Scientific and Technical Advisory Committee

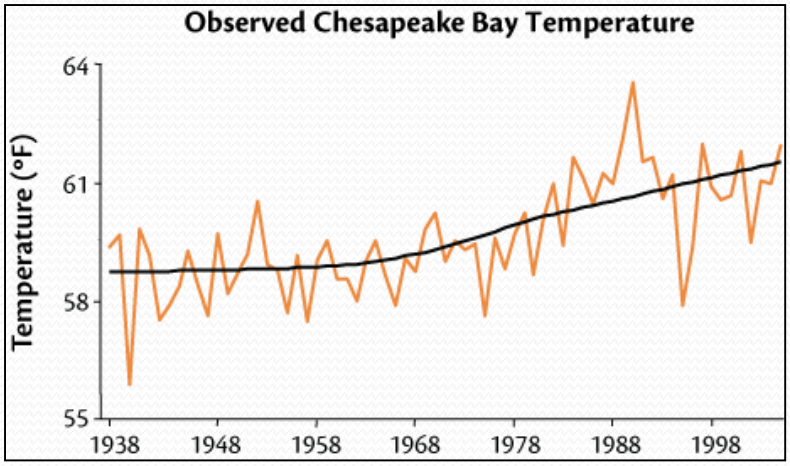
Climate Change Update

September 8, 2015

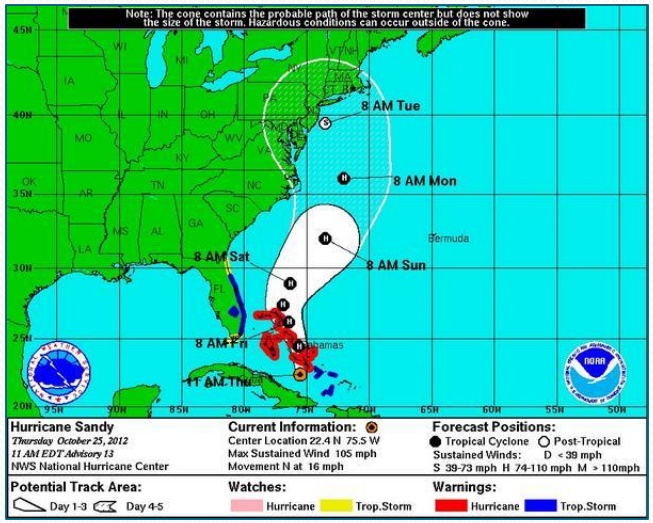
Chesapeake Bay Program
Science. Restoration. Partnership.

Climate Change: Real Consequences

Sea level has risen approximately one-foot in the last century.



Chesapeake Bay has warmed by more than 2°F.

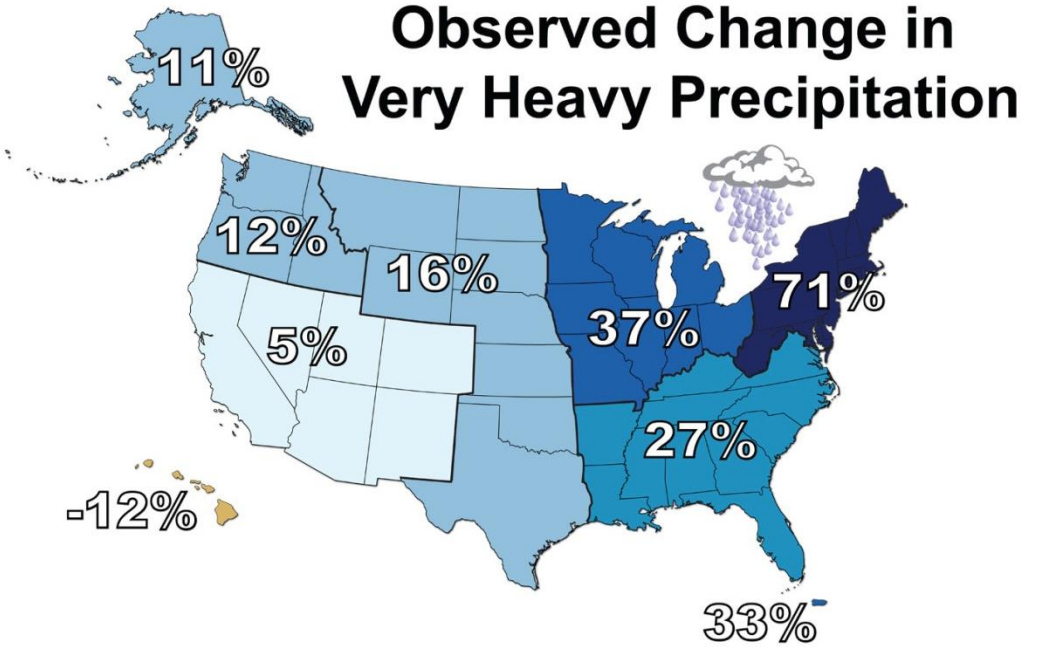


Extreme Events, such as Hurricane Sandy in 2012, foreshadow the Watersheds vulnerability to climate change impacts.

Source: www.umces.edu/climateimpacts/

Consequence: Increased Precipitation & Extreme Rainfall Events

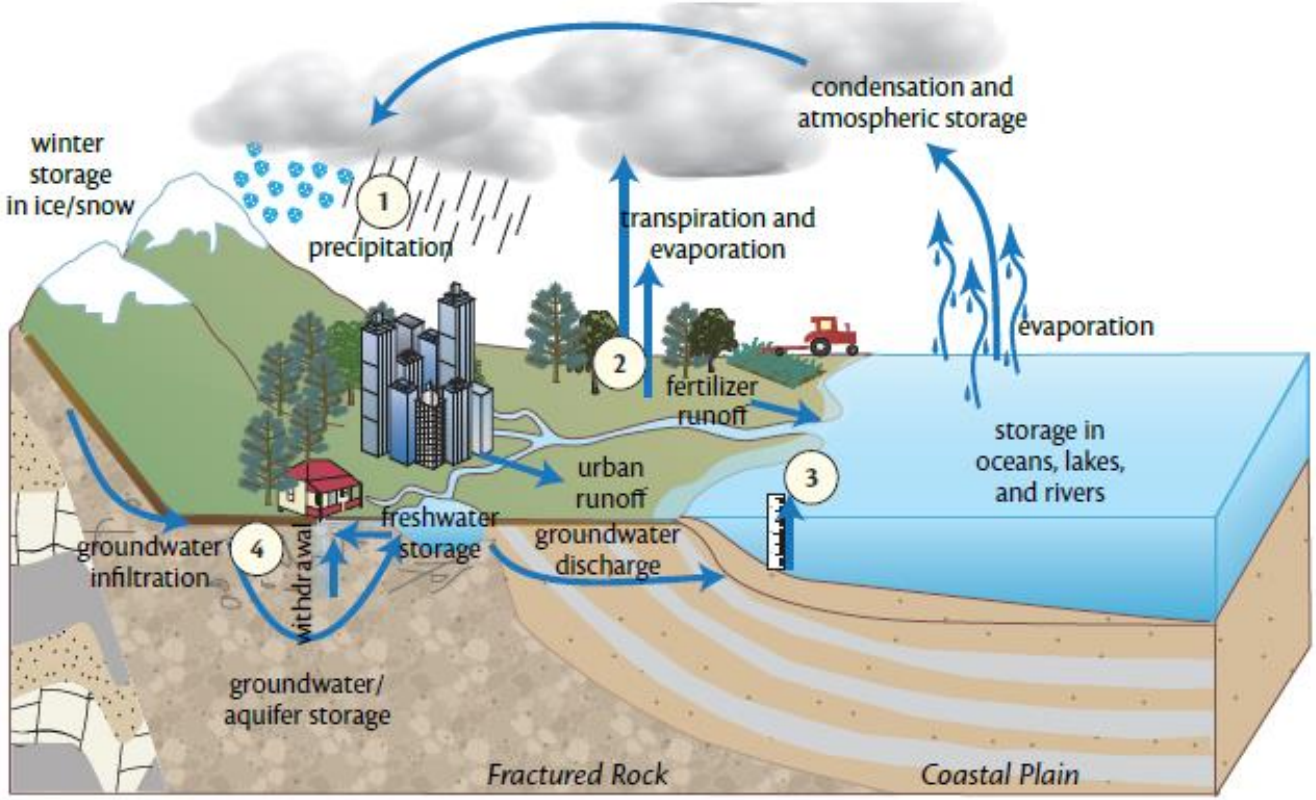
There is a clear national trend toward a greater amount of precipitation being concentrated in very heavy events, particularly in the Northeast and Midwest.



Percent changes in the amount of precipitation falling in very heavy events (the heaviest 1%) from 1958 to 2012 for each region.

Source: National Climate Assessment (2014)

Consequences - Changes to Water Supply

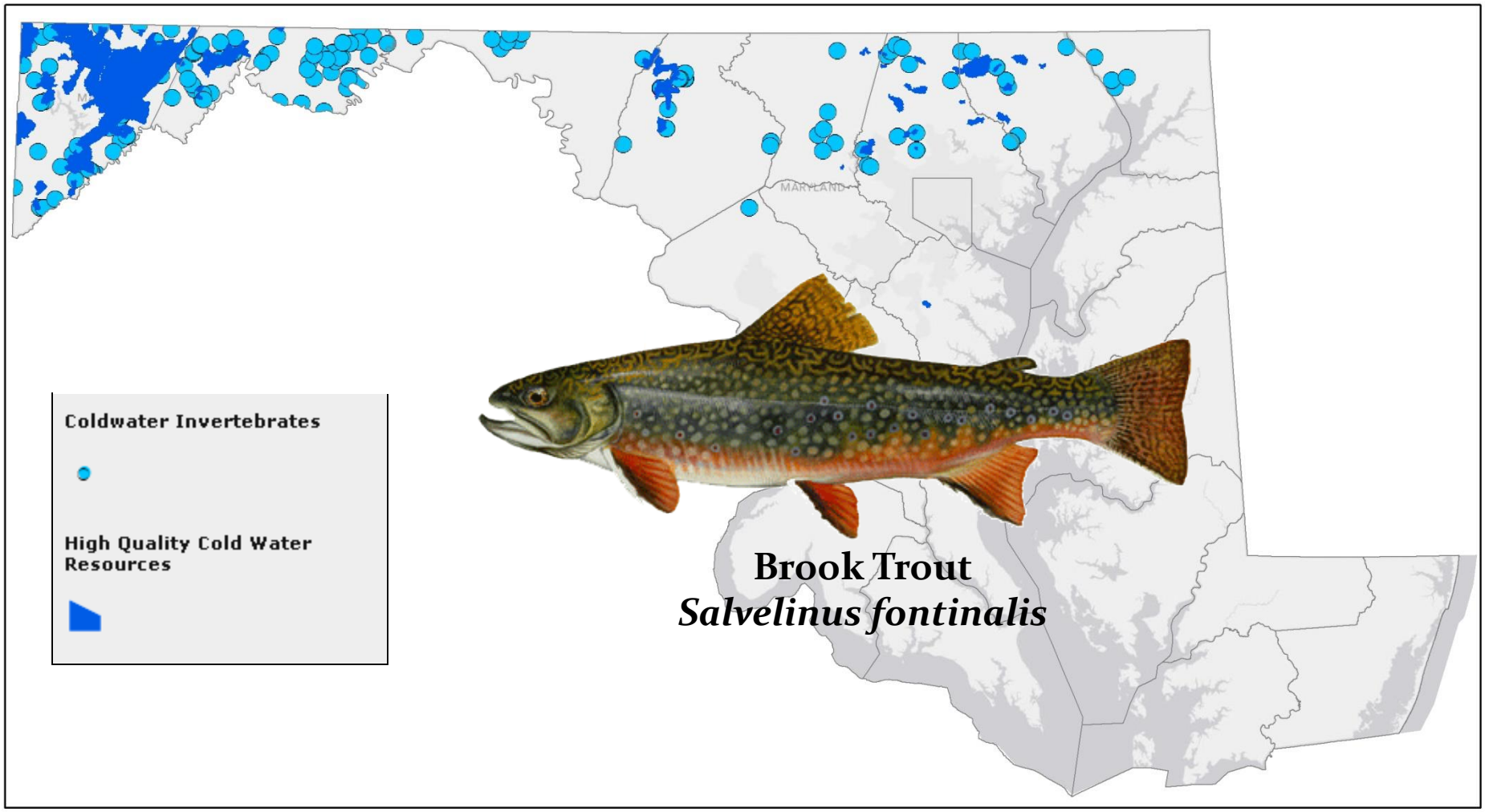


Climate change impacts

1. Increased frequency and variability of extreme rain may lead to flooding, surface runoff, and high energy flows, impacting water quality, stormwater infrastructure, and water and wastewater treatment infrastructure.
2. Increased likelihood of summer drought may affect stream ecosystems, lead to increased demand for irrigation, and result in water shortages.
3. Saline intrusion of freshwater resources may occur as a result of the combined effects of sea level rise and storm surge, and as a result of increased rates of groundwater withdrawal.
4. Increased withdrawal due to drought may reduce groundwater supplies.

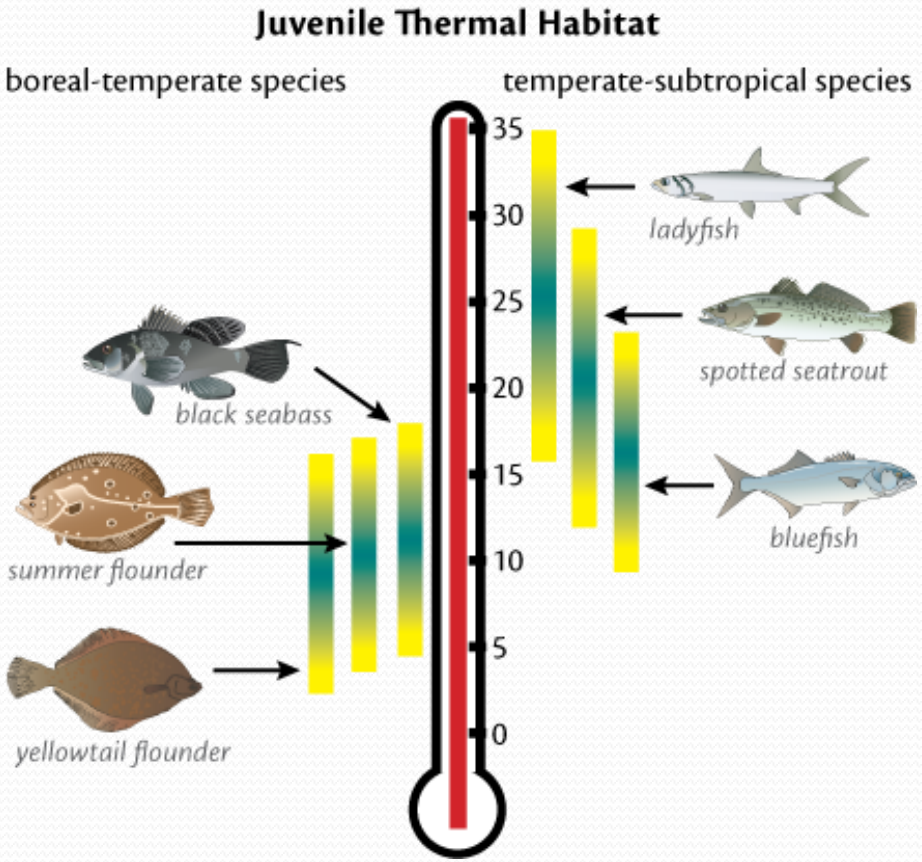
Source: www.umces.edu/climateimpacts/

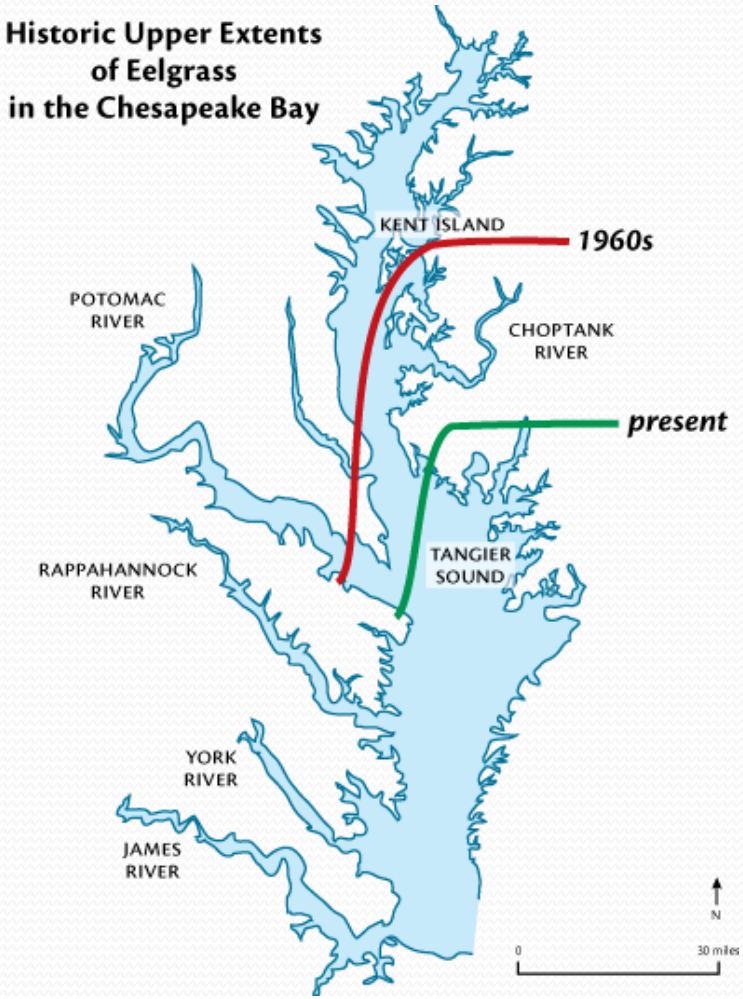
Consequences – Impacts to High Quality Cold Water Resource Areas



Source: Maryland Dept. of Natural Resources

Consequences - Impacts to Bay & Aquatic Resources





Source: www.umces.edu/climateimpacts/

Consequences – Loss of Vital Habitats

Photo Credit: Zoe Johnson

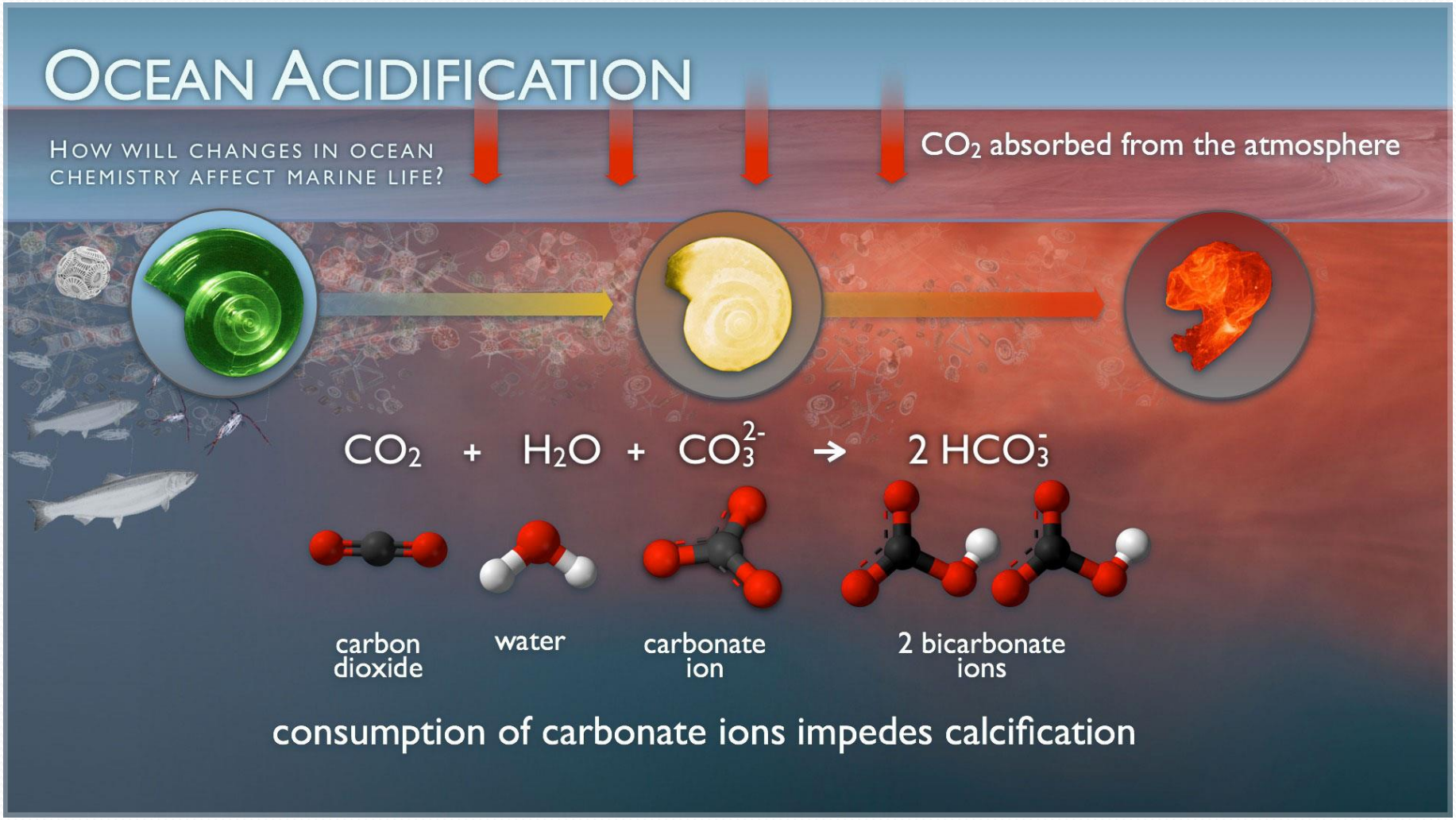
Consequences – Increased shoreline erosion

Photo Credit: Zoe Johnson

Consequences – Coastal Community Impacts

Photo Credit: UMCES, IAN

Consequences – Bay Acidification



Key Partnership Climate Change-Related Commitments and Recommendations

- *2008 STAC Report "Climate Change and the Chesapeake Bay: State-of-the-Science Review and Recommendations"*
- *2009 Presidential Executive Order 13508*
- *2010 Chesapeake Bay TMDL*
- *2011 Adapting to Climate Change in the Chesapeake Bay: STAC Workshop Report*
- *2010 Executive Order 13058: Strategy for Protecting and Restoring the Chesapeake Bay Watershed*
- *2014 Chesapeake Bay Watershed Agreement*

2010 Chesapeake Bay TMDL

"To carry out a more complete analysis of climate change effects, changes will be needed to the current suite of Bay models and tools including:

- **Applying the results from the next generation of global climate change models** to develop the best available estimates of the effects of climate change on the mid-Atlantic region
- Developing a better means for **down-scaling the results from the applicable global climate change models** to match the finer segmentation of the Phase 5.3 Chesapeake Bay Watershed Model
- Developing the means to better understand and fully simulate the **interactions between increased evapotranspiration and high intensity precipitation events** within the Chesapeake Bay Watershed Model
- Building the capacity to **simulate the effects of change in tidal water column temperatures** on all the existing temperature dependent rates and processes currently simulated with the hydrodynamic, estuarine water quality, sediment transport, living resources and filter feeder component models of the Chesapeake Bay Water Quality and Sediment Transport Model
- Reevaluate the **temperature dependent effects on key species and communities** (e.g., eelgrass) to ensure the latest scientific understanding has been factored into the suite of Bay models."

2014 Chesapeake Bay Agreement

CLIMATE RESILIENCY

GOAL: Increase the resiliency of the Chesapeake Bay watershed, including its living resources, habitats, public infrastructure and communities, to withstand adverse impacts from changing environmental and climate conditions.

- **Monitoring and Assessment Outcome:** Continually monitor and assess the trends and likely impacts of changing climatic and sea level conditions on the Chesapeake Bay ecosystem, including the effectiveness of restoration and protection policies, programs and projects.

- **Adaptation Outcome:** Continually pursue, design and construct restoration and protection projects to enhance the resiliency of Bay and aquatic ecosystems from the impacts of coastal erosion, coastal flooding, more intense and more frequent storms and sea level rise.

Participation in Management Strategy – Signatory Representatives

Outcome	Participating Jurisdictions /CBC	Participating Agencies
Climate Resiliency Goal		
Monitoring and Assessment Outcome	MD, DC, DE, PA, VA, CBC	**DOI** (USGS/FWS), NOAA, EPA, NPS, USACE
Adaptation	MD, DC, DE, PA, VA, NY, CBC	**USACE**, **NOAA**, **FWS**, EPA, DOT, DOI (FWS/NPS/USGS)

10+ Self-Identified Stakeholders

Climate Resiliency

Management Strategy

CURRENT EFFORTS

Scientific Assessments

- Peer-reviewed papers and agency reports related to climate change monitoring and assessment
- Numerous research institutions have active and ongoing research on climate science, including projections for the Chesapeake Bay
- A growing toolbox of climate change vulnerability assessments

Adaptation and Research Planning

- F*ederal partners* are taking action to build capacity in climate science and to develop tools to assist in planning
- *State partners* have developed standalone climate change adaptation plans or a sustainability plan incorporating climate change
- *Local governments and communities* have started to adapt to the impacts of climate change in new and creative ways (i.e. implementing best management practices, adaptation strategies)

GAPS

Coordination of Modeling

- Missing a coordinated and concerted effort to integrate modeling within the Bay assessments

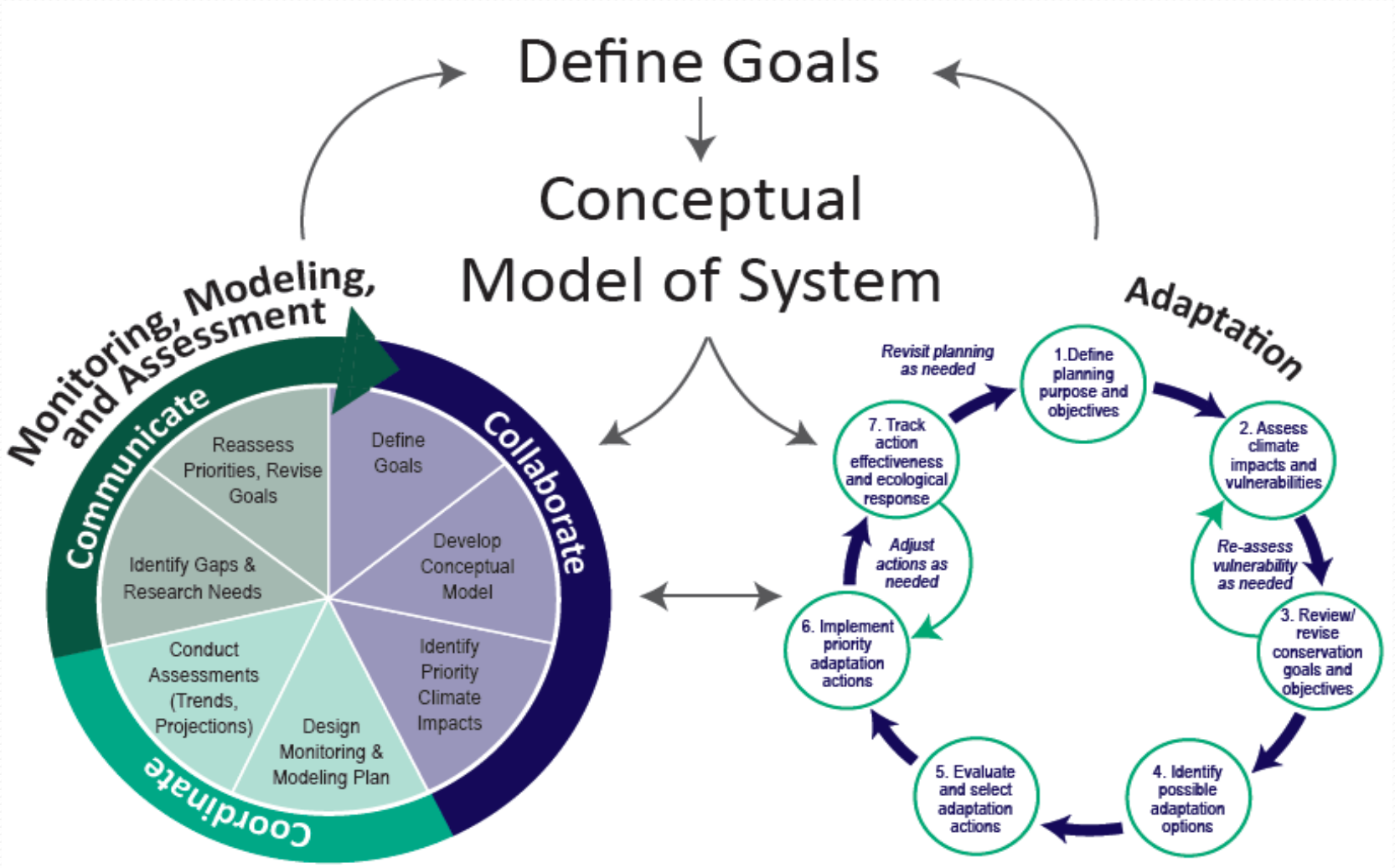
Climate Science

- Develop a comprehensive understanding of current science and management actions relevant to the goals of the Bay program
- Need continued assessment and analysis, as well as new approaches to fill critical science gaps

Adaptation

- Improve institutional capacity to collaborate data, communications, policy, programs, and implementation
- Revise or reconsider current plans to anticipate climate-related impacts
- Link science to implementation of climate resiliency projects and policy
- Engage stakeholders earlier to discuss implementation and planning

Management Approach



MANAGEMENT APPROACH

Develop a framework for engaging one-on-one with CB Partnership Goal Implementation Teams on climate related management needs.

Management Strategy	Baseline	Factor Influencing Success	Current Efforts & Gaps	Management Approach	Cross-Outcome Collaboration and Mutual Benefit	Adaptive Mgmt. & Monitoring Progress	No Mention	Rating
Water Quality		x		x	x	x		4
Black Duck		x	x	x		x		4
Brook Trout		x	x	x		x		4
Wetlands		x	x	x				3
Protected Lands		x	x	x				3
Public Access		x		x				2
Healthy Watersheds		x		x				2
Urban Tree Canopy			x	x				2
Blue Crab		x			x			2
Oyster Restoration		x			x			2
Fish Habitat		x			x			2
SAV		x						1
Diversity				x				1
Local Leadership		x						1
Fish Passage		x						1
Forage Fish		x						1
Toxics Research	x							1
Stream Health							x	0
Land Use Methods and Metrics							x	0
Land Use Options Evalations							x	0
Citizen Stewardship							x	0
Environmental Literacy							x	0
Toxics Prevention and Policy							x	0
Forest Buffer							x	0

x = climate change related element

Key Management Actions and the Role for STAC

Monitoring & Assessment

- Define goals and establish baselines
- Develop conceptual monitoring, modeling, and assessment model
- Prioritize climate impacts
- Determine whether available data and tools are sufficient
- Identify necessary forecasts and projections models
- Outline an integrated monitoring and assessment agenda
- Design monitoring and monitoring plans for climate adaptation assessments and plans
- Assess trends and conduct assessments
- Develop a research agenda
- Undertake public, stakeholder and local engagement

Adaptation

- Compile and assess current efforts and lessons-learned
- Assess climate impacts and vulnerabilities
- Review and revise conservation, restoration and protection goals and objectives
- Establish adaptation outcome priorities
- Increase the institutional capacity of the Chesapeake Bay Program to prepare for and respond to climate change
- Foster larger discussion on linkage between climate impacts and diversity
- Implement priority adaptation actions
- Track adaptation action effectiveness and ecological response
- Increase local engagement by conducting targeted conversations, increasing regional collaboration, education, and outreach

Monitoring Progress in Addressing Climate Change across the Chesapeake Bay Watershed

2011 STAC Workshop

- **Actionable actions identified by the workshop participants:**
- Embed climate change in decision making.
- Focus on solutions to specific problems.
- Identify and prioritize vulnerabilities and adaptive opportunities.
- Build capacity.
- Research priorities.

Chesapeake Bay Climate Change Workshop

Organizers: Chris Pyke, Kevin Sellner, Denice Wardrop, Marel Raub, Mark Bennet, Rick Keister, Skip Stiles, and Matt Johnston

Supported by STAC and hosted by EPA Region 3

Biennial Work Plan
Opportunities for STAC Involvement

- A thoughtful and strategic analysis of current research findings
  - There is a tremendous effort afoot; however a more cohesive vision, aligned with the Climate Resiliency Management Strategy, is needed. STAC could assist through:
    - Development of new research priorities and research agenda; both will be necessary to address critical gaps (i.e., data, tools, capacity).

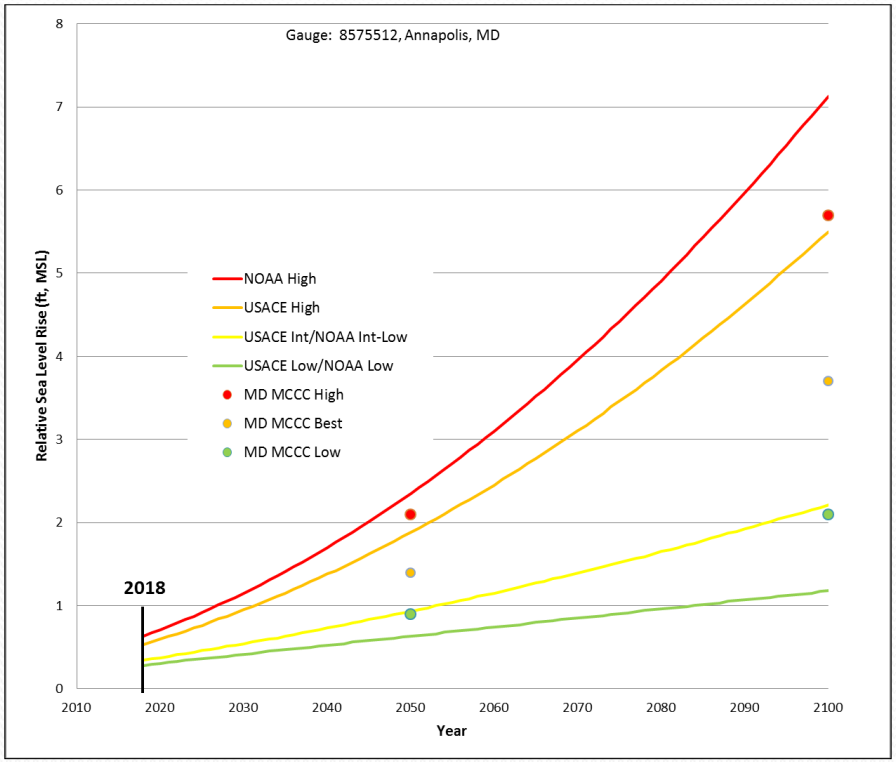
- Contributions to achieve key elements of the Management Strategy, including:
  - Defining goals and establishing baselines.
  - Assessing trends and conducting assessments.
  - Informing scientific analysis used for review and revision of conservation, restoration and protections goals and objectives.
  - Participating in regional climate change workshops, outreach and capacity building workshops.

The Development of Standardized Climate Projections for Use in Chesapeake Program Assessments

STAC Workshop (early 2016)

- What process should be utilized to identify plausible range of future conditions?
- Which climate variables does the CBP need projections for?
- What future time frames should climate scenarios be projected to in order to best assist CBP planning and management?
- How should climate simulations best be conducted to inform management strategies to meet CBP goals and outcomes?

Relative Sea Level Rise Projections for the Chesapeake Bay

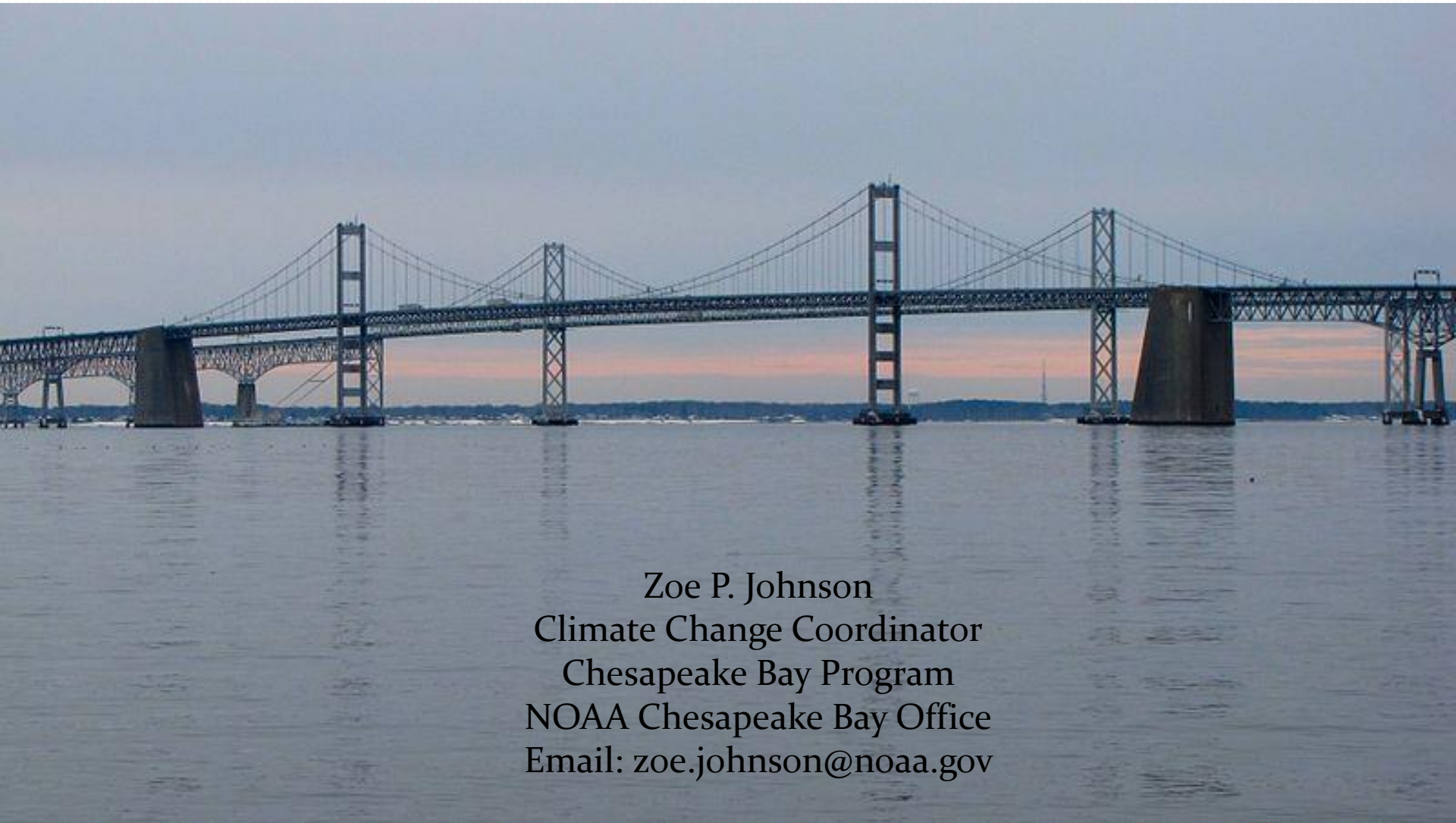


Source: USACE. 2015. NACCS Study. Appendix D. USACE, Baltimore, MD.

Additional Roles for STAC

- Cross-GIT Climate Change Resiliency Analysis Matrix Workshops (literature review and vulnerability assessments)
- Update 2008 STAC report on Climate Change and the Chesapeake Bay
- Member participation in annual climate change research forums
- Mid-Point Assessment – STAC review of climate change integration elements
- Inform prioritization of climate change impacts (those most important to goal attainment)
- STAC Liaisons to Climate Change Work Group
  - Susan Julius
  - Ray Najaar
  - Carl Hershner
  - Marjy Friedrick
  - Lisa Wainger

Discussion?



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