Chesapeake Bay Restoration Effort



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A Shallow Bay with a Large Watershed



The Chesapeake Bay is the Economic Engine of the Region



INVESTMENT: \$1 of water and sewer infrastructure investment increases private output (Gross Domestic Product) in the long term by \$6.35.



FISHERIES: Commercial seafood industry in Maryland and Virginia contributed \$3.39 billion in sales, \$890 million in income, and almost 34,000 jobs to the local economy. (2009 Fisheries Economics of the U.S. report)



PROPERTY VALUES: An EPA study indicated that clean water can increase the value of single family homes up to 4,000 feet from the shoreline by up to 25 percent.

Source: Chesapeake Bay Foundation, 2012 "The Economic Argument for Cleaning Up the Chesapeake Bay and its Rivers

Chesapeake Bay Challenges

- water quality impaired by pollution
 - Extensive low to no summer dissolved oxygen conditions
- historic overfishing
- population growth
- poor land use management
- loss of habitat
- invasive species
- climate change and sea level rise



Big Challenge: Nutrient Over-enrichment Causes fundamental, pervasive alteration of the ecosystem



Nutrients come from all sectors



Key Habitats Declined

Oysters are at 0.3% of historic populations

Decline caused by overfishing and disease

- Oyster reefs are important
- Economic potential
- filtration of water
- Only natural hard substrate
- Increase biodiversity



- Sanctuaries and targeted restoration programs
- Stable (but small) population is increasing

Key Habitats Declined

- Seagrass beds have declined 8-10 fold
- Decline caused by eutrophication and warming temperatures

Seagrass beds are important

- Fishery nursery grounds
- Reduce resuspension
- Increase water clarity
- Act as nutrient filter
- Limit shoreline erosion



- Currently rebounding in some areas

Chesapeake Bay Management: 25 Years

Ches Bay Agreement: 1987-2000 • Reduce nutrients by 40% from all controllable sources by 2000

• Focus on *modeling* and monitoring

Accountability Phase: 2003-2008 •Focus on *monitoring* and modeling • Cost and nutrient reduction effectiveness assessments











Governments Work Together: 1983 -1987 • Md, Pa, Va, DC, and USEPA • Recognize degradation

of Bay after Tropical Storm Agnes (1972) Chesapeake 2000: • 1987 nutrient goals remain unmet •Begin Enforcement of TMDL in 2010 • Establish over 100

new goals – many unrelated to nutrients Adaptive Management 2009 – Future

2 Year Goals to hold politicians accountable
Enforce TMDL
beginning in 2011
Target problem areas & focus on Bay response

Sources of N and P to the Bay are Diverse



Geography Matters Delivered loads of Nitrogen and Phosphorous



Based on the SPARROW model, U.S. Geological Survey . 2011. Scientific Investigations Report 2011-5167.

Watershed Population Continues to Increase



Each Person is Using More Developed Land



Applying Adaptive Management Principles



Academia's Role in Bay Restoration

- Formal Role: Science and Technical Advisory Committee of the Chesapeake Bay Program
- Focus on the Big Challenges
- Apply adaptive management principles
 - Analyze and assess Bay health
 - Identify new problems and challenges
 - Provide advice to the management community
- Remain engaged with restoration programs for the long-term
- Provide advice to emerging challenges in a timely manner

Provide Scientific Leadership to Emerging Challenges

Organize scientific panels to provide consensus on causes and solutions

Engage the management community in the deliberations

Provide reports in a public friendly manner to communicate the problems and solutions to a broad audience



Harmful Algal Blooms



Sea Level Rise

Introduced Species

Conowingo Dam

Adaptive Management: Monitor and Measure Bay Health

- Track changes over time to determine responsive to management actions
- Develop metrics that addresses both the habitat and biological response
- Communicate results to a broad audience
- Improve scientific understanding and impact of management actions



Virginia Estuarine and Coastal Observing System (VECOS) Susquehanna River Basin Commission Remote Water Quality Monitoring Network Delaware Natural Resources and Environmental Control Water Quality Monitoring Network Data Portal

Current Health



UMCES bases the Bay Health Index on 7 indicators

- These indicators include:
 - Water Clarity
 - Dissolved Oxygen
 - Nitrogen Concentrations
 - Phosphorus Concentrations
 - Aquatic Grasses
 - Phytoplankton Community
 - Chlorophyll a

Analyzing and Integrating Monitoring Data

Bay Health Index 2013

Upper Bay Overall Jpper Eastern Upper Western Bay Shore Shore Patapsco and D Back Rivers Lower Western Shore (MD) Mid Bay D* Choptank River Potomac River D C-Patuxent River Lower Eastern C-Shore (Tangier) Rappahannock River D York River James River Lower B-Bav Miles 10 20 Very poor Very good 0 20 40 60 80 100% D C B A Elizabeth CENTER FOR ENVIRONMENTAL SCIENCE River Insufficient data

Improve Understanding

A sequence of events contributed to 2012 health

Tropical Storm Lee Rain from Tropical Storm Lee (September 7) brought tons of sediment and fresh water to the Upper Bay. Spring Rains High flow in the spring was caused by large imputs of fresh water S. This resuspended sediments , which decreased dissolved oxygen , and affected aquatic grasses .

Summer Drought 🌿

The hot summer led to increases in dissolved oxygen and improved water clarity due to low flow from lack of rainfall. Aquatic grasses WW slightly declined.

Hurricane Sandy 🍠

While Hurricane Sandy (October 22–31) did not bring as much sediment to the Bay as Tropical Storm Lee, its affects will not be seen until the 2013 Report Card.



A Warmer Chesapeake Bay



Global Warming

and the Free State

REPORT OF THE SCIENTIFIC AND TECHNICAL WORKING GRO MARYLAND COMMISSION ON CLIMATE CHANGE

Juvenile Thermal Habitat Historic Upper Extents of Eelgrass boreal-temperate species temperate-subtropical species in the Chesapeake Bay KENT ISLAND - 1960s ΡΟΤΟΜΑC RIVER СНОРТАНК RIVER present TANGIER RAPPAHANNOCK SOUND RIVER YORK RIVER La v RIVER

Sea-level Rise Will Redraw Maps

Mean sea level in Baltimore, 1903-2006





Global Warming in the Free State

More Challenging Coastal Restoration

Squeeze Zone for Striped Bass



Solutions to Restore the Bay be Diverse

- Critical Areas Law (1984) protection of shorelines (revised in 2008)
- Phosphate Laundry Detergent Ban (1988) reduced phosphorous loads
- Water Quality Improvement Act (1998)– nutrient management on farms
- Bay Restoration Fund (2005) primarily for waste water treatment plant upgrades, also funds cover crops and septic upgrades
- Water Resources Element of Comprehensive Plans (2006) ensure water and sewer capacity available for growth
- Chesapeake Bay 2010 Trust Fund (2008) reduce non-point sources of pollution



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