



NOAA
FISHERIES



NMFS Headquarters Ecosystem Based Fisheries Management Implementation Plan

2019



2019 Headquarters EBFM Implementation Plan

Purpose

The National Marine Fisheries Service (NMFS) has long recognized the importance of ecosystem-based fisheries management (EBFM). The [Ecosystem Based Fishery Management Policy](#) and [Road Map](#) describe how NMFS implements EBFM based on six guiding principles. NMFS defines EBFM in the Policy as “a systematic approach to fisheries management in a geographically specified area that contributes to the resilience and sustainability of the ecosystem; recognizes the physical, biological, economic, and social interactions among the affected fishery-related components of the ecosystem, including humans; and seeks to optimize benefits among a diverse set of societal goals.” To implement EBFM, the Policy identifies and outlines six Guiding Principles:

1. Implement ecosystem-level planning
2. Advance our understanding of ecosystem processes
3. Prioritize vulnerabilities and risks of ecosystems
4. Explore and address trade-offs within an ecosystem
5. Incorporate ecosystem considerations into management advice
6. Maintain resilient ecosystems

The EBFM Road Map calls for the development of implementation plans to guide NMFS’ efforts in implementing EBFM over the next five years. The purpose of this implementation plan is to identify and coordinate priority EBFM milestones across headquarters (HQ) offices that will complement regional EBFM priorities. This document also outlines a national engagement strategy as called for in the EBFM Road Map.

1.0 Headquarters (HQ) Context

NMFS is responsible for the stewardship of the Nation's living marine resources and their habitats that provide vital services for the Nation. NMFS implements an ecosystem-based approach to management to better inform and improve management decisions. The Nation’s living marine resources are managed by the NMFS HQ and Regional Offices, Regional Fishery Management Councils, and co-managers including states, tribes, and other partners. The NMFS Science Centers provide the science and data to support management decisions for these resources.

NMFS HQ offices provide national-level coordination of the agency’s science, policy, and management programs in collaboration with NMFS Regional Offices and Science Centers. This implementation plan focuses on domestic fisheries, habitat, and protected resources, and thus includes milestones from the Office of Sustainable Fisheries (OSF), Office of Science and Technology (OST), Office of Habitat Conservation (OHC), and Office of Protected Resources (OPR). The primary role for NMFS HQ in implementing EBFM is to incorporate EBFM Policy guiding principles through: 1) development and administration of national programs and policies; 2) facilitation of EBFM discussions through national

working groups and meetings; and 3) coordination of interactions with Congress, other federal agencies, and other NOAA Line Offices.

1.1 Develop and administer national programs and policies

NMFS HQ offices lead development of national programs, strategic documents, and policies to facilitate effective living marine resource science and management across the Nation (see Box 1 for programs, strategic documents, and policies relevant to EBFM). NMFS HQ offices implement the strategic direction of the agency, enhance the science tools available, and respond to policy issues associated with EBFM. For example, HQ experts work with regions to address questions related to the intersection of EBFM initiatives and statutory mandates.

Engagement with the Regional Fishery Management Councils on these national-level efforts is generally through the Council Coordination Committee.¹ The national-level programs are topic-specific (e.g., stock assessments, bycatch reduction, and habitat conservation), but generally span all NMFS regions and thus include regional representation. In many of these programs, HQ administers internal and/or external funds that support cutting-edge EBFM research and initiatives. Strategic documents, policies, and guidelines clarify agency priorities and actions within our mandates, and often address an emerging issue or need.

NOAA's Integrated Ecosystem Assessment (IEA) Program is an integral part of NMFS's EBFM strategy. The IEA program is a NOAA-wide initiative that funds projects across the agency, including many NMFS priorities. For example, the IEA program supports regional development and distribution of ecosystem status reports, and identification and development of methodologies for ecosystem thresholds and reference points relevant to NMFS and other NOAA Line Offices. The IEA program also continues to develop capacity for trade-off analyses of socio-ecological systems, including support for management strategy evaluations.² The IEA program integrates all components of an ecosystem, including humans, into the decision-making process so that managers can balance trade-offs and determine what is more likely to achieve their desired goals.

1.2 Facilitate internal discussions on EBFM

NMFS HQ offices provide a national forum to discuss EBFM issues and share information across programs, offices, and regions through national working groups and meetings. Providing an opportunity for regional and topical experts to discuss their challenges and solutions enables the agency to share valuable information, advance the implementation of creative solutions, and produce more consistent implementation of authorities. For example, in May 2018, the National Stock Assessment Workshop brought together experts from across NMFS Science Centers to discuss advances in synthesizing multiple competing models to better characterize scientific uncertainty, one of the recommendations in the EBFM Road Map. While facilitating discussions across regions is currently occurring as needed within offices, execution of this HQ implementation plan will promote more cross-office discussions of relevant EBFM issues (see expected outcomes below) and clarify where national-level products would be useful.

1.3 Coordinate interactions with NOAA Line Offices, Federal Agencies and Congress

HQ office staff often represent NMFS on national committees and facilitate interactions with Congress, other federal agencies, and other NOAA offices. HQ offices support the agency's budget planning process, educate and inform Congress on status and progress, and compile NMFS responses to inquiries relating to national level policies, science results, and regional challenges and solutions. HQ offices also coordinate with other programs within NOAA to identify overlapping priorities and explore opportunities for working synergistically.

¹ The Council Coordination Committee consists of the chairs, vice chairs, and executive directors from each Regional Fishery Management Council, or other staff, as appropriate. For more information go to <https://www.fisheries.noaa.gov/national/partners/council-coordination-committee>.

² Management Strategy Evaluation is a resource-intensive stakeholder-driven analytical process for exploring the consequences of alternative management approaches on a set of objectives.

BOX 1-- EXAMPLE NMFS PROGRAMS, STRATEGIC DOCUMENTS, AND POLICIES AND GUIDELINES ASSOCIATED WITH EBFM

Programs

- Integrated Ecosystem Assessment Program³
- National Fish Stock Assessment Program⁴
- Essential Fish Habitat Program⁵
- Deep-sea Coral Research and Technology Program⁶
- Community-based Restoration Program⁷
- Damage Assessment, Remediation and Restoration Program⁸

Strategic Documents, Policies, and Guidelines

- EBFM Policy⁹
- EBFM Road Map¹⁰
- Stock Assessment Improvement Plan¹¹
- Protected Species Improvement Plans¹²
- Habitat Assessment Improvement Plan¹³
- NOAA's Habitat Blueprint¹⁴
- NMFS Climate Science Strategy¹⁵
- Integrated Ecosystem Assessment National Plan¹⁶
- NMFS Allocation Policy¹⁷
- National Standard 1 Guidelines¹⁸
- National Bycatch Reduction Strategy¹⁹

³ <https://www.integratedecosystemassessment.noaa.gov/>

⁴ <https://www.fisheries.noaa.gov/topic/population-assessments>

⁵ <https://www.fisheries.noaa.gov/national/habitat-conservation/essential-fish-habitat>

⁶ <https://www.fisheries.noaa.gov/national/habitat-conservation/deep-sea-coral-habitat>

⁷ <https://www.fisheries.noaa.gov/national/habitat-conservation/strategic-habitat-restoration>

⁸ <https://www.darrp.noaa.gov/>

⁹ <https://www.fisheries.noaa.gov/resource/document/ecosystem-based-fisheries-management-policy>

¹⁰ <https://www.fisheries.noaa.gov/resource/document/ecosystem-based-fisheries-management-road-map>

¹¹ <https://www.fisheries.noaa.gov/feature-story/updated-stock-assessment-improvement-plan-builds-past-success>

¹² <https://repository.library.noaa.gov/view/noaa/3421> and <https://spo.nmfs.noaa.gov/sites/default/files/tm78.pdf>

¹³ <https://www.fisheries.noaa.gov/resource/document/habitat-assessment-improvement-plan-2010>

¹⁴ <https://www.habitatblueprint.noaa.gov/>

¹⁵ [https://www.fisheries.noaa.gov/sites/default/files/2018-09/NOAA%202019-2021_3-](https://www.fisheries.noaa.gov/sites/default/files/2018-09/NOAA%202019-2021_3-yr%20IEA%20plan_FINAL%20%282%29.pdf)

http://dev-iea.nmfs.noaa.gov/sites/default/files/2018-09/NOAA%202019-2021_3-yr%20IEA%20plan_FINAL%20%282%29.pdf

¹⁷ <https://www.fisheries.noaa.gov/national/laws-and-policies/allocation-fishery-resources>

¹⁸ <https://www.fisheries.noaa.gov/national/laws-and-policies/2016-revisions-national-standard-1-guidelines>

¹⁹ <https://www.fisheries.noaa.gov/national/bycatch/national-bycatch-reduction-strategy>

The long-term vision for EBFM in HQ is to:

- work with NMFS leadership to guide the national direction for implementing EBFM;
- strengthen linkages and coordination between national science initiatives and national priority management needs;
- leverage aligned work from the different program areas;
- provide a forum for cross-regional collaboration and coordination;
- support projects that advance the principles of the EBFM Road Map by enhancing our understanding of ecosystem processes and improving management approaches and decision-support tools; and
- generate national communication products and messages that articulate agency-wide progress in EBFM implementation for external stakeholders.

2.0 Expected outcomes and benefits

It is important that HQ EBFM activities be aligned and strategic across national science and management programs. Looking across HQ and regional EBFM implementation plans enables NMFS to better understand the current direction of EBFM implementation nationwide. Using the EBFM Road Map as an organizing framework, NMFS is positioned to identify areas where we are advancing EBFM, leverage activities in different program areas where there is synergy, determine the science and management gaps, and identify actions that may need to be encouraged.

The primary roles of HQ are to provide a forum for cross-regional collaboration and coordination and to support and implement national programs to guide regional implementation of EBFM. The HQ Implementation Plan does not intend to establish consistent priority goals or activities across all regions. However, to fulfill its coordination role and guide the national direction for EBFM implementation, HQ will facilitate discussions to identify cross-cutting priorities among the regions, and advance innovative tools and techniques.

Implementation of this plan will enhance communication and improve effectiveness and efficiency in applying EBFM principles to priority science and management needs. This approach should reduce duplicative efforts and be more responsive to NMFS' fishery management goals. Planning discussions have increased awareness of the challenges and opportunities facing each office and region, leading to a better understanding of where future collaborations may be beneficial. In addition to improved coordination between HQ offices, this plan will facilitate discussion of relevant EBFM issues and solutions across the country. Providing a forum for cross-project or cross-office discussions of emerging challenges and opportunities will foster innovative solutions and will result in more effective and efficient EBFM implementation.

Expected outcomes from the implementation of HQ EBFM milestones include:

- EBFM management actions supported by robust ecosystem science;
- fishery managers (including Councils) have tools and support to integrate ecosystem (e.g., habitat, climate) and socio-economic (e.g., community vulnerability) considerations into management decisions;
- EBFM activities are coordinated across NOAA regions, programs, and the science-management spectrum, and best practices are shared;
- resources are prioritized toward Council interests and geographic and topical areas most in need of ecosystem science and management action; and
- the public is informed of EBFM activities and has opportunities to provide input into the process.

3.0 Milestones by guiding principles

In order to track progress in EBFM, HQ milestones are articulated for applicable Road Map actions under each of the six guiding principles (see Tables 1 and 2). The listed EBFM milestones will be addressed during the next five years. Longer-term milestones may be adapted based on agency needs and opportunities that emerge from the initial actions.

While there are specific actions and milestones HQ plans to take over the next five years to advance national EBFM initiatives, there are also a multitude of ongoing activities that are necessary to support EBFM. As many of these ongoing activities are not associated with a specific product or discrete activity, we are not including them in our list of milestones. For example:

- NMFS will continually assess science and management needs in
 - staffing expertise;
 - economic and sociocultural data collection;
 - ecosystem models (including capacity to complete management strategy evaluations);
 - integrated ecosystem assessments;
 - economic or socio-economic analyses (including community vulnerability assessments); and
 - stock assessment priorities (including identifying stock assessments that could benefit from inclusion of ecosystem information);
- NMFS will provide data and information to support U.S. interests in aquaculture as needed or requested; and
- NMFS will support effective implementation of the National Standard 1 guidelines, which includes guidance on incorporating ecosystem information into stock management.

Below is a summary of the milestones that support each of the guiding principles. See Tables 1 and 2 for the specific ongoing and completed milestones, respectively.

3.1 Guiding Principle 1: Implement ecosystem level planning

Guiding Principle 1 contains two core components: implementing ecosystem-level planning (i.e., supporting development of fishery ecosystem plans (FEPs)), and developing engagement strategies and outreach materials. Actions 1a1 and 1b1 in the Road Map call for establishing EBFM points of contact or FEP coordinators for each HQ office. The experts identified as participants on the EBFM WG are the EBFM experts within each HQ office. In addition, a national EBFM coordinator has been identified and can be reached via [e-mail](#).

HQ offices will focus on engagement and outreach, since supporting fishery ecosystem plans mainly occurs within the regions. HQ has created a cross-region outreach team that is developing materials on the benefits of EBFM for use across all regions. The HQ engagement strategy is outlined in Section 4 of this document. Milestones related to governance challenges associated with stocks that have shifted their distribution across jurisdictional boundaries are also included under this guiding principle.

3.2 Guiding Principle 2: Advance our understanding of ecosystem processes

Guiding Principle 2 contains two core components: conducting science to understand ecosystems and providing ecosystem status reports for each large marine ecosystem. For the first element, HQ will continue to support relevant programs (see Box 1) and grant opportunities that advance EBFM initiatives. HQ offices will also organize pertinent meetings and workgroups, including a national fish survey working group, an analysis of gaps in economic and socio-cultural data, and a biennial EBFM science and management meeting. For the second element, an expert working group has identified milestones to improve development, coordination and dissemination of ecosystem status reports.

3.3 Guiding Principle 3: Prioritize vulnerability and risks to ecosystems and their components

Guiding Principle 3 focuses on identifying and understanding species and ecosystem-level cumulative risks and vulnerabilities as well as cumulative pressures that pose the most risk to communities dependent on ecosystems. The associated milestones include utilizing the results of regional habitat

assessment prioritizations, implementing the stock assessment prioritization process, and piloting a methodology for assessing the vulnerability of habitats to climate change. HQ offices will also support regional development and implementation of assessments of ecosystem risk, habitat risk, community vulnerability, and fish stock climate vulnerability.

3.4 Guiding Principle 4: Explore and address trade-offs within an ecosystem

Guiding Principle 4 addresses the reality that fisheries management often requires trade-offs between different management goals. The core components of this guiding principle are to establish sufficient EBFM modeling capabilities to analyze trade-offs and to develop management strategy evaluation capabilities. HQ offices will continue to support regions' ecosystem modeling activities, including management strategy evaluations. HQ will evaluate stock assessment demands and gaps, continue to create appropriate EBFM tools, and explore scenario planning²⁰ as a management tool.

3.5 Guiding Principle 5: Incorporate ecosystem considerations into management advice

Guiding Principle 5 emphasizes that Incorporation of ecosystem considerations into management is key to the success of EBFM, but can also be challenging. Three core components are listed under this guiding principle: developing and monitoring ecosystem level reference points, incorporating ecosystem considerations into assessments and management decisions, and providing ecosystem advice related to essential fish habitat, bycatch, and aquaculture. HQ has the most milestones within this guiding principle, reflecting its importance and relevance to HQ programs and projects. A few key milestones in this section include exploring ecosystem-level reference points and the use of stock complexes in management, investigating protocols for incorporating habitat and other ecosystem considerations into fisheries management, exploring options for strengthening the effectiveness of existing habitat authorities, and improving protected species management.

3.6 Guiding Principle 6: Maintain resilient ecosystems

Guiding Principle 6 focuses on core components related to ecosystem resilience and community well-being. This includes improving our understanding of community vulnerabilities, supporting multiple projects to advance tools for estimating ecosystem services, and developing a suite of output- and outcome-oriented approaches to track EBFM progress nationally.

4.0 Engagement strategy

This EBFM Engagement Strategy for the HQ offices outlines approaches and strategies to enhance coordination, collaboration, and communication practices with external NMFS partners. To be successful, an engagement strategy requires the long-term commitment of multiple partners and involves a spectrum of approaches and methods that are effective in advancing EBFM.

The HQ engagement strategy will employ the following approaches, given the many roles the HQ offices play:

- Inform - provide balanced and objective information with respect to the EBFM process, objectives, obstacles, alternatives, opportunities and/or solutions. Ensure effective communication and collaboration by employing useful tools.
- Consult - ask science and management partners for feedback throughout the process to identify informational needs, ensure products and approaches address their needs, and clarify and resolve obstacles.
- Partner - work with new and current science and management partners in each phase of EBFM implementation, including the recognition of issues, identification of solutions, and leveraging of resources to enhance EBFM implementation.

²⁰ Scenario planning is an expert-based, qualitative (or semi-quantitative) methodology that embraces uncertainty and explores plausible alternative conditions under different assumptions (i.e., stories) to help manage risk and prioritize management actions.

The HQ engagement plan builds upon existing, integrated networks of partnerships (e.g., NMFS Climate Science Strategy network.) Among the strengths that the HQ plan brings to this effort is a history of collaboration across the science-management continuum with respect to living marine resources, as well as active collaborations with other federal agencies and stakeholder, academic, and non-governmental organizations. To strengthen science and management capabilities that will support EBFM implementation, the HQ plan will strengthen existing partnerships and strategically seek out new collaborations.

Key partners include the Regional Fishery Management Councils, states, interstate commissions, other NOAA Line Offices, tribes, indigenous communities, non-governmental agencies, and other government agencies. HQ offices interact with Councils during presentations on national initiatives and through interactions with the Council Coordination Committee. HQ will collaborate and seek new partnerships with NOAA programs that provide scientific expertise and products. HQ staff also coordinate and collaborate with other external partners and stakeholders, including interagency workgroups, NMFS advisory committees and regional bodies, academic and research organizations, non-governmental organizations, and interested stakeholder groups. Where appropriate, HQ staff will solicit local and traditional ecological knowledge to supplement more conventional data streams.

Strategies to facilitate participation by external partners and stakeholders in the implementation of the plan include:

- seek out and share information with collaborators, within and external to NOAA, that will enable synergistic partnerships to achieve EBFM actions;
- partner with organizations that have technologies and approaches that will advance EBFM;
- deliver scientific advances, products, and new information to users to support management decisions; and
- employ a variety of communication strategies that facilitate information sharing (i.e., best practices for engagement from among the regions and partners) and to ensure constructive dialogue and feedback with management partners.

5.0 Updating and measuring effectiveness

HQ Offices will track the progress of each of its milestones on an annual basis. This implementation plan is a “living document” that will be revised and updated. NMFS solicited input from the public in spring and summer of 2018 on a draft version of the HQ implementation plan. Some of the recommendations were addressed directly in the HQ implementation plan while others were more appropriately addressed in regional implementation plans. Many comments included ideas that NMFS hopes to add to future HQ EBFM Implementation Plans, but that are not currently feasible given existing resources. Please feel free to provide continued feedback on this plan via e-mail (nmfs.hq-ebfm@noaa.gov).

Table 1. HQ milestones for road map actions. Road map actions that did not have an associated HQ milestone are not included.

Road Map Action	Road Map Timing	Milestones (target date)
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1a2. Develop national and regional EBFM engagement strategies	Short	<ul style="list-style-type: none"> Continue to host the national EBFM WG meetings that will focus on specific informational and coordination needs throughout the implementation phase (ongoing). Identify, develop, and/or disseminate training material for managers and scientists to obtain a common understanding of EBFM principles, best practices, and latest decision-support tools. Training material may include case studies (ongoing). Implement external engagement strategies listed in the Headquarters Engagement Strategy (ongoing).
1a3. Develop best practices where there are overlapping jurisdictions	Mid	<ul style="list-style-type: none"> Create NMFS white paper that summarizes existing governance approaches for situations where stocks are found in multiple jurisdictions (2019).
1a4. Develop Standardized EBFM Policy and Road Map Materials for widespread use	Short	<ul style="list-style-type: none"> Update 1-pager, general presentation, and FAQ on EBFM for use by NMFS staff and partners (Councils, Sea Grant, etc.) (Updated as needed). Review and update NMFS EBFM Road Map every five years, with public input as appropriate (2021).
1a5. NMFS supports any Ecosystem Plan Development Teams, Ecosystem Committees (or equivalent groups) that Councils establish	Continuing	<ul style="list-style-type: none"> Participate in preparation of the Council Coordination Committee's Habitat Workgroup-generated overview and comparison of how Councils have used discretionary authority for deep-sea coral protection (2020).
2a1. Advance resources to conduct EBFM	Continuing	<ul style="list-style-type: none"> Encourage Science Centers to implement EBFM and Regional Climate Action Plans through variety of mechanisms including funding regional work plans per planning guidance (annual).
2a2. Develop capacity for NMFS to conduct end-to-end ecosystem studies	Mid	<ul style="list-style-type: none"> Prioritize research that utilizes integrated modeling for evaluating tradeoffs associated with harvest strategies (annual). Implement joint NMFS-OAR Climate and Fisheries Research Grants Program to understand impacts of changing climate and oceans on marine and coastal ecosystems, NMFS Trust Resources and the people that depend on them (annual). Support science on impacts of changing climate and oceans on marine and coastal ecosystems. Fund priority projects annually that support the Regional Climate Action Plans and national activities (annual).
2a3. Conduct biennial EBFM Science & Management Conference	Mid	<ul style="list-style-type: none"> Organize first EBFM Science and Management Meeting (2019).

2a4. Develop and maintain core data and information streams	Continuing	<ul style="list-style-type: none"> ● Coordinate with regional stock assessment scientists to improve and maintain the Species Information System (SIS) which is used to store results from all NMFS stock assessments (ongoing).
2a5. National review of the data collection programs across a wide range of disciplines, including but beyond the typical abundance and basic biological data	Mid	<ul style="list-style-type: none"> ● Establish a national fisheries independent survey working group that evaluates survey methodology, statistical designs, data management and dissemination, and survey prioritization, and develops best practices for maximizing data collection resources and improve stock and ecosystem assessments (2019). ● Using Economics & Human Dimensions Program working groups, assess gaps in economic and sociocultural data coverage and prioritize according to meeting both current and emerging (e.g., EBFM, management strategy evaluations, IEA) needs (ongoing). ● Comparison of regional deep-sea coral and sponge data collection programs to increase standardization/comparability, where possible (2021).
2b2. Establish routine, regular, and dynamic reporting of ecosystem status reports (ESRs) for each large marine ecosystem	Mid	<ul style="list-style-type: none"> ● Implement recommendations from the 2017 ESR Workshop and Technical memo (NMFS-F/SPO-174), including the automation of ESRs to increase efficiency and production (ongoing). ● Provide national support and guide development of a national system of ecosystem indicators and reports to track the condition of the nation's valuable marine ecosystems (ongoing).
3a1. Conduct Systematic Risk Assessments for relevant NOAA regional ecosystems	Long	<ul style="list-style-type: none"> ● Develop a comparison of risk assessments methodologies (2020).
3a2. Explore protocols for conducting regional habitat risk assessments for those areas known to serve important ecological functions for multiple species groups or will be especially vulnerable or important in the face of climate change	Mid	<ul style="list-style-type: none"> ● Lead nation-wide effort to assess climate vulnerability of major fish stocks in 6 US regions (Fish Stock Climate Vulnerability Assessments) (2020). ● Continue to support National Fish Habitat Partnership regional habitat assessments in all regions, beginning with Mid-Atlantic and Southeast Alaska (ongoing). ● Complete a regional habitat climate vulnerability assessment pilot project in the Northeast (2020).
3b1. Ensure that factors which impact 800+ US managed species are being considered	Continuing	<ul style="list-style-type: none"> ● Implement the revised stock assessment prioritization process/3-step decision process in multiple regions to determine and track the stocks that are highest priority for incorporating ecosystem considerations, establish assessment targets, and identify gaps for assessment

		data (2020).
3b2. Conduct Habitat Assessment Prioritization for all NMFS regions	Mid	<ul style="list-style-type: none"> Encourage the use of regional habitat assessment prioritizations within regional work plans of the Science Centers and regional Habitat Conservation Divisions, with a focus on identification of key habitats that intersect with multiple priority stocks (2019).
3b3. Conduct Fishing Community Vulnerability Assessments for all NMFS regions	Short	<ul style="list-style-type: none"> Support conducting community vulnerability assessments in all regions (ongoing).
4a2. Develop an EBFM analytical toolbox that includes ecosystem modeling tools and best practices, data-poor qualitative and semi-quantitative tools, and related decision support tools	Mid	<ul style="list-style-type: none"> Build capacity for scenario planning tools within NMFS in order to improve management in the face of uncertainty (2019). Work with US Fish and Wildlife Service National Conservation Training Center to develop a marine-focused scenario planning course to help address climate adaptation within marine resource management (2019). Expand NOAA Fisheries Toolbox to include ecosystem modeling tools in coordination with other efforts (2020). Hold a workshop to discuss the development, implementation, groundtruthing, and applications of deep-sea coral predictive habitat modeling (among US, Canada, Europe) (2021).
4a3. Encourage and expand the use of multi-model inference	Continuing	<ul style="list-style-type: none"> Complete report for the 13th National Stock Assessment Workshop held in May 2018 with theme of exploring use of multi-model inference in fish stock assessments (2019).
5a1. Delineate, evaluate, and explore best practices for estimating and using system-wide or aggregate group harvest limits, eco-production measures, and other ecosystem level reference points, to inform management decisions	Mid	<ul style="list-style-type: none"> Investigate current use of stock complexes in US fisheries management (possible white paper or publication) (2020). Prepare summary of approaches and suggested indicators for ecosystem reference points and clarify existing state of the research on the approaches (2021).
5b1. Develop and track fishery stock status indices that denote when ecosystem considerations are used	Mid	<ul style="list-style-type: none"> Expand the Species Information System to improve tracking and reporting of stock assessments that include ecosystem considerations (2019).

<p>5b3. Identify best practices for incorporating ecosystem considerations into management decisions</p>	<p>Short-Mid</p>	<ul style="list-style-type: none"> ● In conjunction with Centers' Economic & Human Dimensions programs, develop research strategies that develop model pathways for evolving current social and economic models towards EBFM and management strategy evaluations (2020). ● Develop strategies to better incorporate habitat science and assessments into stock assessment and integrated ecosystem assessment approaches and products (2020). ● Investigate best practices/approaches to facilitate flexible and adaptive fisheries management (2020).
<p>5c1. Explore protocols for considering ecosystem-level information in essential fish habitat (EFH) reviews, identifying ecosystem-level habitat areas of particular concern, and setting habitat conservation objectives and/or indicators</p>	<p>Short</p>	<ul style="list-style-type: none"> ● Gather instances of Councils effectively incorporating deep-sea coral/sponge information into EFH reviews (2019). ● Evaluate the utility of incorporating prey into EFH descriptions (2019). ● Identify and support Council pilot projects to develop habitat conservation objectives, including conducting an expert workshop to advance and refine habitat conservation objective approaches (2019).
<p>5c2. Finalize and implement National Bycatch Reduction Strategy</p>	<p>Short</p>	<ul style="list-style-type: none"> ● Finalize HQ action plan for implementing the National Bycatch Reduction Strategy (2019). ● Hold workshop to review best practices for estimating damage to deep-sea coral and sponge habitat using existing bycatch data from the West Coast and Alaska to inform bycatch reduction efforts (2021). ● Hold a workshop on the human behavioral aspects of bycatch (2019).
<p>5c5. Review long-term protected species recovery and rebuilding plans to ensure they account for the potential effects of near-term and long-term climate change, particularly relating to alterations to food web structure</p>	<p>Long</p>	<ul style="list-style-type: none"> ● Complete white paper on Atlantic Salmon Scenario Planning Workshop (2019). ● Conduct Marine Mammal Climate Vulnerability Assessment in the Atlantic, Gulf of Mexico and Caribbean (2019). ● Conduct Sea Turtle Climate Vulnerability Assessment with global set of populations (2020).
<p>6a2. Evaluate, conduct and track ecosystem goods and services valuation methods and best practices</p>	<p>Mid</p>	<ul style="list-style-type: none"> ● Complete economic impact analysis of oyster reef restoration in the Choptank River Complex, including the fisheries harvesting sector (2018). ● Refine salt marsh/seagrass ecosystem services valuation model and develop online tool and written managers' guide (2019).

		<ul style="list-style-type: none"> • Conduct a survey of fishery managers to better understand their use of and the challenges to using ecosystem service valuations (2019). • Develop best practices for valuing ecosystem services (2020). • Complete project with EPA to develop and test method for evaluating climate-related impacts on fisheries economics (2020).
6a4. Develop National EBFM Performance measures	Mid	<ul style="list-style-type: none"> • Develop approach to track EBFM progress nationally (2019).
6b1. Explore community health and well-being socio-economic metrics	Mid	<ul style="list-style-type: none"> • Support integrating the social vulnerability assessments of coastal fishing communities with the regional biological vulnerability assessments (ongoing). • Use the results of the Habitat Focus Area (HFA) Effectiveness Review to establish best practices for potential new HFAs (2019).
6b2. Adopt community vulnerability analyses to a broader range of cumulative factors	Mid	<ul style="list-style-type: none"> • Prioritize research that extends community vulnerability models that incorporate cumulative factors (ongoing).

Table 2. List of completed HQ milestones.

Road Map Action	Road Map Timing	Milestone (completion date)
1a3. Develop best practices where there are overlapping jurisdictions	Mid	<ul style="list-style-type: none"> • Created NMFS Technical Memorandum outlining recommendations for improving the data collection, analysis, and delivery to managers of information relating to shifting species distributions and changes in productivity (2018)
2b1. Conduct a national review of existing ecosystem status reports (ESRs) to assess fishery science center indicator information needs to identify where ecosystem status reports address similar indicators across large marine ecosystems	Short	<ul style="list-style-type: none"> • Conducted national Ecosystem Status Report (ESR) Workshop on common analytical techniques including improving indicators (2017).

3b2. Conduct Habitat Assessment Prioritization for all NMFS regions	Mid	<ul style="list-style-type: none"> ● Updated Habitat Assessment Improvement Plan (HAIP) and align HAIP and EBFM actions (2018).
5a1. Delineate, evaluate, and explore best practices for estimating and using system-wide or aggregate group harvest limits, eco-production measures, and other ecosystem level reference points to inform management decisions	Mid	<ul style="list-style-type: none"> ● Published NMFS Technical Memorandum that provides an economic perspective of National Standard 1 requirement to prevent overfishing while achieving the optimum yield (OY) from each fishery (2018).
5c1. Explore protocols for considering ecosystem-level information in essential fish habitat (EFH) reviews, identifying ecosystem-level habitat areas of particular concern, and setting habitat conservation objectives and/or indicators	Short	<ul style="list-style-type: none"> ● Prepared a synthesis paper of approaches for developing habitat conservation objectives (2018).
5c5. Review long-term protected species recovery and rebuilding plans to ensure they account for the potential effects of near-term and long-term climate change, particularly relating to alterations to food web structure	Long	<ul style="list-style-type: none"> ● Incorporated high priorities and other actions identified during the Atlantic salmon workshop into Draft Atlantic Salmon Recovery Plan (2018). ● Developed pilot Regional Protected Resources Climate Science Toolkits for the West Coast and Greater Atlantic Regions (2018). Revisions are ongoing as new information becomes available. ● Convened expert panels to identify next steps regarding North Atlantic right whale management and recovery (2018).
6a2. Evaluate, conduct and track ecosystem goods and services valuation methods and best practices	Mid	<ul style="list-style-type: none"> ● Complete ecosystem modeling of the Choptank River Complex using Ecopath with Ecosim (2018). ● Establish Ecosystem Services Working Group (2018).