Submerged Aquatic Vegetation Habitat Requirements and Restoration: A Third Technical Synthesis

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Very brief background on the Technical Synthesis (TechSyn) series

- First TechSyn was completed in 1992 and a synopsis was published in *Estuaries* in 1993
  - Had the first water quality habitat requirements (HRs) and restoration goals for Chesapeake Bay SAV species and communities
- Second TechSyn was completed in 2000, and a synopsis was published in *Estuaries* in 2004
  - Attempted to refine HRs to include epiphyte fouling
  - More detailed light requirements by species
  - Physical habitat requirements
  - Called for the establishment of a new restoration target

Purpose of TechSyn3

- Revise existing habitat requirements
- Consider if existing water quality standards are not only protective of existing SAV, but adequate to allow recovery/restoration of SAV
- Improve results of the Bay model for predicting SAV growth
- Consider “new” stressors’ impacts to SAV

TechSyn3 Authors

21 Authors
13 Institutions
$100,000 from EPA

Author	Affiliation		Author	Affiliation
Tom Arnold	Dickinson Univ.		Bob Orth	VIMS
Katia Engelhardt	UMCES Appalachian Lab		Cindy Palinkas	UMCES Horn Point
Chuck Gallegos	SERC		Chris Patrick	EPA/SERC
Becky Golden	MD-DNR		Nancy Rybicki	USGS
Cassie Gurbisz	UMCES Horn Point		Erin Shields	VIMS
Lee Karrh	MD-DNR		Court Stevenson	UMCES Horn Point
Mike Kemp	UMCES Horn Point		Chris Tanner	St. Mary's College of MD
Chris Kennedy	George Mason Univ.		Lisa Wainger	UMCES CBL
Brooke Landry	MD-DNR		Don Weller	SERC
Ken Moore	VIMS		Dick Zimmerman	Old Dominion Univ.
Maile Neel	UofM College Park			

TechSyn3 is broken into themes, with each being a chapter, for a total of 12

1. Each chapter will be a stand-alone unit
2. Strive to publish each chapter in peer-review journals to increase credibility, maybe in a special issue
3. The authors of each chapter form their own working group to synthesize information related to the theme of the chapter

Chapter 1: Executive Summary

(Karrh, Kemp, Moore, Kennedy)

Chapter 2: Introduction

(Landry, Karrh, Moore)

Chapter 3: Factors affecting SAV habitat requirements

(Moore, Gallegos, Kemp, Palinkas, Tanner, Zimmerman)

1. Update current information on how interactive factors such as nutrients, salinity, temperature, sediments may impact the habitat requirements for growth and persistence of SAV and their implication for population management.
2. Discuss the current knowledge of the factors affecting light attenuation to the SAV including bed canopy development, optical depth and periphyton development.
3. Review of how light conditions are currently measured and their effectiveness and appropriateness for SAV management.

Chapter 4: The effects of events of varying intensity/duration/timing on SAV resilience and restoration

(Gurbiz, Golden, Kemp, Moore, Shields, Tanner, Orth)

1. Response mechanisms
2. Factors that affect the magnitude of response
3. Resilience
4. Implications for management

Chapter 5: The effects of climate change on Chesapeake Bay SAV

(Arnold, Engelhardt, Gallegos, Patrick, Stevenson, Tanner, Zimmerman, Moore)

1. Determine the recent effects of climate change on SAV in the Bay.
2. Describe the potential scenarios for climate change in this region.
3. Discuss the potential effects of climate change on bay SAV communities under current conditions.
4. Describe how future climate conditions may be mitigated for different bay SAV communities through management.
5. Determine the potential for natural processes such as community succession to affect SAV response to a changing climate.

Chapter 6: SAV Bed Feedbacks Effects and Processes: Consequences for Water Quality, SAV Recovery and Restoration (Kemp, Moore, Palinkas)

SAV Bed Feedback Mechanism

1. Physics of Particle Trapping and particle resuspension
2. Effects of Plant Density and Canopy Structure
3. Wave versus Tide Effects on Particle Resuspension
4. Effects of Bed Size and Shape

SAV Bed Feedback Effects on Restoration

1. Effects on Habitat Criteria Needed for Restoration
2. Determine if current habitat requirements are appropriate for achieving conditions necessary for SAV resilience and restoration.
3. Importance of feedbacks near threshold values is greater

Chapter 7: The effects of plant community diversity, structure and community succession on SAV resilience, resurgence and restoration

(Rybicki/Orth, Engelhardt, Shields, Stevenson, Tanner, Patrick)

1. Discuss the effects that pioneer species may have on enhancing SAV restoration
2. Demonstrate examples of plant diversity in maintaining bed resilience
3. Describe how native species may be positively or negatively affected by invasive species.
4. Determine if existing habitat requirements and Bay SAV management are appropriate for assessing changing community

Chapter 8: The role of propagule dispersal, seed bank persistence and genetic diversity on SAV resilience and recovery

(Engelhardt/Neel, Kennedy, Orth, Wainger, Weller, Patrick)

1. Patterns of genetic diversity for SAV
2. Biotic factors that affect genetic diversity
3. Environmental factors that affect genetic diversity
4. Links between genetic diversity and ecological function
5. Role of population genetic diversity in SAV restoration

Chapter 9: The effects of land use including shoreline hardening on SAV

(Weller/Patrick, Golden, Landry, Palinkas, Stevenson)

1. Effects of land use on SAV
2. Mechanisms that land use influences SAV and water quality
    1. Land use effects in Chesapeake Bay
3. Role of shoreline hardening in SAV distribution
4. Relationship between land use and shoreline modification
5. Future land use changes, shoreline hardening impacts on SAV, particularly in regards to climate change, sea level rise
6. Potential for decoupling of observed land use impacts due to BMP implementation

Chapter 10: Fisheries practices and their effects on SAV persistence and recovery

(Golden, Karrh, Landry, Orth)

1. Describe the direct and indirect impacts of fisheries practices on SAV, especially of shellfish aquaculture
2. Provide examples of management actions that have modified these effects
3. Determine if other actions may be required to mitigate or enhance these effects

Chapter 11: Evaluation of ecosystem services of SAV in the Chesapeake Bay (Kennedy/Wainger, Rybicki, Stevenson)

1. Overview of SAV's ES
2. Benefits of SAV
    1. Utility of monetizing SAV
    2. Review of existing economic ES studies
3. Implications for Chesapeake Bay
    1. How SAV improves quality/quantity of ES as a result of ecological structural and functional change
    2. Thresholds needed to see benefits
    3. Baseline and Trends in SAV-derived ES
    4. Benefit transfer

Chapter 12: Conclusions for Management

(Karrh, Kennedy, Moore)

1. Summarize knowledge gaps in SAV research, restoration and management
2. Prioritize information needs that would be most useful in the near term
3. Describe mechanism by which resources might be made available to address the most pressing needs
4. Discuss strengths and limitations of existing water quality/SAV criteria and standards
5. Provide a summary of recommended management actions, based on the reviews of current science in the synthesis, to be undertaken in the short and longer run (relative to climate change and other potential changes such as population growth) to improve management of SAV for increased resilience and restoration

Progress to date

- Several conference calls and two face-to-face meetings of all authors
- A comprehensive, detailed outline for the whole document has been produced
- Each chapter’s working group have had their own conference calls to put prose in the outlines

Future Activities

- “Touch-base” call in January and another face-to-face meeting in April
- Goal to have each chapter 85% complete by June
- Work towards submitting chapters to journal(s)
- Final document due to Bay Program December 31, 2015