Attaining 185,000 Acres of SAV for a Restored Chesapeake Bay Part 3

STAC Workshop on Designing Sustainable Coastal Habitats

April 16, 2013

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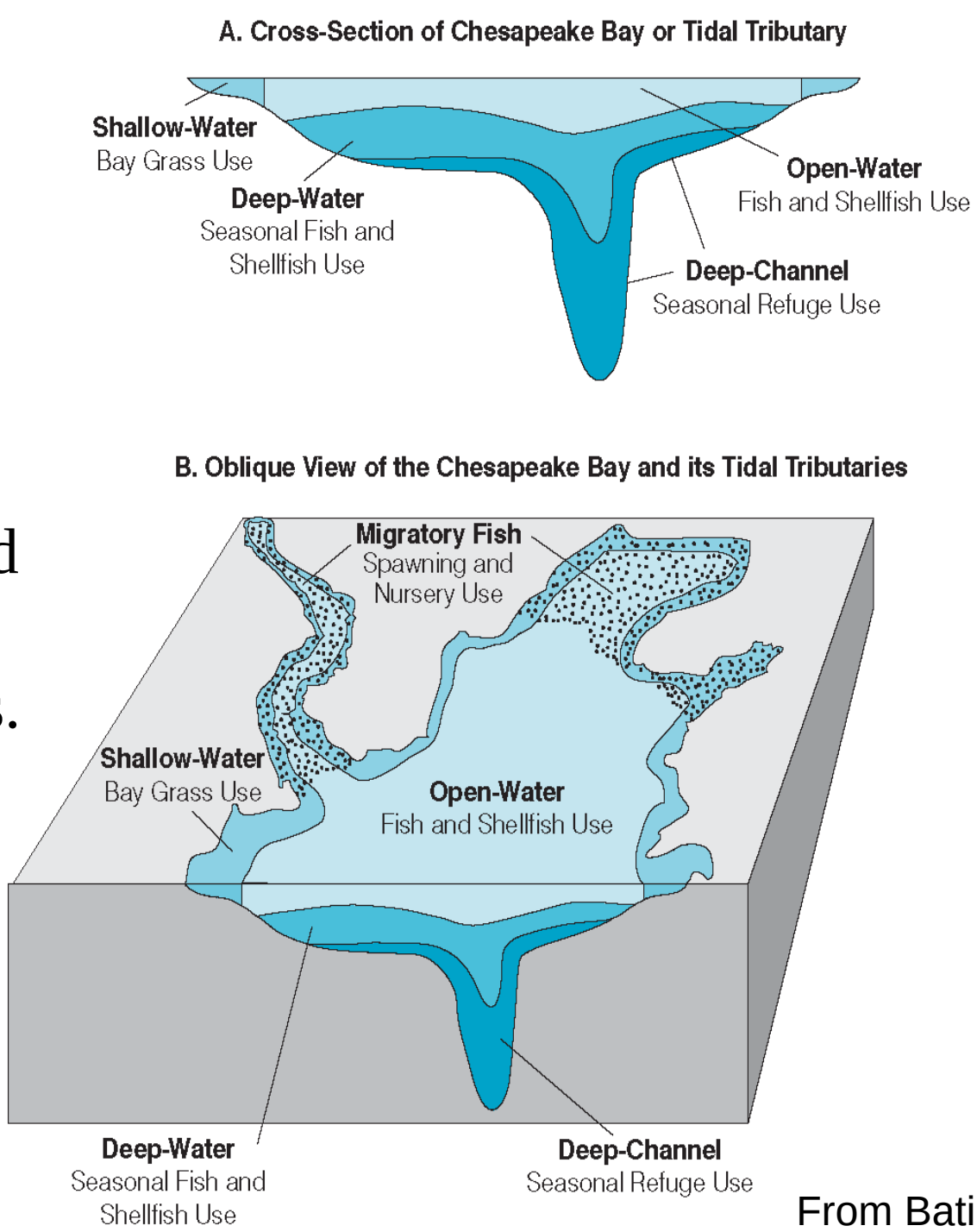
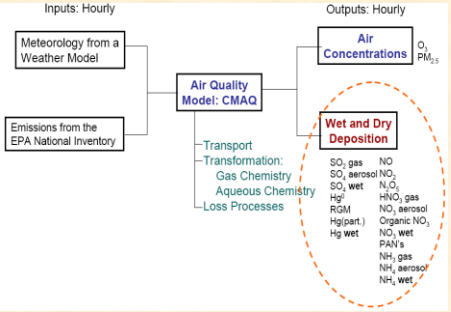
Water quality standards of clarity/SAV are designed to protect SAV and shallow water living resources.

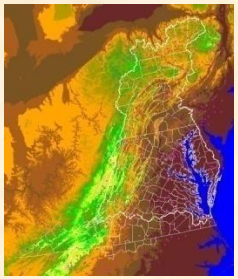


From Batiuk (2003)

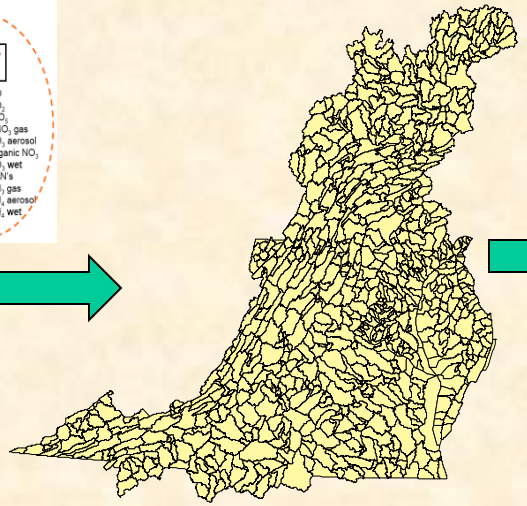
Nutrient/Sediment Allocation Decision Support System

Airshed

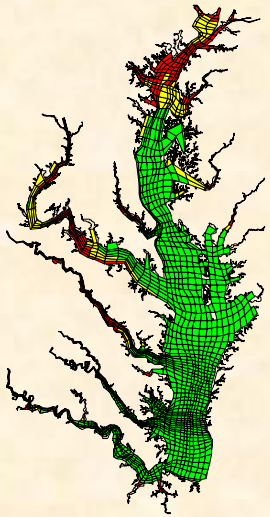




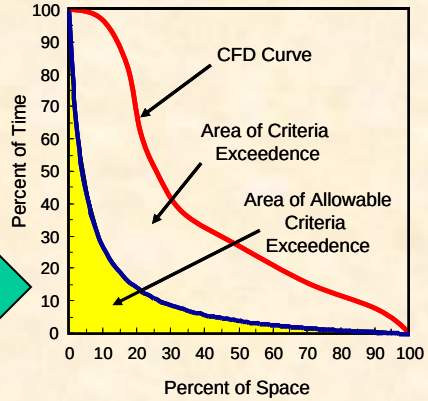
Watershed Model



Bay Model



Criteria Assessment Procedures

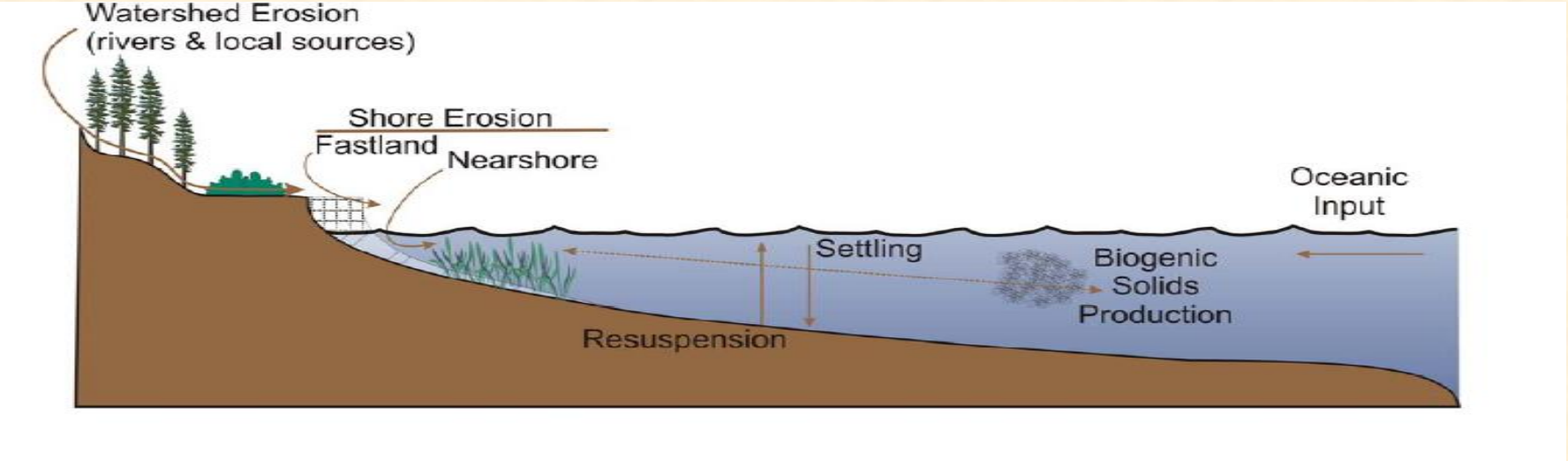


Effects

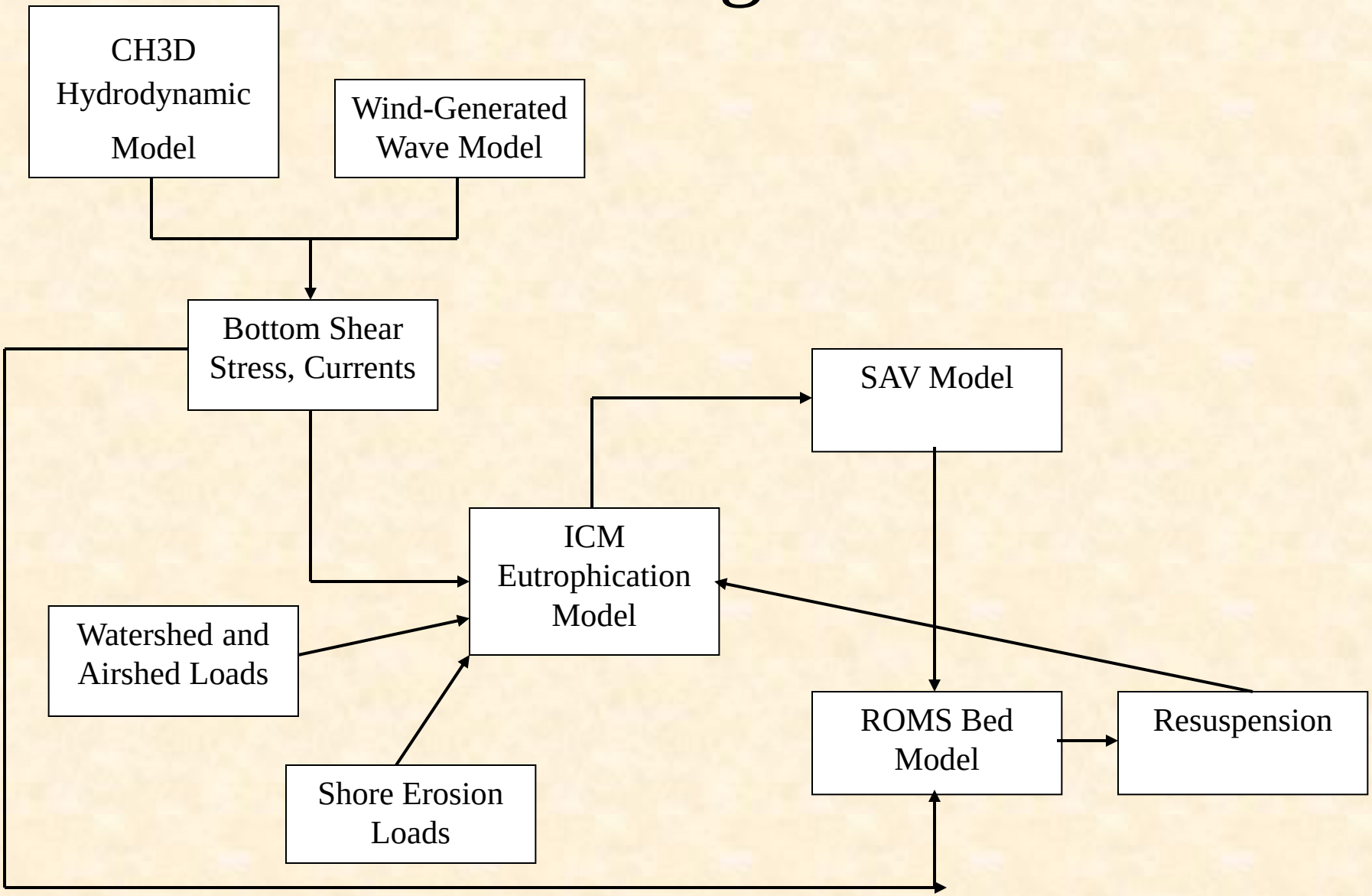
Allocations

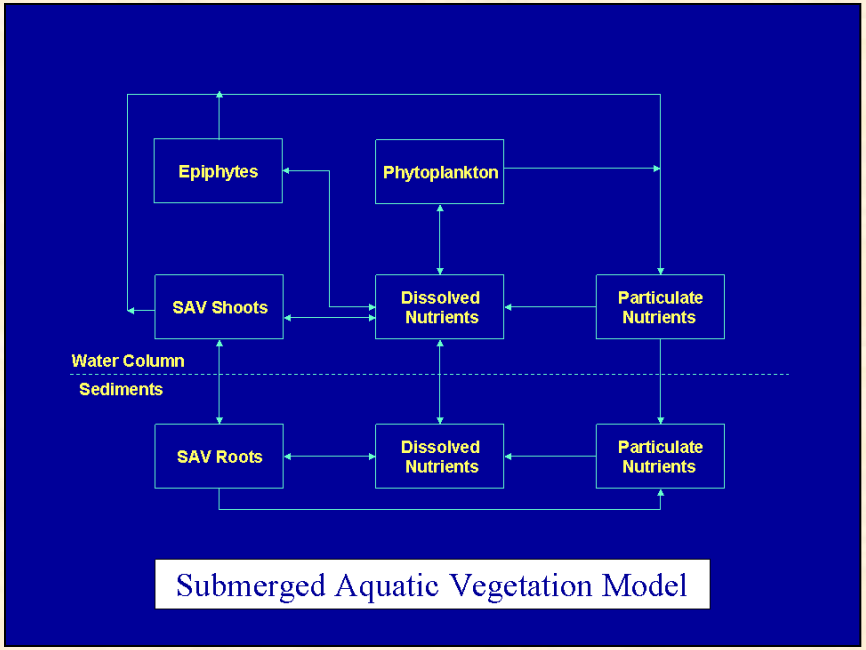
What the Bay Model Tracks in the Simulation of Light Attenuation

The five sources of suspended solids are shown here, including watershed sources, shore erosion, resuspension, biogenic solids production and oceanic input. Nutrient loads influence light absorption by chlorophyll and light attenuation by SAV epiphytes.



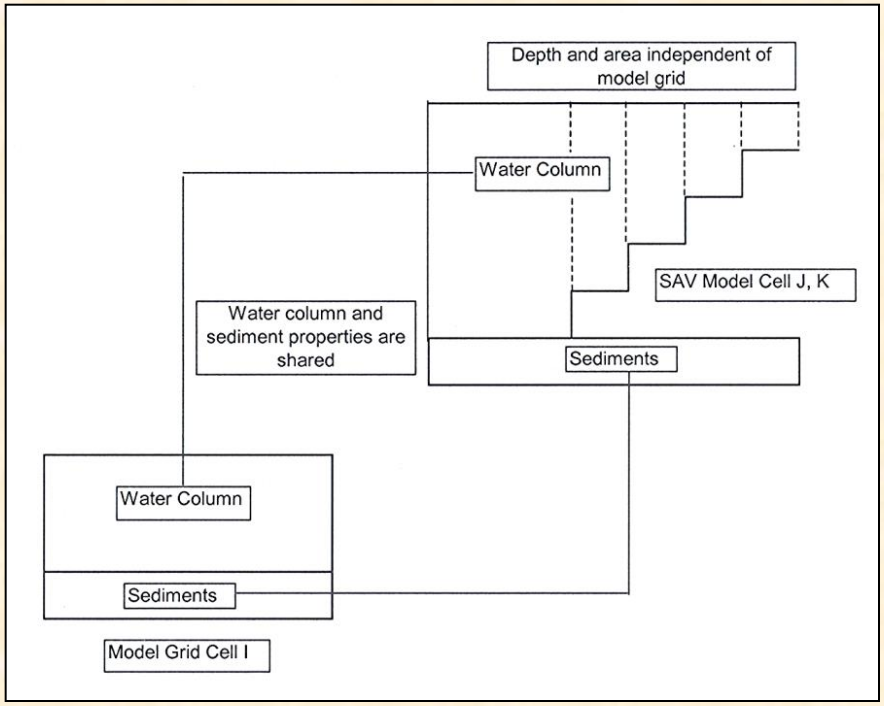
Model Interactions in the Simulation of Light Attenuation





SAV Unit Model

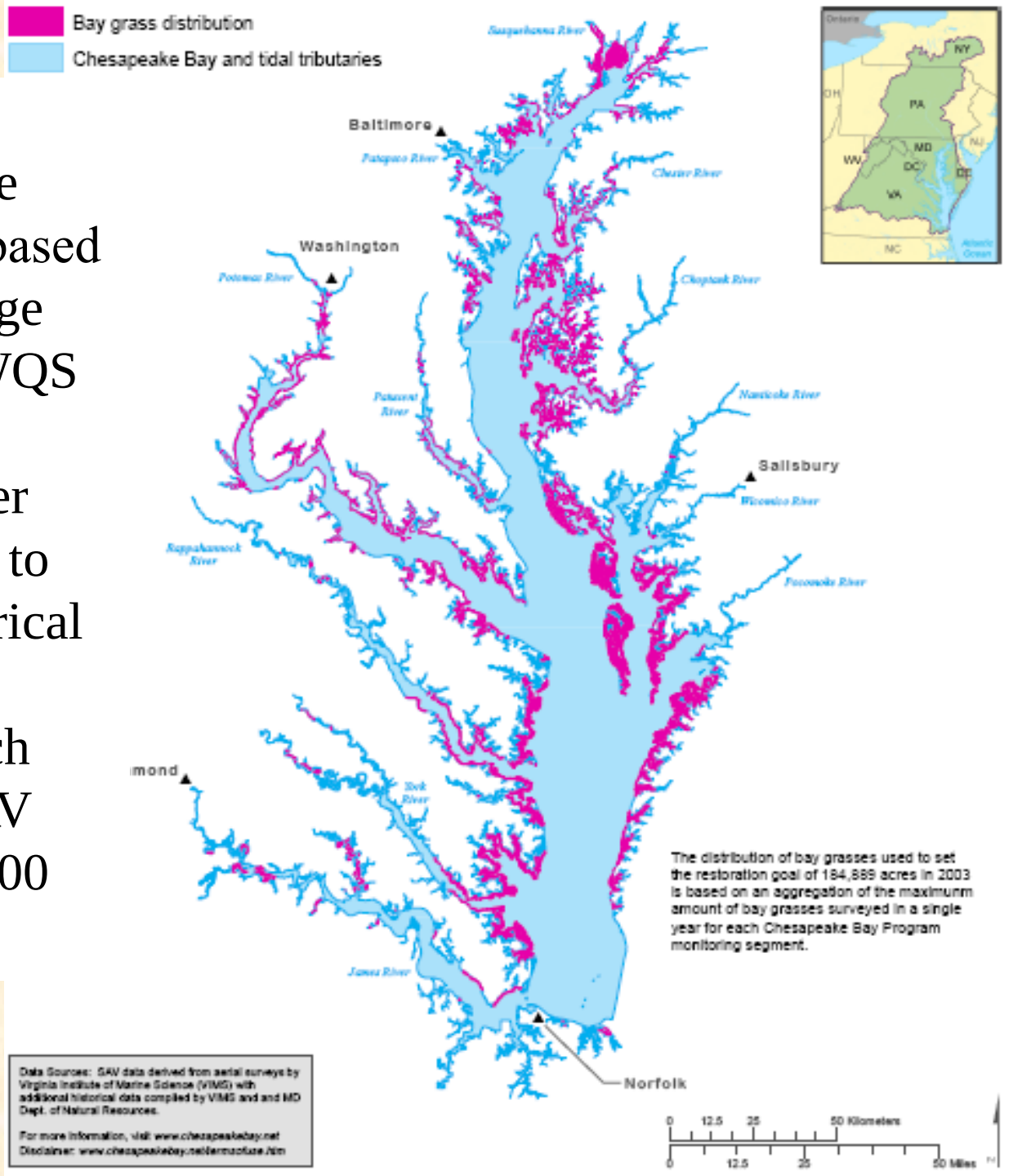
- Computes SAV density (mass/unit area) as a function of irradiance and nutrients.
- Irradiance and epiphytes calculated separately.
- Interacts with water column and bed sediments.



SAV Sub-Grid

- SAV is computed on a sub-grid independent of the hydrodynamic grid.
- Sub-grid areas are based on observed SAV beds rather than arbitrary computational elements.
- Sub-grid elements permit refined depth increments for computation of available light.

The Chesapeake SAV restoration acreage in the jurisdictions' WQS are based on achieving SAV acreage goals set forth in state WQS that were based on the highest SAV acreage ever observed over a 40-year to more than 70-year historical record depending on the records available for each basin. Bay-wide, the SAV restoration goal is 185,000 acres.



Critical Elements for Assessing the Clarity/SAV Water Quality Standard:

- SAV acres.
- Clarity acres.
- Percent light through the water (PLW = $e^{-ke*z} * 100\%$)
- Application depth.
- When the standard is in effect, or the SAV growing season for three key oligohaline, mesohaline, and polyhaline SAV communities.

VA Water Quality Standards for Clarity/SAV

9 VAC 25-260 March 2005

B. Submerged Aquatic Vegetation and Water Clarity

If the submerged aquatic vegetation (SAV) acres in this subsection are met in any individual Chesapeake Bay Program segment as described in subsection D of this section, then the shallow-water submerged aquatic vegetation use is met in that segment. If the SAV acres in this subsection are not met in any individual Chesapeake Bay Program segment, then the water clarity criteria shall apply to the water clarity acres in that segment. If these water clarity criteria are met to the bottom water-sediment interface for the number of water clarity acres in that segment, then the shallow-water submerged aquatic vegetation use is met; regardless of the number of acres of SAV in that segment.

Designated Use	Chesapeake Bay Program Segment	SAV Acres[1]	Water Clarity Criteria (percent light-through-water)[2]	Water Clarity Acres[1]	Temporal Application
Shallow-Water Submerged Aquatic Vegetation Use	CB5MH	7,633	22%	14,514	April 1 - October 31
	CB6PH	1,267	22%	3,168	March 1 - November 30
	CB7PH	15,107	22%	34,085	March 1 - November 30
	CB8PH	11	22%	28	March 1 - November 30
	POTTF	2,093	13%	5,233	April 1 - October 31
	POTOH	1,503	13%	3,758	April 1 - October 31
	POTMH	4,250	22%	10,625	April 1 - October 31
	RPPTF	66	13%	165	April 1 - October 31
	RPPOH	0	-	0	-
	RPPMH	1700	22%	5000	April 1 - October 31
	CRRMH	768	22%	1,920	April 1 - October 31
	PIAMH	3,479	22%	8,014	April 1 - October 31
	MPNTF	85	13%	213	April 1 - October 31
	MPNOH	0	-	0	-
	PMKTF	187	13%	468	April 1 - October 31
	PMKOH	0	-	0	-
	YRKMH	239	22%	598	April 1 - October 31
	YRKPH	2,793	22%	6,982	March 1 - November 30
	MOBPH	15,901	22%	33,990	March 1 - November 30
	JMSTF2	200	13%	500	April 1 - October 31
	JMSTF1	1000	13%	2500	April 1 - October 31
	APPTF	379	13%	948	April 1 - October 31
	JMSOH	15	13%	38	April 1 - October 31
	CHKOH	535	13%	1,338	April 1 - October 31
	JMSMH	200	22%	500	April 1 - October 31
	JMSPH	300	22%	750	March 1 - November 30
	WBEMH	0	-	0	-
	SBEMH	0	-	0	-
	EBEMH	0	-	0	-
	LAFMH	0	-	0	-
	ELIPH	0	-	0	-
	LYNPH	107	22%	268	March 1 - November 30
	POCOH	0	-	0	-
	POCMH	4,066	22%	9,368	April 1 - October 31
	TANMH	13,579	22%	22,064	April 1 - October 31

1 = The assessment period for SAV and water clarity acres shall be the single best year in the most recent three consecutive years. When three consecutive years of data are not available, a minimum of three years within the most recent five years shall be used.

How An SAV Standard Assessment is Done

- Using the Bay Water Quality Model, the SAV/water clarity WQS were assessed by starting with measured area of SAV in each Bay segment from the 1993–1995 critical period.
- On the basis of regressions of SAV versus load, the estimated SAV area, resulting from a particular nitrogen and phosphorus or sediment load reduction, was estimated (TMDL Appendix P).
- Then the estimated water clarity acres from the Bay Water Quality Model were added after adjustment by a factor of 2.5 to convert to the water clarity acres to water clarityequivalent SAV acres.
- Finally the water clarity equivalent SAV acres were added to the regression-estimated SAV acres and compared to the Bay segment-specific SAV WQ Standard.

How An SAV Standard Assessment is Done

A strategy was developed to achieve WQSs by first setting the nutrient allocation for achieving all the DO and chlorophyll a WQSs in all 92 segments, and then making any additional sediment reductions where needed to achieve the SAV/water clarity WQS. That strategy was supported by management actions in the watershed to reduce nitrogen and phosphorus loads.

Just as the SAV resource is responsive to nitrogen, phosphorus, and sediment loads, many management actions in the watershed that reduce nitrogen and phosphorus also reduce sediment loads. Examples include conservation tillage, farm plans, riparian buffers, and other key practices. The estimated ancillary sediment reductions resulting from implementation actions necessary to achieve the nitrogen and phosphorus reductions needed to achieve the allocations are estimated to be about 40 percent less than 1985 sediment loads and 25 percent less than current (2009) load estimates.

Challenges in the SAV Standard Assessment

The linked SAV and water clarity WQS are unique in some respects. Rather than covering the entire Bay as the DO WQS does, the SAV-water clarity WQS applies in only a narrow ribbon of shallow water habitat along the shoreline in depths of 2 meters or less. That presents certain challenges for the Chesapeake Bay model simulation and monitoring systems, both of which have long been more oriented toward the open waters of the Chesapeake Bay and its tidal tributaries and embayments.

Challenges in the SAV Standard Assessment

Scientific understanding of the transport, dynamics, and fate of sediment in the shallow waters of the Chesapeake Bay and understanding and simulating all the factors influencing SAV growth continues to develop.

Complicating the simulation of SAV:

- Strong dependence on temperature for some species
- Strong dependence on last year's distribution
- Strong effect from species shifts

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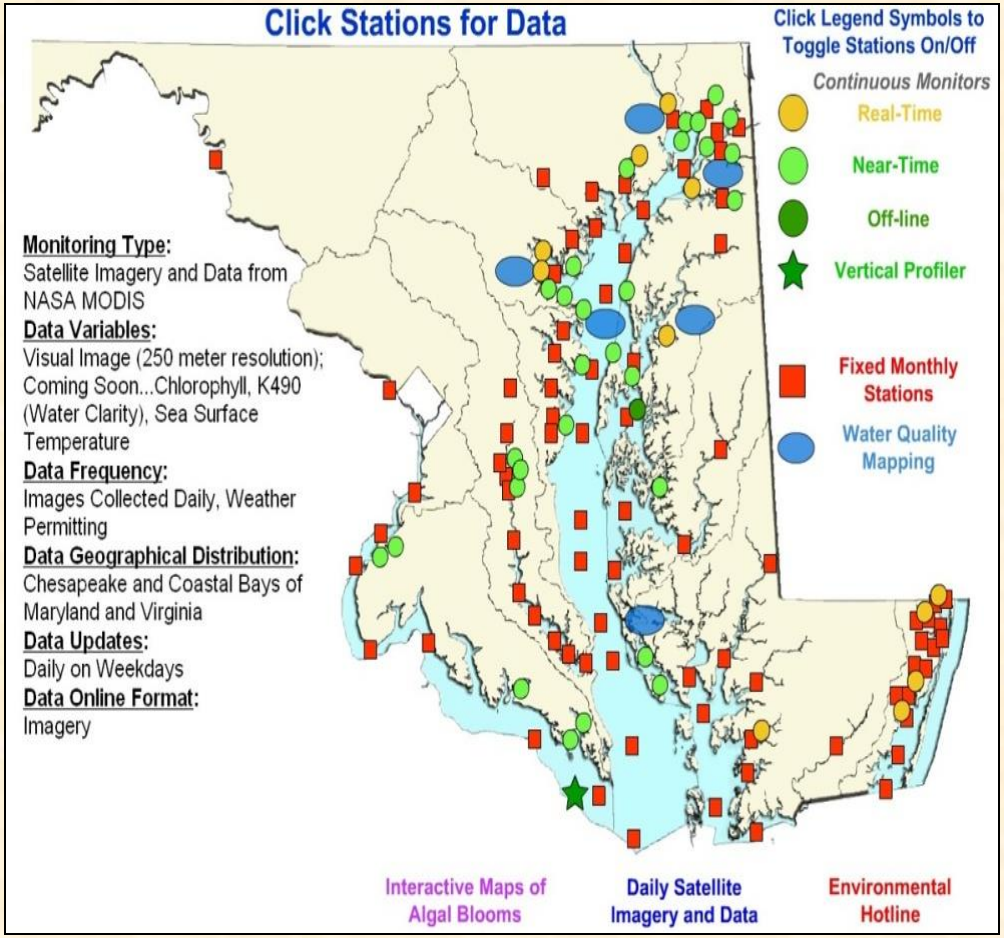
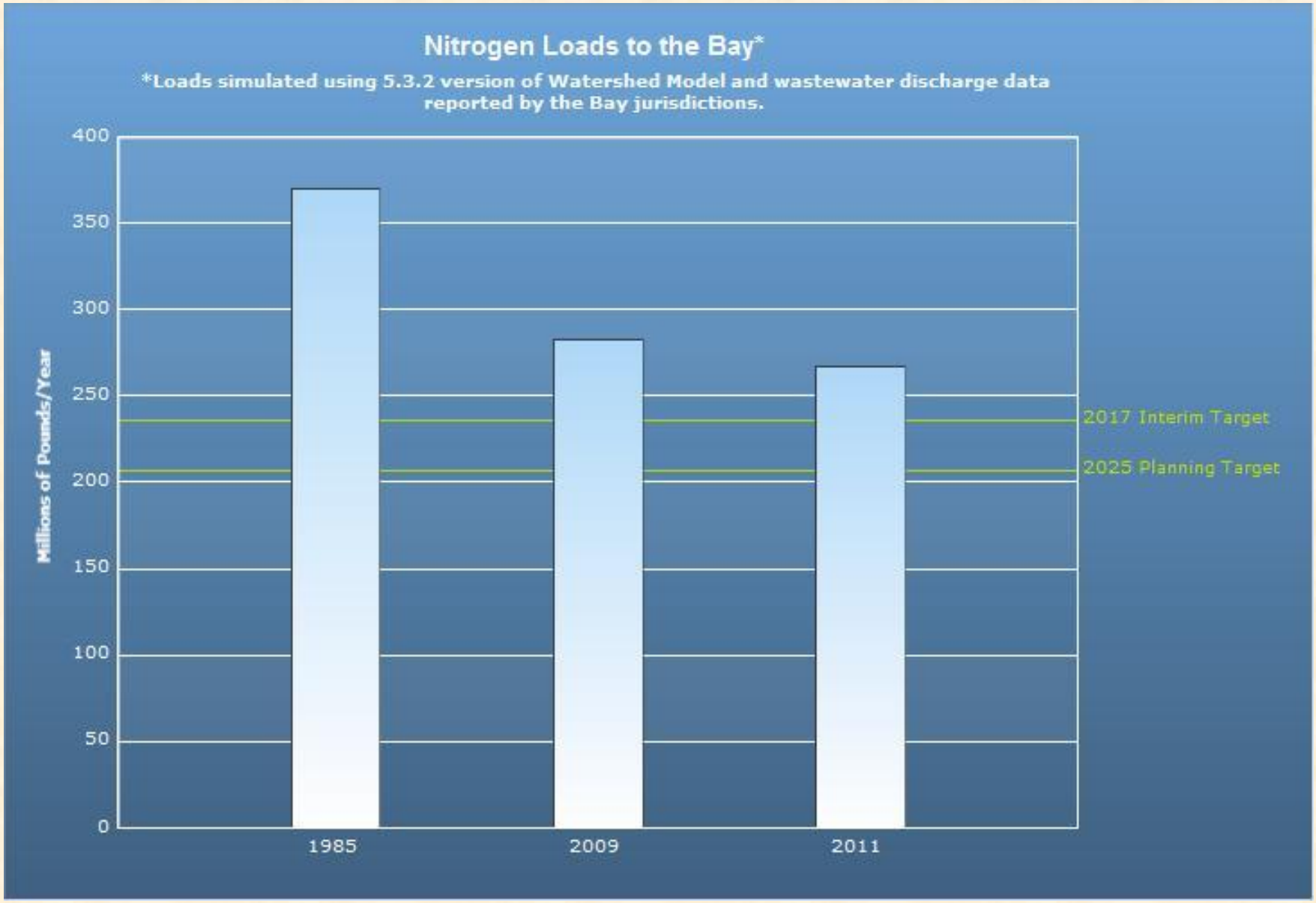
Shallow-Water Monitoring



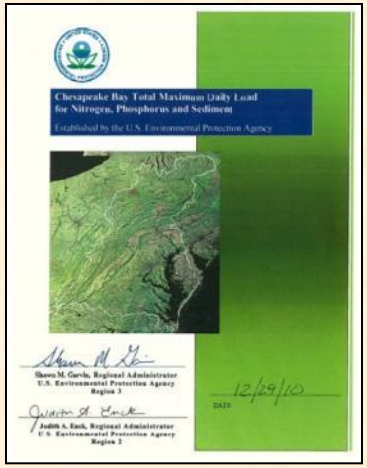
- Maryland and Virginia operate an outstanding shallow-water monitoring program.
- Preparing to employ this data in the Bay Model:
  - Expanding simulation period of the Bay model to overlap with the shallow water observations.
  - Initiating detailed observed/simulated comparisons.
  - Initiating shallow water multiple model pilot program.

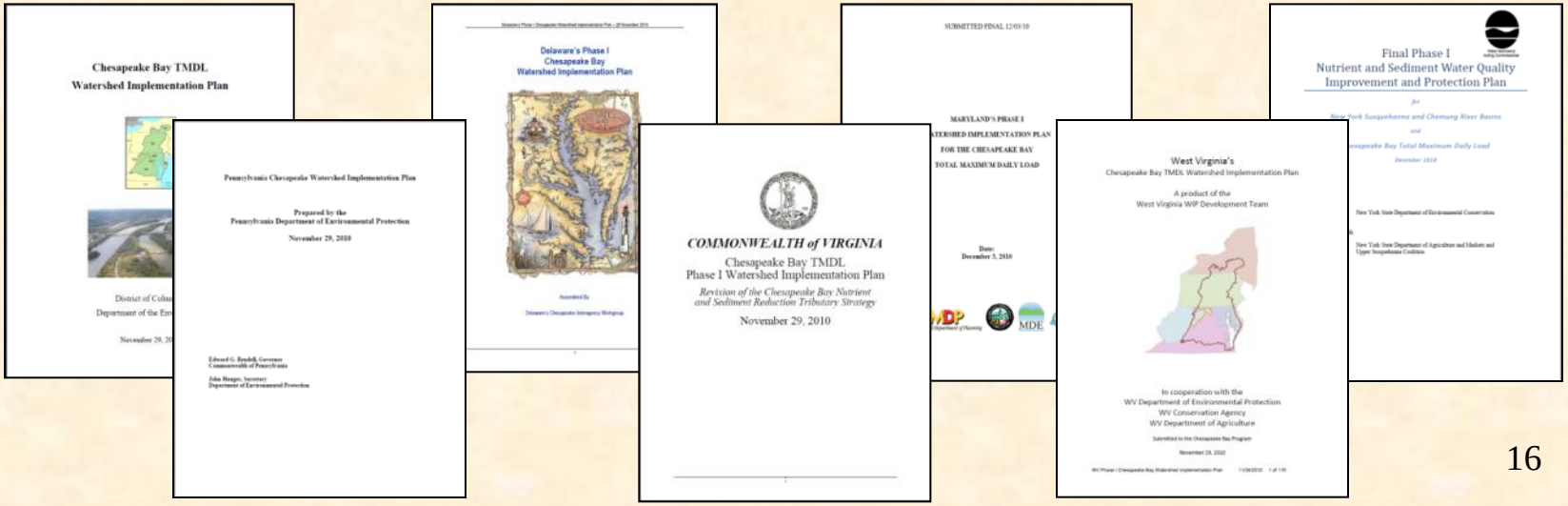
Modeling Information Using Average Hydrology



Approximately 267 million pounds nitrogen delivered to Bay in 2011

Chesapeake Bay TMDL Based on 7 Watershed Implementation Plans





Influence of Filter Feeders on Clarity/SAV Water Quality Standard: Oyster Aquaculture and Sanctuary Reef Development

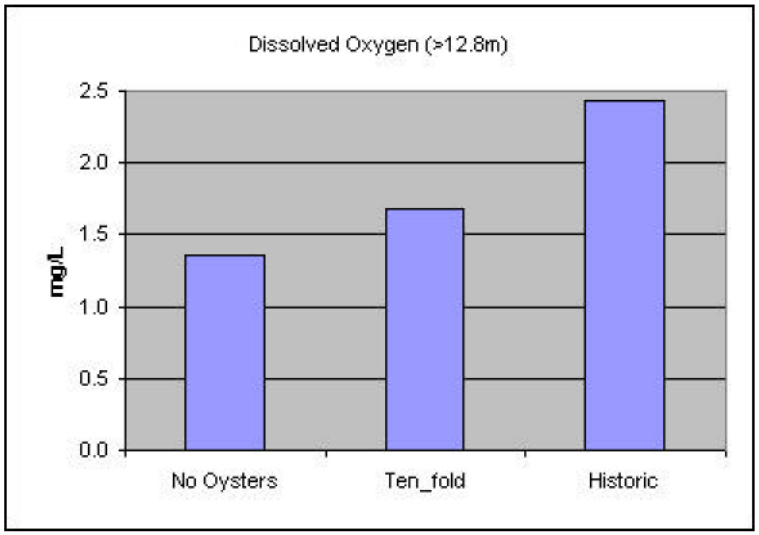
Assessing a Ten-Fold Increase in the Chesapeake Bay Native Oyster Population

A Report to the EPA Chesapeake Bay Program

July 2005

Carl F. Cerco and Mark R. Noel

US Army Engineer Research and Development Center, Vicksburg MS



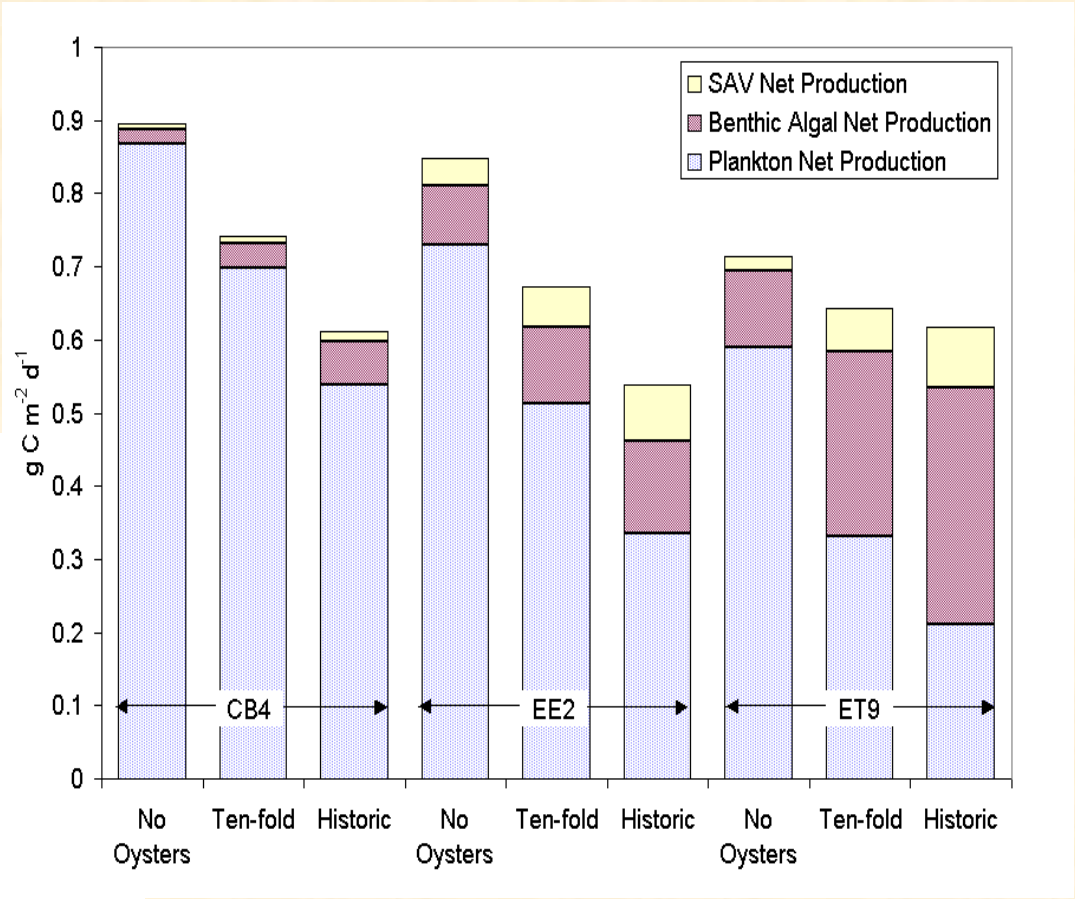
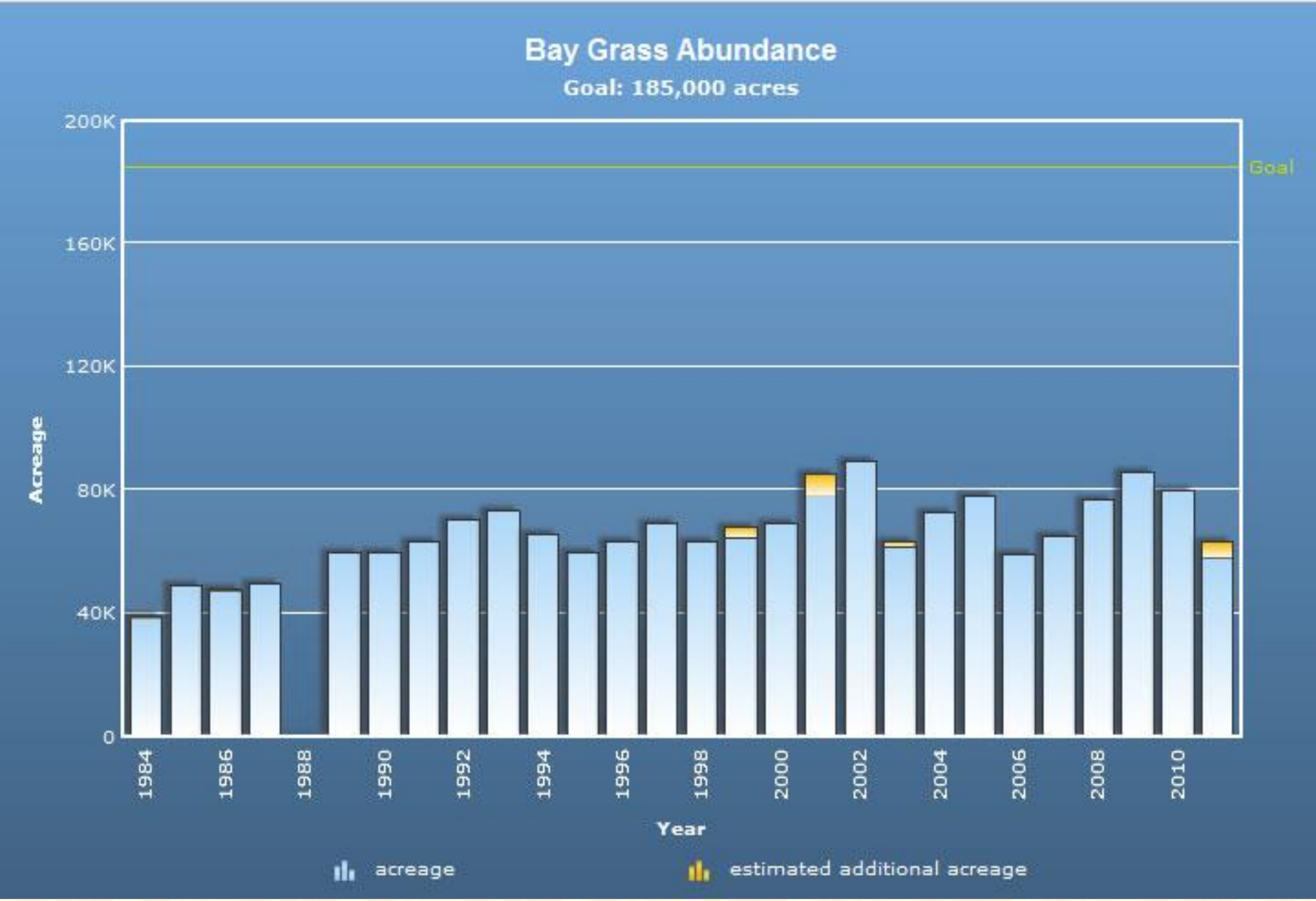


Figure 17. Effect of oysters on summer-average, bottom, dissolved oxygen in CB4.



Long term increases in Bay grasses keep hitting the ceiling of lack of improving clarity, hotter summers.

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http://www.chesapeakebay.net/calendar/event/19335/

www.chesapeakebay.net