Division of Marine Fisheries (DMF) Vulnerability Assessment Report

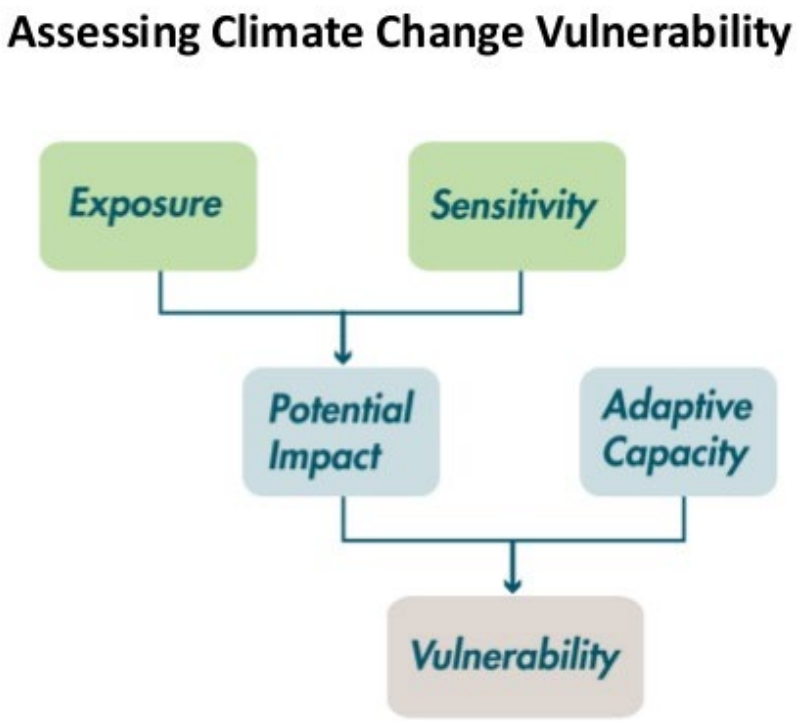
08/16/2018

Table of Contents

Introduction

This report provides a summary of the vulnerability assessment completed by the Division of Marine Fisheries (DMF) using the State Agency Vulnerability Assessment Survey Tool, which was developed as part of the 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan. This self-assessment was completed to help identify agency vulnerabilities to climate change and natural hazards and provides the basis for the development of agency-specific priority actions to strengthen resilience and preparedness to climate change and extreme events. This vulnerability assessment report also satisfies the state agency vulnerability assessment required by *Executive Order No. 569 – Establishing an Integrated Climate Change Strategy for the Commonwealth*.

The vulnerability of a state agency to climate change and natural hazards is a function of exposure, sensitivity, and adaptive capacity, as illustrated in the figure below.



Glick et al. 2011

This vulnerability assessment involved the agency's evaluation of the natural hazards identified in the table below, including how those hazards are likely to evolve as a result of climate change. The natural hazards are organized by primary climate drivers, and representative related climate change impacts are also provided.

Primary Climate Driver	Natural Hazard	Related Climate Change Impacts
Sea Level Rise and Storm Surge	Coastal Flooding (including daily tidal flooding from sea level rise)	Beach erosion, marsh migration, inundation of coastal and marine ecosystems, elimination of wetlands
	Hurricanes/ Tropical Storms	
	Nor'easter	
	Coastal Erosion	
Precipitation	Extreme Precipitation	Flash flooding, urban flooding, public health impacts from mold, worsened indoor air quality, vector-borne diseases from stagnant water
	Inland/Riverine Flooding	
	Severe Winter Storm	
	Ice Storms	
	Landslide	
	Dam Failure	
Temperature	Increase in Average Summer Temperature	Shifting in seasons (longer summer, early spring including earlier timing of spring peak flow), increase in length of growing season, increase of invasive species, frequent energy brown-outs from higher energy demands, public health impacts from high heat exposure, poor outdoor air quality
	Extreme Temperatures/Heat Waves	
	Drought	
	Wildfires	
Other Extreme Events	Tornadoes	Damage to property, infrastructure, and loss of life
	Tsunami	
	Earthquake	

This vulnerability assessment report includes the following sections:

- Key Terms: Provides definitions of key terms used for the vulnerability assessment.
- Section 1 General Agency Information: Provides an overview of the agency's mission along with a summary of the agency's critical assets, functions, and population groups.
- Section 2 Climate Change Exposure and Sensitivity: Summarizes agency confirmation of natural hazard and climate change impacts that will affect its critical assets, functions, and population groups and the agency's sensitivity to anticipated future climate conditions.
- Section 3 Agency Capability and Adaptive Capacity: Describes the agency's adaptive capacity to natural hazards and climate change.
- Section 4 Vulnerability Scores: Provides a summary of vulnerability score for each natural hazard and related climate change impacts that were assessed for a particular critical asset, function, or population group.
- Section 5 Concluding Remarks: Provides a summary of additional concerns or observations regarding the vulnerability of the agency, both in its services and overall mission, to the effects of natural hazards and climate change.

Key Terms

Adaptive capacity: The ability of a system (or, in this case, your agency) to adapt to changing circumstances, both in the short- and long-term. For example, an agency which can operate remotely likely has greater adaptive capacity than an agency which must operate from a flood-prone building. Similarly, a facility that can continue to operate during extended periods of drought due to a resilient water supply system has greater adaptive capacity than one that may encounter water restrictions.

Assets: For the purposes of this survey, there are two main types of assets: physical and non-physical. These are defined below.

> **Physical assets:** These include any tangible facilities, equipment, landholdings, natural resources, etc. that meet the definition of criticality below by playing a significant role in the operation and mission of your agency.
>
> **Non-physical assets:** This category captures non-tangible resources, such as power, Internet connectivity, or cloud-based data that are essential to your agency's functions (functions are defined below).

Climate change: A statistically significant variation in climate data or patterns over a given period of time, due to either natural climate variability or human activity.

Climate change adaptation: Measures taken in response to actual or projected climate change in order to eliminate, minimize, or manage related impacts on people, infrastructure, and the environment.

Climate change impact: Consequences of climate change on natural and human systems.

Climate driver: The manifestation of a change in climatic conditions through one or more weather variables, such as a change in precipitation or sea level rise, to create an impact.

Criticality: This definition is provided to aid agencies with the identification of critical assets or functions for the purpose of this survey. Criticality is based on three parameters: scope, time, and severity.

- Scope describes the geographic area and population that would be affected by the loss or inoperability of an asset or function. An asset or function is considered critical if it serves a region or the entire state, or would affect greater than 10,000 people.
- Time describes the length of time that an asset or function can be inoperable without consequences. An asset or function is considered critical if it is inoperable immediately after a hazard event or one to two days after an event.
- Severity describes the consequences of the loss and inoperability of an asset or function. There are a multitude of consequences, including public health and safety, economic losses, environmental effects, interdependencies, political effects, and psychological effects. An asset or function is considered critical if the consequences include loss of life or severe injuries, significant economic loss, extensive environmental contamination, significant impact on other agencies, significant impact to service delivery, or significant loss of confidence in the agency.

These parameters and examples were taken into consideration when identifying the agency's critical assets and functions for the purpose of this survey. An asset or function does not need to satisfy all three parameters to be considered critical.

Exposure: The extent to which physical and non-physical assets, functions, and population groups are in direct contact with natural hazards or their related climate change impacts. Exposure is often determined by examining the number of people or assets that lie within a geographic area affected by a natural hazard or by determining the magnitude of the climate change impact. For example, measurement of

flood depth outside a building or number of heat waves experienced by a county are measurements of exposure.

Functions: The programs and services an agency provides to its customers in order to fulfill its mission. These programs and services depend on the mission of your agency and could include activities such as planning, policy development, regulatory enforcement, research, permitting, or outreach/education, or stewardship of critical resources.

Natural hazard: Natural events that threaten lives, property, and other assets.

Natural resources: These are components of natural systems that exist without human involvement. For the purpose of this survey, key natural resource categories include forested ecosystems, aquatic ecosystems, coastal ecosystems, wetland ecosystems, and old field ecosystems.

Sensitivity: Sensitivity refers to the impact on a system, service, or asset when exposed to natural hazards. For example, if a facility is exposed to storm surge, how will its ability to function be affected? When a critical threshold has been identified, the level of sensitivity of your agency, a specific asset, function, or population group served to a hazard indicates how much or to what extent does the occurrence of a hazard exceed the critical threshold for that asset or function such that it would disrupt the ability of the agency/asset/function to continue normal operation. If the critical threshold is not exceeded, then the sensitivity to a certain hazard is low, even if it is exposed.

Vulnerability: The overall vulnerability of your agency to a hazard is determined by combining your exposure, sensitivity, and adaptive capacity. Agencies or assets that are highly vulnerable may be highly sensitive to a certain natural hazard or climate change impact, highly exposed, and/or have low adaptive capacity. On the other hand, agencies or assets that have low sensitivity or high adaptive capacity may not be impacted by a natural hazard or climate change impact at all.

Section 1 General Agency Information

The agency mission statement is provided in this section, as well as the agency's self-selected critical assets, functions, and population groups (up to ten for each category for the purpose of this vulnerability assessment). Information is also provided regarding the agency's primary concerns regarding impacts from climate change and natural hazards, as well as interaction with communities and other state agencies.

Agency Mission Statement

DMF manages the state's commercial and recreational saltwater fisheries and oversees other services that support the marine environment and fishing communities.

Critical Physical and/or Non-Physical Assets

Critical Physical/ Non-Physical Assets (refer to the "criticality" definition to aid in identification of critical assets)	Reason for Criticality selected from option provided	Reason for Criticality if anything other	Critical threshold(s), which if exceeded is likely to disrupt normal operation of the program or service.	Location		Who Owns / Manages the Asset?	If Another Agency, Provide the Point of Contact
				Description of customers / audience served	Municipality		
Shellfish Purification Plant - 84 82nd St.	Provides critical services		coastal flooding greater than or equal to 4' 3" above MHW, or power outage	Commercial shellfishermen; Shellfish consumers	Newburyport	State / DMF	
Annisquam River Marine Fisheries Field Station - Emerson Avenue	Provides critical services		Don't Know	Commercial / Recreational marine resource users, scientists, staff	Gloucester MA	State / DMF	
South shore staff support facility - Duchaine Blvd	Supports critical infrastructure		Any amount of flooding, 12" or more of snow	Staff supporting municipalities and constituents	New Bedford	Private	
New Bedford South Shore Field Station and Bacteriological Lab - W. Rodney French Blvd	Provides critical services		Don't know	Staff. Commercial and recreational marine resource users. Scientists.	New Bedford	State / DMF / SMAST	
DMF Marthas Vineyard Field Office - Shirley Street	Supports critical infrastructure		MV coastal flooding		Oak Bluffs	State / DMF	
Boston Main Office - Causeway Street	Provides critical services		Don't Know	Commercial and recreational marine resource users. Staff	Boston	State	
Water Berthed Research Vessels > 28' (3)	Provides critical services		Tsunami	DMF Staff. Scientists and Researchers	New Bedford, Gloucester	State / DMF	
Data and IT Equipment - agency wide	Provides critical services		Don't Know	Commercial / Recreational marine resource users. Scientists. Fisheries Managers	all facility locations	State	

Critical Functions

Critical Functions (refer to criticality definition to aid in identification of critical functions)	Reason for Criticality selected from option provided	Reason for Criticality if anything other	Critical threshold(s), which if exceeded is likely to disrupt normal operation of the program or service.	Description of customers / audience served	Municipality(ies) Served
Shellfish public health closure notifications	Number of people served		Widespread power outages. Disruptions to electronic communications	Seafood consuming public	all
Tracking the sales and distribution of fisheries products	Number of people served		Widespread power outages. Disruptions to electronic communications	Seafood consuming public	all
Fisheries management	Vulnerable population impacted		Economic Impacts	Commercial fishers, seafood consuming public	all
Marine fisheries licensing	Revenue generation		Don't Know	Commercial and recreational fishers	all
Marine fisheries surveys and stock assessments	Data or information collection		Don't Know	Fisheries managers and scientists	all coastal
Endangered species protection	Law enforcement		Don't Know	Law enforcement	all coastal
Fisheries habitat restoration		environmental services	Don't know	Fisheries Scientists	all coastal
Oil Spill Response		Public health and safety	Don't know		All coastal
Grant Management	Revenue generation		Don't Know	MA cities and towns, recreational boaters, fisheries scientists	all

Critical Population Groups

Critical Population Groups Served	Reason for Criticality selected from option provided	Reason for Criticality if anything other	Municipality(ies) Served
Shellfish Consumers	Number of vulnerable population impacted		all
Fish Consumers	Number of vulnerable population impacted		all
Commercial fishers	Severity of impact to the population group		all
Recreational fishers	Severity of impact to the population group		all
Coastal alteration project permit applicants	Severity of impact to the population group		all coastal
Fisheries Scientists		Fisheries management - public health and safety	all
Recreational Boater			all coastal

Primary Concerns Regarding Impacts from Climate Change and Natural Hazards

- Impacts to specific facilities
- Impacts to infrastructure controlled by others (e.g. electricity, data, transit and access)
- Response capacity (i.e. sufficient resources or personnel)
- Likelihood of occurrence of extreme climate events or changes in the future that may not have been experienced in the past
- Ability to assist clients/stakeholders
- Loss of workforce productivity
- Failure to provide critical services
- Failure to meet agency mission or goals
- Health and welfare of the public (seafood consumption); environmental changes resulting in adverse affects to fisheries; loss of samples in freezers

How Agency Serves Local Communities

What impacts would occur to the community if your agency's operations were temporarily interrupted by a natural hazard or extreme weather event?

Potential public health threat (seafood consumption). Shellfish area closures put harvesters out of work; disrupting shellfish wholesale industry and; retail market supply. Overexploitation of marine fisheries resources. Lack of access to food resources and to public resources .

How quickly would those impacts be experienced by the community?

Contaminated seafood consumption threat – immediate. Harvesters; dealers and retail impacts - immediate. Overexploitation of marine fisheries resources -– unknown. Lack of access to food resources and to public resources - unknown.

How might long-term impacts of climate change disrupt community operations?

Prohibition of harvest will disrupt local economies reliant upon the sale of seafood. Contaminated seafood consumption is a public health concern.

What impacts would be experienced by the community?

Seafood scarcity. Economic losses resulting from displaced commercial fishers. Illness.

Are any of your agency's assets designated as shelters or community resources in emergencies or extreme weather events?

no

Agency Interdependencies

What other state agencies, regional authorities, or local municipalities could be impacted by loss of your agency's operations?

all coastal communities involved in commercial / recreational marine finfishing and/or shellfishing and recreational boating

Do your operations depend on any other agencies, regional authorities, or local municipalities? If so, which agency/ies?

yes – Environmental Law Enforcement and Public Health. Shellfish areas require properly functioning local and regional wastewater treatment plants. We also share a facility with UMass (SMAST - New Bedford).

Do your operations depend on any private utility company? If so, which company/ies?

National Grid for electricity, and Osterman Propane for heat at the shellfish purification plant in Newburyport. Natural Gas at Annisquam River Marine Field Station.

Does your agency depend on the regular delivery or transport of resources or people to and from facilities?

yes – shellfish deliveries to shellfish purification plant

Section 2 Climate Change Exposure and Sensitivity

This section presents the results of the agency's evaluation of its exposure and sensitivity to natural hazards and climate change. Detail is provided for the agency's critical assets, functions, and populations identified in Section 1 when possible. For future risk, the agency considered the 2070 planning horizon for its assessment of exposure and sensitivity to future conditions. Reference materials used for considering future conditions included resources provided in the State Agency Vulnerability Assessment Survey Tool for each natural hazard as well as downscaled climate change data available on the Resilient MA Climate Clearinghouse website (www.resilientma.org).

Climate Change Exposure and Sensitivity							
Primary Climate Driver	**Natural Hazards**	**Related Climate Change Impacts**	**To the best of your knowledge, list which critical assets, functions, or population groups (as identified in Question 2) have been impacted by each hazard identified in the preceding column *(add additional rows as needed to accommodate your critical items)***	**To the best of your knowledge, indicate if the critical asset, function or population group served by your agency has been negatively impacted by this hazard in the past.**	**Based on how the natural hazard is likely to change in the future as a result of climate change (see supplemental reference maps identified in the second column), to what extent is the critical asset, function, or population group served exposed to each hazard? High (i.e. all of asset is exposed) Medium (i.e. some of asset is exposed) Low (i.e. asset is minimally exposed) Not Exposed (i.e. no exposure)**	**On a scale of 1 to 5, rate how sensitive the critical asset, function, or population group served is to the natural hazards. Sensitivity should be determined based on whether a critical threshold has been exceeded. If exceeded for a hazard, then assign a "5". If a critical threshold has not been exceeded, or if a critical threshold has not been identified, a qualitative assessment should be conducted to assign a score based on consideration of the nature of the critical item and the natural hazard and related climate change impacts. In other words, to what degree is the critical item affected or impacted by exposure? N/A = no relevance 1 = minimally sensitive if minimum disruption to function/minimal impact to population group served 5 = extremely sensitive if significant disruption to function/significant impact to population group served**	**Notes or Explanation (use this column to document information that is specific to a critical item) or Additional Comments**
Sea level Rise and Storm Surge	**Coastal Flooding (including daily tidal flooding from sea level rise) for *Physical/Non Physical Assets***	**Beach erosion, marsh migration, inundation of coastal and marine ecosystems, elimination of wetlands**	Shellfish Purification Plant - 84 82nd St.	Infrequently	High (i.e. all of asset is exposed)	5	Shellfish Purification Plant - Plum Island in Newburyport is only accessible by a single road, Plum Island Turnpike, which is subject to coastal flooding during storms becoming inaccessible from mainland. Coastal flooding at 4' 3" above MHW will flood facility and saltwater wells. Beach erosion from 1/11/18 storm threatens inundating mission critical saltwater wells. Annisquam facility is located on Cape Ann, which is only accessible via Rt. 128 (A. Piatt Andrew Bridge) or Rt. 127 (Blyman Bridge). Both routes are subject to coastal flooding during storms and may become inaccessible from the mainland. New Bedford Field Office is located on a shoreline-hardened peninsula in New Bedford, seaward of a hurricane barrier. It has large amounts of glass, but was designed for a category 3 hurricane. Backup generators are on property and critical infrastructure is on 2nd floor and roof, so it is relatively safe from flooding. Primary access road is at relatively high elevation. MV Facility - Access threatened by extreme coastal flooding events. Research Vessels - Ocean berths subject to exposure to extreme tides and storm enhanced sea level rise. Fisheries management - pubic health impacts. Economic impacts. Commercial shellfishing - Nor'easters in springtime drive toxic phytoplankton blooms south into Massachusetts waters resulting in shellfish toxicity. Higher shellfish toxicity results in more frequent area closures, for longer durations, over larger geographic areas (PSP/"red tide"). New Bedford Support facility - relatively poor stormwater control. Precipitation flooding could be a problem.
			Annisquam River Marine Fisheries Field Station - Emerson Avenue	No	Low (i.e. asset is minimally exposed)	2	
			South shore staff support facility - Duchaine Blvd	Don't know	Low (i.e. asset is minimally exposed)	3	
			New Bedford South Shore Field Station and Bacteriological Lab - W. Rodney French Blvd	No	Low (i.e. asset is minimally exposed)	1	
			DMF Marthas Vineyard Field Office - Shirley Street	Don't know	Low (i.e. asset is minimally exposed)	2	
			Boston Main Office - Causeway Street	Infrequently	Medium (i.e. some of asset is exposed)	5	
			Water Berthed Research Vessels > 28' (3)	Infrequently	Low (i.e. asset is minimally exposed)	3	
			Data and IT Equipment - agency wide	Infrequently	Low (i.e. asset is minimally exposed)	1	
	Coastal Flooding (including daily tidal flooding from sea level rise) for *Critical Function*		Shellfish public health closure notifications	Infrequently	High (i.e. all of asset is exposed)	5	
			Tracking the sales and distribution of fisheries products	Infrequently	Low (i.e. asset is minimally exposed)	1	
			Fisheries management	Infrequently	Low (i.e. asset is minimally exposed)	1	
			Marine fisheries licensing	Infrequently	Low (i.e. asset is minimally exposed)	2	
			Marine fisheries surveys and stock assessments	Infrequently	Low (i.e. asset is minimally exposed)	1	
			Endangered species protection	Infrequently	Low (i.e. asset is minimally exposed)	1	
			Fisheries habitat restoration	Infrequently	Low (i.e. asset is minimally exposed)	1	
			Oil Spill Response	Infrequently	Low (i.e. asset is minimally exposed)	1	
			Grant Management	Infrequently	Low (i.e. asset is minimally exposed)	1	
	Coastal Flooding (including daily tidal flooding from sea level rise) for *Critical Population*		Shellfish Consumers	Infrequently	High (i.e. all of asset is exposed)	5	
			Fish Consumers	Infrequently	High (i.e. all of asset is exposed)	4	
			Commercial fishers	Infrequently	Medium (i.e. some of asset is exposed)	3	
			Recreational fishers	Infrequently	Medium (i.e. some of asset is exposed)	3	

Climate Change Exposure and Sensitivity							
Primary Climate Driver	**Natural Hazards**	**Related Climate Change Impacts**	**To the best of your knowledge, list which critical assets, functions, or population groups (as identified in Question 2) have been impacted by each hazard identified in the preceding column *(add additional rows as needed to accommodate your critical items)***	**To the best of your knowledge, indicate if the critical asset, function or population group served by your agency has been negatively impacted by this hazard in the past.**	**Based on how the natural hazard is likely to change in the future as a result of climate change (see supplemental reference maps identified in the second column), to what extent is the critical asset, function, or population group served exposed to each hazard? High (i.e. all of asset is exposed) Medium (i.e. some of asset is exposed) Low (i.e. asset is minimally exposed) Not Exposed (i.e. no exposure)**	**On a scale of 1 to 5, rate how sensitive the critical asset, function, or population group served is to the natural hazards. Sensitivity should be determined based on whether a critical threshold has been exceeded. If exceeded for a hazard, then assign a "5". If a critical threshold has not been exceeded, or if a critical threshold has not been identified, a qualitative assessment should be conducted to assign a score based on consideration of the nature of the critical item and the natural hazard and related climate change impacts. In other words, to what degree is the critical item affected or impacted by exposure? N/A = no relevance 1 = minimally sensitive if minimum disruption to function/minimal impact to population group served 5 = extremely sensitive if significant disruption to function/significant impact to population group served**	**Notes or Explanation (use this column to document information that is specific to a critical item) or Additional Comments**
			Coastal alteration project permit applicants	Infrequently	Low (i.e. asset is minimally exposed)	1	
			Fisheries Scientists	Infrequently	Low (i.e. asset is minimally exposed)	1	
			Recreational Boater	Infrequently	Low (i.e. asset is minimally exposed)	1	
	Hurricanes/ Tropical Storms for *Physical/Non Physical Assets*		Shellfish Purification Plant - 84 82nd St.	Infrequently	High (i.e. all of asset is exposed)	5	Shellfish Purification Plant - Plum Island in Newburyport is only accessible by a single road, Plum Island Turnpike, which is subject to coastal flooding during storms becoming inaccessible from mainland. Coastal flooding at 4' 3" above MHW will flood facility and saltwater wells. Beach erosion from 1/11/18 storm threatens inundating mission critical saltwater wells. Annisquam facility is located on Cape Ann, which is only accessible via Rt. 128 (A. Piatt Andrew Bridge) or Rt. 127 (Blyman Bridge). Both routes are subject to coastal flooding during storms and may become inaccessible from the mainland. New Bedford Field Office is located on a shoreline-hardened peninsula in New Bedford, seaward of a hurricane barrier. It has large amounts of glass, but was designed for a category 3 hurricane. Backup generators are on property and critical infrastructure is on 2nd floor and roof, so it is relatively safe from flooding. Primary access road is at relatively high elevation. MV Facility - Access threatened by extreme coastal flooding events. Research Vessels - Ocean berths subject to exposure to extreme tides and storm enhanced sea level rise. Fisheries management - pubic health impacts. Economic impacts. Commercial shellfishing - Nor'easters in springtime drive toxic phytoplankton blooms south into Massachusetts waters resulting in shellfish toxicity. Higher shellfish toxicity results in more frequent area closures, for longer durations, over larger geographic areas (PSP/"red tide"). New Bedford Support facility - relatively poor stormwater control. Precipitation flooding could be a problem.
			Annisquam River Marine Fisheries Field Station - Emerson Avenue	Infrequently	Medium (i.e. some of asset is exposed)	3	
			South shore staff support facility - Duchaine Blvd	Infrequently	Medium (i.e. some of asset is exposed)	3	
			New Bedford South Shore Field Station and Bacteriological Lab - W. Rodney French Blvd	Infrequently	Medium (i.e. some of asset is exposed)	3	
			DMF Marthas Vineyard Field Office - Shirley Street	Infrequently	High (i.e. all of asset is exposed)	5	
			Boston Main Office - Causeway Street	Infrequently	Medium (i.e. some of asset is exposed)	5	
			Water Berthed Research Vessels > 28' (3)	Infrequently	Medium (i.e. some of asset is exposed)	3	
			Data and IT Equipment - agency wide	Infrequently	Low (i.e. asset is minimally exposed)	1	
	Hurricanes/ Tropical Storms for *Critical Function*		Shellfish public health closure notifications	Infrequently	High (i.e. all of asset is exposed)	5	
			Tracking the sales and distribution of fisheries products	Infrequently	Medium (i.e. some of asset is exposed)	3	
			Fisheries management	Frequently	High (i.e. all of asset is exposed)	5	
			Marine fisheries licensing	Infrequently	Low (i.e. asset is minimally exposed)	2	
			Marine fisheries surveys and stock assessments	Frequently	High (i.e. all of asset is exposed)	5	
			Endangered species protection	Infrequently	Low (i.e. asset is minimally exposed)	1	
			Fisheries habitat restoration	Infrequently	Medium (i.e. some of asset is exposed)	3	
			Oil Spill Response	Infrequently	Low (i.e. asset is minimally exposed)	1	
			Grant Management	Infrequently	Low (i.e. asset is minimally exposed)	1	
	Hurricanes/ Tropical Storms for *Critical Population*		Shellfish Consumers	Frequently	High (i.e. all of asset is exposed)	5	
			Fish Consumers	Frequently	High (i.e. all of asset is exposed)	5	

Climate Change Exposure and Sensitivity							
Primary Climate Driver	**Natural Hazards**	**Related Climate Change Impacts**	**To the best of your knowledge, list which critical assets, functions, or population groups (as identified in Question 2) have been impacted by each hazard identified in the preceding column *(add additional rows as needed to accommodate your critical items)***	**To the best of your knowledge, indicate if the critical asset, function or population group served by your agency has been negatively impacted by this hazard in the past.**	**Based on how the natural hazard is likely to change in the future as a result of climate change (see supplemental reference maps identified in the second column), to what extent is the critical asset, function, or population group served exposed to each hazard? High (i.e. all of asset is exposed) Medium (i.e. some of asset is exposed) Low (i.e. asset is minimally exposed) Not Exposed (i.e. no exposure)**	**On a scale of 1 to 5, rate how sensitive the critical asset, function, or population group served is to the natural hazards. Sensitivity should be determined based on whether a critical threshold has been exceeded. If exceeded for a hazard, then assign a "5". If a critical threshold has not been exceeded, or if a critical threshold has not been identified, a qualitative assessment should be conducted to assign a score based on consideration of the nature of the critical item and the natural hazard and related climate change impacts. In other words, to what degree is the critical item affected or impacted by exposure? N/A = no relevance 1 = minimally sensitive if minimum disruption to function/minimal impact to population group served 5 = extremely sensitive if significant disruption to function/significant impact to population group served**	**Notes or Explanation (use this column to document information that is specific to a critical item) or Additional Comments**
			Commercial fishers	Infrequently	Medium (i.e. some of asset is exposed)	2	
			Recreational fishers	Infrequently	Medium (i.e. some of asset is exposed)	1	
			Coastal alteration project permit applicants	Infrequently	Low (i.e. asset is minimally exposed)	1	
			Fisheries Scientists	Infrequently	Low (i.e. asset is minimally exposed)	1	
			Recreational Boater	Infrequently	Medium (i.e. some of asset is exposed)	2	
	Nor'easter for *Physical/Non Physical Assets*		Shellfish Purification Plant - 84 82nd St.	Frequently	High (i.e. all of asset is exposed)	5	Shellfish Purification Plant - Plum Island in Newburyport is only accessible by a single road, Plum Island Turnpike, which is subject to coastal flooding during storms becoming inaccessible from mainland. Coastal flooding at 4' 3" above MHW will flood facility and saltwater wells. Beach erosion from 1/11/18 storm threatens inundating mission critical saltwater wells. Annisquam facility is located on Cape Ann, which is only accessible via Rt. 128 (A. Piatt Andrew Bridge) or Rt. 127 (Blyman Bridge). Both routes are subject to coastal flooding during storms and may become inaccessible from the mainland. New Bedford Field Office is located on a shoreline-hardened peninsula in New Bedford, seaward of a hurricane barrier. It has large amounts of glass, but was designed for a category 3 hurricane. Backup generators are on property and critical infrastructure is on 2nd floor and roof, so it is relatively safe from flooding. Primary access road is at relatively high elevation. MV Facility - Access threatened by extreme coastal flooding events. Research Vessels - Ocean berths subject to exposure to extreme tides and storm enhanced sea level rise. Fisheries management - pubic health impacts. Economic impacts. Commercial shellfishing - Nor'easters in springtime drive toxic phytoplankton blooms south into Massachusetts waters resulting in shellfish toxicity. Higher shellfish toxicity results in more frequent area closures, for longer durations, over larger geographic areas (PSP/"red tide"). New Bedford Support facility - relatively poor stormwater control. Precipitation flooding could be a problem. Difficult to differentiate sea level rise vs. precipitation impacts, especially looking at scenarios assessing extremes. Nor'easters in springtime drive toxic phytoplankton blooms south into Massachusetts waters resulting in shellfish toxicity. Higher shellfish toxicity results
			Annisquam River Marine Fisheries Field Station - Emerson Avenue	Frequently	Medium (i.e. some of asset is exposed)	3	
			South shore staff support facility - Duchaine Blvd	Frequently	Medium (i.e. some of asset is exposed)	3	
			New Bedford South Shore Field Station and Bacteriological Lab - W. Rodney French Blvd	Frequently	Medium (i.e. some of asset is exposed)	3	
			DMF Marthas Vineyard Field Office - Shirley Street	Frequently	Medium (i.e. some of asset is exposed)	3	
			Boston Main Office - Causeway Street	Frequently	Medium (i.e. some of asset is exposed)	3	
			Water Berthed Research Vessels > 28' (3)	Frequently	Medium (i.e. some of asset is exposed)	3	
			Data and IT Equipment - agency wide	Infrequently	Low (i.e. asset is minimally exposed)	1	
	Nor'easter for *Critical Function*		Shellfish public health closure notifications	Frequently	High (i.e. all of asset is exposed)	5	
			Tracking the sales and distribution of fisheries products	Frequently	Medium (i.e. some of asset is exposed)	3	
			Fisheries management	Frequently	Medium (i.e. some of asset is exposed)	3	
			Marine fisheries licensing	Frequently	Low (i.e. asset is minimally exposed)	1	
			Marine fisheries surveys and stock assessments	Frequently	Medium (i.e. some of asset is exposed)	3	
			Endangered species protection	Frequently	Low (i.e. asset is minimally exposed)	1	
			Fisheries habitat restoration	Frequently	Medium (i.e. some of asset is exposed)	2	
			Oil Spill Response	Infrequently	Low (i.e. asset is minimally exposed)	1	

Climate Change Exposure and Sensitivity							
Primary Climate Driver	**Natural Hazards**	**Related Climate Change Impacts**	**To the best of your knowledge, list which critical assets, functions, or population groups (as identified in Question 2) have been impacted by each hazard identified in the preceding column *(add additional rows as needed to accommodate your critical items)***	**To the best of your knowledge, indicate if the critical asset, function or population group served by your agency has been negatively impacted by this hazard in the past.**	**Based on how the natural hazard is likely to change in the future as a result of climate change (see supplemental reference maps identified in the second column), to what extent is the critical asset, function, or population group served exposed to each hazard? High (i.e. all of asset is exposed) Medium (i.e. some of asset is exposed) Low (i.e. asset is minimally exposed) Not Exposed (i.e. no exposure)**	**On a scale of 1 to 5, rate how sensitive the critical asset, function, or population group served is to the natural hazards. Sensitivity should be determined based on whether a critical threshold has been exceeded. If exceeded for a hazard, then assign a "5". If a critical threshold has not been exceeded, or if a critical threshold has not been identified, a qualitative assessment should be conducted to assign a score based on consideration of the nature of the critical item and the natural hazard and related climate change impacts. In other words, to what degree is the critical item affected or impacted by exposure? N/A = no relevance 1 = minimally sensitive if minimum disruption to function/minimal impact to population group served 5 = extremely sensitive if significant disruption to function/significant impact to population group served**	**Notes or Explanation (use this column to document information that is specific to a critical item) or Additional Comments**
	Nor'easter for *Critical Population*		Grant Management	Infrequently	Low (i.e. asset is minimally exposed)	1	in more frequent area closures, for longer durations, over larger geographic areas (PSP/"red tide").
			Shellfish Consumers	Frequently	High (i.e. all of asset is exposed)	5	
			Fish Consumers	Frequently	High (i.e. all of asset is exposed)	2	
			Commercial fishers	Frequently	Medium (i.e. some of asset is exposed)	3	
			Recreational fishers	Frequently	Medium (i.e. some of asset is exposed)	2	
			Coastal alteration project permit applicants	Infrequently	Low (i.e. asset is minimally exposed)	1	
			Fisheries Scientists	Frequently	Low (i.e. asset is minimally exposed)	1	
			Recreational Boater	Infrequently	Low (i.e. asset is minimally exposed)	2	
	Coastal Erosion for *Physical/Non Physical Assets*		Shellfish Purification Plant - 84 82nd St.	Frequently	High (i.e. all of asset is exposed)	5	See previous comments entered for Section II
			Annisquam River Marine Fisheries Field Station - Emerson Avenue	Infrequently	Medium (i.e. some of asset is exposed)	3	
			South shore staff support facility - Duchaine Blvd	No	Not Exposed (i.e. no exposure)	3	
			New Bedford South Shore Field Station and Bacteriological Lab - W. Rodney French Blvd	Don't know	Low (i.e. asset is minimally exposed)	2	
			DMF Marthas Vineyard Field Office - Shirley Street	Infrequently	High (i.e. all of asset is exposed)	3	
			Boston Main Office - Causeway Street	No	Not Exposed (i.e. no exposure)	N/A	
			Water Berthed Research Vessels > 28' (3)	No	Not Exposed (i.e. no exposure)	N/A	
			Data and IT Equipment - agency wide	No	Not Exposed (i.e. no exposure)	N/A	
	Coastal Erosion for *Critical Function*		Shellfish public health closure notifications	Infrequently	Medium (i.e. some of asset is exposed)	2	
			Tracking the sales and distribution of fisheries products	No	Not Exposed (i.e. no exposure)	N/A	
			Fisheries management	Infrequently	Low (i.e. asset is minimally exposed)	1	
			Marine fisheries licensing	No	Not Exposed (i.e. no exposure)	N/A	
			Marine fisheries surveys and stock assessments	No	Not Exposed (i.e. no exposure)	N/A	
			Endangered species protection	No	Not Exposed (i.e. no exposure)	N/A	
			Fisheries habitat restoration	Infrequently	Low (i.e. asset is minimally exposed)	1	
			Oil Spill Response	No	Not Exposed (i.e. no exposure)	N/A	

Climate Change Exposure and Sensitivity							
Primary Climate Driver	**Natural Hazards**	**Related Climate Change Impacts**	**To the best of your knowledge, list which critical assets, functions, or population groups (as identified in Question 2) have been impacted by each hazard identified in the preceding column *(add additional rows as needed to accommodate your critical items)***	**To the best of your knowledge, indicate if the critical asset, function or population group served by your agency has been negatively impacted by this hazard in the past.**	**Based on how the natural hazard is likely to change in the future as a result of climate change (see supplemental reference maps identified in the second column), to what extent is the critical asset, function, or population group served exposed to each hazard? High (i.e. all of asset is exposed) Medium (i.e. some of asset is exposed) Low (i.e. asset is minimally exposed) Not Exposed (i.e. no exposure)**	**On a scale of 1 to 5, rate how sensitive the critical asset, function, or population group served is to the natural hazards. Sensitivity should be determined based on whether a critical threshold has been exceeded. If exceeded for a hazard, then assign a "5". If a critical threshold has not been exceeded, or if a critical threshold has not been identified, a qualitative assessment should be conducted to assign a score based on consideration of the nature of the critical item and the natural hazard and related climate change impacts. In other words, to what degree is the critical item affected or impacted by exposure? N/A = no relevance 1 = minimally sensitive if minimum disruption to function/minimal impact to population group served 5 = extremely sensitive if significant disruption to function/significant impact to population group served**	**Notes or Explanation (use this column to document information that is specific to a critical item) or Additional Comments**
			Grant Management	No	Not Exposed (i.e. no exposure)	N/A	
						N/A	
	Coastal Erosion for *Critical Population*		Shellfish Consumers	No	Not Exposed (i.e. no exposure)	N/A	
			Fish Consumers	No	Not Exposed (i.e. no exposure)	N/A	
			Commercial fishers	Infrequently	Low (i.e. asset is minimally exposed)	1	
			Recreational fishers	Infrequently	Low (i.e. asset is minimally exposed)	2	
			Coastal alteration project permit applicants	Infrequently	Low (i.e. asset is minimally exposed)	1	
			Fisheries Scientists	No	Not Exposed (i.e. no exposure)	N/A	
			Recreational Boater	Infrequently	Low (i.e. asset is minimally exposed)	1	
Precipitation	**Extreme Precipitation for *Physical/Non Physical Assets***	**Flash flooding, urban flooding, public health impacts from mold, worsened indoor air quality, vector-borne diseases from stagnant water**	Shellfish Purification Plant - 84 82nd St.	Frequently	Low (i.e. asset is minimally exposed)	5	See previous comments entered for Section II
			Annisquam River Marine Fisheries Field Station - Emerson Avenue	No	Low (i.e. asset is minimally exposed)	1	
			South shore staff support facility - Duchaine Blvd	No	Low (i.e. asset is minimally exposed)	1	
			New Bedford South Shore Field Station and Bacteriological Lab - W. Rodney French Blvd	No	Low (i.e. asset is minimally exposed)	1	
			DMF Marthas Vineyard Field Office - Shirley Street	Infrequently	Low (i.e. asset is minimally exposed)	1	
			Boston Main Office - Causeway Street	Infrequently	High (i.e. all of asset is exposed)	5	
			Water Berthed Research Vessels > 28' (3)	Infrequently	Low (i.e. asset is minimally exposed)	3	
			Data and IT Equipment - agency wide	No	Not Exposed (i.e. no exposure)	N/A	
	Extreme Precipitation for *Critical Function*		Shellfish public health closure notifications	Frequently	High (i.e. all of asset is exposed)	5	
			Tracking the sales and distribution of fisheries products	No	Not Exposed (i.e. no exposure)	N/A	
			Fisheries management	Frequently	High (i.e. all of asset is exposed)	5	
			Marine fisheries licensing	No	Not Exposed (i.e. no exposure)	N/A	
			Marine fisheries surveys and stock assessments	No	Not Exposed (i.e. no exposure)	N/A	
			Endangered species protection	No	Not Exposed (i.e. no exposure)	N/A	
			Fisheries habitat restoration	Infrequently	Low (i.e. asset is minimally exposed)	2	
			Oil Spill Response	No	Not Exposed (i.e. no exposure)	N/A	

Climate Change Exposure and Sensitivity							
Primary Climate Driver	**Natural Hazards**	**Related Climate Change Impacts**	**To the best of your knowledge, list which critical assets, functions, or population groups (as identified in Question 2) have been impacted by each hazard identified in the preceding column *(add additional rows as needed to accommodate your critical items)***	**To the best of your knowledge, indicate if the critical asset, function or population group served by your agency has been negatively impacted by this hazard in the past.**	**Based on how the natural hazard is likely to change in the future as a result of climate change (see supplemental reference maps identified in the second column), to what extent is the critical asset, function, or population group served exposed to each hazard? High (i.e. all of asset is exposed) Medium (i.e. some of asset is exposed) Low (i.e. asset is minimally exposed) Not Exposed (i.e. no exposure)**	**On a scale of 1 to 5, rate how sensitive the critical asset, function, or population group served is to the natural hazards. Sensitivity should be determined based on whether a critical threshold has been exceeded. If exceeded for a hazard, then assign a "5". If a critical threshold has not been exceeded, or if a critical threshold has not been identified, a qualitative assessment should be conducted to assign a score based on consideration of the nature of the critical item and the natural hazard and related climate change impacts. In other words, to what degree is the critical item affected or impacted by exposure? N/A = no relevance 1 = minimally sensitive if minimum disruption to function/minimal impact to population group served 5 = extremely sensitive if significant disruption to function/significant impact to population group served**	**Notes or Explanation (use this column to document information that is specific to a critical item) or Additional Comments**
			Grant Management	No	Not Exposed (i.e. no exposure)	N/A	
	Extreme Precipitation for *Critical Population*		Shellfish Consumers	Frequently	High (i.e. all of asset is exposed)	5	
			Fish Consumers	Frequently	Medium (i.e. some of asset is exposed)	3	
			Commercial fishers	Frequently	High (i.e. all of asset is exposed)	5	
			Recreational fishers	Frequently	Low (i.e. asset is minimally exposed)	2	
			Coastal alteration project permit applicants	No	Low (i.e. asset is minimally exposed)	1	
			Fisheries Scientists	Infrequently	Medium (i.e. some of asset is exposed)	3	
			Recreational Boater	Infrequently	Low (i.e. asset is minimally exposed)	1	
	Inland/Riverine Flooding for *Physical/Non Physical Assets*		Shellfish Purification Plant - 84 82nd St.	Frequently	High (i.e. all of asset is exposed)	5	See previous comments entered for Section II
			Annisquam River Marine Fisheries Field Station - Emerson Avenue	Infrequently	Medium (i.e. some of asset is exposed)	2	
			South shore staff support facility - Duchaine Blvd	Frequently	Medium (i.e. some of asset is exposed)	2	
			New Bedford South Shore Field Station and Bacteriological Lab - W. Rodney French Blvd	No	Not Exposed (i.e. no exposure)	N/A	
			DMF Marthas Vineyard Field Office - Shirley Street	No	Not Exposed (i.e. no exposure)	N/A	
			Boston Main Office - Causeway Street	Infrequently	Medium (i.e. some of asset is exposed)	2	
			Water Berthed Research Vessels > 28' (3)	No	Not Exposed (i.e. no exposure)	N/A	
			Data and IT Equipment - agency wide	No	Not Exposed (i.e. no exposure)	N/A	
	Inland/Riverine Flooding for *Critical Function*		Shellfish public health closure notifications	Frequently	High (i.e. all of asset is exposed)	5	
			Tracking the sales and distribution of fisheries products	No	Not Exposed (i.e. no exposure)	N/A	
			Fisheries management	Frequently	High (i.e. all of asset is exposed)	5	
			Marine fisheries licensing	No	Not Exposed (i.e. no exposure)	N/A	
			Marine fisheries surveys and stock assessments	No	Not Exposed (i.e. no exposure)	N/A	
			Endangered species protection	Infrequently	Medium (i.e. some of asset is exposed)	3	

Climate Change Exposure and Sensitivity							
Primary Climate Driver	**Natural Hazards**	**Related Climate Change Impacts**	**To the best of your knowledge, list which critical assets, functions, or population groups (as identified in Question 2) have been impacted by each hazard identified in the preceding column *(add additional rows as needed to accommodate your critical items)***	**To the best of your knowledge, indicate if the critical asset, function or population group served by your agency has been negatively impacted by this hazard in the past.**	**Based on how the natural hazard is likely to change in the future as a result of climate change (see supplemental reference maps identified in the second column), to what extent is the critical asset, function, or population group served exposed to each hazard? High (i.e. all of asset is exposed) Medium (i.e. some of asset is exposed) Low (i.e. asset is minimally exposed) Not Exposed (i.e. no exposure)**	**On a scale of 1 to 5, rate how sensitive the critical asset, function, or population group served is to the natural hazards. Sensitivity should be determined based on whether a critical threshold has been exceeded. If exceeded for a hazard, then assign a "5". If a critical threshold has not been exceeded, or if a critical threshold has not been identified, a qualitative assessment should be conducted to assign a score based on consideration of the nature of the critical item and the natural hazard and related climate change impacts. In other words, to what degree is the critical item affected or impacted by exposure? N/A = no relevance 1 = minimally sensitive if minimum disruption to function/minimal impact to population group served 5 = extremely sensitive if significant disruption to function/significant impact to population group served**	**Notes or Explanation (use this column to document information that is specific to a critical item) or Additional Comments**
			Fisheries habitat restoration	Infrequently	Low (i.e. asset is minimally exposed)	1	
			Oil Spill Response	No	Not Exposed (i.e. no exposure)	N/A	
			Grant Management	No	Not Exposed (i.e. no exposure)	N/A	
	Inland/Riverine Flooding for *Critical Population*		Shellfish Consumers	Frequently	High (i.e. all of asset is exposed)	5	
			Fish Consumers	Frequently	High (i.e. all of asset is exposed)	5	
			Commercial fishers	Frequently	Medium (i.e. some of asset is exposed)	4	
			Recreational fishers	Frequently	Low (i.e. asset is minimally exposed)	2	
			Coastal alteration project permit applicants	Frequently	Low (i.e. asset is minimally exposed)	1	
			Fisheries Scientists	Frequently	Low (i.e. asset is minimally exposed)	1	
			Recreational Boater	Infrequently	Low (i.e. asset is minimally exposed)	1	
	Severe Winter Storm for *Physical/Non Physical Assets*		Shellfish Purification Plant - 84 82nd St.	Infrequently	High (i.e. all of asset is exposed)	5	See previous comments entered for Section II
			Annisquam River Marine Fisheries Field Station - Emerson Avenue	Infrequently	Medium (i.e. some of asset is exposed)	3	
			South shore staff support facility - Duchaine Blvd	Infrequently	Medium (i.e. some of asset is exposed)	3	
			New Bedford South Shore Field Station and Bacteriological Lab - W. Rodney French Blvd	Infrequently	Medium (i.e. some of asset is exposed)	3	
			DMF Marthas Vineyard Field Office - Shirley Street	Infrequently	High (i.e. all of asset is exposed)	5	
			Boston Main Office - Causeway Street	Infrequently	Medium (i.e. some of asset is exposed)	3	
			Water Berthed Research Vessels > 28' (3)	Infrequently	Medium (i.e. some of asset is exposed)	3	
			Data and IT Equipment - agency wide	Infrequently	Low (i.e. asset is minimally exposed)	1	
	Severe Winter Storm for *Critical Function*		Shellfish public health closure notifications	Infrequently	High (i.e. all of asset is exposed)	5	
			Tracking the sales and distribution of fisheries products	Infrequently	Medium (i.e. some of asset is exposed)	3	
			Fisheries management	Infrequently	Low (i.e. asset is minimally exposed)	1	
			Marine fisheries licensing	Infrequently	Low (i.e. asset is minimally exposed)	2	
			Marine fisheries surveys and stock assessments	No	Not Exposed (i.e. no exposure)	N/A	
			Endangered species protection	No	Not Exposed (i.e. no exposure)	N/A	

Climate Change Exposure and Sensitivity							
Primary Climate Driver	**Natural Hazards**	**Related Climate Change Impacts**	**To the best of your knowledge, list which critical assets, functions, or population groups (as identified in Question 2) have been impacted by each hazard identified in the preceding column *(add additional rows as needed to accommodate your critical items)***	**To the best of your knowledge, indicate if the critical asset, function or population group served by your agency has been negatively impacted by this hazard in the past.**	**Based on how the natural hazard is likely to change in the future as a result of climate change (see supplemental reference maps identified in the second column), to what extent is the critical asset, function, or population group served exposed to each hazard? High (i.e. all of asset is exposed) Medium (i.e. some of asset is exposed) Low (i.e. asset is minimally exposed) Not Exposed (i.e. no exposure)**	**On a scale of 1 to 5, rate how sensitive the critical asset, function, or population group served is to the natural hazards. Sensitivity should be determined based on whether a critical threshold has been exceeded. If exceeded for a hazard, then assign a "5". If a critical threshold has not been exceeded, or if a critical threshold has not been identified, a qualitative assessment should be conducted to assign a score based on consideration of the nature of the critical item and the natural hazard and related climate change impacts. In other words, to what degree is the critical item affected or impacted by exposure? N/A = no relevance 1 = minimally sensitive if minimum disruption to function/minimal impact to population group served 5 = extremely sensitive if significant disruption to function/significant impact to population group served**	**Notes or Explanation (use this column to document information that is specific to a critical item) or Additional Comments**
			Fisheries habitat restoration	Infrequently	Low (i.e. asset is minimally exposed)	2	
			Oil Spill Response	Infrequently	Not Exposed (i.e. no exposure)	1	
			Grant Management	No	Not Exposed (i.e. no exposure)	N/A	
	Severe Winter Storm for *Critical Population*		Shellfish Consumers	Infrequently	High (i.e. all of asset is exposed)	5	
			Fish Consumers	Infrequently	Medium (i.e. some of asset is exposed)	3	
			Commercial fishers	Infrequently	Medium (i.e. some of asset is exposed)	3	
			Recreational fishers	Infrequently	Low (i.e. asset is minimally exposed)	2	
			Coastal alteration project permit applicants	Infrequently	Medium (i.e. some of asset is exposed)	3	
			Fisheries Scientists	No	Not Exposed (i.e. no exposure)	N/A	
			Recreational Boater	Infrequently	Medium (i.e. some of asset is exposed)	3	
	Ice Storms for *Physical/Non Physical Assets*		Shellfish Purification Plant - 84 82nd St.	Infrequently	High (i.e. all of asset is exposed)	5	See previous comments entered for Section II
			Annisquam River Marine Fisheries Field Station - Emerson Avenue	Infrequently	Low (i.e. asset is minimally exposed)	2	
			South shore staff support facility - Duchaine Blvd	Infrequently	Low (i.e. asset is minimally exposed)	2	
			New Bedford South Shore Field Station and Bacteriological Lab - W. Rodney French Blvd	Infrequently	Low (i.e. asset is minimally exposed)	2	
			DMF Marthas Vineyard Field Office - Shirley Street	Infrequently	Low (i.e. asset is minimally exposed)	2	
			Boston Main Office - Causeway Street	Infrequently	High (i.e. all of asset is exposed)	5	
			Water Berthed Research Vessels > 28' (3)	Infrequently	Low (i.e. asset is minimally exposed)	2	
			Data and IT Equipment - agency wide	Infrequently	Low (i.e. asset is minimally exposed)	1	
	Ice Storms for *Critical Function*		Shellfish public health closure notifications	Frequently	High (i.e. all of asset is exposed)	5	
			Tracking the sales and distribution of fisheries products	Infrequently	Low (i.e. asset is minimally exposed)	2	
			Fisheries management	Frequently	High (i.e. all of asset is exposed)	5	
			Marine fisheries licensing	Infrequently	Low (i.e. asset is minimally exposed)	1	
			Marine fisheries surveys and stock assessments	No	Not Exposed (i.e. no exposure)		

Climate Change Exposure and Sensitivity							
Primary Climate Driver	**Natural Hazards**	**Related Climate Change Impacts**	**To the best of your knowledge, list which critical assets, functions, or population groups (as identified in Question 2) have been impacted by each hazard identified in the preceding column *(add additional rows as needed to accommodate your critical items)***	**To the best of your knowledge, indicate if the critical asset, function or population group served by your agency has been negatively impacted by this hazard in the past.**	**Based on how the natural hazard is likely to change in the future as a result of climate change (see supplemental reference maps identified in the second column), to what extent is the critical asset, function, or population group served exposed to each hazard? High (i.e. all of asset is exposed) Medium (i.e. some of asset is exposed) Low (i.e. asset is minimally exposed) Not Exposed (i.e. no exposure)**	**On a scale of 1 to 5, rate how sensitive the critical asset, function, or population group served is to the natural hazards. Sensitivity should be determined based on whether a critical threshold has been exceeded. If exceeded for a hazard, then assign a "5". If a critical threshold has not been exceeded, or if a critical threshold has not been identified, a qualitative assessment should be conducted to assign a score based on consideration of the nature of the critical item and the natural hazard and related climate change impacts. In other words, to what degree is the critical item affected or impacted by exposure? N/A = no relevance 1 = minimally sensitive if minimum disruption to function/minimal impact to population group served 5 = extremely sensitive if significant disruption to function/significant impact to population group served**	**Notes or Explanation (use this column to document information that is specific to a critical item) or Additional Comments**
	Ice Storms for *Critical Population*		Endangered species protection	No	Low (i.e. asset is minimally exposed)	N/A	
			Fisheries habitat restoration	No	Not Exposed (i.e. no exposure)	N/A	
			Oil Spill Response	Infrequently	Medium (i.e. some of asset is exposed)	3	
			Grant Management	No	Not Exposed (i.e. no exposure)	N/A	
			Shellfish Consumers	Infrequently	Low (i.e. asset is minimally exposed)	2	
			Fish Consumers	Infrequently	Low (i.e. asset is minimally exposed)	2	
			Commercial fishers	Infrequently	Low (i.e. asset is minimally exposed)	2	
			Recreational fishers	No	Not Exposed (i.e. no exposure)	N/A	
			Coastal alteration project permit applicants	Infrequently	Low (i.e. asset is minimally exposed)	2	
			Fisheries Scientists	Infrequently	Low (i.e. asset is minimally exposed)	2	
			Recreational Boater	No	Low (i.e. asset is minimally exposed)	2	
	Landslide for *Physical/Non Physical Assets*		Shellfish Purification Plant - 84 82nd St.	No	Not Exposed (i.e. no exposure)	N/A	See previous comments entered for Section II
			Annisquam River Marine Fisheries Field Station - Emerson Avenue	No	Not Exposed (i.e. no exposure)	N/A	
			South shore staff support facility - Duchaine Blvd	No	Not Exposed (i.e. no exposure)	N/A	
			New Bedford South Shore Field Station and Bacteriological Lab - W. Rodney French Blvd	No	Not Exposed (i.e. no exposure)	N/A	
			DMF Marthas Vineyard Field Office - Shirley Street	No	Not Exposed (i.e. no exposure)	N/A	
			Boston Main Office - Causeway Street	No	Not Exposed (i.e. no exposure)	N/A	
			Water Berthed Research Vessels > 28' (3)	No	Not Exposed (i.e. no exposure)	N/A	
			Data and IT Equipment - agency wide	No	Not Exposed (i.e. no exposure)	N/A	
	Landslide for *Critical Function*		Shellfish public health closure notifications	No	Not Exposed (i.e. no exposure)	N/A	
			Tracking the sales and distribution of fisheries products	No	Not Exposed (i.e. no exposure)	N/A	
			Fisheries management	No	Not Exposed (i.e. no exposure)	N/A	
			Marine fisheries licensing	No	Not Exposed (i.e. no exposure)	N/A	
			Marine fisheries surveys and stock assessments	No	Not Exposed (i.e. no exposure)	N/A	

Climate Change Exposure and Sensitivity							
Primary Climate Driver	**Natural Hazards**	**Related Climate Change Impacts**	**To the best of your knowledge, list which critical assets, functions, or population groups (as identified in Question 2) have been impacted by each hazard identified in the preceding column *(add additional rows as needed to accommodate your critical items)***	**To the best of your knowledge, indicate if the critical asset, function or population group served by your agency has been negatively impacted by this hazard in the past.**	**Based on how the natural hazard is likely to change in the future as a result of climate change (see supplemental reference maps identified in the second column), to what extent is the critical asset, function, or population group served exposed to each hazard? High (i.e. all of asset is exposed) Medium (i.e. some of asset is exposed) Low (i.e. asset is minimally exposed) Not Exposed (i.e. no exposure)**	**On a scale of 1 to 5, rate how sensitive the critical asset, function, or population group served is to the natural hazards. Sensitivity should be determined based on whether a critical threshold has been exceeded. If exceeded for a hazard, then assign a "5". If a critical threshold has not been exceeded, or if a critical threshold has not been identified, a qualitative assessment should be conducted to assign a score based on consideration of the nature of the critical item and the natural hazard and related climate change impacts. In other words, to what degree is the critical item affected or impacted by exposure? N/A = no relevance 1 = minimally sensitive if minimum disruption to function/minimal impact to population group served 5 = extremely sensitive if significant disruption to function/significant impact to population group served**	**Notes or Explanation (use this column to document information that is specific to a critical item) or Additional Comments**
			Endangered species protection	No	Not Exposed (i.e. no exposure)	N/A	
			Fisheries habitat restoration	No	Not Exposed (i.e. no exposure)	N/A	
			Oil Spill Response	No	Not Exposed (i.e. no exposure)	N/A	
			Grant Management	No	Not Exposed (i.e. no exposure)	N/A	
	Landslide for ***Critical Population***		Shellfish Consumers	No	Not Exposed (i.e. no exposure)	N/A	
			Fish Consumers	No	Not Exposed (i.e. no exposure)	N/A	
			Commercial fishers	No	Not Exposed (i.e. no exposure)	N/A	
			Recreational fishers	No	Not Exposed (i.e. no exposure)	N/A	
			Coastal alteration project permit applicants	No	Not Exposed (i.e. no exposure)	N/A	
			Fisheries Scientists	No	Not Exposed (i.e. no exposure)	N/A	
			Recreational Boater	No	Not Exposed (i.e. no exposure)	N/A	
	Dam Failure for ***Physical/Non Physical Assets***		Shellfish Purification Plant - 84 82nd St.	No	Not Exposed (i.e. no exposure)	N/A	See previous comments entered for Section II
			Annisquam River Marine Fisheries Field Station - Emerson Avenue	No	Not Exposed (i.e. no exposure)	N/A	
			South shore staff support facility - Duchaine Blvd	No	Not Exposed (i.e. no exposure)	N/A	
			New Bedford South Shore Field Station and Bacteriological Lab - W. Rodney French Blvd	No	Not Exposed (i.e. no exposure)	N/A	
			DMF Marthas Vineyard Field Office - Shirley Street	No	Not Exposed (i.e. no exposure)	N/A	
			Boston Main Office - Causeway Street	No	Not Exposed (i.e. no exposure)	N/A	
			Water Berthed Research Vessels > 28' (3)	No	Not Exposed (i.e. no exposure)	N/A	
			Data and IT Equipment - agency wide	No	Not Exposed (i.e. no exposure)	N/A	
	Dam Failure for ***Critical Function***		Shellfish public health closure notifications	Infrequently	Medium (i.e. some of asset is exposed)	3	
			Tracking the sales and distribution of fisheries products	No	Not Exposed (i.e. no exposure)	N/A	
			Fisheries management	Infrequently	Medium (i.e. some of asset is exposed)	3	
			Marine fisheries licensing	No	Not Exposed (i.e. no exposure)	N/A	
			Marine fisheries surveys and stock assessments	No	Not Exposed (i.e. no exposure)		
			Endangered species protection	Infrequently	Low (i.e. asset is minimally exposed)	1	

Climate Change Exposure and Sensitivity							
Primary Climate Driver	**Natural Hazards**	**Related Climate Change Impacts**	**To the best of your knowledge, list which critical assets, functions, or population groups (as identified in Question 2) have been impacted by each hazard identified in the preceding column *(add additional rows as needed to accommodate your critical items)***	**To the best of your knowledge, indicate if the critical asset, function or population group served by your agency has been negatively impacted by this hazard in the past.**	**Based on how the natural hazard is likely to change in the future as a result of climate change (see supplemental reference maps identified in the second column), to what extent is the critical asset, function, or population group served exposed to each hazard? High (i.e. all of asset is exposed) Medium (i.e. some of asset is exposed) Low (i.e. asset is minimally exposed) Not Exposed (i.e. no exposure)**	**On a scale of 1 to 5, rate how sensitive the critical asset, function, or population group served is to the natural hazards. Sensitivity should be determined based on whether a critical threshold has been exceeded. If exceeded for a hazard, then assign a "5". If a critical threshold has not been exceeded, or if a critical threshold has not been identified, a qualitative assessment should be conducted to assign a score based on consideration of the nature of the critical item and the natural hazard and related climate change impacts. In other words, to what degree is the critical item affected or impacted by exposure? N/A = no relevance 1 = minimally sensitive if minimum disruption to function/minimal impact to population group served 5 = extremely sensitive if significant disruption to function/significant impact to population group served**	**Notes or Explanation (use this column to document information that is specific to a critical item) or Additional Comments**
			Fisheries habitat restoration	Infrequently	Low (i.e. asset is minimally exposed)	1	
			Oil Spill Response	No	Not Exposed (i.e. no exposure)	N/A	
			Grant Management	No	Not Exposed (i.e. no exposure)	N/A	
	Dam Failure for *Critical Population*		Shellfish Consumers	Infrequently`	Medium (i.e. some of asset is exposed)	3	
			Fish Consumers	No	Not Exposed (i.e. no exposure)	N/A	
			Commercial fishers	Infrequently	Medium (i.e. some of asset is exposed)	3	
			Recreational fishers	Infrequently	Low (i.e. asset is minimally exposed)	1	
			Coastal alteration project permit applicants	Infrequently	Low (i.e. asset is minimally exposed)	2	
			Fisheries Scientists	Infrequently	Medium (i.e. some of asset is exposed)	3	
			Recreational Boater	No	Not Exposed (i.e. no exposure)	N/A	
Temperature	**Increase in Average Summer Temperature for *Physical/Non Physical Assets***	**Shifting in seasons (longer summer, early spring including earlier timing of spring peak flow), increase in length of growing season, increase of invasive species, frequent energy brown-outs from higher energy demands, public health impacts from high heat exposure, poor outdoor air quality**	Shellfish Purification Plant - 84 82nd St.	Infrequently	Low (i.e. asset is minimally exposed)	1	See previous comments entered for Section II. Shellfish borne illness increases with increasing temperatures (Vibrios which are naturally occurring human pathogens in coastal waters)es. Higher temperatures and longer summer season increases Vibrio growth resulting in more frequent shellfish area closures; longer closures and larger area closures.
			Annisquam River Marine Fisheries Field Station - Emerson Avenue	Infrequently	Low (i.e. asset is minimally exposed)	1	
			South shore staff support facility - Duchaine Blvd	Infrequently	Low (i.e. asset is minimally exposed)	1	
			New Bedford South Shore Field Station and Bacteriological Lab - W. Rodney French Blvd	Infrequently	Low (i.e. asset is minimally exposed)	1	
			DMF Marthas Vineyard Field Office - Shirley Street	Infrequently	Low (i.e. asset is minimally exposed)	1	
			Boston Main Office - Causeway Street	Infrequently	Low (i.e. asset is minimally exposed)	1	
			Water Berthed Research Vessels > 28' (3)	No			
			Data and IT Equipment - agency wide	Infrequently	Low (i.e. asset is minimally exposed)	1	
	Increase in Average Summer Temperature for *Critical Function*		Shellfish public health closure notifications	Frequently	High (i.e. all of asset is exposed)	5	
			Tracking the sales and distribution of fisheries products	No	Not Exposed (i.e. no exposure)	N/A	
			Fisheries management	Infrequently	Medium (i.e. some of asset is exposed)	3	
			Marine fisheries licensing	No	Not Exposed (i.e. no exposure)	N/A	

Climate Change Exposure and Sensitivity							
Primary Climate Driver	**Natural Hazards**	**Related Climate Change Impacts**	**To the best of your knowledge, list which critical assets, functions, or population groups (as identified in Question 2) have been impacted by each hazard identified in the preceding column *(add additional rows as needed to accommodate your critical items)***	**To the best of your knowledge, indicate if the critical asset, function or population group served by your agency has been negatively impacted by this hazard in the past.**	**Based on how the natural hazard is likely to change in the future as a result of climate change (see supplemental reference maps identified in the second column), to what extent is the critical asset, function, or population group served exposed to each hazard? High (i.e. all of asset is exposed) Medium (i.e. some of asset is exposed) Low (i.e. asset is minimally exposed) Not Exposed (i.e. no exposure)**	**On a scale of 1 to 5, rate how sensitive the critical asset, function, or population group served is to the natural hazards. Sensitivity should be determined based on whether a critical threshold has been exceeded. If exceeded for a hazard, then assign a "5". If a critical threshold has not been exceeded, or if a critical threshold has not been identified, a qualitative assessment should be conducted to assign a score based on consideration of the nature of the critical item and the natural hazard and related climate change impacts. In other words, to what degree is the critical item affected or impacted by exposure? N/A = no relevance 1 = minimally sensitive if minimum disruption to function/minimal impact to population group served 5 = extremely sensitive if significant disruption to function/significant impact to population group served**	**Notes or Explanation (use this column to document information that is specific to a critical item) or Additional Comments**
			Marine fisheries surveys and stock assessments	No	Not Exposed (i.e. no exposure)	N/A	
			Endangered species protection	No	Not Exposed (i.e. no exposure)	N/A	
			Fisheries habitat restoration	Infrequently	Low (i.e. asset is minimally exposed)	2	
			Oil Spill Response	No	Not Exposed (i.e. no exposure)	N/A	
			Grant Management	No	Not Exposed (i.e. no exposure)	N/A	
	Increase in Average Summer Temperature for *Critical Population*		Shellfish Consumers	Frequently	High (i.e. all of asset is exposed)	5	
			Fish Consumers	Frequently	Medium (i.e. some of asset is exposed)	3	
			Commercial fishers	Infrequently	Medium (i.e. some of asset is exposed)	3	
			Recreational fishers	Infrequently	Low (i.e. asset is minimally exposed)	2	
			Coastal alteration project permit applicants	No	Not Exposed (i.e. no exposure)	N/A	
			Fisheries Scientists	No	Not Exposed (i.e. no exposure)	N/A	
			Recreational Boater	No	Not Exposed (i.e. no exposure)	N/A	
	Extreme Temperatures/Heat waves for Physical/Non Physical Assets		Shellfish Purification Plant - 84 82nd St.	Infrequently	Low (i.e. asset is minimally exposed)	1	See previous comments entered for Section II. Shellfish borne illness increases with increasing temperatures (Vibrios which are naturally occurring human pathogens in coastal waters)es. Higher temperatures and longer summer season increases Vibrio growth resulting in more frequent shellfish area closures; longer closures and larger area closures. Drought conditions provide favorable growth conditions in coastal waters for blooms of toxic phytoplankton resulting in more and longer shellfish poisoning closures (ASP).
			Annisquam River Marine Fisheries Field Station - Emerson Avenue	Infrequently	Low (i.e. asset is minimally exposed)	1	
			South shore staff support facility - Duchaine Blvd	Infrequently	Low (i.e. asset is minimally exposed)	1	
			New Bedford South Shore Field Station and Bacteriological Lab - W. Rodney French Blvd	Infrequently	Low (i.e. asset is minimally exposed)	1	
			DMF Marthas Vineyard Field Office - Shirley Street	Infrequently	Low (i.e. asset is minimally exposed)	1	
			Boston Main Office - Causeway Street	Infrequently	Low (i.e. asset is minimally exposed)	1	
			Water Berthed Research Vessels > 28' (3)	No	Not Exposed (i.e. no exposure)	N/A	
			Data and IT Equipment - agency wide	Infrequently	Low (i.e. asset is minimally exposed)	1	
	Extreme Temperatures/Heat waves for *Critical Function*		Shellfish public health closure notifications	Infrequently	Medium (i.e. some of asset is exposed)	3	
			Tracking the sales and distribution of fisheries products	No	Not Exposed (i.e. no exposure)	1	

Climate Change Exposure and Sensitivity							
Primary Climate Driver	**Natural Hazards**	**Related Climate Change Impacts**	**To the best of your knowledge, list which critical assets, functions, or population groups (as identified in Question 2) have been impacted by each hazard identified in the preceding column *(add additional rows as needed to accommodate your critical items)***	**To the best of your knowledge, indicate if the critical asset, function or population group served by your agency has been negatively impacted by this hazard in the past.**	**Based on how the natural hazard is likely to change in the future as a result of climate change (see supplemental reference maps identified in the second column), to what extent is the critical asset, function, or population group served exposed to each hazard? High (i.e. all of asset is exposed) Medium (i.e. some of asset is exposed) Low (i.e. asset is minimally exposed) Not Exposed (i.e. no exposure)**	**On a scale of 1 to 5, rate how sensitive the critical asset, function, or population group served is to the natural hazards. Sensitivity should be determined based on whether a critical threshold has been exceeded. If exceeded for a hazard, then assign a "5". If a critical threshold has not been exceeded, or if a critical threshold has not been identified, a qualitative assessment should be conducted to assign a score based on consideration of the nature of the critical item and the natural hazard and related climate change impacts. In other words, to what degree is the critical item affected or impacted by exposure? N/A = no relevance 1 = minimally sensitive if minimum disruption to function/minimal impact to population group served 5 = extremely sensitive if significant disruption to function/significant impact to population group served**	**Notes or Explanation (use this column to document information that is specific to a critical item) or Additional Comments**
			Fisheries management	Infrequently	Medium (i.e. some of asset is exposed)	3	
			Marine fisheries licensing	No	Not Exposed (i.e. no exposure)	N/A	
			Marine fisheries surveys and stock assessments	No	Not Exposed (i.e. no exposure)	N/A	
			Endangered species protection	No	Not Exposed (i.e. no exposure)	N/A	
			Fisheries habitat restoration	Infrequently	Low (i.e. asset is minimally exposed)	1	
			Oil Spill Response	No	Not Exposed (i.e. no exposure)	N/A	
			Grant Management	No	Not Exposed (i.e. no exposure)	N/A	
	Extreme Temperatures/Heat waves for *Critical Population*		Shellfish Consumers	Infrequently	High (i.e. all of asset is exposed)	5	
			Fish Consumers	Infrequently	Medium (i.e. some of asset is exposed)	3	
			Commercial fishers	Infrequently	Low (i.e. asset is minimally exposed)	2	
			Recreational fishers	No	Not Exposed (i.e. no exposure)	N/A	
			Coastal alteration project permit applicants	No	Not Exposed (i.e. no exposure)	N/A	
			Fisheries Scientists	No	Not Exposed (i.e. no exposure)	N/A	
			Recreational Boater	No	Not Exposed (i.e. no exposure)	N/A	
	Drought for *Physical/Non Physical Assets*		Shellfish Purification Plant - 84 82nd St.	No	Not Exposed (i.e. no exposure)	N/A	See previous comments entered for Section II Drought conditions provide favorable growth conditions in coastal waters for blooms of toxic phytoplankton resulting in more and longer shellfish poisoning closures (ASP).
			Annisquam River Marine Fisheries Field Station - Emerson Avenue	No	Not Exposed (i.e. no exposure)	N/A	
			South shore staff support facility - Duchaine Blvd	No	Not Exposed (i.e. no exposure)	N/A	
			New Bedford South Shore Field Station and Bacteriological Lab - W. Rodney French Blvd	No	Not Exposed (i.e. no exposure)	N/A	
			DMF Marthas Vineyard Field Office - Shirley Street	No	Not Exposed (i.e. no exposure)	N/A	
			Boston Main Office - Causeway Street	No	Not Exposed (i.e. no exposure)	N/A	
			Water Berthed Research Vessels > 28' (3)	No	Not Exposed (i.e. no exposure)	N/A	
			Data and IT Equipment - agency wide	No	Not Exposed (i.e. no exposure)	N/A	
	Drought for *Critical Function*		Shellfish public health closure notifications	No	Not Exposed (i.e. no exposure)	N/A	

Climate Change Exposure and Sensitivity							
Primary Climate Driver	**Natural Hazards**	**Related Climate Change Impacts**	**To the best of your knowledge, list which critical assets, functions, or population groups (as identified in Question 2) have been impacted by each hazard identified in the preceding column *(add additional rows as needed to accommodate your critical items)***	**To the best of your knowledge, indicate if the critical asset, function or population group served by your agency has been negatively impacted by this hazard in the past.**	**Based on how the natural hazard is likely to change in the future as a result of climate change (see supplemental reference maps identified in the second column), to what extent is the critical asset, function, or population group served exposed to each hazard? High (i.e. all of asset is exposed) Medium (i.e. some of asset is exposed) Low (i.e. asset is minimally exposed) Not Exposed (i.e. no exposure)**	**On a scale of 1 to 5, rate how sensitive the critical asset, function, or population group served is to the natural hazards. Sensitivity should be determined based on whether a critical threshold has been exceeded. If exceeded for a hazard, then assign a "5". If a critical threshold has not been exceeded, or if a critical threshold has not been identified, a qualitative assessment should be conducted to assign a score based on consideration of the nature of the critical item and the natural hazard and related climate change impacts. In other words, to what degree is the critical item affected or impacted by exposure? N/A = no relevance 1 = minimally sensitive if minimum disruption to function/minimal impact to population group served 5 = extremely sensitive if significant disruption to function/significant impact to population group served**	**Notes or Explanation (use this column to document information that is specific to a critical item) or Additional Comments**
			Tracking the sales and distribution of fisheries products	No	Not Exposed (i.e. no exposure)	N/A	
			Fisheries management	Infrequently	Low (i.e. asset is minimally exposed)	2	
			Marine fisheries licensing	No	Not Exposed (i.e. no exposure)	N/A	
			Marine fisheries surveys and stock assessments	No	Not Exposed (i.e. no exposure)	N/A	
			Endangered species protection	No	Not Exposed (i.e. no exposure)	N/A	
			Fisheries habitat restoration	Infrequently	Low (i.e. asset is minimally exposed)	1	
			Oil Spill Response	No	Not Exposed (i.e. no exposure)	N/A	
			Grant Management	No	Not Exposed (i.e. no exposure)	N/A	
	Drought for *Critical Population*		Shellfish Consumers	Infrequently	High (i.e. all of asset is exposed)	5	
			Fish Consumers	Infrequently	Medium (i.e. some of asset is exposed)	3	
			Commercial fishers	No	Not Exposed (i.e. no exposure)	N/A	
			Recreational fishers	No	Not Exposed (i.e. no exposure)	N/A	
			Coastal alteration project permit applicants	No	Not Exposed (i.e. no exposure)	N/A	
			Fisheries Scientists	No	Not Exposed (i.e. no exposure)	N/A	
			Recreational Boater	No	Not Exposed (i.e. no exposure)	N/A	
	Wildfires for *Physical/Non Physical Assets*		Shellfish Purification Plant - 84 82nd St.	No	Not Exposed (i.e. no exposure)	N/A	
			Annisquam River Marine Fisheries Field Station - Emerson Avenue	No	Not Exposed (i.e. no exposure)	N/A	
			South shore staff support facility - Duchaine Blvd	No	Not Exposed (i.e. no exposure)	N/A	
			New Bedford South Shore Field Station and Bacteriological Lab - W. Rodney French Blvd	No	Not Exposed (i.e. no exposure)	N/A	
			DMF Marthas Vineyard Field Office - Shirley Street	No	Not Exposed (i.e. no exposure)	N/A	
			Boston Main Office - Causeway Street	No	Not Exposed (i.e. no exposure)	N/A	
			Water Berthed Research Vessels > 28' (3)	No	Not Exposed (i.e. no exposure)	N/A	
			Data and IT Equipment - agency wide	No	Not Exposed (i.e. no exposure)	N/A	
	Wildfires for *Critical Function*		Shellfish public health closure notifications	No	Not Exposed (i.e. no exposure)	N/A	

Climate Change Exposure and Sensitivity							
Primary Climate Driver	**Natural Hazards**	**Related Climate Change Impacts**	**To the best of your knowledge, list which critical assets, functions, or population groups (as identified in Question 2) have been impacted by each hazard identified in the preceding column *(add additional rows as needed to accommodate your critical items)***	**To the best of your knowledge, indicate if the critical asset, function or population group served by your agency has been negatively impacted by this hazard in the past.**	**Based on how the natural hazard is likely to change in the future as a result of climate change (see supplemental reference maps identified in the second column), to what extent is the critical asset, function, or population group served exposed to each hazard? High (i.e. all of asset is exposed) Medium (i.e. some of asset is exposed) Low (i.e. asset is minimally exposed) Not Exposed (i.e. no exposure)**	**On a scale of 1 to 5, rate how sensitive the critical asset, function, or population group served is to the natural hazards. Sensitivity should be determined based on whether a critical threshold has been exceeded. If exceeded for a hazard, then assign a "5". If a critical threshold has not been exceeded, or if a critical threshold has not been identified, a qualitative assessment should be conducted to assign a score based on consideration of the nature of the critical item and the natural hazard and related climate change impacts. In other words, to what degree is the critical item affected or impacted by exposure? N/A = no relevance 1 = minimally sensitive if minimum disruption to function/minimal impact to population group served 5 = extremely sensitive if significant disruption to function/significant impact to population group served**	**Notes or Explanation (use this column to document information that is specific to a critical item) or Additional Comments**
Other Extreme Events	**Tornadoes for *Physical/Non Physical Assets***	**Damage to property, infrastructure, and loss of life**	Tracking the sales and distribution of fisheries products	No	Not Exposed (i.e. no exposure)	N/A	
			Fisheries management	No	Not Exposed (i.e. no exposure)	N/A	
			Marine fisheries licensing	No	Not Exposed (i.e. no exposure)	N/A	
			Marine fisheries surveys and stock assessments	No	Not Exposed (i.e. no exposure)	N/A	
			Endangered species protection	No	Not Exposed (i.e. no exposure)	N/A	
			Fisheries habitat restoration	No	Not Exposed (i.e. no exposure)	N/A	
			Oil Spill Response	No	Not Exposed (i.e. no exposure)	N/A	
			Grant Management	No	Not Exposed (i.e. no exposure)	N/A	
	Wildfires for *Critical Population*		Shellfish Consumers	No	Not Exposed (i.e. no exposure)	N/A	
			Fish Consumers	No	Not Exposed (i.e. no exposure)	N/A	
			Commercial fishers	No	Not Exposed (i.e. no exposure)	N/A	
			Recreational fishers	No	Not Exposed (i.e. no exposure)	N/A	
			Coastal alteration project permit applicants	No	Not Exposed (i.e. no exposure)	N/A	
			Fisheries Scientists	No	Not Exposed (i.e. no exposure)	N/A	
			Recreational Boater	No	Not Exposed (i.e. no exposure)	N/A	
	Tornadoes for *Physical/Non Physical Assets*	**Damage to property, infrastructure, and loss of life**	Shellfish Purification Plant - 84 82nd St.	No	Not Exposed (i.e. no exposure)	N/A	See previous comments entered for Section II
			Annisquam River Marine Fisheries Field Station - Emerson Avenue	No	Not Exposed (i.e. no exposure)	N/A	
			South shore staff support facility - Duchaine Blvd	No	Not Exposed (i.e. no exposure)	N/A	
			New Bedford South Shore Field Station and Bacteriological Lab - W. Rodney French Blvd	No	Not Exposed (i.e. no exposure)	N/A	
			DMF Marthas Vineyard Field Office - Shirley Street	No	Not Exposed (i.e. no exposure)	N/A	
			Boston Main Office - Causeway Street	No	Not Exposed (i.e. no exposure)	N/A	
			Water Berthed Research Vessels > 28' (3)	No	Not Exposed (i.e. no exposure)	N/A	
			Data and IT Equipment - agency wide	No	Not Exposed (i.e. no exposure)	N/A	
	Tornadoes for *Critical Function*		Shellfish public health closure notifications	No	Not Exposed (i.e. no exposure)	N/A	
			Tracking the sales and distribution of fisheries products	No	Not Exposed (i.e. no exposure)	N/A	

Climate Change Exposure and Sensitivity							
Primary Climate Driver	**Natural Hazards**	**Related Climate Change Impacts**	**To the best of your knowledge, list which critical assets, functions, or population groups (as identified in Question 2) have been impacted by each hazard identified in the preceding column *(add additional rows as needed to accommodate your critical items)***	**To the best of your knowledge, indicate if the critical asset, function or population group served by your agency has been negatively impacted by this hazard in the past.**	**Based on how the natural hazard is likely to change in the future as a result of climate change (see supplemental reference maps identified in the second column), to what extent is the critical asset, function, or population group served exposed to each hazard? High (i.e. all of asset is exposed) Medium (i.e. some of asset is exposed) Low (i.e. asset is minimally exposed) Not Exposed (i.e. no exposure)**	**On a scale of 1 to 5, rate how sensitive the critical asset, function, or population group served is to the natural hazards. Sensitivity should be determined based on whether a critical threshold has been exceeded. If exceeded for a hazard, then assign a "5". If a critical threshold has not been exceeded, or if a critical threshold has not been identified, a qualitative assessment should be conducted to assign a score based on consideration of the nature of the critical item and the natural hazard and related climate change impacts. In other words, to what degree is the critical item affected or impacted by exposure? N/A = no relevance 1 = minimally sensitive if minimum disruption to function/minimal impact to population group served 5 = extremely sensitive if significant disruption to function/significant impact to population group served**	**Notes or Explanation (use this column to document information that is specific to a critical item) or Additional Comments**
			Fisheries management	No	Not Exposed (i.e. no exposure)	N/A	
			Marine fisheries licensing	No	Not Exposed (i.e. no exposure)	N/A	
			Marine fisheries surveys and stock assessments	No	Not Exposed (i.e. no exposure)	N/A	
			Endangered species protection	No	Not Exposed (i.e. no exposure)	N/A	
			Fisheries habitat restoration	No	Not Exposed (i.e. no exposure)	N/A	
			Oil Spill Response	No	Not Exposed (i.e. no exposure)	N/A	
			Grant Management	No	Not Exposed (i.e. no exposure)	N/A	
	Tornadoes for *Critical Population*		Shellfish Consumers	No	Not Exposed (i.e. no exposure)	N/A	
			Fish Consumers	No	Not Exposed (i.e. no exposure)	N/A	
			Commercial fishers	No	Not Exposed (i.e. no exposure)	N/A	
			Recreational fishers	No	Not Exposed (i.e. no exposure)	N/A	
			Coastal alteration project permit applicants	No	Not Exposed (i.e. no exposure)	N/A	
			Fisheries Scientists	No	Not Exposed (i.e. no exposure)	N/A	
			Recreational Boater	No	Not Exposed (i.e. no exposure)	N/A	
	Tsunami for *Physical/Non Physical Assets*		Shellfish Purification Plant - 84 82nd St.	No	High (i.e. all of asset is exposed)	5	See previous comments entered for Section II. Extreme tsunami event could impact facilities located on/near the coastline and disrupt physical and non-physical assets and services
			Annisquam River Marine Fisheries Field Station - Emerson Avenue	No	High (i.e. all of asset is exposed)	5	
			South shore staff support facility - Duchaine Blvd	No	Medium (i.e. some of asset is exposed)	3	
			New Bedford South Shore Field Station and Bacteriological Lab - W. Rodney French Blvd	No	High (i.e. all of asset is exposed)	5	
			DMF Marthas Vineyard Field Office - Shirley Street	No	High (i.e. all of asset is exposed)	5	
			Boston Main Office - Causeway Street	No	Medium (i.e. some of asset is exposed)	3	
			Water Berthed Research Vessels > 28' (3)	No	High (i.e. all of asset is exposed)	5	
			Data and IT Equipment - agency wide	No	Not Exposed (i.e. no exposure)	N/A	
	Tsunami for *Critical Function*		Shellfish public health closure notifications	No	High (i.e. all of asset is exposed)	5	
			Tracking the sales and distribution of fisheries products	No	Medium (i.e. some of asset is exposed)	3	

Climate Change Exposure and Sensitivity							
Primary Climate Driver	**Natural Hazards**	**Related Climate Change Impacts**	**To the best of your knowledge, list which critical assets, functions, or population groups (as identified in Question 2) have been impacted by each hazard identified in the preceding column *(add additional rows as needed to accommodate your critical items)***	**To the best of your knowledge, indicate if the critical asset, function or population group served by your agency has been negatively impacted by this hazard in the past.**	**Based on how the natural hazard is likely to change in the future as a result of climate change (see supplemental reference maps identified in the second column), to what extent is the critical asset, function, or population group served exposed to each hazard? High (i.e. all of asset is exposed) Medium (i.e. some of asset is exposed) Low (i.e. asset is minimally exposed) Not Exposed (i.e. no exposure)**	**On a scale of 1 to 5, rate how sensitive the critical asset, function, or population group served is to the natural hazards. Sensitivity should be determined based on whether a critical threshold has been exceeded. If exceeded for a hazard, then assign a "5". If a critical threshold has not been exceeded, or if a critical threshold has not been identified, a qualitative assessment should be conducted to assign a score based on consideration of the nature of the critical item and the natural hazard and related climate change impacts. In other words, to what degree is the critical item affected or impacted by exposure? N/A = no relevance 1 = minimally sensitive if minimum disruption to function/minimal impact to population group served 5 = extremely sensitive if significant disruption to function/significant impact to population group served**	**Notes or Explanation (use this column to document information that is specific to a critical item) or Additional Comments**
			Fisheries management	No	Medium (i.e. some of asset is exposed)	3	
			Marine fisheries licensing	No	Medium (i.e. some of asset is exposed)	3	
			Marine fisheries surveys and stock assessments	No	Medium (i.e. some of asset is exposed)	3	
			Endangered species protection	No	Medium (i.e. some of asset is exposed)	3	
			Fisheries habitat restoration	No	High (i.e. all of asset is exposed)	5	
			Oil Spill Response	No	High (i.e. all of asset is exposed)	5	
			Grant Management	Infrequently	Low (i.e. asset is minimally exposed)	1	
	Tsunami for *Critical Population*		Shellfish Consumers	No	High (i.e. all of asset is exposed)	5	
			Fish Consumers	No	High (i.e. all of asset is exposed)	5	
			Commercial fishers	No	High (i.e. all of asset is exposed)	5	
			Recreational fishers	No	Medium (i.e. some of asset is exposed)	3	
			Coastal alteration project permit applicants	No	Medium (i.e. some of asset is exposed)	3	
			Fisheries Scientists	No	High (i.e. all of asset is exposed)	5	
			Recreational Boater	Infrequently	High (i.e. all of asset is exposed)	5	
	Earthquake for *Physical/Non Physical Assets*		Shellfish Purification Plant - 84 82nd St.	No	Not Exposed (i.e. no exposure)	N/A	See previous comments entered for Section II
			Annisquam River Marine Fisheries Field Station - Emerson Avenue	No	Not Exposed (i.e. no exposure)	N/A	
			South shore staff support facility - Duchaine Blvd	No	Not Exposed (i.e. no exposure)	N/A	
			New Bedford South Shore Field Station and Bacteriological Lab - W. Rodney French Blvd	No	Not Exposed (i.e. no exposure)	N/A	
			DMF Marthas Vineyard Field Office - Shirley Street	No	Not Exposed (i.e. no exposure)	N/A	
			Boston Main Office - Causeway Street	No	Not Exposed (i.e. no exposure)	N/A	
			Water Berthed Research Vessels > 28' (3)	No	Not Exposed (i.e. no exposure)	N/A	
			Data and IT Equipment - agency wide	No	Not Exposed (i.e. no exposure)	N/A	
	Earthquake for *Critical*		Shellfish public health closure notifications	No	Not Exposed (i.e. no exposure)	N/A	

Climate Change Exposure and Sensitivity							
Primary Climate Driver	**Natural Hazards**	**Related Climate Change Impacts**	**To the best of your knowledge, list which critical assets, functions, or population groups (as identified in Question 2) have been impacted by each hazard identified in the preceding column *(add additional rows as needed to accommodate your critical items)***	**To the best of your knowledge, indicate if the critical asset, function or population group served by your agency has been negatively impacted by this hazard in the past.**	**Based on how the natural hazard is likely to change in the future as a result of climate change (see supplemental reference maps identified in the second column), to what extent is the critical asset, function, or population group served exposed to each hazard? High (i.e. all of asset is exposed) Medium (i.e. some of asset is exposed) Low (i.e. asset is minimally exposed) Not Exposed (i.e. no exposure)**	**On a scale of 1 to 5, rate how sensitive the critical asset, function, or population group served is to the natural hazards. Sensitivity should be determined based on whether a critical threshold has been exceeded. If exceeded for a hazard, then assign a "5". If a critical threshold has not been exceeded, or if a critical threshold has not been identified, a qualitative assessment should be conducted to assign a score based on consideration of the nature of the critical item and the natural hazard and related climate change impacts. In other words, to what degree is the critical item affected or impacted by exposure? N/A = no relevance 1 = minimally sensitive if minimum disruption to function/minimal impact to population group served 5 = extremely sensitive if significant disruption to function/significant impact to population group served**	**Notes or Explanation (use this column to document information that is specific to a critical item) or Additional Comments**
	Function		Tracking the sales and distribution of fisheries products	No	Not Exposed (i.e. no exposure)	N/A	
			Fisheries management	No	Not Exposed (i.e. no exposure)	N/A	
			Marine fisheries licensing	No	Not Exposed (i.e. no exposure)	N/A	
			Marine fisheries surveys and stock assessments	No	Not Exposed (i.e. no exposure)	N/A	
			Endangered species protection	No	Not Exposed (i.e. no exposure)	N/A	
			Fisheries habitat restoration	No	Not Exposed (i.e. no exposure)	N/A	
			Oil Spill Response	No	Not Exposed (i.e. no exposure)	N/A	
			Grant Management	No	Not Exposed (i.e. no exposure)	N/A	
	Earthquake for *Critical Population*		Shellfish Consumers	No	Not Exposed (i.e. no exposure)	N/A	
			Fish Consumers	No	Not Exposed (i.e. no exposure)	N/A	
			Commercial fishers	No	Not Exposed (i.e. no exposure)	N/A	
			Recreational fishers	No	Not Exposed (i.e. no exposure)	N/A	
			Coastal alteration project permit applicants	Don't know	Not Exposed (i.e. no exposure)	N/A	
			Fisheries Scientists	Infrequently	Not Exposed (i.e. no exposure)	N/A	
			Recreational Boater	No	Low (i.e. asset is minimally exposed)	N/A	

Section 3 Agency Capability and Adaptive Capacity

This section presents the agency's assessment of existing capabilities related to hazard mitigation and climate change adaptation and identifies specific hazard mitigation, climate adaptation, or emergency response measures that have been identified to intervene and reduce the vulnerability of the agency's at-risk critical assets, function, or population groups (as identified in Section 1).

Ability to Withstand Natural Hazards and Climate Impacts

Fair (likely to result in damage/disruption)

Boston office and the shellfish plant both had major issues in a winter storm at high tide; many of our staff live coastally; we also have fairly limited facilities support so facilities needs fall to staff with other responsibilities] Good geographic distribution of staff and facilities. Good working relationships with coastal communities. Potential delay / disruption of services if internet / electronic connectivity between agency and coastal municipalities is disrupted.

Length for Agency to Return to Essential Functionality Following Severe Extreme Weather Event

Weeks

Remote Operation Capability

Yes

Status of Incorporating Natural Hazard Mitigation and Climate Change Adaptation into Programs

Planning to incorporate

some – fisheries management regulations are beginning to address potential species shifts / impacts resulting from climate change impacts. Agency also collects data to monitor impacts to marine resources and habitats resulting from climate change. DMF currently monitors coastal waters for the sanitary classification for shellfish harvesting subject to national water quality standards. Standard rainfall and wastewater treatment plant upset shellfish area closure policies are in place for many areas and communities coastwide. Marine biotoxins in shellfish are monitored annually. In 2012 due to increased illness an annual Vibrio management plan is administered statewide for the harvest of oysters May to October.

Challenges to Improving or Maintaining Ability to Withstand Natural Hazards and Climate Impacts

Funding, permitting, and response time is a challenge DMF has to overcome to improve agency assets ability to withstand climate impacts. For example the shellfish purification plant will need funding in the near future to develop a long term plan to either fortify or move saltwater wells inland to protect them from contamination due to severe beach erosion and coastal flooding. This was not a problem before the big winter storm on 1/3/2018, which eroded about 40 feet of sand dune next to the wells. The permitting and approval process to drill new wells is estimated to take about 3 to 5 years. The Gloucester Marine Field Station is a 1950's cinderblock structure with its original electrical system supported primarily by fuses. The electrical system is interconnected, one major malfunction could shut down the main building and the associated Bacteriological Lab. During average wet weather events, the cider block walls in the office wing leak, flooding several offices. The facility parking lot floods. Increased frequency and severity of natural hazards will require capital investments in the building to increase the capacity and resiliency of

the electrical system, to find a permanent solution to water infiltration through the cinder block walls, and a permanent solution to the parking lot drainage problem.

Current Capabilities to Accommodate or Recover from Natural Hazards

DMF will use all of the tools necessary to accommodate or recover from natural hazards. This will include short-term strategies to protect vulnerable assets now, as well as long-term planning to mitigate climate impacts. We don't have existing vulnerability assessments or climate change adaptation plans. For example the shellfish purification plant currently has two saltwater wells that provide water to the shellfish plant. Both wells are threatened by coastal flooding due to recent and sever beach erosion. The short-term strategy is to shift capital funding to cap the well heads with water tight caps that have a snorkel air vent to prevent flooding of the wells during coastal storms. The long-term approach is to put together a plan to relocate the wells further inland. DMF keeps a running list for capital improvement projects, not climate-change focused.

Plans, Policies, or Procedures to Reduce Potential Risk of Disruption

License sales, catch / landings data collection (backing up data?), fisheries management adaptations (shifting ranges of managed species), infrastructure protection from SLR (shellfish plant ?), We have a text tree on the south coast – project leaders are asked to contact individual staff. At SMAST we'll have a backup generator. Our server is backed up offsite (EEA IT policies/procedures – we don't oversee this ourselves).

Plans, Policies, or Procedures in Need of Revision to Better Consider Climate Change

No

some informal policies and procedures could be formalized, used to address climate change, there is no current effort underway to address this.

Adaptive Capacity for Specific Critical Items

Critical Asset, Function, or Population Group	Mitigation/Adaptation/Emergency Response Measure	Status	Effectiveness/ Improvements Required
Commercial shellfishing	Timely closures to protect public health from consumption of contaminated shellfish	In place / ongoing	
Commercial shellfishing	Depuration	In place / ongoing	Species specific
Commercial Shellfishing	Shellfish biotoxin management (PSP, DSP,…)	In place / ongoing	Frequency of testing? Expansion of testing sites?
Commercial / Recreational fisheries catch / landing data collection	unknown	unknown	
Protecting marine habitats	Oil spill response team participant	ongoing	
Shellfish Purification Plant	Coastal flooding leading to contaminated well water	Planning	Install watertight caps on well heads and start developing a plan to relocate the wells.
Staff	Communication with staff	Informal - in place	Needs to be made more formal

Studies or Plans to Support the State's Hazard Mitigation and Climate Adaptation Program

Yes

- Shellfish diseases (Vibrio, ASP, and human pathogenic viral studies) for public health protection, natural resource protection and the resulting economic impacts. Expanded and more frequent phytoplankton monitoring for the emerging threat of previously rare toxic species. –Ongoing-

Section 4 Vulnerability Scores

This section presents the vulnerability scores for each of the agency's critical assets, functions, and population groups that were evaluated. A vulnerability score is provided for each applicable natural hazard and related climate change impacts that were assessed for a particular critical item, and the scores are presented in summary table for that item. This enables identification of the climate driver/s and natural hazard/s that contribute to the vulnerability of a critical item. This information will be used by the agency to aid in the development of strategies and actions to make the critical item more resilient.

As previously stated, vulnerability to climate change and natural hazards is a function of exposure, sensitivity, and adaptive capacity. To arrive at the vulnerability scores, first the exposure and sensitivity scores determined in Section 2 were combined to arrive at an initial risk rating of low (yellow), moderate (orange), or high (red). Then the adaptive capacity score based on findings in Section 3 was applied to the risk rating to arrive at, a vulnerability score of low (yellow), moderate (orange), or high (red) as shown in the matrix below. If a critical item was determined to not be exposed to a natural hazard or was not assessed by the agency, then a "N/A" (not applicable) value was assigned.

Note that the risk ratings and vulnerability scores are both reported in the summary tables since the adaptive capacity scores developed as part of this vulnerability assessment are preliminary, vary in level of accuracy, and may overstate the adaptive capacity for a particular critical item to a natural hazard and related climate change impacts. Therefore, particular attention should be paid to the risk ratings.

A critical item with a high vulnerability score for one or more natural hazard and related climate change impacts is considered a high priority for future resilience planning and investment. Conversely, a critical item with only low to moderate vulnerability scores suggests that it is already resilient or has minimal exposure or sensitivity to current and projected conditions. Additional detail on the method used to develop the vulnerability scores is provided in Appendix A.

The vulnerability scores reflect an initial high level self-assessment conducted by the agency, and the results contained herein should be considered preliminary. More detailed analyses should be conducted to further the agency's resilience planning efforts and to refine the preliminary vulnerability assessment results, including closer evaluation of adaptive capacity for each critical item.

Adaptive Capacity Low ↓ High	**Sensitivity: Low → High**	
	Moderate Vulnerability	**High Vulnerability**
	Low Vulnerability	**Moderate Vulnerability**

VULNERABILITY SCORE TABLE FOR CRITICAL PHYSICAL/NON-PHYSICAL ASSETS:

Shellfish Purification Plant - 84 82nd St.

Primary Climate Driver	Natural Hazard	Risk Rating	Vulnerability Score
Sea Level Rise and Storm Surge	Coastal Flooding (including daily tidal flooding from sea level rise)	High	Moderate
	Hurricanes/Tropical Storms	High	Moderate
	Nor'easter	High	Moderate
	Coastal Erosion	High	Moderate
Precipitation	Extreme Precipitation	Low	Low
	Inland/Riverine Flooding	High	Moderate
	Severe Winter Storm	High	Moderate
	Ice Storms	High	Moderate
	Landslide	N/A	N/A
	Dam Failure	N/A	N/A
Temperature	Increase in Average Summer Temperature	Low	Low
	Extreme Temperatures/Heat Waves	Low	Low
	Drought	N/A	N/A
	Wildfires	N/A	N/A
Other Extreme Events	Tornadoes	N/A	N/A
	Tsunami	High	Moderate
	Earthquake	N/A	N/A

Annisquam River Marine Fisheries Field Station - Emerson Avenue

Primary Climate Driver	Natural Hazard	Risk Rating	Vulnerability Score
Sea Level Rise and Storm Surge	Coastal Flooding (including daily tidal flooding from sea level rise)	Low	Low
	Hurricanes/Tropical Storms	Moderate	Low
	Nor'easter	Moderate	Low
	Coastal Erosion	Moderate	Low
Precipitation	Extreme Precipitation	Low	Low
	Inland/Riverine Flooding	Low	Low
	Severe Winter Storm	Moderate	Low
	Ice Storms	Low	Low
	Landslide	N/A	N/A
	Dam Failure	N/A	N/A
Temperature	Increase in Average Summer Temperature	Low	Low
	Extreme Temperatures/Heat Waves	Low	Low
	Drought	N/A	N/A
	Wildfires	N/A	N/A
Other Extreme Events	Tornadoes	N/A	N/A
	Tsunami	High	Moderate
	Earthquake	N/A	N/A

South shore staff support facility - Duchaine Blvd

Primary Climate Driver	Natural Hazard	Risk Rating	Vulnerability Score
Sea Level Rise and Storm Surge	Coastal Flooding (including daily tidal flooding from sea level rise)	Low	Low
	Hurricanes/Tropical Storms	Moderate	Low
	Nor'easter	Moderate	Low
	Coastal Erosion	N/A	N/A
Precipitation	Extreme Precipitation	Low	Low
	Inland/Riverine Flooding	Low	Low
	Severe Winter Storm	Moderate	Low
	Ice Storms	Low	Low
	Landslide	N/A	N/A
	Dam Failure	N/A	N/A
Temperature	Increase in Average Summer Temperature	Low	Low
	Extreme Temperatures/Heat Waves	Low	Low
	Drought	N/A	N/A
	Wildfires	N/A	N/A
Other Extreme Events	Tornadoes	N/A	N/A
	Tsunami	Moderate	Low
	Earthquake	N/A	N/A

New Bedford South Shore Field Station and Bacteriological Lab - W. Rodney French Blvd

Primary Climate Driver	Natural Hazard	Risk Rating	Vulnerability Score
Sea Level Rise and Storm Surge	Coastal Flooding (including daily tidal flooding from sea level rise)	Low	Low
	Hurricanes/Tropical Storms	Moderate	Low
	Nor'easter	Moderate	Low
	Coastal Erosion	Low	Low
Precipitation	Extreme Precipitation	Low	Low
	Inland/Riverine Flooding	N/A	N/A
	Severe Winter Storm	Moderate	Low
	Ice Storms	Low	Low
	Landslide	N/A	N/A
	Dam Failure	N/A	N/A
Temperature	Increase in Average Summer Temperature	Low	Low
	Extreme Temperatures/Heat Waves	Low	Low
	Drought	N/A	N/A
	Wildfires	N/A	N/A
Other Extreme Events	Tornadoes	N/A	N/A
	Tsunami	High	Moderate
	Earthquake	N/A	N/A

DMF Marthas Vineyard Field Office - Shirley Street

Primary Climate Driver	Natural Hazard	Risk Rating	Vulnerability Score
Sea Level Rise and Storm Surge	Coastal Flooding (including daily tidal flooding from sea level rise)	Low	Low
	Hurricanes/Tropical Storms	High	Moderate
	Nor'easter	Moderate	Low
	Coastal Erosion	Moderate	Low
Precipitation	Extreme Precipitation	Low	Low
	Inland/Riverine Flooding	N/A	N/A
	Severe Winter Storm	High	Moderate
	Ice Storms	Low	Low
	Landslide	N/A	N/A
	Dam Failure	N/A	N/A
Temperature	Increase in Average Summer Temperature	Low	Low
	Extreme Temperatures/Heat Waves	Low	Low
	Drought	N/A	N/A
	Wildfires	N/A	N/A
Other Extreme Events	Tornadoes	N/A	N/A
	Tsunami	High	Moderate
	Earthquake	N/A	N/A

Boston Main Office - Causeway Street

Primary Climate Driver	Natural Hazard	Risk Rating	Vulnerability Score
Sea Level Rise and Storm Surge	Coastal Flooding (including daily tidal flooding from sea level rise)	Moderate	Low
	Hurricanes/Tropical Storms	Moderate	Low
	Nor'easter	Moderate	Low
	Coastal Erosion	N/A	N/A
Precipitation	Extreme Precipitation	High	Moderate
	Inland/Riverine Flooding	Low	Low
	Severe Winter Storm	Moderate	Low
	Ice Storms	High	Moderate
	Landslide	N/A	N/A
	Dam Failure	N/A	N/A
Temperature	Increase in Average Summer Temperature	Low	Low
	Extreme Temperatures/Heat Waves	Low	Low
	Drought	N/A	N/A
	Wildfires	N/A	N/A
Other Extreme Events	Tornadoes	N/A	N/A
	Tsunami	Moderate	Low
	Earthquake	N/A	N/A

Water Berthed Research Vessels > 28’ (3)

Primary Climate Driver	Natural Hazard	Risk Rating	Vulnerability Score
Sea Level Rise and Storm Surge	Coastal Flooding (including daily tidal flooding from sea level rise)	Low	Low
	Hurricanes/Tropical Storms	Moderate	Low
	Nor’easter	Moderate	Low
	Coastal Erosion	N/A	N/A
Precipitation	Extreme Precipitation	Low	Low
	Inland/Riverine Flooding	N/A	N/A
	Severe Winter Storm	Moderate	Low
	Ice Storms	Low	Low
	Landslide	N/A	N/A
	Dam Failure	N/A	N/A
Temperature	Increase in Average Summer Temperature	N/A	N/A
	Extreme Temperatures/Heat Waves	N/A	N/A
	Drought	N/A	N/A
	Wildfires	N/A	N/A
Other Extreme Events	Tornadoes	N/A	N/A
	Tsunami	High	Moderate
	Earthquake	N/A	N/A

Data and IT Equipment - agency wide

Primary Climate Driver	Natural Hazard	Risk Rating	Vulnerability Score
Sea Level Rise and Storm Surge	Coastal Flooding (including daily tidal flooding from sea level rise)	Low	Low
	Hurricanes/Tropical Storms	Low	Low
	Nor'easter	Low	Low
	Coastal Erosion	N/A	N/A
Precipitation	Extreme Precipitation	N/A	N/A
	Inland/Riverine Flooding	N/A	N/A
	Severe Winter Storm	Low	Low
	Ice Storms	Low	Low
	Landslide	N/A	N/A
	Dam Failure	N/A	N/A
Temperature	Increase in Average Summer Temperature	Low	Low
	Extreme Temperatures/Heat Waves	Low	Low
	Drought	N/A	N/A
	Wildfires	N/A	N/A
Other Extreme Events	Tornadoes	N/A	N/A
	Tsunami	N/A	N/A
	Earthquake	N/A	N/A

VULNERABILITY SCORE TABLE FOR CRITICAL FUNCTIONS:

Shellfish public health closure notifications

Primary Climate Driver	Natural Hazard	Risk Rating	Vulnerability Score
Sea Level Rise and Storm Surge	Coastal Flooding (including daily tidal flooding from sea level rise)	High	Moderate
	Hurricanes/Tropical Storms	High	Moderate
	Nor'easter	High	Moderate
	Coastal Erosion	Low	Low
Precipitation	Extreme Precipitation	High	Moderate
	Inland/Riverine Flooding	High	Moderate
	Severe Winter Storm	High	Moderate
	Ice Storms	High	Moderate
	Landslide	N/A	N/A
	Dam Failure	Moderate	Low
Temperature	Increase in Average Summer Temperature	High	Moderate
	Extreme Temperatures/Heat Waves	Moderate	Low
	Drought	N/A	N/A
	Wildfires	N/A	N/A
Other Extreme Events	Tornadoes	N/A	N/A
	Tsunami	High	Moderate
	Earthquake	N/A	N/A

Tracking the sales and distribution of fisheries products

Primary Climate Driver	Natural Hazard	Risk Rating	Vulnerability Score
Sea Level Rise and Storm Surge	Coastal Flooding (including daily tidal flooding from sea level rise)	N/A	N/A
	Hurricanes/Tropical Storms	Moderate	Low
	Nor'easter	Moderate	Low
	Coastal Erosion	N/A	N/A
Precipitation	Extreme Precipitation	N/A	N/A
	Inland/Riverine Flooding	N/A	N/A
	Severe Winter Storm	Moderate	Low
	Ice Storms	Low	Low
	Landslide	N/A	N/A
	Dam Failure	N/A	N/A
Temperature	Increase in Average Summer Temperature	N/A	N/A
	Extreme Temperatures/Heat Waves	N/A	N/A
	Drought	N/A	N/A
	Wildfires	N/A	N/A
Other Extreme Events	Tornadoes	N/A	N/A
	Tsunami	Moderate	Low
	Earthquake	N/A	N/A

Fisheries management

Primary Climate Driver	Natural Hazard	Risk Rating	Vulnerability Score
Sea Level Rise and Storm Surge	Coastal Flooding (including daily tidal flooding from sea level rise)	N/A	N/A
	Hurricanes/Tropical Storms	High	Moderate
	Nor'easter	Moderate	Low
	Coastal Erosion	N/A	N/A
Precipitation	Extreme Precipitation	High	Moderate
	Inland/Riverine Flooding	High	Moderate
	Severe Winter Storm	N/A	N/A
	Ice Storms	High	Moderate
	Landslide	N/A	N/A
	Dam Failure	Moderate	Low
Temperature	Increase in Average Summer Temperature	Moderate	Low
	Extreme Temperatures/Heat Waves	Moderate	Low
	Drought	Low	Low
	Wildfires	N/A	N/A
Other Extreme Events	Tornadoes	N/A	N/A
	Tsunami	Moderate	Low
	Earthquake	N/A	N/A

Marine fisheries licensing

Primary Climate Driver	Natural Hazard	Risk Rating	Vulnerability Score
Sea Level Rise and Storm Surge	Coastal Flooding (including daily tidal flooding from sea level rise)	Low	Low
	Hurricanes/Tropical Storms	Low	Low
	Nor'easter	Low	Low
	Coastal Erosion	N/A	N/A
Precipitation	Extreme Precipitation	N/A	N/A
	Inland/Riverine Flooding	N/A	N/A
	Severe Winter Storm	Low	Low
	Ice Storms	Low	Low
	Landslide	N/A	N/A
	Dam Failure	N/A	N/A
Temperature	Increase in Average Summer Temperature	N/A	N/A
	Extreme Temperatures/Heat Waves	N/A	N/A
	Drought	N/A	N/A
	Wildfires	N/A	N/A
Other Extreme Events	Tornadoes	N/A	N/A
	Tsunami	Moderate	Low
	Earthquake	N/A	N/A

Marine fisheries surveys and stock assessments

Primary Climate Driver	Natural Hazard	Risk Rating	Vulnerability Score
Sea Level Rise and Storm Surge	Coastal Flooding (including daily tidal flooding from sea level rise)	Low	Low
	Hurricanes/Tropical Storms	High	Moderate
	Nor'easter	Moderate	Low
	Coastal Erosion	N/A	N/A
Precipitation	Extreme Precipitation	N/A	N/A
	Inland/Riverine Flooding	N/A	N/A
	Severe Winter Storm	N/A	N/A
	Ice Storms	N/A	N/A
	Landslide	N/A	N/A
	Dam Failure	N/A	N/A
Temperature	Increase in Average Summer Temperature	N/A	N/A
	Extreme Temperatures/Heat Waves	N/A	N/A
	Drought	N/A	N/A
	Wildfires	N/A	N/A
Other Extreme Events	Tornadoes	N/A	N/A
	Tsunami	Moderate	Low
	Earthquake	N/A	N/A

Endangered species protection

Primary Climate Driver	Natural Hazard	Risk Rating	Vulnerability Score
Sea Level Rise and Storm Surge	Coastal Flooding (including daily tidal flooding from sea level rise)	Low	Low
	Hurricanes/Tropical Storms	Low	Low
	Nor'easter	Low	Low
	Coastal Erosion	N/A	N/A
Precipitation	Extreme Precipitation	N/A	N/A
	Inland/Riverine Flooding	Moderate	Low
	Severe Winter Storm	N/A	N/A
	Ice Storms	N/A	N/A
	Landslide	N/A	N/A
	Dam Failure	Low	Low
Temperature	Increase in Average Summer Temperature	N/A	N/A
	Extreme Temperatures/Heat Waves	N/A	N/A
	Drought	N/A	N/A
	Wildfires	N/A	N/A
Other Extreme Events	Tornadoes	N/A	N/A
	Tsunami	Moderate	Low
	Earthquake	N/A	N/A

Fisheries habitat restoration

Primary Climate Driver	Natural Hazard	Risk Rating	Vulnerability Score
Sea Level Rise and Storm Surge	Coastal Flooding (including daily tidal flooding from sea level rise)	Low	Low
	Hurricanes/Tropical Storms	Moderate	Low
	Nor'easter	Low	Low
	Coastal Erosion	Low	Low
Precipitation	Extreme Precipitation	Low	Low
	Inland/Riverine Flooding	Low	Low
	Severe Winter Storm	Low	Low
	Ice Storms	N/A	N/A
	Landslide	N/A	N/A
	Dam Failure	Low	Low
Temperature	Increase in Average Summer Temperature	Low	Low
	Extreme Temperatures/Heat Waves	Low	Low
	Drought	Low	Low
	Wildfires	N/A	N/A
Other Extreme Events	Tornadoes	N/A	N/A
	Tsunami	High	Moderate
	Earthquake	N/A	N/A

Oil Spill Response

Primary Climate Driver	Natural Hazard	Risk Rating	Vulnerability Score
Sea Level Rise and Storm Surge	Coastal Flooding (including daily tidal flooding from sea level rise)	Low	Low
	Hurricanes/Tropical Storms	Low	Low
	Nor'easter	Low	Low
	Coastal Erosion	N/A	N/A
Precipitation	Extreme Precipitation	N/A	N/A
	Inland/Riverine Flooding	N/A	N/A
	Severe Winter Storm	N/A	N/A
	Ice Storms	Moderate	Low
	Landslide	N/A	N/A
	Dam Failure	N/A	N/A
Temperature	Increase in Average Summer Temperature	N/A	N/A
	Extreme Temperatures/Heat Waves	N/A	N/A
	Drought	N/A	N/A
	Wildfires	N/A	N/A
Other Extreme Events	Tornadoes	N/A	N/A
	Tsunami	High	Moderate
	Earthquake	N/A	N/A

Grant Management

Primary Climate Driver	Natural Hazard	Risk Rating	Vulnerability Score
Sea Level Rise and Storm Surge	Coastal Flooding (including daily tidal flooding from sea level rise)	Low	Low
	Hurricanes/Tropical Storms	Low	Low
	Nor'easter	Low	Low
	Coastal Erosion	N/A	N/A
Precipitation	Extreme Precipitation	N/A	N/A
	Inland/Riverine Flooding	N/A	N/A
	Severe Winter Storm	N/A	N/A
	Ice Storms	N/A	N/A
	Landslide	N/A	N/A
	Dam Failure	N/A	N/A
Temperature	Increase in Average Summer Temperature	N/A	N/A
	Extreme Temperatures/Heat Waves	N/A	N/A
	Drought	N/A	N/A
	Wildfires	N/A	N/A
Other Extreme Events	Tornadoes	N/A	N/A
	Tsunami	Low	Low
	Earthquake	N/A	N/A

VULNERABILITY SCORE TABLE FOR CRITICAL POPULATIONS:

Shellfish Consumers

Primary Climate Driver	Natural Hazard	Risk Rating	Vulnerability Score
Sea Level Rise and Storm Surge	Coastal Flooding (including daily tidal flooding from sea level rise)	High	Moderate
	Hurricanes/Tropical Storms	High	Moderate
	Nor'easter	High	Moderate
	Coastal Erosion	N/A	N/A
Precipitation	Extreme Precipitation	High	Moderate
	Inland/Riverine Flooding	High	Moderate
	Severe Winter Storm	High	Moderate
	Ice Storms	Low	Low
	Landslide	N/A	N/A
	Dam Failure	Moderate	Low
Temperature	Increase in Average Summer Temperature	High	Moderate
	Extreme Temperatures/Heat Waves	High	Moderate
	Drought	High	Moderate
	Wildfires	N/A	N/A
Other Extreme Events	Tornadoes	N/A	N/A
	Tsunami	High	Moderate
	Earthquake	N/A	N/A

Fish Consumers

Primary Climate Driver	Natural Hazard	Risk Rating	Vulnerability Score
Sea Level Rise and Storm Surge	Coastal Flooding (including daily tidal flooding from sea level rise)	High	Low
	Hurricanes/Tropical Storms	High	Moderate
	Nor'easter	Moderate	Low
	Coastal Erosion	N/A	N/A
Precipitation	Extreme Precipitation	Moderate	Low
	Inland/Riverine Flooding	High	Moderate
	Severe Winter Storm	Moderate	Low
	Ice Storms	Low	Low
	Landslide	N/A	N/A
	Dam Failure	N/A	N/A
Temperature	Increase in Average Summer Temperature	Moderate	Low
	Extreme Temperatures/Heat Waves	Moderate	Low
	Drought	Moderate	Low
	Wildfires	N/A	N/A
Other Extreme Events	Tornadoes	N/A	N/A
	Tsunami	High	Moderate
	Earthquake	N/A	N/A

Commercial fishers

Primary Climate Driver	Natural Hazard	Risk Rating	Vulnerability Score
Sea Level Rise and Storm Surge	Coastal Flooding (including daily tidal flooding from sea level rise)	Moderate	Low
	Hurricanes/Tropical Storms	Low	Low
	Nor'easter	Moderate	Low
	Coastal Erosion	N/A	N/A
Precipitation	Extreme Precipitation	High	Moderate
	Inland/Riverine Flooding	Moderate	Low
	Severe Winter Storm	Moderate	Low
	Ice Storms	Low	Low
	Landslide	N/A	N/A
	Dam Failure	Moderate	Low
Temperature	Increase in Average Summer Temperature	Moderate	Low
	Extreme Temperatures/Heat Waves	Low	Low
	Drought	N/A	N/A
	Wildfires	N/A	N/A
Other Extreme Events	Tornadoes	N/A	N/A
	Tsunami	High	Moderate
	Earthquake	N/A	N/A

Recreational fishers

Primary Climate Driver	Natural Hazard	Risk Rating	Vulnerability Score
Sea Level Rise and Storm Surge	Coastal Flooding (including daily tidal flooding from sea level rise)	Moderate	Low
	Hurricanes/Tropical Storms	Low	Low
	Nor'easter	Low	Low
	Coastal Erosion	Low	Low
Precipitation	Extreme Precipitation	Low	Low
	Inland/Riverine Flooding	Low	Low
	Severe Winter Storm	Low	Low
	Ice Storms	N/A	N/A
	Landslide	N/A	N/A
	Dam Failure	Low	Low
Temperature	Increase in Average Summer Temperature	Low	Low
	Extreme Temperatures/Heat Waves	N/A	N/A
	Drought	N/A	N/A
	Wildfires	N/A	N/A
Other Extreme Events	Tornadoes	N/A	N/A
	Tsunami	Moderate	Low
	Earthquake	N/A	N/A

Coastal alteration project permit applicants

Primary Climate Driver	Natural Hazard	Risk Rating	Vulnerability Score
Sea Level Rise and Storm Surge	Coastal Flooding (including daily tidal flooding from sea level rise)	Low	Low
	Hurricanes/Tropical Storms	Low	Low
	Nor'easter	Low	Low
	Coastal Erosion	Low	Low
Precipitation	Extreme Precipitation	Low	Low
	Inland/Riverine Flooding	Low	Low
	Severe Winter Storm	Moderate	Low
	Ice Storms	Low	Low
	Landslide	N/A	N/A
	Dam Failure	Low	Low
Temperature	Increase in Average Summer Temperature	N/A	N/A
	Extreme Temperatures/Heat Waves	N/A	N/A
	Drought	N/A	N/A
	Wildfires	N/A	N/A
Other Extreme Events	Tornadoes	N/A	N/A
	Tsunami	Moderate	Low
	Earthquake	N/A	N/A

Fisheries Scientists

Primary Climate Driver	Natural Hazard	Risk Rating	Vulnerability Score
Sea Level Rise and Storm Surge	Coastal Flooding (including daily tidal flooding from sea level rise)	Low	Low
	Hurricanes/Tropical Storms	Low	Low
	Nor'easter	Low	Low
	Coastal Erosion	N/A	N/A
Precipitation	Extreme Precipitation	Moderate	Low
	Inland/Riverine Flooding	Low	Low
	Severe Winter Storm	N/A	N/A
	Ice Storms	Low	Low
	Landslide	N/A	N/A
	Dam Failure	Moderate	Low
Temperature	Increase in Average Summer Temperature	N/A	N/A
	Extreme Temperatures/Heat Waves	N/A	N/A
	Drought	N/A	N/A
	Wildfires	N/A	N/A
Other Extreme Events	Tornadoes	N/A	N/A
	Tsunami	High	Moderate
	Earthquake	N/A	N/A

Recreational Boater

Primary Climate Driver	Natural Hazard	Risk Rating	Vulnerability Score
Sea Level Rise and Storm Surge	Coastal Flooding (including daily tidal flooding from sea level rise)	Low	Low
	Hurricanes/Tropical Storms	Low	Low
	Nor'easter	Low	Low
	Coastal Erosion	Low	Low
Precipitation	Extreme Precipitation	Low	Low
	Inland/Riverine Flooding	Low	Low
	Severe Winter Storm	Moderate	Low
	Ice Storms	Low	Low
	Landslide	N/A	N/A
	Dam Failure	N/A	N/A
Temperature	Increase in Average Summer Temperature	N/A	N/A
	Extreme Temperatures/Heat Waves	N/A	N/A
	Drought	N/A	N/A
	Wildfires	N/A	N/A
Other Extreme Events	Tornadoes	N/A	N/A
	Tsunami	High	Moderate
	Earthquake	N/A	N/A

Section 5 Concluding Remarks

No response

Appendix A Vulnerability Scoring Method

This appendix presents the method used to develop the vulnerability scores for the state agency critical assets, functions, and population groups that were evaluated as part of this vulnerability assessment. The questions referenced below are from the State Agency Vulnerability Survey Tool, which was developed as part of the 2018 Massachusetts State Hazard Mitigation and Climate Adaptation Plan.

Exposure and Sensitivity Scores

The following exposure and sensitivity scores are used when responses are provided in Section II of the State Agency Vulnerability Assessment Survey for natural hazards for specific critical items.

Item	Response	Score
Exposure: Based on how the natural hazard is likely to change in the future as a result of climate change, to what extent is the critical asset, function, or population group served exposed to each hazard?	Not Exposed	0
	Low	1
	Medium	2
	High	3
Sensitivity: On a scale of 1 to 5, rate how sensitive the critical asset, function, or population group served is to the natural hazards. Sensitivity should be determined based on whether a critical threshold has been exceeded.	N/A	0
	1	1
	2	2
	3	3
	4	4
	5	5

- Minimum Exposure Score: 0; Maximum Exposure Score: 3
- Minimum Sensitivity Score: 0; Maximum Sensitivity Score: 5

Risk Rating

A risk rating is assigned by combining exposure and sensitivity. Thus, the following equation is used to arrive at a risk rating for each critical item:

*Risk Rating = Exposure Score * Sensitivity Score*

Based on the score ranges used for exposure and sensitivity, there is a possible vulnerability score range of 0-15 as shown below.

- Maximum Risk Rating (Maximum Exposure*Maximum Sensitivity) = 15
- Minimum Risk Rating (Minimum Exposure*Minimum Sensitivity/Maximum AC) = 0

The resulting risk rating for each applicable natural hazard and related climate change impacts that are assessed for a particular critical item is reported as low (yellow), moderate (orange), or high (red) as shown in the table below. If a critical item is determined to not be exposed to a natural hazard, a “N/A” (not applicable) value is assigned.

Score Total	Risk Rating
0-5	Low
6-10	Moderate
11-15	High

Adaptive Capacity Score

An adaptive capacity score range of 1-3 is used, with 1 reflecting low adaptive capacity and 3 reflecting high adaptive capacity. If a mitigation, adaptation, or emergency response measure is identified for a specific critical item in response to Question 15 of the survey (i.e. please identify any specific hazard mitigation, climate adaptation, or emergency response measures that have been identified for a critical item), an adaptive capacity score of 3 is assigned.

If a measure is not identified for a specific critical item in response to Question 15, a general agency adaptive capacity score is developed and assigned by deferring to the agency responses to the five general capability and adaptive capacity survey questions as shown in the table on the following page.

To arrive at the general agency adaptive capacity score, an unweighted average score for the responses to these five questions is used. The general agency adaptive capacity score may not be as accurate as an adaptive capacity score for a specific critical item, but it is used in the absence of better information.

Question	Response	Score
Question 7: How would you rate your agency's overall ability to withstand natural hazards and climate impacts in terms of potential physical damage or disruption to its assets, mission, functions, staff, and the public?	Excellent	3
	Good	2
	Satisfactory	2
	Fair	1
	Poor	1
Question 8: How long would it take your agency to return to essential functionality after a severe extreme weather event, like a hurricane or tornado, that results in significant damage to critical assets and/or functions?	Months	1
	Weeks	1
	Days	2
	Hours	3
Question 9: Does your agency have any remote operation capability (could services be provided from an alternate location if assets were temporarily damaged?)?	Yes	3
	No	1
	Don't know	1
Question 10: Is your agency currently incorporating natural hazard mitigation and climate change adaptation into your programs?	Currently incorporating	3
	Planning to incorporate	2
	Not incorporating	1
	Don't know	1
Question 14: Are there critical agency plans, policies, regulations, or procedures not currently being addressed that could be adjusted to better consider climate change?	Yes	1
	No	3
	Don't know	1

- Minimum Adaptive Capacity Score: 1; Maximum Adaptive Capacity Score: 3

Vulnerability Score

Vulnerability is a function of exposure, sensitivity, and adaptive capacity. Thus, the following equation is used to arrive at a vulnerability score for each critical item:

*Vulnerability Score = Exposure Score * Sensitivity Score / Adaptive Capacity Score*

Based on the score ranges used for exposure, sensitivity, and adaptive capacity, there is a possible vulnerability score range of 0-15 as shown below.

- Maximum Vulnerability Score (Maximum Exposure*Maximum Sensitivity/Min Adaptive Capacity) = 15
- Minimum Vulnerability Score (Minimum Exposure*Minimum Sensitivity/Maximum AC) = 0

The resulting vulnerability score for each applicable natural hazard and related climate change impacts that are assessed for a particular critical item is reported as low (yellow), moderate (orange), or high (red) as shown in the table below. If a critical item is determined to not be exposed to a natural hazard, a "N/A" (not applicable) value is assigned.

Score Total	Vulnerability Ranking
0-5	Low
6-10	Moderate
11-15	High