

United States input for the 17th Informal Consultation of States Parties to UN Fish Stocks Agreement: “Sustainable Fisheries Management in the Face of Climate Change”

The United States welcomes the opportunity to share information related to climate change and sustainable fisheries management in support of the 17th Informal Consultation of States Parties to UN Fish Stocks Agreement. This document summarizes U.S. efforts to assess and address the impacts of climate change on fisheries, implement ecosystem-based fisheries management and the precautionary approach, and incorporate economic, social and cultural aspects into sustainable fisheries management. The document concludes with a brief discussion of future actions to advance climate change adaptation in international fisheries, including related to the need for increased action within regional fisheries management organizations/arrangements (RFMO/As) and other regional fisheries bodies (RFBs), as appropriate.

The United States is actively developing methods to assess the impacts of climate change on fisheries, with an emphasis on user-friendly tools and interdisciplinary research.

The U.S. National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS or NOAA Fisheries) uses [*Climate Vulnerability Assessments*](#) (CVAs) to assess the vulnerability of fish species, protected species (marine mammals, sea turtles), habitats and fishing communities to changing climate and ocean conditions. CVAs identify what species may be most vulnerable based on their exposure to projected changes in the environment (*e.g.*, warming oceans) and their sensitivity or adaptability to handle those changes based on their life history characteristics (*e.g.*, reproductive rates, diet *etc.*). CVA methodology uses information on species’ life histories, species’ distributions, and projected future climate and ocean conditions to estimate vulnerability—specifically, how climate-related changes could affect fish species’ abundance, and to some extent, their distribution. The results are intended to guide research on possible climate impacts on species or stocks and help decision-makers consider how to prepare for and respond to climate-related changes.

[The Distribution Mapping and Analysis Portal \(DisMAP\)](#) is a user-friendly and interactive website designed to provide visualization and analysis tools to better track, understand, and respond to shifting distributions of marine species. DisMAP, launched in the spring of 2022, provides distribution information for over 400 marine fish and invertebrate species caught in fishery-independent surveys conducted by NOAA and its partners. The portal allows users to quickly identify species that have experienced changes in their distributions and abundance over time. Users can explore maps of species distributions, view time series plots showing changes in spatial indicators (*e.g.*, center of biomass), and download data for exploration outside the portal in 9 U.S. regions: Eastern Bering Sea, Northern Bering Sea, Aleutian Islands, Gulf of Alaska, Main Hawaiian Islands, U.S. West Coast, Gulf of Mexico, Southeast U.S. Shelf, and Northeast U.S. Shelf.

Broadly, ongoing U.S. research aims to support climate informed management by reviewing available management approaches, documenting and predicting changes in productivity and regime shifts, and understanding the on-ramps for climate science into the fisheries management process (*e.g.*, Klaer *et al.*, 2015; Morrison and Termini, 2016; Holsman *et al.*, 2019; Link *et al.*, 2021; Szuwalski *et al.*, 2023). U.S. scientists are identifying and integrating ecosystem indicators into stock assessments through research that aims to incorporate environmental information into the standardization of indices of abundance and ecosystem status reports (*e.g.*, Schirripa and Goodyear, 2016; Shotwell *et al.*, 2022; Lucey *et al.*, 2023; see also Ecosystem and Socioeconomic Profiles below). To describe and quantify the impacts of climate change on fish stocks and fisheries, researchers are focused on changing species distributions and habitat associations (*e.g.*, Schirripa *et al.*, 2017; Karp *et al.*, 2019; Lonhart *et al.*, 2019; Schirripa *et al.*, 2021) through interdisciplinary studies that use species distribution modeling, cooperative tagging and survey programs, and temperature preference data. For example, [Future Seas](#) and the [Groundfish, Climate Change, and Communities in the California Current \(GC5\)](#) project incorporate species distribution models (SDM) and other methods to better describe climate change impacts on specific fisheries including swordfish, albacore, and Pacific sardine fisheries in the California

Current System (Future Seas) and U.S. west coast groundfish fisheries (GC5).

The United States aims to address the impacts of climate on fisheries through the development and implementation of scientific and management strategies, predictive tools, and regional scenario planning.

[The NOAA Fisheries Climate Science Strategy](#) (Link *et al.*, 2015), which was developed to meet the growing demand for information to better prepare for and respond to climate-related impacts on U.S. living marine resources and resource-dependent communities. The Strategy is intended to tailor and prioritize ongoing federal fisheries research toward seven key priorities that range from building science infrastructure to identifying climate-informed reference points for fisheries management. It is part of a proactive approach to produce, deliver, and use climate-related information to fulfill NOAA Fisheries' mandates in a changing climate. Implementation of the Strategy is intended to bolster our capabilities to track climate change, understand mechanisms of that change, and project future conditions to inform our fisheries management. The strategy calls for each region to develop a climate science regional action plan. [NOAA Fisheries updated regional action plans in 2023](#), including efforts to track change, forecast conditions, assess risk, evaluate management strategies, and prepare for change.

In 2018, NOAA Fisheries published a technical memo on the [Next Generation Stock Assessment \(NGSA\) Enterprise \(NGSA\)](#) (Lynch *et al.*, 2018), which updates the Stock Assessment Improvement Plan (SAIP) that NOAA Fisheries published in 2001 (NMFS, 2001). The NGSA framework was envisioned by NOAA Fisheries to address today's demands and challenges. The NGSA strategic vision is designed to complement other strategic efforts, particularly NOAA Fisheries' Ecosystem Based Fisheries Management Road Map and Climate Science Strategy. NGSA advocates for expanding the scope of the stock assessment paradigm to be more holistic and ecosystem-linked by considering ecosystem and socioeconomic factors that affect the dynamics of fish stocks and fisheries.

NOAA Fisheries has recently launched the NOAA [***Climate, Ecosystems, and Fisheries Initiative \(CEFI\)***](#) which aims to build a nationwide, operational ocean modeling and decision support system to provide marine and coastal resource managers with the actionable information and capacity they need for climate-ready decision making, including forecasts of ocean conditions, risk assessments and evaluation of alternative adaptation strategies. Central to this effort is a recognition that without adaptation efforts, fisheries management is likely to become less sustainable as the distribution and abundance of fish stocks change with climate change. Development of the CEFI Decision Support System includes pilot projects in four regions: (1) [***Eastern Bering Sea - Alaska Integrated Climate Modeling Project \(ACLIM\)***](#), (2) [***Gulf of Alaska Integrated Modeling Project \(GOACLIM\)***](#), (3) [***Future Seas - California Current***](#), (4) [***Northeast Integrated Climate Modeling Project \(NCLIM\)***](#)

NOAA is the lead institution for the [***SUPREME programme***](#) (Sustainability, Predictability, and Resilience of Marine Ecosystems), a UN Decade of Ocean Science program that is working to convene global partners through knowledge networks to share information and support robust climate- and ocean-related forecasts, predictions, and projections to guide effective marine ecosystem management and adaptation strategies in a changing climate. The overall goal of this effort is to advance the modeling tools needed to reduce risks and increase resilience of marine/coastal resources and the people who depend on them. The SUPREME Programme partners with other UN Decade Programmes focused on the climate-fisheries nexus, including the [***Fisheries Strategies for Changing Oceans and Resilient Ecosystems by 2030 \(FishSCORE 2030\)***](#).

The [***Highly Migratory Species \(HMS\) Predictive Spatial Modeling \(PRiSM\) Tool***](#) combines observer data and environmental data to predict the probability of where and when a species may interact with a fishery (Crear *et al.*, 2021). This information can then be used to address a variety of U.S. domestic fishery management questions. For example, there are a number of areas closed to HMS fishing that have not been assessed since their implementation in the early 2000s. Since then, ocean conditions, species distributions, and stock statuses have changed and additional

regulations have been implemented. Because these areas have been closed to fishing, there is little data to determine if they are performing as intended. Using PRiSM, NOAA Fisheries generated metrics to assess the performance of closed areas as it relates to protecting various bycatch species. This tool could also be used to: determine where fishing or research vessels should be allowed to fish to collect data in the field; help delineate essential fish habitat; assist in ecosystem-based fisheries management; and understand the impacts of climate change on fisheries.

Some U.S. Regional Fishery Management Councils are undertaking **scenario planning** to plan for and determine appropriate management responses to climate change impacts. Scenario planning is a facilitated strategic thinking and planning process developed to help decision-makers and stakeholders explore alternate potential future states and consider the range of decisions that may arise in preparing for the future (Frens and Morrison, 2021). This process can be implemented without an exact mechanistic understanding of climate's direct impacts on marine species. Scenario planners look for areas of high uncertainty in a system and imagine 3 to 4 plausible future scenarios that could occur given the uncertainties identified. Participants in planning projects then look for management options or changes that would be useful across any of these plausible future scenarios. In this way, scenario planning can help managers and stakeholders understand where management strategies may need to change to prepare for the future. The end goals are to provide better policy or decision support and stimulate engagement in the process of change. NOAA has made information on [scenario planning for managers](#) (Frens and Morrison, 2020) available and the Mid-Atlantic Fishery Management Council has supplied a [Scenario Planning Toolkit](#) online. Examples of efforts include the [East Coast Climate Change Scenario Planning](#) process, which was conducted as a collaboration across multiple management entities, and the [Pacific Fishery Management Council Scenario Planning process](#), conducted through the Council's Climate and Communities Initiative.

Risk Tables help managers set ecosystem-informed catch limits by improving how uncertainty is accounted for, including that related to climate change impacts (*e.g.*, Dorn and Zador 2020). In cases where

uncertainty is not well addressed in a stock assessment model, for example, scientists may recommend implementation of catch limits below those resulting from the stock assessment. When such risk policies are implemented, it is best practice for scientists to explain the conditions or uncertainties that warrant a reduction in catch limit. Risk tables are therefore used to help stock assessment experts qualitatively evaluate each type of consideration/uncertainty (including the effects of climate change on marine resources) to support a decision to implement a catch limit below that resulting from the stock assessment itself. The findings are peer-reviewed and adjusted along with the stock assessment itself. Several U.S. Regional Fishery Management Councils are using risk tables including the [Mid-Atlantic Fishery Management Council](#) and the [North Pacific Fishery Management Council](#).

The United States implements ecosystem and precautionary approaches to fisheries management.

To ensure healthy and resilient fishing communities, NOAA Fisheries released the [Ecosystem-Based Fisheries Management Road Map](#) to guide the Agency's implementation of ecosystem-based fisheries management (EBFM) for the next five years. The Road Map incorporates the best available scientific data on ecosystem components, prioritizes vulnerabilities to ecosystems and their components, and incorporates ecosystem considerations into management advice. The Road Map also incorporates data on economic and social trade-offs of management advice, to support sustainable fisheries and the communities that depend on those fisheries.

[Ecosystem Status Reports \(ESR\)](#) (e.g., Lucey *et al.*, 2023) help stakeholders understand what's happening in their ecosystem of interest, including impacts from climate change, and are used to lay a foundation for EBFM. ESRs gather key indicators of an ecosystem and evaluate how that system is connected and changing. By collecting, combining, and synthesizing information about the ecosystem as a whole, rather than individual fish stocks, ESRs provide a holistic view of ecosystem stressors and trends. They can be used to help stakeholders, including Fishery Management Councils, understand the links between

the ecosystem and the fisheries of interest. Two newly established ESRs that NOAA has released detail the state of ecosystems in the [South Atlantic](#) (Craig *et al.*, 2021) and the [Florida Keys National Marine Sanctuary](#) (Montenero *et al.*, 2020). The reports examine trends in ocean acidification, sea surface temperature, and fish stocks, among other factors. With the release of these ESRs, NOAA further builds out the groundwork necessary to move towards EBFM and to understand ecosystems in context. The 2023 Ecosystem reports for the Mid-Atlantic ([Northeast Fisheries Center, 2023](#)) and New England ([Lucey *et al.*, 2023](#)) region can be found [online](#).

[Ecosystem and Socioeconomic Profiles \(ESP\)](#) facilitate the integration of ecosystem and socioeconomic information into fisheries management decisions to balance tradeoffs between ecological, social, and economic needs. This rapid communication tool distills information from a variety of sources into a succinct, focused report to help resource managers in their decision-making. Developed in the State of Alaska, it is being adapted and adopted across the nation (Shotwell *et al.*, 2023).

The United States strives to incorporate economic, social, and cultural considerations into sustainable fisheries management through the use of complex, interdisciplinary data in climate resilience planning.

The [Climate-Resilient Fisheries Planning \(CRF\)](#) tool is designed to be used by fishery participants, community leaders, managers, NGO partners, scientists and others seeking to enhance the resilience of marine fisheries to climate change. The tool was developed by a [Science for Nature and People Partnership \(SNAPP\)](#) working group on [Climate-Resilient Fisheries](#). The Tool build builds on a [comprehensive resilience framework for fishery systems](#) across (a) ecological, (b) socio-economic and (c) governance dimensions using five resilience domains: assets, flexibility, organization, learning and agency. It integrates scientific research, [case studies](#), and [expert knowledge](#) to guide users through a six-step process that will provide key elements needed to develop a fishery climate-resilience plan. The CRF Tool is the foundation for the UN Ocean Decade Programme Fisheries Strategies for Changing Oceans and Resilient Ecosystems by 2030 (FishSCORE 2030) listed below.

[*Fisheries Strategies for Changing Oceans and Resilient Ecosystems by 2030 \(FishSCORE 2030\)*](#) is an endorsed Programme under the UN Decade of Ocean Science to help sustain fisheries as a global source of food and jobs, while protecting ocean ecosystem health and enhancing equitable benefits from fisheries. The endorsed Decade Programme brings together scientists, fishers, resource managers, community practitioners and policymakers to move marine fisheries towards climate resilience. It uses the [Climate Ready Fisheries Planning Tool](#) and other frameworks to assess vulnerabilities, determine actionable adaptation options, and identify resilience-enhancing measures for fishery systems. It will nurture scientist-practitioner partnerships as it develops, applies, and improves these frameworks. FishSCORE is designed to identify strategies that work in the real world to achieve healthy ecosystems, resilient fishery systems, and equitable benefits in the context of a changing ocean.

Concluding comments on climate change and international fisheries management

The United States is committed to addressing the climate crisis at home and abroad. On November 1, 2021, the U.S. government launched the [President's Emergency Plan for Adaptation and Resilience](#) (PREPARE), a whole-of-government effort to help more than half a billion people in developing countries adapt to and manage the impacts of climate change by 2030. PREPARE aims to deepen the global understanding of climate risks, enhance the resilience of food, water, health, and infrastructure, and mobilize resources, particularly private sector capital, engagement, and innovation..

In line with our broader commitments to mitigation and adaptation, the United States is eager to advance climate change mitigation and adaptation efforts in international fisheries. Responding to climate change is a fundamental responsibility of RFMO/As and RFMO/As should work together to enact the appropriate changes to management regimes in order to support sustainable fisheries in the future. These changes may need to be dramatic, such as requiring new methods to incorporate climate information into management decisions and/or employing new

approaches to organizing governance structures. The United States strongly encourages that RFMO/As should proactively plan for changes in fish distribution and abundance, among other impacts of climate change.

There is no one-size-fits-all solution to the challenges that climate change creates for international fisheries. International collaboration and cooperation are vital to ensure sustainable management of fisheries. Recent years have seen a substantial increase in global focus on climate change and the urgent need for mitigation and adaptation. Efforts through the UNFCCC Ocean and Climate Change Dialogue and other international meetings (*e.g.*, through FAO, RFMO/As and other multilateral organizations) offer opportunities to share best practices and lessons-learned across the fishing sector. These opportunities – and meetings like the 17th Informal Consultation of States Parties to UN Fish Stocks Agreement – are critical venues for information exchange and consensus-building. Mitigation and adaptation will only be possible with diverse, comprehensive approaches. With that in mind, the tools, strategies, and initiatives listed here present a starting point to define what sustainable management of fisheries looks like in the face of climate change.

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