

Addressing Oceans and Climate Change in Federal Legislation

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INTRODUCTION

The purpose of this paper is to provide Congress with information and recommendations to support the enactment of legislation that incorporates ocean science, management, and education into a national initiative to mitigate and adapt to climate change. This initiative must complement ongoing efforts to understand, monitor, and forecast changes associated with natural variability, such as El Niño and the Pacific Decadal Oscillation, since anthropogenic climate change will also impact the frequency, pattern, and severity of these natural processes. The goal is to improve our collective understanding of the role of the oceans in climate change in order to inform policies and strategies intended to reduce the vulnerability of and increase the resiliency of our economic and ecological systems to impacts associated with climate change. It is the Joint Ocean Commission Initiative's view that this goal can best be met through a broad national climate change response strategy that includes an emphasis on the oceans role in climate-related processes.

After consultation with leading experts in ocean and climate change science and policy, the Joint Ocean Commission Initiative suggests that Congress address the link between oceans and climate change by addressing needs in two key areas: governance reform and science. Clearly, additional funding will be necessary to make sustained progress in both areas. The actions recommended by the Joint Ocean Commission Initiative are summarized below and discussed in more detail in the pages that follow.

Governance Reform

1. Charge the National Academy with recommending a process and strategy to respond to climate change, including consideration of the organization and functions of a National Climate Change *Response* Office responsible for guiding federal programmatic and budgetary climate change activities.
2. Codify and strengthen the White House Committee on Ocean Policy, and give it a key role in supporting the activities of the Climate Change Response Office.
3. Codify and strengthen the National Oceanic and Atmospheric Administration (NOAA), realigning the agency's organizational structure to enhance and focus its capacity to provide climate-related services and improve ocean and coastal management.
4. Require a biennial *integrated* assessment of the nation's progress toward meeting its objectives to mitigate and adapt to impacts associated with climate change and variability.
5. Require the submission of an integrated budget to consolidate and highlight priorities established by the National Climate Change Response Office that would accompany the President's annual budget request

Science Requirements

1. Request prioritization of and provide funding to implement the Administration's *Ocean Research Priorities Plan and Implementation Strategy*, with a focus on developing a science enterprise that is responsive to societal and environmental concerns.
2. Enact legislation authorizing the implementation of an Integrated Ocean Observing System, incorporating both coastal and global components.
3. Fund major ocean observation research and monitoring infrastructure systems and supporting science and data management programs, such as an Integrated Ocean Observing System, the Ocean Observatories Initiative, research vessels, and remote sensing programs.
4. Enhance funding support for transitioning ocean and atmospheric data collection and synthesis programs from research to operational status, with ongoing engagement of the ocean science community in the operation, evaluation, and evolution of the programs.
5. Support research to evaluate the impact of greenhouse gas mitigation policies on coastal and ocean processes and ecosystem health (e.g., oceanic carbon sequestration, biofuel production).

THE ROLE OF OCEANS IN CLIMATE CHANGE

Increasing awareness and concerns about climate change have elevated the urgency to take action to mitigate its causes and make preparations to adapt to its anticipated economic and environmental impacts. At continental, regional, and ocean basin scales, numerous long-term changes in climate have been observed. These include changes in arctic temperatures and ice, as well as widespread changes in, ocean salinity, wind patterns, the quantity of precipitation, and various aspects of extreme weather.¹ As Congress moves forward in developing climate change policies, the accompanying legislation should recognize the fundamental role oceans play in governing climate change and Earth-related processes. Some important facts regarding the relationship between oceans and climate change include the following:

- Oceans cover 71 percent of the Earth's surface and average over 12,200 feet in depth.
- Water holds approximately 1,000 times the amount of heat as air, and the interaction between ocean circulation and the global distribution of heat is the primary driver of climatic patterns.
- The oceans are warming, particularly since 1950s, with global mean sea surface temperature having increased roughly one degree Fahrenheit in the 20th century.²
- Sea levels rose 7 inches during the 20th century and nearly 1.5 inches between 1993 and 2003 alone.²
- Oceans are a major carbon sink and have absorbed fully half of all fossil carbon released to the atmosphere since the beginning of the Industrial Revolution.²

¹ Intergovernmental Panel on Climate Change. 2007. Report of Working Group I *The Physical Science Basis*.

² Doney, Scott. 2006. *The Dangers of Ocean Acidification*. Scientific American (March).

- The absorption of carbon has resulted in increasing ocean acidification, impacting the health of marine ecosystems and species, including, but not limited to, those with carbonate-based skeletons (e.g., corals), as well as influencing the important role ocean plays in the global cycling of carbon.
- Little to no Arctic sea ice is expected in the summers by 2100.²

GOVERNANCE REFORM TO ADDRESS OCEANS AND CLIMATE CHANGE

Climate change involves complex and dynamic interactions of the atmosphere, ocean, land, their related ecosystems, and human activities. The complexity and breadth of issues associated with efforts to understand, mitigate, and adapt to climate change, the scale of its impacts from the local to the global level, and the need to understand the relationship between natural variability and climate change make it essential that the nation have a coherent and comprehensive strategy to address this new challenge.

Unfortunately, there is general agreement in the scientific community that the current federal climate change governance regime is too limited in scope and must be expanded if it is to be truly comprehensive. A Climate Change *Response* Office is required to guide the development and implementation of a National Climate Change Response Strategy. Such an office must have the authority to direct the activities of multiple federal agencies and have a strong role in the budget formulation process. This will require designing and implementing a strategy that balances the need to conduct basic and applied research, monitoring and analysis, and modeling and forecasting, with the goal of translating data into information products that can be used to develop sound policies to mitigate and adapt to environmental and socioeconomic impacts stemming from climate change.

Ocean science and management must be recognized as key elements of a national response strategy. Thus, the existing interagency coordination process operating under the White House Committee on Ocean Policy³ should be codified and charged with supporting the effort to institutionalize a broader National Climate Change Response Strategy. An additional action needed to strengthen the federal government's capacity to respond to climate change is to codify and strengthen the National Oceanic and Atmospheric Administration (NOAA). As a key provider of climate-related services and ocean management information, and as one of the principle agencies investigating the ocean's role in climate variability, NOAA plays a lead role in matters related to climate change. However, an outdated organizational structure and the lack of resources have limited NOAA's ability to fulfill its multiple mandates. The opportunity is ripe for Congress to reevaluate NOAA's organizational structure and realign programs along its core functions: environmental assessment, prediction, and operations; scientific research and education; and marine resource and area management. Strengthening NOAA and realigning its functions would greatly enhance its capacity to provide climate-related services and facilitate the implementation of proactive management measures to mitigate anticipated impacts on coastal economies and ecosystems.

Finally, Congress should require a biennial integrated assessment of the nation's progress towards mitigating and adapting to climate change impacts. An integrated assessment evaluating the collective effort of federal programs and activities will provide a baseline from which to measure progress and will help ensure the nation is maximizing the use of available data and information to improve the

³ Executive Order 13366, 2004.

caliber of forecasts and to evaluate the effectiveness of management actions. An additional step that would facilitate better integration of federal programs would be a requirement for the submission of an integrated budget that clearly identifies priorities established by the proposed National Climate Change Response Office and how those priorities relate to and complement efforts directed at understanding the ocean's role in climate change. Congressional oversight the federal budgets is its most powerful tool, but Congress' capacity to help guide a response to an issue as complex as climate change is compromised when information is dispersed throughout the President's budget.

OCEAN AND COASTAL SCIENCE REQUIREMENTS

Credible and timely scientific information will be essential as the nation begins the process of responding to the challenges associated with climate change. Better science, when linked with improved risk management and adaptive management strategies, will help guide a process that must deal with the relatively high levels of uncertainty related to mitigation alternatives and the range of impacts associated with climate change and variability. A much more comprehensive and robust science enterprise that incorporates a better understanding of the ocean's role in climate change is required to forecast more accurately the magnitude and intensity of this change at multiple scales, as well as to evaluate options for mitigation and adaptation. This process must also include strengthening capacity in the social sciences, whose contributions will influence risk and adaptive management strategies significantly given the immense economic impact climate change will have on coastal communities.

Unfortunately, the existing ocean and coastal science enterprise supporting climate change research, observations, data management, and socioeconomic analysis is limited. Despite the unprecedented opportunities to capitalize on technological advances, future capacity is compromised due to a lack of fiscal support for key infrastructure and science programs. For example, the U.S. commitment to constructing an observing system focused on studying physical ocean processes is only half complete, while satellite systems responsible for generating invaluable data across large areas of oceans are aging. The construction of replacement systems are behind schedule, over budget, and as currently configured, may have less capacity than the systems they are replacing. The status of infrastructure supporting on and underwater ocean science, such as ship, buoys, cabled observatories, planes, and other underwater monitoring hardware, is bleak. Additionally, support for shore-side lab work, where data for the observing systems is analyzed, quality-controlled, synthesized, and integrated, has eroded. Further underlying these weaknesses is a lack of capability to transmit large amounts of ocean data in real time and a disjointed data management system that prevents scientists from fully utilizing the data that are being collected now. Stagnant funding supports only bare-bones research, monitoring, modeling, and analysis enterprises that have difficulty providing the quantity and quality of data needed to generate information with the relatively high levels of confidence demanded by decision makers facing difficult policy choices.

Congress can begin to remedy this situation by taking the following series of step. First, it should call on the administration to prioritize and request full funding to implement its *Ocean Research Priorities Plan and Implementation Strategy* (ORPPIS). ORPPIS provides a solid blueprint to guide research on the ocean's role in climate, including the development of a comprehensive observing system and other ocean-related research priorities that will improve our ability to enhance the resiliency of marine ecosystems and coastal economies to climate-induced changes. Particularly noteworthy in ORPPIS is its

emphasis on using improved understanding to provide better and timelier policy and resource management decisions, relying on much stronger support for social and economic research. It is the first comprehensive research strategy developed by the Administration with input from the ocean community and should be used by Congress to guide its ocean science funding priorities.

Congress should also authorize and fund the implementation of an Integrated Ocean Observing System (IOOS). Support for the implementation of the coastal and global IOOS should be driven by a cooperative interagency process that incorporates expertise from outside the federal system. Congressional support should also extend to major observing initiatives supported by the National Science Foundation, as well as to remote sensing satellite programs supported by NASA's Earth Science program. As noted earlier, the loss or diminishment of remote sensing capabilities, in addition to the lack of support for transitioning ocean and atmospheric data collection and synthesis program from research to operational status, has significantly compromised our nation's capacity to monitor the vast expanse of the ocean. Sustained research and operational monitoring and analyses programs supported by enhanced data collection, management, and synthesis capabilities are the foundation of an observation system that can refine climate change models and reduce the level of uncertainty associated with their projections.

Finally, Congress should support research and science programs focused on analyzing the potential impact various greenhouse gas mitigation strategies may have on ocean and coastal processes and ecosystem health. Recommendations for carbon sequestration in the oceans will require particularly careful review, given our growing concern about the sensitivity of marine ecosystems to changes in the biogeochemistry of ocean waters as a result of increased absorption of carbon dioxide, in particular ocean acidification. Similarly, increased biofuel production will generate additional runoff of nutrients, herbicides, and pesticides, further exacerbating pollution and nutrient enrichment problems in coastal waters.

Given their immense size, fundamental role as a driver of climate processes, and critical social and economic importance, it is imperative that Congress focus greater attention and resources on improving our understanding and management of our oceans, coasts, and Great Lakes. The actions recommended above are important steps that will lay the foundation for making great advances in ocean science and allow meaningful progress toward improved stewardship of one of nation's greatest natural resources.