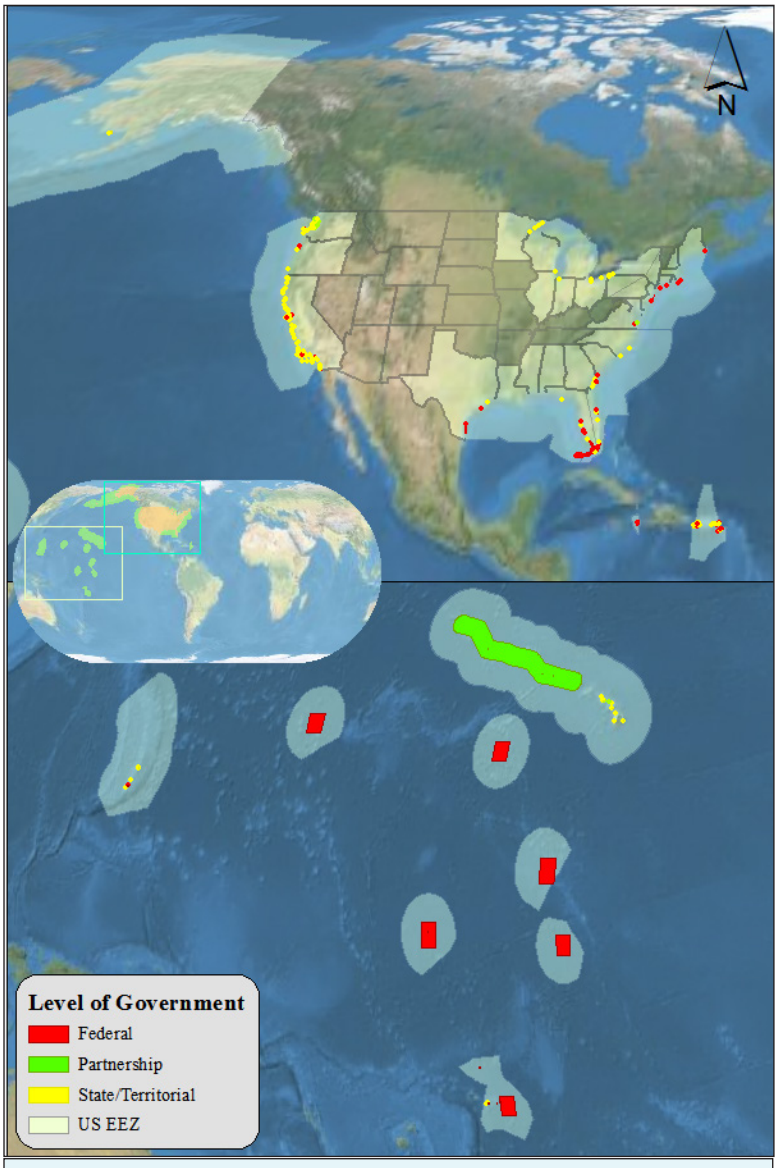
Marine Reserves in the United States

National Marine Protected Areas Center

The Nation's Hub for Building Innovative Partnerships and Tools to Protect Special Ocean Places



Marine reserves of the U.S. and its territories. Marine reserves cover 3.1% of U.S. waters.

What are marine reserves?

Marine reserves, commonly called "no take" areas, are a type of marine protected area (MPA) that provide a high level of protection to marine resources. While MPAs refer to any area of the marine environment that has been protected for long-term resource conservation, marine reserves are a subset of MPAs that restrict extractive uses in order to protect sensitive habitats or threatened species, or to sustain fisheries. Typically, marine reserves do not allow hunting, fishing, or collecting. Certain marine reserves do not allow other activities (such as anchoring a boat) that can harm sensitive, protected resources.

Marine reserves have been established worldwide, from the tropics to temperate waters. While the ocean area covered by marine reserves is quite small, their contribution to marine conservation is important. There are over 1,600 MPAs in U.S. waters, of which 223 are marine reserves. Marine reserves make up 3.1% of U.S. waters, including marine, estuarine and Great Lakes waters. Approximately 7% of the MPA area in the U.S. is in marine reserves, with the other 93% designated for multiple uses, including fishing.

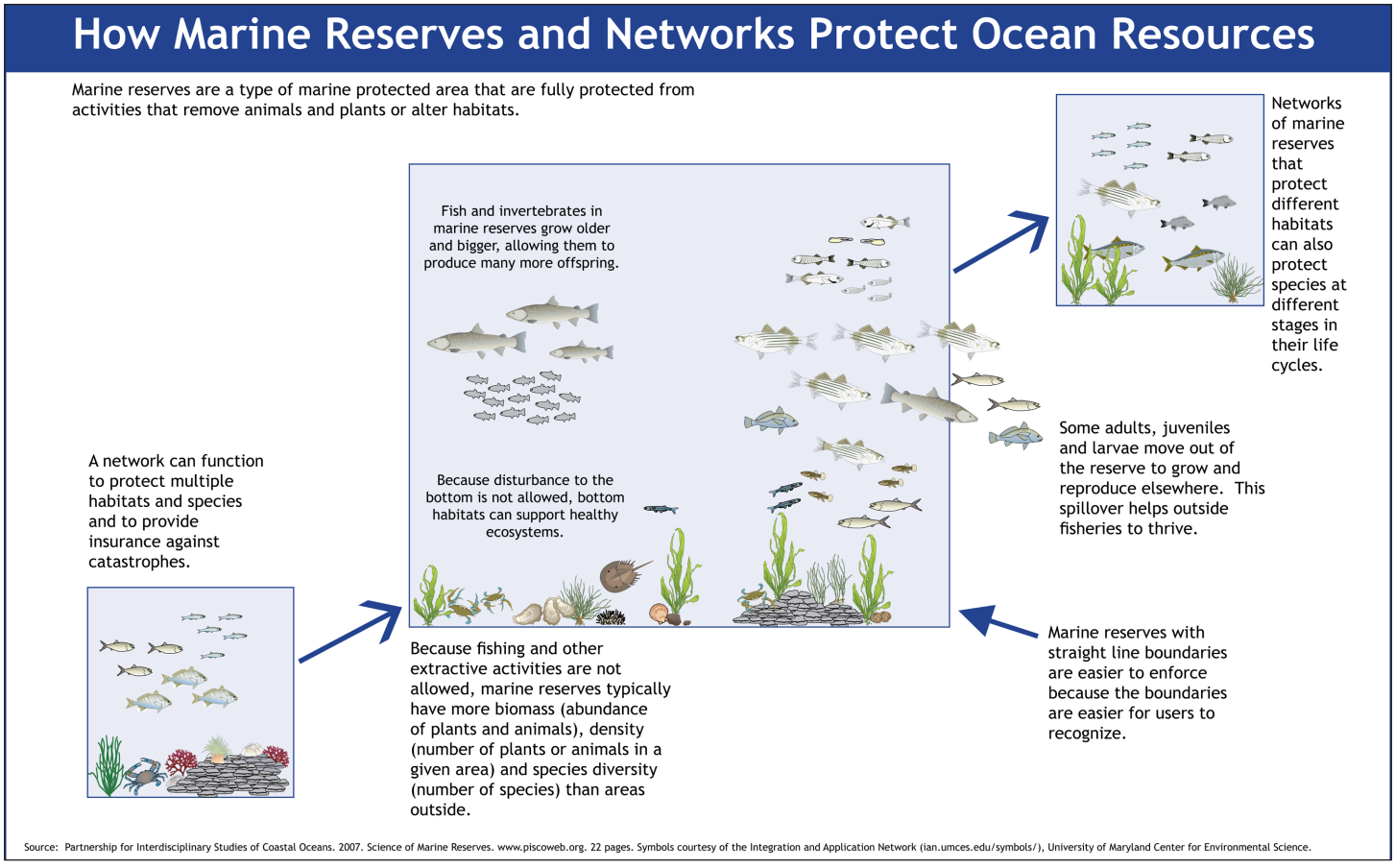
Why establish marine reserves?

Coastal and marine areas in the U.S. serve as routes of transportation, provide us with food and materials, and are places we go for recreation and enjoyment. Coastal development and consumptive uses of marine resources has, however, degraded habitats and caused many species to decline. While past resource management techniques were primarily aimed at restoring or protecting a single species or type of habitat, management agencies have increasingly turned toward an ecosystem-based approach to management, a holistic approach to protecting and restoring ecosystem health. Marine reserves are an important tool because they reduce human pressures and allow the natural connections within an ecosystem to recover from many environmental stressors. Establishing a marine reserve not only protects and helps to restore the habitats and populations of organisms within the reserve, it can also enhance habitats and populations throughout a region. This in turn supports human communities by protecting special places and resources and the economic, social and cultural values they provide.

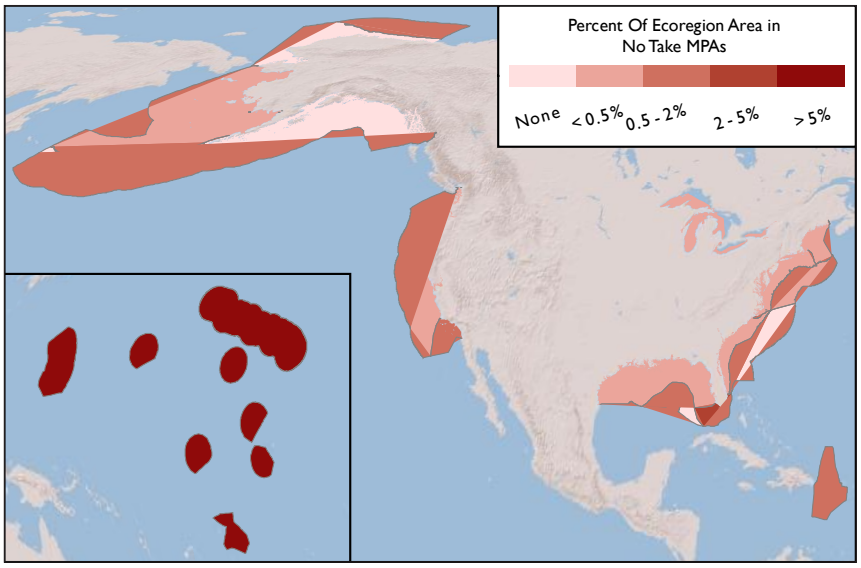
Do marine reserves work?

Studies conducted in many different habitats and ecosystems have shown the effectiveness of well designed and managed marine reserves. When a reserve is established, species that were previously exploited usually begin to recover. Overall, biomass (the total mass of plants and animals) increases in the reserve, as does the size and density of organisms and the number of species. Reserves also help restore the balance between species including important predator-prey relationships. For example, sea urchins graze on kelp in rocky habitats, and overgrazing by urchins can lead to declines in kelp forest ecosystems. In parts of California, overgrazing occurred when populations of sea urchins exploded due to the reduction in the number of their natural predators such as sea otters, lobsters and California Sheephead (Semicossyphus pulcher). However, the protection provided by marine reserves, along with broader protection of sea otters, has helped restore predator control of sea urchins and promoted recovery of kelp forests. The amount of time required for ecosystem restoration can vary, and depends on the growth and reproductive rates of the local organisms. In colder waters where animals grow more slowly or in areas with organisms that reproduce at larger sizes, the recovery time is longer.

The mobility of organisms is a key factor in how reserves affect adjacent areas. Many species of fish, such as coral reef fish or rockfish, spend much of their lives in the same area. For these species, the benefits of establishing a reserve are mostly observed within its boundaries. Other species, such as the fish and crustaceans present in seagrass beds, are highly mobile, moving in and out of different habitat types over the period of a tidal cycle, day, or season. Larvae and juveniles of mobile species produced within a reserve or network of reserves can enhance the diversity and abundance of organisms across a region as they migrate and support food webs by becoming prey for other species. Similarly, highly mobile adult animals can be caught when they move outside the reserve, improving commercial and recreational fishing. In areas with an active sport fishing community, it's common for areas just outside reserve boundaries to become popular fishing sites.



Where should marine reserves be established?



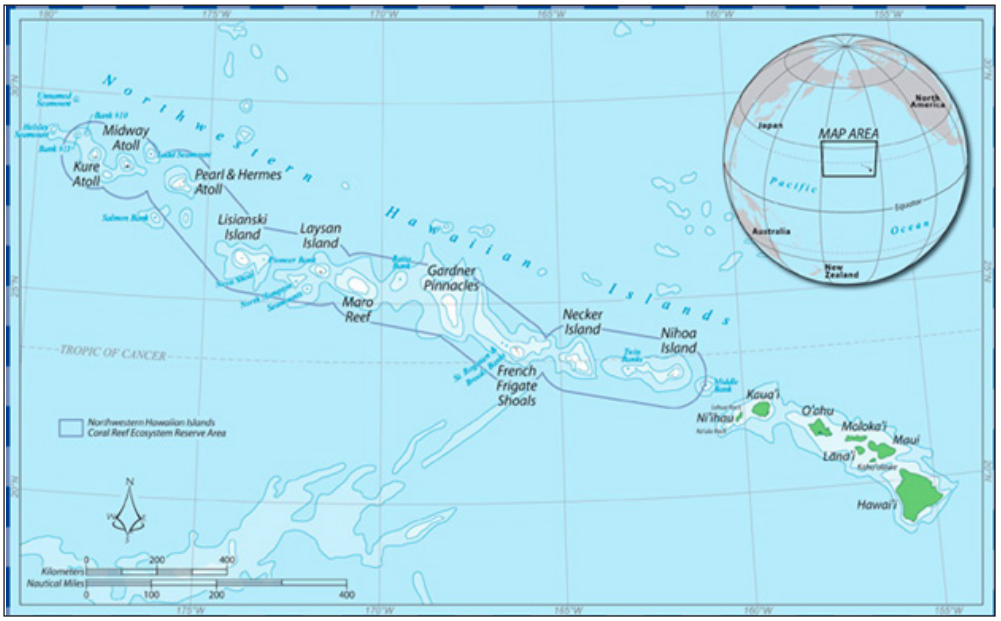
The coastline of the U.S. is 150,590 km long (93,572 miles) and includes a wide range of habitat types, from the Arctic to the Great Lakes to the tropics. Each habitat type within a region may support a distinct mix of species, including endangered species and organisms of commercial, recreational, or cultural importance. As a result, what is considered ecologically important and valued often varies from place to place.

MPAs are established to achieve specific conservation goals, usually a result of a dialogue among resource managers, scientists, local communities and other stakeholders. Once these goals have been established, the management measures needed to achieve these goals must be evaluated. Because marine reserves are the most highly protected type of MPA, they necessarily involve tradeoffs with socio-economic uses of an area. As a result, they are generally established only when this management tool is determined to be the most appropriate one available to achieve the management objectives. Given the diversity of habitats and communities in coastal and marine areas, management tools must be science-based, and must address local and regional uses of the area. Successful marine reserves depend on proper design, community engagement, compliance and evaluation and monitoring.

Marine reserves vary greatly in size. Nearly 94 percent of marine reserve area in the U.S. is located in the 363,680 km^2 Papahānaumokuākea Marine National Monument in Hawaii. The remaining 6 percent is located in small reserves around the country. Marine reserves are established through the existing authorities of federal agencies, states or territories. Fifty-seven are federally managed as part of National Parks, National Wildlife Refuges, or National Marine Sanctuaries systems. Others are managed at the State (171) and territorial level (24), or through partnerships (9).

The following three examples illustrate the ways in which marine reserves are playing a key role in conserving our ocean resources.

In Focus: Papahānaumokuākea Marine National Monument



Created in 2006, the Papahānaumokuākea Marine National Monument includes 363,680 km^2 of ocean waters in the Northwestern Hawaiian Islands (NWHI). It is home to over 7,000 species, a quarter of which are found only in the Hawaiian archipelago. Islands and shallows in the northern areas are dominated by endemic and subtropical species, while the more southerly areas have predominantly tropical species.

Human use of the Northwestern Hawaiian Islands has been generally limited because of the isolation of many of the islands, the limited space suitable for habitation in the chain, and cultural protection from the area's status as a sacred place to Native Hawaiians. Papahānaumokuākea

Kure Atoll (Image courtesy of the Image Science & Analysis Laboratory, NASA Johnson Space Center, ISS008E14407, http://eol.jsc.nasa.gov)

is of great cultural importance to Native Hawaiians, with significant cultural sites found on the islands of Nihoa and Mokumanamana. Native Hawaiian people seasonally fished and hunted and in later years, Americans, Europeans, and Japanese hunted whales and seals, mined guano, and fished the waters, but never to the extent seen in main Hawaiian Islands. The area first came under protection in the 1700s, when the Kingdom of Hawaii required Japanese ships to obtain permission to collect seabird feathers and eggs. In response to the illegal activity of bird hunters, President Theodore Roosevelt signed an Executive Order in 1909 protecting many of the islands as a Federal Bird Reservation, establishing what would later become the Hawaiian Islands National Wildlife Refuge.

Despite locally significant impacts from past use as military bases and commercial overfishing of a number of species such as lobster and grouper, much of the island chain is still relatively pristine. The Northwestern Hawaiian Islands have three times the biomass of shallow-water reef fish than the Main Hawaiian Islands, in large part because most of the apex predators in the waters around the Main islands have been fished to near extinction. The lagoonal habitats and deep coral reefs of the larger atolls in the Northwestern Hawaiian Islands also provide abundant nursery habitat sheltered from waves for many juvenile fish. This island chain is one of the few predator dominated coral reef ecosystems remaining.

Designating Papahānaumokuākea as a marine national monument helps to protect the rich and unique biodiversity of the area. As part of the establishment of the Monument, all commercial fishing ceased in 2010. Current uses are restricted to traditional uses by Native Hawaiians, limited tourism, and scientific research. Populations of previously fished species such as lobster and bottomfish are being monitored for signs of recovery. It's too early for definitive results of the effects of reduction and removal of fishing pressure. From historical anecdotal evidence and scientific research, ecosystem recovery has been documented numerous times in the waters surrounding the islands when the human activity responsible for the decline has been removed for long periods of time.

The Monument is home to about 900 of the 1,100 Hawaiian monk seals that exist today. While the seal population overall is still in decline in the NWHI, some island populations have stabilized or even increased in recent years. Historical threats included human disturbance and harvesting, but currently the decline is driven by food limitation, shark predation, entanglement and other factors. The recovery efforts by NOAA and their partners in the Monument have resulted in the monk seal population being up to 30% larger than it would have been without intervention. The impacts of invasive species have mainly been felt on land, where exotic plant species pose threats to birds and other wildlife. In the water, native species exhibiting invasive behavior have impacted coral reef habitat and a number of established marine alien species have been found, but their impacts have yet to be fully ascertained.

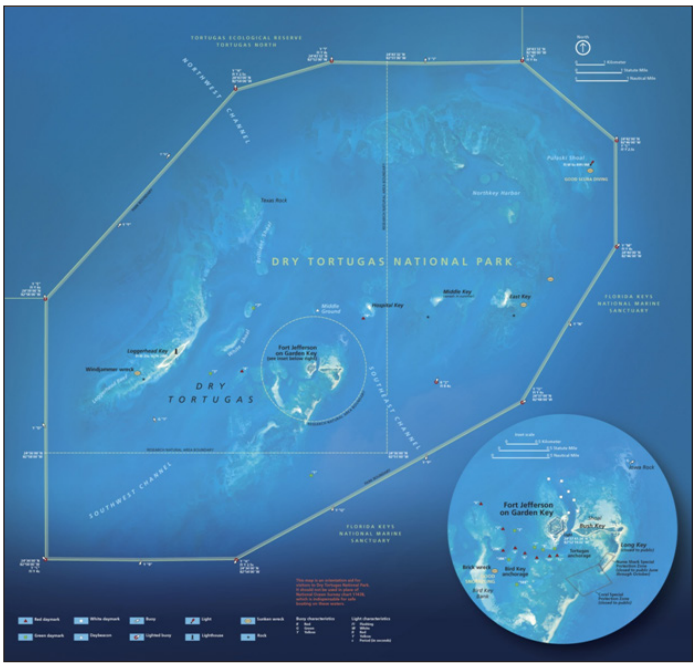
Hawaiian Monk Seal, *Monachus schauinslandi* (Photo by James Watt)

The value of Papahānaumokuākea is that it contains a large number of unique species, protects a large pristine coral reef ecosystem which has been degraded

elsewhere by overuse, and protects large predators that have been overfished in the main Hawaiian Islands. The goal of the Monument is to ensure ecological integrity and achieve strong, long term protection and perpetuation of the NWHI ecosystems, Native Hawaiian culture, and heritage resources for current and future generations. The islands, atolls, reefs and waters of the NWHI provide a rare opportunity to study a large, relatively intact and undisturbed ecosystem that still exists much as it did before human contact.

In the years since the Monument was established, efforts have expanded to map and monitor its resources and determine their diversity and abundance. Due to the Monument's immense size and location, only about 50% of the shallow water habitats within have been mapped. This information will be essential for assessing the effectiveness of Papahānaumokuākea's protection.

In Focus: Dry Tortugas Research Natural Area and Ecological Reserves



The seven islands comprising Dry Tortugas National Park are located approximately 112 km west of Key West, Florida. Fort Jefferson was established in 1847 on Garden Key to protect shipping in the straits between the Gulf of Mexico and the Atlantic. The Fort was never completed, but served as a military prison during and after the Civil War until it was finally abandoned in 1874. Franklin D. Roosevelt declared it a National Monument in 1935, and Congress established Dry Tortugas National Park in 1992 expanding the boundary to 100 square miles with a mandate to "protect and interpret a pristine subtropical ecosystem." Lighthouses have been located at Garden Key and Loggerhead Key to aid in navigation and reduce the number of shipwrecks occurring in the area. The Carnegie Institute operated the Laboratory for Marine Biology on Loggerhead Key from 1905 to 1939, making significant scientific contributions to coral reef research and mapping and pioneering the first underwater photographs.

The coastal and marine areas of South Florida are heavily impacted by development and other human uses. Commercial and recreational fishing are major industries in the area, but fish populations have declined due to fishing pressure and habitat loss. Similarly, corals throughout the Keys have declined precipitously in the last several decades, in part linked to land-based sources of pollutants, including bacteria found in human and animal waste. Seagrass beds have been shrinking, both from a change in the flow of freshwater into the region and through direct damage by boat propellers. Because of their isolation well apart from the main Florida Keys chain, the Dry Tortugas have experienced fewer of these impacts. While recreational fishing has been limited due to the area's relative isolation, game fish including snapper, grouper, and grunts had been declining in both size and abundance before the establishment of the reserve areas.

In 2001, the Tortugas Ecological Reserve was established in waters managed by the state of Florida, the Florida Keys National Marine Sanctuary, and the Gulf of Mexico Fisheries Management Council. The Ecological Reserve is a 391 km^2 area made up of two sections: Tortugas North, containing some of the most pristine coral reefs in the Florida Keys, and Tortugas South, which includes Riley's Hump, a 30m tall seamount that has been identified as a critical spawning site for many fish including five commercially important snapper species. In 2007, Dry Tortugas National Park established a 119 km^2 Research Natural Area, where fishing and anchoring are prohibited. Together, the Research Natural Area and the Ecological Reserve make up the second largest no-take marine reserve in the continental U.S.

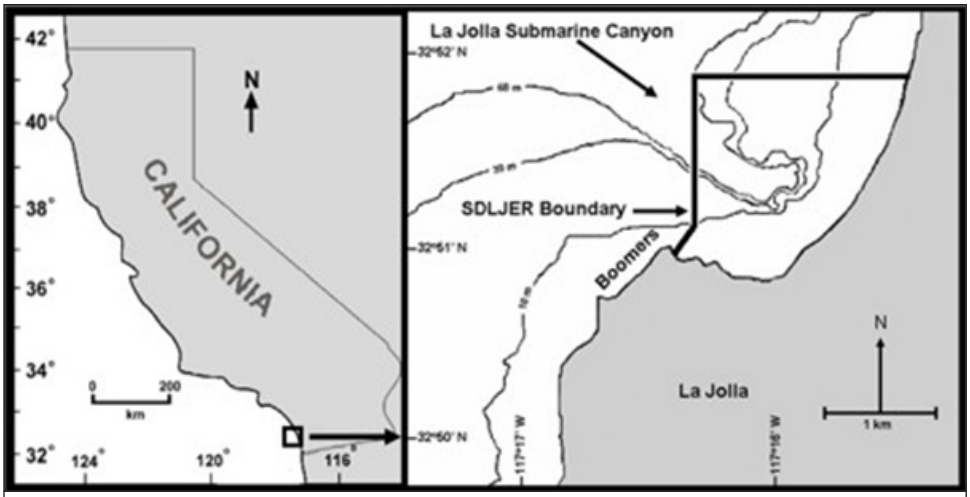
Garden, Hospital, and Bush Keys (Image courtesy of the Image Science & Analysis Laboratory, NASA Johnson Space Center, ISS017E008188, http://eol.jsc.nasa.gov)

Coral and fish community, Dry Tortugas National Park (Image courtesy of NPS http://www.nps.gov/drto/photosmultimedia/Flora-and-Fauna-of-Dry-Tortugas.htm)

Establishing marine reserves in the Dry Tortugas region serves two major goals. First, it protects some of the most productive and least disturbed marine areas in South Florida with healthy coral colonies and fish populations that are overfished elsewhere. Secondly, it protects an important regional source of larval and juvenile fish and coral organisms for the Florida Keys and Southeast Florida. Since the establishment of the reserves, the number and size of several fish species (e.g. red grouper) within its boundaries have increased. Bottom habitat previously disturbed by shrimping gear on a regular basis now supports increased biomass and diversity of organisms. A 2012 study by the National Park Service and the State of Florida found increases in the number and size of red grouper, mutton snapper, yellowtail snapper, and hogfish in the Dry Tortugas National Park Research Natural Area. In contrast, abundance and size of these species either remained the same or decreased in nearby areas outside the Research Natural Area and the Tortugas Ecological Reserves. The marine reserves are also working together as a network to enhance ecosystem benefits – for example, protection of mutton snapper in the shallow water habitat of the Research Natural Area likely contributed to the recovery of a spawning aggregation in the deep water habitats of the Tortugas South Ecological Reserve. Protecting this ecological crossroads supports reproduction and distribution of species throughout South Florida, including those important for commercial and recreational fishing.

In Focus: Matlahuayl State Marine Reserve (La Jolla Ecological Reserve)

Beginning in the 1940s, researchers at the Scripps Institute of Oceanography observed declines in the abundance of marine animals in La Jolla Bay, particularly giant sea bass (Stereolepis gigas), broomtail grouper (Mycteroperca xenarcha) and red, black and green abalone. Squid trawlers working in the area were also thought to be damaging the habitats along the rim of the submarine canyon. Researchers and community members lobbied for decades until the City of San Diego and the California Department of Fish and Game established the reserve in 1971.



Matlahuayl State Marine Reserve (previously called the San Diego-La Jolla Ecological Reserve, or SDLJER) (Image courtesy of California SeaGrant, http://www-csgc.ucsd.edu/)

Originally established as the San Diego-La Jolla Ecological Reserve, the Matlahuayl State Marine Reserve (SMR) includes a range of habitats, from kelp forests to boulder reefs to a submerged canyon at depths from the intertidal to 400 feet (120 m). The City of San Diego and the California Department of Fish and Game established the 533 acre (1.92 km2) no-take reserve, which was later amended to allow some commercial squid fishing by hand held scoop nets and renamed the La Jolla State Marine Conservation Area (SMCA). In 2010, the area was expanded and renamed as the Matlahuayl State Marine Reserve (SMR) and was adopted by the California Fish and Game Commission as part of a new network of MPAs in Southern California established under California's Marine Life Protection Act (MLPA). The reserve's goal is to protect threatened or endangered native plants, wildlife, or aquatic organisms or habitats. In particular, it aims to protect the canyon wall habitat and populations of green abalone.

Prior to the MLPA Initiative, analysis of the La Jolla SMCA's effectiveness showed that its strength was primarily in protecting species that are sessile or do not travel significantly beyond its boundaries, such as abalone. Green abalone, one of the

The Matlahuayl State Marine Reserve (image courtesy of the CA State Water Resources Control Board http://www.swrcb.ca.gov/water_issues/programs/ocean/docs/asbs/asbs_areas/swqpa29c_lo-jolla_asbs.jpg)

species of concern in this area for decades, are found in higher abundance in the reserve than in other similar locations in the region, although populations are still low compared to historic levels. The establishment of the reserve was also effective in halting the on-going decline of canyon wall habitat due to squid trawling. However, the reserve did not have a significant effect on the abundance or diversity of larger, more mobile organisms. One reason for this could be because the area is too small and doesn't contain ecologically important areas such as a spawning ground or rookery. Over the years, the reserve has become increasingly impacted by land based development in the watershed, as have other coastal areas in this region. Fishing pressure is also high in areas immediately adjacent to the MPA, and poaching is common, as much of the public in the area is unclear on the area's protected status. In a survey conducted in the area, only 21% of the general public and 35% of fishers could correctly identify the MPA boundaries.

One goal of the MLPA Initiative was to address concerns that the State's MPAs had been established on a piecemeal basis, sometimes without coordinated planning or a strong scientific basis. Under the MLPA, the state established regional MPA networks to protect critical areas and ensure that reserves and conservation areas are in the right place and of the right size to accomplish their goals. In the case of the La Jolla SMCA, the reserve area was increased in size by the length of two city blocks and is now adjacent to another conservation area with controls on fishing and collecting (San Diego-Scripps Coastal State Marine Conservation Area). The reserve went from being an isolated protected area to being a part of a coordinated network with complementary goals and benefits. The reserve is important as one of the first in U.S. waters, and in demonstrating its effectiveness in protecting sessile species, its inclusion in the network is expected to improve its effectiveness in protecting a wider range of species.

Marine Reserves: Helping to Conserve Important Marine Areas

Marine reserves are critical tools for marine conservation, allowing for the protection of important resources such as the Riley's Hump spawning grounds in the Dry Tortugas and unique and threatened places such as the remote islands of the Papahānaumokuākea Marine National Monument. Public engagement is a critical component of the success of a marine reserve, particularly those in developed areas like those near the San Diego – La Jolla Ecological Reserve. Long-term monitoring within marine reserves is essential for effective management and enforcement.

Both large and small reserves have been proven effective at increasing the size and abundance of organisms within their boundaries, and new studies are emerging that show how reserves can help support the ecosystems and fisheries in areas adjacent to them. Large reserves tend to support a greater diversity of organisms than small reserves. A reserve has to include the right habitats. Protection of rookeries or spawning areas helps to assure that larval and juvenile organisms continue to broadcast across a region, supporting both ecosystems and commercial and recreational fishing. Even a small reserve centered on such an area can have widespread positive impacts. In areas highly impacted by people, the preservation of the remaining least disturbed habitat can protect threatened or endangered species and habitats by providing a place of refuge, as well as supporting the diversity of adjacent areas by maintaining a supply of young organisms. However, marine reserves are only one tool for marine conservation, and should be evaluated and used in the context of other resource management tools such as other fishing restrictions and measures to restore coastal and marine water quality.

Increasingly, scientists and managers are advocating that MPAs should be ecologically linked in regional networks to protect representative examples of the different ecosystems, habitats and natural communities in our oceans. MPA networks can connect different habitats, often fulfilling ecological aims more effectively and comprehensively than a single MPA. The development of regional MPA networks in the United States is still in its early stages, but marine reserves play an important role within them.

How do we balance the needs of the communities to use marine areas with the need to assure that the resources that support both a healthy ecosystem and human uses continue at sustainable levels into the future? Managers, scientists and stakeholders should identify the highest priority coastal and marine areas for protection. To do this, information is needed on where organisms are located, their migration routes, how they use habitats, the locations of critical areas, such as spawning or nursery grounds. Decision-makers also need information on the socio-economic costs and benefits of establishing marine reserves to more accurately evaluate trade-offs. Ultimately, a dialogue among all those who care about and depend on the ocean is needed to identify and protect strategic locations to help ensure the health and survival of species and habitats and the many benefits they provide.

For Further Reading

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