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Steps for Future Progress in Ecosystem-Based Fisheries Management: What's Next?

Gordon H. Kruse
University of Alaska Fairbanks, School of Fisheries and Ocean Sciences, Juneau, Alaska, USA

Howard I. Browman
Institute of Marine Research, Ecosystem Processes Group, Austevoll Research Station, Storebø, Norway

Kevern L. Cochrane
Food and Aquaculture Organization, Fishery Resources Division, Rome, Italy

Diana Evans
North Pacific Fishery Management Council, Anchorage, Alaska, USA

W.J. (Rick) Fletcher
Department of Fisheries, Western Australia, North Beach, WA, Australia

Glen S. Jamieson
Department of Fisheries and Oceans, Pacific Biological Station, Nanaimo, British Columbia, Canada

Patricia A. Livingston
Alaska Fisheries Science Center, NOAA Fisheries, Seattle, Washington, USA

Douglas Woodby
Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau, Alaska, USA

Chang Ik Zhang
Pukyong National University, Division of Marine Production System Management, Busan, Korea

Background

Since the 1990s, fisheries managers have been advised to broaden their scope of awareness beyond single-species considerations. Motivations for this broader approach stem from typical poor performance of single-species fishery management worldwide, heightened awareness of interactions among fisheries and ecosystems, a growing understanding of the functional value of ecosystems to humans, and recognition of a wider range of societal objectives for marine ecosystems beyond fishery catches. This new approach is often called ecosystem-based fisheries management (EBFM) or an ecosystem approach to fisheries (EAF). An EAF strives to balance diverse societal objectives by taking into account the knowledge and uncertainties of biotic, abiotic, and human components of ecosystems and their interactions, and applying an integrated approach to fisheries within ecologically meaningful boundaries (Garcia et al. 2003).

Considerable progress has been made by organizations such as the Food and Agriculture Organization of the United Nations (FAO), International Council for the Exploration of the Sea (ICES), North Pacific Marine Science Organization (PICES), and many others to develop the conceptual frameworks, ecosystem indicators, modeling approaches, risk assessments, and other facets of EBFM/EAF. Additional development and implementation of EBFM remains a high priority internationally. For instance, it forms the foundation of the current ICES Strategic Plan, "A Vision Worth Sharing," and it is an important component of the new PICES Science Program, "Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Marine Ecosystems" (FUTURE).

The goals this international symposium, "Ecosystems 2010: Global Progress on Ecosystem-Based Fisheries Management," were to: (1) evaluate global progress toward EBFM by reviewing regional case studies, development of new analytical tools and practical approaches toward future progress; and (2) offer explicit, practical advice for future progress in implementation of EBFM. The 18 papers published in this volume have each contributed toward the first goal. Toward the second goal, a panel session was held on the last day of the symposium. The panel was chaired by Glen Jamieson and also included Howard Browman, Rick Fletcher, Kwame Korenteng, Mitsutaku Makino, and Patricia Livingston. Panelists offered their perspectives on the take-home messages from the symposium, and meeting participants posed questions and proffered their insights. Our attempt to provide a succinct summary of the panel session follows.

Panel discussion

The symposium achieved a general consensus on several aspects of EBFM. There was a convergence on broad ecosystem management objectives, principles, approaches, tools, and the need for involvement of stakeholders. The foundations for this approach have been articulated by the FAO (Garcia et al. 2003) and others. Important elements for the practical implementation of EBFM emerged from progress in the Gulf of Maine (Stephenson and Annala 2012) which, thanks to shared governance by two wealthy neighboring nations, is one of the world's best studied ecosystems. This partnership has been able to provide: (1) *leadership* to move forward with respect to existing activities in a changing environment with a vision to the future; (2) *effective governance* of people that takes advantage of advances in the field of management science; (3) *manage or change expectations* to conform with those of society for the world's last wild capture activities; (4) *interdisciplinary teams* of experts to address the inherent multidisciplinary problems associated with EBFM; and (5) a *participatory process*—active involvement of a diverse set of stakeholders.

A consensus emerged that fisheries management is a people-based process that is informed by science and other information. Consequently, stakeholder involvement is essential with a dedicated commitment from those in leadership roles being necessary to achieve this. From a practical standpoint, effective implementation and enforcement of regulations requires "buy in" from stakeholders, just as in the case of single-species management. However, it was also pointed out that stakeholders can help with two frequently cited obstacles to EBFM implementation: failure to define operational objectives and lack of data and information. It may take numerous meetings to build trust among various sectors, as was well documented in the case of EBFM in the Shiretoko World Natural Heritage in Japan (Makino 2012).

During the panel discussion there was general agreement that EBFM should move forward even with imperfect/incomplete information. The contrasts in data, knowledge, models, and governance between the world's developed versus developing countries were quite stark. For this reason, it was noted that different kinds of situations call for different kinds of EBFM. For instance, the most successful attempts to implement EBFM in developing countries presented at this symposium all appeared to involve minimal data and no quantitative modeling, but a very high level of stakeholder involvement and commitment. It was also pointed out that EBFM is an adaptive process, changing as new data and information become available. In other words, the common statement, EBFM is an evolutionary process not a revolutionary process, remains apropos.

Through the talks presented at the conference it was made clear that EBFM will ultimately evolve toward the establishment of regional

level plans within which the actions and arrangements for individual fisheries will be nested. Therefore, while EBFM will require consideration of multiple interactions at the regional level of the ecosystem, most of the management actions will still have to be made at the level of single species and individual fisheries. In other words, it is important not to become lost in the EBFM process, but instead to focus on generating good outcomes; and conventional fisheries management tools will still be the primary mechanisms used to deliver good outcomes.

Symposium participants agreed that adopting a risk-based approach provides the most appropriate and practical framework for implementing EBFM across the spectrum of data-limited to data-rich situations. With fisheries management essentially a specific form of risk management, a clear consensus emerged during the panel session for the need to conduct risk assessments to help set priorities. A large number of risk assessment tools are available for application to fisheries management situations (e.g., Fletcher 2005; Fletcher et al. 2010; Zhang et al. 2009, 2011; Hobday et al. 2011) with summaries of these now available from FAO's EAF Toolbox website (www.fao.org/fishery/eaf-net). The regional level EBFM system applied in Western Australia (Fletcher et al. 2012) highlighted the need not only to consider ecological risks but also to consider social, economic, and governance risks to determine which of these most requires direct action to deliver the best community outcomes. This approach also showed how the complexity generated by regional level assessments need to be reduced to enable practical use within the management decision making process.

There are already a number of quantitative techniques, such as stock assessment, management strategy evaluations, and ecosystem modeling (e.g., Atlantis, Ecosim), that can where appropriate be applied to assist in the application of EBFM. With respect to modeling, some presenters during the panel session stressed that the end goal of the effort should not be the model itself, but rather linkage to management. Atlantis is an example of an ecosystem model that was designed for use in management strategy evaluations (Fulton et al. 2011). Nevertheless, some symposium participants voiced concern about how the multitude of uncertainties can be addressed in a satisfactory manner using multispecies and ecosystem models where local data were lacking. Management strategy evaluations for single species have been developed whereby the perceived primary sources of uncertainty can be addressed singly or in combination. However, new methods will need to be developed to address the many sources of uncertainty in multispecies and ecosystem models. There was also a recognition that the collection of data necessary to "feed" these models comes at a cost and must be justified in terms of whether it will improve management or whether some other actions may be more beneficial. Additionally, advancements

are needed in tools for spatial management and for improving predictions of the impacts of climate change.

Nonetheless, a suite of tools, ranging from expert judgment to complex ecosystem models, are currently being employed globally to address management questions. The consensus from the symposium was that we have clearly moved from trying to define or understand the concept of EBFM/EAF to actual implementation. Development of the social dimensions of EAF are at an earlier stage of development compared with the ecological aspects. The next global challenge appears to be moving toward the broader concept of an ecosystem approach to management (EAM), which involves cross-sectoral ecosystem-based management. Challenges to progress in that area are primarily institutional, legal, and social.

Finally, a clear conclusion of this symposium was that the greatest risk to the world's fisheries is not the lack of scientific information, but rather the lack of effective governance. While there was much discussion about the enormous costs required to learn all the things about marine ecosystems that we would like to know, the fact is that we can already implement EBFM even in data-limited situations by adopting a risk-based approach. Good outcomes can be achieved by applying a practical and precautionary approach that adopts good governance principles with effective implementation by having suitable political and institutional commitment. The corollary is that for systems where single-species fisheries management has failed owing to ineffective governance, adopting EBFM is likewise doomed to failure. Rectifying this common central problem of poor governance is a prerequisite for any form of successful fishery management from single species to EBFM.

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