PROPOSAL FOR STAC REVIEW OF WATER TEMPERATURE INCREASES IN THE BAY AND ITS WATERSHED: ECOLOGICAL SIGNIFICANCE AND IMPLICATIONS FOR TIDAL WATER QUALITY STANDARDS, BMPS AND HABITAT STRATEGIES, AND TIDAL & NON-TIDAL MONITORING

For discussion at STAR Meeting, September 24, 2020,
with Water Quality Cohort

Rebecca W. Hanmer, Chair of the Forestry Workgroup, with
Sally Claggett (USDA-FS) and Anne Hairston-Strang (MD DNR-Forestry)

Proposal:

A STAC review of water temperature increases in both non-tidal and tidal waters of the Chesapeake Bay watershed should be given priority in 2021. It should focus on:
- the ecological significance of water temperature increases for the aquatic species and habitat that the Program is seeking to protect and restore;
- needed modifications in Bay tidal water quality criteria and standards (WQS);
- programmatic implications, especially highlighting BMPs in Watershed Implementation Plans and Bay Program habitat strategies that prevent/moderate adverse effects of increasing temperatures on aquatic resources; and
- changes needed in non-tidal and tidal water monitoring strategies.

Discussion

Non-tidal waters. USGS monitoring of non-tidal waters shows that notable water temperature rises have already occurred, and significant warming is projected for the future. As Dr. Anne Hairston-Strang of the Maryland Forest Service and CBP Forestry Workgroup states in support of this STAC proposal, water temperature is "an important measure to look at since it affects all of our chemical and biological processes for growth and pollution, as well as being directly linked to survival for temperature-related organisms like the brook trout."

- A STAC review should consider the likely ecological significance of the temperature increases for survival and growth of Bay watershed aquatic species, in particular salmonids like native brook trout.

- STAC should also consider what mitigation strategies could be most successful. For example, Dr. Hairston-Strang notes, "One of the takeaways from 15 years of monitoring riparian forest buffers was how much they changed the microclimate around streams, moderating extremes of temperature on the high and low end, and creating more tolerable conditions for everything making a living there."
- What watershed BMPs in the CBP's Water Quality and Habitat programs have the greatest potential to slow and mitigate water temperature rises – such as riparian forest buffer restoration

and forest conservation? The STAC review could consider the implications of water temperature rises for WIP strategies and favored BMPs, along with priorities for specific geographic areas and aquatic resources to focus adaptation measures on.

The results of the STAC review could be used to inform the States' priorities for BMP implementation in their WIPs in the years leading up to 2025 (and beyond). It will inform the Riparian Forest Buffer outcome management strategy, and may affect the Brook Trout outcome management strategy.

- Are USGS and the States/research institutions doing the right kind of monitoring? Should there be any changes in the nature and frequency of monitoring of non-tidal water temperature to improve the Program's assessment capability?

- Rebecca Chillrud posted a water temperature paper on 1-7-20. She cites USGS as saying average non-tidal stream temperatures increased 2.52 degrees F from 1960 to 2010, while air temperatures increased 1.99 degrees. (Could that ratio of water to air temperature increases hold?)

- Note that Maryland Forestry has offered to contribute information for the STAC review, from its review - now in draft - on the relationship between stream temperature and riparian forest buffers. Also, Jonathan Leiman of MDE's Integrated Water Planning Program (IWPP) indicated that IWPP could assist or help lead, based on IWPP's development of water temperature TMDLs and complementary guidance.

Tidal waters (from Rich Batiuk). Raising the issue of water temperature within the CBP partnership is timely. We know that tidal water temperatures have been rising. And we are already seeing temperature impacts on eelgrass, with summertime temperatures causing die-backs. We know increasing temperatures will continue to have an increasingly adverse effect on more and more of the Bay ecosystem.

The best reference that I am aware of that addressed temperature tolerances of an array of Chesapeake Bay species was the 1991 Habitat Requirements for Chesapeake Bay Living Resources, Second Edition.

In the 2003 Chesapeake Bay water quality criteria, the dissolved oxygen criteria protective of shortnose sturgeon are based on temperature. When water column temperatures are higher than a specific temperature, a higher dissolved oxygen criterion applies to the waters in that segment. So we at least have one specific example of how we can effectively address temperature effects.

Lew Linker, Gary Shenk and the rest of the CBPO Modeling Team went to great lengths to factor in simulation of changes of temperature on watershed processes and tidal water biological rates and processes anticipating the need to better simulate the effects of climate change on the Bay ecosystem.

The Partnership should ask STAC to conduct an in-depth review of the implications of continued

increases in Bay water column temperatures based on scenarios of estimated increases in temperatures over the next 10-20 years. I have always found this is one of the best mechanisms for not only synthesizing the available science, but also to start building a consensus within the Partnership on the dimensions of concern for specific forthcoming issues. STAC has options to convene a team to conduct a review and write up a synthesis paper, ask a STAC member to write up a white paper, and fund a workshop on this topic on this topic to seek input from a larger array of scientists.

The findings from STAC would be a solid foundation for getting the rest of the Partnership's full attention on addressing temperature. The states' WQS regulations certainly address temperature, but not nearly to the degree that they now address dissolved oxygen, water clarity and SAV. Strengthening their WQS for temperature effects tailored to the different designated uses already adopted into regulation would be my recommendation for driving more management attention to increased water column temperatures. This may need to be an issue championed, at least at the start, by the CAC."

Note: the first draft of this proposal was written in January 2020, at the time of the Climate Resiliency Workgroup meeting, and forwarded to participants in that meeting. The following replies were received:

Jonathan Leiman, Integrated Water Planning Program (IWPP) at MDE:
"IWPP would be interested in participating and/or helping to organize a temperature oriented STAC workshop as we are currently developing temperature TMDLs and complementary guidance for the development of watershed implementation plans."

Susan Julius (julius.susan@epa.gov) wrote that Dr. Thomas Johnson, a hydrologist in the USEPA Office of Research and Development – and a STAC member – would want to work on this issue. (johnson.thomas@epa.gov)

As noted above, key contributions were also received from:

Richard Batiuk, retired CBP Science Director, also replied positively to the idea of a STAC review of water temperature, placing his emphasis on tidal waters. The above proposal for tidal waters is from on Rich's reply.

Anne Hairston-Strang, Associate Director, Maryland Forest Service, Department of Natural Resources