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Marine Protected Areas and Reserves are Vital Conservation Tools

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COMMENTARY

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MARINE PROTECTED AREAS AND RESERVES ARE VITAL CONSERVATION TOOLS.—In the time it takes you to read this article, the world will gain about 800 more people. With more than half the world's population clustered along the coasts, our population increases by about 1 billion people every 12 yr will be disproportionately felt by coastal and marine ecosystems. Already, marine life is stressed by nutrient and sediment runoff from land, overfishing and excessive bycatch, habitat destruction, invasions of alien species, oil spills and other marine pollution, and global climatic changes, such as warming sea temperatures. The degradation of our marine environment resulting from these multiple threats is becoming painfully obvious: an anoxic "Dead Zone" the size of New Jersey in the Gulf of Mexico appears each summer, catches of favorite seafoods like snapper and cod have drastically declined, harmful algal blooms take over our shorelines more frequently, 35 square miles of wetlands disappear from the Louisiana coast each year, and endangered marine mammals like manatees continue to decline. We know these stresses are increasing, and we see the declines in marine species and ecosystems, but we don't always fully understand the connection between the two. Even when we do understand enough to act, too often, needed changes aren't made.

These deficiencies suggest at least two courses of action. First, we need to increase research and monitoring in order to improve our understanding of how to protect, restore, and sustainably use marine life. Second, we need to insure ourselves against management failures by establishing marine protected areas and reserves that minimize human effects on marine biological diversity.

The National Marine Sanctuary Program provides a primary vehicle in the United States for pursuing these dual tracks together. Research and monitoring conducted in sanctuaries significantly improves our understanding of marine ecosystems and, hence, our conservation efforts elsewhere. For example, data gathered on the relatively healthy corals in Flower Garden Banks can shed light on why so many coral reefs are deteriorating elsewhere—a pressing environmental and economic con-

cern throughout the Caribbean and Southeast Asia.

But in general, our Sanctuary Program is less successful in providing a hedge against uncertainty and mismanagement. Marine scientists and conservation biologists are increasingly stressing the importance of true marine protected areas and reserves as a way to protect critical or sensitive areas, to prevent overfishing, and even to enhance surrounding fisheries. Reserves in which fishing and other harmful activities are prohibited serve as a buffer against the inevitable errors associated with predicting appropriate catch levels in fisheries. They can allow fish populations to rebound and to increase in average size and age. These larger, older fish typically have higher reproductive output than do the younger and smaller fish found in heavily fished areas, and therefore, such reserves can enhance fisheries by acting as centers for dispersal into surrounding areas. Protected areas can allow important breeding, spawning, nursery, or feeding habitat for many types of marine life to remain undisturbed. Moreover, these areas can protect significant segments of natural communities containing a wide diversity of species by preventing the habitat loss and declines in marine life that accompany many human activities. Allowing an ecosystem to function as it would without human disturbances allows even those species that are not recognized as commercially valuable to thrive. Maintaining this biodiversity is critical for protecting genetic material that can lead to new medicines and for sustaining ecosystem services provided by this web of life—such as stabilizing climate and protecting coasts from storm surges. And because so few areas remain pristine, these less disturbed areas provide scientists with essential baseline information on how natural marine ecosystems function in the absence of human activities, providing insights into environmental impacts and management needs in more heavily used areas.

Yet many damaging human activities occur in our National Marine Sanctuaries, including commercial fishing with destructive fishing gear like bottom trawls. Only one sanctuary—Florida Keys National Marine Sanctuary—has a comprehensive zoning system, in which many or all uses are prohibited in certain areas. Even there, the no-take areas cover only a tiny fraction of the total sanctuary. Moreover, enforce-

ing the restrictions that do exist in sanctuaries can be difficult because of large areas and small budgets, and funding for the National Marine Sanctuary Program has remained too low to meet all of its obligations. Clearly, many marine protected areas provide little protection and cannot provide scientists and managers with valuable baseline information about ecosystem functioning in the absence of human use.

Flower Garden Banks National Marine Sanctuary presents an interesting case study of compatible use in marine protected areas. With thoughtful foresight, benthic cover and coral growth studies were initiated in the mid-70s, before hydrocarbon production began to provide a baseline against which future data could be compared and from which conclusions about the effects of these activities could be reached. Conscientious research and monitoring have continued over the years, and the data suggest that the coral reefs remain healthy. Moreover, these data have specifically been used to manage oil and gas activities in the area in order to reduce the impact on the reefs, and no-activity zones surround the banks. The oil and gas industry has cooperated and has supported these activities in the Sanctuary in a way we can only wish all industries would, given the numerous threats to the biosphere from human activities. In an ideal world, we would have such informed and coordinated management in all our resource extraction and consumption activities.

And yet clearly this is not a pristine system. Fishing has profound effects on marine ecosystems, and fishing for snappers and groupers occurs throughout much of the Sanctuary. Pre-fishing baseline data on targeted fish populations and other marine life caught as bycatch do not exist, and so fishing effects are difficult (if not impossible) to determine. Even when we have better information, such as we do with oil and gas activities, uncertainty remains. Given how little we truly understand about these systems, are there ways in which oil and gas or other human uses are altering the ecosystem that we have not yet detected? How much certainty do we have that all species associated with the reefs remain unaffected by the human activities allowed within the Sanctuary? And given the tremendous other stresses that these species face outside of the Sanctuary, can we fully understand the cumulative effects of global pollution, habitat loss, overfishing, and bycatch on Sanctuary marine life and how Sanctuary activities might add stresses to already diminished populations? There is also the ulti-

mate uncertainty: accidents. Wherever human activities occur, the potential for unexpected errors with disastrous implications and results exists.

Despite better conservation within sanctuaries than without, inadequate management throughout most of the world and our poor understanding of the marine environment in general suggest that we need some areas in which no human activities are allowed as an insurance policy against ignorance and bad management. Could species like endangered sea turtles, threatened by loss of nesting areas, diseases, fish trawls, and marine debris, benefit from substantial oil and gas-free zones or no-take areas free from fishing? Common sense suggests the answer is yes; reducing the overall stresses that these fragile species face should help them recover. But in what cases and for what species are "no activity" or "no-take" zones effective? Where should we place these zones? How much area should they encompass? Increased marine conservation biology research and monitoring, not just in Flower Garden Banks but throughout the world, can help us answer these questions and can help us design and manage more effective marine protected areas.

We have a lot to learn to improve our management in most of the marine environment. This knowledge—often gleaned from our National Marine Sanctuaries and other protected areas—will help us both sustain and use those living marine resources that we need for economic, ecological, cultural, aesthetic, and other reasons. But given the complexities of natural systems, we will never know it all. A certain amount of uncertainty will always be with us, and hence the need to have some areas that we simply leave alone.

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BALANCING RESOURCE UTILIZATION WITH RESOURCE PROTECTION: THE FLOWER GARDEN BANKS MARINE SANCTUARY—A SUCCESS STORY.—The Gulf of Mexico is an incredibly rich resource, providing the nation with food, energy, transporta-