Building and Sustaining Integrated Networks (BASIN)

Sustaining the Chesapeake Bay and Watershed Water Quality Monitoring Networks through 2025

Prepared by the Science and Technical Analysis and Reporting Team (STAR)

Bill Dennison, Chair
Mark Bennett, Co-Chair
Peter Tango, Coordinator

CBP STAC
September 18, 2013

Outline

- Monitoring value review
- Monitoring funding shortfall considerations
- Describe phased approach to monitoring reevaluation

Long term data set allows new analyses, interpretations and Bay understanding

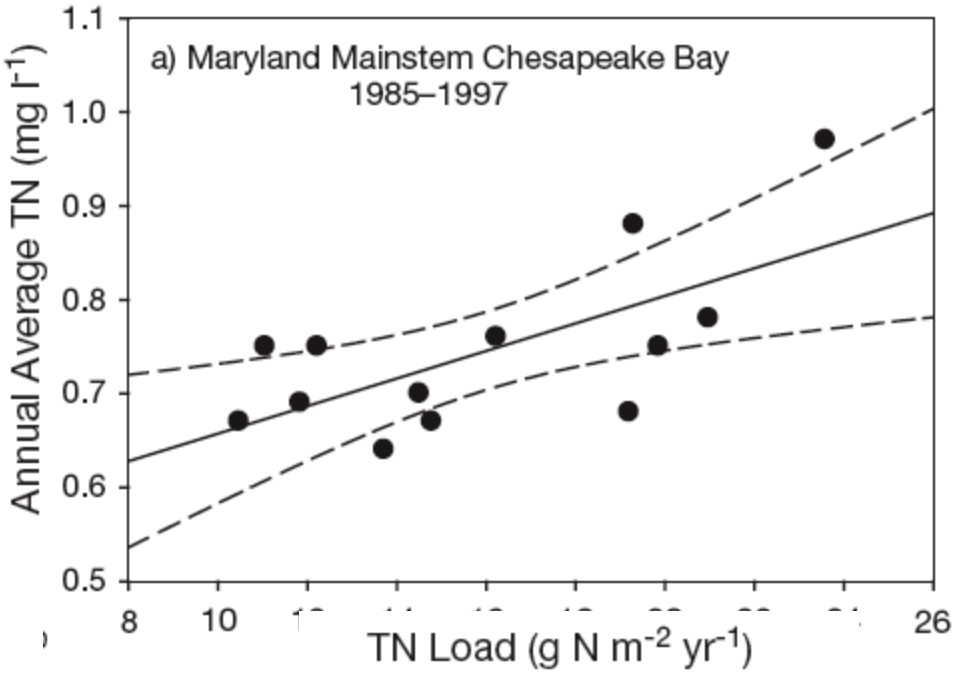
Vol. 303: 1–29, 2005 | MARINE ECOLOGY PROGRESS SERIES Mar Ecol Prog Ser | Published November 21

FEATURE ARTICLE: REVIEW

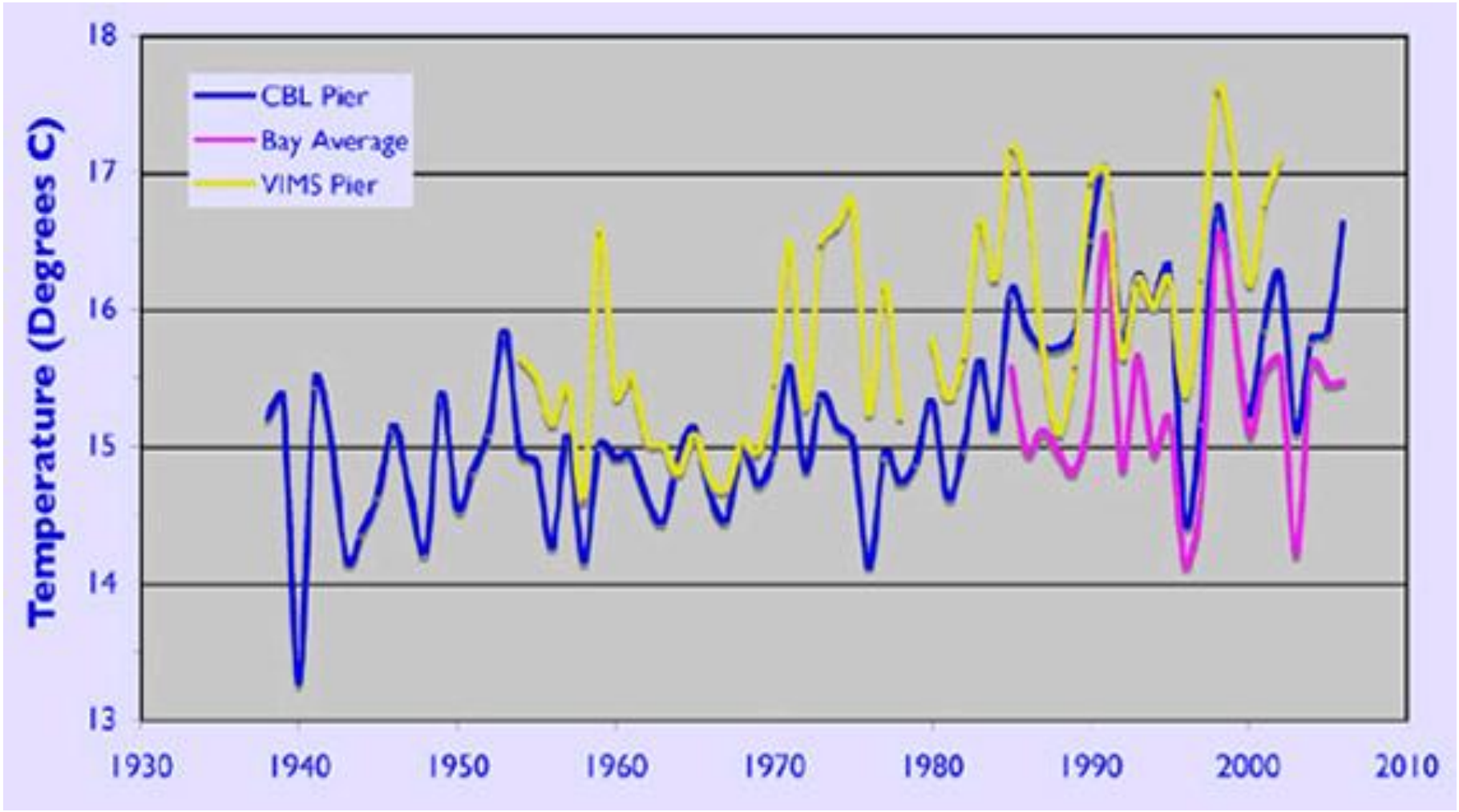
Eutrophication of Chesapeake Bay: historical trends and ecological interactions

W. M. Kemp[1,*], W. R. Boynton[2], J. E. Adolf[1], D. F. Boesch[3], W.
J. C. Cornwell[1], T. R. Fisher[1], P. M. Glibert[1], J. D. Hagy[5], L. W.
D. G. Kimmel[1], W. D. Miller[1], R. I. E. Newell[1], M. R. Roman[1], E. M

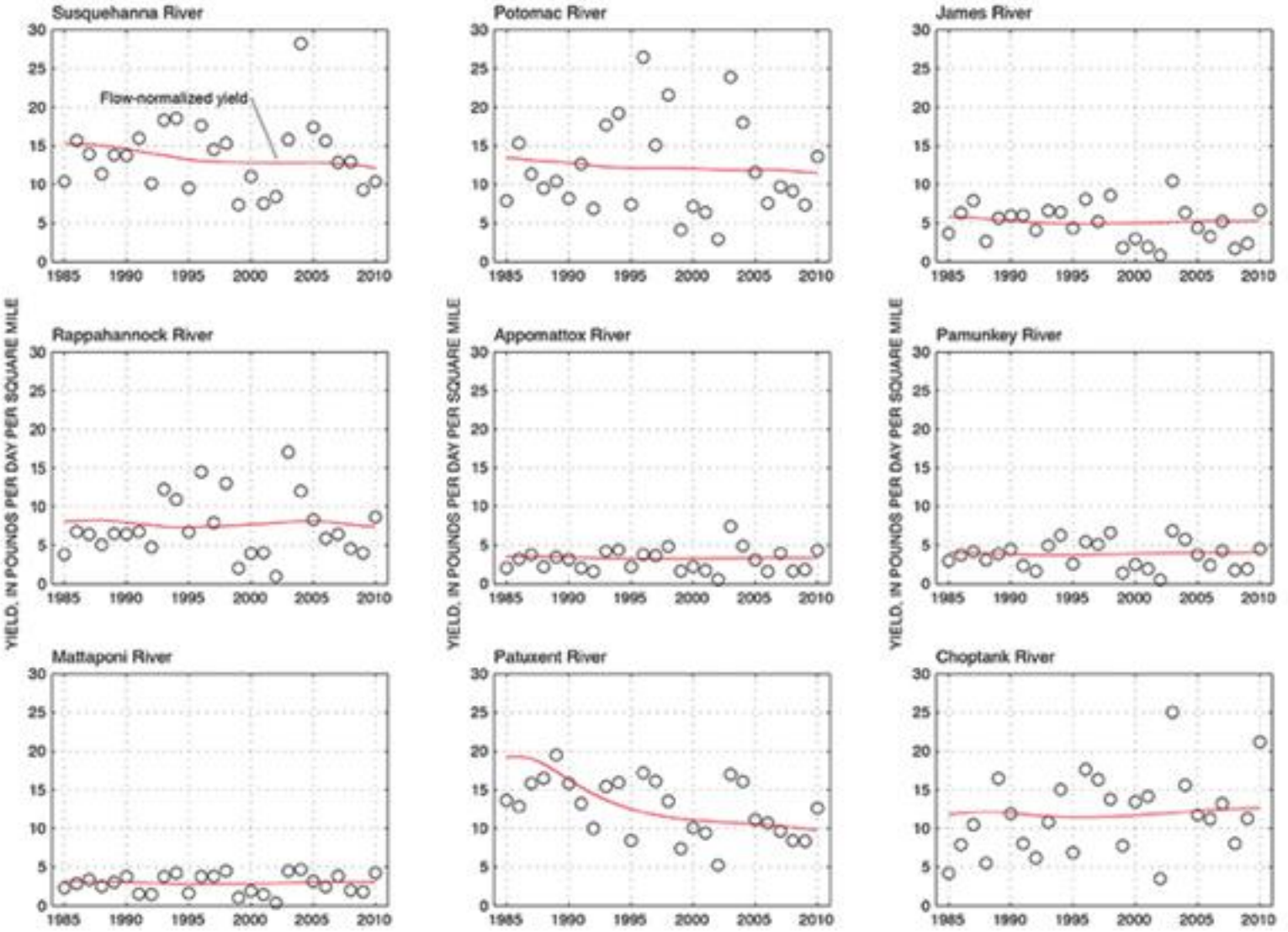
[1]University of Maryland, Center for Environmental Science, Horn Point Laboratory, C
[2]University of Maryland, Center for Environmental Science, Chesapeake Biological Labora
[3]University of Maryland, Center for Environmental Science, Cambridge, M
[4]Johns Hopkins University, Department of Geography & Environmental Engineering,
[5]U.S. Environmental Protection Agency, NHEERL, Gulf Ecology Division, Gulf
[6]University of South Carolina, Department of Biology, Columbia, South C



Climate change impacts detected through monitoring



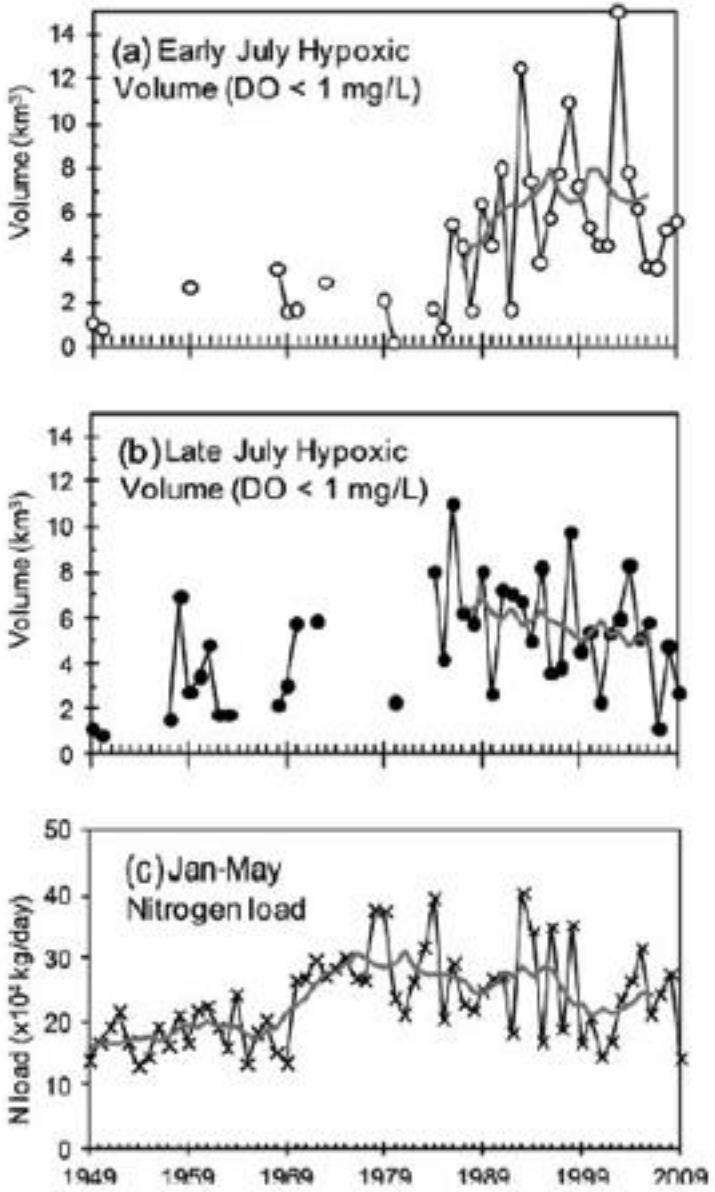
Monitoring data used to analyze nutrient trends



ian.umces.edu

Hirsch, et al., 2010 J. American Water Res. Assoc. 46: 857-880

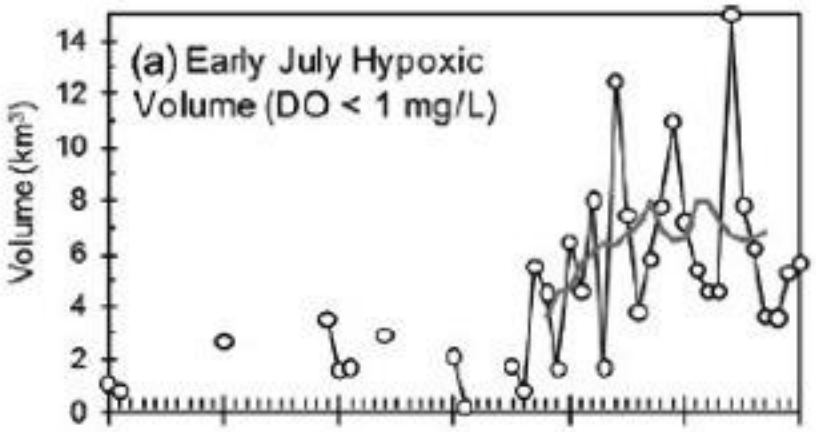
Analysis of monitoring data used to infer late July hypoxia declining due to N reductions



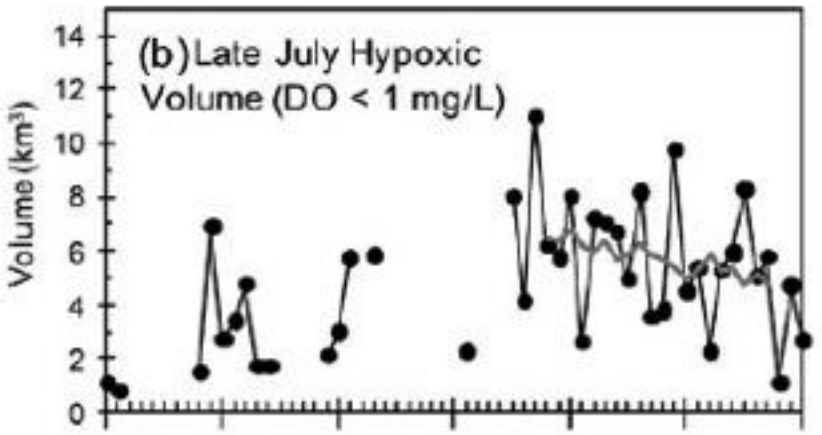
Murphy et al.; 2011. Estuaries and Coasts 34: 1293-1309

Dissolved oxygen trends: Good news and bad news

- Bad news: Spring hypoxia enhanced due to climate change



- Good news: Summer hypoxia reduced due to nutrient reductions



Murphy et al.; 2011. Estuaries and Coasts 34: 1293-1309

Monitoring data crucial for model development

Estuaries and Coasts (2008) 31:1021–1037
DOI 10.1007/s12237-008-9095-y

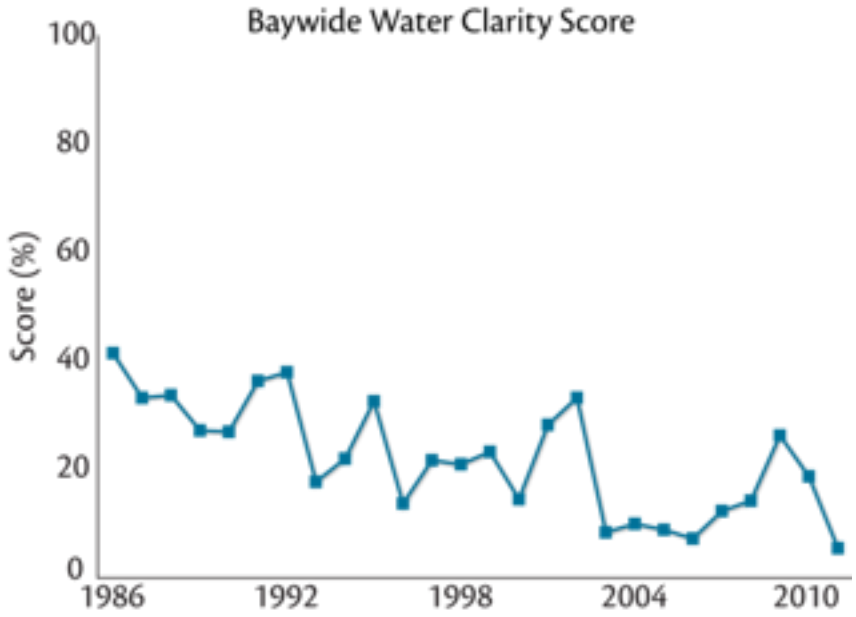
Long-Term Changes in Water Quality and Productivity in the Patuxent River Estuary: 1985 to 2003

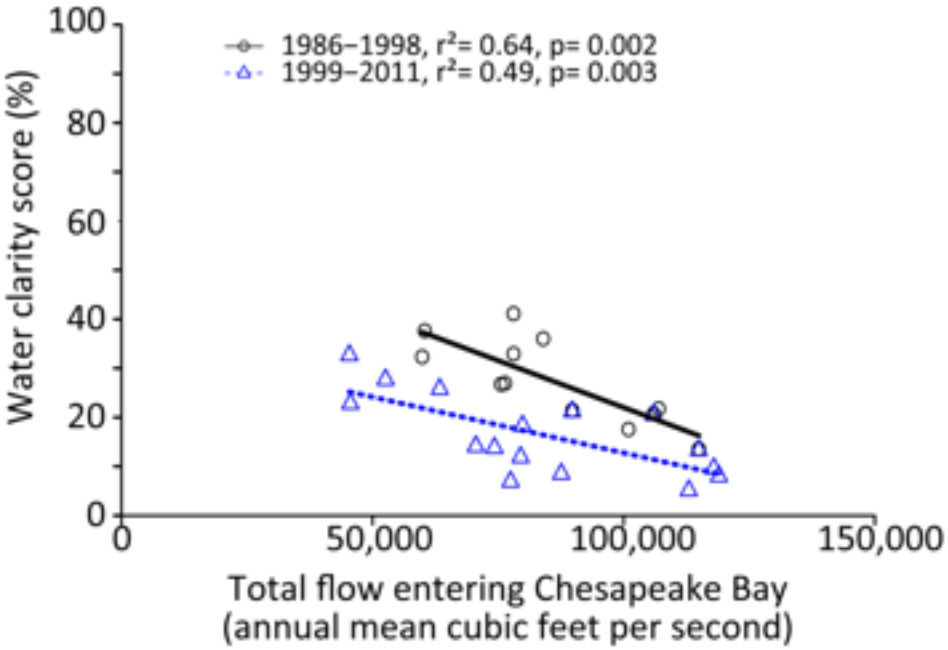
Jeremy M. Testa · W. Michael Kemp · Walter R. Boynton · James D. Hagy III

Implications

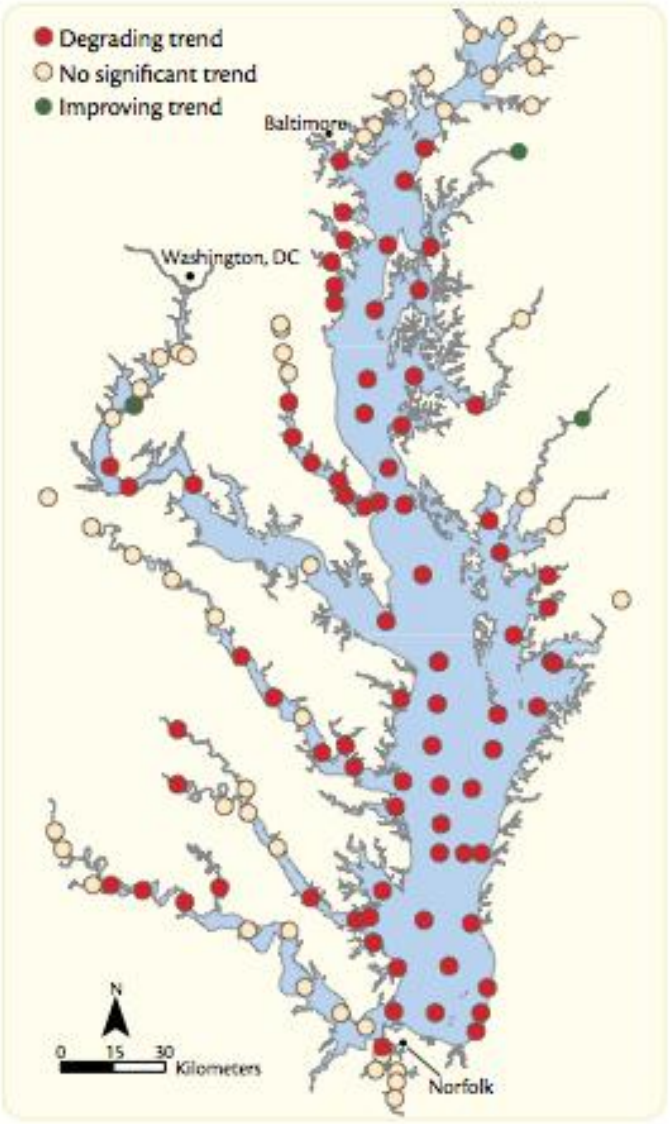
This analysis illustrates the utility of long-term water quality monitoring data to provide a basis for empirical analysis and to support box-model computations of net O_2 production and nutrient transport rates. Box-model computations of nutrient transport provide an interpretive framework to examine possible causes and mechanisms underlying water quality trends and are thus useful for management-related research. Our results underscore the fact that even complex water quality patterns in variable and open estuaries can be better understood when detailed

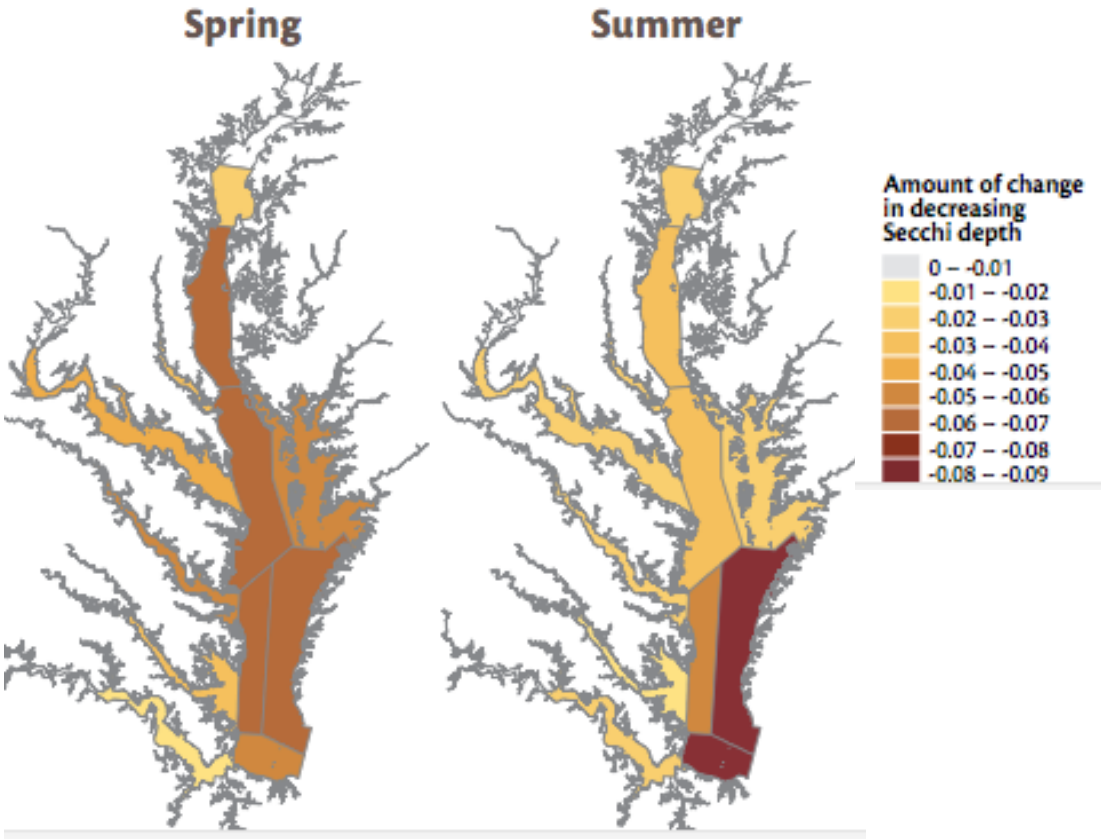
Water clarity is degrading over time and affected by flow



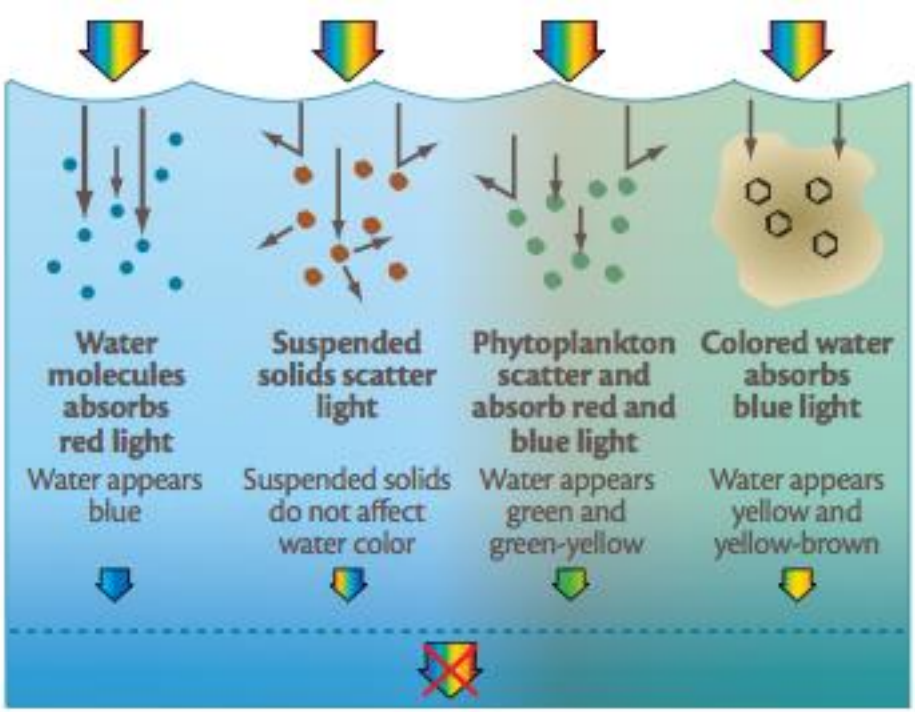


Degrading water clarity

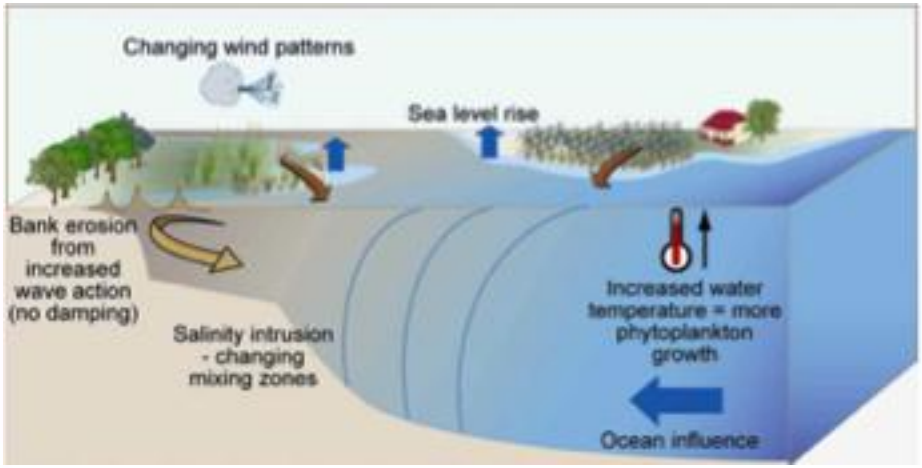




Reason for water clarity decline remains enigmatic



The four factors affecting water clarity: water, suspended solids, phytoplankton, and colored water (dissolved organic matter). Modified from Smithsonian Environmental Research Center's Phytoplankton Lab website.



Monitoring methods published in peer review journals

Estuaries Vol. 25, No. 6A, p. 1231–1242 December 2002

An Estuarine Benthic Index of Biotic Integrity for the Mid-Atlantic Region of the United States. II. Index Development

Roberto J. Llansó[1]* Lisa C. Scott[1] Jeffrey L. Hyland[2] Daniel M. Dauer[3] David E.

Estuaries Vol. 23, No. 1, p. 115–127 February 2000

Analysis of the Abundance of Submersed Aquatic Vegetation Communities in the Chesapeake Bay

Estuaries and Coasts Vol. 29, No. 4, p. 598–616 August 2006

Phytoplankton Index of Biotic Integrity for Chesapeake Bay and its Tidal Tributaries

Richard V. Lacouture[1,*], Jacqueline M. Johnson[2], Claire Buchanan[3], and Harold G. Marshall[4]

[1] *Morgan State University Estuarine Research Center, 10545 Mackall Road, St. Leonard, Maryland 20685*
[2] *Interstate Commission on the Potomac River Basin, Environmental Protection Agency, Chesapeake Bay Program, 410 Severn Avenue, Suite 109, Annapolis, Maryland 21403*
[3] *Interstate Commission on the Potomac River Basin, Suite 300, 6110 Executive Boulevard, Rockville, Maryland 20852*
[4] *Department of Biological Sciences, Old Dominion University, Norfolk, Virginia 23529-0266*

Monitoring data used for Chesapeake Bay report card

Marine Pollution Bulletin 59 (2009) 14–25

Contents lists available at ScienceDirect

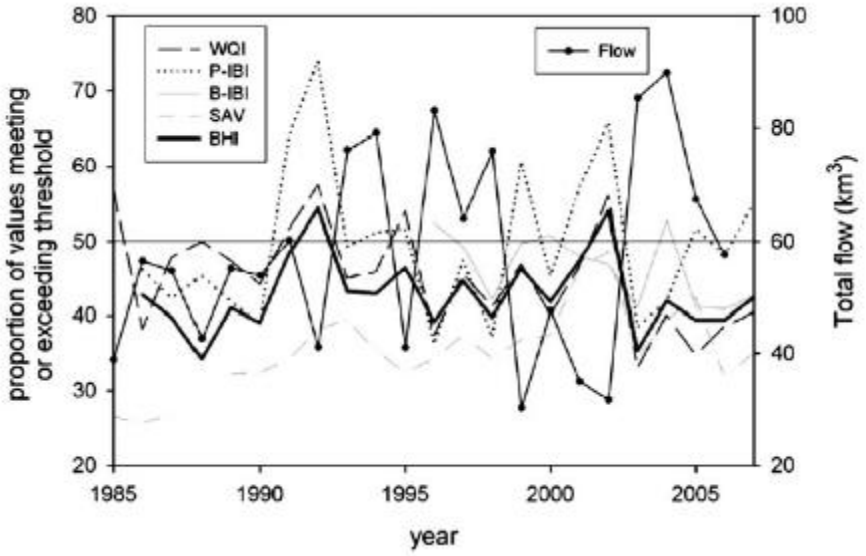
Marine Pollution Bulletin

journal homepage: www.elsevier.com/locate/marpolbul

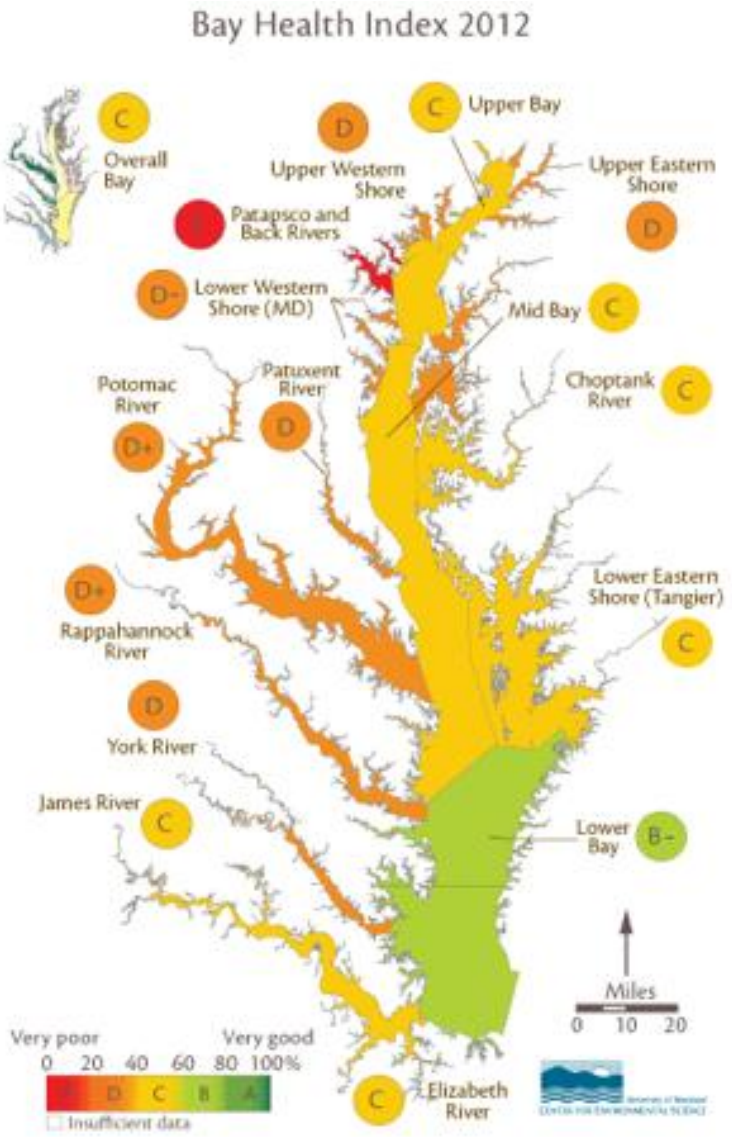
Development and evaluation of a spatially-explicit index of Chesapeake Bay health

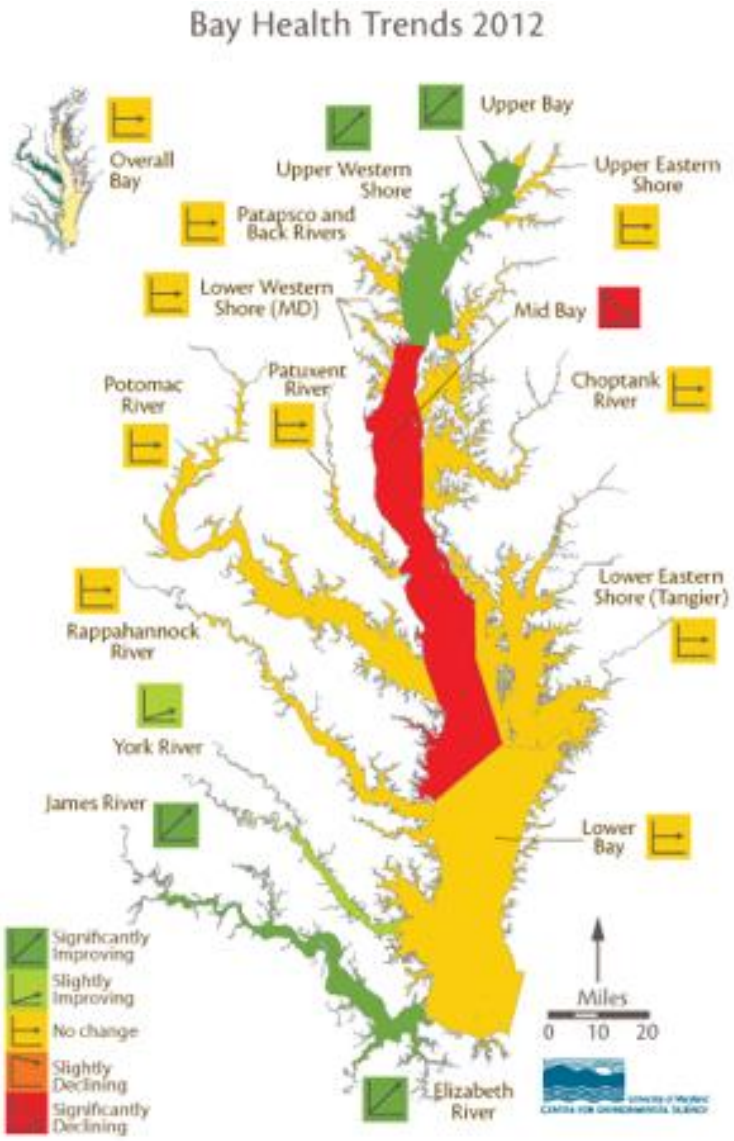
Michael Williams [a,*], Ben Longstaff [b], Claire Buchanan [c], Roberto Llansó [d], William Dennison [a]

[a] University of Maryland Center for Environmental Science, Annapolis Synthesis Center, Sui
[b] NOAA-UMCES Partnership, Cooperative Oxford Laboratory, Oxford, MD 21654, USA
[c] Interstate Commission on the Potomac River Basin, 51 Monroe St., Suite PE-08, Rockville,
[d] Versar Inc., 9200 Rumsey Road, Columbia, MD 21045, USA

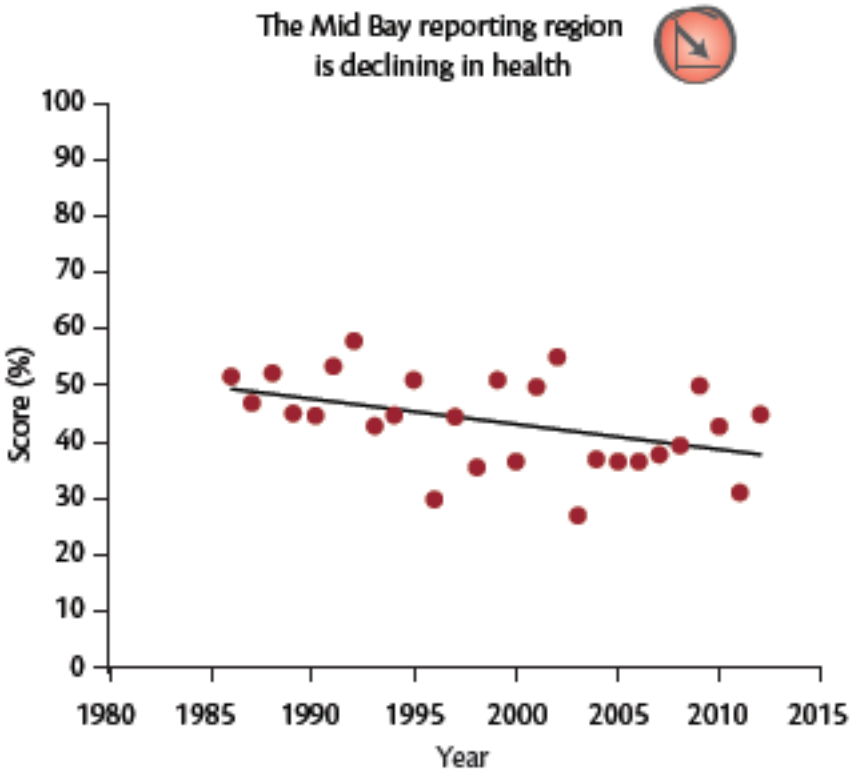


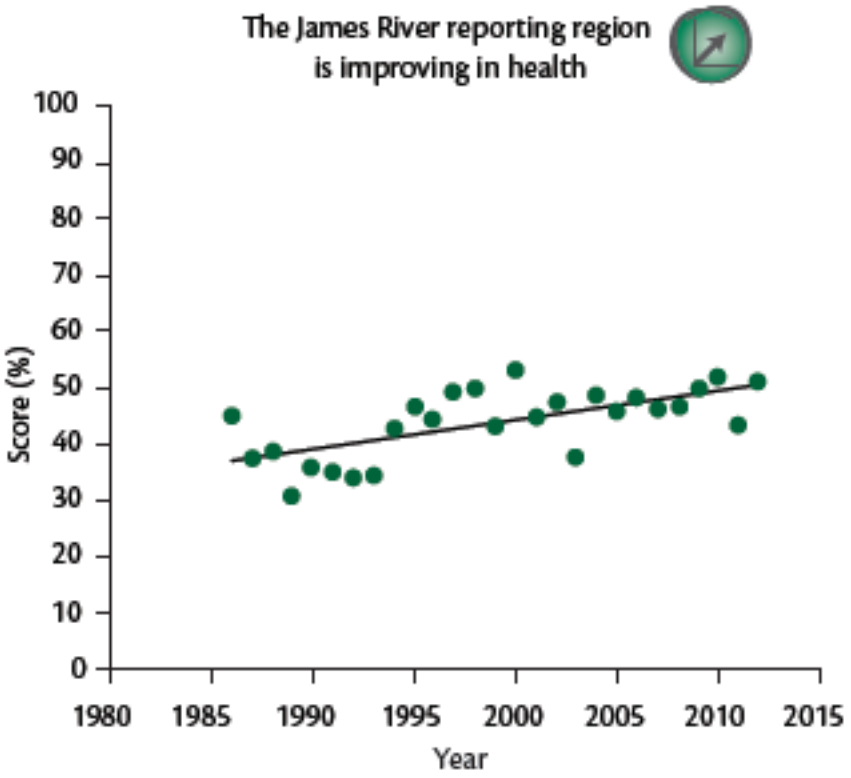
Chesapeake Bay report card & trajectories





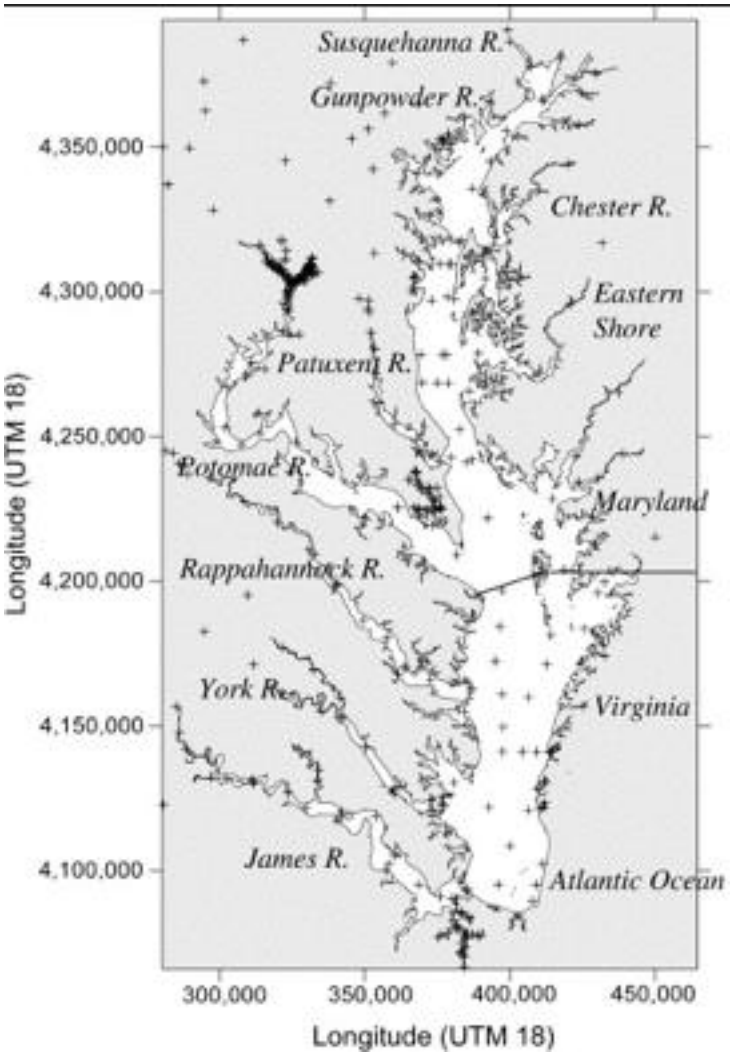
Different trajectories observed





Institutional monitoring needed

- CBP sponsored monitoring provides the skeletal backbone of additional monitoring (e.g., citizen science monitoring)
- High quality, timely, accessible data with continuity is essential
- Piecemeal data does not replace integrated monitoring (Boynton example of 44 studies on Patuxent R. without discernable trends)



Monitoring funding context

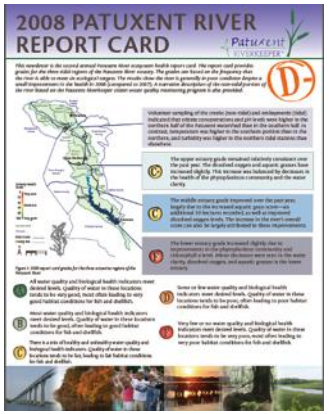
- Monitoring efforts have been curtailed over time (e.g., zooplankton, phytoplankton, sediment deposition, various rates, sediment regeneration)
- MRAT (Monitoring Realignment Action Team) intensively reviewed monitoring activities and ~$1 M was reduced from tidal to help get more non-tidal monitoring

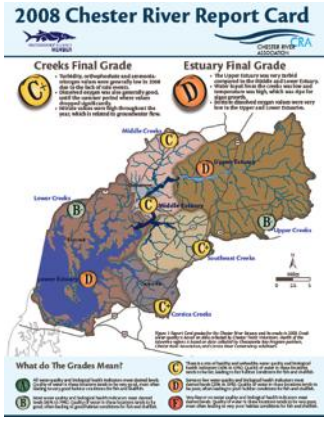
Effective monitoring requires significant resources

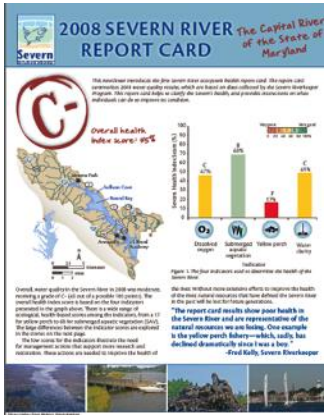
- Field work is expensive (people, equipment, vehicles, boats)
- Data analysis is time intensive (database development & maintenance, statistical analyses)
- Recurring costs are subject to inflationary pressures

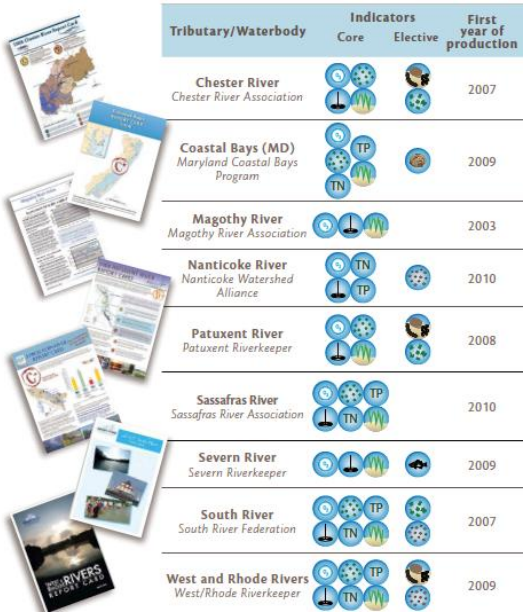
Citizen scientists conducting regional environmental monitoring

MTAC
Mid-Atlantic
Tributary
Assessment
Coalition









DRAFT - 1/25/2011

Indicator sampling and analysis protocol for use in tributary report cards

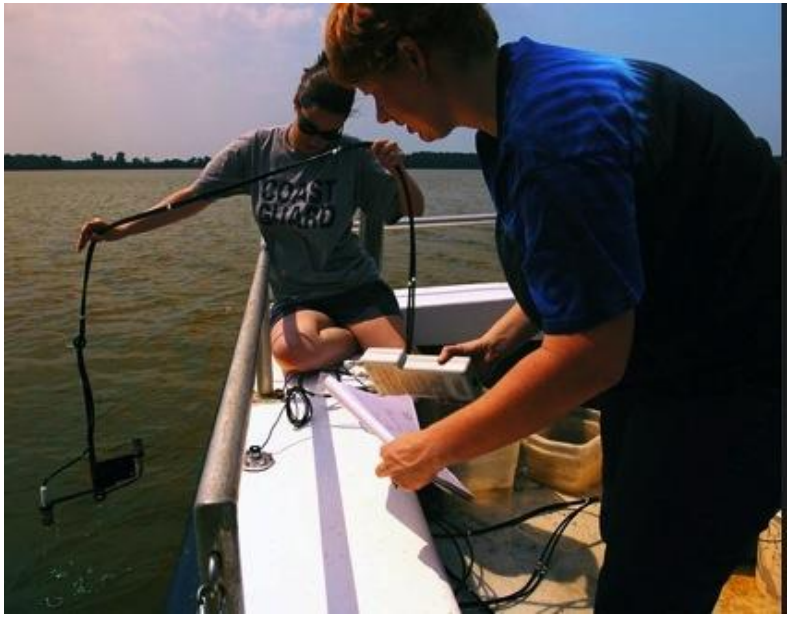
TN TP

2011

Editors: Caroline Wicks, Heath Kelsey, Melissa Andreychek, Sara Powell

Citizen science can augment but CANNOT replace institutional monitoring

- Coordination needed
- Training needed; personnel turnover issue
- Continuity essential
- QA/QC issues
- There are some difficult and dangerous locations where trained personnel are needed



Technology can augment but CANNOT replace in situ sampling

- Purchase price of technology can be prohibitive
- Technology requires calibration, maintenance, operational costs
- Some features (e.g., nutrient samples) need to be sampled on site
- We are already using technology to augment monitoring as much as possible

Local jurisdictions CANNOT contribute to funding shortfalls (for the short term)

- Cost sharing is already happening
- Internal funding restrictions reduce ability to reallocate implementation funds to monitoring
- Overall reduced budgets mean that local jurisdictions funds are already committed

Monitoring cuts = Loss of irreplaceable institutional knowledge

- Monitoring cutbacks on the order of $1 M will lead to a minimum of 10 lost jobs
- The highly specialized training (e.g., microscopic phytoplankton analysis, image analysis, nutrient sampling and analyses)0 very difficult to replace
- Production of high quality, timely and accurate data depends on qualified personnel

Workgroups have taken a responsible, careful and considered look at monitoring budgets

- Tidal Monitoring and Analysis Workgroup and Non-tidal Analysis Workgroups called special meetings to address funding issues
- Science & Technical Analysis & Reporting called a special meeting to consolidate input
- A multi-tiered funding option scheme proposed

Do not go gentle into that black abyss

Do not go gentle into that black abyss
Scientists should burn and rave at the budget cuts
Rage, rage against the data that they will miss

Though wise men everywhere know monitoring is right
Because it keeps them from thinking in ruts
Do not go gentle into that black night

Good men, the data trends right, noting how bright
Their insights gleaned for Chesapeake Bay
Rage, rage against the dying of the light.

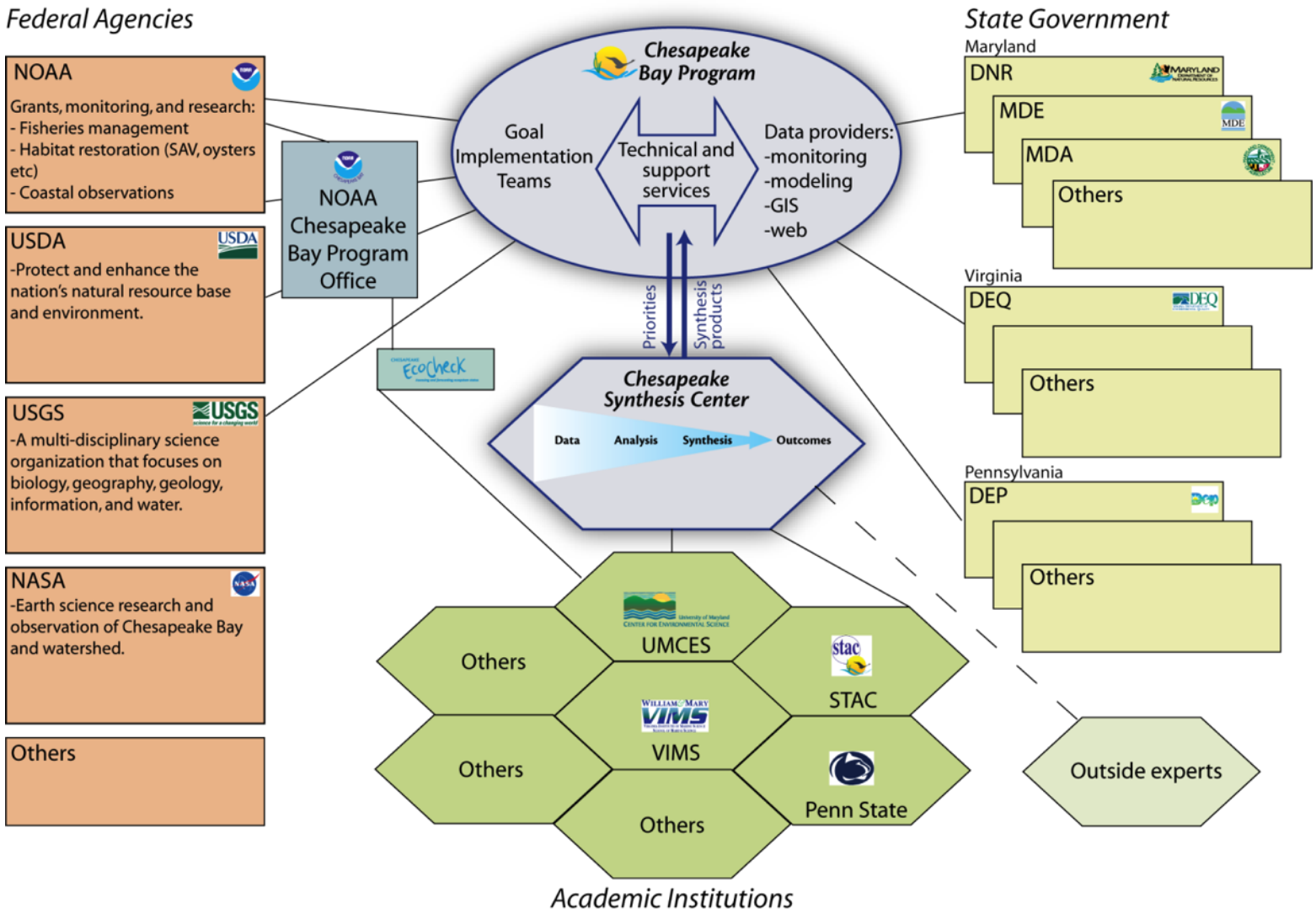
Do not go gentle into that black abyss

Watermen who caught oysters and crabs in the light
And learn, too late, they grieved it on its way,
Do not go gentle into that good night.

Chesapeake Bay, once near death, needs people with blinding sight
Blind eyes should blaze like meteors on their way
Rage, rage against the dying of the light.

And you, my EPA, there on the sad height,
Curse, bless, me now with your fierce support, I pray.
Do not go gentle into that good night.
Rage, rage against the dying of the light.

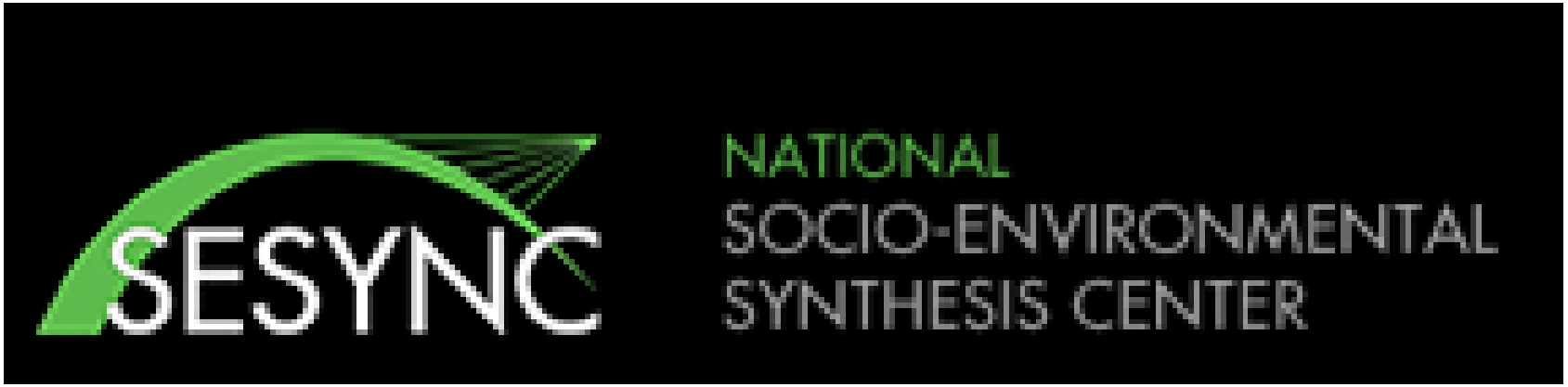
Unsuccessful proposal from MRAT: Chesapeake Synthesis Center



MRAT

Roadkill

SESYNC formed in 2011, NSF funded



The National Socio-Environmental Synthesis Center (SESYNC – sā-sink) funds the world's leading social and natural scientists to travel to our Annapolis facility and work intensively in transdisciplinary groups to advance fundamental research on socio-environmental problems. The formal mission of the Center is to foster synthetic, actionable scholarship related to the structure, functioning, and sustainability of socio-environmental systems.

Phased approach: Overview

- Phase I FY13 monitoring networks funding decision made by the Management Board August 2013.
- Introduce Phase II Monitoring Networks “BASIN” review process and schedule
- Maintain current operations of Chesapeake Bay/ Watershed Monitoring networks for another year
- Approval of a 14-month BASIN review process led by STAR with cooperation of STAC
  - to develop recommendations on sustaining the monitoring networks to meet CBP priorities through 2025

August 2013 Management Board Decision on the CBP Water Quality Monitoring Program Budget Reduction Options

Reduction Option 2		
	Tidal	Nontidal
Amount (Tot=$755,000) (Gap=$189,000)	$55,000	$700,000

Action	• Virginia ($27.5K) Maryland ($27.5K)
	  • Eliminate January cruise
	  • Eliminate nutrients from 2 summer cruises
	  • Eliminate planned benthic analysis
		• **14 station reduction***
		• MD-3, **PA-4**, VA-2, DC-2, NY-2, WV-1
		• 44% reduction in support for expanded monitoring.
		• Target Source Sectors affected
		  • Urban
		  • **Agriculture**
		* (The list of stations cut TBD by NTW)

Impact	• 2017 mid-point evaluation will not include a reevaluation of benthic IBI-derived reference curves for dissolved oxygen assessment • Loss of critical data linking winter production with summer oxygen conditions • Reduced ability to the strengthen the Bay water-quality model	• Loss long-term trend information at 5 locations with greater than 10 years of history. • Loss of trend and load assessment capabilities in key settings needed for TMDL and Mid-point assessment • Inability to strengthen WSM for targeted source sectors

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The August 2013 Management Board Decision accepted a $189,000 gap in monitoring support that still needed to be addressed

Funding Gap Filling Activities Following the Management Board Decision

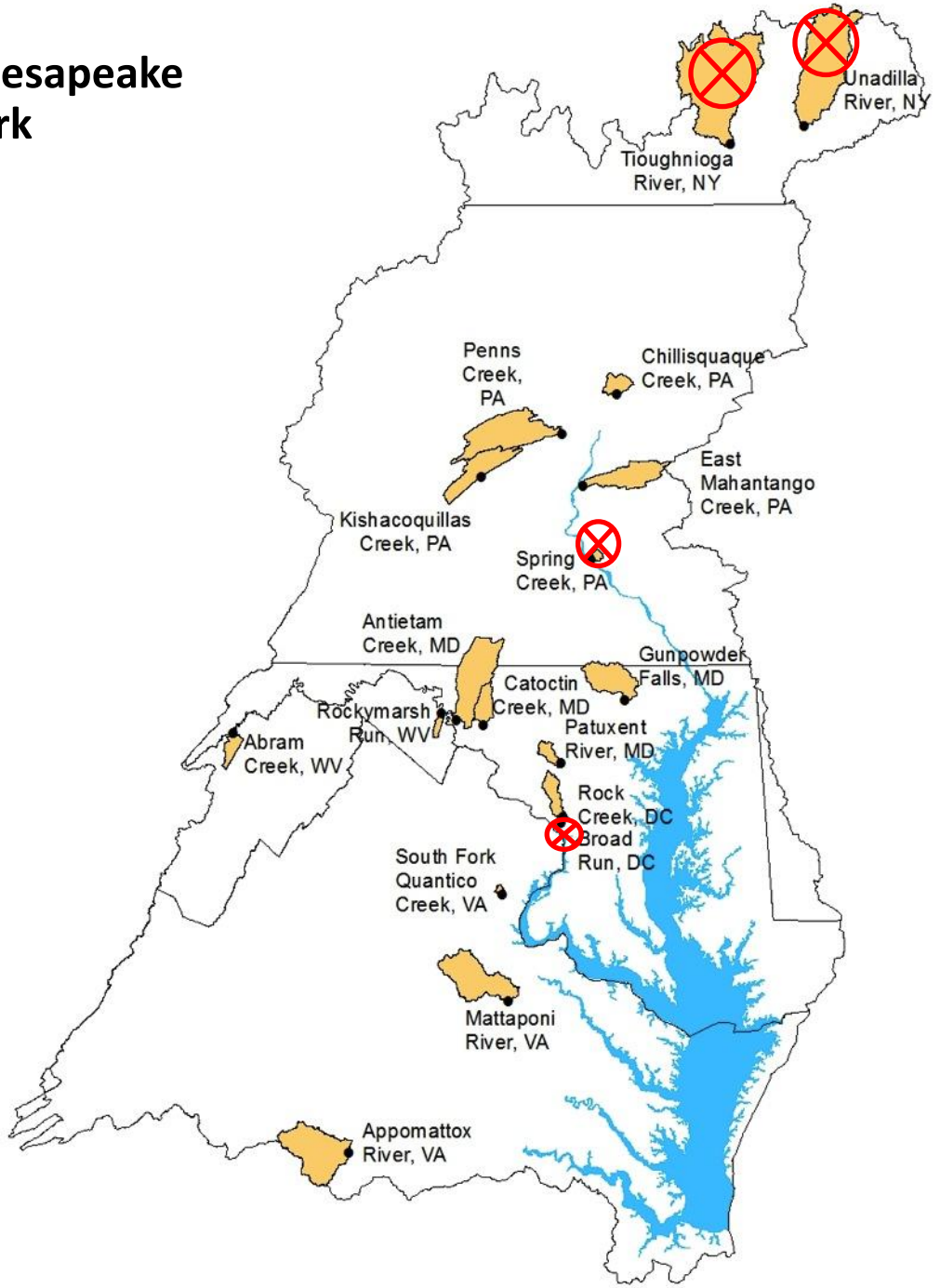
- The final list of potential non-tidal network site losses included 18 stations
- Additional funding from EPA ($300,000), USGS ($100,000), and state partners reduced network losses to 4 sites (for 2013); no storm monitoring at 20 sites in PA in the final quarter of FY13.
- Tidal monitoring cruise and sampling reductions remained the same as Management Board decided

Proposed Station Cuts to the Chesapeake Bay Nontidal Monitoring Network (Option 1-August 2013)

Possible Cuts By Jurisdiction

- Maryland-4
- Pennsylvania – 5
- Virginia 3
- District of Columbia- 2
- New York -2
- West Virginia- 2

⊗ **Update September 2013:**
4 Sites actually cut in FY13



Phase I Findings/Implications

- Through conducting the Phase I process, we identified financial/operation thresholds below which the networks can't be sustained

- The Partnership must evaluate alternative monitoring network business and operations models in order to sustain our shared networks in the coming decade – Phase II Review.

- The previously envisioned 6-month Phase II process is not workable given these findings

Phase II BASIN Process

1. Assessment of sustainable business models to support Chesapeake Bay and watershed monitoring programs over the next decade

2. Re-assess the primary products that the monitoring networks are expected to deliver to its customers

3. Optimization of the networks—re-designing the networks to meet funding realities and Partnership management needs over the next decade

Phase II BASIN Schedule

- **September-December 2013**: *Evaluation of Alternative, Sustainable Business Models for Bay and Watershed Monitoring Networks*
- **January-April 2014**: Re-assessing *Customer Expectations and Network Products*
- **February-July 2014:** *Optimizing Monitoring Strategies to Support CBP Priorities*
- **August-October 2014:** *Options Developed on Monitoring Network Design, Monitoring Network Operations, and Funding Support*
- **November 2014-February 2015:** Partnership *Decision-making and Integrating Findings into Monitoring Program Operations*.

Phase II BASIN Schedule

- **September-December 2013**: *Evaluation of Alternative, Sustainable Business Models for Bay and Watershed Monitoring Networks*
  - Three, 3-hour sessions, for 9 case-studies (e.g. Puget Sound, Upper Mississippi, San Francisco Bay, Gulf of Maine, Great Lakes, Moreton Bay Australia, Great Barrier Reef, Everglades, Boston Harbor)

September-December 2013: *Evaluation of Alternative, Sustainable Business Models for Bay and Watershed Monitoring Networks: Sessions to include*

- Brief statement of your monitoring network
- Explain your business model
- What new technologies have you incorporated?
- What institutional structure do you have to sustain your monitoring network (e.g. CBP-STAR, WGs and STAC)
- Describe the 3 biggest challenges you have faced and how you worked through them to sustain your network operations.

Phase II BASIN Schedule

- **January-April 2014**: Re-assessing *Customer Expectations and Network Products*
  - Working with the Communications Workgroup, re-evaluate monitoring and interpretive products required to assess progress and how this information is delivered to the Partnership
  - Potential reference: MARACOOS Needs Assessment

Phase II BASIN Schedule

- **February-July 2014:** *Optimizing Monitoring Strategies to Support CBP Priorities*
  - Review 'Lessons Learned' (Autumn 2013) and other new science reporting (e.g. Aaron J. Bever et al. 2013. Combining observations and numerical model results to improve estimates of hypoxic volume within the Chesapeake Bay, USA. JGR) that can influence the strategies we use to monitor, improve the accuracy of our estimates of Bay and watershed responses to management actions, and improving linkage assessments for factors affecting trends.

Phase II BASIN Schedule

- **August-October 2014:** *Options Developed on Monitoring Network Design, Monitoring Network Operations, and Funding Support*
  - Options to evolve the current water quality monitoring networks in the Bay and watershed toward their next generation designs to be implemented through 2025.

Phase II BASIN Schedule

- **November 2014-February 2015:** Partnership *Decision-making and Integrating Findings into Monitoring Program Operations*.
  - Implementation of decisions affecting any changes to the networks, their funding and operations, will go into FY15/16 grants/IAGs starting with April 1, 2015 grant applications through January 1, 2016.

Phase III: STAC led Monitoring Assessment

- Water quality analysis; stats, models
- Moving beyond water quality
- Monitoring and accountability to address the suite of new Chesapeake Bay Agreement Goals and Outcomes.