# Development of a Bering Sea Fishery Ecosystem Plan *7/29/2015*

DRAFT for Ecosystem Committee discussion in August 2015[1]



## 1 Introduction

The Council has been considering whether to develop a Bering Sea Fishery Ecosystem Plan (FEP) since June 2013, including what the objectives might be for a Bering Sea FEP and how the plan could be structured to benefit fishery management decision making. Between February and October 2014, the Council received public input from stakeholders and its advisors, which expressed interest in developing an FEP, although caution about the resources involved. In October 2014, the Council requested the Ecosystem Committee continue work to draft a set of goals and objectives for Council consideration. The Council has not yet committed to tasking of the FEP, but rather has asked the Committee to develop a proposed approach and format for an FEP for a future Council discussion. This preliminary paper has been prepared for the Ecosystem Committee's discussion in August 2015, with the intent that it will be revised to incorporate Committee recommendations before it is presented to the Council.

## 2 Availability of ecosystem information for the Bering Sea

The Bering Sea is one of the most well-studied marine ecosystems in the world. Recent scientific efforts to describe the Bering Sea Ecosystem include publications from the National Research Council (1996), Alaska Sea Grant (1999), and the North Pacific Marine Science Organization (2010). There are annual research programs by the National Marine Fisheries Service, Bureau of Ocean Energy Management (BOEM), and projects funded annually by the North Pacific Research Board (NPRB).

Recently, the NPRB and the National Science Foundation (NSF) completed a multi-year (2007-2013) study of the impacts of a changing climate and dynamic sea ice cover on the eastern Bering Sea ecosystem. This collaborative project, known as the Bering Sea Project, included more than 100 scientists from around the world conducting studies to link climate, physical oceanography, plankton, fishes, seabirds, marine mammals, humans, traditional knowledge, and economic outcomes to better understand the mechanisms that drive this region. The project has resulted in nearly 150 peer-reviewed publications, to date, including three special issues of Deep-Sea Research II, with the fourth special issue on the way. Results are also available as project reports to the NPRB, and as "Project Headlines", two page summaries of each project available on the NPRB website[2].

[1] Prepared by Diana Evans and Steve Maclean (Council staff), and Kerim Aydin, Kirsten Holsman, Ivonne Ortiz, and Stephani Zador (AFSC).

[2] http://www.nprb.org/bering-sea-project/explore-the-science/project-headlines

The data provided by these new and recurring studies are being used to develop models to better describe the dynamics of the Bering Sea ecosystem. These new models may allow resource managers to consider multi-step interactions between exploitable resources and other ecosystem components, including ecological interactions, environmental drivers, human activities, and human wellbeing. Current modeling efforts in the Bering Sea use hind cast models (such as ROMS, NPZ, FEAST) to forecast the effects of management scenarios (FAMINE).

The annual Ecosystem Considerations chapter of the SAFE Report, and the Bering Sea ecosystem assessment (Zador 2014) provide an annual summary of multiple ecosystem and management indicators of the Bering Sea ecosystem. Through the structuring theme of production, the Bering Sea ecosystem assessment focuses in on ten key community-level indicators of ecosystem-wide productivity. Together, these documents allows scientists and managers to track the state of the ecosystem across time.

Other studies have focused on the potential impacts of opening the Arctic, and an increase in transportation through Bering Strait. In 2015, the U.S. Coast Guard (USCG) published a Port Access Route Study (PARS) for the Chukchi Sea, Bering Strait, and Bering Sea. This study was designed to allow the USCG to designate necessary fairways and traffic separation schemes to provide safe access routes for vessels transiting through the Bering Straits region. The 2009 Arctic Marine Shipping Assessment was commissioned by the Arctic Council to address this question, and there have been periodic progress reports to update the assessment since then[3]. The Aleutian Islands Risk Assessment project[4] also tracks the potential increase in Arctic shipping, which also affects the Aleutian Islands, and has developed a number of risk reduction strategies in the follow-up to its 2011 report (AIRA 2011).

# 3 History of Council and public discussions about the FEP

## 3.1 Council / Ecosystem Committee discussions

In September 2014, the Ecosystem Committee held a workshop to discuss recommendations for the Council about initiating a Bering Sea FEP. The Committee identified general objectives for the FEP, as follows:

- Set up a framework for considering policy choices and tradeoffs affecting FMP species and the ecosystem
    - Resiliency of Council management strategies, and options for responding to changing circumstances (e.g., climate change scenarios, changes in shipping patterns, etc.)
    - Evaluation of management tradeoffs – among FMPs, fisheries, or with other activities
- Identify most relevant Bering Sea ecosystem characteristics from a fishery management perspective
- Serve as a communication tool for ecosystem science and Council policy
- Create a transparent public process for Council to identify ecosystem values and management responses

The Committee also began to consider what format the FEP could take, and whether the goal should be a traditional FEP document, or more of a strategic planning process. The Committee was convinced by the PFMC mantra that an FEP should "inform but not overwhelm", and so the goal should not be a huge compilation of material. The Committee also identified that the FEP should be action-informing rather than action-forcing. The FEP should not replace FMPs, but there needs to be clear forethought about how the development of the FEP will affect the Council management process, so that the FEP will be useful

[3] http://www.pame.is/amsa
[4] http://www.aleutianriskassessment.com/

and used in the Council process. Committee members suggested that the FEP should provide specific, actionable metrics. The Committee began to explore a concept of the FEP as a strategic planning document, which forms the umbrella framework for initiating specific analyses or tasks that move forward as and when the Council has the staff resources available to prioritize them.

In October 2014, both the SSC and the Council supported continued development of the FEP by the Ecosystem Committee, including their focus on an approach for an action-informing planning process. The Council and the SSC agreed with the Ecosystem Committee that tactical actions should still be vetted through the existing Council process and incorporated into the FMPs. The SSC noted that the FEP could provide a framework for strategic planning that would guide and prioritize research and modeling. The Council also expressed concerns about staff resources needed for this project in relation to other Council priorities. As such, the Council has not yet committed to tasking of the FEP, but asked the Committee to explore a format and approach for further Council discussion.

The Ecosystem Committee met again in March 2015, to explore the concept of a strategic document describing specific action modules that could be initiated in a priority order and according to the resources of the Council and the agency. The Committee requested that the discussion paper be expanded to provide a strawman example of what the strategic document would contain, the types of action modules that have been suggested to date, and some example action modules that might be developed for the FEP.

### 3.2 Synthesis of public comments

Public comment hearings on the Bering Sea FEP were held in Nome, Seattle, and Anchorage in June, September, and October 2014, respectively. The Council also heard public testimony during their discussion in October 2014. The Council requested the following input from stakeholders:

- What should be the objectives of the Bering Sea FEP? What questions should the FEP answer?
- What kind of actions should be considered in the FEP? Should the FEP provide specific or general guidance for fishery management? (for example, strategies to respond to climate change, preserve subsistence fishing and hunting resources, maintain healthy populations of top level predators, etc.)
- Would the FEP provide added value over existing Council documents, and if so, how? (for example, annual SAFE reports, essential fish habitat descriptions, etc.)

A synthesis of public comments from each venue was prepared and is available on the Council's website[5]. Generally, public comment themes were similar at the various hearings, including broad support for continuing with development of a Bering Sea FEP. The following provides a summary of comments that addressed the process of developing an FEP, goals and objectives for the FEP, and tasks (syntheses, evaluations, research) that might be included within an FEP. There is some overlap between categories.

**Process:**

- The FEP must have a nexus to management action.
- The FEP should be a planning process rather than a plan.
- We need to identify how the FEP fits within Council management.
- FEP planning should take into account concerns raised about staff time and resources.
- The FEP should be a framework for how we move forward/ setting priorities.
- The Council should utilize a tool similar to the PFMC initiative process, to prioritize tasks every couple of years.
- The FEP should focus on procedural objectives in order to achieve ecosystem goals (tools).

[5] http://www.npfmc.org/bsfep/

- The FEP should be a social contract with the public, telling the public how the Council intends to act (a tool for accountability and transparency).
- Now is the time to do an FEP, while stocks are sustainable, as we look ahead at change to come.
- The scope of the FEP should include subsistence and other fisheries (halibut, State) as well as Council FMPs.
- The FEP planning should make a clear statement of what can and cannot be done; it is important to manage expectations.
- The FEP should be developed with close collaboration of Bering Sea communities, subsistence users, and other stakeholders.

**Goals/objectives:**

- Understand and plan for impacts of climate change
- Understand tradeoffs among ecological, social, and economic factors of fishery harvest
- Identify buffers needed to mitigate uncertainty
- Create a cohesive plan for Bering Sea EBFM (rather than current piecemeal approach); define EBFM for the Council
- Undertake precautionary management, and a shifting of the burden of proof
- Prioritize research, management based on ecosystem understanding, identify pathway of research to management
- Identify areas of risk and opportunities to mitigate
- Consider subsistence needs and traditional ecological knowledge
- Define the Council's management process for the broader public (for transparency and accountability – e.g., a social contract). The audience is largely a fishery audience, but the importance of food security is also applicable to a broader audience.
- Balance the different values of Bering Sea user groups

**Tasks:**

- Information on the Bering Sea ecosystem
    - Describe the **function** on the Bering Sea ecosystem, its processes, ecosystem services, baseline information on habitat
    - Identify **human linkages** with the ecosystem
    - Describe Bering Sea **forage fish**, the fisheries, forage fish habitat, and their relationship with the food web
    - MSE investigations regarding what happens when we perturb the ecosystem, how it affects **resiliency**, what are key nodes without functional resiliency
    - Document and collect information on **subsistence**
    - Describe the **values** different user groups have for the Bering Sea
- Compile information on **climate change** and its impacts
    - effects of shipping
    - information on presence of new species (including traditional knowledge)/ winners and losers under different climate scenarios
    - impacts to coast communities (especially small ones with few jobs)
    - research to understand how recruitment relationships will change under a changing climate – where are the thresholds
- Council management
    - Explain the **Council's current ecosystem-based management** (how science is used, adaptive management)
    - **Gap analysis** of the Council's EBM

  - **Risk assessment** of the Council fisheries/FMPs
  - Identify **ecological, social, and economic factors that contribute to optimum yield**, tradeoffs among them, and uncertainty associated with each
  - Develop a framework for **explicit protocols for ecosystem consideration** in TAC setting
  - Develop a framework for an **explicit process to include traditional knowledge** in management
  - **Explore models**/other tools to evaluate the impact of management actions on the ecosystem
  - Evaluate the **effects of fishing** over time on the ecosystem; specific focus on bottom-contact fisheries
- Monitoring/response
  - Identify and monitor **indicators**, including social and economic indicators, and consider in management measures
  - Identify **indicator thresholds** based on Council objectives, that tie to action or at least an alert

# 4 How to structure the FEP as a planning document

The Committee's interest has been to develop an FEP that a) provides added value to existing Council documents and plans, b) does not overwhelm the audience with a compilation of ecosystem information, and c) results in measurable improvements to Bering Sea fishery management, but does not directly authorize management actions. The FEP would be a strategic planning document, identifying Council values and policies, and prioritizes specific actions, analyses, and tasks within a structured framework that both identifies their utility and allows the Council to take staff resources into account.

The core FEP would identify Council's EBM principles, goals and objectives, the role of public involvement in the development of the FEP and resulting decision making, and a description of the framework process for prioritizing and initiating specific tasks under the "umbrella" of the FEP. The FEP could also adopt an operational definition of ecosystem-based fishery management, as a benchmark against which to evaluate the Council's management.

The strategic document might contain the following material:

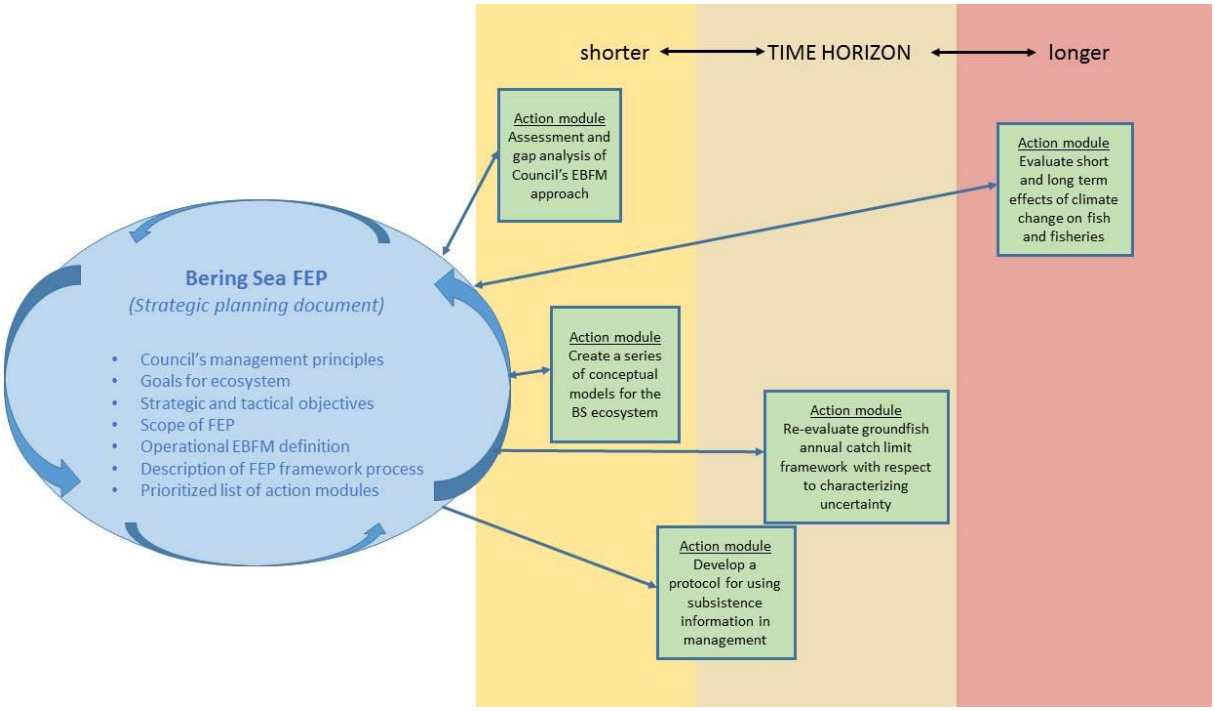
- Council's management principles
- Goals for the ecosystem (e.g., healthy ecosystem, sustainable species levels, etc.)
- Strategic objectives and tactical objectives for managers to achieve those ecosystem goals
- Scope of the FEP (geographical boundaries, fisheries and FMPs encompassed)
- Council's operational EBFM definition
- Description of the FEP as a framework process
- Prioritized list of tasks (research and action modules) to achieve objectives

Final decisions as to the FEP components should wait until the Council has formally initiated the Bering Sea FEP as a Council project, however to help the Council to understand what is intended by the FEP, this paper includes some draft language (in Section 0) with respect to these components.

The FEP would then include a list of action modules that represent specific tactics or tasks relating to the FEP's tactical objectives. The undertaking of and outcome of the tasks would not formally be part of the FEP strategic document, but the task would be described in the FEP, and the Council would be able to

individually initiate specific tasks based on the Council's priorities and available resources. A simple illustration of the relationship of the FEP with example action modules is found in Figure 1.

**Figure 1 Illustration of the relationship between the FEP and draft action modules**




At a minimum, the framework of the FEP would require that for each module, specific questions should be addressed. One of the advantages of the strategic FEP/action module process is that it requires the Council to consider the utility of a project's outcome, its staffing requirements, and how it will be implemented, before it is initiated. By requiring the Council to specify at the outset how the work product will be used in Council decision making, the Council ensures that there is a constant connection between the FEP and direct management action. The potential list of questions to be answered for each action module could include:

1. Synopsis of the task, including how it will be accomplished
2. Estimate of time and staff resources required to achieve it
3. Purpose it will achieve (relationship to the FEP's tactical objectives)
4. How it will affect the Council's decision making and management
5. How it will be implemented in the Council process

We envision that the modules would be a fluid part of the FEP, and would change over time. The Council could decide exactly how action modules would be suggested and adopted into the FEP, but as with other aspects of the FEP development, we anticipate that there would be public involvement in identifying possible action modules, and opportunities for input on how they are prioritized. Once the FEP strategic document is prepared, the Council may wish to initiate a periodic review process to consider whether action modules should be revised, new modules added, priorities changes, or actions initiated.

As with the rest of the content of the FEP document, developing a specific list of individual modules will wait until the Council has initiated the BS FEP, but identifying a plausible list of some FEP modules may help the Council to understand the potential value added of an FEP. Section 0 identifies both a draft

(though incomplete) list of potential action modules, as well as sketching out the 5 question description for a few specific examples.

It is likely that some modules will be run concurrently, while others are more likely to be sequential, as they build on another's outcomes. By identifying the staffing resources required for completing each module, this will also help with staff tasking. Some modules will be largely synthetic exercises, pulling together information from disparate sources to create an evaluation for the Council (e.g., a compilation of information available about climate change impacts, to inform Council NEPA analyses). Others will require more specialist knowledge, and be projects of longer duration. For example, there has been suggestion of developing management strategy evaluations to address the impacts of climate change, with a view to identifying which species are most resilient or vulnerable. These exercises would require AFSC expertise. In fact, each action module will invoke a different cast of stakeholders and agency personnel. Different from the AI Ecosystem Team model, where a single FEP team wrote the entire AI FEP, it is envisioned that there would be a different cast of authors for the different FEP modules. This has the advantage of providing an opportunity for broader participation in the FEP process, and also presents opportunities to involve other stakeholders beside agency personnel in the development of FEP products.

As described above, the action modules would be written so as to focus on a specific outcome for Council management, to ensure a strong connection between FEP work and its utility in the Council process. The modules are an expression of the Council's interests and priorities. It is not expected that the FEP will be the only guideline directing the work of other agencies. For example, even though the Council may not yet have initiated a specific module with respect to understanding the implications of the 2 million metric ton cap, it is expected that NMFS will initiate studies to understand the implications of the cap. The Council's prioritization of action modules provides guidance on Council priorities, and the modules should be specific to actions that the Council will take as an outcome of that task. The FEP will be able to inform research necessary to prepare for Council action modules that have not yet been initiated.

In initiating the FEP, Council may choose to prioritize some action modules for immediate work, at the same time that the strategic document is being prepared. For example, it may make sense to begin work on an assessment of the Council's management with respect to EBFM best practices concurrently, or to begin defining conceptual models of the Bering Sea ecosystem. The Council may choose to incorporate the findings from some action modules directly into the FEP, rather than keeping it as a separate work product.

It is the view of staff that the approach to the FEP proposed by the Committee to date captures all of the process comments that were heard in public comment, and which are captured in Section 3.2.

## 5 How does a Bering Sea FEP add value?

Fisheries management in Alaska has long been recognized as being particularly responsive to ecosystem concerns. It should also be recognized that a significant amount of this work is "bottom-up" science. That is, the Alaska Fisheries Science Center's ecosystem scientists have worked continually and closely with management scientists (i.e. stock assessment authors, Plan Team, and SSC members) since the early 1980s to incorporate ecosystem science into decision-making. The most visible current product of this collaboration is the Ecosystem Considerations report of the groundfish SAFE, presented annually to the SSC and the Council as an immediate prelude to setting quotas on groundfish. With or without an FEP, we expect this strong atmosphere of collaboration to continue.

However, it's important to note that the strong relationships between management and ecosystem scientists, while recognized worldwide as exemplary, often remain informal; for example, the presentation of the Ecosystem Considerations report is wholly dependent on the willingness of the SSC

chair to prioritize the presentations. So a first purpose of the FEP will be to document our current procedures and best practices for EBFM. A single source for this documentation will continue to allow Alaska to lead internationally, formalize any procedures that may need formalization, and set forward policies that are most suited to Alaskan management.

Secondly, the Integrated Ecosystem Assessment (IEA) program emphasizes that best practices for EBFM include developing a shared vision for ecosystem-based management between stakeholders and scientists. Researchers need to develop science that is both timely and actionable for managers, while managers need to be prepared and expected to receive and (as relevant) act on results. The Action Module structure of this FEP ensures that this "handshake" takes place for individual pieces of research before they are conducted, thus setting clear expectations on both sides for any given module or piece of research.

Third, while we are not moving in Alaska from EBFM to full multisector EBM, Alaskan fisheries are increasingly coming into potential conflicts with other sectors (e.g. shipping or oil extraction). In working with other agencies or stakeholders in other industries, it is extremely valuable to have a clear statement of the ecosystem goals and concerns of the fishing sector available and current.

Fourth, the development of work through clear action modules coincides well with the process of Activity Planning that is currently used to prioritize research in the Center. While multiple methods of prioritization exist (e.g. Council Research Priorities), the combination of action plans and activity plans will aid in prioritizing (and allocating) current funds and when seeking future growth.

Finally, the FEP helps ensure that management is flexible, and responsive to changing environmental conditions. It can be used to regularly evaluate management tools (e.g., harvest limits, 2MMT limit, time/area closures) and their effectiveness (especially stationary and static management tools). An FEP also provides a mechanism to regularly incorporate new research and best available science directly into management. Similarly, it would provide a framework to inform new lines of research relevant to management.

## 6 Next steps if the Council decides to develop an FEP

The Council asked the Ecosystem Committee to come back with a fully fleshed proposal for a Bering Sea FEP, for Council discussion. If the Council decides to move forward with an FEP following this discussion, staff would begin undertaking the following steps.

- Begin with the strategic document, including outlining action modules
- Consider whether any of the action modules should be initiated concurrently
- Appoint a Bering Sea FEP Team to develop the strategic document
    - Who should be on it? Think through the tradeoffs between having a manageable size, and having broad representation.
    - AI team had major stock authors, Kerim's group, seabird/ marine mammal/ habitat/ PMEL reps, anthropologist, persons from each of Council's AI plan teams, NPRB, and wanted to have a socio-economist
    - Should it be all agency (as with AI FEP) or others too? AI team structured similarly to a Plan Team. We may not be able to solicit non-government team members without some kind of stipend, unlike agency members. But can we get the right expertise?
    - Need to appoint a chair; chairing and coordinating the team is too much work for a single person
- Consider the Terms of Reference for the Bering Sea FEP Team
    - How will the team interact with the Ecosystem Committee, the Council process, stakeholders (AI Ecosystem Team example – the team developed the FEP content, and

scientific concepts, which were vetted through the Ecosystem Committee for review and policy input)
    - What will be the role of the primary Bering Sea FEP team in relation to the development of specific action modules? For example, would you always try to have at least one or more member of the primary FEP team on any action module subgroup, for continuity? Do the action module teams report to the FEP team, or to the Ecosystem Committee?
    - What is the time commitment we are asking of team members
- Outreach/ public involvement plan for developing the FEP
    - How do we address the need for stakeholder input? Membership on the team? Public comment at team meetings? General outreach meetings and public hearings? Targeted outreach to key stakeholders?

# 7 STRAWMAN - Draft content of the FEP strategic document – EXAMPLE ONLY

As described above, the sections that follow pull together draft text solely as an example of a strategic FEP document, for the purpose of helping the Council's discussion as to the value of initiating a Bering Sea FEP. If the Council chooses to move forward with the FEP, a more deliberative process would be undertaken to write the FEP. This section, and the example action modules that follow, are offered to help the Council get a sense for what an FEP might contain and how it might operate. The sections bring in draft text offered by Ecosystem Committee members, as well as staff's contributions.

## 7.1 An ecosystem-based management approach

The Council recognizes the following statement on ecosystem-based management:

**2005 Scientific Consensus Statement on Marine Ecosystem-Based Management**

> [e]cosystem-based management is an integrated approach to management that considers the entire ecosystem, including humans. The goal of ecosystem-based management is to maintain an ecosystem in a healthy, bio-diverse productive and resilient condition so that it can provide the wide range of services humans want and need. Ecosystem-based management differs from current approaches that usually focus on a single species, sector, activity or concern; it considers the cumulative impacts of different sectors. Specifically, ecosystem-based management:
>
> - emphasizes the protection of ecosystem structure, functioning, and key processes;
> - is place-based in focusing on a specific ecosystem and the range of activities affecting it;
> - explicitly accounts for the interconnectedness within systems, recognizing the importance of interactions between many target species or key services and other non-target species;
> - acknowledges interconnectedness among systems, such as between air, land and sea; and
> - Integrates ecological, social, economic, and institutional perspectives, recognizing their strong interdependences.[6]

Ecosystem-based management of living resources of the oceans has made substantial progress over the past decade by:

1) establishing and showing the effectiveness of marine protected areas (Halpern 2003);
2) building ecosystem resilience and resource sustainability (Levin and Lubchenco 2008), in part by avoiding tipping points and ecosystem state changes (Scheffer et al. 2009, Travis et al. 2014); and
3) adapting management to test and, upon monitoring impacts of management actions, modify further predictive model scenarios of food web dynamics (e.g., Pauly et al. 2000).

Moreover, food web modeling has capacity to guide fisheries management to conserve seabird and marine mammal populations, while sustaining fisheries, by consideration of the important role of forage fishes and by managing their stocks accordingly in an ecosystem-based context by developing and using scientifically sound food web models (Pikitch et al. 2012).

[6] McLeod, K. L., et al., *Scientific Consensus Statement on Marine Ecosystem-Based Management* (2005), *available at* http://www.compassonline.org/science/EBM_CMSP/EBMconsensus.

Specifically in the context of fisheries management, implementing ecosystem-based management requires:

1) recognition that no fish population is independent of other species in the ecosystem;
2) acknowledgement of the presence of and interactions with humans; and
3) use of the best available models of interactions among interdependent ecosystem components to sustain fisheries and conserve all valued components of marine ecosystems.

Significant progress has been made at the Regional Fishery Management Council-level toward implementing ecosystem-based management approaches for fisheries. The North Pacific Fishery Management Council (NPFMC) has been a leader in implementing these approaches including developing fishery ecosystem plans, protecting forage species, basing management choices on reliable science and modeling, and implementing precautionary protection measures. These steps and others made toward ecosystem-based management are of great benefit to the conservation and management of fishery resources. Particularly in light of changing conditions in the ocean, continuing the momentum and progress toward ecosystem-based management approaches is a key to ensuring the long-term sustainability of the nation's fisheries.

### 7.2 Scope of the FEP

Geographical area of the FEP

The geographic area of the FEP is approximated by the eastern Bering Sea LME, excluding the Aleutian Islands west of 169° W. longitude. The area should be defined by biophysical characteristics rather than bounded by the U.S. EEZ, and where appropriate, the geographic boundaries should be relaxed to allow understanding external pressures and drivers that may contribute to the connectivity of the ecosystem with neighboring areas.

The area is consistent with findings from Sigler et al (2011) which identified a distinct, subarctic biogeographic province in the Bering Sea, identified as the Eastern Shelf Province (the eastern Bering Sea shelf, south of Saint Lawrence Island). The area to the north of Saint Lawrence Island is part of an entirely different biogeographic province, and is generally not considered part of the geographic area of the FEP. Within the Eastern Shelf Province, the influence of the cold pool distinguishes central and southern Bering Sea regions, with the boundary following the line of minimum ice extent in March, and in the paper was estimated at approximately 60° N. latitude, although it may bend northwards towards the outer shelf. In the central region, bottom temperatures do not vary much from year to year, whereas in the south (which also includes the whole of the Bering Sea slope area, and where the fisheries mostly occur), temperatures are annually variable. If appropriate, the southeastern area should be prioritized, in a stepwise approach to FEP development.

Fisheries included in the FEP

The scope of the FEP encompasses all Federal fisheries within the area, and considers the interactions of Federal and State fisheries with each other, and with other components of the ecosystem. The FEP encompasses relationships among fisheries, communities, prey and predators of target and non-target species, their habitat, the impacts of climate, and the cumulative impact on ecosystems from all fisheries and non-fishing impacts.

### 7.3 Bering Sea ecosystem goals

One of the significant steps managers can take to move toward ecosystem-based management is to develop and implement Fishery Ecosystem Plans. These plans, though not legally binding, should incorporate explicit principles, policies, and guidelines for ecosystem-based management to be

implemented in Fishery Management Plans, including measures designed to meet the mandates of the Magnuson-Stevens Fishery Conservation and Management Act, other applicable law, and the following goals:

1) Protect, restore, and maintain healthy marine ecosystems, which are ecosystems in which ecological processes, habitats, trophic levels, and productive capacity are comparable to an unexploited system and the diversity of the native flora and fauna is preserved at the genetic, species, and community level;
2) Rebuild, restore, and maintain fish stocks at levels sufficient to protect, maintain, and restore food web structure and function;
3) Conserve habitats for fish and other wildlife;
4) Provide for subsistence, commercial, recreational, and non-consumptive uses of the marine environment;
5) Avoid irreversible or long-term adverse effects on fishery resources and the marine environment; and
6) Provide a legacy of healthy ecosystems for future generations.

### 7.4 Strategic and Tactical Objectives

The following are strategic and tactical objectives for the Bering Sea FEP:

1) Synthesize current scientific understanding of Bering Sea ecosystem processes and status, including fisheries and subsistence use, to inform fishery management.
    - The synthesis should include social and economic considerations, and incorporate traditional and local knowledge.
    - Include an assessment of the food web, that identifies forage species, apex predators, and indicator species; and compiles information from ecosystem and food web models to inform management, to the extent they are available and reliable
    - Include an assessment of marine habitats including information from current management; specific potential risks posed by fishing and non-fishing activities; and identification of important ecological areas and sensitive habitat types;
    - Identification and assessment of the ecological role of target and nontarget species managed by Fishery Management Plans
    - Identification of relevant ecological factors to be considered in determining the Optimum Yield for each species harvested under Fishery Management Plans

2) Implement the Council's Ecosystem Vision Statement and create a cohesive plan for Bering Sea EBFM
    - Adopt an operational definition of EBFM for the Council
    - Define the Council's management process for the broader public (for transparency and accountability). The audience is largely a fishery audience, but the importance of food security is also applicable to a broader audience.
    - Provide a mechanism for incorporating new sources of ecosystem information into Council processes.
    - Prioritize research, management based on ecosystem understanding, identify pathway of research to management
    - Balance the different values of Bering Sea user groups

3) Provide a framework for considering policy options and associated opportunities, risks, and trade-offs as they affect FMP species and the broader Bering Sea ecosystem.
    - Evaluate ecosystem health and areas of risk under novel or intensified stressors, and opportunities to mitigate
    - Recommend how to use ecosystem information to inform decisions for adaptive management
    - Understand and plan for impacts of climate change
    - Understand tradeoffs among ecological, social, and economic factors of fishery harvest
    - Identify buffers needed to mitigate uncertainty
    - Consider subsistence needs and traditional ecological knowledge

4) Refine existing measurable indices for assessing the sustainable management and health and productivity of the Bering Sea ecosystem, including its fisheries and fishing communities.

5) Review and evaluate the direct, indirect and cumulative effects of fishery management actions on the Bering Sea ecosystem (shelf, slope and canyons) to provide a baseline for evaluation of future council actions.
    - Conduct an assessment of cumulative impacts of proposed harvest levels across Fishery Management Plans; and interaction pressures and conditions (e.g., effect of harvest pressure under cold and warm regimes)

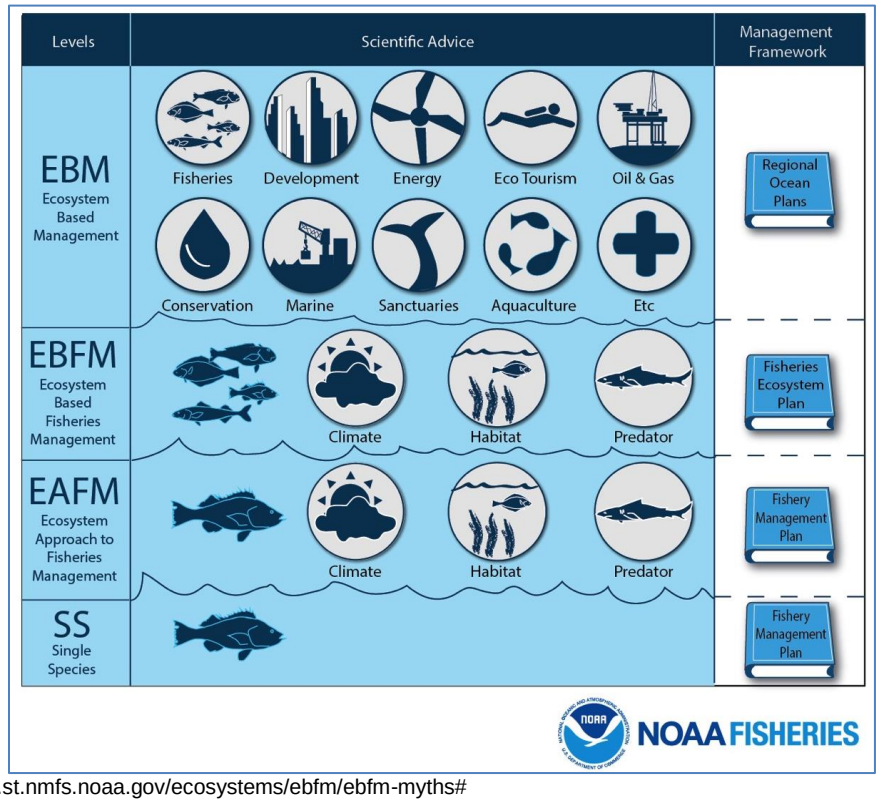
6) Communicate to the public the Council's vision for a healthy Bering Sea ecosystem and sustainable fisheries, and the science and management strategies to achieve that vision.

7) Assure a direct guiding relationship of the FEP with respective FMPs

### 7.5 Operational EBFM definition

In their paper, Link and Brownman (2014) describe EBFM on the spectrum of management philosophies between EBM and single species management (Figure 2). EBM, which may be considered place-based management, necessarily considers and tries to balance trade-offs in multisectoral (sometimes conflicting) mandates that may be acting on system of interest (e.g., between tourism, extraction, shipping, fisheries, land use, and conservation). In contrast, single species management (SSM) is focused on a species of interest but does not specifically consider the species in the context of the broader ecosystem or food-web, or effects of the species-specific managed activities on non-target species per se (usually due to a lack of sufficient data). An Ecosystem Approach to Fisheries management (EAFM), is on the EBM – SSM spectrum, where fisheries management considers the ecological and ecosystem context of the focal species in that habitat, environmental, and trophic considerations are included in the management process. EBFM builds upon EAM while still primarily focused on the fisheries sector. In EBFM, trophic and environmental interactions and cumulative impacts are specifically accounted for in the management process (e.g., using multi-species or environmentally enhanced singles species models, food web-models, coupled physical-fishery-socioeconomic models).

**Figure 2 The spectrum of ecosystem based fisheries management**




Source: http://www.st.nmfs.noaa.gov/ecosystems/ebfm/ebfm-myths#

Both EBFM and EBM are expected to result in more holistic management recommendations that are robust to the nonstationarity characteristic of ecosystem dynamics, which can confound single species management. EBFM has the particular advantage of quantifying the value of marine resources beyond fisheries extraction and provides the management framework for optimizing fisheries productivity and meeting ecosystem-level goals (Fogarty, 2014; Large et al., 2013; Link, 2010; Samhouri et al., 2010).

Operationalizing EBFM could include:

a. Models are maintained with current and up-to-date information and are set up to deliver results in a timely manner so that outputs can feed directly into the management cycle.

b. Regular incorporation of emergent science and tools to address novel challenges and changing conditions.

c. Regular evaluation of management tools, in particular stationary and static management limits in order to ensure that they are effective under changing environmental conditions.

d. Regular collaboration between stock assessment, physical, ecosystem, and socio-economic research scientists through action modules, and periodic ecosystem workshops reviewing new and existing science (assessment).

e. Regular review and evaluation of ecosystem-level science as part of the ongoing stock assessment (in order to evaluate the integration of new science into management).

f. Regular (e.g., annual) quantification of the effects of harvest on both target and non-target marine species and habitats (and interactions) as well as the effects of trophic and environmental processes on target fisheries.

g. Consideration/evaluation of the aforementioned direct and indirect effects on management limits and recommendations (e.g., recommended harvest rates, fishing season, lower and upper harvested biomass limits, and/or exclusion zones of fisheries in the EBS).

### 7.6 FEP framework

The FEP is a strategic plan, with goals and objectives as listed above, and project descriptions for specific action modules related to the FEP's objectives. Each action module is described in the FEP, which will explain the purpose it would serve, the resources required to accomplish it, how it will affect Council decision making, and what is required for it to be implemented in the Council process.

The Council will prioritize these action modules and, if appropriate, initiate them for action, based on consideration of other Council's priorities and available resources. The modules would be a fluid part of the FEP, and would change over time. A process for public involvement in identifying possible action modules will be developed, and opportunities for input on how they are prioritized. The development and outcome of the specific action modules would not be formally part of the FEP strategic document, a reporting and feedback mechanism would be developed to track action modules as part of the FEP document. Once the FEP strategic document is prepared, the Council may wish to initiate a periodic review process to consider whether action modules should be revised, new modules added, priorities changes, or actions initiated.

### 7.7 Ideas for action modules

Below are some initial ideas for action modules that have been suggested by the Committee, staff and stakeholders. Not all of these may be included in the FEP, and it may be that some are developed concurrently with the strategic planning document, and become incorporated into that document, rather than as individual action modules.

- Comprehensive assessment of the Council's Bering Sea management with respect to EBFM best practices (using the adopted operational EBFM definition?) – assessment of successes, and gap analysis of areas to improve
- Define conceptual models of the Bering Sea based on key ecosystem focal points (e.g., groundfish, crab, Norton Sound communities, etc.)
- Synthesis of the Bering Sea ecosystem information from a Council fishery management perspective
- Evaluate the short- and long-term effects of climate change on fish and fisheries
- Evaluate the 2 million metric ton groundfish OY cap in the BSAI
- Re-evaluate groundfish annual catch limit framework with respect to characterizing uncertainty
- Develop ecosystem risk assessment frameworks
- Develop methodology for defining thresholds for key ecosystem indicators
- Describe fishery impact considerations for other agencies to use in evaluating non-fishery activities impacting the marine environment
- Develop a protocol for using subsistence information in management
- …

The sections that follow expand on several example action modules, illustrating how their description might be included in the FEP. For each action module, the FEP would answer five questions about the module's purpose, the resources involved, and how it will affect the Council process. Once the Council

starts initiating and then completing the action modules, we will likely also want to add in additional steps that provide for reporting, review and follow-up mechanisms appropriate to the action module. These will be developed at a later stage.

### 7.7.1 Assessment and gap analysis of Council's EBFM approach against best practices - EXAMPLE

1. Synopsis of the task, including how it will be accomplished

Conduct an assessment of the Council's Bering Sea management with respect to EBFM best practices. Evaluate different sources for a list of best practices, and then evaluate Council management across Council-managed fisheries with respect to the criteria. Also compare Council practice against the Council's Ecosystem Vision Statement, groundfish management approach statement, and, if adopted, the operational definition of EBFM in the FEP. Identify areas of success, and gaps indicating opportunities for improvement. Report the findings of the study in a format that communicates with a diverse audience of stakeholders.

2. Estimate of time and staff resources required to achieve it

The assessment will require a dedicated staff person to spend two to three months compiling the background information and criteria on which to base the evaluation, and making an initial assessment of the Council's management program with respect to each criterion. Once a draft is prepared, the assessment will need input from a variety of stakeholders, ideally through an interdisciplinary team, to ensure that the review accurately captures the state of Council EBFM. Once the assessment is reviewed and finalized, staff time will also be required to turn the findings into a glossy report.

3. Purpose it will achieve (relationship to the FEP's tactical objectives)

This assessment would serve as an internal assessment of the Council's state of EBFM practice, and a gap analysis of areas where there may be opportunity for further action. Such a gap analysis would help to prioritize areas of future work for other action modules. Additionally, the Council has recognized that the FEP could be an effective tool for better communication about the Council's current integration of the ecosystem approach in its management, and developing a report would address that need.

4. How it will affect the Council's decision making and management

On the basis of this study, the Council will have a more informed understanding of the strengths and areas of improvement of its ecosystem approach to management. This will allow the Council to prioritize its efforts with respect to other action modules, and to exercise increased precaution in certain areas if appropriate.

5. How it will be implemented in the Council process

The study itself will not be implemented in the Council process, but by identifying areas in need of Council action, will prompt the Council to initiate an appropriate response, be it a request for more research, or specific analyses.

### 7.7.2 Create a series of conceptual models for the Bering Sea ecosystem - EXAMPLE

1. Synopsis of the task, including how it will be accomplished

Non-quantitative ecosystem "conceptual models" (system diagrams) will be created to each highlight a key ecosystem component (e.g. "groundfish", "crabs", "salmon", "marine mammals", "Norton Sound coastal communities") and detail our conceptual understanding of the pressures and drivers that contribute to the status and trends of that sector. This will allow the scope to be organized from the entire ecosystem

into a set of connected ecosystem components, each one of which may be researched separately or as a whole. For the development of these models, the analysts will consider the appropriate geographic scope, even if it is outside of the Bering Sea ecosystem boundary that is defined in the FEP.

2. Estimate of time and staff resources required to achieve it

The development of the models will require an interdisciplinary and interagency team of scientists, and a graphic designer or scientist with exceptional graphic design skills. The time commitment will vary based on how many different models are determined to be most useful.

3. Purpose it will achieve (relationship to the FEP's tactical objectives)

It is envisioned that using these conceptual models to frame the scope will greatly improve the targeting of specific research, as well as ensuring that no critical components are missed. These conceptual models will also serve to synthesize ecosystem information for the Council as well as the public, through inclusion in glossy documents and presentations.

4. How it will affect the Council's decision making and management

By illustrating connections among ecosystem components, both environmental and human, the models will help the Council in assessing tradeoffs of management actions on different components of the ecosystem, leading to more informed decision making.

5. How it will be implemented in the Council process

It may be that the conceptual models are most effective integrated into the FEP strategic document.

#### 7.7.3 Evaluate the short- and long-term effects of climate change on fish and fisheries - EXAMPLE

1) Synopsis of the task, including how it will be accomplished

- Develop a climate assessment team to model physics to fish and evaluate socio-economic impacts of climate change on Alaskan ecological and human communities.
- Run projections of ROMS/NPZ model under future climate scenarios.
- Evaluate potential changes in the biomass and distribution of fish species under future climate change.
- Evaluate ecological and economic outcomes under various harvest strategies.
- Identify the risk of species and fisheries (economic) collapse under various climate x harvest scenarios.
- Evaluate trophic impacts of harvest under climate scenarios using climate enhanced single and multispecies stock assessment, food-web, and end to end models.
- Use the risk profiles above to identify optimal harvest rates that balance yield and risk under future climate scenarios.

2) Estimate of time and staff resources required to achieve it

One to two years for full MSE; 1-2 physical modelers (12 mo), 1 NPZ modeler (12 mo), 2-3 fisheries modelers (12 mo), 1-2 socioeconomic modelers (12 mo), 1-2 fisheries biologists to evaluate/identify potential effects of future climate on fish life history, ecology, and habitat (3 mo).

3) Purpose it will achieve (relationship to the FEP's tactical objectives)

Consider the direct and indirect effects of climate and harvest under differing climate conditions.

4) How it will affect the Council's decision-making and management

It depends on the result of the analyses. Analyses may validate annual and adaptive management (status quo). Analyses may also suggest altering harvest area boundaries and implementing novel protected areas.

5) How it will be implemented in the Council process

Various MSE (management strategy evaluations) will provide risk profiles or risk tables of target and non-target species (and ecosystem processes) associated with various management options and climate conditions (e.g., static no-fishing areas vs new or altered exclusion or fishing zones, etc.). This information can provide the scientific basis for council recommendations and limits.

### 7.7.4 Evaluate the 2 million metric ton groundfish OY cap in the BSAI - EXAMPLE

The 2 million metric ton OY for the BSAI has been in place for over 30 years, and no formal analysis of its use and effectiveness has been conducted. Establishing ecosystem-level OYs is a stated goal of other regions' EBFM efforts, and no ecosystem has been under such a cap for as long as the Bering Sea/Aleutian Islands.

1) Synopsis of the task, including how it will be accomplished

Using the food web model of the Bering Sea created by Aydin et al. (2007), the researchers will test a set of alternate OY rules on past conditions, applying historical recruitment residuals to simulate populations from 1977-present under different OY regimes. The resulting "alternate current states" of the ecosystem will be used to quantify "present day" ecosystem metrics for several OY choices.

2) Estimate of time and staff resources required to achieve it

Approximately 6 months of AFSC FTE time (expert modeler) and 1 year of research scientist (postdoc) time.

3) Purpose it will achieve (relationship to the FEP's tactical objectives)

It will specifically offer a set of alternative methods of calculating the OY cap (both fixed and variable) and present the resulting different "ecosystem states" to allow the methods to be evaluated as to the success/failure of the alternative management policies.

4) How it will affect the Council's decision making and management / How it will be implemented in the Council process

In the BSAI Groundfish FMP, it is written into law that the 2 million mt OY cap may not be exceeded. Therefore, if alternative methods for calculating the OY upper limit suggest that it may be set higher than 2 million mt, there is no mechanism for the Council to implement such a change. The Council does have the ability to redefine OY, within the constraint of the 2 million mt limit, and the exercise of evaluating how different ecosystem states may affect optimum yield could still prove to be useful to the Council in considering harvest specifications for groundfish species.

### 7.7.5 Develop a protocol for using subsistence information in management - EXAMPLE

Subsistence use of marine resources has been a part of the Native Alaskan's relationship with the Bering Sea for thousands of years. In recent years, the potential impacts of commercial fisheries on subsistence resources or use patterns have received increasing attention. Organizations such as the Alaska Marine Conservation Council and the Bering Sea Elders, and Pew Charitable Trusts, Oceana, and Kawerak, Inc. have begun working to describe and document the subsistence use patterns of Alaska Native communities

in the Bering Sea region[7]. These traditional use data are now available in map and GIS formats that allow managers to evaluate them for potential conflicts with commercial fisheries. Now, the North Pacific Fishery Management Council is interested in understanding the ways that removals from commercially important fish stocks may affect the subsistence resources important to Native Alaskan communities, or affect the resource use patterns of those communities.

1. Synopsis of the task, including how it will be accomplished

A Bering Sea Fishery Ecosystem Plan provides opportunity for the NPFMC to prescribe how subsistence use and other traditional data will be used to describe and understand the potential impacts of commercial fisheries on subsistence resources and use and, if appropriate, mitigate those potential impacts to ensure that subsistence use of marine resources continues unabated in the Bering Sea. Where subsistence use data are available, they can be incorporated into models that predict fishery behavior or responses to changes in conditions or regulations. Where the potential for conflict (methods to be determined later) exists, that potential can be evaluated and mitigation measures proposed, where necessary.

2. Estimate of time and staff resources required to achieve it

The major hurdle to incorporating traditional use data into management decisions has been the collection of data and preparation of data products. The Northern Bering Sea Mapping Project and Bering Strait Marine Life and Subsistence Use Data Synthesis are two products that have made subsistence use and subsistence species occurrence data available to fishery managers. The collection and preparation of these data products are major undertakings that the NPFMC is not staffed to accomplish. The NPFMC will, therefore, continue to rely on other organizations to collect and prepare subsistence data. To develop the subsistence module of the FEP, it is likely that the NPFMC would need to develop a partnership with Native Alaskan organizations (Kawerak, Bering Sea Elders…), organizations that are familiar with subsistence data (Pew Charitable Trust, Oceana, AMCC…), social scientists, and agency scientists to ensure data quality and ensure that data and products are in a form that is useful to fishery analysts. This would likely be a 6-12 month process to collect existing data, and a smaller recurring commitment to maintain the dataset. Once the data are in a format (GIS, maps, other?) that can be accessed and used by analysts, there would be little commitment of NPFMC time or staff resources to incorporate the data into analyses. Some regular staff time would be required to update descriptions in the FEP.

3. Purpose it will achieve

The subsistence module of the Bering Sea FEP will prescribe the way that subsistence data are incorporated into NPFMC analyses, and will describe the circumstances in which measures may be necessary to mitigate potential impacts to subsistence resources, or the use of those resources by Alaska Natives. The FEP will not automatically require mitigation for circumstances where the potential for impacts exist, nor will the FEP limit the sorts of actions that the Council may take. Rather, the FEP will provide a roadmap for the Council to follow to assess the likelihood of impacts and develop mitigation measures should they be necessary.

4. How it will affect the Councils decision-making and management

The subsistence module of the Bering Sea FEP, once completed, will affect the Council's decision-making by directly providing an assessment of the likelihood that a Council action would affect subsistence resources or the ability of Native Alaskans to access those resources. The subsistence module would provide ready access to subsistence data for use in analyses, and provide a guideline for when mitigation may be necessary. Management measures may be changed by consideration of subsistence

[7] Northern Bering Sea Mapping Project available at http://www.akmarine.org/fisheries-conservation/protect-habitat/northern-bering-sea-initiative/ and Bering Strait Marine Life and Subsistence Use Data Synthesis available at http://oceana.org/publications/reports/the-bering-strait-marine-life-and-subsistence-data-synthesis.

data, but there are likely to be many circumstances when subsistence resources or subsistence use would not be affected by a management decision. Where management measures may be changed, the Council may, ultimately, be more responsive to National Standard 8, when fishing communities also rely on subsistence resources.

5. How it will be implemented in the Council process

The subsistence module of the Bering Sea FEP will provide a framework, and data for analysts to consider whether fishery activities or changes in regulation are likely to impact subsistence resources or patterns of subsistence use. It is anticipated that incorporating subsistence data in to the Council process would involve adding a section to future analyses. Some actions would require no additional section, for other actions the additional section could be much longer and more involved. If included in the discussion paper and preliminary draft stages, it is likely that subsistence data would be considered during the development of alternatives, and impacts to subsistence resources or use would be considered throughout the Council process.

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## Attachment 1: Experiences and lessons learned from the Aleutian Islands FEP

In 2005 to 2007, the Council developed and adopted an Aleutian Islands Fishery Ecosystem Plan (NPFMC 2007a). The goal of the AI FEP was "to provide enhanced scientific information and measurable indicators to evaluate and promote ecosystem health, sustainable fisheries, and vibrant communities in the Aleutian Islands region". Through the AI FEP, the Council experimented with the concept of FEPs, to see whether they could be a useful tool for fishery management. The Council purposely selected the Aleutian Islands ecosystem area because it is the least predictable of the ecosystems in which the Council manages, and therefore the Council might be in need of non-traditional tools. Additionally, the AI is managed jointly with the Bering Sea for groundfish, and the Council wanted to consider whether area-specific management was warranted.

The FEP was written by an interagency team, the Aleutian Islands Ecosystem Team, appointed by the Council. Members represented various scientific disciplines and different agencies (although most members were from NOAA, and especially the Alaska Fisheries Science Center). The Council's initial invitation letter suggested that the time commitment would be for approximately ten work days over the period of a year, including two team meetings. In actuality, most of the participants invested considerably more of their time on the project.

**Contents of the AI FEP**

- Synthesized AI ecosystem processes: what do we know about the AI ecosystem
    - The resulting document successfully described and synthesized the main ecosystem processes and interactions in the Aleutian Islands ecosystem, using available information from multiple sources.
- Identified key interactions and relationships: what should we understand and monitor as fishery managers
    - The document provides an understanding of the AI ecosystem by highlighting historical perspectives, and the physical, biological, socioeconomic, and management relationships of the area.
- Qualitative risk assessment of interactions: how to prioritize concerns
    - A qualitative ecosystem risk assessment then identifies key ecosystem interactions relevant for fishery management, and how risk associated with these interactions is currently addressed by managers.
- Discussed management implications: what is the Council already doing / what more might be done to mitigate risks?
    - A discussion of what else might be done to address any risk, the indicators that could be used to monitor the interactions, and priority data gaps and research needs are also identified.
- Research and data gaps

**Has the AI FEP been effective as an EBFM tool? Yes – examples:**

- Evaluations of AI ecosystem have been used in some Council analyses
    - A key finding of the FEP is that interactions and relationships within the AI area are clearly distinct from neighboring systems of the Bering Sea and Gulf of Alaska, and that this should be recognized in fishery management. Information synthesized in the FEP has been used by the Council in some discussions of area specific stock assessment, or other analyses (most recently, the Steller Sea Lion EIS).
- FEP selection of indicators was beginning of AI ecosystem assessment process
    - As described above, the FEP began the process of filtering useful indicators for the AI ecosystem, relating them to the key interactions identified in the document. This work was continued by the AFSC, with participation by the AI Ecosystem Team, after the FEP

was adopted, and has been used to develop an AI ecosystem assessment as part of the annual Ecosystem Considerations report.

- 20 page overview brochure has been a tool for science communication
    - As a companion to the ~200 page FEP, the team prepared a 'glossy' overview of the AI FEP (NPFMC 2007b), which summarized the key information in ~20 pages. Information in the overview pamphlet has been widely shared among stakeholders and further afield.
- Alaska Marine Ecosystem Forum created to discuss with other agencies the effects of all activities on the marine ecosystem
    - The FEP also highlighted the influence of non-fishing activities on the AI ecosystem, and the Council's development of the Alaska Marine Ecosystem Forum, as a venue to communicate with other agencies about issues affecting the marine ecosystem, was partially driven by discussions generated by the AI FEP.

**But there have also been challenges in making it effective**

- No direct management action outcome included, so where does the Council go from here?
    - The FEP was, however, consciously designed as a guidance document and resource to the Council, rather than a document with legal standing, such as a fishery management plan (FMP). The intent was that all management actions would continue to be analyzed through the regular Council process, but would be informed by the FEP. The FEP design purposely omitted an avenue leading to direct management action.
- Ad hoc use of FEP by team members/ others, but not a mainstream resource
    - The document was intended to provide information to the Council process at every level: stock assessment scientists, FMP teams, the Council's SSC and Advisory Panel, and the Council itself. In practice, information from the FEP has been used in an ad hoc fashion, largely at the instigation of members of the interdisciplinary team in their other work.
    - Much of the discussion by members of the Aleutian Islands Ecosystem Team since its adoption has been about how to improve the relevancy of the FEP in the management process.

**AI FEP lessons learned**

- Need clear pathway for FEP information to feed into the Council process
    - What is the objective of FEP for fishery managers?
    - How will it be used in the current fishery management process, or how will it change the process?
- Consider the intended time frame for FEP information – will resources be available and prioritized to keep it updated and useful?

## Attachment 2: Reconciling Committee FEP objective drafts

The Ecosystem Committee asked staff to work with two drafts of suggested objectives for the FEP. We found it helpful to create the following table, identifying similarities among the tasks or objectives suggested in the drafts, in public comment, and during the March 2015 Ecosystem Committee presentations. This is a shorthand table; omissions are not intended to indicate any disinterest on the part of the attributed party.

| | AFSC March 2015 presentations | JA draft | BT draft | Public comment |
|---|---|---|---|---|
| **Bering Sea ecosystem information** | • Conceptual models of focus species or user groups<br>• Identifying resiliency | • Description of ecosystem<br>• Food web assessment<br>• Habitat assessment<br>• Ecological role of target/non FMP spp | • Synthesis of ecosystem knowledge | • Function<br>• Forage fish<br>• Human linkages<br>• Subsistence<br>• User values<br>• Resiliency |
| **Climate change** | • Impact models/ MSEs | | | • Shipping<br>• Species shifts<br>• Thresholds of recruitment change<br>• Coastal communities |
| **Council management** | • Ecological risk assessment<br>• Impact models | • Ecological factors in OY<br>• Cumulative impacts of removals (cross-FMP) | • Communication tool<br>• Bringing new eco info into mgmt<br>• Impacts on ecosystem | • Explain Council's EBFM<br>• Gap analysis<br>• Risk assessment<br>• Explicit re OY factors and their uncertainty<br>• Protocols for ecosystem considerations in harvest specs<br>• Protocol for TEK in mgmt<br>• Impacts model/ effects of fishing |
| **Monitoring/ Response** | • Indicators<br>• Thresholds | • Indicators | • Indicators | • Indicators<br>• Thresholds |