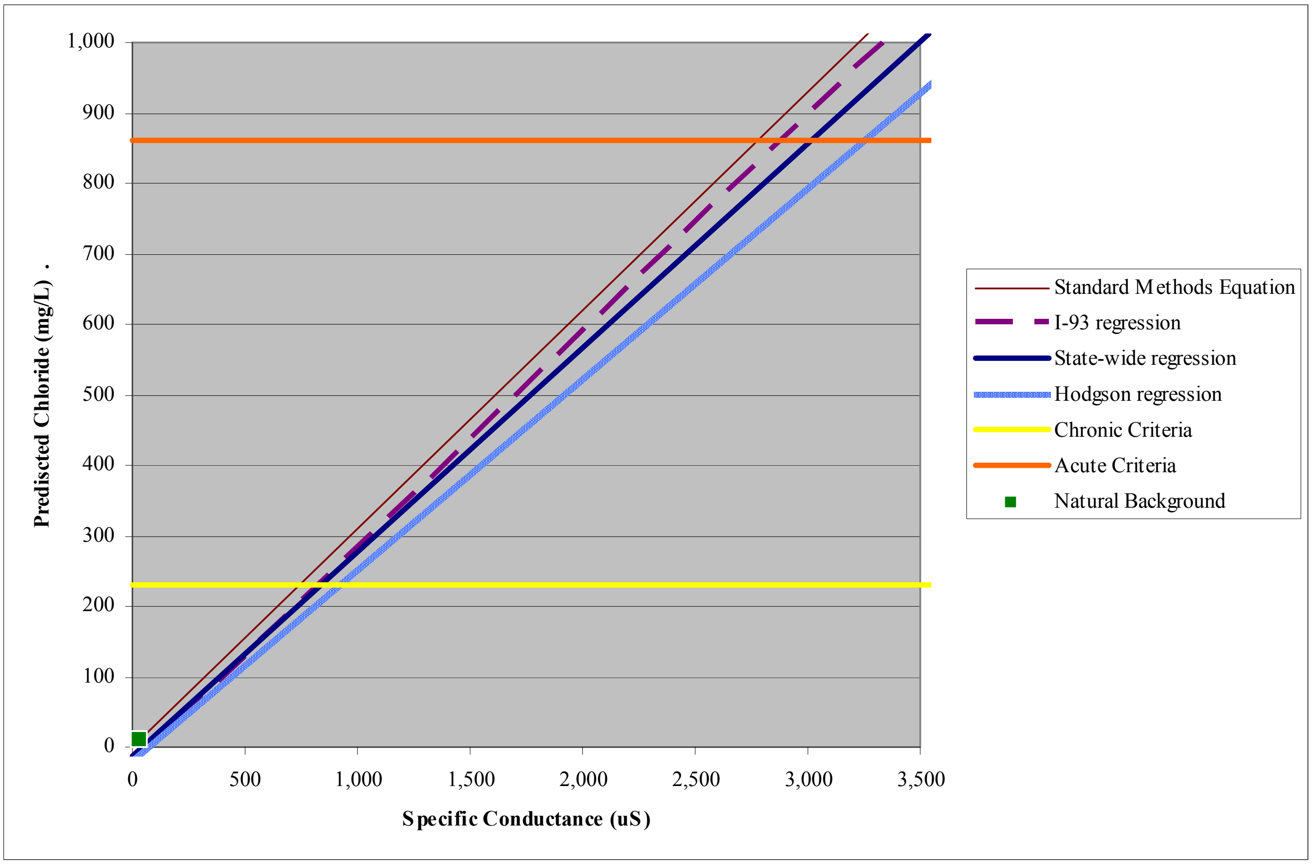
With regards to the effect of ions other than chloride on specific conductance readings, it is worth noting that "natural" levels of specific conductance and chlorides in ambient waters are typically less than 30 uS/cm and 10 mg/L respectively (Figure 1). To assess a waterbody as impaired for chloride based on chronic water quality criterion, the specific conductance must be greater than 835 us/cm which is almost 30 times higher than natural background. With the exception of few rare instances where a surface water is obviously polluted (foam, scum, etc.) by other sources, DES is not aware of any ambient surface water sample collected in the past decade with such high specific conductance that was not primarily attributable to chlorides. Consequently, based on DES experience to date, and the statewide regression, the potential for ions other than chloride to result in a waterbody being incorrectly assessed as impaired for chloride is considered to be extremely low.

In practice, nearly all chloride impaired waterbodies have chloride samples to complement the specific conductivity measurements (42 of 46 in the 2012 assessment). In the cases where only specific conductivity was used, concentrations were predicted to exceed the chloride chronic criteria by 72 to 933 mg/L, there was no evidence of confounding ions, and all waterbodies drained from highly impervious areas that were treated with road salt for de-icing.

EXHIBIT 37 (AR J.2)

In summary, DES is confident in making assessments using specific conductivity as a surrogate for chloride. That said, samples collected by DES typically include both chloride and specific conductance. DES intends to continue this practice in order to further test the relationship and encourages others to do the same. This is especially important in the rare instances where a water body is obviously polluted by other sources. However, for the reasons mentioned above and for the vast majority of surface waters, DES does not feel it is necessary or protective of surface water quality to exclude data based solely on specific conductance measurements for assessing chloride impairment. Consequently, the wording in the CALM will remain unchanged.

Figure 1. Chloride to specific conductance relationships used in the CALM.



*Although not used in the assessment of surface waters, the Standard Methods equation for chloride in pure water has been is displayed for reference. Chloride (mg/L) = 0.3097*Specific Conductance (in uS/cm) – 0.0843

Response to Comments Received from Stephen Silva,
Chief, Water Quality Branch, USEPA Region 1

COMMENT (1):

Concerns over the 10% Rule
Section 3.1.17, Page 18: EPA understands the reluctance of the State to make listing decisions based on a single exceedance in datasets with less than 20 total samples. Ideally datasets for a particular water body should include at least 20 samples, but this is not always possible due to budget and staffing constraints. Particularly in the case of toxics, but also with regard to other parameters, EPA believes that it is sometimes appropriate to list based on a single exceedance. However, EPA recommends that the State use Best Professional Judgment when making listing decisions with less than 20 samples in a dataset. In cases where sufficient metadata and QA/QC data support listing based on a single exceedance, EPA recommends listing the water body as impaired. For datasets that do not have adequate metadata or QA/QC data, the application of the 10% rule seems appropriate. EPA also recommends including the parameters for which the 10% rule is applied in the supporting text for Table 3-13 to clarify exactly which parameters this rule applies to.

DES RESPONSE:

In cases where the '10 percent' rule applies and there are fewer than 25 samples, only two exceedences are required to list the waterbody as impaired for the particular parameter. As the number of samples increases, the number of exceedences needed to impair the waterbody increase as shown in Table 3-13 of the 2012 CALM with the exception of large exceedences as outlined in "Magnitude of Exceedance Criteria" (MAGEXC) (Section 3.1.18). As shown in Section 3.2, MAGEXC are typically set well beyond the standard water quality criteria or as a function of measurement precision +/- the standard criteria; consequently when MAGEXC criteria are exceeded, one can be reasonably confident that there is an exceedence of the water quality criteria. As a general rule, if two or more samples exceeded the MAGEXC, waters were assessed as impaired (i.e. not supporting), regardless of the total number of samples taken.

The department agrees that it is important for the public to understand the circumstances when the 10 percent rule applies. This information is contained within Section 3.2 which covers Assessment criteria by designated use.

COMMENT (2):

Concerns over Nutrient Decision Matrix Tables

Table 3-28 (page 56) and Table 3-29 (page 63) would be easier to read if the Category 3 (3-ND, 3-PAS and 3-PNS terms were defined in the text describing the table. Revisions to both of these tables are recommended to reduce confusion on final assessment categories regarding phosphorus and nitrogen.

DES RESPONSE:

The department agrees, short descriptions of 3-ND, 3-PAS, and 3-PNS have been added to the notes for the nutrient decision matrix tables.

COMMENT (3):

US EPA Region 1 provided several comments on the proposed ‘channel instability’ metric. Those comments are addressed with similar comments in a subsequent section.

Response to Comments Received on the Proposed "Channel Instability" Metrics

COMMENT (1):

Stephen Silva, Chief, Water Quality Branch, USEPA Region 1

Comments Concerning Addition of Stream Channel Stability Assessment

Stream Bank Instability as a Pollutant in Note 3
EPA disagrees that an unstable stream bank is a non-pollutant "cause". Stream channel instability is a potential source of impairment, where a cause of impairment listing may be sedimentation, high turbidity, low dissolved oxygen, a chemical pollutant, or a non-pollutant. Therefore, whether or not to list the water body as impaired (category 5) will depend on the specific information provided by the assessment. We recommend that this note be deleted.

Use of the terms "moderately confined" and "unconfined" in Notes 6C and 7C
In order to reduce confusion on how the stream channel assessment should be applied, EPA recommends that these two terms be defined.

Potential Impacts of Trouble Points in Notes 6E & 7D
Assessment should take into account whether the localized trouble points have the potential to cause system wide changes to the system based on growth potential. We are concerned about the potential impacts that trouble points can cause to water quality of downstream reaches. The assessment should take into account how modifications can affect downstream uses.

Use of the term "crossing" in Note 8
EPA recommends defining this term and how it applies in this particular circumstance.

COMMENT (2):

Sean Sweeney, Headwaters Hydrology, PLLC

The following comments are in reference to the proposed additions to the CALM for stream impairment due to channel incision dated 7/22/11.

1. I believe the proposed methodology for determining impairment (i.e. combination of high incision ratio (IR) and high BEHI score) is appropriate.

2. The numerical scores required for an impairment finding (IR $\geq$ 1.5 and BEHI $\geq$ 40) are quite high. Essentially the channel must be "deeply" incised and have a "very high" bank erosion potential to be impaired.

3. I recommend some field testing at one or more sites known to be unstable to determine: (1) their IR and BEHI scores and (2) if they would be considered impaired under the proposed methodology. The Mad River in Farmington would be a good site. The results of this testing could be used to determine if modifications to the numerical thresholds are warranted.

I would be happy to assist with the field testing if it is to occur.

DES RESPONSE:

The department has decided that the proposed channel instability criteria requires further study and therefore did not include it in the final 2012 CALM. The department appreciates the thoughtful comments and will take them into consideration as the department continues to refine the decision matrix.

Response to Comments Received from the Great Bay Municipal Coalition

COMMENT (1):
From: Dean Peschel representing the Great Bay Municipal Coalition
Date: September 12, 2011
Comment:

> *"The Coalition requests that the following clarifications be made to the 2012 impairment listings for the Great Bay area:*
>
> 1. *Delete all of the transparency/TN-based listings for the tidal rivers and harbor; and*
> 2. *Amend the Great Bay listing to reflect that transparency is not the impairment of concern."*

DES RESPONSE:
The impairments for light attenuation ("transparency/TN-based listings") cannot be deleted from the 303(d) list because light attenuation is a good indicator of eelgrass survival and there is a statistically significant relationship between light attenuation and total nitrogen in the estuary. The Great Bay Municipal Coalition has argued that light attenuation is naturally occurring and unrelated to nitrogen, especially in the tidal rivers. In the N.H. Surface Water Quality Regulations, "naturally occurring" means conditions which exist in the absence of human influences (Env-Wq 1702.29). Figure 2a shows that light attenuation and total nitrogen have statistically significant relationships in the estuary, including in the tidal rivers (Figure 2b). Total nitrogen concentrations are a strong indicator of human influence. Therefore, given the relationship between light attenuation and total nitrogen in the estuary, including in the tidal rivers, it cannot be justified that light attenuation is "naturally occurring" nor can it be justified that light attenuation is unrelated to nitrogen concentrations.

Explanation:
There are multiple ways that excess nitrogen impacts eelgrass in the Great Bay Estuary. First, like all plants, eelgrass needs light to survive. Increasing nitrogen concentrations cause algae blooms (Figure 3) and elevated primary productivity in general. The plant matter floating in the water shades the eelgrass plants so they do not get enough light to survive. Figure 4 shows that light attenuation in the Great Bay Estuary is more strongly correlated with plant/organic matter in the water than any other factor. Second, excess nitrogen creates an environment in which epiphytes can grow on the leaves of eelgrass and macroalgae can out-compete and smother eelgrass. Field studies in Nettleton et al. (2011) and Pe'eri et al. (2008) have demonstrated that macroalgae has increased, dramatically in some places, as nitrogen has increased in the estuary. Finally, excess nitrogen disrupts cellular processes for eelgrass (Burkholder et al., 2007).

The dominant mechanism by which nitrogen affects eelgrass is different in different parts of the Great Bay Estuary and can vary over time. Light attenuation, a general measure of water clarity, is a good indicator of the presence or absence of eelgrass especially in the deeper areas of the estuary. Subtidal eelgrass beds in these areas need clear water to transmit light to the growing depths. In shallower areas, overgrowth and smothering by macroalgae and/or celluar disruption may be the immediate cause of eelgrass loss. However, even in shallow areas, light attenuation is still an important contributing factor for eelgrass viability because sufficient light is a requirement for plant survival in all areas.

Eelgrass may be impacted by other factors such as sediments, dredging, and disease. However, the strong relationships between nitrogen, light attenuation and algae growth demonstrate that nitrogen is most likely the dominant cause of, and certainly contributes significantly to, eelgrass losses in the Great Bay Estuary. Figure 5 shows that light attenuation increases with increasing nitrogen concentrations in the Great Bay Estuary, even accounting for changes in salinity. The same robust relationship is evident between total nitrogen and algae growth (chlorophyll-a) (Figure 3). These figures show that the relationships are robust, not merely correlations due to salinity differences. The strong relationships between nitrogen and chlorophyll-a and light attenuation are not surprising because these factors are well established indicators of eutrophication, which is caused by excess nutrients.

Literature Cited:

Burkholder, J.A., D.A. Tomasko, and B.W. Touchette. 2007. Seagrasses and eutrophication. *Journal of Experimental Marine Biology and Ecology* 350: 46-72.

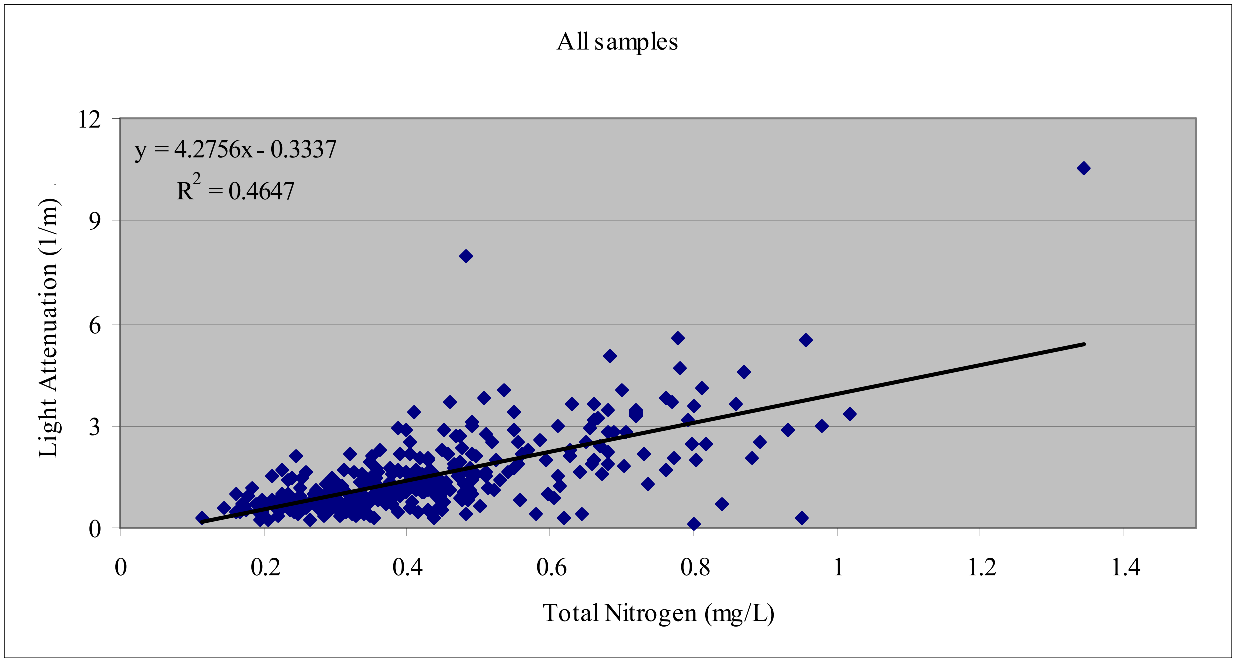
Gallegos, C.L. 2001. Calculating optical water quality targets to restore and protect submersed aquatic vegetation: Overcoming problems in partitioning the diffuse attenuation coefficient for photosynthetically active radiation. *Estuaries* 24: 381-397.

Nettleton, J.C., C.D. Neefus, A.C. Mathieson, and L.G. Harris (2011) Tracking environmental trends in the Great Bay Estuarine System through comparisons of historical and present-day green and red algal community structure and nutrient content. A final report to the National Estuarine Research Reserve System under Graduate Research Fellowship Award NA08NOS4200285. University of New Hampshire, Department of Biological Sciences, Durham, NH.

Pe'eri, S., J. R. Morrison, F.T. Short, A. Mathieson, A. Brook, and P.R. Trowbridge. 2008. Macroalgae and eelgrass mapping in Great Bay Estuary using AISA hyperspectral imagery. A Final Report to the Piscataqua Region Estuaries Partnership from the University of New Hampshire, Durham, NH. December 2008. Published online: http://www.prep.unh.edu/resources/pdf/macroalgae_and_eelgrass-unh-09.pdf.

Figure 2. Statistically-significant relationships ($p<0.05$) between light attenuation and total nitrogen concentrations in the Great Bay

(a) All samples (2003-2010)



(b) Samples from tidal rivers (2003-2010)

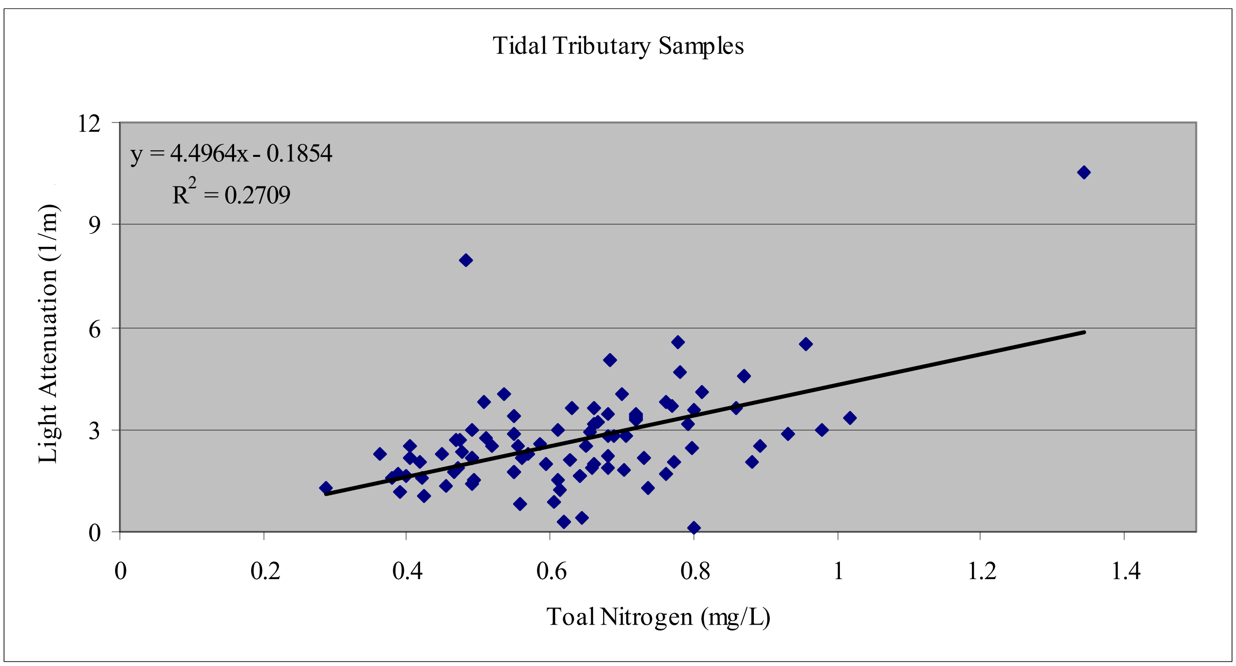


Figure 3. Frequency of Phytoplankton Blooms at Different Total nitrogen Concentrations (for all samples and for samples in each salinity category)

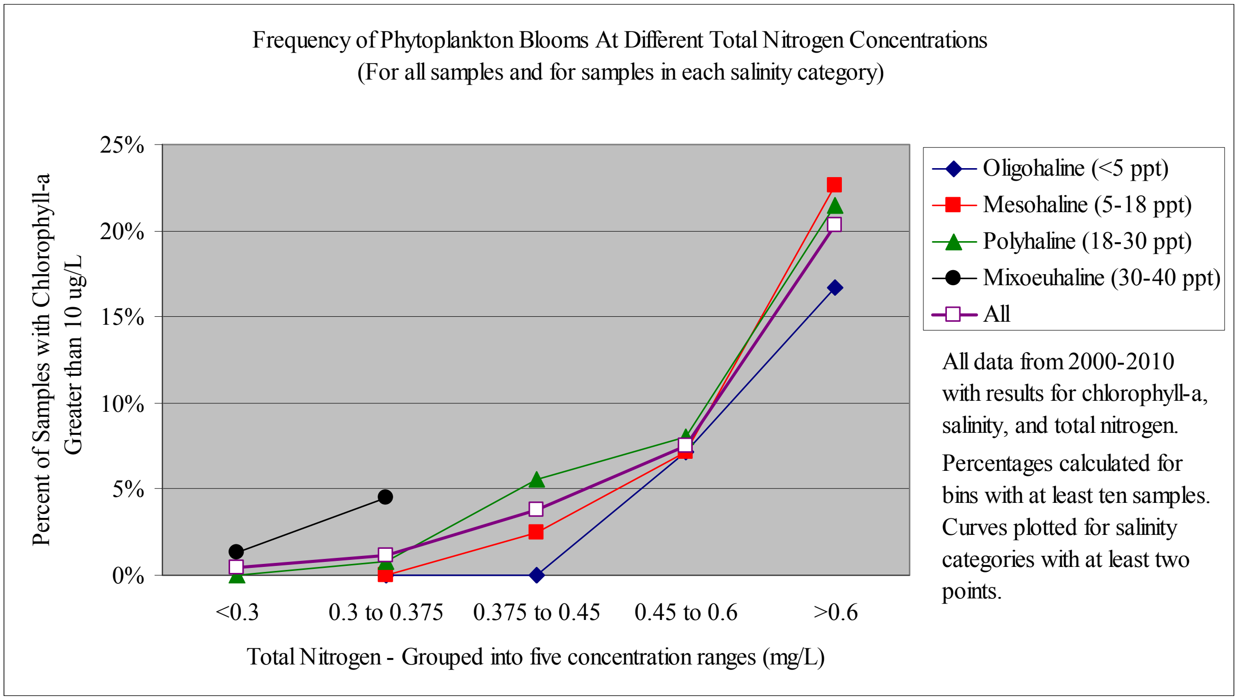
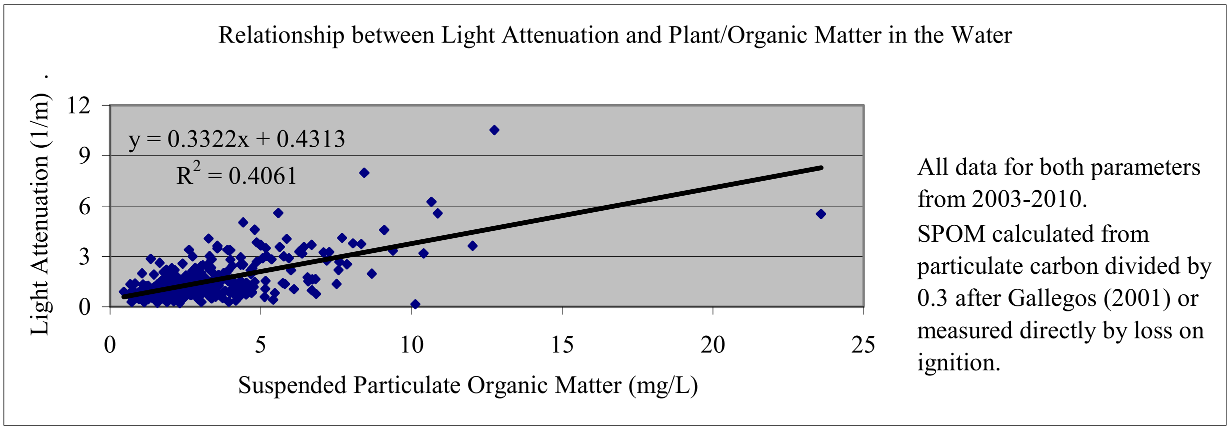
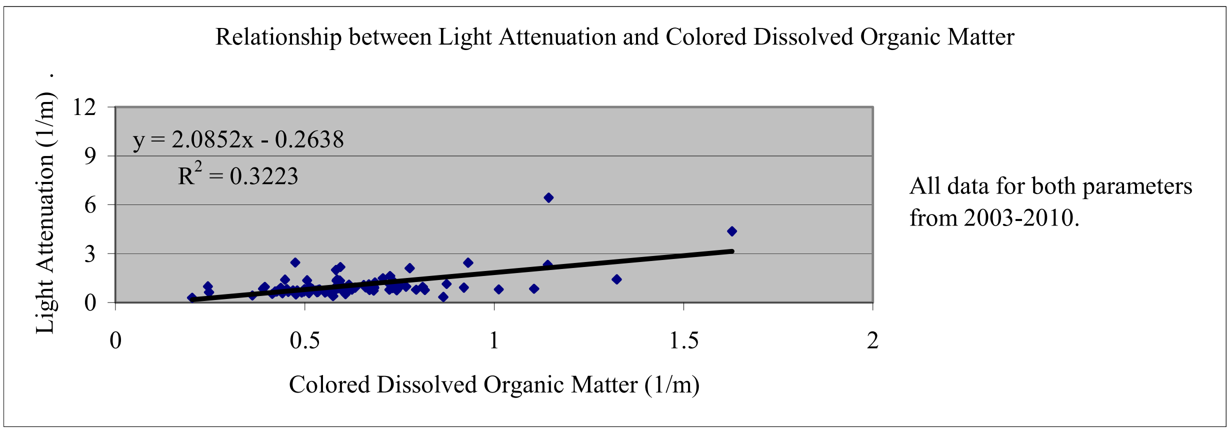


Figure 4. Light Attenuation Relationships with; Plant/Organic Matter, Colored Dissolved Organic Matter, and Particulate Organic Matter





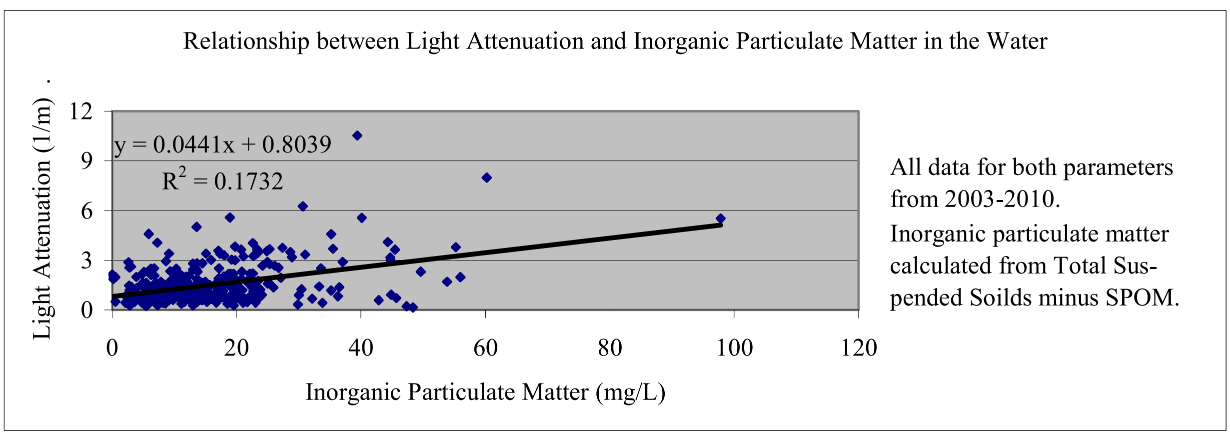
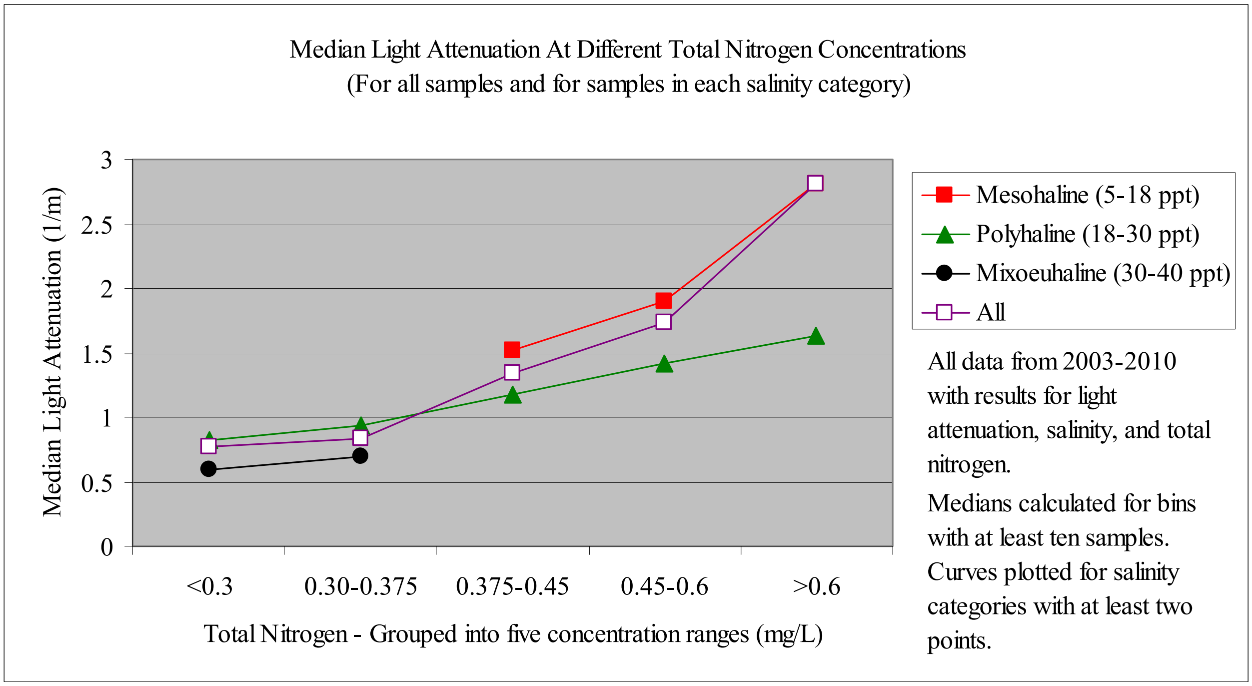


Figure 5. Median Light Attenuation at Different Total nitrogen Concentrations (for all samples and for samples in each salinity category



COMMENT (2):
From: Dean Peschel representing the Great Bay Municipal Coalition
Date: November 14, 2011
Comment:

- All references to reduced transparency/light attenuation as the cause of eelgrass losses in the tidal rivers, Great Bay, or the Piscataqua River and the need to attain a 0.3 mg/l TN instream value should be removed from this and future Section 303(d) reports.
- All Category 5 non-supporting designations that were based on applying either the 0.45 mg/l draft criteria for DO attainment or the presumed protective chlorophyll *a* target of 10 ug/l should be withdrawn (*see, e.g.,* Cocheco River chlorophyll *a*-based DO impairment determination). Actual DO data collected within the system should form the basis for any impairment determination.
- Great Bay waters (excluding the tidal rivers) should be identified as impaired due to excessive macroalgae growth, and the parameter of concern causing the impairment should be identified as DIN.

DES RESPONSE:
First bullet:

See response to Comment 1 from Dean Peschel (9/12/11).

Second bullet:

For the 2010 and 2012 assessments, the tidal Cocheco River was the only assessment unit for which a nitrogen impairment was based on exceedences of the chlorophyll-a criteria but not the dissolved oxygen criteria. A detailed explanation for this impairment is provided below.

For the tidal Cocheco River assessment unit, the total nitrogen and chlorophyll-a thresholds for the prevention of low dissolved oxygen (0.45 mg/L median total nitrogen and 10 ug/L 90^{th} percentile chlorophyll-a) are the applicable thresholds for the stressor-response matrix assessment. This assessment unit was listed as impaired for nitrogen on the 2010 303(d) list because of high nitrogen concentrations (TN median = 0.763 mg/L, n=21) and exceedences of the chlorophyll-a threshold (90^{th} percentile = 11.9 ug/L, n=32). For the 2012 assessment cycle, there were insufficient nitrogen data for a new assessment but the available data continued to show high nitrogen (TN median = 0.99 mg/L, n=3) and high chlorophyll-a concentrations (90^{th} percentile = 62 ug/L, n=5). The nitrogen impairment from the 2010 303(d) list will be retained because: (1) Assessment units that were impaired in the previous cycle cannot be removed from the 303(d) list if there are insufficient data to make a new assessment; and (2) the limited data available continue to indicate high nitrogen and high chlorophyll-a concentrations in this assessment unit. It should be noted that the Cocheco River has also been classified as impaired for nitrogen under the Primary Contact Recreation designated use due to high chlorophyll-a concentrations.

Similar to the 2010 assessment, grab sample data for dissolved oxygen reviewed for the 2012 cycle did not fall below standards, but these results were not considered representative of dissolved oxygen in the assessment unit. Half of the grab samples were collected at station (GBCW-17), which is just downstream of the rapids in downtown Dover where the water is almost fresh, fast-moving, and well aerated. Only one sample was collected in an area of slower water movement near the mouth of the river and this sample had dissolved oxygen levels less than 6 mg/L and <70% saturation. No high-frequency datasonde measurements were available. Therefore, the dissolved oxygen measurements in this assessment unit are not likely to be representative of conditions in slower-moving areas where dissolved oxygen exceedences would occur. High frequency datasonde measurements of dissolved oxygen, which provide more accurate and representative data, are needed to characterize conditions in slower-moving sections of the Cocheco River. In the meantime, dissolved oxygen and dissolved oxygen saturation will be categorized as “insufficient information”.

Third bullet:

DES agrees that proliferation of macroalgae is a factor in the eelgrass decline evident in the Great Bay Estuary. Eelgrass habitat has been lost through the combined effects of shading by plant/organic matter in the water, epiphyte/macroalgae over-growth, and disruption of cellular processes. DES uses the indicators of eelgrass cover and light attenuation to measure the effects of these nitrogen-related factors on eelgrass populations. Eelgrass assessments are reported on the 305(b)/303(d) lists under the parameter “estuarine bioassessments” for the Aquatic Life designated use. The impairments to eelgrass from macroalgae and other factors are captured by this indicator.

There is strong evidence that macroalgae proliferation is impacting eelgrass and changing the species composition and diversity in the Great Bay. A recent report by Nettleton et al. (2011) documented large increases in macroalgae populations in Great Bay in 2008-2010 relative to baseline studies in 1979-1980. The report concluded that:

> “Great increases in both mean and peak *Ulva* and *Gracilaria* biomass and percent cover have occurred in the Great Bay Estuarine System. These changes coincide with increases in water nitrogen levels observed over the past two decades. The increases in nuisance algal blooms are likely the result of increased nutrient loading in the bay, and, in the case of *Gracilaria vermiculophylla*, may also be a symptom of a harmful invasion. Current nitrogen levels in the system are substantial enough to support even larger *Ulva* and *Gracilaria* blooms than were observed in this study, based on minimum growth requirements.” (p. 82)

In addition, using data from Pe’eri et al. (2008), DES determined that macroalgae mats had replaced nearly 5.7% of the area formerly occupied by eelgrass in Great Bay in 2007 (DES, 2009). This information on macroalgae impact to eelgrass has been included in the Technical Support Document regarding the 2012 Aquatic Life Use Assessments for the Great Bay Estuary.

DES has developed numeric nutrient thresholds as numeric translators of the narrative standard for the Great Bay Estuary to determine compliance with Env-Wq 1703.14 (DES, 2009). Translators are a common tool employed by state environmental agencies as a method to interpret existing narrative water quality standards so that they can be applied to specific waters. For nitrogen, DES uses stressor-response decision matrix with total nitrogen as nutrient stressor indicator and dissolved oxygen, dissolved oxygen saturation, chlorophyll-a, eelgrass assessments, and water clarity as response indicators. Dissolved inorganic nitrogen is a component of total nitrogen. Therefore, the impacts of dissolved inorganic nitrogen and other forms of nitrogen are recorded by the total nitrogen indicator. Total nitrogen is a stable indicator of excess nutrients, as opposed to the more reactive form of dissolved inorganic nitrogen, which is rapidly removed from the water by algae and plants.

For the 2012 assessments, the Great Bay and many other tidal waters will continue to be impaired for “estuarine bioassessments” and “nitrogen (total)”. Given that these two indicators encompass macroalgae and dissolved inorganic nitrogen, respectively, among other factors, the information in the comment has been incorporated into the 2012 assessments.

Literature Cited:

DES. 2009. Numeric Nutrient Criteria for the Great Bay Estuary. New Hampshire Department of Environmental Services, Concord, NH. June 2009. Published online:

http://des.nh.gov/organization/divisions/water/wmb/wqs/documents/20090610_estuary_criteria.pdf.

Nettleton, J.C., C.D. Neefus, A.C. Mathieson, and L.G. Harris (2011) Tracking environmental trends in the Great Bay Estuarine System through comparisons of historical and present-day green and red algal community structure and nutrient content. A final report to the National Estuarine Research Reserve System under Graduate Research Fellowship Award NA08NOS4200285. University of New Hampshire, Department of Biological Sciences, Durham, NH.

Pe'eri, S., J. R. Morrison, F.T. Short, A. Mathieson, A. Brook, and P.R. Trowbridge. 2008. Macroalgae and eelgrass mapping in Great Bay Estuary using AISA hyperspectral imagery. A Final Report to the Piscataqua Region Estuaries Partnership from the University of New Hampshire, Durham, NH. December 2008. Published online: http://www.prep.unh.edu/resources/pdf/macroalgae_and_eelgrass-unh-09.pdf.