Chesapeake Bay Program
Science. Restoration. Partnership.

Blue Crab Abundance and Management Outcomes

Management Strategy

2015–2025, v.3

A pair of mating blue crabs, known as a "doubler," in a dip net in Kent Island, MD, on August 27, 2010. (Photo by Alicia Pimental/Chesapeake Bay Program)

I. Introduction

The blue crab (*Callinectes sapidus*) is an iconic species in the Chesapeake Bay region. Blue crabs are highly valuable as an important component of the ecosystem and a key fishery resource in the Bay. Juvenile blue crabs are a forage (i.e., prey) species for other important predators, such as striped bass (*Morone saxatilis*), red drum *(Sciaenops ocellatus*), Atlantic croaker (*Micropogonias undulatus*), and even adult blue crabs. Adult blue crabs are generalist predators and scavengers, feeding on a diversity of benthic invertebrates (e.g., polychaetes, clams, crustaceans), small fishes, plant material, and detritus. Mature adults also support lucrative commercial and recreational fisheries throughout the region. Given the significant ecological and economic importance of blue crabs, effective management is critical to ensure the sustainability of this resource.

Three jurisdictions work together to manage blue crabs in the Chesapeake Bay: the State of Maryland, the Commonwealth of Virginia, and the Potomac River Fisheries Commission. These jurisdictions are

aided by the Chesapeake Bay Stock Assessment Committee (CBSAC), a scientific workgroup of the Chesapeake Bay Program's Sustainable Fisheries Goal Implementation Team (SFGIT). CBSAC is composed of fisheries managers from each of the jurisdictions, blue crab scientists along the Atlantic coast, technical experts from the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service, and representatives from the SFGIT. The roles of CBSAC are to identify and implement strategic science priorities that support resource management, and to provide the jurisdictions with science-based advice for sustainable management of the blue crab stock in the Chesapeake Bay.

II. Goal, Outcome, and Baseline

This management strategy identifies approaches for achieving the following goal and outcomes:

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 Outcome

Maintain a sustainable blue crab population based on the 2021 target of 196 million adult females. Refine population targets through 2025 based on best available science.

Blue Crab Management Outcome

Manage for a stable and productive crab fishery, including working with the industry, recreational crabbers, and other stakeholders to improve commercial and recreational harvest accountability. By 2018, evaluate the establishment of a Bay-wide, allocation-based management framework with annual levels set by the jurisdictions for the purpose of accounting for and adjusting harvest by each jurisdiction.

Baseline and Current Condition

Abundance

Since 1990, the Maryland Department of Natural Resources (MDNR) and the Virginia Institute of Marine Science (VIMS) have conducted the annual Winter Dredge Survey (WDS) to estimate the abundance of blue crabs in the Chesapeake Bay. A period of sustained low abundance throughout the 1990s and 2000s inspired the jurisdictions to implement female-specific management regulations in 2008 to improve spawning potential, and consequently, recruitment. Since implementing female-specific management, the average adult female abundance doubled from the previous decade.

A 2011 benchmark stock assessment recommended that the jurisdictions implement a management framework with reference points specific to adult female blue crabs (age 1+) because they represent the spawning stock, a critical component of population dynamics. The results of the assessment recommended an abundance target of 215 million adult female crabs and a threshold of 70 million adult females. These abundance reference points were developed using a conventional approach in fisheries management, and are associated with reference points for exploitation (i.e., harvest). The jurisdictions

officially adopted these female-specific reference points in 2012 and used them to assess the stock status through 2020.

In 2017, a stock assessment update was conducted using additional WDS data through 2017 and harvest data through 2016, and in November 2020, the three jurisdictions formally adopted the new female-specific reference points generated by this update. The target abundance of 215 million adult female crabs decreased to 196 million, and the threshold abundance of 70 million adult females increased to 72.5 million. CBSAC determined that these new reference points represent the best available science by which the blue crab stock should be assessed and managed.

Management

The management jurisdictions, with stakeholder input, evaluated the application of an allocation-based management framework for the Chesapeake Bay blue crab fishery. This type of management framework defines methods for allocating an annual total allowable catch (TAC) of male and female crabs among the three management jurisdictions in the Bay: Maryland, Virginia, and the Potomac River. TAC is the total number or pounds of crabs that can be harvested by commercial and recreational fisheries each year. In 2017, the jurisdictions decided to maintain the current management approach rather than implementing an allocation-based framework. The jurisdictions submitted a summary of their evaluation to the Chesapeake Bay Program, officially completing the Blue Crab Management Outcome.

III. Participating Partners

The following partners participated in the development of this management strategy.

Chesapeake Bay Watershed Agreement Signatories

- State of Maryland
- Commonwealth of Virginia
- Potomac River Fisheries Commission
- National Oceanic and Atmospheric Administration
- Chesapeake Bay Commission

Key Participants

Members of the Chesapeake Bay Stock Assessment Committee (CBSAC) are the key participants in this coordinated effort, and represent the following partner organizations:

- Maryland Department of Natural Resources (MDNR)
- Virginia Marine Resources Commission (VMRC)
- Potomac River Fisheries Commission (PRFC)
- Virginia Institute of Marine Science (VIMS)
- University of Maryland Center for Environmental Science (UMCES)
- University of North Florida (UNF)
- National Oceanic and Atmospheric Administration (NOAA)

Stakeholder Engagement

Stakeholders include commercial and recreational harvesters, the general public, and interested nonprofit organizations. Each management jurisdiction actively engages commercial and recreational harvesters through established stakeholder committees and advisory groups, including:

- Maryland Blue Crab Industry Advisory Committee
- Maryland Tidal Fisheries Advisory Commission
- Maryland Watermen's Association
- Potomac River Crab Advisory Committee
- Virginia Crab Management Advisory Committee
- Virginia Watermen's Association

IV. Factors Influencing Success

Chesapeake Bay blue crabs and their associated fisheries are affected by a variety of natural and human factors that present challenges to meeting the objectives of this management strategy. While some of these factors may be addressed directly through this strategy, others cannot be directly controlled or managed, and will therefore require managers to use the best available science to make informed management decisions. The following factors influence the blue crab population and fishery, and consequently, the Chesapeake Bay Program's ability to attain the Blue Crab Abundance Outcome.

Population Dynamics

The Chesapeake Bay blue crab population exhibits high natural variability in abundance and recruitment, in part because of the blue crab's complex life history. Larval abundance is often dependent on the abundance of spawning females, although a high abundance of mature females does not guarantee consistently high rates of recruitment. Blue crabs produce many offspring in multiple broods released over a period of two or more years, but larval survival in the coastal shelf waters is unpredictable. Recruitment of blue crab megalopae into the Bay's nursery habitats also fluctuates widely from year to year, and is influenced by various oceanic and climatic conditions that affect not only survival, but also larval transport, such as wind and tidal currents. Once juvenile crabs settle in the Bay, many environmental and ecological factors continue to influence their survival, including water temperature, salinity, habitat condition, predation and prey abundance, hypoxia, and disease. Many of these factors are discussed further in the following sections.

Environmental Variability and Climate Change

Blue crab reproduction, growth, and survival are often dependent on environmental conditions. For example, larval blue crabs require the higher salinity waters of the coastal shelf for their development, so egg-bearing females migrate to the mouth of the Chesapeake Bay to spawn. Recruitment success of blue crab larvae has been correlated with patterns of oceanic, tidal, and wind currents. Timing of life history events, such as migration and overwintering, is regulated by changes in temperature. When water temperature drops below 10°C, adult blue crabs typically move into deeper channels and burrow in the sediment for their overwintering period of dormancy, while juveniles remain in their shallow nursery habitats. Extremely cold winter water temperatures can result in significant overwintering mortality of

blue crabs in the Bay. Therefore, annual variability in environmental conditions has the potential to dramatically impact the Chesapeake Bay blue crab population.

In the long term, climate change could have a wide range of effects on blue crab population dynamics in the Bay. Changes in temperature could alter the species assemblage of predators and prey in the ecosystem, which could increase blue crab mortality due to increased predation or decreased food availability. For example, the distribution of red drum, a warmer-water species known to feed on juvenile blue crabs, could shift north and start inhabiting the Chesapeake Bay more frequently and for longer periods of time. In addition to temperature, changes in salinity and sea level rise could negatively affect marsh and seagrass habitats that serve as critical nurseries and foraging grounds for blue crabs. Warming temperatures and changes in precipitation patterns would likely increase the extent and duration of hypoxic zones, which would reduce foraging resources and available suitable habitat. Although it is likely that climate change will affect Chesapeake Bay blue crabs, the specific impacts and outcomes are uncertain given the complexity of the interactions between all the biotic and abiotic factors involved.

Habitat Availability

Submerged aquatic vegetation (SAV), such as seagrass, is the primary nursery habitat for juvenile blue crabs in the Chesapeake Bay, providing a refuge from larger predators and an abundant source of smaller prey. Shallow marshes provide similar nursery habitats. The loss of SAV and natural marsh due to poor water quality, sea level rise, and shoreline hardening raises concerns for blue crabs because of their dependence on these structured habitats for food and refuge. Reduced habitat availability could also result in larger concentrations of young juveniles in the limited nurseries, increasing competition and the risk of predation and cannibalism.

Predation and Prey Availability

Predation is a limiting factor on blue crab abundance in the Chesapeake Bay, and affects population dynamics, survival, and reproduction. Predation on blue crabs varies seasonally, spatially, among habitats, and by crab size/life stage. Predation mortality is highest in the early life stages when blue crab larvae are drifting in the coastal waters just outside the Bay. Predation mortality of larger juveniles and adults is highly dependent on the species of finfish, birds, and other potential predators in the Bay. Cannibalism is also a major source of mortality, especially for juvenile crabs as their smaller size increases their susceptibility to cannibalism and predation. Limited habitat availability can concentrate blue crabs into smaller areas which also increases competition and cannibalism pressure.

Blue crabs are generalist predators and scavengers, feeding on a diversity of benthic invertebrates (e.g., polychaetes, clams, crustaceans), small fishes, plant material, and detritus. Poor environmental conditions can reduce prey abundance, particularly of sessile species that are unable to relocate to more optimal habitats. Significant reductions in benthic prey abundance due to eutrophication, hypoxia, habitat loss or alteration, and increased abundance of competitor species could limit prey availability to blue crabs, affecting growth and survival.

Hypoxia

Blue crab responses to hypoxia (i.e., low dissolved oxygen concentrations) are determined by the severity of the hypoxic event (i.e., extent and duration) and the crab's tolerance to low oxygen levels. Hypoxic zones have been increasing in volume and duration due to an increase in impervious surfaces around the Chesapeake Bay watershed and nutrient loading from land-based sources. Typically, blue

crabs move out of deeper, hypoxic waters and aggregate in shallow, nearshore areas. In doing so, they become more susceptible to fishing gear, density-dependent predation, and agonistic interactions. Hypoxia may also interfere with the dispersal of larval blue crabs in the Bay and with mature females migrating to the mouth of the Bay to spawn.

Disease

Blue crabs harbor a variety of pathogens that can be fatal to the carrier, but are not harmful to humans. *Hematodinium perezi* commonly infects crabs in the fall in high-salinity areas of the lower Chesapeake Bay. A reo-like virus can be found Bay-wide and is often observed in dead crabs from shedding facilities. The effects of these and other diseases on the blue crab population in the Bay remain poorly understood and likely contribute to mortality in the fishery as well as the general population. Managers are interested in gaining a better understanding of the role of disease in blue crab natural mortality, particularly in separating disease/discard mortality and harvest mortality in the peeler fishery.

Harvest Reporting

Blue crabs support valuable commercial and recreational fisheries in the Chesapeake Bay. The blue crab fishery is complex, with multiple commercial and recreational gear types, and differing regulations across the three management jurisdictions. Blue crab ecology, such as migration patterns and habitat use, also affects fishing practices and the resulting harvest throughout the Bay. Given the spatial complexity of the blue crab population and its fisheries, harvest regulations may affect crabbers differently across regions of the Bay. To effectively manage the fishery, managers require a better understanding of Bay-wide fishing effort and how harvest levels change from year to year, as well as within each year. Improving harvest accountability and gathering more effort information would inform more insightful management decisions to maintain a sustainable blue crab population.

Public Engagement

Ensuring that the public understands blue crab fishing regulations and that they are invested in maintaining a healthy blue crab population is important for managers to achieve this outcome. Engaged stakeholders can help improve harvest reporting and provide other useful information regarding the state of the fishery to the jurisdictions. Each year, CBSAC publishes the Blue Crab Advisory Report to inform interested stakeholders and the public about the status of the blue crab population and fishery.

Partner Coordination

Planning and implementing a benchmark stock assessment requires coordination across all three management jurisdictions. The jurisdictions need to reach a consensus on the need for a new assessment, determine the terms of reference, and identify sources of funding. Additional coordination with federal, academic, and nonprofit organizations will also likely be necessary to fund and implement future benchmark stock assessments. CBSAC members must also work together to identify and prioritize blue crab science needs that will improve the stock assessment model and advance understanding of blue crab population dynamics.

Scientific and Technical Understanding

Resource managers make informed decisions based on the best available science, and must make assumptions when data and other important information are unavailable. Key knowledge gaps for blue crabs in the Chesapeake Bay include accurate estimates of harvest and effort, juvenile abundance, non-harvest mortality (e.g., bycatch, discards, etc.), natural mortality, catchability, and stock assessment

model performance evaluation. Addressing these data gaps would reduce uncertainty in the blue crab stock assessment and consequent management decisions. Availability of funding and other resources will affect how and when these data gaps can be addressed.

V. Current Efforts and Gaps

Annual Surveys and Reports

The Winter Dredge Survey (WDS) is a comprehensive, Bay-wide survey designed specifically to estimate the number of blue crabs present in the Chesapeake Bay by gender and size class. The WDS has been conducted every winter since 1990 and is the cornerstone of the annual population assessment. MDNR conducts the Maryland portion of the survey and VIMS conducts the Virginia portion of the survey. Each year, a total of 1,500 sites in waters deeper than 5 feet are sampled in a random, stratified survey design.

There are other surveys in the Bay that collect blue crabs, but not at the spatial resolution of the WDS. Both MDNR and VIMS have conducted annual trawl surveys in the summer and fall since the 1970s. These surveys provide valuable ancillary information about growth, distribution, and recruitment of blue crabs in the Bay. CBSAC currently has plans to evaluate the utility of these surveys as indices of abundance for stock assessment. CBSAC is also interested in obtaining more accurate estimates of juvenile blue crab abundance through a shallow-water recruitment survey to better understand stock-recruitment dynamics, as the WDS is not effective at sampling smaller crabs.

Every year, upon completion of the WDS, CBSAC conducts an assessment of the blue crab stock status by reviewing the WDS results, trawl survey data, and harvest estimates, and then comparing the estimated abundance of adult females and the estimated exploitation rate to the established biological reference points. CBSAC publishes the results of this analysis in the annual Blue Crab Advisory Report, along with management recommendations and priority science needs.

Benchmark Stock Assessments

Management of the Chesapeake Bay blue crab population is guided largely by benchmark stock assessments. Benchmark stock assessments are comprehensive, mathematical analyses that utilize the most up-to-date information (i.e., harvest data, survey data) to answer important questions about the health and management of a harvested species. Benchmark assessments inform managers about levels of fishing pressure that will ensure maintenance of a healthy population, and provide guidance on the abundance of spawning-age individuals necessary to ensure that the population is self-sustaining. These estimated levels of fishing pressure and abundance are known as biological reference points.

The most recent Chesapeake Bay blue crab stock assessment was conducted in 2011 by scientists from UMCES, MDNR, VMRC, and VIMS, and peer reviewed by international fisheries scientists from the Center of Independent Experts. The 2011 benchmark assessment established a management framework with female-specific reference points. A stock assessment update was conducted in 2017 to evaluate the performance of the 2011 assessment model with new data from 2016 and 2017. The jurisdictions determined that the model was still performing well and a new benchmark assessment was not needed. In 2020, the jurisdictions adopted the refined reference points from the 2017 update, determining that they represented the best available science by which the population should be assessed and managed. Currently, jurisdiction leaders are satisfied with the present management framework. However, CBSAC

continues to discuss the timing and impetus for a new benchmark stock assessment, and is committed to focusing on addressing blue crab science priorities in the meantime.

Harvest Reporting

Reliable harvest, effort, and catch composition data are essential for accurate assessment of the blue crab stock and for developing effective management strategies. All three management jurisdictions require commercial crabbers to report their daily (MDNR, VMRC) or weekly (PRFC) harvest. However, the primary challenges to these reporting measures are compliance and catch verification. In 2012, MDNR implemented a voluntary electronic reporting program, which has allowed for catch verification through monitoring. VMRC and PRFC have also recently started planning and implementing their own electronic reporting programs. However, availability of funding and staff resources remain significant barriers to verification monitoring. More detailed information about harvest reporting efforts in the Chesapeake Bay can be found in CBSAC's Blue Crab Harvest Reporting document, completed and published in 2022.

MDNR has also made efforts to characterize catch composition (e.g., sex, size, life stage). In 2002, MDNR established the Cooperative Data Collection Program in which commercial crabbers voluntarily sample their own catch or allow MDNR observers to ride along and sample the catch. CBSAC is interested in incorporating these kinds of data into the stock assessment model, but this would require a greater spatial resolution. VMRC and PRFC would need to implement similar programs to collect the required data, and these data would need to be standardized to include them in the stock assessment.

Model Performance Evaluation

Since 2020, MDNR has committed to conducting an annual stock assessment update to evaluate the performance of the current stock assessment model with the addition of another year's WDS and harvest data. This is not a formal effort, but rather an internal assessment of the model that is meant to apprise CBSAC of any potential issues in the model's ability to estimate blue crab abundance. Major discrepancies in the model estimates could indicate a need for a new analytical approach and/or a benchmark stock assessment.

Scientific and Technical Understanding

Despite the wide base of knowledge surrounding blue crab biology and ecology, gaps still exist that raise questions for fisheries managers about population dynamics. For example, a female-specific management framework was implemented in 2011 under the assumption that a healthy, robust female spawning stock would result in strong recruitment and, consequently, a self-sustaining population. In recent years, however, the Chesapeake Bay has experienced low blue crab recruitment despite high levels of adult female abundance, as determined by the biological reference points. This has led CBSAC to question the strength and reliability of the stock-recruitment relationship, and has generated interest in drivers of recruitment and abundance. CBSAC is interested in quantifying the impacts of various environmental (e.g., temperature, currents, storm events) and ecological (e.g., predation, disease) factors on blue crab population dynamics. From these analyses, CBSAC could identify the most important drivers of recruitment and abundance, and then potentially explain some of the interannual variability exhibited by the population. This work could also lay the foundation for future ecosystem-based approaches to blue crab management in the Chesapeake Bay.

Similarly, identification and quantification of natural (e.g., disease, predation) and non-harvest (e.g., bycatch) sources of mortality could help improve blue crab stock assessment by providing more accurate mortality estimates. CBSAC also has a continued interest in evaluating the impacts of catchability and gear effects on WDS abundance estimates, particularly in variable habitats. MDNR and VIMS have been conducting annual paired-tow comparisons to assess gear affects across the MD and VA portions of the WDS, but additional data need to be collected and analyzed to draw conclusions about gear efficiency and incorporate correction factors into the stock assessment model.

VI. Management Approaches

CBSAC will implement the following actions and strategies to achieve the Blue Crab Abundance Outcome. These approaches seek to address the factors affecting the partnership's ability to meet the outcome and the gaps identified above.

Assess Blue Crab Stock Status and Communicate the Results to Managers and the Public

The Blue Crab Abundance Outcome aims to maintain the blue crab population at a sustainable level based on the target abundance of adult females. Each year, CBSAC analyzes WDS data and harvest data to assess the stock status, and reports the results to the jurisdictions along with science-based management recommendations. CBSAC then compiles the data, results, and recommendations into the annual Blue Crab Advisory Report, which is distributed widely to the public through the Chesapeake Bay Program and the NOAA Chesapeake Bay Office. The primary objectives of this approach are to: (1) coordinate collaboration between fisheries managers, scientists, and technical experts to effectively manage the Chesapeake Bay blue crab population using the best available science; and (2) inform the public about and generate interest in the status and health of the blue crab population in the Bay. This management approach is highly correlated with the monitoring aspect of the adaptive management process and will therefore be discussed further in the Monitoring Progress section below.

Evaluate and Improve the Effectiveness of the Blue Crab Stock Assessment Model

Sound management of the blue crab population depends on an accurate stock assessment model with appropriate parameters that reduce uncertainty in population estimates. To ensure that the best available science, data, and modeling techniques are used to assess and manage the population, CBSAC has committed to continued evaluation and improvement of the stock assessment model. To obtain better estimates of blue crab harvest from year to year, CBSAC has prioritized accurate harvest reporting, including effort and catch composition data. Spatially and temporally explicit effort and catch composition data would help improve the effectiveness of management regulations Bay-wide. CBSAC has also prioritized evaluation of the WDS and other fishery-independent surveys as indices of abundance to determine the best approaches for stock assessment. Furthermore, CBSAC continues to pursue a better understanding of catchability and gear effects on abundance estimates from these surveys. Similarly, CBSAC is interested in obtaining more estimates of juvenile blue crab abundance through a shallow-water recruitment survey to better understand stock-recruitment dynamics, as the WDS is not effective at sampling smaller crabs. CBSAC reports its priorities for stock assessment improvement in the annual Blue Crab Advisory Report along with its management recommendations.

Identify and Address Priority Blue Crab Science Needs

In addition to improving blue crab stock assessment, CBSAC has committed to prioritizing and conducting research that examines relationships between, and primary drivers of, blue crab abundance, recruitment, and other important aspects of population dynamics. This includes understanding the influence of environmental conditions (e.g., temperature, currents, storm events) on blue crab survival and recruitment, and the population-level effects of the loss of key nursery habitats (e.g., SAV, marsh). Understanding the ecological and environmental factors that affect blue crab population dynamics will help managers plan ahead, particularly in the face of climate change, and could support future efforts for ecosystem-based management.

VII. Monitoring Progress

The WDS is the primary mechanism for monitoring progress in maintaining a sustainable blue crab population. The WDS is conducted annually to estimate the total blue crab abundance in the Chesapeake Bay, as well as abundance of adult females (age 1+), adult males, and juveniles. The Assessing Progress section below further describes how these estimates from the WDS are used to determine the status of the stock each year.

VIII. Assessing Progress

To assess progress toward the Blue Crab Abundance Outcome, CBSAC conducts an annual review of the WDS data and the harvest data from the management jurisdictions. The abundance estimates in a given year are paired with the harvest data from that season to calculate the percentage of the population removed by harvest that year. This percentage is known as the female exploitation rate and has its own biological reference points that are used to assess stock status.

To assess stock status, CBSAC compares the estimate of adult female abundance from the WDS to the abundance reference points. This assessment is directly tied to the Blue Crab Abundance Outcome, which states that the abundance of adult females must be maintained at sustainable levels with respect to the target abundance. If the estimate of female abundance provided by the WDS is above the threshold, the population is considered to be at a sustainable level; if the abundance estimate is below the threshold, the population is considered overfished and the outcome is no longer on target. Although the female exploitation rate is not directly related to the Blue Crab Abundance Outcome, it is still important to consider in this context as the maintenance of the annual exploitation rate at or near target levels maximizes the probability of achieving and maintaining the target abundance level. The annual, Bay-wide WDS is essential for monitoring the blue crab stock and determining the need for changes in management to maintain a sustainable population.

IX. Adaptively Manage

CBSAC is committed to adaptive management of the Chesapeake Bay blue crab population. CBSAC will continually evaluate and refine these management approaches to achieve the Blue Crab Abundance Outcome. Specifically, CBSAC will use the following approaches to ensure adaptive management:

- Annually estimate blue crab stock status using the best available data
- Regularly evaluate the performance of the stock assessment model and update the management reference points as needed
- Identify, prioritize, and address science needs that will improve stock assessment and understanding of blue crab population dynamics
- Discuss management response when the stock becomes overfished and/or overfishing is occurring

X. Biennial Workplan

Development of a workplan (i.e., Logic & Action Plan) is a critical step in the Chesapeake Bay Program's adaptive management process. A workplan describes the actions a workgroup will take to address the approaches outlined in the management strategy to achieve the outcome. With the input and support of CBSAC, the SFGIT developed the first Blue Crab Logic & Action Plan in 2016. Every two years since then, CBSAC has reviewed its progress and action outcomes to inform the next workplan. CBSAC will continue this biennial adaptive management process until the Blue Crab Abundance Outcome is achieved. Each workplan includes the following:

- Key actions to take over the next two years
- Expected timeline for each action
- Partners responsible for each action
- Expected response of each action in addressing a gap