Water Quality Results and Discussion

State of the Bays 2016
Andrew McGowan, Environmental Scientist, CIB
Introduction

• Review of water quality data from both DNREC’s General Assessment Monitoring Network, and the University of Delaware’s Citizen Monitoring Program

• Short term trends were assessed as changes in status since the previous State of the Bays Report (2011)

• Long term trends cover the full data set (>10 years) and were assessed via Mann Kendall test
Determining Status

For Nutrients, Algae, and Water Clarity:
• Data was subset to March through November
• Only years with at least 3 observations were preserved
• Only stations with at least one valid year from 2013 or later were preserved
• Median values were calculated for each year at each station
• Median of the yearly medians between 2011 and 2015 was the station’s status
Determining Status

For Dissolved Oxygen:
• Data was subset to June through mid-September between hours of 5 AM – 9 AM
• Status was the percent of samples below 4 mg/L

For Bacteria:
• Data was subset to June through September
• Each site needed at least 5 observations per year
• At least one valid year of data between 2011-2015
• Status was percent of samples exceeding safe swimming single sample limit of 104 cfu/100 mL
Determining Trend

For Nutrients, Algae, Water Clarity, and Dissolved Oxygen:
• Mann Kendall on each station’s yearly medians

For Bacteria:
• Mann Kendall on each station’s geometric mean bacteria concentration each year

For all parameters:
• Only stations with at least 10 years of valid data were assessed
Water Quality Standards

• Standards based on eelgrass growing conditions

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Criteria for Indicator Status</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Far Below Standard</td>
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<tr>
<td>Dissolved Inorganic Nitrogen (mg/L)</td>
<td>&gt;0.28</td>
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<tr>
<td>Dissolved Inorganic Phosphorus (mg/L)</td>
<td>&gt;0.020</td>
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<td>Chlorophyll a (µg/L)</td>
<td>&gt;30 to 100</td>
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<tr>
<td>Secchi Depth (feet)</td>
<td>&lt;1.3</td>
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</tbody>
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• U.S. Environmental Protection Agency Region III Chesapeake Bay Program and Office and Water Protection Division. 2003. Ambient water quality criteria for dissolved oxygen, water clarity, and chlorophyll a for the Chesapeake Bay and its tidal tributaries. EPA 903-R-03-002, Annapolis, MD.

DIN

STATUS:
• 52% of stations meet standard

CHANGES SINCE 2011 SoB:
• In 2011 35% of sites met standard
• Currently 50% of those same sites now meet standard

LONG TERM TRENDS:
• Four significantly improving stations near inlet
• One degrading station at Dirickson Creek
DIP

STATUS:
• 46% of stations meet standard

CHANGES SINCE 2011 SoB:
• In 2011 33% of sites met standard
• Currently 48% of those same sites now meet standard

LONG TERM TRENDS:
• Six significantly improving stations
• Two degrading stations
**CHLOROPHYLL A**

**STATUS:**
- 73% of stations meet standard

**CHANGES SINCE 2011 SoB:**
- In 2011 53% of sites met standard
- Currently 72% of those same sites now meet standard

**LONG TERM TRENDS:**
- Eight significantly improving stations spread throughout watershed
- One degrading station
**WATER CLARITY**

**STATUS:**
- 55% of stations meet standard

**CHANGES SINCE 2011 SoB:**
- In 2011 48% of sites met standard
- Currently 52% of those same sites now meet standard

**LONG TERM TRENDS:**
- Six significantly improving stations, five of which are in Little Assawoman Bay
- Six degrading stations including 3 in open water near inlet
WQI

STATUS:
• 41% of stations meet standard

CHANGES SINCE 2011 SoB:
• One fewer site now meets standards than in 2011

LONG TERM TRENDS:
• Two significantly improving stations both in Little Assawoman Bay
• One degrading station also in Little Assawoman Bay
DISSOLVED OXYGEN

STATUS:
• 44% of stations meet standard

CHANGES SINCE 2011 SoB:
• Three fewer sites now meet standard compared to 2011

LONG TERM TRENDS:
• Trends are highly localized, with neighboring stations showing opposite patterns
ENTEROCOCCUS BACTERIA

STATUS:
- 34% of stations meet standard

CHANGES SINCE 2011 SoB:
- Fecal bacteria concentrations have remained mostly the same
- Tributaries largely exceed threshold
- Open water largely meets threshold

LONG TERM TRENDS:
- 1 significantly increasing site located at the mouth of Love Creek
Conclusions

- Nutrient concentrations have improved both over the short term (since last report) and over long term with a number of sites showing significant improvements.
- Algae has shown decline both short term and long term.
- Clarity has seen no discernable improvement.
- WQI remains poor.
- Dissolved Oxygen has seen no discernable improvement and remains very variable.
- Bacteria levels are still high in tributaries and canals.
Discussion Questions
Why have Clarity levels remained the same while large improvements in Algae have been seen?
Why is Little Assawoman Bay changing the most?

- Conversion from agriculture to developed?
- Greater water to land area ratio?
- Better nutrient management?

Chlorophyll a

DIN

DIP

Water Clarity

WQI

Dissolved Oxygen
Data recommendations to better explain changes in water quality

• How can we get better and more readily accessible, geospatial information about BMP’s, septic conversion, storm water retrofits, cover crops, and manure relocation?
  - GIS portal?
  - Watershed level if parcel level is unavailable

• A need for an additional inlet flushing data point to help explain changes seen immediately surrounding the inlet
Acknowledgements

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• Thanks to Scott Andres, Ed Whereat, Robin Tyler, Michael Bott, Rick Greene, Ed Hale, Dave Wolanski, and Jenn Volk for their comments and help with the analyses