Chesapeake Bay Restoration: Managing Water Quality for Living Resources in a Changing Climate

2024 Chesapeake Community Research Symposium

KEY HIGHLIGHTS FROM SPECIAL SESSION 11:

TACKLING ECOSYSTEM-LEVEL IMPACTS FROM RISING WATER TEMPERATURES IN THE TIDAL WATERS OF THE CHESAPEAKE BAY

Session Focus: Share research that aligns with the tidal recommendations from the Rising Water Temperature STAC Workshop, including topics around habitat suitability, extreme stressors, and climate change modeling for fish, benthic organisms, and submerged aquatic vegetation related to habitat use, living resource response, and/or species community shifts and the communication of such information.

Recommendations in the report focused on several themes to build resilience to the effects of rising water temperatures on living resources in tidal waters, including:

– promoting ecosystem-based management

– increasing understanding of extreme stressors on living resources and habitats

– minimizing multiple stressors on living resources

– maximizing nearshore habitat restoration and protection

– preparing for and communicating future water temperature conditions

Highlights:
Presentations focused on a wide range of topics, which all addressed the tidal recommendations from the Rising Water Temperature STAC Workshop

- Marine Heatwaves:
  - Marine heatwave events are increasing in frequency, intensity and duration, with potential to impact key living resources in the Chesapeake Bay
  - Vertical structure of these events vary spatially and seasonally
    - Shallow water: the cumulative impact of individual events are comparable between the surface and bottom
    - Deeper water: surface measurements do not always reflect subsurface patterns

- Striped Bass:
  - Climate impacts (i.e., increasing temperature and decreasing flow) on year-class success of striped bass
    - Spawning season has shortened by ~20% from 2000 – 2023; shorter season may impact expected buffering from high spawning stock; greater potential for mismatch of first-feeding larvae
  - Climate-driven changes (i.e., increasing temperature and marine heatwave frequencies) in summer habitat conditions
    - Suitable habitat has degraded since 1986 and prior to 2010, condition was primarily driven by dissolved oxygen
    - In Maryland, summertime suitable and tolerable habitat has decreased by ~10% since 1999
    - Chesapeake Bay fishery will likely experience more frequent and longer lasting periods of degraded habitat condition

Highlights:
Presentations focused on a wide range of topics, which all addressed the tidal recommendations from the Rising Water Temperature STAC Workshop

- Atlantic Sturgeon:
  - Research to understand climatic impacts (i.e., summer warming and fall storms) on Atlantic sturgeon fall-spawning in volume-sensitive waters
    - Findings indicate that raw summer temperatures and fall storms do not have an impact on spawning, despite evidence of tropical storms impacting sturgeon distribution
    - Continued research to understand whether the gradients and rates of change in temperature and flow have an impact
- Habitat
  - Climate impacts to submerged aquatic vegetation (SAV)
    - Temperature increases will widen shift in dominant species (from *Zostera* to *Ruppia*)
    - Nutrient reductions are integral for new dominant species (*Ruppia sp.*), with local/regional targeted actions to offset/ slow impacts from climate change
  - Ecological and economic effects of oyster restoration and seagrass habitat change
    - Ecosystem modeling to simulate habitat change scenarios and using model to estimate economic impacts
    - Efforts with any seagrass (*Zostera Marina*) restoration and maintaining current levels of oyster restoration with no harvesting *together* results in increased productivity and habitat through 2040
- Communication
  - Retrospective look at previous season's environmental conditions (i.e., temperature, salinity, dissolved oxygen, precipitation, and flow) relative to long-term trends
  - Making connections to living resources for informed ecosystem-based management

Making Connections

Presentations focused on different aspects of temperature impacts on the Bay, from extreme heat events, to effects on species and habitats, to how to communicate environmental conditions

These findings can inform:
- Habitat risk assessment and forecasting tools for key fishery species (*Monitoring and Assessment Outcome*)
- Where to target nearshore monitoring networks (*Monitoring and Assessment Outcome*)
- How to build resilience through habitat restoration to allow for increased longevity (*Adaptation Outcome*)

Acknowledgements