Representativeness of Marine Protected Areas of the United States

Presence of MPAs in U.S. marine ecoregions

How were marine ecoregions developed and defined?

In 2002, the Commission for Environmental Cooperation (CEC)—a tri-national organization promoting environmental cooperation across the U.S., Canada and Mexico -- assembled ecologists, marine biologists, geographers, planners and managers to assess North America's marine biodiversity and identify ecoregions that describe the distinct physical, biological and oceanographic characteristics of each of these areas. Through this process, the CEC classified the ocean and coastal regions of North America into 24 marine ecoregions, 19 of which include U.S. marine waters (Figure 1).

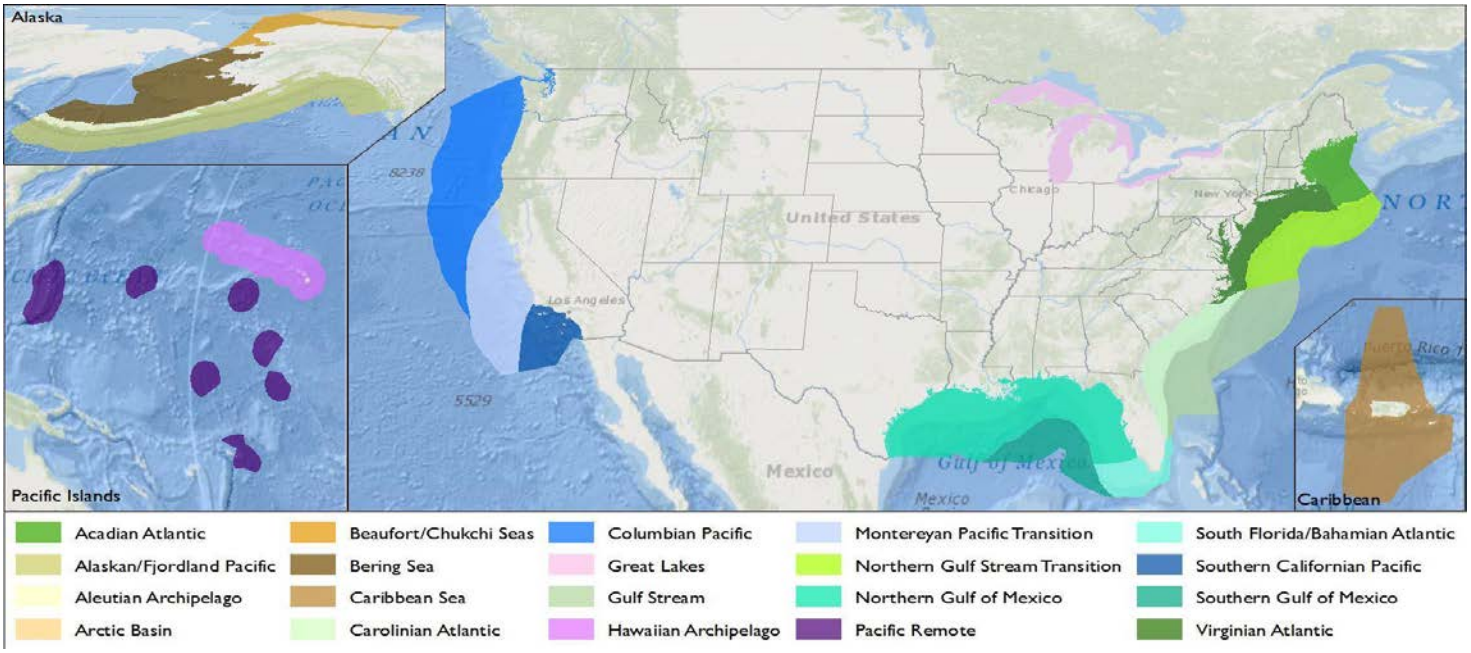

Figure 1. CEC Marine Ecoregions of North America highlighting those found in U.S. Waters (credit: NOAA MPA Center)

How was MPA representativeness assessed?

NOAAs National Marine Protected Areas Center (Center) maintains a comprehensive inventory of the nation's MPAs. The Inventory notes the presence/absence of key ecological, physical and cultural resources of more than 1,700 MPAs, along with geospatial boundaries provided by the managing agencies. The ecological, physical and cultural data were collected from online repositories that held source documents, including site descriptions, management plans, code of federal and state regulations, and scientific papers. In spreadsheets developed by marine ecoregion, presence of various marine features and processes is noted for each MPA site.

What were the data limitations?

This assessment identifies the presence of ecosystem features and processes found within the nation's 1,628 MPAs as listed in the MPA Inventory as of May 2013. The MPA inventory does not include data on the spatial coverage of each ecosystem feature or process within the MPA (such as area of seagrass area within the Florida Keys National Marine Sanctuary) because this information was not readily available for most ecosystem features and processes. The MPA inventory also does not describe whether the resources receive any special protection inside the MPA (such as implementing no anchor zones or boating restrictions in shallow water to protect seagrass beds).

How does the United States define "MPAs"?

The U.S. defines marine protected areas 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* (Executive Order 13158). These are places with long term protection for natural heritage (ecosystems and biodiversity), cultural heritage (living and non-living) and sustainable production (fisheries). While many countries do not include fisheries management areas as MPAs, the sustainable production MPAs in the U.S. MPA Inventory are included in this analysis. MPAs also include areas with varying levels of protection – from multiple-use to highly protected "no take" areas where all extractive uses are prohibited.

What is "representativeness"?

Representativeness means resources that are ecologically important to a defined area or marine ecoregion can also be found within one or more of the MPAs in that marine ecoregion. The Convention on Biological Diversity's Azores Scientific Guidance (2009) notes that representativity is "*captured in [an MPA] network when it consists of areas representing the different biogeographical subdivisions of the global oceans and regional seas that reasonably reflect the full range of ecosytems, including the biotic and habitat diversity of these ecosystems*."[i]

Why work towards a representative MPA System?

In 2000, President Clinton signed Executive Order (EO) 13158, directing the National Oceanic and Atmospheric Administration (NOAA), the Department of the Interior and other federal agencies to collaborate with states, territories and tribes to "*develop a scientifically based, comprehensive national system of marine protected areas (MPAs) representing diverse U.S. marine ecosystems*." The EO further specifies that the national system should "*preserve representative habitats in different geographic regions of the marine environment*." The U.S. has developed a national system of MPAs to advance the conservation and sustainable use of the nation's natural and cultural marine resources. MPAs can choose to join the national system through a nomination process in order to collaborate with other MPAs on shared issues. The analysis of national system MPA representivity assesses how well NOAA and its interagency partners have fulfilled the directives of the EO (such as developing a national system of MPAs that are representative of the diverse marine ecosystems of the nation) as well as identify remaining information gaps.

Where are MPAs found in U.S. waters?

MPAs are not evenly distributed among the nation's ecoregions and vary significantly in numbers and size. The marine ecoregions with the most MPAs are found along the Atlantic and Gulf coasts of the U.S. The Virginian Atlantic (n=333), Carolinian Atlantic (n=178) and Northern Gulf of Mexico (n=273) contain a total of 784 MPAs. Although representing only about 7% of the total marine ecoregion area of the U.S., these three ecoregions alone represent nearly half (48%) of the total number of MPAs of the U.S. In contrast, the polar Bering Sea, Beaufort/ Chukchi Seas, Aleutian Archipelago, and Alaskan/Fjordland Pacific Ecoregions contain only 95 MPAs combined. These four large marine ecoregions represent 28% of the entire U.S. marine ecoregion area but only 6% of the nation's total number of MPAs.

Representativeness of Habitats

Habitat types listed in the MPA Inventory include (a) sand dunes, beaches, and barrier islands; (b) rivers, streams, and wetlands; (c) nearshore rocky intertidal, mangroves, and seagrass; (d) both tropical and temperate coral reefs as well as rocky reefs; (e) kelp and algae; and (f) offshore seamounts, pinnacles, and submarine canyons (Table 1). Nationally, 70% of these various habitat types that are present within the 19 marine ecoregions of the U.S. are also present in at least one National System MPA in each ecoregion.

Table 1 illustrates, for a range of major habitat types, whether they occur in the ecoregion and if so, whether they are located within a National System MPA (green), are located only within a non-National System MPA (yellow), are located within the ecoregion but are not found in any type of MPA (red), or are not present within that ecoregion (grey).

Table 1. Presence of select habitats within the National System of MPAs

CEC Marine Ecoregion	Rivers/ Streams	Wetlands/ MudFlats	Sand Dunes	Beach	Barrier Islands	Rocky Intertidal	Mangroves	Sea Grass	Coral Reefs (Temperate)	Coral Reefs (Tropical)	Rocky Reefs	Kelp & Algae	Seamounts/ Pinnacles	Submarine canyons
Bering Sea														
Beaufort/ Chukchi Seas														
Alaskan/ Fjordland Pacific														
Aleutian Archipelago														
Southern Californian Pacific														
Montereyan Pacific Transition														
Columbian Pacific														
Hawaiian Archipelago														
Pacific Remote														
South Florida/Bahamian Atlantic														
Northern Gulf of Mexico														
Southern Gulf of Mexico														
Caribbean Sea														
Acadian Atlantic														
Virginian Atlantic														
Northern Gulf Stream Transition														
Gulf Stream														
Carolinian Atlantic														
Great Lakes														

Present both within an ecoregion and within a National System MPA in that ecoregion
Present within the ecoregion, but only within an MPA that is not a member of the National System
Known or expected to be present within the ecoregion, based on scientific literature and/or expert opinion, but in not present within an MPA in that ecoregion
Not present within this ecoregion (e.g., not applicable)

Representativeness of Fish and Marine Mammals

Various types of (a) fish (e.g., anadromous, estuarine, reef, demersal/groundfish, coastal pelagic, migratory, freshwater, deepwater), (b) marine mammals (e.g., cetaceans, pinnepeds, fissipeds, sirenia), (c) sea turtles, and (d) other Endangered Species Act (ESA) listed species are listed in the MPA Inventory. Nationally, 71% of these fish, marine mammal or sea turtle ecosystem features and ESA listed species that are present within the 19 marine ecoregions of the U.S. are also present in at least one National System MPA in each ecoregion.

Representativeness of Birds, Invertebrates and Algae

Various types of (a) marine and coastal birds (e.g., coastal waterfowl, estuarine, seabirds), (b) invertebrates (e.g., subtidal and rocky intertidal), and (c) algae (e.g., benthic and intertidal), are listed in the MPA Inventory. Nationally, 82% of birds, invertebrates and algal ecosystem features that are present within the 19 marine ecoregions of the U.S. are also present in at least one National System MPA in each ecoregion.

Representativeness of Ecologically Important areas

MPAs that protect important life history stages of species are extremely important and support sustainability of extracted species and help ensure future success of the population. These MPAs protect where fish spawn and grow (juvenile nursery areas) as well as where seabirds nest and rest during long migrations. In many marine ecoregions, sea turtles need beaches to nest and new hatchlings require areas to forage for food. Several marine ecoregions also contain beaches and rock outcrops for marine mammals to haul out to rest, escape predation, breed, and nurse their young. Nationally, 87% of ecologically important ecosystem processes that are present within the 19 marine ecoregions of the U.S. are also present in at least one National System MPA in each ecoregion.

Conclusions

This preliminary analysis demonstrates that the full spectrum of the 19 recognized marine ecoregions in U.S. waters are nominally represented in the current National System of MPAs. Moreover, National System MPAs encompass many of the key ecosystem features and ecologically important processes within each ecoregion. If one eliminates the ecoregions with no National System MPAs (Gulf Stream and Southern Gulf of Mexico), the representativeness of the National System is even stronger (by an additional 5-10%). No one ecoregion appears to be clearly more or less representative overall than the others in all ecosystem features. This analysis does not investigate whether being present within an MPA does provides more protection to a specific resource or process than compared with those outside an MPA.

While generally encouraging, these results do not alone signify that the current National System is either fully representative or operationally effective. For example, this initial analysis highlights critical gaps in our collective understanding about the structure and function of U.S. marine ecosystems and about the nature and efficacy of our efforts to manage them spatially with MPAs. Creating that knowledge base and capacity will require additional investment.

Report Availability

Electronic copies of the full representativeness report and detailed analyses for each CEC marine ecoregion may be downloaded from the National Marine Protected Areas Center web site at:
http://marineprotectedareas.noaa.gov/dataanalysis/mpainventory/

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[i] http://www.cbd.int/marine/doc/azores-brochure-en.pdf