# Report on NPFMC climate-related scientific initiatives and outcomes of the SCS8 discussions

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## 1 Introduction

Climate change has already had large impacts on North Pacific fisheries and ecosystem, and impacts are expected to increase over the next decade, with largest changes and risks associated with warmest future scenarios (i.e., higher carbon emission scenarios) (IPCC 2022). With climate change already impacting federally managed fisheries in the North Pacific, the North Pacific Fishery Management Council (Council) has been pursuing various initiatives in the interest of preparing for climate-resilient fisheries management. The Council also recently received funding under the Inflation Reduction Act (IRA) to develop and advance climate-related fisheries management planning and implementation efforts. Specifically, the Council's funded proposal includes an objective to develop and implement new tools for the harvest specifications process, to adapt to risk in the face of uncertainty due to climate-driven marine ecosystem changes.

Recent meetings have highlighted the urgency of the Council's work and identified several promising tools for Council development, such as dynamic reference points, changes to reference periods for determining productivity of the stocks, improvements to risk tables and use of ESPs, operationalizing climate vulnerability assessments, and review and revision of harvest control rules and the tier system. As described in the IRA proposal, the Council's intent was to leverage the 8th national meeting of the Scientific Coordination Subcommittee of the Council Coordination Committee (SCS8) in August 2024 to advance Council discussions about how to make fisheries more climate resilient.

This report provides a summary of ongoing NPFMC initiatives, as well as preliminary discussions by Alaska attendees at SCS8 about potential next steps. The intent of this discussion paper is to facilitate the process of Council prioritization of short- and long-term adjustments to the harvest specifications process to better adapt to climate risk.

[1] Prepared by Diana Stram, Council staff, with input from SCS8 NPFMC SSC representatives (Sherri Dressel, Franz Meuter, Mike Downs, and Chris Anderson)

For definition of acronyms and abbreviations, see online list: https://www.npfmc.org/library/acronyms

# 2 Recent climate-related NPFMC activities

The following is a non-exhaustive list of some current endeavors and activities in which the Council is participating in the interest of climate-resilient fisheries management.

### 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.[2] 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)[3], a key output in support of Objective 1 and 2. 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 communities, industry, and NMFS and Council knowledge bases.

The synthesis aims to understand the current state of "climate readiness' (see definition above). Importantly, this synthesis does not evaluate management effectiveness. Management measures and policies that are not designed to specifically address climate change can still be effective at managing resources in a changing climate, especially those that are designed to be robust to natural climate variability. However, climate change, the long-term trends, shifts in underlying ecological conditions, and especially the impacts of increasingly extreme conditions do pose a novel and large risk that may require approaches specifically designed to address this unique challenge. The first step in understanding what needs to be evaluated and developed to support climate ready advice and decision making is to identify the current state of climate readiness.

The CCTF will conclude its work in 2024 with a final meeting in November and a report to the Council in December.

### Climate Scenario Workshop (CSW)

In conjunction with the work of the CCTF, Council, public input and the Steering Committee, the Council convened a Climate Scenarios Workshop in June 2024 in Kodiak AK. The Climate Scenarios Workshop was an opportunity for the Council community to develop a shared frame of reference for the current and potential climate change impacts to North Pacific fisheries, and generate ideas for improving climate readiness in the Council process. The CSW report captures the range of ideas shared at the workshop as a starting point for further discussion and planning. At the October 2024 Council meeting, the CSW report

[2] 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.
[3] Climate Readiness Synthesis. Prepared by the NPFMC Climate Change Task Force 2022

will be presented as a discussion item for the Council to consider how ideas from the workshop could be implemented through new or existing pathways.

### SSC 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.[4]

The 2023 meeting report includes recommendations for next steps (see the report's Appendix 2), including the recommendation to convene a Council-SSC subgroup and to hold a follow-up workshop.

Additionally, at an April 2024 workshop[5], the SSC developed a draft Terms of Reference for a potential research contract in support of Council IRA climate-readiness funding, and developing advice to the Council on approaches to TAC setting in the face of environmental and market variability that may arise under climate change. The goal of the contract would be to develop a tool to support Council TAC-setting decisions for stocks experiencing climate-induced variability, with an initial calibration and application for the sablefish fishery.

### NOAA's Climate, Ecosystems, and Fisheries Initiative

The Climate, Ecosystems, and Fisheries Initiative (CEFI) is a cross-NOAA effort to build the nationwide, operational ocean modeling and decision support system needed to reduce impacts, increase resilience, and help adapt to changing ocean conditions. The system will provide decision makers with the actionable information and capacity they need to prepare for and respond to changing conditions today, next year, and for decades to come. The system addresses four core requirements for climate-ready decision-making for marine resources: 1. Robust forecasts and projections of ocean and Great Lakes conditions for use in developing climate-informed advice 2. Operational capability to assess risks, evaluate options, and provide robust advice on adapting to changing conditions 3. Decision-maker capability to use climate-informed advice to reduce risks and increase the resilience of resources and the people that depend on them 4. Continuous validation and innovation through observations and research The Initiative is a timely, efficient, and effective way to address NOAA's requirements for climate-informed management of marine and Great Lakes resources. Working with many partners, the Initiative will provide decision makers the information and capacity they need to help safeguard resources and resource-dependent communities in a rapidly changing world. The 8 fishery management councils are anticipated to begin providing a guiding role in management relevant outcomes needed from CEFI to assist in managing climate ready fisheries. Some coordination exercises with NPFMC Council members and staff have already been ongoing and are anticipated to continue moving forward in 2025.

[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. NPFMC SSC Workshop, February 7-8, 2023.
[5] See April 2024 SSC minutes, beginning page 20.

## National SCS Meetings

The Scientific Coordination Subcommittee (SCS) of the Council Coordination Committee (CCC) periodically convenes national meetings in order to discuss scientific issues of importance to the Regional Fishery Management Councils and their Scientific and Statistical Committees (SSCs). Table 1 lists the themes for the 8 SCS national meetings to date.

**Table 1 Date, host and focus of previous SCS meetings.**

| Year | Host | Focus |
|---|---|---|
| 2008 | WPFMC | Developing Best Practices for SSCs |
| 2009 | CFMC | Establishing a Basis for Annual Catch Limits |
| 2010 | SAFMC | ABC Control Rule Implementation and Peer Review Procedures |
| 2011 | MAFMC | Ecosystem and Social Science Considerations in U.S. Fishery Management |
| 2015 | WPFMC | Providing Scientific Advice in the Face of Uncertainty |
| 2018 | PFMC | The Use of Management strategy evaluation to Inform Decisions Made by the Regional Fishery Management Councils |
| 2022 | NPFMC | Adapting Fisheries Management to a Changing Ecosystem |
| 2024 | NEFMC | Applying Acceptable Biological Catch (ABC) Control Rules in a Changing Environment |

### *SCS7: Adapting Fisheries Management to a Changing Ecosystem*

The 7th national meeting of the Scientific Coordination Subcommittee (SCS7) was hosted by the North Pacific Fishery Management Council in August 2022 in Sitka, Alaska. Participants in SCS7 discussed three primary foci:

- How to incorporate ecosystem indicators into the stock assessment process?
- Developing information to support management of interacting species in consideration of Ecosystem Based Fisheries Management (EBFM).
- How to assess and develop fishing level recommendations for species exhibiting distributional changes?

As in previous meetings, each discussion theme was introduced by an invited keynote speaker followed by a series of contributed talks describing regional case studies. Extended abstracts from each keynote speaker are included in this report. The list of presenters and abstracts for each case study can be found in the appendices. Although the primary purpose of the meeting was to provide coordination across Fishery Management Council Scientific and Statistical Committees (SSCs), members of the public were welcome to listen to the plenary discussions. Additionally, the meeting was streamed for on-line viewing.

For SCS7, five breakout groups were assembled for each session. Each breakout group included representatives from a cross-section of the Councils. This approach fostered cross-communication and synthesis on each theme. Key findings from each breakout group were presented in plenary and similarities and differences between groups were discussed. The SCS7 report provides a synthesis of the discussions and the recommendations emerging therefrom. The main overall findings from SCS7 are summarized below.

- **Councils need to start preparing now for increasingly complex management decisions due to climate change**

The effects of climate change on US fisheries are being observed now, with more profound implications expected over the next 20 years in several regions. Regional Fishery Management Councils (RFMCs) need to consider adaptation options to sustain fisheries in a changing environment. Adaptation tools need to be tailored to regional differences in how climate change is now and will affect marine ecosystems. Several FMCs have started considering models that include ecosystem linkages and / or have adopted

climate-informed risk assessments. However, challenges remain including: pros and cons of shifting biological reference points, carrying capacity, and management units.

Additional studies of the performance of current and alternative management strategies are needed to identify pathways to sustain fisheries in a future, non-stationary marine environment. RFMCs may encounter new issues due to competing uses of marine systems, abrupt shifts in distribution or abundance, and changes in ecosystem structure and function, with impacts on sectors and communities, and data collection methodologies. Guidance will be necessary to define biological reference points given non-stationarity. Finding equitable management adaptation pathways will be challenging.

- **Investment is needed in the development of new data collection and analysis tools that are responsive to changing conditions**

Maintaining suites of models of different levels of complexity will be needed to inform management of marine resources undergoing complex responses to non-stationary environmental conditions. This suite could include Models of Intermediate Complexity for Ecosystems (MICE), including ecosystem linked single- or multi-species assessment models; foodweb models, and full end-to-end (climate to fish and fisheries) models that include human elements of fishing communities. Consideration must be given to on-going and enhanced monitoring efforts and assessments of whether we are measuring what we need to best prepare for the future and to identify climate ready-management scenarios. This is a particular challenge in regions that have high diversity and complex monitoring challenges. Enhanced monitoring includes consideration of multiple ways to detect change, including greater use of local, traditional and subsistence knowledge. Collaborations amongst regions would be strengthened by streamlining data management systems, and allowing for more 'open source' type data flows and interoperability. These collaborations would be strengthened by cross-jurisdictional data management systems and access to a broader set of users (e.g. easier access to data available for those not affiliated to agencies). Interdisciplinary research teams will be needed to ensure future success, and training students in this field will be critical.

- **SSCs and Councils need to be prepared to transition toward a more sophisticated toolbox**

SSCs need to prepare for a transition from reliance on indicators derived from observations, to those informed by dynamic simulations of marine ecosystem change, tuned (or skill tested) to observations (Climate Ecosystem and Fisheries Initiative, CEFI), including consideration of next generation guidelines for climate-ready management and adaptation option evaluation. Scenario planning should begin now to avoid reactive responses. Additional flexibility should be considered in the management process, diversification of fishing portfolios to address population changes as well as the creation of more opportunities for strategic and creative thinking at the regional and national levels.

- **Stakeholder engagement will be critical for adaptive management to be successful**

Climate-adaptive fisheries management will require engagement from all stakeholders and native communities and new understanding of increasingly complex models and uncertainty due to environmental variability. Science-based recommendations and management risks need to be clearly presented to build stakeholder confidence in new models or tools that quantify tradeoffs given increased uncertainty. An inclusive process for increased public engagement will benefit both stakeholder education as well as informing ecosystem-based management approaches.

# 3 SCS8: Applying Acceptable Biological Catch (ABC) Control Rules in a Changing Environment

The 8th national meeting of the Scientific Coordination Subcommittee (SCS8) took place in August 2024 in Boston, MA, and focused on the topic of "Applying Acceptable Biological Catch (ABC) Control Rules in a Changing Environment" and convened SSC members from across all eight council regions to discuss this topic in depth.

The workshop agenda and overarching meeting objectives focused on three main themes:

- Advances in ecosystem science and assessment to inform ABC control rules in a dynamic environment
- Application of social science to achieve management goals under dynamic conditions
- Adaptation of reference points, control rules and rebuilding plans in a changing environment.

Each session included a round robin highlighting the mechanisms employed within each Council, a keynote talk, relevant regional case studies as well as breakout sessions with regional representatives across all 8 Councils. There was also opportunity provided for region specific discussions in response to these topics. For the North Pacific, case studies from AFSC scientists were provided in Session 2 (Dr. Dan Goethel, Sablefish recruitment and socioeconomic considerations and Session 3 (Dr. Paul Spencer, Temperature dependent recruitment for EBS pollock and dynamic control rule).

Proceedings from this meeting will be available in the Spring of 2025 and could help inform the Council's work on this topic. In the meantime, this discussion paper briefly summarizes conversations held within the NPFMC delegation to SCS8 as it relates to ongoing considerations within the Council process. These relate to consideration of harvest control rules in a changing environment and compiling socio-economic information to help inform Council decision making. Strengthening the consideration of uncertainty and risk in harvest specifications is also an objective of the Council's IRA funding proposal.

### NPFMC priorities and follow-on discussions

The format of the SCS8 meeting provided some agenda time for participants from the individual regions to discuss issues of particular interest to them. In addition to these conversations, a post meeting wrap up amongst NPFMC participants provided time to prioritize the main issues relevant to NPFMC and to summarize these for further discussion with full SSC in October about next steps. The NPFMC group consisted of the following:

- SSC delegates: Dr. Sherri Dressel, Dr. Franz Meuter, Dr. Mike Downs, Dr. Chris Anderson[6]
- Council staff: Dr. Diana Stram
- AFSC staff: Dr. Paul Spencer, Dr. Dan Goethel.

The following summarizes the results of these discussions, categorized into two primary considerations.

1. **Consider to what extent, and whether, to revise groundfish harvest control rules (HCRs) to be more climate-resilient.**

   3 primary considerations:

   a. Identify available flexibility and/or fixed rigidity in current tier system (groundfish) and stock assessment process
      - Note strengths and weaknesses of current system and what potential solutions to these may be

[6] Chris Anderson was not able to attend in-person at the last minute, and thus remotely attended plenary sessions and participated in the NPFMC-specific meeting following the workshop.

- e.g., strengths: surveys, frequency of assessments, robust shape of HCR, etc.
- potential weaknesses: fixed $F_{40}$ policy, lack of consistent consideration of stock specific productivity

b. Identify recent issues by stock, with application of existing system and potential solutions (both regulatory and non-regulatory)
   - Can these be addressed within existing framework and be resilient to continued future non-stationary conditions (e.g. climate-linked F40/B40)
   - Or do we need to pursue an amendment analysis to make changes to either benchmark levels (e.g. different F%, B% by life history type), the shape of the HCR, or default reduction in maxABC from OFL (risk tolerance)?
   - If so, how and what are we trying to 'fix' by doing so that is not possible under the current system?

c. Compile existing literature and ACLIM results to help inform sensitivity of stocks to shape of HCRs as compared to benchmark biomass/fishing rate modifications

   i. If result of 'b' is to recommend changes, existing literature and/or ACLIM simulation results can help to inform direction
      1. Council would need to weigh in on policy objectives (including the current risk tolerance embedded in our harvest control rules) to be achieved by a modification in ABC control rules or reference levels [examples of various HCRs, objective can be provided]
      2. Alternatively, can the Council achieve stated policy objectives through TAC-setting and is that process sufficient to buffer against climate change

**2. Compile social and economic information to meet the needs of using the best scientific information available (BSIA) and informing Council decision-making**

a. Recommend that the SSC weigh in on the appropriate vehicle for providing relevant social, economic, and community information, in a concise format, to the decision-makers/Council at the time of TAC-setting (and other Council decisions)
   - Begin with discussion of appropriate ecological and socioeconomic profile (ESP) indicators for sablefish in October 2024

b. This information may come through a combination of ecosystem status reports (ESRs), ESPs or Stock Assessment and Fishery Evaluation (SAFE) reports

c. Information relevant for groundfish should be available and presented in conjunction with November Groundfish Plan Team meetings, prior to industry developing their groundfish TAC recommendations following the Plan Team meeting

d. Following current practices, social and economic information would not be considered by the SSC in setting the ABC. Rather, that the SSC would provide the Council advice on what is the appropriate level and aggregation of social, economic, and community information to best inform TAC setting and other management considerations.

# 4 Action and next steps

The Council's intent was to leverage the national SCS8 meeting as an opportunity to get national feedback and then prioritize Council discussions about how to make Alaska fisheries more climate resilient, and the potential added value of different risk adaptations. Specifically, this discussion paper as well as the report from the Climate Scenarios Workshop that the Council held in June, provide the SSC and Council an opportunity to consider how to identify next steps and further actions in support of the development and implementation of new tools.

Under its approved IRA proposal, the Council anticipated that following SCS8, the Council and SSC would prepare for a next SSC workshop to prioritize among potential directions and appropriate timelines for developing and implementing procedures for better accounting of biological, economic, and socioeconomic information throughout the harvest specifications process. While the proposal acknowledges that the timeline of the grant funding is insufficient to analyze, recommend, and implement FMP amendment changes such as to harvest control rules or the tier system, some opportunities to improve accounting for risk in decision-making may be implemented without FMP changes. A future SSC workshop might highlight which of the proposed mechanisms and tools should be pursued in the short-term, while for longer term FMP amendments, the SSC and Council could develop a strategic workplan for systematically approaching such changes.

**At this meeting, the Council and SSC have the opportunity to further define how to meet Objective 3 of the IRA proposal.** Actions in support of this objective may include choosing to initiate specific projects to address climate-resilience; planning for a future SSC-workshop to discuss various ideas; or defining a process by which to develop a workplan and priority ideas at a subsequent meeting.