Ocean Dynamics and Ecosystem Management

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Source: BioScience, 61(4) : 318-320

Published By: American Institute of Biological Sciences

URL: https://doi.org/10.1525/bio.2011.61.4.12

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Marine Ecosystems and Global Change. Manuel Barange, John G. Field, Roger P. Harris, Eileen E. Hofmann, R. Ian Perry, Francisco Werner, eds. Oxford University Press, 2011. 440 pp., illus. $67.50 (ISBN 9780199600892 paper).

Ecosystem-based Management for the Oceans. Karen McLeod, Heather Leslie, eds. Island Press, 2009. 392 pp., illus. $45.00 (ISBN 9781597261555 paper).

These books—*Marine Ecosystems and Global Change* and *Ecosystem-based Management for the Oceans*—do not so much overlap as mesh. One book asks, "What is the state of our changing oceans?" and the other asks, "What ought we do about it?" It is axiomatic (and perhaps even true) that describing a problem is a more straightforward prospect than prescribing a solution. Thus *Ecosystem-based Management for the Oceans* has the harder task.

Marine Ecosystems and Global Change is largely a summary of findings of the Global Ocean Ecosystems Dynamics Project (GLOBEC), which ran from 1999 to 2009. GLOBEC was established to examine dynamics, the interplay between living and nonliving components of ocean ecosystems. A basic premise was that understanding the role of natural variability in marine ecosystem functioning was essential to managing global marine living resources. A major focus was to understand drivers of zooplankton abundance and to link physical variability to the numerical ups and downs of juvenile fishes. With that as background, the book's stated objective is "to explore what has been learned about the fundamental dynamics of marine ecosystems and their responses to anthropogenic change (from climate change to overexploitation) as well as to natural variability" (p. 6).

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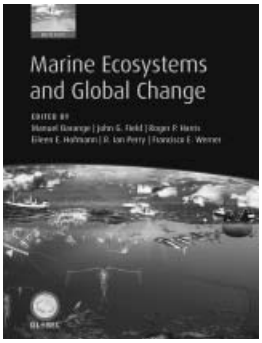


The book's writing is noticeably clear and even, a major accomplishment for an edited volume. The graphics are consistent, and all references match their citations. The 11 chapters are well organized into four parts: Part I (The Changing Ocean Ecosystems) looks at how climate variability affects ocean ecosystems at large scales, and how human exploitation (largely fishing) has reached or exceeded globally sustainable limits; part II (Advances in Understanding the Structure and Dynamics of Marine Ecosystems) discusses modeling marine physical and biological interactions in the GLOBEC context, and the responses of biological communities to physical drivers; part III (The Human Dimensions of Changes in Marine Ecosystems) devotes two chapters to the need to incorporate social sciences in understanding human interactions with marine and coastal systems; and part IV (A Way Forward) explores future routes for scientific investigation and, with appropriate caveats, attempts predictions of the oceans' future responses to global change scenarios.

Marine Ecosystems and Global Change dedicates one chapter to ecosystem-based management. That chapter begins by noting that, "despite some successes, global fisheries management has generally failed to achieve the biological, ecological, and socio-economic objectives of marine resource exploitation" (p. 253). That's quite an indictment. But the authors don't quite blame the basic ideas and techniques of classic fisheries management such as net mesh sizes, catch limits, closed areas, and minimum allowed fish sizes. Instead, they say those measures were "overwhelmed by an increasing fleet size (both local and distant) and unresolved access." They also note that managers cause problems when they ignore scientific advice and set overall catch quotas too high.

To me, these are not so much failures of the management system as they are failures of cooperation. As such, the question is whether any system—single species focused or based on fully integrated ecosystem-based management—will garner the cooperation needed to succeed.

In considering ecosystem-based management in the GLOBEC context, the authors and editors of *Marine Ecosystems and Global Change* note that overfishing, combined with recruitment failure (as a result of unfavorable physical factors such as temperature and salinity and biological factors such as food scarcity), can suppress already depleted fish such as northern cod. But basing catch quotas on predicted abundance of young fish entering a fishery using physical (weather-related) drivers is dicey. In some places this approach has proven helpful; in others it hasn't worked. In California, known effects of sea surface temperature on sardine recruitment are used to protect the stock from overfishing and to help provide adequate food for other fish, seabirds, and marine mammals. Barange and colleagues noted that it is easier to include multispecies interactions in colder, relatively simple systems and more difficult in more complex systems. Add the shifting scene caused by climate change, and things certainly get more complicated.

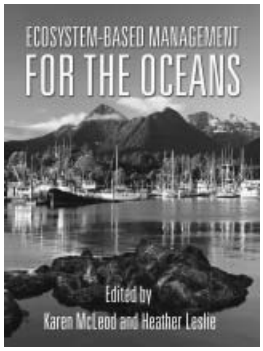
Their conclusion? "The historical separation between fish stock assessment experts and experts within various fields of basic marine sciences needs to be bridged" (p. 267).

We've heard this for decades now. In fact, the advocates of ecosystem approaches continue to refer to the 1992 Rio Earth Summit and the subsequent Convention on Biological Diversity, which formalized ecosystem-based conservation as "a strategy for the integrated management of land, water, and living resources that promotes conservation and sustainable use in an equitable way." But 2010 was the resulting International Year of Biological Diversity, and as far as I can see, we're failing to achieve most of the goals. Biodiversity is, instead, going downhill.

So, given the weaknesses of managers and the managed, can an ecosystem-based approach to management work? *Marine Ecosystems and Global Change* notes, "the increase in the scope and sophistication of the science in proportion to ecosystem complexity and escalating uncertainty is likely to be constrained by human and financial resources" (p. 269). In other words, there probably won't be enough money or the right people to do it successfully. And getting people to actually agree on the goals will make things even harder: "Addressing inter-sectoral issues in a multidisciplinary manner, dealing with data-poor situations, broadening the scope of information used to include fishers' knowledge, assessing their relevance and reliability and resolving apparently conflicting signals, to name a few, are significant challenges" (p. 269).

This raises the question of whether the thinking behind ecosystem-based management has gotten too complicated for practical application. Is there anything further to say at this time? Plenty. Another whole book's worth.

For proponents of ecosystem-based management, the good news is that another new book, *Ecosystem-based Management for the Oceans*, conveys the topic at its state-of-the-art level of development. That's also the bad news. I could not help thinking that the thought leaders on this topic have not yet begun to narrow the field to provide the simple tools and rules that managers will need. As long as ecosystem-based management is more complicated, it seems unlikely to succeed in replacing a simpler system of



more conventional management techniques, even one that performs poorly in many cases. For most, the devil you know is preferable to the one you don't. One chapter states, "To move toward a more desirable stable state, Chesapeake Bay management efforts must first *erode* the resilience of the current state, with the aim of breaching potentially distant thresholds to access a more desirable state" (p. 277).

That does not sound easy. But people do what's easy; if we don't make it easy, they won't do it. When people untie their boats and cast their nets, they don't need to understand ecosystems or the big picture. They need simple, fair rules. Fishery managers, who are employed to tell people what to do, need easy—or at least workable—procedures for deciding what they will indeed tell people to do, and understandable explanations of why.

Ecosystem-based Management for the Oceans is organized into five parts: Setting the Stage, Conceptual Basis, Connecting Concepts to Practice, Marine Ecosystem-based Management in Practice, and Looking Ahead. The book should appeal to students and researchers because its chapters are full of lists of questions such as: "How can we better account for the interactive and cumulative effects of the growing number of human activities affecting marine ecosystems?", "How well do we understand feedbacks between social and ecological components of systems, and what are the broader implications of these linkages?", and "How do we know how likely systems are to shift to a fundamentally different state that will produce a radically different set of services?" In my opinion, such questions should have informed the writing, not formed it. I have been both a researcher and a fisheries manager; researchers would prefer more testable statements and hypotheses. Managers would prefer a drink, or at least answers in the form of guidance.

The volume is full of appropriate calls for greater communication among scientists, managers, and stakeholders—the usual suspects. But communication starts with clarity. Much of the text could have benefited from a sterner editorial hand that had clarified and smoothed out the writing, and removed the many redundancies (it seemed that nearly every chapter informed us again that ecosystems "provide services"). It has become axiomatic that editors nowadays don't have time to edit. Unfortunately, the products suffer. Here, for instance, is the beginning of one chapter's conclusions: "We suggest that coastal ecosystems can operate as nonequilibrium systems where nonlinear interactions among spatially and functionally structured components lead to internal fluctuations in time and space." Editors shouldn't let people get away with writing sentences that don't communicate. If the authors can't write, editors must rewrite for them.

And who else but two economists could in one chapter write so cheerily (and noncredibly): "At its core, economics is the study of human well-being…. In the absence of philosophical or political clarity on these matters, economists pursue a more practical objective: Achieve the greatest good overall" (p. 93–95). Really? I was unaware that economists "pursue" objectives. Their pursuit of the greatest good must explain why the economy has made things right for everyone and everything. Why do we need

management when all of economics is already pursuing what's good for everyone?

From all corners and in both books come calls for greater involvement of stakeholders. But few acknowledge directly that because management is about limiting human behavior, stakeholders are the whole obstacle to science- and information-based management. (Stakeholders who extract resources, such as fishermen, often see science as the obstacle to common sense, and it's not always possible to know who's right.) Stakeholders can be brought along, and the management process can benefit from their knowledge, but only within certain limits. And stakeholders are often at odds with each other, and with managers. As one chapter notes, intensive surveys in the Chesapeake region "identified three major beliefs held by watermen that come in direct conflict with the goals of setting targets for the blue crab fishery." One: "Only God and nature" determine crab scarcity or abundance; two: Science does not have direct relevance. Humans cannot understand the blue crab and should "trust God's stewardship"; Three: Regulations cannot manage nature and should not attempt to change "naturally occurring cycles" (p. 281). Not surprisingly, attempts to broaden the dialogue failed. The biggest advance in US fisheries management in decades, the Sustainable Fisheries Act (1996) and its subsequent amendments, has increasingly confined managers to a narrower set of options, directing them to end overfishing and recover most stocks within a decade. The situation has improved because managers' options were legislatively narrowed toward the goal.

In my experience, stakeholders often want less regulation, fewer limits, less competition from competitors such as marine mammals, and no closed areas. Unfortunately, those are things that ecosystem-based management proponents generally consider necessary for recovery and long-term system sustainability and resilience. Regardless of whose approach would actually yield the greatest overall good, there are groups whose desires remain diametrically opposed. So, those issuing blanket calls for "greater stakeholder involvement" should be careful what they wish for.

Despite the editors' and authors' enthusiasm for their subject, many of the case studies in *Ecosystem-based Management for the Oceans* reinforced my impression that ecosystem-based management is too poorly defined and too complicated to work well today. But even if that is true, the book is still a broadly valuable insight. In McLeod and Leslie's next volume—and I hope they will continue to develop this field—I'd like to see a discipline that has moved past truisms and rhetorical questions to providing decision rules that can be implemented in various contexts. As deeply as the authors dig into the science, they will have to study management and constraints on managers, and fit ecosystem-based management goals into existing successful processes, truly workable guidelines, and new, simple models.

For instance, if the goal is to leave enough forage fish to support upper trophic levels, managers might be instructed to determine the forage species' maximum sustainable yield (MSY) through conventional calculations, identify the forage species' trophic level, then subtract some percentage of the MSY (i.e., 20 percent) for each trophic level the ecosystem supports above the forage species' trophic level to arrive at the allowable catch. Thus in a system where herring are eaten by king salmon and salmon are eaten by killer whales, the total allowable catch for herring might become 0.6 (MSY). That might be a rough approximation of reality, but from the standpoint of ecosystem-based management it would be a vast improvement over setting the herring catch target at MSY. Would stakeholders agree? It depends on whether the stakeholder is a herring fishing company, a salmon fishing company, the World Wildlife Fund, or a killer whale. That's why the stated goal (to leave enough forage fish) must be set first as a matter of policy, usually legislatively or by treaty or decree.

Taken together, both books demonstrate that our understanding of ocean ecosystem dynamics has advanced admirably; our management of human behavior hasn't. How to advance it? As fieldworkers get their hands dirty, those working in ecosystem management need to experience the mess and unpleasantness of trying to manage people's activities. Then, they must devise ways to bend management toward ecological and long-term thinking. The task is not to imagine and conceive of a truly comprehensive form of management. For scientists and academics, that's the easy part. The task is to fit such concepts into the framework of what's possible, within the narrow confines of that most imperfect of all of nature's forces: human nature.

My gripes aside, both *Marine Ecosystems and Global Change* and *Ecosystem-based Management for the Oceans* are valuable troves that could profitably be mined, and any academic bookshelf would wear them well.

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