

Introduction

In June 2010, I had the extreme good fortune to be able to spend a week on Midway Atoll in the United States' Papahānaumokuākea Marine National Monument as part of a ten-day program, Papahānaumokuākea 'Ahahui Alaka'i, run by Monument personnel. Given its World War II history and other significant human interventions, neither Midway nor the Northwestern Hawaiian Islands as a whole can be considered pristine environments. Indeed, one of my favorite photographs from the trip is of a Hawaiian monk seal (Figure 0.1)—a species of marine mammal considered to be critically endangered by the International Union for the Conservation of Nature (IUCN)—sleeping in a sunny spot of beach, surrounded by rusting hunks of metal dumped by the United States military at the northwestern end of Sand Island, the largest of the three islands that make up Midway Atoll. The spot is nicknamed "Rusty Bucket," and for good reason. Among other things, it explains why we participants in the program were advised to get a tetanus booster before we left home.

Nevertheless, Midway Atoll and the Papahānaumokuākea Marine National Monument more generally support a rich diversity of marine life and seabirds, well justifying the Monument's elevation in July 2010 to the status of a World Heritage Site. The coral reefs in the Monument are free from fishing pressures (fishing is now prohibited in the Monument) and—Rusty Bucket notwithstanding—relatively free from significant marine pollution. Not coincidentally, apex marine predators (sharks of various species, ulua, and other large and carnivorous fish) account for over half of the ocean's biomass within the Monument, compared to 3 percent in most other places in the world, including the main Hawaiian Islands. The presence of such a significant percentage of apex predators testifies to the health of the coral reefs that dominate the marine environment within the Monument.

It doesn't take much thought to conclude that marine ecosystems like that in the Papahānaumokuākea Marine National Monument are preferable to a proliferation of jellyfish seas—the frequent end result of marine ecosystems overtaxed by too many stressors. If healthy and resilient marine ecosystems are our goal, however, we—the human community of the world at large—are far from implementing a sustainable governance



Source: Photograph by Robin Kundis Craig.

Figure 0.1 Hawaiian monk seal at Rusty Bucket, Midway

regime for the Earth's oceans. In the high seas, very little active management and regulation occurs at all, and, even closer to shore, fisheries "management" tends to favor the fishers rather than the fish or the larger ecosystem of which they are a part. Increasing coastal development and coastal populations world-wide destroy important habitat and pollute coastal waters.

And then there's climate change, the impacts of which affect even the most remote of marine ecosystems. Coral reefs like those in the Papahānaumokuākea Marine National Monument are especially vulnerable to the combined effects of increasing sea surface temperatures, changes in ocean chemistry, altering currents, sea-level rise, and ocean acidification. Indeed, toward the end of the summer in 2010, the Northwestern Hawaiian Islands suffered from coral bleaching events. "Coral bleaching" describes many coral species' reaction to quickly increasing sea surface temperature, which causes them to eject their symbiotic algae, or zooxanthellae. Under normal conditions, these zooxanthellae photosynthesize and help to supply the coral with nutrition; they also produce oxygen and

help the coral to remove wastes. Zooxanthellae are often responsible for corals' bright colors as well, and when the corals eject them, they become ghostly white—hence the term “bleaching.” Corals can recover from short-term bleaching events, but longer exposure to increased temperatures can result in widespread coral death—and the depletion or death of the ecosystems that they support.

This book looks at what climate change might mean for ocean management and regulation. In particular, it looks at how climate change might (or should) affect an emerging trend in marine management: the shift from resource-based to place-based management, with an increasing emphasis on ecosystem-based management and marine zoning. Traditional ocean management regimes, to the extent that they have existed at all, have tended to focus on particular activities and marine resources. The classic example is fisheries management, which almost always focuses on one or a few key species and the fishers who hunt for them. However, this specifically targeted approach has also been the approach used in marine pollution regulation, which distinguishes regulatory requirements more by source of the pollution (ships, offshore facilities, land-originating ocean dumping, land-based runoff) and type of pollution (oil, toxic chemicals, sand and dirt) than by the places that such pollution impacts.

Place-based marine management, in contrast, focuses on a particular ocean environment. At its most complete implementation, place-based marine management attempts to address all uses and needs—including the needs of the particular ecosystem itself—simultaneously. Marine protected areas, marine reserves or no-take areas, ecosystem-based management, and ocean zoning are all tools in this rapidly expanding approach to marine management.

To date, however, place-based marine management has not fully grappled with the implications of climate change for governance of the oceans. The major premise of this book is thus fairly simple: Given that the world's scientists have reached consensus that climate change is occurring and is already affecting the oceans, and given that governments and other governance institutions are already moving toward place-based ocean management regimes for other reasons, place-based ocean governance should incorporate climate change considerations from the beginning. *Comparative Ocean Governance* seeks to begin the exploration of what such climate change considerations would actually mean for ocean governance, emphasizing the increasing dynamism that climate change is already bringing to marine ecosystems.

Some initial caveats, disclaimers, and definitions are in order. First, this book accepts that climate change is real, occurring right now, and already

affecting species and ecosystems throughout the world. It thus spends no time rehashing the scientific evidence that supports these conclusions, but rather focuses its attention on the ways that climate change is affecting and is expected to impact oceans and marine ecosystems throughout the 21st century. Readers wanting more background regarding the details of climate change science and the multiple threads of evidence that support the conclusion that the phenomenon is real should consult the numerous studies that exist elsewhere, beginning with the Intergovernmental Panel on Climate Change's (IPCC's) Fourth Assessment Report, *Climate Change 2007*, and its November 2011 *Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*. As this book goes to press, the IPCC's Fifth Assessment Report is due out in March 2014.

Second, place-based marine management is not a panacea for resolving all ocean management problems. In particular, place-based marine management can do very little to slow or reverse the process of climate change itself, a type of governance generally referred to as climate change *mitigation*. Climate change mitigation regimes, such as the Kyoto Protocol, seek to reduce anthropogenic sources of greenhouse gases, which managers of ocean ecosystems have few opportunities to do. Instead, this book posits that place-based marine management could become a necessary and powerful tool in promoting climate change *adaptation*—the adjustments that both humans and other species will have to make in response to their changing environments.

In the field of natural resource management—of which marine management is one part—one important goal for climate change adaptation is to ensure the continued productivity and value of natural ecosystems despite ongoing ecological changes. One helpful rubric for thinking about the value inherent in the continued productivity of ecosystems is the concept of *ecosystem services*. The identification of ecosystem services provides one means of acknowledging that functional ecosystems provide both goods (in the oceans, fish, seafood, kelp, minerals, salt) and services (in the oceans, coastal protection, climate regulation, nutrient cycling, oxygen production) that have real economic value for human beings. Discussions of ecosystem services are openly anthropocentric—but in a discussion of ocean governance, this focus is appropriate, because it is, after all, human beings who make the rules about how to manage the oceans.

Another important concept for climate change adaptation and a goal for ensuring the continuing productivity of ecosystems is *resilience*. Resilience generally refers to the ability of ecosystems to absorb change and continue to function, and there are several ways that managers and governance regimes can increase the resilience of focal ecosystems, such as by reduc-

ing stressors and increasing functional redundancy, often by increasing or preserving biodiversity. However, resilience thinking also acknowledges that complex ecosystems can and do cross thresholds into different states, often quite suddenly and unexpectedly, as a result of complex dynamics and positive feedback loops. On land, for example, the permafrost-based Arctic tundra is currently becoming the Arctic shrubland as the permafrost melts, a self-accelerating process because of positive feedback: bright white ice reflects much light and heat, but as it melts in response to increasing air temperatures, the newly exposed dark ground absorbs more heat, quickening the process. In the oceans, ecosystems have (so far) most often crossed thresholds in response to overfishing of key species and the resulting change in ecosystem dynamics. For example, overharvesting of sea otters in many kelp forests allowed sea urchin populations to explode. The urchins in turn fed on the kelp, destroying these once-widespread forests.

Not all ecosystem shifts are “bad.” Nevertheless, in the oceans as on land, when human overuse and stress are the primary forces driving an ecosystem to cross a threshold, the resulting new ecosystem state is usually less productive than the prior one both ecologically and economically and hence, from an anthropocentric perspective, less desirable. Climate change has the decided potential to accelerate these undesirable shifts in ecosystem states, something that marine managers should consider as they shift to place-based governance regimes.

Finally, “governance” itself deserves some definition. In general, *governance* refers to the activities that guide and manage societies and maintain social order. Governance systems establish acceptable norms of behavior as well as duties and consequences for violating those duties for the myriad actors that make up a social system. Governments are obvious sources of governance and governance regimes, often in the form of laws and regulations—but they are not the only sources. Private organizations can inspire governance regimes, as can international entities and non-governmental organizations (NGOs). This book will often focus on the more formal and legal sources of ocean governance such as international treaties and national laws, but it also acknowledges—as do nearly all proponents of place-based management—the importance of community involvement and the frequent technical and financial support of NGOs in establishing and maintaining effective ocean governance regimes.

Comparative Ocean Governance is, as the title suggests, a comparative contemplation of place-based marine management in a climate change era. However, it is comparative in two senses. First, it is comparative in the common legal sense of comparative law—that is, in identifying and contrasting different approaches to marine governance from different

nations and regions. Thus, this book presents examples not only from the United States but also the Arctic, Australia, the European Union and its constituent nations, New Zealand, and the various oceanic nations most affected by climate change. These comparisons serve initially to highlight the various motivations nations have identified for pursuing a place-based approach to marine management. However, they also showcase various nations' emerging concerns for the future and their nascent attempts to incorporate climate change considerations and climate change adaptation into marine governance regimes.

Second, *Comparative Ocean Governance* is comparative in the sense that it compares three different options for marine governance: the fragmented approach that has dominated marine management, the current approaches to place-based management, and place-based management for a climate change era. Place-based management approaches, as noted, are a reaction to and an attempt to improve the fragmented approach to marine resource regulation that dominated the 20th century. As subsequent chapters will discuss in more detail, place-based management attempts to be a more holistic approach to marine resource management.

Nevertheless, many of the resulting place-based governance regimes that have emerged are primarily static. Specifically, they change the boundaries of managed areas, management objectives, and zoned designations only infrequently and through elaborate amendment processes. This book argues for a more climate change-appropriate vision of marine governance that can acknowledge and more nimbly respond to the increased dynamism of ocean ecosystems that is the likely future in our climate change era. In particular, it will suggest that managers expand their use of two techniques—*anticipatory zoning* and *dynamic zoning*—that build this acknowledgement of change directly into the relevant governance regimes.

Comparative Ocean Governance proceeds in three parts. Part I examines important basic considerations for marine governance regimes in a climate change era. Thus, Chapter 1 begins by reviewing the value and importance of the oceans to human beings. Chapter 2, in turn, describes the many different kinds of stresses that marine ecosystems have been coping with even before climate change, and it briefly discusses some of the legal responses to those stresses. Finally, Chapter 3 looks at the implications of climate change for the oceans, examining both the oceans' roles in climate processes and the existing and likely impacts of climate change on ocean chemistry, physics, and biological and ecological processes.

Part II examines critical governance frameworks for the world's oceans. In particular, Chapter 4 describes the international law regimes, especially the United Nations Convention on the Law of the Sea, that both establish

and limit national sovereignty over different areas of the ocean. It also notes several treaties that help to promote place-based management of the oceans and some of the goals that those treaties, such as the United Nations Convention on Biological Diversity, establish for place-based marine management. Chapter 5, in turn, explores the move in ocean governance toward place-based management and the various tools that place-based management incorporates.

Finally, Part III identifies and describes the various ways in which place-based marine governance regimes are beginning to incorporate climate change adaptation into their governance goals. Chapter 6 begins with the phenomenon of “accidental adaptation”—that is, place-based marine governance regimes established for other purposes that also happen to promote climate change adaptation. Focusing on the Papahānaumokuākea Marine National Monument, it nevertheless concludes that almost any existing place-based management regime that significantly restricts human uses of the marine environment—especially fishing and pollution—is likely already contributing to climate change adaptation, although more could be done. Chapter 7, in turn, examines place-based management regimes that are already actively incorporating climate change into their governance. Not surprisingly, these efforts are currently concentrated around tropical coral reef systems deemed economically and socially critical to the people living near them: Coral reefs are highly productive ecosystems, were already declining world-wide as a result of non-climate stressors, and are widely projected to be some of the most significant ecosystem victims of climate change. Chapter 8 examines the need for more dynamic place-based management in a climate change era, especially for marine ecosystems other than coral reefs. It looks at efforts to anticipatorily manage new fishing grounds as a result of climate change and efforts to make fisheries management responsive to “normal” ocean dynamics to identify two new tools for place-based management in the climate change era. It then suggests ways in which future uses and future users could also be actively incorporated into place-based governance, perhaps simultaneously improving the adaptive capacity of all concerned.

Finally, the book concludes with a short summary of the advantages of incorporating a more dynamic approach to place-based management of the world’s ocean while dispelling at least some bases for managers’ reluctance to do so. In particular, the proposed dynamic approach does not require *more* management and planning to protect ocean ecosystem in our climate change era—just *different* management and planning.

