Bering Sea Fishery Ecosystem Plan

North Pacific
Fishery Management Council
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Photo credits:

Bering Sea wave – Elizabeth Siddon
Bering Sea canyon habitat – Steve MacLean
Birds on boat – Taken on 2009 BSIERP cruise on R/V Knorr
Vessels in winter – Mark Fina
St Paul – Stev Weidlich
Crab fishermen – Hermann Savikko

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Executive Summary

Fisheries management in Alaska has long been recognized as being particularly responsive to ecosystem concerns. The North Pacific Fishery Management Council (Council) has practiced an ecosystem approach for many years. The Alaska Fisheries Science Center (AFSC) has worked closely with the management process (i.e., stock assessment authors, Plan Teams, SSC and Council members) since the early 1980s to incorporate ecosystem science into decision-making. The Council has adopted harvest conservation measures, protection measures for ecosystem resources, and has adopted ecosystem-based policy goals for its groundfish Fishery Management Plans (FMPs). Nonetheless, while these strong relationships between management and ecosystem science in Alaska are recognized worldwide as exemplary, they often remain informal.

At the same time, the Bering Sea is experiencing significant environmental changes. With the loss of sea ice, the ecosystem is undergoing shifts in species distribution that affect fisheries and fishing communities, and which may have sustainability implications for all marine species. Understanding connections among species, humans, and the physical environment within the Bering Sea and throughout surrounding areas is increasingly important. Further, designing, testing and transparently implementing environmentally-robust management systems that account for a full range of ecological and human interactions will be critical to ensuring long-term resource sustainability.

Accordingly, the Council has formalized its ecosystem approach in the Bering Sea as ecosystem-based fisheries management (EBFM) through the development of this Bering Sea Fishery Ecosystem Plan (BS FEP). The Council has acknowledged that moving toward EBFM is a process and as new information or tools become available the Council responds by improving the fishery management program. The BS FEP serves as a framework for continued incorporation of ecosystem goals and actions in regional management. Under the overarching guidance of the Council's Ecosystem Approach Statement, the BS FEP sets goals and objectives for the Bering Sea ecosystem which direct the process by which the Council should manage fisheries, monitor the ecosystem, and prioritize new research through identification of projects, called "Action Modules". This document describes how the BS FEP functions as a framework for transparently describing the Council's current procedures and best practices for EBFM, and guiding Council work on ways to improve that process. The BS FEP also prioritizes the exchange of information through two-way communication with stakeholders, as a means of diversifying information inputs, knowledge, and perspectives. The Council's BS FEP:

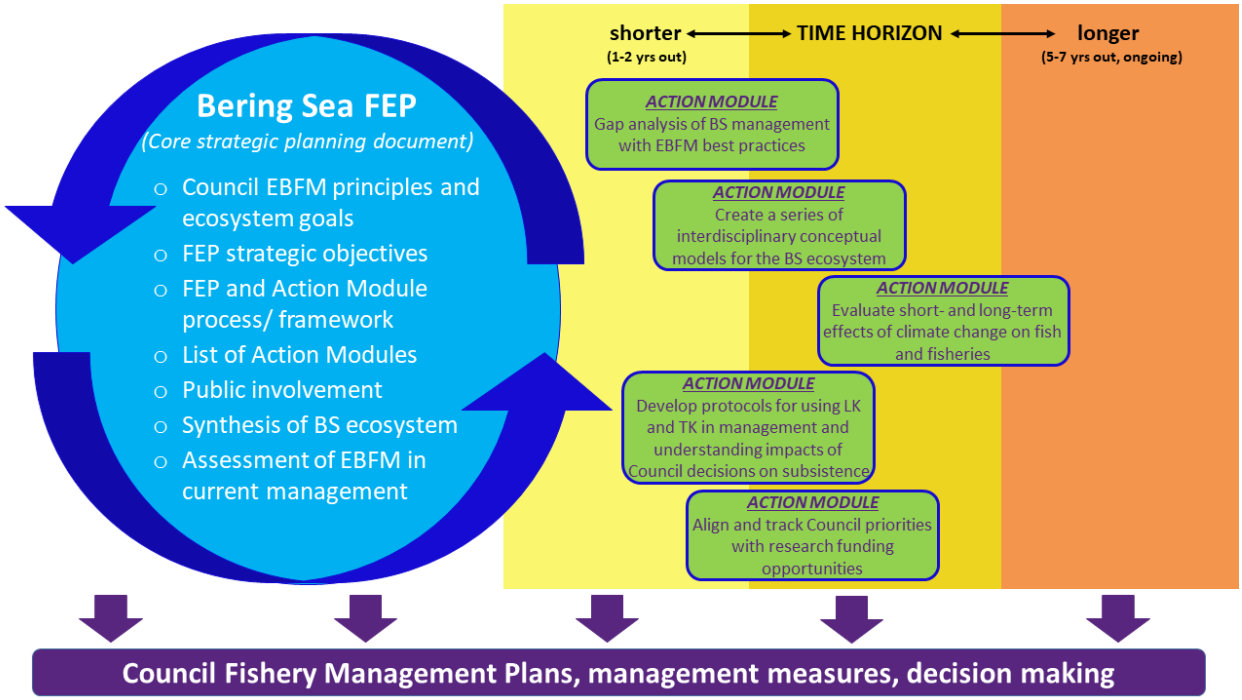
1. provides added value to existing Council documents, processes, and decision-making;
2. delivers targeted, evolving ecosystem evaluations but does not overwhelm the audience with a compilation of ecosystem information; and,
3. facilitates measurable improvements to Bering Sea fishery management but does not directly authorize management actions (action-informing rather than action-forcing).

How will the Bering Sea Fishery Ecosystem Plan function?

This BS FEP uses and improves upon the Council's existing open and transparent process of public involvement in decision making. This is a strategic planning document that describes a process for addressing management concerns about the Council's expressed ecosystem policy and goals and is flexible to new information and changing resources. The BS FEP is structured with a Core BS FEP identifying a series of strategic components for the BS FEP (Figure ES-1). **The Core BS FEP identifies goals for the Bering Sea ecosystem and strategic objectives for the BS FEP to achieve those goals.** There are sections describing the purpose and structure of the BS FEP and assessing the Council's current management approach to establish a baseline for ecosystem-based management elements. A close connection is intended between the Core BS FEP and the annual Ecosystem Status Report for the Bering Sea (also known as the Ecosystem Considerations Report), which will be the annual vehicle for the

Council to monitor the status of the Bering Sea ecosystem compared to BS FEP objectives. The BS FEP includes information about public involvement and methods for the Council to bring information into management from those people closest to the resource, including through local knowledge and traditional knowledge (LK and TK).[1]

Figure ES-1 Illustration of the relationship between the Core Bering Sea Fishery Ecosystem Plan and example Action Modules



The BS FEP forms a framework to regularly evaluate and initiate Action Modules to address Council priorities. **Action Modules are specific projects that can be initiated within the framework of the BS FEP but are analyses or research efforts with their own scope, tasking, and timeline.** The Action Modules are linked directly to the BS FEP's strategic objectives, and the purpose and scope of each task, as well as a description of how the outcome will be used in management, is defined in the Core BS FEP. Action Modules should be designed to focus on a specific Council need, and to ensure a strong connection between BS FEP work and its utility in the Council process.

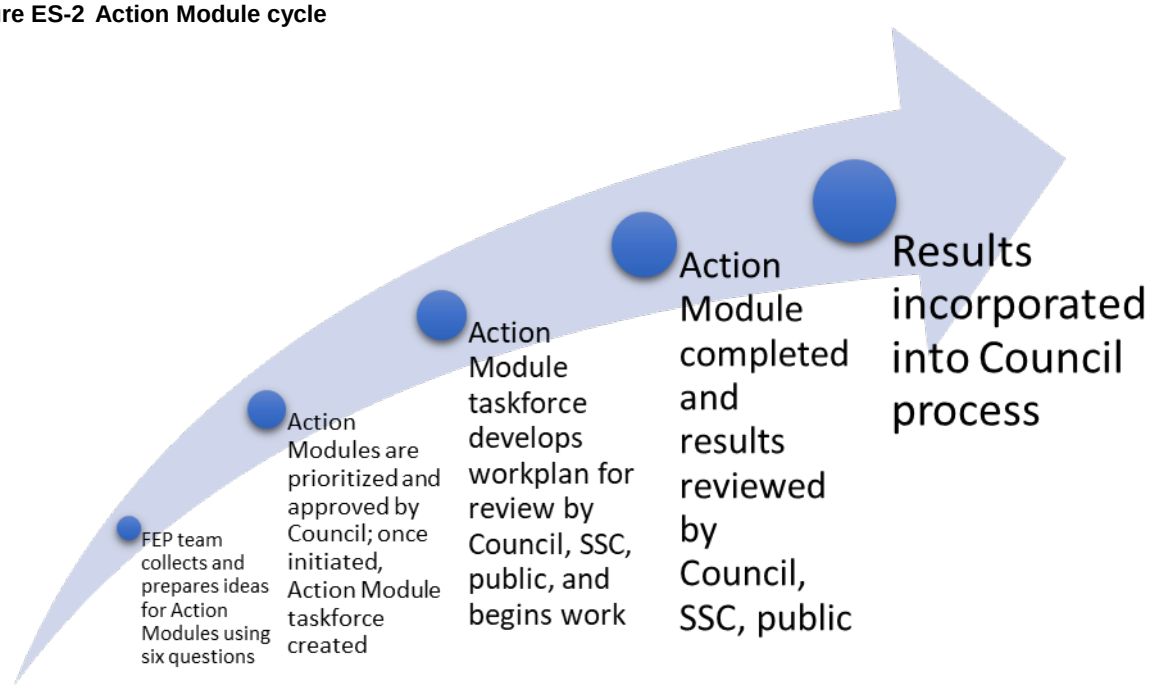
Figure ES-2 provides an overview of how an Action Module moves through the Council BS FEP process. While ideas for an Action Module could originate with the BS FEP Team, the Council, its advisory bodies, or with the public, only the Council can approve an Action Module to be included in the BS FEP. From the approved list, the Council also has the flexibility to decide when to initiate work on each Action Module, depending on the Council's interest, needs, or resource constraints. By providing the list and prioritization, however, even without immediately initiating work on an Action Module, the Council is signaling the specific topics it is considering both now and into the future, which is helpful to research partners.

[1] Local Knowledge (LK) and Traditional Knowledge (TK) are two different types of bodies/systems of knowledge. LK generally describes knowledge of a person or group – non-Indigenous knowledge or Indigenous – that is based on observations, experiences, and other engagements with a particular environ. TK is a form of Indigenous knowledge and is a living body of knowledge which pertains to explaining and understanding the universe and living and acting within it. It is acquired and utilized by Indigenous communities and individuals in/through long-term sociocultural, spiritual and environmental observation, and is transmitted intergenerationally. A more detailed definition of TK can be found in Raymond-Yakoubian et al. (2017).

Once an Action Module has been initiated, the Council will designate a taskforce of staff and agency or external experts, as necessary, to develop a workplan, conduct the work, and prepare results for the Council. The workplan will include an explicit public involvement plan, and the Council and its committees (e.g., the BS FEP Team, Ecosystem Committee, Advisory Panel, Scientific and Statistical Committee) will provide input and review throughout each project. As Action Module work is completed, Action Modules will be synthesized and evaluated in aggregate by the BS FEP Team, with changes made to the Core BS FEP as appropriate. The BS FEP webpage will track the Action Modules, assessing progress that has been made in each active one, and reviewing findings of previous ones.

Action Modules will be an evolving part of the BS FEP that changes over time to meet novel management challenges and ecosystem pressures. As individual Action Modules are initiated by the Council and eventually completed, they will contribute to broader understandings of the Bering Sea ecosystem, EBFM actions that the Council is undertaking, and the tools available to the Council to make informed decisions.

Figure ES-2 Action Module cycle



Goals and objectives

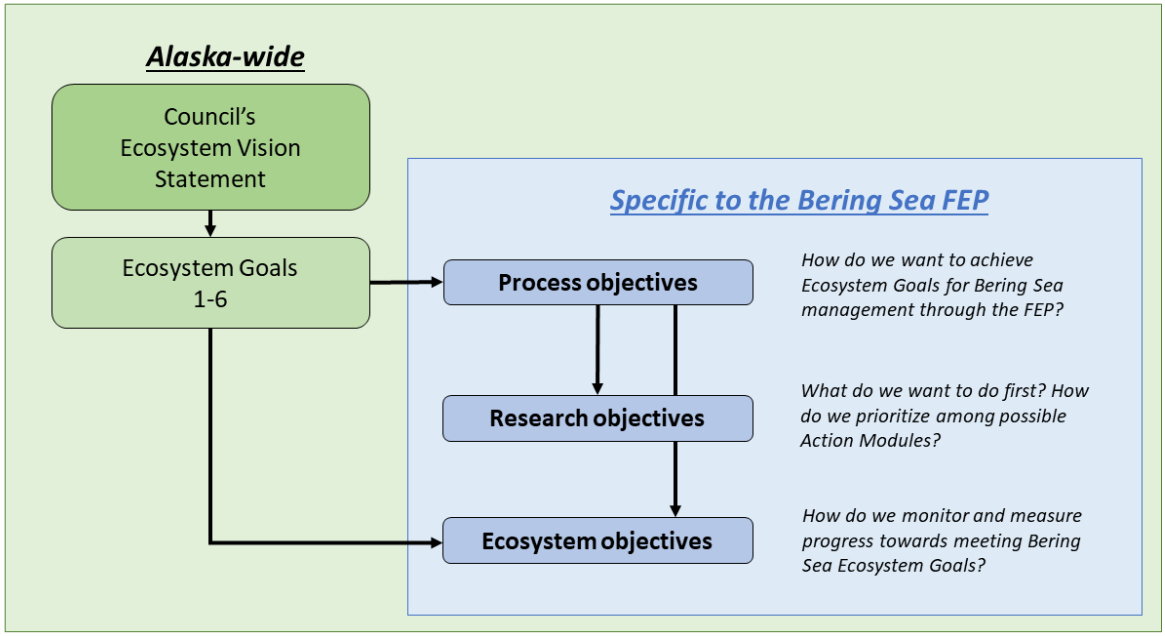
The Council established an Ecosystem Vision Statement in 2014, which overarchingly applies to all Council management in the North Pacific. Through development of the BS FEP, the Council has identified six Ecosystem Goals, which are also universal to the Council's management across all Alaska fisheries. These are:

1. Maintain, rebuild, and restore fish stocks at levels sufficient to protect, maintain, and restore food web structure and function;
2. Protect, restore, and maintain the ecological processes, trophic levels, diversity, and overall productive capacity of the system;
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;
6. Provide a legacy of healthy ecosystems for future generations.

The Council's main purpose with the BS FEP was to create a tool to help enable the Council to achieve the six Ecosystem Goals described above. As such, the BS FEP identifies a series of Process Objectives, which define how the Council aims to manage Bering Sea fisheries (Figure ES-3). Some Process Objectives call for monitoring ecosystem trends and performance metrics, to allow the Council to manage adaptively and responsively to changes in environmental conditions, especially associated with climate change, loss of sea ice, or ocean acidification. To help provide specific targets for monitoring the ecosystem, the BS FEP identifies a series of Ecosystem Objectives that provide specificity as to how the Ecosystem Goals should be translated in the Bering Sea ecosystem. Specific indicators will be associated with each of the Ecosystem Objectives and routinely monitored. An assessment of their status will be reported back to the Council at regular intervals, using the existing Ecosystem Status Report (or Ecosystem Considerations Report) process that is presented to the Council each December.

In addition to the Process Objectives and Ecosystem Objectives, the BS FEP also defines a series of Research Objectives that the Council will use to initiate specific actions to further the overarching Ecosystem Goals. It is expected that Research Objectives will be the most likely to change and evolve as the Council identifies information gaps and research needs, and develops Action Module projects to address objectives under the BS FEP framework (see more on Action Modules in Chapter 3).

Figure ES-3 Schematic of the relationship between the Council's ecosystem goals and the Bering Sea Fishery Ecosystem Plan objectives.



List of Action Modules

Five Action Modules were adopted by the Council in December 2018 when the BS FEP was approved. As part of its adoption of a final BS FEP, the Council prioritized the list of Action Modules, and specifically initiated action on two of them, as listed:

1. Evaluate short- and long-term effects of climate change on fish and fisheries, and develop management considerations — INITIATED
2. Develop protocols for using LK and TK in management and understanding impacts of Council decisions on subsistence use — INITIATED
3. Gap analysis of Bering Sea management with EBFM best practices
4. Interdisciplinary conceptual models for the Bering Sea ecosystem
5. Align and track Council priorities with research funding opportunities

The Council will periodically reconsider the list of Action Modules, their prioritization, and which of them to initiate for action.

Public involvement

The Council recognizes that Bering Sea fisheries are important to coastal communities throughout the Bering Sea region, as well as to communities of people who, while they may reside elsewhere, come to the region to work or are significantly invested in the region (e.g., seasonal fishermen, offshore processors). One intent of the BS FEP is to engage stakeholders and the public in the process of implementing EBFM, so the BS FEP is continually informed by the broadest realm of perspectives and increases public connection with the Bering Sea marine ecosystem. An exchange of information through two-way communication with stakeholders has been highlighted as an important requirement for diversifying information inputs, knowledge, and perspectives (NPFMC 2018). Building shared knowledge can strengthen the Council and stakeholders' understandings of ecosystem function and change, provide insight to anticipate how stakeholders will respond, and develop broad support for fishery management science and decision-making. The BS FEP provides a framework for strengthening trust, transparency, and a sense of shared investment among managers, scientists, and stakeholders.

While the Council's existing framework provides for public outreach and involvement in all Council groups and processes, there is desire to improve that communication and consultation over time. There are three distinct phases of public involvement as relates to the BS FEP, and each phase may draw upon different tools for outreach or engagement.

Initial development of the Core BS FEP: The Council conducted extensive scoping when deciding whether to proceed with developing a BS FEP. The public was encouraged to provide feedback on drafts of the Core BS FEP, whether they met the needs identified in scoping, information gaps that should be addressed through Action Modules, or other input that pertained to the Council's action to adopt the BS FEP.

BS FEP Action Modules: A public involvement plan will be created for each Action Module, including explicit steps for supporting and strengthening two-way communication along with all other forms of involvement (e.g., outreach, engagement, consultation, etc.).

Ongoing BS FEP EBFM process: Now that the BS FEP framework has been adopted by the Council, implementation continues through the development of Action Modules and the monitoring of the Bering Sea ecosystem through the annual Ecosystem Status Report (also known as the Ecosystem Considerations Report). The Council has highlighted two-way communication as critical to enhancing and providing value to the decisions that the Council makes about managing fisheries in the Bering Sea ecosystem, and it will be important to continue considering how best to provide appropriate forums for such information exchange, and how it should be synthesized and assessed in the Council decision-making process.

Other components of the Bering Sea Fishery Ecosystem Plan

The BS FEP includes chapters that provide a high level synthesis of connections and key components of the Bering Sea ecosystem (Chapter 6) and an assessment of the Council's current ecosystem-based fishery management practice (Chapter 7). There is a placeholder in Chapter 8 for a forthcoming ecological risk analysis. Considering risks and tradeoffs is one of the purposes of the BS FEP (there are ongoing studies

at the Alaska Fisheries Science Center that will be synthesized in this chapter once the results are available).

1 Introduction

Fisheries management in Alaska has long been recognized as being particularly responsive to ecosystem concerns. The North Pacific Fishery Management Council has practiced an ecosystem approach for many years. The Alaska Fisheries Science Center (AFSC) has worked closely with the Council management process (i.e., stock assessment authors, Fishery Management Plan Teams, the Scientific and Statistical Committee (SSC), and Council members) since the early 1980s to incorporate ecosystem science into decision-making. The Council has adopted harvest conservation measures, protection measures for ecosystem resources, and has adopted ecosystem-based policy goals for its groundfish Fishery Management Plans (FMPs). Nonetheless, while there are strong relationships between management and ecosystem science in Alaska, which are recognized worldwide as exemplary, they often remain informal.

At the same time, the Bering Sea is experiencing significant change environmentally. With the loss of sea ice, the ecosystem is undergoing shifts in species distribution that affect fisheries, fishing communities, and may have sustainability implications for many marine species. Understanding the connections among species, humans, and the physical environment both within the Bering Sea and with surrounding areas is increasingly important. Further, designing, testing and transparently implementing environmentally-robust management systems that take into account a full range of ecological and human interactions will be critical to ensuring long-term resource sustainability.

Accordingly, the Council has formalized its ecosystem approach as ecosystem-based fisheries management (EBFM) through the development of this Bering Sea Fishery Ecosystem Plan (BS FEP). The Council has acknowledged that moving toward EBFM is a process and as new information or tools become available the Council responds by improving the fishery management program. The BS FEP serves as a framework for continued incorporation of ecosystem goals and actions in regional management. The broad scope and open-ended nature of a FEP lends itself to considering cumulative impacts and tradeoffs across an entire ecosystem, including ecological impacts on habitat or bycatch issues, impacts to communities, and interactions between Federal and state fisheries. Although a FEP is not ‘actionable’ in the way a FMP is, the FEP process encourages thinking ‘outside the box’ about novel solutions to complex problems (Lenfest 2016).

The BS FEP will be used to inform policy options and associated opportunities, risks, and tradeoffs affecting FMP species, communities, and the broader Bering Sea ecosystem in a systematic manner. Under the overarching guidance of the Council’s Ecosystem Approach Statement, the BS FEP sets goals and objectives for the Bering Sea ecosystem which direct how process by which the Council should manage fisheries, monitor the ecosystem, and prioritize new research projects through the identification of Action Modules. This document describes how the BS FEP functions as a framework for transparently describing the Council’s current procedures and best practices for EBFM, and guiding Council work on ways to improve that process. The BS FEP also prioritizes the exchange of information through two-way communication with stakeholders, as a means of diversifying information inputs, knowledge, and perspectives.

The Council’s intent has been to develop a BS FEP bringing together Council FMPs and actions throughout the Bering Sea region in a way that:

1. provides added value to existing Council documents, processes, and decision-making;
2. delivers targeted, evolving ecosystem evaluations but does not overwhelm the audience with a compilation of ecosystem information; and
3. results in measurable improvements to Bering Sea fishery management but does not directly authorize management actions (action-informing rather than action-forcing).

1.1 Purpose of the Bering Sea FEP

The Council has identified the following potential benefits from developing a FEP for the Bering Sea, in the short term and long term:

- Create a transparent public process for the Council to identify ecosystem goals and management responses.
- Guide the Council's implementation of EBFM.
- Serve as a communication tool for ecosystem science and Council policy.
- Provide a framework for strategic planning that would inform and prioritize fishery, habitat, and ecosystem research, modeling, and survey needs.
- Identify connected Bering Sea ecosystem components, and their importance for specific management questions.
- Assess Council management with respect to ecosystem-based fishery management best practices and identify areas of success and gaps indicating areas for improvement on a regular basis.
- Provide a framework for considering policy options and associated opportunities, risks, and tradeoffs affecting FMP species and the broader Bering Sea ecosystem (e.g., evaluation of management tradeoffs among FMPs, fisheries, or with other activities).
- Build resiliency of Council management strategies, and options for responding to changing circumstances (e.g., climate change-driven changes to fish distribution and abundance, changes in shipping patterns, etc.).

The BS FEP provides value by facilitating dialogue and information exchange among stakeholders, scientists, and fishery managers. In the 2014 ecosystem approach statement (see section 2.1), the Council set out a commitment to managing fisheries through a precautionary, transparent, and inclusive process. Public outreach and stakeholder involvement throughout the process helps develop a common understanding of the Bering Sea ecosystem by managers, scientists, and user groups. As such, the BS FEP includes methods for the Council to bring information into management from those people closest to the resource, for example through local knowledge and traditional knowledge (LK and TK).[2] Expanded understandings of existing best available science (including social science) are outlined as well, including best practices for building strong understandings and incorporation of LK and TK in the Council process. Although all of this might also be achieved outside of a FEP, a formal BS FEP provides a framework to coordinate and direct research and outreach resulting in a transparent and efficient mechanism to integrate best available science into management decisions, while maintaining strong communication with stakeholders that are affected by management policies.

While the intention of the BS FEP is to focus on actions within the Council's authority, the Council will also use the BS FEP to promote dialogue with non-fishery authorities about activities affecting fishery resources. The BS FEP framework can also be used to inform new lines of research relevant to management. The value of including individuals who cannot attend Council meetings for various reasons is significant, and by increasing transparency the BS FEP process will make the decision-making process more accessible.

[2] Local Knowledge (LK) and Traditional Knowledge (TK) are two different types of bodies/systems of knowledge. LK generally describes knowledge of a person or group – non-Indigenous knowledge or Indigenous – that is based on observations, experiences, and other engagements with a particular environ. TK is a form of Indigenous knowledge and is a living body of knowledge which pertains to explaining and understanding the universe and living and acting within it. It is acquired and utilized by Indigenous communities and individuals in/through long-term sociocultural, spiritual and environmental observation, and is transmitted intergenerationally. A more detailed definition of TK can be found in Raymond-Yakoubian et al., 2017.

The BS FEP presents a step in the process of EBFM, by allowing the Council to define its information needs with respect to ecosystem considerations in stock assessments and management. The NOAA Integrated Ecosystem Assessment (IEA) program emphasizes that best practices for EBFM include developing a shared vision, or "handshake," for ecosystem-based management between stakeholders and scientists. Researchers need to develop science that is timely and actionable for managers, while managers need to be prepared and expect to receive and (as relevant) act on results. The proposed structure of this BS FEP ensures that this "handshake" takes place early in the process, thus setting clear expectations on both sides for any given analysis or piece of research. Currently, there is a strong atmosphere of collaboration at the AFSC between ecosystem scientists and the management process (see discussion in Chapter 7). A visible product of that collaboration is the Ecosystem Status Report (also known as the Ecosystem Considerations report), presented annually to the Council's SSC and the Council as an immediate prelude to setting quotas on groundfish. Similarly, some stock assessments also directly incorporate ecosystem and climate variables. While this collaboration would continue regardless, the BS FEP provides the Council with greater control over the ongoing transition to EBFM and helps to formalize current ad hoc practices.

The BS FEP provides specific advantages for both the Council and the AFSC by improving communication about management needs and the relationship to research. The FEP process coincides well with the process of Activity Planning that is currently used to prioritize research in the AFSC. While multiple methods of prioritization exist (e.g., the Council's annual Research Priorities), the combination of BS FEP planning and activity plans aids in prioritizing (and allocating) current funds and when seeking future growth.

The Council also believes it is valuable to synthesize our scientific understanding of the Bering Sea ecosystem from a fishery management perspective. The Bering Sea is well-studied, and the Council is not interested in creating a redundant compilation of information that is available elsewhere. Rather, it is useful to develop our understanding of ecosystem connectivity as it may relate to specific fishery management concerns (e.g., the halibut stock, Norton Sound communities, or red king crab spawning habitat in Bristol Bay). The BS FEP builds off the existing Eastern Bering Sea Ecosystem Assessment, which is produced in conjunction with the annual groundfish Stock Assessment and Fishery Evaluation (SAFE) report, and which already synthesizes ecosystem information on an annual basis. BS FEP-relevant findings will be readily incorporated into the existing process.

Another purpose of the BS FEP is to document our current procedures and best practices for EBFM (see Chapter 7). While the Council believes that our current approach is precautionary and effective, documentation is helpful to demonstrate this to the broader public. Additionally, this documentation will allow the Council to conduct a gap analysis (proposed as an Action Module in section 4.1) to have a more informed understanding of the strengths and areas for improvement of its EBFM approach.

Finally, the BS FEP provides a framework to address tradeoff issues that arise, and supplement existing decision-making processes to respond to a range of issues, such as changing environmental conditions, or 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. Under the BS FEP framework, decision tools are developed that allow the Council to evaluate tradeoffs and alternative management policies and tools (e.g., harvest limits, time/area closures) for their performance and effectiveness (especially stationary and static management tools). Thus, the BS FEP helps ensure that management is flexible, responsive, and resilient to ecosystem shifts and changing pressures, and able to continue to support long-term sustainable fisheries harvest in the Bering Sea.

1.2 Background / EBFM theory

NMFS recognizes the importance of considering ecological and human components of any ecosystem during the management process. NMFS defines EBFM as:

> *a systematic approach to fisheries management in a geographically specified area that contributes to the resilience and sustainability of the ecosystem; recognizes the physical, biological, economic, and social interactions among the affected fishery-related components of the ecosystem, including humans; and seeks to optimize benefits among a diverse set of societal goals." (NMFSPD 01-120, 23 May 2016)*[3]

In their paper, Link and Brownman (2014) describe EBFM on the spectrum of management philosophies between EBM and single species management (Figure 4). 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).

Both EBFM and EBM are expected to result in more holistic management recommendations that are robust to the non-stationarity characteristic of ecosystem dynamics, which can confound single species management. EBFM has a particular advantage of quantifying the value of marine resources beyond fisheries extraction and providing a management framework for optimizing fisheries productivity and meeting ecosystem-level goals (Fogarty 2014; Large et al. 2013; Link 2010; Samhouri et al. 2010). Specifically, in the context of fisheries management, implementing ecosystem-based fisheries management requires: recognition that no fish population is independent of other species in the ecosystem; acknowledgement of interdependent biological and human systems; and, use of the best available science (including social science) for understanding interactions among interdependent ecosystem components to sustain fisheries and conserve all valued components of marine ecosystems. EBFM does not require the development of new methods or even necessitate the collection of new data. Instead, it is centered around considering the most comprehensive range of factors possible (qualitative and quantitative), to capture the tradeoffs involved in management decisions (Patrick and Link 2015).

"Implementation of EBFM is not a single large action but rather a series of ongoing and cumulative actions leading to comprehensive management..." (NMFSPD 01-120).

Globally, EBFM of living resources of the oceans has made substantial progress over the past decade in balancing tradeoffs and meeting multiple, sometimes conflicting management objectives for a region (Link 2010; Belgrano and Fowler 2011). Examples include establishing and showing the effectiveness of marine protected areas (e.g., Halpern 2003), building ecosystem resilience and resource sustainability (e.g., Levin and Lubchenco 2008, Link 2010) though anticipating and avoiding tipping points and

[3] It is noted that 'Societal goals' should "consider and include any relevant economic, social, and ecological factors in the context of relating to fisheries and fishery resources."

ecosystem state changes (e.g., Scheffer et al. 2009, Travis et al. 2014), and adapting management to test and monitor impacts of management actions (e.g., Pauly et al. 2000).

In ecosystem-based fisheries management (EBFM), "the point is to not necessarily include more complex data or analytical approaches but rather to be more comprehensive in the range of factors being considered to manage a fishery" (Patrick and Link 2015). One way that the Council intends to become more comprehensive in managing the Bering Sea ecosystem is through the incorporation and integration of local knowledge and traditional knowledge (LK and TK) in fisheries management.

Defining Local Knowledge and Traditional Knowledge (LK and TK)

The BS FEP is part of a 'next generation' of FEPs aimed at assessing tradeoffs between environmental, economic, and social costs and benefits of management decisions (Marshall et al., 2017). As such, this ecosystem plan explicitly includes the human dimension, and aims to continue making forward strides in formalizing the use and review of local knowledge (LK) and traditional knowledge (TK) within and alongside natural and social science in the fisheries management process.

LK broadly includes observations and experiences of local people in a region. LK is the product of knowledge formation and dissemination based on personal, shared and inherited experience (Martin et al. 2007). It is a way of knowing that is connected to a specific place. Bearers of local knowledge are often relatively small groups of people, living in or connected to a common geographic location who actively engage with the environment through local harvest of wild resources. These people may or may not be Indigenous to the area or base their understandings on knowledge that evolves over many generations (PFRCC 2011). In the current Council process LK is commonly utilized in the form of public testimony from skippers, coastal community residents, etc., and stakeholder interactions with Plan Teams.

LK is often recently acquired (over a few generations or less) as compared to TK which is deeply embedded in cultures who have dwelled in a landscape since time immemorial (Berkes 1999:8, Ingold 2000:43). TK refers more specifically to knowledge held by Indigenous people, and is:

> *a living body of knowledge which pertains to explaining and understanding the universe and living and acting within it. It is acquired and utilized by Indigenous communities and individuals in and through long-term sociocultural, spiritual and environmental engagement. [Traditional knowledge] is an integral part of the broader knowledge system of Indigenous communities, is transmitted intergenerationally, is practically and widely applicable, and integrates personal experience with oral traditions. It provides perspectives applicable to an array of human and nonhuman phenomena. It is deeply rooted in history, time, and place, while also being rich, adaptable, and dynamic, all of which keep it relevant and useful in contemporary life. This knowledge is part of, and used in, everyday life, and is inextricably intertwined with peoples' identity, cosmology, values, and way of life. Tradition – and [traditional knowledge] – does not preclude change, nor does it equal only 'the past'; in fact, it inherently entails change. (Raymond-Yakoubian et al., 2017)*

In the Bering Sea ecosystem, LK and TK are relevant for all fisheries sectors and all aspects of fisheries management. LK and TK are relevant to commercial, recreational, and subsistence fisheries issues. For example, LK and TK knowledge holders might be members of remote rural communities that depend on fishing and harvesting activities (e.g., marine mammals, seabirds, ground fish, salmon, and shellfish) for their livelihood as part of the subsistence way of life and might participate in commercial fishing. LK and TK knowledge holders might also be those who are tied to the Bering Sea as commercial fishers who spend considerable time in the region, and are possibly intergenerational participants in the fishery, yet reside part of the year in Pacific Northwest ports such as Seattle or Newport. A comparative description of LK and TK is included in Table 1-1.

Table 1-1 Description of local knowledge and traditional knowledge

Local Knowledge	Traditional Knowledge
• Close environmental observations • Place-based • Empirical • Pragmatic • Often intergenerational	• A living body of knowledge • Acquired through long-term sociocultural, spiritual, and environmental engagement • Defines human – animal reciprocal relationships • Defines human – human kinship and reciprocity • Embodies rules about right conduct that intertwine the pragmatic and spiritual • Transmitted intergenerationally through oral history and ritual • Rooted in time and place, while having wide applicability • Rooted in tradition, while adaptable and dynamic

NOAA Fisheries further recognizes the value of local and traditional ecological knowledge (LEK and TEK) as they relate to EBFM of our Nation's fisheries. *Local ecological knowledge (LEK) generally refers to what people know about the particular environments in which they work or subsist that is acquired through observations and experience* (NOAA, 2007). *Traditional ecological knowledge, or TEK, is the compendium of environmental knowledge Indigenous people have accumulated over numerous generations observing and interacting with the local environment* (NOAA, 2017). Much like TK, TEK involves Indigenous peoples with self-determined ways of life and political sovereignty.

Every Indigenous culture in the Bering Sea region has their own unique TK and TEK system, which may or may not align closely with NOAA Fisheries definitions. More broadly, LEK and TEK may be understood as understandings of the world situated in empirical observations and experience. In the case of TEK these observations and experiences are embedded in an Indigenous cultural context and cannot be separated from it (Usher 2000:186, Nadasdy 1999). Specific Indigenous groups, such as the Inupiat, the Inuit speaking peoples of Northwest Alaska, are tied to knowledge systems such as Inuit Qaujimajatuqangit (IQ), or Inuit knowledge held by those in the northern part of the Bering Sea Region (Collings et al 2017:4). Each of the 12 Inupiaq nations of Northwest Alaska had their own knowledge system (Burch 1998). The same could be shown for Yup'ik and Cup'ik knowledge for those that inhabit the central part of the Bering Sea Region in Western Alaska and Bristol Bay (Fienup-Riordon 1990). The Unangan (Aleut) people of the Aleutian Islands represent the largest east-west span of a single Indigenous culture anywhere on the planet.[4] Inhabiting an island chain of over a thousand miles and a focus on hunting marine mammals by kayak, the Unangan had complex knowledge of weather patterns, animal behavior, and other factors that allowed for success in the Bering Sea region and continue to be a marine orientated culture today (Laughlin 1980: 27, Liapunova 1989, Reedy-Maschner 2010).

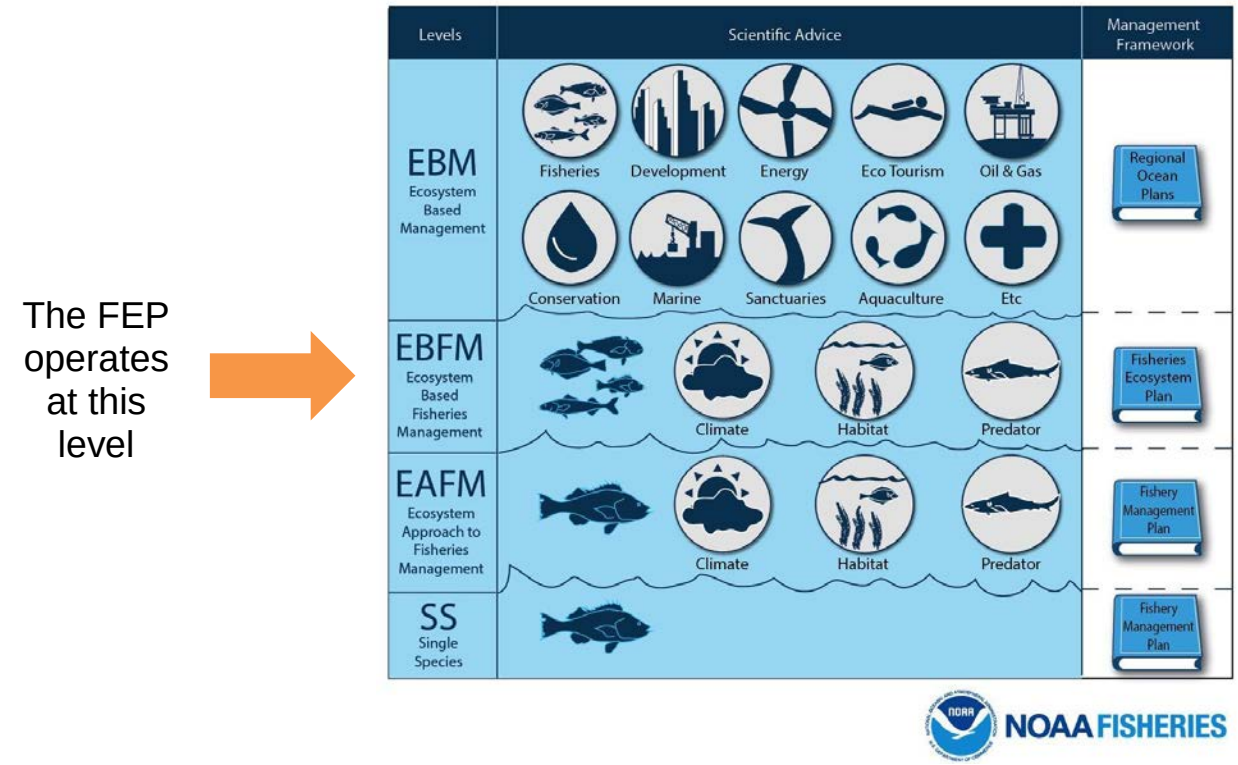
To further expand, LEK and TEK are components of LK and TK, respectively. While the ecological component of LK and TK are of great interest to the Council and its bodies, the Council considers LEK and TEK to be specific versions of LK and TK more broadly. Therefore, 'TK' will be used for most of the remainder of this document to refer to TK, TEK, and other forms of traditional knowledge held by Indigenous peoples in the BS FEP region. 'LK' will be used to refer to LK, LEK, and local fisheries knowledge (LFK) to understand more recent observations and experience by those whose livelihoods depend on the Bering Sea for food security and economic benefit.

[4] After discovery of the Pribilof Islands in 1786 by Russian *promyshlenniki* (Cossack fur trappers and traders), Unangan hunters and their families were forcibly relocated to the islands to hunt fur seals. Descendants of these hunters and their families still make their home on St. Paul and St. George today (Langdon 2014:37).

Tools for implementing EBFM regionally

Regionally, significant progress has been made at the Regional Fishery Management Council-level toward implementing EBFM and EAFM. The North Pacific Fishery Management Council (NPFMC) has been a leader in implementing these approaches including developing a fishery ecosystem plan, protecting forage species, basing management choices on reliable science and modeling, and implementing precautionary protection measures. The resources of the Bering Sea cross multiple jurisdictions, and effective governance of the BS region requires regional and international cooperation in research, enforcement, and management. The importance of regional and international partnerships increases as species distributions and predator-prey relationships respond to a changing climate. Section 6.1.2 highlights several of the partnerships, international treaties, and interjurisdictional efforts that aim to collectively study and manage shared Bering Sea resources. These steps and others 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.

Figure 1-1 Spectrum of ecosystem-based fisheries management



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

FEPs are a tool to assist in the process of operationalizing EBFM approaches (Lenfest 2016). FEPs can outline a process to consolidate information to better understand linkages and tradeoffs between environmental, economic, and social aspects of fisheries ecosystems in the long term (Marshall et al. 2017). Lenfest (2016) produced a conceptual model for translating FEP goals into action, named 'The FEP Loop' (Figure 1-2), visually represented as a nonlinear process based on learning and adjusting over time. The Loop recommends five considerations be re-assessed on a continuing basis throughout the FEP process: 1) Where are we now? 2) Where are we going? 3) How will we get there? 4) Implement the plan, and 5) Did we make it? This approach provides a useful model for the BS FEP process, which complements the Council's existing EBFM processes while providing an opportunity to continually adapt and improve in response to changing environmental conditions and stakeholder feedback.

Figure 1-2 The FEP Loop

Source: Lenfest 2016, page 23

2 Goals and objectives

2.1 Council's Ecosystem Approach

In February 2014, the Council adopted an Ecosystem Approach document that expressed the Council's intent to continue moving towards EBFM:

> **Ecosystem Approach for the North Pacific Fishery Management Council**
>
> ***Value Statement***
>
> The Gulf of Alaska, Bering Sea, and Aleutian Islands are some of the most biologically productive and unique marine ecosystems in the world, supporting globally significant populations of marine mammals, seabirds, fish, and shellfish. This region produces over half the nation's seafood and supports robust fishing communities, recreational fisheries, and a subsistence way of life. The Arctic ecosystem is a dynamic environment that is experiencing an unprecedented rate of loss of sea ice and other effects of climate change, resulting in elevated levels of risk and uncertainty. The North Pacific Fishery Management Council has an important stewardship responsibility for these resources, their productivity, and their sustainability for future generations.
>
> ***Vision Statement***
>
> The Council envisions sustainable fisheries that provide benefits for harvesters, processors, recreational and subsistence users, and fishing communities, which (1) are maintained by healthy, productive, biodiverse, resilient marine ecosystems that support a range of services; (2) support robust populations of marine species at all trophic levels, including marine mammals and seabirds; and (3) are managed using a precautionary, transparent, and inclusive process that allows for analyses of tradeoffs, accounts for changing conditions, and mitigates threats.
>
> ***Implementation Strategy***
>
> The Council intends that fishery management explicitly take into account environmental variability and uncertainty, changes and trends in climate and oceanographic conditions, fluctuations in productivity for managed species and associated ecosystem components, such as habitats and non-managed species, and relationships between marine species. Implementation will be responsive to changes in the ecosystem and our understanding of those dynamics, incorporate the best available science (including local and traditional knowledge), and engage scientists, managers, and the public.
>
> The vision statement shall be given effect through all of the Council's work, including long-term planning initiatives, fishery management actions, and science planning to support ecosystem-based fishery management.

2.2 Ecosystem Goals

The BS FEP, though not legally binding, incorporates 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 six established 'Ecosystem Goals' (Figure 2-1). The Ecosystem Goals are listed below, and are not prioritized in any particular order:

1. Maintain, rebuild, and restore fish stocks at levels sufficient to protect, maintain, and restore food web structure and function;
2. Protect, restore, and maintain the ecological processes, trophic levels, diversity, and overall productive capacity of the system;
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;
6. Provide a legacy of healthy ecosystems for future generations.

2.3 Objectives

Figure 2-1 illustrates how the Council's vision statement and the six Ecosystem Goals described above, which are universal to the Council's management across all of the Alaska fisheries, relate to the objectives that are specific to the BS FEP. The Council's main purpose with the BS FEP is to enable the Council to continue moving toward achieving its six Alaska-wide overarching Ecosystem Goals (above). The BS FEP adds value to and builds on the Council's current ecosystem-based fishery management baseline, which is described in Chapter 7.

The BS FEP identifies a series of 'Process Objectives', which define objectives for how the Council manages Bering Sea fisheries. Some of these Process Objectives call for monitoring of ecosystem trends and performance metrics, to allow the Council to manage adaptively and responsively to changes in environmental conditions, especially associated with climate change, loss of sea ice, or ocean acidification. To help provide specific targets for monitoring of the ecosystem, the BS FEP identifies a series of Ecosystem Objectives that provide more specificity as to how the Ecosystem Goals should be translated in the Bering Sea ecosystem. Specific indicators will be associated with each of the Ecosystem Objectives and routinely monitored. An assessment of their status reported back to the Council at regular intervals, using the existing Ecosystem Status Report (or Ecosystem Considerations Report) process that is presented annually to the Council in December.

In addition to the Process Objectives, the BS FEP also defines a series of 'Research Objectives' the Council will use to initiate specific actions to further the Ecosystem Goals. It is expected that the Research Objectives will be the most likely to change and evolve, as the Council identifies information gaps and research needs, and develops Action Modules to address them under the BS FEP framework (see more on Action Modules in Chapter 3 and 4).

Figure 2-1 Schematic of the relationship between the Council's ecosystem goals and the BS FEP objectives.

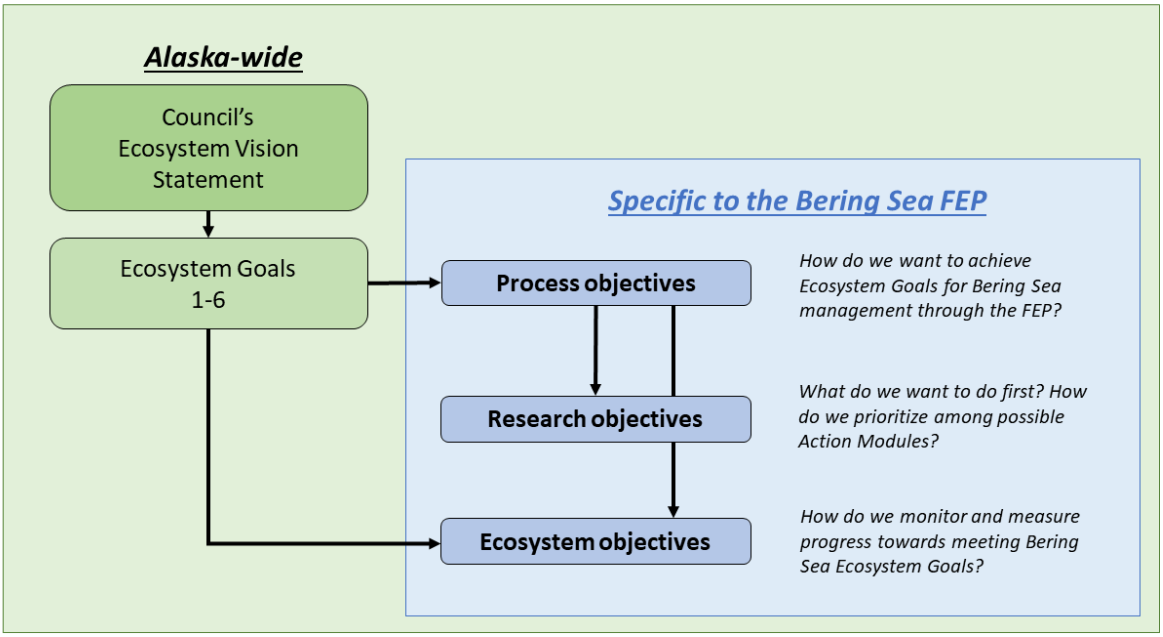
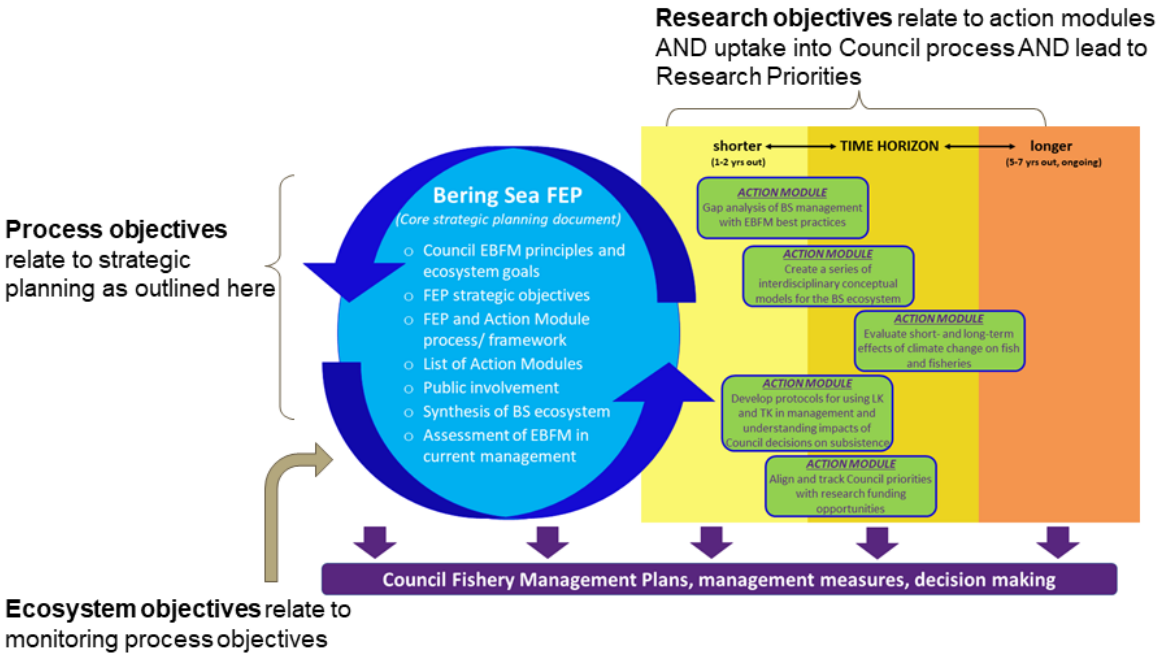


Figure 2-2 provides a different look at the same relationship, by linking the Process Objectives to the Core BS FEP, where they describe what the Council is trying to achieve with the BS FEP. The Research Objectives are linked to the Action Modules, prioritizing among possible actions, and interacting with the Council's research priorities. The Ecosystem Objectives are also identified in the Core BS FEP but will be monitored on a regular basis through linkages with the existing Ecosystem Status Report (also known as the Ecosystem Consideration Report).

Figure 2-2 Relationship of objectives to the structure of the BS FEP



2.3.1 Process Objectives

The following Process Objectives provide the Council's objectives for implementing the Alaska-wide ecosystem goals specifically for the Bering Sea ecosystem area, through the BS FEP.

1. Create and implement a cohesive process for Bering Sea EBFM, using the Council's ecosystem vision statement, which provides a mechanism for incorporating new sources of ecosystem information into Council processes, and defines the Council's management process to improve understanding by the broader public.
2. Create a transparent process to track the Council's progress towards achieving its six ecosystem goals.
3. Maintain and improve upon the open and public process for the Council to identify ecosystem objectives and management responses, including engaging with communities that are in the Bering Sea ecosystem or users of the ecosystem
4. Develop discrete research objectives and associated Action Modules to identify and address research and information needs.
5. Improve incorporation of local knowledge (LK) and traditional knowledge (TK) in Council management for the Bering Sea ecosystem
6. Facilitate and organize communication of ecosystem science, LK, TK, and relevant Council policy between scientists, communities, and decision makers
7. Provide a framework that would identify and prioritize research and information needs across disciplines
8. Synthesize and update current scientific understandings of Bering Sea ecosystem processes and status, including fisheries and subsistence use, to inform fishery management.
9. Maintain and enhance systematic status and trend monitoring of Bering Sea ecosystem processes and status relative to ecosystem objectives to detect change.
10. Create and track performance metrics to evaluate the ecosystem effects of specific management actions.
11. Track how BS FEP information is used in Council process
12. Establish a process to use ecosystem information to inform decisions for adaptive management, including to address changing circumstances under novel or intensified stressors.
13. Provide a framework for considering management strategies and associated opportunities, risks, tradeoffs, and cumulative effects affecting Council-managed species and the broader Bering Sea ecosystem, with consideration for ecological, economic, social, and cultural factors of fishery harvest.
14. Periodically review and refine the content of the Core BS FEP, including specification of process, ecosystem, and research objectives.

2.3.2 Research Objectives

The Research Objectives provide the bridge between the Process Objectives and Action Modules to be initiated under the BS FEP framework. Every Research Objective is related to at least one of the Process Objectives. Additionally, each Research Objective has two equally important parts: the research question, and the avenue for that information feeding into the management process.

1. Evaluate and develop resiliency for the Council's management strategies in the Bering Sea, and investigate options for responding to changing environmental and climatic circumstances such as changes to fish distribution and abundance, shipping patterns, etc.
    - *Links to Process Objective 14*

2. Develop processes to guide the use of subsistence data, local knowledge (LK), and traditional knowledge (TK) information from the Bering Sea in the Council process.
    - *Links to Process Objective 6*
3. Assess Council management in the Bering Sea with respect to ecosystem-based fishery management best practices and identify areas of success and gaps indicating areas for improvement, on a regular basis.
    - *Links to Process Objective 1*
4. Identify and develop interdisciplinary conceptual model(s) of the connected Bering Sea ecosystem components to respond to specific management questions.
    - *Links to Process Objective 7*
5. Develop methods to track whether Council Bering Sea research priorities are effectively articulated to partner research agencies, and how funded research is eventually used in the Council process.
    - *Links to Process Objective 8*

2.3.3 Ecosystem Objectives

Process objectives 9 and 10 call for status and trend monitoring of the Bering Sea ecosystem to detect change, and to track the effectiveness of Council management actions. For fishery management to more explicitly take into account and be responsive to changes in the ecosystem, each of the six overarching Ecosystem Goals identified in section 2.2 are associated with one or more strategic Ecosystem Objectives. The Ecosystem Objectives provide a clear avenue to monitor for change, as they can be associated with specific indicators. Table 2-1 provides an illustration of specific indicators that are currently monitored and reported in the annual Ecosystem Status Report (or Ecosystem Considerations Report) that is presented to the Council each December. Once the Council adopts the BS FEP, the intent would be to identify appropriate indicators for all of the Ecosystem Objectives, which can then be reported through the annual Ecosystem Status Report.

Ecosystem Goal 1: Maintain, rebuild, and restore fish stocks at levels sufficient to protect, maintain, and restore food web structure and function

1. Maintain target biomass levels for target species, consistent with optimum yield, using available tools.
2. Maintain healthy populations and function of non-target and forage species.
3. Adjust fishing-related mortality from the system to be sustainable and commensurate with total productivity and continue to limit optimum yield to 2 million metric tons for the BSAI groundfish fisheries.

Ecosystem Goal 2: Protect, restore, and maintain the ecological processes, trophic levels, diversity, and overall productive capacity of the system

4. Maintain key predator/prey relationships.
5. Conserve structure and function of ecosystem components.

Ecosystem Goal 3: Conserve habitats for fish and other wildlife

6. Minimize adverse impacts to essential fish habitat, to the extent practicable.
7. Avoid and/or minimize impacts to ecologically-sensitive habitat, including habitat areas of particular concern (HAPCs).
8. Avoid and/or minimize impacts to seabirds, marine mammals, and protected species.

Ecosystem Goal 4: Provide for subsistence, commercial, recreational, and non-consumptive uses of the marine environment

9. Support benefits in the Bering Sea fishery and fishery-related industries.
10. Provide opportunities for new entrants in Federal fisheries.
11. Promote economic and community stability to all commercial harvesting and processing sectors.
12. Support sustainable opportunities and community resilience for subsistence users and Alaska Native communities.
13. Provide for directed fisheries including subsistence fisheries by minimizing bycatch mortality.
14. Preserve the ability for stakeholders to derive non-consumptive and cultural value from the Bering Sea ecosystem.

Ecosystem Goal 5: Avoid irreversible or long-term adverse effects on fishery resources and the marine environment

Ecosystem Goal 6: Provide a legacy of healthy ecosystems for future generations

Combined objectives for goals 5 and 6:

15. Establish appropriate thresholds to minimize risk of crossing ecosystem tipping points caused by fishery or other human activity.
16. Encourage responsible parties to minimize adverse impacts to fish and other wildlife associated with changes in shipping activity, tourism, energy, and other types of development.
17. Ensure that fishery management is sufficiently adaptive to account for the effects of climate change or other ecosystem changes, including loss of sea ice and ocean acidification.

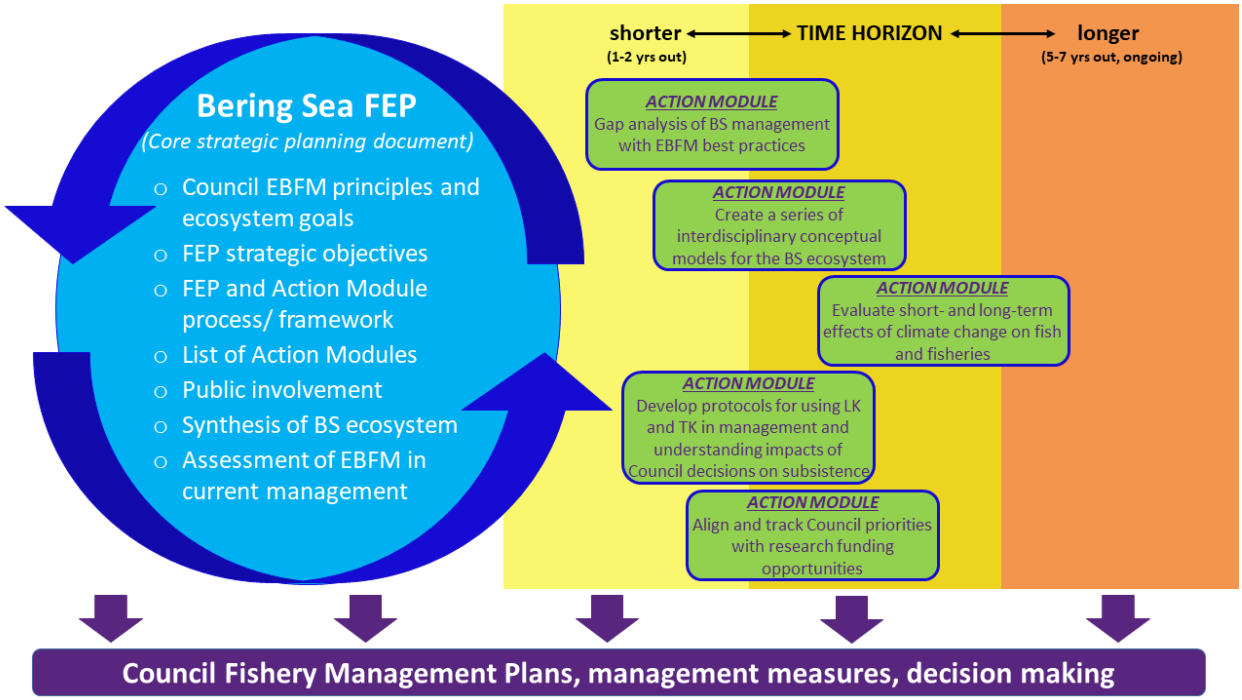
Table 2-1 Indicators that are currently tracked in the annual Ecosystem Status Report, as they relate to the BS FEP Ecosystem Objectives

Ecosystem Objective	Indicators to track
1. Maintain target biomass levels for target species, consistent with optimum yield, using available tools.	Fish Stock Sustainability Index (FSSI); Groundfish distribution and abundance; Groundfish recruitment predictions (P. cod and pollock); Commercial crab biomass indices; Stability of Groundfish Biomass
2. Maintain healthy populations and function of non-target and forage species.	Jellyfish; Forage fish and juvenile salmon distribution and abundance; Groundfish condition metric; Miscellaneous species; Non-target species catch
3. Adjust fishing-related mortality from the system to be commensurate with total productivity and continue to limit optimum yield to 2 million metric tons for the BSAI groundfish fisheries.	Aggregated CPUE
4. Maintain key predator/prey relationships.	RZA zooplankton indicator
5. Conserve structure and function of ecosystem components.	CEATTLE? Species richness and diversity
6. Minimize adverse impacts to essential fish habitat, to the extent practicable.	Winter spawning flatfish recruitment and wind forcing; Area Disturbed by Trawl Gear
7. Minimize and/or avoid impacts to ecologically-sensitive habitat, including habitat areas of particular concern (HAPCs).	Structural epifauna (EBS shelf)
8. Minimize and/or avoid impacts to seabirds, marine mammals, and protected species.	Coccolithophores; Seabird monitoring; Northern fur seal pup production; Seabird bycatch
9. Support benefits in the Bering Sea fishery and fishery-related industries.	Trends in unemployment; Human population; School enrollment
10. Provide opportunities for new entrants in Federal fisheries.	
11. Promote economic and community stability to all commercial harvesting and processing sectors.	Landings; Value and unit value
12. Promote sustainable opportunities and community resilience for subsistence users and Alaska Native communities.	Halibut and salmon subsistence trends
13. Provide for directed fisheries including subsistence fisheries by minimizing bycatch mortality.	Juvenile Chinook index; Groundfish Discards
14. Preserve the ability for stakeholders to derive non-consumptive and cultural value from the Bering Sea ecosystem.	Recreational fishing participation
15. Establish appropriate thresholds to minimize risk of crossing ecosystem tipping points caused by fishery or other human activity.	Mean lifespan, Length of fish community
16. Encourage responsible parties to minimize adverse impacts to fish and other wildlife associated with changes in shipping activity, tourism, energy, and other types of development.	
17. Ensure that fishery management is sufficiently adaptive to account for the effects of climate change or other ecosystem changes, including loss of sea ice and ocean acidification.	North Pacific Climate Overview; Climate indices; Eastern Bering Sea climate; Spatial distribution of groundfish stocks

3 How will the BS FEP function?

This BS FEP uses and improves upon the Council's existing open and transparent process of public involvement in decision making. This is a strategic planning document that describes a process for addressing management concerns about ecological goals, as expressed in the Council's ecosystem policy statement (see section 2.1) and is flexible to new information and changing resources. This BS FEP document is centered around a **Core BS FEP** identifying Council goals and policies. The Core BS FEP forms a structured framework to regularly evaluate and initiate specific projects called **Action Modules** (projects) to address Council priorities (Figure 3-1). This type of structure is responsive to the Council's concerns about staff resources, as the Action Modules can be initiated progressively when management needs and available time/resources allow.

Figure 3-1 Illustration of the relationship between the Core BS FEP and example Action Modules



3.1 Core BS FEP

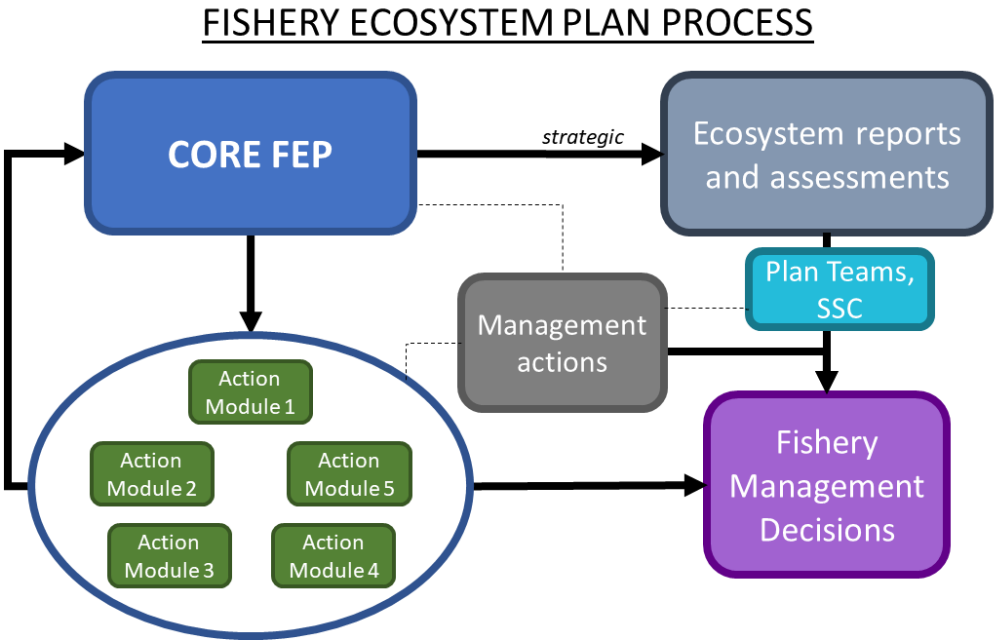
The Core BS FEP contains the strategic components of the BS FEP. Core BS FEP sections describe the purpose and structure of the BS FEP, goals and objectives, and how the BS FEP will function, including the role of public involvement. The Core BS FEP also provides a synthesis of the Bering Sea ecosystem and an assessment of how the current management approach includes ecosystem-based fishery management elements. The Core BS FEP describes the framework process. Through the framework process, the Council can be adaptive to new information and changing circumstances and can manage the workload associated with the BS FEP to match staff time and resources available.

A close connection is intended between the Core BS FEP and strategic evaluation of EBFM products, and the development of new products to support fishery management decisions, such as the annual Ecosystem Status Report for the Bering Sea (also known as the Ecosystem Considerations Report), Ecosystem Socio-Economic Profiles (ESPs) for individual stocks, and analyses such as ecosystem/stock risk assessments or multispecies management strategy evaluations (MSEs; Figure 3-2). For example, the Ecosystem Objectives identified in the Core BS FEP (section 2.3.3) would provide strategic guidance to the selection of ecosystem indicators monitored in the Ecosystem Status Report. This draft BS FEP includes a

preliminary matching of Ecosystem Objectives with existing indicators tracked in the Ecosystem Status Report (Table 2-1), however revisiting these indicators is also a task for the BS FEP Team (see section 3.3).

The BS FEP is intended to be a living framework process rather than a static document, although it is presented as a document for ease of review. To facilitate the living nature of the BS FEP, the BS FEP Team has developed a Core BS FEP webpage that contains the strategic information captured in the BS FEP, and from which progress on Action Module projects will be tracked and made available to the public. In an online environment, the BS FEP can also easily link to non-Council data sources about the Bering Sea that are regularly maintained, to keep synthesis of the Bering Sea ecosystem section current and relevant. Specific Action Module projects under the umbrella of the BS FEP will investigate different connections, processes or data that can improve understanding and management of Bering Sea fisheries. The Core BS FEP describes the process for the Council to approve and prioritize specific Action Modules, and initiate work on them, and the list and description of approved and initiated Action Modules is included in the Core BS FEP.

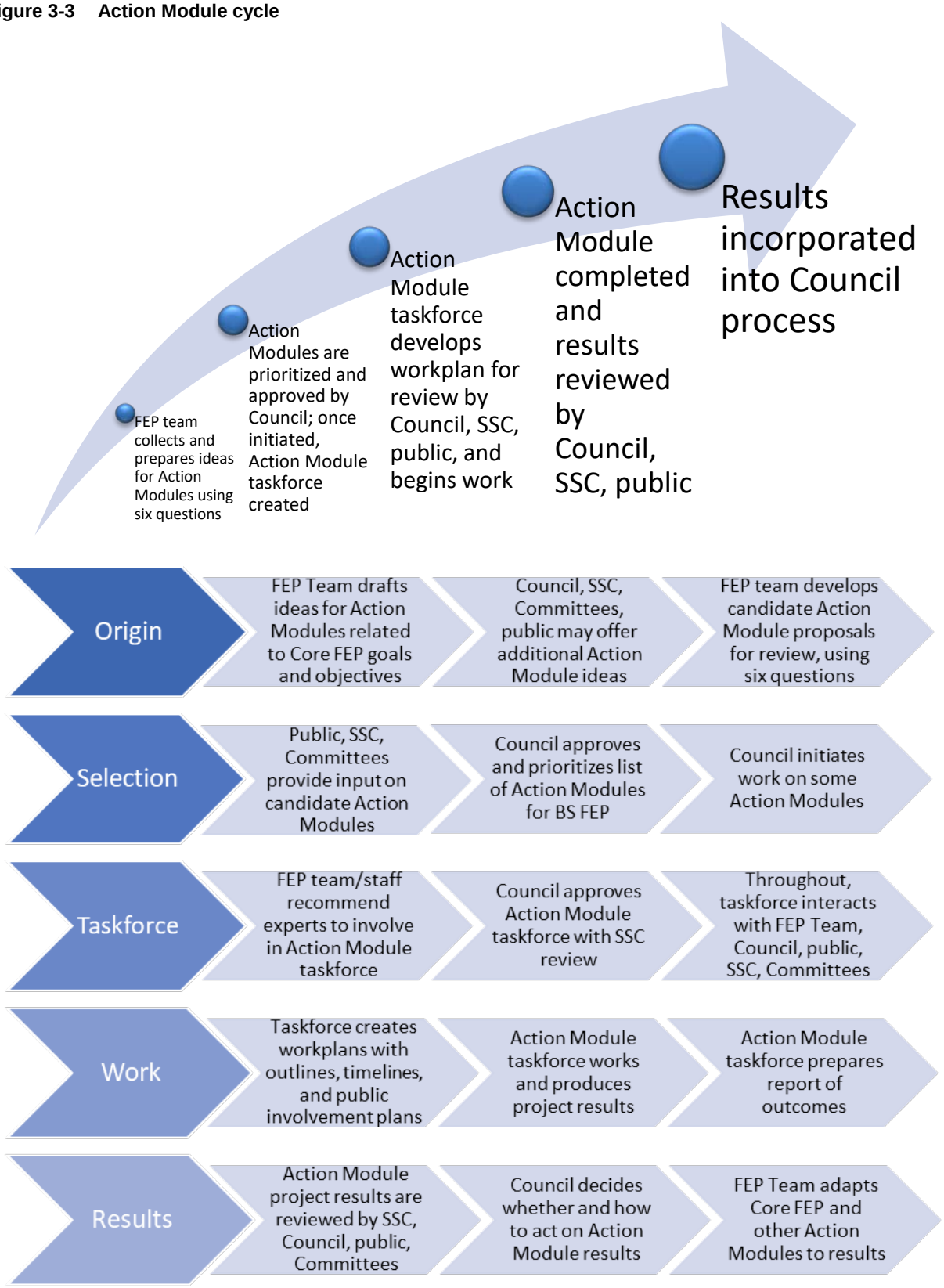
Figure 3-2 Feedback among the Core BS FEP, individual Action Modules, and the management process



3.2 Action Modules

Action Modules are specific analyses or research efforts initiated by the Council, within the framework of the BS FEP. Each Action Module has its own scope, tasking, and timeline. The Action Modules are linked directly to the BS FEP objectives. The purpose and scope of each proposed Action Module, as well as a description of how the outcome(s) may be used in management, is defined in Chapter 4 of the Core BS FEP. For the BS FEP to be fully utilized in the Council process, it is important there be forethought about how Action Modules will be incorporated into the Council management process. Action Modules should be designed to focus on a specific Council need, to ensure a strong connection between BS FEP work and its utility in the Council process. By prioritizing among Action Modules, the Council is also signaling its interests and priorities to other agencies, especially NMFS and the AFSC. The Council must approve each Action Module that is included in the Core BS FEP. Figure 3-3 provides an overview of how an Action Module moves through the Council BS FEP process. This process is also described in the paragraphs that follow.

Figure 3-3 Action Module cycle



An idea for an Action Module could originate with the BS FEP Team (further described in section 3.3); from Council, SSC, Ecosystem Committee or public discussion during meetings; or from a targeted

Action Module solicitation from the public, should the Council choose to announce one. Periodically, the Council will choose to review and modify its list of Action Modules, and the BS FEP team will develop Action Module ideas into candidate proposals. To be considered for an Action Module in this BS FEP, a series of specific questions must be addressed for each candidate project:

1. Synopsis of the task, including how it will be accomplished
2. Purpose it will achieve (relationship to BS FEP objectives)
3. How it will inform the Council's decision making and management process
4. How it will be integrated in the Council's decision making and management process
5. Estimate of time and staff resources required to achieve it
6. Plan for public involvement

Chapter 4 of this draft BS FEP outlines Action Modules that have been prioritized and approved by the Council, based on the Action Module proposal descriptions provided by the BS FEP Team, and reviewed by the Council's Ecosystem Committee. One advantage of this approach is that it allows the Council to specify the expected utility of a project's outcome(s) for decision making and management before it is initiated (including staffing requirements and how it will be applied). Specifying how Action Module results will be used at the outset will support the Council's intention for the BS FEP to provide added value directly relevant to EBFM.

In keeping with the Council's philosophy in developing the BS FEP, it is anticipated that public involvement will be a key part of scoping Action Modules, and public input will be considered when Action Modules are prioritized by the Council. From the approved list, the Council also has the flexibility to decide when to initiate work on each Action Module. Depending on the Council's interest, needs, or resource constraints, the Council could choose to initiate all Action Modules concurrently, or proceed sequentially with the Action Modules. By providing the list and prioritization, even without immediately initiating work on an Action Module, the Council is signaling which specific topics it is considering both now and in the future, which may allow external research projects that are designed to address other needs to also be tailored to meet Council interest.

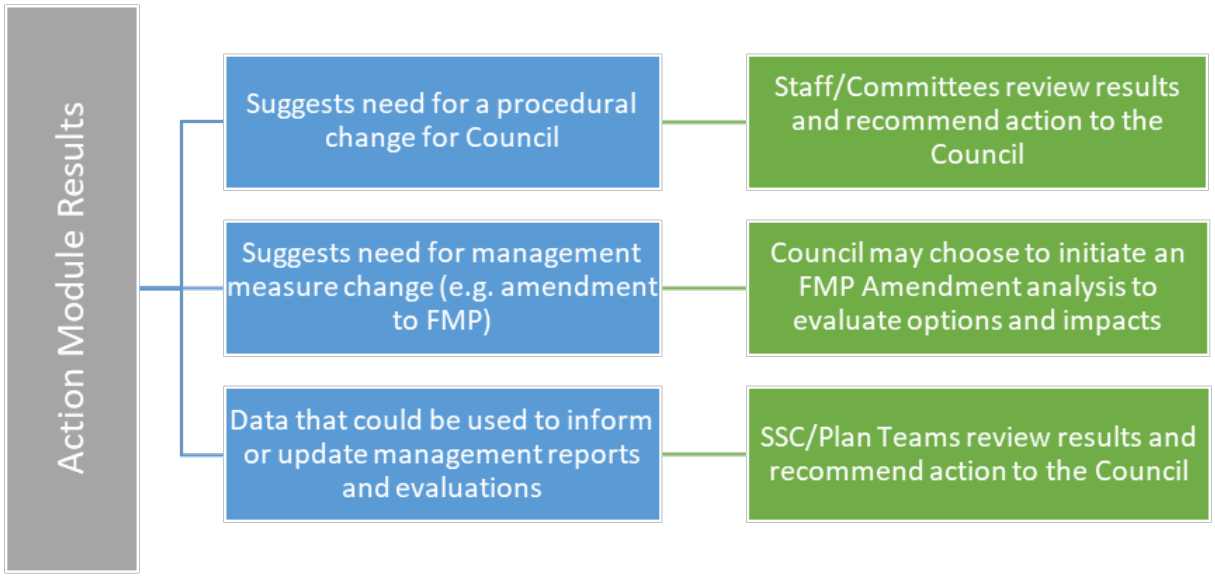
Once an Action Module has been initiated, a more detailed workplan will be created, and a taskforce for accomplishing the Action Module will be identified. Workplans and staffing needs for each Action Module will vary based on the type of project proposed. In some cases, the Action Modules will be focused on improving Council process or communications, and may primarily be tasked to Council and NMFS staff to pull together information for Council evaluation. Other Action Modules will require specific data, knowledge, and tools and thus may be projects of longer duration requiring the involvement of external experts in addition to Council and agency staff. For example, the proposed Action Module that will develop ecosystem decision tools to address climate change will be centered on AFSC modeling and management strategy evaluation expertise. The proposed LK, TK, and subsistence Action Module will be more dependent on the involvement of external stakeholders as well as staff. In all cases, public involvement will be a key part of Action Module progress and completion. It is envisioned that there will be a different taskforce for each BS FEP Action Module, and that these will also vary in size as well as composition. This structure has the advantage of providing an opportunity for broader participation in the BS FEP process and promoting the involvement of diverse stakeholders that are impacted by the issue, including local communities or fishermen, in the BS FEP process.

In each Action Module workplan, the taskforce will propose how frequently to intersect with the Council process during the course of work. Workplans, interim work products as appropriate, and Action Module results should be publicly reviewed in the Council process, with input from Council committees (such as the Ecosystem Committee, Advisory Panel, SSC, and if relevant, Plan Teams). The workplan will include an explicit public involvement plan. To ensure the BS FEP achieves the Council's intent for it to be a transparent, inclusive communication tool, the public involvement plan identifies stakeholders potentially

impacted by or interested in the Action Module, and opportunities for them to participate in its development (which may rely on the Council's existing public process or extend to other opportunities). Each Action Module workplan should also address how both Local and Traditional Knowledge (LK and TK) will be considered.

Once the Action Module work is complete, and vetted through the Council process, the results should be able to be incorporated into the Council process. How that incorporation occurs will vary depending on the nature of the Action Module. Depending on the Module, findings may be relevant to monitoring or research priorities, vulnerability assessments, annual harvest limits, spatial management actions, international agreements, or emerging fisheries (Figure 3-4). Some Action Modules may result in the implementation of a new internal process for the Council, an analytical change for staff in the preparation of amendment analyses, or the development of a new Council policy. For some Action Modules, the analysis or research may suggest the Council consider some fishery management measure response. Because the BS FEP is not action forcing, any such management measure change would need to occur through the existing mechanisms to initiate and analyze potential FMP or regulatory amendments. There may also be Action Modules that result in tangible information that affects future Council decision making, for example identifying a threshold for a monitoring indicator that would be a pivot point for Council action once it is reached. Finally, the outcome of an Action Module may require iterative Council feedback and may lead the Council to re-evaluate this BS FEP or re-prioritize other Action Modules.

Figure 3-4 How different Action Module outcomes may be used in fishery management.



FMP = Fishery Management Plan

As they are initiated and completed, Action Modules will be synthesized and evaluated in aggregate by the BS FEP Team, with changes made to the core BS FEP as appropriate. A BS FEP webpage will be developed to track the Action Modules, assessing progress that has been made in each active one, and reviewing findings of previous ones.

The Council envisions the Action Modules will be an evolving part of the BS FEP which change over time to meet novel management challenges and ecosystem pressures. The Core BS FEP specifies the process for how Action Modules were proposed, considered, and adopted by the Council into the BS FEP. The Council may wish to formalize a periodic review process to consider whether the list of Action Modules should be revised, new projects added, or priorities changed. This could occur as part of an annual report from the BS FEP Team. As individual Action Modules are initiated by the Council and eventually completed, they will contribute to the broader understanding of the Bering Sea ecosystem, the

EBFM actions that the Council is undertaking, and the tools available to the Council to make informed decisions.

3.3 Role of the BS FEP Team

The Council created a BS FEP Team to develop the Core BS FEP from 2017-2018. With the Council's formal adoption of the BS FEP, the BS FEP Team transitioned to an ongoing role. The Team's membership includes participation from ten different agencies (section 9.1), and includes a large group of scientists and managers with diverse expertise, including ecosystem modeling, stock assessment of Bering Sea species, oceanography, seabirds and marine mammals, habitat, social science, and economics. The Team includes members who also participate on the Council's Crab and Groundfish Plan Teams, and while not explicitly on the Team, a key Council staff contributor to the BS FEP is also a member of the Council's Social Science Planning Team.

The Team functions similarly to the other Council Plan Teams. Initially, the BS FEP Team proposes to meet at least once a year, during the early part of the calendar year. The Team will provide recommendations to the Council at either the February or April Council meetings. Any BS FEP Team recommendations will be reviewed through the SSC and Advisory Panel and through the Council's Ecosystem Committee.

The Team's overall objective as an ongoing Plan Team is to provide strategic support for the Council's goals and objective for EBFM, as described in the BS FEP. The Team is not intended to supplant any existing EBFM practices already in place for the Council (as described in Section 7.5). Specific tasks for the BS FEP Team include:

1. Strategic guidance for monitoring Bering Sea ecosystem status
    - Develop and keep current an appropriate suite of ecosystem indicators specific to the BS FEP's Ecosystem Objectives, to be tracked in the annual Ecosystem Status Report. Note, collaboration may be required for developing appropriate social science indicators.
    - Review ecosystem status through recent ESRs and other ecosystem information, report on indicator status for success metrics.
    - Provide a strategic review of ecosystem products, red flags, discussion points from the previous fall cycle, particularly with respect to the BS FEP's Ecosystem Objectives. Coordinate with the ongoing AFSC effort to discuss ecological processes in the spring.
2. BS FEP Action Modules
    - Provide recommendations on new Action Modules, prepare candidate proposals for ideas for Council consideration (six questions).
    - Track progress of ongoing Action Modules, review workplans and recommend staffing, ensure that results are reported to the Council in a way that fosters their use in the management process. Provide appropriate reporting and, if appropriate, recommendations, to the Council and other Council advisory bodies (SSC, Advisory Panel, Ecosystem Committee, others).
3. Maintain the Core BS FEP
    - Consider how completed Action Modules inform the Core BS FEP, update as appropriate with new information and Action Module results.
    - Consider developing a BS FEP summary of how ecosystem information was used in the specifications process or other Council actions each year.
    - Track how information developed as a result of the Council's BS FEP is used in the Council process.

4. Outreach and communication
    - Recommend outreach and communication products in support of the BS FEP.
    - Provide the Council with periodic overviews of Bering Sea ecosystem products and research, including progress with use and review of local knowledge (LK) and traditional knowledge (TK) within and alongside natural and social science in the fisheries management process.
    - Work collaboratively with other Council Plan Teams.

Future North Pacific FEP Team?

During initial review of the draft BS FEP, there was discussion about the merits of having a North Pacific FEP Team rather than focusing the Team exclusively on the Bering Sea. The Council has already developed a FEP for the Aleutian Islands, although not yet for any other of the Council's ecosystem areas. Many of the example Action Modules currently included in the Draft BS FEP address topics that are not necessarily specific to the Bering Sea region (e.g., consideration of how to accommodate LK and TK in fishery management, gap analysis of EBFM in the Council's current management, and procedures for research tracking), and of course the Bering Sea ecosystem does not exist in isolation from neighboring areas and influences.

While the BS FEP Team acknowledges the potential value in having a single North Pacific FEP team in the future, rather than multiple FEP teams for different areas, for the time being, we recommend continuing to limit the scope to focus on (although not to be exclusive to) the Bering Sea. The BS FEP has pioneered a framework FEP approach with Action Modules, and it would be useful to pilot test the durability of that approach with focus on the more limited Bering Sea geographic area. Additionally, the process of developing the BS FEP in the Council process has garnered momentum and interest among many Bering Sea regional stakeholders, especially with respect to the consideration and inclusion of LK and TK information. Expanding the reach of those initiatives to the whole North Pacific might dilute or curb that momentum, which would be unfortunate. The Team will continue to consider the context of the North Pacific in providing Bering Sea ecosystem advice, and will ensure that products with application to other management areas are not unduly limited to the Bering Sea. Once the Council has a sense of how the BS FEP Team is functioning, it may be appropriate to consider how to transition the Team's role to a broader, North Pacific focus.

3.4 BS FEP interaction with Council processes

The BS FEP is inclusive of broad perspectives and is intentionally flexible as a management tool for fisheries in the Bering Sea. As previously stated, the BS FEP is not intended to build a new independent structure within existing Council infrastructure. Rather, it is a key aim of the BS FEP to build on and utilize existing groups and processes. Examples of existing groups and processes for operationalizing the BS FEP are outlined below. These are meant to highlight potential avenues for implementing the BS FEP and are not meant to exclude other possibilities.

Interaction with Council groups

Council: The BS FEP is the Council's document, and any policy embodied in the BS FEP, or actions undertaken under the "umbrella" of the BS FEP must all be authorized by the Council. The BS FEP does not have inherent authority, but the BS FEP can provide context for the Council to take action through its existing authority under the Magnuson-Stevens Act.

SSC: As the Council's scientific advisory body, any recommendations from the BS FEP Team, or recommendations arising from information undertaken through an Action Module of the BS FEP, will be

reviewed by the SSC as per the Council's standard procedure. The SSC may then choose to make recommendations to the Council regarding the BS FEP.

Ecosystem Committee: The Council has designated the Ecosystem Committee with oversight for BS FEP Team's development and ongoing implementation of the BS FEP. The Ecosystem Committee also has an ongoing policy role in advising the Council on EBFM implementation. The Committee will continue to liaise with the BS FEP Team and will provide policy recommendations to the Council on the appropriate direction for the BS FEP and Action Modules. The Ecosystem Committee may also choose to make recommendations to the Council regarding the BS FEP.

Plan Teams: To the extent that BS FEP information affects a particular FMP, that information should be shared with stock assessment authors and the Plan Teams. The Plan Teams may choose to make recommendations to the Council regarding the BS FEP.

Social Science Planning Team (SSPT): The SSPT was established to improve the quality and application of social science data that informs management decision-making and program evaluation in the Council process. Social science considerations are an important component of EBFM, and feedback from the SSPT concerning social science aspects of the Core BS FEP and Action Module projects may be helpful for the BS FEP Team. The FEP Team approached the SSPT in May 2018 about collaborating on Action Module 4, which focuses on assessing and integrating LK and TK into Council processes as relevant, and members have expressed interest in coordinating. The SSPT may choose to make recommendations to the Council regarding the BS FEP.

Community Engagement Committee: The Council created this new Committee in June 2018 to advise the Council on strategies for improving engagement with rural and Alaska Native communities, but at the time of this draft the Committee had not yet met or developed a Terms of Reference. Much of the Council discussion to date that proved to be the genesis of this Committee has evolved from the development of the BS FEP. It is anticipated that engagement strategies and public involvement that is developed and recommended by the Committee will be applied to the BS FEP as well, and there may be other opportunities for collaboration as well. The Community Engagement Committee may choose to make recommendations to the Council regarding the BS FEP.

Interaction with existing processes

Fishery Management Plans: FEPs are defined by scale of the fishery system, and provide a means for considering the system holistically, which is different from the scope of the Council's Fishery Management Plans (FMPs) in the Bering Sea, which are specific to species groups. There are three Council FMPs that have jurisdiction within the Bering Sea. The Bering Sea/ Aleutian Islands Groundfish FMP outlines the management measures that govern Bering Sea and Aleutian Island groundfish fisheries, excluding salmon, steelhead, Pacific halibut, Pacific herring and tuna. The Bering Sea/ Aleutian Islands King and Tanner Crab FMP governs ten commercial crab fisheries, of which eight occur in the Bering Sea. The Alaska scallop FMP provides management of the weathervane scallop fishery, of which there is some distribution in the southern Bering Sea. While the Council does have an Alaska Salmon FMP, it does not address salmon fishing in the Bering Sea. Finally, the Council manages the allocation of halibut in the Bering Sea under a Catch Share Plan.

FEPs provide a platform to examine cumulative impacts in a system, including the effects across fisheries. Through the BS FEP framework, any new information that leads the Council to think about adjusting its management measures would need to be implemented in the FMPs (or authorizing regulations for halibut), as the FEP does not authorize fishery management regulations.

Ecosystem status report (or ecosystem considerations report): The BS FEP has been designed to integrate closely with the annual ESR for the Bering Sea. The BS FEP Team will review the annual ESR

and use the information as a basis for recommendations for developing and prioritizing Action Modules and the work that they instigate. The ecosystem objectives identified in the BS FEP will be monitored through the ESR. It is of note, however, that the ESR contributes to both strategic and tactical science-based decision-making by the Council, and ths no single Plan Team will be solely responsible for review of its content.

Research priorities: The Council has an established research priorities process by which it annually reviews and produces a list of 5-year research recommendations, including 'top ten' research priorities, which is disseminated to other agencies. Under the current system, the Council's Plan Teams all provide their top research priorities to the SSC, for them to consider holistically and integrate into a single list. It is anticipated that the BS FEP Team will similarly identify top research priorities for the Bering Sea ecosystem, likely linked to the Council's prioritized Action Modules, for the SSC to assimilate.

The BS FEP also includes a research tracking Action Module (Action Module 5), which was proposed to tighten and track the alignment between the Council's research priorities, funded research, and whether the outcome of that research is effectively meeting the Council's needs. As this tracking process is further developed, staff anticipates that this process will be of interest to the SSC and the Council with respect to the development of the Council's research priorities list.

3.5 How should BS FEP and EBFM information enter into the Council process

A key goal of the BS FEP is to highlight pathways for turning strategic objectives (Section 2.3) into Council action to facilitate progress along the EBFM continuum. In order to do this, it is helpful to understand how ecosystem information is used in the Council process, and where that access needs to occur in order for information to be most of use. Chapter 7 provides an in-depth assessment of how the Council's management incorporates EBFM, but this section focuses on identifying the process for effectively using incoming information, and the specific **onramps** for information (i.e., action or entry points into the existing Council process). Understanding these onramps is a critical component for thinking through how the outcome of an Action Module can most effectively be used in the Council management process, which is a primary directive of the BS FEP framework (that all work conducted under the FEP should add value).

Specific Council management Onramps

In considering Action Modules, it may be of value to identify *a priori* which of the potential Council Onramps will be targeted for a specific set of results, to accommodate the transfer of information during the applicable part of the process. For example, identifying a new ecosystem indicator would be an input to the ESR analysts (ramp 2), whereas policy input on adjusting annual total allowable catch would be targeted directly to the Council (or its policy committees, ramp 5). Note that specific actions will often move through several Onramps, but that clearly identifying where they might start and stop is important.

Current NPFMC ecosystem Onramps and examples:

1. **Inputs to data collection and strategic planning:** Natural and social science data to be collected, survey timing, geographic range of surveys, the Observer Program, targeted research studies, LK, TK, etc.

2. **Inputs to analysts and/or stock assessment authors:** Covariates for potential consideration for stock assessment or MSE, model structural considerations, LK, TK, etc.

3. **Inputs to the FMP Plan Teams:** Ecosystem status report, recommendations on model structural considerations, contextual ecosystem information (based on indicators, LK, TK, etc.), for setting ABCs relative to OFLs (scientific buffers), for research prioritization, etc.

4. **Inputs to the SSC:** Ecosystem status report, contextual ecosystem information (based on indicators, LK, TK, etc.), recommendations for setting ABCs relative to OFLs (scientific buffers), for research prioritization, for amendments to the FMPs (e.g., control rules, reference points), etc.

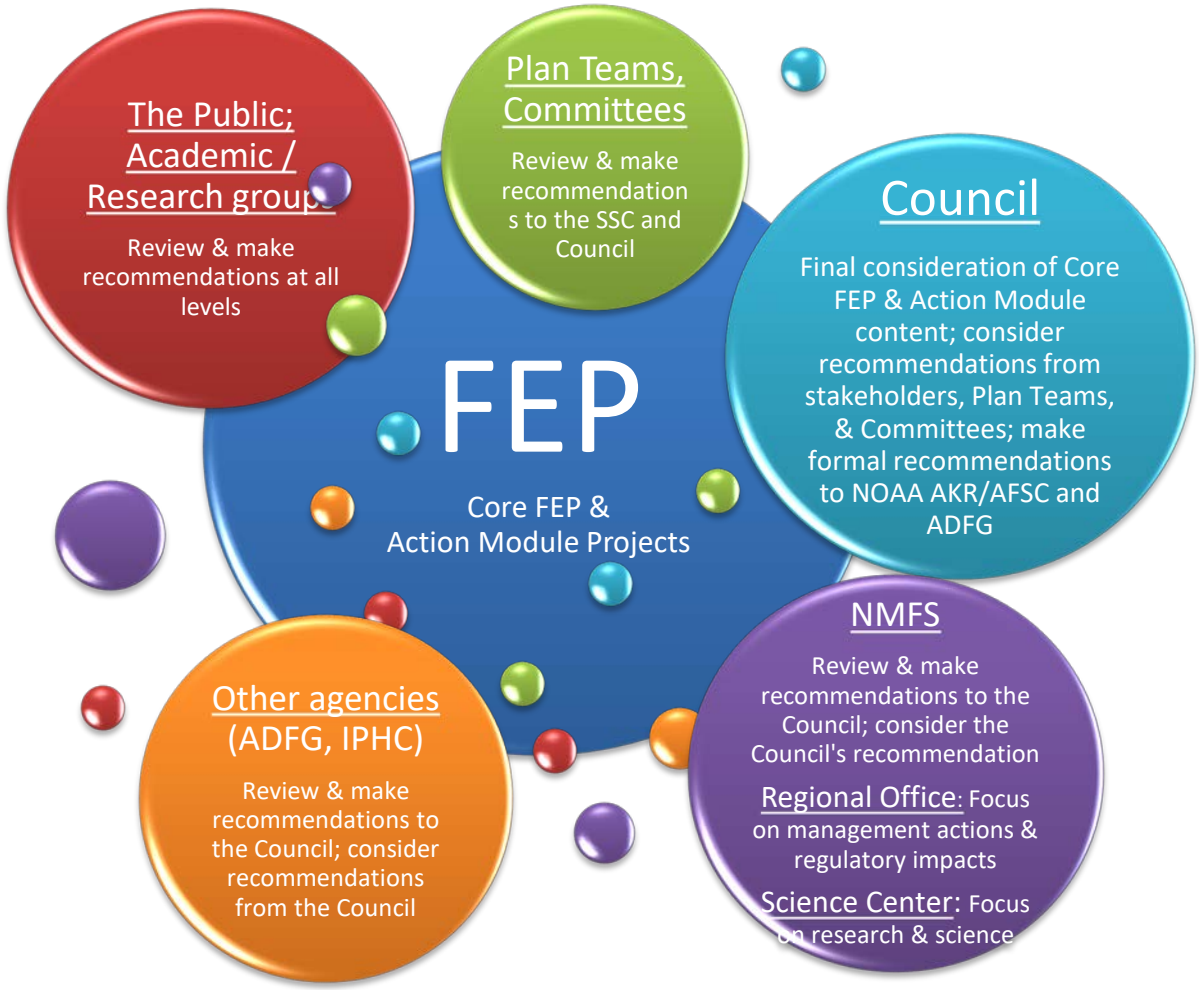
5. **Inputs directly to the Council:** Ecosystem status report, recommendations for amendments to the FMPs, guidance on setting TACs relative to ABCs, spatial closures, identification of thresholds for management action, information/ideas/concerns posed by members of the public during staff tasking (e.g., LK and TK holders), etc.

6. **Inputs to regulation:** OY limits, Biological Opinions, Social Impact Assessment results and other social science, LK, TK, etc.

7. **Inputs to NMFS and other agencies:** Ongoing natural and social science research, LK, TK, outcomes from Tribal consultation activities, etc.

3.6 BS FEP interaction with agencies

Figure 3-5 How the Core BS FEP and the Action Modules interact with the Council and other entities.



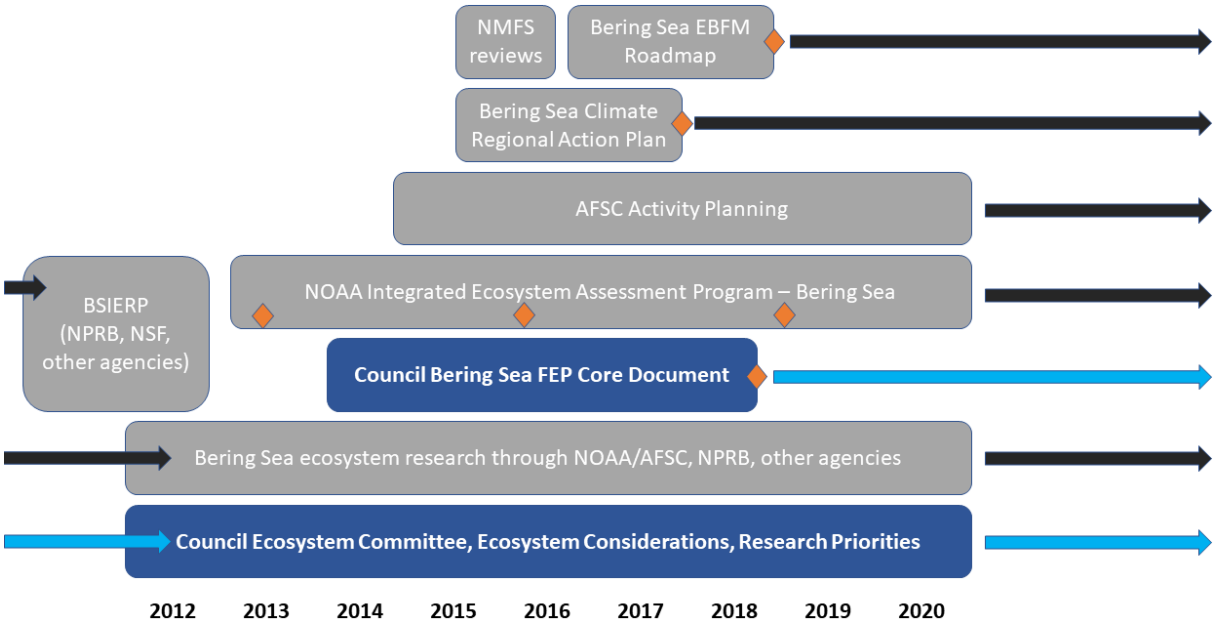
3.6.1 Interaction with NOAA

The Council works closely with NOAA. In the most general of terms, the Council makes final decisions about the Core BS FEP and Action Module content after considering recommendations from all other groups (Plan Teams, Committees, the public, academic or research institutions, other agencies, NOAA). The Council may also choose to make formal recommendations to NOAA regarding specific issues or actions.

Between 2011-2018, NOAA Fisheries has conducted a range of planning activities at both the national and the regional level; these include stock assessment and habitat assessment improvement plans (SAIP and HAIP), climate regional action plans (climate RAPs), research plans for the NOAA Integrated Ecosystem Assessment (IEA) program, and a national EBFM Policy and Roadmap (Figure 4-3 in NOAA 2018). In the Alaska region, these planning exercises included AFSC scientists, Regional Office staff, and Council staff.

In 2016, NOAA Fisheries conducted both national and regional-level reviews of EBFM programs at all fisheries science centers. At the national level, a key finding was that the science for conducting EBFM had been strongly developed, but there was the need of better integration and coordination between existing programs, and the need to ensure operational ecosystem science was making the "final step" of being delivered to management in such a way as to maximize uptake by management bodies through stakeholder-driven processes.

Figure 3-6 Planning documents/programs for conducting EBFM in the Bering Sea. Blue denotes a Council project. Orange diamonds show planning documents produced.



The results of the AFSC program review further stressed that the data, technologies, and science for conducting EBFM had a strong history of support by the Center (e.g., data collection and research on ecosystem processes, ecosystem models, and the Ecosystem Status Report), a history of Council uptake of EBFM, and recognized the good dialog between the Center and Council to identify Council needs. The reviewers noted that substantial resources at AFSC had been committed to EBFM research and uptake. However, the reviewers also noted:

1. There was not a single "ecosystem program" at AFSC, but "rather a series of programs including the Recruitment Processes Alliance addressing recruitment processes for fish, several other programs addressing loss of sea ice, ocean acidification, and essential fish habitat, and a separate ecosystem modeling and assessment program", further noting that "There does not appear to be an overarching set of goals and objectives for ecosystem research that could be used to help prioritize or even organize/streamline projects at the AFSC. A vision for ecosystem science connected with ecosystem-based advice is not yet evident."
2. The work prioritized a relatively small set of (commercially important) processes and species, and while the science was high quality it omitted much of the ecosystem – it is "delivering to the Council's perception of what is needed today, but it may overlook the need to consider broader (or future) stressors and risks that may not be directly requested by the Council today."
3. Much of the capacity existed in "research and development" mode rather than "operational" mode; that is, EBFM funding sources and projects were not necessarily stable. For the Council to include a product (e.g., ecosystem indicators) in its management process, there must be reasonable certainty that the product will be available on an ongoing basis. Further, the products needed to be proactive rather than reactive; there is insufficient time to develop tools and indicators in response to a crisis as opposed to having a range of applicable information maintained beforehand.

A standing Council BS FEP Team with coordinated links to NOAA planning processes will greatly enhance these programs. A standing BS FEP Team will not recommend reorganization of programs away from the diversity that exists at AFSC but will form a bridge between the Council's ecosystem vision, goals and objectives and AFSC/NOAA Fisheries science goals and objectives. The BS FEP Team's ongoing process objectives will guide coordination of individual research programs in implementing EBFM, for example using the IEA process (Figure 4-4) as an organizational framework that includes stakeholder-driven goal setting, indicators, monitoring, risk assessment, and management strategy evaluation.

Figure 3-7 The Integrated Ecosystem Assessment (IEA) process for conducting Ecosystem-Based Management.

The Action Modules for gap analysis, interdisciplinary conceptual models, and research prioritization will provide valuable feedback in coordinating separate programs and ensuring the EBFM research portfolio is sufficiently broad while continuing critical information for high-value species. The BS FEP Team, on an ongoing basis, will track successes and gaps, and in addition to addressing immediate needs (prioritization from Plan Teams and the Council) can recommend the development of specific operational capacity in advance of potential developing crises.

In 2016, NOAA Fisheries adopted a national EBFM Policy and Roadmap to assist the agency in coordinated implementation of EBFM across its mandates, in part by establishing a framework of EBFM guiding principles (see section 1.2). In 2017, Roadmap implementation was begun at a regional level by the formation of regional teams, consisting in each U.S. fishery region of members from the science centers, regional offices, and Council staffs, to develop region-specific plans. The Alaska regional team further separated its EBFM implementation plan into Large Marine Ecosystem (LME)-specific implementation plans for each of the Bering Sea, Gulf of Alaska, Aleutian Islands and High Arctic LMEs.

The development of implementation plans for each Alaska ecosystem is staged, beginning with the Bering Sea EBFM Roadmap in conjunction with the current Core BS FEP. The staging of ecosystem plans is specifically aligned with:

1. the completion of ecosystem-wide scientific studies and synthesis through NPRB Integrated Ecosystem Research Programs (IERPs, completed for the Bering Sea in 2012); and,
2. Council interest in strategic EBFM planning as reflected through the development of ecosystem-specific FEPs.

All members of the Alaska regional EBFM team are also members of the Core BS FEP Team. As NPRB is currently completing IERP synthesis for the Gulf of Alaska, it is anticipated that Bering Sea efforts will be followed by similar development in the GOA.

The national policy recognizes that EBFM has been ongoing for many years in many places, but serves to coordinate and communicate this work, while the regional implementation plans allow differing regional approaches to match regional needs. The national policy does not in itself add effort or resources, but helps to organize, prioritize and coordinate EBFM activities while identifying gaps.

Strategically, the NOAA Fisheries Alaska Region EBFM Roadmap (NOAA 2018) describes specific regional research and efforts to fulfill the EBFM Roadmap's guiding principles. Tactically, EBFM Roadmap progress (progress of implementation in each region) will be tracked at the national level with annual updates. The EBFM Roadmap focuses on aligning EBFM milestones with Council needs through the BS FEP. In the EBFM Roadmap, the six EBFM Principles (Table 3-1) are paired with short-, medium-, and long-term goals for implementation (NOAA 2018). As the BS FEP Action Modules change over time, tracking Action Module progress through the Roadmap will form a bridge between Council priorities and both regional and national NOAA research and implementation.

Table 3-1 NOAA Fisheries' EBFM principles

EBFM Principles	1. Implement ecosystem level planning 2. Advance our understanding of ecosystem processes 3. Prioritize vulnerabilities and risks of ecosystems and their components 4. Explore and address trade-offs within an ecosystem 5. Incorporate ecosystem considerations into management advice 6. Maintain resilient ecosystems

3.6.2 Other agencies

The Council works closely with many agencies. In the most general of terms, the Council makes final decisions about the Core BS FEP and Action Module content after considering recommendations from all other groups (Plan Teams, Committees, the public, academic or research institutions, other agencies, NOAA). The Council may also choose to make formal recommendations to other agencies regarding specific issues or actions.

In more specific terms, the BS FEP provides an opportunity for ongoing engagement with many agencies, including NOAA, ADFG, IPHC, and USFWS. Creation of the Core BS FEP has been a collaborative, interdisciplinary process, using materials and input from all these agencies and individual staff members. The resulting Core document streamlines a number of definitions for jargon and terms that can sometimes be unclear or misinterpreted when used outside their original agency or context. This is expected to aid in future inter-agency collaboration during completion of Action Modules. Comprehensive overviews have also been incorporated where possible to allow for diversity in how ideas relate to terms across different agency or stakeholder groups (e.g., see section 6.3.3 for a comprehensive overview of how subsistence is understood in different contexts by ADFG, NMFS, and stakeholders). Streamlining definitions while allowing for comprehensiveness will be a great resource for a broad spectrum of agencies to use as a living document going forward.

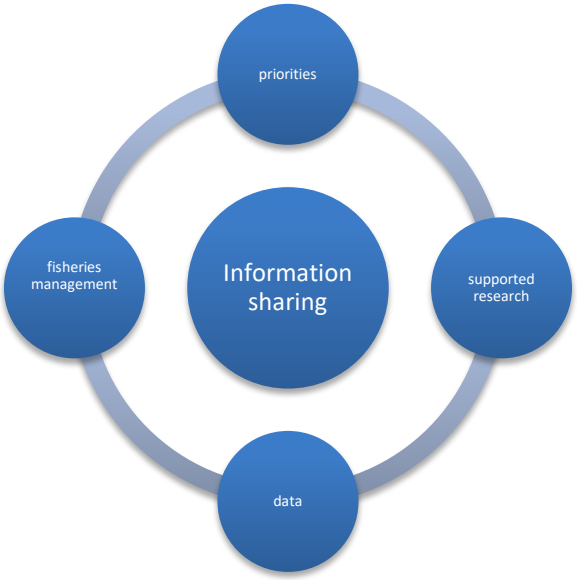
The completed Core BS FEP will serve as a living summary of the Bering Sea ecosystem as well as an assessment of the current management approach for its ecosystem-based elements. The Action Module process will use the completed Core BS FEP to guide each project. Complete Action Modules are specific efforts initiated by the Council, and meant to have real-world, potentially inter-agency, impacts. Efforts made from the beginning of the BS FEP process to streamline while allowing for comprehensive summaries will aid in future processes when other agencies wish to use information, guidelines, and outcomes from the BS FEP (including the Core BS FEP and completed Action Modules).

3.7 Relationship with funding agencies

The Council relies on original research from Federal, state, and academic organizations to evaluate potential management actions. Management plans and fishery regulations are continuously changing as new information or problems arise. The Council prepares and modifies management plans (FMPs) for fisheries under its jurisdiction. Council and NMFS staff prepare regulatory and FMP amendment analyses using the best scientific information available (including natural and social science, LK, TK, etc.).

In keeping with the shift to integrated science in general, and to EBFM in particular, many agencies and organizations are actively pursuing ways to strengthen existing collaborations, engage new partners, and increase the effectiveness of their outputs beyond typical metrics (e.g., publications). The platform for these endeavors is enhanced communication and information sharing among groups that share complementary missions. Broader understandings of flexibility and accessibility across organizational protocols will strengthen Onramps for effective information sharing (Figure 3-8).

Figure 3-8 Information cycle. Connections are bi-directional and cross-organizational.



In its simplest form, a partnership consists of two organizations with additional groups as relevant to a specific Action Module or larger BS FEP effort (see Chapter 4). The Council and the North Pacific Research Board (NPRB) are an example for one method of approaching enhanced communications. This includes a description of the overlap in mission, a draft agreement for information sharing, and types of optional actions to be considered for specific needs.

3.7.1 Example Partnership: North Pacific Research Board

The mission of the North Pacific Research Board is 'To develop a comprehensive science program of the highest caliber that provides a better understanding of the North Pacific, Bering Sea, and Arctic Ocean ecosystems and their fisheries.' NPRB has historically funded basic and applied science that has relevance to Council management actions. NPRB's protocol for the development of requests for proposals also includes several portals for Council priorities to be considered, making it a prime candidate for a strong partnership effort.

Despite several formal and informal linkages, no standard protocol for the transfer of information that would be relevant to both NPRB and the NPFMC existed. Similar to the Council, NPRB has significant interest in developing and strengthening relationships that promote effective application of funded research and contribute to the development of robust research programs. Modern approaches to the assessment of impacts are likely to be most effective with a wider-ranging, collaborative effort and bi-directional flow of information. A review of the basic and enhanced avenues for communications from NPRB, as a representative funding agency, to the Council and other potential partners (e.g., ADF&G, NOAA, as described in the research tracking Action Module in section 4.5) is summarized in Table 3-2.

Table 3-2 Basic and enhanced avenues for information transfer among partners

NPRB	Basic	NPRB Board includes a seat for the Council, as well as two other Council members: the State of Alaska Commissioner of Fish and Game, and the Regional Administrator of the National Marine Fisheries Service
		NPRB Science Panel typically includes one Council staff member
		Council staff participate in external peer reviews of NPRB proposals
		Consideration of Council priorities during the development of the Core RFP
		Inclusion of "Management and Ecosystem Implications" narrative section in proposals
		Regular distribution of final reports to Council Staff (quarterly to semi-annually)
		Council staff engage NPRB staff on relevant teams (e.g., BS FEP Team)
	Enhanced	Development of a standard practices document that outlines intent and defined pathways to share information in a meaningful manner for both parties
		Specific Council priorities highlighted to the NPRB during RFP development (e.g., BS FEP relevance)
		Inclusion of Council-specific tracking tags to proposal metrics (e.g., BS FEP, risk analysis)
		Information on newly-funded projects provided to Council staff
		Facilitation of access to NPRB embargoed data for time-sensitive analyses
		Enable early dialogue between appropriate active research projects and Council staff
		Identification of Council awareness/consideration of NPRB-funded research in management decisions
		Participation of NPRB-funded researchers in Council meetings

While many avenues were pre-existing, and some actions were already in place, a single document that outlined current formal and informal practices was lacking. A standard practices document was drafted to serve as a template to incorporate both general information sharing and specific attributes as needed (e.g., BS FEP, see research tracking Action Module in section 4.5 for more information). Implementation will also include adoption of the standard practices and evaluation of appropriate enhanced features.

3.8 Tracking and feedback mechanisms

The Council wants to ensure that the development and implementation of the BS FEP are transparent and effective and afford the opportunity to adapt in response to feedback from stakeholders. One important question to consider is: how do we know if the BS FEP is working?

What to communicate to the Council (SSC, Ecosystem Committee, Plan Teams, etc.).

This requires defining our performance measures and management strategies (Lenfest 2017)

1. **Effectiveness monitoring** (Lenfest 2017) or performance measures
   Used to evaluate whether specific management actions had the desired effect on the system component that is directly targeted by the management action. It links threat reduction to changes in the status of the fishery system components that are specified in the operational objectives.
   - New EBFM indicators, tracked in the ESR (objective, significance threshold, indicators).
   - Example: Describe specific example of current indicator that can monitor effectiveness or description of new indicator to develop.
   - Annual synthesis of performance measures with specific reference to BS FEP objectives.

2. **Trend monitoring** (Lenfest 2017) Did we make it? Comparing monitoring data with predictions. Have unanticipated outcomes or trade-offs occurred since implementation of the management strategies?
   A systematic series of observations over time for the purpose of detecting change in the state of the fishery system (Metcalf et al., 2008). It is directly tied to the initial "taking inventory" activities of the BS FEP, and to the subsequent adaptive management process, risk analyses, and management strategy evaluations. These subsequent activities will reveal if additional indicators

need to be included as part of the monitoring process. Typically, trend monitoring is not used to evaluate management actions, although some indicators may prove useful for this.

- Ecosystem Status Report, Report Cards.
- Already included in the Ecosystem Assessment. Expand to specifically include discussion of predictions and outcomes.

3. **Uptake of BS FEP information into Council management process -** These are metrics for representing success, defined as uptake by Council and others. Ideally, all summaries listed below would be undertaken at least once per year. Metrics that are quantifiable (such as word searches in minutes) could be presented in time series. Other summaries could be provided in a report presented to Council bodies according to the timeline listed below in the "When To Communicate To Council" section.
    - Summary of SSC and Council minutes pertaining to BS FEP-provided information.
        - Track the volume (text analysis of ecosystem and BS FEP-related words, including LK, TK, etc.) and location (SSC discussion of stock assessments vs. ecosystem status reports vs. BS FEP). Are there changes over time in how ecosystem information is being used by the Council?
    - Use the Fine/Not Fine framework to document contextual ecosystem information usage in annual harvest specifications. Taken from Zador and Harvey (in prep).
    - Real-time recording/note-taking by Council staff of when Council *considers* BS FEP-related information either in discussion or in the analysis and this occurs in say, the preamble to regulatory actions such as FMP amendments
    - Feedback that affects research priorities – BS FEP-related issues added to research priorities indicates success
    - Uptake of research priorities/Action Modules into external RFPs
        - Inclusion in RFP - keyword searches in RFPs and/or proposals
        - Funding through RFP (and how many proposals)
    - Summary of BS FEP-informed actions in other sources
        - Reports, publications?
        - Databases (e.g., surveys, environmental indices)
    - Summary reports of Action Module status
        - Action Module status
        - Action Module completion
        - Documentation of Action Module incorporation/use in management - annual tracking, whose responsibility?

4. **Update on outreach activities.** Summaries of activities that are relevant to the BS FEP
    - Partnerships - who, what, etc.
    - Stakeholder workshops - who, what, when, etc.
    - Website Google Analytics - how many views? how many section downloads (as appropriate depending on downloadable content on website)?

<u>How to communicate these metrics to the Council?</u>

- Website - same as for public outreach?
    - Social media - primarily for public outreach
    - Online database (information delivery platform)
- BS FEP Report?
    - New report
    - Metrics for success/uptake statistics

    - Action Module status
    - Ecosystem Status Report
    - BS FEP objective indicators summary
- Presentations
    - During various Council meetings
- Periodic workshops (more opportunities for informal information sharing)

4 List of Action Modules

The Council has adopted five Action Modules for the BS FEP. The five were selected from a longer list of potential candidates considered by the BS FEP Team and the Ecosystem Committee. As part of its adoption of a final BS FEP, the Council prioritized the list of Action Modules, and specifically initiated action on two of them, as listed:

1. Evaluate short- and long-term effects of climate change on fish and fisheries, and develop management considerations — INITIATED
2. Develop protocols for using LK and TK in management and understanding impacts of Council decisions on subsistence use — INITIATED
3. Gap analysis of Bering Sea management with EBFM best practices
4. Interdisciplinary conceptual models for the Bering Sea ecosystem
5. Align and track Council priorities with research funding opportunities

The Council will periodically reconsider the list of Action Modules, their prioritization, and which of them to initiate for action.

The intent is for each Action Module to link specifically to one or more of the research objectives identified in section 2.3.2. In this chapter, each of the Council's approved Action Modules is outlined using the six questions identified in section 3.2:

1. Synopsis of the task, including how it will be accomplished
2. Purpose it will achieve, including relationship to BS FEP objectives
3. How it will inform the Council's decision making and management process
4. How it will be integrated in the Council's decision making and management process
5. Estimate of time and staff resources required to achieve it
6. Plan for public involvement

4.1 Evaluate short- and long-term effects of climate change on fish and fisheries, and develop management considerations

1. Synopsis *including how it will be accomplished*	The goal of this climate project is to evaluate the vulnerability of key species and fisheries to climate change, to strengthen resilience in regional fisheries management. Methods will leverage projects at AFSC. The Action Module will address the following objectives: (1) coordinate to synthesize results of various ongoing and completed climate change research projects; (2) evaluate the scope of impacts on priority species identified in initial studies; and (3) strategically revaluate management strategies every 5-7 years; (4) include synthesis to evaluate climate-resilient management tools. The climate change Action Module team will work with the Council to iteratively identify and assess the performance of potential short-term, medium and long-term management actions for climate adaptation (i.e., derive alternative strategies for MSEs).
2. Purpose *relationship to the BS FEP's strategic objectives*	This Action Module is specifically responsive to Process Objective 13, to establish a process for addressing change under novel or intensified stressors, as well as the implementation strategy of the Council's ecosystem policy vision statement. While the Action Module leverages ongoing AFSC research projects on climate change, including it in the BS FEP provides a direct link for the Council to be involved in prioritizing that research to focus on questions that are most relevant for the Council's fishery management. This is in keeping with the BS FEP's purpose to facilitate dialogue between managers and scientists. This Action Module will provide a seven-year climate context within which to interpret and respond to annual signals and will establish a more formal process for considering those variables. This is responsive to the BS FEP purpose to build resiliency into the Council's management strategies, and to provide options for responding to changing circumstances.
3. How it will inform the Council process	Climate-ready fisheries management will help continue the legacy of sustainable fisheries management in the region, including management to promote a productive marine ecosystem and healthy vibrate marine fisheries. Results will inform short, medium, and long-term "climate ready" tactical and strategic management measures.
4. How it will be integrated in the Council process	Short-term "climate-ready" management actions can be developed and implemented relatively quickly, thus climate change management strategy evaluations would be focused on testing their performance under the full scope of potential future conditions. In contrast, modification of medium- and long-term management measures require more specific characterization of risk and uncertainty around future trajectories, with thorough scientific evaluation as well as ample stakeholder and Council review and feedback. This information can provide a frame of reference for setting harvest recommendations and implementation of other management actions. Alternatively, climate-specific biomass reference limits (e.g., temperature-specific F_{ABC}) are derived using projections of environmentally enhanced single- or multi-species assessment models and can be used to set harvest rates that account for future climate variability. If management strategy evaluations as part of objective (3) determine the performance of these reference points is acceptable or preferable, they could be used to set harvest recommendations (or alternatively, could be presented along with status-quo assessment values). See above for additional examples.
5. Estimate of time and staff resources	Multiple ongoing projects at AFSC are already providing the logistical and analytical support to meet the first two parts of the Action Module, as well as provide the modeling platforms for part 3. Interdisciplinary teams like those already assembled for ongoing projects will be needed to conduct the full 5- to 7-year MSE evaluations, but personnel needs will depend greatly on the number and complexity of MSE scenarios and the number of new species evaluations.
6. Plan for public involvement	For this Action Module, the Council may solicit public input (including LK and TK), to identify priorities for MSE evaluations. Stakeholders will also be involved through the Council process.

4.2 Develop protocols for using LK and TK in management and understanding impacts of Council decisions on subsistence use

1. Synopsis *including how it will be accomplished*	This Action Module has two parts. In Part A, methods for integrating/incorporating LK and TK into Council processes in the short- to long-term will be addressed. In Part B, a methodology will be developed for how the Council can consider potential impacts to subsistence species, habitats that support those species, and access to subsistence resources. To develop this Action Module, the Council will strengthen and broaden ties with Alaska Native organizations, organizations that are familiar with subsistence data, non-economic social scientists, and agency scientists. Through collaboration with LK, TK, and subsistence experts, a protocol will be developed to ensure Council analysts know how to review and utilize LK, TK, and subsistence information successfully in analyses.
2. Purpose *relationship to the BS FEP's strategic objectives*	This Action Module is most responsive to BS FEP Research Objective 4, which links directly to Process Objective 6. As relates to Part A, the Council is interested in strengthening relationships with bearers of LK and TK and better capturing LK and TK in Council analyses. As relates to Part B, the Council is interested in developing a process for better understanding and considering how removals from commercially important fish stocks may affect subsistence resources important to Alaska Native communities or affect resource use patterns of those communities.
3. How it will inform the Council process	This Action Module will improve Council decision-making by giving the Council access to a more complete picture of the ecosystem and the potential impacts of their actions. This Action Module aims to provide a roadmap for operationalizing LK, TK and potentially processes like Co-Production of Knowledge (CPK) in the short- to long-term, as well as formulate a method for assessing the likelihood a given Council action may affect subsistence resources or the ability of users to access those resources. This project will guide the use of subsistence data in analyses and is expected to help the Council be increasingly responsive to National Standards 2 and 8.
4. How it will be integrated in the Council process	This Action Module is meant to positively inform the overall Council process and decision-making structure. The completed work will provide a framework and data for analysts to consider ways to make better use of non-economic social science data in the form of LK and TK along with outcomes from engagement actions (e.g., CPK processes), as well as 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. If included in the discussion paper and preliminary draft stages, it is expected that subsistence data would be considered during development of alternatives for specific actions. Impacts to subsistence resources or use will thus be considered throughout the Council process.
5. Estimate of time and staff resources	This is expected to be an ongoing process to cultivate relationships, with short- to medium-term goals including gathering existing data about specific issues. Once protocols for reviewing and using LK, TK, and subsistence use information are in a format that can be accessed and used by analysts, there may be limited commitment of Council time or staff resources to incorporate that information into analyses. Regular staff time would be required to maintain ongoing relationships and update descriptions in the BS FEP.
6. Plan for public involvement	As described above, the Council is reliant on partnering with other organizations to create an environment conducive to processes like CPK, as well as identifying and using subsistence data in analyses. It is anticipated that LK, TK, and subsistence experts would need to be actively involved on the development team for this Action Module. Outreach to partner agencies and their constituents as well as ongoing collaboration with Tribes and communities throughout the Bering Sea region will be important in verifying the data, products, and methods to use in management.

4.3 Gap analysis of Bering Sea management with EBFM best practices

1. Synopsis *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 (i.e., the objectives that came out of the 2004 Groundfish Programmatic SEIS), and the NOAA EBFM definition. Identify areas of success, and gaps indicating opportunities for improvement (e.g., using methods like citizen science data collection). Report the findings of the study in a format that communicates with a diverse audience of stakeholders.
2. Purpose *relationship to the FEP's strategic 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 Council management and for other Action Modules. This Action Module is specifically responsive to Process Objective 1, which calls for the implementation of a cohesive plan for Bering Sea EBFM. This Action Module also dovetails with an identified benefit of a BS FEP, to be an effective tool for better communication about the Council's current integration of the ecosystem approach in its management and is consistent with the Council's ecosystem vision statement.
3. How it will inform the Council process	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, and its findings will be incorporated in the Core BS FEP. As such, there may be some benefit to begin work on this project concurrently with the preparation of the Core BS FEP document.
4. How it will be integrated in the Council process	This work will allow the Council to prioritize its efforts with respect to initiating other Action Modules, and to exercise increased precaution in certain areas if appropriate. The results of the study itself will not be implemented as a FMP amendment, but if the study identifies areas in need of Council action, the Council will be prompted to initiate an appropriate response, be it a request for more research, or specific analyses.
5. Estimate of time and staff resources	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 (including LK and TK), 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.
6. Plan for public involvement	Public participation in the development of this Action Module will be most important in reviewing the initial assessment of the Council's management program with respect to EBFM best practices. All stakeholders are affected by the process by which the Council manages fisheries and may have input into the assessment of both EBFM best practice benchmarks, and how the Council management program measures up against them. While the Council process will provide one avenue for facilitating input from stakeholders (including LK and TK), it may be more inclusive to schedule other opportunities to solicit input on the review. A discussion of EBFM practices should address how human observations, whether from LK and TK, are used in Bering Sea fishery management, and there should be specific outreach to experts to review the findings on this topic. Once the report is prepared, there should also be a broader effort to publicize the findings outside of the Bering Sea ecosystem region.

4.4 Interdisciplinary conceptual models for the Bering Sea ecosystem

1. Synopsis *including how it will be accomplished*	Develop non-quantitative interdisciplinary "conceptual models" (system diagrams) of the Bering Sea ecosystem through an interdisciplinary process to highlight key ecosystem components (e.g., "groundfish", "crabs", "salmon", "marine mammals", "Norton Sound coastal communities") and detail conceptual understandings of pressures and drivers that contribute to the status and trends, including habitat areas of particular concern. This will allow the scope to be organized around 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 BS FEP. The diagrams resulting from this Action Module will form the basis of the Bering Sea ecosystem synthesis, currently included in skeleton form in Chapter 6.
2. Purpose *relationship to the BS FEP's strategic objectives*	It is envisioned that using interdisciplinary conceptual models to frame this work will greatly improve the targeting of future research, as well as ensuring that no critical components are missed. These conceptual models will also serve to synthesize ecosystem information for the Council and the public, through inclusion in glossy documents and presentations. As such, this Action Module is directly responsive to Process Objective 7, to organize communication of ecosystem science between scientists and decision makers.
3. How it will inform the Council process	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. Interdisciplinary conceptual models will enrich existing understandings of the Bering Sea ecosystem through collection of social, economic, biological, physical, non-scientific, and other forms of knowledge. It may be that the conceptual models are most effective integrated into the BS FEP strategic document.
4. How it will be integrated in the Council process	Conceptual models may be integrated in annual SAFE reports, FMP updates, and may inform the setting of TACs. These models could help provide an ecosystem context for decisions that have typically been made with a narrow focus on one or only a few species at a time.
5. Estimate of time and staff resources	The development of the models will require a multi-disciplinary and inter-agency 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.
6. Plan for public involvement	For this work, the Council may solicit public input (including LK and TK) to identify priorities for conceptual models. Stakeholders will also be involved in the review process for interdisciplinary conceptual models, through the Council process.

4.5 Align and track Council priorities with research funding opportunities

1. Synopsis *including how it will be accomplished*	The focus of this Action Module is on tracking research that is relevant to the BS FEP Action Modules, and how that information is subsequently used in management. A review of the basic and enhanced avenues for communications from NPRB, as a representative funding agency, to the Council and other potential partners (e.g., ADF&G, NOAA) will be summarized.
2. Purpose *relationship to the BS FEP's strategic objectives*	This is most responsive to process objectives 4, 7, and 11 of the BS FEP (see Chapter 2) and is potentially relevant for all ecosystem objectives of the BS FEP. The Council relies on original research from partners such as NMFS, ADF&G, IPHC, other Federal agencies and academia to evaluate potential management actions. Modern approaches to the assessment of impact are most effective with a wider-ranging, collaborative effort and bi-directional flow of information. For several years, the Council has been working to make the identification of research priorities, and the tracking of research stemming from those priorities, more relevant and useful.
3. How it will inform the Council process	Better aligning and tracking Council priorities with research funding opportunities will improve the efficiency and effectiveness of research throughout the Bering Sea Region. This Action Module will strengthen existing partnerships with organizations that support and perform research, as sharing reciprocal information about the research needs and outcomes is mutually beneficial.
4. How it will be integrated in the Council process	The Council may identify more effective ways to engage with researchers addressing the Council's research priorities to ensure that results are relevant and useful in management.
5. Estimate of time and staff resources	Staff would engage in regular, periodic communication with research partners to enhance dialogue and ensure that effective tracking is occurring for how funded research is used in the management process. This project requires communication and strategic discussion, but is not labor intensive and requires few resources.
6. Plan for public involvement	The Council and different research funding sources have pre-established protocols for receiving public input (including LK and TK) about research priorities. Action Module procedures and results would be shared with the SSC, AP, and Council, with the opportunity for public testimony at each stage.

5 Public involvement

This BS FEP is a strategic planning document that describes a process for addressing management concerns about the Council's expressed ecosystem policy and goals and is flexible to new information and changing resources. Some sections describe the purpose and structure of the BS FEP; others assess the current management approach for its ecosystem-based elements. This section describes public involvement. The Council recognizes that Bering Sea fisheries are important to coastal communities throughout the Bering Sea region, as well as communities of people who, while they may reside elsewhere, come to the region to work, or are significantly invested in the region (e.g., seasonal fishermen, offshore processors). One objective of the BS FEP is to engage stakeholders and the public in the process of implementing EBFM, so that the BS FEP is informed by the broadest realm of perspectives and increases public connection with the Bering Sea marine ecosystem. In this way, it is important that outreach and public involvement take place at every stage of developing the BS FEP framework and the Action Modules that will be initiated within that framework.

One of the primary goals of the BS FEP is to continue to strengthen the Council's EBFM processes with respect to management of Bering Sea fisheries, which depend on meaningful outreach to, and integration of input from, the public in the fisheries management process. An exchange of information through two-way communication with stakeholders has been highlighted as an important requirement for diversifying information inputs, knowledge, and perspectives (NPFMC 2018). Building shared knowledge can strengthen the Council and stakeholders' understanding of ecosystem function and change, provide insight to anticipate how stakeholders will respond, and develop broad support for fishery management science and decision-making. The BS FEP offers a framework for strengthening trust, transparency, and a sense of shared investment among managers, scientists, and stakeholders.

The Council already has a robust system for receiving stakeholder input, especially in the form of local knowledge (e.g., through public comments during meetings, as well as participation on Plan Teams, Committees, and Workgroups). The public have a space for involvement and sharing of local knowledge and traditional knowledge at every stage of the BS FEP process, and the Council supports involvement from the public in all arenas of creating and operationalizing the BS FEP, including in the form of sharing LK and TK.

The BS FEP does not necessarily aim to develop new groups of processes within existing Council infrastructure. Rather, it is a key aim of the BS FEP framework to rely on existing Council groups and processes. Some particular Council arenas that are focused on public involvement include the following.

Rural Outreach Committee (active 2009-2011): The Council's Rural Outreach Committee has worked in the past to advise the Council on how to provide opportunities for better understanding of fishery management issues and participation from Alaska Native and rural communities; provide feedback on community impacts sections of specific analyses; and provide recommendations to the Council about which proposed actions need a specific outreach plan. Through the Rural Outreach Committee, the Council developed a set of public involvement tools that are successfully in use for project-specific outreach, most recently for Council consideration of salmon and halibut bycatch reduction measures. These include (in no particular order):

- improvements to the Council website,
- Council presence on social media,
- direct mailings of flyers and summary documents when Council actions are upcoming,
- maintaining a list of regional contacts,
- statewide teleconferences for providing information and/or receiving testimony,
- staff presence and presentations at community, fishermen, or Alaska Native conferences and annual meetings,

- Council member and staff regional outreach,
- holding Council meetings in different locations in Alaska,
- audio streaming of Council meetings,
- development of educational workshops (by the Council or with partners),
- contractors or Council staff dedicated as a community liaison.

Community Engagement Committee (established 2018): The Council's Community Engagement Committee was created in June 2018 to identify and recommend strategies for the Council and Council staff to enact processes that provide effective community engagement with rural and Alaska Native Communities. Much of the Council discussion to date which provided the genesis of this Committee has evolved along with the development of the BS FEP. It is anticipated that engagement strategies and public involvement that are developed and recommended by the Committee will be applied to the BS FEP as well.

Tribal Consultation: It is the Council's independent desire to improve communication and consultation with communities and Alaska Native entities. In 2004, the Council adopted a priority goal statement and accompanying objectives in the groundfish management policy that is in the Council's groundfish FMPs, to increase Alaska Native and community consultation. The establishment of the Rural Outreach Committee, and ideas for improving consultation stemmed directly from this goal statement.

Executive Order 13175 (see section 7.3) requires "executive agencies" to establish regular and meaningful consultation and collaboration with Indian Tribes in the development of Federal policies that have Tribal implications. The Council does not fall under the definition of "executive agency" for the purposes of EO 13175, and the formal responsibility for Tribal Consultation on actions taken by the Council remains within NMFS. The Council may request to be a part of the formal consultation process, which has occurred in the past on specific Council actions. More generally, however, the Council and the Ecosystem Committee have reaffirmed the importance of the consultation objective in the groundfish management policy, throughout development of the BS FEP.

5.1 Phases of public involvement for the BS FEP

While the Council's existing framework provides for public outreach and involvement in all of the Council groups and processes, there is also a desire to improve that communication and consultation over time. The ultimate goal of a successful BS FEP is to support a robust EBFM-based fishery management system. There are three distinct phases of public involvement as relates to the BS FEP, and each phase may draw upon different tools for outreach or engagement. The BS FEP will use and build on the Council's existing open process of public involvement in decision making. The three phases are described below.

Initial development of the Core FEP

The Council conducted extensive scoping when deciding whether to proceed with developing a BS FEP. Generally, there was broad support for developing the BS FEP, and stakeholders provided comments about how the BS FEP process should work, potential goals and objectives, and tasks that might be included within an BS FEP. During the Council's scheduled initial review and final action on this draft BS FEP, the public is encouraged to provide feedback about whether this draft of the Core BS FEP is meeting the needs that were identified in scoping, information gaps that should be addressed through Action Modules, or other input that pertains to the Council's action to adopt the BS FEP.

Public involvement tools in use:

- Scoping meetings held by staff in Anchorage, Nome, and Seattle, where comments were synthesized and presented to the Council (a form of Comment Analysis Report or CAR).

- The Council public testimony process: opportunities for the public to submit written and verbal comment on the development of the Core BS FEP at BS FEP Team meetings, Ecosystem Committee meetings, SSC/AP/Council meetings
- Ad hoc engagement opportunities with partners and community representatives: meetings during the Council trip to St Paul, BS FEP Team discussion with the USFWS Bering Sea and Aleutian Islands Landscape Conservation Cooperative Steering Committee
- Council Ecosystem Workshop in February 2018, which created a model for information sharing and exchange among Council stakeholders

BS FEP Action Modules

A public involvement plan will be created for each Action Module (see section 3.2), including explicit steps for supporting and strengthening two-way communication along with all other forms of involvement (e.g., outreach, engagement, consultation, etc.). Public involvement plans will provide a framework to guide all forms of consultation, engagement, outreach, etc. with Bering Sea stakeholders and the public on that topic. It is anticipated that the public involvement plans will be individually tailored to each Action Module but will draw upon tools for public involvement that are highlighted in this document and developed through Council committees. The project teams for the Action Modules should also include external expertise where appropriate, which may include Tribal and community representatives, and non-economic social scientists (particularly those with experience working with TK and Alaska communities).

Ongoing Bering Sea BS FEP EBFM process

Once the BS FEP is adopted by the Council, operationalization of the BS FEP will continue through the development of Action Modules and the monitoring of the Bering Sea ecosystem through the annual Ecosystem Status Report (also known as the Ecosystem Considerations report. The Council has highlighted two-way communication as critical to enhancing and providing value to the decisions that the Council makes about managing fisheries in the Bering Sea ecosystem, and it will be important to consider how best to provide appropriate forums for such information, and how it should be synthesized and assessed in the Council decision-making process. It is envisioned that this will be an evolving discussion, supported through this BS FEP.

Public involvement tools identified in the FEP so far:

- The BS FEP contemplates periodic reporting to the Council on the BS FEP, the status of the ecosystem, findings from Action Modules (Chapter 3). This will include public testimony opportunities at BS FEP Team meetings, Ecosystem Committee meetings, and SSC/AP/Council meetings.
- The BS FEP also proposes development of a BS FEP website or other digital mechanisms (social media, smartphone accessible apps) to get information out to stakeholders about resources, Action Modules, engagement opportunities relating to fishery management in the Bering Sea ecosystem. Note that given the need for regular updating, the Team has discussed opportunities to develop this in partnership with other organizations.

The BS FEP Team, the Ecosystem Committee, and the Council have also received many ideas for public involvement tools from public testimony on the BS FEP, the Council's February 2018 Ecosystem Workshop, and the Council's consideration of establishing a Community Engagement Committee. A synthesis of the ideas that have arisen from public testimony is included in Appendix A. The Council could choose to develop any of these ideas for ongoing application in the BS FEP.

6 Synthesis of the Bering Sea Ecosystem

The EBFM management approach used in this BS FEP document recognizes:

> *fishing is only one variable that affects a species' population. Additional elements come in to play, such as interactions with other species, the effects of environmental changes, or pollution and other stresses on habitat and water quality. To more effectively assess the health of any given fishery and to determine the best way to maintain it, fishery managers should take ecosystem considerations into account.*[5]

Every ecosystem has many interrelated variables, or components. This BS FEP aims to consider the Bering Sea ecosystem as a synthesis of its components, rather than focusing on a single species or a single fishing sector (see section 1.2).

The chapter that follows presents the Bering Sea ecosystem through a description of three major components: section 6.1 outlines the BS FEP ecosystem area and associated regulatory boundaries; section 6.2 summarizes major ecological and oceanographic characteristics; and, section 6.3 highlights key human networks throughout the region. The descriptions in this chapter are not meant to be comprehensive; there are many references in other sources that provide a detailed discussion of the Bering Sea ecosystem and the species and people that inhabit and use the area. Rather, these sections are meant to assist the reader in better understanding linkages between major Bering Sea ecosystem components at a big picture perspective. Ultimately, promoting stronger understandings of linkages between ecosystem components is expected to enhance EBFM in the Bering Sea.

6.1 BS FEP Boundaries

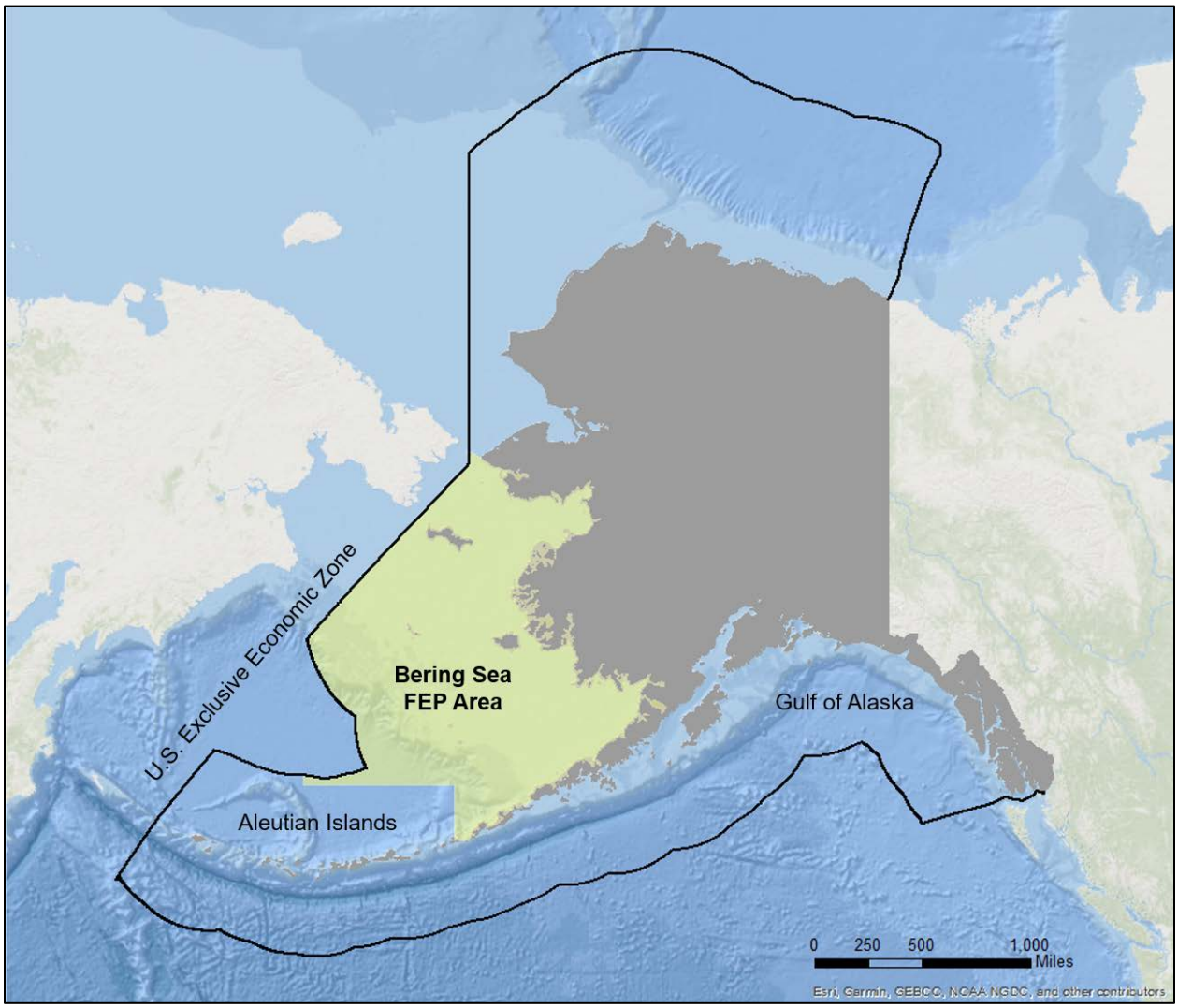
The geographic extent of the BS FEP is approximated by the eastern Bering Sea large marine ecosystem or LME. The LME concept was developed by NOAA and the University of Rhode Island to help assess, manage, and sustain resources and environments that are continuous in their physical and biological characteristics[6]. The BS FEP ecosystem area comprises the area of the East Bering Sea LME that is in the U.S. Exclusive Economic Zone, excluding the Aleutian Islands west of 169° W. longitude (Figure 6-1).

The Council recognizes that there is considerable connectivity of the Bering Sea ecosystem with neighboring areas. Where appropriate, the geographic boundaries are relaxed to allow understanding external pressures, impacts, and drivers, for example, as they relate to nearby regions, including eastern Russia, the North Slope region in Alaska, or the Western Gulf of Alaska. As such, the BS FEP boundary of the Bering Sea ecosystem is also flexible. Studies have shown that there are multiple biogeographic regions within the BS FEP ecosystem area as well (e.g., Sigler et al. 2011).

[5] Sourced from NOAA: https://www.st.nmfs.noaa.gov/ecosystems/ebfm/about

[6] "Large Marine Ecosystems (LMEs) are regions of ocean and coastal space that encompass river basins and estuaries and extend out to the seaward boundary of continental shelves and the seaward margins of coastal current systems. As their name states, LMEs are relatively large regions that have been delineated according to continuities in their physical and biological characteristics, including inter alia: bathymetry, hydrography, productivity and trophically dependent populations. The LME as an organizational unit facilitates management and governance strategies that recognize the ecosystem's numerous biological and physical elements and the complex dynamics that exist amongst and between them" (UN 2018).

Figure 6-1 Map of BS FEP ecosystem area



6.1.1 Regulatory authority

Although there is a single geographical boundary of the BS FEP, fishery management boundaries vary with respect to species and agency. The BS FEP considers the interactions of Federal and State fisheries with each other and with other components of the ecosystem.

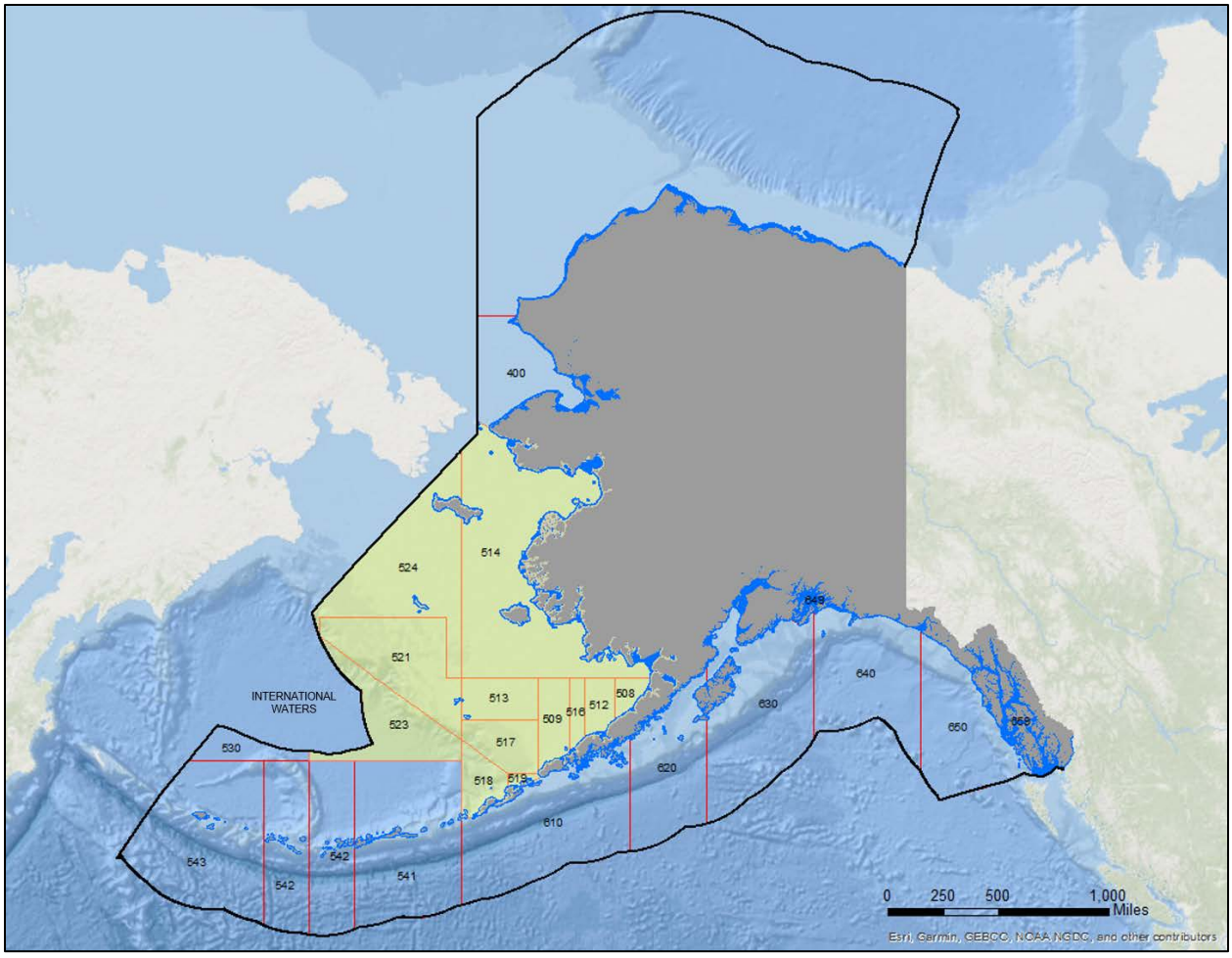
The bulk of Federally managed fisheries in the Bering Sea are concentrated in the southern region, which also includes the southern shelf and the whole of the Bering Sea slope area. Federal fisheries within the geographical area include those for groundfish crab, scallops, and halibut. Groundfish species in Federal waters are managed under the authority of the Bering Sea/Aleutian Islands fishery management plan (BSAI FMP). The BSAI FMP includes two subareas, for the Bering Sea and the Aleutian Islands, and defines the Bering Sea subarea as that area of the exclusive economic zone (from 3-200 miles offshore) that is north of the Aleutian peninsula, south of Bering Strait, and does not include the Aleutian Islands subarea (that area west of 170° W. and south of 55° N.). The Bering Sea subarea accounts for approximately 95% of BSAI groundfish catch.

For management purposes, the Bering Sea subarea is divided into a series of reporting areas (Figure 6-2). Certain groundfish species may also be harvested in State of Alaska waters, within 3 nm of shore. The

State of Alaska is also responsible for day-to-day management of the king crab, Tanner crab, and snow crab fisheries that take place in the Bering Sea, as well as the Alaska scallop fishery. These fisheries are managed under the oversight of the Council's Bering Sea and Aleutian Islands King and Tanner Crab Fishery Management Plan and Alaska Scallop Fishery Management Plan, which defer direct management to the State. Additionally, the State manages herring and salmon fisheries in the areas, which are wholly prosecuted within State waters, and some groundfish, octopus, and squid fisheries. The State of Alaska uses its own grid of statistical areas to record catch and manage these fisheries.

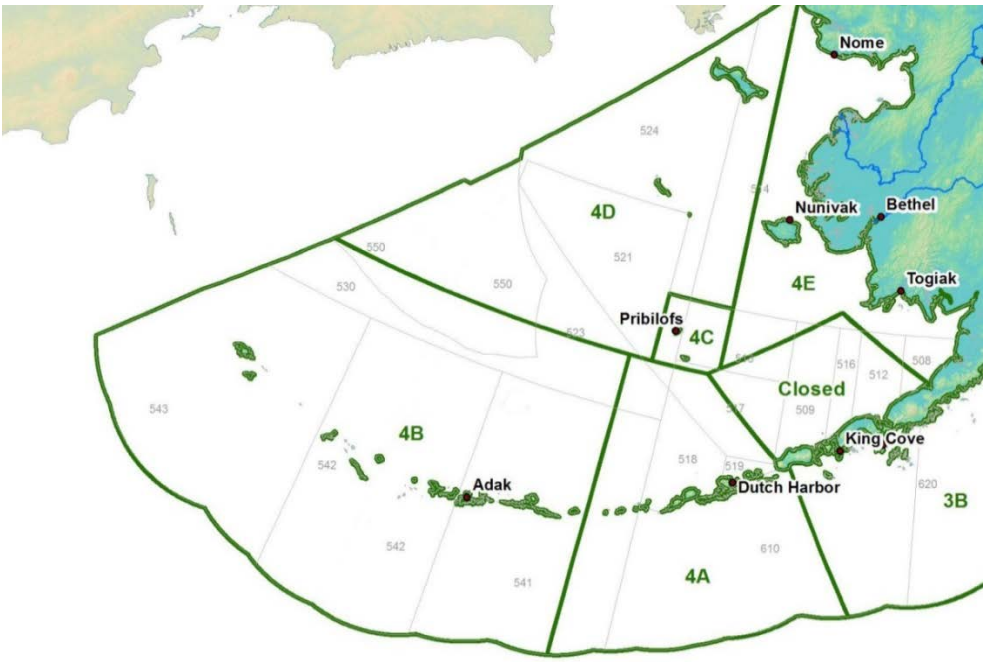
Figure 6-2 Map of Federal groundfish management areas in the Bering Sea ecosystem

Note, areas in blue denote State waters that are outside of Federal jurisdiction. Yellow is BS FEP area.



Pacific halibut fisheries in the Bering Sea are governed under the authority of the Northern Pacific Halibut Act of 1982. For the United States, the Halibut Act gives effect to the Convention between the United States and Canada for the Preservation of the Halibut Fishery of the North Pacific Ocean and Bering Sea (Convention). The Convention gives the International Pacific Halibut Commission broad authority to adopt regulations to maintain halibut abundance, while the Council and NMFS have the authority to develop management measures governing harvesting privileges among U.S. fishermen in U.S. waters. The Council has developed halibut management programs for three fisheries that harvest halibut in Alaska: the subsistence, sport, and commercial fisheries. The IPHC regulatory areas do not match exactly to NMFS management areas (Figure 6-3), and for the BS FEP ecosystem area, include Areas 4C, 4D, 4E, and part of Area 4A.

Figure 6-3 Map of IPHC regulatory areas in the Bering Sea.



Source: Adapted from NMFS Alaska Region map by Northern Economics Inc.

Jurisdiction for subsistence activities in the Bering Sea falls under the remit of the USFWS or NMFS, with the exception of halibut subsistence which is under the jurisdiction of the Council and NMFS. In October 2000, the Council recognized and now manages the subsistence fishery for halibut. The subsistence halibut regulations authorize eligible persons who possess subsistence halibut registration certificates (SHARCs) to conduct subsistence halibut fishing in waters in and off Alaska. A person was eligible for a SHARC to harvest subsistence halibut only if he or she is a rural resident of a specified community or rural area, or a member of an Alaska Native Tribe, with customary and traditional uses of halibut.

Inseason data are collected at many spatial levels, including Federal reporting areas, State of Alaska statistical areas, IPHC areas. Additionally, for some directed fisheries, precise global positioning systems provide specific haul locations.

Figure 6-4 describes the regulatory responsibility of various international, Federal, State, and municipal agencies over the resources and people of the Aleutian Islands ecosystem. While the Council only has direct authority to recommend management actions for fisheries occurring in the Federal waters off Alaska, information that is learned through the BS FEP process can be shared with other agencies with management jurisdiction by the Council or through partnership with NMFS.

Figure 6-4 Regulatory responsibility in the BS FEP area

Resource, Population	Agency	Responsibility
Groundfish	NPFMC/NMFS ADF&G	3-200nm; population abundance; setting harvest levels, fishery management, monitoring, and enforcement 0-3nm
Pacific halibut	IPHC NPMFC/NMFS	population abundance, setting harvest levels management of fishery
Crab spp.	NPFMC/NMFS ADF&G	monitor overfishing levels, allocations harvest levels; fishery management, monitoring, enforcement
Scallop	NPMFC/NMFS ADF&G	monitor overfishing levels harvest levels, fishery management, monitoring, enforcement
Salmon spp.	ADF&G NPFMC/NMFS	population abundance, harvest levels, fishery management retention prohibited 3-200nm
Herring	ADF&G	population abundance, harvest levels, fishery management
Other fishes	NMFS	advisory authority for habitat for all fish incl nearshore watersheds
Marine mammals (except walrus and otters)	NMFS and others	population abundance, advisory authority, protection under MMPA and ESA, co-management (ANC for polar bears; ISC for ice seals)
Walrus and otters	USFWS and others	population abundance, advisory authority, protection under MMPA and ESA, co-management (EWC for walrus)
Birds	USFWS AMBCC	population abundance, advisory authority, protection under MBTA
Citizens of each coastal community	Municipal entities Tribes Boroughs Cities	municipal responsibility
Land	USFWS BLM DNR Tribes Native Corporations Cities	protection of Alaska Maritime National Wildlife Refuge including marine responsibility extending offshore own some small parcels
Shipping	DEC USCG	oversight of spill response ensure safety of vessels in US ports and waterways
Oil and gas development	BOEM DNR or DEC	3-200nm 0-3nm
Military activity	Alaskan Command Pacific Command	Military defense
Formerly used defense sites	AFCEE	cleanup

KEY: ADF&G – Alaska Department of Fish and Game; AFCEE – US Air Force Corps of Engineers; DEC – Alaska Department of Environmental Conservation; DNR – Alaska Department of Natural Resources; DOD – Department of Defense, EPA – Environmental Protection Agency, MMS – Minerals Management Service, NMFS – National Marine Fisheries Service, NPFMC – North Pacific Fishery Management Council, USFWS – US Fish and Wildlife Service

6.1.2 Partnerships in the Bering Sea Region

Because Bering Sea resources are multi-jurisdictional, management decisions at the Council level can have consequences beyond our borders. Many marine species in the BS FEP region (e.g., marine mammals, salmon species) cross political boundaries throughout their life cycles, and utilize habitat in Russian, Japanese, Chinese, or other national waters, and international waters. Coastal and marine activities beyond the Council's jurisdiction (including fishing, shipping, oil and gas extraction, pollution, etc.) can therefore impact species of importance to the Bering Sea ecosystem. The importance of this interconnectedness as a part of the Council decision-making process is anticipated to increase as climate change alters physical and biological components of the Bering Sea ecosystem.

- In the middle of the Bering Sea, the area of international waters nested between territorial waters of the United States and Russia is known as the "Donut Hole" (Figure 6-2). In the 1980s,

unregulated catch of pollock in this area caused long-lasting damage to the resource. The Agreement Between the Government of the United States of America and the Government of the Union Soviet Socialist Republics on Mutual Fisheries Relations, which established the Intergovernmental Consultative Committee (ICC), was signed in 1988 and set the stage for conservation, management and optimal utilization of shared fisheries resources between both nations (U.S. Department of State n.d.). The Council Chairperson and Executive Director, or their designee, attend the ICC meetings each year.

- In 1994, the Convention on the Conservation and Management of the Pollock Resources in the Central Bering Sea was signed in 1994 by the People's Republic of China, the Republic of Korea, the Republic of Poland, the Russian Federation, Japan, and the United States of America to establish an international regime for conservation, management, and optimum utilization of the pollock resources in the international waters (beyond 200 nautical miles) in the Bering Sea. This international agreement banned commercial fishing in the Donut Hole. In 2017, foreign fishing vessel activity was low along the marine boundary line with an average of two vessels detected within 20 miles of the marine boundary line during October (USCG 2017). Additional objectives include of the Convention include restoring and maintaining pollock resources in the Bering Sea at levels that permit their maximum sustainable yield, cooperating in gathering and examining factual information concerning pollock and other living marine resources in the Bering Sea, and providing a forum in which to consider the establishment of necessary conservation and management measures for living marine resources other than pollock in the Bering Sea as may be required.
- The United States and Russia consult on issues of fisheries conservation and management beyond their exclusive economic zones and third-party zones, and cooperate to address illegal, unreported, and unregulated (IUU) fishing activities on the high seas of the North Pacific Ocean and Bering Sea. Other agreements to combat IUU fishing have been signed by the U.S. and Russia, as it remains a concern in the western Bering Sea, particularly for illegally harvested Russian king crab. The U.S. and Russia also cooperate on scientific research, such as: 1) walrus research in the Russian and U.S. sides of the Bering Sea, 2) ice seal research in the Bering and Chukchi Seas, 3) pollock research on both sides of the transboundary area of the northern Bering Sea, and 4) salmon and integrated ecosystem research in the Arctic region. 5) Other species such as seabirds, steller sea lions, right whales, and fur seals.
- Disputes between the United States and Canada surrounding harvest of at-sea salmon led to a framework for conserving Pacific salmon coast-wide. The 1985 Pacific Salmon Treaty, which established the bilateral Pacific Salmon Commission, was designed to conserve and optimize the production of intermingling salmon stocks along the coasts of Oregon, Washington, British Columbia, and Southeast Alaska, to reduce interceptions of salmon originating in one country by fisheries of the other country, and to regulate salmon harvests between the two countries (U.S. Department of State n.d).
- The North Pacific Anadromous Fish Commission (NPAFC) is an intergovernmental organization established in 1992 by the Convention for the Conservation of Anadromous Stocks in the North Pacific Ocean. The objective of the Commission is to promote the conservation of anadromous stocks (Pacific salmon and steelhead trout) in the Convention Area. The Convention Area includes the international waters of the North Pacific Ocean and its adjacent seas north of 33° North beyond the 200-mile zone (exclusive economic zones) of the coastal States. Current member countries include: Canada, Japan, the Republic of Korea, the Russian Federation and the United States of America (NPAFC 2018).
- The North Pacific Fisheries Commission (NPFC) is an intergovernmental organization established in 2015 by the Convention on the Conservation and Management of High Seas Fisheries Resources in the North Pacific Ocean. The objective of the Convention is to ensure the long-term conservation and sustainable use of the fisheries resources in the Convention Area

while protecting the marine ecosystems of the North Pacific Ocean in which these resources occur. Current Members include: Canada, China, Japan, the Republic of Korea, the Russian Federation, Chinese Taipei, the United States of America and Vanuatu (NPFC n.d.)

- The Arctic Council is an intergovernmental forum promoting cooperation, coordination and interaction among the Arctic States, Arctic indigenous communities and other Arctic inhabitants on common Arctic issues. The Council focuses on arctic contaminants, monitoring and assessment, biodiversity conservation, emergency prevention, preparedness, and response, protection of the marine environment, and sustainable development in the Arctic. Their work encompasses the Bering Sea as part of the 18 Arctic LMEs, and their members include Canada, the Kingdom of Denmark, Finland, Iceland, Norway, the Russian Federation, Sweden and the United States. In addition, six organizations representing Arctic indigenous peoples have status as Permanent Participants.
- Management of marine mammals:
    - The International Whaling Commission (IWC), established in 1946, is the global body charged with the conservation of whales and the management of whaling. The IWC currently has 87 member governments from countries all over the world. Uncertainty over whale numbers led to the introduction of a moratorium on commercial whaling in 1986. The Commission also works to understand and address a wide range of non-whaling threats to cetaceans including entanglement, ship strike, marine debris, climate change and other environmental concerns (IWC n.d.).
    - The Eskimo Walrus Commission (EWC), formed in 1978, represents 19 Alaskan coastal walrus hunting communities from Barrow to Bristol Bay. Initially formed as a consortium of Native hunters, the EWC is now a recognized statewide entity working on resource co-management of walrus on behalf of Alaska Natives. A cooperative agreement between the U.S. Fish and Wildlife Service (FWS) and the EWC, authorized under the MMPA, was developed in 1997 to ensure the participation of subsistence hunters in conserving and managing walrus stocks in the coastal communities (EWC 2018).
    - The Ice Seal Committee (ISC), originally called the Ice Seal Working Group, was formed in December of 2004 and consisted of five delegates, one from each of the five regions where ice seals occur in Alaska. The purpose of the is "to preserve and enhance the marine resources of ice seals including the habitat; to protect and enhance Alaska Native culture, traditions, and especially activities associated with subsistence uses of ice seals; to undertake education and research related to ice seals." The ISC has identified the collection of harvest information as a priority and is an important contribution to management that federal managers have not been able to accomplish. In 2006, the ISC and the National Marine Fisheries Service (NMFS) entered into an agreement for the co-management of Alaska Ice Seal Populations (North Slope Borough 2018).

6.2 Bering Sea Ecological and Oceanographic Characteristics

The Bering Sea is a high-latitude, partially enclosed sea that supports considerable fish, seabird, marine mammal, and invertebrate populations and some of the world's most productive fisheries. Furthermore, the eastern Bering Sea shelf is one of the most studied large marine ecosystems in the world. In addition to nearly 40 years of annual fisheries-independent annual trawl to support fisheries, and regular monitoring of marine mammals and bird populations, a range of process studies has gathered significant information on all parts of the marine food web.

From 2007-2012, the National Science Foundation and North Pacific Research Board collaborated on the Bering Sea Program, an extensive research program with over 45 researchers to investigate mechanisms connecting the physical and biological processes from nutrients and plankton through fish, marine mammals, birds, and humans. This work greatly expanding mechanistic understandings of the Bering Sea,

especially with respect to differences in ecological processes occurring between warm and cold conditions. The results of these studies have led to direct uptake of ecosystem information into fisheries management, through environmentally-linked stock assessments and the development of the Bering Sea ESR Bering Sea Report Card, which tracks productivity indices from the bottom to the top of the food web as initially identified by Bering Sea Program results.

Direct, mechanistic understanding of ecosystem linkages is the gold standard for incorporating EBFM into tactical management processes. However, even with the far-reaching scale of the Bering Sea Program, many links between species remain uncertain. Furthermore, controlling mechanistic links may shift over time, not just with climate conditions, but with shifts in human communities and management practices. Therefore, developing a more qualitative "conceptual" model of ecosystem linkages, and the limits at which those linkages break down, can help to create a more robust management system, by identifying gaps in understanding and assisting in proactive determination of processes which may increase in importance in the future (e.g. through qualitative risk analyses). Conceptual models can also serve as a bridge between traditional science and LK/TK by putting different knowledge bases into a "common currency" of ecosystem connections.

Here, we briefly describe eastern Bering Sea biogeography and key species groupings; detailing these communities, their species composition, biological/human interactions, and the drivers and pressures affecting each one, will be conducted through the interdisciplinary conceptual model Action Module (section 4.4).

6.2.1 Biomes

The Bering Sea is made up of a deep central basin surrounded by continental shelves of Alaska and Kamchatka. The western and eastern continental shelves are considered separate large marine ecosystems (LMEs). The waters in the Bering Sea form part of the North Pacific sub-Arctic gyre, with water entering from the Gulf of Alaska through several Aleutian passes, continuing counter-clockwise around the Bering Sea, and exiting through Kamchatka Strait. Further, northward currents over the northern Bering Sea shelf flow through the Bering Strait into the Arctic Ocean.

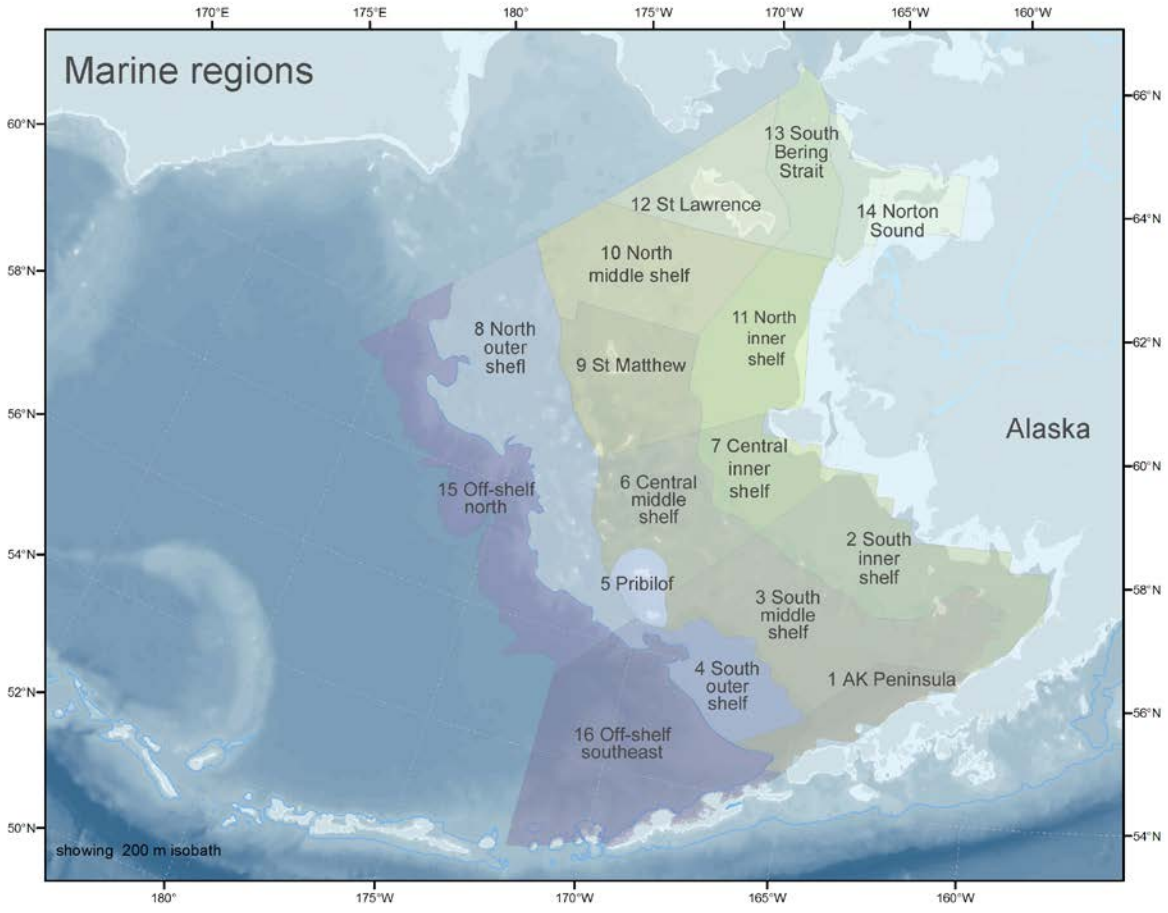
The Bering Sea straddles a major Arctic/sub-Arctic atmospheric front and is influenced by both Arctic and sub-Arctic weather patterns, in particular the Aleutian Low and the Siberian High pressure systems. The relative strength of these systems and the gradient between them affects the path and intensity of Bering Sea storms, which have a major influence on ice, mixing of nutrients in the water, temperature, and other oceanographic processes. The Aleutian Low and Siberian High themselves vary in response to decadal climate variability over the North Pacific and in the Arctic, and also respond to shorter-term variability in the tropical Pacific.

Winter ice coverage is a major driver of the ecosystem dynamics of the Bering Sea and shows extreme seasonal and interannual variability. The northern continental shelf is generally covered by sea ice in the winter, whereas cover in the southern Bering Sea is highly variable. The advance and retreat of sea ice each year is larger than in any other sub-Arctic sea, averaging about 1,700 km but varying greatly from year to year, both in extent and timing. When ice is at its maximum extent each year, between 20–56% of the Bering Sea is ice covered. Winter ice conditions strongly influence temperature conditions during the following summer. In particular, melting ice in the eastern Bering Sea results in the formation of a subsurface cold pool of water that persists into summer that affects the spatial distribution of species in the region, including commercial fish stocks during summer.

The western (Kamchatka) shelf is narrow, covering less than 10% of the portion of the Bering Sea within the Russian exclusive economic zone (EEZ). On the other hand, the eastern Bering (Alaskan) shelf (EBS) has an extremely broad continental shelf (4500 km). The broad EBS is separated by ocean stratification and tidal movement into Inner, Middle and Outer shelf domains with differing species and community

compositions. In the EBS, the combination of a broad shelf with inner, middle, and outer shelf oceanographic domains, in combination with the north/south variation of climatology and ice, leads to the definition of several distinct biomes. As these biomes are partially defined by oceanography and climate, their precise boundaries may vary over time. The combination of inner to outer shelf and slope, and a north to south gradient, leads to a range of biomes and conditions being identifiable (Figure 6-5).

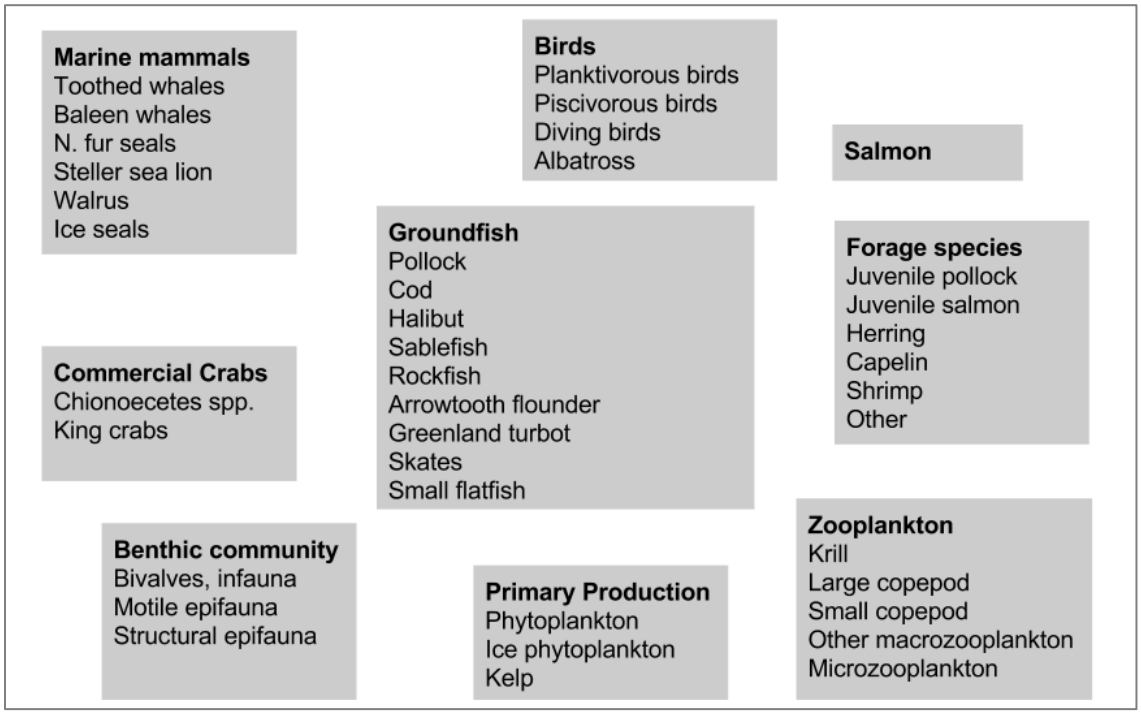
Figure 6-5 Map of bioregions in the Bering Sea identified by the Bering Sea Program



6.2.2 Species Groupings

The ecological biomes of the Bering Sea are complex and highly productive, with the relatively shallow and broad shelf providing habitat for extensive interplay between benthic and pelagic species. In general, species can be grouped by different metrics depending on the ecological or social context, including grouping by taxonomy, life history, ecology, habitat, feeding habits, human importance, or management system. For the interdisciplinary conceptual model Action Module (section 4.4), we have developed non-human species groupings ("guilds") that combine aspects of all of these elements to describe key interactions within and across biomes. The guilds are as follows (1) Primary Production; (2) Zooplankton; (3) Benthic Community; (4) Forage Species; (5) Groundfish; (6) Commercial Crabs; (7) Salmon; (8) Birds; and (9) Marine Mammals. Major species within each guild in the EBS are shown in Figure 6-6. Through the Action Module, a figure showing relative non-human species distribution within the biome, and detailing critical connections, will be developed for each guild.

Figure 6-6 Dominant non-human species groups with ecological and management importance in the Bering Sea

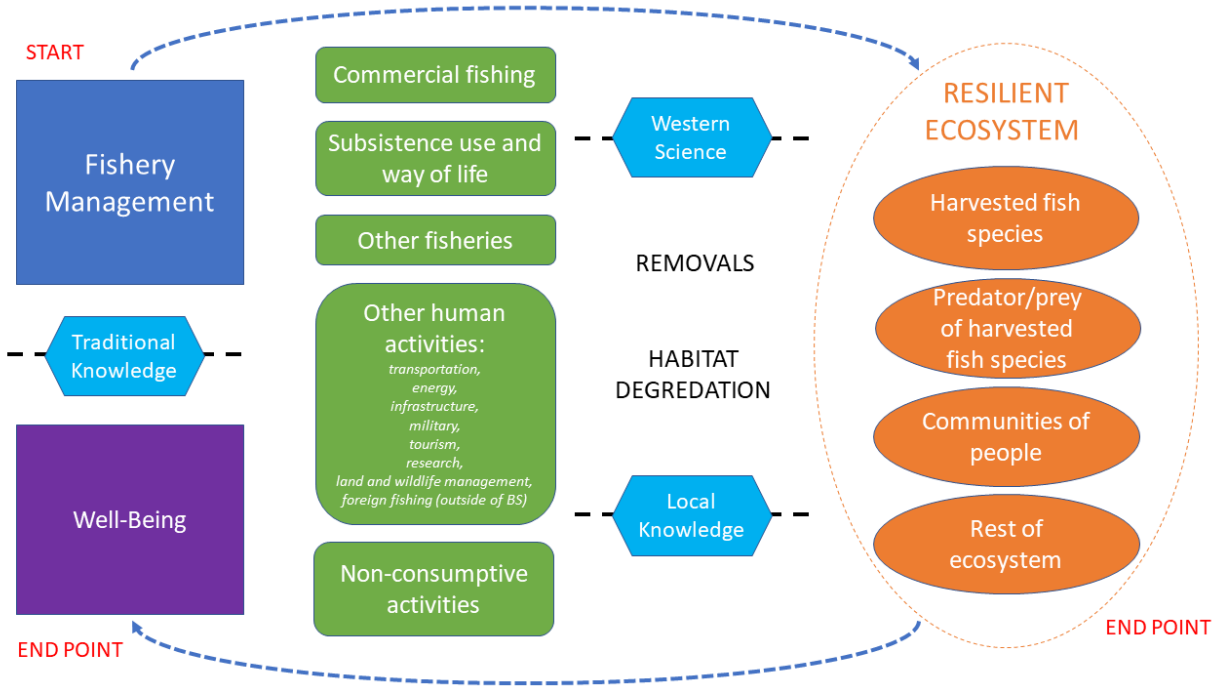


6.3 Bering Sea Human Networks

This section summarizes five key human networks that exist in the Bering Sea ecosystem. This set of examples is not meant to be exhaustive but is meant to act as a starting point for conceptualizing human components within the Bering Sea ecosystem. Human networks have interrelated characteristics. A spatial map of the Bering Sea region provides a starting point for comparing communities active within the Bering Sea ecosystem area; commercial fishing; subsistence activities; local knowledge and traditional knowledge guiding human activities; and other human and non-consumptive activities (Figure 6-7).

Figure 6-7 presents some of the ways that different human networks interact and influence one another in the Bering Sea ecosystem. Overall, this figure is meant to communicate the interrelatedness of all components within the ecosystem. Additionally, it is shown that comprehensive assessment—such as that outlined in the BS FEP—should not be limited to addressing *some* environmental, economic, and social factors in an ecosystem, but should strive to address the complex and interrelated networks within each of these categories as well.

Figure 6-7 Schematic of the connections between fishery management, human activities, maintaining a healthy ecosystem, and human well-being and culture.



6.3.1 Communities

For the purposes of community and social impact assessment of fishery management actions, Council analyses have typically focused on the provisions of National Standard 8 of the MSA, which requires conservation and management measures to "take into account the importance of fishery resources to fishing communities…in order to: (1) provide for the sustained participation of such communities; and (2) to the extent practicable, minimize adverse economic impacts on such communities" (50 CFR 600.345). In regulation, National Standard 8 defines the term "fishing community" as "a community that is substantially dependent on or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew and fish processors[7] that are based in such communities." The MSA defines "sustained participation" as meaning continued access to the fishery within the constraints of the resource," but does not define the term "substantial."

While NMFS has developed specific quantitative indicators for reliance and engagement[8] for use across multiple NOAA regions, these indicators may have limited utility in the context of small, rural, and/or Indigenous Alaskan communities. In the Bering Sea region, the presence of a single active vessel or

[7] Current guidelines for National Standard 8- Communities (found at https://www.ecfr.gov/cgi-bin/retrieveECFR?gp=&SID=6b0acea089174af8594db02314f26914&mc=true&r=SECTION&n=se50.12.600_1345) are inconsistent with the text in the MSA itself, which includes the language "United States" after "fish processors". Given this inconsistency, to err on the side of consideration of the full range of potential community impacts, the Council community and social impact analyses have typically included a treatment of impacts to all shore-based processors (even those owned by foreign companies, but still within the geographic area of the United States) operating in a given community that are engaged in the relevant fishery(ies).

[8] Within this set of indicators, engagement is measured using permits and vessel landings. Reliance is measures engagement in relation to the population of a community, or per capita. In short, engagement represents the scale of the industry in the community in absolute numbers while reliance represents the importance to the community of the industry relative to population. More information available at: https://www.st.nmfs.noaa.gov/humandimensions/social-indicators/ind-categories https://www.afsc.noaa.gov/Quarterly/jfm2014/JFM14_Feature.pdf

permit may be important, communities may be home to a local fleet but not shore-based processing, locally important engagement in federally managed fisheries may occur primarily through Community Development Quota (CDQ) organizations, and the interdependence of commercial and subsistence fishing may be of a different nature and order of magnitude than seen in other parts of the country.

Similarly, the National Standard 8 definition of a fishing community as "a social or economic group whose members reside in a specific location and share a common dependency on commercial, recreational, or subsistence fishing or on directly related fisheries-dependent services and industries" provides a relatively narrow focus on geographic place. Within an ecosystem analytic context and in the Bering Sea region in particular, defining "fishing communities" as tightly specified, fixed geographic locations risks excluding the complexity inherent in social networks and the flow of people, information, goods, and services. Traditions of seasonal and longer-term movements of regional residents in response to changes in resource availability result in "fishing communities" throughout the Bering Sea region that are not fixed in space or time. The human dimension of regional fisheries sustainability is dependent on understanding the importance of cultural traditions and shared histories that long predate the development of commercial fishing in the region.

In response to these complexities, researchers have expanded the concept of "community" to include those areas, resources, and social networks on which people depend (Calhoun et al. 2016, St. Martin and Hall-Arber 2008). Further, the National Standard 8 focus on "sustained" participation of fishing communities tends to favor a focus on single-species fisheries. Council analyses therefore typically focus on communities already substantially engaged in or substantially dependent on federally managed fisheries, leaving out those Bering Sea communities that share the same ecosystem, depend on subsistence fisheries, and/or are substantially dependent on participation in state managed fisheries, but that have not (exclusive of the CDQ program) historically been a part of federally managed fisheries in the region due to a variety of factors, including the capital-intensive nature of what are often industrial-scale fisheries.

The NMFS annual Ecosystem Status Report (or Ecosystem Considerations Report; Zador and Siddon 2017), identifies fishing communities by three criteria:

1. Geographical location,
2. Current fishing engagement (commercial, recreational, and subsistence),
3. Historical linkages to subsistence fishing.

The BS FEP uses a holistic approach similar to the Ecosystem Status Report to include both 'communities of place' as well as 'communities of interest' in the Bering Sea ecosystem. The Council aims to better assess and understand community issues as they relate to our fishery management context. This will be an ongoing process, which is expected to require continued coordination with NMFS, the SSPT, and others involved in the Council process. For example, through Action Modules, the Council may decide to further modify, develop, and apply different quantitative and/or qualitative social indicators. Using appropriate criteria to identify and consider communities in the decision-making process is central to effective marine resource management. The following sections highlight some of these criteria in relation to the Bering Sea ecosystem.

The geographic area of the BS FEP region includes over 60 inhabited coastal communities adjacent to waters where commercial fishing occurs (Recognizing the shift toward EBFM, Kevin St. Martin and co-authors (2007) have suggested a move in fisheries social science, "to emphasize community-level processes, practices, interactions and interdependencies as *starting points* for understanding the relationship between the rich and complex social practice of fishing and marine ecosystems." In this way, the term "fishing community" can refer geographically to a place where fishermen live (Kodiak, St. Paul, Seattle) or more abstractly to a community based on gear type, fishery, geography, values, or other factors. Bering Sea human networks may extend into adjacent FMP areas and into other states, especially

if encompassing communities substantially engaged in, or substantially dependent on, Bering Sea fisheries or other activities that occur in the BS FEP region. Some of these communities, such as the aforementioned GOA communities, do not necessarily fall into the physical BS FEP region. Residents of upriver communities rely on river networks to the coast to participate in both subsistence harvesting and commercial fishing activities. Inland communities in Alaska and Canada rely on fish from the Bering Sea, such as Pacific salmon, a key component of subsistence and commercial fisheries throughout the region. Other communities that may be engaged in and dependent upon the Bering Sea include fishing ports in other parts of Alaska and the Pacific Northwest that are homeports to vessels that participate in Bering Sea fisheries. Additionally, vessel owners and crew often come from outside of the Bering Sea region to participate in commercial fisheries; commercial and subsistence fishery participation is discussed in section 6.3.2 and section 6.3.3.

Figure 6-8).[9] For the purposes of the FEP, these communities are referred to as "BS communities." There are a number of different communities around the Bering Sea that are reflective of linguistic, historic, or cultural differences, and legal distinctions. Bering Sea human networks can be grouped or mapped for various analytic or thematic purposes (e.g., CDQ areas to map a particular type of fisheries engagement; ANCSA regions to map aspects of legal, cultural, sociopolitical, and economic cohesion; and, maps reflective of historic linguistic differences or ADF&G subsistence regions for other types of data aggregation). In addition, Traditional Knowledge (TK) is embedded within all these different human network systems.

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Figure 6-8 identifies communities from the State of Alaska Community Index[10] which lie within 50 nautical miles (nm) of the BS FEP area, and for which the Bering Sea is the primary ocean of access for that community. Communities on the Gulf of Alaska side of the Alaska Peninsula/AI that have road

[9] For the purposes of this chapter, communities are considered coastal and within the Bering Sea ecosystem area if they are within 50 nautical miles of the coast. Communities on the Gulf side of the peninsula that have road access to, or a port in only the GOA are considered Gulf Communities, even if they are within 50 nm of the Bering Sea. While these communities are recognized as potentially substantially dependent on the Bering Sea, they are not included in the "Bering Sea FEP region" due to their direct access to the Gulf of Alaska which makes them distinct from communities that only have access to waters of the the Bering Sea by road or ports.

[10] This may not be an entirely comprehensive list of every inhabited community within 50nm of the Bering Sea. This list is not meant to be exhaustive of all communities that may be affected by, and therefore should be considered in, management decisions. As the FEP addresses different aspects of ecosystem management, different groups of communities will be important to consider as stakeholders in the process. The State of Alaska Community Index found at: https://www.commerce.alaska.gov/dcra/DCRAExternal/community

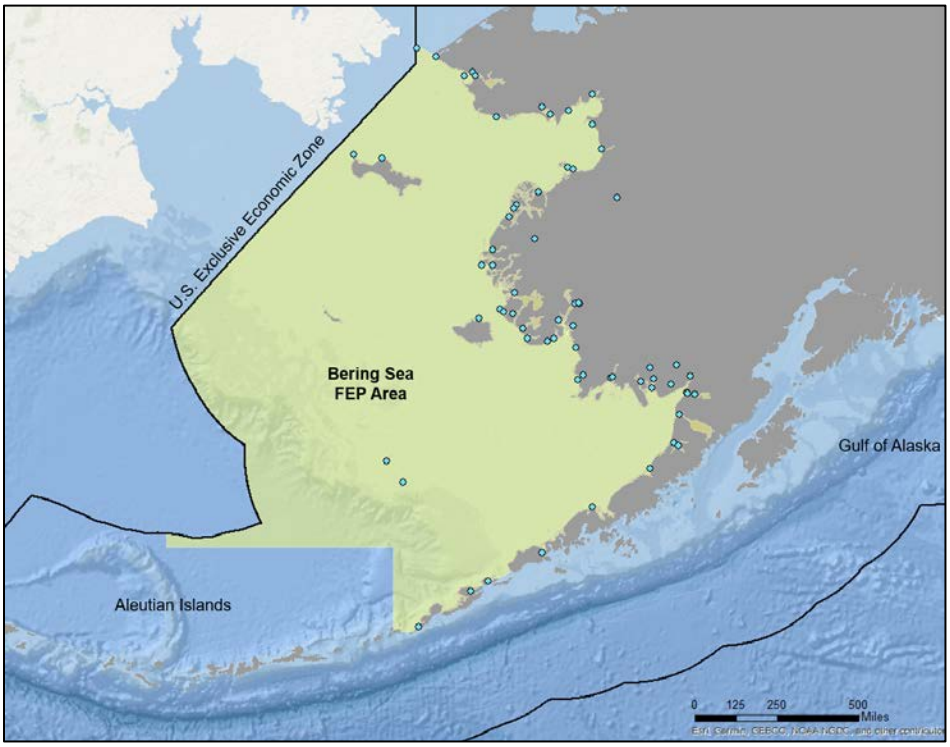
access to, or a port in the GOA are considered Gulf communities, despite some communities on the Gulf side being located within 50 nm of the Bering Sea. While these communities are recognized as potentially substantially engaged in and/or substantially dependent on the Bering Sea fisheries or otherwise importantly linked to other Bering Sea resources and communities, they are not included in the "BS FEP region" due to their direct access to the Gulf of Alaska, as opposed to communities that only have access to waters of the Bering Sea by road, port, or other waterway such as a river system.

Although the jurisdiction of the Council ends at the boundary of Federal and State waters 3nm from shore, the human communities on the map include those extending 50 nm inland for the purposes of understanding and acknowledging human communities that may be impacted by changes in the Bering Sea and decisions surrounding its resources.[11] Some communities in the State of Alaska Community Index are currently listed as having a population of zero or are without census data. Those communities were not included in the list of Bering Sea communities.

Recognizing the shift toward EBFM, Kevin St. Martin and co-authors (2007) have suggested a move in fisheries social science, "to emphasize community-level processes, practices, interactions and interdependencies as *starting points* for understanding the relationship between the rich and complex social practice of fishing and marine ecosystems." In this way, the term "fishing community" can refer geographically to a place where fishermen live (Kodiak, St. Paul, Seattle) or more abstractly to a community based on gear type, fishery, geography, values, or other factors. Bering Sea human networks may extend into adjacent FMP areas and into other states, especially if encompassing communities substantially engaged in, or substantially dependent on, Bering Sea fisheries or other activities that occur in the BS FEP region. Some of these communities, such as the aforementioned GOA communities, do not necessarily fall into the physical BS FEP region. Residents of upriver communities rely on river networks to the coast to participate in both subsistence harvesting and commercial fishing activities. Inland communities in Alaska and Canada rely on fish from the Bering Sea, such as Pacific salmon, a key component of subsistence and commercial fisheries throughout the region. Other communities that may be engaged in and dependent upon the Bering Sea include fishing ports in other parts of Alaska and the Pacific Northwest that are homeports to vessels that participate in Bering Sea fisheries. Additionally, vessel owners and crew often come from outside of the Bering Sea region to participate in commercial fisheries; commercial and subsistence fishery participation is discussed in section 6.3.2 and section 6.3.3.

[11] The 50 nautical mile line is reflective of the original qualification criteria for participation in the Community Development Quota program (see also section 6.3.2).

Figure 6-8 Map and list of communities in the Bering Sea FEP region



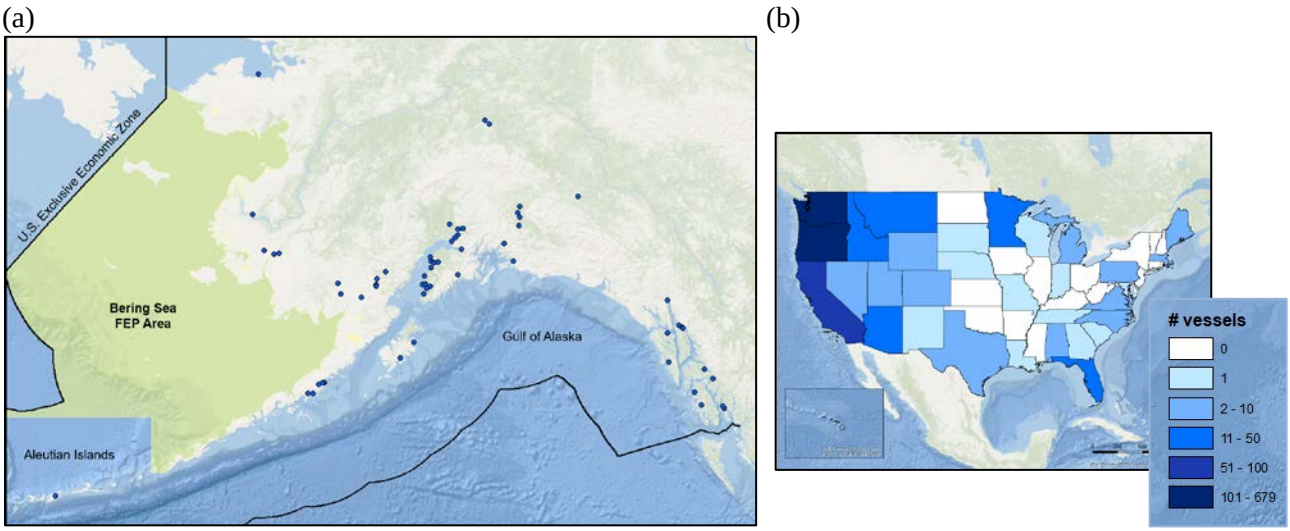
Brevig Mission	White Mountain	Kotlik	Platinum	Unalakleet	Nanek
Diomede/Inalik	Alakanuk	Kwigilllingok	Quinhagak	Akutan	Nelson Lagoon
Elim	Chefornak	Mekoryuk	Scammon Bay	Aleknagik	Nikolski
Gambell	Chevak	Mountain Village	Shaktoolik	Clark's Point	Pilot Point
Golovin	Eek	Napakiak	St George	Dillingham	Port Heiden/Meschick
Koyuk	Emmonak	Napaskiak	St Michael	Egegik	Portage Creek
Nome	Goodnews Bay	Newtok/Metarvik	St Paul	Ekwok	South Naknek
Savoonga	Hooper Bay	Nunam Iqua	Toksook Bay	King Salmon/Savohoski	Twin Hills
Teller	Kipnuk	Oscarville	Tuntutuliak	Levelock	Ugashik
Wales	Kongiganak	Pitkas Point	Tununak	Manokotak	Unalaska/Dutch

Figure 6-9 (a) and (b) presents communities which fall outside of the BS FEP region (the coastal communities shown in Recognizing the shift toward EBFM, Kevin St. Martin and co-authors (2007) have suggested a move in fisheries social science, "to emphasize community-level processes, practices, interactions and interdependencies as *starting points* for understanding the relationship between the rich and complex social practice of fishing and marine ecosystems." In this way, the term "fishing community" can refer geographically to a place where fishermen live (Kodiak, St. Paul, Seattle) or more abstractly to a community based on gear type, fishery, geography, values, or other factors. Bering Sea human networks may extend into adjacent FMP areas and into other states, especially if encompassing communities substantially engaged in, or substantially dependent on, Bering Sea fisheries or other activities that occur in the BS FEP region. Some of these communities, such as the aforementioned GOA communities, do not necessarily fall into the physical BS FEP region. Residents of upriver communities rely on river networks to the coast to participate in both subsistence harvesting and commercial fishing activities. Inland communities in Alaska and Canada rely on fish from the Bering Sea, such as Pacific salmon, a key component of subsistence and commercial fisheries throughout the region. Other communities that may be engaged in and dependent upon the Bering Sea include fishing ports in other

parts of Alaska and the Pacific Northwest that are homeports to vessels that participate in Bering Sea fisheries. Additionally, vessel owners and crew often come from outside of the Bering Sea region to participate in commercial fisheries; commercial and subsistence fishery participation is discussed in section 6.3.2 and section 6.3.3.

Figure 6-8), but which are involved in Bering Sea federal fisheries. Figure 6-9 includes Aleutian Islands, Gulf of Alaska, or inland communities that participated in Bering Sea federal fisheries in 2017. Participation, for the purposes of these figures, was determined by communities where owners of vessels that made one or more landings in federally-managed commercial Bering Sea fisheries reported their address. The points in Figure 6-9(a) represent individual communities, not number of vessels/owners reported. Figure 6-9(b) illustrates vessels by state, with the color of each state denoting a range of the number of vessels owned in each state. While the home location of vessel owners is one way to define participation, the Council recognizes there are additional ways to define participation (where crewmembers are from, for example), and any one way is likely to exclude some participants. The Council acknowledges that these maps may not account for every stakeholder and acknowledges the importance of accounting for all stakeholders that may be affected by resource decisions.

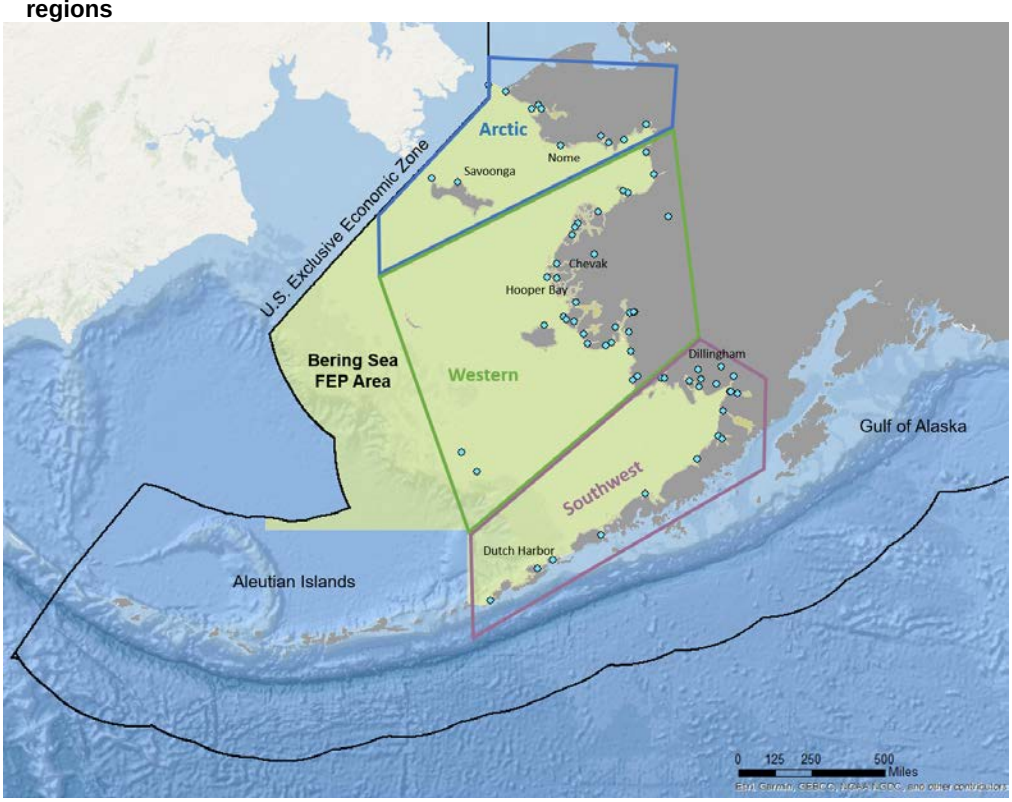
Figure 6-9 Distribution of vessel owners that made one or more landings in federally-managed BS commercial fisheries in 2017, in (a) Alaska cities or villages, or (b) other U.S. states, based on self-reported address.



Note: Multiple vessel owners in the same location not shown in (a). To compare (b) the number of vessel owners in Alaska who made landings was 1,074.

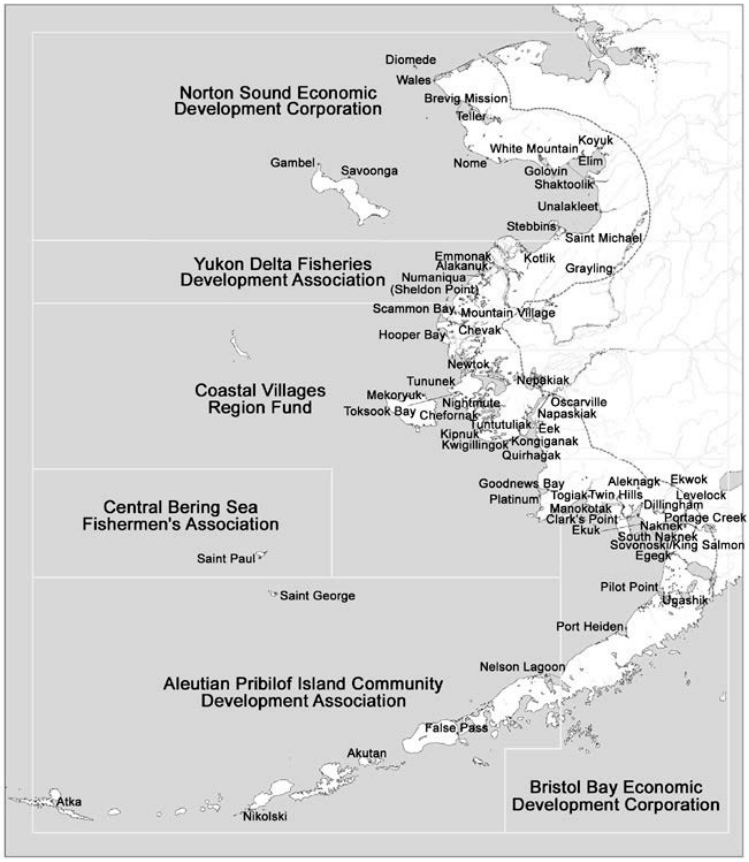
Another way to group human activity in the Bering Sea region is through the subsistence regions developed by ADF&G (included in section 6.3.3). Describing communities in this way, communities fall into one of three regions: Arctic (including communities from Diomede south to Koyuk, including those on St. Lawrence Island), Western (encompasses communities from Shaktoolik to Platinum/Security Cove (essentially covering the Yukon and Kuskokwim River regions, and also including the Pribilof Islands and St. Matthews), or Southwest (Togiak to Nikolski, encompassing communities in the Bristol Bay and the Peninsula regions). Bering Sea communities grouped according to ADF&G subsistence areas are shown in Figure 6-10.

Figure 6-10 Map of Bering Sea communities in the FEP ecosystem area, based on ADF&G Subsistence regions



Similarly, Bering Sea communities may be usefully grouped for some purposes along the boundaries of the CDQ groups (Figure 6-11), which reflect a specific type of engagement in and dependence on federally-managed Bering Sea commercial fisheries, although different groups have emphasized different forms of engagement through those entities, and multiple types of important relationships may extend across group boundaries.

Figure 6-11 Western Alaska CDQ groups and eligible communities



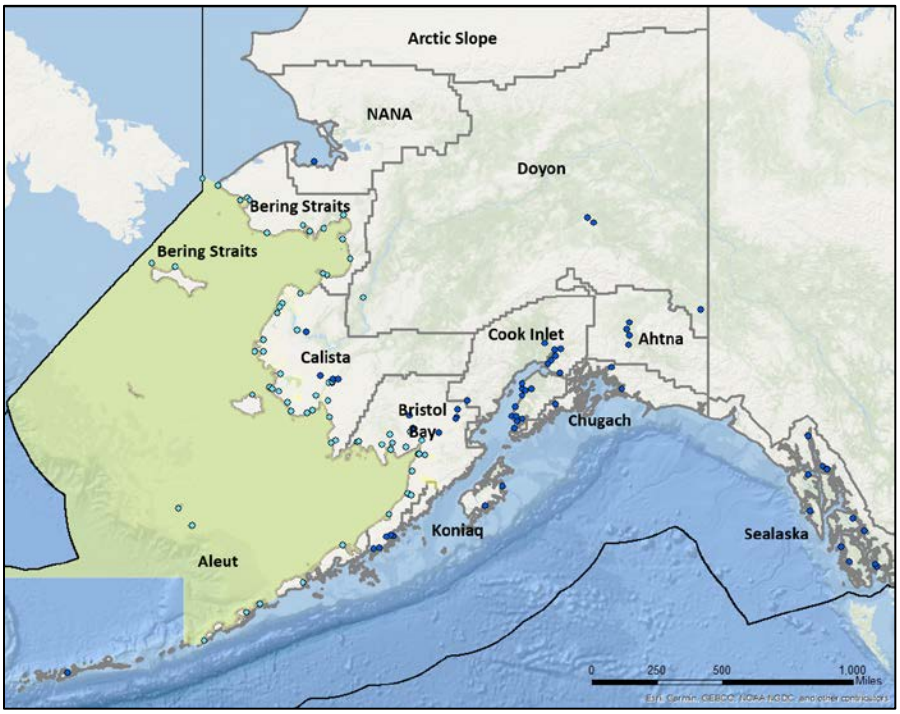
Many Alaskan communities directly involved in the federally-managed fisheries off Alaska are substantially dependent on these fisheries as a key component of relatively small and undiversified cash economies. Some of the communities substantially dependent on these fisheries are predominately Alaska Native, while others have drawn a relatively high percentage of non-Indigenous residents for opportunities in the commercial fishing sector. Indigenous communities along or near the coast may be distinct from "non-Indigenous" or "non-Native" communities (which have become demographically heterogenous over time) in their longstanding connections to subsistence lifestyle (see section 6.3.3), cultural systems, or in their current governmental, corporate, or administrative status (e.g., location of Borough/City governments, Tribal Council(s), Village Corporation(s), CDQ entities, etc.). Indigenous populations also exist within demographically plural or "non-Indigenous communities" and these populations are also important repositories of TK that represent a continuity of tradition with a time horizon as distant as those communities that have retained a nearly exclusive Indigenous population. TK held by Indigenous populations within communities that have become demographically heterogenous over time (e.g., Unalaska) should not be overlooked because of its existence in a "non-Indigenous" community (see section 6.3.4 for more info on TK).

Another way to group the communities involved in Bering Sea federal fisheries is through use of the boundaries of Alaska Native Regional Corporations formed under the Alaska Native Claims Settlement Act (ANCSA). In 1971, the ANSCA was passed to settle land and financial claims made by Alaska Natives and to provide for the establishment of 12 regional corporations within Alaska to administer lands and other assets conveyed to those corporations.[12] The determination of the boundaries of these regions

[12] A thirteenth non-land-owning corporation was also established for Alaska Natives who had left the state.

included input from a range of Indigenous organizations and while there are drawbacks to any attempt at fixed line boundaries of dynamic systems, they are reflective of a range of common cultural, social, economic, organizational, and historic ties between communities within the individual regions. Each ANCSA region, however, is home to multiple Alaska Native villages and Alaska Native groups,[13] each with its own distinct attributes, and communities within regions and across regions may choose to group themselves in different ways depending on the context.

Figure 6-12 Alaska Native Claims Settlement Act (ANCSA) Regions with BS communities (light blue) and location of home address of owners of vessels that made one or more landings in federally-managed BS commercial fisheries in 2017 (dark blue).



Note: Multiple vessel owners in the same location not shown.

In short, Bering Sea communities can be usefully grouped in different ways depending on the context, each of which may reflect multiple dimensions of connectivity between communities and to the resources of the Bering Sea ecosystem. As fisheries managers and policy makers continue to develop management strategies which directly affect fishing communities, it is essential to advance a greater understanding of the complexity of social systems. The BS FEP aims to create processes by which the Council can better account for this complexity (for example, see Action Module 4 in Appendix A.3).

There are several comprehensive resources available for understanding Alaska fishing communities; a brief summary is provided in section 9.2.

[13] In the Alaska Native Claims Settlement Act, "Native village" means any tribe, band, clan, group, village, community, or association in Alaska listed in sections 1610 and 1615 of this title, or which meets the requirements of this chapter, and which the Secretary determines was, on the 1970 census enumeration date (as shown by the census or other evidence satisfactory to the Secretary, who shall make findings of fact in each instance), composed of twenty-five or more Natives; whereas "Native group" means any tribe, band, clan, village, community, or village association of Natives in Alaska composed of less than twenty-five Natives, who comprise a majority of the residents of the locality.

6.3.2 Commercial fishing

The Bering Sea ecosystem provides fish and other seafood products that are consumed all over the world. Residents of Bering Sea communities as well as those from communities throughout the West coast and United States interact with the Bering Sea ecosystem through federal and state commercial fisheries. The Federal fisheries of Alaska are managed by the Council and NMFS. The largest fishery is the Federal groundfish fishery, which primarily targets pollock, cod, and flatfish, along with some rockfish and other species. State-managed commercial fisheries in the Bering Sea include salmon fisheries, as well as nearshore groundfish, herring, octopus and squid fisheries. The Council has joint management agreements with the State of Alaska for the Federal crab and scallop fisheries. The Council also has jurisdiction over the Bering Sea halibut fishery, with the International Pacific Halibut Commission (IPHC); the IPHC oversees the biological management of halibut throughout its range in the U.S. and Canada, while the Council and NMFS oversee the allocative management of halibut within EEZ waters off Alaska.

NMFS has developed a set of quantitative indices to describe participation in Federal commercial fisheries including, but not limited to, reliance and engagement.[14] In this context, commercial fishing *reliance* measures the presence of commercial fishing in relation to the population of a community through fishing activity, while commercial fishing *engagement* measures the presence of commercial fishing through fishing activity as shown through permits and vessel landings. In the Bering Sea, existing data gaps[15] in crew and processing labor data make meaningful indices of participation like reliance or engagement unreliable. For this reason, participation by communities in the commercial Bering Sea fisheries is not described quantitatively in this chapter.

Qualitatively, many Bering Sea community economies are dependent on commercial fisheries. Participation in Federal and state commercial fisheries varies by community and by fishery. For example, some Bering Sea communities may not be heavily engaged in federal fisheries yet are substantially dependent on state fisheries, such as salmon. Bering Sea community residents are often involved in multiple commercial fisheries, and that this diversification may be related to the diversity in Bering Sea ecology, the remoteness of Bering Sea communities, and lack of access to other income and employment opportunities. Due to the variations within the human and ecological components of the Bering Sea and the fisheries it manages, the Council and its stakeholders use particular management tools that are oftentimes unique to each fishery in order to effectively achieve management goals.

One important connection between commercial fishing in the Bering Sea and the BS communities in Recognizing the shift toward EBFM, Kevin St. Martin and co-authors (2007) have suggested a move in fisheries social science, “to emphasize community-level processes, practices, interactions and interdependencies as *starting points* for understanding the relationship between the rich and complex social practice of fishing and marine ecosystems.” In this way, the term “fishing community” can refer geographically to a place where fishermen live (Kodiak, St. Paul, Seattle) or more abstractly to a community based on gear type, fishery, geography, values, or other factors. Bering Sea human networks may extend into adjacent FMP areas and into other states, especially if encompassing communities substantially engaged in, or substantially dependent on, Bering Sea fisheries or other activities that occur in the BS FEP region. Some of these communities, such as the aforementioned GOA communities, do not necessarily fall into the physical BS FEP region. Residents of upriver communities rely on river networks to the coast to participate in both subsistence harvesting and commercial fishing activities. Inland communities in Alaska and Canada rely on fish from the Bering Sea, such as Pacific salmon, a key component of subsistence and commercial fisheries throughout the region. Other communities that may be engaged in and dependent upon the Bering Sea include fishing ports in other parts of Alaska and the

[14] https://www.st.nmfs.noaa.gov/humandimensions/social-indicators/ind-categories

[15] See pages 2-3, in: http://npfmc.legistar.com/gateway.aspx?M=F&ID=93b24773-f5d5-4524-9b5d-0bbb6c052d81.pdf; and page 168, in: https://www.npfmc.org/wp-content/PDFdocuments/halibut/IFQProgramReview_417.pdf

Pacific Northwest that are homeports to vessels that participate in Bering Sea fisheries. Additionally, vessel owners and crew often come from outside of the Bering Sea region to participate in commercial fisheries; commercial and subsistence fishery participation is discussed in section 6.3.2 and section 6.3.3.

Figure 6-8 is through the Western Alaska Community Development Quota (CDQ) program (Figure 6-11). The CDQ Program allocates a percentage of all BSAI quotas for groundfish, prohibited species, halibut, and crab to eligible BS communities. As described in the Magnuson-Stevens Fisheries Conservation and Management Act, this allocation is intended to (i) provide eligible western Alaska communities an opportunity to participate and invest in the BSAI fisheries; (ii) to support economic development in western Alaska; (iii) to alleviate poverty and provide economic and social benefits for residents of western Alaska; and (iv) to achieve sustainable and diversified local economies in western Alaska.

Commercial fishing cooperatives provide another opportunity for participation in Federal fisheries. Commercial fishing cooperatives are contracted arrangements among harvesters (or processors), which can be voluntary or regulated. Several sectors have developed cooperatives as part of federal fishery programs. There are no cooperatives for state-managed fisheries.[16] Vessels that are associated with cooperatives are responsible for the harvest of the vast majority of fish and shellfish in the Bering Sea Federal fisheries (Figure 6-16), thus their coordinated harvesting decisions have an impact on the Bering Sea ecosystem. In establishing the internal infrastructure and personnel to coordinate and monitor the harvesting activities of these fleets, cooperatives have also become an important source of information into the Council process. Cooperatives and third-party contractors act as data repositories and facilitate sharing and analysis of large amounts of data on bycatch, fishery movements, business practices, etc. This information, as well as on-the-water knowledge of fishery operations, informs management through annual reporting to the Council. Figure 6-16 illustrates some of the changes to management, enforcement, and benefits that can occur through the use of cooperatives as a management tool in BS Federal fisheries.

The four sectors with operational cooperatives in the Bering Sea are the pollock fishery, whose cooperatives were authorized under the American Fisheries Act (AFA); Amendment 80, a limited access privilege program implemented by the Council which allocates a portion of total allowable catch for six groundfish[17] species and prohibited species catch quota to the groundfish non-AFA trawl catcher/processor sector in the BSAI and allowed the formation of cooperatives; the BSAI Crab Rationalization fisheries, where individuals and entities were issued crab quota share based on their history in these Federal fisheries and can form voluntary cooperatives that are associated with one or more processors holding processor quota shares; and the freezer longline, or CP hook-and-line sector of the Pacific cod fishery, which received congressional approval to form a voluntary cooperative to fish their Pacific cod sector allocation.

Apart from the role harvest cooperatives have played in facilitating the consolidation of the fleet and concentration of catch, cooperative managers and other representatives have played an increasingly important role as mediators between industry sectors and fishery managers. The influential role of cooperatives potentially provides an alternative mechanism for pursuing collective management objectives through non-regulatory means, and cooperative managers have in recent years been increasingly important to facilitating communication between industry and the Council. Annual reports to the Council help to monitor and assess the effectiveness of measures undertaken within the cooperatives in pursuit of Council management objectives.

[16] The FMP for commercial king and Tanner Crab fisheries in the BSAI establishes a joint State/Federal cooperative management regime that defers crab management to the State of Alaska with Federal oversight.

[17] The groundfish species in the BSAI allocated under Amendment 80 include Atka mackerel, AI Pacific ocean perch, Flathead sole, Pacific cod, Rock sole, and Yellowfin sole.

The following series of graphics (Figure 6-13 through Figure 6-17) provide information on commercial fishing harvest in the Bering Sea, the role of cooperatives in BS federal fisheries, the species composition of landings, and how BS catch represents a valuable portion of Alaska's seafood products and its relation to global seafood markets. Additionally, these graphics also illustrate differences in participation in the harvesting and processing sectors of various fisheries, and how different geographic regions, both within the Bering Sea region as well as outside, contribute to these sectors.

Much of this information is included annually in the Economic SAFEs, and in periodic Economic Value of Alaska's Seafood Industry reports commissioned by the Alaska seafood marketing Institute (e.g., McDowell 2017). Data in the SAFE documents are, however, generally displayed to include BSAI fisheries together, rather than the Bering Sea region on its own. The graphics that follow (Figure 6-13 through Figure 6-17) present BS FEP area-specific commercial fisheries information. Confidentiality requirements prevent a full disclosure of the details of much of this information.

Figure 6-13 Fishery species caught and processed in the Bering Sea in 2017

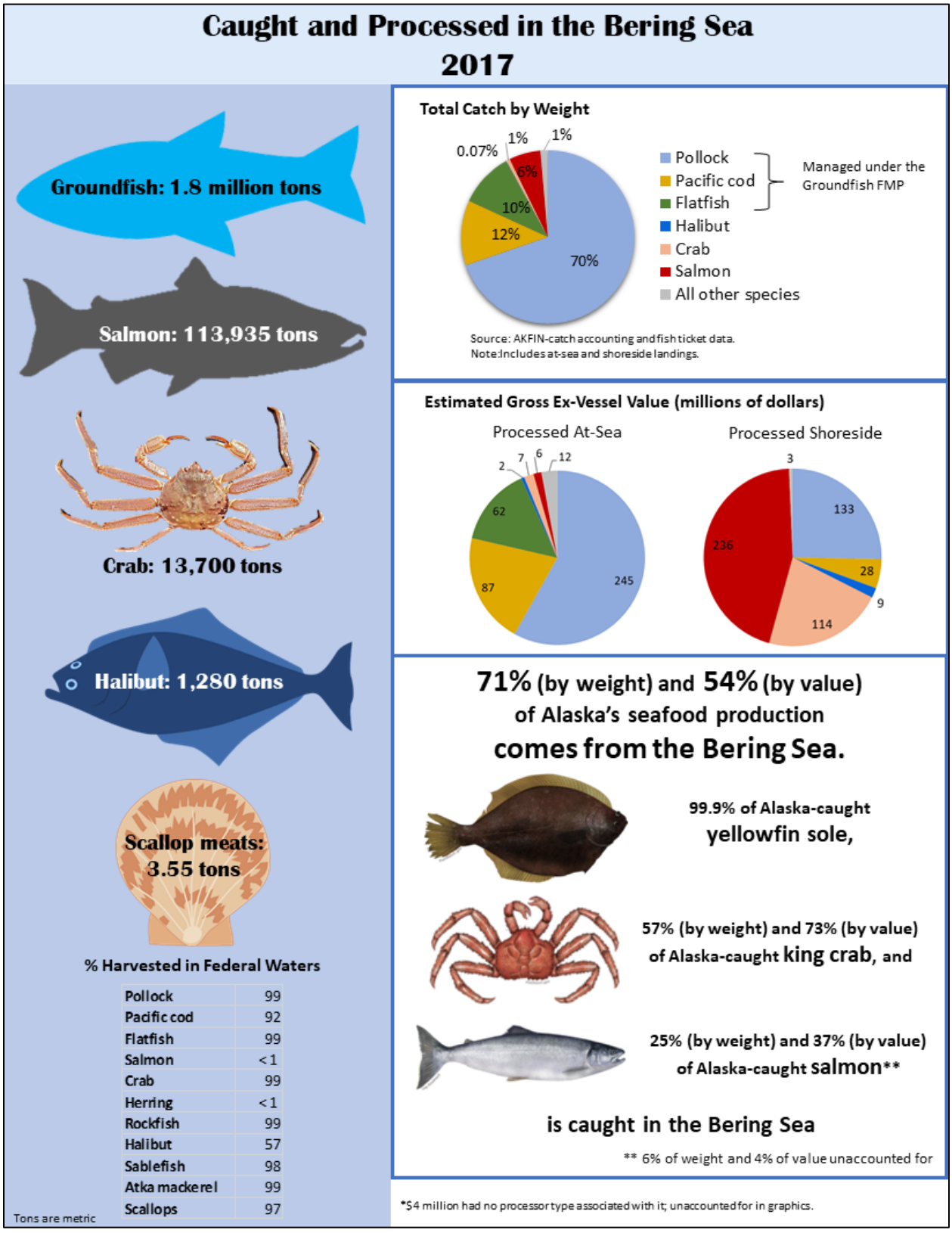


Figure 6-14 Commercial fishing in the Bering Sea by gear type, 2013-2017

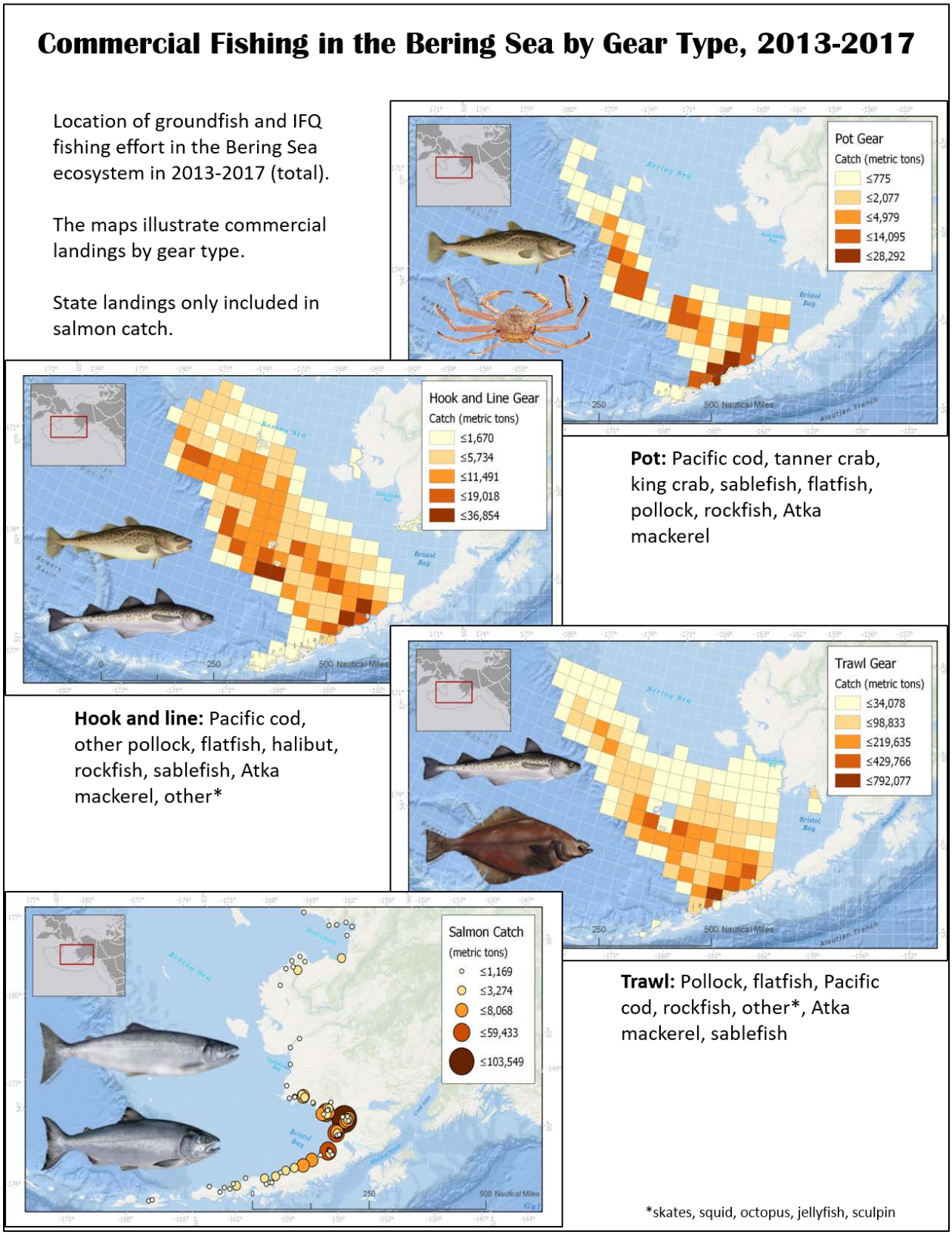


Figure 6-15 Vessels and processors participating in commercial Bering Sea fisheries

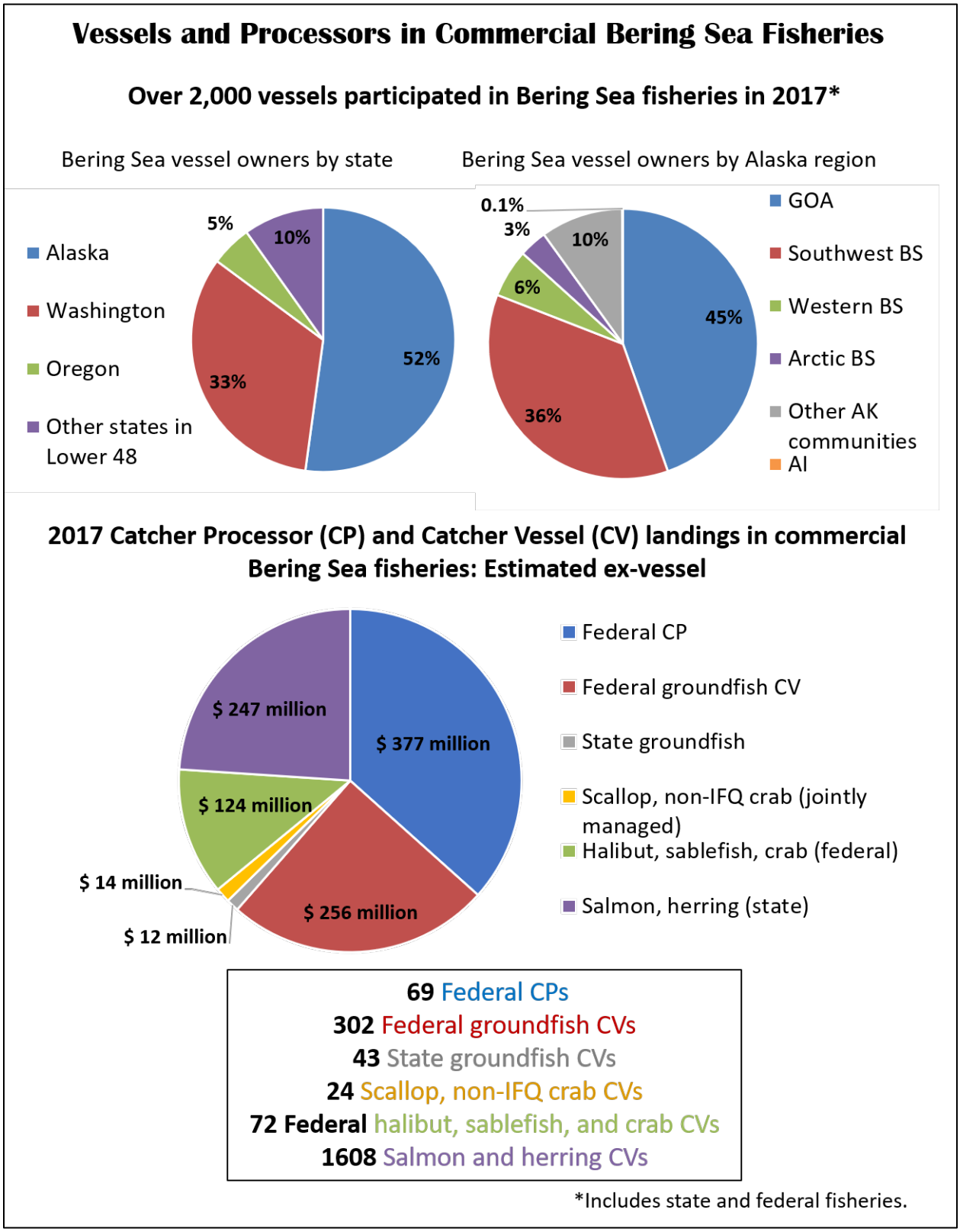


Figure 6-15 (continued) Vessels and processors participating in commercial Bering Sea fisheries

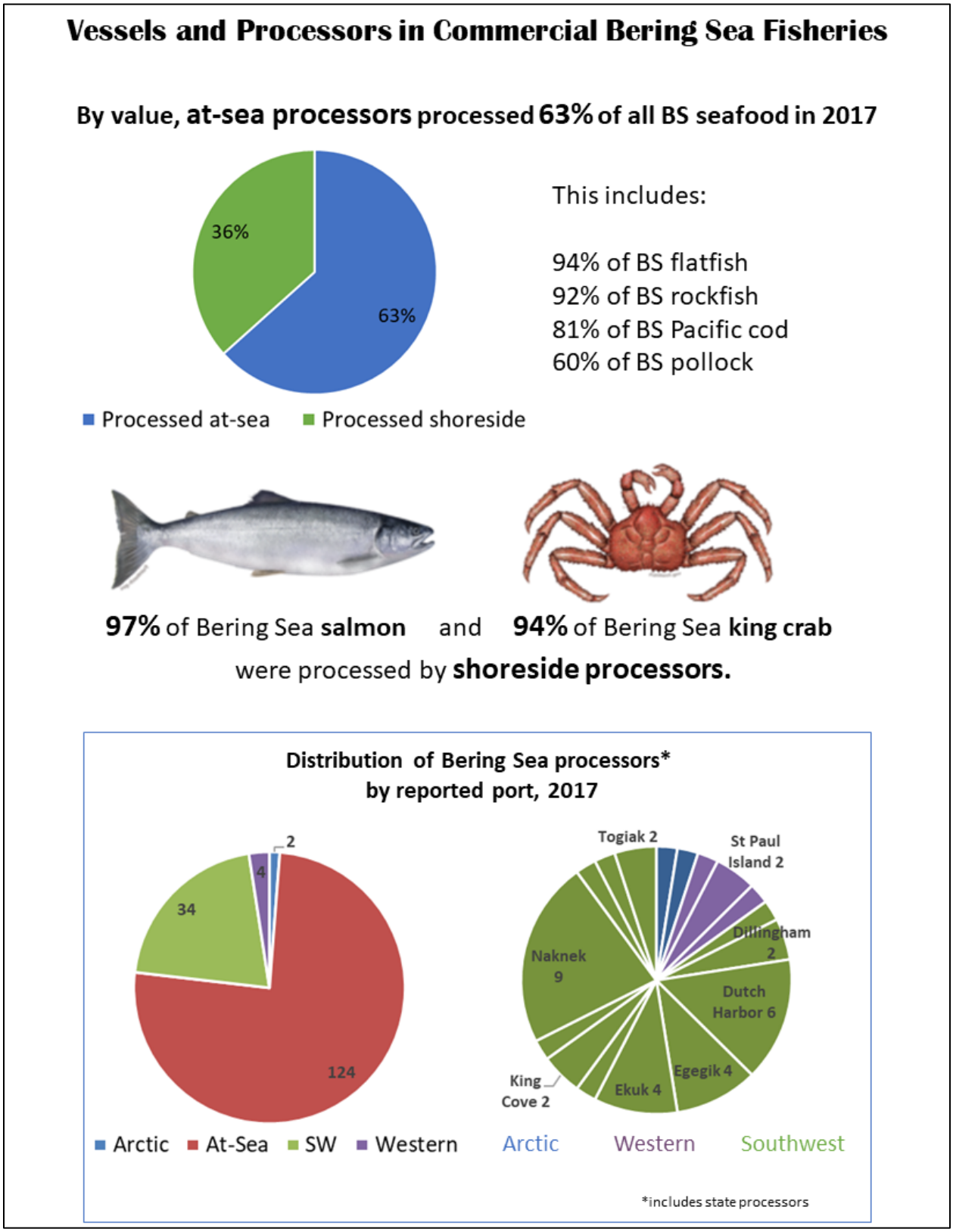


Figure 6-16 Commercial Fishing Cooperatives in the Bering Sea

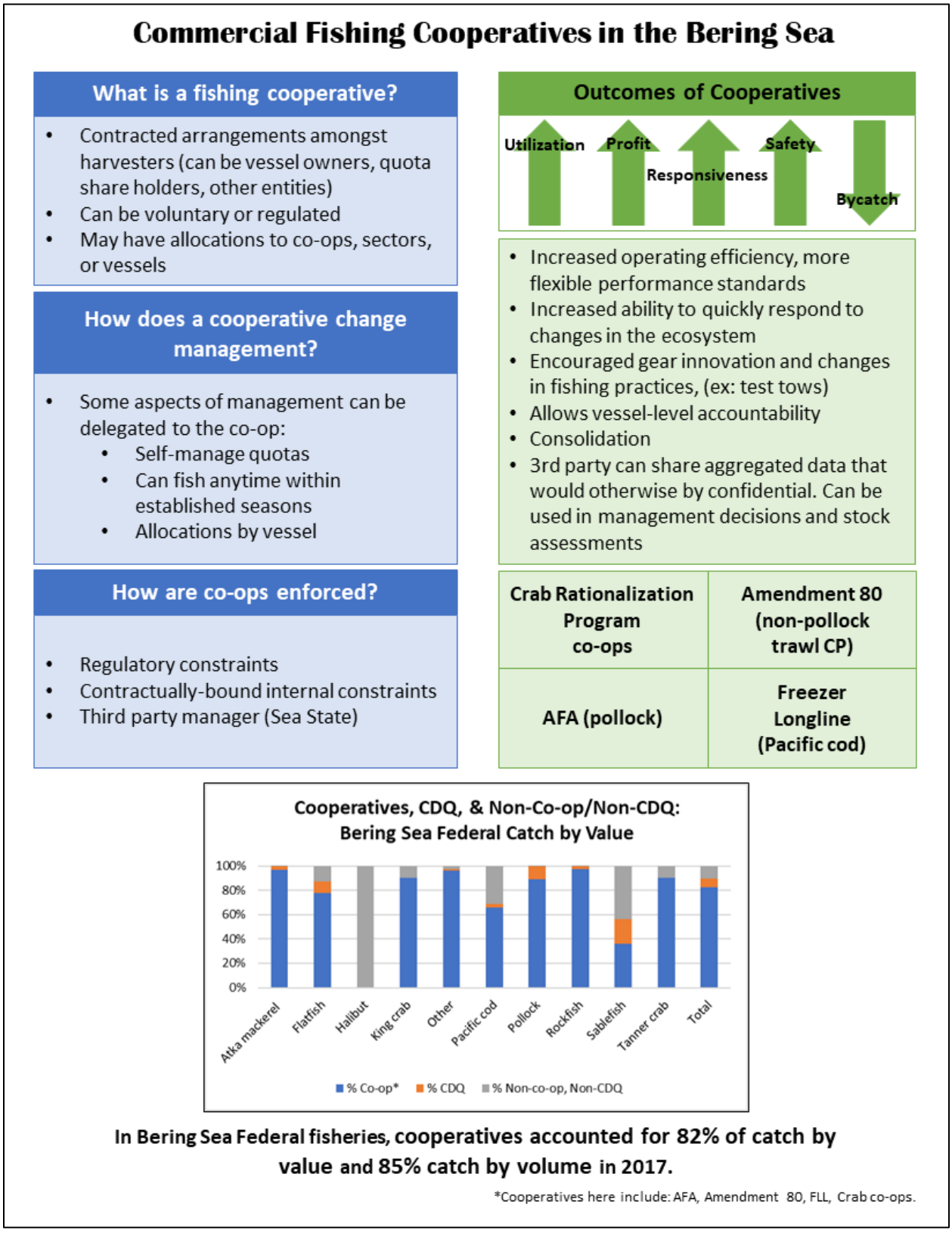


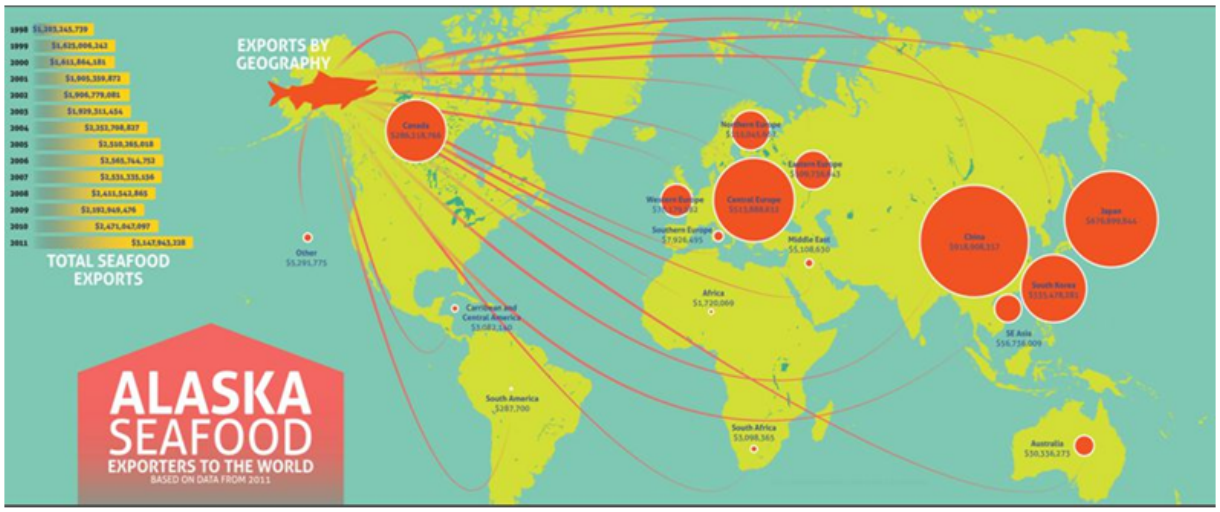
Figure 6-17 Export of Bering Sea seafood

Where are Bering Sea seafood exports going?

Bering Sea seafood commodities are exported all over the world with markets that include Canada, China, Japan, Korea, and many other countries. For example, Europe imports pollock fillets and king crab while Canada imports king crab and sockeye salmon. A complication is that some U.S. trade partners such as China, Japan, and Korea, re-export seafood products back home, but presently, U.S. trade data do not report country of origin for imported seafood commodities.

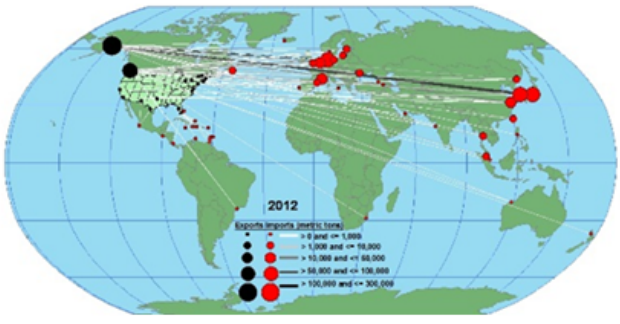
McDowell Group's Alaska seafood exports Tableau profile includes an interactive map of where Alaska's seafood is exported. The maps can be displayed by species group, species, and year.

Alaska's seafood exports in 2011:

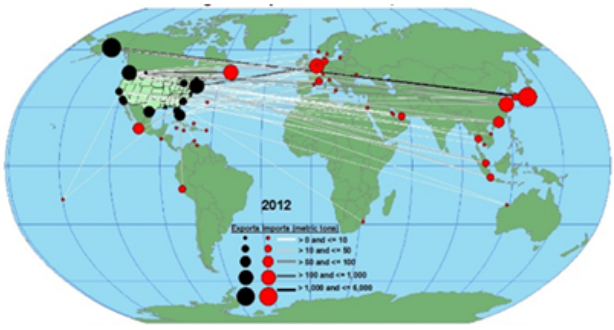


Alaska Department of Commerce, Community, and Economic Development

U.S. walleye pollock exports, 2012



U.S. King crab exports, 2012



Black disks represent U.S. customs districts and red disks represent importing countries.

Source: U.S. Merchandise Trade Statistics, GIS: Alaska Fisheries Science Center (Michael.Dalton@noaa.gov)

6.3.3 Subsistence activities

There are various definitions of subsistence which exist, and people may refer to any one of them in a given context (e.g., the legal definitions of subsistence are relevant to people's activities). Subsistence uses of wild resources is defined in Alaska state law as:

> *noncommercial, customary and traditional uses for a variety of purposes. These include: Direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation, for the making and selling of handicraft articles out of nonedible by-products of fish and wildlife resources taken for personal or family consumption, and for the customary trade, barter, or sharing for personal or family consumption (AS 16.05.940[32]).*[18]

NOAA defines subsistence fishing in comparison with commercial or recreational fishing:

> *Commercial – catching and marketing fish and shellfish for profit.*
> *Recreational – fishing for sport or pleasure.*
> *Subsistence – fishing for personal, family, and community consumption or sharing.*[19]

Subsistence is also a concept often used by Indigenous people of the region to refer a wide variety of activities from hunting, fishing, gathering of foods, to the gathering of firewood, bones, drinking water, and other interactions with the environment that lead to food security and well-being:

> *By the term "subsistence," the authors employ the senses commonly used by Indigenous residents of this region (as opposed to, for example, the State of Alaska's understanding). The Indigenous perspective on subsistence encompasses hunting and gathering related activities which have a deep connection to history, culture, and tradition, and which are primarily understood to be separate from commercial activities. (Raymond-Yakoubian et al. 2017: 133; and Kawerak, Inc. Social Science Program 2017).*

Subsistence in terms of food security is a way of life for many rural residents to meet their needs for nutrition, personal, family, and community wellbeing, as well as spiritual and ritual ties to the land and animals, fish, and birds they harvest (Holen et al. 2017:90). The subsistence way of life continues strong traditions governing human-animal relations. The subsistence way of life includes both cultural characteristics and pragmatic aspects of food security (Holen et al. 2017:90). Food security allows for Inuit in the northern Bering Sea to:

> *Obtain, process, store and consume sufficient amounts of healthy and nutritious preferred food – foods physically and spiritually craved and needed from the land, air and water, which provide for families and future generations through the practice of Inuit customs and spirituality, languages, knowledge, policies, management, practices and self-governance. It includes the responsibility and ability to pass on knowledge to younger generations, the taste of traditional foods rooted in place and season, knowledge of how to safely obtain and prepare tractional foods for medicinal use, clothing, housing, nutrients and, overall, how to be within one's environment (ICC 2015:5).*

Similar sentiments have been expressed regarding this topic in non-Inuit areas of the Bering Sea, though formal definitions for food security have not been developed in all these other areas. Subsistence is

[18] http://www.adfg.alaska.gov/index.cfm?adfg=fishingSubsistence.main Retrieved June 22, 2018.
[19] https://www.fisheries.noaa.gov/insight/fisheries-management-united-states Retrieved June 22, 2018.

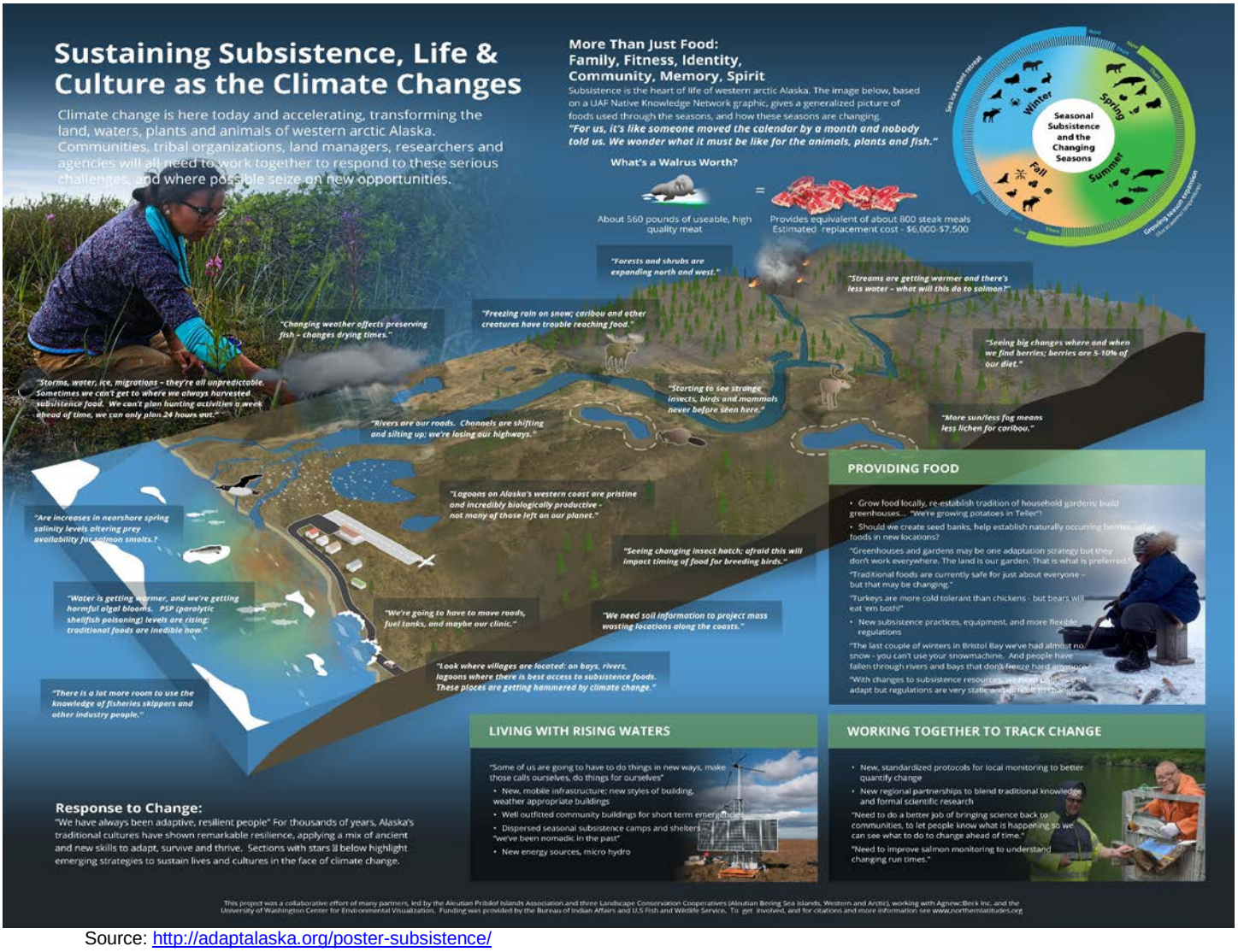
centrally important to culture and is a key priority for rural Indigenous communities. Subsistence activities are highly informed by TK and are connected to healthy, protected ecosystems. Subsistence is a crucial part of identity and social structure and is related to key cosmological principals. Subsistence is informed by values (e.g., sharing, not wasting, etc.) and entails important forms of natural resource management. Subsistence is closely related to food security, though it is not synonymous with it.[20] In sum, subsistence is connected to TK as well as to all kinds of human-animal and human-environment relationships (e.g., intergenerational relationships; intra- and inter-community relationships; relationships to place and personal or collective identity; rules for being in and with the environment; and, much more).[21]

In 2016, a partnership of organizations led by the Aleutian Bering Sea Islands and Western AK Landscape Conservation Cooperatives and the Aleutian Pribilof Islands Association held a series of coastal resilience and adaptation workshops in Western Alaska and the Aleutian Islands, which involved over 200 stakeholders in discussions about how the environment is changing, and how communities can adapt. Using the feedback and input from these workshops, in 2017 they developed two posters to visually describe the importance of subsistence (Figure 6-18) and communities' connection to the ocean (Figure 6-19). The posters are a result of four workshops held with residents in the Bering Sea region who participated in Nome, King Salmon, Unalaska, and Kotzebue. Residents of small communities converged in these four hub communities to participate in the workshops. As part of the workshops the over 200 participants reviewed draft posters created by the organizers, added their own content, and directed what the posters would cover.

[20] The definition of 'food security' can be found in ICC Alaska's 2015 food security report. This report also discusses the many components of food security and drivers of food in/security.

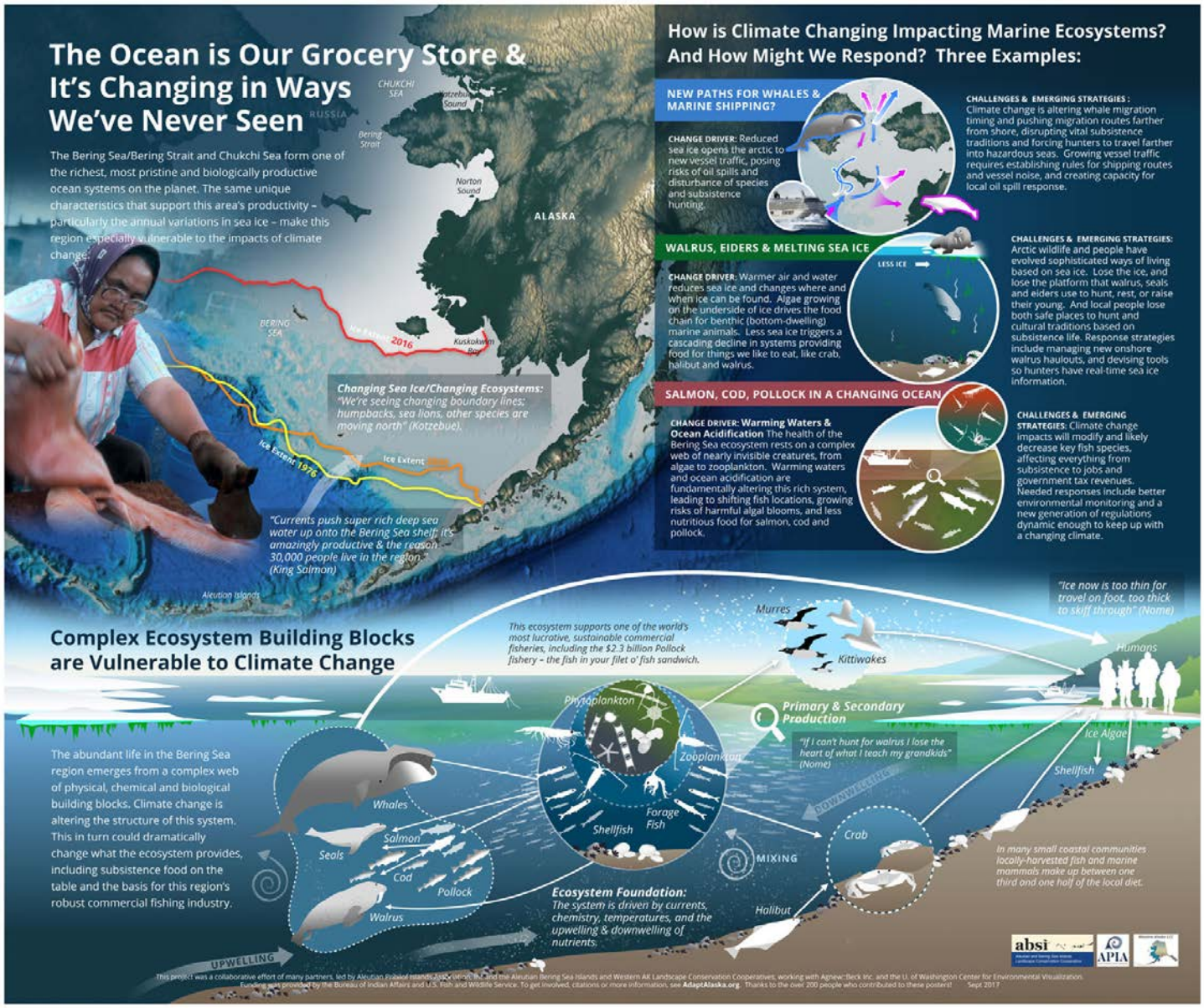
[21] Raymond-Yakoubian and Raymond-Yakoubian 2017; Moncrieff and Bue 2010; Moncrieff and Bue 2012; Moncrieff and Klein 2009; Raymond-Yakoubian 2013; Raymond-Yakoubian and Raymond-Yakoubian 2015; Kawerak 2013a; Kawerak 2013b; Oceana and Kawerak 2014; ICC 2015; Gadamus 2013; Raymond-Yakoubian and Raymond-Yakoubian 2015; Raymond-Yakoubian 2013; Durkalec et al. 2015; Gadamus 2013; Gamble et al. 2016; Gadamus and Raymond- Yakoubian 2015; Raymond-Yakoubian et al. 2014; ICC 2015; UNESCO 2018; Magdanz et al. 2007; Thornton 1998; Thornton 2001; Cunsolo Willox et al. 2013; Raymond-Yakoubian 2013; Gadamus and Raymond-Yakoubian 2015; ICC 2015; Oceana and Kawerak 2014; Raymond- Yakoubian and Raymond-Yakoubian 2015; Raymond-Yakoubian 2013; Gadamus and Raymond-Yakoubian 2015; Audubon Alaska et al. 2017; see the Kawerak White Paper for a discussion of this;

Figure 6-18 Poster outlining the relevance and meaning of subsistence harvests in coastal Alaska.



Source: http://adaptalaska.org/poster-subsistence/

Figure 6-19 Poster outlining the relevance and meaning of climate change in coastal Alaska communities.



Source: http://adaptalaska.org/poster-ocean/

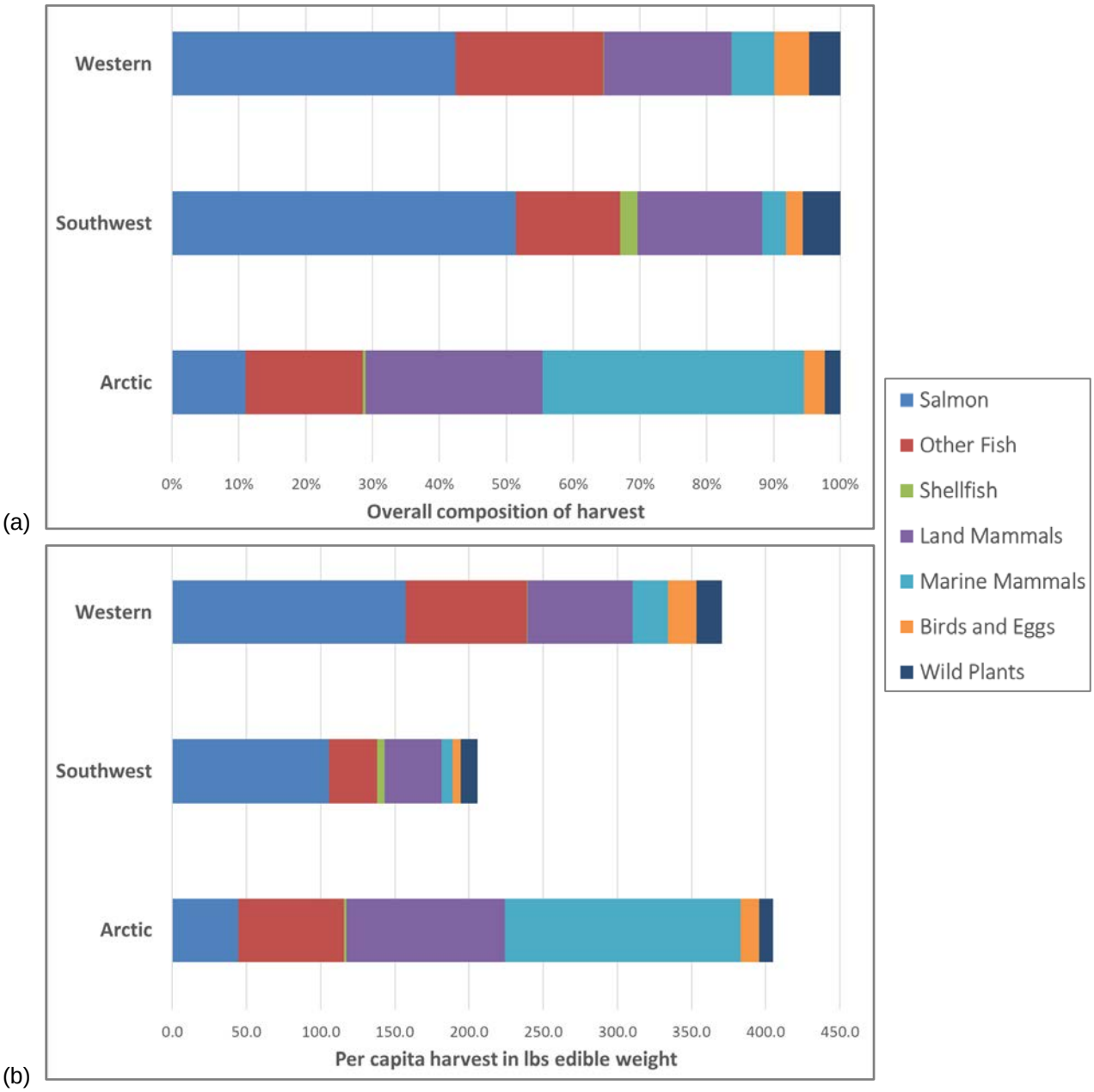
Harvest and use of wild resources in coastal communities in the Bering Sea is diverse across the region, as well as between neighboring communities. Indigenous people use an enormous portion of the marine and coastal environment for subsistence harvest activities. Subsistence data has been compiled by ADFG for three areas of Bering Sea. ADF&G management areas that fall within the BS FEP area include the 'Arctic', which is the north slope of Alaska to Norton Sound; 'Western', which mainly comprises Yukon and Kuskokwim River area communities; and, 'Southwest', which is Bristol Bay, the Alaska Peninsula and the Aleutian Islands.

ADF&G study reports (Braem et al. 2017; Evans et al. 2013; Fall et al. 2012; Holen et al 2012; Holen et al. 2011; Hutchinson-Scarbrough & Koster in prep; Ikuta et al. 2016; Magdanz et al. 2010, Rufola et al. 2017) demonstrate the massive spatial extent of subsistence activities throughout the Bering Sea region. Subsistence harvests cover nearly all the nearshore environment and further offshore areas are used for marine mammal harvests. This means that subsistence use is potentially impacted by all Council decisions

that may impact the coastline(s) in the Bering Sea region. Figure 6-20(a) shows the overall composition of harvest (based on pounds edible weight) for these areas, while Figure 6-20(b) shows the same composition in terms of overall per capita harvest of pounds edible weight. In Southwest Alaska for example, in pounds edible weight, salmon make up 51% of the harvest, while in the Arctic the largest source of protein comes from marine mammals at 39% of the harvest in pounds of edible weight (Fall 2016). Although types of marine mammals vary between the regions, harbor seals dominate in Southwest and Western Alaska, while in the Arctic there is greater diversity including ringed seals, bowhead whales, and walrus. Land mammals vary greatly by region and include caribou, moose (especially in Southwest Alaska), black bear, and small edible furbearers such as rabbits and hare. The "other fish" category is quite diverse and includes resident marine and freshwater fish. Birds and eggs harvested include both resident upland game birds such as ptarmigan and grouse, migratory waterfowl, and eggs (especially sea gull eggs, which are highly sought after especially by people in Southwest and Western Alaska). Wild plants, although not a high percentage overall represent a high degree of effort and include berries, mushrooms where available, and plants commonly eaten or used for medicinal reasons.

The Arctic area has the highest per capita harvest of wild foods at 405 lbs per person, while Western Alaska communities have an average harvest of 370 lbs per person, and Southwest Alaska an average harvest of 205 lbs per person (Figure 6-20(b). Both Southwest and Western Alaska harvests (Figure 6-20(a)) are mainly comprised of fisheries resources.

Figure 6-20 Subsistence harvest composition in 2014 in the Western, Southwest, and Arctic coastal areas of the Bering Sea, in terms of (a) overall composition and (b) composition in terms of overall per capita harvest in pounds.



Source: Adapted from Fall (2016) by D. Holen.

There is a broader diversity of resources harvested in Western Alaska, and in the Arctic marine mammals are dominant in the diet. Of the recommended daily allowance of protein, residents of the Arctic region receive 259%, Western Alaska 237%, and 131% in Southwest Alaska from locally harvested wild sources (Fall 2016). The relationship between commercial harvest and subsistence harvest is a complex one and not subject to easy dichotomization (see Reedy-Maschner, 2009; Raymond-Yakoubian and Raymond-Yakoubian, 2015). However, a household's wild food harvest tends to be greater (by 125.8%) if the household is also involved in commercial fishing (Wolfe et al. 2010).

6.3.4 Local Knowledge and Traditional Knowledge

The Council intends to become more comprehensive in managing the Bering Sea ecosystem through explicitly valuing Local Knowledge (LK) and Traditional Knowledge (TK). Valuing LK and TK can take multiple forms, through integrating LK and TK into decisions made regarding fisheries management processes. Over the past few decades empirical observations provided from LK and TK to understand marine systems, especially related to changes occurring in habitat, species, and livelihoods at small local scales, have been increasingly recognized by researchers (Thornton et al. 2012). This provides an opportunity for local residents who live on the land, or work on the water, to be included in research and management decisions for resources on which their livelihoods depend.

Recent academic work has identified evaluative criteria for how best available social science—especially qualitative social science—might be incorporated into the Council process alongside other forms of best available science (Huntington, 2013; Charnley et al., 2017; Raymond-Yakoubian et al., 2017). "These studies caution against simple, extractive approaches and show how deeper-level ethnographic, participatory, and iterative methods can lead to more ethical, respectful, and constructive engagement" with knowledge holders and communities (Thornton et al. 2012). Qualitative social science "does not seek a single or generalizable truth, but rather uncover[s] multiple perspectives and interpretations" of the world (Charnley et al., 2017). Social science can take many forms, including methods that utilize the ecological knowledge of Indigenous people and fishermen or coastal residents. Traditional and local ecological knowledge (TEK and LEK) is:

> *not an information source of last resort when others are limited; traditional and local ecological knowledge can provide a rich source of scientific information to consider in any best available natural or social science effort. When attempting to include TEK and LEK as a source of BASS [best available social science], it is important to recognize that some TEK and LEK is sacred or proprietary; and, that use and engagement with TEK or LEK and its knowledge holders should follow established local protocols for free, prior, and informed consent (c.f. Harding et al., 2012; Williams and Hardison, 2013). (Quotation source: Charnley et al., 2017)*

LK is intrinsically rooted in a locale, while TK is not necessarily constrained to a single place. At the same time, commonly, LK and TK can provide fine-scale ecosystem observations that are unobtainable by larger scale scientific efforts. As a form of best available social science, fine-scale LK and TK can be used alone or results may be combined with large scale scientific efforts to paint a more complete picture of the ecosystem than either type of information produces on its own. Actively seeking out LK and TK from local residents, Tribes, fishing vessel captains, crew, processors, and others in structured, systematic ways may prove critical in understanding and reacting to shifting ecosystem characteristics over time (e.g., resulting from climate change). Actively seeking LK and TK also creates a dialogue between researchers and communities to answer sometimes complex research questions that are meaningful to residents of the region.

LK and TK are not limited to use with science, but also comprise knowledge systems that operate independently from Western science, and especially in the case of TK include best practices and rules about how to live within and engage with the natural world on which livelihoods depend. LK and TK can interface with science by providing narrative histories of ecosystems and species and can "refine research questions and suggest multiple plausible solutions" (Bart 2006: 546 in Thornton et al. 2012). Local residents want to participate in discussions on the resources and ecosystems on which their livelihoods depend, share their knowledge about the biological, physical, cultural, and spiritual worlds in which they inhabit and engage with, and participate in ensuring the continuity of their way of life for future generations (ICC 2015:7).

Implications for Council Management Strategies

Benefits of including LK and TK of the marine environment for research, management, and policy include better understanding of changes occurring at a number of levels in the Bering Sea and better inclusion of local and Indigenous voices in decision making. Steps for improvement by the Council could include "1) stronger recognition of the relationship between marine biodiversity and the cultural diversity among maritime peoples; 2) acknowledgement of threats and stresses to marine LK, TK, and sustainable livelihoods by historical and contemporary commercial harvesting, development, and environmental change in coastal zones and seascapes; and, 3) the nurturing of traditional and collaborative stewardship systems to protect, restore, and enhance the productivity, diversity, and resilience of critical marine ecosystems that support sustainable maritime cultures." (Thornton et al. 2012).

With the understanding that LK and TK may not be relevant in every ecological research and management activity, LK and TK will be "promoted on [their] merits, scrutinized as other information is scrutinized, and applied in those instances where it makes a difference in the quality of research, the effectiveness of management, and the involvement of resource users in decisions that affect them" (Huntington, 2000).

The intent of the BS FEP is for LK and TK to be incorporated into the Council decision-making process *from the beginning* through meaningful collaboration with local and Indigenous peoples who reside and/or work in the Bering Sea region. LK and TK will not simply be integrated *into* Western science, as it currently exists in the Council process. Instead, space will be made for LK and TK to influence the decision-making process in forms that LK and TK knowledge holders feel are appropriate and relevant.

NMFS has a responsibility for government-to-government consultation with Tribal governments, and the NMFS Alaska Regional Office conducts formal consultation with Federally-recognized Tribes[22] in the Bering Sea region and share that information with the Council. Council staff are encouraged to develop collaborative relationships with bearers of LK and TK, through communications with Tribal governments, community organizations, Alaska Native organizations, fisheries organizations, individuals, and others, as well as through reviews of existing literature pertaining to LK and TK in the Bering Sea region.

An initial consideration of best practices for how LK and TK may be gathered, communicated, and considered *from the beginning* of the Council decision-making process is outlined in the preliminary study plan for Action Module 4, in Appendix A. Emphasis is placed on developing appropriate ways to build relationships between LK and TK knowledge holders and Council members, Council staff, and other groups (e.g., the SSC, AP), at all levels of the Council process. Short- and medium-term perspectives may be developed that focus on making space for LK and TK in the existing management process. Medium and long-term perspectives may be developed that focus on ways for LK and TK knowledge holders to inform the evolution of Federal fisheries management in the North Pacific, to increasingly reflect the standards of EBFM (e.g., informing development of social and cultural indicators).

Recent work by Indigenous leaders and Western scientists in Alaska develops a conceptual framework for carrying out Co-Production of Knowledge (CPK; Behe, Daniel, and Raymond-Yakoubian, 2018). CPK is a process for bringing together knowledge-holders from different systems. The CPK conceptual framework is focused on bringing together TK knowledge systems with LK and Western science through an equitable process that strengthens partnerships between these different knowledge systems. CPK will

[22] Politically sovereign, Federally-recognized Tribes within the Bering Sea region can be identified for consultation, from the list at → https://www.bia.gov/regional-offices/alaska/Tribestribes-served.

be approached as a potential method for carrying out BS FEP objectives focused on bringing together LK, TK, and Western science for evidence-based decision making and policy.

6.3.5 Other human and non-consumptive activities

Some human and non-consumptive activities are detailed below. This list is not meant to be exhaustive, but instead it is meant to highlight and summarize a broad spectrum of human and non-consumptive activities.

Recreational fisheries

Recreational fisheries are currently not a major factor in the Bering Sea ecosystem, due to the relative remoteness of the ports. Most recreational fishing occurs nearshore, and less than 1% of all halibut removals were those recreationally caught in the Bering Sea (IPHC 2017). In some remote communities, however, where all sources of income and employment are important, fishing lodges and guided recreational salmon fisheries have been important sources of both. Small scale guided fishing has episodically been a focus of effort in other communities, for example, Unalaska/Dutch Harbor. Also, logistical support of hunting (for example, use of small commercial fishing vessels to support remote hunting camps) has similarly provided additional small-scale income opportunities in some communities.

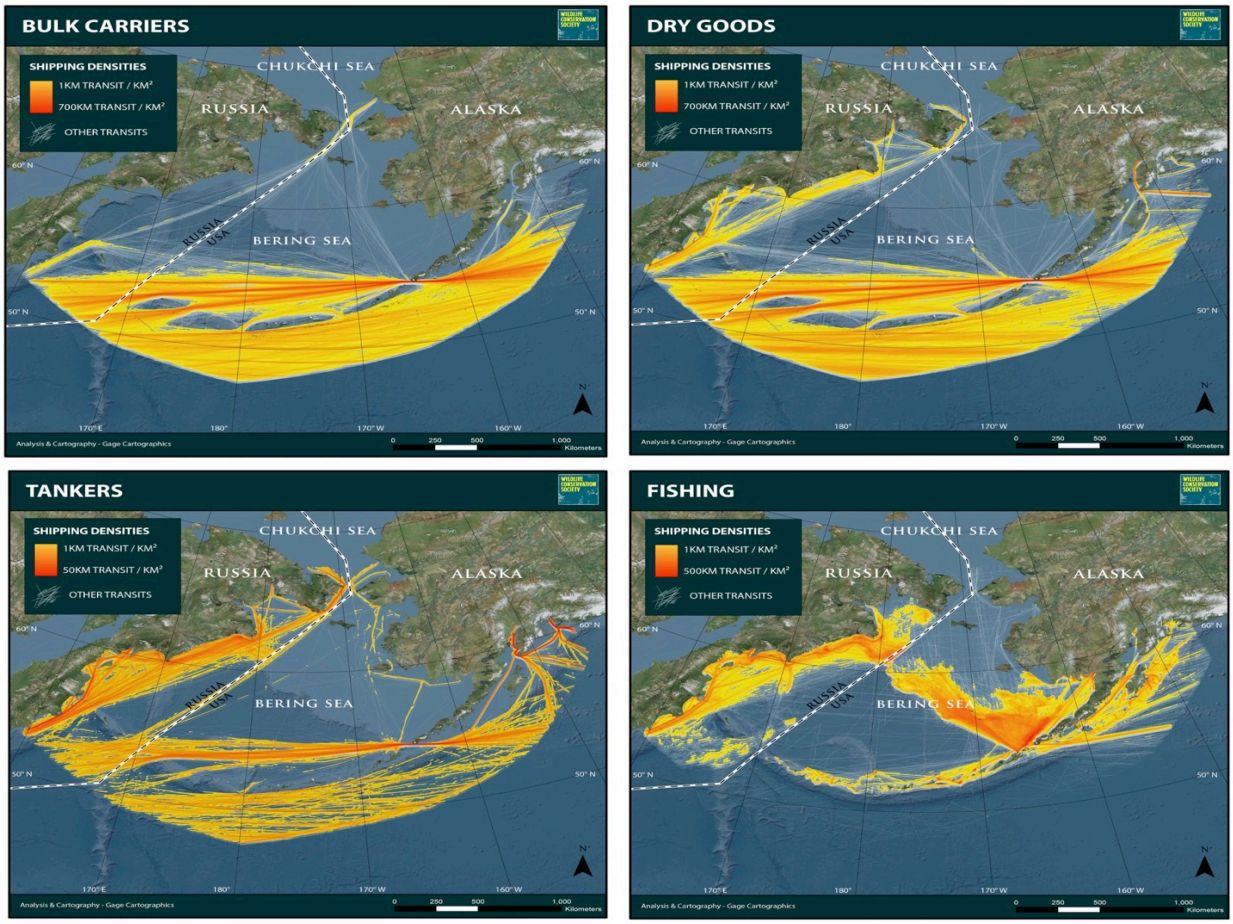
Transportation

Vessels that travel through the Bering Sea include cargo ships (bulk carriers, container ships), fishing vessels, government vessels (research, U.S. Coast Guard), passenger vessels (cruise ships), tankers, tugs, and barges. Bering Sea shipping is dominated by traffic through the Aleutian Islands between North America and East Asia, particularly during the summer and fall. The North Pacific Great Circle Route enters the southern Bering Sea at Unimak Pass, in the eastern Aleutian Islands (Figure 6-21). Only a small portion of this route traverses the BS FEP area, however, the vessel traffic in the area is significant; each year, several thousand deep-draft vessels such as bulk carriers and tankers travel this route between the United States and major ports in Asia (Nuka Research and Planning Group, LLC 2014).

Shipping and transportation in the Bering Sea region creates an overlap between human and animal communities in the region and the noise, air emissions, and waste associated with increased vessel activities. It also increases the potential for marine mammals strikes or spills of oil or other hazardous substances (Nuka Research and Planning Group 2016). Vessel traffic is dominated by fishing vessels and vessels serving communities and industrial activity in the Bering Sea area (Nuka Research and Planning Group, LLC 2016). Commercial fishing vessels operate in the southern Bering Sea year-round, traveling back and forth from fishing grounds to ports and processing plants. Cargo ships and containerships carry processed seafood to global markets throughout the region. Tankers, cargo ships, and barges carry goods and materials to communities in Western Alaska. The hub port of Nome receives fuel deliveries from barges for transport to outlying communities. The Arctic Marine Shipping Assessment found that community supply activity, primarily by tug/barge combinations in the Bering Sea region, is likely to grow as populations increase in the Arctic (Arctic Council 2009). Figure 6-22 depicts cumulative vessel tracks in the Bering Strait region from 2013-2015 by vessel type[23].

[23] The dataset included Automatic Identification System (AIS) data from 532 unique vessels operating for a total of 18,321 days in the area. Due to the extensive use of barges to serve ports on the U.S. side, tugs are far more prevalent there than in Russian waters. Similarly, fishing vessels are more common on the Russian side where there is less sea ice coverage and different fishing rules. Note that barges are not required to carry AIS transmitters, but most of the tugs that move them do.

Figure 6-21 Bulk carrier, dry goods, tanker, and fishing vessel traffic in the Bering Sea, 2010-2013.



Source: https://absilcc.org/science/SitePages/MVT%20gifs.aspx. Based on July 2010 - August 2013 satellite AIS data compiled by the Aleutian Islands and Bering Sea LCC, Wildlife Conservation Society, and University of Alaska Fairbanks' SNAP using exactEarth data.

As a chokepoint between the Arctic and Pacific Oceans, shipping activity in the Bering Sea and the Bering Strait is expected to continue expanding as Arctic sea ice retreats and both trans-Arctic shipping and resource extraction increase. An estimated 480 transits were made through the Bering Strait in 2012 (Nuka Research and Planning Group, LLC 2014). In comparison, there were over 4,500 transits the same year through Unimak Pass (Nuka Research and Planning Group, LLC 2014). This speaks to the vast difference in traffic between the southern and northern Bering Sea. However, the general trend is towards increasing maritime activity in both regions, as transits through the Bering Strait more than doubled between 2008 and 2012 (Nuka Research and Planning Group, LLC 2014). The U.S. Coast Guard has been working to propose safer shipping routes that avoid shallow waters and areas of heightened concern for subsistence and environmental considerations (USCG 2016).

Figure 6-22 Vessel traffic Automatic Identification System (AIS) data from 2013-2015 for the Bering Strait region.

Source: Nuka Research and Planning Group, LLC 2016

There has been concern and work in the Indigenous community related to vessel traffic as well. See, for example, the work of the Kawerak Marine Program, which has produced several reports on Arctic shipping,[24] highlighting concerns that Tribes and Tribal organizations have regarding current and projected vessel traffic in the region.

Mining and oil and gas development

A few public offshore gold mining areas exist around Nome, both less than 350 acres in size (Alaska DNR n.d.). Some suction dredging activities occur in offshore waters in Norton Sound. The DNR will likely not have another lease sale offshore of Nome until these leases expire in 2021. As some state lands are open to mining, extraction of mineral resources in areas that border the Bering Sea (such Bristol Bay) have the potential to affect salmon fisheries in that region.

As of January 2018, the Trump Administration has included the northern Bering Sea in their Five-Year Outer Continental Shelf Offshore Leasing Program for oil and gas. While this proposal is just a draft, there is potential for one sale each in Bering Sea areas such as Norton Basin, St. Matthew-Hall, Navarin Basin, Aleutian Basin, St. George Basin, and Bowers Basin in the year 2023. There is also potential for one sale each in the Aleutian arc, and Hope Basin which border the BS FEP region (BOEM 2018).

In the long-term, vessel activity associated with exploration, development, production, and extraction of massive petroleum reserves and mineral resources are expected to grow (Bird et al. 2008). The extraction of natural resources in the Arctic has the potential to increase traffic through the Bering Sea. This can

[24] http://kawerak.org/natural-resources/marine-program/

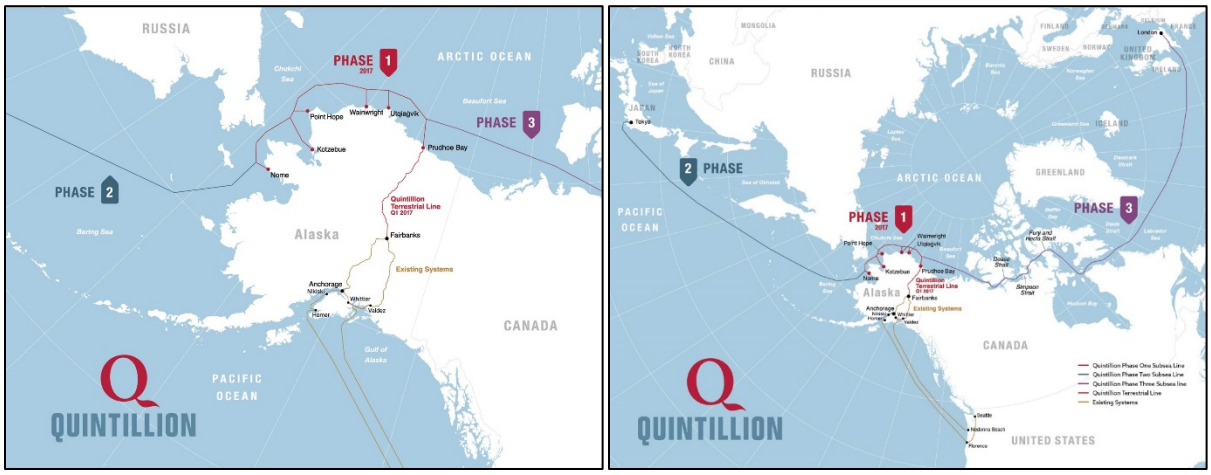
include vessel activity associated with supply or construction, pollution response, and offshore drilling rigs, depending on the type of activity. With the extraction of mineral resources and oil and gas development both expected to expand in the Arctic, related shipping is expected to increase as well (Nuka Research and Planning Group, LLC 2016).

Infrastructure

The current trend in decreasing arctic sea ice extent has initiated the construction of cable projects in the Arctic region. The Alaska Arctic portion (Phase 1) of the international Quintillion Subsea Cable System was completed in October 2017. This is a 1,200-mile submarine fiberoptic cable main trunk line between Nome and Prudhoe Bay, Alaska. Additional branches are installed into the Alaskan communities of Kotzebue, Point Hope, Wainwright and Utqiagvik (Barrow). The system has been in service since December 1, 2017, enabling 21st Century communications in the Alaska Arctic for the first time. The Quintillion Subsea Cable System is ultimately intended to connect Asia to Western Europe through the Alaska and Canadian Arctic via the Northwest Passage (Phases 2 and 3) (Quintillion 2016). There is potential for this cable system to expand to other parts of the Aleutian Islands in the future, and oil, shipping, and mining companies which can benefit from faster internet will continue to increase with access to ice-free waters.

When installing an undersea cable, a plow digs a narrow trench, which self-seals when dirt collapses over the cable. Fishing gear causes the "vast majority" of damage to underwater cable, however in Alaska, ice scouring is a larger issue than fishing gear hitting the cable. The burial of the Quintillion cable several feet under the sea floor should aid in prevention of damage. Figure 6-23 illustrates the current extent and future plans for the Quintillion Subsea Cable System.

Figure 6-23 The three phases of the Quintillion Subsea Cable System. Phase 1 was completed in 2017



Source: Quintillion 2016. http://qexpressnet.com/system/.

U.S. Coast Guard and military

U.S. Coast Guard presence in the area is mostly limited to search and rescue operations and the 17th Coast Guard District cutters conducting lengthy patrols. These vessels' primary objectives are to provide law enforcement and ensure safety for the domestic fishing fleet in the Bering Sea. As countries such as China and Russia boost their military presence in the resource-rich far north, these vessels may traverse the Bering Sea with more frequency.

Foreign fishing (outside of Bering Sea)

In Figure 6-22, the map in the top right illustrates the vast difference in fishing tracks between the eastern (US) Bering Sea and the western (Russian) Bering Sea. Fishing vessels dominate the overall number of vessels and operating days associated with the Russian portion of the Bering Sea, operating mostly south and west of the Bering Strait (Nuka Research and Planning Group, LLC 2016). Fishing fleets of the Far Eastern Basin annually produce and process 2.6–2.8 million tons of various aquatic living resources including 1.5–1.7 million tons of pollock. About 200 catchers and processors of various types and classes operate annually in the pollock fishery in the Far Eastern Basin (Pollock Catchers Association 2015).As discussed in section 6.1.2, international agreements exist to manage the resources in the Donut Hole and IUU fishing.

Tourism

Tourism is relatively limited in the Bering Sea ecosystem but is expected to grow. Marine tourism on cruise ships of various sizes is on the rise globally and cruises through the Arctic sometimes pass through the Bering Sea. 2016 marked the first voyage of a larger cruise ship through the Northwest Passage, from Seward, AK, to New York City. The 1,000 passenger *Crystal Serenity* stopped in Nome, Alaska on its way through the Bering Sea. The fuel capacity of these large ships can be over 20,600 bbl (Nuka Research and Planning Group, LLC 2016). Many smaller cruise vessels which carry up to 200 passengers also offer expeditions on these routes. Cruises occasionally stop for short layovers in the Pribilof Islands while in route to Nome.

Ecotourism groups also visit the Bering Sea region for wildlife viewing, photography, and other opportunities. The Pribilof Islands are world-renowned for birdwatching, as they are home to nesting seabirds, migrating shorebirds and waterfowl from Asia and other parts of Alaska. For this reason, the islands are sometimes referred to as the "Galapagos of the North." Approximately 250 birders travel to the island each year, which represent approximately 70% of all tourists on the island (Alaska Dispatch News 2011). Other popular birding destinations include the city of Nome and Gambell, a community on the northwest corner of St. Lawrence Island (ADFG n.d.). Travelers also come to the region to see the marine mammals that travel to the region, such as fur seals, sea lions, walruses, and whales.

Research

The Bering Sea and its surrounding areas host ongoing oceanographic, ecological, climatological, anthropological, and other research conducted by many agencies, academic bodies, research foundations, and other entities. In 2008, the NPFMC implemented the Northern Bering Sea Research Area (NBSRA) which prohibited bottom trawling in the northern part of the Bering Sea. The purpose for this was to gain further understanding of the potential impacts of trawling on the benthic and epibenthic fauna of the northern Bering Sea before authorizing commercial trawling. Research on Alaskan coastal communities in the Bering Sea has increased in recent years, particularly as these communities face the direct impacts of climate change and the importance of local knowledge and traditional knowledge gains acceptance.

Land and wildlife management

Areas around the Bering Sea host administrative and research facilities for land and wildlife management purposes.

Islands within the Bering Sea region are owned largely by Alaska native corporations (St. Lawrence Island, St. Paul and St. George Islands) or are within the public estate (e.g., Alaska Maritime National Wildlife Refuge, Yukon Delta National Wildlife Refuge). Mainland areas adjacent to the region of interest represent a wide variety of public (state and federal), private, and Tribal ownership. Throughout the region, ecological monitoring is conducted by federal and state agencies, Tribes and communities

including studies of oceanography, terrestrial wildlife, seabirds, marine mammals, fish, contaminants and biotoxins. Table 6-1 contains a non-comprehensive list of major non-fisheries activities in the region.

Table 6-1 Non-comprehensive list of major activities in the region.

Habitat/Population Management Activities:

- Research/management studies and methodologies using:
  - Moorings;
  - Benthic sampling;
  - Station occupancy and sampling (both biotic and abiotic)
  - Manned and unmanned vessels
  - Icebreakers; research vessels; marine and aerial drones; survey aircraft
- Ecological monitoring
- Fish and wildlife inventories
- Habitat improvement
- Wildlife stocking
- Water quality and quantity monitoring
- Administrative facilities
- Remote camera facilities

Public Facilities

- Visitor contact facilities
- Boat launch sites
- Roads, airstrips, trails
- Navigation aids/remote weather stations (includes facilities for national defense, and facilities for monitoring weather, climate, and fisheries research and monitoring

Subsistence

- Fishing, hunting, trapping, berry picking
- Access (snowmobiles, motor boats etc)

Fisheries Development

- Fish passes, weirs, spawning channels
- Physical habitat modifications
- Native fish reintroductions
- Fish hatcheries
- Fish rearing ponds
- Supplemental fish production
- Egg take sites
- Chemical habitat modification
- Predator / competitor control

Public Access

- Nonmotorized access (kayaks, rafts)
- Motorboats, airplanes, helicopters, etc.
- Hunting and fishing
- Wildlife observation
- Interpretation and environmental education

Economic Uses

- Surface geology studies
- Core sampling
- Seismic studies (geophysical)
- Oil and gas leasing
- Other mineral leasing
- Hydroelectric power development
- Transmission lines / pipelines
- Guiding / outfitting / transporting

Non-consumptive activities

Many residents in other parts of the country appreciate the "existence value" of the Bering Sea ecosystem. People who may never directly interact with the ecosystem often still share the intrinsic value of a healthy Bering Sea marine ecosystem. Mainstream media and reality shows such as "Deadliest Catch" have fostered widespread awareness this ecosystem and the living marine resources it supports.

6.4 Summary

EBFM and FEP literature sources typically highlight the importance of simultaneously considering the environmental, the economic, and the social during consideration of costs, benefits, objectives, and priorities of potential or proposed actions (e.g., Marshall et al. 2017; NMFS 2017). This chapter has attempted to summarize overarching characteristics of physical geography, ecological and oceanographic characteristics, and key human networks that exist in the Bering Sea ecosystem at present. Comprehensive consideration is useful for EBFM, but it does not mean that all characteristics will be relevant for every action. Tradeoffs are often made out of necessity to balance multiple types of information and the interests of multiple stakeholders. FEPs can help prioritize systemic issues that managers face, and establish goals, so that comprehensive consideration can occur in an organized way that leads to specific actions.

7 Assessment of EBFM in current Bering Sea fishery management

NMFS defines EBFM as "a systematic approach to fisheries management in a geographically specified area that contributes to the resilience and sustainability of the ecosystem, recognizes the physical, biological, economic and social interactions among the affected fishery-related components of the ecosystem, including humans; and seeks to optimize benefits among a diverse set of societal goals" (NMFS 2016). This section documents how the Council's existing procedures and policies for managing fisheries in the Bering Sea EEZ account for interactions among Bering Sea fisheries, ecosystems, and human activities to optimize food production and protect the marine ecosystem.

7.1 Description of the Council process

The North Pacific Fishery Management Council (the Council) is one of the eight regional Councils established by the Magnuson-Stevens Fishery Conservation and Management Act in 1976 to manage fisheries in the U.S. 200-mile Exclusive Economic Zone. The Council's jurisdiction includes all Federally managed fisheries off Alaska, with a focus on groundfish species (including cod, pollock, flatfish, mackerel sablefish, and rockfish), harvested by trawl, longline, jig, and pot gear. The primary purpose of the Council is to develop fishery management plans to provide sustainable fisheries, through a partnership of the Council and National Marine Fisheries Service (NMFS), with input from the Alaska Department of Fish and Game (ADFG), other state and Federal agencies, and the affected public (including LK and TK).

The guiding law for Federal marine fisheries in the U.S. is the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). Adopted in 1976, the Act established:

- Federal jurisdiction in the form of the 3-200 nm exclusive economic zone (EEZ) [200-mile limit];
- National standards and other requirements for conservation and management of resources; and,
- A system of eight regional Councils (composed of fishermen and government agency representatives) to develop fishery management plans (FMPs) and other regulations for their specific area, subject to approval and implementation by the Federal government (i.e., the National Marine Fisheries Service).

It is important to note that in Alaska, Federal jurisdiction generally does not extend into State of Alaska waters (within 3 nm from shore) nor beyond the EEZ (200 nm from shore). Federal requirements outside the EEZ can, in certain circumstances, be extended to vessels operating with a Federal fisheries permit (e.g., VMS and other monitoring requirements). An exception is Federal management of the Pacific halibut fishery, which extends throughout U.S. waters (including State of Alaska waters). In all circumstances, however, coordination between state, Federal, and international[25] management organizations is critical. The Council's membership is purposely designed to help facilitate such coordination (see further description below), and the Council also has joint meetings periodically with the State of Alaska Board of Fish (the management body for State of Alaska fisheries).

The Magnuson-Stevens Act encourages integrated management of fish stocks via FMPs and stipulates that FMPs must prevent overfishing; rebuild overfished stocks; and, protect, restore, and promote the sustainability of fish stocks. In addition to the Magnuson-Stevens Act, U.S. FMPs must be consistent with the Marine Mammal Protection Act (MMPA), the Endangered Species Act (ESA), the Migratory Bird Treaty Act, the National Environmental Policy Act (NEPA), the Regulatory Flexibility Act, as well as other applicable law and executive orders.

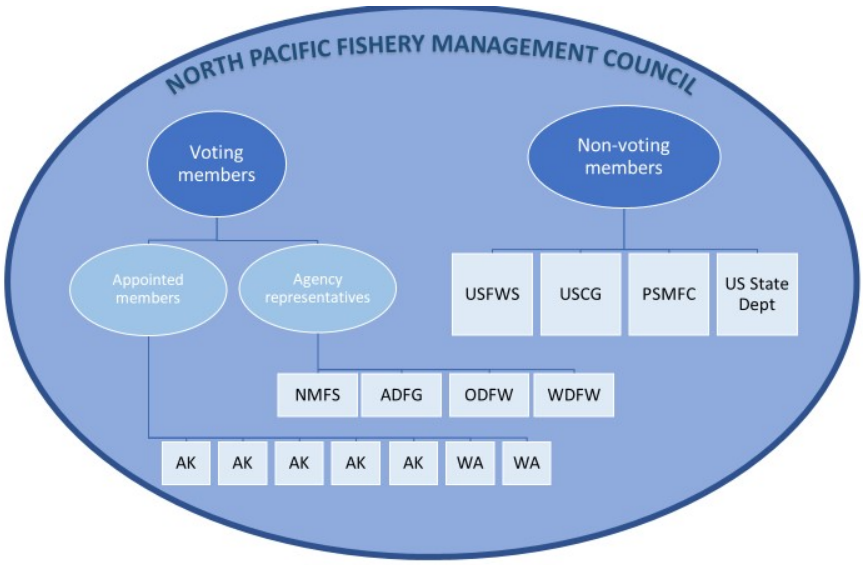
To maintain its commitment to responsible fisheries management, the Council adjusts harvest specifications, gear requirements, and closure areas as necessary. FMPs may also include limited access

[25] Especially for halibut (through the International Pacific Halibut Commission) and salmon (under the Pacific Salmon Treaty).

regimes, harvest incentives for reduced bycatch, requirements for fishery observers, and conservation of target and nontarget species and habitats (Lenfest 2016). The Council can also affect the policy process, by writing letters of support to representatives, providing guidance to NMFS, and hold consultations regarding important conservation topics such as essential fish habitat. The FMPs and fishery regulations are dynamic and continuously changing as new information or issues arise.

The Council is made up of 11 voting members—five appointees from Alaska, two appointees from Washington, and four agency representatives from: NMFS, Alaska, Oregon, and Washington (Figure 7-1). Additionally, there are four non-voting members representing the U.S. Fish and Wildlife Service, the U.S. Coast Guard, the Pacific States Marine Fisheries Commission (PSMFC), and the U.S. State Department.

Figure 7-1 Council membership



When reviewing potential rule changes, the Council draws upon the services and recommendations of knowledgeable people from State and Federal agencies, universities, and the public, who serve on advisory bodies. These experts provide written and oral comments on relevant issues being considered by the Council. Advisory bodies include the Advisory Panel (AP), the Scientific and Statistical Committee (SSC), Plan Teams, and Committees.

- **Advisory Panel** members represent experts from the fishing industry and several related fields, representing a variety of gear types, industry, and related interests as well as a spread of geographic regions of Alaska and the Pacific Northwest having major interest in the fisheries off Alaska. The Council relies on the AP for comprehensive advice on how various fishery management alternatives will affect the industry and local economies, on potential conflicts between user groups of a given fishery resource or area, and on the extent to which the United States will utilize resources management by the Council's FMPs. The Advisory Panel often relies heavily on Local Knowledge and has used Traditional Knowledge in some cases.
- **SSC** members include Federal and State agency personnel, academics, and independent experts[26] that have strong scientific or technical credentials and experience relevant to Alaska fisheries. The SSC is composed of experts in biology, statistics, economics, sociology, and other relevant disciplines. The SSC provides ongoing scientific and technical advice for management decisions;

[26] Independent experts on the SSC cannot be employed by an interest group or advocacy group.

assists in the identification, development, collection, and evaluation of scientific information relevant to fishery management planning, particularly with regard to determining the best scientific data available; and serves as the Council's peer review body. The SSC often relies heavily on natural science and economic information and has recently discussed ways to increase usage of Local Knowledge and Traditional Knowledge.

- **Plan Team** members are appointed by the Council from government agencies and academic institutions having expertise relating to a given plan. The Council has Plan Teams for each of its FMPs with active fisheries (BSAI and GOA groundfish, BSAI crab, and Alaska scallop). The purpose of the Plan Teams is to provide the Council with advice in the areas of regulatory management, natural and social science, mathematics, and statistics as they relate to the Council's fisheries. In practice, the primary function of these teams is as a stock assessment review body for fishery species. The Council has established Plan Teams for each of its Fishery Ecosystem Plans, including this BS FEP, although the Aleutian Islands FEP Team is currently inactive. The FEP Teams' purpose is to develop the FEPs, and update and maintain information on ecosystem interactions as they relate to each ecosystem. Plan Teams often rely heavily on natural science and economic information and have made less use of Local Knowledge or Traditional Knowledge. The Council also established a Social Science Planning Team, whose advice is not focused on a plan per se, but rather was formed to facilitate and enhance the use of social science in the management process.
- **Committees** are convened by the Council to address specific, timely topics and are appointed to advise the Council on a particular issue. The Council has standing Committees that have been in existence for many years and meet periodically, for topics such as enforcement, observer issues, of IFQ implementation. For example, the Ecosystem Committee has been active since 1996 and among other things, has played an integral role in the development and implementation of the Council's FEPs. There are also Committees that are formed to complete a specific task and then disbanded, such as to provide advice on contentious management measures such as a salmon bycatch amendment, the development of a binding arbitration clause, or the implementation of an electronic monitoring program. Committees often rely on a mix of natural science, social science, and Local Knowledge, and have used Traditional Knowledge in some cases.

The Council meets five times each year, with each meeting lasting about seven days. The SSC and AP usually meet around the same times as the Council, following the same agenda, but beginning their meetings two days earlier. As needed, Committee meetings are held either in conjunction with the Council meeting or preceding it. Three of the annual Council meetings are held in Anchorage, one (usually in June) is held in a fishing community in Alaska, and the other (usually in February) is held in either Seattle or Portland. The SSC and AP provide input to the Council at each meeting, and public testimony is taken on each agenda item.

The Council process is, by design, an open and public process where all decision materials are shared with the public and recommendations are made in an open forum. All Council-related meetings (including Committees and Plan Teams) are open to the public, except for occasional executive sessions where the Council deals with personnel, administrative, or litigation issues. Anyone may attend meetings of the SSC, AP, the Council, or other advisory bodies, and may provide written and/or oral comments for the public record at any Committee or Council meeting (these commonly include some form of LK and/or TK). Minutes are taken for each Council meeting and are available to the public. Additionally, the Council broadcasts meetings online, with links and details posted on the website. Archived digital audio files of the Council meetings are available on the internet.

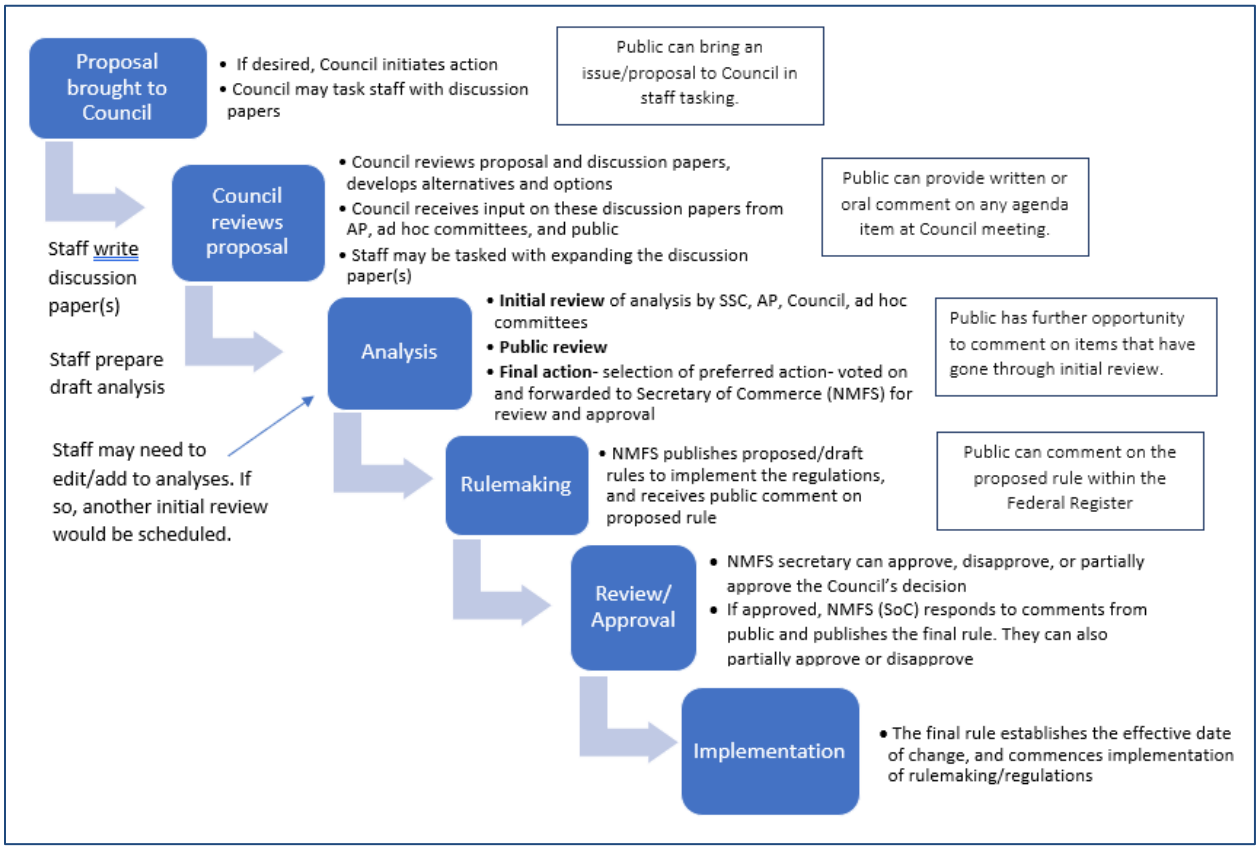
Concerns and proposals for change are brought to the Council's attention by the public through the AP or another advisory body, or directly to the Council via written or oral comment from the public or a stakeholder group during the 'Staff Tasking' agenda item at each Council meeting (Figure 7-2). The

Council reviews each proposal and decides whether to initiate analysis of alternatives and options. Often, the Council directs staff to prepare a discussion paper to fully flesh out the scope of an issue that has been identified. For relatively simple changes to a FMP, a discussion paper may not be necessary. In contrast, very complex issues may require several discussion papers before reasonable alternatives can be developed.

When the Council determines that discussion papers are warranted, they review each proposal and completed discussion paper, provide recommendations, and identify and develops options and alternatives. After discussion papers are reviewed, the Council normally adopts a problem statement and tasks Council staff with draft analyses. Draft analyses are reviewed by the SSC and the AP during an initial review, and the proposed action may either go through final public review or be required to undergo further analysis and another initial review before going to final public review. If the analysis is deemed ready, the Council votes on a preferred alternative which is then forwarded to the Secretary of Commerce for review and approval.

NMFS then prepares draft regulations, and once cleared by the national Office of Management and Budget, the proposed rule is published in the Federal Register. The public is provided with time to comment on the proposed rule. NMFS region staff may adjust the rule based on the public comments and publish a final rule. They can also partially approve or disapprove the action. A final rule establishes the effective date of change and commences implementation of rulemaking/regulations.

Figure 7-2 Council process and opportunities for public input (including LK and TK)



The Council's policy is to proactively apply judicious and responsible fisheries management practices, based on sound scientific research and analysis, to ensure the sustainability of fishery resources and associated ecosystems for the benefit of future, as well as current generations. The Council utilizes a precautionary approach to management that incorporates forward-looking conservation measures that

address differing levels of uncertainty. Recognizing that potential changes in productivity may be caused by fluctuations in natural oceanographic conditions, fisheries, and other non-fishing activities, the Council intends to continue to take appropriate measures to insure the continued sustainability of managed species. This precautionary approach to management recognizes the need to balance many competing uses of marine resources and different social and economic goals for sustainable fishery management, including protection of the long-term health of the resource and the optimization of yield.

7.2 EBFM Measures Embedded in Magnuson-Stevens Act Legal Framework

In addition to establishing a regional public process for fishery management in the United States (see description in section 7.1), the Magnuson-Stevens Act embodies other ecosystem-based principles. Specifically, the Magnuson-Stevens Act provides for the development of FMPs which achieve and maintain the optimum yield from each fishery and promote the protection of essential fish habitat (EFH) in the review of Federal permits, licenses, or projects of any nature. The Magnuson-Stevens Act requires that fishery conservation and management measures be designed to ensure that irreversible or long-term adverse effects on the fishery resources and environment are avoided and that there are a multiplicity of options available with respect to future uses of these resources.

The Magnuson-Stevens Act established 10 national standards for fishery conservation and management and requires that all FMPs or regulations implementing the FMPs be consistent with these standards. Several of these standards compel the Council to take non-fishery aspects of the ecosystem into account when making fishery policy and setting fishery total allowable catch. For example, National Standard 1 compels the Council to take the protection of marine ecosystems into account and to consider relevant social, economic and ecological factors when setting the fishery optimum yield (OY). National Standard 2 requires that management decisions be based on the best available scientific information. National Standard 8 compels the Council to take the importance of fishery resources to fishing communities into account when establishing conservation and management measures and National Standard 9 requires management measures to minimize bycatch and bycatch mortality in the fisheries to the extent practicable[27].

By design of the Magnuson-Stevens Act, all FMPs center on preventing overfishing and protecting the long-term productivity of the fishery resource to allow for the achievement of OY on a continuing basis. Magnuson-Stevens Act section 3(33) further defines the term "optimum" with respect to the yield from a fishery to mean, “the amount of fish which -- (A) will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems; (B) is prescribed on the basis of the maximum sustainable yield from the fishery, as reduced by any relevant social, economic, or ecological factor; and (C) in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery.”

The Magnuson-Stevens Act requires each FMP to describe and identify EFH for the fishery, minimize adverse effects of fishing on EFH to the extent practicable, describe non-fishing effects on EFH, and identify other actions to encourage the conservation and enhancement of EFH. All Council FMPs identify and describe EFH. To date, all Council-managed fishery impacts on EFH have been found to be no more than minimal and temporary in nature, however, the Council has adopted precautionary conservation and management measures to conserve EFH. Such measures adopted by the Council in the Bering Sea are described in section 7.5.

[27] A complete explanation of the National Standards is provided online at: http://www.fisheries.noaa.gov/sfa/laws_policies/national_standards/

Regulations relating to EFH provide a means for the Council to identify Habitat Areas of Particular Concern (HAPCs) [50 CFR 600.815(a)(8)] within FMPs. Specific to fishery actions, HAPCs are areas within EFH that are ecologically important, sensitive to disturbance, or rare. In 2010, the Council revised the process by which it solicits nominations for HAPC designations to align the nomination process with the EFH 5-year review. During each EFH 5-year review, the Council decides whether to initiate a call for HAPC proposals focused on specific sites consistent with HAPC priorities identified by the Council.

The Council may designate HAPCs as habitat sites and consider management measures to be applied to a habitat feature or features in a specific geographic location if needed. The habitat feature(s), as identified on a map or chart, must meet the considerations established in the Federal regulations and address identified problems for a FMP species. Proposals must provide clear, specific, and adaptive management objectives. HAPC designations in the Bering Sea are described below.

7.3 EBFM requirements of applicable Federal Law

The Council must comply with all applicable Federal law when establishing fishery conservation and management measures. NMFS must comply with all applicable law when authorizing fisheries per the Council's FMPS in the Bering Sea. Many Federal laws require consideration of and/or minimization of effects of the fisheries on components of the ecosystem. Such applicable laws and policy related to EBFM include the National Environmental Policy Act (NEPA), the Regulatory Flexibility Act (RFA), the Endangered Species Act (ESA), the Marine Mammal Protection Act (MMPA), and Executive Order 12866 (EO 12866).

NEPA

The chief purpose of NEPA is to declare a national environmental policy, which directs Federal agencies to use all practicable means to maintain conditions in which man and nature can live in productive harmony (i.e., fulfilling the social, economic, and other requirements of present and future generations of Americans). NEPA includes requirements for Federal agencies to consider the effects of their actions on the environment, to consider alternatives during the decision-making process, and to provide opportunities for public involvement.

Environmental review under NEPA is required whenever the Council proposes to take an action. The environmental review under NEPA can involve three different levels of analysis: categorical exclusion determination (CATEX), environmental assessment/finding of no significant impact (EA/FONSI), and an environmental impact statement (EIS). An action may be categorically excluded from the requirement to prepare a detailed environmental analysis under NEPA if the action does not individually or cumulatively have a significant effect on the human environment. Each Federal agency has a set of procedures detailing the categories of actions eligible to be categorically excluded from environmental review under NEPA. If an action does not meet the CATEX criteria, then Council staff prepare an EA which determines whether or not the action has the potential to cause significant environmental effects.

In essence, the EA and EIS analytical documents compare and contrast the effects of the various alternatives on the affected environment so that decision-makers and the public are informed of the tradeoffs associated with policy choices. For example, a NEPA analysis examines effects of fishery management alternatives on the target species, non-target species, marine mammals, seabirds, habitat, and the marine ecosystem.

RFA

The RFA (5 USC 601, et seq.) requires Federal agencies to assess the impacts of their proposed regulations on small entities and to seek ways to minimize economic effects on small entities that would be disproportionately or unnecessarily adverse. Under the RFA, a business primarily engaged in commercial fishing is classified as a small business if it is independently owned and operated, is not

dominant in its field of operation (including its affiliates) and has combined annual receipts not in excess of $11 million for all its affiliated operations worldwide. For Alaska fisheries, these criteria include most fishing firms except for the large catcher processor vessels and most coastal communities except for Anchorage. Although the RFA allows agencies to certify that a proposed rule will not have significant impacts on a substantial number of small entities, an initial regulatory flexibility analysis (IRFA) is routinely prepared for most proposed Alaska fishery management measures. Information describing whether the action affects small entities will be included in the analysis supporting the action. If, following public comments on the proposed rule, the action is still considered to meet the criteria for requiring RFA analysis, then a final regulatory flexibility analysis (FRFA) must be prepared. The FRFA contains most of the same information presented in the IRFA, but also must include (1) a summary of significant issues raised in public comment on the IRFA and the agency's response to those comments, and (2) a description of the steps the agency has taken to minimize the significant economic impacts on small entities, including a statement of factual, policy, and legal reasons for selecting the alternative adopted in the final rule and why all other alternatives considered were rejected. Finally, the FRFA or a summary of it must be published in the Federal Register with the final rule.

EO 12866

Regulatory Planning and Review EO 12866 requires agencies to take a deliberative, analytical approach to rulemaking, including assessment of costs and benefits of the intended regulations. For fisheries management purposes, it requires NOAA Fisheries (1) to prepare a regulatory impact review (RIR) for all regulatory actions, (2) to prepare a unified regulatory agenda twice a year to inform the public of the agency's expected regulatory actions, and (3) to conduct a periodic review of existing regulations. The purpose of an RIR is to assess the potential economic impacts of a proposed regulatory action. As such, it can be used to satisfy NEPA requirements and to serve as a basis for determining whether a proposed rule will have a significant impact on a substantial number of small entities which would trigger the completion of an IRFA under the RFA. For this reason, the RIR is frequently combined with an EA in a single EA/RIR document that satisfies the analytical requirements of NEPA, and EO 12866. Criteria for determining "significance" for EO 12866 purposes are different than those for determining significance for RFA purposes. A significant rule under EO 12866 is one that is likely to (1) have an annual effect on the economy (of the nation) of $100 million or more; (2) create serious inconsistency or otherwise interfere with an action taken or planned by another agency; (3) materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or (4) raise novel legal or policy issues.

Although fisheries management actions rarely have an annual effect on the national economy of $100 million or more, or trigger any of the other criteria, OMB makes the ultimate determination of significance under this EO, based in large measure on the analysis in the RIR.

EA/RIR

In sum, an EA/RIR provides assessments of the environmental impacts of an action and its reasonable alternatives (the EA), the economic benefits and costs of the action alternatives, as well as their distribution (the RIR). An EA/RIR is a standard document produced by the Council and NOAA Fisheries Alaska Region to provide the analytical background for decision-making.

ESA

The ESA (16 USC 1531 et seq.) provides a means for the conservation of threatened and endangered species and the ecosystems upon which they depend. Section 7 of the ESA requires Federal agencies to use their authorities to advance conservation for threatened and endangered species and to ensure that any action authorized, funded, or conducted by a Federal agency is not likely to jeopardize the continued existence of a listed species or destroy or adversely modify designated critical habitat.

NOAA Fisheries conducts consultations under the ESA on any proposed action that may affect a listed species or its designated critical habitat. If a proposed action has the potential to adversely affect a listed species or critical habitat, NOAA Fisheries or the USFWS (depending on the affected species) conducts an analysis of the expected effects to determine whether the effects of the action, when added to the baseline, would be expected to reduce a species' survival or recovery. If the proposed action may reduce a species' survival or recovery, or adversely modify critical habitat, the Federal agency must include reasonable and prudent alternatives with the implementation of the action, developed in consultation with NOAA Fisheries or the USFWS, to ensure that the action is not likely to jeopardize the continued existence of the species or destroy or adversely modify critical habitat. As discussed below, many conservation and management measures have been implemented in the Bering Sea fisheries to conserve threatened and endangered species and their critical habitat.

MMPA

The MMPA (16 USC 1361, et seq.) establishes a Federal responsibility to conserve marine mammals. Congress declared that marine mammals are resources of great international significance and that they should be protected, and their development promoted to the greatest extent feasible, commensurate with sound resource management policies. Finding that certain species and populations of marine mammals are or may be in danger of extinction or depletion due to human activities, Congress vested NOAA Fisheries with management responsibility for cetaceans (whales) and pinnipeds (seals and sea lions) other than walrus. All other marine mammals found in Alaska, such as the sea otter, walrus, and polar bear, fall under the jurisdiction of the USFWS.

The MMPA's primary management objective is to maintain the health and stability of the marine ecosystem, with a goal of obtaining an optimum sustainable population of marine mammals within the carrying capacity of the habitat. The MMPA is intended to work in concert with the provisions of the ESA. The MMPA prohibits take of marine mammals where "take" is broadly defined to mean "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal." If a fishery affects a marine mammal population, then the potential impacts of the fishery must be analyzed in the appropriate EA or EIS, and the Council may be requested by NOAA Fisheries or the USFWS to consider regulations to mitigate adverse impacts. As discussed below, conservation and management measures have been implemented in the Bering Sea fisheries to mitigate incidental take of marine mammals.

EO 13175

Consultation and Coordination with Indian Tribal Governments EO 13175, signed by the President on November 6, 2000, and published November 9, 2000 (65 FR 67249), is intended to establish regular and meaningful consultation and collaboration between Federal agencies and Tribal governments in the development of Federal regulatory practices that significantly or uniquely affect Tribal communities. EO 13175 also prohibits regulations that impose substantial direct compliance costs on Tribal communities. EO 13175 requires "executive agencies" to establish regular and meaningful consultation and collaboration with Indian Tribes in the development of Federal policies that have Tribal implications. "Policies that have Tribal implications" refers to regulations, legislative comments or proposed legislation, and other policy statements or actions that have substantial direct effects on one or more Indian Tribes, on the relationship between the Federal government and Indian Tribes, or on the distribution of power and responsibilities between the Federal government and Indian Tribes. The Council does not fall under the definition of "executive agency" for the purposes of EO 13175 and is not required to conduct formal consultation with Indian Tribes. The responsibility for consultation as required under EO 13175 remains with NMFS. NMFS has a responsibility to carry out government-to-government consultation with Tribal governments, and the NMFS Alaska Regional Office is encouraged to conduct

formal consultation with Federally-recognized Indian Tribes[28] in the Bering Sea region and share that information with the Council.

EO 13186

Signed by the President on January 10, 2001, this EO directs executive departments and agencies to take action to further implement the Migratory Bird Treaty Act (16 U.S.C. 703-711). EO 13186 directed each Federal agency taking actions that have, or are likely to have, a measurable negative effect on a migratory bird population to develop and implement a Memorandum of Understanding (MOU) with the USFWS to promote the conservation of migratory birds.

Summary

Many Federal laws and policies require the Council and NOAA Fisheries to consider effects of the fisheries on the ecosystem when choosing and implementing conservation and management measures. The Council considers tradeoffs among ecosystem components and cumulative impacts of fishery management decisions through analyses presented in an EA/RIR/IRFA (or EIS/RIR/IRFA) prepared for each action it proposes. When Council members make a final recommendation on a proposed management measure, they will frequently justify for the record how they balanced the various tradeoffs of their final decision based on the dictates of the Magnuson-Stevens Act National Standards and other applicable law. The Council recommends measures to ensure compliance with the ESA, MMPA and relevant EOs to minimize effects of the fisheries on other components of the ecosystem. In approving the Council's recommendations, NMFS also reviews applicable law to ensure compliance.

7.4 Ecosystem-considerations in Council management policies

7.4.1 Council's Overarching Ecosystem Approach to Management

In 2014, the Council underscored its commitment to EBFM by formally adopting an Ecosystem Approach document including a value statement, a vision statement, and an implementation plan for fisheries in the EEZ off Alaska (see section 2.1). The Council's ecosystem approach applies to all of the Council's work, including long-term planning initiatives, fishery management actions, and science planning to support EBFM, and is included in full in section 2.1.

7.4.2 Policy statements in the Council's Bering Sea Management Plans

The Council's fishery management policy in the Bering Sea EEZ recognizes the dynamics of the Bering Sea ecosystem and the need for a flexible management regime to accommodate new information as more is learned about the ecosystem. This section describes the extent to which ecosystem considerations are incorporated into the management approach in each Bering Sea FMP. A more detailed description of management and fishing activity under the fishery management plans is included in section 6.

Groundfish FMP

The BSAI groundfish FMP, implemented in 1981, is based on ecosystem principles reflected in policy goals and objectives. These policy goals and objectives were unchanged from 1981 through 2004. Through the 2004 Alaska Groundfish PSEIS, the Council updated its management approach and objectives for BSAI groundfish fisheries and formalized its intention to consider and adopt measures that accelerate the Council's precautionary, adaptive management approach through:

- community-based or rights-based management;

[28] Politically sovereign Federally-recognized Tribes within the Bering Sea region can be identified for consultation, from the list at: https://www.bia.gov/regional-offices/alaska/Tribes-served.

- EBFM principles that protect managed species from overfishing; and,
- where appropriate and practicable, increase habitat protection and bycatch constraints.

The Council uses the management objectives in the 2004 Alaska Groundfish PSEIS as guideposts when considering amendments to the BSAI groundfish FMP. Forty-five management objectives are organized into the following nine categories:

- prevent overfishing;
- promote sustainable fisheries and communities;
- preserve the food web;
- manage incidental catch and reduce bycatch and waste;
- avoid impacts to seabirds and marine mammals;
- reduce and avoid impacts to habitat;
- promote equitable and efficient use of fishery resources;
- increase Alaska Native consultation; and,
- improve data quality, monitoring and enforcement.

The Council's BSAI groundfish policy goals and objectives include a broad ecosystem view of the fisheries. The goals and objectives[29] are multifaceted and in aggregate comprise a precautionary, ecosystem-based approach. The Council's groundfish management approach incorporates forward-looking conservation measures that address differing levels of uncertainty. All management decisions are based on the best scientific information available to:

- provide sound conservation of living marine resources;
- provide socially and economically viable fisheries for the wellbeing of fishing communities;
- minimize human-caused threats to protected species;
- maintain a healthy marine resource habitat; and,
- incorporate ecosystem-based considerations into management decisions.

Crab FMP

The goals and objectives of the crab FMP have not been updated since the FMP was implemented in 1989. However, an ecosystem focus was added to the crab FMP through the requirement in the 1996 Magnuson-Stevens Act reauthorization to identify essential fish habitat (EFH) in every FMP. The policy objectives of the crab FMP are to:

- ensure the long-term viability of king and Tanner crab populations;
- maximize the social and economic benefits to the nation over time; and,
- protect, conserve, and enhance adequate quantities of EFH to support king and Tanner crab populations and maintain a healthy ecosystem.

The FMP also notes the importance of considering the potential impact of king and Tanner crab fisheries on other fish and shellfish populations.

Scallop FMP

The management goals and objectives of the scallop FMP were established in 1998 and centered on operational, biological, and socio-economic aspects of the scallop fishery. In 1999, the scallop FMP was amended to add a habitat objective: to protect, conserve, and enhance adequate quantities of EFH to support scallop populations and maintain a healthy ecosystem.

[29] Applies to Bering Sea/Aleutian Islands and Gulf of Alaska groundfish management

Salmon FMP

The Council's existing salmon FMP is the application of judicious and responsible fisheries management practices, based on sound scientific research and analysis, proactively rather than reactively, to ensure the sustainability of fishery resources and associated ecosystems for the benefit of future, as well as current generations. The salmon FMP recognizes the need to balance many competing uses of marine resources and different social and economic objectives for sustainable fishery management, including protection of the long-term health of the resource and the optimization of yield. The management objectives of the FMP center on conserving the fishery resource, maximizing economic and social benefits of the fishery, and promoting crew safety at sea. As with all FMPs, the salmon FMP identifies EFH needed to support targeted populations and maintain a healthy ecosystem.[30]

Halibut Fisheries

Pacific halibut fisheries are governed under the authority of the Northern Pacific Halibut Act of 1982. For the United States, the Halibut Act gives effect to the Convention between the United States and Canada for the Preservation of the Halibut Fishery of the North Pacific Ocean and Bering Sea (Convention). The Convention gives the International Pacific Halibut Commission broad authority to adopt regulations to maintain halibut abundance, while the Council and NMFS have the authority to develop management measures governing harvesting privileges among U.S. fishermen in U.S. waters. The Council has developed halibut management programs for three fisheries that harvest halibut in Alaska: the subsistence, sport, and commercial fisheries. There is no formal halibut management plan, however, so there is no specific policy statement for managing the halibut fisheries.

Nonetheless, in 1991, the Council recommended an Individual Fishing Quota program for the management of the commercial fixed gear (hook-and-line) halibut and sablefish fisheries off Alaska and included allocations of halibut and fixed gear sablefish to the Community Development Quota Program that divides the quota among 66 communities in Western Alaska. The IFQ and CDQ programs were implemented in response to growing concerns about issues that had emerged from management of the fixed-gear halibut and sablefish fisheries under the open access regime and included clear objectives for management under the program. In both fisheries, growth in fishing capacity under open access had necessitated large reductions in length of the fishing seasons and caused a host of undesirable biological, economic, and social effects. The fixed gear halibut and sablefish IFQ program successfully reduced the previously overcapitalized fleet, extended the fishing season, reduced gear conflicts, reduced deadloss from lost gear, increased fisher safety, reduced bycatch and discard mortality and resulted in increased economic stability in the fisheries.

Summary

Through the requirements of the Magnuson-Stevens Act and the Council's stated ecosystem policy objectives, both in their vision statement and in individual FMPs, the Council approaches Bering Sea fishery management with EBFM principles. The Magnuson-Stevens Act requires the Council to take the protection of the marine environment and the social, economic, and ecological factors into account when setting the fishery OY; to take into account the effects of conservation and management measures on fishing communities; and to minimize any adverse effects of fisheries on EFH. Moreover, the Council has used an ecosystem approach to groundfish fishery management since 1981, to halibut fishery management since 1991, and has expanded those broad ecosystem principles to all FMPs through its 2014 Ecosystem Approach document.

[30] Ninth Circuit Court of Appeals (Court) remanded to NMFS, Amendment 12 to the salmon FMP on February 21, 2016. Amendment 12 removed the historic net-fishing area of Cook Inlet from the salmon FMP and delegated management authority to the State of Alaska. The Council is developing an analysis to amend the salmon FMP in response to the Court's remand. However, the overarching management objectives of the existing salmon FMP are not affected by the February 2016 ruling.

7.5 Existing Ecosystem-based Fishery Management in the Bering Sea

This section describes examples of existing processes employed by the Council to take ecosystem considerations into account during the annual TAC setting process and the existing ecosystem-based conservation and management measures that the Council has recommended (and NMFS has implemented) in the Bering Sea fisheries in accord with the overarching policies, objectives, and applicable law described above. The following sections address each of these topics:

- Protecting marine food webs
- Monitoring ecosystem health
- Evaluating ecological, social, and economic tradeoffs of different management actions
- Reducing bycatch
- Conserving important habitat
- Avoiding impacts to seabirds and marine mammals
- Adapting management to maintain resilient fisheries and ecosystems in a changing climate
- Providing for sustained participation of fishing communities
- Fostering meaningful and diverse stakeholder participation in the Council process

7.5.1 Protecting Marine Food Webs

Optimum Yield

All OY amounts account for protection of marine ecosystems

- The OY of the BSAI groundfish complex is 85% of the historical estimate of MSY, or 1.4 to 2.0 million mt.
- Salmon OY specifications vary according to species and area and are based on the State of Alaska's MSY escapement goal policies.
- The weathervane scallop OY (BSAI and GOA combined) is 1.284 million lbs and is based on the average retained catch from 1990 through 1997 plus additional fishing mortality from discards mortalities in the directed scallop fishery, the groundfish fisheries, and agency surveys.
- The OY for king and Tanner crab is 0 to < OFL where OFL is the annualized MSY. The annualized MSY is derived through the annual stock assessment process using a five-tier system.

Ecosystem Considerations for Total Allowable Catch

The annual groundfish fishery TAC setting process considers the marine food web. Formally, stock assessments focus on biological limits and stock production variability; account for uncertainty at each step to manage in a precautionary manner; account for natural mortality, including predation mortality; and aim to continually reduce uncertainty through continually improved understanding of functional relationships. The status of ecosystem indicators in the Ecosystem Status Report (ESR, also referred to as the "Ecosystem Considerations Report") are considered through informal steps in the annual groundfish TAC setting process.[31] Interdisciplinary experts serve on the Council's FMP teams and on the Council's SSC and consider ecosystem factors in the recommendation of the annual ABCs. The Council considers biological, social and economic tradeoffs when it specifies the TAC for each groundfish fishery at an amount not to exceed ABC.

[31] Currently there is no stock assessment model for weathervane scallops. OTHERS

With reference to the groundfish management cycle, one current best practice is to present contextual ecosystem information from the ESRs immediately preceding the review of species-specific harvest recommendations. This allows for general discussion of ecosystem status and observations that are outside the scope of individual stock assessments yet may have impacts to the considerations of harvests. These may reflect new or very recent observations or an accumulation of observations across multiple ecosystem indicators that suggest a widespread shift. This process allows for rapid incorporation of ecosystem information that may or may not be based on previously established causal relationships or mechanisms. Examples would be temperature patterns outside the range of that previously observed ("the Blob") and unusual die-offs of seabirds and marine mammals that may indicate that additional caution is warranted (or not) in the consideration of individual harvest recommendations. With this process, all single-species harvest recommendations are then evaluated in light of the overall ecosystem status. There are multiple documented occurrences of this process supporting adjustments or maintenance of max ABC.

A complementary effort still in development, currently identified as an Ecosystem Socio-Economic Profile or ESP, is the identification of ecosystem indicators with established mechanistic relationships mapped to the managed species life cycle conceptual model. These indicators can be presented alongside the stock assessment and can be evaluated in stoplight or scoring form with reference to the species. Additionally, ecosystem indicators with valuations or thresholds may eventually be directly incorporated into the stock assessment model. A best practice is for the ESP to be coordinated by the stock assessment author with an ecosystem scientist(s) and/or specialist(s) in ecosystem factors influencing different life stages of the assessed species. The ESP enters the annual groundfish management cycle through the stock assessment, presented concurrent to the individual stock assessments.

IPHC Harvest Strategy for Halibut

The IPHC Harvest Strategy Policy is designed to manage the Pacific halibut resource for long-term ecological sustainability and economic viability and has been developed to be consistent with the Pacific halibut in the food web and marine environment during the establishment of annual harvest levels.[32]

Forage Fish Protections

Groundfish FMP Amendment 36 (1998) established a forage fish category as a FMP ecosystem component. Regulations to implement FMP Amendment 36 prohibited directed fishing on forage fish species to conserve prey for marine mammals, seabirds, and commercially important groundfish species. The forage fish category includes sand lance, herring, capelin, smelts, gunnels, sand fish, krill and species in the *Stichaeidae* and *Gonostomatidae* family.

In 2017, the Council recommended that squid species be reclassified from their current classification as target species to non-target ecosystem component species in the BSAI groundfish FMP. Squid are caught incidentally in other directed fisheries for groundfish. Squid are short-lived, highly productive, and there are currently no conservation concerns about incidental harvest of squid. However, given their ecological importance as prey, the Council recommended keeping squid species in the FMP and recommended that directed fishing for squid be prohibited, that a maximum retainable amount be established to discourage retention of squid in other fisheries, and that recordkeeping and reporting of squid catch be required to continue to monitor squid catch. This proposed amendment to the BSAI groundfish FMP is under review by the Secretary of Commerce.

[32] Source: https://iphc.int/the-commission/harvest-strategy-policy, accessed January 9, 2018.

Conserving Prey for Steller sea lions

Since the listing of Steller sea lions under the Endangered Species Act in 1990, the Council and NMFS have taken many actions to reduce the potential for the groundfish fisheries to compete for prey with Steller sea lions.

Beginning in 2001, NOAA Fisheries implemented a modified harvest control rule for three Steller sea lion prey species (Atka mackerel, pollock, and Pacific cod) targeted in the groundfish fisheries.[33] There are directed fisheries for pollock and Pacific cod in the Bering Sea. The 2001 emergency interim rule and 2002 final rule, modified the harvest control rule for these species to reduce the fishing mortality rate when the biomass of a pollock or Pacific cod stock is projected to be below a biomass necessary to achieve maximum sustainable yield; when the spawning biomass per recruit is estimated to be 20 percent of its unfished level (or lower), fishing for that species would be prohibited. For all other groundfish species, fishing for a target species would be prohibited when the spawning biomass per recruit of the target stock is reduced to 2 percent of its unfished level.[34] This modified harvest control rule is designed to ensure adequate levels of prey for Steller sea lions.

Beginning in 1999, NMFS closed important foraging areas around Steller sea lion rookeries to fishing with trawl gear to conserve prey for Steller sea lions. Additional areas around Steller sea lion rookeries and haul outs were closed to directed fishing for pollock and Pacific cod starting in 2002. The number of sea lion sites closed to each Bering Sea fishery within 10 and 20 nm of the site is shown in Table 7-1. Fishing for pollock and Pacific cod is prohibited within 20 nm of all five Steller sea lion rookeries in the Bering Sea.

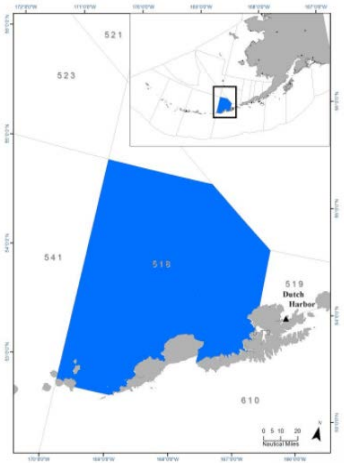
Annual Bering Sea pollock and Pacific cod TACs are apportioned among seasons to disperse harvest and reduce the potential that the fisheries deplete Steller sea lion prey on time scales relevant to foraging sea lions.

Table 7-1 Number of sites in the Bering Sea where directed fishing for pollock or Pacific cod is closed out to 10 or 20 nm to conserve prey for Steller sea lions.

Closure Area	Pollock Trawl [1]	Pacific Cod		
		Trawl [1]	Hook and Line [1, 2]	Pot [1, 2]
10 nm	8	10	2	0
20 nm	7	5	7	7

[1] The Bogoslof Area (Figure 7-3) is also closed to these
[2] One site, Sea Lion Rock, is closed out to 7 nm to hook-and-line and pot gear

Figure 7-3 The Bogoslof Area, closed to fishing for pollock and Pacific cod.



Source: Steve Lewis, AKR.

[33] 66 FR 7276, January 22, 2001 and 67 FR 956, January 8, 2002
[34] Regulations at 50 CFR 679.20(d)(4)

7.5.2 Monitoring Ecosystem Health

Stock Assessments and Annual Catch Limits

Annual catch limits are based on the biological condition of the stock and socioeconomic considerations ~ based on annual stock assessments, annual stock assessments based on current survey and fishery dependent data. [Need to add expanded overview].

Bottom Trawl Surveys

The AFSC Groundfish Assessment Program (GAP), in cooperation with the AFSC Shellfish Assessment Program, conducts bottom trawl surveys to assess the condition of groundfish and and king and Tanner crab stocks in the Bering Sea shelf (annually since 1979) and Bering Sea slope (intermittently from 1979 to 1991 and biennially in even years since 2000). Biennial bottom trawl surveys in the Northern Bering Sea began in 2017. GAP also investigates biological processes and interactions with the environment to estimate growth, mortality, and recruitment to improve the precision and accuracy of forecasting stock dynamics. Impacts of bottom trawls on the seafloor and the description of bottom type are also being studied in the Bering Sea via data generated from these surveys. The ADFG conducts triennial stock assessment surveys for red king crab in Norton Sound.

Midwater/Acoustic Trawl Surveys

The AFSC Midwater Assessment and Conservation Engineering Program has assessed the status of Bering Sea pollock since 1977. Pollock assessment is conducted with midwater trawl surveys combined with acoustic (echo integration) technology to develop distribution and abundance time series. Winter surveys of spawning pollock abundance have been conducted annually in the Bogoslof Island area of the Bering Sea since 1988. Assessment of summer pollock abundance in the Bering Sea has occurred routinely since 1979. The acoustic/midwater trawl survey estimates of distribution and abundance are documented in various scientific reports and incorporated into stock assessment advice to the Council.

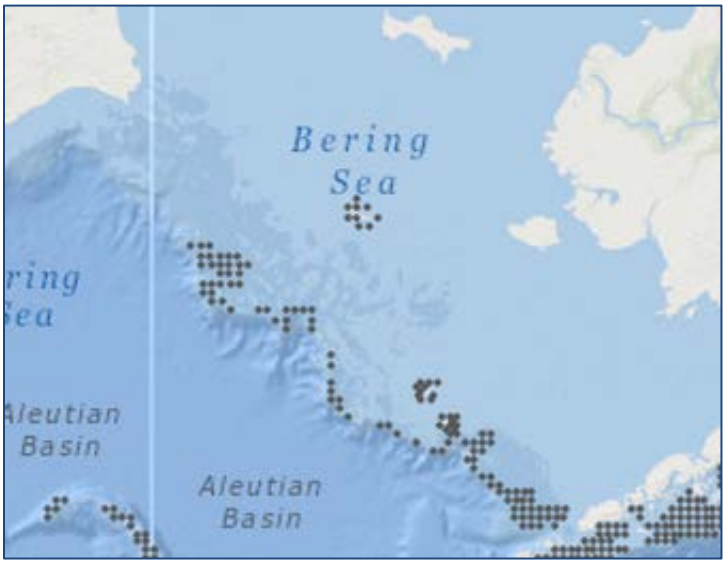
Longline Survey

The AFSC Marine Ecology and Stock Assessment Program conducts annual longline surveys to assess the sablefish stock in the Bering Sea. These data are combined with fishery-dependent data to estimate abundance and determine ABC for several groundfish species.

IPHC Fishery-Independent Setline Survey (FISS)

The IPHC FISS is conducted across Pacific halibut fishing grounds each summer. Biological data collected on the FISS are used to monitor changes in biomass, growth and mortality of the Pacific halibut population. These data are also valuable for other stock assessments (e.g., Pacific cod). IPHC's FISS is one of the most extensive fishery-independent surveys in the world.

Figure 7-4 IPHC FISS stations in the Bering Sea.



Source: https://iphc.int/data/fiss-data-query, assessed January 17, 2018.

Bering Sea Integrated Ecosystem Research Program

The Bering Sea Project, a partnership between the North Pacific Research Board (NPRB) and the National Science Foundation (NSF), sought to understand the impacts of climate change and dynamic sea ice cover on the eastern Bering Sea ecosystem. NOAA also committed major in-kind resources of personnel, equipment, and ship time as well program leadership.

More than one hundred scientists engaged in field research and ecosystem modeling to link climate, physical oceanography, plankton, fishes, seabirds, marine mammals, humans, traditional knowledge and economic outcomes to better understand the mechanisms that sustain this highly productive region.

Field research began in 2007 and concluded in 2010. Synthesis and reporting concluded in 2016. Major program results were reported at the 2014 Alaska Marine Science Symposium and to NPRB and NSF.[35]

Alaska Integrated Ecosystem Assessment

NOAA's Integrated Ecosystem Assessment Program (IEA) supports EBFM by providing a tool to help transfer scientific information to management. IEAs are intended to provide a structure to assess ecosystem status relative to objectives, account for the holistic impact of management decisions, and guide management evaluations. The Alaska IEA leverages substantial ongoing ecosystem assessment work conducted by the AFSC Resource Ecology and Ecosystems Modeling (REEM) group. This group works closely with the AFSC Status of Stocks and Multispecies Assessment group to address fisheries impacts on Alaska marine ecosystems including non-target and ESA listed species. Members from both groups have been appointed by the Council to participate on the assessment Plan Teams. In particular, the Council requires that FMPs in Alaska include annual updates of an Ecosystems Consideration chapter of the Groundfish Stock Assessment and Fishery Evaluation (SAFE) reports. The ecosystems considerations (EC) chapter is currently assembled in part with programmatic support from FATE (Fisheries And The Environment) and many scoping and indicator selection efforts have been completed to meet the needs of the EC chapter. The Alaska IEA will compliment this process, leverage current efforts, and provide an assessment tool that will be used to evaluate various concomitant ecosystem outcomes from climatic or

[35] A presentation of the major results is available online: https://www.afsc.noaa.gov/HEPR/docs/2014_04_30_AMSS_2014_revised_for_NPRB.pdf

fishery effects under different management and/or climate scenarios. In particular, the Alaska IEA will be used to further quantify and strengthen the Implications section of each ecosystem indicator of the EC chapter.

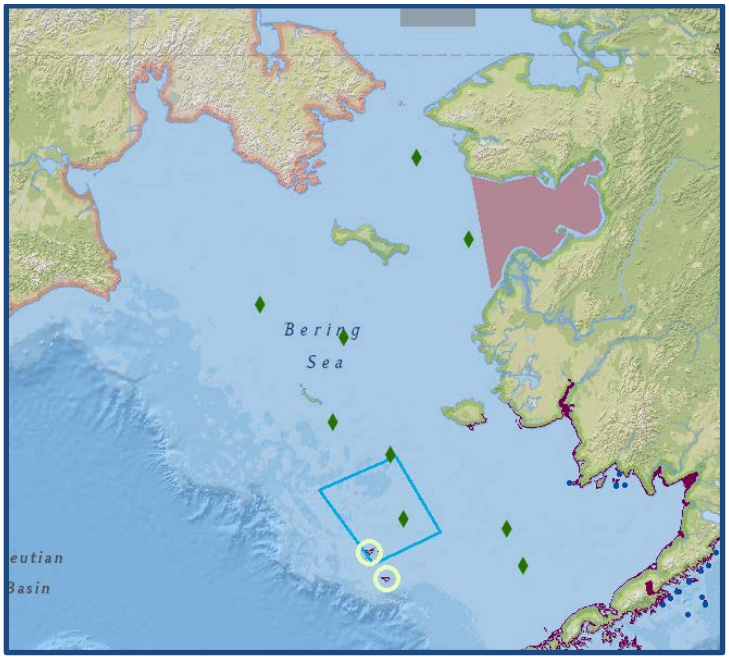
Marine Mammal Assessment

Marine mammal research in support of NOAA's mission in Alaska is conducted by the AFSC Marine Mammal Lab (MML). MML uses a variety of methods and tools to obtain needed marine mammal information. Determination of status and trends of marine mammal populations requires information on abundance, stock structure, mortality and net productivity. To obtain these data, censuses are carried out from ships, aircraft and on land. Radio and satellite-linked telemetry is used to determine movements and migrations, critical feeding areas and depths, and other behavioral data. Sophisticated analyses and modeling are carried out to determine necessary population parameters. Research programs are carried out cooperatively with many other Federal, state and private sector collaborators.

Ecosystem Component Species

Ecosystem component species are stocks that a Council has determined do not require conservation and management but are listed in a FMP to achieve ecosystem management objectives. In addition to the forage species mentioned above, the Council has designated grenadier species as ecosystem component species in the BSAI groundfish FMP. The Council also designated all non-targeted scallop species, including pink or reddish scallops, spiny scallops, and rock scallops as ecosystem component species in the Scallop FMP. Directed fishing on these species is prohibited and they will continue to be monitored to ensure they are not targeted and that incidental catch does not reach a point where there are concerns for the sustainability of these stocks.

Figure 7-5 Location of National Marine Mammal Lab fieldwork in the Bering Sea in 2017.



Note: Green diamonds are locations of marine mammal passive acoustic recorders, the blue box represents northern fur seal foraging and diet study locations, the shaded polygon in Norton Sound represents the location of EBS beluga aerial surveys, the maroon nearshore polygons represent the location of harbor seal aerial surveys, blue dots indicate Steller sea lion aerial survey locations, and yellow circles on the shelf represent the location of northern fur seal demographic studies.

7.5.3 Evaluating Ecological, Social and Economic Tradeoffs of Different Management Actions

Available information and processes allow for varying degrees of formal evaluations of ecological, social and economic tradeoffs of different management actions. Existing evaluations of tradeoffs are conducted through NEPA, RFA and E O 12866 analyses. Tradeoff analyses could be advanced to allow for more systematic, formal evaluations which explicitly consider tradeoffs among multiple, relevant ecosystem components. Continued development of the Alaska IEA is intended to support these types of analyses going forward. Supporting Tribal consultation as defined in E O 13175 and continued strengthening of relationships with rural and Indigenous communities throughout Alaska is also intended to support these analyses.

The AFSC Economic and Social Science research program collects economic and sociocultural data for the conservation and management of living marine resources off Alaska and provides information in support of analyses conducted under NEPA, the RFA and E.O. 12866 to evaluate ecological, social and economic impacts of fishery management actions. The AFSC Economic and Social Science Research Program prepares an annual Economic Status Report for the BSAI groundfish fisheries and for the King and Tanner Crab Fisheries of the BSAI. The Groundfish Economic Status Report presents summary statistics on catch, discards, prohibited species catch, ex-vessel and first-wholesale production and value, participation by small entities, and effort in these fisheries. The BSAI Crab Economic Status Report includes information on: production, sales, revenue, and price indices in the harvesting and processing sectors; income, employment, and demographics of labor in both sectors; capital and operating expenditures in the fishery; quota share lease and sale market activity; changes in distribution of quota holdings; productivity in the harvesting sector; U.S. imports and exports of king and Tanner crab; price forecasts; performance metrics for catch share programs and other information regarding data collection and ongoing economic and social science research related to the BSAI crab fisheries and related communities.

In addition, the Council's Ecosystem Committee reviews pending Council actions with ecological implications and provides input to the Council on potential impacts of fishery management decisions on ecological and social tradeoffs of various fishery management decisions.

7.5.4 Reducing Bycatch

Bycatch reduction is a key part of fisheries management in the Bering Sea. Impacts of bycatch reach across social, cultural, ecological, and economic aspects of the ecosystem. As such, the Council has adopted measures to limit the catch of species taken incidentally in directed fisheries. Certain species are designated as prohibited species in the FMPs because they are the target of other, fully utilized domestic fisheries. For example, halibut, herring, salmon, steelhead trout, king crab and Tanner crab are prohibited species in the groundfish fisheries. The Council has managed salmon prohibited species catch (PSC) in the Bering Sea since 1981 (beginning with Amendment 1a to the BSAI groundfish FMP). With limited exceptions (e.g., for food donation, for a full salmon census, and some exceptions for operators with halibut IFQ), PSC may not be retained and must be returned to sea immediately, with a minimum of injury, regardless of its condition.

The Council has taken numerous actions to control and reduce PSC in the BSAI groundfish fisheries (Table 7-2). The Council has set prohibited species catch limits in the groundfish fisheries for many of these species, which trigger either spatial closures or fishery closures for specific gear types and groundfish target fisheries. The Bering Sea trawl fisheries also report to the Council annually on PSC reduction efforts for salmon and halibut through cooperative reports.

Table 7-2 Amendments to the BSAI Groundfish FMP that addressed prohibited species catch

Amendment number	Year	Action
1a	1981	Foreign Fleet Salmon PSC Caps
3	1980	Halibut, Crab, and Salmon PSC Caps for Foreign Fleet
8	1983	1984 and 1985 Salmon PSC Caps for Foreign Trawl Vessels
10	1986	Crab and Halibut PSC Caps
12	1988	PSC Framework
12a	1988	Revised Crab and Halibut PSC Caps
16	1990	Revised Crab and Halibut PSC Caps
16a	1990	Herring PSC
19	1991	Establish PSC Caps for Non-Trawl Fisheries
21	1992	Halibut PSC Framework
21b	1995	Chinook Salmon Savings Area
25	1992	Adjust Trawl Halibut PSC Caps
29	1993	Salmon Bycatch Accounting
35	1995	Chum Salmon Savings Areas
37	1996	Red King Crab PSC Caps
40	1996	Establish Opilio PSC Caps
41	1996	Reduce Bairdi PSC Caps
50	1997	Halibut Donation Program
57	1998	Reduce Crab and Halibut PSC Caps
58	1999	Reduce Chinook Salmon PSC Caps
80	2006	Reduce Halibut and Crab PSC for non-AFA groundfish trawl CPs
84	2005	Salmon Bycatch—Exemption for rolling hotspot closures
91	2009	Salmon Bycatch
110	2014	Salmon Bycatch Measures
111	2014	Reduce Halibut PSC Caps

Seabird Bycatch Mitigation Measures

In 1996 the Council adopted seabird bycatch avoidance measures for all hook-and-line vessels fishing for groundfish in the BSAI (and GOA) and expanded similar measures for the Pacific halibut fisheries using hook-and-line gear in 1997. These measures were designed to reduce interactions between the hook-and-line fisheries and seabirds, including the rare, but occasional interactions with short-tailed albatross. From 1999 through 2005, several research projects were conducted to test the efficacy of various seabird avoidance tactics on hook-and-line vessels. For example, at its June 2004 meeting, the Council approved an Exempted Fishing Permit for IWG research. As a result of this research, the seabird avoidance requirements for hook-and-line vessels were revised in 2007 (72 FR 71601) and again in 2009 (74 FR 13355). These regulations and additional information on seabirds and commercial fisheries are available on the NMFS AK Region web site. The Council has also encouraged research on integrated weight groundline gear and seabird interactions with trawl sonar cables, called “third wires.” To date, bycatch of seabirds in trawl third wires represents a small proportion of seabird bycatch in Alaska fisheries, and no regulatory measures have been introduced to require seabird avoidance.

Each year, NMFS provides a report to the USFWS on the amount of seabird bycatch in the fishery in the prior year. The USFWS issued a Biological Opinion under section 7 of the ESA on the effects of the groundfish hook-and-line fisheries on endangered short-tailed albatross in December, 2015 and concluded that the fisheries were not likely to jeopardize the continued existence of the short-tailed albatross. NMFS reinitiated ESA section 7 consultation on the effects of the hook-and-line halibut fisheries with the USFWS on September 1, 2017.

Annual crab Bycatch Limits

Annual crab bycatch limits in the Bering Sea scallop fishery are specified red king crab and Tanner crab by the State of Alaska Board of Fisheries.

7.5.5 Conserving Important Habitat

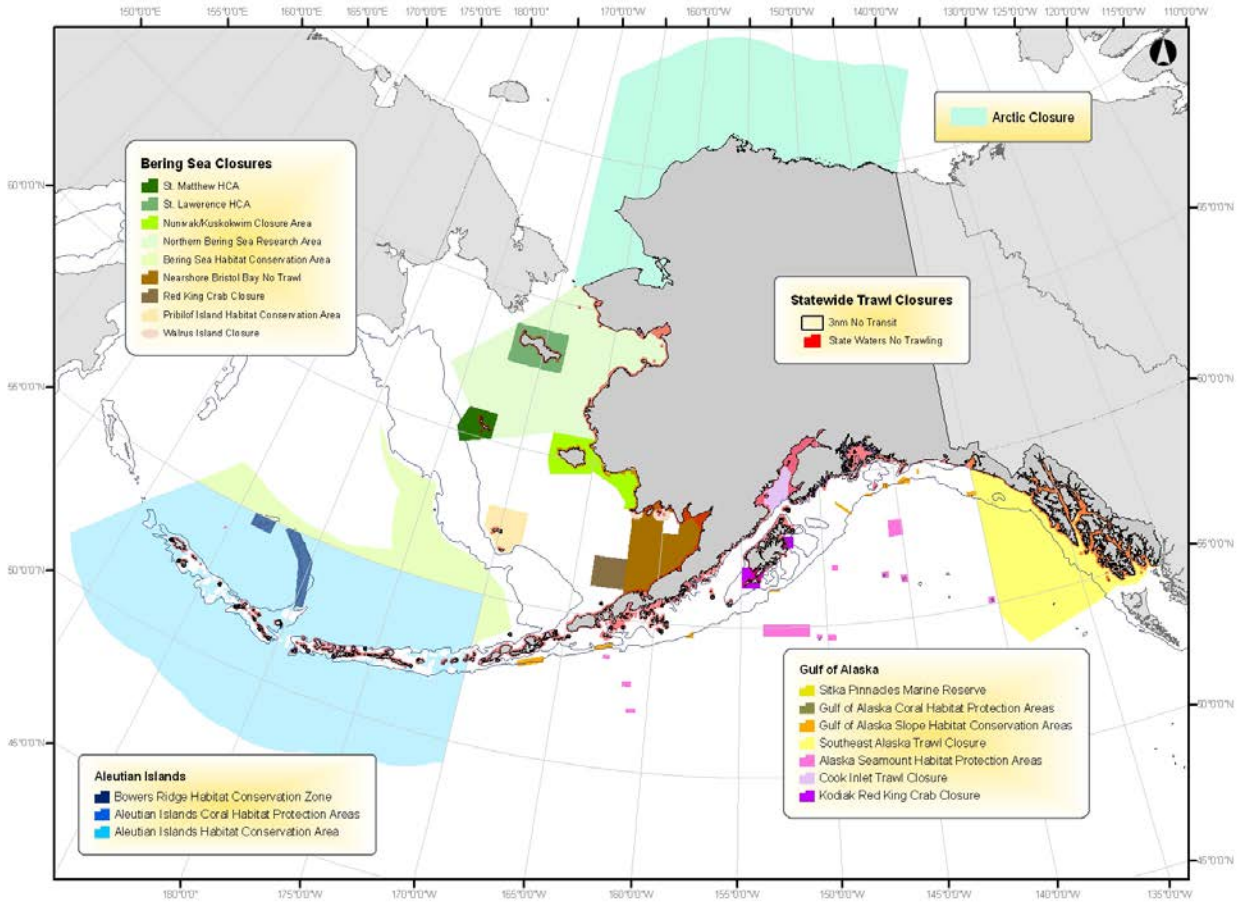
The Council has taken numerous actions to conserve essential Bering Sea habitats (Table 7-3, Figure 7-6).

Table 7-3 Amendments to the BSAI Groundfish FMP that addressed habitat protection

Amendment number	Year	Action
9	1985	Incorporate Habitat Protection Policy
21a	1992	Establish the Pribilof Island Habitat Conservation Area (HCA)
37	1996	Establish Bristol Bay Red King Crab Savings Area
55	1998	Define EFH
57	1998	Pollock Bottom Trawl Prohibition
78	2005	EFH EIS, which redefined EFH, and established the Aleutian Islands (AI) HCA, the AI Coral Habitat Protection Areas, Alaska Seamount Halibut Protection Areas, and the Bowers Ridge HCA
89	2007	Bering Sea Habitat Conservation Area
94	2009	Required bottom trawl sweep modification to revise boundaries of the Northern Bering Sea Research Area and the Saint Matthew Island HCA
98	2011	Essential Fish Habitat Omnibus Amendments
104	2013	Develop Skate HAPCs
115*	2017	Essential Fish Habitat Omnibus Amendments

***** Pending public notice and Secretarial approval as of January 18, 2018.

Figure 7-6 North Pacific habitat conservation areas, including areas closed to fishing in the Bering Sea.



Bering Sea Habitat Conservation Area

In June 2007, the Council adopted precautionary measures to conserve benthic fish habitat in the Bering Sea by "freezing the footprint" of bottom trawling by limiting trawl effort only to those areas more recently trawled. Implemented in 2008, the new measures prohibit bottom trawling in a deep slope and basin area (47,000 nm^2), and three habitat conservation areas around St Matthew Island, St Lawrence Island, and an area encompassing Nunivak Island-Etolin Strait-Kuskokwim Bay. The Council also established the Northern Bering Sea Research Area that includes the shelf waters to the north of St. Matthew Island (85,000 nm^2). The northern Bering sea was set aside for research on impacts of bottom trawling on benthic habitat. Bottom trawling is prohibited in the Northern Bering Sea Research Area. The Council sought to develop a research plan that would provide data to allow better understanding of the potential impacts of trawling on the benthic and epibenthic fauna of the northern Bering Sea before any commercial trawling was authorized.

Bering Sea HAPC

The most recent call for HAPC proposals was April 26, 2010. The process concluded with the designation of the only HAPCs in the Bering Sea to date, the designation of six areas in the eastern Bering Sea where relatively high concentrations of skate eggs occur for several skate species (family Rajidae). Fishing activities are not restricted within these skate egg HAPCs.

- Large areas around Pribilof Islands, Bristol Bay and the Bering Sea Red King Crab Closure Area closed to scallop fishing and bottom trawling to protect crab and other sensitive habitat
- Ten miles around St. Lawrence, King and Little Diomede Islands closed to king and Tanner crab fishing to protect subsistence fisheries for crab.

Bering Sea Canyons and Deep Sea Corals

The North Pacific Fishery Management Council has consistently acted to identify significant concentrations of deep sea corals and to protect those areas from fishery impacts. Between 2006 and 2016 the Council considered whether protections were needed for deep sea corals in five submarine canyons along the Eastern Bering Sea slope. Results from a 2007 video transect survey in Zhemchug and Bering Sea Canyons (Miller et al. 2012) indicated that the canyons supported high densities of deep sea corals and demersal fish habitat and the Council received many requests to enact protections from fishing gear in the canyons. After careful evaluation of data compiled from the best information available prior to 2014 (Sigler et al. 2015) and, subsequently, from direct observations of deep sea coral occurrence and density from an underwater camera survey conducted by the AFSC in 2014 (Rooper et al. 2016), the Council determined that protections from fishing gear for deep sea corals and are not needed. MacLean et al. (2017) provide a thorough summary of the process the Council used to carefully consider and determine that deep sea corals are not present in significant densities in the Eastern Bering Sea canyons and that deep sea corals in the canyons, and Pribilof Canyon in particular, have low vulnerability to impacts from fishing. In this instance of implementing EBFM, the best available science did not support the need to enact fishing limitations to conserve important deep sea corals or fish habitat.

7.5.6 Avoiding impacts to seabirds and marine mammals

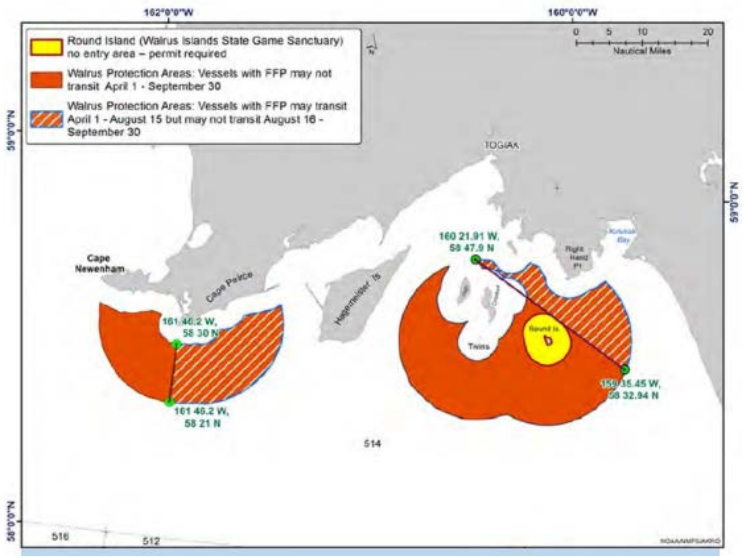
In addition to required seabird avoidance gear requirements and Steller sea lion protection measures described above, the Council has adopted measures to reduce vessel disturbance on Pacific walrus.

Walrus Transit Areas

Beginning in 1990, waters surrounding the Walrus Islands (Round Island and the Twins) and Cape Pierce, between 3 and 12 nm were closed to fishing for groundfish from April 1 through September 30 to protect hauled-out walrus from fishing vessel disturbance (BSAI Groundfish FMP Amendment 13; renewed via

Amendment 17). In 2014, the Council adopted Amendment 107 to the BSAI Groundfish FMP to permit vessels with Federal Fishing Permits to transit in designated areas near Round Island and Cape Pierce (Figure 7-7) from April 1 to August 15 each year. Vessels are still prohibited from deploying fishing gear in these areas.

Figure 7-7 Cape Pierce and Round Island Walrus Protection Areas

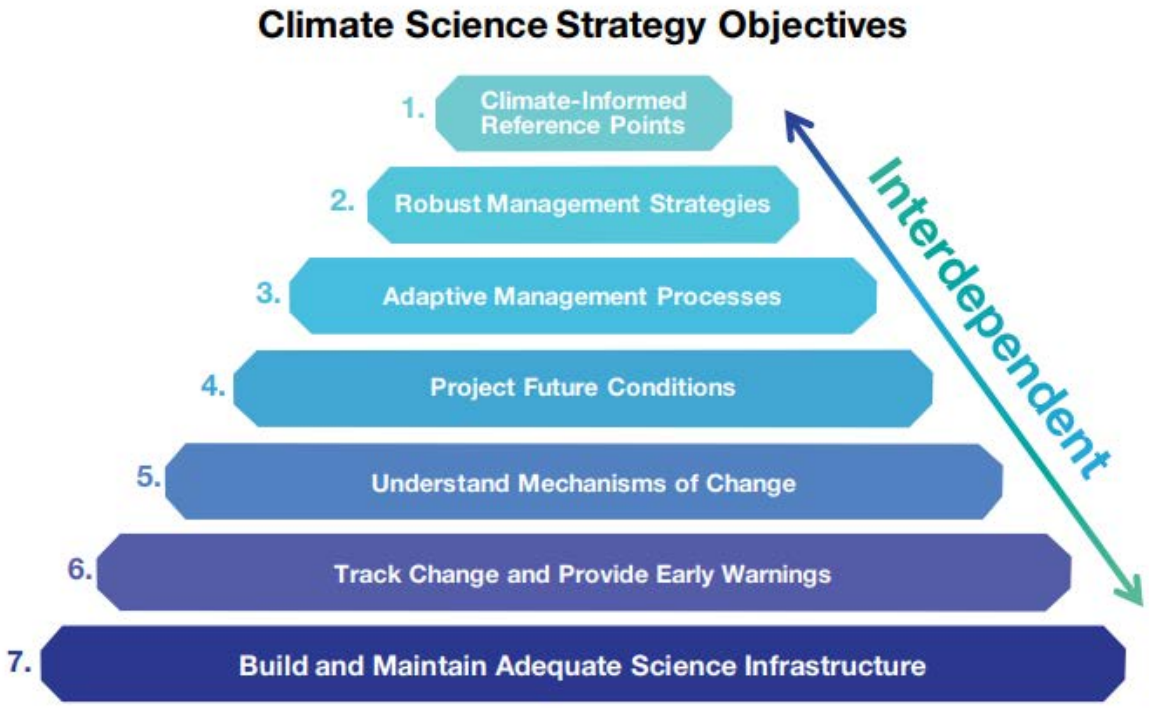


7.5.7 Adapting management to maintain resilient fisheries and ecosystems in a changing climate

Climate-related changes are impacting Bering Sea living marine resources and are projected to continue and increase (IPCC 2013). To meet the Council and NMFS's long-term sustainable fishery goals, management will need to be sufficiently responsive to accommodate ecosystem changes resulting from long-term climate change. NMFS and its partners are conducting research to improve the scientific understanding of baseline and projected climate and oceanographic conditions and the response of Bering Sea ecosystem components to projected changes.

In 2016, NMFS released a Regional Action Plan (RAP) for Southeastern Bering Sea Climate Science (Sigler et al. 2016). The goal of the RAP is to increase the production, delivery and use of climate related information for Bering Sea marine resource management. The RAP identifies strengths, weaknesses, priorities, and actions to implement the NOAA Fisheries Climate Science Strategy (Strategy) in Alaska in the near term and focuses on building regional capacity and partnerships to address the Strategy's seven science objectives (Figure 7-8). The RAP discusses the current knowledge of projected climate impacts on species' productivity and abundance and describes the information needed to make connections between the environment and species' response. The RAP notes the challenges for predicting species' responses to climate change and incorporating emerging information into management decisions in a relevant time frame and provides an action plan for the Alaska Fishery Science Center and the Pacific Marine Environmental Laboratory for the next 3 to 5 years to advance climate-ready fisheries management in the eastern Bering Sea.

Figure 7-8 NOAA Fisheries Climate Science Strategy Objectives.



The Council's Ecosystem Approach Value Statement, Vision Statement and Implementation Strategy are underpinned by understanding and planning for managing fisheries for current and future generations under rapidly changing conditions. To advance this vision, the Council has identified research priorities to increase understanding about effects of climate change on living marine resources in the North Pacific. The Council identified the following climate-related research priorities at its meeting in June 2017:

- Assess how changes in pH and temperature would affect managed species, upper level predators and lower trophic levels.
- Develop and evaluate global climate change models (GCM) or downscaled climate variability scenarios to assess impacts to recruitment, growth, and spatial distributions.
- Collect climate and oceanographic information covering a wider range of seasons.
- Develop projection models to evaluate (a) the robustness and resilience of different management strategies under varying environmental and ecological conditions and (b) to forecast seasonal abundance.
- Evaluate incorporation of climate change impacts into stock assessments.

In February 2018, the Council held a one-day ecosystem research workshop in conjunction with its February meeting. Tools that are currently available and under development for understanding and planning for climate change effects was a focal topic of the workshop. The Council will use the results of that workshop to continue advancing EBFM. The climate change Action Module (see section 4.1) planned as part of this BS FEP will advance the Council's framework for ensuring its policies are sufficiently responsive to accommodate ecosystem changes resulting from long-term climate change.

7.5.8 Providing for sustained participation of fishing communities

Understanding how fishing communities may be affected by changes in the Federally managed fisheries begins with understanding how these communities are currently engaged in and dependent upon those fisheries, as well as the overall social and economic context of those communities. Impacts to

communities involved in fisheries can occur as a result of changes to FMPs, fish stocks, the location of productive fishing grounds, etc., or a combination of all of these factors. The Council is required, under the Magnuson-Stevens Act, to consider the importance of fisheries to fishing communities, and minimize adverse impacts to the extent practicable. It is the Council's goal to balance the needs of all human communities that rely on the Bering Sea to survive and thrive. The Council recognizes that Bering Sea fisheries are important to coastal communities throughout the region, as well as communities of people who, while they may reside elsewhere, come to the region to work or are significantly invested in the region (e.g., seasonal fishermen, offshore processors).

Information about community needs is often heard in the form of LK or TK during the public comment process and the Council has a long practice of considering coastal community needs in its management decisions. The Council has also built various different community protection measures into catch share programs that have been developed, as well as balancing the needs of communities in developing protection measures for Steller sea lions to ensure continued local access for small boat fleets. In 1992, the Council's Western Alaska Community Development Quota (CDQ) program went into effect to set aside an allocation of all groundfish, crab, and halibut quota in the BSAI for exclusive use by 65 remote, coastal communities along the Bering Sea with limited alternative economic infrastructure. In 2001, the Council developed regulations to fully recognize and authorize halibut subsistence fishing activities by certain rural residents and Alaska Native Tribal members of Alaska, with the acknowledgement that Alaska Native Tribes have customary and traditional practices of using halibut to feed their families and support local economies (through sharing and bartering) that have occurred for thousands of years.

7.5.9 Fostering meaningful and diverse stakeholder participation in the Council process

The Council is committed to creating an environment that fosters meaningful participation from diverse groups of stakeholders, including the incorporation of LK and TK. This commitment has led to a longstanding pattern of successful public participation through public comments at meetings, membership on Plan Teams and Committees, and attendance at Council-hosted workshops. In some cases, like that of the Electronic Monitoring Committee, the public have played a crucial role in working collaboratively with Committee member representatives from industry, agency, management, and the science community to develop new regulations, from start to finish. In situations when controversial decisions must be made, Council, SSC, and AP members, staff, agency representatives, and the public all take décorum seriously. It is a shared sense of purpose and respect for process that has fostered and continues to foster meaningful stakeholder engagement throughout the Council process.

From a practical standpoint, travel in Alaska can be prohibitively expensive and Council meetings are designed to be accessible. To mitigate financial stressors of in-person attendance at meetings, the Council hosts:

- joint meetings of the SSC, AP, and the Council;
- three meetings in the centrally-located city of Anchorage each year;
- a meeting in Seattle/Portland each year; and,
- a meeting in a coastal Alaskan community each year.

The Council additionally has been able to make every meeting accessible online. The Council meetings have been streamed through user-friendly Adobe Connect web conferencing software since February 2014, so that in-person attendance is not necessary for members of the public that want to listen to Council presentations, discussions, and decisions. Starting in February 2018, stakeholders have been able to submit their meeting comments electronically through http://meetings.npfmc.org/ and meeting agendas will be available on the same site starting in December 2018.

8 Risk analysis – PLACEHOLDER

Ecological risk assessment is defined as a process that evaluates the likelihood that adverse ecological effects may occur or are occurring as a result of exposure to one or more stressors. A risk does not exist unless (1) the stressor has the inherent ability to cause one or more adverse effects and (2) it co-occurs with or contacts an ecological component (i.e., organisms, populations, communities, or ecosystems) long enough and at a sufficient intensity to elicit the identified adverse effect. An ecological risk assessment may evaluate one or many stressors and ecological components (EPA 1992).

Ecological risk may be expressed in a variety of ways. While some ecological risk assessments may provide true probabilistic estimates of both the adverse effect and exposure elements, others may be deterministic or even qualitative in nature. In these cases, the likelihood of adverse effects is expressed through a semiquantitative or qualitative comparison of effects and exposure (EPA 1992).

The BS FEP Team is interested in evaluating different ways to assess risk within the Bering Sea ecosystem area. Considering risks and tradeoffs is one of the purposes of the BS FEP and relates specifically to Process Objective 14 in section 2.3.1. There are some studies ongoing that may prove useful, and which can be synthesized here once the results are available. For example, there is a study ongoing within NMFS that is evaluating vulnerability of Alaska fishery species to climate change, which will be finalized this year. The climate change Action Module that is described in section 4.1 also evaluates risk from potential future climate scenarios. The Council may choose to include other research objectives or future Action Modules to prioritize other evaluations.

9 Preparers, References, Resources

9.1 Preparers

The BS FEP was written by members of the BS FEP Team, with contributions from various other Council (NPFMC) and Alaska Fisheries Science Center (AFSC) staff members. Early drafts of the FEP were extensively reviewed by the Council's Ecosystem Committee and members of the public who participated in that process. The Committee was instrumental in developing the goals and objectives of the BS FEP, and curating the example Action Modules included in the draft.

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9.2 Resources for Bering Sea ecosystem information

Community information

Defining Fishing Community (Excerpt from a document produced by the Alaska Fisheries Science Center)

Identifying and considering appropriate communities is central to effective marine resource management. The National Marine Fisheries Service interprets the MSA definition to emphasize the relevance of geographic place, stating "A fishing community is a social or economic group whose members reside in a specific location…"[36] Pacific States Marine Fisheries adheres to this definition as well, although it is recognized that taking social networks and shared interests into account "would result in a greater

[36] *50 CFR 600.345 - National Standard 8 – Communities.*

understanding of socioeconomic indicators."[37] While location may be relatively easy to determine, defining fishing community solely on geography risks excluding social complexity including social networks valuable to the flow of people, information, goods, and services. Some managers have turned to "multiple constructions of communities"[38] to better understand fishing communities.

By restricting the definition of fishing community to a geographic place—particularly in the marine environment—St. Martin and Hall-Arber (2008) argue that geographically restricted notions of community ignore the complexity of social landscapes.[39] The authors expand "community" to include those areas, resources, and social networks on which people depend.[40] In an effort to acknowledge women's role in fisheries, Calhoun, Conway, and Russel (2016) discuss fishing community in terms of participation in the broader industry.[41] Acknowledging power dynamics and the issue of scale when describing "fishing community," Clay and Olson (2008) complicate the MSA definition, bringing forward the importance of "political, social, and economic relationships."[42] Kevin St. Martin and co-authors (2007) recognize the shift toward ecosystem-based management within fisheries and suggest a similar move in fisheries social science, "to emphasize community-level processes, practices, interactions and interdependencies as *starting points* for understanding the relationship between the rich and complex social practice of fishing and marine ecosystems."[43] As fisheries managers and policy makers continue to develop management strategies which directly affect fishing communities, it is essential to advance a greater understanding of the complexity of social systems.

Communities and the Alaska Marine Ecosystem Status Report

In the context of the Alaska Marine Ecosystem Status Report, fishing communities were identified by three criteria: 1) Geographical location, 2) Current fishing engagement (commercial, recreational, and subsistence; 3) Historical linkages to subsistence fishing. Engagement was defined as the value of each indicator as a percentage of the total present in the state, for example, the percent of all fishing vessels registered in the state that are owned by residents of a given community. The quantitative indicators used to represent commercial fisheries participation included commercial fisheries landings (e.g., landings, number of processors, number of vessels delivering to a community), communities that are the registered homeports of vessels participating in the fisheries, and communities that are home to documented participants in the fisheries (e.g., crew license holders, state and Federal permit holders, and vessel owners). The indicators used to represent recreational fisheries participation included sportfish licenses sold in the community, sportfish licenses held by residents, and the number of charter businesses and guides registered in the community. The indicators used to represent subsistence fisheries participation included participation in the Subsistence Halibut Registration Certificate program, number of subsistence salmon permits issued to households in the community, and local marine mammal harvests. A community was selected to be profiled when it surpassed the median index score on either the ranking of community dependence or engagement. Given the heavy dependence on subsistence fishing for survival in Alaska, as well as the reliance on river networks for marine resource extraction, a buffer area was created along

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[37] Langdon-Pollock, J. (2004). West coast marine fishing community descriptions. *Pacific State Marine Fisheries Commission, Economic Fisheries Information Network*, Pp. 85. Portland Oregon.
[38] Olson, J. (2005). Development in Theory: Re-Placing the Space of Community: A Story of Cultural Politics, Policies, and Fisheries Management. *Anthropological Quarterly*, 78(1), 247-268.
[39] St. Martin, K. S., & Hall-Arber, M. (2008). The missing layer: Geo-technologies, communities, and implications for marine spatial planning. *Marine Policy*, 32(5), 779-786.
[40] ibid
[41] Calhoun, S., Conway, F., & Russell, S. (2016). Acknowledging the voice of women: implications for fisheries management and policy. *Marine Policy*, 74, 292-299.
[42] Clay, P. M., & Olson, J. (2008). Defining" fishing communities": vulnerability and the Magnuson-Stevens fishery conservation and management act. *Human Ecology Review*, 143-160.
[43] Martin, K. S., McCay, B. J., Murray, G. D., Johnson, T. R., & Oles, B. (2007). Communities, knowledge and fisheries of the future. *International Journal of Global Environmental Issues,* 7(2-3), 221-239.

coastal Alaska to identify those communities living near coastal resources. Up river communities with historic ties to subsistence fishing were included. Anchorage and Fairbanks were excluded in some analyses to avoid skewing results.

Alaska Fisheries Science Center Community Profiles and interactive maps

https://www.afsc.noaa.gov/REFM/Socioeconomics/Projects/communities/profiles.php

In 2005, the Alaska Fisheries Science Center (AFSC) compiled baseline socioeconomic information about 136 Alaska communities most involved in commercial fisheries to produce the first version of the Community Profiles for North Pacific Fisheries - Alaska. In 2010 and 2011, AFSC went through the process of evaluating the Community Profiles and determining how to update them. A NOAA Technical Memorandum, *Improving Community Profiles for the North Pacific Fisheries*, documents the process for updating the Community Profiles, including modifying the community selection methodology to ensure that communities with significant reliance on commercial, recreational and subsistence fishing were included. A total of 196 communities have been profiled. The updated profiles add new information to better contextualize communities' reliance on fishing.

Fishing Communities of Alaska Engaged in Federally Managed Fisheries

(The North Pacific Fishery Management Council, May 2016)

https://npfmc.legistar.com/View.ashx?M=F&ID=4472388&GUID=9A7B5279-6583-4BEC-BA28-2FB45B4EB9C0

A summary of communities that are most engaged in the Federally-managed commercial fisheries off Alaska, including groundfish, crab, halibut, and scallops. This resource includes communities in Southeast Alaska, the Central Gulf, Western Gulf, and Aleutian Islands in addition to those in the Bering Sea region. The document includes communities with access to an engaged fishing port on the coastal waters of Alaska with one of three factors for the year 2014: (1) a resident had to have an active Alaska Commercial Fisheries Entry Commission (CFEC) permit; (2) a resident had to be an owner of a vessel that participated in a Federally-managed fishery; or (3) local processing of fish caught as part of the Federally managed fishery had to have occurred.

Comprehensive Baseline Commercial Fishing Community Profiles

(Prepared for North Pacific Research Board and NPFMC by EDAW/AECOM with Northern Economics)

https://www.npfmc.org/wp-content/PDFdocuments/resources/AKCommunityProfilesVol1.pdf

https://www.npfmc.org/wp-content/PDFdocuments/resources/AKCommunityProfilesVol2.pdf

These include Unalaska, Akutan, King Cove, and Kodiak (March 2005) and Sand Point, Adak, St. Paul, and St. George (June 2008). These profiles include in-depth demographic and economic information on the specified fishing communities, meant as a template for the collection and analysis of community profile information for fishing communities of the North Pacific region. The results of this resources are intended to provide information central to the understanding of community engagement in, and dependency on, the range of Federally managed commercial fisheries.

Additionally, the ***10-year program review for the Bering Sea/Aleutian Islands crab rationalization program*** included a social impact assessment includes harvest trends, fleet participation, processor information, and other fishery and economics trends for specified communities involved in the program.

https://www.npfmc.org/wp-content/PDFdocuments/catch_shares/Crab/AppendixA-SocialimpactAssessment.pdf

Information Resources for LK and TK [44]

Arctic Research Consortium of the United States https://www.arcus.org/
Principles for the conduct of research in the arctic http://ankn.uaf.edu/IKS/conduct.html
Products of social science research with Bering Strait communities www.kawerak.org/socialsci.html
Heritage Program Archives www.kawerak.org/ehp.html
Marine Program at Kawerak www.kawerak.org/marine.html
A video about best practices for research on the North Slope https://vimeo.com/197939591
Information about the North Slope http://www.leadershipandstrength.com/collaboration/
Database maintained by the University of Alaska Fairbanks http://jukebox.uaf.edu/site7/
Principles and guidelines for the protection of the heritage of Indigenous people
http://ankn.uaf.edu/IKS/protect.html
Research ethics: a source guide to conducting research with Indigenous peoples
http://www.Indigenousgeography.net/ethics.shtm
Source of information about changes related to climate change around the region (mix of LEK and TEK)
http://adaptalaska.org/stories/
Bering Sea Sub-Network Indigenous observations of the environment and subsistence harvest
http://www.bssn.net/

Bering Sea Elders Advisory Group: The Northern Bering Sea

This resource is explicitly "not an in-depth inquiry into traditional ecological knowledge of the natural history of species and their environment." It includes maps of the Bering Sea and coastal areas which were developed through interviews and mapping activities with experts from Tribes, local commercial fishermen, and the Coastal Resource Service Areas. Accompanying these maps are descriptions from a combination of Western science sources, information produced by TEK related to the subsistence or local commercial use of certain species, cultural practices, and short anecdotal quotes describing specific knowledge of the resource provided by community elders. Migratory routes included in these maps illustrate routes from both TEK sources as well as NOAA DATA. The maps depict areas used for hunting walrus, seals, whales, and important habitat areas for each of these species, such as migratory routes. Additionally, this book contains maps with general areas for harvesting subsistence fish and shellfish, as well as areas for small-scale commercial fisheries for halibut, herring, salmon and crab. Areas that elders and hunters believe to be important habitat for eiders were also illustrated, as these areas are also thought to be ecologically important to marine mammals. Often species are grouped together in terms of their distribution on the maps, including:

- Pacific walrus (subsistence use areas & migratory routes)
- All seals (subsistence use)
- Bearded, ribbon, ringed, spotted seals (migratory routes)
- All whales (category includes bowhead, beluga, gray as one) (subsistence use)
- Beluga whales (subsistence use, feeding grounds, migratory routes)
- Bowhead whales (subsistence use, feeding grounds, migratory routes)
- Shellfish: clams, mussels, king crab, shrimp (subsistence use, commercial harvesting)
- Blue and red king crab (subsistence use, commercial harvesting)
- Herring, salmon, halibut (migratory routes, commercial harvesting, subsistence)
- Area of potential growth for commercial halibut fishery

[44] This list is a work in progress

Oceana and Kawerak: Bering Strait Data Synthesis

This resource includes ecological information specifically about the Bering Strait, not the entire Bering Sea, using data from both TEK and Western scientific studies. The primary source of TEK used in the synthesis is the Kawerak Ice Seal and Walrus Project (ISWP). This synthesis consists of seasonal subsistence use areas for bowhead whales, belugas, walruses, polar bears, seals, fish (grouped as one category) & invertebrates (grouped as one category). Additionally, local community experts used their traditional knowledge to edit landfast ice extents in the ISWP (used in this document).

Some details: subsistence use areas cover regions where they are hunted. Information that conflicted with ISWP data or local expert experience was removed from analysis. Species-level fish distributions within this synthesis did not employ TEK, however a different Kawerak document includes a non-salmon subsistence harvest survey in five Bering Strait communities, followed by semi-structured ethnographic interviews with local experts. Spatial information was documented during interviews and a map was produced for each community. This report documents knowledge regarding when, where, and how residents harvest non-salmon fish; information about fish abundance and biology; cultural values associated with fish; climate change observations; community concerns related to fishing; and, other topics.

Ecological Atlas of the Bering Sea

This resource is a comprehensive, trans-boundary atlas that contains over 100 maps of Arctic marine mammals, seabirds, sea ice, subsistence, and more. The Atlas is organized into six sections that build, layer by layer, the ecological foundation of the Bering, Chukchi, and Beaufort seas. The Atlas represents ecological information using Western science, LK, and TK, and can be downloaded at: http://ak.audubon.org/conservation/download-ecological-atlas-bering-chukchi-and-beaufort-seas.

The Atlas contains spatial information derived from Kawerak's ISWP. TEK is expressed in subsistence-use areas and species use patterns. Natural history maps (species' ranges and concentrations) for BS FEP species where TEK was used: Pacific walrus, ice seal, beluga whale. Additionally, TEK data was used for the "subsistence harvest by species" maps.

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Appendix A: Public comments on FEP public involvement

During the active development of the BS FEP in 2017-2018, the BS FEP Team, the Ecosystem Committee, and the Council received many ideas for public involvement tools from public testimony on the BS FEP, the Council's February 2018 Ecosystem Workshop, and the Council's consideration of establishing a Community Engagement Committee. A synthesis of the ideas that arose from public testimony is included here. They have been categorized to indicate the level of time or staff commitment associated with each suggestion, but otherwise are in no particular order.

Require lower level of time or staff commitment:

- Increase awareness of and education regarding TK, Tribal, and subsistence concerns among Council members and staff. Acknowledge that 'outreach' and 'engagement' are not the same thing and are distinct from 'co-production of knowledge' or 'incorporation' of TK in the management process.
- Provide inclusive opportunities for affected communities to have regular and meaningful input as part of the Council and Council committee process.
- Develop a list of key contact organizations for informing different Bering Sea communities about Council activities.
- Consider how to receive nominations for committee/Plan Team membership from traditionally underrepresented Tribes and rural Alaskan communities, and seek participation from external experts who have positive experience engaging with communities. Encourage and facilitate increased Indigenous representation on Council advisory bodies, including the BS FEP Team.
- Recognize the burdens of participating in the process for rural subsistence users, which is often prohibitively expensive, and requires taking time away from conducting subsistence practices to advocate for the right to conduct subsistence practices.
- Public involvement and engagement should be based on the following principles: based on the principle of equity; two-way communication and exchange of information; involvement and engagement that is robust, meaningful, and inclusive.
- Identify Bering Sea tribes and communities who may be affected by current and future Council decisions.
- Commit to an inclusive process that lets affected communities meaningfully participate in the Council and committee meetings, on a regular basis. For example, the Ecosystem Committee invites presentations and participation from tribes and other entities to contribute to Committee discussions.

Require medium level of time or staff commitment:

- Work with tribal communities and organizations to help incorporate their perspectives, concerns, and information into the FEP document.
- Evaluate the success of meeting the early goals of the FEP document through involvement of the public through the normal and existing Council channels (e.g., comment periods, participation of the public at the Ecosystem Committee, etc.) as well as potentially new avenues for engagement that are currently being considered or developing (e.g., the Ecosystem Workshop, etc.) and analysis of comments received.
- Continue issue-specific outreach, especially continuing to have Council members and staff travel to communities and engage directly with a broad cross-section of community and Tribal members (many of whom cannot travel to Anchorage).
- When appropriate to a Council action, consider holding in-person meetings, video conferences, and/or teleconferences as necessary.

- Within existing Council groups (e.g., the Social Science Planning Team, the Ecosystem Committee), consider developing public involvement plans on a community by community basis.
- Work to ensure an equitable playing field for public involvement and outreach. Specifically, work to ensure that any expansion of public involvement and outreach does not push to the side stakeholders that regularly participate in the Council meetings, the public comment process, etc., or label their input as less important than newer input.
- Incorporate community feedback in a way that does not put strict time limits on community comments. If the Council would like to pursue this idea, the next step would be to task staff with assessing current onramps for community comments, including identifying time-sensitive and non-time-sensitive comment periods.
- Integrate Tribal input into decisions relevant to their region.
- Conduct ongoing outreach and engagement, which will make project-specific outreach more effective. For example, participate in conferences pertaining to Tribal and rural community fishing interests.
- Hold a series of workshops to provide space for community engagement (the Council's Ecosystem Workshop was a positive step). If the Council would like to pursue this idea, the next step would be to define goals and key locations for such events.
- Conduct a review of existing participants in the Council process with stakeholder interests in the Bering Sea region. Who is left out? How would they would like to a) communicate; b) get information; c) provide feedback? Are there communities who prefer to not be engaged regularly by the Council? Consider developing an RFP document for seeking input from Tribes, Alaska Native organizations, and rural communities.
- Develop a formal process for evaluating engagement strategies to provide broader opportunities for sharing of information between the Council and communities.
- Participate in national, regional, and local conferences pertaining to tribal and rural community fishing interests (update and expand current list of possible events).
- Develop a protocol for the collection and use of citizen science information, while recognizing that citizen science is not the same as LK or TK.
- Create a plan for ensuring that existing and future TK appropriately informs Council documents and decisions. Form formal partnerships with Tribes and Alaska Native organizations.
- Create a plan for ensuring commercial fisheries and fishery management does not negatively impact subsistence. Included in this is the need to develop a plan for ensuring subsistence data is incorporated into Council documents and decisions.
- Consider using a co-production of knowledge approach within the Council process to bring together TK and science in an equitable process. Encourage processes that foster co-production of knowledge.
- Maintain a direct link to Tribal Consultation conducted by NMFS (perhaps through a designated staff person). Develop a framework that gives the Council access to Tribal Consultation information on a regular basis and ensure that consultation information is used in the Council's decision-making processes.
- Include Tribal and community membership on all Council committees and Plan Teams, including the long-term BS FEP Team and the FEP Action Module Teams, as well as non-economic social scientists (particularly those with experience working with TK and Alaska communities). Consider how to receive nominations for committee membership from traditionally underrepresented Tribes and rural Alaskan communities, and seek participation from external experts who have positive experience engaging with communities.

Require significant time or staff commitment:

- Increase capacity related to TK on staff at the Council (e.g., hiring a Council staff with TK specialty).
- Consider hiring an outreach or engagement liaison on staff at the Council (this might be someone qualified in engagement/outreach, but not necessarily the academic side of things). If the Council would like to pursue this idea, the next step would be to define roles and responsibilities of such a position.
- Encourage and facilitate increased TK representation through increased Indigenous/Tribal representation on the Council and Council bodies (e.g., Tribal seats on the Council are desired by Indigenous communities), understanding that a permanent Indigenous/Tribal seat (voting or non-voting) on the Council would require a change to the MSA.
- Develop a joint tribal consultation process and protocol with NMFS, to strengthen and improve processes for tribal consultation.