SCIENCE POLICY

Proposed U.S. Policy for Ocean, Coast, and Great Lakes Stewardship

Regional planning bodies would implement coordinated, ecosystem-based approaches to coastal and marine spatial planning.

Jane Lubchenco[1]* and Nancy Sutley[2]

The Deepwater Horizon–BP oil spill in the Gulf of Mexico is a stark reminder of the intimate dependence of coastal communities on healthy coastal and oceanic ecosystems and of the urgent need to revise policies to ensure wise stewardship of coasts, oceans, and Great Lakes. In the Gulf, and around the world, scientific evidence indicates that coastal and oceanic ecosystems are being disrupted and depleted, with serious consequences for human well-being (*1*, *2*). Oil spills are but one threat. Overfishing, destructive fishing gear, nutrient and chemical pollution, habitat loss, and introduction of nonnative species threaten the health of these ecosystems. Climate change and ocean acidification interact with and exacerbate the impacts of these stressors. The result is the loss of many benefits that humans want and need from these ecosystems, including healthy seafood, clean beaches, resilient economies and jobs, cultural and recreational opportunities, vibrant coastal communities, protection against hurricanes, abundant wildlife, provision of drinking water, and the oxygen that we breathe (*2*).

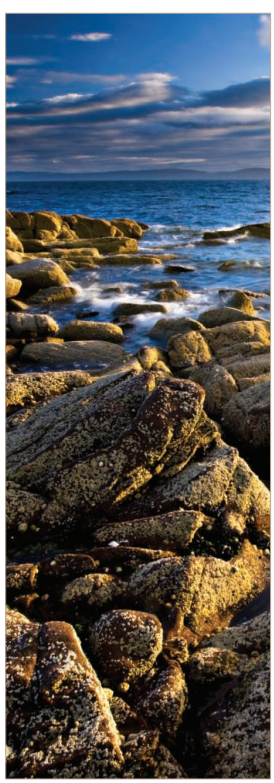
Although the United States has laws to address many individual issues (e.g., water quality, fishing, and shipping), the historical sector- and issue-based management does not ensure good stewardship across the plethora of uses. Furthermore, the sector-by-sector approach is inadequate to incorporate current scientific knowledge about the interconnectedness among habitats, species, and ecosystems, or between healthy ecosystems and human health and economic and social well-being (*1*, *3*). The need for science-based solutions and forward-thinking, holistic approaches to management has never been greater (*4*–*6*).

An Ecosystem-Based Approach

President Obama in June 2009 constituted his Interagency Ocean Policy Task Force and charged it with developing a national ocean policy and recommending actions that include "a comprehensive, ecosystem-based framework for the long-term conservation and use of our resources" (*7*).

The task force sought input from citizens and proposed a national ocean policy, a coordinating structure, and priority areas, outlined in the interim reports released in September 2009 (*8*) and December 2009 (*9*). Public comments on each report have been deliberated by the task force to finalize recommendations for the president. Recommendations (*8*–*10*) incorporate the fundamental changes consistently emphasized previously (*4*–*6*) as essential to addressing the heretofore "failure of understanding" and "failure of governance" to achieve the stewardship for continued, sustainable use of oceans, coasts, and the Great Lakes. If adopted, the proposed National Ocean Policy (NOP) would, for the first time, constitute a cohesive, national approach to enhancing this stewardship. The NOP would send the resounding message that healthy oceans matter and that policies will now reflect the goal of ensuring healthy, productive, and resilient ecosystems.

The recommendations incorporate ecosystem approaches to management and complement innovative state and regional efforts, such as coastal governors' agreements for regional ecosystem-based management (EBM) (*9*, *11*). EBM is a place-based, ecosystem approach to management that considers connections between people and ecosystems, as well as connections among ecosystem components (*3*). The recommendations draw on experiences with EBM and coastal and marine and spatial planning (CMSP) from Australia, New Zealand, the European Union, and Canada (*12*).



The proposed NOP encompasses a diversity of activities and ecosystem services, including freedom of navigation; access to traditional and renewable energy sources; promotion of human health; provision of food; protection of coasts from flooding and erosion; maintenance of military readiness; support for recreational activities (e.g., boating, fishing, and surfing); respect of cultural heritage; enhancement of homeland security; and support for maritime commerce and coastal economies. A core principle unifying these diverse interests is the protection and restoration of the productivity, biodiversity, and resilience of ecosystems. A consistent priority is the maintenance and recovery of ecosystem integrity and the continual provision of the range of valuable ecosystem services that humans depend on.

The proposed NOP includes a series of regional planning bodies (RPBs), consisting of federal, state, and tribal agencies in each region, to develop and implement EBM through comprehensive coastal and marine spatial plans within their existing statutory and regulatory authorities (*9*). Through CMSP, they can identify areas suitable for specific types of activities in order to reduce user conflicts, minimize environmental impacts, facilitate compatible uses, and preserve critical ecosystem functioning and services (*13*, *14*).

Linking Science and Management

Two fundamental tenets of the NOP are that (i) cross-sectoral EBM is a mature governance concept, and (ii) the science supporting EBM is sufficiently developed to address the complex issues inherent in managing simultaneous pressures (*3*, *15*). Although many governance and scientific challenges have yet to be resolved, it is clear that EBM is not only feasible, it is the only logical approach to reconcile the inherent trade-offs when managing for multiple uses and conserving the ability of ecosystems to sustain-

[1]Under Secretary of Commerce for Oceans and Atmosphere and Administrator of the National Oceanic and Atmospheric Administration, Washington, DC 20230, USA. [2]Chair of the Council on Environmental Quality and the Interagency Ocean Policy Task Force, Washington, DC 20500, USA.

*Author for correspondence. E-mail: jane.lubchenco@noaa.gov

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ably produce services (*16*). EBM represents a fundamental shift toward more comprehensive, integrated techniques that acknowledge the interconnected components of ecosystems, including linkages between humans and the natural environment. By emphasizing these connections, the EBM approach sets up decisions to incorporate a wider range of ecosystem services than are inherent in the sector-by-sector approach. Contrary to sector-by-sector management, EBM specifically allows cross-sectoral trade-offs to be considered (*3*). Although ecosystem approaches are already being pursued incrementally within current statutes (*15*), a more explicit, comprehensive policy is needed for EBM to be fully operational and effective at a national scale.

The proposed NOP supports a broad portfolio of scientific research, mapping, monitoring, observation, and assessment to provide critical knowledge to inform EBM decisions. Scientific information—such as species and habitat distributions, human-use patterns, and knowledge of key ecosystem processes—is essential for the development of decision-support tools for effective implementation of EBM and CMSP within an integrated ecosystem framework (*3*, *17*). Priority gaps need to be filled to conduct assessments and forecasts, develop models, and create visualization and valuation tools. Observational and monitoring systems and indicators of the natural and socioeconomic characteristics of these ecosystems need to be expanded to support the wide array of activities called for in the NOP.

Sustainably managing ecosystems requires an understanding of the functional connections between living and nonliving components, the position of nonlinear thresholds, and ways in which ecosystems could change under different management scenarios. Precaution is needed to avoid unintentional losses of ecosystem resilience or diversity. Increased knowledge of complex relations takes on real value when ecosystems can be managed sustainably, without reaching or exceeding critical tipping points (*18*). The proposed NOP supports precautionary, adaptive, and integrated management approaches to enhance understanding of how ecosystems respond to cumulative human impacts. RPBs will be responsible for developing science-based coastal and marine spatial plans that follow national principles and require the development and evaluation of alternative future-use scenarios and trade-offs. The solutions will not be immediate. Reaching the desired outcomes of CMSP will take time, commitment, and the understanding that a continuous learning process will be necessary for all parties involved.

The overarching new NOP is based upon societal choices about goals (e.g., the desire to have healthy oceans, secure and healthy citizens, and minimal conflicts among users). Science informs the approaches and tools (EBM, CMSP, regional focus, and stakeholder engagement) to achieve the goals and identify constraints on trade-offs. So too must science inform each RPB's analyses and decisions. Accomplishing the priorities of the proposed NOP (*8*, *9*) will require effective, two-way communication between scientists and information users, including decision-makers, resource managers, and the general public. Therefore, stakeholder and user group engagement is embedded in every step of the CMSP process, and their input will help to build the socioeconomic knowledge base and understanding of societal values. These efforts will benefit from the integration of social and natural sciences, including the development of tools to evaluate and communicate the full range of provisioning, supporting, regulating, and cultural ecosystem services, and the trade-offs in services associated with different decisions (*16*–*18*).

Making the Vision a Reality

Achieving the comprehensive vision of the proposed NOP will challenge federal agencies with ocean-related mandates to better coordinate their activities and to engage more effectively with partners and stakeholders. A proposed National Ocean Council, co-chaired by the Council for Environmental Quality and the Office of Science and Technology Policy and composed of senior administration officials from 24 departments and agencies, would spearhead the development of initial plans, structures, and dispute-resolution mechanisms. The vision outlined by the Interagency Ocean Policy Task Force would unfold in a series of specific implementation plans for the task force's nine priority objectives (*10*).

This framework embodies flexible, adaptive management, where new knowledge continually informs and improves management and policy decisions. In addition, the acknowledgment that sustainable land practices benefit coastal and oceanic water quality emphasizes the links between land and sea. Finally, the objectives identify the need to protect and restore ecosystems through sustainable management in order to build resilience to climate change and ocean acidification.

A charge to enact a NOP could not be more timely, as the country tackles the challenges of dealing with the unprecedented dimensions of the BP oil spill in the Gulf. The large scale of the impacts and the diversity of sectors affected emphasize the need for a more holistic, integrated approach to ocean management, one that acknowledges the interconnectedness of human and natural systems. Oil spill responses benefit from the planning, thought, and assessment that occur before the event. Under the proposed CMSP framework (*9*), regional plans would enhance preparedness, consider risks posed by all ocean uses, and inform the implementation of a comprehensive national energy policy.

The vision of the proposed National Ocean Policy priority objectives will be achieved through enhanced coordination and integration across the federal government and its local, state, tribal, and regional partners. Although this policy applies specifically to the waters of the United States, given the interconnectedness of the global ocean, it is a vision that our nation will pursue in its relationships and deliberations with international partners.

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