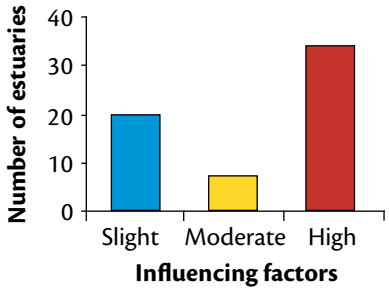
KEY FINDINGS

1. The majority of estuaries assessed were highly influenced by human-related activities.

Highly influenced estuaries had high nitrogen loads compared to the estuary's dilution or flushing capacity (Figure 1). High nitrogen loads were largely attributed to the influence of expanding and dense coastal human populations.

Figure 1. Factors influencing eutrophication (nitrogen load and susceptibility) were high for the majority of assessed systems.



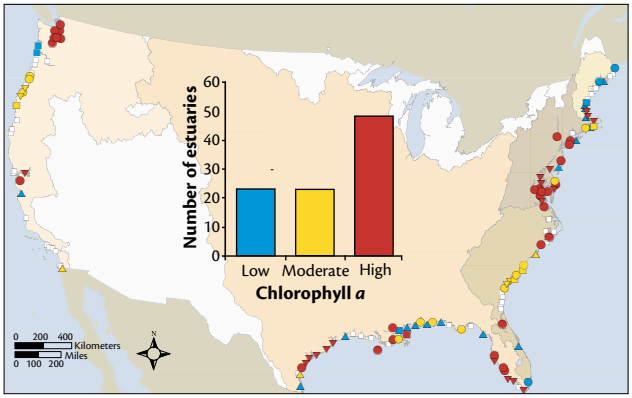
2. The majority of estuaries assessed had overall eutrophic conditions rated as moderate to high.

Eutrophication has a predictable suite of symptoms including increased chlorophyll *a*, macroalgae and nuisance/toxic blooms, decreased dissolved oxygen, and submerged aquatic vegetation loss (Figure 2).

3. The most commonly occurring eutrophic symptom was high spatial coverage and high frequency of elevated chlorophyll *a* levels.

Most estuaries also exhibited at least one other moderate to high symptom expression in addition to chlorophyll *a* (Figure 3).

Figure 3. A high chlorophyll *a* rating was observed in a large number of the Nation's estuaries.



4. Overall eutrophic condition and symptom expressions were geographically variable.

There were differences in eutrophic status among estuaries in close proximity (Figure 4). The net effect of this variability was that there was no national

Figure 2. A conceptualization of the relationship between overall eutrophic conditions, associated eutrophic symptoms, and influencing factors (nitrogen loads and susceptibility).

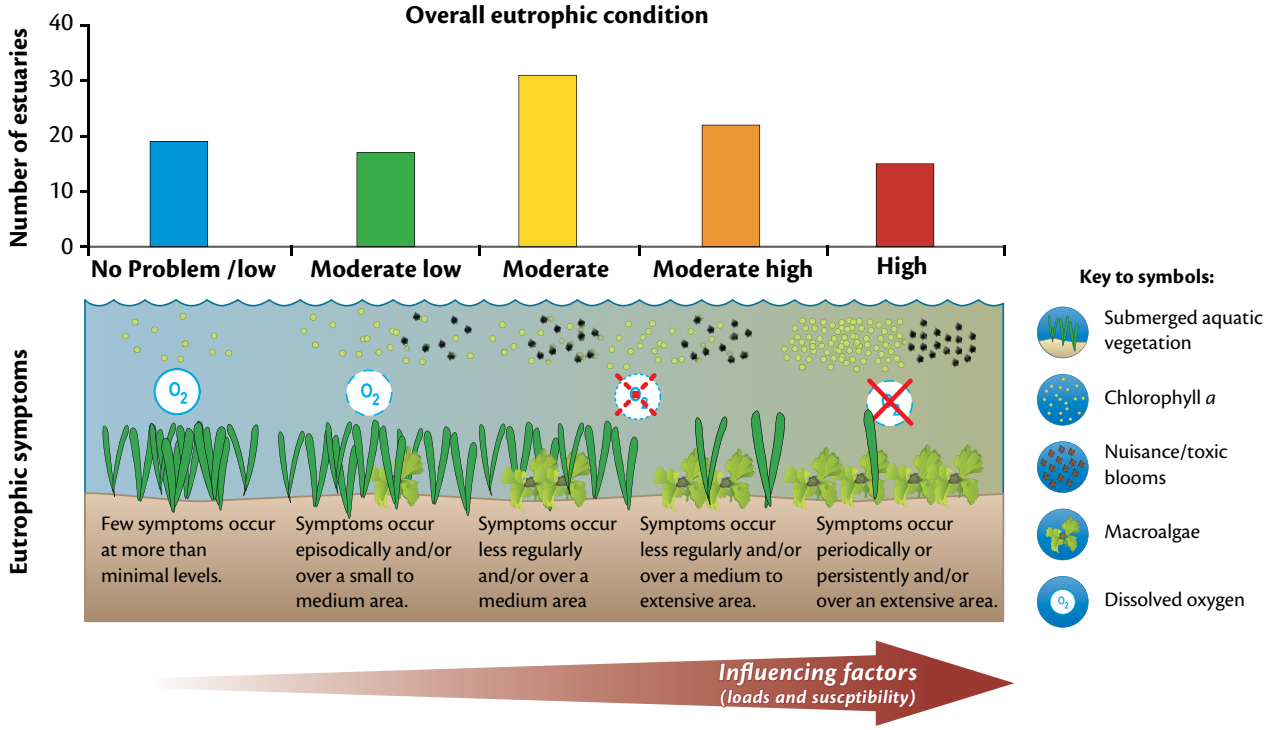
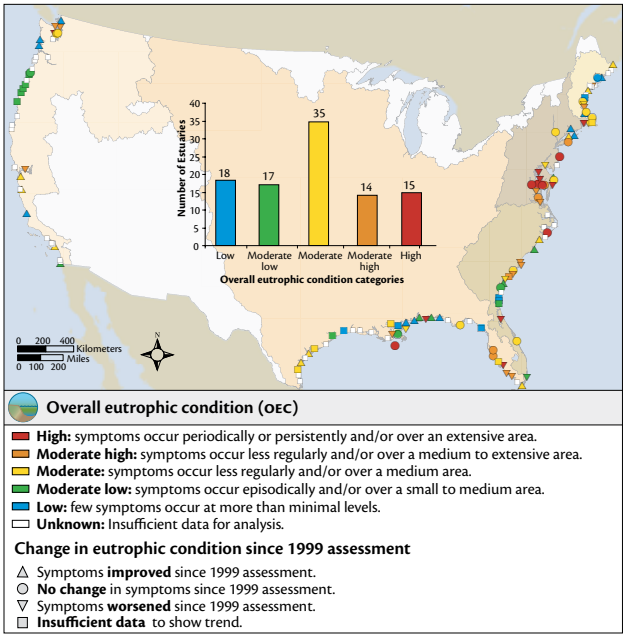


Figure 4. National overall eutrophic condition was geographically variable.

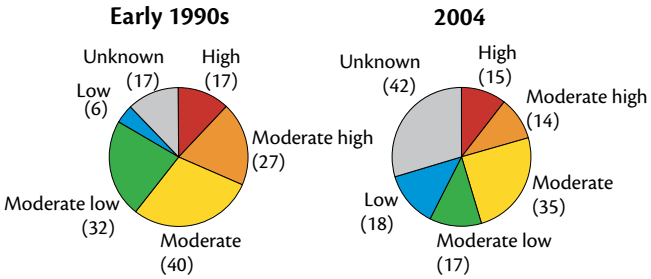


pattern of overall eutrophic conditions or symptom expressions except that the largest concentration of highly eutrophic systems was in the mid-Atlantic.

5. Comparison of eutrophic conditions assessed from the early 1990s to 2004 indicates similar levels of eutrophication.

Direct comparison of eutrophic status between assessments was impeded by reduced data availability in 2004 (70% of systems in 2004 vs. 88% in 1990s) due in part to changes in the data collection method (*see chapter 3: National assessment*). If only assessed systems are considered, conditions have improved in 13 estuaries, worsened in 13, and remained the same in 32 systems. In 1999, 69% of assessed systems (72% of assessed area) had moderate to high eutrophic conditions compared to 65% of assessed systems (78% of assessed area) in 2004 (Figure 5).

Figure 5. Number of estuaries in each eutrophication category in the early 1990s (1999 assessment) and 2004 (this assessment).



6. Considerations for management action, monitoring, research, and communication (Figure 6)

Management: Implement more aggressive action to achieve nutrient reductions for widespread reductions in eutrophic conditions. Notable improvements have been achieved (e.g., Tampa Bay and Boston Harbor) with aggressive management intervention, but these are isolated cases.

Monitoring: Capitalize on technology (e.g., observing systems, remote sensing) to improve comprehensive assessment of eutrophication in a coordinated and timely fashion. Future national assessments would benefit from rigorous, easily accessible data (both *in situ* and remotely sensed) provided on the web by local and regional assessment programs.

Research: Focus on improving monitoring and assessment of eutrophication, resolving uncertainties, and establishing criteria and thresholds. In particular, macroalgae and submerged aquatic vegetation indicators should be improved. Elucidate potential and evaluate current management options.

Communication: Engage resource managers, researchers, policy makers, and the community with frequent assessment updates at local, regional, and national levels. Environmental report cards, illustrative graphics, and maps, will foster interest and inform, and empower the public to support critical management action.

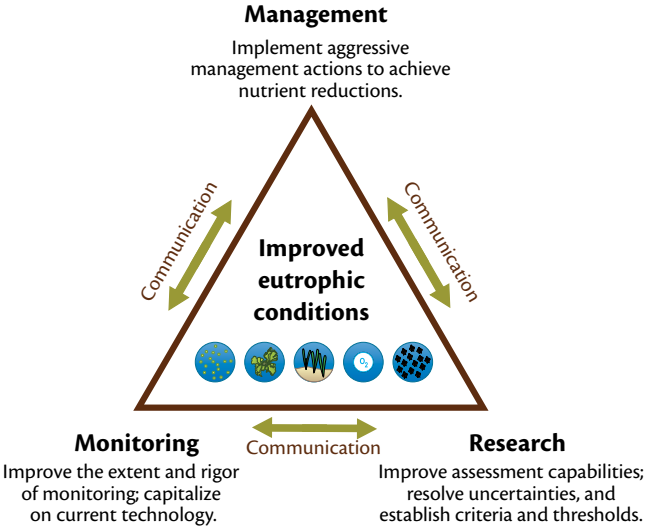



Figure 6. Improvements in eutrophic condition can only be achieved by management, research, and monitoring programs working together.