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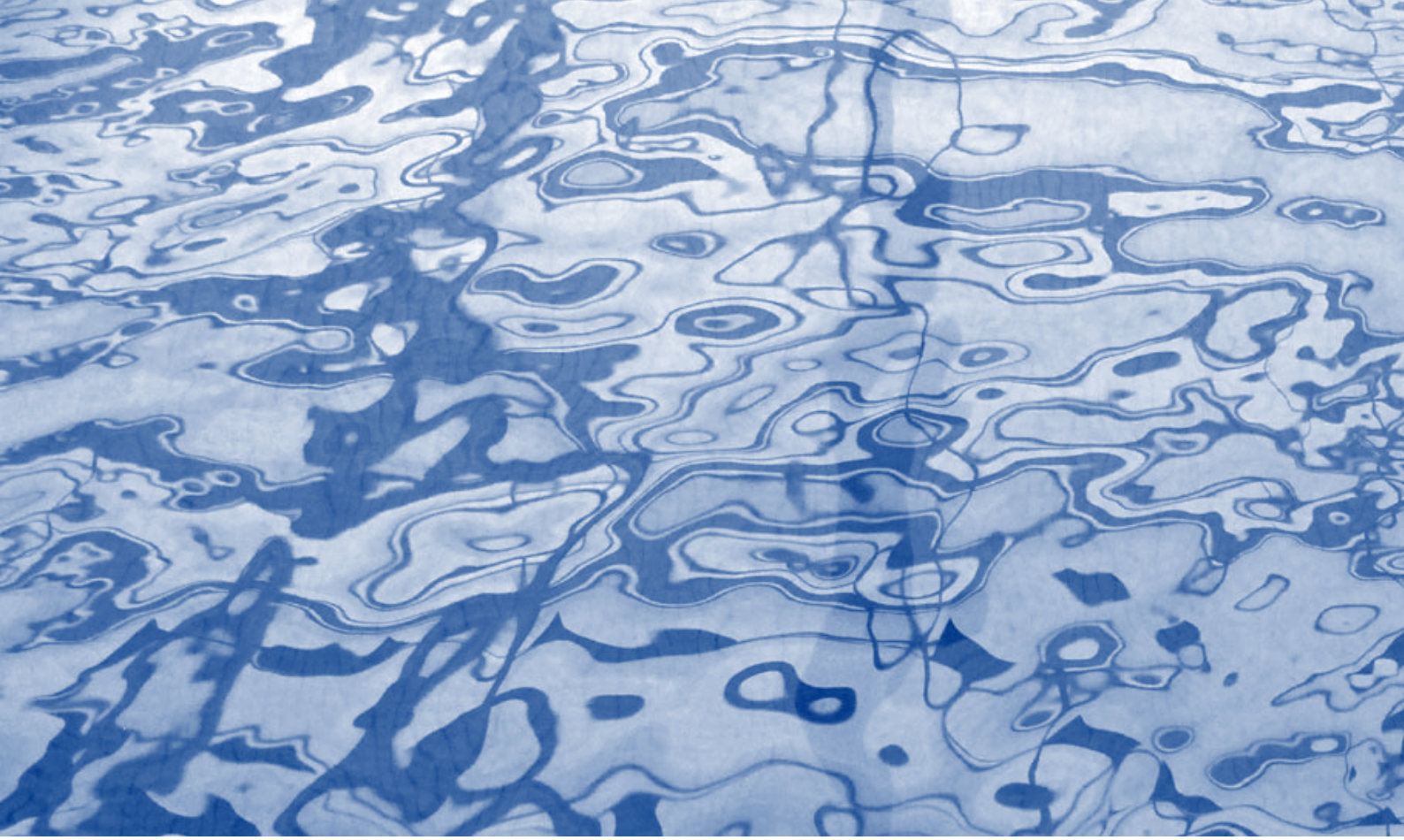

Marine area management in sustainable allocation

Another look at an old favorite: review of the marine area management tool in the sustainable allocation of U.S. Fisheries resources

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Abstract

The marine realm is a dynamic and unpredictable environment with temporal and spatial variability in the supply of, and competition for, limited resources. Resource management is further complicated by the multiple levels of authorities responsible for governing and allocating natural marine resources. In this sense, the U.S. coastal and marine resource management system is not unlike its global counterparts, which are also composed of multiple jurisdictional layers representing a range of interests. In light of the inherent complexity of these natural systems and the complexity of the system under which they are managed, sustainable use of our fishery resources and preservation of important natural resources require innovation, cooperation, and the use of creative tools.

As the lead agency for U.S. marine fisheries management, the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) is responsible for coordinating the allocation of fishery resources and promoting the stewardship of living marine resources and their habitats. NMFS has developed a number of tools to manage and allocate fisheries resources and has worked to refine them over time: one of these tools is place-based management of marine protected areas (MPAs).

This paper articulates the array of issues surrounding the effectiveness and applicability of MPAs in fisheries management. Through an analysis of the national inventory of MPAs under U.S. federal fisheries jurisdiction, and a review of jurisdictional parameters and relevant legislation, recommendations are made to begin to address the question, How can NMFS improve the MPA tool for fisheries management and resource allocation while continuing to fulfill its legislative mandates?

Introduction

Historically, great difficulties have confronted those who pursue a livelihood through the harvest of natural resources and the managers who seek to both sustain the resource and ensure that source stocks are maintained at economically viable levels. The complexity of managing natural resources and achieving sustainability is exacerbated in cases involving highly mobile species, such as fish and sea turtles. Further complications stem from the multiple levels of authorities and jurisdictions responsible for governing and allocating these resources.

Jurisdiction

The U.S. fishery management system is composed of NMFS headquarters and six regional offices, each with an associated science center that collaborates with its respective regional office. NMFS carries out its responsibilities under numerous laws, treaties, international conventions, and agreements. Among the key authorities for managing fisheries is the Magnuson Fishery Conservation and Management Act of 1976, which was renamed the Magnuson-Stevens Fishery Conservation and Management Act when amended on October 11, 1996. The Magnuson-Stevens Act gave NMFS the authority to manage marine species within the federal waters of the U.S. exclusive economic zone (EEZ), which ranges between three and 200 miles offshore and accounts for approximately 3.36 million square nautical miles (11.5 million sq km) of coastal and ocean waters.

The Magnuson-Stevens Act also created eight Regional Fishery Management Councils to manage the living marine resources within each area. Council membership is a balance of commercial and recreational fishermen, marine scientists, and state and federal fisheries managers. In addition, three interstate Marine Fisheries Management Commissions (Atlantic, Gulf of Mexico, and Pacific) address multi-state fisheries primarily in non-federal waters. An additional interstate aquatic fishery commission covers the Great

Lakes region. Each commission is composed of resource managers, legislators, and private citizens who represent the coastal states of that region and assist in managing and conserving their shared coastal fishery resources. Through various longstanding natural resource treaties and agreements, Native American tribes are granted governance over resources in their care.

Each coastal and Great Lakes state maintains a department to manage the fisheries within state jurisdiction (out to three nautical miles for most coastal states, three marine leagues for the Gulf States, and the whole of the Great Lakes for those bordering states). When targeted species are primarily found in state waters, federal harvest is governed under either state or interstate management plans.

Other federal entities, such as the U.S. Department of the Interior's Fish and Wildlife Service (USFWS) and National Park Service (NPS), as well as NOAA's National Marine Sanctuary Program, share jurisdiction with NMFS over some species. For example, jurisdiction over sea turtles is split between NOAA and USFWS according to location: NOAA has jurisdiction over sea turtles in the water and the USFWS has jurisdiction on land (USCOP Final Report 2004).

By design, the U.S. ocean resource management system is complex and allows for the active representation of many interested groups through an open, public, participatory process. However, individual participants working together in the overall structure constitute more than just a group with shared interests—these participants are integral to the strength of the system. Although NMFS may serve a lead role in coordinating these separate entities, Congress and the states, through the enactment of various laws, have ensured that each group is a part of the development of laws, regulations, and the overall management and allocation of resources. For example, the National Environmental Policy Act (NEPA) of 1969 is our national charter for environmental protection. According to NEPA section 101(a) … it is the continuing policy of the Federal Government, in cooperation with state and local governments, and other concerned public and private organizations, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans.

Tools

The Magnuson-Stevens Act requires science-based, sustainable management of fishery resources while minimizing bycatch and habitat impacts. Magnuson-Stevens also calls for attention to impacts on fishing communities and

encourages safety at sea. In striving to meet these goals, a suite of management tools has been developed (Table 1).

Table 1. Fishery management tools currently used by NMFS

Tool	Strategy
Output controls	Quotas/trip/days-at-sea limits
Input controls	Size limits/ limited entry
Technical controls	Gear restrictions/vessel regulations
Marine area management	Limitations on access/activities
Closed areas	No take/access areas

Definition

Where conventional means of regulating fishing, such as those shown in Table 1, are impractical, unenforceable, too costly, or not supported by available science, spatial management measures could become the primary management tool (NRC 2001). These types of management measures have also been used to protect spawning in nursery areas and reduce fishery conflicts.

Area-based management measures can be defined in many ways. A plethora of terminology has been used to describe degrees of resource protection and management parameters placed on geographically distinct areas. This jargon can be confusing, and requires explicit definition for the purposes of this paper and the current body of work in the United States. Under U.S. Presidential Executive Order (E.O. 13158), a marine protected area is defined as: "any area of the marine environment that has been reserved by federal, state, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources within them" (Federal Register Notice Vol. 65, No. 105, 2000). This definition includes key words (underlined) that required further clarification (e.g., "lasting"), thus leaving open the question of whether seasonal fishing closures are MPAs.

In an effort to better understand the MPA tool and the ways it is used in U.S. waters, an interagency team, with representatives from NOAA and other federal agencies, determined that using a more general term—marine managed area (MMA)—would incorporate a broader spectrum of management areas beyond the more traditional MPA closures. Through a public process, key words in the MPA definition were defined to create a more clear definition of what constitutes an MMA (Table 2).

Table 2. MMA criteria and definitions.

Criteria	Definition
Area	Must have boundaries
Marine	Includes intertidal and Great Lakes areas
Reserved	Established through legislation/regulations
Duration	Must provide the same protection, for any duration within a year, for at least two consecutive years
Protection	Greater within boundaries; can be for single species
Cultural	Submerged cultural resources

In general, MMAs established for fishery management purposes in the United States permit multiple uses, restricting only specific gear types during certain months of the year. By comparison, the World Conservation Union (IUCN) definition for an MPA, which is commonly used throughout the world, is broken into six general categories of protected area management and applies to both terrestrial and marine protected areas (Table 3). NMFS MMAs are comparable to the IUCN definition of a category VI MPA—Managed Resource Protected Area (IUCN 1994)

Table 3. IUCN categories for protected areas.

I. Strict nature reserve or wilderness area	Primarily for scientific research or environmental monitoring. Protected and managed to preserve its unmodified condition.
II. National park	Protected and managed to preserve its natural condition.
III. Natural monument	Protected and managed to preserve its natural or cultural features.
IV. Habitat/species management area	Managed primarily, including (if necessary) through active intervention, to ensure the maintenance of habitats or to meet the requirements of specific species.
V. Protected landscape/ seascape	Managed to safeguard the integrity of the traditional interactions between people and nature.
VI. Managed resource protected area	Managed to ensure long-term protection and maintenance of biological diversity with a sustainable flow of natural products and services to meet community needs.

Authorities and Mandates

In addition to the Magnuson-Stevens Act, U.S. fisheries management responsibilities are guided by other Congressional directives, including the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA), Endangered Species Act (ESA), and Marine Mammal Protection Act (MMPA). All marine managed areas established by NMFS have been put in place though federal regulations in accordance with one or more of these authorizing statutes. The promulgation of regulations under a combination of authorities allows NMFS to promote fisheries sustainability, protect endangered species and habitats, and maintain protected marine mammal populations.

Under the Magnuson-Stevens Act, each U.S. fishery must have a fishery management plan (FMP) that is developed by the appropriate regional council(s) and implemented by NMFS. Regulations implementing FMPs may include area-based management measures designed to identify essential fish habitat (EFH), prevent overfishing or habitat destruction, protect spawning aggregations or juvenile nursery habitat, rebuild stocks, and reduce conflicts between fishing gear types.

The Atlantic Coastal Fisheries Cooperative Management Act, as amended in 1996 (ACFCMA, 16 U.S.C. 5101 et seq.), was enacted to support and encourage the development, implementation, and enforcement of the Atlantic Commission's Interstate Fisheries Management Plans (ISFMP) to conserve and manage Atlantic coastal fishery resources. No similar law exists for the other interstate fisheries commissions. The ACFCMA requires that Atlantic coastal states comply with the ISFMPs, which address the coordinated management of coastal migratory or "straddling" fisheries along the U.S. Atlantic coast. A joint effort of NOAA, USFWS, and the Commission, ISMFPs provide the evidence and articulate a rationale for using a particular fishery management tool to protect the target species; in some cases, the tool used is a protected area. For example, the Carl N. Shuster Jr. Horseshoe Crab Reserve was established in 2001 under authority of the ACFCMA to protect the Delaware Bay population of the Atlantic coast horseshoe crab stock (Federal Register Vol. 66 No. 8906, 2001). The issue of insufficient stock size to maintain ecosystem services or functions and the greater goal to promote stock recovery to improve allocation numbers reflect issues found in other fisheries, and offer another mechanism through which MMAs are established.

The Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531-1544) provides for the protection of species determined to be at risk of extinction and allows for the designation of "critical habitat" as a means to help promote recovery of those species. Federal actions and actions involving a federal nexus (e.g., federal permits or funding) that could affect protected species or their designated critical habitat must be evaluated. Critical habitat may be protected through regulations directly under ESA or through regulations articulated in specific FMPs under the Magnuson-Stevens Act or through the MMPA, if applicable. For example, when critical habitat was designated under the ESA to protect listed Steller sea lions off the northwest coast of Alaska, the Magnuson-Stevens Act was used to set the regulations that direct fishing activities within the critical habitat.

Marine managed areas can also be established under the MMPA. The MMPA was established in 1972 to prohibit take of marine mammals in U.S. waters and by U.S. citizens on the high seas (16 U.S.C. 1361–1407) and was amended substantially in 1994 (to allow certain exceptions to the 1972 take prohibitions and to establish a program to authorize and control the

taking of marine mammals incidental to commercial fishing operations). The reauthorization also called for the preparation of stock assessments for all marine mammal stocks in waters under U.S. jurisdiction and take reduction plans (TRPs) to assist in the recovery or prevent the depletion of strategic marine mammal stocks that interact with fisheries. Take reduction teams established to develop these plans consist of a balance of representatives from the fishing industry, councils, state and federal resource management agencies, the scientific community, and conservation organizations. For example, the Massachusetts Bay Closure Area was established under the authority of the MMPA as part of the Harbor Porpoise TRP for the purpose of reducing the incidental take of harbor porpoises in the commercial groundfish sink gillnet fishery.

Although this section has described several congressionally mandated authorities allowing for the establishment of marine area protection, it is important to note that other parts of these same mandates can limit their use or create implementation challenges. For example, among other regulations, National Standard 8 of the Magnuson-Stevens Act requires that, to the extent practicable, conservation and management measures take into account the importance of fishery resources to fishing communities. There has been considerable litigation over the application of this standard relative to other parts of the act. Similar discord has been observed in implementation of the other statutes. As management challenges increase in response to increasing demands on our natural marine resources, we will need to further refine and coordinate the tools we use to manage our ocean resources. Recognizing this need, in 2000 President Clinton signed Executive Order 13158, which mobilized federal efforts toward improving our understanding of marine protected area management.

Methods

Executive Order 13158 called for the establishment of an interagency Marine Protected Area Center to develop a framework for a national system of MPAs and seek expert advice by convening an MPA Federal Advisory Committee. In addition, it requires the Secretaries of Commerce and the Interior to jointly manage a public information website and "publish and maintain a list of MPAs that meet the definition of MPA for the purposes of this order." The precursor to this list is the MMA Inventory, the initial pool of sites from which the list of MPAs will be developed. NOAA published proposed MMA Inventory criteria on July 23, 2003 (Federal Register doc. 00-13830, 5/26/2000), the criteria were vetted through a public process, and final criteria were released in January 2005 (shown in Table 1).

The MMA Inventory is supported by a searchable database that describes each site. Sites added to the inventory are characterized by approximately 50 attributes encompassing biological, physical, and legal factors. Biological characteristics include names of protected species within the site and the ecological function of the site. Physical characteristics include information on special geologic features, size of the site, geographical boundaries, and whether the site overlaps or is adjacent to other sites. Legal characteristics include the authorities that established the site, the agencies with management authority over it, and the regulations being implemented to manage it.

Collection and synthesis of these data allow analysis, on a national scale, of trends such as the type of sites being established, the level of protection afforded, the duration of protection, and relative sizes of the sites. Development of the inventory and subsequent analysis of the data collected are the first steps toward establishing a baseline of information that will serve to aid in the pursuit of improved resource responsibility through ecosystem area–based management strategies.

The next phase in the development of the database is to work with the U.S. fisheries management system to add to the inventory and ensure that all

appropriate managed areas are integrated into the database. This involves soliciting comments from NMFS Regional Offices and the councils for further verification of existing data on newly formed MMAs for consideration. Finally, an additional list of sites will be generated to capture all of the area based management efforts that do not meet the official criteria for an MMA but that must be accounted for if we are to understand the full extent of our efforts.

Results

A total of 87 sites under NMFS jurisdiction met the definition of an MMA and were found to vary substantially in how they were implemented. Most notably, the data indicate that the number of established MMAs has risen steadily over time, from an average of two per year during 1983–1989, to an average of 3.14 per year over the next seven year time period (1990–1996), and 6.43 per year during 1997–2003. More than half (62 percent) of the current MMAs under NMFS jurisdiction were established in the past eight years.

Looking across all years, NMFS MMAs show variation in the extent of protections for the targeted resource, the authority used to establish the area, the degree of integration with neighboring sites or a larger system, the duration of protections, and overall size. With respect to resources targeted for protection, the majority of sites (41 percent) include management measures designed specifically to preserve fishery stocks or fish assemblages. A similar number of sites (42 percent) were established to promote the recovery of threatened or endangered species. A smaller percentage of the sites include specific measures to protect benthic habitats (16 percent).

Because many of the sites were established to promote healthy fish stocks or multi-species fish assemblages, it follows that most of the sites were established under the Magnuson-Stevens Act (48); the majority of the remaining sites were established under the MMPA (24). A smaller number of sites were established under joint authority of the Magnuson-Stevens Act and the ESA (11) or under joint authority of MSA and another statute (3). Although each MMA was established for a specific purpose (e.g., habitat protection, fish stock protection, or protected species conservation), 16 percent of the sites were established under more than one statute and have multiple, complementary management objectives. In addition, 90 percent of sites were designed and are managed as part of a larger network and thus may confer protections beyond those attributable to an individual site. For example, nine of the MMAs in the North Atlantic region are part of a Harbor

Porpoise Take Reduction Plan network that consists of a series of seasonal gillnet fishery closures designed to reduce incidental capture of harbor porpoises.

The data indicate that NMFS implements far more year-round management measures (66 percent of MMAs) than seasonal ones. Among the remaining sites, protective measures are in place for 4 to 9 months of the year for 16 percent of the sites, and for 3 months or less for 17 percent of the sites. This may reflect an effort to improve enforceability of associated prohibitions because compliance typically increases with simplicity of regulations and user group understanding of site purpose (NRC 2001).

The knowledge necessary to critique the effectiveness of established areas is limited by the parameters in place to evaluate them. Analysis of the inventory database revealed that only two percent of the existing sites have adequate baseline monitoring data to perform detailed inside–outside comparison studies. This prevents a thorough analysis of how well most sites are meeting their management objectives and prevents the development of comprehensive progress reports for stakeholders. However, the data also indicate that 64 percent of the established MMAs have some associated documentation that could assist in a preliminary evaluation of how well a site is meeting its management objectives. The discrepancy here may be due to the interpretation of the Magnuson-Stevens Act mandate requiring incorporation of rebuilding data into FMPs, which is often considered sufficient evaluation documentation by regional MMA Inventory consultants.

Examination of these various site characteristics also indicates that the majority of the larger MMAs (tens of thousands of square kilometers) are protected on a year-round basis, whereas the smaller MMAs (less than 100 square kilometers) typically have shorter-term, seasonal restrictions with regulatory protections in place for three months or less.

Discussion

Although spatial management tools have been used to control access to resources for centuries (Cushing 1988), they have not played a central role in fisheries management until recently. NMFS has employed MMAs as a fisheries management tool since the early 1980s, with an early site (the Lobster Closed Areas) established in 1983 off the Hawaiian Islands. This increase may be in response to the national call for ecosystem approaches to management. Simultaneous enhancements in the understanding of the tool's utility and improvements in perception and subsequent acceptance of the MPA tool by some user groups (New England Fishery Management Council Policy Statement, 2005) may also attribute to this change. Nonetheless, from this review it is clear that, although we have come a long way in implementing this fishery management tool, our understanding of it remains limited.

Monitoring to determine effects and performance is paramount to the analysis of any management tool (Rudd 2002), yet monitoring mechanisms are conspicuously absent in many NMFS sites. This area is in need of attention and suggests that revisiting goals and objectives determined at the outset may help strengthen the U.S. area-based management program as a whole. Aggressive monitoring and evaluation programs will also help make the link between improvements, if any, in resource allocation and the use of MMAs. With an increase in understanding we can begin to determine which allocation scenarios are more suitable for this management tool and target efforts toward specific purposes. For example, when shrinking stock sizes are coupled with rising ecosystem demands (where marine mammals compete for resources), are MMAs the preferred tool over fishing quotas or gear restrictions? In this case, clearly set goals and objectives, a solid understanding of the science behind the fishery and the ecosystem needs, and a baseline to examine success are all critical elements in determining the best tool.

Studies have shown that without codified enforcement mechanisms there is little to no real benefit to the targeted marine system (NRC 2001). Evidence has been compiled to this effect in the recent report, Enforcing U.S.

Marine Protected Areas (Davis & Moretti 2005), which describes existing enforcement programs and suggests ways to improve enforcement of U.S. MPAs. The United States should work to incorporate enforcement data into the MMA Inventory profiles of each site in order to begin to address effectiveness of regulations.

It is critical that further analysis be conducted to improve our understanding of socioeconomic implications of proposed management measures such as the establishment of MMAs. Although required under NEPA, the Magnuson-Stevens Act, and other laws, too often the economic repercussions of management actions are an afterthought in the development and implementation of these areas (Haynie 2004).

NMFS' ability to implement marine managed areas remains limited by existing legal authorities, available science and relevant data, and our ability to effectively enforce the regulations put in place. Establishment of these areas is both supported and restricted by our existing authorities. More information on monitoring, enforcement, habitat composition, species recovery, and socioeconomic implications are needed to evaluate the effectiveness of each site and to improve the science for the establishment of future sites. Next steps include expanding the inventory to include such data for all spatially based management measures.

Specifically, we have learned that smaller, more well defined areas that are easier to enforce (i.e., closer to shore and with clear boundaries) with regulatory protections in place on a year-round basis may be more effective in the long run, simply because they are enforceable. Place-based management measures that have clear goals, objectives, targets, and milestones are critical to increasing our understanding of the utility of the tool, and also serve as a baseline for success. Areas designed and developed with the involvement of all constituents and stakeholders throughout the process are more likely to be accepted and less likely to have associated perceptions of inequity in the allocation of resources (Kelleher & Recchia 1998). Likewise, participation in the management process can improve compliance, ensuring that where possible, cooperative agreements with states and local entities are in place. Effective and thorough enforcement will also help regulate compliance. The existing base of information found in analyses such as FMPs and TRPs should be augmented to support development and upkeep of the MMA inventory.

No simple generalizations can be made about the application of place-based management in every region of the United States. The system of well-defined jurisdictional boundaries and complex legal mandates requires the use and constant refinement of multiple fishery management tools. Increasing pressures on U.S. fisheries, coupled with a slow increase in our understanding of fisheries science, both requires and allows for adaptive management and the continued enhancement of management tools. Fisheries management in

the United States has traditionally been managed on a species-by-species basis. Ecosystem-based fishery management is a new direction for fisheries management, essentially reversing the order of management priorities to start with the ecosystem rather than the target species (Pikitch et al. 2004). MMAs are becoming a primary fishery management tool in the move toward ecosystem-based management. As we learn more about each federally managed species—through examination of the science and biology behind the development of analyses such as FMPs and TRPs—we also learn better ways to implement, adapt, and apply this and other fishery management tools.

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