

**Climate Working Group Report**  
In support of the NOAA Science Advisory Board

Review of the NOAA Climate and Fisheries Initiative  
Implementation Approach

August 07, 2021

## **Review of the “NOAA Climate and Fisheries Implementation Approach”**

### **Reviewers:**

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### **Introduction:**

We want to congratulate the authors for their hard work and care in developing the NOAA Climate and Fisheries Initiative (CFI) Implementation Approach. As the ocean and Great Lakes experience rapid change, environmental factors will increasingly drive extremes in the physical system, likely resulting in unexpected variability in fish stocks, other living marine resources, and whole ecosystems. Coastal communities are integral to the blue economy; however, they are facing a growing number of complex, climate-related impacts, and the unpredictable and intensifying nature of these events is threatening ecosystems and the economies that rely on them. Ocean-dependent economies include commercial fisheries, marine transportation of goods, offshore energy drilling, fish cultivation, recreation, tourism, and subsistence and cultural uses. All aspects of local economies are at risk due to the potential for infrastructure disruptions and displaced populations. As a result, the need for reliable and timely information about how climate change is impacting our coastal communities has never been greater. The unpredictable nature of these climate impacts confound communities' ability to plan, prepare, respond, and adapt to multiple changes.

We commend NOAA for recognizing that the agency currently lacks the nationally-integrated observing, modeling, and decision-support system needed to deliver the climate information required to meet NOAA’s Living Marine Resource (LMR) mandates in the face of these rapid changes and the challenges they present. These mandates, for all U.S. Territorial waters (Figure 1) include: fisheries management (e.g., Magnuson-Stevens Fishery Conservation and Management Act), protected resource conservation (e.g., Endangered Species Act, Marine Mammal Protection Act), and others (e.g.,

National Marine Sanctuaries Act, Coastal Zone Management Act and Harmful Algal Bloom and Hypoxia Research and Control Act).

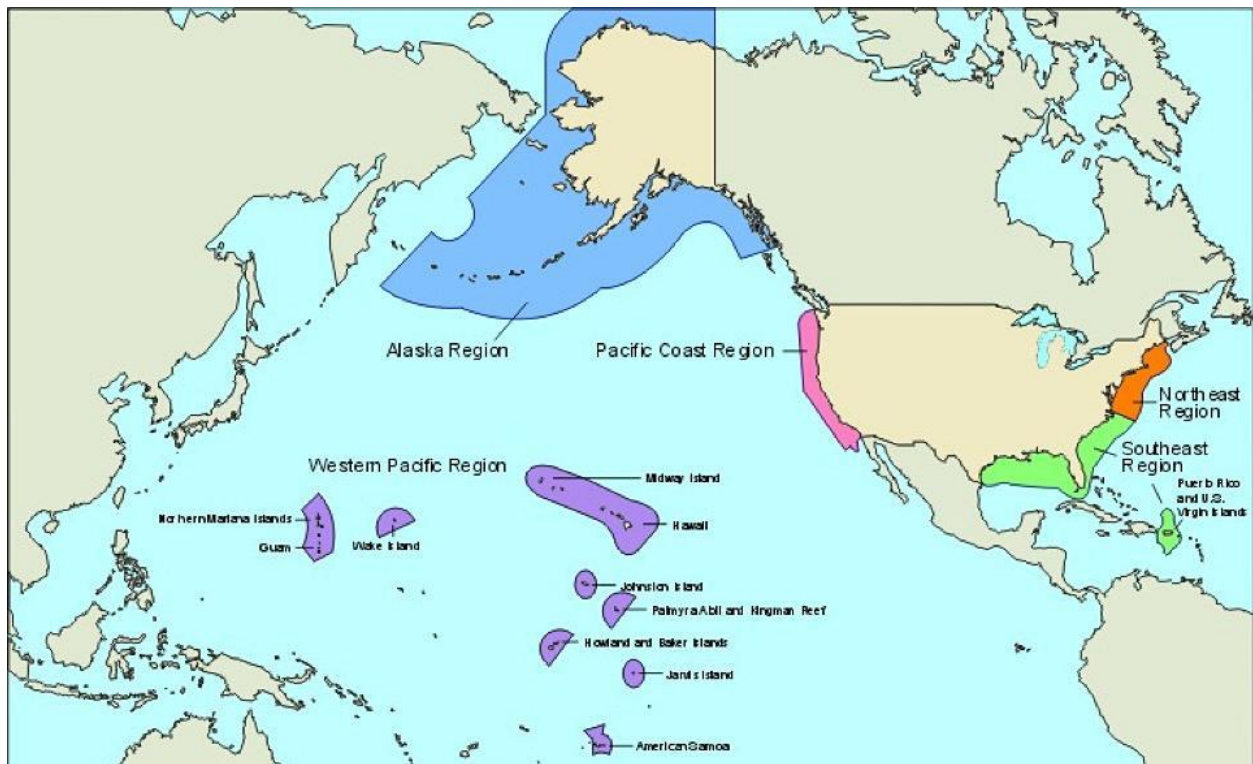


Figure 1: The Exclusive Economic Zone (EEZ) of the United States and affiliated islands which border the U.S. and U.S. Territorial coasts for which NOAA is responsible<sup>1</sup>.

To address these needs, NOAA proposes to build a nationwide operational ocean modeling and decision-support system with the following four core requirements:

- Operational delivery of ocean forecasts and projections for use by the National Marine Fisheries Service (NMFS) and others
- Operational capability to turn ocean forecasts into climate-informed management advice
- Capacity for continuous validation and innovation through observations and research
- Increased capability to use climate-informed advice to reduce risks and increase the resilience of resources and the people that depend on them

The proposed CFI System is meant to leverage current capabilities and make new investments in the following elements:

- Advancing climate, ocean, and ecosystem understanding
- Operational climate, ocean, ecosystem decision-support systems

<sup>1</sup> The National Oceanic and Atmospheric Administration, <https://oceanservice.noaa.gov/facts/eez.html>

- Climate-ready decision making

The NOAA CFI Implementation Approach demonstrates that NOAA is preparing to make critical strides to fill key gaps that exist in its current ocean modeling and decision-support systems.

The Climate Working Group, of the NOAA Science Advisory Board, was asked by NOAA to review this Implementation Approach to provide guidance on clarifying and improving the approach prior to the agency's next step to develop the Implementation Plan. The Climate Working Group established a small team of experts to consider this document. The Climate Working Group acknowledges and understands that this is an Implementation Approach and not an Implementation Plan. In light of that, the team provides the following recommendations.

## **Recommendations:**

### ***1.0 - Accelerate implementation of an integrated modeling system***

**Recommendation:** In order to accelerate and expedite the development of the necessary and important new products for a NOAA-wide integrated modeling system, the CFI should designate responsible parties within NOAA for each of the critical enhancements, the required components across the NOAA line offices, and to stress the necessity of coordination between them.

**Need:** The lines and program offices within NOAA work well together, but function best if every aspect of each implementation plan has a designated party for each component. In order to move from research to operations, there is a need to identify people for each component, a dedicated coordinating structure, and the resources required to produce these new and necessary products in order to bring about a NOAA-wide integrated modeling system. In addition to an integrated modeling system, it is critical that the Climate Information Hub proposed in the document also be integrated across all of NOAA. This will require a great deal of coordination and designation of responsible parties.

## **Actions:**

- 1.1 Carefully identify responsibility, coordination, and resources required to accelerate the transition to an integrated modeling system.
- 1.2 Create a timeline, as part of the full implementation plan, that takes into account the research required, model development, and transition.

## **2.0 - Stakeholder engagement in products and process**

**Recommendation:** The CFI should elaborate on approaches to working with more diverse groups of interested and affected stakeholders, in order to ensure that models inform management products providing usable information for decision-making. One possibility for helping with this includes the newly-developed NOAA Service Delivery Model.

**Need:** The CFI sets out a broad vision to provide robust climate and ocean hindcasts and predictions which will reduce risk and increase the resilience of the individuals, communities, sectors, and economies that depend on marine and coastal resources. The document could be strengthened by including the broader applications and value of the initiative for NOAA beyond fisheries, with more discussion of these diverse stakeholder groups (e.g., recreational boaters, aquaculture, ports, coastal communities), the degree to which their challenges and needs are known, or if further investigation with them is needed to build understanding. Clear and transparent processes are needed for inclusive engagement over time and for communicating user needs among lines and program offices through NOAA. New information resources will need to be tailored and presented within the decision contexts and capabilities of stakeholders, including an “off-the-shelf” version for those not able to afford value-added services. Recognizing that stakeholders will be working in a context of deep uncertainty, strategies to communicate uncertainty and tools to support decision-making under deep uncertainty merit further attention. Better delineating the scope of need and decision contexts among stakeholders could inform the design of elements of the CFI, such as the Fisheries and Climate Decision Support System (FACSS) Teams.

### **Actions:**

- 2.1 Utilize social science expertise when developing monitoring systems, incorporating stakeholders in co-production / collaborative design for data synthesis, model, product, and tool development, and establish clear, formal mechanisms for reporting stakeholder needs back to research and development.
- 2.2 Advance the research on how projections will impact diverse communities and sectors. This will include addressing multi-stressor interactions, refining vulnerability indices, developing projections of community impacts and adaptation strategies, and evaluating policy impacts on communities.
- 2.3 Develop research and tools for decision making under uncertainty that will support the identification of policies that create benefits even under adverse conditions.

2.4 Clarify goals and approaches to evaluating the accessibility and useability of products for a broader, diverse set of stakeholders and Climate Information Hub.

### **3.0 Trust in products and process**

**Recommendation:** As the CFI process proceeds, NOAA should continue its exemplary practices in assuring scientific integrity and consider how to further enhance trust as it engages with diverse stakeholders who are making decisions in a dynamic scientific environment under deep uncertainty.

**Need:** Trust in science and government organizations varies among organizations, groups, and topics and is declining in some spheres. Overall trust can be viewed as having four facets: *trust in competence, in caring, in commitment, and in predictability*. NOAA's central role in providing processes, products, tools, and predictions as the environment changes rapidly and creates a situation where incorporating the best science, guidance and associated information provided may change over time. Such changes without understanding can potentially be viewed as inconsistency or lack of competence. Providing clear explanations about the rationale for changes will be an important element of communication for maintaining trust.

NOAA's draft Service Delivery Model emphasises two-way communication to build relationships. That type of communication expresses caring, which can be demonstrated by responsiveness to concerns and can operate on an individual and agency level. As NOAA continues to engage long-term partners and seeks to engage more deeply with a greater diversity of stakeholders, current efforts, as well as past experiences, may influence potential partners' willingness to participate in co-design activities. The CFI will be seeking stakeholder inputs on needs that could potentially cross activities of multiple programs and line offices. Stakeholders are more likely to invest their time and energy if they are confident that the input they are offering receives consideration by the office and programs most capable of addressing their needs. A formal process for conveying stakeholder needs across the agency could build confidence in the *One NOAA* coordination of efforts to listen and respond. In instances where past efforts have not been as successful as desired, such as meeting the needs of historically marginalized and underserved communities, especially with respect to the design and accessibility of data portals, a comprehensive view of trust can inform efforts to establish better relationships.

The CFI is most likely to be successful in linking knowledge to action, or boundary-spanning, if the new products, tools, and processes are seen as not just credible (e.g., authoritative information), but also as salient (e.g., relevant and usable for decisions), and legitimate (seen as being produced by a "fair" process that considers the

appropriate values, concerns, perspectives, circumstances, and types of knowledge). These traits are related to trust and reflect competence, caring/responsiveness, commitment, and predictability. The central facets of trust should also be considered in the development and updating processes, and in the accessibility of tools and products.

**Actions:**

- 3.1 Ensure the multiple facets of trust are considered when developing and disseminating new guidance and information products.
- 3.2 Develop and publish a formal process for consideration and feedback on stakeholder needs to demonstrate agency responsiveness to public needs.
- 3.3 Develop metrics to assess trust.

**4.0 - Upgrading the ocean observing system**

**Recommendation:** The CFI should engage across NOAA to upgrade the ocean observing system to fill crucial gaps such as physical observations on the shelf and nearshore, and biogeochemical observations in shelf, nearshore, and offshore waters. These data are central to enabling the attribution and predictive capability called for by the CFI.

**Need:** A key part of the CFI approach involves developing the capability for credible predictions and projections of both the physical, geochemical, and ecosystem context of U.S. fisheries and other living marine resources. Such predictions, and the models that are used to generate them, are highly reliant on a fit-for-purpose ocean data stream that captures the major modes of variability and long term changes in key parameters. The present observing system is likely inadequate, being particularly thin on the shelf/slope and with few biogeochemical parameters measured at a scale that can inform model improvement and ocean prediction.

**Actions:**

- 4.1 Work across NOAA, and amongst stakeholders/partners, to assess the adequacy of the observing system, including the observing system design and cost, particularly on the slopes, shelves and nearshore, to support ocean predictions and projections at the spatial and temporal scales required to support management and decision-making for fisheries and other living marine resources.

- 4.2 Use this assessment to guide key investments to target major gaps, possibly exploiting more robust satellite coverage and autonomous technologies, such as gliders and profiling floats, to scale up the spatial and temporal coverage over what is delivered by the present ship and buoy-based system.
- 4.3 Ensure that the present and new observational data streams are made available as quality-controlled, real time feeds for the operational ocean analyses and models.
- 4.4 Perform periodic assessments of the efficacy of the observing networks in supporting analyses and predictions for the CFI application areas.

### **5.0 - Multi-stressor predictions at multiple scales**

**Recommendation:** NOAA's CFI should extend to include steps towards development of climate-informed, multi-stressor predictions at multiple temporal and spatial scales that meet the needs of *One NOAA* managers and stakeholders.

#### **Need:**

The CFI has a focus on enhancing ocean modeling capabilities, especially with respect to fish stock prediction and forecasts, but does not directly address the need for developing models for multi-stressor predictions. The U.S. territorial waters encompass 11 Large Marine Ecosystems that range from the cold waters of the Arctic to the tropical waters of the Pacific Islands and include the Great Lakes that are the world's largest system of freshwater lakes. Climate impacts can cascade through these ecosystems resulting in marine heat waves, shifting habitats, increasing harmful algal blooms, hypoxia, loss of coral reefs, extreme storms, sea level rise and fluctuating lake levels in the Great Lakes. These changes affect not only marine and freshwater organisms, but coastal economies such as fisheries, tourism and maritime transportation, and can happen at time scales that can range from hours to seasonal to decadal.

#### **Actions:**

- 5.1 Accelerate development of coupled physical-chemical-biological models that can detect and forecast ecological impacts and changes at multiple time scales and over space and time.
- 5.2 Enable more substantial collaborative modeling (Figure 2) between technical experts, managers, and stakeholders including the development of interactive tools for decision-ready support. This will need to be founded on a solid basis where scientists and modelers collaborate to produce effective



and realistic models and analysis tools, and where stakeholders and decision makers are involved so targeted products are usable.

5.3 Incorporate the input and perspectives from social scientists, economists, modelers, oceanographers, biologists, computer scientists, product developers and communication experts to model development and vision.

5.4 Ensure that all relevant NOAA line offices are jointly involved in planning these efforts.

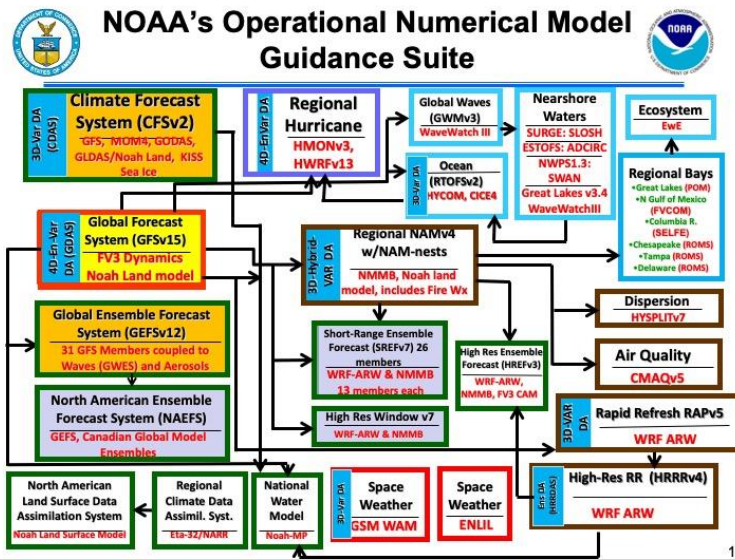


Figure 2: NOAA's Operational Numerical Model Guidance Suite. Courtesy of Brian Gross, Director, Environmental Modeling Center.

**Conclusion:**

With acknowledgements to NOAA, the Weather, Water, and Climate Board, the NOAA Climate Team, and each contributor to the Implementation Approach, this document demonstrates the great amount of time and effort that NOAA is contributing to this initiative. This review was a collaborative effort to assist NOAA as it continues to move forward with this laudable effort. The Climate Working Group of NOAA's Science Advisory Board is grateful for the opportunity to review the Implementation Approach and look forward to engaging again.