Sustaining Benefits from Marine Protected Areas in a Changing Ocean

Findings and Recommendations of the MPA Federal Advisory Committee

DRAFT #1 (August 31, 2018)

Executive Summary

In January 2018, the Marine Protected Areas Federal Advisory Committee (MPA FAC) was charged by the U.S. Department of Commerce (DOC) and the Department of Interior (DOI) with identifying benefits of U.S. marine protected areas (MPAs) to marine [i] ecosystems, economies and communities. The United States defines a marine protected area 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] The MPA FAC was also directed 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.

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] For example, U.S. MPAs sustain and enhance our marine resources, restore degraded habitats, provide living laboratories to assess the pace and impacts of climate change, and protect cultural resources, heritage and landscapes. MPAs also support local and national economies through enhanced ocean tourism and recreational opportunities. Education and outreach from MPA programs connect diverse communities with their local ocean heritage and issues. Nationwide, many MPAs are engaging the public in citizen science, where people participate in data gathering, monitoring, and analysis to inform local ocean management. The specific benefits generated by an MPA will be influenced by its purpose, design, level of protection and management approach.

The MPA FAC concludes that properly designed and managed U.S. MPAs have significant societal value to the nation, particularly given the many emerging challenges facing our ocean ecosystems. Chief among these challenges are: growing coastal development, energy production, and other industrial uses; changes in ocean condition driven by climate change; and a shifting landscape of federal ocean policies that threaten to reduce, weaken, or eliminate existing MPAs and hinder the future establishment of new MPAs where needed.

In order to sustain and enhance the benefits our MPAs provide in the face of these mounting pressures, the MPA FAC recommends that Federal and state governments:

1) **Maintain and Support the Nation's System of MPAs**

   Fully support, fund, maintain, and, where needed, strengthen or expand the nation's MPAs in U.S. coastal, ocean, and Great Lakes waters. Ensure that any proposed alterations to the number, size, location, purposes, or protections of federal MPAs are based on a clearly articulated need and objective, best available science, and a transparent and inclusive public planning process.

2) **Ensure Compatibility of Ocean Uses in MPAs**

   Anticipate and 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**

   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**

   Support and fund MPA programs to actively engage local communities around the U.S. in the design, establishment and adaptive management of their MPAs.

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

   Explore, characterize, monitor, study, and evaluate US MPAs to detect and anticipate impacts of climate change on natural and cultural resources and on human uses of the sites, and employ the results to inform their long-term adaptive management and resilience.

By implementing these five recommendations in Federal MPAs, and by supporting their adoption in other non-Federal MPA programs, the Departments of Commerce and Interior can ensure that our nation's MPAs continue to benefit our marine ecosystems, economies, local communities, and culture. U.S. MPAs are often considered international models of place-based ocean management. The MPA FAC's recommended actions will help the U.S. achieve our long-standing national commitment and leadership to a healthy, productive and secure ocean, by enhancing the stewardship and management of its most important places and the natural and cultural resources they contain.

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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 benefits 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, social, 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 1.)

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

a. MPAs Sustain and Enhance Marine Ecological Communities

By reducing impacts of human activities within their boundaries, MPAs contribute to: more abundant, larger, longer-lived, and more fecund resident animals including fish and other economically important species; 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 the sites.[iv] Studies from around the world, including those conducted in some U.S. MPAs (e.g., California and Florida), show positive population-level responses to the protections afforded by MPAs, and encouraging but 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." *(BOX 2 – graphic showing conceptual model of ecological changes post-MPA)*

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 species and habitats *(endnote iii and references therein).* For example, recent studies of temperate kelp communities in California and elsewhere demonstrate how protected and robust ecological communities prevented invasions by exotic species and, thus, avoided catastrophic damage to the kelp ecosystems and the valuable ecosystem services they provide. *(BOX 3 – a summary of Mark's 2 studies w/ images of each study).*

c. MPAs Support Restoration of Degraded Habitats

Many U.S. MPAs actively restore degraded or otherwise damaged habitats and communities within their boundaries (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 also benefit from 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. *(BOX 4 – images of habitat restoration)*

d. MPAs Allow Scientists to Detect and Provide Context for Ocean Change

MPAs with dedicated monitoring programs are vitally important *sentinel sites* for detecting and contextualizing changes in ocean ecosystems around the U.S. 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. *(BOX 5 – description of CA MPA monitoring program, NERRS SWMP, NPS Vital Signs, Refuge and NMS programs needed here.).*

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 three examples of how MPAs benefit coastal communities and their visitors.

a. MPAs are Economic Engines for Coastal Tourism and Recreation

Many U.S. MPAs are home to thriving and diverse ocean ecosystems like coral reefs, kelp beds, submarine canyons, hard bottom communities, wetlands, and estuaries. Others protect important cultural landmarks and heritage, such as shipwrecks or sacred sites, for the benefit of current and future generations. MPAs help protect the integrity of these resources and values, which, in turn, generates economic benefits.

Indeed, many MPAs have become destinations for people seeking outdoor recreational and cultural opportunities. Ocean-based recreation (e.g. SCUBA diving, boating, kayaking, whale watching, sport fishing) is rapidly growing along America's coastlines. Money spent on these activities and on associated supporting services (e.g. gear sales and rentals, boat charters, transportation, lodging, and dining) can be an important contributor to coastal communities. Following are some illustrative examples of how MPAs and coastal communities are intertwined through ocean tourism and recreation. *(BOX 6 – panel w/ images of ocean recreation)*

i. Ocean Recreation in MPAs Provides Economic Benefits

California – The waters off California (0-200nm) host 267 federal and state MPAs, many of which are in major tourist destinations for ocean-based recreation (e.g. Monterey, San Francisco, Santa Barbara). 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). [vi]

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) accounts annually for (2001 study) $174 million.[vii] Much of the ocean off the Florida Keys is covered by a patchwork of federal and state MPAs, the largest of which are the 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 *$$$* annually.

Hawai'i – On the main Hawaiian Islands, researchers documented an annual $304 million value for coral reef tourism and recreation.[viii] 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. That MPA averages 3,000 visitors a day, or approximately 1 million visitors per year, making it one of the Top 3 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 locals on Oahu love this beach as well and many of them visit it daily.[ix] Estimates of economic value for the Hanauma Bay MPA are *$$$* annually.

Great Lakes – Although the Great Lakes host fewer MPAs than other coastal regions, these sites have a major impact on local economies and culture. For example, diving and interpretive programs around shipwrecks in Michigan's Thunder Bay National Marine Sanctuary generate *$$$* annually, and it is widely credited with revitalizing a struggling local economy by highlighting and facilitating access to the area's important maritime history. Broad support for this MPA is reflected in the site's nickname in its town of Alpena, Michigan: *The Sanctuary of the Great Lakes*.

ii. MPAs Facilitate Sustainable Ocean Recreation.

U.S. MPAs are doing more than providing a place 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 the sanctuary and its value to ocean conservation and coastal communities, and to educate visitors about conserving its resources (e.g. wildlife viewing etiquette). The Monterey Bay NMS also engages hundreds of thousands of visitors per year in its visitor centers, connecting people to the sanctuary and encouraging them to explore and experience the coast and ocean and other facilities like the Monterey Bay Aquarium, Seymour Center, and Elkhorn Slough National Estuarine Research Reserve. *(BOX 8 – panel of images of various MPA visitor centers)*

In addition to general visitor outreach, several MPAs are strategically partnering with the ocean recreation industry (e.g. dive charters, fishing guides, whale watching, cruise lines) to develop and apply best practices for sustainable uses of these areas. For example, the Florida Keys National Marine Sanctuary's "Blue Star Certification" for

responsible dive operations is a promising model that is being applied in other MPAs around the US. *(BOX 9 – image and short description).*

Similarly, many MPAs that allow recreational fishing within their boundaries actively promote this popular activity. For example, National Parks, Refuges, and Sanctuaries and some state sites support and encourage responsible sport fishing through: (a) targeted education and outreach materials about where and how to fish sustainably, often located at popular access points; (b) dedicated recreational fishing MPAs or zones; and (c) specially themed events like the "Sanctuary Classic" fishing derbies intended to foster youth engagement in responsible ocean *angling* *(BOX 10 – image of Sanctuary Classic Sport Fishing Tournament)*

iii. MPAs Are Being Used Promote Coastal Tourism and Recreation

MPAs are often featured in advertisements for travel and tourism in coastal areas. For example, *Visit California* – a nonprofit organization promoting 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.[xxi] Additionally, the hotel booking service Booking.com/hotels has developed a service for visitors to find hotels near National Marine Sanctuaries anywhere throughout the nation.[xii] *(BOX 7 – image of the web site and other advertisements)* Clearly, MPAs are an effective marketing tool and tourist draw for coastal communities around the US.

b. MPAs 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 US$300 billion over the past decade.[xiii] In the U.S., severe storms have led to: loss of life; population dislocation and cultural disruption; widespread damage to critical infrastructure; secondary pollution and health impacts; 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.

For example, scientists estimate that coastal habitats such as dunes and marshes in the mid-Atlantic averted $625M in damage during Hurricane Sandy. [xiv] Similarly, coral reefs can dissipate up to 97% of storm-driven wave energy that would otherwise hit the shoreline. Although U.S. reefs face growing challenges from heat-induced bleaching, disease outbreaks, algal overgrowth, and invasive species, recent models predict that protecting coral reefs could vastly reduce the costs and impacts of severe storms. [xv] *(BOX 11 – images of storms and damage).*

Scientists, economists, emergency management agencies, and insurance companies are beginning to explore this issue, including efforts to create insurance policies for offshore reefs to restore them if damaged and to encourage their conservation. While these investigations are preliminary, they support the idea that that MPAs that are designed and effectively managed to protect naturally buffering habitats can help protect lives, property, infrastructure, investments, and critical services along the nation's coasts.

c. MPAs Build Local Capacity for Ocean Management

Although all MPAs focus internally on managing the natural and/or cultural resources they contain, many also look outward beyond their boundaries and engage local communities in 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. *(BOX 12 - images of MPA thematic events).*

NOAA's National Estuarine Research Reserve System (NERRS) – a state and federal MPA partnership – 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 valuable 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 Ocean Heritage.

Increasingly, MPAs are providing a space for people – both local residents and visitors— to connect personally to the nation's coastal ecosystems, to engage in their shared cultural heritage, and to become effective stewards of the waters off their shores. Following are a few encouraging examples of MPAs fulfilling this crucial role by providing living laboratories, fostering citizen science, 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 and in application of the resulting data in the sites' management. 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 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. *(BOX 13 – image of volunteers)*

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 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.[xvi] *(BOX 14 – panel of images of MLPA Collaborative, SACs at work)*

Among Federal MPAs, NOAA's National Marine Sanctuaries rely on 14 community-based Sanctuary Advisory Councils to "provide advice and recommendations to the superintendents"[xvii] on important and timely issues including management, science, service, and stewardship. These diverse and influential citizen advisors comprise more than 440 members and represent a broad cross-section of the local communities and stakeholders adjacent to national marine sanctuaries.

All of these citizen advisory bodies also invest significant effort and time toward educating the public 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 Engage Native Americans around Shared Values

MPA planning can provide effective venues for engaging Native American Tribes – which have been stewards of our coastlines since time immemorial — in the place-based management of ocean environments. For example, local Santa Barbara, California, 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 specifically to protect tribal heritage. *(BOX 15 – image of Chumash ocean going canoe).*

At the state level, although California's MPA planning effort did not originally include a distinct role for or consultation with tribes, 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 tribal representative on the California Fish and Game Commission; and four tribal positions in the California MPA Leadership Team, which oversees the ongoing management of state MPAs. Additionally, the Tolowa Dee Ni' Nation California led an innovative MPA baseline characterization project between 2014 and 2017, in partnership with a number of other tribes. This project drew on traditional tribal knowledge and interviews with local tribes to study culturally important coastal and marine species.[xviii]

These examples illustrate the breadth of ways that MPAs routinely engage, and increasingly rely on, tribes, local communities, stakeholders, and citizen scientists and advisors to help understand the best approaches to effectively and equitably manage these special ocean places.

Emerging Challenges Facing US 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 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 recreation; (b) expanding industrial and commercial uses; (c) ecosystem impacts of climate change; and (d) changes in federal ocean policy.

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. *(BOX 16 – a set of images).*

Examples of common recreational uses of the ocean include motor boating, sailing, kayaking, jet skiing, sport 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, parasailing, and jet packs being used for recreation inside U.S. MPAs.

As the number of people recreating in the ocean 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 cultural resources and values, and conflicts with other users. Having the necessary information, tools, and strategies to manage the growing number and variety of recreational uses sustainably is key to the long-term effectiveness of the nation's MPAs.

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. *(BOX 17 – panel of images all uses in this section).* America's new drive for offshore energy development brings potential 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; managers must able to evaluate and exercise the authority to proactively address these impacts.

ii. *Aquaculture*

To minimize the ecological impacts of wild-capture fisheries, the U.S. is encouraging aquaculture along the nation's coasts and potentially in or near MPAs. Potential risks to MPAs may include: escape of exotic, invasive species; nutrient pollution; and disease transmission to wild, native species.

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. Risks may include mortality of larvae and juveniles, and localized increased in salinity.

iv. *Deep-Sea Industrial Uses*

Some U.S. MPAs encompass very deep waters and benthic habitats. 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. And, 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 thus may need new approaches to sustainably manage and perhaps benefit from them (e.g. through 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. Examples of this trend include: ocean acidification and oxygen depletion impacting shellfish growers and fishermen; ocean "heat waves" bleaching coral reefs and altering fish stocks; 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 are not immune to these large-scale ocean impacts and managers must have the capacity to address them. *(BOX 18 – panel of images illustrating some of these situations).*

d. Policy Measures to Weaken, Reduce, or Eliminate MPAs

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 [xix], and an assessment of their opportunity cost for oil and gas development in U.S. waters [xx]. A third, issued in 2018, rescinds the 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 [xxi]. *(BOX 19 – citations and descriptions of the 3 EOs and the OCSLA plans, in lieu of the current Endnotes).*

This emerging U.S. ocean policy framework has the potential to diminish the protections to natural and cultural resources provided by some U.S. MPAs, especially those managed by federal agencies. Potential pathways for weakening MPA protections 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 MPAs' 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;
- Disrupting natural animal behaviors, including dislocation from normal habitats;
- Altering natural soundscapes and the 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 actions, the ability of US MPAs to address these and other challenges to their effectiveness.

Findings and Recommendations for Sustaining MPA Benefits

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 benefits offered by U.S. MPAs, the Departments of Commerce and Interior must exercise foresight, coupled with innovative technical, management, and policy solutions. Specifically, these Departments must:

- Act on the following recommendations through their respective federal MPA programs. For DOC/NOAA, relevant MPAs include the National Marine Sanctuaries and 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.

- Actively encourage and support the broad implementation of these recommendations among the wide array of non-federal, MPA partner agencies around the United States.

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, and, where needed, strengthen or expand the nation's MPAs in U.S. coastal, ocean, and Great Lakes waters. Ensure that any proposed alterations to the number, size, location, purposes, or protections of federal MPAs are based on a clearly articulated objective and need, 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 scientific information on impacts and/or appropriate management strategies to address them.

Recommendation 2: Anticipate and 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.

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 actively engage local communities around the U.S. in the design, establishment and adaptive management of their MPAs.

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

Finding 5: Many emerging challenges to US MPAs 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 supports them.

Recommendation 5: Explore, characterize, monitor, study, and evaluate US MPAs to detect and anticipate impacts of climate change on natural and cultural resources and on human uses of the sites, and employ the results to inform their long-term adaptive management and resilience.

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ENDNOTES

[i] For the purpose of our current MPA FAC charge, the term "marine" includes 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 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.

[vv] http://www.piscoweb.org/sites/default/files/portfolios/CI_10-Yr_Brochure_web.pdf

[vi] NOAA. National Ocean Economic Project. https://cbe.miis.edu/noep_publications/

[vii] Luke Brander and Pieter van Beukering, "A Total economic value of US coral reefs: a literature review," NOAA Coral Reef Conservation Program. 2013.

[viii] Cesar, H. van Beukering, P. "Economic valuation of the coral reefs of Hawaii" *Pacific Science* Vol 58: 231-242, 2004

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