DELINEATING WATER-QUALITY CRITERIA for SAV HABITATS with a BIO-OPTICAL MODEL

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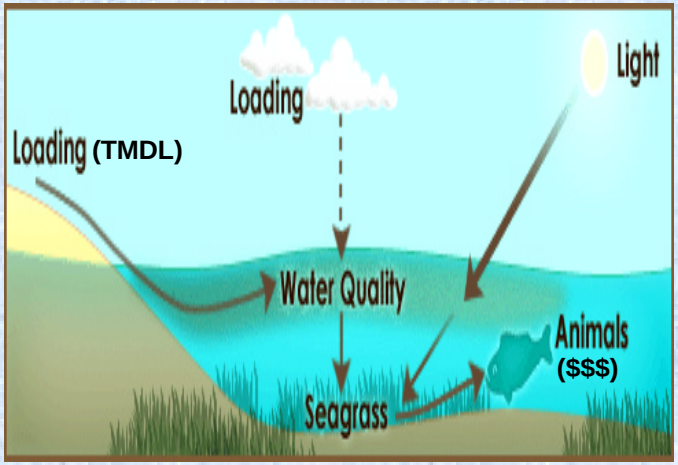
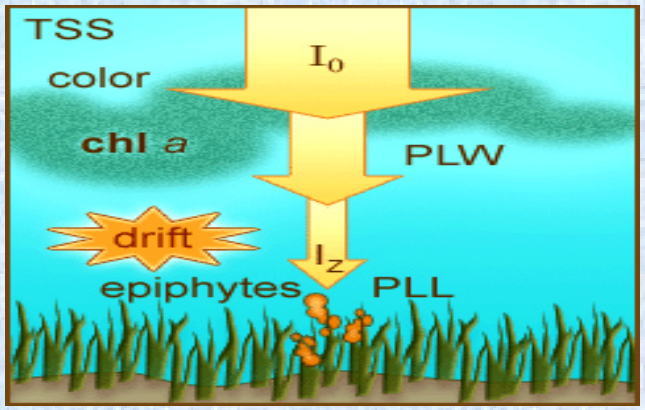
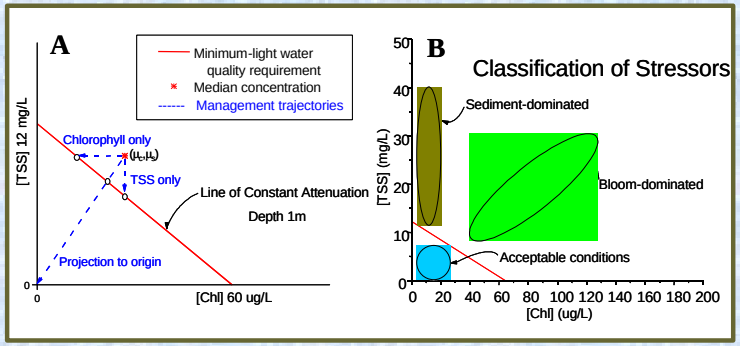


Introduction:

Light available to submerged aquatic vegetation (SAV) for photosynthesis has been determined to be the major criterion limiting their distribution under otherwise appropriate environmental conditions. Seagrasses are, therefore, potentially **sensitive indicators** of declining water-quality in estuaries because of their high light requirements (15-25% surface irradiance) compared to that of other aquatic primary producers such as algae and phytoplankton (<5% surface irradiance). Certain water-quality criteria, particularly those related to water-column clarity may need to be revised in order to provide light conditions suitable for the sustainable survival and growth of most SAV depending on the region of interest and depth of SAV coverage.



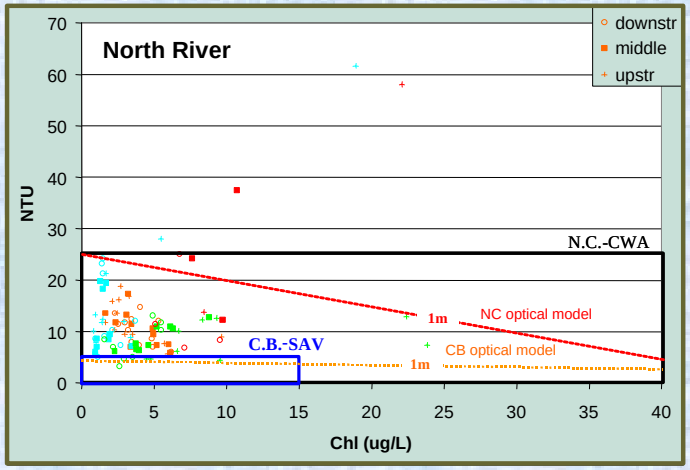
Light attenuation occurs down the water column (PLW = % light through water-column) as depth increases. The relative contributions of turbidity (TSS), chlorophyll (chl *a*), and color on light attenuation all result in significantly reduced light at depth. Additional attenuation can occur at the seagrass leaf surface due to epiphyte fouling and drifting macroalgal blooms (PLL = % light at leaf), which occurs primarily under heavily eutrophic conditions.



A) Graphical representation of the bio-optical model. Components of light attenuation in the water column are presented on the axes as concentrations in which they are typically measured. Median concentrations for one site are plotted on this graph and compared to a minimum-light water quality requirement for SAV at a given depth (red line of constant attenuation). Target minimum water-clarity requirements for seagrass survival are found at the intersection of vectors perpendicular to the axes or the origin from the median sample concentration. The target concentrations in this figure suggest that both TSS and chl *a* need to be reduced to meet the minimum light requirements of this seagrass species.

B) Stressors related to water-quality conditions fall into turbidity-dominated (brown), or chlorophyll = phytoplankton-dominated (green) regions. Acceptable water-quality conditions (blue) for SAV occur below the red line of constant light attenuation.

Application of Bio-optical Model in North River, N.C.



Conclusions:

Monthly water quality conditions in 2003 plotted for North River, using the bio-optical modeling framework. Point colors indicate season (blue =winter, green = spring, red = summer, orange = fall), symbol indicates location within North River. Additionally the N.C. tidal saltwater-quality criteria are shown (black box), and the suggested survival requirements for SAV derived from Chesapeake Bay seagrasses of 15mg/L TSS and 15ug/L Chl *a* (blue box). The bio-optical model was used to predict water-quality criteria for survival of seagrass to 1m depth in Chesapeake Bay (orange line) and North River, NC (red line). The N.C. tidal saltwater-quality criteria for turbidity appear to provide acceptable conditions for SAV survival **only** when chlorophyll concentration remains low.

NEED MORE INFO?

References:

• Dennison et al. 1993. Assessing water quality with submersed aquatic vegetation. Bioscience 43:86-94

• Gallegos 1994. Refining habitat requirements of submersed aquatic vegetation: role of optical models. Estuaries 17:187-199.

Website: http://www.marine.unc.edu/Paerllab/research/seagrass/index.html

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