Symptom expressions

- Chlorophyll *a* was the most frequently expressed eutrophic symptom nationally.
- Macroalgae was an occasional problem, and where present, has become worse.
- Except for a few locations, dissolved oxygen was not a major national problem.
- Nuisance/toxic blooms were a problem in the mid- and South Atlantic regions.
- Submerged aquatic vegetation loss was not a major national problem.

The primary symptoms of increased nutrient concentrations in the water column are high levels of chlorophyll *a* and/or macroalgae (see *Chapter 3*, Table 2.2). Once primary symptoms are observed at high levels, an estuary is in the first stages of displaying problematic eutrophic conditions. While high levels of primary symptoms are strong indicators of the onset of eutrophication, secondary symptoms (dissolved oxygen, nuisance/toxic blooms, and submerged aquatic vegetation) indicate more serious problems, even at moderate levels.

Half of the estuaries for which there were data for evaluation exhibited high chlorophyll *a* symptom expression, indicating that many of the Nation's estuaries are exhibiting initial signs of eutrophication. While estuaries with high chlorophyll *a* expression were found along all coastlines, the North Atlantic region had relatively few systems with high chlorophyll *a* expression (Figure 3.8a).

Information on macroalgae was limited. However, the data available showed a low or no problem symptom expression for half of the assessed systems. High macroalgae expression was observed in 15 estuaries (Figure 3.8b). In some cases, high levels of macroalgae may be a natural occurrence and not an indication of eutrophication.

Dissolved oxygen has the most complete national dataset (DO) compared with other symptoms. This assessment shows that only a few (8) estuaries have high DO symptom expression, with the vast majority (73 of the 97 systems with DO data) rated at a low or no problem expression (Figure 3.8c). However, low dissolved oxygen levels are a significant problem in localized areas.

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Loss of submerged aquatic vegetation is an indicator of eutrophication.

Of the 81 systems for which nuisance/toxic bloom data were reported, 26 exhibited a moderate or high symptom expression. While systems with moderate or high bloom expression occurred along all coasts, the majority were located in the mid-Atlantic region (Figure 3.8d).

Data for submerged aquatic vegetation (SAV) were scarce, with only 55 systems reporting on conditions. Of the systems for which SAV data were available, the vast majority (50) reported low or no problem symptom expression, indicating no or little loss of SAV in the early 1990's to 2004 period (Figure 3.8e). Those systems recording a moderate or high SAV symptom expression were located in the mid-Atlantic region. It is notable that 13 systems (one in the mid- and 12 in the South Atlantic region) have not historically had SAV and thus this indicator cannot be used.

Overall, moderate or high levels of at least one secondary symptom was observed in 44 estuaries, representing 41% of the Nation's total and 56% of the assessed estuarine surface area—an indication that eutrophication is well developed and potentially causing problems in over half of U.S. estuaries.