
Ecosystem-Based Fisheries Management: Perspectives of fishery management councils and stakeholders in the New England and Mid-Atlantic regions



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Prepared by:

Ingrid S. Biedron and Barbara A. Knuth
Human Dimensions Research Unit, Department of Natural Resources, Cornell University

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EXECUTIVE SUMMARY

Ecosystem-based fisheries management (EBFM) is a component of the broader concept of ecosystem-based management (EBM), a holistic approach to wildlife and fisheries management (K. L. McLeod & Leslie, 2009). EBFM has been defined as the process of “managing fisheries to coordinate, account for, and include all factors in a holistic, synthetic, integrated fashion” (Link, 2010). The purpose of our study was to characterize how Council members, Council staff members, Scientific and Statistical Committee (SSC) members, recreational anglers, commercial fishermen, and non-governmental organization (NGO) leaders in the New England (NE) and Mid-Atlantic (MA) regions perceived adoption of EBFM by the New England and Mid-Atlantic fishery management councils. We hoped to determine how well Council members understand the perceptions of stakeholders regarding EBFM. Increased understanding between decision makers and stakeholders may contribute to efforts to foster adoption of EBFM as an approach for managing marine fisheries.

Methodological Approach

We collected interview and survey data from Council members, Council staff members, SSC members, commercial fishermen, recreational anglers, and NGO leaders from the NE and MA regions about their perspectives regarding EBFM. We observed 32 Council meetings and interviewed 66 individuals about EBFM, including Council members, Council staff members, and SSC members in the NE and MA regions. We distributed more than 5,600 mail surveys to commercial fishermen, recreational anglers, NGO leaders, SSC members and Mid-Atlantic Fishery Management Council (MAFMC) and New England Fishery Management Council (NEFMC) members in the NE and MA regions and received over 1,000 responses. We explored the extent to which Council members and stakeholders agreed about EBFM topics, how well the Council members predicted stakeholder responses, and how similar Council member predictions about stakeholders were to their own responses.

Summary of results

Council members and stakeholders in the NE and MA regions generally agreed regarding concepts that should be included in the definition of EBFM, practices that should be implemented in fishery management plans, potential barriers to the implementation of EBFM science, social science needs, and implementation time lines. These findings suggest that Council members and stakeholders understand what EBFM entails and have a desire to transition to EBFM, and that Council members either understand and agree with their constituents’ attitudes toward EBFM or perceive that their constituents agree with their own views.

Overall, Council members and stakeholders overwhelmingly supported some level of transition from single species fisheries management (SSFm) to EBFM. These findings demonstrate that Council members and stakeholders define EBFM as a

holistic approach to management, support practices that are believed to be central to EBFM, and desire a gradual transition to EBFM.

Council members and stakeholders labeled most potential barriers as moderate or significant. The variable which most respondents labeled as a *Significant barrier* was *Concern that if EBFM is implemented, then the profits for fishermen and the fisheries industry will be less than they are now under current management*, followed by a tie between *Lack of science to support EBFM plans* and *Lack of funding*. Many fewer barriers were labeled as minor, and none as insurmountable. These findings suggest that although Council members and stakeholders perceive that barriers to EBFM are serious, these barriers could be overcome (Biedron, 2014).

With respect to Council members' ability to predict stakeholders' perceptions about potential barriers, both NE and MA Council members repeatedly underestimated SSC member perception of the difficulty of overcoming some barriers, including increases in administrative requirements, decreases in profits, increases in fishing regulation complexity, and lower fish quotas.

However, neither lack of agreement between Council members and stakeholders nor lack of Council member understanding of stakeholder perceptions appeared to be an obstacle for Council transition to EBFM. These findings suggest that although Council members and stakeholders perceive major challenges to EBFM, Council members and stakeholders do not perceive that any of these challenges are permanent. These results may demonstrate that work is needed to reduce the barriers to EBFM and to increase social science information for fisheries management but also that the practice of EBFM is possible, with no insurmountable obstacles preventing its implementation.

ACKNOWLEDGMENTS

We thank the many individuals, including stakeholders from the New England and Mid-Atlantic fishery management councils, who participated in the interviews and surveys completed to inform this study. Without their help and cooperation this project would not have been possible.

We thank Nancy Connelly who reviewed this report and Karlene Smith of the Cornell University Human Dimensions Research Unit who assisted with mail survey implementation and data entry. The Survey Research Institute at Cornell University conducted the non-respondent telephone follow-up interviews. Carol B. Cook transcribed all audio recordings for the in-person interviews.

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BACKGROUND

The purpose of the research conducted for this project was to identify factors influencing the Mid-Atlantic Fishery Management Council's (MAFMC) and the New England Fishery Management Council's (NEFMC) adoption of ecosystem-based fisheries management (EBFM) and was excerpted from a dissertation (Biedron, 2014). Additionally, the study explored the degree of understanding about EBFM between Council decision makers and stakeholders. The insights and results discovered during this study are summarized in this report, with implications for future research and management. A distinguishing feature of EBFM is that it is based on a multi-species approach, which varies significantly from the single species fisheries management (SSFm) approach currently practiced under the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA). The MSFCMA (Commerce, 2007) is the guiding legislation regarding the federal United States (U.S.) exclusive economic zone. In practice, the Councils have followed an institutional precedent to practice SSFM under the MSFCMA; however, the MSFCMA is currently undergoing reauthorization, which may result in changes that would more explicitly mandate the use of EBFM under amended legislation.

Definition of EBFM

EBFM is a component of the broader concept of ecosystem-based management (EBM), a holistic approach to wildlife and fisheries management (K. L. McLeod & Leslie, 2009). EBFM has been defined as the process of “managing fisheries to coordinate, account for, and include all factors in a holistic, synthetic, integrated fashion” (Link, 2010). Several key reports, including the U.S. Commission on Ocean Policy's *An Ocean Blueprint for the 21st Century* (USCOP, 2004) and the PEW Ocean Commission's *America's Living Oceans: Charting a Course for Sea Change* report (POC, 2003), in addition to President Obama's *National Ocean Policy* (CEQ, 2010) have encouraged using EBM as a guiding approach to ocean management, including fisheries management.

RESEARCH OBJECTIVES

The purpose of our study was to characterize how Council members, Council staff members, Statistical Committee (SSC) members, recreational anglers, commercial fishermen, and non-governmental organization (NGO) leaders in the New England and Mid-Atlantic regions perceived adoption of EBFM by the New England and Mid-Atlantic fishery management councils. We collected interview and survey data from Council members, Council staff members, SSC members, commercial fishermen, recreational anglers, and NGO leaders about their perspectives regarding EBFM. For our study, the term “stakeholders” referred to commercial fishermen, recreational anglers, NGO leaders, and SSC members. Understanding how Council members and stakeholders perceive EBFM and how well members understand the perceptions of other stakeholders may contribute to efforts to foster adoption of EBFM as an approach for managing marine fisheries.

THEORETICAL MODELS

Coorientation Model

We used the *Coorientation Model* (Connelly & Knuth, 2002; Leong, McComas, & Decker, 2008; J. M. McLeod & Chaffee, 1973) to characterize understanding about EBFM between the Council and fisheries-related stakeholder groups. The survey methods in this study employed the Coorientation approach used by Leong et al. (2008) to study aspects of communication between managers and stakeholders. The *Coorientation Model* (Figure 1) was used to measure the degree of understanding (*Agreement*, *Accuracy*, and *Congruency*) between Council members and stakeholders in the New England and Mid-Atlantic regions. We defined *Agreement* as “the extent to which the Council members and stakeholders hold the same attitudes and beliefs,” *Accuracy* as “the extent to which Council members’ predictions of stakeholder attitudes and beliefs is similar to the stakeholders’ actual attitudes and beliefs,” and *Congruency* as “the extent to which the Council members’ predictions of stakeholder attitudes and beliefs is similar to their own” (Leong et al., 2008). Coorientation measures allowed us to characterize the similarity of Council member and stakeholder attitudes about EBFM, how accurate Council members are in predicting stakeholder attitudes about EBFM, and how Council member predictions for stakeholders compare to their own responses. Council decision makers could use the information learned from this study about levels of *Agreement* and *Accuracy* between stakeholders and themselves to inform future decisions about which topics related to EBFM communication between Council members and stakeholders could be improved.

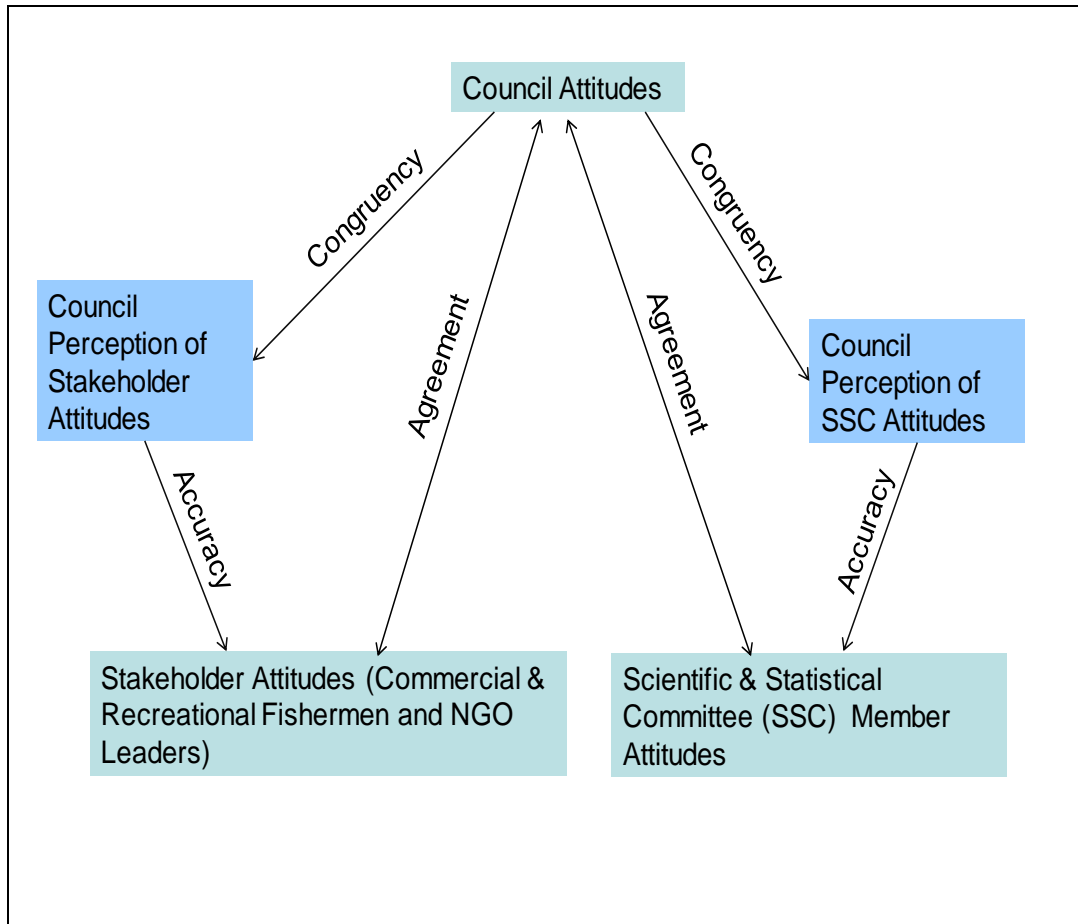


Figure 1. *Coorientation Model* used in the study, adapted from previous work (Connelly & Knuth, 2002; J. M. McLeod & Chaffee, 1973). The figure represents how *Agreement*, *Accuracy*, and *Congruency* were measured among Council members and stakeholders for the MA and the NE regions. The term *Council* refers to either NEFMC or MAFMC members.

METHODS

We used three types of data collection techniques:

- Exploratory approach
- Interviews
- Surveys

Exploratory approach: January 2011- December 2013

We used an exploratory approach to learn about NEFMC and MAFMC members, Council staff members and SSC members, including an information review and meeting observations. This approach helped us to focus the development of interview questions. For the exploratory approach, we observed 15 NEFMC and 17

MAFMC meetings and 3 workshops and reviewed documents and websites related to the Councils' organization and processes.

Information review

To gather contextual information about the Councils, including organizational structure, legal mandates underlying their creation and operation, procedures for appointment of staff and members, descriptions of Council members, past Council action related to EBFM, and Council culture, we reviewed literature, documents, and websites about Council and SSC organization and research, relevant fisheries and environmental legislation, and Council and SSC-generated reports, papers, agendas, and presentations (Appendix A). Both the NEFMC and the MAFMC websites provided thorough coverage of and open access to information. The information review and meeting observations were used to develop the interview questions.

Meeting observations: April 2011 – December 2013

We attended all MAFMC (17) and NEFMC (15) full council meetings held between April 2011 and December 2013 to gain a contextual understanding of Council dynamics, organizational structure, and major issues and themes, and toward the end of the research, to present the results of the research. During the meetings we sat with the public audience and recorded general notes about Council processes, opportunities for public input, and policy discussions and presentations related to EBM and EBFM. During the meetings, we had informal conversations with many of the Council members, Council staff, SSC members, and fisheries-related stakeholders during breaks, meals, and designated networking sessions. These social interactions provided insight into potential social factors that could impede and/or facilitate the implementation of EBFM by the Councils. In addition to attending Council meetings, we attended several Council-related workshops specifically about EBFM (Appendix B). The meeting observation data provided a basis for understanding the Councils' cultures to inform development of the interview and survey questions. Additionally, the meeting observations provided context within which to understand the responses Council participants provided during interviews. The information review and meeting observation research methods qualified for Exemption from Cornell University IRB Review (IRB Protocol ID#: 1006001489).

Interviews: March 2012-July 2012

We used semi-structured interviews to identify Council participant perceptions of barriers to EBFM and recommendations regarding EBFM implementation. We interviewed 66 individuals, who were Council members, Council Staff members, or SSC members in the NE and MA regions, about EBFM. The interviews qualified for Exemption from Cornell University IRB Review (IRB Protocol ID#: 1006001489). Council staff and SSC members with expertise related to EBFM were

invited to participate in interviews. Council member, Council staff, and SSC member contact information was available on the NEFMC and MAFMC websites. We distributed interview invitations initially via e-mail and followed up by phone and/or in person communications. We invited all NEFMC members (19) and selected NEFMC staff members (6) and NEFMC SSC members (7), and all MAFMC members (25) and selected MAFMC staff members (7) and MAFMC SSC members (6), and members of both Councils (4), totaling 74, to participate in interviews; 66 individuals completed interviews.

Interviews were semi-structured (Keyton, 2006), contained approximately 8-10 questions, and lasted 30-60 minutes, depending on interviewee response duration (Appendix C). The interviews were structured to initiate conversation relating to the study objectives; however there was enough flexibility in the interview format to allow for unanticipated themes to emerge from the conversation. The interviews were open-ended, so for all the interviews, all questions may not have been asked in order nor read verbatim. The purpose of the questions was to provide an outline for the interview to structure discussion on the material/content that was essential to the study.

We used the computer software *Atlas.ti* (ATLAS.ti, 2014) to analyze interview data. *Atlas.ti* was used to code interview transcripts, which included highlighting transcript sections that suggested potential barriers to or recommendations for EBFM. After identifying the answers to the questions asked, we consolidated the codes into categories of barriers and recommendations. We took precautions in reporting, such as grouping of results, to protect the anonymity of interviewees.

Mail survey methodology

We used a mail survey to study perceptions about EBFM between Council members, SSC members, and fisheries-related groups (commercial fishermen, recreational anglers, and NGO leaders) in the NE and MA regions and to characterize understanding between Council members and stakeholders based on the *Coorientation Model*. We measured *Agreement*, *Accuracy*, and *Congruency* (Connelly & Knuth, 2002; Leong et al., 2008) and compared beliefs and attitudes about EBFM among Council members compared to SSC members and stakeholders. We developed two versions of the mail survey. The “decision maker” survey was sent to all Council members and SSC members from the NE and MA regions. The “stakeholder” survey was sent to a sample of commercial fishermen, recreational fishermen, and NGO leaders working on fisheries policy in the NE and MA regions. Beginning on January 16, 2013, we sent out the first mailing to non-respondents, and sent out reminder mailings until March 1, 2013. We sent up to four mailings to selected NE and MA survey recipients to encourage participation (Dillman, 1978).

We distributed a total of 5,651 surveys in the NE and MA regions to selected individuals, including all NEFMC and MAFMC members and SSC members, to

leaders of NGOs with interests in federal fisheries in the NE and MA regions, and to individuals randomly selected from the Councils' lists of contacts for commercial fishermen and recreational anglers and from lists of commercial and recreational fishing permit holders in NE and the MA. Some individuals were members of both the NEFMC and the MAMFC. Due to their central positions on the councils, each of these dual-council participants was invited to respond to both surveys. Our study protocol was reviewed by the Cornell University Institutional Review Board and deemed exempt (IRB Protocol ID#: 1006001489).

From the perspective of Council members and stakeholders, we asked specifically: *What concepts should be included in the definition of EBFM? What practices do you think should be included in EBFM? What are your preferred outcomes (time lines) for EBFM? What are the potential barriers to EBFM? and What are the social science needs for EBFM?*

Identification of survey recipients

We compiled NEFMC and MAFMC member and SSC member contact information from the NEFMC (NEFMC, 2014) and MAFMC (MAFMC, 2014a) websites. We created the list of commercial fishermen and recreational anglers by randomly selecting a subsample of individual names from the list of permit holders for each group from both the NE and MA regions. We included only commercial fishermen and recreational anglers whose interests were related to federally-regulated fisheries within either the region regulated by the NEFMC or the MAFMC.

We used several techniques to compile the NGO leader stakeholder list for marine fisheries organizations in the NE and MA regions. We conducted an internet search for the phrases “nongovernmental organizations in New England fisheries” and “nongovernmental organizations in Mid-Atlantic fisheries.” Additionally, we reviewed sign-in sheets and observation notes from NEFMC and MAFMC full meetings from 2011 and 2012 and included the representatives of those marine fisheries-related organizations listed in the survey sample. We also used contact lists provided by the Council staff members to identify leaders of marine fisheries organizations in the NE and MA regions. Because the final list of NGO contacts was relatively short, we sent surveys to all NGO contacts that had been identified through the various identification processes.

Non-respondent phone follow-up

We conducted non-respondent phone follow-up surveys, consisting of a shortened version of the mail survey, from March 28, 2013 through April 16, 2013, with 200 mail survey non-respondents (50 NE commercial fishermen, 50 NE recreational anglers, 50 MA commercial fishermen, and 50 MA recreational anglers) (Loker, Decker, & Schwager, 1999; Tarrant, Manfredo, Bayley, & Hess, 1993).

Survey data analyses

We entered the data from the returned questionnaires into a computerized data file and used SPSS (IBM SPSS Statistics 21) for analysis. We conducted a *Two-Way Analysis of Variance*. We checked the standard assumptions (Ltd, 2013) and found them reasonable and consistent throughout the analysis. We used the results of the *Two-Way Analysis of Variance* to calculate *Agreement*, *Accuracy*, and *Congruency* between Council members and SSC members and stakeholders.

For the purposes of this study, *Agreement* was defined as “the extent to which the organization and the public hold the same attitudes and beliefs” (Leong et al., 2008), where the “organization” represents the Council members and “the public” represents SSC members and stakeholders. To calculate *Agreement Level* between Council members and one of the relevant stakeholder groups from the appropriate region, we calculated the mean survey responses for each stakeholder group to each question. All survey responses were measured on a Likert scale of 1-5 (6’s, “Don’t Know” responses were removed from the data set for analysis). We then calculated the absolute value of the difference in mean response between the two groups. The maximum possible difference in mean response was 4, which would represent the lowest possible agreement. The minimum difference in mean response was 0, which would be complete agreement. To represent *Agreement Level* as directly correlated to agreement, *Agreement Level* was calculated by subtracting the absolute value of the mean response difference from 4. Therefore, 4 = highest *Agreement Level* and 0 = lowest *Agreement Level* ($AGREEMENT LEVEL = \{4 - (Absolute\ value\ of\ mean\ response\ difference)\}$).

For the purposes of this study, *Accuracy* was defined as “the extent to which the organization’s or the public’s estimate of the other’s attitudes and beliefs is similar to the other’s actual attitudes and beliefs” (Leong et al., 2008), where the “organization” represents the Council members and “the public” represents SSC members and stakeholders. To calculate *Accuracy Level* between Council members and one of the relevant stakeholder groups from the appropriate region, we calculated the mean survey responses for each stakeholder group to each question as well as Council member mean predictions of each stakeholder group’s responses to each question. We then calculated the absolute value of the difference in the mean prediction of Council members for the stakeholder group in question and the mean response of the stakeholder group. The maximum possible difference in mean response was 4, which would represent the lowest possible *Accuracy*. The minimum difference in mean response was 0, which would be complete *Accuracy*. To represent *Accuracy Level* as directly correlated to *Accuracy*, *Accuracy Level* was calculated by subtracting the absolute value of the mean response difference from 4. Therefore, 4 = highest *Accuracy Level* and 0 = lowest *Accuracy Level* ($ACCURACY LEVEL = \{4 - (Absolute\ value\ of\ mean\ response\ difference)\}$).

For the purposes of this study, *Congruency* was defined as “the extent to which the organization’s or the public’s estimate of the other’s attitudes and beliefs is similar

to their own” (Leong et al., 2008), where the “organization” represents the Council members and “the public” represents SSC members and stakeholders. To calculate *Congruency Level* between Council members and one of the relevant stakeholder groups from the appropriate region, we calculated the mean survey responses of Council members to each question as well as Council member mean predictions of each stakeholder group’s responses to each question. We then calculated the absolute value of the difference in the mean prediction of Council members and the mean response predicted for the stakeholder group in question. The maximum possible difference in mean response was 4, which would represent the lowest possible *Congruency*. The minimum difference in mean response was 0, which would be complete *Congruency*. To represent *Congruency Level* as directly correlated to *Congruency*, *Congruency Level* was calculated by subtracting the absolute value of the mean response difference from 4. Therefore, 4 = highest *Congruency Level* and 0 = lowest *Congruency Level* ($CONGRUENCY\ LEVEL = \{4 - (Absolute\ value\ of\ mean\ response\ difference)\}$).

RESULTS AND DISCUSSION

The study highlights specific definitions, practices, time lines, social science needs, barriers, and recommendations that MAFMC and NEFMC decision makers could focus on to facilitate the transition to EBFM from SSFM. Below, the findings from surveys and interviews about EBFM are presented and discussed.

Interview Results

Interviewees identified 29 barriers to EBFM and suggested 14 recommendations for approaching implementation challenges to EBFM. *Lack of science, data, and modelling capability* was identified as a barrier by the highest number of interviewees. The recommendation *Define EBFM, identify objectives, and determine specific plan and time line for implementation* was cited by the highest number of interviewees (Biedron, 2014).

Survey Results

Survey response rate and non-respondent bias

The overall survey response was 1,083 returns out of 5,651 surveys mailed; the response rate varied by group from 57% to 14% (Table 1). Although response rates were relatively low for commercial and recreational fisheries stakeholder groups in each region, we found no evidence of non-response bias.

Table 1. Survey response rates to decision maker and stakeholder surveys distributed to recipients in the NE and MA regions.

SURVEY RECIPIENT GROUP	# RETURNS	# SENT	% RESPONSE RATE
Members of both Councils	10	10	100%
New England Council decision makers	27	59	46%
Mid-Atlantic Council decision makers	35	61	57%
New England NGO Leaders	39	78	50%
Mid-Atlantic NGO Leaders	16	56	29%
New England Commercial Fishermen	238	1333	18%
Mid-Atlantic Commercial Fishermen	279	1333	21%
New England Recreational Anglers	190	1333	14%
Mid-Atlantic Recreational Anglers	232	1333	17%

Survey responses: Agreement Levels and Accuracy Levels

Agreement Levels and Accuracy Levels for responses to the survey questions about definitions, practices, and outcomes for EBFM are described below (Figures 2a-2f).

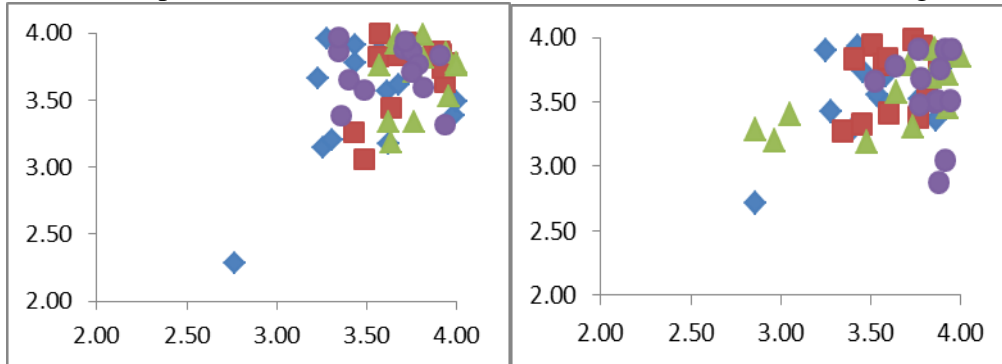


Figure 2a. MA: EBFM Definition

Figure 2b. NE: EBFM Definition

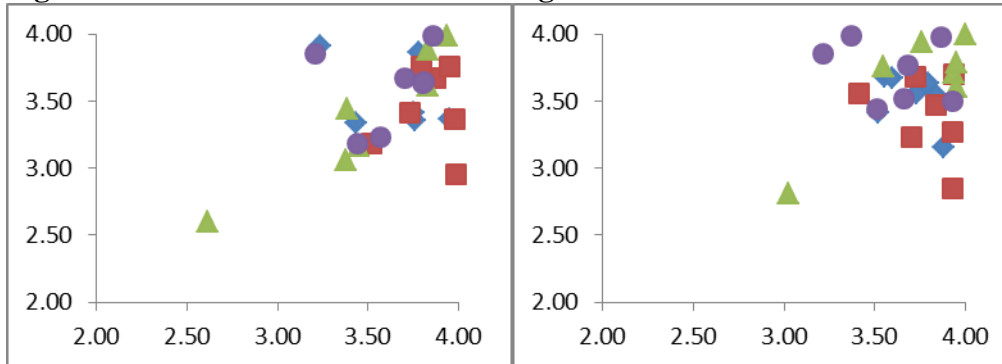


Figure 2c. MA: Mgmt. Practices

Figure 2d. NE: Mgmt. Practices

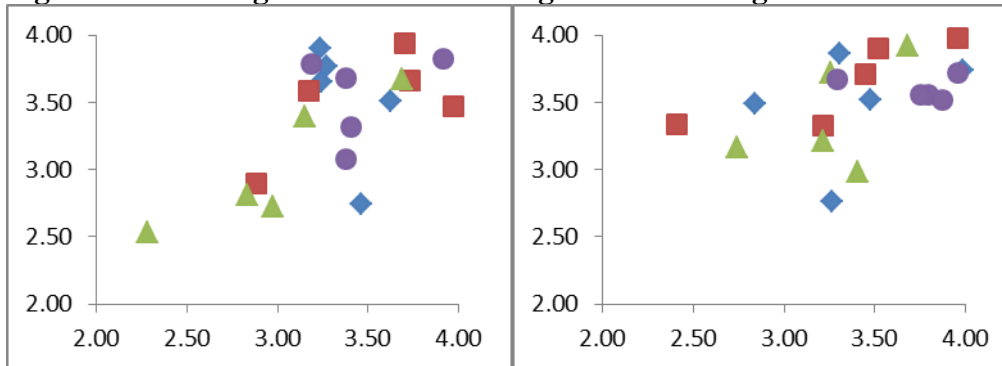
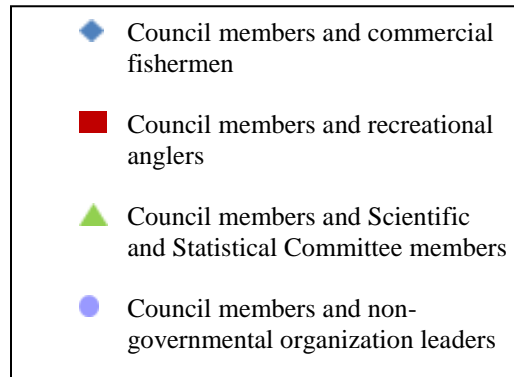


Figure 2e. MA: Mgmt. Outcomes

Figure 2f. NE: Mgmt. Outcomes

Figures 2a-2f. The x-axes are AGREEMENT LEVEL (0 = Lowest Agreement Level; 4 = Highest Agreement Level). The y-axes are ACCURACY LEVEL (0 = Lowest Accuracy Level; 4 = Highest Accuracy Level). Figures 2a and 2b show Mid-Atlantic (MA) and New England (NE) survey responses regarding the definition of ecosystem-based fisheries management, respectively. Figures 2c and 2d show MA and NE survey responses regarding fisheries management practices, respectively. Figures 2e and 2f show MA and NE survey responses regarding fisheries management outcomes, respectively.



Defining EBFM: Agreement, Accuracy, and Congruency

Agreement:

Agreement Levels were relatively high between both MA (Figure 2a) and NE (Figure 2b) Council member and stakeholder responses for the question: *Please indicate to what extent YOU agree or disagree that the definition of “ecosystem-based fisheries management” should include the following concepts?*

The high *Agreement Levels* (Figures 2a and 2b) demonstrate that Council members and stakeholders in both the MA and NE regions generally responded identically to each other or similarly to the question about what concepts to include in the definition of EBFM. MA and NE Council members and stakeholders responded either *Strongly agree*, *Agree*, or *Neutral* to whether the definition of EBFM should include the concepts listed in the survey. These results suggest that Council members and stakeholders often have the same perspectives about factors that should be included in the definition of EBFM.

Accuracy:

Accuracy Levels were relatively high for both MA (Figure 2a) and NE (Figure 2b) Council member responses for the question: *Please indicate to what extent YOU think fishers, environmental nongovernmental organization leaders, and Scientific and Statistical Committee members in the Mid-Atlantic/New England Region would agree or disagree that the definition of “ecosystem-based fisheries management” should include the following concepts.*

The high *Accuracy Levels* (Figures 2a and 2b) demonstrates that Council members often correctly predicted the preferences of stakeholders regarding the definition of EBFM.

Congruency:

Congruency Levels were relatively high between both MA and NE Council member responses and Council member predictions for the question about concepts to include in a definition of EBFM. Council member responses and Council member predictions of stakeholder responses were either the same or similar, suggesting that Council members in both the MA and NE regions predicted stakeholders would hold similar views to them regarding what concepts to include in the definition of EBFM (Biedron, 2014).

Management practices: Agreement, Accuracy, and Congruency

Agreement:

Agreement Levels were relatively high between both MA (Figure 2c) and NE (Figure 2d) Council member and stakeholder responses for the question: *How important do YOU think it is that the following practices should be implemented as part of fisheries management in the Mid-Atlantic/New England Fishery Management Council (MAFMC/NEFMC) over the next 10 years?*

The most common difference for this question was between *Very important* and *Moderately important*. Council members and stakeholders in both the MA and NE regions generally responded the same or similarly to each other for the question about what EBFM practices should be implemented as part of fisheries management in the MAFMC/NEFMC over the next 10 years. With 2 exceptions, MA and NE council members and stakeholders responded that it was *Very important* or *Moderately important* that all of the EBFM practices listed be implemented as part of fisheries management in the MAFMC/NEFMC over the next 10 years. This indicates that overall, MA and NE Council members and stakeholders both generally support EBFM practices listed in the survey being implemented as part of fisheries management in the MAFMC/NEFMC over the next 10 years. These results suggest that Council members and stakeholders often have the same perspectives about practices that should be implemented in fisheries management in the NE/MA regions over the next 10 years.

Accuracy:

The *Accuracy Levels* were relatively high for both MA (Figure 2c) and NE (Figure 2d) Council member responses to the question: *How important do YOU think fishers, environmental nongovernmental organization leaders, and Scientific and Statistical Committee members in the Mid-Atlantic/New England Region think it is that the following practices should be implemented as part of fisheries management in the Mid-Atlantic/New England Fishery Management Council (MAFMC/NEFMC) over the next 10 years?* These results suggest that Council members in both the MA and NE regions often usually correctly predicted or closely predicted stakeholder responses about what practices should be implemented as part of fisheries management in the NEFMC/MAFMC over the next 10 years.

Congruency:

The *Congruency Levels* were relatively high between both MA and NE Council member responses and Council member predictions for the question about practices to implement as part of fisheries management. Council member responses and Council member predictions of stakeholder responses were either the same or similar, suggesting that Council members in both the MA and NE regions predicted stakeholders would hold similar views to themselves regarding what practices should be implemented as part of EBFM (Biedron, 2014).

Management outcomes: Agreement, Accuracy, and Congruency

Agreement:

Agreement Levels were fairly high between both MA (Figure 2e) and NE (Figure 2f) Council member and stakeholder responses for the question: *How strongly would YOU support each one of the following options as a desired outcome for fisheries management in the MAFMC/NEFMC over the next 10 years?*

Council members and stakeholders in both the MA and NE regions responded with a wider range of answer levels than for the previous two survey questions. Council

members and stakeholders expressed varying levels of support for the different options for fisheries management outcomes in the MAFMC/NEFMC over the next 10 years. Overall, the most supported option was: *Incremental change from SSFM to EBFM*. Though this option was followed closely in support by: *An intermediate change from SSFM to EBFM* and *A complete, gradual (5-10 years) transition from SSFM to EBFM* (MA SSC members *Moderately opposed* this option but all NE stakeholders *Moderately supported* this option). The two most unfavorable preferences were those on either end of the time spectrum. These results suggest that Council members and stakeholders do want to begin transitioning to EBFM, either partially or fully, but that they want the evolution to be slow.

Accuracy:

Accuracy Levels were relatively high for both the MA (Figure 2e) and NE (Figure 2f) Council member responses for the question: How strongly do YOU think fishers, environmental nongovernmental organization leaders, and Scientific and Statistical Committee members in the Mid-Atlantic/New England Region would support each one of the following options as a desired outcome for fisheries management in the Mid-Atlantic/New England Fishery Management Council (MAFMC/NEFMC) over the next 10 years? These results suggest that Council members are usually aware of the preferences of stakeholders regarding EBFM outcomes.

Congruency:

Congruency Levels were relatively high between both MA and NE Council member responses and Council member predictions for the question about outcomes for fisheries management. Council member responses and Council member predictions of stakeholder responses were either the same or similar, suggesting that Council members in both the MA and NE regions predicted stakeholders would hold similar views to them regarding desired outcomes of EBFM (Biedron, 2014).

Agreement Levels and Accuracy Levels for responses to the survey questions about potential barriers to and social science needs for EBFM are described below (Figures 3a-d).

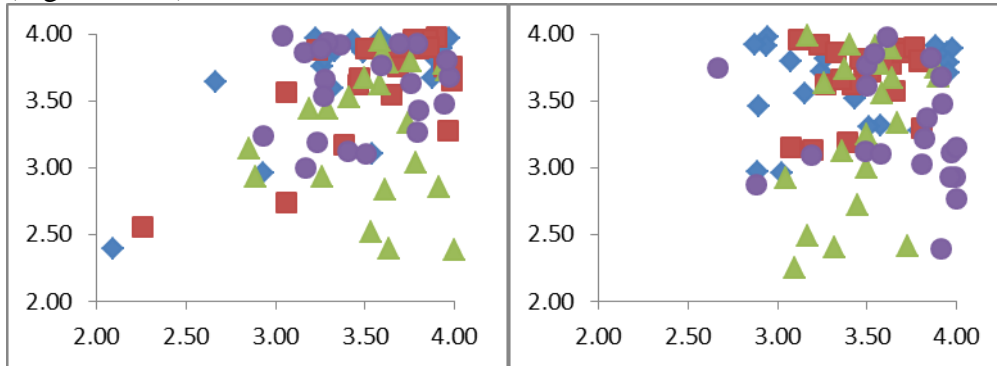


Figure 3a. MA: Potential Barriers

Figure 3b. NE: Potential Barriers

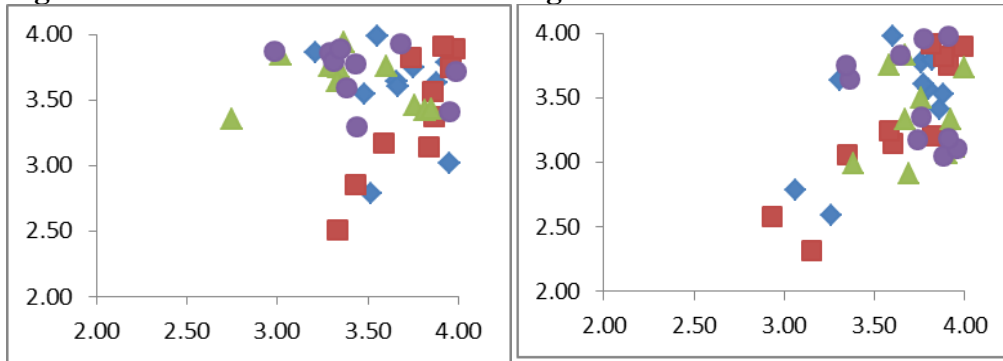


Figure 3c. MA: Social Science Needs

Figure 3d. NE: Social Science Needs

Figures 3a-d. The x-axes are AGREEMENT LEVEL (0 = Lowest Agreement Level; 4 = Highest Agreement Level). The y-axes are ACCURACY LEVEL (0 = Lowest Accuracy Level; 4 = Highest Accuracy Level). Figures 3a and 3b show Mid-Atlantic (MA) and New England (NE) survey responses regarding potential barriers to ecosystem-based fisheries management, respectively. Figures 3c and 3d show MA and NE survey responses regarding social science needs for ecosystem-based fisheries management, respectively.



Barriers to EBFM: Agreement, Accuracy, and Congruency

Agreement:

Agreement Levels were relatively high between both MA (Figure 3a) and NE (Figure 3b) Council member and stakeholder responses for the question: *How significant do YOU think each of the following is as a potential barrier to the Mid-Atlantic Fishery Management Council (MAFMC) or New England Fishery Management Council (NEFMC) in implementing ecosystem-based fisheries management (EBFM)?* These results suggest that Council members and stakeholders perceive that there are many significant, moderate, and/or minor

potential barriers to the implementation of EBFM, but no potential barriers that are not a barrier and no insurmountable barriers.

Accuracy:

Accuracy Levels were relatively high for both MA (Figure 3a) and NE (Figure 3b) Council member responses for the question: *How significant do YOU think fishers, environmental nongovernmental organization leaders, and Scientific and Statistical Committee members in the Mid-Atlantic or New England Region think each of the following is as a potential barrier to the Mid-Atlantic Fishery Management Council (MAFMC) or New England Fishery Management Council (NEFMC) in implementing ecosystem-based fisheries management (EBFM)?* These results suggest that Council members often perfectly or closely predict the preferences of stakeholders regarding potential barriers to the implementation of EBFM. The exceptions illustrate that Council members underestimated how significant SSC members think administrative requirements, loss of profits, complexity of management, and lower quotas are as barriers to EBFM.

Congruency:

Congruency Levels were relatively high between both MA and NE Council member responses and Council member predictions for the question about potential barriers to EBFM. Most Council member responses and Council member predictions of stakeholder responses were either the same or similar, suggesting that Council members in both the MA and NE regions predicted stakeholders would hold similar views to them regarding potential barriers for EBFM (Biedron, 2014).

Social science needs: Agreement, Accuracy, and Congruency

Agreement:

Agreement Levels were relatively high between both MA (Figure 3c) and NE (Figure 3d) Council member and stakeholder responses for the question: *How important do YOU think the following types of social science information are to support informed decisions for federally-managed fisheries in the Mid-Atlantic or New England region?* Council members and stakeholders in both the MA and NE regions generally responded identically or similarly to the question about social science needs for fisheries management.

Accuracy:

Accuracy Levels were relatively high for both MA (Figure 3c) and NE (Figure 3d) Council member responses for the question: *How important do YOU think fishers, environmental nongovernmental organization leaders, and Scientific and Statistical Committee members in the Mid-Atlantic or New England region think the following types of social science information are to support informed decisions for federally-managed fisheries in the Mid-Atlantic or New England?* Council members generally predicted stakeholder responses to the question with an *Accuracy Level* of 3.0 or higher, suggesting that Council members in both the MA and NE regions correctly predicted or closely predicted stakeholder responses about social science

needs for fisheries management. These results suggest that both NE and MA Council members underestimated the importance that fishermen place on the role of the *Magnuson-Stevens Fishery Conservation and Management Act* regarding the implementation of EBFM.

Congruency:

Congruency Levels were relatively high between both MA and NE Council member responses and Council member predictions for the question about social science needs for fisheries management with almost all comparison pairs having a *Congruency Level* of 3.0 or higher (0 = no *Congruency* and 4 = perfect *Congruency*). All Council member responses and Council member predictions of stakeholder responses were either the same or similar suggesting that Council members in both the MA and NE regions predicted stakeholders would hold similar views to themselves regarding social science needs for fisheries management (Biedron, 2014).

Survey responses: Tables

Defining EBFM

The top survey results collected in response to the question *How do you define EBFM?* are summarized in Table 2. The order of responses is not significant.

Table 2. New England and Mid-Atlantic stakeholders and Council members *Strongly agreed* or *Agreed* that the definition of Ecosystem-Based Fisheries Management (EBFM) should include the concepts listed.

Considering the interactions between the physical, biological, and human factors that affect the health of fisheries
Protecting and/or enhancing habitat
Monitoring and enforcing EBFM
Assessing the social, economic, and cultural impacts on industries and communities that depend on fisheries
Adapting to changing biological and social conditions
Incorporating geographically-specific management needs
Including flexibility into management strategies
Considering many ecological factors
Engaging stakeholders
Accounting for uncertainty in ecosystems
Addressing human needs, including those of fishermen and fishing communities

Council members and stakeholders in the NE and MA regions generally agreed regarding concepts that should be included in the definition of EBFM. These findings demonstrate that Council members and stakeholders define EBFM as a holistic approach to management. These perspectives parallel the definitions experts use to describe EBFM (Essington & Punt, 2011; Francis, Hixon, Clarke, Murawski, & Ralston, 2007; Levin, Fogarty, Murawski, & Fluharty, 2009).

Management practices

The top survey results collected in response to the question *What practices do you think should be included in EBFM?* are summarized in Table 3. The order of responses is not significant.

Table 3. New England and Mid-Atlantic stakeholders and Council members responded that it was *Extremely important*, *Very important* or *Moderately important* that the following practices be implemented as part of fisheries management by the Mid-Atlantic (MAFMC) and/or New England Fishery Management Council (NEFMC) over the next 10 years.

Continuing inclusion of stakeholders on the MAFMC/NEFMC Advisory Panel for ecosystem-based fisheries management (EBFM)
Establishing a specific operational plan for incorporating ecosystem considerations into MAFMC/NEFMC decision making
Identifying and prioritizing the key biological, physical, social, and economic factors that should drive decisions
Rewriting the MAFMC/NEFMC management requirements, under the Magnuson-Stevens Fishery Conservation and Management Act, to explicitly incorporate EBFM principles
Incorporating the EBFM approach into MAFMC/NEFMC priorities
Integrating social, economic, and community impact analyses into the MAFMC/NEFMC decision making processes

These results suggest that Council members and stakeholders often have the same perspectives about practices that should be implemented in fisheries management in the NE and MA regions over the next 10 years. These findings demonstrate that Council members and stakeholders support practices that are thought to be central to EBFM (Essington & Punt, 2011; Francis et al., 2007; Levin et al., 2009).

Management outcomes

The top survey results collected in response to the question *What are your preferred outcomes (time lines) for EBFM?* are summarized in Table 4. The order of responses is not significant.

Table 4. All New England and Mid-Atlantic stakeholders and Council members *Moderately supported* or were *Neutral* to each one of the following options as a desired outcome for fisheries management in the New England and/or Mid-Atlantic Fishery Management Council over the next 10 years.

Incremental change from single species fisheries management (SSFm) to ecosystem-based fisheries management (EBFM)
An intermediate change from SSFM to EBFM

The study suggests that most Council members and stakeholders in the MA and NE regions want a change from SSFM to EBFM at an incremental, intermediate, or complete, gradual (5-10 years) pace. These results suggest that Council members and stakeholders do want to begin transitioning to EBFM, either partially or fully, but that they want the evolution to be slow. Council members and stakeholders in both regions showed the least support for management options for no change from current SSFM and for complete immediate change (0-4 years) to EBFM, the extreme ends of the management spectrum. Overall, Council members and stakeholders overwhelmingly supported some level of transition from SSFM to EBFM, which may take acceptance of some uncertainty and patience as the transition to EBFM takes on momentum and is adapted to fulfill management needs.

Barriers to EBFM

The top survey results collected in response to the question *What are the potential barriers to EBFM?* are summarized in Table 5. The order of responses is not significant.

Table 5. New England and Mid-Atlantic stakeholders and Council members responded that each of the following was a *Moderate* or *Significant* barrier to implementing EBFM.

Insufficient scientific data to support the transition to EBFM
There are so many variables that must be considered
Council structure is currently organized to deal with individual fishery management plans
Lack of science to support EBFM plans
Lack of definitive, achievable action plan for EBFM
Lack of funding
Lack of reliable fish population models based on ecosystem-based principles
Lack of political support
Concern about lower fishing quotas

Concern that if EBFM is implemented, then the profits for fishermen and the fisheries industry will be less than they are now under current management
Concern that if EBFM is implemented, then the level of uncertainty in fish population assessments will be greater than it is now under current management
Concern that if EBFM is implemented, then fishing quotas for individual managed species will be less than they are now under current management

Overall in survey responses, the Council members and stakeholders responded that there were moderate and significant barriers to implementing EBFM. Notably, no barriers were listed as insurmountable.

Additionally, from our interviews with Council members, Council staff members, and SSC members in the NE and MA regions, we identified 29 barriers to EBFM. The top 10 barriers, ranked by overall number of interviewees who mentioned them, are listed in Table 6.

Table 6. The top 10 potential barriers to ecosystem-based fisheries management (EBFM) in rank by the number of interviewees who mentioned them at least once.

Rank	Barriers
1	Lack of science, data, and modelling capability
2	EBFM is constrained by the Magnuson-Stevens Fishery Conservation and Management Act; EBFM is not legally mandated
3	Need socioeconomic information
4	Lack of funding for EBFM
5	Governance
6	Lack of goals and an implementation plan for EBFM
7	Lack of stakeholder engagement
8	Reluctance to change
9	Lack of universally accepted definition of EBFM
10	Lack of stakeholder buy-in

Lack of science, data, and modelling capability was identified as a barrier by the highest number of interviewees. The perceived barrier *Lack of science, data, and modelling capability* suggests that there is a lack of scientific information about EBFM being conveyed to Council members, staff members, and SSC members, which may indicate that more scientists with expertise in EBFM should be included in Council decision-making processes (i.e. as voting Council members or SSC members). Additionally, perhaps increased communication between scientists from the Northeast Fisheries Science Center (NEFSC) and the SSCs and Council

members is needed. The SSC Chairman attends and reports at all MAFMC meetings. This practice is credited with improving communication and understanding of science related to Council business and relations between the MAFMC and SSC. If the NEFMC chose to adopt this practice, understanding and communication of science may improve between NEFMC members and the SSC. Finally, some members of the SSC have ideas for research that could be useful to the Councils, but some frustration was expressed by SSC members that although the Councils may be open to this research if it were proposed, the Council members are not aware of the need and therefore do not request that the studies to be completed by the SSC. This communication oversight may suggest that the Councils create a process by which they solicit ideas about potential research from the SSC for consideration by the Council.

The MSFCMA was an influential factor regarding implementation of EBFM. The study suggests that the MSFCMA and the *National Standards* included in the MSFCMA (Commerce, 2007) play a large role in which groups' interests are addressed in final management decisions. The results suggest that both NE and MA Council members underestimated the importance that fishermen place on the role of the MSFCMA regarding the implementation of EBFM. The MSFCMA was due for reauthorization in 2013 but reauthorization has not yet been completed. Under the current version of the MSFCMA many interviewees perceived that the Councils are under threat of litigation if they practice EBFM; however, if the reauthorization contains language that more specifically mandates EBFM, these interviewees believed that Councils will experience more legal pressure and less legal uncertainty toward transitioning to EBFM.

The barrier *Need for socioeconomic information* was mentioned by many interviewees in each of the interviewee groups (Table 6). A large percentage of interviewees had the impression that the socioeconomic information required to make holistic management decisions and mandated under *National Standard #4, Conservation and management measures shall not discriminate between residents of different States...* and *National Standard #8, Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities by utilizing economic and social data that meet the requirements of paragraph (2), in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities,* was not available. Some interviewees would prefer more certainty about the effects of EBFM on regulations, economics, and jobs. Many interviewees would prefer more surveys and more inclusion of stakeholder input before Council decisions are made.

With respect to Council members' ability to predict stakeholders' perceptions about potential barriers to EBFM, both NE and MA Council members repeatedly underestimated SSC member perception of the difficulty of overcoming some

barriers, including increases in administrative requirements, decreases in profits, increases in fishing regulation complexity, and lower catch quotas.

The barrier *Lack of universally accepted definition of EBFM* was mentioned by the majority of MA Staff members. One concern of interviewees is that people may have differing opinions about how EBFM is defined. The reason this could be a problem is that while many stakeholders support EBFM in theory, once the specifics of an EBFM plan are outlined, there may be more disagreement about the implementation of EBFM.

The barrier *Lack of stakeholder buy-in* was mentioned by the majority of MA SSC members. There was concern from some interviewees that if stakeholders did not perceive a benefit to EBFM then there would not be an incentive to support it. For stakeholders to learn about how EBFM would affect the specifics of fisheries regulation, the NEFMC, the MAFMC and the NEFSC would need to do more educational outreach about EBFM.

These results suggest that Council members and stakeholders perceive that there are many significant, moderate, and/or minor potential barriers to the implementation of EBFM, but no potential barriers that are insurmountable. These results may demonstrate that work is needed to reduce the barriers to EBFM but also that the practice of EBFM is possible, with no permanent obstacles blocking its implementation.

Social science needs

The top survey results collected in response to the question *What are the social science needs for EBFM?* are summarized in Table 7. The order of responses is not significant.

Table 7. New England and Mid-Atlantic stakeholders and Council members thought that each of the following was a *Very important* or *Moderately important* social science need to support fisheries management decisions.

Economic impact of fisheries management on the commercial and recreational fishing industries, including revenue and job availability
Social, economic, and cultural impact of fisheries management on coastal communities
Consumer support and market demand for sustainable seafood
Improved understanding of how the Magnuson-Stevens Fishery Conservation and Management Act supports ecosystem-based fisheries management (EBFM) practices
Predicted regulation and quota changes to commercial fisheries under EBFM
Anticipated future political support for EBFM
Anticipated future state and federal funding to support EBFM

Willingness of commercial fishermen to modify fishing practices
Willingness of recreational fishermen to modify fishing practices

These results suggest that there are needs for social science information in fisheries management, but that stakeholders do not feel the needs for social science information listed in the survey were necessary enough to be designated as *Extremely important*.

It seems that there is not clear access or representation for social science needs related to human dimensions. A handful of SSC members are experts in human dimensions and/or social science and can provide their input via SSC recommendations. Some human dimensions input comes from social scientists or economists on Council-affiliated committees, plan development teams, and advisory panels or from experts asked to present data at meetings. Council staff members often include information about human dimensions in reports and materials given to Council members but this information may be lost in the large amount of information given to Council members to review. Based on interviews, it seemed that there are no or very few Council members with expertise in human dimensions. There is a Social Sciences Branch at the NEFSC, but it seems that direct communication with the Social Sciences Branch is lacking. Power to influence Council decisions about human dimensions may increase if reports or studies with specific statistics about numbers of jobs or income that were or would be lost due to a change in a specific fishery management plan were available, but such studies seem scarce and some social scientists interviewed suggested that the data required for these studies is unavailable. Additionally, Council members and staff have the power to increase consideration of human dimensions in EBFM by prioritizing inclusion of human dimensions in Council discussions.

Recommendations for NEMFC/MAFMC transition to EBFM

We solicited recommendations regarding the implementation of EBFM from Council participants. Interviewees, NEFMC and MAFMC members, staff members, and SSC members, suggested 14 recommendations for approaching implementation challenges to EBFM. The top 10 recommendations, ranked by overall number of interviewees who mentioned them, are listed in Table 8.

Table 8. The top 10 recommendations for transitioning to ecosystem-based fisheries management (EBFM) in rank by number of interviewees who mentioned them at least once.

Rank	Recommendations
1	Define EBFM, identify objectives, and determine specific plan and time line for implementation
2	Transition to EBFM incrementally
3	Implement EBFM on an experimental or pilot study scale, observe outcomes, and adapt management as necessary
4	Develop buy-in with all stakeholders about EBFM
5	Practice EBFM based on spatial management (ecosystem production units)
6	The fishery management councils and leaders should look to the SSC and the science center for science and models that would support EBFM
7	Consider removals based on a biomass cap
8	Increase understanding of ecosystems to prepare for long-term ecosystem changes
9	Practice EBFM as supported by some Magnuson-Stevens Fishery Conservation and Management Act National Standards
10	Evaluate tradeoffs of EBFM plans

The recommendation *Define EBFM, identify objectives, and determine specific plan and time line for implementation* was cited by the highest number of interviewees, which expressed a desire for more specifics regarding EBFM. There was general concern that EBFM is too vague and could be interpreted in a variety of ways depending on the interests of the user group. Interviewees suggested a variety of objectives or plans for implementation of EBFM, including developing terms of reference for the SSC regarding EBFM and creating Council subcommittees, plan development teams, and advisory panels for EBFM.

The recommendation *Transition to EBFM incrementally* reflected the high level of support for an incremental transition to EBFM by interviewees. This support of an incremental transition to EBFM was also expressed by the commercial and recreational fishermen, non-governmental organization leaders, Council members, and SSC members.

The recommendation *Implement EBFM on an experimental or pilot study scale, observe outcomes, and adapt management as necessary* highlighted a common response heard during the study, which is that in order for the Council to implement EBFM on a regional scale, it would be helpful to first try EBFM on a smaller scale or experimental basis, and then adapt or modify the EBFM plan as needed to correct

for unanticipated problems and to improve the plan based on observations of the pilot EBFM study.

From the survey data, we found that there was relatively high *Agreement, Accuracy, and Congruency* between Council decision makers and stakeholders in both the NE and MA regions for topics related to EBFM. The high *Agreement, Accuracy, and Congruency* means that for both the NE and MA regions: decision makers and stakeholders responded the same or similarly to survey questions about EBFM; decision makers usually correctly predicted or nearly correctly predicted stakeholder responses to survey questions; and decision makers usually responded similarly or the same as the answers they predicted for stakeholders. Lack of understanding between Council members and stakeholders did not appear to be a barrier to MA or NE Council transition from SSFM to EBFM. It appears that, at least for the MA and NE regions, most stakeholders generally agreed about definitions, practices, social science needs, and outcomes for EBFM.

CONCLUSIONS

Meeting Observations and Interviews

During all the meeting observations and interviews, and consistently across managers and stakeholders in both the NE and MA regions, there was general consensus that EBFM is a holistic approach to fisheries management which includes biological, environmental, and human factors and that the Councils should gradually transition to a management plan that reflects EBFM. Once the specifics of EBFM time lines, science, and quotas were discussed, opinions diverged, but overall there was agreement between Council decision makers and stakeholders in the NE and MA regions about what EBFM is and if it should be done.

Interviews

Barriers

The top 3 ranked barriers to EBFM by total number of interviews in which barrier was mentioned at least once were, respectively: *Lack of science, data, and modelling capability; EBFM is constrained by the Magnuson-Stevens Fishery Conservation and Management Act/EBFM is not legally mandated; and Need socioeconomic information* (Table 6).

Recommendations

Overall, the top 3 ranked recommendations for transitioning to EBFM by total number of interviews in which the recommendation was mentioned at least once, were, respectively: *Define EBFM, identify objectives, and determine specific plan and time line for implementation; Transition to EBFM incrementally; and*

Implement EBFM on an experimental or pilot study scale, observe outcomes, and adapt management as necessary (Table 8).

Surveys

Neither low agreement nor low understanding between Council members and stakeholders appeared to be a barrier to NEFMC or MAFMC transition from SSFM to EBFM. Overall, managers and stakeholders in both the NE and MA regions generally agreed that EBFM is a holistic approach to fisheries management which includes biological, environmental, and human factors, and that the Councils should gradually transition to a management plan that reflects EBFM. In general, there was agreement between Council decision makers and stakeholders in the NE and MA regions about what EBFM is and whether it should be done.

Summary

Council members and stakeholders in the NE and MA regions generally agreed regarding concepts that should be included in the definition of EBFM, practices that should be implemented in fishery management plans, potential barriers to the implementation of EBFM science, social science needs, and implementation time lines. These findings suggest that Council members and stakeholders understand what EBFM entails and have a desire to transition to EBFM, and that Council members either understand and agree with their constituents' attitudes toward EBFM or expect that their constituents agree with their own views.

Overall, Council members and stakeholders overwhelmingly supported some level of transition from SSFM to EBFM. These findings demonstrate that Council members and stakeholders define EBFM as a holistic approach to management, support practices that are believed to be central to EBFM, and desire a gradual transition to EBFM.

Regarding potential barriers to EBFM, Council members and stakeholders labeled potential barriers mostly as moderate or significant, labeling many fewer as minor, and none as insurmountable. These findings suggest that although Council members and stakeholders perceive that barriers to EBFM are serious, these barriers could be surpassed.

With respect to Council members' ability to predict stakeholders' perceptions about potential barriers, both NE and MA Council members repeatedly underestimated SSC member perception of the difficulty of overcoming some barriers, including increases in administrative requirements, decreases in profits, increases in fishing regulation complexity, and lower fish quotas.

However, neither lack of agreement between Council members and stakeholders nor lack of Council member understanding of stakeholder perceptions appeared to be an obstacle for Council transition to EBFM. These findings suggest that

although Council members and stakeholders perceive major challenges to EBFM, Council members and stakeholders do not perceive that any of these challenges are permanent. These results may demonstrate that work is needed to reduce the barriers to EBFM and to increase social science information for fisheries management but also that the practice of EBFM is possible, with no insurmountable obstacles preventing its implementation.

MANAGEMENT IMPLICATIONS

The application of the *Coorientation Model* theory provided insights into how an improved understanding of the attitudes, beliefs, and communication of Council members, SSC members, and stakeholder groups could potentially help overcome barriers and facilitate the implementation of EBFM. The information reported by the study highlights EBFM topic areas that are important to Council decision makers and stakeholder groups and in which communication, discussion, and combined action between Council decision makers and stakeholder groups could increase the effectiveness and efficiency of implementing EBFM in the NE and MA regions. This document provides feedback from a representative selection of NEFMC and MAFMC stakeholders about the transition to EBFM, including how to define EBFM, how to practice EBFM, preferred time lines for transition to EBFM, potential barriers to EBFM, social science needs for EBFM, and recommendations for implementing EBFM. This feedback could be incorporated into NEFMC and MAFMC decisions about Council EBFM implementation plans. The study highlights specific barriers, social science needs, and recommendations for EBFM which concern stakeholders that managers could focus on to facilitate the implementation of EBFM.

A recurring theme throughout the study was that a source of conflict for EBFM is that sometimes, in the short term, what is in the best interest of humans, fishing communities, and industry is not always in the best interest of fish populations. The well-being of both humans and fish stocks is supported by the *National Standards*, which makes prioritizing one entity's interests over the other's complicated. *National Standard #1, Prevent overfishing while achieving optimum yield* (Commerce, 2007) illustrates this tension. However, in the long term, the interests of both humans and fish stocks will likely be optimized by management based on the best available science and a precautionary approach, practices inherent to EBFM.

FUTURE RESEARCH

One recommendation for future research builds on a recommendation suggested by interviewees (Table 8). This recommendation, "Evaluate tradeoffs of EBFM plans," recognizes that EBFM outcomes are uncertain and may or may not lead to improved outcomes in fisheries management. This recommendation suggests that managers should attempt to compare the consequences of SSFM, EBFM, and/or a plan that includes both approaches, such as an Ecosystem-Approach to Fisheries

Management plan, which incorporates ecosystem principles into existing plans under SSFM (MAFMC, 2014b), before deciding to implement any of them.

Future analysis of data from this study could focus on “intra-Council” understanding, including characterizing *Agreement*, *Accuracy*, and *Congruency* between Council members, Council staff members, and Council SSC members. Subsequent *Coorientation* analysis could evaluate understanding between Council members and Priority Recreational Anglers (Council-affiliated recreational anglers) compared to understanding between Council members and non-Council affiliated recreational anglers. Evaluation of understanding between Priority Recreational Anglers and non-Council affiliated recreational anglers could also provide insight into improving Council communication processes between Council members and stakeholders.

Additional future research, also based on survey data from this study, could compare the responses of those recreational and commercial stakeholders who identified themselves as “familiar with EBFM” to those who identified themselves as “not familiar with EBFM.” Similarly, responses of those recreational and commercial stakeholders who identified themselves as “familiar with the MAFMC/NEFMC” and of those who identified themselves as “not familiar with the MAFMC/NEFMC” could be compared. These comparisons could explore whether or not familiarity with EBFM and the MAFMC and/or NEFMC influences perceptions of EBFM.

Other research which could be explored more thoroughly based on survey data collected during this study includes the effectiveness of communication about EBFM from the MAFMC and NEFMC to the public, the effectiveness of communication about EBFM from the public to the MAFMC and NEFMC, and suggestions for effective approaches to fostering communication between the MAFMC and NEFMC and the public.

Based on many recommendations from decision makers and stakeholders during meeting observations, interviews, and survey responses, the development and implementation of a pilot plan for EBFM, which includes a time line for specific actions, reference points, monitoring outcomes, evaluation, and adaptation as necessary, could inform and facilitate the transition of the NEFMC and the MAFMC from SSFM to EBFM on a regional scale.

Note: Perspectives of government officials are personal views and do not necessarily represent the views of the United States’ government.

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APPENDIX A

Websites and documents included in the information review.

Website or Document	Year	MAFMC	NEFMC	Document	Website
Ecosystem Status Report	2009	*	*	*	
White Paper On Ecosystem-Based Fishery Management For New England Fishery Management Council	2010		*	*	
Ecosystem-based Fishery Management for the Northeast Continental Shelf	2010	*	*	*	
http://www.mafmc.org/workshop/ssc-national-workshop-4	2011	*			*
Visioning and Strategic Planning: Stakeholder Input Report	2012	*			*
Report of a National SSC Workshop on Scientific Advice on Ecosystem and Social Science Considerations in U.S. Federal Fishery Management	2012	*		*	
http://www.mafmc.org/workshop/forage-fish-workshop	2013	*			*
http://www.nefmc.org/ecosystems/index.html	2013		*		*
http://www.nefmc.org	2014		*		*

APPENDIX B

A list of the meetings and workshops attended as part of the exploratory phase of the study.

Meetings/Workshops	Dates	Location	MAFMC	NEFMC	NOAA Fisheries
Review of Modeling Approaches in Support of Ecosystem-Based Fishery Management	March 29-31, 2011	Northeast Fisheries Science Center, Woods Hole, MA			*
Fourth National Scientific and Statistical Committee Workshop	October 4-6, 2011	Williamsburg, VA	*		
Full Council meeting	April 12-14, 2011	Annapolis, MD	*		
Full Council meeting	June 14-16, 2011	Port Jefferson, NY	*		
Full Council meeting	August 16-18, 2011	Wilmington, DE	*		
Full Council meeting	October 11-13, 2011	Galloway, NJ	*		
Full Council meeting	December 13-15, 2011	Williamsburg, VA	*		
Full Council meeting	April 26-28, 2011	Mystic, CT		*	
Full Council meeting	June 21-23, 2011	Portland, ME		*	
Full Council meeting	September 26-29, 2011	Danvers, MA		*	
Full Council meeting	November 15-17, 2011	Newport, RI		*	
Full Council meeting	February 14-16, 2012	Virginia Beach, VA	*		
Full Council meeting	April 10-12, 2012	Duck, NC	*		
Full Council meeting	June 11-14, 2012	New York, NY	*		
Full Council meeting	August 13-16, 2012	Philadelphia, PA	*		
Full Council meeting	October 15-18, 2012	Long Branch, NJ	*		
Full Council meeting	December 10-13, 2012	Baltimore, MD	*		
Full Council meeting	January 31-February 2, 2012	Portsmouth, NH		*	
Full Council meeting	April 24-26, 2012	Mystic, CT		*	
EBFM Plan Development Team (PDT) meeting	5/1/2012	Taunton, MA		*	
Full Council meeting	June 19-21, 2012	Portland, ME		*	

Full Council meeting	September 25-27, 2012	Plymouth, MA		*	
Full Council meeting	November 13-15, 2012	Newport, RI		*	
Full Council meeting	February 12-14, 2013	Hampton, VA	*		
Full Council meeting	April 9-11, 2013	Raleigh, NC	*		
Full Council meeting	June 10-13, 2013	Eatontown, NJ	*		
Full Council meeting	August 13-15, 2013	Wilmington, DE	*		
Full Council meeting	October 7-10, 2013	Philadelphia, PA	*		
Full Council meeting	12/12/2013	Annapolis, MD	*		
Full Council meeting	January 29-31, 2013	Portsmouth, NH		*	
Full Council meeting	April 23-25, 2013	Mystic, CT		*	
Full Council meeting	June 18-20, 2013	Portland, ME		*	
Full Council meeting	September 24-26, 2013	Hyannis, MA		*	
Full Council meeting	11/20/2013	Newport, RI		*	
Full Council meeting	December 16-18, 2013	Danvers, MA		*	

APPENDIX C

Key survey and interview questions for MAFMC and NEFMC members, staff, and SSC members.

What concepts should be included in the definition of EBFM?

What practices should be implemented in the NEFMC/MAFMC over the next 10 years?

What should be the desired outcomes for fisheries management in the NEFMC/MAFMC over the next 10 years?

What are potential barriers to Council implementation of EBFM?

What type of social science information is needed to support informed decisions for federally-managed fisheries in the New England/Mid-Atlantic region?

How could communication about EBFM between the Council and the public be improved?

Are there other factors influencing Council adoption of EBFM in addition to those mentioned already? If so, could you please describe some of them?