Themes and Ideas for Climate Readiness Planning

Excerpted from October 2023 Staff Discussion Paper: Inflation Reduction Act Funding for Climate Readiness Planning[1]

Introduction, May 2024

This document is provided as background information for the June 2024 Climate Scenarios Workshop (June 5-6, 2024 in Kodiak, AK), and is excerpted from a staff discussion paper[2] that was originally prepared to support the Council's October 2023 discussion of developing a proposal for Inflation Reduction Act funding.

The purpose of the 2024 Climate Scenarios Workshop is to generate ideas for short- and long-term management approaches and tools to improve climate resiliency of federally managed fisheries in the North Pacific. While the Council has already submitted its proposal for IRA funding, the information in this discussion document continues to be relevant to the Climate Scenarios Workshop and the Council's consideration of ideas for advancing climate readiness and resilience. Importantly, many of the issues, themes, and ideas originally described in the discussion document are now reflected in the objectives and agenda for the workshop, and/or may be captured in next steps the Council could choose to pursue as an outcome of workshop discussions.

The original purpose of this discussion document was to describe past and ongoing work the Council could draw upon to prepare a proposal for IRA-funded activities and deliverables. Council staff reviewed ongoing Council projects and initiatives that relate to climate ready fisheries, and also synthesized themes, issues, and ideas highlighted in recent Council documents including the Climate Readiness Synthesis (CRS)[3] prepared by the Council's Climate Change Taskforce (CCTF) and the final report[4] from the Scientific and Statistical Committee's (SSC's) February 2023 workshop.

The Council has made progress on the following items since this discussion document was first published in October 2023.

Submittal of IRA funding proposal: Since December, staff have finalized and submitted grant applications totaling $2.5 million through the IRA grant process administered by NMFS. The Council's proposal focuses on building climate readiness through three linked pathways that will build upon existing work by 1) developing a climate-resilient management policy, 2) continuing

[1] Prepared by Diana Evans, Council staff, and Katie Latanich, Consultant
[2] The original discussion paper is available under B1 of the October 2023 Council meeting eAgenda
[3] Climate Readiness Synthesis. Prepared by the NPFMC Climate Change Task Force 2022
[4] Final Workshop Report: Rapid change in the northern Bering and southern Chukchi Seas - Identifying ecosystem responses and effects on the management of Federal fisheries. North Pacific Fishery Management Council Science and Statistical Committee Workshop, February 7-8, 2023

work to incorporate local and traditional knowledge, and 3) strengthening the consideration of uncertainty and risk in harvest specifications and other aspects of Council management.

Progress on Council initiatives for climate readiness: The 2023 discussion paper identified two ongoing Council initiatives, the 2024 Climate Scenarios Workshop and the work of the CCTF, and the Programmatic Evaluation, as opportunities to support climate readiness planning. As anticipated, both the workshop and Programmatic Evaluation process continue to be foundational components of the Council's climate readiness work. The Programmatic Evaluation will revisit the management policies, goals, and objectives for all of the Council's federally managed fisheries in the Bering Sea, Aleutian Islands, and Gulf of Alaska. Through this process, the Council will consider whether its management approach should be updated and revised in consideration of current environmental variability and the ability of the management framework to respond to change. The workshop will help support development of the Programmatic Evaluation as a forum to help identify broad concerns and themes of discussion that can help inform the Council's consideration of programmatic alternatives. Additionally, the workshop may also identify specific ideas for climate readiness that could be further explored through subsequent management actions to implement a revised programmatic management policy, or through other onramps.

Adoption of the Local Knowledge, Traditional Knowledge, and Subsistence (LKTKS) Protocol: In October 2023, after this discussion document was first published, the Council adopted the LKTKS Protocol[5] that was developed by the LKTKS Taskforce. The LKTKS Protocol defines these knowledge systems and includes guidance to inform the Council's decision-making process for how to appropriately identify, analyze, and incorporate Local Knowledge, Traditional Knowledge, and subsistence information into the Council's decision-making process. The Taskforce also identified onramp recommendations for the Council's consideration at final action that identified potential changes to the Council's process to better incorporate these knowledge systems. While the work of the LKTKS task force is not explicitly focused on climate change, diverse knowledge systems are a vital component of climate readiness and adaptation.

The remainder of this document includes the following excerpts, which are provided unchanged from the October 2023 discussion document. Some of the initiatives, ideas, and recommendations included in the Appendices may have been updated or no longer relevant.

- **Climate readiness themes**: Provides a synthesis of climate readiness themes from recent and ongoing work by the Council, SSC, and CCTF.
- **Appendix 1**: describes climate-related Council, Scientific and Statistical Committee and NMFS initiatives that can support climate readiness planning
- **Appendix 2**: provides a summary of cross-cutting topics and includes the ideas and recommendations provided by the SSC and the Climate Change Task Force for supporting climate readiness, including addendums with specific excerpts from the SSC and CCTF reports.

[5] D2 LKTKS Protocol, April 2023. Protocol for Identifying, Analyzing, and Incorporating Local Knowledge, Traditional Knowledge, and Subsistence Information into the North Pacific Fishery Management Council's Decision-making Process. NPFMC 2023

Climate readiness themes

The Council's current initiatives and the body of work by the CCTF, NMFS, and SSC together help advance common themes related to building climate readiness. The Council could reflect on these themes to consider what objectives, issue areas, or projects might be included in a NPFMC proposal for IRA funding. The Council can also consider other questions, for example:

- ❖ Are there other attributes of climate readiness that aren't captured here?
- ❖ Are there themes that have been difficult to gain traction on, or seem to be lacking clear next steps?
- ❖ Are there topics that are particularly challenging to discuss, and areas in which the Council community could become more conversant?

Appendix 2 provides a more detailed description, mapping these themes to ideas and recommendations proposed by the CCTF and SSC.

Theme 1: Support a Council process that can be both proactive and responsive

The Council can develop strategies to think proactively, respond quickly, and better understand linkages between management approaches and adaptive capacity, including by:

- Evaluating and improving the climate resilience of management actions: The Council can build on the CRS by taking a comprehensive look at its management tools to better understand their current flexibility and limitations, how they interact, and think about how to build approaches that are specifically designed to work well under climate change.
- Learning from past experience and "what if" scenarios: The Council has already experienced climate-related disruptions to the Gulf of Alaska Pacific cod and Bering Sea crab stocks. The Council can analyze what has been learned from these experiences, as well as explore and test hypothetical future scenarios to consider how to respond. The 2024 Climate Scenarios workshop will support this.
- Supporting a timely, responsive Council process: The decision-making and regulatory process are designed to support deliberation and public involvement, and can move slowly as a result. The Council can explore how to support the public process while also enabling rapid response to change and systematically looking at management actions through a climate readiness lens. This will be supported by the PEIS process.
- Building a shared understanding of resilience and adaptive capacity: People, communities, and fisheries are likely to respond to climate change in very different and personal ways. Discussing resilience and adaptive capacity with the Council community could help build a shared understanding of how and why people might respond to change, and how these responses might impact the effectiveness of management measures.

Theme 2: Build and use climate information on-ramps

The Council can contribute to building on-ramps and capacity for considering climate information in Council processes, including by:

- Including more climate information in analytical products: The CRS describes opportunities for increasing the uptake of climate information into SAFE reports and Ecosystem Status Reports. There are opportunities for further dialogue with SAFE report authors, especially as the Council refines its priorities and information needs for climate readiness including through the PEIS process and 2024 Climate Scenario Workshops.
- Strengthening the Council community's ability to talk about risk: Climate change will require making decisions in the face of increasing uncertainty, and clearly communicating with stakeholders about the likelihood and consequences of climate change impacts. The Council can become more conversant in the language of risk and risk tolerance through more dialogue with the SSC (i.e., the newly formed Council-SSC subgroup) and exploration of risk-based management approaches and tools including risk policies and risk tables.
- Linking ecosystem approaches with climate readiness: Ecosystem-based management approaches can help account for changing ecosystem conditions and provide a pathway for bringing diverse sources of knowledge into the Council process. The Council can more clearly articulate how EBFM supports climate readiness and continue building on EBFM approaches.

Theme 3: Include stakeholders and partners in building climate readiness

The Council can more fully integrate diverse knowledge bases and support two-way stakeholder engagement to support climate readiness, including by:

- Strengthening engagement with Alaska Native communities: The Council can take steps to more fully integrate traditional knowledge and support two-way dialogue with Tribes and stakeholders, as detailed in the LKTKS protocol and on-ramps documents, and the CRS.
- Communicating clearly and regularly about climate readiness planning: Climate change amplifies the need for the Council to communicate about its work and to discuss complex issues in clear, accessible terms. The Council can consider how to create new and more accessible opportunities for participation and information sharing.
- Building a stronger network of partnerships: Climate change deepens the need for coordination and collaboration across agencies, research partners, industry sectors, communities, tribal governments, and other groups to share knowledge, fill data gaps, and account for the impacts of other activities. The Council can continue efforts to increase accessibility and broad participation in the Council process. Workshops are one way to provide greater access.

Appendix 1: Initiatives and Resources

The Council, SSC, and NMFS are investing in work that provides context, scientific tools and information products, and ideas and recommendations that can support the Council's IRA funding proposal. These resources include work specifically focused on climate change, as well as efforts to develop ecosystem-based management (EBFM) pathways and include diverse perspectives and knowledge, which are also critical to climate readiness.

The resources cited in this section also synthesize the potential impacts of climate change to North Pacific fisheries, identify problem statements and needs for climate readiness planning, provide working definitions of key terms including adaptation and resilience, and describe linkages with national policy guidance; this information is incorporated by reference and not restated here. A table describing the climate-related functions of Council bodies is also provided in Table 3-4 of the Climate Readiness Synthesis.

Council initiatives

Council-SSC Subgroup

In April 2023 the Council approved the SSC's recommendation to form a subgroup of Council and SSC members to develop a roadmap that builds a bridge from assessment and climate science to adaptive management under climate change.[6,7] This recommendation is an output of the SSC's February 2023 workshop focusing on rapid change in the northern Bering Sea and southern Chukchi Seas. The Council's motion also tasked this subgroup with discussing capacity and planning for a February 2024 follow-up workshop that would focus on science and management recommendations from the 2023 SSC workshop, and options for increasing the level and frequency of dialogue between the Council and the SSC on issues that straddle the science-policy interface.

Bering Sea Fishery Ecosystem Plan

In 2018, the Council adopted the Bering Sea Fishery Ecosystem Plan (FEP)[8] and prioritized the concurrent development of two action modules to 1) Evaluate short- and long-term effects of climate change on fish and fisheries, and develop management considerations, and 2) Develop protocols for using Local Knowledge (LK) and Traditional Knowledge (TK) in management and understanding impacts of Council decisions on subsistence users. Under the FEP framework, action modules are intended to be discrete, time-bounded projects developed by an ad hoc taskforce. The Council also supported ongoing work under the FEP to develop a new Strategic Ecosystem Evaluation report, to provide a strategic focus on multi-year trends and whether the Council is achieving ecosystem objectives for the Bering Sea as identified in the FEP. As action modules are completed, the Council will consider how to support future work through staff tasking.

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[6] Final SSC February 2023 Workshop Report, B13 April 2023
[7] Council motion on D1, April 2023
[8] Bering Sea Fishery Ecosystem Plan, NPFMC 2019

BS FEP Climate Change Action Module and Climate Change Taskforce

The Climate Change Task Force (CCTF) was convened by the Council to develop and execute a work plan for a Climate Change Action Module under the Bering Sea FEP. The goal of the Climate Change Module is to facilitate the Council's work toward climate-ready fisheries management that helps ensure both short-term and long-term resilience for the interconnected ecological and human communities of the Bering Sea.[9] The CCTF's work plan identifies three objectives:

- Objective 1. Collate: Coordinate the review of existing and emergent climate information on impacts, adaptation, and residual risk.
- Objective 2. Synthesize: Assess key climate change impacts, adaptation actions, and residual risk.
- Objective 3. Communicate: Summarize and communicate potential risks and adaptation actions.

The CCTF recently completed the Climate Readiness Synthesis (CRS)[10], a key output in support of Objective 1. The CRS is intended as a starting point for the Council to take stock of the climate readiness of the management system, and describes climate readiness in terms of "whether management tools, assessments, and information on-ramps are designed to address and consider long-term climate change and the unprecedented conditions and unique challenges that it presents (in contrast to addressing natural climate variability)." The synthesis is organized into three sections evaluating the climate readiness of 1) the management system, 2) Stock Assessment and Fishery Evaluation (SAFE) reports and products including Ecosystem Status Reports; 3) knowledge bases that support climate readiness and adaptation, focusing on indigenous community, industry, and NMFS and Council knowledge bases.

BS FEP Local Knowledge, Traditional Knowledge, and Subsistence Action Module and Taskforce

Also under the Bering Sea FEP, the Council convened a Local Knowledge, Traditional Knowledge, and Subsistence (LKTKS) Taskforce charged with developing a roadmap for integrating LK and TK into the management process, and methods for assessing the intersection of Council actions with subsistence resources, users, and practices. The Taskforce has produced a protocol for identifying, analyzing, and integrating Bering Sea LKTKS into Council processes and a description of 11 onramps for integrating the eight guidelines contained in the Protocol;[11,12] the Council will decide in October whether to approve one or both documents.

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[9] Supporting climate-resilient fisheries through understanding climate change impacts and adaptation responses: Climate Change Task Force work plan of the Bering Sea Fishery Ecosystem Plan. NPFMC 2021.
[10] Climate Readiness Synthesis. Prepared by the NPFMC Climate Change Task Force 2022
[11] D2 LKTKS Protocol, April 2023. Protocol for Identifying, Analyzing, and Incorporating Local Knowledge, Traditional Knowledge, and Subsistence Information into the North Pacific Fishery Management Council's Decision-making Process. NPFMC 2023.
[12] D2 LKTKS Onramp recommendations, April 2023. Onramps for Local Knowledge, Traditional Knowledge, and Subsistence Information in the North Pacific Fishery Management Council's Process. NPFMC 2023.

While the work of the LKTKS task force is not explicitly focused on climate change, Indigenous community knowledge is recognized in the CRS as a vital knowledge base contributing to climate readiness and adaptation. Other work including the February 2023 SSC workshop and NMFS Regional Action Plans recognize the importance of integrating diverse knowledge sources, particularly as climate change leads to more interactions between the Council management process and communities in the Northern Bering Sea and Arctic regions.

Research priorities

The Magnuson-Stevens Act requires that Councils develop 5-year research priorities for "fisheries, fisheries interactions, habitats, and other areas of research that are necessary for management purposes". The SSC conducts this review on a triennial basis, and provides final recommendations to the Council. The Council's research priorities consist of a wide range of science-based needs and interests that support or improve the Council's ability to provide stewardship over marine resources off Alaska and maintain sustainable fishing communities. Council research priorities are provided to the Secretary of Commerce, the Alaska Fishery Science Center, as well as research and funding entities.

SSC activities

National SSC Meetings

The Seventh National Meeting of the Scientific Coordination Subcommittee of the Council Coordination Committee (SCS7) was hosted by the Council in August 2022, and focused on "Adapting Fisheries Management to a Changing Ecosystem." A key message from the meeting was that while the impacts of climate change are increasing, the scientific products to support Council decision-making have advanced as well. The meeting report includes four findings:[13]

- Councils need to start preparing now for increasingly complex management decisions due to climate change;
- Investment is needed in the development of new data collection and analysis tools that are responsive to changing conditions;
- SSCs and Councils need to be prepared to transition toward a more sophisticated toolbox; and
- Stakeholder engagement will be critical for adaptive management to be successful.

The next national meeting (SCS8) is scheduled for August 2024, with the theme: "Applying ABC control rules in a changing environment." The workshop will explore strategies for how to adapt ABC control rules given the highly variable and changing dynamics of climate, recruitment, and productivity, and use of alternative reference points and indicators in the absence of analytical assessments. The SCS8 workshop will explore how SSCs can better use their expertise in the

[13] Hollowed, A. and D. Stram (editors). 2023. Seventh National Meeting of the Scientific Coordination Subcommittee of the Council Coordination Committee. Report of the Regional Fishery Management Council's National SSC Workshop. North Pacific Fishery Management Council, Anchorage AK.

social sciences to provide critical insight on the potential for control rules to achieve management goals, and how fisheries and communities can adapt to dynamic conditions.

SSC February Workshops

The SSC habitually holds a workshop in February to provide the opportunity for an in-depth discussion on a relevant issue. In February 2023, the SSC expanded the scope and format of their workshop to include broader public involvement and more opportunities for informal dialogue and exchange. The 2023 workshop focused on "Rapid change in the northern Bering Sea and southern Chukchi Seas - Identifying ecosystem responses and effects on the management of Federal fisheries." The goal of the workshop was to identify the science and monitoring requirements for supporting future Council decision-making under increased uncertainty, including exploration of proactive approaches for achieving management goals in a changing environment, and an assessment of how existing frameworks may or may not be able to address ecosystem variability.[14]

The meeting report includes recommendations for next steps, including the recommendation to convene a Council-SSC subgroup and to hold a follow-up workshop. Additional ideas and recommendations from the SSC workshop report are summarized in Appendix 2.

NMFS initiatives

Climate, Ecosystem, and Fisheries Initiative

The NOAA Climate, Ecosystem, and Fisheries Initiative (CEFI) is a cross-NOAA effort to provide information and resources to support climate-informed decision-making. CEFI will receive $40 million of the IRA funding dedicated to support climate-ready fisheries.

Climate Science Strategy Regional Action Plans

NMFS recently published updated Regional Action Plans that describe the regional work to implement the objectives of the NOAA Fisheries Climate Science Strategy through 2024. The three RAPs prepared for the Bering Sea, Gulf of Alaska, and Arctic large marine ecosystems describe the Alaska Fisheries Science Center's current work, gaps and information needs, and proposed activities under level and increased funding scenarios; including work that informs the Council management process.

Stock Assessment and Harvest Specifications Reports and Products

The Council Plan Teams, working with Alaska Fisheries Science Center and Alaska Department of Fish and Game stock assessment authors, prepare annual Stock Assessment and Fishery Evaluation (SAFE) reports summarizing the best available scientific information to support the Council's annual harvest specifications process. Several Plan Teams also develop risk tables to assist the SSC in determining whether it is appropriate to reduce ABC from the maximum resulting from application of the control rules in the Tier system.

[14] Final SSC February 2023 Workshop Report, B13, April 2023

In conjunction with the SAFE reports, Ecosystem Status Reports (ESRs) are prepared for the Bering Sea, Aleutian Islands, and Gulf of Alaska and provide contextual information to describe ecosystem conditions and trends and support decision-making.

The Arctic RAP recommends updating the Ecosystem Status Report for the Arctic LME to provide a regular mechanism for presenting information to the Council on ecosystem conditions and resource-dependent communities, and to support response to climate change impacts in the Chukchi and Beaufort Seas.[15]

Climate Vulnerability Assessments

Climate vulnerability assessments (CVAs) characterize the relative sensitivity and exposure of stocks to climate change, and can help focus research and actions to reduce risk, and identify priorities for further analysis (e.g., management strategy evaluation). NMFS and partners completed a vulnerability analysis for Bering Sea groundfish, crabs, and salmon stocks in 2019[16] and a similar analysis is planned for the Gulf of Alaska.[17]

Alaska Climate Integrated Modeling Project (ACLIM)

The Alaska Climate Integrated Modeling project (ACLIM) is a comprehensive effort by NOAA Fisheries and partners to describe and project responses of the Bering Sea ecosystem— both the physical environment and human communities—to varying climate conditions. The second phase of ACLIM will support the use of scenario planning to evaluate and inform the resilience of management strategies and provides an important opportunity for interaction between the ACLIM team, Council, and public.

Gulf of Alaska Climate Integrated Modeling Project (GOA-CLIM)

The Gulf of Alaska Climate Integrated Modeling Project (GOA-CLIM), is a similar effort that includes research pathways focusing on ecosystem model development and socioeconomic modeling. The GOA RAP notes that one management application of GOA-CLIM is evaluating the Optimum Yield range for total groundfish removals in the GOA.[18]

EEJ Strategy

NMFS recently released the agency's Equity and Environmental Justice Strategy, which includes the goal of prioritizing identification, equitable treatment, and meaningful involvement of underserved communities. The agency is currently developing regional implementation plans.

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[15] Chukchi and Beaufort Seas Regional Action Plan to Implement the NOAA Fisheries Climate Science Strategy Through 2024. NMFS 2023 (p.18)

[16] Spencer PD, Hollowed AB, Sigler MF, Hermann AJ, Nelson MW. Trait-based climate vulnerability assessments in data-rich systems: An application to eastern Bering Sea fish and invertebrate stocks. Glob Change Biol. 2019;25:3954–3971. https://doi.org/10.1111/gcb.14763

[17] Gulf of Alaska Regional Action Plan to Implement the NOAA Fisheries Climate Science Strategy Through 2024. p. 26

[18] GOA Regional Action Plan, p. 31

Appendix 2: Issues and themes

This appendix provides a more detailed description and mapping of the themes in Section 4 to specific ideas and recommendations provided by the CCTF, SSC, and in other Council and NMFS documents.

Theme 1: Support a Council process that can be both proactive and responsive

Evaluating and improving the climate resilience of management actions

Table 1-2 in the CRS ("Management measures and potential strengths and weaknesses") examines the potential adaptive and maladaptive qualities of broad categories of management measures, and identifies opportunities for improvement. The SSC and CCTF have both expressed support for building on the approach used in Table 1-2 to identify concrete ideas for tactical and strategic steps for building resilience. The CCTF notes this is intended to be an outcome of the 2024 Climate Scenarios workshop.

A primary suggestion of the CRS for future work is to develop metrics for resilience and considering time scales for management responses:

> *Future work could create a set of metrics that provide measures of climate resilience across management actions and, potentially, climate warming scenarios. These key metrics could provide detail that better ties management actions to adaptation, maladaptation, limits to adaptation, and amount of adaptive flexibility relative to anticipated climate outcomes. In addition, time scales related to management response could also be considered such that some events may require a large and rapid response (e.g., heat waves), whereas other events may be slow to develop and offer a longer lead-in period for management response (e.g., movement of core stock areas).*

Additional ideas suggested in the CRS include:

- Evaluate the effectiveness and feasibility of measures that increase flexibility in current and future Council- defined management actions and which may allow for rapid responses to change
    - The CRS notes a comprehensive approach that considers interactions between management measures could assist with identifying adaptive and maladaptive characteristics.
- Explore measures that support appropriate and timely response mechanisms in management
- Development of metrics to evaluate climate resilience in management measures
- Explore the performance of, and feasibility to implement, spatial and temporal dynamic management measures through case studies like those identified in [Section 1 of the CRS]

- Evaluate / re-evaluate OY cap performance under climate change and alternative sub-designs (e.g, proportional caps, dynamic as function of climate indices) below the 2MT to ensure this measure continues to impart stability and productivity benefits under future change.
- Identify enabling factors to support industry led measures to increase rapid adaptation, reduce impacts, and respond to climate driven changes (e.g., communication and near-real time information sharing).

The CRS also notes that the potential for current in-season regulations has not been investigated and is likely of interest to the Council.

Learning from past experience and "what if" scenarios

Exploring future scenarios and analyzing past events are both valuable approaches for investigating management readiness, identifying information needs, and identifying actionable outcomes to improve the climate readiness of management actions. Socioeconomic scenario planning is an important component of ACLIM 2.0, and will help evaluate how management scenarios interact with environmental changes, estimate social and economic impacts, and explore tradeoffs and potential management changes for coping with climate change impacts.[19]

The 2024 Climate Scenarios and Advice workshop will provide one opportunity to engage in scenario planning exercises and examine case studies.

The SSC and CCTF have identified ideas for workshops and scenario testing, including:

- Utilize case-studies as thought exercises and consider the following questions: 1) what information was available and could shocks and impacts have been anticipated in terms of scope, timing, and impacts ahead of time; and 2) what information would have been needed to be able to plan and respond to such impacts, but was missing at the time of evaluation, to help characterize the types of tools and information needed to be ready for unforeseen events and climate impacts on management[20]
- Focus workshop discussions on how to anticipated or respond to infrequent shocks or tipping points; systematically develop a catalog of types of shocks and how they manifest for specific stocks[21]
- Conduct a quantitative assessment of Council bodies' efforts and actions in the years preceding the GOA Pacific cod or EBS snow crab stock collapses to identify what we could have done (or not done) to increase our awareness of climate impacts taking place. This evaluation would be useful in designing scenarios for consideration in scenario planning exercises, as well as providing more realistic expectations about what is achievable by a "climate-ready" management system.[22]
- The SSC suggests that [case studies from Alaska and elsewhere] would be a good starting point in that learning from the past will help inform future scenarios, with an

[19] ACLIM presentation to Council, October 2021
[20] D3 CCTF March 2023 Report, April 2023
[21] B10 SSC Final Report, February 2023
[22] B10 SSC Final Report, February 2023

emphasis on examples of what was done correctly vs. what would have been necessary for more effective management responses. Specifically, the SSC suggests that the CCTF should consider whether it is possible to draw upon examples of effective climate readiness in fisheries from both Alaska and other regions globally.[23]

Supporting a timely, responsive Council process

Another component to climate readiness includes the procedural readiness to support a timely decision making and regulatory process. The PEIS process now underway is a primary mechanism for supporting procedural responsiveness and incorporating the ideas suggested by the CCTF and SSC. One of the SSC's suggested next steps from the February 2023 workshop is to incorporate the recommendations of this meeting into the PEIS process.

Additional ideas include:

- Build periodic review of climate ready actions into the Council process; conducting programmatic reviews through the lens of climate change might help identify how to make management more nimble; for example, distributional shifts are not systematically reviewed and regular review may help identify climate effects on catchability and access.[24]
- Identify process guidance on how to accomplish complementary and simultaneous policy actions, or omnibus actions, as part of a climate-ready toolbox[25]

Building a shared understanding of resilience and adaptive capacity

The resilience of individuals, businesses, and communities to climate change impacts, and the adaptive strategies they may employ, are complex and challenging to discuss with a shared frame of reference. The SSC identified the opportunity for deeper exploration of community resilience, noting that community resilience has proven difficult to define and quantify and relates to how community is defined. The Regional Action Plans also cite the need for additional research on the relationships between fishery resources, participants and communities, and their adaptive strategies and capacity under climate change.

The SSC emphasized that community outcomes are dependent on policy, and provided suggestions to inform a deeper exploration of community resilience:[26]

- Comparing and contrasting the goal of community resilience (as generally defined in terms of community sustainability) and mandated policy goals like the sustained participation of fishing communities (as defined as being those communities that are substantially engaged in or dependent on fisheries with a federal management nexus).
- Exploring the different scales at which community resilience may be described and thinking across fisheries

[23] B13 SSC Final Report, April 2023
[24] D3 CCTF March 2023 Report, April 2023
[25] B10 SSC Final Report, February 2023
[26] B10 SSC Final Report, February 2023

- Clarifying what the goals of climate readiness, which are related to achieving the national standards, implies at the level of species and communities
- The CCTF suggested the 2024 Climate Scenarios and Advice workshop could provide a participatory approach to exploring community resilience by:[27]
- Collaboratively identifying and reviewing definitions of resilience and critically evaluating alternative methods and metrics to measure and evaluate community resilience.

Theme 2: Build and use information on-ramps

This section includes ideas for building and utilizing on-ramps for diverse sources of information and knowledge.

Including more climate information in analytical products

SAFE reports provide the basis for the Council's ecosystem-based fisheries management and harvest specifications. Section 2 of the CRS assesses the climate readiness of SAFE reports and information products, identifies on-ramps for climate change-informed advice, and provides ideas for improvement ranked high, medium, or low in near-term feasibility (see Appendix 1). The CCTF and SSC support continuing to evaluate "what information belongs where" to avoid overloading documents, and support both short-term tactical decision making and longer term planning.[28]

While implementing the CRS report ideas for would depend primarily on the capacity of NMFS contributors including stock assessment authors, Ecosystem Status Report editors, and plan team members, SAFE reports and products are intended to facilitate discussion and provide context for decision making, and can evolve in response to the Council's interests and guidance. Operationalizing scientific products is one of the priorities NMFS identified for Councils' use of IRA funds.

Strengthening the Council community's ability to talk about risk

Managing fisheries under changing climate conditions will involve adjusting expectations and assumptions, and potentially managing to a "new normal." The SSC commented that the objectives for managing fisheries in a rapidly changing environment are not always clear, and the reality of changing productivity, changing distributions, and the increased likelihood of future ecological surprises need to be communicated to stakeholders and accounted for in management.[29] Addressing these uncertainties and specific questions–such as when and how to adjust assumptions about stock dynamics–are linked scientific and policy considerations that require understanding and communicating about risks and risk tolerance.

The SSC workshop report suggests forming a Council and SSC subgroup and planning for a February 2024 SSC workshop to address key management recommendations, including:

[27] D3 CCTF March 2023 Report, April 2023
[28] B10 SSC Final Report, February 2023 and D3 CCTF March 2023 Report, April 2023
[29] February 2023 SSC Final Workshop Report

- Increase dialogue between SSC and Council on issues that straddle the science-policy interface;
- Renewed discussion on reference period determinations in light of increased periodicity of extreme events; and
- Improve the use of approaches that explicitly consider risks.

Another suggestion is to consider lessons from other regions or management bodies, such as the risk framework used by the Mid-Atlantic Fishery Management Council.

Linking ecosystem approaches with climate readiness

Ecosystem-based management approaches can support climate readiness and provide a pathway for bringing diverse knowledge bases (as discussed in the CRS) into the management process. Ideas include:

- Articulate more clearly how ecosystem approaches will help support climate readiness[30]
- Increased development and implementation of EBFM tools across Council processes[31]
- Scope development of Fishery Ecosystem Plans in other regions for connectivity issues (e.g., Gulf of Alaska, Arctic), as discussed at the March 2022 meeting of the Ecosystem Committee[32]
- In order to implement EBFM in the Northern Bering Sea region and develop the science required to support it, develop goals and objectives in collaboration with residents. A review of ecosystem-level objectives, including the need for regional objectives, could be undertaken as part of a Programmatic EIS[33]

Theme 3: Include stakeholders and partners in building climate readiness

The linked themes of leveraging diverse knowledge bases and supporting two-way stakeholder engagement to support climate readiness are prominent across all of the resources cited in this document. Section 3 of the CRS describes three knowledge bases, including Indigenous community, industry, and NMFS/NPFMC, and assesses the extent to which each is currently integrated into Council and NMFS processes.

The CRS provides the following suggestions for leveraging all knowledge bases and incorporating diverse sources of climate information and knowledge.

- Provide input into the Research Priority setting process foregrounding the importance of diverse sources of climate information and their relationship to climate-ready fisheries science and management

[30] Opening remarks from 7th National Meeting of the Scientific Coordination Committee of the CCC
[31] Climate Readiness Synthesis
[32] Climate Readiness Synthesis
[33] B10 SSC Final Report, February 2023

- Test mechanisms within the CCTF (e.g., Climate Briefings, Ecosystem Matrix tool, etc.) for bringing diverse knowledge sources related to climate change into the Council process
- Finalize and implement LKTKS Taskforce protocol regarding incorporation of LK, TK, and subsistence information into the Council process
- Track and consider climate change information and implications in light of recommended evaluations (as suggested by the Ecosystem Committee in March 2022) of the Programmatic EIS
- Scope development of Fishery Ecosystem Plans in other regions for connectivity issues (e.g., Gulf of Alaska, Arctic), as discussed at the March 2022 meeting of the Ecosystem Committee
- Increased development and implementation of EBFM tools across Council processes
- Work on marine planning and protections that are equitable and inclusive of a diverse set of communities, people, knowledges, methodologies, and values
- Implement a number of the CEC Final Report (NPFMC 2021) recommendations which could increase the flow of diverse sources of climate change information (including resilience tools) into the Council process
- Increased uptake of broader climate change knowledge base not, or not fully, integrated into the Council process through additional steps not indicated above in other bullets, e.g., through exploring collaborations, partnerships and co-production (also see Section 2 for near-term steps to advance climate integrated advice)
- Conduct an analysis of Council documents as outlined above to explore whether and how the climate-relevant information from a variety of 'other' knowledge bases are currently making their way into the Council process in order to facilitate a gap analysis and recommendations for improvement, as necessary

Strengthening engagement with Alaska Native communities

The CRS, the 2023 SSC workshop, and three Regional Action Plans recognize that inclusion of Indigenous community knowledge is critical to climate readiness, and not currently well integrated. This presents a particular challenge in the rapidly changing Northern Bering Sea, Southern Chukchi Sea, and broader Arctic region, where the Council process may increasingly need to consider user groups that it has not interacted with extensively in the past, and for whom marine resources are a matter of food security. There also exists the opportunity for deeper engagement and the integration of knowledge held by stakeholders and communities.

The recently completed LKTKS Protocol and on-ramps document, which are not focused specifically on climate readiness, were developed to consider pathways for integrating these valuable sources of knowledge into Council processes. The CRS, which does focus specifically on the integration of Indigenous community knowledge for the purpose of climate readiness, ranks Indigenous community knowledge as "1 - Not Ready," concluding that while community knowledge is expansive and contains detailed information about changes and impacts" it is not

discussed or utilized in the management process. The report's suggestions, also cited in the introduction to this section, include finalizing and implementing the LKTKS protocol, and implementing recommendations from the Council's Community Engagement Committee's final report.[34]

The SSC's recent review[35] of the LKTKS protocol provides additional recommendations for improving the integration of LKTKS overall, and in ways that could help leverage Indigenous community knowledge base to support climate readiness. These ideas include:

- Should the Council support the protocol and/or specific onramps, have a communication strategy to roll out the protocol and allow Tribes and stakeholders to choose how best to engage
- Convene a formal or informal interagency group of individuals involved in efforts to incorporate LKTKS into management decision making processes, including Council, AFSC, Regional Office, other federal agencies, State personnel, and others[36]
- Consider potential onramps within the recurring cycles of updating and improving existing decision-informing analytic products such as Ecosystem Status Reports (ESRs), SAFE documents, including Ecosystem and Socioeconomic Profiles (ESPs) where relevant, and Annual Community Engagement and Participation Overview (ACEPO), among others.

Communicating clearly and regularly about climate readiness planning

Climate change amplifies the overall need for the Council to communicate about its work and support meaningful opportunities for stakeholder engagement. This is a key message of SCS7 as well as the February 2023 SSC workshop, which recommends improving engagement with tribes and communities in the Northern Bering Sea and Chukchi Sea regions. One suggestion of the CRS is to implement recommendations of the Council's Community Engagement Committee, which focuses on rural and Alaska Native communities. Additional ideas for enhancing Council outreach and engagement are referenced in other documents, and include procedural opportunities to augment outreach components of existing and proposed Council initiatives. For example:

- The SSC suggested that the Council could collaborate with NBS residents to identify regional ecosystem-level goals and objectives as part of the Programmatic EIS process[37]
- The LKTKS Task Force recommends holding a workshop to solicit public input as part of the Research Priorities process planned for 2024.[38]

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[34] D1 Community Engagement Committee Report, February 2021. North Pacific Fishery Management Council (NFPMC) (2021) Report of the Community Engagement Committee: Recommendations to improve Council engagement with rural and Alaska Native Communities. February 2021.
[35] B13 SSC Report, April 2023
[36] The October 2021 SSC Final Report review of the RAPs also emphasized the need for coordination and efficient use of resources
[37] February 2023 SSC Final Workshop Report

[38] D2 LKTKS Onramp recommendations, April 2023

Other suggestions for outreach and engagement focus on key messages and methods. The 2023 SSC workshop report highlights the need to communicate complex and difficult messages about changing conditions, the increasing likelihood of increasing ecological disruptions, and the concept of non-stationarity and potentially managing to a "new normal." The SCS7 report findings also cite the importance of building stakeholder confidence in scientific products and management approaches for decision making increased uncertainty. Additional ideas identify examples of the barriers to reaching stakeholders (e.g. meeting costs, technical jargon) and solutions such as community-level workshops and plain language summaries such as the recent brochure summarizing outcomes of the February SSC meeting.[39]

Communication and engagement can be an agency as well as a Council function; the RAPs note steps the NMFS will take to share information and build and strengthen relationships, including through the newly created Tribal Research Coordinator position.

Building a stronger network of partnerships

Climate change is deepening the need for efficient coordination and collaboration across agencies, academic and research partners, industry sectors, communities, tribal governments, and other groups to use resources efficiently in order to consider policy intersections, build knowledge and meet data and information gaps, and support inclusion and engagement.[40] While many of these opportunities are external to the Council process (e.g. NMFS, research community), the Council is able to engage and communicate its needs more broadly through its committees, advisors, and task forces, and through processes including the research priorities process.

[39] February 2023 SSC Final Workshop Report
[40] February 2023 SSC Final Workshop Report; B10 October 2021 SSC Final Report

Addendum 1: Excerpts from Climate Readiness Synthesis Report[41]

Excerpt from Section 1: Management Overview

1.6 Future directions/Potential Future Work

As previously discussed, this report is not intended to be a comprehensive overview of all management measures in the BSAI. Future work could create a set of metrics that provide measures of climate resilience across management actions and, potentially, climate warming scenarios. These key metrics could provide detail that better ties management actions to adaptation, maladaptation, limits to adaptation, and amount of adaptive flexibility relative to anticipated climate outcomes. In addition, time scales related to management response could also be considered such that some events may require a large and rapid response (e.g., heat waves), whereas other events may be slow to develop and offer a longer lead-in period for management response (e.g., movement of core stock areas).

1.6.1 Near-term considerations

- Evaluate the effectiveness and feasibility of measures that increase flexibility in current and future Council- defined management actions and which may allow for rapid responses to change
    - Seasonal flexibility in allocations, quota programs
    - Transferability amongst sectors and seasons
- Explore measures that support appropriate and timely response mechanisms in management
    - More rapid response in some circumstances while others may exhibit longer-term stability and/or flexibility in response timing
- Development of metrics to evaluate climate resilience in management measures
    - Improved integration of fishery dependent information with fishery independent information (e.g., habitat, oceanographic, survey, climate model outputs, stock dynamics) and coordination amongst data providers
- Explore the performance of, and feasibility to implement, spatial and temporal dynamic management measures through case studies like those identified in [Section 1 of the CRS]
- Evaluate / re-evaluate OY cap performance under climate change and alternative sub-designs (e.g, proportional caps, dynamic as function of climate indices) below the 2MT to ensure this measure continues to impart stability and productivity benefits under future change.
- Identify enabling factors to support industry led measures to increase rapid adaptation, reduce impacts, and respond to climate driven changes (e.g., communication and near-real time information sharing).

[41] Climate Readiness Synthesis. Prepared by the NPFMC Climate Change Task Force 2022

Excerpt from Section 2: SAFE Report Review

This table summarizes the potential near-term, medium- high feasibility measures identified by the team. Details regarding these are provided below in the section 2.7 of the CRS, "Potential On-ramps".

Table 2-5 Summary Table: Potential near-term On-ramps

Potential on-ramps	Near Term Feasibility
1. Indicator / climate change section in ESR	
a. Add ESR indicator regarding long term projections of climate variables (e.g., bottom temperature, cold pool, OA)	High
b. Add climate change synthesis section, similar to the climate variability and forecast section (Bond et al.) of the ESR	Medium
2. Separate section in SAFE or an independent climate change report	Low-Medium (requires an author to produce annually)
3. Intro section for each SAFE report could include a climate change section (e.g., in the ecosystem section)	Medium- High
4. SAFE Chapters (each species individual assessment) could include climate change information	Medium
a. Species specific climate change paragraph in each safe chapter	Medium
b. Each stock assessment chapter could include a climate change information section or slightly modified ESP	
c. Risk, vulnerability (and adaptation potential) table	
d. Safe author survey of climate readiness of each stock (based on their opinion and set criteria for climate readiness)	
5. Econ Safe Report could include climate change information (especially around risk, portfolio approaches to reduce risk, and future opportunities) a. General paragraph on climate change, global demand, and global to regional economics b. Risk, vulnerability (and adaptation potential) table c. Synthesis of integrated socio-econ MSE results (e.g. ACLIM)	Low-medium
6. Include a climate briefing as part of the Plan Team meetings to help inform this section	High
7. CCTF climate report(s) can be used to periodically update this information through producing synthesis sections for each species as well as the ecosystem as a whole.	Medium (will take coordination to draft and dedicated resources)

Excerpt from Section 3: Knowledge base overview

Section 3.6: Gaps and next steps: knowledge base elements and activities which can potentially be brought into the existing management system in the near-term

- Provide input into the Research Priority setting process foregrounding the importance of diverse sources of climate information and their relationship to climate-ready fisheries science and management
- Test mechanisms within the CCTF (e.g., Climate Briefings, Ecosystem Matrix tool, etc.) for bringing diverse knowledge sources related to climate change into the Council process
- Finalize and implement LKTKS Taskforce protocol regarding incorporation of LK, TK, and subsistence information into the Council process
- Track and consider climate change information and implications in light of recommended evaluations (as suggested by the Ecosystem Committee in March 2022) of the Programmatic EIS
- Scope development of Fishery Ecosystem Plans in other regions for connectivity issues (e.g., Gulf of Alaska, Arctic), as discussed at the March 2022 meeting of the Ecosystem Committee
- Increased development and implementation of EBFM tools across Council processes
- Work on marine planning and protections that are equitable and inclusive of a diverse set of communities, people, knowledges, methodologies, and values
- Implement a number of the CEC Final Report (NPFMC 2021) recommendations which could increase the flow of diverse sources of climate change information (including resilience tools) into the Council process. This includes:
    - Co-presentation from Tribal representatives on all agenda items
    - Standing Community Engagement or Tribal Advisory Committee
    - Increase the input of Tribal Consultation activities into the Council process
    - Council travel to rural communities for Council meetings and visits
    - Continuation and ongoing improvement of current outreach practices to foster two-way engagement
    - Taking steps towards Co-Production of Knowledge
    - Increased capacity at AFSC in the non-economic social sciences, particularly as regards expertise working with Alaska Native communities and their knowledge
    - Increased Indigenous inclusion on Council advisory and working bodies
- Increased uptake of broader climate change knowledge base not, or not fully, integrated into the Council process through additional steps not indicated above in other bullets, e.g., through exploring collaborations, partnerships and co-production (also see Section 2 for near-term steps to advance climate integrated advice)
- Conduct an analysis of Council documents as outlined above to explore whether and how the climate-relevant information from a variety of ‘other’ knowledge bases are currently making their way into the Council process in order to facilitate a gap analysis and recommendations for improvement, as necessary

Addendum 2: Excerpts from SSC February 2023 Workshop Report[42]

The following is an excerpt from the final section of the workshop report, focusing on key recommendations and next steps.

Key science and management recommendations (for science community and the Council)

	Science	Management
Local (NBS & Chukchi)	• Develop a monitoring program focused on understanding process changes in the NBS that inform current understanding of carrying capacity and expectations for future commercial fisheries. • Develop recommendations and secure additional funding for a periodic assessment of the southern Chukchi Sea ecosystem. • Improve overall science coordination in the region.	• Improve engagement with tribes and communities. • Consider mechanisms for incorporating the full spatial distribution of transboundary stocks into management.
'Global'	• Re-assess the time periods that are currently used to define the productivity of crab and groundfish stocks. • Consider alternatives to current HCRs based on available analyses. • Increase dialogue between SSC and Council on issues that straddle the science-policy interface. • Identify which stocks are likely to do better or worse in a changing environment to help fishers build the best fishing portfolio.	• Increase dialogue between SSC and Council on issues that straddle the science-policy interface. • Renewed discussion on reference period determinations in light of increased periodicity of extreme events. • Improve the use of approaches that explicitly consider risks

[42] Final SSC February 2023 Workshop Report, B13, April 2023

Recommendations for next steps

- Consider outcomes from this workshop as the Council identifies research priorities for 2023-24.
- Incorporate the recommendations from this workshop into the development of the planned Programmatic Environmental Impact Statement process to better address the impacts of climate change on the marine ecosystems and on the people dependent on those ecosystems.
- Produce a brief, plain language summary report from this workshop as a useful outreach tool to invite further input and engagement, and to learn more about local needs and concerns.
- Form a sub-group of Council and SSC members (2-3 members each) to develop a roadmap that builds a bridge from assessment and climate science to adaptive management under climate change.The roadmap should include the products and recommendations from the Climate Change Task Force, the LKTK Task Force, and the national Council Coordination Committee - Scientific Coordination Subcommittee (SCS) meeting held in August 2022. The roadmap would recommend a direction and timeline for moving forward, recognizing the urgency for action as the North Pacific expects continued change in the near future. Questions for the subgroup to consider include:
    - Is the use of more dynamic reference points a viable alternative to current management practices, given the current Council processes under the Magnuson Stevens Act? This includes consideration of when to change the time periods over which reference points are calculated for crab and groundfish stocks.
    - Could and should social or economic objectives (e.g. Maximum Economic Yield, biomass thresholds, catch stability) be incorporated into adaptive management approaches for some stocks?
    - As stock footprints expand and shift in distribution, are regional allocations of catches in the EBS and NBS appropriate and could they be dynamic enough to address temporal variability?
    - Can risk considerations be improved upon in the context of both stock assessments (ABC considerations) and management (TAC considerations).
- Plan for a February 2024 follow-up workshop that focuses on discrete aspects of the key recommendations for science and management raised at this workshop to advise the Council. In addition to the outcomes from the sub-group roadmap, the SSC may consider the following questions that emerged during this workshop:
    - What temporal and spatial scales of information are needed to track non-stationary production, shifting boundaries, and changing species interactions?
    - What baseline information is required ahead of future extreme events to be better positioned to manage fishery responses?
    - How can we better identify ecosystem bottlenecks influencing production of key commercial fish species so the limited resources are effectively focused.
    - Can overall as well as benthic vs. pelagic carrying capacity be reasonably assessed and tracked to inform optimum yields in an environment changing as quickly as the NBS?