

WHY MARINE PROTECTED AREAS?

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Abstract

Two key ideas in conservation—biological diversity and marine protected areas—have evolved dramatically in the past two decades. Experience on land and in the sea has shown that the place-based (ecosystem-based) approach to conservation offers some powerful advantages over activity-based and species-based approaches. In the past decade, scientists have realized that the greatest threat to the sea's biodiversity—fishing, most of all fishing methods such as bottom trawling that destroy marine habitats—is one that most existing marine protected areas (MPAs) do not protect against. Australia and the USA became world leaders on MPAs in the 1970s, but opposition from user groups and a lack of political backing for MPAs in the USA means that Australia now has an opportunity to become the uncontested world leader in establishing and managing MPAs. Doing so would have benefits far beyond Australia's borders.

Keywords: biological diversity, marine protected areas, marine reserves, bottom trawling, place-based management, ecosystem-based management

MARINE BIODIVERSITY AND MPAs: ORIGINS OF TWO IDEAS

Although it isn't any longer, it was lonely when I began working on MPAs as a tool for marine conservation in 1978, so I have had the privilege of being both witness and participant for much of its evolution. Rather than writing the usual sort of review paper, I would like to provide some personal reflections on marine protected areas (MPAs), more broadly on the idea of marine biological diversity, and on the reasons for my interest in these.

I did my graduate and postdoctoral studies on the ecology of Caribbean and Tropical East Pacific blue crabs in the genus *Callinectes*, family Portunidae, the swimming crabs. Under normal circumstances I would have become a faculty member and continued my research and teaching, but as luck would have it, that was not to be my life's course. Instead, I began my career in 1978 at the Ocean Programs Branch of the US Environmental Protection Agency, working on the impacts of offshore oil and gas operations on a proposed National Marine Sanctuary (NMS) in the Gulf of Mexico called the Flower Garden Banks. Then, in late 1979 I was invited to become the Staff Ecologist at the President's Council on Environmental Quality (CEQ) in the

administration of President Jimmy Carter, a statesman with a strong personal interest in conservation. This was a once-in-a-lifetime opportunity to do things from the inside that I could never have done from outside the halls of power. While I was at CEQ, I managed to accomplish two things that have had lasting impact. One was a new idea in conservation; the other was to help secure protection for four pieces of undersea real estate.

My first assignment was to write a chapter for CEQ's annual report on a novel, unprecedented and dauntingly broad topic, namely what's happening to life on Earth. At that time, the dominant paradigm in conservation was utilitarian: species were good if you could shoot, hook or saw them, bad if they ate species you could shoot, hook or saw, and not worth noticing if they were neither, a category that includes the vast majority of life (Fig. 1). The astute reader will realize that this is not the most profoundly enlightened conservation ethic. A new concept embodied in the US Endangered Species Act of 1973 was that all species are intrinsically important whether they are useful or not, and that government should intervene on their behalf if it could be shown that there is high risk of extinction. This was a great leap forward, but the problem with this idea is that, by the time a

species is shown to be in danger of extinction, human intervention is often too late to save it, and is almost always difficult and expensive.

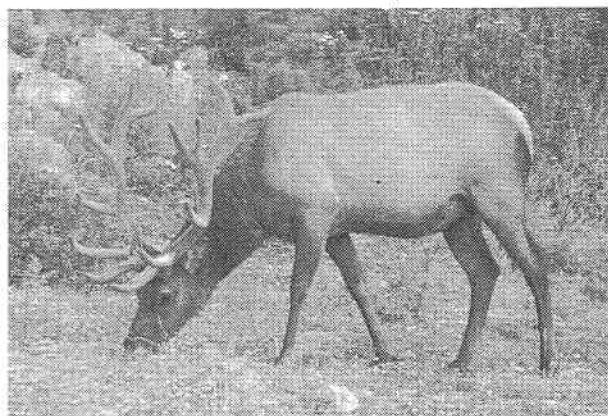


Fig. 1. Wapiti or American elk (*Cervus elaphus*), Mendocino County, California. Elk exemplify the kinds of species that utilitarian conservationists consider "good" by virtue of the fact that one can either shoot, hook or saw them. Long after endangered species and biodiversity ethics joined utilitarian ethics in shaping conservation practices on land, marine conservation is still shaped mainly by humans' interest in acquiring meat (Elliott A. Norse).

There needed to be a newer, deeper ethic, one that embraced the idea that species are both valuable to humans and intrinsically good, but that is operationally robust, putting conservation in force long before they become endangered whenever possible. Moreover, a new ethic had to go beyond species, reflecting the growing understanding that hierarchical levels of organization above and below the level of species are also critically important to conserve. My personal experience and readings to that point made it clear that the Earth was rapidly losing the diversity of life at three hierarchical levels—the diversity of its genes, species and ecosystems—so my coauthor and I grouped these phenomena as the loss of biological diversity (Norse and McManus 1980). Ironically, completely unbeknownst to us, Tom Lovejoy, another conservation biologist working in the same city, Washington DC, had twice used the same term just months earlier (Lovejoy 1980a, 1980b), but he hadn't defined it, although the context of his two brief mentions made it clear that he meant loss of species diversity. The chapter Roger McManus and I wrote was the first document to define the concept and explore its dimensions, so it seems fair to say that Tom and we share parental pride in the idea of biological diversity. Ed Wilson (Wilson 1988) and many others subsequently brought this idea—often

shortened to biodiversity—to the eyes of the public and decision makers worldwide.

Seeing that the appropriate goal of conservation is much more than merely increasing the population of species that we use, even more than protecting species about to disappear, but, rather, is maintaining the diversity and functioning of life, is the most important thing I have ever done or ever will do. To my gratification, this idea has proved to have legs. Maintaining biological diversity has since become the primary focus of conservation worldwide. On land, that is. Thinking about marine biodiversity has lagged terrestrial biodiversity thinking, and it was not until the last decade that there was there a comprehensive examination of marine biodiversity conservation worldwide (Norse 1993). In the sea, the prevailing ethic is still utilitarian, and marine conservation and management are principally concerned with extraction of tonnage from a small fraction of fish species. That seems equally true in Australia and the United States, although there are now changes in the wind in both.

As an American addressing a largely Australian audience, I must admit that I am fascinated by the ways that our peoples relate to the geography and biological diversity of the places where they live. Australia and the USA have some really striking similarities. In the State of Washington, where Marine Conservation Biology Institute (MCBI) is headquartered, we have many towns with names such as Aberdeen, Bellingham, Everett and Kirkland, reflecting the spread of people who came from the British Isles. Australia has Innisfail, Rockhampton, Gladstone and Ipswich. But the dominant cultures in both Australia and America are relative newcomers. In Washington we are reminded of cultures that were established thousands of years before the European invasion by place names such as Hoquiam, Duwamish, Skykomish and Snoqualmie. Similarly, Australia has Dirrinbandi, Cunnamulla, Toowoomba and Oenpelli. Our peoples, newcomers and ancient ones alike, recognized that our lands are comprised of distinct places that are crucial to our nations' identities. The waves of cultural succession indicated in these place names hint at the profound changes in the ways with which Australians and Americans deal with biological diversity.

As Alfred Crosby (1986), Tim Flannery (1994, 2001), Jared Diamond (1997) and others have explained, the people who came to Australia and the USA in the past several centuries quickly built frontier societies whose independent spirit and livestock helped them to subdue the land. If one can see what is missing, there are many signs of our having done so in the form of species now

extinct and places now irrevocably altered. Fortunately for our native biota, a few people were observant and wise enough to notice that treating our lands as frontiers had profoundly harmful effects. As a result, America and Australia were among the very first nations to set aside some places as national parks. The USA (Fig. 2) first did so in 1872, Australia in 1879. Other nations followed our example. And in both Australia and the USA, it took about a century after the invention of national parks to recognize the need to protect places in the sea. The USA passed the *National Marine Sanctuaries Act* in 1972; Australia passed the *Great Barrier Reef Marine Park Act* in 1975. As with protected places on land, other nations followed our example.

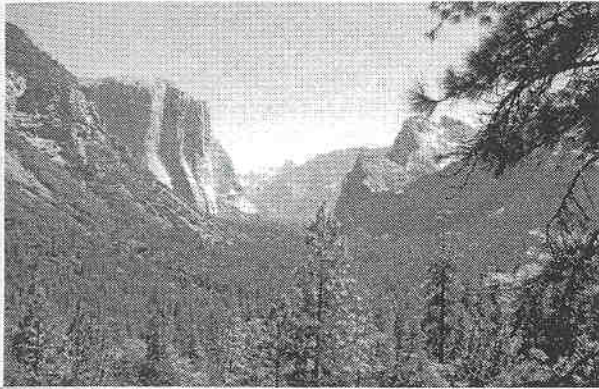


Fig. 2. Yosemite National Park, California, USA, was established in 1890, making it one of the world's first national parks. Marine protected areas have lagged their terrestrial counterparts by about a century (Elliott A. Norse).

REMEMBERING WHAT UNCLE BEN TOLD US

When it comes to marine life, the USA and Australia have ample reason to assume leadership roles; both countries can legitimately claim marine biodiversity world records. From Guam and Saipan in the West Pacific to Alaska and California in the East Pacific, and from Maine and Florida to the Virgin Islands in the West Atlantic, the USA probably has greater marine ecosystem diversity than any other nation. But Australia is clearly the world champion when it comes to the diversity of species that scientists have described. For example, the USA has 11 species of squirrelfishes and soldierfishes, family Holocentridae, in our Caribbean waters (Robins *et al.* 1986), but the Great Barrier Reef has some 27 (Allen 2000). These are but a tiny fraction of a Great Barrier Reef fish fauna approaching 2000 species, to which we must add the species of Australia's western waters and the extraordinary rich and endemic fish fauna in southern

Australian waters. And fishes constitute only a fraction of the species in the seas off Australia. I unashamedly love marine life everywhere on this Earth, but I don't think it is excessive to say that our two lucky countries have an exceptional wealth of marine biodiversity.

Of course, we all need to remember what Uncle Ben taught Peter Parker, aka Spider-Man, and the rest of us: "With great power comes great responsibility". Australia and the USA have undertaken many measures to protect marine life, and, individually and together, have accomplished some impressive things, such as the near-cessation of commercial whaling. But despite these, we are both facing loss of marine biodiversity in our own waters and far beyond. Unless we behave responsibly, intelligently and quickly, we will certainly lose much more of the marine biological wealth we inherited.

PLACE-BASED AND OTHER APPROACHES

This is where the idea of marine protected areas comes to the surface. There are really only three basic approaches to marine conservation. One can focus on activities, an example being the prohibition against oil drilling in the Great Barrier Reef Marine Park (GBRMP). One can focus on species, for example, by setting catch quotas for each fish species. Or one can focus on places or ecosystems, for example, by establishing marine protected areas, which are best defined as places that are managed to protect against at least one kind of threat. Although eliminating one or a few kinds of threats—such as ocean dumping, oil and gas operations or spearfishing—can be a useful tool for conservation, the most effective of the various kinds of MPAs is no-take marine reserves, areas that are fully protected against *all* preventable threats, both things that humans extract and ones that we add to the natural ecosystems.

There are situations in which the activity-based or species-based conservation approaches work best, but the place-based (or ecosystem-based) approach has some really compelling advantages for marine biodiversity conservation. One is that it is based on the realization that places are heterogeneous, that both biological and human communities differ markedly from one place to another. Humans can value places for diverse reasons, including historic, economic, recreational, spiritual, educational, scientific or ecological importance. Places that people consider important to conserve for whatever reason can be protected from threats that are allowed in other places without resorting to "one-size fits all" management. The sea is no more homogeneous than the land.

Another great advantage of the place-based approach is that scientists and managers don't have to know everything about all the components of an ecosystem to be effective in conserving them. For example, we don't have to know habitat needs, age structure, reproductive biology and effects of environmental variations on every one of the thousands of species in an ecosystem, nor the myriad of trophic, symbiotic and other interactions among them. As the number of species increases beyond a few tens, that kind of information quickly becomes prohibitively expensive to gather, and there just aren't enough scientists to do it. Moreover, stock-assessment and ecosystem models are only cartoons, heuristic tools that interpolate or extrapolate information when we don't have it, and greatly oversimplify the behavior of real species and ecosystems. Nature is far too complex for us to understand all that is necessary to "manage" it with the degree of confidence that befits its importance to us. With the place-based approach, however, it is not necessary to micromanage. One needs only to protect enough of the sea to encompass viable, interacting populations that can meet their habitat needs, reproduce successfully, function in their communities, maintain ecosystem services and retain their evolutionary potential to deal with inevitable changes, as they did in the eons before we came upon the scene.

Of course, I recognize that some species are in such deep trouble that they need special help. In the USA, MCBI established a valuable precedent by successfully proposing the listing of white abalone, *Haliotis sorenseni*, under the *Endangered Species Act*. It was the first marine invertebrate ever listed under this crucial law. As a result, US scientists are now moving forward with captive breeding of these endangered gastropods so that we can outplant them in places where we can be confident they won't be fished. Left to their own, white abalone could not recover because they are broadcast spawners whose populations are now so low that they have apparently had no successful recruitment for three decades, thus exhibiting what ecologists call the Allee effect. But on the whole, it is less expensive and more effective to remove the threats from some places and let species recover on their own wherever possible. Three and a half billion years of experience shows that Nature generally knows best, and the best tool for conservation is maintaining or restoring the conditions in which organisms can do what they have been shaped to do on the forge of evolution.

Another advantage of the place-based approach concerns compliance and enforcement (Fig. 3).



Fig. 3. Coast Guard cutter off Haida Gwaii (Queen Charlotte Islands, British Columbia, Canada). Fully protected marine reserves greatly ease the task of enforcement. When enforcement agencies, perhaps based on tips from law-abiding fishermen or data from vessel monitoring systems, find certain kinds of vessels and equipment within marine reserve boundaries, they can presume that someone is violating the law (Elliott A. Norse).

It is much easier to determine whether a person is doing something prohibited if he is physically in a place where society has decided he shouldn't be. If, for example, a trawler loaded with prawns is caught inside a no-trawling zone, the captain has some serious explaining to do. Indeed, the development of vessel monitoring systems (VMS) allows enforcement agencies to ensure that our society does not have to rely solely on fishery observers or self-reporting by people at sea. Clearly, boats might have a need for innocent passage across MPAs. But one can easily imagine a device on a trawler like a flight-data recorder that simply signals to a satellite whether the net is stored or deployed, along with the trawler's coordinates. If a trawl net is deployed in a place where trawling is prohibited, that constitutes compelling evidence that somebody is doing something he shouldn't.

I must also point out that MPAs aren't a panacea. They won't provide much protection against the effects of global warming, although I suspect that scientists such as Terry Done can provide some useful suggestions for reducing impacts. MPAs cannot stop the entry of non-native organisms that have been introduced from other areas of the world in ships' ballast tanks and by other means, although scientists such as Nic Bax might offer some useful observations on invasibility of intact versus disturbed ecosystems. And for MPAs adjacent to or near the land, the greatest threat may be land-based human activities such as logging, agriculture or urbanization. However, most MPAs—with rare exceptions such as the GBRMP—lack the legal authority to prevent damaging uses of adjacent lands, which can

profoundly affect the sea. Of course, those legal authorities aren't of much use if authorities don't have the courage to use them. In Queensland and Florida alike, nutrient runoff from sugar plantations on land is a major threat to coral reefs, and requires continued attention and creative thinking from our political leaders.

LOST MOMENTUM AND NEW UNDERSTANDING ABOUT THREATS

One difference between the USA and Australia is our record on marine protected areas. It is a bit embarrassing for me to admit this, but Australia, a nation with just 1/15th the population of the USA, has done a better job of establishing MPAs. Many of my colleagues in the USA and elsewhere see Australia as the world leader on MPAs. But there are things both of our nations really need to improve. I would like, first, to discuss the USA experience, because that is what I know best, and then I will be cheeky enough to offer some thoughts about ways that I think Australia can continue its leadership on MPAs.

Although the USA has had a national MPA program for three decades now, this program has been plagued by lack of vision, timidity and interference by politicians who are beholden to fishermen and other user groups. In those 30 years, America has managed to establish just 13 National Marine Sanctuaries. There were only two in 1978, when I got my first job in conservation, which was focused on establishing a NMS in the Gulf of Mexico. Although my efforts did not achieve much short-term success, it was a good, if painful, learning experience. But in 1980, when I worked for President Carter, I helped the birth of four others, at that time bringing the total to six. The pride I once felt at having helped establish these four MPAs has dimmed, however, as scientists, conservationists and managers have learned more, because in the USA, Sanctuaries are sanctuaries more in name than in fact. Most are too small, and, together, they are too few to sustain populations of many species that have larval dispersal. The largest sanctuaries are only a tiny fraction the size of the Great Barrier Reef World Heritage Area, but their scant size and numbers are only part of the problem. An even greater weakness is that NMSs in the USA provide very little protection from the greatest threat to marine biodiversity.

Although oil platforms, spilled oil and fouled seabirds are highly visible indicators of the harm humans are doing in the sea, oil pales in comparison with another threat to marine biodiversity: fishing (Jackson *et al.* 2001). It has not escaped my notice that my family, my staff and I are very much part of the reason this is so. We all eat some kinds of commercially caught

seafood and a number of us are recreational fishermen (Fig. 4); we are anything but anti-fishing. We understand fully that seafood is an important, even crucial component in the diets of many peoples around the world, and both commercial and recreational fishing are economically significant activities in many localities. MCBI is not saying that people should stop fishing.

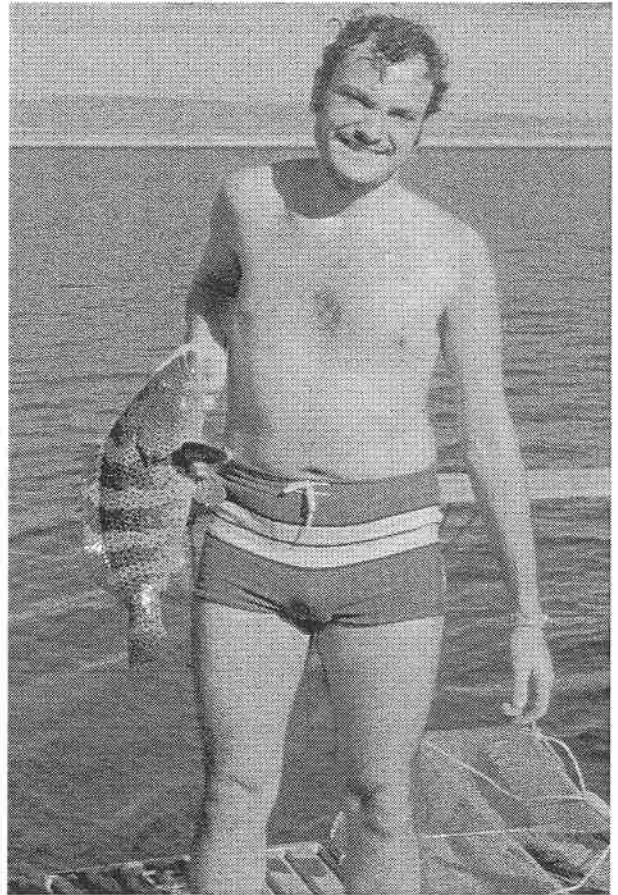


Fig. 4. The author as a graduate student in 1971, having caught a spotted cabrilla (*Epinephelus analogus*), Pacific Coast, Baja California Sur, Mexico. Recreational and commercial fishing are important economic activities, but increasing evidence also indicates that fishing is the leading threat to marine biodiversity worldwide (Richard Huddleston).

But it is now unmistakably clear that, around the USA and around the world, more marine biodiversity loss is due to fishing than to any other cause. Moreover, commercial and recreational fishing interests in the USA are generally opposed to protecting places in the sea. They have been very successful in lobbying the US Congress and Bush Administration officials to prevent the establishment of fully protected marine reserves. As a result, the USA has a very few of them, the newest—thanks to the dedicated leadership of Billy Causey—being portions of the

Florida Keys NMS. But they are nowhere near what we need to conserve the full range of America's marine biodiversity, and the future is worrisome because opposition from fishermen is hardening.

This is how weak our NMSs are: one of them—Hawaiian Humpback Whale NMS—offers no protection within its boundaries that does not already occur outside them. Only a microscopic portion of our NMS system is managed as fully protected no-take marine reserves. Indeed, even the world's most destructive fishing methods—trawling and dredging—are allowed in most sanctuaries.

I have been contemplating trawling for a long time; I spent my first night on a trawler in the Sea of Cortez, Mexico, as a Ph.D. student in 1971. I was studying the ecology of blue crabs, and decided to hitch a ride on a trawler because I had been told that they caught great numbers of these crabs, particularly *Callinectes arcuatus*. As it turned out, about 95% of the biomass in the trawls I observed were not the targeted shrimp species, but were *C. arcuatus* and other portunid, calappid and majid brachyuran crabs, hermit crabs, stomatopods, starfishes, elasmobranchs and bony fishes (Fig. 5).

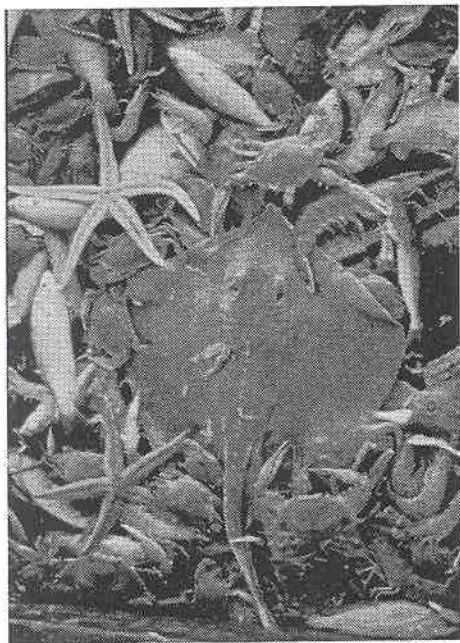


Fig. 5. "Trawl trash" on trawler deck, Gulf of California, Sonora, Mexico. 95% of shrimp or prawn trawl catches can consist of non-target species that die and are shoveled overboard. This greatly underestimates the damage, however, as trawling crushes, buries or exposes many more organisms on the seafloor that do not come up in the net. Marine protected areas that prohibit trawling are a crucial tool for maintaining the diversity and integrity of marine ecosystems (Elliott A. Norse).

These animals comprise what fishermen in the USA call "trawl trash," and what I later called biological diversity. Moreover, this and other experiences on trawlers sowed another seed in my mind: the question, "What happens to all the organisms that don't come up in the nets?"

In 1990, when I was Chief Scientist of a nongovernmental organization called the Center for Marine Conservation, a conversation about impacts of shrimping with CMC's Fishery Biologist Harry Upton led to a back-of-the-envelope calculation that the Texas and Louisiana trawling fleets for the brown shrimp (*Farfantepenaeus aztecus*) swept the brown shrimping grounds an average of 300% per year. We were astounded to think that large areas of the seafloor could be disturbed with an average return interval of only four months, and I began looking through the scientific literature for studies on the impacts of trawling. Published information was very sparse, and in whole regions of the world—including the waters of Asia, Africa and the US Gulf of Mexico—I could find no published studies at all.

In 1996, after I founded MCBI, the first thing I did was to hold a scientific workshop on effects of trawling on the world's marine ecosystems in Maine, USA. It was the first such workshop to integrate this information from around the world. It included outstanding scientists from Australia, New Zealand, the UK, Canada and the USA. From it we published seven papers in *Conservation Biology* (e.g. Watling and Norse 1998) and another (Norse and Watling 1999) in a book published by the American Fisheries Society. Since that time we, and a growing number of other scientists, have learned even more about effects of trawling. Indeed, earlier this year, the National Research Council of the US National Academy of Sciences (2002) issued a report on impacts of trawling and dredging.

Trawling for prawns or demersal fishes and dredging for scallops on the seafloor are not unlike catching kangaroos with bulldozers. They crush, bury, expose species to scavengers and remove structure-forming species, including stony corals, gorgonians, sponges, bryozoans, tubicolous polychaetes and amphipods, as well as a host of others. Some of these animals are large and visible; others extend only a centimeter or two above the substratum. But by smashing them, trawling dramatically reduces structural complexity on the seafloor, and eliminates feeding and hiding places crucial to the young and adult stages of many species, including commercially important fishes (Sainsbury 1987). A single pass of a trawl or scallop dredge can remove anything from a few percent to 76% or more of macrobenthic organisms (National Research

Council 2002). The effects of even one pass can last months, years, decades or centuries. Repeated trawls increase harmful effects on species abundance, community composition and benthic productivity. The overwhelming preponderance of evidence compels me to conclude that trawling and dredging are incompatible with maintaining biological diversity in areas that people want to be protected. These are the kinds of threat that highlight the need for MPAs.

The most encouraging development that has happened for MPAs in the USA grew out of a scientific workshop that MCBI held in early 2000 in partnership with The Cousteau Society. The participating scientists (from Australia, the Philippines, UK, Canada and USA) called upon then-President Clinton to issue an executive order establishing a comprehensive national system of MPAs that would fully protect 20% of US waters by 2015. That would have meant no trawling or other fishing, or other kinds of preventable harm. The Clinton Administration was interested, and we negotiated for months with Administration officials. But by the time President Clinton finally did issue the Executive Order in mid 2000, it had been weakened in many ways. And since George Bush became President in 2001, government progress on marine protected areas has ground virtually to a halt. Until there is either a profound and almost unimaginable change-of-heart or else a new administration, the USA is not going to be setting an example worldwide on MPAs. We have dropped the ball.

REGAINING LEADERSHIP

What does this have to do with Australia? Well, stimulated largely by concern about the prospect of oil and gas drilling, Australia immediately became the world leader in MPAs when it established the GBRMP nearly three decades ago. Scientists, conservationists and managers have learned a lot since then, including the fact that commercial and recreational fishing is an even greater threat to marine biodiversity than oil drilling. It stands to reason that the GBRMP and other MPAs in Australia should reflect this new understanding, as should the National Marine Sanctuary system in the USA. Yet Australia, like the USA, still allows a broad range of commercial and recreational fishing in most of its MPAs, including bottom trawling. Not all; some coral-covered seamounts off Tasmania are still intact because they were too deep to trawl and are now protected from all fishing except for pelagic species. But as CSIRO's Tony Koslow explained at the *First International Symposium on Deep Sea Corals* in Halifax, Nova Scotia, in 2000, trawling

has had a profound impact on coral communities of the shallower seamounts.

Australia now protects less than 5% of the Great Barrier Reef from fishing and only about 50% from trawling (WWF-Australia 2002). Even areas that are officially protected are illegally trawled (Poiner *et al.* 1998). So if my Australian colleagues, who invited me to address the First World Congress on Aquatic Protected Areas, are open to hearing the view of an outsider, I will say this: knowing the profound impact of trawling and other methods of fishing in our countries on marine biodiversity and the fact that the world's scientists are increasingly calling for more fully protected no-take marine reserves, something has to change. Australians are the stewards of what many people consider the world's best piece of underwater real estate. That is why the United Nations designated it as a World Heritage Area. If Australia wants to continue being the world leader in marine protected areas, you need to protect a much larger portion of the Great Barrier Reef World Heritage Area from trawling and other methods of fishing. Indeed, to show real leadership, Australia needs to fully protect a sizeable fraction of the waters around the continent and in the waters of Australia's island territories. It doesn't make a lot of sense for Australia to allow the activity that is most destructive to marine biodiversity in the world's most diverse marine ecosystem.

Of course, conservation of your incredibly rich marine biodiversity will benefit Australians today and tomorrow. That is what Americans call a "no-brainer." But there are two other reasons why you might consider dramatically expanding your system of fully protected no-take reserves. The first is that the world's most diverse area of ocean is the so-called "coral triangle" that includes the northern portion of the Great Barrier Reef. And this triangle is the heart of the world's richest shallow-water marine biogeographic region, the Indo-West Pacific. The other countries in the Indo-West Pacific are nearly all poor nations. And poor people all around the world catch seafood any way they can, even if that means using explosives and cyanide. Poverty makes people do desperate things, so the prognosis for marine life in Australia's poorer neighbors is not good.

I know that the world's economy, including Australia's, is not exactly thriving right now. But no other nation in the Indo-West Pacific region has the knowledge or the wealth to be able to protect, recover and sustainably use marine life that Australia does. Australia stands out as the very best hope for the myriad species of the Indo-West Pacific, from highly visible ones such as dugongs (*Dugong dugon*), humpback whales

(*Megaptera novaeangliae*), Napoleon wrasse (*Cheilinus undulatus*) and *Acropora* corals to the myriad small invertebrates that have not yet even been described. If anyone is going to conserve the miraculous diversity of marine life in this vast region, both the individual components and the web of connections among them, it is going to be Australia. Moreover, given the rate of marine biodiversity loss, it will have to happen in this generation. It is unfair and unrealistic to expect nations with far lower per capita gross domestic products and far fewer scientists, such as Tanzania, India, Papua New Guinea, Indonesia, the Philippines or the Federated States of Micronesia, to take the lead in this.

The second reason is that, if Australia takes the bold but scientifically justified step of fully protecting marine life in a much larger portion of your waters, you will have impact far beyond Australia's seas. In the USA, when advocates for marine protected areas see that Australia has, once again, leaped beyond the USA in protecting its wealth of marine life, they will hold Australia up as a shining example of a nation that does it right. Decades of observing our political system leads me to suspect that American politicians will rise to the bait. Being proud of their country, and more than a little competitive, they won't like the idea of America's not being the best at something. So, the biggest impact that Australia could have by creating a national system of fully protected no-take marine reserves might actually happen in the USA, Canada, New Zealand, Italy, Mexico and other nations showing increasing interest in conserving marine life. Who knows: perhaps even Japan, Taiwan, China and Spain—nations that relate to marine biodiversity mainly on a plate—might follow Australia's example. That is what leadership is all about.

ACKNOWLEDGMENTS

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