

Ecosystem-Based Fisheries Management: Confronting Tradeoffs

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BOOK REVIEW

Ecosystem-Based Fisheries Management: Confronting Tradeoffs.
By Jason Link. Cambridge University Press, New York. 2010. 207 pages. \$72.00 (hard cover).

“Ecosystem approaches to management,” or a variant of that phrase, is appearing in policy documents at global, regional, and national levels and is being applied to a wide array of practices, including fisheries management. Books with ecosystem-based approaches are beginning to appear as well, and this one is a welcome addition. Although explicitly presented as the author’s personal thoughts rather than institutional ones, it is a very credible presentation of the thinking that is typical in the United States, and particularly the northeastern United States, where the concept of ecosystem-based management has been a focal theme for a decade or more.

This book is a welcome addition because as use of the phrase “ecosystem-based approach” increases, the concept is frequently being challenged by decision makers, managers, and even scientists to the effect that “We don’t know what it is” or “It’s too complex to be practical.” These circumstances make a book on ecosystem-based fisheries management timely. This is a book that I can recommend to expert audiences who are already generally aware of the ecological aspects of ecosystem-based fisheries management (EBFM) and want a clear summary of some important areas where ecology meets fisheries. Unfortunately, I cannot recommend it to those expressing the more basic concerns because it does not adequately address either of the challenges that I noted above. It provides too narrow a treatment to really inform managers and decision makers about what EBFM is, and the themes it does treat tend to confirm the preconception that it is all very complex.

On the positive side, this is a necessary book for all fisheries and marine ecosystem scientists interested in how physical and especially trophodynamic processes affect the dynamics of harvested (and assessed) stocks. Part I of the book explains the importance of these classes of drivers very well, with clear illustrations, good verbal treatments of the ecological relationships, and fair mathematical treatments. Even readers who are experts in the field are likely to encounter things they did not know. All such experts will get unqualified endorsement that the work they are doing really matters. It is also at least a useful book for readers interested in the reciprocal perspective of the footprint of fisheries on ecosystems. The book is quite strong on the trophodynamic footprint of fisheries and at least fair on bycatch and habitat impacts.

In terms of the audiences for the book, the list should probably stop there, however. Once readers reach Chapter 7, assess-

ment scientists in particular will feel that they are being preached at—criticized, largely unfairly, for not adding a lot more poorly quantified and parameterized, data-hungry, and noisy functional relationships to their assessment models. They will probably feel that the criticism comes from someone who claims to have spent a lot of time at their assessment meetings, but based on the book, the author was there more to correct their errors than to understand why they do assessments the way they do. Link makes a convincing case that physical and trophodynamic forcings affect stock dynamics. However, it is an unproven assumption that because the effects of these forcings can be demonstrated, we can represent them analytically well enough that their inclusion in assessment models will provide better advice and lead to better decision making. Link comes close to acknowledging this when, on page 15, he chides assessment scientists for being overly concerned with accuracy (reducing variance) and giving too little attention to precision (reducing bias). Without question, adding more functional relationships to assessment models is likely to add realism. However, the additions will only reduce bias if the relationships are formulated correctly. Many environmental drivers may have large effects under some conditions and little or no effect under others. Those conditions may relate to the driver itself (as with match–mismatch factors), to the condition of the stock (there may be a large effect on an overexploited stock in which only a few year-classes comprise the spawning biomass but much less effect on a stock in which many year-classes do), or be conditional on the state of yet another environmental factor (there may be a strong predator effect only when favored oceanographic conditions are so scarce that stocks are densely aggregated). Representing any of those driver–recruitment relationships by a smooth continuous function is likely to be wrong more often than it is right. Including such complexities might or might not reduce bias overall, but the practice will certainly increase uncertainty in most years even if it does reduce the effect of the occasional outlier.

Meanwhile, the assessment community has some very good reasons for not being overly concerned with a source of consistent bias. Assessment models typically have several built-in scaling parameters, and one of them links the percentage of the stock that can be sustainably harvested to the estimate of the size of the fishable biomass. The estimate of fishable biomass from an assessment can be biased substantially relative to the true biomass. However, as long as the bias is consistent over a series of assessments, a well-tested exploitation rate should have a compensatory bias leading to an estimate of annual harvest that actually is sustainable. Admittedly, this is not a perfect system, but it works well as long as there is a time series of

data giving feedback on how harvest levels (measured in absolute terms if catch monitoring is decent) affect successive biomasses. Such feedback allows adjustments to the target exploitation rate to be informed by the past performance of the assessment–management system. Moreover, without a long time series of data it will not be possible to estimate the shapes of the functional forms of the more complex ecosystem driver–stock productivity relationships that Link argues need to be incorporated into fish stock assessments. Nor will there be enough information to parameterize the relationships correctly if they can be derived from data or theory.

In a book review, I should not just challenge assertions that I consider unsupported with other assertions unless I can offer support for my concerns. In addition, my apologia for assessment practices that may appear myopic to systems ecologists focused on consistent sources of bias, and of course the effects of these environmental forcings may not be consistent over time. Fortunately, these types of concerns are *not* new, even if the term EBFM is. By far the most thorough studies of what these ecosystem complexities (particularly the trophodynamic ones) do and do not add to actual assessment and advisory practice are those of the International Council for the Exploration of the Sea’s Multispecies Assessment Working Group in the 1980s and 1990s. Back then, the belief that one could just simulate one’s way to mastery of *any* process was not as deeply entrenched as it is now. Rather, the experts examined comparatively how much their documented and parameterized relationships actually added to assessment performance and advisory outcomes. Moreover, back then they had available vastly more diet data than is considered necessary now. The “old” conclusion was that the trophodynamic information was rarely even adequate to document definitively which of several possible functional feeding relationships to use, let alone to track year-to-year variations in predation mortality (M2). The annual estimates of M2 were affected by uncertainty in both the trophodynamic relationships and the year-to-year estimates of the abundances of interacting predators and prey, and the annual diet data were inadequate to capture any prey switching that might be occurring. Consequently, practitioners concluded that using annual estimates of M2 actually worsened annual assessment performance rather than improving it. The recommended strategy was to update the M2 estimates every 5–10 years based on updated and smoothed information on how the prey and predator fields had changed and recent diets. It took at least half a decade to effectively extract any new signal from the noise in the ecosystems and in the models of them.

Link states that one of the key motivators for adopting an EBFM is “to provide more accurate assessments and evaluations of living marine resources” (page 17). Given that, one might expect that he would first acknowledge the evidence-based counterview of a decade or more ago and then present new evidence that we have advanced far enough that assessment practice actually is improved when these functional relationships are included. We do not see such evidence—only

evidence throughout Part I that many factors other than fishing affect stock dynamics and that assessment results would be *different* (not that they would be less biased and have a variance that was at least no higher) if the relationships were included (Chapters 7 and 8)

The same situation applies to adding environment–recruitment relationships to the assessment tools. For short-lived species, most of the fishable and spawning biomasses may consist of new recruits and anything that helps predict recruitment is an asset. However, for longer-lived species in which several cohorts contribute to the fishing and spawning biomasses, new recruits should comprise only minor portions of the respective biomasses. In such cases, management should not bet the future of the fishery and the stock on better predictions of incoming recruits. Rather, management should focus on keeping exploitation rates low enough that the standing stock is not overharvested and the spawning and fishable biomasses are not dependent on annual recruitment, however well or poorly it may be estimated.

How does such management come about? As the book acknowledges in Chapter 2 (page 21), it comes about by managing people’s behavior. That consideration gets us squarely into the social and economic sciences. If economists and social scientists want to learn about the effects of environmental and trophodynamic forcings on stock dynamics, they will find the early parts of the book interesting. They should definitely not read the latter half of the book. With good reason, they will feel patronized and believe that the contributions they make to management are devalued and largely dismissed. In the appropriate places throughout Part II, Link says the right things about the importance of the social and economic sciences. However, as early as page 75 he tells readers that although these are important aspects of EBFM they are not important enough for him to have studied them and that he can write a book on EBFM without mentioning the social aspects of fisheries. In fact, the very title of Chapter 10 (“Why Most Fisheries Scientists Become Amateur Social Scientists”) should be a clarion call to bring *professional* social scientists in as full partners in EBFM rather than implying that ecologists can do the work of social scientists once they have finished the important work. Fisheries economists have to wait for pages 106–107 for a similar polite brush-off.

Social and economic scientists should definitely avoid the second half of this book. Without a professional treatment of the social and economic dimensions of what it means to be sustainable, EBFM is not EBFM; it is just EB research and assessments, and social and economic scientists will find no place for their knowledge and insights. Dismissing the social and economic aspects of fisheries in a few paragraphs scattered over Part II of the book is a major flaw. That flaw is all the more glaring because as early as Table 3.1 Link actually presents a hierarchical list of policy and management priorities. At the very top of the list one finds “human existence” and “human rights”—topics the book does not consider important enough to discuss. The livelihoods of communities and the nasty concept of economic benefit are only considered legitimate after all

biological ecosystem needs are fully accommodated. When the book gets to the nuts and bolts of implementing EBFM, only at step 5 (of 7) does anything resembling a human consideration come into play. Even then it is only as “Allocate different sub-caps to different fleet sectors,” followed in the next step by establishing management measures that allow sectors to harvest within their allocations. This failure to integrate the social and economic dimensions of sustainability with the environmental dimension is very unfortunate and greatly limits the value of the book.

Finally, I particularly would not want managers and decision makers to take this book as the “how to” guide to EBFM. The middle section will be read as saying that we are capable of modeling our way into answers to all the important questions if the models include enough factors, and throughout the book nothing social or economic matters enough for the author to try to integrate those aspects of management with the ecological factors. Consequently, the book will give managers and policymakers wrong answers to both major concerns raised at the beginning of this review. Regarding the concern that EBFM is too complex, to all but the top rank of researchers on ecosystem dynamics this book will indeed make the concepts appear very complex. Regarding the concern that no one knows what EBFM is, this book sends the wrong message there as well.

Notwithstanding the token nod to other disciplines, when the book talks about the way forward it strongly implies that actual *study* of the social and economic dynamics of fisheries is not necessary after all. What really matters is deeper, richer ecology. That message is inconsistent with all the platitudes about social and economic scientists in the book itself, but more importantly, it poorly reflects what is going on in the rest of the world. Ecosystem-based fisheries management is not about more and better trophodynamic and physics–biology modeling, even though experts in those fields have made many important contributions to EBFM. It is about strengthening *all* the dimensions of sustainability—social, economic, and ecological. This book does an excellent job on one of the three. That is not bad, and if you are interested primarily in that dimension this book is a must-read. However, we still need a book on EBFM (or EAM) that will give far more balanced treatment to the three pillars of conservation and sustainable use of living marine resources.

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