

**SUSTAINING MARINE PROTECTED AREA BENEFITS IN A CHANGING OCEAN:
FINDINGS AND RECOMMENDATIONS**

**FROM THE
MARINE PROTECTED AREAS FEDERAL ADVISORY COMMITTEE
2018 TERM**

Submitted to:

***The Honorable Wilbur L. Ross, Secretary of Commerce
and***

The Honorable Ryan K. Zinke, Secretary of the Interior

Addressing the Committee’s Charge

In January 2018, the Marine Protected Areas Federal Advisory Committee (MPA FAC) was charged by the United States Department of Commerce (DOC) and Department of the Interior (DOI) with identifying benefits of U.S. marine protected areas (MPAs) to marineⁱ ecosystems, economies and communities. The U.S. defines an MPA 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 therein.”ⁱⁱ

**Box 1. BIG SUR COAST IN MONTEREY BAY
NATIONAL MARINE SANCTUARY**



In response, the MPA FAC conducted an extensive investigation that identified significant and far-reaching benefits to U.S. ecosystems, economies, communities and cultures resulting from the creation and long-term implementation of the nation’s MPAs.ⁱⁱⁱ Generally, the MPA FAC has found that our nation’s MPAs: 1) support healthy, productive, and resilient ecosystems; 2) support coastal communities; and 3) connect America’s people to their ocean heritage. (Box 1)

The MPA FAC was also directed by DOC and DOI to identify emerging uses and challenges facing federal, state, territorial and tribal MPAs and to make recommendations for sustaining MPA benefits in the face of those challenges. Chief among these challenges are: growing ocean tourism and recreational uses; expanding industrial and commercial uses; emerging ecosystem impacts of climate change; and recent policy measures to weaken, reduce or eliminate MPAs.

In order to ensure that U.S. MPAs continue to achieve their statutory goals, and to sustain and enhance the benefits they provide in the face of these mounting pressures, the MPA FAC recommends a series of practical actions be undertaken within federal MPA programs administered by the Departments, and supported among non-federal ocean management agencies and partners. These actions are detailed in the final section of this report, entitled “Findings and Recommendations.”

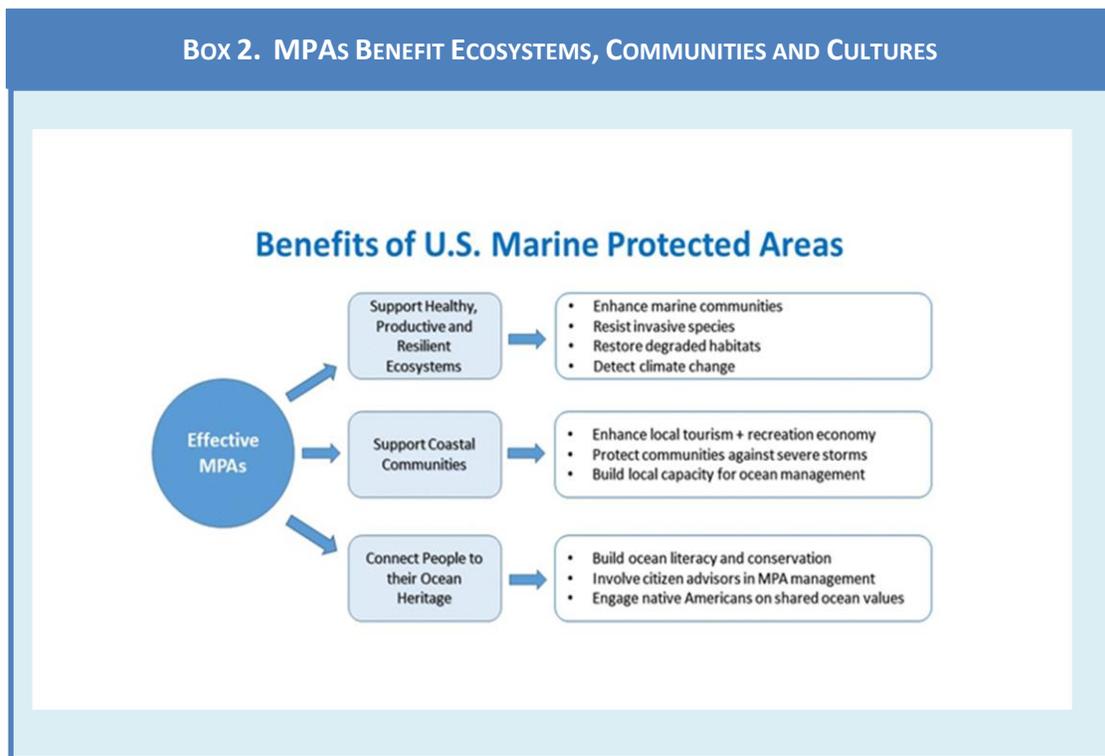
MPAs Create Ecological, Economic and Social Benefits for This and Future Generations

Well-designed MPAs that protect ecologically important species and processes can provide tangible and lasting ecological, economic, community and cultural benefits, both inside and beyond their boundaries. In the section below, we provide examples of three major benefits provided by MPAs in U.S. waters.

BENEFIT #1: MPAs SUPPORT HEALTHY, PRODUCTIVE AND RESILIENT ECOSYSTEMS

MPAs are typically created to conserve ocean places of value to the nation – whether ecological, economic, community and/or cultural. While management approaches may vary depending on the site’s statutory purpose(s), most U.S. MPAs share a similar goal: to sustain the species, habitats, ecological assemblages, ecosystem processes, and cultural resources contained within their boundaries. (Box 2)

BOX 2. MPAs BENEFIT ECOSYSTEMS, COMMUNITIES AND CULTURES



When actively and effectively managed, enforced, monitored and evaluated, the resulting robust MPAs can provide valuable benefits within their boundaries, in surrounding waters, and in nearby coastal communities. Below we provide four illustrative examples of such MPA benefits.

a. MPAs Can Sustain and Enhance Marine Ecological Communities

By reducing impacts of human activities within their boundaries, MPAs support more abundant, larger, longer-lived, and more fecund resident animals, including fish and other important species with limited site fidelity. MPAs can also sustain: a greater diversity of size- and age-classes within populations; more diverse (both taxonomically and functionally) and productive ecological communities; and more robust and resilient ecosystem functions and services within sites.^{iv} Studies from around the world, including some U.S. MPAs (e.g., California and Florida), show positive population-level responses to the protections afforded by MPAs, and encouraging, if limited, evidence of spillover of harvested species into nearby unprotected waters. For example, the ten-year review of MPAs at the Northern Channel Islands, which were established in 2003, found that “average biomass of fish targeted by fishermen, including rockfish, increased both inside and outside of MPAs since the five-year review, but the increase is much greater inside MPAs where fish are protected.”^v Additionally, “California spiny lobster, sea cucumber, and red urchin are more abundant inside [marine] reserves.” Similar success stories have been documented in MPAs off the Florida Keys.

b. Protected Marine Communities Resist Invasion by Exotic Species

By maintaining intact, natural communities and trophic structures, MPAs can help ecological communities resist invasions by harmful exotic species, thereby minimizing adverse impacts on the site's native species and habitats (see endnote iii and references therein). For example, recent studies of kelp forest communities in California demonstrate how robust ecological communities protected inside MPAs prevented invasions by an exotic algae (*Sargassum*), and, thus, avoided catastrophic damage to the kelp forest ecosystems and the valuable ecosystem services they provide. ^{vi}

c. MPAs Support Restoration of Degraded Habitats

Many U.S. MPAs conduct projects to actively restore degraded or otherwise damaged habitats and communities within their boundaries (e.g., coral reefs and other reef structures, salt marshes, sand dunes, tidal and subtidal habitats). Ecological restoration in MPAs helps protect biodiversity, habitat and valued ecosystem services stemming from overuse, accidental damage (e.g. prop scars, large vessel groundings) or catastrophic natural events like hurricanes. Restoration efforts in MPAs are facilitated by the sites' ability to manage access to the restored area, conduct long-term monitoring of its recovery, and take corrective action where needed to accelerate recovery. Some MPAs support broader, ecosystem-scale restoration efforts as well. For example, the Comprehensive Everglades Restoration Plan (CERP) is a multi-agency effort to bring back the "river of grass," by restoring water flows that were profoundly altered by development over the past century. This effort benefits coastal watersheds, aquatic vegetation and wildlife in South Florida and in Florida Bay, a 1,000 square-mile marine protected area and world class sport fishery that depends on these flows. (Box 3)

Box 3. MPAs RESTORE DEGRADED COASTAL HABITATS

Habitat restoration in US MPAs (clockwise): Structural restoration and recovery of a coral reef damaged by ship grounding in Florida Keys National Marine Sanctuary (NMS); Community-based oyster reef restoration in ACE Basin National Estuarine Research Reserve (NERR) in South Carolina; Sediment dredging in the Blackwater National Wildlife Refuge (NWR) in Maryland.



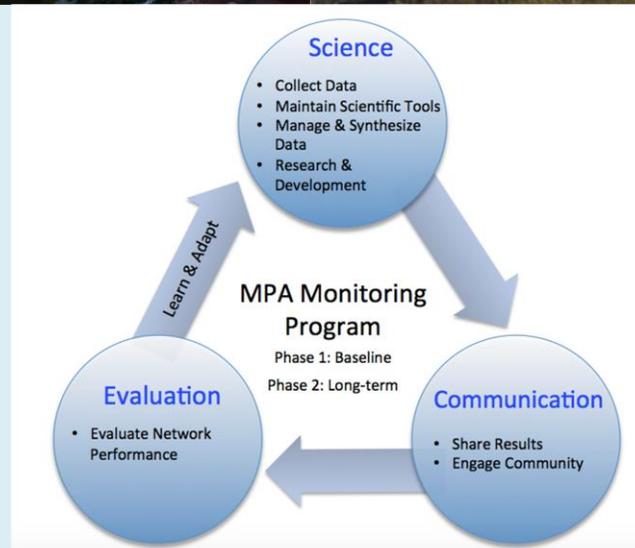
d. MPAs Allow Scientists to Detect and Understand Impacts

MPAs with dedicated monitoring programs serve as critically important *sentinel sites* around the U.S. for detecting and contextualizing changes in ocean ecosystems and their uses. Careful and regular tracking of environmental conditions, climate-driven impacts, and human uses can provide critical data to decision-makers and better inform management measures within MPAs and beyond. Many MPA sites in federal programs (e.g. national parks, national wildlife refuges, national marine sanctuaries), and in their state counterparts (e.g. National Estuarine Research Reserves, and California's

MPA network) have ongoing inventory and monitoring programs to assess trends in MPA condition and guide their adaptive management over time. (Box 4)

BOX 4. MPAs MONITOR ECOSYSTEM HEALTH

MPAs serve as sentinel sites through monitoring programs that track ecosystem status and guide adaptive management in a changing ocean (downward): Sampling marsh grasses in the Lake Superior NERR in Wisconsin; Surveying submerged vegetation in Kenai Fjord National Park (NP) in Alaska; Understanding climate impacts on salt marshes in Merritt Island NWR, Florida; Process for acquiring and applying monitoring data in California’s MPA network.



BENEFIT #2: MPAs SUPPORT COASTAL COMMUNITIES

The nation's nearly 1,200 MPAs do much more than conserve important natural habitats and species within their boundaries. Increasingly, these critical ocean places and the human activities they support are becoming woven into the fabric of local coastal economies and cultures. Following are five diverse examples of how MPAs can benefit coastal communities and their visitors.

a. Healthy Oceans and Vibrant Recreation and Tourism as Economic Engines

Ocean-based recreation (e.g. SCUBA diving, boating, kayaking, wildlife watching, and recreational fishing) is growing in many areas of the U.S. Money spent on these activities and on associated services can be an important contributor to coastal communities. Ocean-dependent recreational activities draw visitors from near and far, who use and pay for a variety of local services, including charters and guides, outfitters and equipment vendors, restaurants, lodging, transportation and entertainment.

Many U.S. coastal areas contain MPAs, which are often home to thriving and diverse ecosystems like coral reefs, kelp forests, submarine canyons, hard bottom communities, wetlands, estuaries and Great Lakes. Others conserve important cultural landmarks and heritage, such as shipwrecks or sacred sites, for the benefit of current and future generations. Additionally, many MPAs provide added value to users and coastal communities by actively promoting and facilitating a variety of sustainable ocean recreation activities, often including fishing. Indeed, many MPAs have become destinations for people seeking outdoor recreational and cultural opportunities. (see Box. 2)

When MPAs are effectively designed and managed, they can help protect the integrity of these shared resources and values. These, in turn, contribute to the economic vitality of local tourism and recreation. While documenting the relative contributions of specific MPAs to broader coastal economies can be challenging and additional studies of the benefits and costs of MPAs would be useful, it is clear that ocean tourism and recreation thrive on healthy, productive and inviting ecosystems, such as those maintained in these managed areas. Below we summarize several examples of documented economic benefits of ocean tourism and recreation in U.S. coastal areas. In accordance with the Committee's charge from the U.S. Departments of Commerce and Interior, these case studies necessarily focus on coastal areas containing federal, state or local MPAs.

Washington National Wildlife Refuge -- In 2011 Willapa National Wildlife Refuge (NWR) had 114,680 visits. The Refuge is located on Willapa Bay, one of the most pristine estuaries in the United States. Visitors enjoy hiking, camping, canoeing, fishing and hunting on Refuge lands. The local economic effects associated with recreational visits to the Refuge totaled \$2.6 million with associated employment of 21 jobs, \$719,800 in employment income and \$311,300 in total tax revenue.^{vii}

National marine sanctuaries – Several federally managed MPAs have compiled statistics on documented economic value of recreational activities to their areas. For example, a comprehensive economic assessment of the total economic contribution of Michigan’s Thunder Bay National Marine Sanctuary indicates an income in 2015 of just over \$42 million. The site is widely credited with revitalizing a struggling local economy by highlighting and facilitating access to the area’s important maritime history. In fact, the sanctuary had 93,000 visitors in 2017 and was chosen as one of the Top 10 Best Michigan attractions in a USA Today Readers’ Choice poll. Broad support for this MPA is reflected in the site’s nickname in its town of Alpena, Michigan: “*The Sanctuary of the Great Lakes.*” Similar positive economic gains were documented at other national marine sanctuary sites in 2015, including:

- Monterey Bay NMS, California (\$804 million)
- Flower Garden Banks NMS, Texas (nearly \$985,000)
- Florida Keys NMS, (\$1.3 billion)
- Hawaiian Islands Humpback Whale NMS (over \$46 million)
- Channel Islands NMS, California (\$44.5 million)

South Florida – In Florida’s four southernmost Atlantic counties: Broward, Palm Beach, Miami-Dade, and Monroe, coral reef recreational value (compiled only for recreational fishing, scuba diving, snorkeling, and glass-bottom boat rides) accounted for \$174 million annually, according to a 2001 study.^{viii} Much of the ocean off this area’s Florida Keys is covered by a patchwork of federal and state MPAs, the largest of which are Florida Keys National Marine Sanctuary, Florida Keys National Wildlife Refuge Complex, Dry Tortugas National Park, Biscayne Bay National Park and John Pennekamp State Park. Estimates for the value of ocean recreation in the sanctuary alone are *\$1.3 billion* annually. Annual visitor spending for the Dry Tortugas NP and Biscayne Bay NP total \$3.2 and \$28 million dollars, respectively.

Hawai’ian State MPA – On the main Hawai’ian Islands, researchers documented an annual \$304 million value for coral reef tourism and recreation.^{ix} Many of these areas are conserved by a network of federal, state, and local MPAs. For example, in 1967 Hanauma Bay was declared a state protected marine life conservation area and underwater park. This MPA averages 3,000 visitors a day, or approximately 1 million visitors per year, making it one of the top three destinations on Oahu. In 1990, the City and County of Honolulu developed a plan to restore and more actively manage the Bay’s MPA, which had become degraded through unmanaged overuse by the millions of visitors over the years. Today, Hanauma Bay limits visitor numbers to a sustainable level and focuses on educating tourists about the thriving natural wildlife of the area. The vast majority of visitors to the Bay are tourists, but many locals on Oahu continue to visit it daily.^x

California– According to the National Ocean Economic Project (NOEP), tourism and recreation is the largest of California’s six ocean-dependent sectors, accounting for 39 percent (\$17.6 billion) of the ocean economy’s GDP, 75 percent of the ocean economy’s employment (368,000), and 46 percent of the ocean economy’s wages (\$8.7 billion) in 2012. The gross domestic product value (GDP) for recreation and tourism of the Central Coast of California – home of several federal and state MPAs -- is \$1.6 billion (NOAA ENOW, 2015).^{xi} The waters off California (0-200nm) host 267 federal and state MPAs, many of which are located in major tourist destinations for ocean-based recreation (e.g. Monterey, San Francisco, Santa Barbara and San Diego).^{xii}

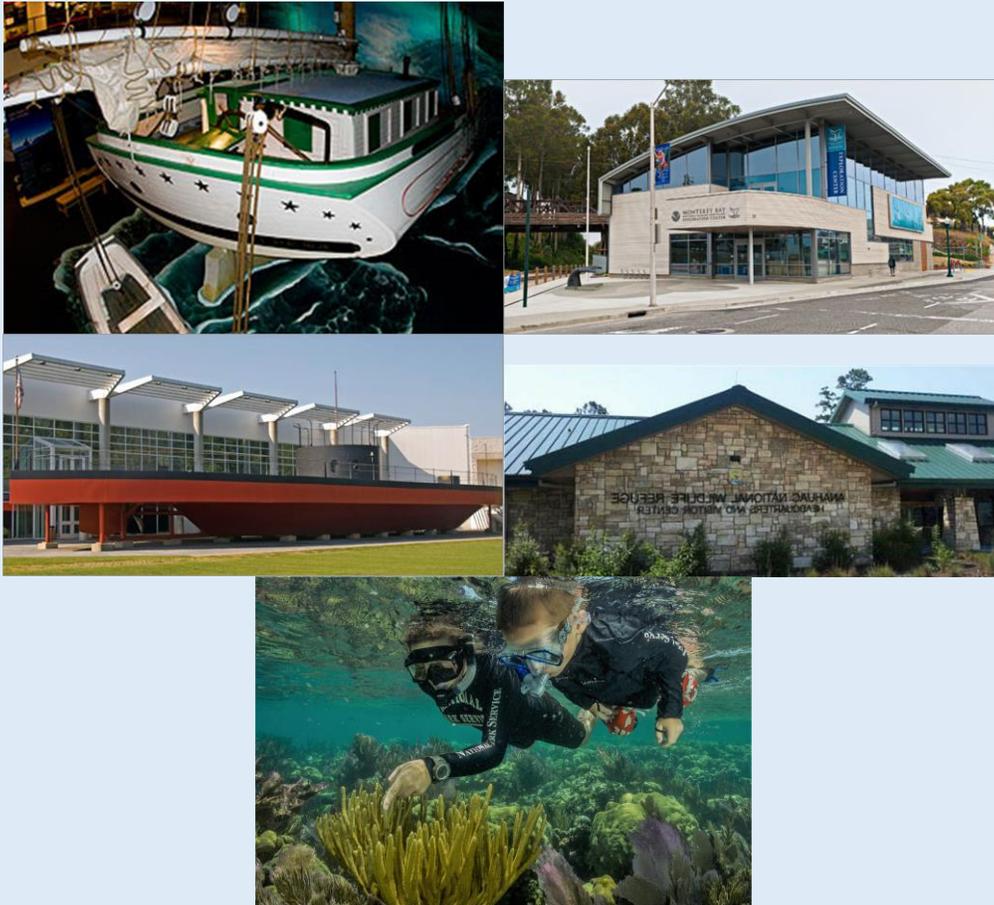
Clearly, healthy oceans can support recreation and tourism in coastal communities. Effectively designed and managed MPAs can help sustain those benefits by conserving local ecosystems and the services they provide.

b. MPAs Provide Gateways to Ocean, Coastal and Great Lakes Ecosystems

U.S. MPAs are doing more than providing a destination for ocean recreation. Increasingly, they are also fostering responsible recreation in ways that both sustain the sites’ ecosystems and continue to generate benefits for the local community. For example, many national marine sanctuaries engage with visitor bureaus, hospitality associations, and marine recreation businesses to raise awareness of these MPAs and their value to conservation and coastal communities and to educate visitors about conserving its resources (e.g. wildlife viewing practices). Monterey Bay NMS also engages hundreds of thousands of visitors per year in its visitor centers, connecting people from across the country to the sanctuary and encouraging them to explore and experience the coast and ocean and other facilities like the Monterey Bay Aquarium, Seymour Marine Discovery Center, and Elkhorn Slough National Estuarine Research Reserve. (Box 5)

BOX 5. ENGAGING MPA VISITORS

Visitor centers provide portals to MPA ecosystems, the resources and values they protect, and the issues affecting their health and management (downward): Thunder Bay NMS in Michigan; Monterey Bay NMS in CA; Monitor NMS in Norfolk, VA; Anahuac NWR Visitor Center in TX; habitat tour in Dry Tortugas NP, Florida.



c. MPAs Foster and Facilitate Sustainable Recreational Fishing

In addition to general visitor outreach, many MPAs reach out specifically to key user groups in their sites. For example, many MPAs that permit recreational fishing, including many national parks, national wildlife refuges, national marine sanctuaries, and state MPAs, actively encourage and support responsible recreational fishing in their protected waters. Examples (Box 6) include: (a) targeted education and outreach materials about where and how to fish sustainably, often located at popular access points or visitor centers; (b) dedicated recreational fishing MPAs or zones; (c) specially themed fishing events intended to foster youth engagement in responsible angling and ocean stewardship; and, (d) partnerships with recreational fishing guides and other key

recreation sectors (e.g. dive charters, whale watching, cruise lines) to develop, teach and apply best practices for sustainable uses of these special areas.

BOX 6. MPAS SHARE BEST PRACTICES FOR SUSTAINABLE RECREATIONAL FISHING

MPAs partner with user groups and businesses to share best practices for sustaining ecosystems and the services they provide (downward): Recreational fishermen promoting the Sanctuary Blue Star certification program for sustainable dive and fishing operations in the Florida Keys NMS; Young angler and winner of the Sanctuary Classic tournament in the Hawai’ian Islands Humpback Whale Sanctuary; “Let’s Go Fishing” activity booklet used in National Parks and Wildlife Refuges to encourage responsible recreational fishing.



Certification: The Florida Keys National Marine Sanctuary’s “Blue Star Certification” that provides guidance on Best Practices that businesses can follow to ensure sustainable fishing and dive operations is a promising model that is being applied in other MPAs around the U.S. Biscayne National Park in Florida also sponsors a Fisheries Awareness Class, taught by experienced fishing guides and park scientists. The classes help

recreational fishers to identify the fish they catch, follow fishing regulations, and understand the stewardship role of anglers in conserving park fish populations.

Best Practices Education: Similarly, the National Park Service and U.S. Fish and Wildlife Service partnered to create a “Let’s Go Fishing!” Junior Ranger Activity Book **to** support and encourage sustainable fishing practices. The activity book teaches kids about aquatic habitats and fishing safety, and how to protect native fish and the habitats on which they depend. Kids who complete the booklet’s activities successfully can earn an “Angler’s Badge” at a participating NWR, National Park, or Fish Hatchery.^{xiii}

Sustainable fishing opportunities are available at more than 270 National Wildlife Refuges, and is a valuable economic contributor, supporting over 828,000 jobs in the U.S. Anglers spend over \$48 billion dollars annually on equipment, licenses, trips, and other fishing-related events.^{xiv} Over time, these engagement efforts by U.S. MPAs will not only help generate local revenue from this popular activity, but will also help contribute to the long-term sustainability and stewardship of America’s MPAs and the recreational activities they support.

d. Coastal Tourism and Recreation Highlights MPAs

MPAs are increasingly featured in advertisements for travel and tourism in coastal areas. For example, *Visit California* – a nonprofit organization promoting California as a premier travel destination – highlights MPAs as a great way to experience California’s remarkable coastal habitats. *Visit California* featured 10 select California MPAs as places to observe wildlife and to enjoy recreational activities like kayaking, swimming, snorkeling, and SCUBA diving.^{xv} Additionally, the hotel booking service [Booking.com/hotels](https://www.booking.com/hotels) has developed a service for visitors to find hotels near national marine sanctuaries anywhere throughout the nation.^{xvii} Clearly, MPAs are a growing marketing tool and tourist draw for coastal communities around the U.S.

e. MPAs Help Protect Coastal Communities from Severe Storms

Frequent and intense storms are becoming more common in some U.S. coastal areas. Global economic losses from such storms exceeded U.S. \$300 billion over the past decade.^{xviii} In the U.S., severe storms have led to: loss of life; population displacement and cultural disruption; widespread damage to critical infrastructure; secondary pollution and health impacts; closures of small businesses; and, impacts to coastal ecosystems. Intact coastal and marine habitats such as salt marshes, sand dunes, coral reefs, and mangrove forests – often protected by MPAs -- can buffer the impacts of such storms on adjacent shores by absorbing and diffusing their wave energy.

Scientists estimate that mid-Atlantic coastal habitats such as dunes and marshes averted \$625 million in damage during Hurricane Sandy.^{xix} Similarly, intact coral reefs can dissipate up to 97% of storm-driven wave energy that would otherwise hit the shoreline.

A recent report estimates that US coral reefs provide \$94 billion worth of storm protection annually.^{xx} Although U.S. reefs face growing challenges from heat-induced bleaching, disease outbreaks, algal overgrowth, and invasive species, models predict that protecting coral reefs could vastly reduce the costs and impacts of severe storms.^{xxi}

Scientists, economists, emergency management agencies, and insurance companies are beginning to explore the financial importance of intact coastal habitats for the protection of coastal towns from storms. For example, the Nature Conservancy is working with insurance companies to develop policies for offshore reefs to restore the reefs if they become damaged, and to encourage their long-term conservation in between major storms. While these investigations are preliminary, they support the idea that MPAs that are designed and effectively managed to protect naturally buffering habitats can help protect lives, property, infrastructure, investments, economies and critical services along the nation's coasts.

f. MPAs Build Local Capacity for Ocean, Coastal and Great Lakes

Although all MPAs focus within their boundaries on managing the natural and/or cultural resources they contain, many are increasingly looking outward and engaging local communities in finding and using solutions to ocean issues of common concern. For example, many U.S. MPAs present public lectures, workshops, and festivals intended to inform residents and visitors about timely and locally relevant environmental issues.

Additionally, NOAA's National Estuarine Research Reserve System (NERRS) – a state and federal MPA partnership authorized by the Coastal Zone Management Act – regularly hosts professional trainings for local resource managers and decision-makers at 28 Reserve sites. There, participants learn new scientific approaches and best practices for meeting today's conservation challenges. Identified by local user needs, topics covered have included: coastal restoration, living shorelines, managing visitor use in MPAs, coastal flooding, blue carbon, storm-water, low-impact development, reducing non-point pollution through redevelopment, watershed planning, coastal resilience, and more. Since its inception in 1988, approximately 200,000 coastal professionals have been trained in approximately 5,000 workshops at these estuarine MPAs. These highly successful and valued learning experiences build local capacity and a sense of shared purpose among those most directly responsible for sustaining the community's and the nation's coastal and ocean ecosystems.

BENEFIT #3: MPAS CONNECT AMERICA'S PEOPLE TO THEIR HERITAGE

Increasingly, MPAs are providing a space for people – local residents and visitors—to connect personally to the nation's coastal ecosystems, to engage in their shared cultural heritage and history, and to become effective stewards of the waters off their shores and the cultural resources they contain. Following are a few encouraging examples of

MPAs fulfilling this crucial role by providing living laboratories, fostering citizen science, opening windows to the past, and engaging meaningfully with Native American Tribes.

a. MPAs Foster Citizen Science and Support Robust Data Sets

Many MPAs provide opportunities for people to engage in citizen science, which can help inform site management. For example, in the Chesapeake Bay National Estuarine Research Reserve, thousands of children and adults are engaging in hands-on citizen science in the laboratory and in the MPA habitats. Volunteers get training in data collection, and then collect summer juvenile and larval fish to determine species diversity and habitat productivity.

These citizen-led efforts have created a robust and useful 15+ year data set on economically and socially important species that matches the scientific integrity of data collected by fish biologists. Fisheries managers in Maryland, Delaware, and Virginia have been able to use this information to better understand local herring, shad, and yellow and white perch, as well as to conserve their habitats. Citizen science programs are also actively used in many federal MPAs including national wildlife reserves, national marine sanctuaries and national parks. (Box 7)

BOX 7. CITIZEN SCIENTISTS HELP INFORM MPA MANAGEMENT

Citizen scientists helping MPA (downward): Volunteer monitoring of commercial fish populations and habitats in Chesapeake Bay NERR in MD; Marine debris inventory and removal program in National Wildlife Refuges.



b. MPAs Inspire Local Community Engagement in Coastal Management

While MPAs are created by government agencies, their day-to-day management is increasingly shaped by voluntary citizen advisory groups with members drawn from local communities. For example, Oregon has formed a network of Marine Reserve Community Teams that engage diverse fishermen, recreationalists, conservationists, scientists, and local elected officials in a bottom-up effort to manage their coastal MPAs. Similarly in California, there are 14 locally-driven MPA County Collaboratives that support a “localized and participatory approach” to the management of the state’s 124 MPAs.^{xxii}

Among federal MPAs, NOAA’s national marine sanctuaries rely on 14 community-based sanctuary advisory councils to “provide advice and recommendations to the superintendents”^{xxiii} on important and timely issues including management, science, service, and stewardship. Similarly, Acadia National Park, Boston Harbor Islands National Recreation Area, Cape Cod National Seashore, and National Park of American Samoa are served by local citizen advisory committees. These diverse and influential citizen advisors comprise hundreds of members and represent a broad cross-section of the local communities and stakeholders adjacent to MPAs.

All of these citizen advisory bodies also invest significant effort and time toward educating the public, including their own sectors, about the purpose and rules of their local MPAs. Empowering local citizen groups to guide MPA implementation helps ensure that their management addresses the goals and priority issues of the coastal communities they support.

c. MPAs Celebrate America’s Maritime Heritage

Many federal and state MPAs encompass more than just ecosystems; they also protect physical artifacts of cultures historically connected to America’s coasts and Great Lakes. Ranging from relatively recent shipwrecks to Native American villages in New England, to coastal dwellings built by escaped slaves in the Southeast, to towns built by Chinese immigrants to California, all tell powerful and compelling stories of life at the interface between land and sea in America. Increasingly, these MPAs provide an avenue for the celebration, continuation and renewal of traditional cultural ways and values. (Box 8)

BOX 8. MPAs PROTECT AND CELEBRATE AMERICA'S COASTAL HERITAGE

Sapelo Island NERR helps conserve the living communities and unique culture of the Low Country's Gullah Geechee people, descendants of former slaves living along the Georgia coast; Great Bay NERR recreates a Native American village to help visitors understand their history and connection to the coast; San Francisco Bay NERR preserves and interprets the history of Chinese immigrants to the U.S. who lived and worked along the bay's shores.



e. MPAs Provide Opportunities to Partner with and Learn from Indigenous Communities and Native Americans around Shared Values

MPA planning processes can provide effective venues for partnering with indigenous communities and Native American Tribes – who have been stewards of our coastlines since time immemorial – in the place-based management of ocean environments. Protections provided by MPAs have created opportunities for federal and state government to uphold a trust responsibility and respect the government-to-government relationship, which has sometimes led to co-management and monitoring of resources.

i. Native Americans Engage in Federal Process for MPA Designation

Some local Santa Barbara, California, Indian Tribes have brought together scientists, elected officials, and local community members in support of protecting multiple Chumash sacred sites through proposed designation as a Chumash Heritage National Marine Sanctuary. Chumash records suggest these sites were occupied by Native Americans for up to 18,000 years and represent significant cultural value to local tribes. If designated, this would be the first U.S. national marine sanctuary created expressly to protect tribal heritage. (Box 9)

BOX 9. CHUMASH INDIAN CANOE AND TRIBE MEMBERS

Members of the Chumash Tribe of Central California paddling a traditional ocean-going canoe, a tomol, in Channel Islands National Marine Sanctuary off Santa Barbara.



ii. Native Hawai'ians Inform MPA Management

Native Hawai'ians are engaged in the management of marine protected areas. Papahānaumokuākea Marine National Monument in the Northwestern Hawai'ian Islands is considered a sacred area, from which Native Hawai'ians believe all life springs, and to which spirits return to after death. Papahānaumokuākea is also a place for Native Hawai'ian cultural practitioners of today to reconnect with their ancestors and gods, who they believe are manifested in nature, as with the Polynesian deity Kanaloa, whom they believe is embodied by the vast expansive ocean, and can take the form of all life within it. The Monument's Native Hawai'ian Cultural Working Group provides a forum for discussion and engagement around cultural aspects of place-based-management. Additionally, in recognition of this strong cultural connection to the ocean, the Monument also provides for subsistence fishing within the MPA boundaries. Similar provisions exist within many federal and state MPAs throughout U.S. waters.

iii. Native Americans are Researchers and Co-Managers of Some State MPAs

Although California's state MPA planning effort did not originally include a distinct role for or consultation with tribes or understand Tribal Traditional Tribal Knowledge and the tribal connection to the ocean, the process led to several positive outcomes. These included: select North Coast MPAs that exempt specific tribes from MPA prohibitions on take; a Cabinet-level Tribal Liaison; a California Fish and Game Commissioner seat who advocates for tribes and established a tribal committee that has been preserved in legislation; and four tribal positions in the California MPA Leadership Team, which oversees the ongoing management of state MPAs. Additionally, the Tolowa Dee-ni' Nation of Smith River California, led an innovative MPA baseline characterization project between 2014 and 2017, in partnership with a number of other North Coast tribes. This project drew on Traditional Tribal Knowledge and interviews with local tribes to study culturally important coastal and marine species.^{xxiv}

These examples illustrate the breadth of ways that MPAs engage, and increasingly rely on, tribes, indigenous and other cultures to help understand the best approaches to effectively and equitably manage these special ocean places.

Emerging Challenges Facing U.S. MPAs

Many of America's MPAs are several decades old, with some dating back over a century. Much has changed since their initial design and establishment. Coastal populations have grown; human uses of the ocean abound; and climate-driven changes in ocean conditions are increasingly evident. As a result, today's MPAs strive to adaptively manage a complex and dynamic seascape that is increasingly altered from the scene that led to the original conservation measures.

Below, we summarize four important challenges facing U.S. MPAs today: (a) growing ocean tourism and recreational uses; (b) expanding industrial and commercial uses; (c) ecosystem impacts of climate change; and (d) recent policy measures that may weaken, reduce or eliminate MPAs. The final section of this report provides specific Findings and Recommendations that address these challenges and needs.

a. Growing Ocean Tourism and Recreational Uses

Americans and international visitors flock to our ocean, coasts, and Great Lakes as places for relaxation and outdoor recreation. Many of those recreation destinations are in U.S. MPAs, due in part to their healthy ecosystems, ocean education programs, and easy access for users. As a reflection of this trend, MPAs are increasingly featured in tourism promotions and commercial ads highlighting their value and services to visitors and locals alike.

Examples of common recreational uses of the ocean include motor boating, sailing, kayaking, jet skiing, recreational fishing, diving and snorkeling, beach use, tide pooling, swimming, and surfing. In addition to these more familiar activities, the variety of recreational uses is also expanding rapidly in the U.S. For example, it is not uncommon now to encounter stand-up paddle-boards, fishing kayaks, wake boards, SNUBA scooters, parasails, and jet packs being used for recreation inside U.S. MPAs.

As the number of people recreating in our protected waters grows, so too can their potential impacts on MPAs and the resources and qualities these sites seek to conserve. Depending on the specific use and context in which it occurs, ocean recreation impacts may include wildlife disturbance, habitat damage, resource depletion, harassment of protected species, damage to shipwrecks and other cultural resources and values, disruption of the natural soundscape or seascape, and conflicts with other users.

A rapidly emerging global problem at popular tourism destinations, including some MPAs, is *over-tourism*, defined as “tourism that has moved beyond the limits of acceptable change in a destination through overcrowding, degradation of the environment and infrastructure, and/or negative impacts on residents, due in part to planning and policies unprepared to manage increased visitation.”^{xxv} Familiar examples of federal MPAs under increasing pressure from recreational users include Florida Keys NMS, Biscayne NP and Crystal River NWR. Having the necessary information, tools, strategies and flexibility to adaptively manage the nation’s MPAs will be key to their ability to meet their goals and objectives over time in a changing ocean.

b. Expanding Industrial and Commercial Uses

America’s oceans, coasts, and Great Lakes have long been places of commerce, industry and exploration. Like the recent expansion of ocean recreation, the nation’s demand for

industrial uses of the ocean is growing, as well. Some key examples with implications for U.S. MPAs include:

i. *Energy Development*

The United States' emerging emphasis on energy independence and dominance is driving interest in extracting fossil fuels and other sources of energy from the ocean (see Section (d) below for more detail). Similarly, the promise of generating non-polluting, renewable energy from wind and waves continues to gain momentum across the U.S., with new plants being constructed, permitted, and proposed in several regions. America's new drive for offshore energy development brings the potential for impacts to U.S. MPAs, as well as the ocean ecosystems and human uses they support. The nation's MPAs are not exempt from this trend, and their managers must be able to evaluate and exercise the authority to proactively address these impacts.

ii. *Aquaculture*

The U.S. is currently encouraging aquaculture along the nation's coasts in order to: build a sustainable seafood supply into the future; meet an ever-growing demand for protein; adjust the balance of trade in seafood products; and to minimize the ecological impacts of wild-capture fisheries. To the extent that aquaculture operations may occur in or near existing MPAs (e.g., Willapa Bay NERR), potential risks such as escape of exotic species; nutrient pollution; and disease transmission to wild, native species will need to be addressed.

iii. *Coastal Desalination*

As the frequency and intensity of droughts increase along the U.S. West Coast, some coastal areas, including those hosting MPAs, are considering desalination plants to supplement supplies of drinking and irrigation water. For example, a new desalination plant has been approved in Central California, directly in Monterey Bay National Marine Sanctuary and substantial measures were put in place to ensure this facility would be consistent with sanctuary goals, rules, and regulations. General risks of desalination on marine ecosystems may include mortality of larvae and juveniles, and localized increases in salinity.

iv. *Deep-Sea Industrial Uses*

Some U.S. MPAs encompass very deep waters and benthic habitats, some of which are dominated by slow-growing corals and sponges. Unfortunately, some of these often-fragile ecosystems face emerging and expanding industrial uses. For example, demand for rare-earth metals used in modern electronics is driving a global initiative to explore and extract valuable minerals from the deep seabed. Additionally, technological advances and shifting seafood markets are expanding some fisheries into increasingly

deeper waters. Finally, America's seabed is overlain by a lattice of undersea cables carrying electricity, communications, and data between regions and across ocean basins. MPAs protecting such deep-water habitats, most of which are federally managed, may soon face challenges from these uses and may need new approaches to sustainably manage and perhaps benefit from them (e.g. through carefully crafted special-use permit fees).

c. Emerging Ecosystem Impacts of Climate Change

America's ocean is undergoing marked environmental changes due, in part, to the increasingly apparent impacts of a changing global climate. Familiar examples of this trend include: ocean acidification and oxygen depletion impacting shellfish growers and fishermen; ocean "heat waves" bleaching coral reefs and causing mass mortality of marine life; severe storms damaging vulnerable, low-lying coastal communities; rising sea level eroding or submerging near-shore ecosystems like salt marshes, mangroves, and coral reefs; and, invasions by harmful non-native (i.e. exotic) species into habitats where they do not naturally occur. MPAs, especially in well-designed and effectively managed networks of ecologically connected sites, can help buffer some of these impacts.^{xxvi} However, many U.S. MPAs remain vulnerable to these large-scale impacts and their managers will need effective tools to anticipate and adaptively manage their impacts in a changing ocean.

d. National Policy Measures that May Weaken, Reduce, or Eliminate MPAs

In addition to a changing climate, recent shifts in the focus of U.S. national ocean policy may impact America's MPAs as well. Specifically, two recent Presidential Executive Orders issued in 2017 call for a review of recently designated or expanded federal MPAs created via the National Marine Sanctuaries Act or the Antiquities Act^{xxvii} and direct federal ocean agencies to conduct an assessment of their opportunity costs for oil and gas development in U.S. waters,^{xxviii} A third, issued in 2018, rescinds the former conservation-based National Ocean Policy established in 2010 and replaces it with new priorities emphasizing economic development, energy production and national security uses of America's ocean.^{xxix} Additional proposals that may narrow or weaken bedrock environmental protection laws, such as the Clean Water Act, Endangered Species Act and Migratory Bird Treaty Act, also pose significant threats to the ability of many U.S. MPAs to meet their statutory goals.

This emerging U.S. environmental and ocean policy framework has the potential to diminish or eliminate the protections to natural and cultural resources provided by some U.S. MPAs, especially those managed by federal agencies. Potential impacts include: (i) eliminating MPAs through de-designation; (ii) reducing MPA number, size, and level of protection, or changing their fundamental purpose and goals; (iii) allowing potentially incompatible ocean uses to operate inside MPAs; and (iv) restricting the

nation's ability to expand existing MPAs or to create new sites where needed to meet changing ocean conditions.

e. Implications of Emerging Challenges for America's MPAs

As outlined above, today's MPAs face a growing array of new and emerging challenges stemming from expanding ocean uses and from the federal policies that govern them. Depending on the specific context – including the sites' purpose and level of protection - some of these challenges could, whether alone or in combination, adversely impact the nation's MPAs, and the many benefits they provide, by:

- Damaging physical and biogenic habitats, including reefs and submerged aquatic vegetation;
- Reducing biological populations, including rare, threatened, or endangered species;
- Changing ecological community structure, biodiversity, composition, and dynamics, especially with the introduction of non-native species;
- Disrupting natural animal behaviors, including dislocation from normal habitats;
- Altering natural soundscapes and affecting species such as marine mammals that rely on sound for feeding, mating, migrating, and predator avoidance;
- Reducing water quality, including ocean acidification and hypoxia;
- Damaging cultural resources or diminishing the value of the cultural heritage landscape associated with MPAs;
- Impairing traditional or subsistence ocean uses, including those critical to native American peoples; and,
- Reducing, through policy and budgetary actions, the ability of US MPAs to address these and other challenges to their effectiveness.

Findings and Recommendations for Sustaining MPA Benefits in a Changing Ocean

America's marine protected areas represent an enduring national commitment to healthy and productive oceans. This goal is achieved, in part, by conserving places of ecological, economic, and cultural significance. Established with public input and managed by federal, state, local, and tribal agencies, many of the nation's MPAs face significant emerging challenges from rapidly changing ocean uses and conditions, as well as from shifting national policy priorities for managing our ocean and its resources.

In order to sustain the myriad ecological, social and economic benefits offered by U.S. MPAs, the Departments of Commerce and Interior must exercise foresight, coupled with innovative technical, management, and policy solutions to meet these emerging challenges.

Specifically, the Departments must act on the following recommendations through their respective federal MPA programs. For DOC/NOAA, relevant MPAs include the national marine sanctuaries and marine national monuments, and the federal-state partnerships in National Estuarine Research Reserves. For DOI, those MPAs include the national parks, the marine national monuments, and the national wildlife refuges. Additionally, the departments should actively encourage and support the broad implementation of these recommendations among the wide array of non-federal, MPA partner programs around the United States, including state, territorial, local, tribal and indigenous agencies.

1) Maintain and Support the Nation’s System of MPAs

Finding 1: America’s MPAs face increasing challenges to achieving their objectives stemming from expanding ocean uses, climate-driven changes in ocean conditions, and recent realignments of federal ocean management policies and priorities.

Recommendation 1: Fully support, fund, maintain, evaluate, and adaptively manage the nation’s MPAs in U.S. coastal, ocean, and Great Lakes waters.^{xxx} Ensure that any proposed alterations to an MPA’s size, location, purpose, protection or designation are based on clearly articulated objectives, a rigorous evaluation of effectiveness using best available science, and a transparent and inclusive public planning process.

2) Ensure Compatibility of Ocean Uses in MPAs

Finding 2: New and expanding ocean uses, coupled with rapidly changing ocean conditions, could pose significant threats to achieving the goals and objectives of US MPAs, particularly when sites lack sufficient scientific information to evaluate potential impacts and/or appropriate management strategies to address them.

Recommendation 2: Evaluate emerging ocean uses, and ensure that those occurring in MPAs are consistent with the sites’ purposes, compatible with other valued human uses of the protected areas, and effectively managed to be ecologically sustainable over time.

3) Provide Sufficient Enforcement for Compliance with MPA Rules

Finding 3: Consistent user compliance with MPA rules can greatly improve sites’ ability to meet their objectives and to fulfill their promise to coastal communities and the nation.

Recommendation 3: Support and employ innovative approaches to outreach, monitoring, and enforcement, and use emerging technologies to more effectively enforce U.S. MPA regulations and encourage compliance by MPA users.

4) Work with Communities to Improve MPA Effectiveness

Finding 4: America's ocean resources belong to its people. Proactively informed and engaged coastal communities can become effective stewards of their MPAs for the benefit of current and future generations.

Recommendation 4: Support and fund MPA programs to proactively engage local communities around the U.S. in the design of new MPAs where needed, and the adaptive management of existing MPAs where changing conditions require new site management approaches for achieving their goals.

5) Use Best Available Science to Adapt MPAs to Changing Ocean Conditions

Finding 5: Many emerging challenges to US MPAs, such as a changing climate, could not have been foreseen when the sites were first designed and established, and are not consistently reflected in today's management strategies or in the science that informs them.

Recommendation 5: Explore, characterize, monitor, study, and evaluate U.S. MPAs to detect and assess impacts of climate change and emerging ocean uses on the natural and cultural resources and ecosystem services of the sites, and employ the results to advance their long-term resilience and adaptive management to achieve their statutory goals.

Conclusion

U.S. MPAs are often considered to be international models of place-based management of ocean, coastal and Great Lakes ecosystems. The Marine Protected Areas Federal Advisory Committee was directed to explore the benefits of MPAs to ecosystems, economies and cultures around the U.S. and to recommend practical ways sustain those benefits in the face of a changing ocean.

The Committee concludes that by implementing the above recommendations in federal MPAs, and by supporting their adoption in other non-federal MPA programs, the Departments of Commerce and the Interior can continue help the U.S. achieve our long-standing national commitment to a healthy, productive and secure ocean, by conserving our most important places and the natural and cultural resources they protect.

ENDNOTES

ⁱ For the purpose of our current MPA FAC charge, the terms “marine” and “ocean” include ocean, coastal, estuarine and Great Lakes ecosystems throughout the United States.

ⁱⁱ Executive Order 13158. Marine Protected Areas. 2000.

ⁱⁱⁱ The U.S. network of MPAs includes the full spectrum of place-based protections; some (3% - will confirm Mon) prohibit all extractive activities within their boundaries, while most others allow a range of activities such as some sport and/or commercial fishing.

^{iv} See Mark Carr, et al., 2018. Marine Ecosystems and their Services: A Supplemental Report by the Marine Protected Areas Federal Advisory Committee’s Ecosystem Team. 2018. Mark H. Carr (UC Santa Cruz), Katherine L.C. Bell (MIT Media Lab), Peter Leary (US Fish and Wildlife Service), Heather L. Sagar (NOAA National Marine Fisheries Service), Steven Tucker (US Coast Guard), and references therein.

^v http://www.piscoweb.org/sites/default/files/portfolios/CI_10-Yr_Brochure_web.pdf

^{vi} See endnote iv.

^{vii} USFWS. 2013. Banking on Nature. 365p. Available from:
<https://www.fws.gov/refuges/about/refugereports/pdfs/BankingOnNature2013.pdf>

^{viii} Luke Brander and Pieter van Beukering, “[A Total economic value of US coral reefs: a literature review](#),” NOAA Coral Reef Conservation Program. 2013.

^{ix} Cesar, H. van Beukering, P. “Economic valuation of the coral reefs of Hawai’i” *Pacific Science* Vol 58: 231-242, 2004

^x <https://hanaumabaystatepark.com/hanauma-bay-history/>

^{xi} NOAA. National Ocean Economic Project. https://cbe.miis.edu/noep_publications/

^{xii} See NOAA’s MPA Inventory maintained by the National MPA Center,
<https://marineprotectedareas.noaa.gov/dataanalysis/mpainventory/>

^{xiii} (<https://www.fws.gov/fisheries/junior-ranger-fishing.html>).

^{xiv} Southwick Associates. Sportfishing in America: An Economic force for conservation. Produced for the American Sportfishing Association under a US Fish and Wildlife Service (USFWS) Sport Fish Restoration grant (F12AP00137, VA M-26-R) awarded by the Association of Fish and Wildlife Agencies (AFWA) 2012.

^{xv} <http://www.visitcalifornia.com/node/83031>

^{xvi} AAA article on California’s MPAs -- <https://www.viamagazine.com/destinations/california-coastal-ranger-qa>

^{xvii} <https://www.booking.com/landmark/us/national-marine-sanctuary.html>

^{xviii} Curt Storlazzi et al. 2017. Coastal Dynamics. Paper No. 035.

^{xix} S. Narayan et al., “The value of coastal wetlands for flood damage reduction in the northeastern USA,” *Scientific Reports* 7 (2017): 9463. Online at <https://www.nature.com/articles/s41598-017-9269-z>. See also Narayan S, Beck MW, Reguero BG, Losada IJ, van Wesenbeeck B, Pontee N, et al.

(2016) The Effectiveness, Costs and Coastal Protection Benefits of Natural and Nature-Based Defences. *PLoS ONE* 11(5): e0154735. doi:10.1371/journal.pone.0154735

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- ^{xx} <https://www.nature.com/articles/s41467-018-04568-z>. “The value of coastal wetlands for flood damage reduction in the northeastern USA,” Scientific Reports 7 (2017): 9463. Online at <https://www.nature.com/articles/s41598-017-09269-z>. See also Narayan S, Beck MW, Reguero BG, Losada IJ, van Wesenbeeck B, Pontee N, et al. (2016) The Effectiveness, Costs and Coastal Protection Benefits of Natural and Nature-Based Defences. PLoS ONE 11(5): e0154735. doi:10.1371/journal.pone.0154735.
- ^{xxi} Michael Beck et al. 2018. Nature Communications. 9:2186.
- ^{xxii} <http://www.mpacollaborative.org/about/aboutus/>
- ^{xxiii} <https://sanctuaries.noaa.gov/management/ac/>
- ^{xxiv} <http://oceanspaces.org/projects/north-coast-traditional-ecological-knowledge-keystone-marine-species-and-ecosystems>
- ^{xxv} Center for Responsible Travel, 2018
- ^{xxvi} See MPA FAC recommendations, action agenda and scientific report on Connectivity in MPA Networks. 2016. <https://nmsmarineprotectedareas.blob.core.windows.net/marineprotectedareas-prod/media/archive/fac/products/connectivity-report-combined.pdf>
- ^{xxvii} Executive Order 13792. Review of Designations under the Antiquities Act. April 26, 2017.
- ^{xxviii} Executive Order 13795. Implementing an America-First Offshore Energy Strategy. April 28, 2017.
- ^{xxix} Executive Order 13840. Ocean Policy to Advance the Economic, Security, and Environmental Interests of the United States. June 19, 2018
- ^{xxx} See also the MPA FAC’s previous 2017 recommendations on adaptive management in US MPAs. <https://nmsmarineprotectedareas.blob.core.windows.net/marineprotectedareas-prod/media/docs/mpafac-adaptivemanagement-recommendations.pdf>

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