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Navigating U.S. Fishery Management into the 21st Century

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Introduction

In 1969, the Stratton Commission recommended the creation of the National Oceanic and Atmospheric Administration (NOAA) and laid the groundwork for the 1976 Fishery Conservation and Management Act (FCMA). Thirty-four years later, U.S. ocean policy is again subject to a systematic, broad-scale assessment. In 2003, the Pew Oceans Commission (POC) released its review of the status of living marine resources, and in 2004 the U.S. Commission on Ocean Policy (USCOP) released its preliminary report assessing both living and nonliving marine resources and a full array of ocean and coastal uses.

The two reports agree on the current degraded state of marine ecosystems and its causes, including overfishing, overcapacity, habitat destruction, and land-based pollution. They detail the causes of fishery problems, recommending many changes for the way fisheries are managed. Both reports agree on a number of important fishery management needs: end the race for fish, take an ecosystem-based approach to marine resource management, advocate a regional approach with strong central oversight, support strengthening the role of science in management decisions, and separate “conservation” decisions (how much fish can be taken) from “allocation” decisions (who can take).

Despite the similar assessment of needed change, the reports differ substantially in the approaches to implementing change. These differences reflect fundamental philosophical approaches to the operational nature of fishery governance and the achievement of sustainable resource use. The Pew Commission is philosophically aligned with Aldo Leopold, who once said, “a thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community.” The U.S. Commission takes a more pragmatic approach and recognizes that public input, which includes many diverse views, is an important element in implementing ocean policy.

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This article highlights key recommendations and differences between the two reports, with a focus on sustainable fisheries management. Before we discuss the reports, however, it is instructive to look at the path to the current fishery “crisis.” We conclude with our own set of recommendations and highlight issues that we feel need to be addressed immediately and those that can wait. It is important to point out that no one reading the two commission reports can fail to appreciate and respect the work of the commissioners.

The Current State of U.S. Fisheries

In the late 1960s, the problem facing U.S. fisheries was how to rehabilitate the domestic fishing industry and promote expansion. The U.S. fleet was in disrepair and could not compete successfully in world seafood markets. Seafood imports were increasing and excessive levels of foreign fishing off both coasts created public concern. There was a national consensus on the urgent need to renovate and expand American fisheries. The 1969 Stratton Commission reinforced this view.

Passage of the FCMA in 1976 reflected public support for foreign exclusion and domestic expansion. By moving boundaries beyond the former 12-mile limits out to 200 miles, the U.S. effectively encompassed vast fisheries that are found along the narrow continental shelf and upwelling areas. But the FCMA did little to resolve the problem of open-access fishing by domestic fleets. In the 27 years since FCMA implementation, American fisheries have been characterized by a race for fish, an over-investment in fishing capital, and shortened seasons.

By the 1990s, pressures for change were increasing. The 1996 Sustainable Fisheries Act (SFA)—heralded by President Clinton and Republican and Democratic senators—sent a powerful signal of the public’s desire for sustainable fisheries. It added several important strictures to federal fishery management: eliminate over-fishing, rebuild overfished stocks, minimize bycatch (incidental take of nontarget species), document and protect essential fish habitat, and account for the effects of regulations on fishing communities.

The implementation of the SFA has proved harder than anticipated. Its objectives are vague and in many cases immeasurable given the current level of scientific and socioeconomic information. The SFA also did little to address the fundamental economic problems that continue to plague fisheries. Looking back over the 27-year history of federal fishery management, one might be tempted to conclude that it has not worked. But we must look at where we might be without the FCMA. Even with some highly visible management failures, the overall trend has been toward sustainable management using scientific methods to assess stocks and set targeted harvests.

Although science has an increasingly prominent role in management, we can significantly improve its use. Many scientists argue that precautionary measures proposed to accommodate uncertainty often succumb to short-run economic considerations in regional fishery management council (RFMC) decisions. To a limited extent, this blame is appropriately placed. But these pressures are only symptoms of the underlying economic problem. Economically depressed fisheries are vulnerable to short-term thinking and risk-taking, and people cannot afford to invest in long-term sustainability.

Where does this leave us? In many fisheries, stocks are overfished, habitats are degraded, fishermen are scraping by from one season to the next, and the public is receiving very little return from its marine assets. We look now at how the two commissions recommend resolving this predicament.

Pew Oceans Commission Report

The POC was funded by Pew Charitable Trusts to undertake a comprehensive review of U.S. ocean management with particular attention to marine life and ecosystems. The eighteen-member commission spent two and a half years analyzing the current state of marine ecosystems and management structures and released a set of recommendations in June 2003 (available at www.pewoceans.org).

These recommendations are divided into four main categories: governance, sustainable fisheries, coastal development and planning, and water pollution. Our focus will be on governance and sustainability, with an emphasis on sustainable fisheries.

Ocean Governance

The Pew Commissioners developed two premises. First, the results of the last 27 years of management and the difficulties in meeting the SFA requirements signal that fisheries are mismanaged. Second, it is impossible for the government to develop a coherent ocean policy when there are currently approximately 140 laws and a dozen agencies and departments having jurisdiction over some aspect of marine ecosystems. These led to the conclusion that the redesign of management priorities and the consolidation of ocean policy are needed.

To achieve both goals, they recommend a National Oceans Policy Act (NOPA). NOPA would create an Oceans agency that would subsume NOAA and all of its sub-components, marine mammal programs of the U.S. Fish and Wildlife service, the ocean minerals program of the Department of Interior, coastal and marine programs of the Environmental Protection Agency, aquaculture programs of the U.S. Department of Agriculture, and coastal protection programs of the U.S. Army Corps of Engineers. NOPA would also establish a permanent National Oceans Council within the Executive Office of the President, with the head of the new agency serving as chair of the new Council.

Under NOPA, healthy marine ecosystems are the top priority of ocean management and any action will not be permitted “until it is demonstrated that the action, individually or in combination with other actions, will not significantly harm a marine ecosystem or impede its restoration.” NOPA would also *mandate* the creation of a network of marine reserves, closed to all extractive uses, throughout the seascape.¹ The authority to block actions and create marine reserves would rest with Congress and the head of the Oceans Agency.

NOPA would also legislate the creation of regional ecosystem councils to develop and implement ecosystem and zonal plans. These plans would encompass oil and gas exploration, offshore wind farms, aquaculture, and commercial and recreational fishing and would need to meet the approval of the Oceans Agency. Because of concern with “overrepresentation” of industry and recreational fishing interests on RFMCs, the Pew commissioners strongly recommend that the ecosystem councils be democratic and representative of the “broadest possible range of stakeholders.”

¹ Marine reserves are likely to be one of the more practical means of implementing ecosystem approaches to management, as they can provide protection for the habitats and species that reside within their boundaries. See the report by Palumbi, Stephen R. 2002. *Marine Reserves: A Tool for Ecosystem Management and Conservation*. Pew Oceans Commission, Arlington, VA. (available at www.pewoceans.org).

Sustainable Fisheries

Fishery management plans have traditionally focused on harvested species and have been based on single species stock assessments. Under the Pew recommendations, this focus will change such that the plans ensure that ecosystem function and productivity are not adversely affected. Accomplishing this goal would entail setting policies to reduce habitat damage by mobile bottom gear, such as bottom trawling—which the Pew Commission recommends phasing out over time. Plans would also need to account for the incidental catches of marine mammals. Predator-prey relationships need to also be incorporated when setting catch levels to ensure that catches of one species do not affect the sustainability of others. The commissioners also suggest that a statutory goal to eliminate bycatch be set. Current fishery management plans attempt to take these factors into account, but not to the satisfaction of many natural scientists and marine conservationists.

Management Objectives: To ensure that the focus of fishery management plans is ecosystem function and productivity, the POC recommends redefining the objectives of fishery management. The principal objective “should be to protect the long-term health and viability of fisheries by protecting, maintaining, and restoring the health, integrity, productive capacity, and resilience of the marine ecosystems upon which they depend.” The other, socioeconomic objective should be “to conserve and manage fisheries in order to support diversity, flexibility, resilience, and adaptability within the industry and fishing communities.”

Many complain that the SFA is vague when it comes to the weight that should be given to different objectives, such as accounting for the effects of fishery regulations on fishing communities and minimizing bycatch. This has led to numerous lawsuits filed against NMFS by conservation organizations and has left the courts to determine the relative weights in fishery management plans. Pew commissioners recommend that NOPA legislate that the “ecosystem” objective “should *always* take precedence over the socioeconomic objective.” However, the report contains very little guidance on how to measure either objective.

Conservation and Allocation: Currently, the RFMCs make decisions regarding the target total allowable catch (TAC) of a particular species based on recommendations from Scientific and Statistical Committees (SSCs). The councils also decide on the allocation of that catch among competing interests. Some see this process as akin to having the “fox watch the hen house.” NOPA would require that NMFS, with oversight from the regional ecosystem councils to ensure consistency with regional ecosystem plans, make any “conservation” decisions. These decisions would then be subject to peer review.

Some of the RFMCs do not set an explicit cap on catches for a particular fishery; rather they attempt to use controls on fishing effort as an indirect means of controlling the annual take. The New England Council, for example, prefers to limit a vessel’s days at sea to achieve a target biological catch for groundfish. New England fishers prefer this approach because they are free to catch as much as they can within their time limits. Pew commissioners recommend that these types of programs should be evaluated every three years to ensure that they are meeting the regional ecosystem plans.

Fishery Allocation Plans: RFMCs would oversee the allocation process, but fishers would devise allocation plans. Under the Pew plan, a supermajority of the participants is required to approve the initial development of a plan and its implementa-

tion. The fishers do not have a blank slate, however. The Pew Commission mandates the creation of a national policy to guide the development of fishery allocation plans and define the minimum set of plan components. Along with setting precautionary TACs, the components include limiting access and entry, allocating rights, reducing fishing capacity using transitional buyback programs, and scheduling five-year reviews.

The Pew Commission acknowledges that current fishery management fails to address economic incentives and encourages the use of rights-based approaches (called privileges) under some specific conditions. First, “quota should be periodically allocated using a combination of catch history, bids in the form of offered royalty payments on catch, and conservation commitments offered by the bidder.” Second, the “quota should be allocated across different groups before being auctioned, and trades should not be allowed across groups (such as new entrants, small, medium and large vessels).” We note, however, that restrictions on trading reduce the efficiency gains in terms of cost reduction and elimination of excess capacity. Whether society has similar concerns about family-owned fishing operations is unclear, as is whether such a social engineering policy is best implemented through restrictions on trading. Third, royalty payments should be used initially for buybacks and community economic development, and only then for cost recovery.

All allocation plans, including rights-based approaches, should be regularly assessed to ensure that the objectives of sustainable fisheries management are met. Programs should be revised if they fail to meet the criteria, and allocation plans should be designed to prevent excessive consolidation and concentration of market power.

Funding Sustainable Fisheries: Royalty payments and fees under the allocation plans will be used to finance permanent conservation-and-management funds. The funds must be spent in the regions where the money is collected and will be overseen by another panel appointed by the Secretary of Commerce.

The U.S. Commission on Ocean Policy Preliminary Report

The USCOP was established by the Oceans Act of 2000 (P.L. 106-256). Their charge was to establish findings and develop recommendations for a new, comprehensive ocean policy.

The sixteen-member commission received testimony from a wide variety of interests from around the country on the use and stewardship of marine resources, including a twenty-six member Science Advisory Panel. The USCOP released its Preliminary Report in April 2004 and delivered its final report to Congress on September 20 (available at <http://www.oceancommission.gov>). The scope of the report is broader than the Pew report, encompassing nonliving as well as living resources and including the full array of ocean and coastal issues, including fisheries, recreation, energy extraction, biodiversity, water quality, invasive species, natural hazards, human health, technology development, transportation, and national defense. We discuss the USCOP recommendations on ocean governance and fisheries management, focusing on Part II and Chapter 19 of the report.

Ocean Governance

The USCOP bases its recommendations on the premise that to be effective, ocean policy must be grounded in an understanding of ecosystems. Ocean and coastal resources should be managed to reflect the relationship among all ecosystem

components—including humans—and the environments in which they live. Ecosystem-based management must encompass broader than traditional jurisdictional boundaries and must promote learning, adaptation, and innovation. The USCOP advocates implementing such an approach through the establishment of a National Ocean Policy Framework. This framework would have national coordination and leadership, a regional approach, coordinated offshore management, and a strengthened and streamlined federal agency structure.

To improve national coordination and leadership, the U.S. Commissioners recommend the establishment, within the Executive Office of the President, of a National Ocean Council and a Presidential Council of Advisors on Ocean Policy to coordinate and harmonize policies at the highest levels of government. The National Ocean Council would be composed of cabinet secretaries and directors of agencies with ocean and coastal responsibilities and chaired by an assistant to the President. Its role is to provide high-level attention to ocean and coastal issues and leadership in developing ocean policy, coordinating ocean and coastal programs, and helping federal agencies move toward ecosystem-based management. An Office of Ocean Policy should be established to support this effort. The formation of additional committees and processes to improve intersectoral and inter-regional coordination is also recommended.

To address the need for better coordination across jurisdictional boundaries, the USCOP report recommends the *voluntary* formation of regional ocean councils through processes developed by the National Ocean Council. The purpose of the regional ocean councils would be to coordinate state, territorial, tribal, and local governments in developing regional responses to issues. They also recommend the development of coordinated regional ocean information programs and ecosystem assessments.

The USCOP also emphasizes the need to realize the full economic potential of the ocean's resources while fulfilling stewardship responsibilities. They recommend that Congress, working with the national and regional ocean councils and with the active participation of stakeholders, fill in the existing legal, policy, and institutional gaps through the development of an ecosystem-based offshore management system. They also make several recommendations for strengthening existing international fishery agreements to which the U.S. is a party, and for ensuring effective U.S. implementation plans for these agreements. The National Ocean Council would take a leadership role in encouraging other nations to implement and follow such fishery agreements.

The report also recommends reconfiguring NOAA to improve its abilities to meet current mandates and to enable implementation of the national ocean policy. It also recommends a three-phase approach of solidifying NOAA's role as the lead ocean agency, consolidating other agencies' ocean and coastal programs within NOAA, and implementing the ecosystem-based management approach across agencies.

Sustainable Fisheries

While the USCOP finds many attributes of the RFMC system laudable—in particular its emphasis on local participation, the coupling of science and management, and regional flexibility—it also notes several problems and concludes that the performance of fishery management must be improved.

Regional Fishery Management Councils: The USCOP concludes that RFMC membership is often unbalanced among the many fishery interests and that the long-term interests of the public are not best served. They recommend that governors be required to submit diverse slates of candidate council members and that the NOAA Administrator be given the authority and responsibility for appointing council members to ensure that all sides are represented. The report also focuses on the needed skills of council members, recommending that training of new council members be required.

Role of Science: The USCOP recommends strengthening the role of science in fishery management to avoid the tendency to allow short-term economic, social, or political considerations to overwhelm scientific ones involving sustainability and recovery of stocks. To this end, the USCOP focuses on the role of the RFMCs SSCs, asking Congress to require reliance on SSC advice and that SSCs meet more stringent conflict-of-interest requirements. In addition, the USCOP proposes that all scientific information generated by the SSCs be subject to independent scientific review. Congress is also asked to increase support for a cooperative research program that funds collaborative research among scientists and commercial and recreational fishermen. To improve data on recreational fishing, licenses will be required of all saltwater anglers.

Conservation and Allocation: The report proposes that RFMCs be required to rely on SSC determinations of allowable biological catch, and that catch limits be set at or below the allowable level. Deadlines for SSC determination of allowable biological catches should be established, and no fishing should take place until a fishery management plan is reviewed and approved by NMFS.

Race for Fish: The U.S. Commissioners acknowledge that the race for fish is at the root of many of the conservation and economic problems facing U.S. fisheries. In their proposals, Congress would amend the current legislation (Magnuson-Stevens Fishery Conservation and Management Act) to affirm the right of RFMCs to institute dedicated access privileges. The term “dedicated access privileges” rather than “fishing rights” is preferred, because it highlights that fishing is a privilege granted by the government and is vague enough to encompass several different types of access control tools. They recognize that the problem of overcapitalized fleets is a result of the race for fish and, accordingly, would recommend ending government finance programs that encourage overinvestment in fishing capital and implementing capacity reduction programs. Reforms in existing tax-deferred accounts are also recommended.

Enforcement: The Commission makes several recommendations to strengthen and enhance the cooperative fishery enforcement conducted by the NMFS and U.S. Coast Guard in order to improve the ability to conduct ecosystem-based management. They would, among other things, increase funding for joint enforcement, develop cooperative strategic enforcement plans, and require vessel monitoring systems (VMS) for all fishing vessels. VMS data would be incorporated into larger maritime databases.

Ecosystem-based Management: Beyond more integrated regional approaches to management, the report recommends that essential fish habitat designation change from a single to multispecies approach and eventually to an ecosystem-based approach. They also recommend that bycatch be addressed through the development of

regional reduction plans that address ecosystem impacts of bycatch, to all species, not only those that are commercially important. Marine protected areas, including marine reserves, are seen to be most effective when designed in the broader context of regional ecosystem planning and used in conjunction with other management tools.

Comparison of the Reports

The two reports are similar in their assessment of fundamental problems. Both conclude that changes are urgently needed in the approach to managing U.S. ocean resources and that taking an ecosystem-based approach is essential. Both agree that the focal management scale should be regional with strong central oversight. Both also recommend separating “conservation” decisions from “allocation” decisions and the need to end the race for fish. Finally, both emphasize the need for better use of science and social science information and analysis in decisionmaking at all levels.

Despite the similar assessment of problems and needed action, there are some substantial differences in the approaches to implementation. We summarize several key points of difference between the two reports in table 1.

Table 1
Some Differences between the U.S. Commission and Pew Commission Recommendations

	USCOP	POC
Approach to Governance	Strengthen and work with the existing institutional structure.	Focus on replacing existing structures with alternatives.
Role of Regional Fishery Management Councils (RFMCs)	Retain much of the existing character of RFMCs, but introduce a much stronger role for independent science and scientific advisors.	Limit the role of the RFMCs to allocation, with fishing industry participants charged with developing allocation plans under operational guidelines and oversight.
Rights-based Management	Encourage the use of dedicated access privileges to end the race for fish.	Recognize the role of rights-based management, but include restrictions to protect small-scale operations and fishing communities.
Scale and Types of Fishing Operations	Emphasize the role of science in ensuring prudent and sustainable choices, rather than a focus on the “right” scales of operation.	Emphasize a “small boat, small community” focus, for example, requiring a supermajority vote in FMP development and restricting trading.
Marine Reserves	Acknowledge that marine reserves are helpful tools in the larger context of ecosystem management.	Emphasize the role of marine reserves beyond achieving sustainable fishery management and mandate the creation of a network of marine reserves.
Role of Technology	Emphasize the potential for new technology to enhance data collection, monitoring, and enforcement in fisheries, such as vessel monitoring systems.	Emphasize the need for better enforcement and monitoring, but do not discuss the use of technology for fishery management.

Our Recommendations

Building on the two reports, we develop a set of short-term and long-term steps that Congress and agencies can take to promote sustainable change in fisheries management. We emphasize the need in the short term to address the difficult underlying incentive problems and to put in place hard caps on allowable catches for all major fish stocks. In the long term, the need is to move management toward improving the health of marine ecosystems and sustainable fisheries and to monitor and evaluate the extent to which these are being achieved.

Unlike the two reports, we do not focus on particular organizational reshuffling or statutory change. We agree that there is a need for streamlining the process, consolidating marine governance, and clarifying the goals of fishery management. We do not agree, however, that these are the most pressing issues that need to be addressed, at least not in the short term. Further, we believe that too much emphasis on restructuring in the short run is likely to delay getting many reforms in place—reforms that can be accomplished under the current institutional structure with increased central oversight. More delays will also prolong current trends.

Overall, we believe that all fishery management plans need to explicitly address incentives that would ensure better resource stewardship. This could entail developing approaches to pair responsibilities with rights through contracting and to broaden the application of incentive-based tools such as individual fishing quotas. Research should also be conducted to develop other mechanisms to strengthen accountability among fishery participants.

In many cases, the funds required to implement our recommendations should come from the users of the marine environment (oil/gas leases, commercial and recreational fishing licenses, etc.). When rights to harvest the fish are allocated, those holding the rights should be required to contribute to the cost of management, including monitoring and enforcement, stock assessment research, and data collection programs. Retraining programs for displaced fishers or other social programs for fishing communities should be financed by other government funds.

Table 2 summarizes our list of short-term recommendations. In some cases, we take stronger positions than both commissions, for example, in the setting of harvest controls. In other cases, we do not go as far as one or both of the commissions. For example, we do not put *ex ante* restrictions on the development and design of rights-based management approaches, as is done in the Pew report. Finally, we acknowledge that our recommendations are not subject to some of the other constraints placed on the commissioners and are subject to some of the same critiques we highlighted with respect to the reports.

Implementing these immediate changes will keep the current crisis from getting worse and provide a foundation from which to begin serious and needed reforms. We focus our discussion of needed longer-term reforms on changing the management scope and scale.

Any new, long-run plan should, in our opinion, significantly increase investment in marine natural *and* social science research and data acquisition. NOAA estimates that 95% of the ocean area is unexplored. We also have little social science data on fisheries. These data could be used to develop regulatory approaches that restore economic health to fisheries and provide a greater integration of social, biological, and physical science for ecosystem-based management.²

² See the report by Anderson, L.G., R. Bishop, M. Davidson, S. Hanna, M. Holliday, J. Kildow, D. Liverman, B. J. McCay, E.L. Miles, R. Pielke, Jr., and R. Pulwarty. 2003. *Social Science Research Within NOAA: Review And Recommendations*. Final Report of the Social Science Review Panel to the NOAA Science Advisory Board. Washington, DC: 18 March.

Table 2
Our Recommendations on the Immediate Changes Needed to Benefit U.S. Fisheries

	Our Recommendations	Comments
Harvest Controls	Require total allowable catch limits be set for all major fish stocks by 2006. Ecological and socioeconomic rebuilding plans decided upon and implemented by 2006.	Need to explicitly factor in ecosystem effects, including bycatch, when setting the limits. When there is a lack of information to calculate these factors, NMFS should set a minimum percentage that single species limits—to be set based on biological assessments—need to be adjusted. Plans should explicitly address economic as well as ecological rebuilding.
Conservation and Allocation	Separate these decisions.	Grant NMFS authority to determine the catch limits with oversight from an outside scientific peer-review panel. Regional councils focus on allocation issues with oversight to ensure protection of essential habitat.
Harvest Rights	Develop access controls for all fishery uses, including recreational.	NMFS economists should assess the potential for tradable individual fishing quotas in all fisheries. Where not appropriate, modify existing regulations to change the incentives toward long-term stability in operations.
Fishing Capacity	Pursue aggressively opportunities to reduce capacity in fisheries.	Consider tradable permit systems as market-based approaches to capacity reduction. Supplement with transitional vessel buyback programs, when needed, to dampen the short-term economic effects of these programs.
Information and Data	Require accountability to scientific advice in RFMCs settings. Require fishers to provide adequate, reliable information on fishing activities.	Supplement SSC peer review of natural and social science information and analysis used in fishery management plans with additional independent peer review. ¹ Amend the Magnuson-Stevens FMCA to allow collection of economic data with guarantees of confidentiality. Allocate funds for training RFMC members.
Technology	Assess the potential use of electronic logbooks and vessel monitoring systems.	Create a fund supported by users of the marine environment to improve data collection methods, such as covering the costs of deploying new data reporting technologies to the fishing fleets.
Evaluation	Assess and evaluate regularly the biological, ecological, and socioeconomic performance of fishery management plans.	Expand the current Stock Assessment and Fishery Evaluation documents to address ecosystem and human system effects.

¹ To be clear, we are not advocating that every fishery management plan be initially subject to additional peer review, as this would be a costly process, but rather that the methods and data collection be standardized across fisheries to ensure that the best available natural and social science information is used.

We must also prepare for the future of fishery management by developing new programs and strengthening current ones, such as Sea Grant, to train decisionmakers and to educate future fishery scientists.

Management Scope and Scale

Adopting an Ecosystem Management Approach: Recent proposed legislation in the 107th and 108th Congresses, along with both reports, emphasized the need to design ecosystem-based management plans. However, from an operational standpoint many of the hard questions remain, such as what a “true” ecosystem management plan entails. In addition, ecosystem-based management will involve difficult trade offs, and there is likely not to be one “right” plan.

We recommend that NOAA in consultation with other agencies, the RFMCs, and a scientific advisory committee develop operational guidelines for implementing ecosystem-based management. These would include measuring ecosystem processes and functions, implementing precautionary buffers, and incorporating economic values. In addition, resolving tradeoffs needs to be done in an open, fair, and democratic process rather than mandating and constraining the political process *ex ante* (or leaving it for the courts to decide).

Incorporating Spatial Information: New scientific research is finding that the marine environment is patchy with population abundances varying across space. Because fisheries have been historically managed under the concept of relative uniformity, this shift in understanding may result in a more zonal approach. This would entail a change in focus in fishery management from managing stocks to managing zones, requiring the support of additional research. For example, very little information is available on what biological, legal, and economic criteria should be used to determine the scale and scope of the zones. VMS technology will be an important source of data that can help inform the development of zonal management.

Incorporating Non-use Values: Policymakers should also consider allocating areas of the ocean for marine biodiversity conservation that are limited in their uses, such as marine reserves. Allocations to the public should be made simultaneously with the allocation of the catch to the individual fishers. Combining the two processes would lessen any economic transition effects due to closing areas to fishing and might increase the probability of buy-in from the fishing industry.

Taking a Multiple Sector Approach: We often equate fishery policy and the fishing industry with those who catch the fish. The industries and economic sectors of a fishery are much broader in scope than fishers. Just as there are potential benefits from taking an ecosystem approach, there are potentially economies of scope in incorporating and considering seafood markets, fishing community economies, aquaculture, and other marine sectors directly into fishery management plans. We also encourage stronger user group participation in cooperative management and experimental approaches to management.

Discussion

The existence of these two commissions is a signal that the U.S. is on the cusp of a revolution in managing marine resources. These resources do not need to be threatened, fishing companies and the communities they support do not have to go the way of old-growth logging towns, and future generations can enjoy the bounty of the oceans much as we do today. Reversing the current trends, however, will not be easy—many will not get what they want.