Science to Support Adaptive Management in the Chesapeake Bay Program:
Approaches and Challenges

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On behalf of many others
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Decision Framework

- **Goals**
  - Populations/habitat

- **Factors**
  - Ecosystem stresses

- **Management strategies**
  - Models

- **Monitor**
  - Indicators

- **Assess**
  - Status and trends
  - Explain change

- **Adapt**
  - Implications
Water Quality and TMDL

- Declining fisheries
- Poor DO
- Loss of SAV
- TMDL
  - WQ standards
  - Nutrients and sediment
    - Actions by 2025
    - WIPs: States and federal agencies
- Decision framework
In July 2004, 35 percent of the volume of the Chesapeake Bay was considered a Dead Zone.
Goals: Fisheries Habitats

- Designated uses
- DO, Clarity
- Nutrients and sediment allocations
- Model scenarios

Source: EPA, 2009
Models: setting allocations

Reduce/Readjust Loads to Meet Standards

INPUTS
- BMP Data
- LU Data
- Point Sources Data
- Septic Data
- U.S. Census Data
- Agricultural Census Data

MODEL-DERIVED
- Airshed Model
- Land Use Change Model
- Precipitation Data
- Meteorological Data
- Elevation Data
- Soil Data

SCENARIO BUILDER

WATERSHED MODEL

CHESAPEAKE BAY MODEL

MEET WQS?
- NO
- YES

Source: EPA, CBP
Factors affecting goal

- Population growth and land use
- Climate change & variability
- System Response
- Costs
- Uncertainty
Management Strategies

- Allocations for each state
- Watershed Implementation Plans
- Programs and practices
- 2-year milestones
- MPA

Source: EPA, CBP
Monitoring to assess progress

- Practices
- Watershed
  - Nutrients and sediment
- Tidal waters
  - DO, Clarity, and Chl
  - Nutrients
- Flow adjustment

Source: USGS, 2016
WRTDS Load and Trend

Total reduction nitrogen:
1985 to 2014 = -25%
2005 to 2014 = -18%
Nitrogen River Yields

- Range: 1.2 to 33 lbs/acre
- Avg: 7.5 lbs/ac

Influenced by:
- Agriculture
- Urban lands
- WWTP
- Atmospheric dep.
- Practices

Source: USGS, 2016
Nitrogen Change (2005-2014)

- Trends
  - Improving: 54%
  - Degrading: 27%
  - No Trend: 19%

- Vary by watershed

- Practices and pressures

Source: USGS, 2016
Rivers entering the Bay

Source: USGS, 2016
Changes in tidal waters

Water Quality Standards Attainment

Fraction of Bay Attaining (Area-Weighted)

3-Year Period

Source: EPA, CBP
Assess and Explain

- Practices to water quality
- Sources and land use
- Management practices
- Climate
- Response times
- Case studies
Explaining Trends

1. What Works
   - Upgrades to WWTPs
   - Reductions in air emissions
   - Some agricultural practices

2. Challenges
   - Response times
   - Development and intensified agriculture

3. What We Need
   - Targeting
   - Stormwater management and monitoring

UMCES, USGS, EPA (2014)
Adapt for Water Quality

- Implement WIPs
- 2-year milestones
- Midpoint Assessment
  - Enhance models
  - Assess allocations
  - Revise WIPs
- 2025: practices in place
- Meeting standards
Meeting Expanding Needs

• Bay Agreement
  – 10 goals
  – 31 outcomes

• Expanding Needs
  – Supporting AM

• Challenges
  – Beyond water quality
  – Prioritizing
  – Changing monitoring
  – Expanding capacity

• Approaches to address
CHESAPEAKE SCIENCE SUPPORT

GOAL IMPLEMENTATION TEAMS: SCIENCE NEEDS

- FISHERIES
- HABITAT
- WATER QUALITY
- HEALTHY WATERSHEDS
- STEWARDSHIP
- LEADERSHIP

STAC: Science Advisors
- GUIDANCE
- REVIEW
- ADVICE ON PROVIDERS

STAR: Science Coordination
- MONITORING
- DATA INTEGRITY
- STATUS AND TRENDS
- EXPLAIN AND PREDICT CHANGE

Science Providers
- CBP OFFICE
- FEDERAL
- STATE
- LOCAL
- ACADEMIC
- NGOs
Expanding capacity

Short-term:
- Workshops on:
  - Aligning resources
  - Expanding monitoring needs
- Set priorities
- Better integrate ongoing efforts
- Modify existing monitoring

Longer-term:
- Multi-outcome approaches
- Collaborate with new partners
- Incentives and funding to build science capacity
Summary

• Adaptive management
  • Selected successes
  • Difficult for entire CBP
  • Multiple goals, outcomes

• Science support
  • Selected strengths
  • Increased needs
  • Integrate existing efforts
  • Expand capacity through new partners and incentives

• Sessions 35 & 38