Marine Conservation Biology: The Science of Maintaining the Sea's Biodiversity

Author: GERRODETTE, TIM

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HOW TO SAVE OCEANIC LIFE


Conservation biology—that combination of biology, economics, and policy trying to stem the loss of biodiversity—has focused mainly on terrestrial problems and issues. Perhaps this is inevitable, since we are a terrestrial species, and perhaps even appropriate, since the impact of humans has been greater on the land than in the sea. But the sea covers 70 percent of our planet’s area, and 95 percent of the volume where life occurs, so a treatment from a marine perspective is overdue. Marine Conservation Biology: The Science of Maintaining the Sea’s Biodiversity, edited by Elliott Norse and Larry Crowder, delivers. The 25 chapters by 43 authors, with a foreword by conservation biology pioneer Michael Soulé, cover a wide range of topics: population biology, species invasions, fisheries management, habitat destruction, pollution, marine reserves, restoration efforts, and legal and ethical issues.

Part 1, “Marine Populations: The Basics,” covers topics that set the stage for the rest of the book. Stephen Palumbi and Dennis Hedgecock note that high fecundity and wide larval dispersal have implications for the design of marine reserves, and also for the probability and speed of recovery after population reductions. Don Levitan and Tamara McGovern review the Allee effect in the sea, the tipping point that makes recovery from small population sizes especially difficult. Ransom Myers and Andrea Ottensmeyer discuss extinction risk. Because species in the sea are harder to observe and monitor, it is likely that many marine species extinctions are unrecorded “silent extinctions.” Julia Parrish illustrates how knowledge of behavior can contribute to effective conservation actions. This introductory section could have been strengthened by a chapter on changes in the sea from a long-term perspective. Marine conservation efforts are handicapped by the difficulty of conceiving what pristine ecosystems really were like. Worse, each generation of marine biologists takes an increasingly degraded state as the goal for restoration (the “sliding baselines” syndrome).

Part 2 is entitled “Threats to Marine Biological Diversity.” The editors introduce this section by listing five main threats to marine diversity: over-exploitation, pollution, alien species, and climate change. Global warming is mentioned only briefly as an extinction threat, mainly in relation to coral reef bleaching.

In part 3, “The Greatest Threat: Fisheries,” we get to the heart of the matter. The problem is not simply that we catch too many fish. Richard Law and Kevin Stokes document how fishing alters the size, age, and genetic structure of exploited populations, usually selecting for greater rates of reproduction at the expense of growth and survival. Les Watling compares bottom trawling to forest clearcutting and oil exploration: Although the destructive effects of trawling are often more widespread and longer lasting, the general public is far less aware of them. Fisheries also catch animals that are not the target of the fishery (bycatch). This incidental catch is often the main threat to long-lived marine animals such as turtles, seabirds, dolphins, and whales. Selina Heppell and colleagues discuss how the life histories of long-lived species, including targeted species such as sharks, make them highly vulnerable to the effects of fishing.

The title of the chapter by Dave Preikshot and Daniel Pauly poses the central question: “Global Fisheries and Marine Conservation: Is Coexistence Possible?” They contend that fisheries management fails to meet broader conservation goals because of two “pathologies”: a focus on single species instead of whole ecosystems, and the traditional view that the fishing industry is the sole legitimate user, in effect the owner, of marine living resources. The final chapter of part 3 seems to illustrate the point. Ray Hilborn refers to unharvested fish as “surplus,” is sanguine about ecosystem changes as a result of fishing, and defends the single-stock approach to fisheries management. As I read the chapter, the core philosophical issue became clear. By current standards, well-managed fisheries, such as the ones Hilborn describes, reduce the target species (often a top predator) to about 30 percent of its natural (unfinished) abundance. The target species is in no danger of extinction, and let us assume that bycatch of other species is not an issue. Under these conditions, is the 70 percent reduction of a top predator acceptable? If not, what level is compatible
with maintaining a healthy ecosystem? Calling for a sustainable level of fishing is not sufficient because, as Hilborn points out, fishing can be sustainable at different levels. Sustainable overfishing is not an oxymoron.

Part 4, “Place-based Management of Marine Ecosystems,” has four chapters on how marine reserves contribute to conservation goals. Reserves are defined as areas with the highest level of protection. The term “sanctuary” seems to have been captured by the US Marine Sanctuary Program, which, paradoxically, allows fishing). Marine reserves hold great promise as effective tools for fisheries management (Joshua Sladek Nowlis and Alan Friedlander) and as a means of restoring habitats and populations already damaged by fishing (Callum Roberts). Because many (but, importantly, not all) marine organisms have a planktonic larval dispersal stage, metapopulation aspects of marine reserves are important (Romuald Lipcius et al.).

In the open sea, the concept of “place” is literally more fluid, so reserves might be defined on the basis of oceanographic features, such as fronts or isotherms, rather than fixed coordinates (Elliott Norse et al.).

The book appropriately concludes with part 5, “Human Dimensions.” James Acheson provides an illuminating cross-cultural perspective on the circumstances that lead to successful fisheries management. Alison Rieser and colleagues discuss the legal framework for marine conservation, but limit their excellent discussion mainly to US laws—so many marine conservation problems are inter- and extranational that a broader coverage of legal issues would have been useful. Robert Richmond offers a measured review of the benefits and limits of marine restoration efforts, and cautions against the hubris of assuming that we can restore whole ecosystems. He emphasizes that restoration efforts, while valuable, should not be used as an excuse for further degradation.

The best-known cooperative effort in this regard was Chase and colleagues’ (1993) publication on seed plant phylogeny, coordinated in large part by Mark Chase and Doug Soltis. These two, along with their coauthors here, Pamela Soltis, Peter K. Endress, and Mark W. Chase. Sinauer, Sunderland, MA, 2005. 370 pp., illus. $62.95 (ISBN 9780878938176 paper).

**DARWIN’S “ABOMINABLE MYSTERY” DEMYSTIFIED**


The past two decades have seen tremendous advances in understanding plant phylogeny, including Darwin’s “abominable mystery,” the origin of angiosperms. Most of this has come from molecular systematic studies. The pace of advances in angiosperm systematics has been remarkable, the envy of systematists working on many other groups of organisms. That this has been so is due largely to the cooperative nature of many plant systematists, molecular and otherwise, who have contributed to collaborations around the world, as exemplified by the “Deep Green” Research Coordination Network (RCN) and its subsequent spin-offs “Deep Gene” and “Deep Time.”

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Through detailed study of many plant species chosen carefully to represent critical lineages, Endress has been able to decipher the broad trends in floral evolution in angiosperms in a phylogenetic context.
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