CHARTING THE
COURSE FOR
OCEAN SCIENCE
IN THE
UNITED STATES
FOR THE
NEXT DECADE

AN OCEAN RESEARCH PRIORITIES PLAN
AND IMPLEMENTATION STRATEGY — SUMMARY

NSTC JOINT SUBCOMMITTEE ON OCEAN SCIENCE AND TECHNOLOGY

We envision a future in which our understanding of the world ocean, national coasts, coastal watersheds, and Great Lakes protects lives, enriches livelihoods and enhances quality of life.

The ocean, consisting of the open ocean, coasts, coastal watersheds, and Great Lakes, provides food and recreation, contributes to the nation's economic engine, is an element of national security, and is a major influence on the global climate system. Despite its vast extent, the ocean is finite and cannot indefinitely absorb all the stresses being placed on it; thus, the United States must commit to protecting the ocean through responsible stewardship and scientifically sound management. Understanding society's impact on the ocean and the ocean's impact on society forms the basis for ensuring a clean, healthy, and stable ocean environment that can be responsibly used and enjoyed for generations to come. The goal of *Charting the Course for Ocean Science in the United States for the Next Decade: An Ocean Research Priorities Plan and Implementation Strategy* is to provide the guidance to fortify and expand the scientific foundation for improving society's stewardship and use of, and interaction with, the ocean. By identifying national ocean research priorities and outlining an implementation strategy, this document will help facilitate coordinated investment and effort in critical areas of ocean science.

Three central elements of science and technology will provide the United States with the knowledge and means to redefine its relationship with the ocean for the better. The *capability to forecast key ocean and ocean-influenced processes and phenomena* will change how society takes action in the future, much like weather forecasts do today. Providing the *scientific support for ecosystem-based management* will allow resources to be managed in ways that account for the complex interactions between those resources and other parts of the marine environment, including humans. *Deploying an ocean-observing system* that can accurately describe the state of the ocean will revolutionize access to and view of the ocean, and increase the pace, efficiency, and scope of ocean research. In turn, this observing capability will enable ocean forecasting and ecosystem-based management.
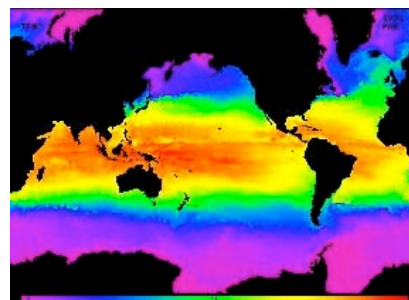
The focus on ocean forecasting, scientific support for ecosystem-based management, and ocean-observing capabilities was born out of a comprehensive community effort to define ocean research priorities for the United States for the next decade. Aspects of these three central elements are evident throughout the 20 national ocean research priorities, described below. The research priorities are oriented around the most compelling issues in key areas of interaction between society and the ocean (societal themes). These priorities, each with equal weight, focus on understanding critical ocean processes and interactions, and applying that understanding toward stewardship and responsible use of the ocean.

Theme 1: Stewardship of Natural and Cultural Ocean Resources

Research Priority 1: Understand the status and trends of resource abundance and distribution through more accurate, timely and synoptic assessments

Research Priority 2: Understand interspecies and habitat/species relationships to support forecasting resource stability and sustainability

Research Priority 3: Understand human-use patterns that may influence resource stability and sustainability

Research Priority 4: Apply advanced understanding and technologies to enhance the benefits of various natural resources from the open ocean, coasts, and Great Lakes

Theme 2: Increasing Resilience to Natural Hazards

Research Priority 5: Understand how hazard events initiate and evolve and apply that understanding to improve forecasts of future hazard events
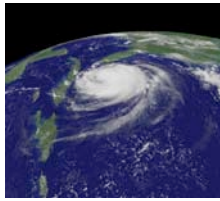
Research Priority 6: Understand the response of coastal and marine systems to natural hazards and apply that understanding to assessments of future vulnerability to natural hazards

Research Priority 7: Apply understanding to develop multi-hazard risk assessments and support development of models, policies, and strategies for hazard mitigation

Theme 3: Enabling Marine Operations

Research Priority 8: Understand the interactions between marine operations and the environment

Research Priority 9: Apply understanding of environmental factors affecting marine operations to characterize and predict conditions in the maritime domain

Research Priority 10: Apply understanding of environmental impacts and marine operations to enhance the marine transportation system

Theme 4: The Ocean's Role in Climate

Research Priority 11: Understand ocean-climate interactions within and across regions

Research Priority 12: Understand the impact of climate variability and change on the biogeochemistry of the ocean and implications for its ecosystems

Research Priority 13: Apply understanding of the ocean to help project future climate changes and their impacts

Theme 5: Improving Ecosystem Health

Research Priority 14: Understand and predict the impact of natural and anthropogenic processes on ecosystems

Research Priority 15: Apply understanding of natural and anthropogenic processes to develop socioeconomic assessments and models to evaluate the impact of multiple human uses on ecosystems

Research Priority 16: Apply understanding of marine ecosystems to develop appropriate indicators and metrics for sustainable use and effective management

Theme 6: Enhancing Human Health

Research Priority 17: Understand sources and processes contributing to ocean-related risks to human health

Research Priority 18: Understand human health risks associated with the ocean and the potential benefits of ocean resources to human health

Research Priority 19: Understand how human use and valuation of ocean resources can be affected by ocean-borne human health threats and how human activities can influence these threats

Research Priority 20: Apply understanding of ocean ecosystems and biodiversity to develop products and biological models to enhance human well-being

Common to all six societal themes is the need to develop the tools necessary to pursue research, ranging from physical infrastructure to information technology, and to effectively translate the results of that research in ways that are useful to resource managers, policy-makers, and the general public. Expanding society's ability to knowledgeably address key ocean-related societal issues will depend on technological and intellectual innovation, and the incorporation of many assets, including ocean-observing and modeling capabilities. A healthy relationship between society and the ocean depends on having the scientific foundation to develop and implement new strategies to educate and instill a sense of stewardship in the public and translate research results into effective decision-making tools.

Four near-term priorities, reflecting efforts to be pursued over the next two to five years, were developed to initiate rapid progress towards the 20 ocean research priorities. The near-term priorities are not a direct subset of the longer-term research priorities, described previously, but incorporate aspects highlighted in many of them.

Forecasting the Response of Coastal Ecosystems to Persistent Forcing and Extreme Events: Understanding and forecasting the response of natural and constructed landscapes and ecosystems to extreme weather events, natural disasters, and changing ocean conditions will inform hazard mitigation and response plans, support navigation safety, and assist regional resource managers and public health officials in sustaining ecosystem and public health and promoting hazard resilience.

Comparative Analysis of Marine Ecosystem Organization: Marine ecosystem management can be improved by elucidating their underlying dynamics at a variety of scales through development of dynamics models and their application in comparisons of managed ecosystems. This effort will provide a greater basic understanding of ecosystem processes and practical tools for evaluating the effectiveness of local and regional ecosystem-based management efforts.

Sensors for Marine Ecosystems: New sensor capabilities are necessary to realize the full potential of *in situ* ocean observing networks and satellite-based observations. These capabilities will enable expanded and more accurate information on the ocean environment to better define management options, understand processes that influence ecosystem productivity, serve as the basis for forecasting ocean-related risks to human health and safety, and shed light on the impact of climate variability and change on the ocean, marine life, and humans.

Assessing Meridional Overturning Circulation Variability: Implications for Rapid Climate Change: The meridional overturning circulation (MOC) of the Atlantic Ocean, an element of the global-scale ocean circulation responsible for long-term climate variations, has been identified as a key process related to rapid or even abrupt climate change (i.e., changes over a few years to a few decades). Improved understanding of this major component of ocean circulation and the ability to monitor, detect, and analyze changes in it could improve society's response to significant changes in climate.

Addressing the ocean research priorities will require a national and international effort involving many sectors of the ocean community, from state, local, and tribal governance to academic institutions to nongovernmental organizations. The involvement of end users of scientific information, including resource managers, public policy-makers, and individual citizens, will enhance the impact and value of research efforts. The implementation strategy strives to provide guidance and advocate for a collaborative approach, rather than stipulating specific federal-agency actions or budgets, detailing timelines for activities, or mandating how other sectors should respond to the research priorities independent of federal collaboration—activities that are best defined in specific project plans. Thus, the implementation strategy describes characteristics of implementation, roles of various sectors, mechanisms for collaboration, the need for an infrastructure assessment, mechanisms for research translation, strategies for assessment and evaluation, and mechanisms for budget and plan updates. A well-planned and robust federal effort will provide the leadership, focus, and resources against which non-federal efforts can be better leveraged. Implementing this strategy will lay the foundation for the multi-sector collaboration that is needed. Ocean research will give our society the ability to understand the past, observe the present, and predict the future. This knowledge will enable us, as an educated and informed nation, to better anticipate the consequences of our actions in the complex ocean ecosystem.

http://ocean.ceq.gov/about/sup_jsost_prioritiesplan.html

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