

# WEST COAST FORUM 2013

## Responsive and Adaptive Management Strategies

### Summary and Discussion Themes

Monterey, CA  
November 13-16, 2013

*The Fisheries Leadership & Sustainability Forum (“Fisheries Forum”) promotes professional development and continuing education by bringing together fishery managers and experts from a range of disciplines. The Fisheries Forum offers fishery managers opportunities to share experiences, build leadership skills, and enhance their understanding of fisheries law, policy, science, and economics. The semi-annual forums are the cornerstone of the Fisheries Forum’s work and provide members and staff of the regional fishery management councils with access to the latest research and an opportunity to discuss challenges and success stories across regions. The forums focus on learning from experience and applying knowledge and problem solving skills to real world challenges.*

*For more information and to view material from past forums, please visit the [Fisheries Forum website](#).*

## Introduction

The 2013 West Coast Forum (“Forum”) explored the use and potential of responsive and adaptive management strategies for meeting fishery management objectives. The term “adaptive management” is widely used to describe an iterative management approach that responds to new information and changing conditions. Although the term is broadly used, true adaptive management describes an explicit, linked strategy for directing and incorporating learning into the management process. The Forum focused on this more formalized concept of adaptive management, defined as **“learning through management and adapting based on what is learned”** for the explicit purpose of improving management by reducing uncertainty. In this sense, adaptive management describes a management process that embodies a proactive rather than reactive philosophy.

Learning through management to improve future decision-making is an appealing concept. Fishery managers are frequently charged with making decisions under conditions of uncertainty; including characterizing and reducing uncertainty within the annual catch limit (ACL) specification process, and managing fisheries under changing ecosystems. The topic for this Forum reflects an expressed interest by some council members to better understand adaptive management and the benefits it may provide.

While there are several aspects of the federal fishery management council process that facilitate management response and adaptation, the current management process may not necessarily reflect the formalized approach to adaptive management described at the Forum.

The Forum agenda was designed to provide participants with the opportunity to learn about formal adaptive management approaches and to explore aspects of adaptive management that might be valuable to consider for managing federal fisheries in the US. Recognizing that formal adaptive management may not be appropriate for or complement the council process, the Forum agenda was carefully designed to allow for an honest assessment of the benefits and limitations of adaptive resource management. In addition to a conceptual and practical examination of adaptive management, the Forum also incorporated an exploration of the pathways and mechanisms for changing management measures within the council process as well as some innovative non-regulatory pathways for responsive management.

Through presentations and discussion, participants considered how adaptive management provides a structured frame of reference for making decisions and incorporates a learning-based feedback loop to systematically improve outcomes as a result of the new knowledge generated. While there is significant and growing momentum behind the idea of adaptive, learning-based management of natural resources, there are significant challenges associated with its practical implementation. Adaptive management programs require significant and long-term investment of both money and human resources, and do not necessarily provide near-term management advice. The substantial institutional and structural processes required to facilitate the cyclical nature of adaptive management are particularly challenging to maintain without broad and sustained support at all levels of the management process. Given that the adaptive management structure is largely in place within the council system, there may be opportunities to strengthen the linkages between and improve the utility of different steps in the process.

## **Forum Agenda and Learning Objectives**

### **Learning Objectives**

The Forum agenda and learning objectives were developed through an extensive scoping process to identify how the topic of adaptive management could be approached in a meaningful way for council members and staff. The inclusion of case studies and a diverse set of speakers provided a unique opportunity to draw on expertise outside the US federal fisheries management realm and glean lessons learned from other natural resource sectors. Forum participants included council members, executive directors and staff, state and federal agency representatives, scientists and natural resource management experts. The Forum provided participants with an opportunity to:

- Explore the theory, concept and practice of adaptive management;
- Investigate examples of adaptive management in practice across natural resource sectors and draw lessons from those experiences;

- Examine the process components of adaptive management and how they could be utilized in the context of US federal fisheries management;
- Build skills to lead their respective councils in discussions of goals and objectives;
- Discuss the value and structure of learning within the council system, and explore resource management as a platform for targeted learning;
- Consider the potential for existing regulatory structures, processes and tools available to councils to support adaptive management strategies; and
- Explore innovative partnerships and their potential for advancing responsive management.

### **Agenda and Structure**

Guided by the learning objectives described above, the Forum agenda was organized into three sections:

*1) The concept and practice of adaptive management*

The Forum began with an introduction to the conceptual framework for adaptive management to provide a common understanding of its principles and processes. Case study examples demonstrated how adaptive management has been applied across natural resource disciplines.

*2) Adaptive management process components*

To allow a more detailed exploration of adaptive management and a structure for its consideration in relation to the council process, the agenda followed a stepwise progression through several key components of the adaptive management process.

*3) Non-regulatory pathways for responsive management*

Recognizing legal and procedural limitations to timely management responses, the Forum also included a session on the potential for science and management partnerships to promote responsiveness outside traditional regulatory pathways.

### **Summary Structure**

The following summary is structured loosely around the Forum agenda and is organized into two sections:

Section 1: Main points and themes of discussion

Section 2: Guide to presentations and resources

Section 1 captures high level points and discussion themes from the Forum organized around the agenda structure described above. Section 2 provides brief summaries of the presentations given by invited speakers and is organized chronologically. This summary is not intended as a comprehensive report on the Forum proceedings; rather, it is meant to provide an overview and to capture salient themes from the Forum's discussions. A full list of Forum resources, including the final agenda, is available on our website:

[www.FisheriesForum.org](http://www.FisheriesForum.org).

# Section 1: Main Points and Themes of Discussion

## 1. The concept and practice of adaptive management

The Forum began with an introduction to the theory of adaptive management and case studies of adaptive management in practice. The theoretical foundations and lessons learned through adaptive management in practice served as a common thread throughout Forum discussions.

### **Adaptive management in theory**

The concept of adaptive management has been applied in natural resource management settings for many years and continues to evolve in practice. There are numerous definitions and interpretations of adaptive management, though the fundamental premise involves **learning through management and adapting based on what is learned**. The two core elements of adaptive management are learning and adaptation, with the explicit purpose of reducing uncertainty<sup>1</sup> (learning) in order to improve management over time (adaptation). Adaptive management provides a structured frame of reference for making decisions, and incorporates a learning-based feedback loop to systematically improve outcomes as a result of the new knowledge generated. The Forum highlighted three key points that serve as the foundation for adaptive management:

#### 1) Learning is the central premise of adaptive management

Adaptive management is driven by the objective of learning for the explicit purpose of informing management decisions. This approach systematically reduces uncertainties as they relate to management and integrates that learning into the management process. Unlike other strategies that seek desired outcomes through trial and error, adaptive management views each step and decision in the management process as an opportunity to improve knowledge about the resource system, its environmental variability, and its response to imposed management measures. In this way, adaptive management institutionalizes learning so that it is a core mission of the management system.

#### 2) Adaptive management requires structure

In order for learning to occur, the management system must be structured to facilitate the exploration of specific questions and incorporate new insights into the process. To achieve this, adaptive management processes often include both deliberative and iterative phases. The deliberative phase sets up the decision-making architecture by incorporating steps such as setting goals and objectives,

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<sup>1</sup> The treatment of “uncertainty” in adaptive management is different than the context in which councils consider uncertainty when establishing harvest limits under the guidance of National Standards 1 and 2. The majority of council discussions around uncertainty occur through the lens of National Standards 1 and 2, with scientific and management uncertainty being explicitly addressed through the specification of ACLs. Instead of channeling information on uncertainty into a single decision point, adaptive management programs address uncertainty through implementing management measures in a way that directly promotes the reduction of uncertainty through learning.

selecting models and designing monitoring protocols. In the iterative phase, management actions are taken, monitoring data is collected and assessed, and adaptation occurs based upon what is learned. A feedback-learning loop between the iterative and deliberative phases provides a formalized structure and explicit pathways for learning to inform the entire decision architecture, supporting processes, and management decisions.

### 3) Adaptive management mirrors the scientific method

The scientific method seeks to answer questions through observation, measurement and experimentation, and the formation, testing and modification of hypotheses. Adaptive management applies a similar approach to the management process through rigorous exploration of key questions. The selection of goals and objectives helps to identify questions; models articulate our understanding of the resource system, and make assumptions and hypotheses explicit; and monitoring programs collect information to assess outcomes and test hypotheses. The insights gained through this process are used to evaluate the achievement of established objectives, while simultaneously identifying new questions, modifying models to reflect new understanding of the resource system, and adjusting monitoring to test new hypotheses.

### **Adaptive management in practice**

The implementation of adaptive management strategies highlights a number of benefits and limitations of translating theory into practice. Throughout the Forum, invited speakers shared case studies and lessons learned from their experiences.

#### Stakeholder engagement is critical

While many steps in the adaptive management cycle rely on the management and science communities, meaningful engagement of stakeholders throughout the process is critical to success. Engaging stakeholders early in the development phase can help create buy-in and provide a more robust picture of the natural resource system, the management challenges to be addressed, and the questions that need to be resolved. The intimate knowledge of the resource system possessed by stakeholders also strengthens the articulation of models, the design of monitoring programs, and the interpretation and assessment of monitoring data.

#### Champions and institutional support ensure a durable approach

Resistance to acknowledging uncertainty, lack of funding for focused and effective monitoring, and weak decision-making structures are common constraints to successful application of adaptive management approaches. Champions in the management and science realms are critical for creating buy-in, securing necessary funding, and maintaining resolve throughout the adaptive management process. Similarly, institutional commitment and support are essential to ensuring barriers can be overcome and that information gained is folded into future management decisions.

### Adaptive management can help resolve conflict

Many adaptive management programs arise as the result of a management crisis surrounded by significant conflict. Adaptive management is particularly well suited to resolve conflict. Using models to articulate different views of how a natural resource system works can create a platform for uncovering sources of conflict. Multiple viewpoints can be represented through different models and coexist in the adaptive management process until they are resolved through monitoring and assessment phases. The learning context of adaptive management can help managers and stakeholders reach agreement on management priorities and ensure the opportunity to continually revisit decisions in light of new knowledge.

### Adaptive management thinking can be applied to specific process steps

While the term adaptive management is used to describe a cyclical, learning-based process, the principles of adaptive management can be applied to specific elements of the management process. For example, even within traditional management frameworks, monitoring programs can be designed to incorporate learning and adapt with each iteration of the program.

While there is significant and growing momentum behind the idea of adaptive, learning-based management of natural resources, it is not a panacea. Adaptive management programs require significant and long-term investment of both money and human resources, and do not necessarily provide near-term management advice. Many adaptive management programs start strong but lack the funding, commitment and/or inertia for knowledge to be incorporated back into the management process, and therefore do not capitalize on the learning benefits which adaptive management is designed to facilitate. The substantial institutional and structural processes required to facilitate the cyclical nature of adaptive management are particularly challenging to maintain without broad and sustained support at all levels of the management process.

### **Adaptive management and the council process**

Discussions at the Forum highlighted several perspectives and insights into the fishery management system relative to adaptive management. Participants expressed a range of opinions about a) whether councils are already managing adaptively, b) the value an adaptive approach might provide to councils, and c) the legal and procedural aspects of the council process that facilitate or constrain adaptive management of federal fisheries.

### Adaptive management is already incorporated to an extent

Some Forum participants noted that the council system already integrates adaptive management, albeit in slow motion. The slow progression of implementing adaptive management results in a commensurately slow learning process. The steps in the adaptive management process are largely in place within the council system. However, what may distinguish the council system from the adaptive management examples explored at the Forum include the extent to which the steps in the council process are linked, the prominence of learning as a central tenet of the management structure, and the directed incorporation of new insights

into the management process. Some participants noted that adaptive management is perhaps a byproduct of the council system rather than a structural driver of it.

#### There may be value to a more explicit adaptive management approach

Councils often find themselves making management decisions in the face of great uncertainty, and in some cases within the context of unprecedented environmental changes. The analytical process provided through the National Environmental Policy Act (NEPA) used to support decision-making becomes less instructive when a “best” course of action cannot be identified. Adaptive management is designed to alleviate this tension through promoting learning in a controlled environment to better understand the resource system. Thus, there are situations where it might benefit councils to consider implementing robust and directed adaptive management approaches. Climate change, for example, will increase the need to confront uncertainty in the management process and to quickly try new regulatory approaches.

#### Directed adaptive management presents constraints and opportunities

While adaptive management is tailor-made for resolving large, seemingly insurmountable uncertainties, councils may not have the tools that allow this sort of head-on approach to resolving uncertainty.<sup>2</sup> The many procedural requirements of the Magnuson Stevens Act (MSA) and other applicable laws such as NEPA and the Administrative Procedures Act (APA) constrain a council’s ability to quickly adapt management measures. The existing interpretation of NEPA in particular may be the main constraint to applying formal adaptive management through requiring a high standard of analysis and justification for all management actions. However, participants noted that NEPA documents might also hold promise as a vehicle for facilitating learning-based management through articulation of purpose and need statements. There is also potential to leverage existing analytical requirements to translate monitoring and scientific data into a platform for learning. Guidance from NOAA Fisheries could support councils in exploring the potential for using directed adaptive management approaches within the confines of NEPA.

## **2. Adaptive management process components**

In addition to considering adaptive management at a formalized, programmatic level, the Forum also provided a venue for participants to consider potential for leveraging adaptive management concepts and approaches on individual components of the management process. Given that the adaptive management structure is largely in place within the council system, there may be opportunities to strengthen the linkages between and

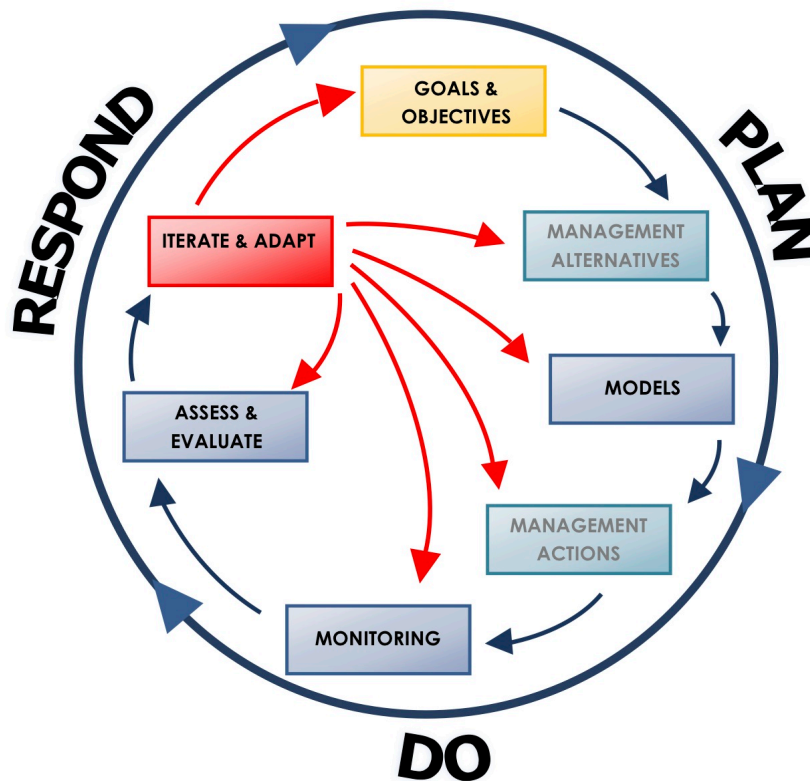
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<sup>2</sup> Adaptive management is predicated on the idea of learning, which directly acknowledges and embraces uncertainty. The MSA instructs councils to acknowledge and quantify uncertainty, and to make the best decisions possible in light of that uncertainty. While there is incentive to reduce uncertainty under the MSA and its associated guidelines, managers in adaptive management programs play a more direct role by implementing management measures that are designed to directly confront and resolve uncertainties.

improve the utility of different steps in the process. The bulk of the Forum was structured to facilitate this stepwise exploration as described in greater detail in the next section.

### Overview/Description

Through examining a number of adaptive management process diagrams in relation to the council system, the following diagram was developed specifically for the Forum to help participants visualize they key process components of adaptive management and serve as a frame of reference for discussions.



This section of the Forum was structured into three parts to facilitate an exploration of five key process components highlighted above, as articulated in the agenda:

Part A: Setting **goals and objectives**

Part B: Resource management as a learning process

- Using **models** and articulating hypotheses
- Developing and implementing targeted **monitoring** programs
- **Assessing** information and observed outcomes

Part C: **Iterate and adapt** management measures and process

The agenda allocated time for the exploration of these process components for the purpose of considering:

- a) How these steps are leveraged in an adaptive management framework;
- b) How councils currently approach the respective steps in the process; and
- c) If there are lessons from adaptive management approaches that could be valuable in the context of the council process.



## Part A: Setting goals and objectives

The specification of goals and objectives is a crucial step in any management process. The establishment of clear and thoughtful goals and objectives sets up management for success by:

- Identifying and articulating the appropriate scope and scale of problems to be solved;
- Providing a frame of reference for evaluating management alternatives;
- Serving as metrics for assessing the success of implemented management strategies; and
- Guiding information needs and data collection strategies.

The process of setting goals and objectives also creates an opportunity for the engagement of stakeholder groups, and can serve as a platform for building consensus and creating a shared frame of reference to facilitate a well-functioning management process. The group's discussion considered the function of goals and objectives within an adaptive management framework, and reflected on the role of and challenges with establishing and utilizing goals and objectives within the council system.

### **Goals and objectives in the context of adaptive management**

Goals and objectives serve as a central mechanism for learning in adaptive management programs. The process of articulating goals and objectives can help unearth areas of uncertainty and identify points of potential conflict. Acknowledging and working through areas of disagreement provides valuable insights into different views of the resource system and highlights crucial management questions. Goals and objectives provide a common zone of agreement for learning, which helps those involved support the process and buy into the results even when they do not align with personal interests. On a larger scale, goals and objectives support the whole adaptive management process through informing the design of models and monitoring programs and providing metrics that allow the evaluation and assessment phases to contribute to targeted learning.

### **Goals and objectives within the council process**

Councils use goals and objectives at a number of different levels within the council process. The 10 National Standards articulated in the MSA serve as the highest order of goals and objectives and inform those established at the programmatic, management plan and management action levels.

#### *Programmatic*

Goals and objectives are established at a larger, programmatic level through visioning and strategic planning initiatives as well as through articulating guiding principles and operating procedures to guide council processes.

#### *Management plan*

Councils articulate goals and objectives at the fishery management plan level. The NEPA process is commonly used as a platform for stating goals and objectives through the purpose and need section of a NEPA document. Goals and

objectives established at this level can be organized hierarchically and can articulate intention and direction at the management plan level, as well as provide guidance for how individual management actions should advance these larger management plan objectives.

#### *Management action*

Councils also set goals and objectives at the level of specific management actions. These goals and objectives are often more targeted and focused on a specific problem being addressed through a management action. NEPA documents are also a common vehicle for expressing goals and objectives at the action-specific level.

While using goals and objectives within the council process is recognized as both necessary and beneficial, there are a number of challenges and limitations with their meaningful application from both process and outcome perspectives.

#### Goals and objectives are not always operationalized to inform management

While goals and objectives are established at multiple levels within the council process, they are not always operationalized in a way that informs management. For example, programmatic goals and objectives are not always referenced to inform specific management actions. They may also be too general or specific for the level at which they are established. The 5-year review of management plans is a vehicle that councils are using to revisit, reflect on and revise goals and objectives, and may provide an opportunity to adapt this process over time.

#### It is challenging to build consensus and maintain management relevance

While goals and objectives can be more tractable when established through an inclusive participatory process, it can be difficult to reach consensus or even general alignment. To reach agreement, goals and objectives often end up reflecting a broad suite of ideas, interests and perspectives, which detracts from their effectiveness at providing clarity and direction. The process can become about finding a compromise amongst objectives rather than finding the best approach for delivering on a management goal.

#### Goals and objectives often lack durability over time

It can be challenging to develop and utilize goals and objectives in ways that provide management-relevant guidance over time. Goals and objectives may continue to evolve and change during the time it takes to develop, approve and implement management actions, which challenges their effectiveness as guideposts and evaluation metrics. Response to crises in management also seems to circumvent and potentially erode the utility of established goals and objectives.

## Part B: Resource management as a learning process

One of the characteristics that distinguish adaptive management from other management strategies is the intentional, directed integration of a learning process. Learning takes place throughout the adaptive management process, and is facilitated by:

- The use and refinement of **models** and the hypotheses they articulate;
- The development, application and refinement of **monitoring** programs; and
- The use of dedicated, institutionalized processes for **assessing** information and outcomes.

### Using models and articulating hypotheses

Models and their underlying hypotheses are an important component of adaptive decision-making processes. Models are a way of stating, communicating and testing our understanding of a resources system, its patterns, and how it will respond to management. In adaptive management, models help managers to translate costs, benefits and consequences of management actions (and environmental uncertainty) on a resource system. In addition, they provide a platform for testing hypotheses and improving our understanding of the system over time. Presentations and discussion at the Forum highlighted several key points about the role of models in adaptive management:

#### Management strategies have implicit underlying models

Just as scientific investigations reflect ideas about how a system works and test hypotheses against evidence, management strategies reflect similar understandings of the resource system. Through their application, managers test and refine their understanding of a system and how it will respond to management actions. Whether or not explicitly stated, managers use implicit models to guide their evaluation of management alternatives and their selection of the action they believe will lead to the best outcome relative to their goals. Without these implicit models we would have no idea what we are managing, how to manage it or what to expect from a range of potential actions.

#### Models can take many forms

Models can take a number of forms, from highly technical computer models to simple diagrams that capture an individual's intuitive concept of a resource system and its linkages. Models do not have to be complicated or technical in order to be useful; models need only reflect a view of the world in a way that supports the decision at hand.

#### There is no "right" model

Given that models reflect interpretations of highly uncertain resource systems, they do not represent an ultimate truth but rather a working theory of how systems function. By employing a variety of different models in the decision framework, a full range of hypotheses can be explored. Over time, the evidence obtained from monitoring programs can resolve assumptions and uncertainties, and inform the

identification of a single model or weighted combination of models that most appropriately represent actual population and system dynamics.

#### Models can be developed through a variety of approaches

Models can be developed by a variety of different interests in the management process. While scientists, managers, and stakeholders may have different ideas of how a system works, encouraging identification of alternative ideas allows for a variety of perspectives to be evaluated through the adaptive management process. It is important to gather the full range of perspectives to have a complete evaluation of potential realities. For example, managers and resource users may have very different understandings of how a system works.

#### Not all models are useful

The kind of model employed in a management situation, and the necessary specificity and technical detail required, depend both on the nature and scale of the management problem and the knowledge needed to inform management. Models are only as useful as the guidance they provide, and thus it is important to use models in a way that help, rather than hinder, managers' ability to manage.

In addition to general discussion around the use of models in adaptive management, Forum participants explored the related and specific tool of Management Strategy Evaluation (MSE). Presentations and discussions at the Forum highlighted some clear synergies between adaptive management and MSE, as well as some valuable points about the use of MSE within the current management structure.

#### MSE can complement adaptive management approaches

Through simulation testing, MSE essentially replicates the steps in the adaptive management loop: setting objectives, taking management actions, performing monitoring and assessment, evaluating against objectives, and learning to inform management. MSE is also a pathway for resolving tensions between different understandings (models) of how a system works through focusing on how the decision-making framework performs across those different models. Managers can also leverage lessons learned through MSE when applying adaptive management approaches in practice. Furthermore, the MSE framework offers another venue for learning within adaptive management by comparing actual outcomes with MSE projections.

#### MSE can provide insights into management tradeoffs

Within the MSE process, articulating implicit and scientific models for how a system works can make assumptions explicit and provide a platform for identifying goals and objectives as well as key points of uncertainty. The outputs from MSE simulations do not provide management advice; rather they help managers evaluate tradeoffs and make decisions in the face of uncertainty. MSE can help identify management actions that are robust to different uncertainties and scenarios of how a system will behave (e.g. under different climate change scenarios).

#### There are costs and benefits to using MSE

MSE can be time consuming, complicated and expensive, characteristics that warrant consideration of where and when the use of MSE makes sense. To begin answering these questions, one could consider how complicated MSE is compared to the current approach, and what other alternatives are available to aid in making necessary management decisions. When there is sufficient information available to run MSE simulations, the process can go relatively quickly. In addition to more formal, technical MSE approaches, MSE can also be used in a more qualitative, less resource-intensive fashion. For example, structural and process uncertainty can be explored qualitatively in a way that helps to understand the relationships that create uncertainty.

#### MSE can help councils elucidate stock assessment discrepancies

MSE can be used to reconcile and move past contention around the results of different stock assessments. MSE allows for the testing of different management strategies given the realities projected by different assessment methods. This helps managers get beyond scientific uncertainty of assessment models to consider the management implications of the resulting projections.

### Developing and implementing targeted monitoring programs

While scientific data needs and compliance efforts are important aspects of the management landscape, the discussion of monitoring at the Forum focused on the relationship between monitoring and decision-making. The design and implementation of monitoring programs plays a critical role in the learning process of adaptive management strategies. Monitoring serves as the platform for evaluating if management actions achieve their stated objectives, improving models and reducing uncertainty, and feeding new information into the process to improve management decisions and subsequent outcomes. While monitoring was discussed in the context of adaptive management, the key points and lessons learned through presentations and discussion could be applied to monitoring in more traditional management frameworks.

#### Monitoring must also be adaptive

Just as the adaptive management process is designed to change over time based upon what is learned, monitoring objectives and protocols should also be updated through time based upon evidence provided from previous monitoring efforts. Monitoring is the vehicle for asking and answering questions, which can and do change over time. Balancing short-term and long-term data collection needs will help to maximize the present and future value of monitoring to managers.

#### Integrate monitoring into the decision-making framework

Monitoring needs to be thoughtful and targeted to be useful in informing management. Embedding monitoring programs into decision-making frameworks formalizes this relationship and establishes monitoring as an integral part of the process rather than optional or ancillary. Monitoring programs often trail off

through time, and keeping the focus squarely on how monitoring will inform management can promote more robust and enduring programs.

#### Consider the clients of monitoring programs

Keeping the end users of monitoring data in mind will help identify what sort of information is relevant to collect. The design of monitoring programs should consider not only what data should be collected, but also when the results are needed to inform future decisions and how the information can be communicated in a way that supports its management purpose.

#### Link monitoring and management questions

Monitoring programs do not need to be comprehensive to be useful; rather, they need only to collect enough data to answer specific questions, which can often be achieved by looking at corresponding indicators. Monitoring and data collection should be focused on answering priority management questions in a way that considers the relationship of costs, risks and benefits. The articulation of management questions to guide monitoring design can be best informed by combining the perspectives and expertise of managers and scientists.

#### Thoughtful monitoring design yields useful results

The selection of system aspects to monitor and the methods to perform that monitoring will influence the information produced and lessons gleaned as a result. Thus it is important to carefully consider the design of monitoring programs to ensure that the results inform the questions being asked and properly account for biases in the data.

#### Stakeholder engagement can provide monitoring capacity

Engaging stakeholders early in the process of developing monitoring programs is important to facilitate trust and cooperation and to establish credibility of the data to be collected. Stakeholders and citizen groups can also engage in structured scientific data collection programs to build additional capacity and manage costs. A careful examination of data collection efforts already underway by different groups within and outside the fishery management community can help fill gaps and focus data collection efforts.

Reflecting on experiences in their managed fisheries, Forum participants highlighted some challenges with the way monitoring is currently designed and conducted. There appears to be a tension between monitoring for the sake of science and monitoring to inform management, which may be compounded by a lack of clarity around the purpose of monitoring efforts. Participants suggested that improved communication between managers and scientists could better direct monitoring in support of management decisions and improve transparency between data collectors and users.

## Assessing information and observed outcomes

The assessment and evaluation phase of the adaptive management cycle allows for the execution of directed learning systems and prepares managers to act based upon generated knowledge. This step is tied very closely with the design and implementation of monitoring programs, and can be thought of as a natural and necessary outcome of that monitoring. Invited speakers shared their experiences with this step in the adaptive management process and highlighted several key points.

### Maintain focus on management questions

Similar to other components of the adaptive management process, the assessment phase must maintain focus on key management questions. Clearly articulating the link between data collection and decision-making allows for the design and execution of a process to produce timely insights into the most relevant management questions.

### Institutionalize assessment processes

The assessment phase is a common place where the adaptive management process stalls: goals and objectives are established, models are articulated and monitoring is performed, but the data are never analyzed in a way that informs management. Institutionalizing the processes for assessing monitoring data and outcomes is essential for capturing the benefits of an adaptive management program. Establishing a feedback process and integrating it into core management activities is essential to ensure learning is embedded and leveraged in management decisions. In the adaptive management examples explored at the Forum, the assessment step was institutionalized into the decision process through the use of management, technical and interdisciplinary committees that thoughtfully aligned processes for analysis, synthesis, interpretation and communication of results with the decision-making schedule.

The assessment phase in federal fisheries management is an inherent yet often informal part of the process. While managers may not necessarily set up formal evaluation and assessment procedures, they receive feedback in the form of new stock assessments, insights from standing committees and comments from stakeholders. Some councils have more formalized processes in place to gauge performance based upon specific indicators that facilitate proactive responses to management challenges.

Forum participants noted several common challenges with this reflective phase of the management process, particularly when management priorities are subsumed by litigation and other management crises. As noted in the previous section, data collection is often disconnected from the decision-making process. Similarly, while a significant amount of data analysis is performed through the NEPA process, improvements could be made in the way NEPA documents are constructed to better assess monitoring results and communicate them to decision makers.

## Part C: Iterate and adapt

Insights gained through structuring resource management as a learning process (models, monitoring and assessment phases) are intended to inform the iteration and adaptation of management measures. For federally managed fisheries, any resulting changes to management measures must be executed through established pathways. MSA calls for the use of fishery management plans (FMPs) as the primary mechanism for conducting management. Once FMPs are developed by the councils, approved by the Secretary of Commerce and implemented by NOAA Fisheries, the councils and NOAA may refine and update management through time. The 1997 Operational Guidelines to the Fishery Management Plan Process (“Operational Guidelines”) outline several pathways for amending management measures under the Continuing and Contingency Fishery Management section.

Through reviewing examples of framework actions, emergency actions, and ACL specification processes, the group identified a number of benefits with employing these continuing management tools. The use of framework actions can help expedite the implementation of anticipated management actions and establish responsive in-season management strategies. To implement ACLs, many councils have established specification processes that allow for setting catch limits without amending the FMP. The use of emergency actions allows councils to take swift action and respond to unforeseen issues on an emergency basis.

Despite the benefits of these processes, their application in practice highlights several challenges and limitations. While these actions are required to comply with APA and MSA requirements, NEPA-related mandates are often the biggest challenge to their implementation. For framework and specification actions that are difficult to define and anticipate, implementing them can require an investment in time and analysis similar to that required by an FMP amendment. To avoid detailed analysis at the time of implementation, framework actions have to be specified with a high degree of detail in the FMP amendment that authorizes their use; the disconnect between timing of the management process and information availability challenges councils’ ability to perform the required analysis in advance. Several council regions are currently challenged with litigation around the use of emergency provisions.

The group’s discussion highlighted a broad range of regional interpretations regarding the continuing management mechanisms. The terminology used to describe framework actions (e.g. closed frameworks, open frameworks, regulatory amendments, specification processes) differs across regions. The interpretation and implementation of these actions are also informed by different legal guidance about what councils are allowed to do and which mechanisms are appropriate for specific actions. NOAA Fisheries is currently reviewing the Operational Guidelines in preparation for providing updated guidance. Participants suggested that advice on how to align the different public comment periods required under relevant laws (NEPA, ESA, APA, MSA) would be beneficial to incorporate in the next iteration of the Operational Guidelines. It was also noted that providing a framework for more consistent use of the continuing fishery management



actions, and an examination of how councils could implement a more adaptive approach to management, would be useful outcomes from the Operational Guidelines revision process.

### **3. Non-regulatory pathways for responsive management**

Recognizing legal and procedural limitations in timely management responses, the Forum also included a session on the potential for science partnerships and co-management to promote responsiveness outside traditional regulatory pathways. Science has advanced to a point where fisheries and oceanographic data can be linked to provide real-time spatial insights such as areas of high bycatch likelihood. Voluntary programs with industry can help leverage these inferences to meet management objectives outside the cumbersome regulatory pathway. Industry involvement in these efforts can support capacity for data collection and inform the ultimate utility of final products. Additionally, engaging fishermen in data collection and providing access to the data empowers them to be partners in the management process and creates investment in achieving desired outcomes. Co-management is another non-regulatory pathway with proven and significant potential for achieving management objectives. When implementing co-management agreements, there are tradeoffs between flexibility and adaptation, and considerations regarding transparency in the public process that need to be considered. Communication and trust between managers and industry are important components of successful co-management strategies, and support the proper balance of innovation and accountability in these programs.

## Section 2: Presentations and Panel Sessions

Video recordings and PDF versions of the following presentations and panel discussions are available on the [2013 West Coast Forum](#) page of the Fisheries Forum website.

### The concept and practice of adaptive management

#### Introduction to adaptive management

Dr. Ken Williams

Executive Director, The Wildlife Society (former Co-Director, Science and Decisions Center, US Geologic Survey)

Dr. Williams provided an introduction to the concept and practice of adaptive management. The concept of adaptive management emerged in the 1950s and was formalized and better articulated through the 70s, 80s and 90s. While there are numerous definitions of what constitutes adaptive management, Dr. Williams provided the group the following definition; **“Learning through management and adapting based on what is learned.”** The two fundamental elements of adaptive management are learning and adaptation. The explicit purpose of the concept is to reduce uncertainty (learning) in order to improve management over time (adaptation). Through the use of three examples, Dr. Williams demonstrated how the inherent uncertainty in natural systems (environmental conditions and response to management actions) limits our ability to manage them. Adaptive management provides a structured frame of reference for making decisions in the face of this uncertainty.

The adaptive management process includes a deliberative and an iterative phase. The deliberative phase establishes architecture for decision-making (i.e. management objectives, monitoring protocols); the iterative phase employs a feedback-learning loop between decision-making, monitoring and assessment and also informs revision of the decision architecture based upon what is learned in the deliberative phase.

There are two different approaches to implementing adaptive management: sequential and parallel strategies. Both approaches feature an integrated, recurrent decision process that examines competing views of the system, though the parallel strategy applies more of an experimental design to expedite and focus on the learning process.

While there are a number of examples where adaptive management has been successful at reducing uncertainties and promoting learning, there are significant challenges to its application in practice. For example, resistance to acknowledging uncertainty, lack of effective decision-making structure and insufficient focus on effective monitoring are common constraints to success in adaptive management approaches. There is significant and growing momentum behind the idea of adaptive, learning-based management of natural resources. In many natural resources programs, such as those for federally managed resources, the architecture for adaptive management (decision-making structure, monitoring protocols, etc.) is largely in place. What may be limiting the adaptive functioning of these approaches are the direct links between steps in the management

process, particularly leveraging monitoring results to learn about the system and incorporating that learning into future decisions and refinement of the management strategy.

### **Adaptive management in the US Forest Service: The Northwest Forest Plan**

Dr. Bernard Bormann

Principal Forest Ecologist, US Forest Service; Professor, Oregon State University

Dr. Bormann shared his experience working with the US Forest Service on the Northwest Forest Plan. The Northwest Forest Plan was implemented in 1994 to improve management of the region's forests through balancing a range of public values and benefits, and was largely driven by litigation around the continued decline of threatened spotted owl populations. The recognition of uncertainty and the need to change management over time prompted the adoption of adaptive management as a pillar of the plan. Adaptive management was effectuated through planning, acting, monitoring and evaluation steps, and the allocation of 7% of lands for adaptive management purposes. A 10-year plan level review identified mixed results from its application: while the adaptive management areas did not produce the desired outcomes, the learning structure in place allowed for the identification of lessons and the development of a new learning-based decision model. The new model incorporates identification of uncertainties, priority questions and learning modes, and interpretation of results into a structured, iterative feedback loop.

Dr. Bormann shared two of the adaptive management studies conducted under the Northwest Forest Plan focusing on the learning modes of stakeholder discourse and management studies. The Five Rivers Landscape Management study was a parallel comparison of three strategies to meet management objectives. Incorporation of learning goals in addition to other management objectives was a large contributor to the success of this study and the identification of the most effective management strategy. The new learning-based decision model referenced above led to the creation of the Eastside Accelerated Landscape Learning study. A group formed to collaboratively develop the study's learning model to ensure learning was built into the experimental design and insight was captured following application of different management strategies.

### **Adaptive management in the US Department of the Interior: Waterfowl Harvest Management**

Dr. Ken Williams

Executive Director, The Wildlife Society (former Co-Director, Science and Decisions Center, US Geologic Survey)

Dr. Williams shared his experience with waterfowl harvest management in North America. In accordance with the Migratory Bird Treaty Act, waterfowl harvest regulations are established annually. For the four US flyways, harvest specifications are determined in collaboration with the US Fish and Wildlife Service, relevant states and stakeholder communities. Lack of clear objectives and agreement about resource response to harvest mortality created significant conflict in the management system and

led to the adoption of adaptive management. Under the adaptive harvest management system, harvest objectives were set to maximize long-term cumulative harvest utility, and four different models of survival and recruitment were used to evaluate management alternatives and to incorporate knowledge acquired through monitoring.

In reflecting on this experience, Dr. Williams shared some benefits and challenges of employing an adaptive harvest approach.

Benefits:

- Adaptive management lets you do the best you can with the available information while promoting improved understanding and better management over time.
- In addition to providing a learning framework, adaptive management also supports conflict resolution and allows for the coexistence of multiple points of view.
- Adaptive management applies rigor and structural progression to natural resource decision-making.

Challenges:

- It is difficult to establish acceptable management goals that reflect the disparate needs and views of those involved.
- Adaptive harvest management requires a big investment in monitoring and assessment, and an institutional commitment to the program over the long term.

### **Adaptive management in Australia: The Great Barrier Reef**

Dr. Campbell Davies

Principal Research Scientist, Pelagic Predator Ecology and Dynamics, Commonwealth Scientific and Industrial Research Organization (CSIRO)

Dr. Davies provided a summary of adaptive management in the Great Barrier Reef (GBR), one of the largest adaptive management experiments conducted on fisheries and coral reef conservation. The Marine Park Authority, a federal body responsible for conservation and wise use of the multi-use park, manages the Great Barrier Reef. The Marine Park Authority was concerned about the impacts of fishing and substantial increases in fishing effort on the park. With very limited biological and ecological knowledge and high uncertainty around the impacts of fishing, the Authority adopted an adaptive management approach to gather information in support of managing coral reefs and associated fisheries.

An Effects of Line Fishing (ELF) study was initiated in 1994 after two design periods where planning and pilot studies were conducted and basic biological data was collected. The ELF study had two objectives: to evaluate the effectiveness of zoning and established MPAs, and to estimate key biological parameters to be used in assessing fish stocks. The experiment was conducted on four reef clusters along the GBR, with different levels of fishing effort applied to reefs both historically closed and open to fishing. Results obtained from monitoring indicated greater abundance and size of fish stocks within MPAs (with strong regional differences), and also provided improved estimates of abundance for population modeling. In response to the ELF study, size limits were revised to reflect a better biological understanding of targeted stocks, zoning was

revisited to maximize effectiveness of closed areas, and guidance was provided to fishery managers regarding the most effective management strategy.

Reflecting on this example, Dr. Davies offered several observations and lessons learned. Management plans for the GBR Marine Park are implemented as federal regulations, and the Australian parliament had to approve changes in legislation to allow for the implementation of the adaptive management experiment. The required legislative changes were controversial at the time; the same sort of adaptive management experiment would be challenging to implement now due to current politics and social climates. Champions within the management and scientific communities, as well as institutional arrangements that created capacity, were crucial ingredients for implementing the program. Lastly, large leaps in learning often require taking large risks to explore areas of high uncertainty; thus, risk aversion of a management system or its decision makers can limit the learning potential of adaptive management programs.

## **Adaptive management process components**

### **Part A: Setting goals and objectives**

#### **Navigating divergent perspectives when setting goals and objectives**

Dr. Janet Martinez

Director, Gould Negotiation and Mediation Program, Stanford Law School, Stanford University

Dr. Martinez provided the group with an interactive presentation and exercise on the purpose and procedure of setting goals and objectives. Setting goals and objectives is an important step in decision-making processes because it helps to identify the problem to be solved, evaluate alternative management strategies, and measure success of implemented management strategies. Through providing this framework, goals and objectives support monitoring efforts by helping to identify what information needs to be collected. In addition to the process benefits, identification of goals and objectives also serves as a platform for participation in the management process. Ensuring comprehensive participation of both managers and stakeholders through an articulated process promotes the development of robust goals and objectives and a zone of agreement about the purpose and scope of management actions.

Dr. Martinez suggested that paying particular attention to defining the problem to be solved could facilitate setting effective goals and objectives. Framing and re-framing the problem can help identify the appropriate scale and scope for tractable goals and objectives. Thinking creatively in defining the problem and continually asking “why” are two ways to articulate the problem in a way that can be best addressed through the decision-making process. Dr. Martinez also led a small group activity where Forum participants worked to build consensus around goals and objectives within a case study scenario.

## Part B: Resource Management as a learning process

### Using models and articulating hypotheses

#### **Panel discussion: The use of models in adaptive management**

Dr. Bormann, Dr. Davies, and Dr. Williams reflected on their experiences developing and applying models in adaptive management programs and shared their lessons learned from those experiences.

Dr. Williams shared five key points about the use of models in the context of adaptive decision-making: 1) every scientific investigation has implicit in it an underlying model; 2) every management strategy has implicit in it an underlying model; 3) models can take many forms; 4) there is no “right” model of a resource system; and 5) if you think about modeling broadly, you can see that you use models most every day.

Dr. Bormann and Dr. Davies built on these five points, illuminating their experience with articulating models. The venue in which models are developed can be very different; for example, scientists, managers, collaborators and stakeholders can all contribute their understanding of how a resource system works. Gathering a diverse range of models supports a robust exploration of the resource system and a process for resolving uncertainties. In particular, engaging stakeholders and others intimately knowledgeable about the resource helps to ensure intuitive and nuanced understandings about the resource are captured and articulated.

#### **Management Strategy Evaluation**

Dr. Campbell Davies

Principal Research Scientist, Pelagic Predator Ecology and Dynamics, Commonwealth Scientific and Industrial Research Organization (CSIRO)

Dr. Davies provided the group with an overview of Management Strategy Evaluation and its application within the Great Barrier Reef ELF adaptive management study. MSE uses models to evaluate the relative likelihood of different management strategies to meet specified objectives in the face of uncertainty. Through simulation testing, MSE essentially replicates the steps in the adaptive management loop and is a pathway for resolving tensions between different understandings (models) of how a system works by focusing on how the decision-making framework performs across those different models. MSE can be used to support management at several levels; it can be run on a larger scale to inform strategic and programmatic management approaches, or at a more tactical scale relating to specific management decisions. In either application, MSE does not provide absolute assessments of risk or performance, but rather a comparison of how different strategies (monitoring, assessment and decision rules) will perform across objectives. Within the context of the GBR adaptive management example, MSE was used to evaluate alternative management strategies for achieving conservation and fisheries management goals relevant to the reef line fishery. Through engaging stakeholders, objectives, strategies and performance indicators were established to gauge relative success of each management strategy. The MSE simulation compared a range of management strategies

using area closures and effort controls, and presented the results in a decision table. The table helped managers visualize the tradeoffs in strategies with respect to the suite of identified objectives. For example, MSE found that MPAs are a good strategy for meeting conservation objectives but not necessarily for the whole suite of objectives. Similarly, effort controls appeared to be more effective than increasing the use of MPAs for fisheries objectives.

## Developing and implementing targeted monitoring programs

### **Science for adaptive management: MPA monitoring in California**

Dr. Liz Whiteman

Program Director, California Ocean Science Trust, MPA Monitoring Enterprise Director

Dr. Whiteman shared her experience with MPA monitoring in California. The California Marine Life Protection Act of 1999 aimed to improve the health and condition of California's oceans through the use of MPAs by directing the state to redesign existing MPAs to form a more cohesive network. The Act called for an adaptive management approach that embedded learning and reevaluation over time into MPA management, and emphasized monitoring as the way in which science informs the process. The Act established a five-year review cycle at which time changes to MPAs could be recommended and considered, thus providing a specific evaluation and decision-making venue for monitoring data to be utilized.

The MPA Monitoring Enterprise (Enterprise) was established as a program of the California Ocean Science Trust to support the five-year review cycle, thus providing dedicated and independent monitoring capacity. This allowed for a novel, adaptive approach to monitoring, and the consideration of not only what information was necessary to gather, but also how the data and results of monitoring would be used and communicated to the suite of end users (scientists, stakeholders, and managers). The resulting monitoring program looked to a) assess trends and conditions to provide insight into the health of the ecosystem, and b) evaluate MPA design and management decisions to determine how they affect the system relevant to their management objectives. The evaluation of MPAs was expressly divided into short and long-term questions to provide management-relevant information at the 5-year review point, while also providing for longer-term evaluations.

Dr. Whiteman shared the challenge of funding monitoring programs, and how the Enterprise was able to maximize the utility of monitoring funds by focusing on what information is most needed at different times. As monitoring data have been collected and analyzed, results are being shared broadly to support the constructive and positive use of science in decision-making. The Enterprise is also exploring new approaches for sharing monitoring results in clear ways. Through embedding monitoring in an adaptive management cycle, the Enterprise has been able to attract a broader funding portfolio by recognizing the utility of monitoring data to other ocean users and managers.

## Assessing information and observed outcomes

### **Panel discussion: Lessons learned from case study examples**

Dr. Bormann, Dr. Davies, and Dr. Williams shared their insights on monitoring programs and the linkage between monitoring and assessment phases of adaptive management programs.

Dr. Williams emphasized the role of adaptive monitoring within an adaptive management framework and shared five key points on monitoring: 1) the two reasons to perform monitoring are to learn and to manage; 2) there is no way to monitor everything and thus monitoring needs to focus on what information is needed to make management decisions; 3) the insights gained by monitoring are influenced by what you choose to monitor and how that monitoring is conducted; 4) the design of monitoring (what and how) should be conditioned on why monitoring is being conducted; and 5) one size does not fit all for monitoring.

Dr. Bormann suggested that monitoring programs should be designed to focus on specific questions, the identification of which can be driven by a formal analysis of uncertainty. The forming and framing of questions benefit from input by managers, scientists and stakeholders to ensure useful outcomes. Monitoring utility can be maximized when anchored in adaptive management; building feedback channels and linkages between monitoring questions and future management decisions ensures policy relevance.

Dr. Davies emphasized the importance of good design in ensuring useful monitoring programs. Clear learning objectives for monitoring feed directly into the assessment phase; if you articulate what you want to learn, you know exactly what you are looking for when analyzing monitoring data. Dr. Davies also emphasized the importance of trust, timeliness and transparency in monitoring programs, particularly to leverage stakeholder engagement and buy-in.

## **Part C: Iterate and adapt**

### **Balancing public participation and the need for speed**

Ms. Marian Macpherson

Management and Program Analyst, Office of Sustainable Fisheries, NOAA Fisheries Service

Ms. Macpherson provided the group with a statutory and legal context for the fishery management process and a description of the tools available for adaptation and iteration of management measures. The primary management mechanism is the development and implementation of FMPs. FMPs must contain 15 mandatory components required under the MSA, comply with the 10 National Standards, and adhere to all other applicable laws such as timing and procedural requirements of the APA.

The Operational Guidelines divide the management process into five phases:

Phase 1 – Planning and scoping (councils)



- Phase II – Drafting documents and analysis (councils)
- Phase III – Public review and council adoption (councils)
- Phase III – Secretarial review and implementation (NMFS)
- Phase V – Continuing management (councils and NMFS)

The purpose of the continuing management phase is to reduce repetition of the work and processes conducted during the first four phases and provide for efficient adaptation of management measures over time. Given the current landscape of science-based decision-making and numerous strict mandates and policy objectives, efficiency is important for meeting deadlines. The Operational Guidelines outline the concept of frameworking as a pathway for structuring and pre-planning future decisions in a way that expedites the implementation of approved actions. Frameworking can be employed in a number of different ways, and has been interpreted differently by different councils. Ms. Macpherson reviewed the statutory authority for these mechanisms, provided four examples of their use, and lessons learned from those experiences.

**Responsiveness in the Federal Fisheries Management Process: The Use of Continuing and Contingency Fishery Management Mechanisms across the Regional Fishery Management Councils**  
Fisheries Leadership & Sustainability Forum

This report was drafted to support discussions at the Forum, and examines the use of the Continuing and Contingency Fishery Management Mechanisms (“mechanisms”) outlined in the Operational Guidelines as pathways for responding to new information, changing conditions and adapting management measures over time. The exploration of how these mechanisms have been utilized across council regions highlights two main findings. First, interpretation and application of these mechanisms varies significantly across council regions. Second, the practical implementation of these mechanisms demonstrates both benefits and limitations in how these mechanisms are employed to improve the responsiveness of councils to new information and changing conditions within a fishery.

## **Non-regulatory pathways for responsive management**

### **Spotlight Session: Partnerships as a strategy for responsive management**

#### **Dynamic ocean management: TurtleWatch in the Western Pacific**

Dr. Elliott Hazen

Assistant Research Biologist, University of California at Santa Cruz; Affiliate Researcher, NOAA Southwest Fisheries Science Center

Dr. Hazen provided an overview of an emerging field of spatial science and management: dynamic ocean management. Traditional spatial management tools (e.g. MPAs and time/area closures) are commonly used in fisheries management. However, these tools lack the flexibility to follow the movement of organisms and dynamic ocean processes. Dynamic ocean management is an innovative strategy that aims to incorporate fixed and

dynamic oceanographic features and integrate new sources of data to avoid undesirable fisheries interactions while minimizing impacts on the fishing industry.

Dr. Hazen shared several examples of these predictive spatial models, with particular focus on the TurtleWatch program run by the Pacific Island Fishery Science Center. The purpose of the program is to empower participants in the Hawaii pelagic longline fishery to reduce bycatch of loggerhead sea turtles. Through exploring the association of swordfish and turtle habitat preferences, scientists use sea surface temperature to predict turtle interactions with the fishery, essentially identifying turtle avoidance areas. These dynamic habitat zones are updated daily and distributed to fishery participants, the use of which has resulted in reduced interactions with loggerhead turtles. Refinement of the TurtleWatch program continues in cooperation with the longline fishery to maximize fishing area and minimize overlap with protected species.

### **Salmon bycatch in the North Pacific: An evolution in regulatory structure**

Mr. John Henderschedt

Executive Director, Fisheries Leadership & Sustainability forum; Vice Chairman, North Pacific Fishery Management Council

Mr. Henderschedt shared the evolution of co-management strategies for addressing Chinook salmon bycatch in the Bering Sea pollock fishery. In the mid 1990s, the North Pacific Fishery Management Council established large time area closures to reduce salmon bycatch. In 2001, the industry implemented voluntary rolling “hot spot” closures for more dynamic bycatch avoidance. In response to the effectiveness of these rolling closures, the council provided exemptions to the time area closures contingent upon participation in the rolling closures, which were authorized through exempted fishing permits (EFPs). The subsequent implementing regulations described in detail the required contents of these private agreements. Despite these efforts, salmon bycatch remained a problem, and in 2011 the Council established hard bycatch caps and incentivized bycatch avoidance through allocating transferrable bycatch limits to vessels operating under incentive plan agreements (IPAs). Through engaging in an IPA, vessels were allowed to fish under a higher bycatch cap, and were allowed significant discretion in how to reduce bycatch, provided they achieve the performance standards specified by the Council.

Reflecting on the two co-management strategies employed for managing salmon bycatch, Mr. Henderschedt explained how neither strategy could have been successfully implemented solely through regulations and noted the benefits and limitations of the two approaches. The exemption afforded through participation in rolling closures is slow to adapt given the prescriptive nature of the regulations; however, this level of detail provides a more transparent process as specific management strategies are analyzed and outlined in publically available analytical documents. The IPAs are more adaptive given the discretion afforded to industry in determining how best to meet the Council’s performance standards, though the arrangement affords less public transparency given that the regulations do not prescribe or analyze specific management strategies. This is instead accomplished through annual IPA reports to the Council. Looking ahead, the

Council will consider the appropriate balance of regulations and civil agreements when making adjustments or considering new bycatch management strategies.