SAV Workgroup’s research activities

(and a tiny little plug for our monitoring needs)

Lee Karrh
MD-DNR
Chair, SAV Workgroup
STAC meeting, September 18, 2013

Talk Outline

- SAV Workgroups (SAVWG) monitoring needs/wants
- Slides submitted by SAVWG members showing their research activities and interests
- “Technical Synthesis III”, a SAVWG-wide effort

Monitoring needs/wants
CRITICAL NEEDS

- Bay-wide, annual aerial survey
- At a minimum maintain current shallow water monitoring effort
  - Continuous Monitoring and Water Quality Mapping
- Continue to collect DIN, DIP, TN, TP, TSS, CHLA, PAR (kD) data at every opportunity

Monitoring needs/wants
CRITICAL WANTS

- Ask STAR to determine if certain fixed stations can be indicative of trends at other stations
  - Seek efficiencies in monitoring
  - If any stations can be eliminated, use cost savings to augment shallow water monitoring
- Add PAR, fluorescence and turbidity (transmission) to profile data
- Expand total alkalinity sampling
  - Useful for SAV and oyster programs

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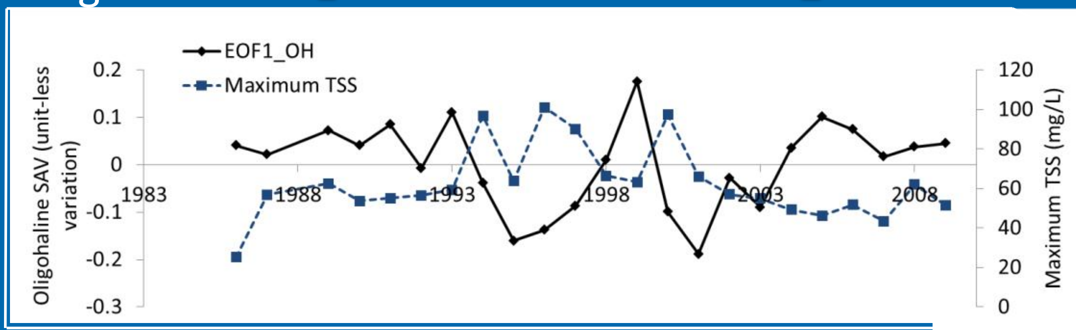
Interannual variation in SAV in different salinity zones of Chesapeake Bay

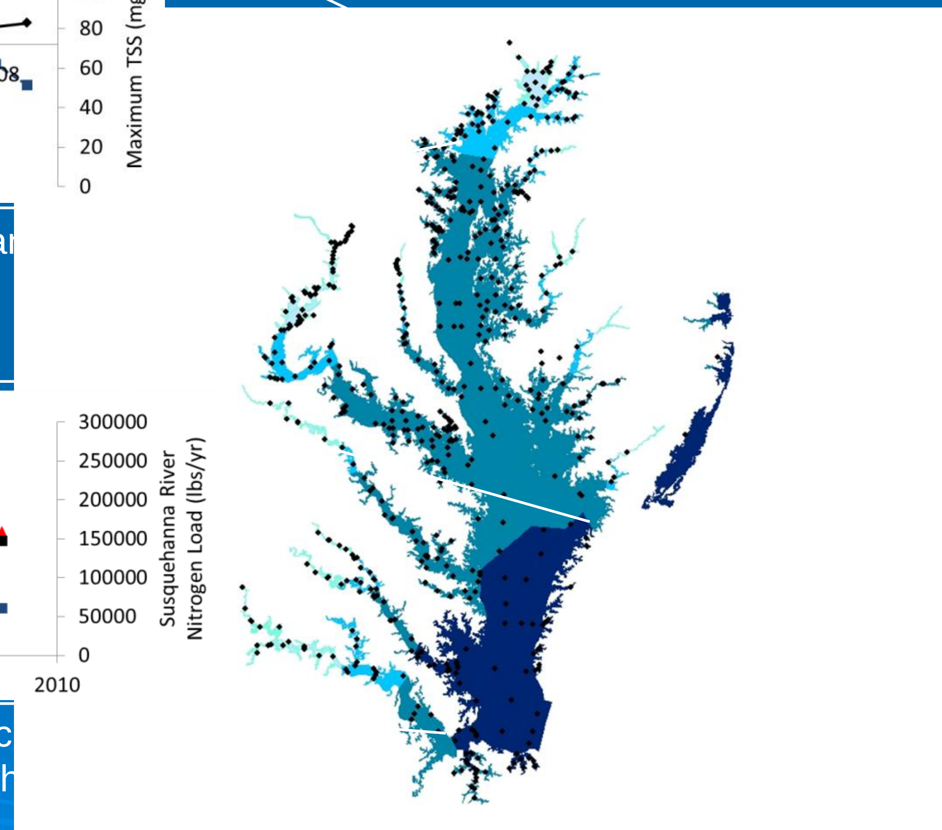
Christopher J. Patrick & Donald E. Weller

Oligohaline

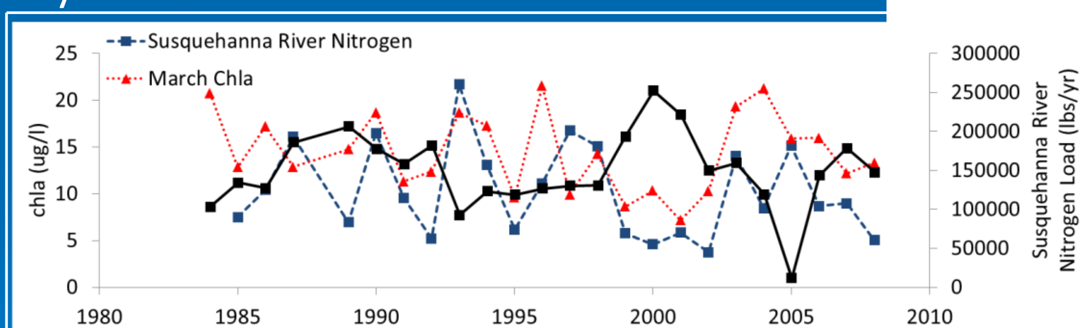


Example: Total suspended solids is negatively significar
cross-correlated with Oligohaline SAV

Patterns of inter-annual variation



Polyhaline



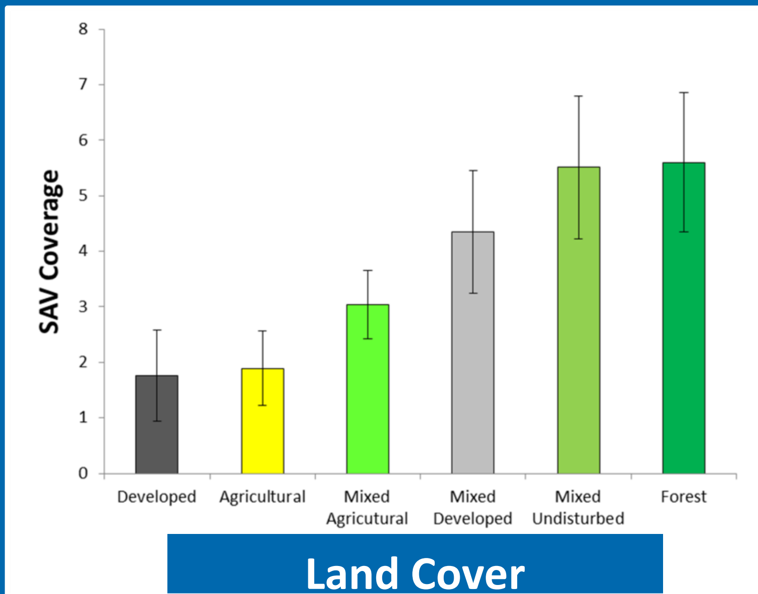
Example: Susquehanna River nitrogen load and Marc
are significantly negatively cross-correlated with Polyh

Implications: Adaptive management by salinity zone or region of the Bay might be more effective than Bay-wide SAV management initiatives.

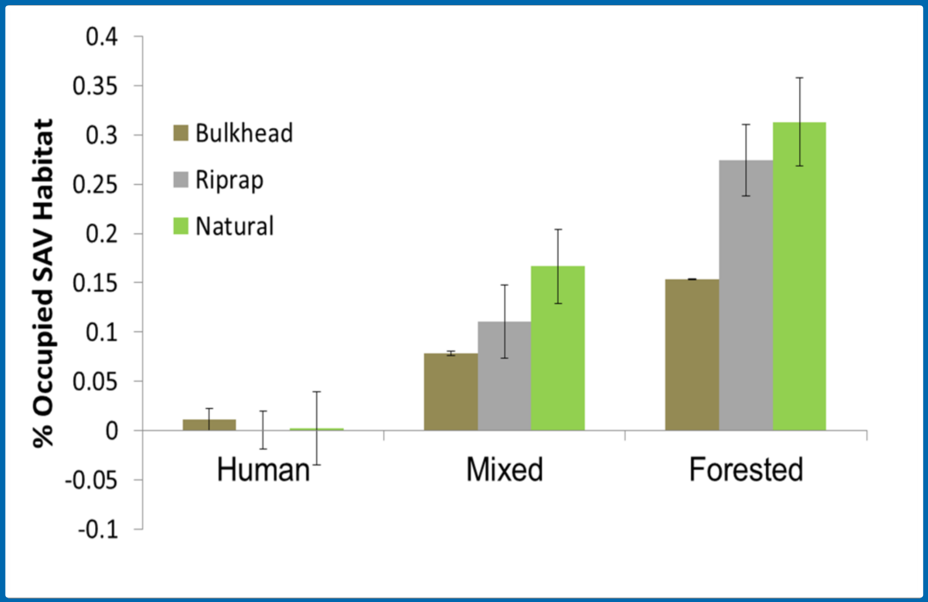
Smithsonian Environmental Research Center

Shoreline alteration affects on near shore SAV

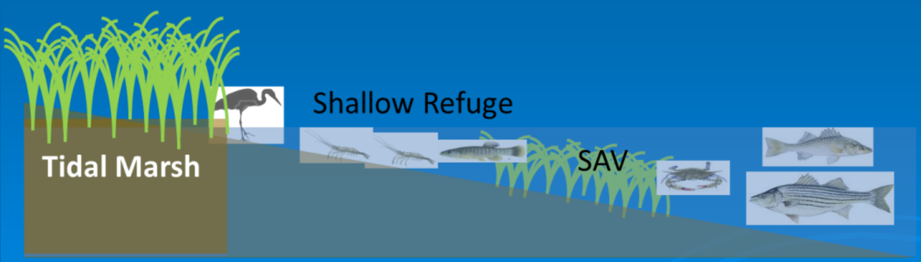
Christopher J. Patrick, Donald E. Weller, & Micah Ryder

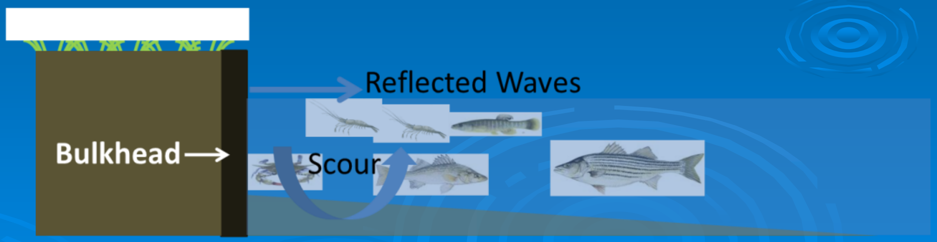


Human land use in the watershed has a negative affect on SAV



Shoreline alteration has an additional negative affect on near shore SAV in the polyhaline zone



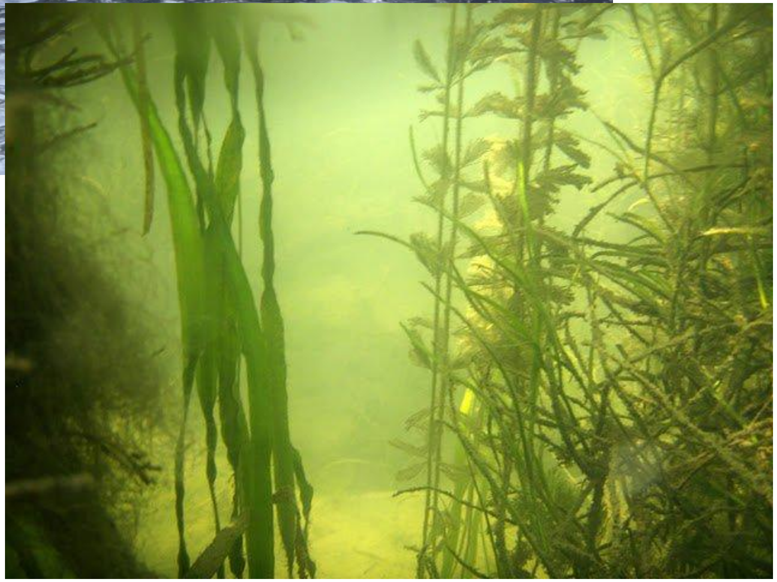


Waves reflected from armored shoreline damage SAV and scour sediments to create deeper water

Smithsonian Environmental Research Center

Predicting Impacts of Stressors at the Land-Water Interface

- Submerged aquatic vegetation (SAV) monitoring performed by MD DNR, funded by NOAA
- Research impacts of shoreline modification (riprap) on SAV
- Between 2010-2013, 34 subestuaries sampled throughout Chesapeake and Atlantic Coastal Bays (including 7 repeated annually)
- Preliminary results suggest that riprap shorelines are having negative effect on SAV and associated habitat
  - **Decreased SAV density, diversity and bed size**
  - **Less available habitat (deeper water and steeper slopes off riprap)**



Kemp group recent SAV work

University of Maryland
CENTER FOR ENVIRONMENTAL SCIENCE

Question: What drove the sudden SAV resurgence at Susquehanna Flats?

Approach: Analyze public time series data (mainstem monitoring, CONMON, RIM, SAV aerial surveys). Manuscript has been submitted for publication.

Question: What causes plant loss during storms?

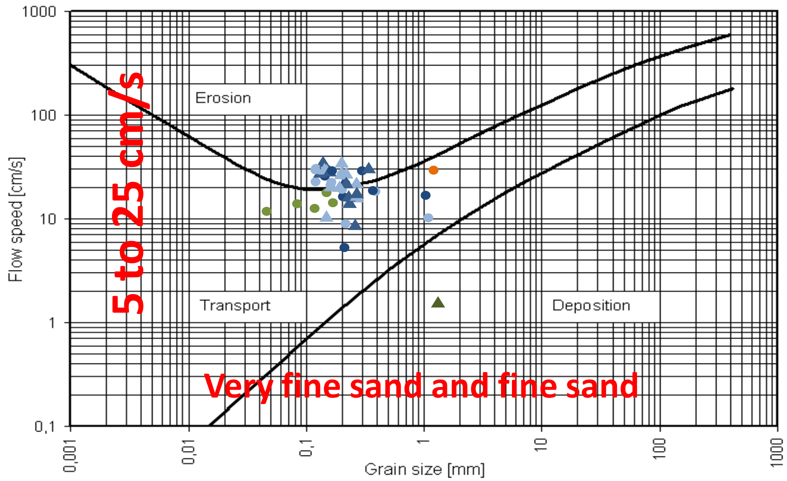
Approach: Analyze monitoring data collected in and around Susquehanna Flats before, during, and after Tropical Storm Lee.

Question: How is the SAV bed at Susquehanna Flats resilient?

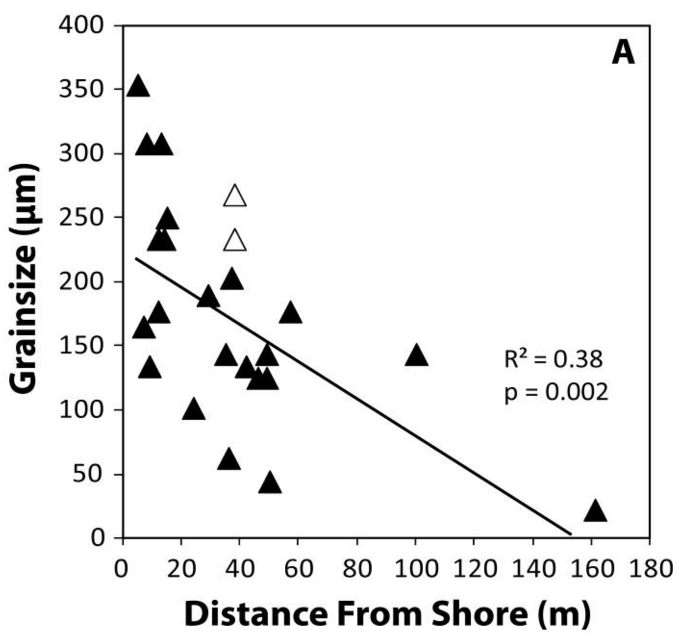
Approach: Measure differences in a suite of biophysical variables at a range of time and space scales to show how the SAV bed improves its own growing conditions.

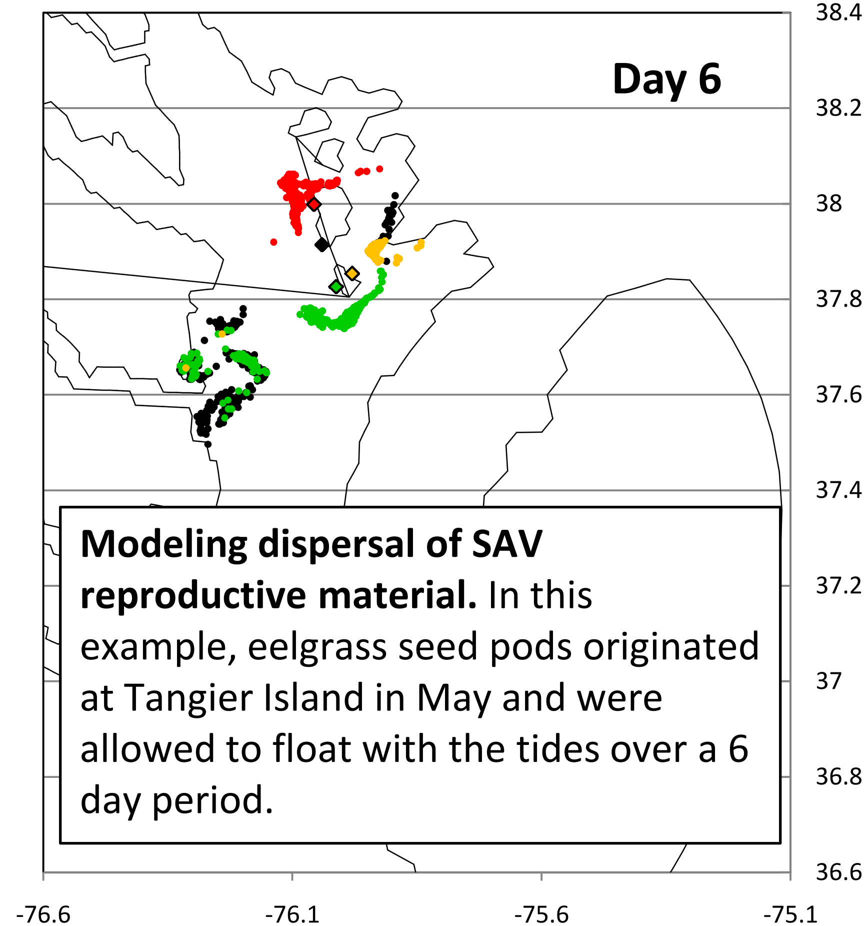
Research in Evamaria Koch's lab at Horn Point

Defining co-varying SAV sediment and water flow habitat requirements.



Studying how to engineer SAV habitats and provide guidelines for managers and coastal engineers.





Modeling dispersal of SAV reproductive material. In this example, eelgrass seed pods originated at Tangier Island in May and were allowed to float with the tides over a 6 day period.

To the left is an example of data that can be used to guide the construction of breakwaters in an SAV-friendly manner. If the sediment preference of a SAV species is known, the graph can recommend how far offshore the breakwater should be build to favor SAV growth.

Virginia Institute of Marine Science Projects

- VIMS SAV Research and Monitoring
  - Annual bay wide SAV aerial survey
  - Eelgrass and Bay Scallop restoration in Virginia's seaside bays
  - Faunal utilization in the restored eelgrass beds of Virginia's seaside bays
  - Bio-monitoring of SAV at the Goodwin Islands NERRS and relating trends to change in climate
  - Monitoring SAV and temperature at key SAV locations in the lower Chesapeake Bay
  - Boat scar monitoring in lower Chesapeake Bay
  - Water quality assessments for evaluation of water quality standards attainment
  - Status and trends of eelgrass in Chincoteague Bay using Seagrass Net Protocols
  - Long term trends in Chesapeake Bay eelgrass populations related to water quality and climate.
  - Role of mesograzers in eelgrass communities (the Zen project)

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VIRGINIA INSTITUTE OF MARINE SCIENCE

Virginia Institute of Marine Science Projects

- Student Thesis/Dissertations
  - Role of abiotic factors influencing flowering of eelgrass (Johnson)
  - Roles of dispersal and seed predation in determining eelgrass population dynamics (Manley)
  - Influence of season on survivorship of bay scallops in eelgrass (Schmitt)
  - Influence of climate change on the faunal utilization of eelgrass and widegongrass beds (French).
  - Habitat suitability of exotic algae *Gracilaria vermiculophylla* versus native seagrass as an alternative nursery habitat for juvenile blue crab (Wood).
  - Overwintering distribution of age-0 blue crabs in shallow habitats of Chesapeake Bay (Ralph).
  - Functional relationship between seagrass characteristics and juvenile blue crabs under high recruitment (Ralph).

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Virginia Institute of Marine Science

Effects of Recent Seagrass Species Change on Habitat Structure and Function: a Master's Thesis

Emily French- VIMS

- As *Zostera marina* (eelgrass) continues to experience dieoff events in the lower Chesapeake Bay, *Ruppia maritima* (widgeongrass), an opportunistic seagrass species, may expand
- I am conducting a survey over three sites in the lower Bay with five different sampling parameters.
- Stay tuned for results!

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Chesapeake Bay National Estuarine Research Reserve

DNA fingerprinting of *Hydrilla, Egeria*, and *Elodea*

(Rybicki, N. B., Kirshtein, J. D., and Voytek, M. A., 2013, Molecular techniques to distinguish morphologically similar *Hydrilla verticillata*, *Egeria densa*, *Elodea nuttallii*, and *Elodea canadensis*, Journal of Aquatic Plant Management, v. 51)

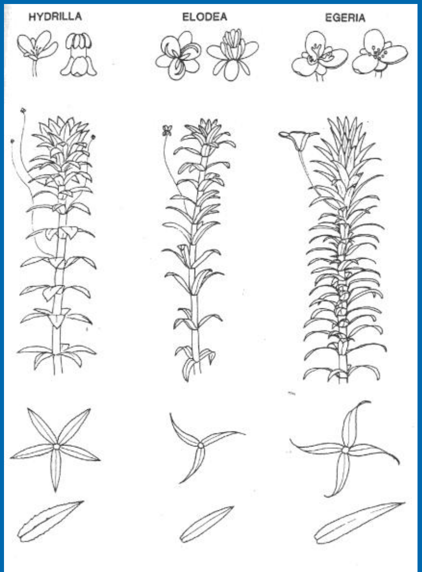

Figure 37. A comparison: illustrations of *Hydrilla verticillata*, *Elodea canadensis*, and *Egeria* spp. showing ends of stems with flowers; leaf whorls; single leaves.

DNA fingerprints are used to positively identify plant species from tissue fragments

The new DNA protocol is helping biologists distinguish between native and invasive species of aquatic vegetation that have almost identical appearances.

Invasive plants from Korea, Brazil and the Indian subcontinent have been spreading through US waterways for decades. With improved methods for identification scientist can better track their progress and provide facts to local managers who develop appropriate control measures.

Early verification and detection expands the potential for targeted management strategies and improved understanding of exotic and native species interactions.

USGS science for a changing world

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Chesapeake Bay Submerged Aquatic Vegetation Habitat Requirements and Restoration Targets: A Third Synthesis

- **OBJECTIVE**
  - Bring together regional leaders in SAV research and management
  - Assemble advances in SAV knowledge acquired since the last TechSyn was finished in 2000

Need for TS III

- Review current habitat requirements and water clarity standard and determine if they are stringent enough to allow for the resurgence of SAV.
  - Are 13% and 22% of incident light at the plant sufficient?
  - Revisit ambient nitrogen, phosphorous and chlorophyll habitat requirements in relation to anticipated reductions in loadings via TMDL/WIP process, provide guidance to Water Quality Standard development
  - Improve modeling results for SAV growth in the Chesapeake Bay Model
  - Will global change require different habitat requirements in the future?
- Revised/re-considered habitat requirements will improve direct SAV restoration (i.e. planting/seeding)
  - As recommend by STAC review of 2011
- Revised habitat requirements will provide greater explanatory power when preparing SAV information for managers and the public (i.e. Bay Barometer, report cards etc.)
- Use ecosystem services evaluation
  - Evaluate effectiveness of TMDL/WIP process relative to SAV
  - Quantifying water quality feedbacks due to SAV to allow Chesapeake Bay Model to account for water quality improvement as SAV is restored (currently not a component of the Model)
  - Determine economic value of SAV for management and public informational products

Topics to be addressed

- SAV Restoration
  - SAV habitat requirements (light, sediments, waves)
  - Habitat criteria for established versus restored SAV beds
  - Impact of pioneer species on SAV resurgence/restoration
  - Feedbacks and resilience of SAV populations (genetics) and communities
  - Large versus small scale restoration
  - Shoreline hardening effects on SAV
- Global change
  - Temperature
  - Sea level rise, coastal erosion and sustainable shorelines
  - CO2 levels
  - Precipitation (variable river flow) and global dimming (incident light)
- Ecosystem services provided by SAV in Chesapeake Bay
  - Ecological functions of SAV (interactions with fisheries, nutrient uptake, carbon sequestration, wave/resuspension reduction, habitat value, improving habitats for other species, water quality challenges (i.e. DO improvements)
  - Economic impact of SAV serving the above functions
- Identification of knowledge gaps in SAV research, restoration and management

- TS III has been funded
- Work will begin in Fall of 2013
- Expect a finished product within 18 months
- As with the previous two TechSyn documents, there will be peer-reviewed publications and opportunities for STAC to participate

Thank you for your attention!