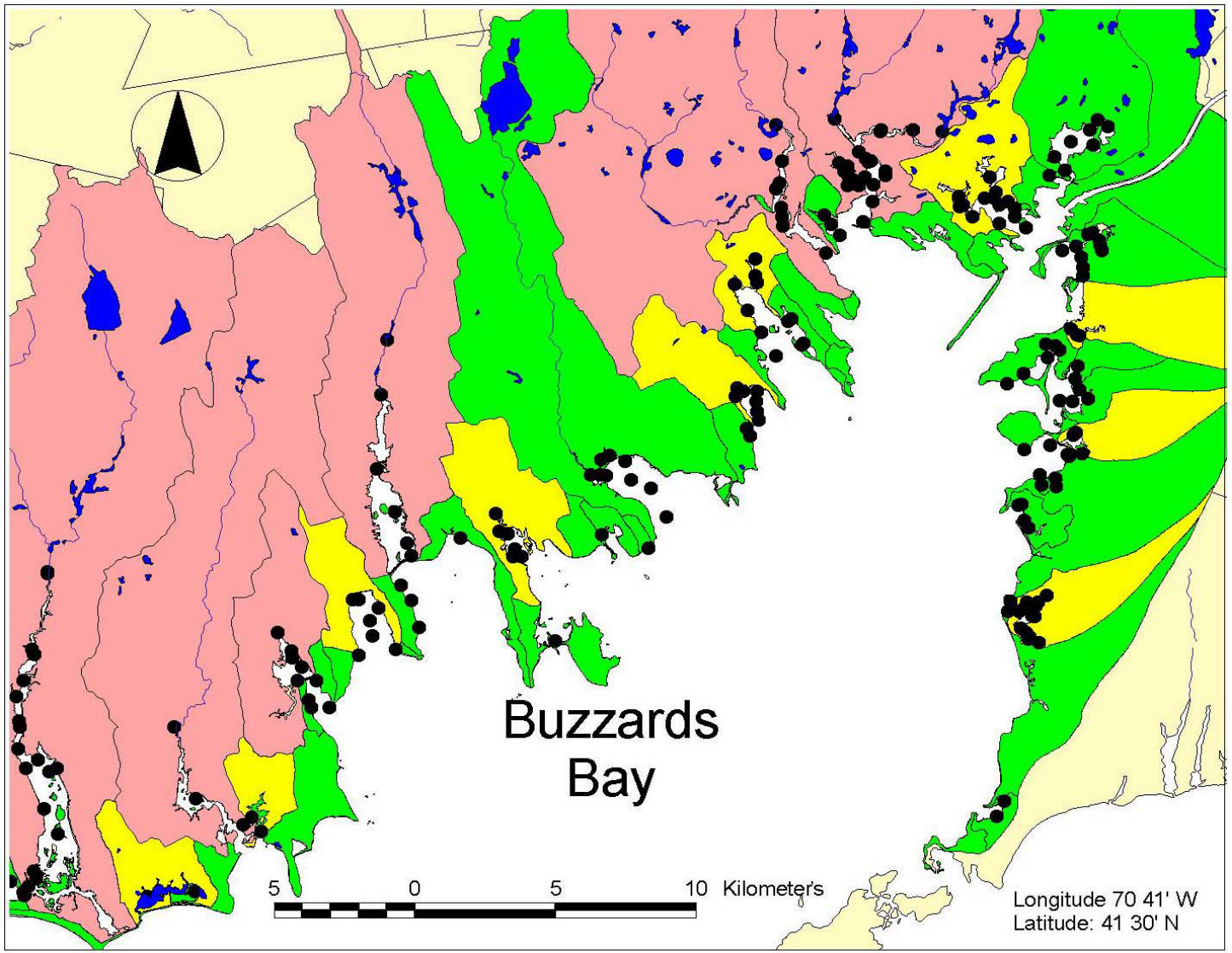
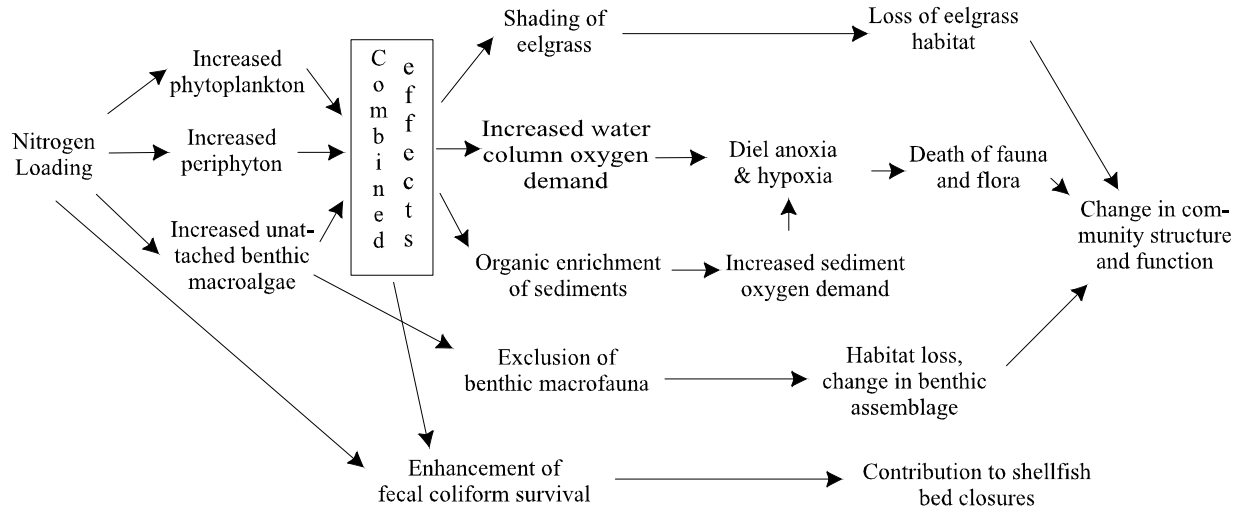
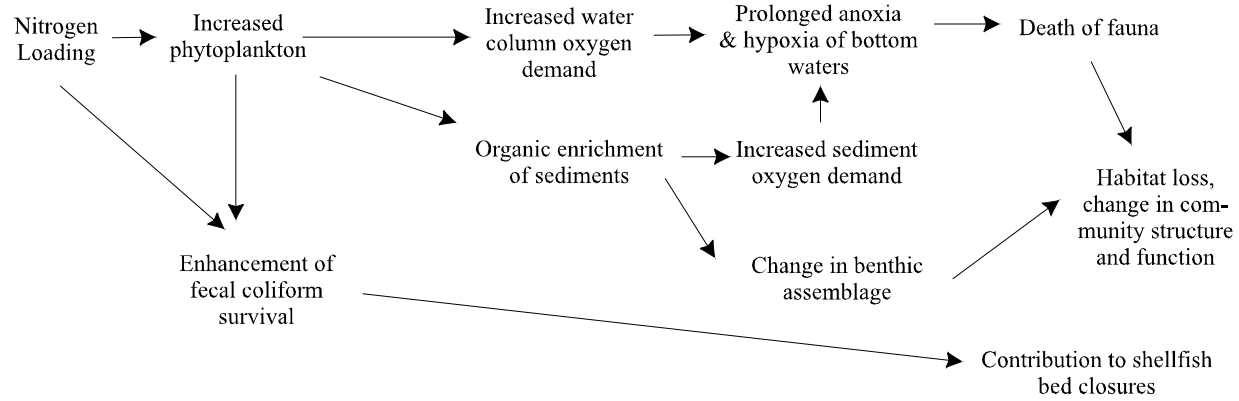


Fig. 1. Buzzards Bay, its drainage basin, and nitrogen management sub-basins, and various water quality monitoring stations surrounding its major embayments.

Fig. 2. Generalized ecosystem responses of a) "shallow", well-mixed and b) "deep", stratified estuaries to nitrogen loading. Modified from Costa et al. (1993). Shallow System have most of their bottom above the light compensation point for seagrasses and algae).





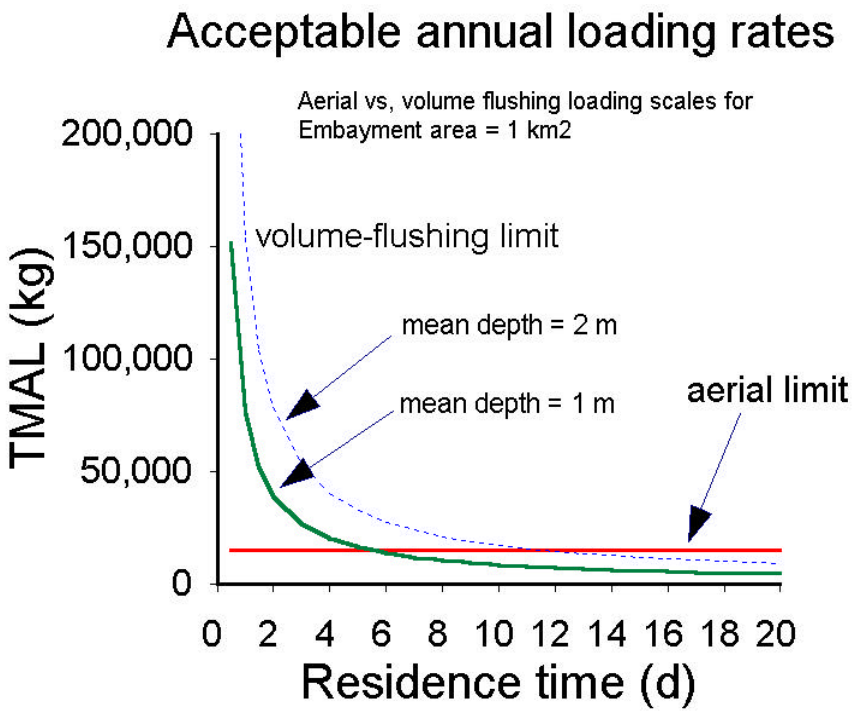
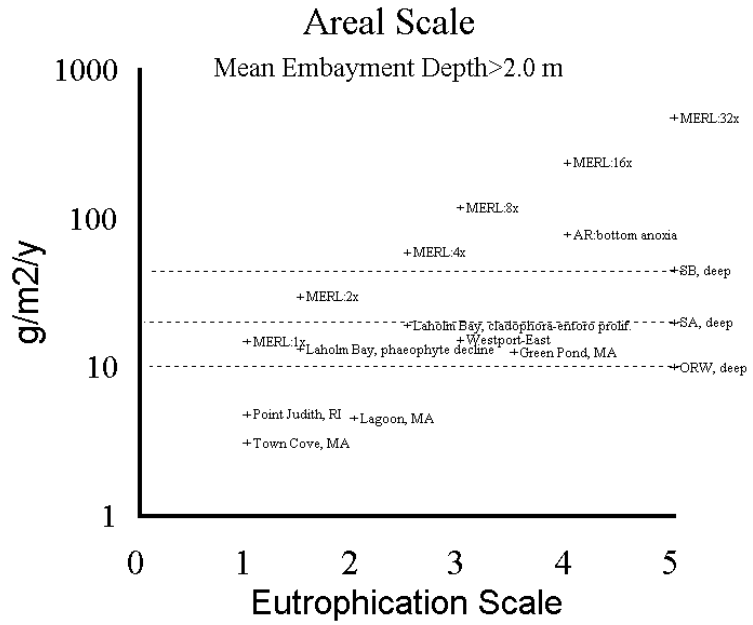
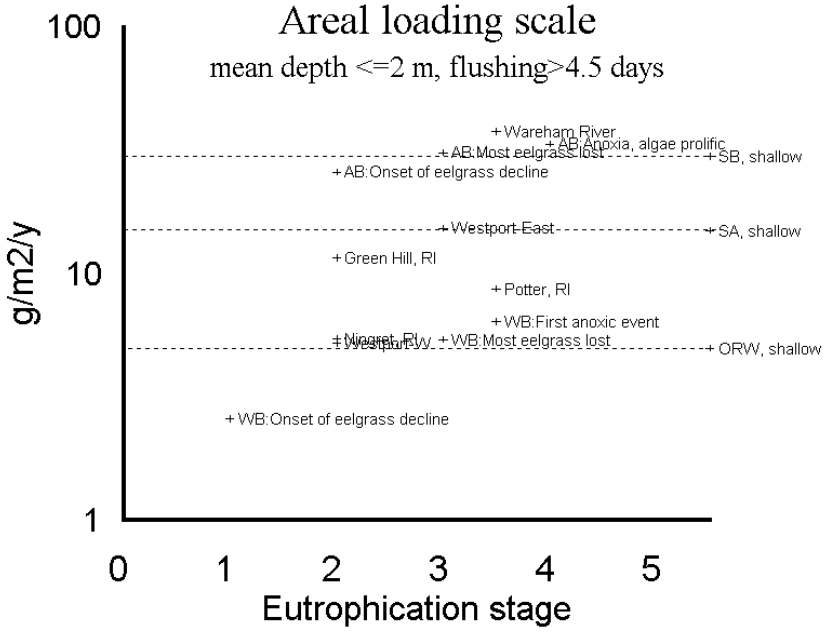


Fig.3. Application of Buzzards bay Project proposed loading limits to a hypothetical 1 km^2 embayment with a 1 m mean depth with different flushing times.

Fig. 4. Comparison of nitrogen loadings using areal based loading scales and Eutrophication Stage for Buzzards Bay area estuaries and published studies as compared to Buzzards Bay Project recommended loading limits. Fig 5a. Areal scale limits for embayment with a mean depth> 2.0 m MLW, especially results of MERL mesocosm experiments. Fig 5b. Areal scale for shallow embayments with flushing times greater than 4.5 days. The assumed hydrologic characteristics and loading to each embayment were based on assumptions used by the Buzzards Bay Project circa 1991(as in BBP, 1991 and Buzzards Bay Project draft reports). Some loadings and flushing times have since been revised (c.f. Table 4) based on new data or changed conditions. See text for explanation.





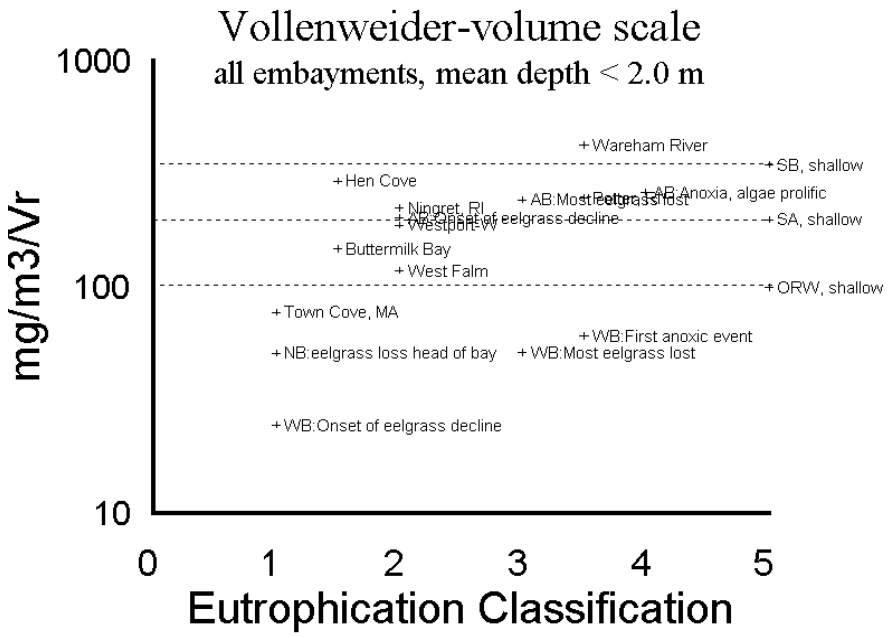


Fig. 5. Comparison of nitrogen loadings using Vollenweider Scale and Eutrophication Stage for shallow (<2.0 m MLW) estuaries in Buzzards Bay and other published studies as compared to Buzzards Bay Project recommended loading limits.

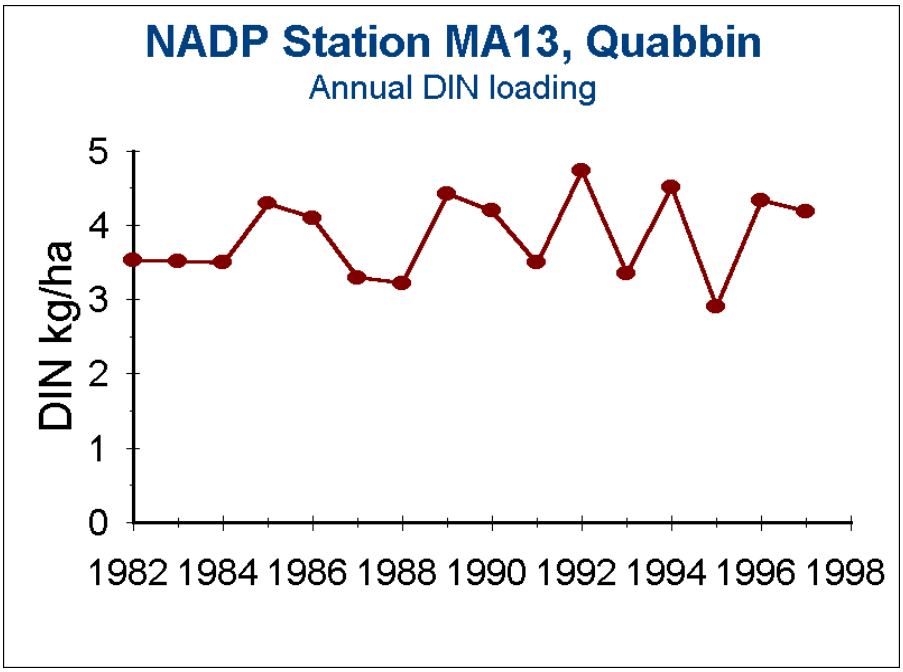


Fig. 6. National Atmospheric Deposition Program annual DIN loading in precipitation data for a Massachusetts station closest to the Buzzards Bay watershed (Station 13, Quabbin Reservoir).

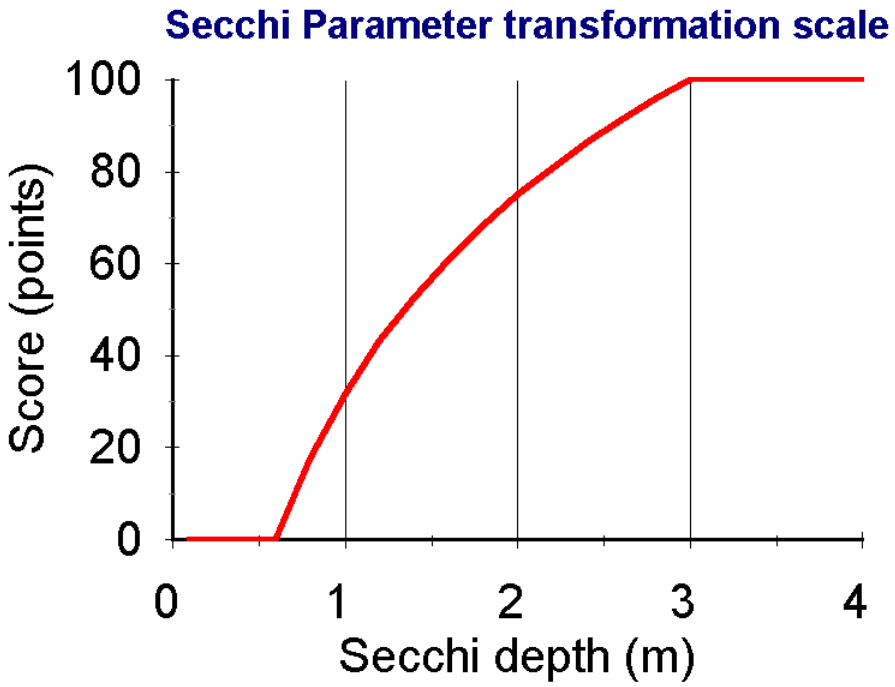


Fig. 7. "Parameter transformation scale" used for evaluating Secchi Depth to create a score for incorporation into the Buzzards Bay "Eutrophication Index".

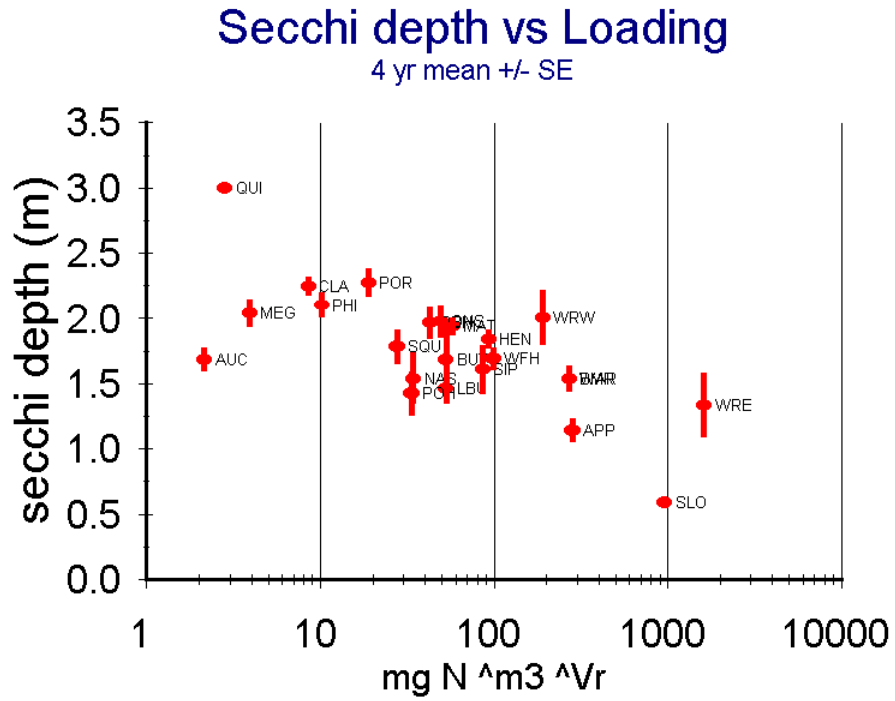


Fig.9. Scatter plots showing correlation between nitrogen loading, expressed using the volume Vollenweider-term flushing scale and the seven year mean (92-95)+/- std. errors of summertime secchi depth.

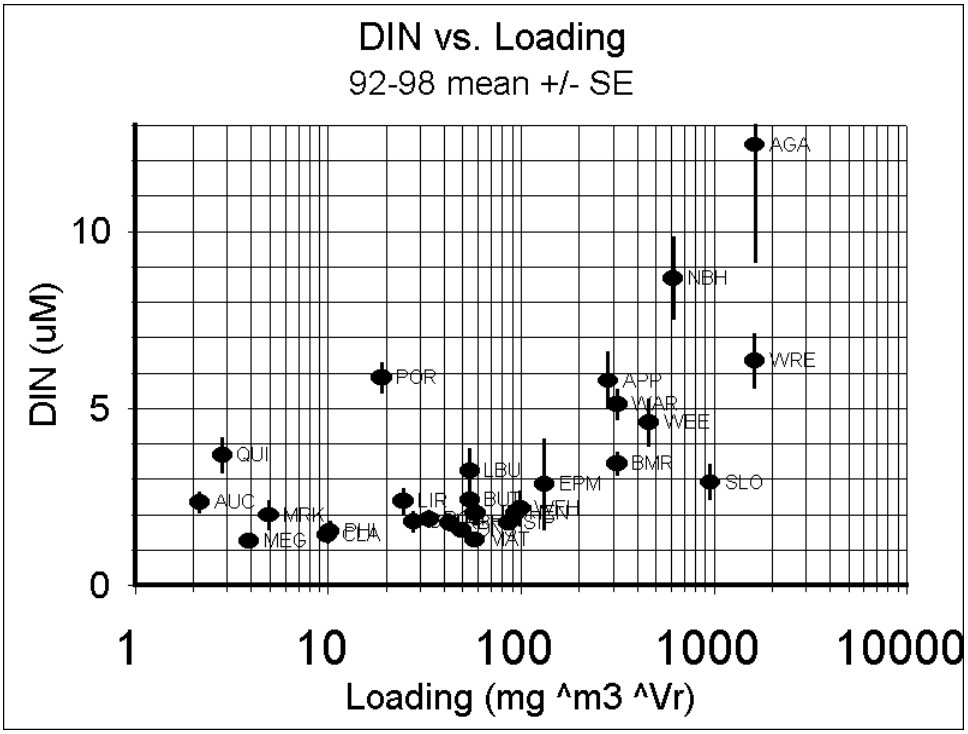


Fig.10. Scatter plots showing correlation between nitrogen loading, expressed using the volume Vollenweider-term flushing scale and the seven year mean (92-98) +/- std. errors of summertime total organic nitrogen.

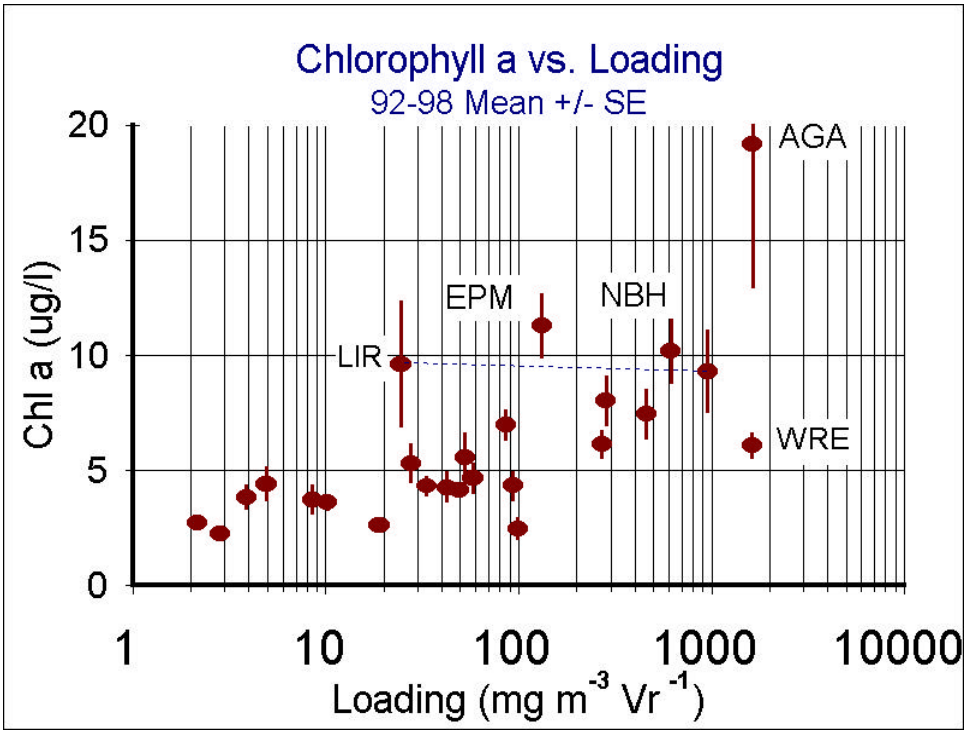


Fig. 11. Scatter plots showing correlation between nitrogen loading, expressed using the volume Vollenweider-term flushing scale and the six year mean (92-98, 1997 unavailable)+/- std. errors of summertime chlorophyll *a*.

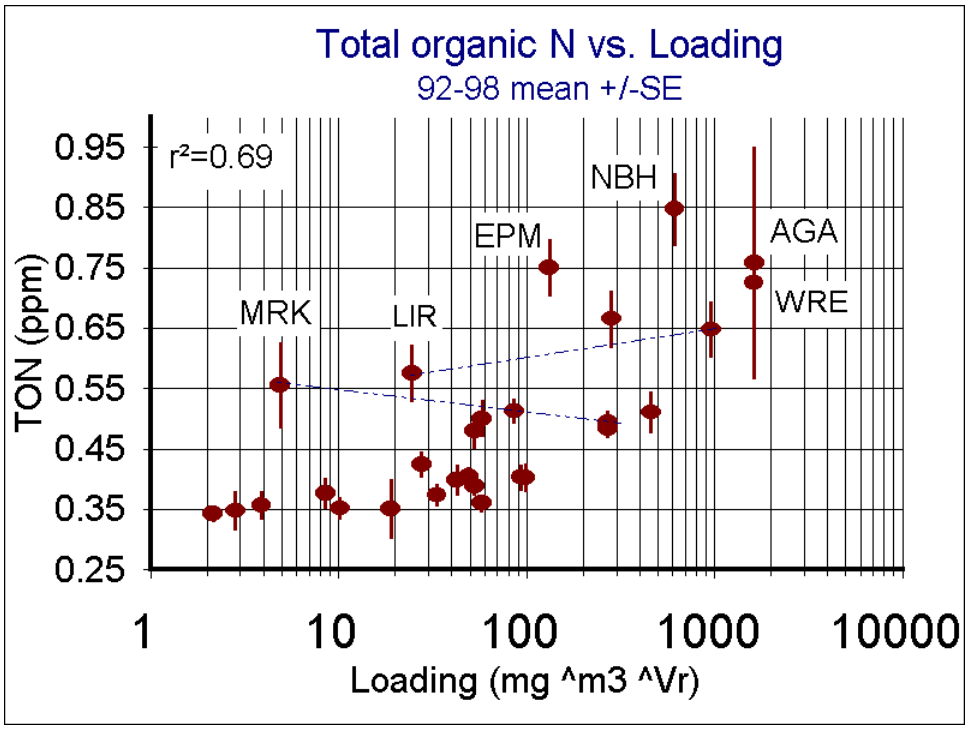


Fig. 12. Scatter plots showing correlation between nitrogen loading, expressed using the volume Vollenweider-term flushing scale and the seven year mean (92-98) +/- std. errors of summertime total organic nitrogen.

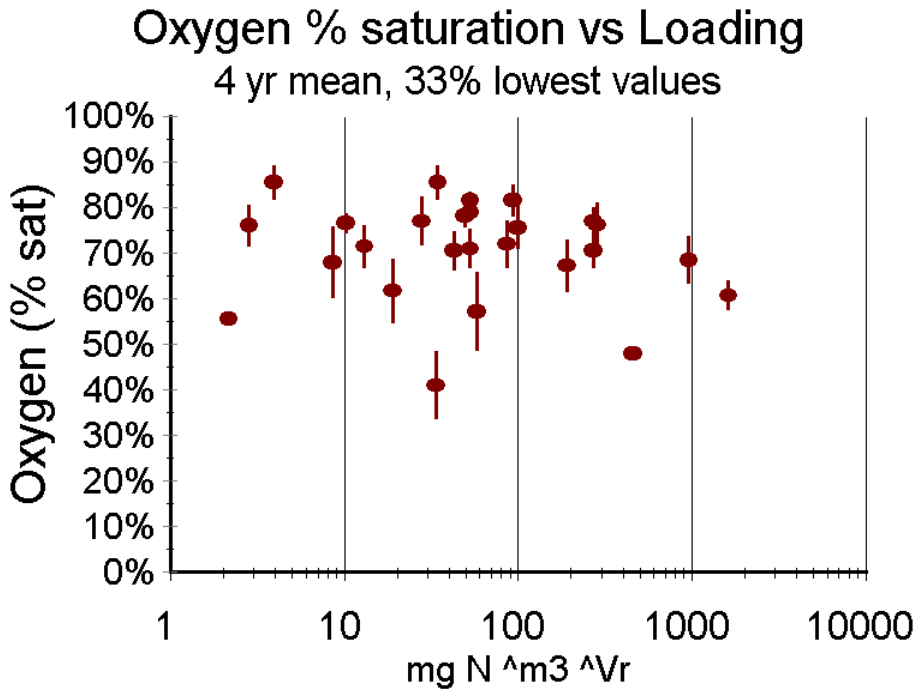


Fig. 13. Scatter plot showing correlation between nitrogen loading, expressed using the volume Vollenweider-term flushing scale, and the four year mean (92-95)+/- std. errors of summertime oxygen saturation

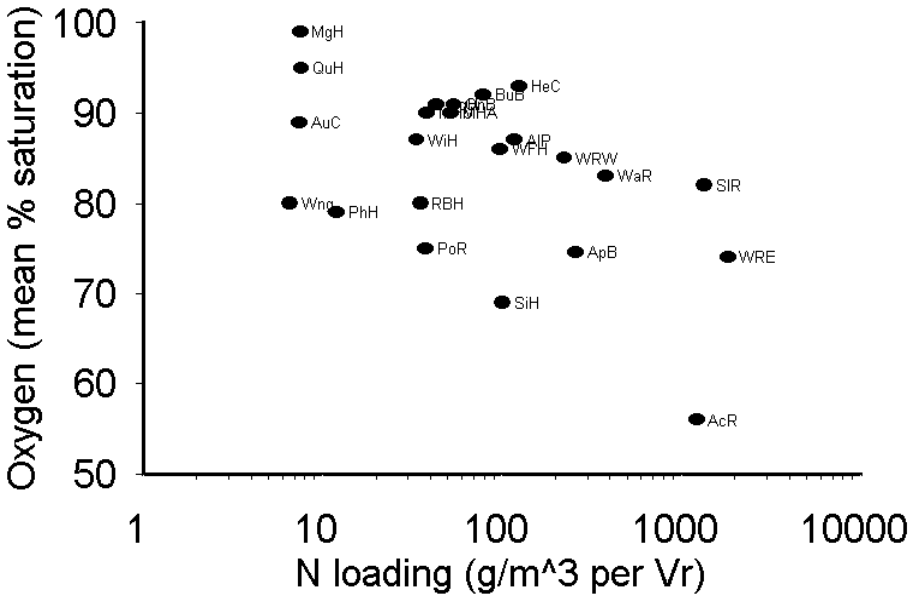


Fig. 14. Scatter plot showing correlation between nitrogen loading, expressed using the volume Vollenweider-term flushing scale, and the 1992 summertime oxygen saturation.

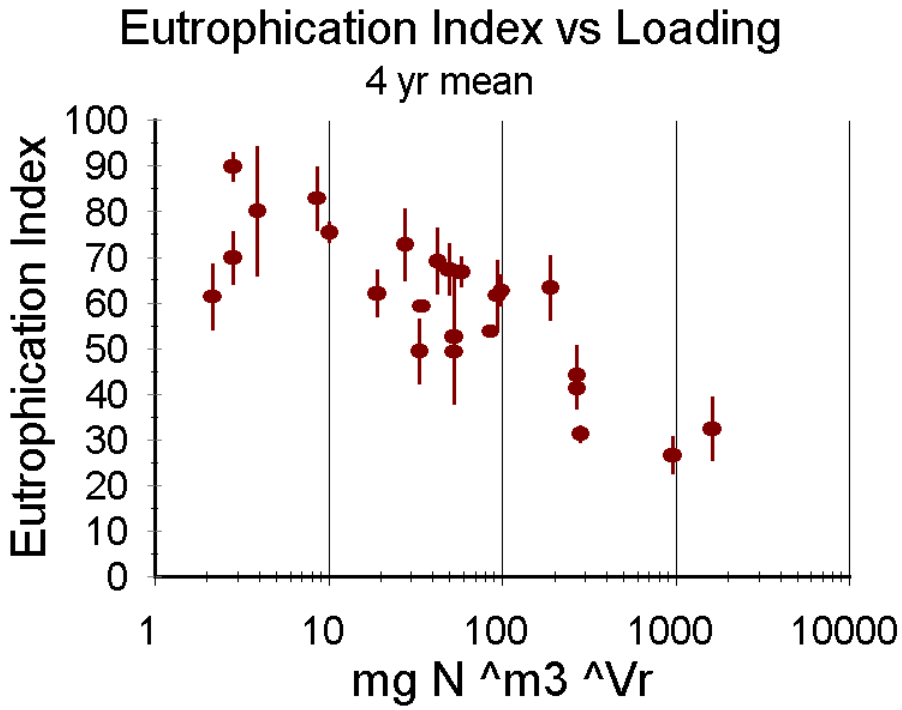


Fig. 15. Scatter plot showing correlation between nitrogen loading, expressed using the volume Vollenweider-term flushing scale, and the four year mean (92-95)+/- std. errors of summertime Eutrophication Index.

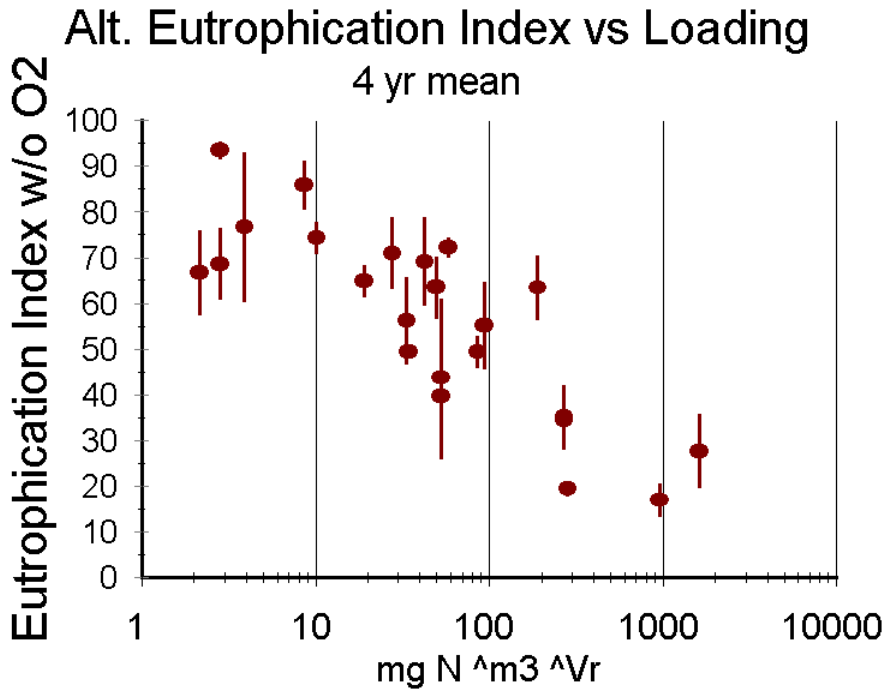


Fig. 16. Scatter plots showing correlation between nitrogen loading, expressed using the volume Vollenweider-term flushing scale, and 92-98 mean +/- std. errors of the Alternate Eutrophication Index scoring (without oxygen scores).

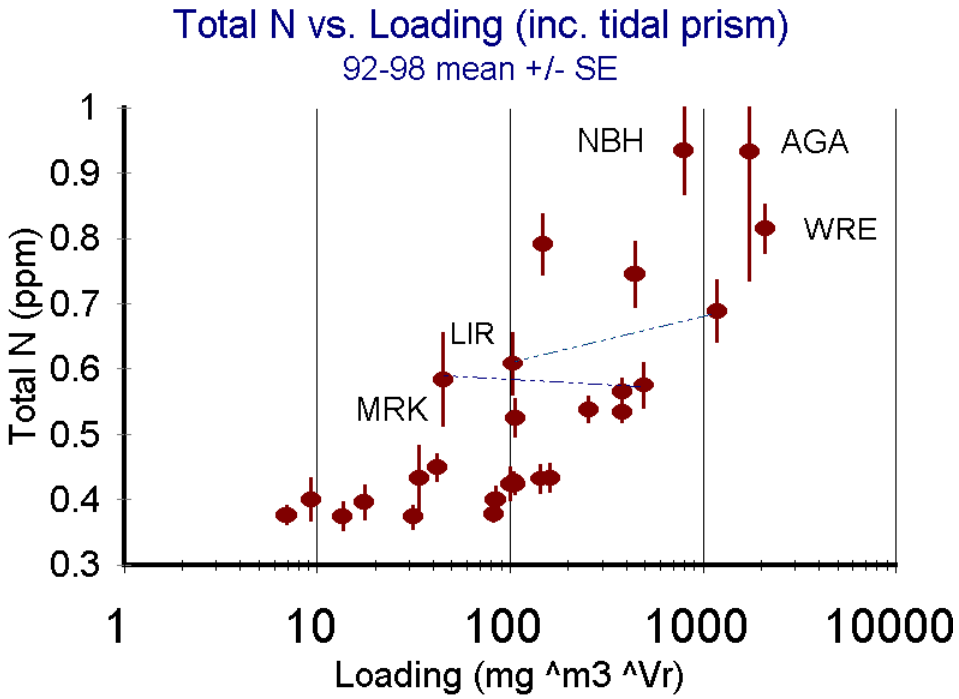


Fig. 17. Scatter plot showing correlation between nitrogen loading including tidal prism inputs, expressed using the volume Vollenweider-term flushing scale, and the 1992-1998 mean +/- std. errors of summertime Total Nitrogen concentration.

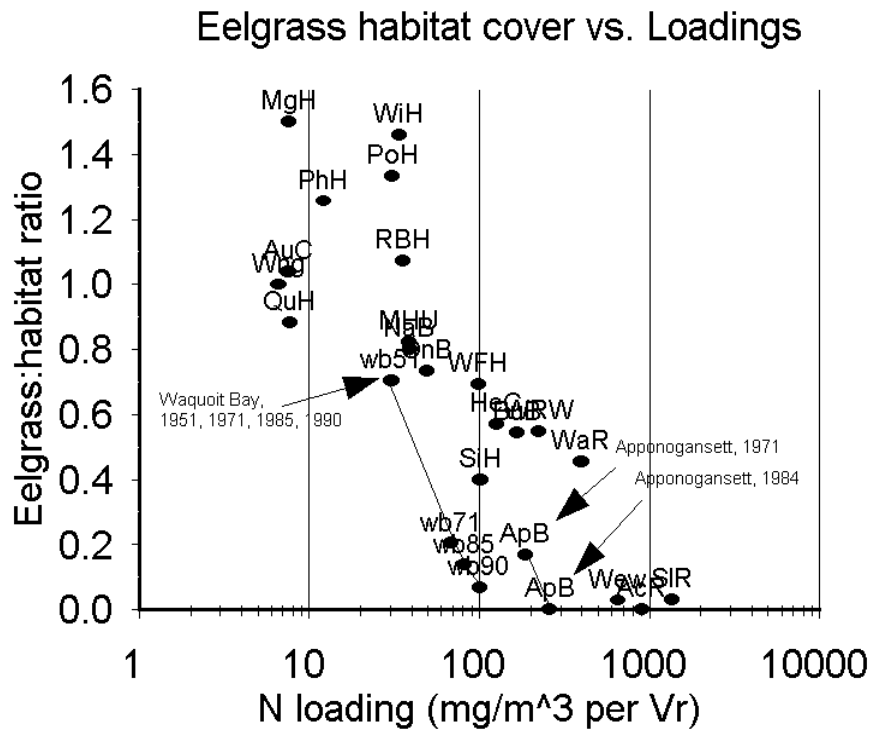


Fig. 18. Ratio of eelgrass habitat area to potential habitat area versus nitrogen loading, expressed using the volume Vollenweider-term flushing scale (see text).

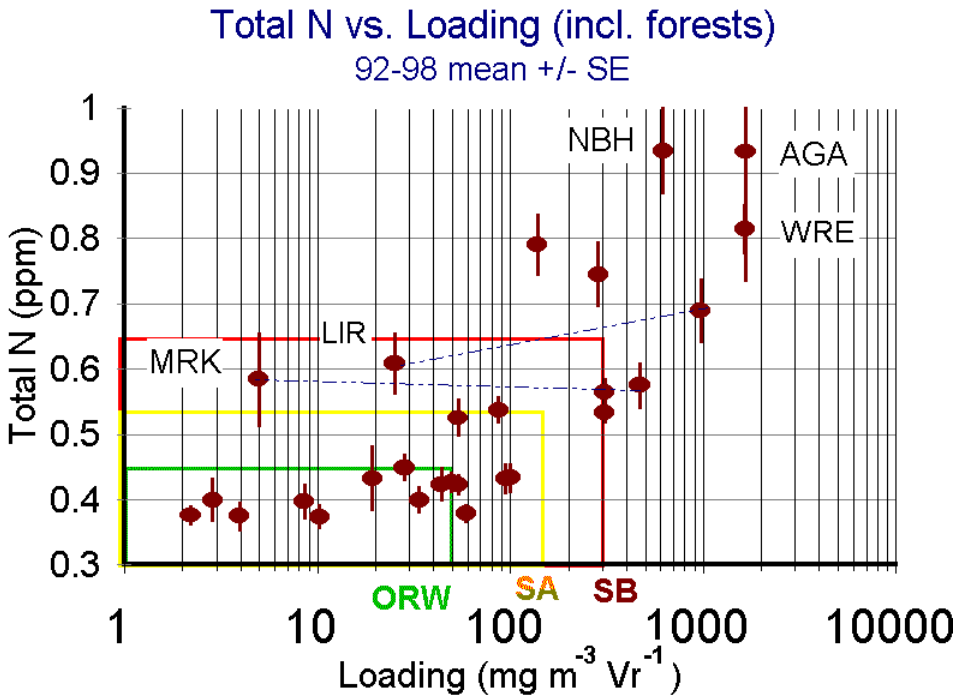


Fig. 19. Scatter plots showing correlation between total nitrogen and watershed loading, expressed as Vollenweider flushing volume scale, including background inputs of forests and other undeveloped lands. New proposed BBP TMALs also shown

Fig. 8. Scatter plots showing correlation between total nitrogen and four alternative measures of characterizing nitrogen loading. Selected stations identified (see Table 7). R^2 on Ln transformed loadings scales and TN. Embayments MRK and LIR not included in correlations.