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Editorial

The case for establishing ecosystem-scale marine reserves

In 1872, the headwaters of the Yellowstone River and the surrounding forests, canyons and geyser basins were designated the world's first national park.

Since then, most nations of the world, whatever their size, have protected important biological, scenic, geological and historic places. That decision to make Yellowstone a national park set in motion a series of events with unforeseen but fortunate implications: Today, 12% of the Earth's terrestrial landscapes are under some sort of protection (Roberts, 2007).

Our relationship to the sea, however, has followed a profoundly different course. Although over two-thirds of the planet's surface is water, little of the marine environment has been protected. As recently as 2008, less than one-tenth of one percent of the world's oceans was safe from exploitation (Wood et al., 2008). Moreover, for many of the areas protected, effective management and enforcement has been weak or nonexistent.

Highly protected reserves, similar to national parks for terrestrial ecosystems, have only recently been considered for marine waters (Lubchenco et al., 2003). Most of these, however, are small and relatively near the shore, and their environmental benefits are largely local. Even so, they often require enormous public support to overcome the entrenched opposition of extractive users, such as the commercial fishing industry. Few nations have been willing to tackle the challenge of establishing world-scale, ecologically significant, no-take marine reserves; and even when they do, the outcome is usually a compromise for ocean protection. Many people would be surprised to learn, for example, that even Australia's Great Barrier Reef Marine Park, one of the world's largest protected ocean areas at 344,400 sq km, allows fishing in more than 65% of its waters (Great Barrier Reef Marine Park Authority, 2004).

Large, highly protected marine reserves where ecological processes and functions can operate much as they have for millennia have been virtually missing from the conservation and management portfolio for the ocean. The world's great terrestrial parks provide an important service in preserving ecosystems, and wide-ranging species and in supporting non-extractive industries such as tourism.

Global Ocean Legacy, a project of the Pew Environment Group and its partners, is dedicated to securing the establishment of very large marine reserves (Pew Environment Group, 2010). The project was launched to protect and preserve some of the Earth's most important and unspoiled marine ecosystems. By establishing a handful of oceanic-scale reserves, we hope to change the conventional view that our oceans contain limitless resources that do not require the same type of protections as the Earth's terrestrial environment.

In 2003, the Pew Environment Group published a study of the marine environment in US waters to see how its management could be improved. That effort concluded that our oceans are in trouble but that solutions are within reach (Pew Oceans Commission, 2003).

The commission identified no-take marine reserves as an important management tool that could help blunt the effects of excessive commercial fishing while also providing a range of benefits for fisheries, local economies and the marine environment. Moreover, no-take marine reserves were found to be more resistant to the effects of pollution, global warming and a wide range of disruptive activities. The report found that well-planned protected areas could conserve biodiversity; increase fish production; protect breeding and feeding areas; support marine science and education; highlight important historic, cultural and geological features; and, in some cases, promote tourism and other non-extractive uses of the environment. In short, fully protected marine reserves, while not a universal remedy, could be a significant protective measure for many parts of the world's oceans.

Following the commission's recommendations, Pew began work in 2005 to support the creation of a fully protected marine reserve in the northwestern Hawaiian Islands. A year later, that effort resulted in the designation of Papahānaumokuākea Marine National Monument – which was at that time the largest permanent, no-take marine reserve in the world, encompassing 362,000 sq km of unspoiled reefs, atolls, shoals, islands and banks. Establishment of this monument set a new standard for the size and scope of highly protected marine parks.

The Global Ocean Legacy project seeks to identify specific sites around the world which can be permanently protected as no-extraction marine reserves (Fig. 1). In selecting sites we consider a number of factors but one is paramount. The areas to be protected must be very large. To date, the sites selected have all been over 250,000 sq km in area and most sites are much larger. Protecting ecosystem-scale swaths of ocean is critical if we are to be able to offer partial refuge to some of the depleted and wide-ranging pelagic species. Large protected areas also can serve as reference sites for the study of effects of climate change and long-range ocean pollution, free from confounding influences of direct human impacts (Williamson, 2009). Global Ocean Legacy sites all possess significant ecological value as measured by biological abundance, diversity, uniqueness or importance to one or more species. Like national parks, legacy marine sites also frequently contain unusual and important geological features, historic or maritime sites and cultural values (Pew Environment Group, 2010).

There are a limited number of sites around the world where establishing a large no-extraction reserve is practical. At present, the absence of effective laws, surveillance and enforcement greatly limits opportunities in international waters. Likewise, total fishing

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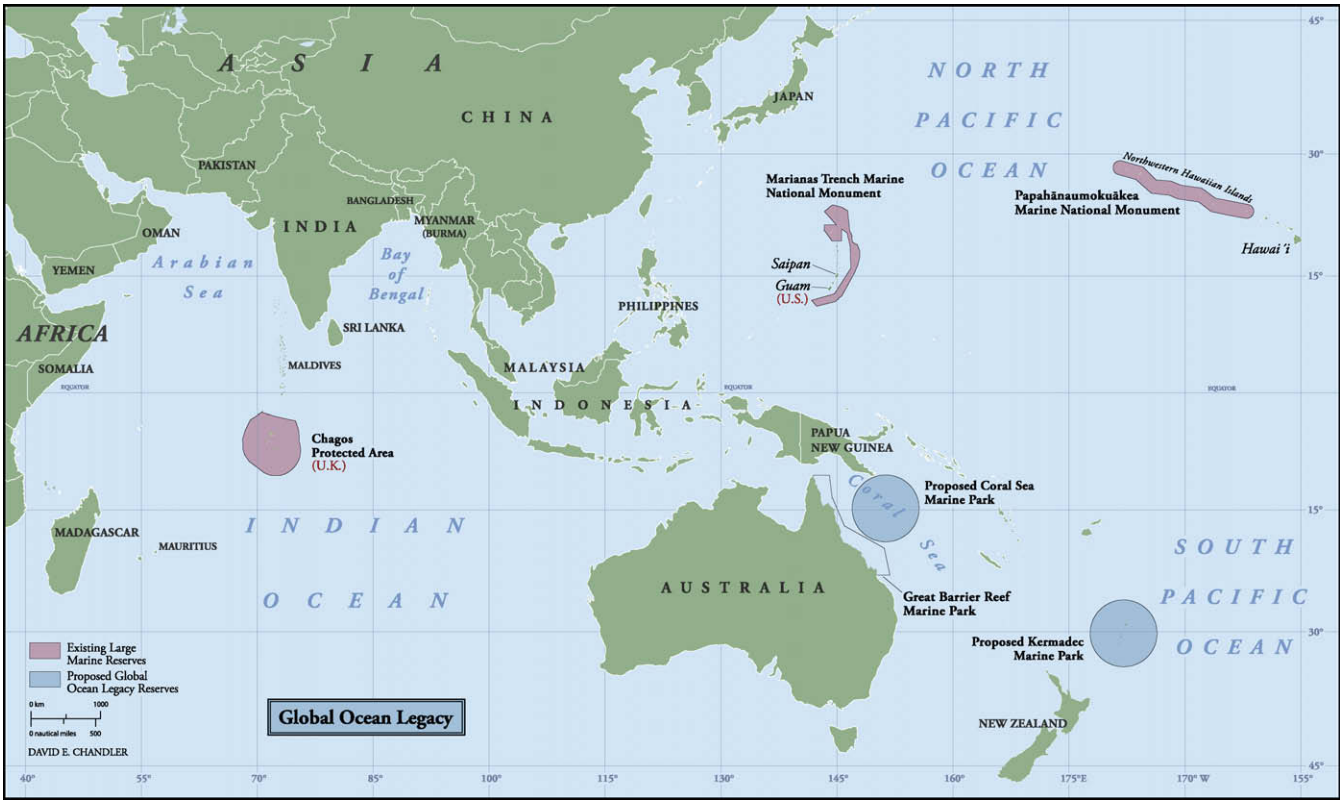

Fig. 1. Global Ocean Legacy project sites.

closures are unlikely to be adopted in areas of highly valuable commercial fishing or those near large fishing-dependent populations. Therefore, the most feasible sites are in remote areas that for various reasons have not yet been the target of large-scale commercial fishing or other extractive activities. These places offer an opportunity to protect some of the ocean's primeval and unspoiled biodiversity and abundance, an opportunity that may very well disappear within the next few years.

A few of the potential large marine reserves sites we identified include:

Marianas Trench in the Commonwealth of the Northern Mariana Islands. This site was initially proposed to the US government as a marine reserve in late 2006 and was designated as a national "monument" which was partially protected at the beginning of 2009. It is one of the most unusual underwater habitats on Earth. These waters, within US jurisdiction, feature numerous deep sea undersea vents and volcanoes that support a wide variety of unusual marine life, including some of the oldest organisms on Earth, an undersea lake of liquid sulfur and unique species of fish. Shallow water hydrothermal vents offer a special opportunity to study an ecosystem where photosynthetic and chemosynthetic species are uniquely intermixed. Highly acidic shallow seeps offer an opportunity to study intense ocean acidification in a shallow water environment.

Covering 246,000 sq km, the Marianas Trench Marine National Monument ranks as one of the largest marine reserves in the world, although the protections afforded the area are complicated and not as protective as would be desirable to prevent future degradation.

British Indian Ocean Territory (*Chagos Islands*). Situated in the central Indian Ocean, the Chagos Archipelago lies approximately 1600 km southwest of India, midway between Africa and Indonesia. A remote and isolated group of more than 50 individual islands on several coral atolls, this British territory covers approximately 544,000 sq km, an area almost the size of France. Among its vast and widely dispersed reefs is the Great Chagos Bank—the largest coral reef structure in the world. This archipelago is arguably the most important marine wilderness area in the Indian Ocean. It is thought to have the greatest documented diversity of corals in the Indian Ocean, about 220 species (Sheppard, 1999), and to sustain more than 750 species of fish (Winterbottom and Anderson, 1999), several of which are unique to the region. The Chagos Archipelago has some of the most unspoiled coral reefs in the world, providing an important biological nursery for marine species elsewhere depleted in the Indian Ocean. Enhancing marine conservation in this region has been discussed for many years, promoted by the Chagos Conservation Trust and other nongovernmental organizations.

In a far reaching and visionary act, the British Foreign Secretary designated the entire area as a no-take marine reserve on 1 April 2010 (UK Government, 2010). Now the largest such conservation area anywhere, this single act put Great Britain in the forefront of global marine conservation.

Australia's Coral Sea. Lying just off Australia's Great Barrier Reef, the Coral Sea is an enormous, biologically rich region of roughly one million sq km in area. It contains more than 30 reefs and atolls, in addition to seamounts, deep-sea canyons, plateaus and a large abyssal plain. Unusually large numbers of pelagic fishes, including sharks, tuna and billfish, combined with undamaged expanses of corals and abundant tropical reef fish populations make this one of the healthiest large oceanic ecosystems anywhere. The Pew Environment Group, in concert with a number of Australian conservation partner organizations is asking the Australian government to establish the Coral Sea Heritage Park, potentially the largest no-take marine reserve in the world (Zethoven, 2008).

New Zealand's Kermadec Trench/Islands. Located north of New Zealand's North Island, the Kermadec Trench extends more than 2000 km northeast toward Tonga. The Exclusive Economic Zone

around New Zealand's Kermadec Islands encompasses more than 600,000 sq km and includes some of the most geologically active and biologically unusual features on Earth. Extending to a depth of more than 10 km in places, the Kermadec ocean trench is the deepest in the Southern Hemisphere and the second deepest in the world. It provides an important habitat for deep sea creatures such as the giant squid and deep-diving mammals such as sperm whales as well as other cetaceans. Much of the area is unexplored, and could contain species new to science, such as a tiny species of bottlenose dolphin found here (Duffy, 2008). Ten to 15 million seabirds use this area as a fishing ground and breed on the Kermadec Islands (Gaskin, in press).

The Future. In 1858, Army Lt. Joseph Christmas Ives, the first US official to visit what was to become known as the Grand Canyon of the Colorado River, reflected the attitudes of his time when he observed:

"The region is, of course, altogether valueless. It can be approached only from the south, and after entering it there is nothing to do but leave. Ours has been the first, and will doubtless be the last, party of whites to visit this profitless region [sic]. It seems intended by nature that the Colorado River, along the greater portion of its lonely and majestic way, shall be forever unvisited and undisturbed." (Ives, 1861).

Today, thanks to leaders who had the will and vision to protect a special place, the Grand Canyon stands as a national park and World Heritage site of global importance. Notwithstanding Lt. Ives' prediction, more than 140 million people have traveled to the Grand Canyon since 1858, making it one of the world's most visited natural areas. Countless other terrestrial treasures around the world have also benefitted from similar designations.

Although much of the Earth's biodiversity lives in our oceans, only a tiny fraction of the world's marine environment is protected from exploitation. Signs of abuse and neglect are clear: Nearly half the world's coral reefs are diseased or dying (Wilkinson, 2008) and fisheries in many parts of the world in a perilous state (Hilborn et al., 2003; Morato et al., 2006).

It is not too late to reverse this trend—but the window of opportunity is closing, and there is urgency to the task ahead. Recent decisions by the British and US governments to create what are now the largest marine reserves on Earth are important precedents for other nations. We hope these actions will set off a "conservation race" that will protect many more large marine ecosystems, so that our oceans, like our national parks on land, are also afforded the protection they deserve for the benefit of future generations.

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