Marine Conservation Biology
THE SCIENCE OF MAINTAINING THE SEA’S BIODIVERSITY

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Foreword by Michael E. Soulé

Marine Conservation Biology Institute
# Contents

**FOREWORD**  
Michael E. Soulé  

**PREFACE**  
Elliott A. Norse and Larry B. Crowder  

**ACKNOWLEDGMENTS**  
Elliott A. Norse  
Larry B. Crowder  

## 1. Why Marine Conservation Biology?  
Elliott A. Norse and Larry B. Crowder  

## 2. Back to the Future in Marine Conservation  
Larry B. Crowder  

## PART ONE. Marine Populations: The Basics  
Larry B. Crowder and Elliott A. Norse  

### 3. The Life of the Sea: Implications of Marine Population Biology to Conservation Policy  
Stephen R. Palumbi and Dennis Hedgecock  

### 4. The Allee Effect in the Sea  
Don R. Levitan and Tamara M. McGovern  

### 5. Extinction Risk in Marine Species  
Ransom A. Myers and C. Andrea Ottensmeyer  

### 6. Behavioral Approaches to Marine Conservation  
Julia K. Parrish  

## PART TWO. Threats to Marine Biological Diversity  
Elliott A. Norse and Larry B. Crowder  

### 7. The Potential for Nutrient Overenrichment to Diminish Marine Biodiversity  
Nancy N. Rabalais  

### 8. The Magnitude and Consequences of Bioinvasions in Marine Ecosystems: Implications for Conservation Biology  
James T. Carlton and Gregory M. Ruiz  

### 9. Diseases and the Conservation of Marine Biodiversity  
Kiho Kim, Andy P. Dobson, Frances M.D. Gulland, and C. Drew Harvell  

### 10. Multiple Stressors in Marine Systems  
Denise L. Breitburg and Gerhardt F. Riedel
PART THREE. The Greatest Threat: Fisheries
Larry B. Crowder and Elliott A. Norse • 183

11. Global Fisheries and Marine Conservation: Is Coexistence Possible?
Dave Preikshot and Daniel Pauly • 185

12. The Global Destruction of Bottom Habitats by Mobile Fishing Gear
Les Watling • 198

13. Effects of Fishing on Long-Lived Marine Organisms
Selina S. Heppell, Scott A. Heppell, Andrew J. Read, and Larry B. Crowder • 211

14. Evolutionary Impacts of Fishing on Target Populations
Richard Law and Kevin Stokes • 232

15. Are Sustainable Fisheries Achievable?
Ray Hilborn • 247

PART FOUR. Place-Based Management of Marine Ecosystems
Larry B. Crowder and Elliott A. Norse • 261

16. Marine Protected Areas and Biodiversity Conservation
Callum M. Roberts • 265

17. Marine Reserve Function and Design for Fisheries Management
Joshua Sladek Nowlis and Alan Friedlander • 280

18. Place-Based Ecosystem Management in the Open Ocean
Elliott A. Norse, Larry B. Crowder, Kristina Gjerde, David Hyrenbach, Callum M. Roberts, Carl Safina, and Michael E. Soule • 302

19. Metapopulation Structure and Marine Reserves
Romuald N. Lipcius, Larry B. Crowder, and Lance E. Morgan • 328

PART FIVE. Human Dimensions
Elliott A. Norse and Larry B. Crowder • 347

20. Developing Rules to Manage Fisheries: A Cross-Cultural Perspective
James M. Acheson • 351

21. The Role of Legal Regimes in Marine Conservation
Alison Rieser, Charlotte Gray Hudson, and Stephen E. Roady • 362

22. Uncertainty in Marine Management
Louis W. Botsford and Ana M. Parma • 375

23. Recovering Populations and Restoring Ecosystems: Restoration of Coral Reefs and Related Marine Communities
Robert H. Richmond • 393

24. Toward a Sea Ethic
Dorinda G. Dallmeyer • 410

25. Ending the Range Wars on the Last Frontier: Zoning the Sea
Elliott A. Norse • 422

ABOUT THE EDITORS • 445
CONTRIBUTORS • 447
INDEX • 451
Foreword

Conservation biology emerged as a recognized field of mission-oriented scholarship about a quarter-century ago when many terrestrial ecologists, geneticists, and systematists were horrified by the gathering momentum of a great planetary extinction event. At the same time, they recognized that responsible governmental institutions and nongovernmental organizations alike were largely ignorant of knowledge from several fields—including systematics, biogeography, evolution, genetics, and ecology—that might inform effective responses to the crisis. What was needed, they saw, was an organized movement to enhance communication between concerned scientists on the one hand and professional conservationists on the other.

Since then, communication of scientific knowledge about biodiversity has improved, but clouds of psychological, ideological, and economic denial—public and private—have generally obscured the accelerating, planetwide catastrophe and have impeded the necessary actions that might save much of the biological beauty and grandeur that took billions of years to evolve. Some rays of light, however, shine through. This book is such a beam, and a declaration by a prestigious cadre of marine scientists that life in the oceans is as vulnerable as it is on the lands. I offer only a few, brief comments based on my interactions with scientists and activists during the last 25 years.

Connections and Obstacles—An Allegorical Fancy

By the year 2012 in California, where sea otters had been rendered morbid by a host of human-generated insults—from pathogen-rich sewage effluents to entrapment in feral fishing gear—the three-dimensional kelp forests were clear-cut by predation-released sea urchins and converted to near two-dimensional sea urchin barrens. The fish and invertebrate diversity was vastly reduced by this habitat simplification. Soon, human beings were saddened that recreational and fishing opportunities had diminished. Finally, coastal real estate values sank because the kelp forests no longer shielded the fragile coastline from wave damage.

The reach of these events was continental in scale; indeed, a piece of eroding shore-front real estate was owned by your mother-in-law in Cleveland, affecting both her retirement options and your life style when she moved in with you.

Such stories illustrate that every marine perturbation, from the functional extirpation of evolving entities like sea otters, whales, sea turtles, cod, or wild salmon, to the smothering sprawl of eutrophic dead zones (Rabalais, Chapter 7) or a shift in the Gulf Stream will change the forests and rivers around Colombo, Oslo, and Moscow. We can also say that all climate is ultimately maritime; in other words, that every change
in the oceans, whether natural or anthropogenic, reflects back into the atmosphere, affecting all the land, sooner than later. Finally, we can say that every material constellation that emerges on the land, whether a mountain, a mansion, or a microchip, will bow to entropy and be swept into the seas. Such is the unity of the biosphere on the short time scale of centuries to millennia. Saying all this another way: Earth is a singularity of pulsating land masses, gyrating waters, and a tossing blanket of gases, all of which are massively perturbed by billions of rampaging, large-brained primates.

What are the implications of such global interactions for marine conservation biology? The emergence of conservation biology in the late 1970s was a timely reaction by scientists to the obvious destruction of ecosystems worldwide by pesticides, bulldozers, and chain saws. At the same time, most people viewed the oceans as nearly inexhaustible. Only a decade or two later, however, marine biologists were stunned by the vulnerability of life in the oceans, and the field of marine conservation biology was born. In celebrating the maturation of marine conservation biology, however, it is helpful to reflect on processes that transcend biogeographic realms and dissolve disciplinary barriers that artificially segregate thinkers. Knowledge of spatial and temporal connectivity that help modulate both planetary anabolism and catabolism has exploded, but the public’s ignorance of this knowledge is an impediment to the deepening awareness of planetary articulations and, hence, a major impediment to the conservation of life. The habit of thinking of oceans as remote but enduring, and land as familiar but fragile, is unsound.

**Loss of Interactions between Species**

Contributing hugely to the planetwide crisis of biotic dissipation is a failure to synthesize across temporal and spatial scales. This is particularly apparent with respect to the deliberate extermination of top predators on the land and the overkilling of the most highly interactive and biggest individuals in the sea, particularly large fishes, reptiles, birds, and mammals. Jeremy Jackson and others have documented many such consequential pathologies, including the effects occurring when big, algae-eating fish are removed from coral reefs. Discoveries like these exemplify an ongoing revolution in ecology: the salience of top-down, cascading interactions, particularly those initiated by large herbivores and predators. More and more we see that the consequences of absent top-down interactions are vortices of degradation and simplification. A problem is that critical interactions are virtually impossible to discover when long-term, spatially extensive research is eschewed and when scientists ignore history. One result of such ignorance is the professional malfeasance dubbed by Daniel Pauly as the “shifting baseline syndrome” (Crowder, Chapter 2).

A terrestrial example is illustrative. Wolves were extirpated from Yellowstone National Park in the 1920s. Among the long-term sequelae of this policy was the failure of aspen seedlings or suckers to reach the forest canopy during the following eight decades; another was the disappearance from the northern reaches of the park of a critical ecosystem in the arid West—beaver wetlands and the beavers themselves. Similar landscape changes are occurring throughout the Rocky Mountain region. The cause of these landscape changes has been overbrowsing on aspen and willows by an exploding population of wolf prey; namely, elk or moose. Since the return of the wolves in 1995, however, aspen saplings are shooting up and willows are flourishing, particularly in areas where wolves abound. As expected, beavers are returning in large numbers and restoring the critical wetland habitat, thereby increasing local species diversity and raising water tables.

The ecological renaissance in Yellowstone, however profound it is as a case study, is only the first step toward continental restoration. The wolf is still confined to only 5 percent of its original US range. The restoration of the wolf and other highly interactive species must be replicated everywhere, not only in flagship lo-
cations such as Yellowstone. The same principle applies to the oceans.

The symbolic persistence of interactive species such as otters, wolves, whales, billfishes, groupers, and sharks in just a few places is a fool’s solace. At best, it is an expedient means or a first step toward recovery, and it should never be seen as an end in itself. Congratulating ourselves for the local persistence (or the presence of juveniles only) of a once widespread, interactive species is like claiming that most cities don’t need emotionally complex, adult music because Philadelphia, Tokyo, and Vienna already have symphony orchestras.

The point is that ecological function and biological diversity in the sea and on the land have always depended on large, potent animals, and that their decimation during the last two or three centuries represents a decapitation of ecosystems. Globally, the general killing of large interactive species, whether in forests, reef systems, steppes, or pelagic regions, will be seen as a decisive episode of the global biotic extinction catastrophe. Those who relate to such animals as mere tonnage, or as ecologically irrelevant epiphenomena of bottom-up driven food webs, will one day be accused of a lethal, ecological myopia.

Nearly all dualisms in ecology are eventually proven to be the two arms of an integrated theory. Top-down dynamics complement, but do not compete for, the gold medal with bottom-up, production-driven dynamics. It is a tragedy that many scientists are reluctant to embrace higher-order, complex theories of ecological determination, preferring, like cowboys, the single-barreled smoking gun. There are at least five interrelated factors contributing to this failure of imagination. One is the narrowness of graduate education; the second is the academic reward system; the third is fashion in statistics; the fourth is the longevity of politically powerful personalities and an inability of most human beings to grow and expand intellectually; the fifth is politics.

First, the marine sciences are balkanized into isolated disciplines, such as oceanography, fisheries biology/management, and marine biology. Graduate students rarely are taught even the fundamentals of other sister disciplines; I doubt that many oceanographers or fisheries managers have read Robert Paine’s work. Second, grants and promotions demand the frequent publication of rigorous, hypothesis-driven, experimental results; this discourages research on long-term and spatially extensive questions, including the top-down effects of long-lived species, on which highly controlled experiments are difficult if not impossible. Third, scientific advance is trammeled by adherence to a particularly nonadaptive trait of modern ecology, the stranglehold of statistical methods developed for agronomic science that require a high degree of replication, controlled environments, and the testing of narrowly constructed hypotheses. This strange, hegemonic paradigm should be applied to only a few aspects of marine science. Fourth, conservatism is exacerbated by the slow turnover of senior scientists relative to the fast turnover of ideas, assuming that most intellectuals rarely discard ideas imprinted on them during their apprenticeships. Finally, politics militates against the repatriation over large areas of predator-driven, top-down dynamics because the government agencies that administer conservation laws such as the Endangered Species Act are strongly influenced by conservative politicians hostile to predators.

Certification and Campaigning

Market-based goals and the religion of economic growth currently dominate nearly every aspect of modern society. An unfortunate corollary of this reigning worldview is the belief in unrestrained competition, which requires short-term profits and unsustainable, often unregulated, use of resources. It behooves marine conservationists, therefore, to make better use of market-based defenses. A terrestrial example is “forest certification.” This is a labeling tool by which consumers can determine if the practices of the wood products industry are minimally destructive and have any redeeming environmental or social
value. It should be noted, however, that antedating forest certification was the “dolphin-safe tuna” campaign. Such campaigns are based on the sociological premise that the public generally resonates better to arguments that appeal to their compassion and their love of life than to promises for new cancer cures. At least it seems clear that the discovery of life-extending pharmaceuticals in rain forest organisms has not slowed the rate of forest destruction.

It bodes well that this technique is being applied more broadly by ocean advocates. Still, an insignificant proportion of shoppers and diners are aware that the consumption of farmed salmon and the capture of long-lived, slow-reproducing fish are unsustainable. The good news is that science-based certification programs are being broadened to include prawns, billfishes, sharks, and old-growth bottom fish. Organizations like the Blue Ocean Institute and the Sustainable Seafood Alliance deserve our support and money.

**Whole-of-Oceans Conservation**

When conservation biologists first called for continental-scale conservation projects based on the critical importance of regional- and continental-scale flows and processes, most conservationists were bemused, thinking that such an audacious scheme would never be taken seriously. They were wrong. Plans are nearly completed for a continuous network of protected lands along the spine of the North American Continent from the Sierra Madre Occidental to the Yukon and Brooks Range in Alaska. Similar projects are being developed in central and eastern Europe, in southern Africa, and in Australia, to name a few. Hundreds of governmental and nongovernmental organizations are involved. Such is the power of a compelling, science-based, vision.

The sea still lacks such a vision, though similar bold, science-based ideas are being proposed for the coastal seas and even for open oceans (Norse et al. Chapter 18). Scientifically rigorous whole-of-oceans visions are the only practical way to respond to the interacting tsunami of overpopulation, perverse economic incentives, technomania, globalized corruption, and market mechanisms such as free trade that currently preclude the competetiveness of environmentally sustainable practices. In addition, the repatriation of large, pelagic predators at ecologically effective densities requires oceanwide protection and management. Moreover, anything less bold and dramatic than a whole-of-seas vision will be ignored by a dazed and laconic public, given the titanic levels of distraction and corporate/government propaganda. Finally, the scale of solutions must match the scales of the underlying, dissipative forces—including open-ocean fisheries, industrially produced climate change, the transport across oceans of invasive marine species, and chemical pollution. Whole-of-oceans strategies, however, complement but do not substitute for local conservation efforts, including the protection of coastal and reef systems.

Whole-of-oceans visions must be rigorous as well as inspiring. And “rigor” means the erection of a seawall between science and politics—not allowing the jetsam of human greed and desire to spill over and smother the murmurings of ocean life. A mistake that many scientists and advocates make when dealing with issues like the sufficiency of protected habitat on land and sea is to be overly conciliatory and to do the developer’s/exploiter’s work for him by prematurely factoring in economic and political considerations before the biological needs are known. This might be called “the neurotic need to appear reasonable in the eyes of the exploiter,” the political analogue of psychological codependency. Instead of clearly stating what is necessary to protect all living beings, including extensive processes in the sea, we often censor ourselves, indulging in the calculus of naive reckonings of social, economic, and political “realities.” This is self-defeating. Policy makers need to know what is biologically necessary for long-term, geographically extensive restoration of ocean life, not what scientists believe to be politically feasible.

Candor and boldness have power. A vision based
on both compassion for all life and solid science evokes respect and wonder and is far more effective than the mincing, qualified, soulless recommendations of committees and expert panels. True, there are times (like these) when it appears that nothing will stop the industrial and population juggernauts that are destroying life on this planet, not to mention the dignity and diversity of human cultures; such times require patience, humor, and solidarity between conservationists and humanitarians. This volume provides the foundation for such a declaration of interdependence of all life, oceanic and terrestrial, nonhuman and human.

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