

# Future Needs for Continued Management Application

This second technical synthesis, which brings together another decade of monitoring and research findings, advances the ability of managers and scientists to assess and diagnose the health of Chesapeake Bay SAV and its supporting habitats. At the same time, the areas requiring further research, assessment and understanding are also brought into sharper focus. Organized by major chapter heading, the following high-priority management needs require that research efforts be directed toward them in the coming years, to set the stage for the next scientific and management synthesis.

## MINIMUM LIGHT REQUIREMENTS

There is a general need for better understanding of the minimum light requirements for survival and growth of the diverse set of SAV species that occur in a wide variety of Chesapeake Bay tridal habitats. A coordinated combination of field and laboratory studies is needed to ensure that results will be both precise and representative of conditions in nature. A more in-depth understanding is needed of how SAV minimum light requirements vary with changes in environmental conditions. The need for different sets of minimum light requirements for recovery/recruitment of new SAV beds versus maintenance and protection of existing SAV beds needs to be researched and clarified. The short-term temporal applications of the minimum light requirements need further study to determine the critical length of time under which SAV can recover when faced with extremely low light levels for short periods of time.

## WATER-COLUMN CONTRIBUTION TO ATTENUATION OF LIGHT

Continued collection of monitoring data is necessary to track recovery (or further degradation) of the system with respect to the optical water quality targets defined for the various regions using the diagnostic tool. However, it is doubtful that additional monitoring data will improve the ability to derive statistical estimates of specific-attenuation coefficients by regression analysis. Inherent variability in the spectral absorption and scattering properties of the optical water quality parameters, combined with normal uncertainty associated with sampling and laboratory analyses, probably account for the low coefficients of determination and statistically insignificant estimates of some specific-attenuation coefficients. Nevertheless, some attempt to determine regionally based estimates of the water, colored dissolved matter and total suspended solids specific-attenuation coefficients should be made. This is needed because of the pronounced changes in the nature of particulate material that occur from the headwaters to the mouth of major tidal tributaries as well as the mainstem Chesapeake Bay itself. An approach based on direct measurement of particulate absorption spectra and optical modeling likely will be needed to obtain regionally customized diagnostic tools.

## EPIPHYTE CONTRIBUTION TO LIGHT ATTENUATION AT THE LEAF SURFACE

While development of the percent light at the leaf surface model was supported by a large data set, there is

real need for more research information to support this approach. Field and laboratory studies are needed to better describe relationships among total suspended solids; the biomass of epiphytic algae growing on SAV leaves and the total dry weight of epiphytic material; and between nutrient concentrations and epiphytic algae biomass in various habitats. Further research is also needed to describe the dynamics of how these relationships vary with wind, tides and sediment resuspension. Finally, there is a substantial need for data to allow field assessment of grazer abundance and potential epiphyte grazing rates. Refined application of this model to specific field sites must be attentive to the nutrient-epiphyte relationship that may be affected by other factors, such as grazing and flushing rates. There is a pressing need for field data on these factors to better calibrate these very site-specific applications. Obtaining such information is complicated by the fact that most of these herbivorous grazers are highly mobile, with flexible and diverse food habits.

While results reported here for Chesapeake Bay are encouraging, it remains to be seen how useful the model might be for analyzing other aquatic ecosystems. The general applicability of this approach outside Chesapeake Bay needs to be tested.

### **PHYSICAL, GEOLOGICAL AND CHEMICAL HABITAT REQUIREMENTS**

In those areas where light attenuation remains the key factor in defining potential habitats for the recovery of SAV populations, the plants are largely restricted to shallow water habitats of the Bay mainstem and tidal tributaries as well as the headwaters of feeder streams. Unfortunately, in these same areas the highest levels of wave energy, sediment resuspension and chemical contaminant exposure are most likely to occur. Thus, the aquatic environments most favorable to SAV growth from the perspective of water clarity are not necessarily the most conducive to SAV reestablishment because of these other factors. Therefore, more attention needs to be given to the interactions among

the secondary stress factors described in Chapter VI if the management objective of restoring SAV to its historic range within Chesapeake Bay is to be achieved. Finally, care must be exercised in extending the inference of chemical contaminant data generated with one species of SAV to other SAV species. Preliminary evidence is beginning to show significant differences in contaminant sensitivity among the various SAV species of the Bay watershed.

To further define new and refine existing physical, geological and chemical habitat requirements, future research should be focused on:

- the maximum wave exposure tolerated by canopy and meadow formers;
- the appropriateness of including wave mixing depth in determining the minimum depth of distribution;
- possible restrictions imposed by sediment grain size on SAV growth and distribution;
- the maximum amount of sediment organic matter tolerated by different SAV species;
- potential nitrogen toxicity in SAV beds;
- sediment sulfide maxima for the survival of SAV exposed to different light levels; and
- the synergistic effect of multiple chemical contaminants on SAV.

### **SAV DISTRIBUTION RESTORATION GOALS**

There is a need to complete work that is already under way to more fully examine the effects of high wave action on limiting SAV survival and growth within the Chesapeake Bay's shallow water habitats. The results of this research should then be applied to the published Tier II and Tier III distribution restoration targets for making adjustments to any areas considered unlikely to support SAV survival and growth due to high wave action.