Chesapeake Bay Program
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Climate Resiliency Workgroup

January 18th, 2023
1:30-3:30 PM EST

Event webpage:
https://www.chesapeakebay.net/what/event/climate-resiliency-workgroup-meeting-january-2023

This meeting will be recorded for internal use to assure the accuracy of meeting notes.

Minutes

Action Items:

- Strategy Review System: The Climate Resiliency Workgroup's 2023-2024 Logic and Action Plan (workplan) and updated 5-year Management Strategy are published for public comment. If you have any comments to add, please follow the instructions in the previous link or send them directly to Jamileh Soueidan (jamileh.soueidan@noaa.gov).
- Strategy Review System: The Climate Resiliency Membership Survey is currently active. Please take the time to complete this survey so that we may have a better understanding of our members' and interested parties' interest, expertise, ideal roles within the workgroup, and preferred meeting structure. This survey closes at **Close of Business on Friday, February 10th, 2023.**

1:30 PM **Welcome, Opening Remarks, and Announcements – Mark Bennett, Co-Chair (USGS), Jackie Specht, Co-Chair (The Nature Conservancy) & Julie Reichert-Nguyen, Coordinator (NOAA) [5 minutes]**

Focus of meeting:

- *Share updates regarding climate change and living resource-related actions in the 2021-2022 Climate Resiliency Workgroup (CRWG) Logic and Action Plan (workplan) to identify collaborative opportunities to incorporate in the CRWG's 2023-2024 workplan. Actions are related to:*
  - *Stream health and brook trout*
  - *Submerged Aquatic Vegetation*
  - *Fish habitat*
- *Discuss collaborative opportunities between the climate resiliency and living resource outcomes*

    - *Identify or tweak actions in the CRWG's 2023-2024 workplan based on discussion and presentations.*
- *Review minor revisions to the Climate Resiliency Workgroup Management Strategy*

Opportunities:

- *2023 NOAA-CRC Summer Internships – two climate change-related opportunities. Please share with your networks. Deadline for applications is February 20, 2023.*
    - *Climate Change and Fish Habitat*
    - *Climate Change Education*

Summary

Julie welcomed the workgroup members and meeting attendees and reviewed the goals and focus for the meeting. The meeting focused on reviewing the actions within the current draft of the CRWG 2023-2024 Workplan that have potential for collaboration across workgroups and Goal Implementation Teams (GITs). She mentioned that there were representatives from the Healthy Watersheds GIT, Sustainable Fisheries GIT, Stream Health Workgroup, Brook Trout Workgroup, and Submerged Aquatic Vegetation (SAV) workgroup who will present on their current efforts and highlight where there is potential for collaboration with the CRWG. Julie stated that the second half of the meeting will focus on discussing these collaborative opportunities and developing them into workplan actions. Julie also mentioned that she would be reviewing the draft Management Strategy, which is a document that is updated during the Strategy Review System (SRS) process. While the Management Strategy is rewritten every 5 years, it is updated every 2 years through this adaptive management process.

Julie also highlighted the NOAA-CRC Summer internship announcement that was recently released. She mentioned that there are two climate change related internship positions available this summer, with one of them directly addressing one of the CRWG workplan actions. She requested that folks please share these opportunities with their networks. Lastly, Julie mentioned the new NOAA funding opportunity that was recently released and focuses on environmental and habitat change related to climate change as well as fisheries impacts.

1:35 PM **Review of Draft Management Strategy (Julie Reichert-Nguyen, NOAA) [15 Minutes]**

- *Julie will review minor revisions to the draft CRWG Management Strategy. The Management Strategy is a five year strategy for the workgroup, which is updated every two years during the Strategy Review System process as part of the CBP's adaptive management process.*

Summary

Julie reviewed the recent updates to the Management Strategy. These additions incorporated new initiatives that the workgroup has focused on over the past two years as well as highlighting the influx of federal infrastructure funding. She provided the link to the current Management Strategy in her presentation.

In section 5 of the strategy, which focuses on current efforts and gaps, Julie added text on the Climate Change Directive as well as provided a link to actions that were identified by state jurisdictions and federal agencies. She also mentioned updating the text under the monitoring and assessment current efforts to include the Management Board's decisions on how to prioritize the climate change indicators, the efforts related to numerical climate change targets in 2025 for the TMDL, and the STAC Climate Change Modeling 2.0 Report. Changes under the adaptation current efforts include adding language capturing activities that the workgroup is directly involved in (e.g., GIT-Funded Marsh Adaptation Project) and adding language on natural infrastructure, with an emphasis on the new funding opportunities that focus on infrastructure.

Section 7 of the Management Strategy review the progress towards the two Climate Resiliency Outcomes (i.e., Monitoring and Assessment and Adaptation). Julie added language to discuss the progress made towards the Adaptation Outcome since our workgroup has focused on a number of adaptation efforts in the past two years, which was the last time this strategy was updated. Efforts highlighted in this section include collaborative efforts (e.g., the Targeted Outreach for Green Infrastructure project) and educational/local outreach products developed by the Strategic Engagement Team. She also added language about the monitoring and science needs identified during the STAC Rising Water Temperature Workshop and the climate change prioritization based on the Management Board. Lastly, she mentioned including some of the cross-Goal Implementation Team (GIT) efforts that the CRWG assisted with, including the GIT-Funded Marsh Migration Data Synthesis project, the Submerged Aquatic Vegetation (SAV) Workgroup project, and the BMP Climate Uncertainty Review, which was a joint effort between the WQGIT and the CRWG.

Lastly, Julie highlighted some of the miscellaneous items that were incorporated into the updated Management Strategy. The first was to change references of local engagement and communications team to the Strategic Engagement Team. She then mentioned that the leadership team of the workgroup discussed how to handle partnership and jurisdictional updates (e.g., recent climate resiliency efforts) to the Management Strategy (appendix B). Currently, the group settled on referencing the updates that the jurisdictions provided for the EC Climate Change Directive and reaching out to specific partners during the public review period for updates. Julie concluded by asking if there were any new key actions that should be referenced in the Management Strategy and if the updates presented were accepted by the workgroup.

1:50 PM **Review of findings from GIT-Funded Project, "Modeling the past to predict the future: forecasting the relative role of climate change and habitat management on Chesapeake Bay submersed aquatic vegetation (SAV)" (Marc Hensel, VIMS) [20 minutes]**

- *This research utilized the Chesapeake Bay's unique long-term, large-scale data sources to build a mechanistic understanding of the past in order to predict how climate change and human activities will affect dominant SAV habitat into the next 40 years. This research was built into the CRWG's 2021-2022 workplan in collaboration with the SAV workgroup.*

After all the presentations, there will be a discussion focused on identifying collaborative opportunities to build into the 2023-2024 CRWG workplan.

Summary

Julie introduced Marc Hensel, who helped lead the SAV Workgroup's GIT-Funded "Envisioning the future for Chesapeake Bay SAV under climate change" project. She also thanked Joel Carr, who is a CRWG member, serving on the steering committee.

Marc started the presentation by sharing the link to their web application for this project; the application provides visualizations of SAV projections under different climate change scales throughout the Bay. Marc shared that the major research question for this project was "how will climate change and human activities affect major communities of submersed aquatic vegetation in the Chesapeake Bay?" Marc separated this question down based on climate change factors (e.g., temperature rise and precipitation extremes/variability) and human activities (e.g., nutrient loadings). He mentioned that because of climate change and human activities the Bay is already different from how it was in the past, and the next step is to understand how SAV populations will look in the future.

Marc described three steps to predicting the future. The first step asks "how have past environmental conditions affected SAV communities?" The second step focuses on what the future looks like and asks "how will environmental conditions shift with climate change and with human activities?" And the third steps builds off the prior two and asks "how will shifting conditions and shifting species affect SAV meadow coverage into the future?"

Step one was completed through VIMS's aerial SAV survey data and the CBP water quality data (1984-2020). The first part of this step was to identify the major communities of seagrass and aquatic vegetation in the Bay; four major communities were identified from this analysis, which were distributed based on salinity (i.e., *Zostera, Ruppia,* freshwater communities, and mixed mesohaline communities). These distributions have changed over time and since the late 1990s to early 2000s, and there was a shift in dominant species from eelgrass (*Zostera*) to tidal freshwater communities and widgeongrass (*Ruppia*). The next portion of this step was to utilize Structural Equation Modeling to understand the past through the creation of complex cause and effect networks and identify cascading effects. The main takeaway from this modeling was that different SAV communities were controlled by different seasonal variables. Furthermore, he discussed how the communities that are currently dominant are the ones that are most likely to benefit from nutrient reduction regulations.

Step 2 focuses on what the future will look like. They utilized the CBP climate modeling scenarios (2020-2060). He mentioned that he would highlight a few of the scenarios in the presentation. The scenarios he reviewed were if there were no further nutrient reduction actions taken versus if there are further nutrient reduction efforts. Both scenarios had the same precipitation and temperature predictions, however with the further nutrient reduction

scenario, there was a greater decrease in nutrients (e.g., nitrogen, phosphorus) compared to the no action scenario.

Step 3 built off the previous two steps by creating predictive mixed effect models under the two scenarios to understand what SAV will look like in the Bay over the next 40 years. The big takeaway from this analysis is that the new dominant species (widgeongrass and freshwater communities), which are the ones that occupy the most space in the Bay currently, are the groups that responded most positively to the further nutrient reductions despite increasing temperatures. Additionally, further nutrient reductions are likely to bolster eelgrass communities for the first decade before water temperatures become too high. In looking at the Bay-wide goal of 74,000 HA of SAV, neither scenario reach the goal, however the nutrient reduction scenario gets closer to the goal compared to the no further action scenario. The takeaway from this analysis is that there should be continued reductions or even readjusting the reduction threshold to further decrease nutrients. Additionally, implementing nutrient reductions in a targeted fashion and on a seasonal scale to maximize impact.

He next presented the predictions on where there will be gains and losses of SAV in the Bay. The Choptank, Lower Eastern Shore, and MD mainstem will likely see increases in total SAV area, while there will likely be losses in the York and James rivers and the VA mainstem. In summary, temperature increases will likely widen the shift in dominant species and management should adjust accordingly, so that nutrient reductions specifically target these dominant species. Lastly, local and regional action offsets and prevents the effects of global climate change. Target nutrient management benefits climate tolerant species and encourages continued recovery.

He ended the presentation by reviewing lessons learned and next steps. They plan on incorporating segment by segment and basin by basin projects into the web application. This segmented data will help set community goals as well as developing a sentinel site program. Another lesson learned is that progress needs to be gauged on multi-year chunks of time as the new dominant species are not as stable as eelgrass. Furthermore, there is a need for modeling and predicting species shifts, food web shifts, and changes in fisheries and blue crab communities that might be a result of the shifts in SAV communities. Lastly, he mentioned that there should be some examination on how other areas who might not have as robust a data set develop similar predictions for their regions.

<u>Clarifying Questions</u>

Fredrika Moser asked if Marc had any thoughts on how an increase in relative sea level rise or extreme events might affect nutrient inputs and SAV response. Marc responded that they did incorporate sea level rise into the projections and the big takeaway is that in the timeframe they were working in (2020-2060) there was no significant reduction in SAV habitat as a result of sea level rise.

Breck Sullivan asked if the nutrient reduction projections were based on what will be reduced from (watershed implementation plan) WIPs or was it based on trends we have seen in reductions so far. Marc responded that the scenarios were based on the WIPs. Julie mentioned that it was important that there are actions that can be taken to help support SAV communities in the Bay, but it will also be important to investigate the new community structures from the new dominant species. Kristin Saunders mentioned that these are timely suggestions and findings as the partnership discusses 2025 and beyond.

2:10 PM **Status Review of Sustainable Fisheries Goal Implementation Team's Climate-Related Efforts (Justin Shapiro, CRC) [20 minutes]**

- *Representatives from the Sustainable Fisheries Goal Implementation Team will provide a brief overview of current and potential future efforts regarding climate change, forage, and fish habitat suitability. After all the presentations, there will be a discussion focused on identifying collaborative opportunities to build into the 2023-2024 CRWG workplan.*

Summary

Justin Shapiro presentation focused on the Sustainable Fisheries Goal Implementation Team's (GIT) recent efforts and how climate can be connected to habitat. The Fish GIT is responsible for four of the outcomes at the Chesapeake Bay Program (i.e., oyster restoration, blue crab abundance, forage fish, and fish habitat). The presentation highlighted the activities that have been underway within those outcomes and how they might overlap with some of the climate habitat work. When thinking about these connections, the Fish GIT team made connections to the CRWG's work with habitat citing restoration projects and interest in developing temperature indicators that are connected to key species.

Justin began the presentation by reviewing recent research projects that highlight considerations when prioritizing habitat restoration for fish and people. The first project he highlighted investigated the impacts on fish abundance from shoreline hardening. This work started in 2015 with a NOAA/SERC study which quantified the influences of shoreline change on ecosystem health at 85 different sites; findings indicated that shoreline is linked to decline in species number. This led to the next research question, which was what are the thresholds for this decline? This lead to a VIMS GIT-Funded study, "Threshold effects of altered shorelines and other stressors on forage species in the Chesapeake Bay." The findings of this study showed that shoreline hardening of 10-30% led to a decline in the seven forage species analyzed in this study. Additionally, juvenile blue crab also showed a general decline with an increase in shoreline development. This led to understanding and compiling information on the state of shoreline hardening within the states of Maryland and Virginia and map them. The Chesapeake Bay Program GIS team was able to take the data from the VIMS Shoreline Inventory efforts and create mapping layers for both VA and MD. The GIS team quantified the percent hardening of shorelines for 1000m segments. Currently, all counties in VA are mapped, and four counties in MD are mapped. Justin then discussed that they have applied these results through products

like the State of the Ecosystem Report, stating that 12% of VA's shorelines are above the 30% thresholds. In the future, there is the opportunity to integrate this data into restoration prioritization to protect areas that might be under the threshold and implementing restoration projects in areas above the threshold.

Justin then reviewed the work focused on characterizing nursery habitat use of juvenile fishes. The focus of this study conducted by VIMS investigated how to characterize nursery habitat use for important juvenile fish species and to better understand the changing nature of these nursery habitats for managed species. This study specifically looked at summer flounder and black sea bass and how "seascape" might be changing under climate change conditions. This work is important for prioritizing restoration strategies. The research focused on oyster reef, sea grass, salt marsh and soft bottom use in the western and eastern shore tributaries and coastal bays. They found that summer flounder abundance is highest in marsh habitat, which underscores the importance of juvenile fish considerations when citing marsh projects. Additionally, they found that juvenile flounder were relatively larger in the Choptank system, which could be connected to significant restoration investment in relation to oysters. They also found that temperature and salinity were important predictors of relative abundance and growth for both flounder and sea bass, and determined temperature suitability thresholds for juvenile summer flounder. Suitable conditions have been decreasing over the last two decades. Next steps include determining ways that these findings are considered in future restoration work and the work that the CRWG is conducting.

The last study that Justin reviewed examines changes in Bay utilization by resident species. This VIMS study looked at the relationship between relative abundance in the Bay compared with coast-wide stocks. Most of the eight target species showed declined in bay usage compared to the coast-wide stocks. Declines in bay relative use were coupled with increased utilization of northward estuaries (e.g., Delaware Bay). Continued warming will likely contribute to the trends of northward movement.

Justin highlighted the ongoing work that is currently being conducted but provide opportunities for connection and collaboration. Currently the Forage Action team is trying to improve the capacity to understand the role of forage species in the Bay. Important, guiding questions include is there enough food for predators, and how are environmental conditions impacting populations? The first step in answering these questions was to identify important forage species, which was addressed through a 2014 STAC report. Based on the report results there was an indicator development plan established to parse out different individual research projects that should be conducted to answer the fundamental questions presented earlier. A large portion of this work has been funded and completed. Some key findings include understanding how springtime warming in the Bay impacts bay anchovy and how habitat suitability impacts abundance of bay anchovy and juvenile spot. The team is currently working on a Forage Status and Trends report to synthesize and highlight all the recent findings about forage abundance and their connection to climate conditions, and also to identify research gaps.

Justin then mentioned some other research and science needs that have been highlighted by some of the workgroups within the Fish GIT but do not have the capacity to address them yet. For the Oyster Restoration Workgroup, since the accomplishment of the 10 tributaries goal, there is thought into what the next oyster restoration goal should look like in the future. Additionally there is interest in developing ways to couple oyster restoration with coastal resilience practices and co-locating oyster and SAV. The Fish Habitat Action Team is interested in collecting data to explore temporal and spatial changes in spawning, and examining mismatches between the environmental changes and management restrictions. This team is also interested in utilizing the new telemetry arrays to trach fish movement in relation to environmental shifts or climatic changes. Additionally, the Fish Habitat Action Team recently procured funding to research quantifying benefits of structured habitat for community resilience. Lastly, the Chesapeake Bay Stock Assessment Committee (i.e., the blue crab workgroup) have research needs about understanding how marsh/SAV loss could impact blue crab abundances and understanding the impact of the changing oceanic conditions at the mouth of the Bay on clue crab.

In closing, Justin highlighted the NOAA Chesapeake Bay Office Seasonal Summaries, which are quarterly reports that are led by the Ecosystem Science Team and using existing environmental and observational data to craft narratives about living resources in the Bay. Currently the seasonal summary reports on water temperature and sea surface temperature anomalies, salinity, and flow. In the future, they are hoping to include more observational data and insights gained from fisheries research, which was presented earlier. Additionally, they would like to include new research that NOAA funds in 2023 and moving forward, and climate change is a priority for these funding awards.

Julie thanked Justin for presenting, and she took the moment to highlight how the recommendations coming out of the STAC Rising Water Temperature Workshop align with some of these research needs that Justin presented on.

2:30 PM **Status Review of Healthy Watershed Goal Implementation Team's Stream Health and Brook Trout Efforts Included in 2021-2022 CRWG Workplan (Renee Thompson, Stephen Faulkner, and John Clune) [20 minutes]**

- *Representatives from the Healthy Watersheds Goal Implementation Team, Brook Trout Workgroup, Stream Health Workgroup, and USGS will provide a brief overview of recent efforts including highlights from the GIT-Funded project titled a "Literature Review: Building Climate Resilience in Stream Restoration Practices," climate resiliency needs around brook trout habitat, and USGS's stream temperature compilation project. After all the presentations, there will be a discussion focused on identifying collaborative opportunities to build into the 2023-2024 CRWG workplan.*

Summary

Julie introduced the next set of presenters from the Healthy Watershed and Habitat Goal Implementation Teams and the Stream Health and Brook Trout Workgroups. She mentioned that there has been collaborative work in the past that was more exploratory, investigating different resilience factors that could be influencing habitat and healthy watersheds. She then introduced John Clune, who presented on the Stream Temperature Compilation Project.

John Clune presentation provided a quick update on the data release and their work related to stream temperature status and trends in the Bay watershed. This stream temperature work is one of seven themes that USGS is focused on as it relates to status and trends of streams in the Bay. For the purposes of this presentation, John focused on temperature. Through this project, they compiled multi-agency data sets for assessing the status and trends of and modeling stream temperature across the Bay watershed and to better understand the drivers and stressors of stream health. The multi-agency data-set is in colleague review and set to be published soon.

The data release collates stream water temperature observations across the Chesapeake Bay watershed. Data included in the release are from the NWIS Daily Values (DV), NWIS Unit Values (UV), Water Quality Portal data, and Aquarius Data. NWIS DV dataset consists of 1.3 million aggregate daily values from 268 stations from 1945-2022. These data can provide longer term trends at the sites that have a longer periods of records. The NWIS UV dataset consists of 44.2 million continuous unit values from 147 stations form 20017-2022. These data are collected every 15 minutes at these sites. The Water Quality Portal is a multi-agency dataset that consists of 421,875 discrete unit values form 14,148 stations from 1923-2022. This dataset is a compilation from various agencies, thus there are a variety of different data types with different levels of metadata associated with it. The Aquarius dataset include 102,902 miscellaneous stream temperature observations collected during discharge measurements at 1,812 stations from 1920-2022. This data are usually not published. John mentioned that he would be happy to talk with anyone about the utility of these various datasets for status and trends analyses. Julie thanked John for presenting on this data; she mentioned that this project could be useful in developing a stream temperature indicator that is linked to living resources.

Renee Thompson presented on stream health and healthy watersheds. She first reviewed the Healthy Watersheds Goal at the Bay program, which aims to sustain state-identified healthy waters and watersheds recognized for their high quality and/or high ecological value. The outcome associated with this goal is to have 100% of the state-identified healthy waters and watersheds remain healthy. She then reviewed the Chesapeake Healthy Watersheds Assessment which is based off of the EPA's framework, but tailored for the Chesapeake Bay watershed. The Assessment contains metrics related to vulnerability and watershed health. These metrics are tracked not just at the catchment scale, but across the entire watershed. Metrics that can be visualized within this tool include landscape condition, hydrology, habitat, geomorphology, water quality, and biological condition. They are currently working on updating the land-use/land-cover data within these metrics. Renee then highlighted the vulnerability metrics, which she mentioned might be of interest for the Climate Resiliency Workgroup; these metrics include Land Use Change, Wildfire, Water Use, and Climate Change. This suite of

metrics looks at a variety of stressors or ways that vulnerability may be characterized in healthy watersheds and watershed protection. For the Climate Change metric, they included sensitive species (e.g., Brook Trout) and habitats and where in the watershed they could be resilient; for brook trout they are hoping to understand where in the watershed they are being resilient to rising temperatures and what factors influence this (e.g., landscape, riparian forest buffers, etc.). Looking at these resiliency metrics can assist in understanding what actually makes a watershed resilient and where can management actions be implemented. Renee then requested that the workgroup assist in identifying other metrics that are important to understanding resiliency in the watershed. They also incorporated the NALCC Climate Stress indicator. With the iteration of their MD Healthy Watershed Assessment, which was conducted with a specific region in mind, and using localized data, they took the opportunity to add additional metrics. These additional metrics include more Brook Trout stream temperature scenarios, the USGS stream temperature model, The Nature Conservancy Resilient Lands Tool, and the NALCC Nature Network Project related to climate stress. Renee also shared the Map Viewer to visualize these other datasets in MD. Renee then discussed opportunities for collaboration with the CRWG, which included how to integrate the work that the CRWG is conducting into their decision support tools and how can these groups work together to develop an indicator. Lastly, Renee highlighted connections between the CRWG and the Stream Health Workgroup, which include understanding how climate change impacts to stream temperature and precipitation can impact biological communities, how to maintain or improve the ability of streams to acclimate to these changes, and assisting in identifying climate related data that can inform their indicators.

Julie thanked Renee for her presentation and asked if the Healthy Watersheds 2.0 was the GIT-Funded project. Renee responded that it is a GIT-Funded project, which they are in the middle of and plan to take the suite of metrics from the MD assessment and develop a region-wide assessment. Julie mentioned that there may be opportunities for workgroup members who work more on the watershed side to assist in reviewing the metrics that might be incorporated. Additionally, Julie mentioned that the workgroup is also thinking about the concept of heater and cooler Best Management Practices (BMPs) that was discussed at the STAC Rising Water Temperature Workshop.

Julie introduced Stephen Faulkner to present on brook trout and climate resiliency. Stephen began the presentation with an overview about brook trout. Brook trout thrive in cold, clean water and complex habitats, which are essentially headwater streams and forested watersheds. So to help achieve the Chesapeake Bay Program Brook Trout Outcome, which is an 8% increase in occupied habitat, they have focused on protecting the highest quality habitat and restoring locations for climate resilient brook trout populations. So the questions that need to be answered are how to go about finding these locations within the watershed, and what actions need to be taken once they are identified? The Brook Trout Workgroup is using a conceptual model to understand how climate change impacts brook trout. This model includes understanding exposure (how and where will conditions change?), sensitivity (which populations will respond?), and adaptive capacity (are there evolutionary/genetic changes in the population that will enable them to persist?). They identify the most climate resilient

population as those with low exposure, low sensitivity, and high adaptive capacity. Stephen discussed that they have a good understanding of exposure at a landscape level, however there is lower certainty at management-relevant scales (e.g., groundwater influenced streams). Likewise, they have a good understanding of sensitivity for single-year effects, but low certainty for multi-year effects. Lastly, for adaptive capacity, there are large gaps in understanding, as this is a new effort to understand what exists in various populations across the range in terms of genetics and adaptive capacity. Within this framework, the workgroup is focused on large-scale priority action items with the greatest impact. This includes targeted forested wetlands for protection, engaging with landowners for land stewardship, and habitat protection and restoration. Stephen then highlighted that there is a need for collaboration across GITs and Workgroups (e.g., Healthy Watersheds GIT, Fish Passage, Forest Buffers, and Protected Lands Workgroups) to coordinate actions at a scale necessary to overcome the detrimental impacts to brook trout habitat. Stephen also mentioned that there are many partners and tools out there that can be utilized in this effort, including the Trout Unlimited Conservation Portfolio tool, which highlights riparian restoration. The tool pulls in metrics from other tools to help site and target locations that can then be conserved or restored to help support riparian forests. Another collaborative effort that Stephen highlighted is the effort to define resiliency across these groups. There is a need for consensus as different groups define resiliency differently.

Julie thanked Stephen for his presentation and mentioned that as the meeting moves into the discussion, there is a workplan action that is focused on understanding what it means to track resiliency. As Stephen highlighted, there are many working definitions but currently no consensus on what resilience means. Julie then mentioned that there may be an opportunity to bring on an intern to focus on compiling definitions of resilience across these different groups.

Clarifying Questions

Katie Brownson asked with regard to stream temperature, has there been any consideration for a metric that would track the occurrence of aquatic heatwaves in addition to mean summer temperatures. Stephen answered, with respect to Brook trout, they use both mean and maximum summer temperature, which would be comparable to a heat wave event. These are also built into the current occupancy models that they have. As more research is conducted to understand aquatic heat waves, the models may be updated to incorporate the new metrics. Renee responded that Katie's point was important. She added that it is overwhelming to incorporate climate metrics into these models and assessments without any sort of contextualization.

2:50 PM **Discuss Cross-Workgroup Collaborative Opportunities for the 2023-2024 CRWG Logic and Action Plan (All) [30 minutes]**

- *Discuss climate resilience-related collaborative opportunities with the living resource outcome workgroups that could be incorporated in the 2023-2024 CRWG logic and action plan.*

Summary

Julie provided context for the discussion portion of this meeting. She reminded folks that the CRWG is a science support workgroup situated under the Scientific Assessment Technical and Report (STAR) team and is responsible for the two climate resiliency outcomes (i.e., Monitoring and Assessment and Adaptation) in the Chesapeake Bay Watershed Agreement. These outcomes are qualitative with no quantitative goal associated with them. To help work towards these outcomes, the workgroup has collaborated with other Bay Program GITs and workgroups on various efforts. These efforts include cross-workgroup climate-themed meetings, connect climate resilience experts to sit on steering committees, assist with developing project ideas and pursue funding, and facilitate discussions to identify climate change science needs.

Julie also highlighted some of the preliminary responses from the CRWG membership survey, as they pertain to additional climate resilience activities that members and interested parties would like to see the workgroup focus on. The general themes in the responses include supporting FY22 GIT-Funded projects, including actions that address climate impact to headwater streams and forests in the workplan, including actions that focus on SAV in the workplan, addressing sunny-day flooding, and assisting and informing governments as they make infrastructure and permitting decisions.

Julie then highlighted some upcoming GIT-Funded projects that have climate-related considerations. The WQGIT has an optimizing Riparian Forest Buffer Implementation for Climate Adaptation and Resilience project. The Habitat GIT has three projects: the first is determining the local effect of flow/stormwater on SAV density and acreage and options for targeting watershed BMPs that protect priority SAV areas; the second is a literature review titled *Building Climate Resilience in Stream Restoration Practices*; and the third is monitoring vegetation condition throughout the Delmarva Peninsula. These projects provide opportunities for collaboration.

Lastly, Julie presented on some cross-cutting climate change themes across the living resource outcomes that came up in one-on-one discussions with these groups. The first is that there needs to be a better understanding of what this new climate regime means for managing species distribution and composition and is there a way to connect it with resilience metrics. The second theme is conducting a synthesis of existing datasets that assess habitat risk of living resources related to climate change trends. Lastly, there needs to be long-term monitoring for aquatic resources related to environmental change.

Julie started the discussion by mentioning that the actions presented during this discussion are ones that are included already in the CRWG workplan and could be fitting for collaboration. The first action (2.1) states to support efforts to identify approaches to track climate resilience activities and define resilience enhancement. This action has two sub-actions: a) plan discussions during CRWG meetings on how the CRWG can feasible track progress on the Adaptation Outcome and b) invite researchers to present on how they are quantifying resilience effectiveness in relation to habitat and community resilience. Julie then posed a question in reference to action 2.1a, inquiring about if there are any topics that other groups would like the CRWG to host a themed meeting about. Julie mentioned that there are creative

ways about how folks in other groups are defining resilience and looking at habitat suitability and setting thresholds for fisheries and also looking at community structure for SAV. She mentioned that she could envision a meeting that brings in experts and having conversations about what these resilience metrics may look like.

Nicole Carlozo was curious by what is meant by resilience effectiveness. She asked if it means how adaptive the habitat is to climate change. Julie agreed that this is good point; when this was drafted Julie was thinking about natural infrastructure and habitat, so she was focused on resilience effectiveness related to shoreline protection. She mentioned that this action can be expanded beyond just thinking about shoreline protection. Julie expanded upon the context of why the term resilience effectiveness was used; she mentioned that she was using it in the sense of the strategies that are put in place to allow for healthy watersheds or habitat. Marc Hensel mentioned that they do not have a good handle on how ecosystem function might be different under different dominant species. Both Joel Carr and Marc mentioned that when discussing resilience as it pertains to SAV, they need to think about SAV trends on both spatial and temporal scales. Marc said it would be important for management decisions and strategies to understand spatially what areas to focus on. Chris Guy added that function is also key. It is not only habitat, native biodiversity, fisheries, waterfowl, and tidal wetland's plant species and wildlife that can be key indicators of resilience. Julie mentioned that there is the opportunity to expand upon the focus to include both tidal and watershed in developing resilience tracking metrics. Brooke Landry also inquired that while this action focuses on tracking activities, she was wondering if there are other actions that are actually conducting the activities themselves. She provided an example of establishing aquatic resource sentinel site program to answer some of the questions that Marc raised earlier. Julie mentioned that this was good point, and she highlighted action 1.2, which focuses on the Monitoring and Assessment Outcome. This action could be amended to incorporate efforts focused on a sentinel site program. She did mention that there is a need for these long-term datasets to information adaptation efforts. Chris Guy followed up on Brooke's point mentioned that the Bay Program is still working within some of the original Watershed Agreement framework from the 1970s, which is water quality focused. He thinks that we can approach this action from outside of the framework and working within the new paradigm which focuses on biodiversity. For action 2.1b, Fredrika Moser commented that it might be interesting to learn more about connecting with private landowners to advance discussions on nature-based solutions for co-benefits of habitat and community resilience to RSLR.

Julie thanked folks for the conversation and mentioned that she would work with the CRWG chairs to revise the actions based on the conversations held at the meeting. She then requested that the workgroups and action teams review the workplan when it is open for public comment to help keep these conversations going.

3:20 PM Wrap-up and announcements

- Local Government Advisory Committee (LGAC) - final report titled Integrating Resilience into Local Planning, appendices, and one-

pager, based on the findings and recommendations from the Local Government Forum held September 29, 2022 is now available on the LGAC webpage (scroll to LGAC Local Government Forums).

- MARISA released their Mid-Atlantic Regional Climate Summary for Fall 2022. Most of the region experienced temperatures that were within two degrees of normal for the fall season. The first week of November was unusually warm: On November 7, Lynchburg, Virginia recorded its warmest November day on record with a high of 84 degrees. The majority of the region also saw near-normal precipitation this season, experiencing between 125 and 75 percent of their normal fall precipitation amounts. In the future, the region is projected to experience a similar number of consecutive dry days. For more highlights and to read the summary, click here.

3:30 PM Adjourn

Next Meeting: February 23, 1:30-3:30 PM (note this meeting was moved to Thursday instead of Monday, since Monday is a Federal Holiday)

First Name	Last Name	Affiliation
Amanda	Small	MD DNR
Ben	McFarlane	HRPDC
Julie	Reichert-Nguyen	NCBO
Joel	Carr	USGS
Stephen	Faulkner	USGS
Angela	Jones	DoD
Becky	Golden	MD DNR
Jennifer	Starr	EPA
Nora	Jackson	NVRC
Justin	Shapiro	CRC/NCBO
Grace	Hansen	HRPDC
Breck	Sullivan	USGS
Nancy	Roth	Tetra Tech
Mark	Bennett	USGS
Renee	Thompson	USGS
Matt	Konfirst	EPA R3
Taylor	Woods	USGS
Amy	Goldfischer	CRC/EPA
Marc	Hensel	VIMS
Rachel	Lamb	MDE
Nicole	Carlozo	MD DNR
Fredrika	Moser	MD Sea Grant

Chris	Guy	USFWS
Kate	McClure	MD Sea Grant
Sophie	Waterman	CRC/EPA
Brooke	Landry	MD DNR
Sushanth	Gupta	MD DNR
Kristin	Saunders	UMCES
Debbie	Herr Cornwell	MDP
Katie	Brownson	USFS
Lisa	Dosmann	DoD
Jim	George	MDE
Katlyn	Fuentes	CRC/EPA
Cassie	Davis	NYS DEC
Elizabeth	Andrews	W&M
Anna	Hamilton	Tetra Tech
Bruce	Vogt	NCBO
John	Clune	USGS
Mike	Kolian	EPA
Jamileh	Soueidan	CRC/NCBO