Tidal Trends Maps

Presentation to the

Integrated Trends Analysis Team

March 17, 2015

Rebecca Murphy (UMCES at CBP)

With input from:

Mike Lane (VA trends), Renee Karrh (MD trends), Howard Weinberg (maps), Jeni Keisman, and team

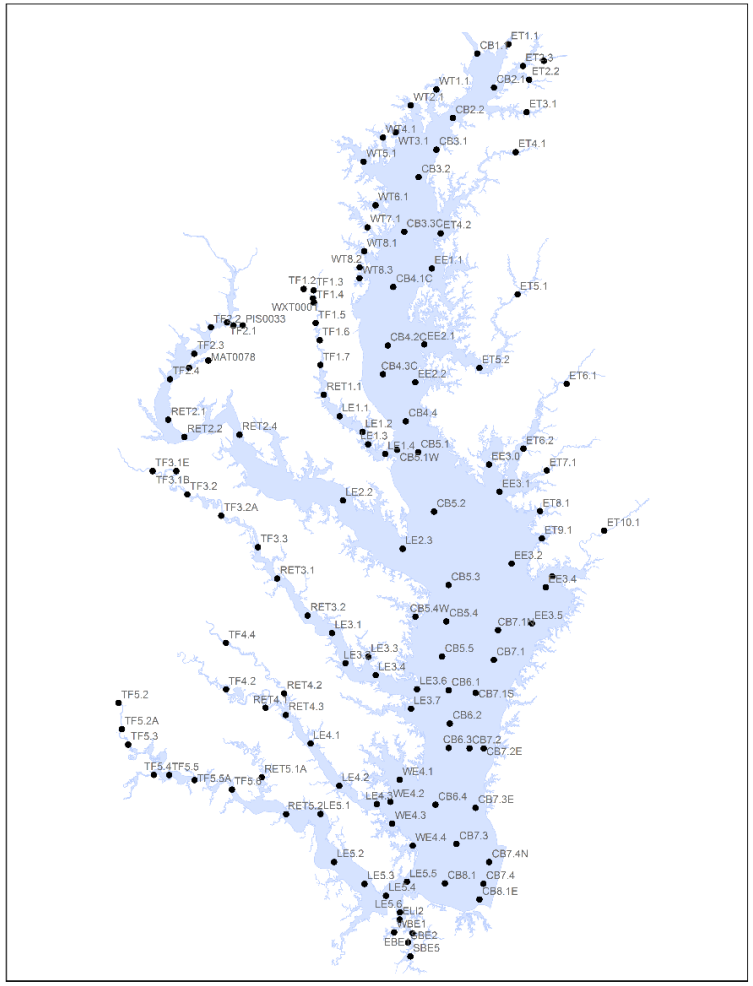
Chesapeake Bay Program

Science. Restoration. Partnership.

Tidal Trends Project Context

Through new analyses, collaborations, or identification of on-going research our goals are to:

- Identify trends in tidal water quality data collected since mid-1980s:
  - Nutrients
  - Chlorophyll-*a*
  - Dissolved oxygen
  - Water clarity
- Explain the trends with analysis of:
  - Watershed loads,
  - Estuarine processes, and
  - Climatic forces
- Link observed trends to:
  - Patterns in water quality criteria attainment
  - Management actions



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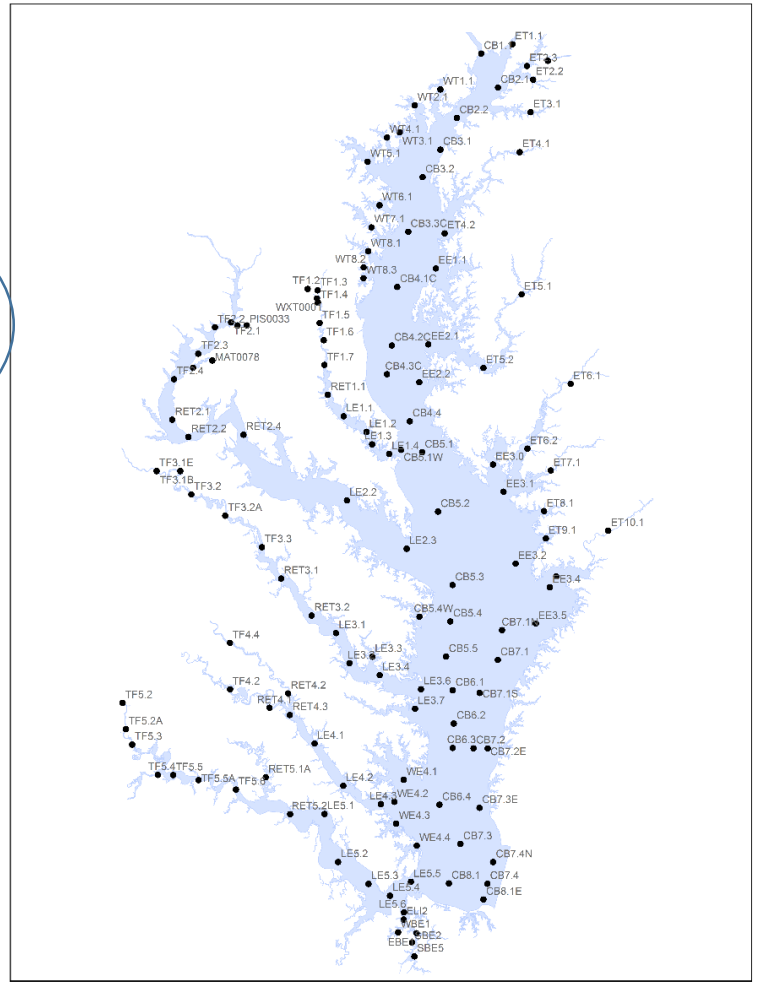
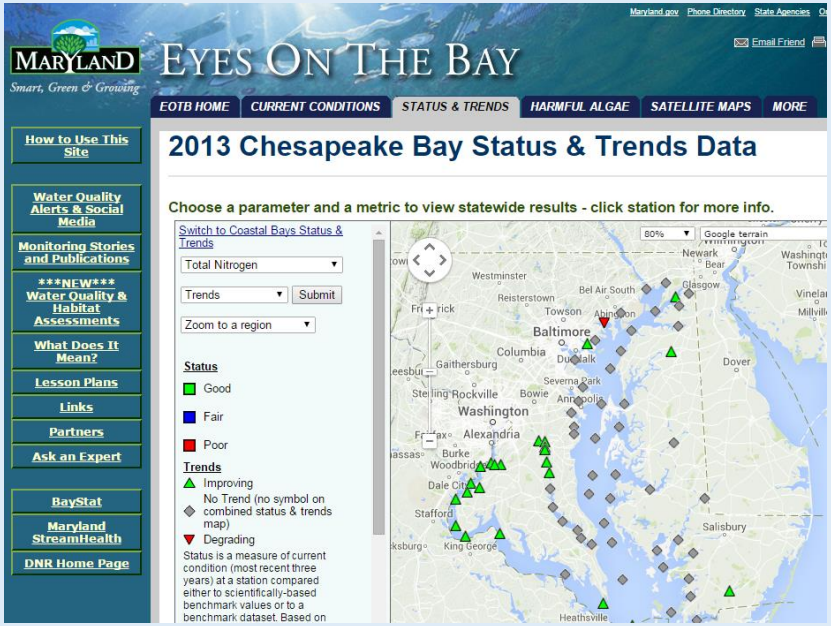


Seasonal-Kendall-Based Trends

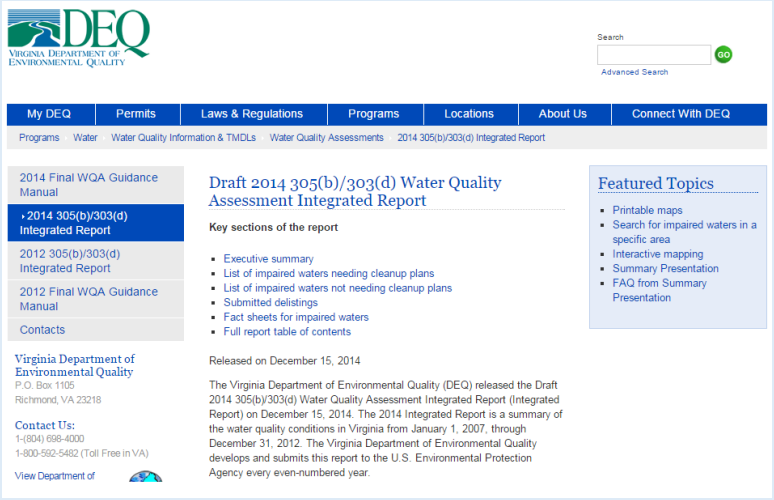
Computed by the states since the '90s:

- Maryland DNR
  - EOTB website and Tributary Water Quality and Habitat Assessments
  - Presentations to managers, politicians; press releases; assess habitat conditions for fisheries decisions and habitat characterizations; track progress in nutrient reduction strategies
- Virginia DEQ
  - Reports: Statewide 2014 Water Quality Assessment Report, Tributaries and Mainstem Trends report
  - Used in scientific studies

Teams involved in analyses/methods at the states: MDDNR and consultant: Renee Karrh, Mark Trice, Elgin Perry; VADEQ and Old Dominion: Mike Lane, Raghavendra Kurada, Arjun Poddar, and Monika Arora; PIs: Drs. Daniel Dauer, John Donat, Harold Marshall, Todd Egerton; Reviewers: Suzanne Doughten and Anthony Rodi



http://mddnr.chesapeakebay.net/eyesonthebay/statustrends.cfm



http://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/WaterQualityAssessments/2014305(b)303(d)IntegratedReport.aspx

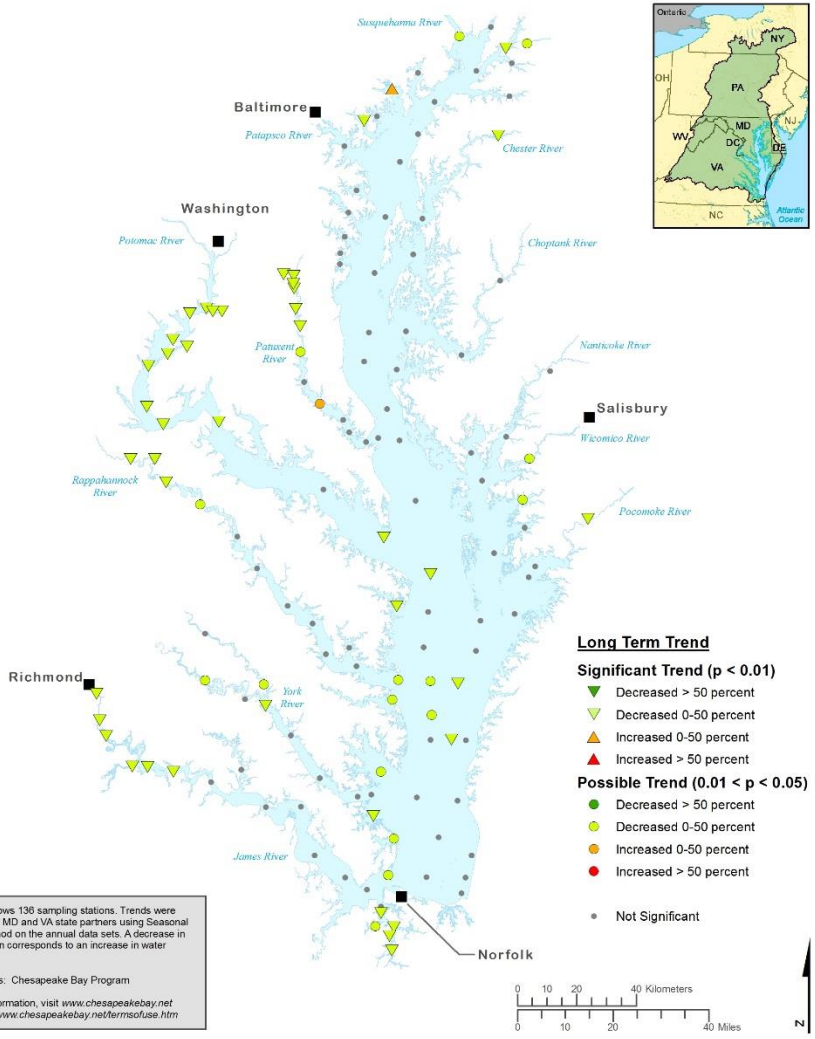
Combined VA and MD Seasonal Kendall Maps

- Analyses not new, but combining the state trends together has not been done recently
- Useful for seeing the big-picture and identifying local differences
- Learned about the Seasonal Kendall approach and improvements that could be made → *inform new technique (Generalized Additive Models, GAMs)*

- Map details:
  - Time-period: 1999-2013
  - Annual data
  - Parameters: TN, TP, Chlorophyll-*a*, Secchi Disk Depth

Long-Term Trends for Surface Total Nitrogen in the Chesapeake Bay: 1999-2013

Chesapeake Bay Program
A Watershed Partnership



This map shows 136 sampling stations. Trends were computed by MD and VA state partners using Seasonal Kendall method on the annual data sets. A decrease in Total Nitrogen corresponds to an increase in water quality.

Data Sources: Chesapeake Bay Program

For more information, visit *www.chesapeakebay.net*
Disclaimer: *www.chesapeakebay.net/termsofuse.htm*

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UTM Zone 18N, NAD 83

Long-Term Trends for Bottom Total Nitrogen in the Chesapeake Bay: 1999-2013

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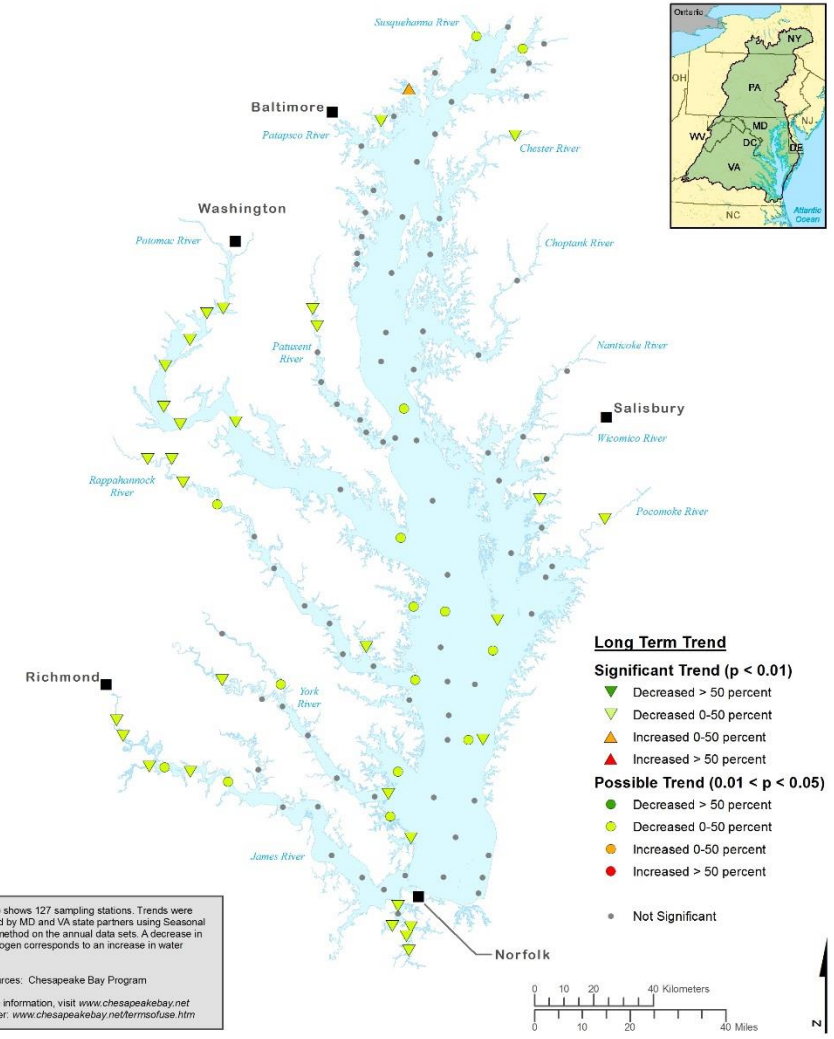

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Long-Term Trends for Surface Total Phosphorus in the Chesapeake Bay: 1999-2013

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Long Term Trend

Significant Trend (p < 0.01)
- Decreased > 50 percent
- Decreased 0-50 percent
- Increased 0-50 percent
- Increased > 50 percent

Possible Trend (0.01 < p < 0.05)
- Decreased > 50 percent
- Decreased 0-50 percent
- Increased 0-50 percent
- Increased > 50 percent

- Not Significant

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Long-Term Trends for Surface Chlorophyll-a in the Chesapeake Bay: 1999-2013

Chesapeake Bay Program
A Watershed Partnership

This map shows 136 sampling stations. Trends were computed by MD and VA state partners using Seasonal Kendall method on the annual data sets. A decrease in Chlorophyll-a (Chla) corresponds to an increase in water quality.

Data Sources: Chesapeake Bay Program

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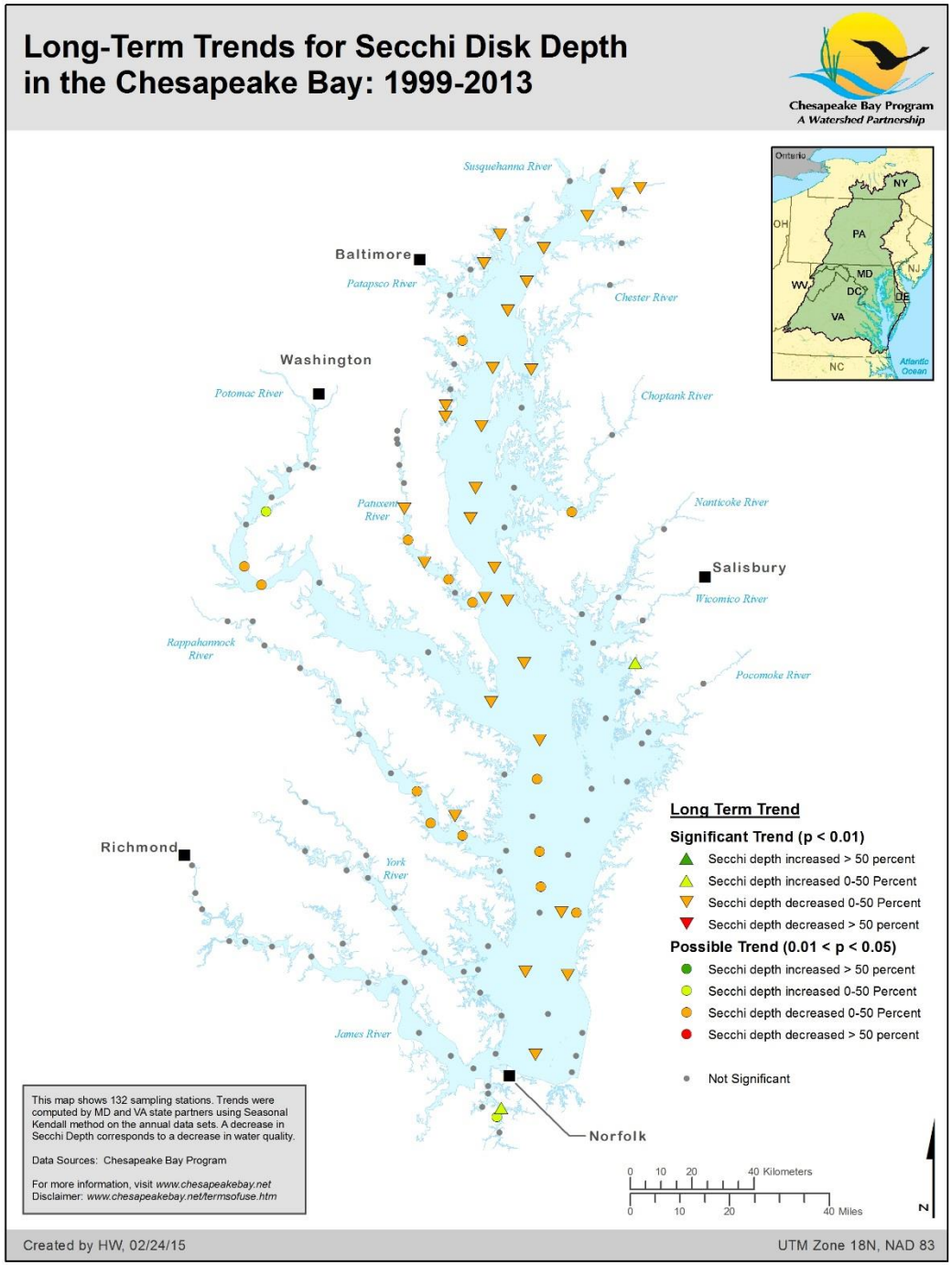
Long-Term Trends for Secchi Disk Depth in the Chesapeake Bay: 1999-2013
Chesapeake Bay Program
A Watershed Partnership
Susquehanna River
Baltimore
Patapsco River
Chester River
Washington
Potomac River
Choptank River
Patuxent River
Nanticoke River
Salisbury
Wicomico River
Rappahannock River
Pocomoke River
Richmond
York River
James River
Norfolk
Ontario
NY
OH
PA
MD
NJ
WV
DC
DE
VA
NC
Atlantic Ocean
Long Term Trend
Significant Trend (p < 0.01)
Secchi depth increased > 50 percent
Secchi depth increased 0-50 Percent
Secchi depth decreased 0-50 Percent
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Possible Trend (0.01 < p < 0.05)
Secchi depth increased > 50 percent
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Secchi depth decreased > 50 percent
Not Significant
This map shows 132 sampling stations. Trends were computed by MD and VA state partners using Seasonal Kendall method on the annual data sets. A decrease in Secchi Depth corresponds to a decrease in water quality.
Data Sources: Chesapeake Bay Program
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0 10 20 40 Kilometers
0 10 20 40 Miles
N
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UTM Zone 18N, NAD 83

Next steps/On-going efforts

Examining tidal trends

- Evaluating over-arching bay-wide patterns, focusing first on chlorophyll-*a* and nutrients
  - Seasonality/timing
  - Nutrient ratio changes
  - Inorganic, organic, particulate nutrient concentrations and fractions
  - Link to watershed loads
- Identify locations/tributaries with different patterns and target/identify further analyses

Parallel tidal efforts

- Identifying on-going synergistic research and what type of collaboration/ communication would benefit both efforts
- Actively developing a new trend approach (GAMs) to apply to these evaluations
- Examining trends in WQ criteria attainment

Questions?

Contact Info:

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rmurphy@chesapeakebay.net

410-267-9837

Maps available on CBP ITAT website, Projects and Resources:

http://www.chesapeakebay.net/groups/group/integrated_trends_analysis_team

Long-Term Trends for Surface Orthohosphate in the Chesapeake Bay: 1999-2013

Chesapeake Bay Program
A Watershed Partnership

This map shows 136 sampling stations. Trends were computed by MD and VA state partners using Seasonal Kendall method on the annual data sets. A decrease in Total Phosphorus corresponds to an increase in water quality.

Data Sources: Chesapeake Bay Program

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Long-Term Trends for Bottom Orthohosphate in the Chesapeake Bay: 1999-2013

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