FEATURE:
FISHERIES MANAGEMENT

FishSmart: An Innovative Role for Science in Stakeholder-Centered Approaches to Fisheries Management

ABSTRACT: Until recently, marine fisheries managers have predominately interacted with a single user group—commercial fisheries. However, changes in participation in fisheries and progress toward ecosystem-based approaches have introduced new stakeholders into the management process. Yet, there are few examples of successful approaches of how to engage the spectrum of stakeholders interested in management policy and decisions. Here we describe one such approach that was used in the fisheries for king mackerel (*Scomberomorus cavalla*) along the U.S. southeast coast. The approach combined consensus building in facilitated workshops and decision analysis in which stakeholders could compare the consequences of alternative management options on trends in the king mackerel population and the fisheries it supports. The process resulted in a workgroup of stakeholders that developed a clear vision for its desired future of king mackerel fisheries and several alternative management options. Decision analysis was used to select the best options that were then recommended to the South Atlantic Fisheries Management Council (SAFMC). These options were more conservative than the council's own recommendations. Additional benefits of the process included stakeholder education, both in stock assessment methodology and in an understanding other stakeholder positions, and the development of closer cooperation among stakeholders and managers.

FishSmart: un papel innovador para la ciencia dentro de los enfoques de manejo de pesquerías centrados en las partes-interesadas

RESUMEN: hasta hace poco tiempo, los administradores de las pesquerías marinas habían interactuado principalmente con grupos individuales de usuarios– de pesquerías comerciales. Sin embargo, los cambios en cuanto a participación en las pesquerías y progreso hacia el enfoque de manejo basado en el ecosistema, han introducido a un mayor número de participantes interesados en el proceso de manejo. Aun así, existen pocos ejemplos de enfoques exitosos acerca de cómo comprometer el espectro de interesados en las decisiones y política de manejo. Aquí se describe uno de estos enfoques, que fue utilizado en la pesquería del peto (Scomberomorus cavalla) a lo largo de la costa sureste de los Estados Unidos de Norteamérica. El enfoque combina el consenso logrado en talleres y análisis de decisión en los que las partes interesadas pudieron comparar las consecuencias de distintas opciones de manejo en las tendencias poblacionales del peto y en las pesquerías que este recurso sostiene. El proceso dio como resultado un grupo de interesados que desarrolló una clara visión de su futuro esperable con respecto a las pesquerías del peto y numerosas opciones alternativas de manejo. El análisis de decisión se utilizó para seleccionar las mejores opciones que después fueron transmitidas al Consejo de Manejo Pesquero del Atlántico Sur (CMPAS). Estas opciones resultaron más conservativas que las recomendaciones del propio consejo. Beneficios adicionales del proceso incluyeron la educación de las partes involucradas, tanto en las metodologías de evaluación de los stocks y en el entendimiento de la postura de otros interesados, como en el desarrollo de una cooperación más estrecha entre involucrados y administradores.

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On 6 December 2008 representatives of a group of stakeholders who had been working to improve the marine fisheries for king mackerel (*Scomberomorus cavalla*) along the U.S. southeast coast presented their recommendations to the South Atlantic Fisheries Management Council (SAFMC). The stakeholder group recommended options which cut the quota by 20% to 8 million lbs., reduced the bag limit from 3 to 2 fish per day, and increased minimum size by 4"to 28"—each option more conservative than those recommended by the council's own Scientific and Statistical Committee

(SSC). Here we explore what led to these precautionary recommendations by the stakeholder group, which included representatives of recreational and commercial anglers, tournament organizers, angling organizations such as the Coastal Conservation Association, tackle shop owners, state biologists, and non-governmental organizations (NGOs) such as The Nature Conservancy and Environmental Defense Fund. We also explore whether this example of stakeholder involvement in developing quantitative recommendations for fisheries management was an anomaly or whether it can apply elsewhere in fisheries management.

The Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (2006) governs fisheries management in U.S. federal waters. The act requires management that "shall prevent overfishing, while achieving, on a continuing basis, the optimum yield from each fishery." Traditionally, the primary stakeholders in U.S. federal fisheries management have been commercial interests, albeit composed potentially of multiple sectors. In this situation developing an agreement on what constitutes the "optimum yield" is possible, if not complicated, because all stakeholders often have similar objectives, i.e., make a profit by capturing and selling fish. However, in recent decades several changes have occurred that have brought more stakeholders into the process who often have very different views of what constitutes "optimum yield." For example, marine recreational fisheries in the United States have expanded substantially. In a recent analysis, Ihde et al. (unpublished data) evaluated U.S. fisheries statistics from 1981–2006 and found that approximately 70% of 55 species examined demonstrated an increase in the proportion of harvest coming from the recreational sector, regardless of whether those species were primarily caught recreationally, commercially, for bait, or as bycatch. For recreational fisheries, neither profit nor the total weight harvested is likely of primary concern (Larkin 1977; Malvestuto and Hudgins 1996; Kirkegaard and Gartside 1998; Ihde et al. in press). Instead, recreational anglers often have a primary goal of the "chance to catch a few fish, and some of them large" (M. Nussman, American Sportfishing Association, pers. comm.). Additional stakeholders such as conservation organizations, recreational divers, and ecotourism operators have all become increasingly engaged in management decisions in the marine environment and each may have a different definition of what constitutes optimum yield (Hilborn 2007).

The diverse array of stakeholder groups that now have a role in management decisions constitutes a new challenge for fisheries managers. Yet, the challenge of involving the multiple criteria in decision making introduced by the presence of multiple stakeholders is not new in the environmental policy arena (Karl et al. 2007; Kiker et al. 2008). This challenge has frequently been met by the use of quantitative decision analysis, in which the outcome of competing policy alternatives are compared (Varis and Kuikka 1999; Harwood 2000). Equally, while environmental policy decisions still require the application of the best available science (Kiker et al. 2008), the full involvement of stakeholders in all phases of decision making has become increasingly common (Gregory and Keeney 1994; Chase et al. 2000; Gregory and Keeney 2002; Karl et al. 2007).

In 2008 we began a project called FishSmart, with the goal of helping recreational anglers explore options for improving the sustainability of marine recreational fisheries. We selected the recreational fisheries for king mackerel (*Scomberomorus cavalla*) along the U.S. southeast coast as a case study (Box 1).

Box 1. King mackerel is a migratory coastal pelagic with a range extending from the northeastern United States to Brazil (Collette and Russo 1984), and is the target of recreational and commercial fisheries. The U.S. king mackerel fishery is managed as two stocks: one centered in the Gulf of Mexico managed by the Gulf of Mexico Fishery Management Council, and a second distributed along the southeastern U.S. Atlantic coast from Florida to North Carolina, which is managed by the South Atlantic Fishery Management Council. For our work we only considered the south Atlantic migratory group. The Atlantic migratory group of king mackerel was considered to be overfished in the late 1980s (SAFMC 1989). As a result, substantial changes in regulations were enacted to reduce fishing mortality rates, such as gear restrictions for commercial fisheries and increased size and reduced bag limits for recreational fisheries. The most recent assessment (Southeast Data, Assessment and Review 2009) concluded that the stock was not overfished, but was fully exploited. During the last decade, the fishery landings have been relatively steady with total landings of approximately 400 metric tons. Harvests are currently managed by quotas, with approximately 70% of total landings allocated to the recreational sector. The recreational fisheries have not achieved their portion of the quota; thus, recreational landings are only approximately 60% of the total landings. In addition to traditional commercial and recreational fisheries, this is an important species for tournaments throughout the southeastern United States. Many of these tournaments are organized by the Southern Kingfish Association (http://www.fishska.com/) and provide substantial prize money for the largest fish brought to the weighing station. However, catches due to tournaments are poorly represented in current data collection programs and stock assessments.


T. F. IHDE.

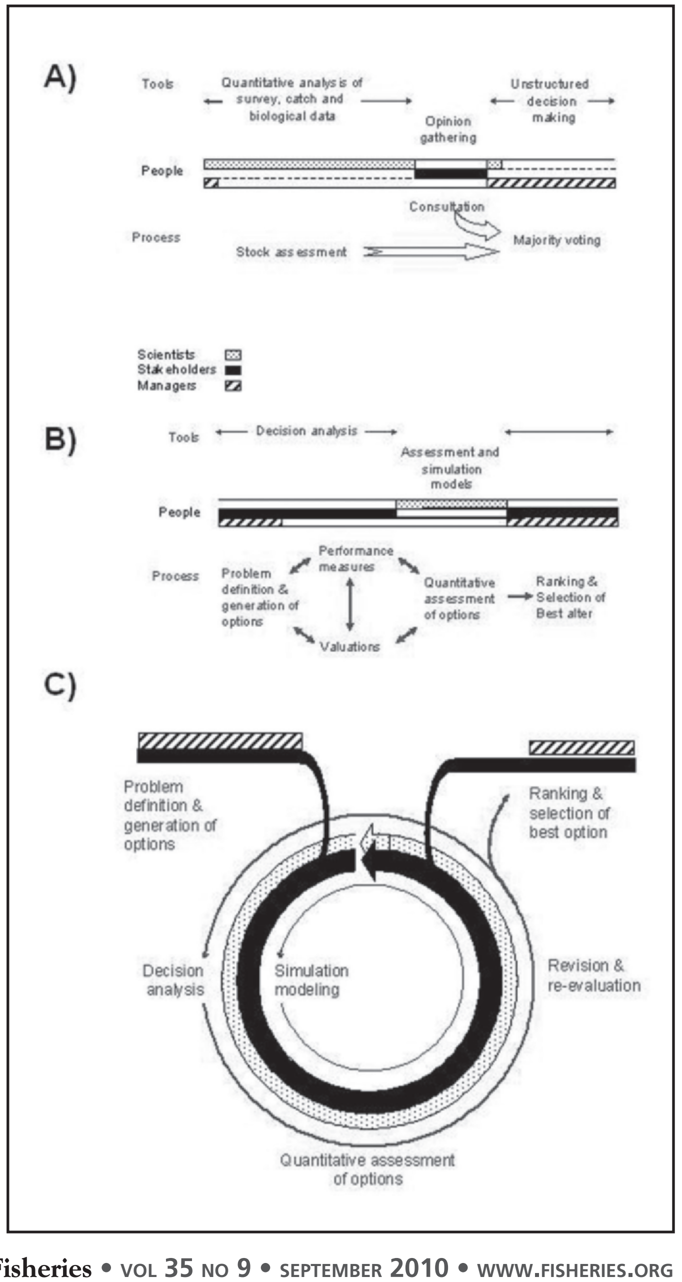
Captain John Adair (a workgroup member) holds a king mackerel caught by Dave Secor (one of the scientific team).

This species and the fisheries it supports had many desirable features for our application. A stock assessment for the species was underway when we began our project, and thus relevant data had been assembled and appropriately summarized (Southeast Data Assessment and Review 2009). Preliminary results of the new assessment concluded that the king mackerel stock in the Atlantic was not overfished, but was experiencing overfishing, which necessitated reconsideration of management policies. A final consideration for our first application was that the different stakeholders had yet to adopt entrenched positions. As a result, we believed we had an opportunity to achieve an informed consensus among stakeholders within the project's one-year time frame. To ensure broad stakeholder support, we involved stakeholders in all phases of the project, from the development through implementation of recommendations, as opposed to the common practice of only allowing comments prior to adoption and during the final implementation phase.

Stakeholder advisory panels are common within both federal and states fisheries management (Figure 1A). However, many stakeholders feel that this involvement is merely perfunctory: that they are invited, informed, and ignored (Karl et al. 2007). Stakeholders can feel as if they are invited in late, and excluded from the development phase of a project, only to choose the most palatable among a suite of unpalatable options devised by managers. Frequently, they blame assessment science and models as being too opaque or rigid for not incorporating their input, which takes diverse forms such as nontraditional knowledge and unstructured data. Stakeholders often feel that their practical knowledge of the biology of the species and of the distribution and nature of the fishing effort are ignored. Ensuring effective stakeholder involvement is not trivial, and there is a wide diversity of approaches to achieving this goal (Hughey et al. 2000; Mikalsen and Jentoft 2008; Reed 2008; Granek et al. 2008). For example, Kiker et al. (2008) described a linear model in which first stakeholders and policy makers interact to define the objectives (Figure 1B). Subsequently, scientists conduct analyses to recommend the changes needed to meet the objectives. The policy makers and stakeholders then reconvene to recommend regulatory changes. We adopted a different approach for the FishSmart project that places the stakeholders at the center of decision making (Figure 1C). In this stakeholder-centered approach, stakeholders are involved in every phase of the process (Wilberg et al. 2008; Ihde et al. in press). They establish the objectives, develop the options that are to be considered for achieving the objectives, consider important sources of uncertainty, and are intimately involved in developing and evaluating the results of the decision analysis that are used to evaluate the performance of the options. We are not unique in using a stakeholder-centered approach. Cox and Kronlund (2008) successfully used a similar approach for fisheries for sablefish (*Anoplopoma fimbria*) on the Canadian west coast.

The FishSmart process is a decision-analytical framework involving three entities—the stakeholders, the science team, and the facilitation team—who develop and use a model that simulates the population of the fish stock of interest to evaluate alternative management policies (Figure 1C). The full participation of each entity is essential to the success of the project. The role of each entity is well defined and sometimes different from that typically asked of them.

Figure 1. Flow charts of three alternative approaches to incorporating stakeholders into fisheries management.
(A) The typical approach currently in use in many councils and states. In this approach the managers identify the problem and request an assessment. The scientists then conduct a formal quantitative assessment which makes recommendations to the managers. The managers seek stakeholder input on options suggested in the assessment or by managers. The final decision is made by majority vote by the managers.
(B) A linear model of stakeholder involvement suggested by Kiker et al. (2008). In this approach managers and stakeholders identify the management problem. Scientists then conduct an assessment. Managers and stakeholders then use decision analysis to select preferred option.
(C) The FishSmart stakeholder-centered approach in which the stakeholders identify the problem, the options, and the performance measures. Scientists serve in a support role in developing a simulation model that the stakeholders use to conduct a decision analysis. The stakeholders make recommendations to the managers based on their ranking of options.

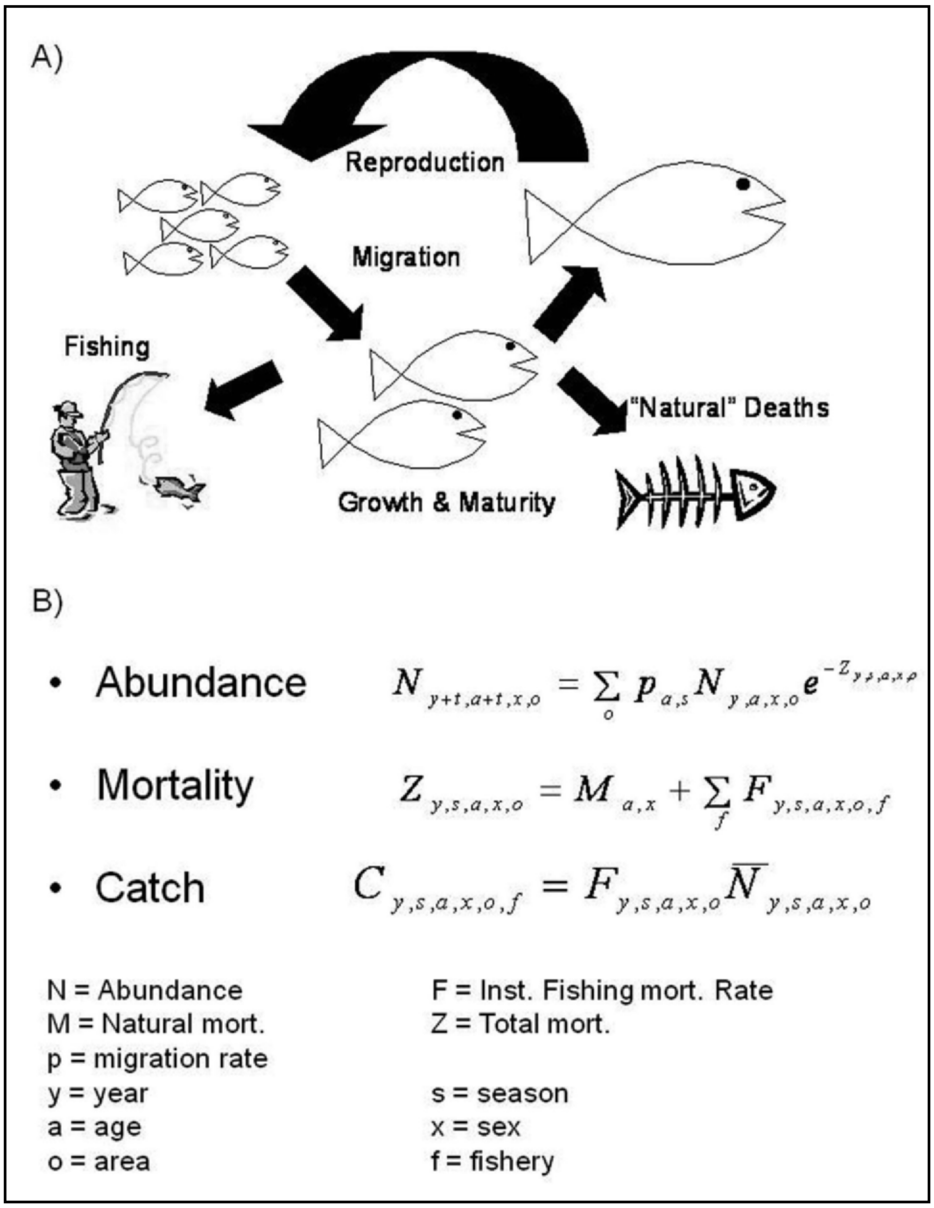


As our description suggests, the stakeholder group is at the center of the process. Members of the group are responsible for developing the objectives for the fishery, suggesting policy options that should be considered to meet those objectives and indices that measure how well the policy options have performed in meeting the objectives. This group also plays a central role in evaluating how to respond to the results from the simulation model. The stakeholders decide when and how to modify their objectives, options, and performance measures based on the simulation results. The demand on individual members of the stakeholder group to be familiar with other stakeholder perspectives and previous stakeholder group decisions and results mandates that stakeholders should be consistently involved throughout the process.

The FishSmart process is designed to empower stakeholders through participation, both ensuring they have the power to influence the process outcomes and decisions and the technical capability to engage effectively in building consensus (Tippet et al. 2000; Richards et al. 2004). Therefore, it is essential that the members of the stakeholder workgroup are selected carefully to represent key constituencies in the fisheries. As part of the process for identifying stakeholders, we evaluated the history, perspectives, and relationships among those with a stake in the king mackerel fishery in the Atlantic. Ensuring the right balance of representation is critical to the success of the project. Equally, inviting the right people to represent the different constituencies in the process is also critical. All should be knowledgeable and influential leaders in their community. But, they should also be open to listening to the views of others, even if those views counter their own opinions. We believe that the time we invested at the beginning of the project in identifying key stakeholders and in process design paid benefits later. The size of the workgroup is also an important consideration. From our experience, workgroups larger than about 20 require a different approach to managing the consensus process and require more time and resources. For fishery management questions that cover a wide geographic area, it can be challenging to provide adequate representation. For our work, we identified candidates for membership based on discussions with management council staff, angler organizations, sports writers, NGOs, and state and federal agencies. The candidates were subsequently interviewed to assess their background and interest in participating. For king mackerel, the final workgroup was composed of 13 members. Stakeholder groups included (number of representatives in parentheses): independent recreational anglers (2), angling organizations (2), charter captains (1), the tournament sector (2), commercial anglers (1), tackle shop owners (1), environmental NGOs (2), and state biologists (1) and managers (1). Workgroup members included the sitting chairperson, the past chairperson, and two other members of the SAFMC Mackerel Advisory Panel, and the managing partner of the Southern Kingfish Association, the largest U.S. tournament circuit for king mackerel. Ihde et al. (in press) provide more details regarding the workgroup.

The second entity in the FishSmart process is the science team. They are responsible for developing the simulation model based on input from the stakeholders, explaining its results, and responding to questions and input from the stakeholders. The initial interactions between the science team and the stakeholders may be very basic, but in our experience a quite sophisticated stakeholder understand-

Figure 2. Schematics used to describe the FishSmart simulation model used in (A) the first meeting and (B) the third meeting to illustrate the evolution of understanding evident in the stakeholder workgroup.

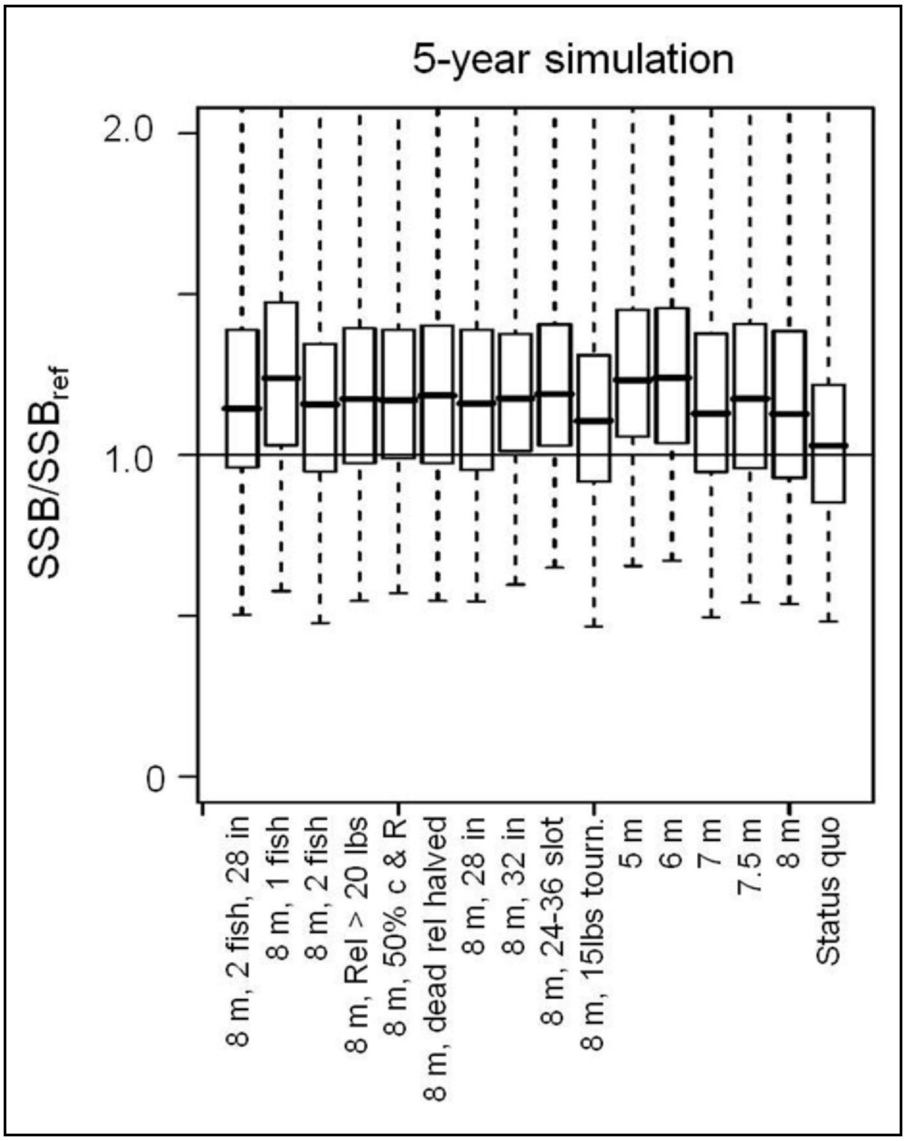


ing of the science behind the numerical decision analysis model is likely to develop. As an example, Figure 2 shows a presentation slide used to explain the model at the beginning and a similar slide used at the end. The iterative nature of the process means that the scientists must also be consistently and actively involved throughout the process. In FishSmart, the scientists do not simply present a completed model with its associated results. Rather, scientists work iteratively with the stakeholders to develop a model structure that is accepted and understood by all. For example, stakeholder views on catch-and-release mortality evolved over time as a result of interactions with the science team. Recreational stakeholders gave initial estimates of a catch-and-release mortality of about 5%. However, following discussions, stakeholders came to realize that they must include not only the obvious initial mortality of released fish, but also the deaths of hooked fish attacked by predators while on the line, and the deaths of fish not brought to the boat. After a fuller consideration, stakeholders increased their estimate to 12.5% mortality of fish released alive and added a 15.5% mortality for the discarded recreational catch.

The role of the scientists in the FishSmart process is perhaps the one that differs most from the traditional one. It is important that the scientists are not viewed, and do not view themselves, as having all the answers. The scientists must be willing to take on the role of teachers early on in the process, providing guidance to the stakeholders as to type of questions that are amenable to the decision analytic approach and those that are not. But, a balance has to be struck in that the scientists should not limit approaches and questions considered. The science team must be willing to listen to stakeholder "local knowledge" and be flexible in how information is presented to the stakeholders. For example, in the king mackerel case study, we tried three or four different approaches to summarizing model results before developing, with the stakeholders, the final graphical summary we adopted (Figure 3). The science team must be able to engage in frank discussions about the uncertainties inherent in the data and the model such that the stakeholders can make informed choices. Scientists may also be asked to provide input on what would be required for the stakeholder's decisions to be credible to the broader management and scientific community in terms of quantitative criteria such as statistical summaries and forecasts.

The final entity involved in the FishSmart process is the facilitation team. The facilitator's process and group dynamic expertise is as essential as that of the scientists in ensuring a successful outcome of the process. The role of the facilitators is multifold. The first critical role for the facilitators is to help the stakeholders develop meeting and process participation rules to which all agree and respect. These rules are structured to ensure a full, open, and respectful discussion of all aspects of the management challenge and serve to build trust as the process moves forward. Determining the standard by which the group's decisions will be made is a central aspect of these early discussions. For FishSmart, the facilitators designed and recommended a consensus-based process, with a minimum threshold of 75% or greater in favor for approval, that was unanimously adopted by the stakeholders.

Figure 3. The final approach used to present simulation results adopted by the FishSmart workgroup. The chart shows a box plot of forecast biomasses in the population relative to the biomass reference point for this species from the stock assessment for each option considered. The options were grouped by category. Initial numbers refer to the size of the quota (x10[6] lbs.), the number of fish refers to the bag limit, and size limits (where given) are in inches. Three recreational catch-and-release options included releasing all fish greater than 20 lbs., improving overall catch and release so that half of the catch is released, and introducing gear or techniques to reduce the dead discard rate by half. The "status quo" condition was always shown on the extreme right. Each box shows the 25th percentile, the median, and the 75 percentile of the distribution of model results. The whiskers show the maximum and minimum values.



A simple majority may allow a single interest group to dominate proceedings. Alternatively, requiring unanimity may permit a single interest group to block progress.

Another critical role for the facilitators is to assure the stakeholders that there would be no final votes until the end of the last meeting. This ensures that stakeholders are not locked into their initial positions and are free to re-evaluate their rankings based on the discussions and new information. Within our process, options and recommendations were evaluated using a four-point ranking scale, with 4's and 3's in favor and 2's and 1's opposed, and could be re-ranked as many times as members wished prior to the final vote. Another role for the facilitation team is run all aspects of the meetings, as neutrals, thereby ensuring all stakeholders are allowed to fully express their views and soliciting the appropriate involvement and interaction of the science team with the stakeholders. To be effective, facilitators should ensure that stakeholders identify and agree on what the key issues are before evaluating the full range of options relevant to each of the key issues. The facilitator's expertise is also important in providing advice on how quickly new material can be presented to the workgroup. However, the facilitators' role is to focus on process, and they should be perceived and function as totally neutral throughout the meetings. A final role of the facilitators is to keep accurate records of the discussions. It is helpful if these notes are projected live on screen during the meeting as this allows people to track discussions and to see that their input is recorded accurately and valued. In our experience, the facilitator's expertise is vital in helping pace the meetings so that objectives are achieved, while ensuring that concerns are fully aired so that stakeholders are ready to make decisions. The facilitation team also serves as a conduit for post-meeting summaries, transcripts, and information for the stakeholders between workgroup meetings. This contact between meetings helps to keep the attention of individual stakeholders on the project.

The FishSmart process involves a series of structured workgroup meetings to come to a final set of recommendations. Wilberg et al. (2008) and Ihde et al. (in press) provide details of the FishSmart meetings conducted to develop the recommendations for the king mackerel fishery that were presented to the SAFMC. Wilberg et al. (2009) provides details of the numerical population simulation model that was used for the decision analysis. Four meetings were held between April–November 2008. The first meeting focused on crafting an objective statement and developing a vision for the future fishery shared among all stakeholders. Another objective of this meeting was to provide guidance to the scientists regarding the likely biological and population dynamic issues that would have to be represented in the model. For example, the workgroup was as interested in the size of fish caught as in the number and thus the model had to be able to predict the size structure in the king mackerel stock. Similarly, workgroup members were less interested in spatial processes at the local level. As a result, the model only had to represent the spatial structure of the stock at a very coarse, regional level. The second meeting introduced a prototype version of the simulation model that included components suggested by the stakeholders. Revised simulation results were presented at the third meeting. The last meeting involved evaluating the final model configuration and results and crafting recommendations.

Progress toward consensus at each meeting was made by ranking resolutions proposed by workgroup members during the meeting as described above. This consensus building approach was central to the FishSmart process. As an example of its use, Box 2 charts the development of specific recommendations on quota, size, and bag limits that were made to the SAFMC. The initial resolution was proposed on 17 October 2008. Members of the stakeholder workgroup were asked by show of hands whether the found the resolution acceptable, whether it was acceptable with minor reservations, whether they had major reservations, or whether it was not acceptable. Votes were then recorded (Box 2). Extended discussion followed and the key themes were captured live on the screen. Based on concerns expressed by the workgroup, the science team was charged with running additional simulations that were reviewed at the next meeting (6–7 November 2008). A second resolution was proposed on November 6th after further discussion regarding the overall level of quota. This resolution met the consensus standard adopted (75% of votes for levels 3 or 4), but reservations remained. A revised resolution led to higher acceptance. Some resolutions received such little support that they were withdrawn after the first vote. Other resolutions, such as the vision for the king mackerel fishery, were viewed as so central to the process that they were reconsidered at each meeting (Box 3).

The FishSmart process is based on the fundamental belief that when stakeholders are truly engaged in the process, they take ownership of the results, which lends credibility to the results and to subsequent implementation (Karl et al. 2007). This was certainly the case for the king mackerel fishery. Workgroup members requested that they present their recommendations to the SAFMC. Council members were open to the recommendations and voted to include them in the options taken to public scoping meetings because they were presented by a broad coalition of stakeholders in the fishery. Indeed, council members were surprised by the specificity of the recommendations and questioned workgroup members why such recommendations had not arisen from the council's own stakeholder process. We would argue that such recommendations were not forthcoming previously because stakeholders were not at the center of the process. Previously, stakeholders were asked to select among options presented to them, but were not vested in developing either the objectives for the fishery, the options themselves, or the method for evaluating the options. In the FishSmart process, stakeholders understood and trusted the way in which the alternative options were evaluated. As a result, the stakeholders felt empowered to select among the alternatives that they themselves had suggested. A fully participatory approach, such as exemplified by FishSmart, is more likely to ensure that stakeholders become passionate advocates for the future of the fishery and willing participants in instituting necessary changes (Granek et al. 2008). FishSmart was a success not because it involved stakeholders, nor because it used decision analysis modeling, or because it was designed as a facilitated consensus-building process, but because it combined all of these features.

There is a widespread desire for increased stakeholder involvement in fisheries management decisions (Hughey et

Box 2. Evolution of a management recommendation. We show each resolution put forward and the votes received. Below each resolution are the abbreviated comments displayed on the screen for the stakeholder workgroup to see.

RESOLUTION 1. Minimum size limit of 28 inches from 24 inches for recreation only.

	4 = acceptable	3 = minor reservations	2 = major reservations	1 = not acceptable
Initial Ranking 17 October 2008	8	1	0	1
Ranking 6 November 2008				

Members Comments (17 October 2008)

- Too early to do this? Need to look at combinations.
- Fought for this to get to 24. Mercury issue is significant for KM. Concern re: safety. Size range has less mercury. But for mercury issue, would support this.
- Don't make this 28 for commercial, but for recreational only.
- Is mercury at 28 inches greater than 24? Evidence shows at 33 inches? Fish grow quickly.
- This would be about 3 years old and sexually mature (sweet 16).
- 32 inches—around 6–8 year old twice the time to gain mercury.
- 28 inch is about 6 lbs. Still in the range—target for commercial take. In this size range mercury not as great a concern.

Member's Comments and Reservations (6 November 2008)

- Have we identified a problem or pressing need for a change in management rules that suggests this is the solution to it?
- Two lines of evidence:
  1. Personal direct experience on the water about whether this is a quality fishery you want or are there things done that could be improve it.
  2. Is there something in the data that suggests whether you are going for face a federal action? Current status quo is at the overfished threshold, in 50 years it will be overfished.
- Proactive fishery management—concern even though this is a great process, we haven't clearly identified a clearly demarked crisis. Hard to put your hands around. We haven't established that in this process.
- From our data—we are going to have a problem down the road with the status quo. What is the best thing we can do this minute that won't overburden recreational or commercial fisheries so they can't live with it.
- Adjust the total catch limit to the 8 million lbs. and the 32-inch size and we will be good to go for sometime to come.
- 28 inches should be a minimum for recreation.
- Can we use the FishSmart data and model to support council decisions? If model valid and conservative in its estimates.
- This is best available science and what the assessment suggested as an approach.
- Specific principles—you could state that you considered these limitations because you don't want a season closure or an area closure for all fisheries. Size limit vs. bag limit, etc.
- What options that were modeled are:
  - Likely to avoid overfished and overfishing thresholds.
  - Result in the least impact to recreational and commercial.
- Make some recommendations about what you don't want, e.g. season closures, etc.
- Best available data says we cannot sustain the 10 million limit.

Resolution failed as no vote called.

RESOLUTION 2. 8M TAC, 32 inch min. size, recreational only

	4 = acceptable	3 = minor reservations	2 = major reservations	1 = not acceptable
Initial Ranking 7 November 2008 First	2	4	1	1
Ranking 7 November 2008 Second				

Member's Comments and Reservations (November 2008)

- Too big of a jump. 24 to 32. Down the road another jump.
- More "noise" in these models—uncertainty re catch-and-release mortality.
- 2nd best—overfishing/overfished mortality.
- Allows most fish to mature or reach maturity.
- 32 inches is still a baby kingfish.
- Public will need to absorb this in a stepwise fashion.
- Over next 5 years—bring in from 28 to 32 over a period of time? Avoid the shock that this may bring by going directly there.
- Precedents in fishery management for going this way.

Resolution passed, and led to:

RESOLUTION 3. 8M TAC, 2 fish bag limit, 28 inch min. size, recreational

	4 = acceptable	3 = minor reservations	2 = major reservations	1 = not acceptable
Initial Ranking 7 November 2008 First	6	1	1	0

Presentation Summary of How the Option Performs Relative to Others

- Performs 2nd best for spawning stock biomass.
- Performs 3rd best in terms of overfishing and overfished-mortality.
- Meets other criteria.

Round of Comments

- Do we need to get a 3rd option to present to the council?
- Presented—for recreational perspective. Commercial will have to respond to the 20% reduction in addition to this. Let them hash that out separately.
- Taking out of NC hide.
- Expected outcome is no season closure.
- What does the model tell us? In terms of 24 and 28 how much more biomass value do we get?

Box 3. Evolution of the objectives for the king mackerel fishery adopted by the workgroup.

C. Create a sustainable management regime that will enable a fair allocation among all user stakeholders and maximum access to the AKM fishery.

	4 = acceptable	3 = minor reservations	2 = major reservations	1 = not acceptable
Initial Ranking 11 April 2008	9	1	0	0

Comments after Ranking of the Goal
- Would like more time to get the words clear and correct.

17 October 2008
GOAL FOR THE ATLANTIC KING MACKEREL FISHERY
A sustainable AKM fishery managed to maintain an optimum yield and genetic diversity of fish to provide acceptable levels of access and allocation for all sectors while conserving biological and ecological functions.

6 November 2008
GOAL FOR THE ATLANTIC KING MACKEREL FISHERY (Revised and Ranked 11-6)

A sustainable AKM fishery should be managed to prevent overfishing from occurring, prevent the species from being overfished, to ensure optimum yield is not exceeded, while maintaining the ~~maintain an optimum yield and~~ genetic diversity of fish ~~to~~ and providing acceptable levels of access and allocation for all sectors while conserving biological and ecological functions.

	4 = acceptable	3 = minor reservations	2 = major reservations	1 = not acceptable
Initial Ranking 11 April 2008	13	0	0	0
Initial Ranking 6 November 2008	9	1	0	0
As Revised 6 November 2008	9	1	0	0

Member's Comments and Reservations (October 2008):
- The following statements should be incorporated into the AKM Fishery Goal Statement:
  Prevent the species from ever being overfished.
- Prevent overfishing from occurring.

Member's Comments and Reservations (November 2008):
- Optimum yield ties old concepts with new

al. 2000; Granek et al. 2008; Mikalsen and Jentoft 2008) and the broader natural resource management arena (Chase et al. 2000; Gregory and Keeney 1994, 2002). However, until stakeholders are actively involved in crafting the policy options themselves, we believe the success of these efforts will be limited. Involving stakeholders will require procedures to balance potential conflicting ideas on how the resources should be managed. In the current fisheries management arena, even when stakeholders are consulted, a mechanism for balancing these conflicting recommendations is lacking. Decision analysis has been used in fisheries before, but often its use has been viewed as tool for scientists and managers alone (Peterson and Evans 2003; Cox and Kronlund 2008; Irwin et al. 2008; Reinert and Peterson 2008). However, these tools are most powerful when incorporated into a consensus building process that enables stakeholders to select among policy options (Cox and Kronlund 2008). Finally, this FishSmart consensus building process demonstrates that a trade-off between meaningful stakeholder participation and scientific rigor is by no means inevitable. Instead, there is a broad recognition that involving stakeholders actively in natural resource management decisions is the best approach to ensuring the sustainability of the resources we seek to conserve and the human activities such as fishing that rely on them (Kates et al. 2001; Karl et al. 2007; Carpenter et al. 2009).

Beyond specific recommendations, the consensus process resulted in the development of highly knowledgeable stakeholders and the integration of both scientific and stakeholder knowledge. This in turn contributed to a more comprehensive consideration of the complex and dynamic fishery system and more robust solutions. Members of the king mackerel workgroup left the process with a deeper understanding of the dynamics of the fisheries, the assessment of the stock, and the king mackerel stock itself. They gained a firsthand understanding of the uncertainty associated with our knowledge of these components. As a result, they became champions of new data collection programs, both volunteering data they already had, but that had not been used in assessments to that point, and in developing new data collection programs. They also saw actions that they could take as individuals to help ensure the sustainability of the stock. For example, the Southern Kingfish Association, the principal tournament organizer in the southeast United States is considering increasing the minimum size of fish caught in the tournament independent of any action by the council and restricting the number of fish checked in at the dock. By the end of the process, all participants had gained an improved understanding of other stakeholder groups and of their concerns. The approach also led to new partnerships between anglers and NGO organizations that share a common interest in the sustainability of the coastal environment.

However, adopting the FishSmart approach is not without its challenges. First and foremost it requires a substantial investment in time and resources. We used four face-to-face meetings and extensive inter-sessional modeling work to achieve the project's objectives. In fisheries that have more challenging conservation issues, a substantially longer period will likely be needed to reach consensus. In our application, there were not substantial conflicts between commercial and recreational interests—such conflicts are present in other fisheries and in such cases, we expect a considerably longer time will be needed to understand opposing views and reach consensus. Indeed, the literature confirms that participatory processes require "long time frames to sensitize, build awareness, strengthen relevant institutions, and work through existing stakeholder dynamics and cultural barriers" (Kessler 2004: 15). The approach is likely not suitable for acute problems, but could serve as a practical approach to address, solve, and more constructively manage chronic challenges in specific fisheries. The time commitment required for success should not be underestimated. Extensive work needs to be invested before the first meeting in identifying the stakeholders and the workgroup members. Once the process is underway a substantial amount of communication with workgroup members is needed to ensure that they understand the steps in the process and remain committed and involved. As we have already noted, the process places a lot of demand on the workgroup members' time—and the longer the process, the more difficult it might be for some individuals and even some constituency groups to commit that time. For example, the commercial anglers and charter boat captains on our workgroup were foregoing working to attend meetings and they were not compensated for their time.

The approach also requires a substantial commitment from the scientists. In many cases, stock assessment biologists are already hugely over-committed and finding additional time to provide the support for a stakeholder-centered process may be difficult. The challenges that the scientific team face in such a project also should not be underestimated. Members of the stakeholder workgroup enter the process with extremely different backgrounds and considerable effort and patience is needed to ensure the process moves to active participation in recommending options. Considerable effort must be expended by the scientific team to ensure that stakeholders feel that the product of the workgroup (i.e., the simulation model) is theirs (though the science team provides the knowledge and skills to build the model), and that the stakeholders take ownership of the results. Of course, the time commitment required by all parties comes with a high associated cost, which may itself challenge the budgets of many agencies.

Despite the challenges noted above, we were able to achieve noteworthy progress in developing specific management recommendations for the king mackerel fisheries that included substantial reductions in quota and bag limits and substantial increases in minimum sizes. We believe this success was a direct result of the process we used, where stakeholders reached consensus in a participatory decision-making process. Central to the success of FishSmart was the ability of the stakeholders to frame not only the options, but also the objectives for the fishery. They were not constrained to consider only biomass and harvest levels. In setting an objective that explicitly focused on minimizing seasonal closures, stakeholders saw that concern for this objective was carried through all of the options considered for management. The stakeholder-centered approach we adopted in FishSmart empowered stakeholders in the fisheries to recognize and jointly come to terms with the challenges faced by the fisheries. We also believe that by placing the responsibility on the stakeholders, we allowed them to take "ownership" of the future of their fisheries. Indeed, a common refrain in the stakeholder discussions was the plea to ensure that king mackerel fisheries will be open and available for the workgroup member's children to enjoy in the years to come.

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