Outcome's Monitoring Needs as of 1.21.22

Sustainable Fisheries Goal

Protect, restore and enhance finfish, shellfish and other living resources, their habitats and ecological relationships to sustain all fisheries and provide for a balanced ecosystem in the watershed and Bay.

Blue Crab Abundance

Oysters

Forage Fish

The Sustainable Fisheries GIT including the Forage and Fish Habitat Action Teams have identified **the need for shallow water fishery independent monitoring that would support both stock assessments and ecosystem-based approaches to fishery management.** With respect to fishery survey interests, shallow water monitoring is broken into two categories 1) Shallow (~8 ft to ~20 ft) mainstem and tributaries 2) Littoral zone (<8 ft). These surveys should target both managed and unmanaged species and both adult and juvenile life stages. They would also include collection of supplementary environmental data to aid analysis of how habitat conditions may be influencing the abundance, distribution and other key parameters. Trawl and seine surveys are the probable best candidates for general application of these surveys baywide. Such surveys provide data on multiple species from multiple habitats; however additional approaches such as underwater video may be included in sampling designs. Shallow water surveys would also require standardization and coordination across jurisdictions. Specific sampling designs, opportunities to link habitat and fish surveys (such as SAV and sampling at restoration sites), and cost estimates would need to be developed. Some recommendations are provided in the 2006 STAC workshop report https://chesapeake.org/wp-content/uploads/2017/05/CRC0163_07_CRC-NCBO-Fisheries-Workshop.pdf

Specific examples of needs include sampling specific structural shoreline habitat such as SAV, restored oyster reefs, natural and develop shorelines to develop species utilization and species assemblages across this full range of shoreline habitats, and shallow water overwinter blue crab surveys. New opportunities include coordinating fish sampling at SAV sentinel sites, using shallow water telemetry arrays, exploring underwater camera and acoustic methods of evaluating fish utilization, and engaging citizen science.

Fish Habitat

Vital Habitats Goal

Restore, enhance and protect a network of land and water habitats to support fish and wildlife and to afford other public benefits, including water quality, recreational uses and scenic value across the watershed.

Wetlands

Black Duck

Stream Health

The priority monitoring need for the Stream Health workgroup is the collection of freshwater macroinvertebrate data from under-represented catchment types. The Chesapeake basin-wide index of biotic integrity for stream macroinvertebrates, or "Chessie BIBI," is a multi-metric index of stream health applicable to freshwater streams and small rivers across the Chesapeake Bay watershed. It is composed of family-level macroinvertebrate metrics, or indicators, that are especially responsive to differences between high quality and degraded stream conditions. The index is calculated from stream macroinvertebrate data collected by state, federal, and local agencies and other groups. Only about 7% of stream catchments (< 200 km^2 drainage area) in the Chesapeake watershed are sampled and some catchment types such as high-quality streams are under-represented. A model was developed that uses landscape features to predict a Chessie BIBI rating for unsampled catchments (Maloney et al. 2018). When monitoring and modeling results are merged, a Chessie BIBI rating can be assigned to 99% of catchments. To estimate the overall percent of healthy streams in the Chesapeake watershed, the ratings are weighted either by their catchment's area or stream miles and summed. Freshwater macroinvertebrate data from under-represented catchment types are critically needed to fill in monitoring gaps and improve model predictions.

Brook Trout

The Brook Trout Outcome requires a more accurate and comprehensive monitoring program for quantifying gains and losses in brook trout habitat across the CBW. Multiple agencies, NGOs, and other practitioners implement restoration projects with the objective to create or expand brook trout habitat. However, there is often little monitoring to determine pre-project baselines or the actual presence of brook trout post-project to document project success and efficacy. More effort and resources are required to develop monitoring protocols (e.g., sampling design, methodologies like eDNA, etc.) that can document results of on-the-ground restoration projects. This will also provide information to help identify the most cost-effective actions to increase brook trout occupancy.

Fish Passage

The outcome does not have any monitoring needs during this monitoring assessment period.

Forest Buffers

The monitoring needs are:

- Monitor forest buffer cover change using hi-rez data
- Monitor forest and tree cover change in developed areas using hi-rez data
- Develop low-cost methods for verifying buffer acres

More details available on the Chesapeake Bay Program Science Needs Database.

Tree Canopy

Monitor forest and tree cover change in developed areas using hi-rez data. More details available on the Chesapeake Bay Program Science Needs Database.

Water Quality Goal

Reduce pollutants to achieve the water quality necessary to support the aquatic living resources of the Bay and its tributaries and protect human health.

Watershed Implementation Plans (WIPs) - 2025

Incorporation of monitoring and trends data into assessment of jurisdictions' progress in achieving the Bay TMDL planning targets. More details available in Chesapeake Bay Program Science Needs Database.

Toxic Contaminants Goal

Ensure that the Bay and its rivers are free of effects of toxic contaminants on living resources and human health.

Toxic Contaminants Research

Please refer to Section 2 of the report which details the monitoring needs for this outcome along with funding estimates.

Toxic Contaminants Policy and Prevention

The outcome does not have any monitoring needs during this monitoring assessment period.

Healthy Watersheds Goal

Sustain state-identified healthy waters and watersheds, recognized for their high quality and/or high ecological value.

Healthy Watersheds

The Chesapeake Bay Program (CBP), through its Maintain Healthy Watersheds Goal Implementation Team (HWGIT), has a goal of maintaining the long-term health of watersheds identified as healthy by its partner jurisdictions. **Therefore, the primary monitoring need of HWGIT is the continued support, maintenance, and timely update of monitoring data that is used to inform the Chesapeake Healthy Watershed Assessment (CHWA).** The CHWA supports the CBP and its jurisdiction partners in detecting signals of change in the state-identified healthy watersheds by assessing current watershed conditions and tracking future conditions. It also

provides information useful to support management applications to protect and maintain watershed health from future degradation. The list of monitoring states rely on to identify healthy watersheds through the CHWA includes:

- Maryland Biological Stream Survey (MBSS)
- Chesapeake Basin-wide Index of Biotic Integrity (Chessie BIBI)
- 6 candidate geomorphic metrics (combination of remote sensing data and modeling analysis):
    - Streambank lateral erosion
    - Streambank change (m2)
    - Streambank sediment flux – incorporates bank height, lateral erosion, and bulk density
    - Streambed D50
    - Streambed fine sediment cover
    - Streambed fine sediment + sand cover
- MBSS Stronghold Watersheds (developed from MBSS monitoring data)
- Conductivity (developed from field data and modeling)
- Recent Forest loss (Hansen data, from remote sensing imagery)

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.

Climate Monitoring and Assessment

The Climate Monitoring and Assessment Outcome has the need for **development of climate change indicators for monitoring and assessing ecological and community effects and resilience related to tidal bay water temperature change, stream temperature change, sea level rise, flooding, and extreme heat.** The Chesapeake Bay Program's Climate Resiliency Workgroup, in coordination with the Management Board and respective workgroups, agreed that there is a need to better connect changes in temperature, precipitation, and sea level rise with ecological and community impacts related to the outcomes in the Chesapeake Bay Watershed Agreement. They prioritized the following natural resource-related climate change indicators: stream and Bay water temperature change related to fish (e.g., brook trout, striped bass) and submerged aquatic vegetation habitat (SAV) and relative sea level rise effects on tidal marsh extent and relevant marsh migration corridors. They also prioritized the following community-related climate change indicators: change in high temperature extremes in connection with tree canopy needs for underserved urban areas and river and coastal flooding effects on communities. To have effective climate change indicators to inform resilience and adaptation decisions there is a need for engagement efforts with stakeholder groups doing the restoration, conservation, and land-use planning to define the purpose of the indicator. Indicator development includes the need to identify the data and methodology, including the temporal and spatial scales needed for the defined purpose, and the determination of whether there are existing monitoring and assessment programs that have the means to provide the data and analyses consistently within a long-term timeframe. Monitoring and assessment considerations for the longevity of the indicator (e.g., cooperative agreements with data providers, indicator maintenance plans) will be important to ensure the continued reliability of the indicator for use in resilience and adaptation decision-making.

A primary monitoring need is the establishment of an Ocean Acidification Monitoring Network. The quickly rising levels of carbon dioxide (CO2) in the atmosphere in conjunction with land pollution is leading to acidification in coastal waters and could impact the survival of living resources in the Chesapeake Bay. Characterizing the carbonate system in the Bay is important for calcifying organisms such as clams and oysters, assessing habitat suitability for these living resources, and understanding carbon storage. There is not a long-standing monitoring network for ocean acidification (OA) in the Bay, but there are current assets where additional monitoring could be implemented to make OA a feature captured and reported. Recommended steps for setting a baseline requires coordination between state agencies (MD, VA, DC) and scientists to understand suitable monitoring sites, if there are discrepancies among methods between the states, and what are the gaps for addressing OA. This monitoring network will identify shifts in the carbonate system allowing managers to make strategic restoration decisions to protect habitats and living resources both ecologically and economically important to the region.

There has been interest expressed by the Chesapeake Bay Program and partners to better understand the **quantification of carbon sequestration from tidal wetlands and submerged aquatic vegetation (SAV) and potential application of conservation and restoration efforts of these resources in the carbon market.** A review of existing blue carbon crediting protocols demonstrated the need for improved understanding of carbon fluxes and long-term storage in coastal ecosystems, including both the aboveground biomass and soil carbon pools. Additional needs include improved knowledge of carbon stock changes from sea level rise pertaining to marsh drowning and erosion and landscape conversions (e.g., mature forest to new marshland). Specific to SAV, gaps in knowledge include the leakage of carbon from degraded seagrasses and the difference in the carbon sink capacity among different seagrass species. There is also a need to better understand how human drivers that lead to ecosystem degradation and loss, such as drainage, harvesting, burning, and clearing of vegetation, affect carbon fluxes and emission rates over time. The monitoring and assessment of blue carbon projects need to allow for the quantification of aboveground and belowground carbon stocks and the assessment of risk associated with potential loss in carbon stocks in the project area over a period of 100 years. The establishment of baseline emissions include the consideration of carbon stock change from sea level rise and change in biomass pool and net greenhouse gas (GHG) emissions from soil. Additionally, assessments are needed on whether the project will lead to increased GHG emissions outside the project area from both an ecological (e.g., hydrological connectivity with adjacent areas) and economical (e.g., displacement of economic activities) perspective. Monitoring and assessment to verify blue carbon projects needs to be maintained for at least 30 years and the baseline reevaluated every ten years. Models used in the blue carbon assessments need to be validated with direct measurements from a system with the same or similar water table depth, salinity, hydrology, sediment allocation, and plant community. Overall, the monitoring and assessment of blue carbon projects for application in carbon markets needs to support the quantification of GHG emissions and removals, establish the permanence of carbon stocks, and evaluate sea level rise effects on the carbon stocks in the project area. Activities that could result in leakage leading to an increase in emissions or a decrease in removals of GHG outside the project area also need evaluation for blue carbon projects.

Climate Adaptation

The outcome does not have any monitoring needs during this monitoring assessment period.

Land Conservation Goal

Conserve landscapes treasured by citizens in order to maintain water quality and habitat; sustain working forests, farms and maritime communities; and conserve lands of cultural, indigenous and community value.

Protected Lands

The outcome does not have any monitoring needs during this monitoring assessment period.

Land Use Methods and Metrics

Please refer to Section 2 of the report which details the monitoring needs for this outcome along with funding estimates.

Land Use Options Evaluation

The outcome does not have any monitoring needs during this monitoring assessment period.

Stewardship Goal

Increase the number and diversity of local citizen stewards and local governments that actively support and carry out the conservation and restoration activities that achieve healthy local streams, rivers and a vibrant Chesapeake Bay.

Citizen Stewardship

The outcome does not have any monitoring needs during this monitoring assessment period.

Local Leadership

Diversity

Diversity Indicator Target/Goal for 2025 using American Community Survey Data (Overlaying state Demographic and Economic census block data over Chesapeake Bay Watershed). More details available in Chesapeake Bay Program Science Needs Database.

Public Access Goal

Expand public access to the Bay and its tributaries through existing and new local, state and federal parks, refuges, reserves, trails and partner sites.

Public Access Site Development

Identify public access sites and potential effects from climate change (sea-level rise and flooding). More details available in Chesapeake Bay Program Science Needs Database.

Environmental Literacy Goal

Enable students in the region to graduate with the knowledge and skills to act responsibly to protect and restore their local watershed.

Environmental Literacy Planning; **Sustainable Schools**; **Student**

The primary monitoring need for the Environmental Literacy Planning, Sustainable Schools, and Student Outcomes is the continued collection of data through the Environmental Literacy Indicator Tool (ELIT). The ELIT survey to public-school districts is the source of information to assess progress towards these outcomes. To ensure that every student in the region graduates with the knowledge and skills to act responsibly to protect and restore their local watershed as called for in the Chesapeake Watershed Agreement, environmental education should be embedded into the local curriculum and Meaningful Watershed Educational Experiences should occur at least once during each level of instruction (elementary, middle, and high school).

The data is collected biannually, and the survey has Paperwork Reduction Act clearance through NOAA as the lead agency for this work. ELIT provides data for three indicators on Chesapeake Progress that determine:

1. Percentage of Local Education Agencies (LEAs) that are “Well Prepared” or “Somewhat Prepared” to implement environmental education program(s).
2. The quantity and support of BMP installation and restoration at schools to contribute directly to Bay restoration goals.
3. Percentage of Local Education Agencies that have “system-wide,” “some,” or “no MWEE” availability at the elementary, middle, and high school level.