

APPENDIX B: Challenges to EBFM

BUILDING EFFECTIVE FISHERY ECOSYSTEM PLANS:
A REPORT FROM THE LENFEST FISHERY ECOSYSTEM TASK FORCE

Appendix B

CHALLENGES TO EBFM

The following page presents a table of challenges to EBFM identified from the scientific literature, with the Task Force's suggestions for how a new generation of FEPs can overcome them.

Theme	EBFM Challenge	FEP Solution
System boundaries and jurisdictions	Scale issue: mismatch between ecological, social, and legal jurisdictional scales ¹⁻⁴	FEPs explicitly state the scope of the issues they are trying to address in the "Where are we?" step of the FEP loop; these will be prioritized in the "Where are we going?" step
Integrated management/ Interdisciplinarity	Mismatch of spatial and temporal scale of social science and natural science data	FEPs can identify where there are data gaps and mismatches in the "Where are we?" step of the FEP loop and the prioritization process "where are we going?" will identify where they matter. This can lead to identification of strategies to match the data scales
Stakeholder involvement	Many issues with stakeholder participation that are present with single-species management-are amplified with EBFM, especially with respect to trade-off decisions ⁵	FEPs involve stakeholders at every step of the FEP loop. Concept diagrams identified in the "Where are we going?" step identify relevant stakeholders, and trade-offs analysis in the "How do we get there?" step explicitly recognize stakeholder values.
Uncertainty	Adding drivers to stock assessment increases estimation and measurement uncertainty ⁶	FEPs can incorporate model uncertainties and identify robust management strategies in the "How do we get there?" step of the FEP loop
	Ecosystems are complex adaptive systems that require an adjustment in our modeling and thinking ⁷	
	Prediction of effects of climate change on fisheries production and distribution is uncertain ⁸	
	Reduced predictability about future stock sizes of key specoes ⁹	
	There is high uncertainty in ecosystem models because of knowledge gaps in basic ecology ¹⁰	
Indicators and Reference Points	Defining thresholds and limits for ecological functioning is difficult ¹¹	FEPs loop can define process to assess risk, and allowable activities based on risk, using well-established science tools
	If diversity (stock, genetic, taxonomic, etc.) is important, what tools are available to ensure that diversity is maintained? ¹¹	FEPs can use the "How do we get there?" step to explore common sense rules to minimize intense selectivity on a limited set of ecosystem components
Trade-offs	Difficulty reconciling tradeoffs among competing interests and values ^{2,4}	An explicit strength of FEPs is that they can explore trade-offs, with stakeholders, in the "How do we get there?" step of the FEP loop
Objectives	Objectives of EBFM are not as clear as they are for single species management ^{7,9}	FEPs explicitly state the scope of the issues they are trying to address in the "Where are we?" step of the FEP loop; these will be prioritized in "Where are we going?" step
	Should EBFM attempt to protect every species or only those deemed necessary to maintain ecosystem health ⁵	
	It is unrealistic to protect or restore to a natural state ³	FEPs involve stakeholders at every step of the FEP loop. Concept diagrams identified in the "Where are we going?" step identify relevant stakeholders, and trade-offs analysis in the "How do we get there?" step explicitly recognize stakeholder values.
	EBFM means different things to different people ^{3,10}	
	Sustainability can be operationally defined in single species assessments (MSY-related) but becomes much more complicated in EBFM. ⁷	
Costs and Resources	Costs of monitoring and implementation ^{1,12,13}	The prioritization process in the "Where are we going?" step of the FEP loop will identify and triage where to focus limited resources
	Mismatch between expectations and resources for EBFM ²	The stakeholder-inclusive prioritization process in the "Where are we going?" step of the FEP loop will identify and triage where to focus limited resources
	Incorporating stakeholders into an entire process is expensive ^{2,4,14}	
Data and knowledge limitations	Perception that EBFM is too data-hungry, and we have insufficient knowledge and too much uncertainty to move forward ^{2,3,9}	FEPs can incorporate model and data uncertainties and identify robust management strategies in the "How do we get there?" step of the FEP loop. Qualitative approaches are possible for data poor situations
Complexity	Science is overly complex and difficult ^{1,9,15-17}	FEPs prioritize explicitly stated objectives in the "Where are we going?" step of the FEP loop, which defines a range of tools that can inform the "How do we get there?" step
	Some practitioners (including scientists) think that doing EBFM means you have to model everything ⁴	FEP includes ecosystem status assessment and prioritization of threats in the "Where are we?" step of the FEP loop
	Many hypotheses about ecosystem structure and function ⁹	FEPs can incorporate of model and process uncertainties and identify robust management strategies in the "How do we get there?" step of the FEP loop
Perceptions	EBFM proponents perceive any failure of management is due to the lack of EBFM approach, rather than a failure for other reasons. ³	FEPs involve stakeholders at every step of the FEP loop. Concept diagrams identified in the "Where are we going?" step of the FEP loop will identify pressures and threats, and the different perception of why management may have failed.
	EBFM analyses tend to treat humans as a disturbance rather than a member of the ecosystem. ³	FEPs involve stakeholders at every step of the FEP loop. Concept diagrams identified in the "Where are we going?" step of the FEP loop will identify pressures and threats, and the different perception of why management may have failed.

References:

1. Jr, J. H. C. et al. Challenges for Implementing an Ecosystem Approach to Fisheries Management. *Mar. Coast. Fish.* **4**, 496–510 (2012).
2. FAO. *Fisheries Management. 2. The ecosystem approach to fisheries.* (2003).
3. Christie, P., Fluharty, D. L., White, A. T., Eisma-Osorio, L. & Jatulan, W. Assessing the feasibility of ecosystem-based fisheries management in tropical contexts. *Mar. Policy* **31**, 239–250 (2007).
4. Leslie, H. M. *et al.* Operationalizing the social-ecological systems framework to assess sustainability. *Proc. Natl. Acad. Sci.* **112**, 5979–5984 (2015).
5. Gray, T. & Hatchard, J. A complicated relationship: stakeholder participation and the ecosystem-based approach to fisheries management. *Mar. Policy* **32**, 158–168 (2008).
6. Skern-Mauritzen, M. *et al.* Ecosystem processes are rarely included in tactical fisheries management. *Fish Fish.* n/a–n/a (2015). doi:10.1111/faf.12111
7. Gaichas, S. K. & Francis, R. C. Network models for ecosystem-based fishery analysis: a review of concepts and application to the Gulf of Alaska marine food web. *Can. J. Fish. Aquat. Sci.* **65**, 1965–1982 (2008).
8. Szuwalski, C. S. & Hollowed, A. B. Climate change and non-stationary population processes in fisheries management. *ICES J. Mar. Sci. J. Cons.* fsv229 (2016).
9. Mace, P. M. A new role for MSY in single-species and ecosystem approaches to fisheries stock assessment and management. *Fish Fish.* **2**, 2–32 (2001).
10. Field, J. C. & Francis, R. C. Considering ecosystem-based fisheries management in the California Current. *Mar. Policy* **30**, 552–569 (2006).
11. Frid, C. L., Paramor, O. A. & Scott, C. L. Ecosystem-based management of fisheries: is science limiting? *ICES J. Mar. Sci. J. Cons.* **63**, 1567–1572 (2006).
12. Walters, C. J. Is adaptive management helping to solve fisheries problems? *AMBIO J. Hum. Environ.* **36**, 304–307 (2007).
13. Hilborn, R. Future directions in ecosystem based fisheries management: A personal perspective. *Fish. Res.* **108**, 235–239 (2011).
14. Tallis, H. *et al.* The many faces of ecosystem-based management: making the process work today in real places. *Mar. Policy* **34**, 340–348 (2010).
15. Murawski, S. A., Brown, R., Lai, H.-L., Rago, P. J. & Hendrickson, L. Large-scale closed areas as a fishery-management tool in temperate marine systems: the Georges Bank experience. *Bull. Mar. Sci.* **66**, 775–798 (2000).
16. Link, J. S. What does ecosystem-based fisheries management mean. *Fisheries* **27**, 18–21 (2002).
17. Rice, J. Managing fisheries well: delivering the promises of an ecosystem approach. *Fish Fish.* **12**, 209–231 (2011).